INFORMATION HANDOUT

WATER QUALITY

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

CIWQS Place No. 778847
401 Database No. 02-49-C0302

PERMITS

UNITED STATES ARMY CORPS OF ENGINEERS

Permit No. SPN-2001-262140 N

CalOSHA UNDERGROUND CLASSIFICATION

#'S: C097-097-12T thru C098-097-12T

AGREEMENTS

STATE OF CALIFORNIA DEPARTMENT OF FISH AND GAME
NOTIFICATION OF LAKE OR STREAMBED ALTERATION

NOTIFICATION NO. 1600-2012-0060-R3

UNITED STATES DEPARTMENT OF THE INTERIOR FISH AND WILDLIFE SERVICE
(Biological Opinion)

DATED 4/1/2009

UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
(Biological Opinion)

DATED 1/26/2009

MATERIALS INFORMATION

SITE INVESTIGATION REPORT

DATED 2/10/2011

GEOTECHNICAL DESIGN REPORT

DATED 3/12/2012

FOUNDATION REPORT
U.S. 101N/SR116 SOH (REPLACE)

DATED 5/20/2011

FOR CONTRACT NO. 2640K4

FOUNDATION REPORT ADDENDUM
U.S. 101S/SR116 SOH (WIDEN)

DATED 5/20/2011

FOUNDATION REPORT
RETAINING WALL No. 293

DATED 5/20/2011

STORM WATER INFORMATION HANDOUT

DATED 4/2012

May 17, 2012
CIWQS Place No. 778847
401 Database No.: 02-49-C0302

Sent via electronic mail--no hard copy to follow

California Department of Transportation
Attn: Mr. Wajahat Nyaz
Wajahat_Nyaz@dot.ca.gov
111 Grand Ave.
Oakland, CA 94612-3717

Subject: Water Quality Certification for the Marin Sonoma Narrows Widening Project, Contract C3, City of Petaluma, Sonoma County

Department Project No.: EA 04-2640K

Dear Mr. Nyaz:

We have reviewed and hereby issue water quality certification to the California Department of Transportation (Department) for the Marin Sonoma Narrows Widening Project, Contract C3 (Project). The Department is seeking an Individual Permit for the Project from the U.S. Army Corps of Engineers pursuant to Section 404 of the Clean Water Act (33 U.S.C. § 1344). As such, the Department has applied to the San Francisco Bay Regional Water Quality Control Board (Water Board) for a Clean Water Act Section 401 water quality certification that the Project will not violate State water quality standards.

Project: The Department is proposing to upgrade United States Highway 101 (U.S. 101) between Novato and Petaluma as part of the Marin-Sonoma Narrows HOV Widening Project (MSN). The Department has divided the overall MSN project into at least seven individual contracts:

- A1, from State Route 37 to just north of Atherton Avenue in Novato. A 401 certification was issued for this project on July 22, 2010;
- A2, in Novato, between U.S. 101 northbound post-miles 20.5 and 20.9. A 401 certification application was submitted to the Water Board on May 4, 2012;
- A3, between Marin County U.S. 101 post-miles 22.2 and 24.1. A 401 certification application was submitted to the Water Board on April 17, 2012;

- B-1, between Marin County U.S. 101 post-miles 23.3 and 27.6 in the vicinity of Old Redwood Landfill Road. A 401 certification was issued for the Project on March 26, 2012;
- B-3, in the vicinity of San Antonio Creek between Marin County U.S. 101 post-miles 27.0 and 27.6, and Sonoma County U.S. 101 post-miles 0.0 and 2.5. The Department intends to submit a 401 certification application in 2013;
- B-2/B-4, between Sonoma County U.S. 101 post-miles 3.4 and 4.1, from the Petaluma Bridge south to the vicinity of Cloud Lane. A 401 certification was issued for the Project on March 26, 2012; and
- C-3, the subject of this certification.

This certification addresses proposed activities along U.S. 101 in the vicinity of State Route 116, between just north of the Petaluma River Bridge and approximately 0.2 miles north of Caulfield Lane, in the City of Petaluma. The Project extends between U.S. 101 Sonoma post-miles 3.4 and 4.1. Major elements of the Project include:

- Replacement of the existing four-span northbound U.S. 101/State Route 116 separation and overhead with a new four-span structure;
- Widening of the recently constructed southbound U.S. 101/State Route 116 separation and overhead by 24 feet, along the eastern deck edge;
- Reconstruction of the northbound U.S. 101 on/off-ramp at the State Route 116 interchange;
- Construction of retaining and sound walls along the northbound on-ramp at the State Route 116 interchange;
- Construction of a temporary auxiliary lane along southbound U.S. 101 between the southbound on-ramp, from State Route 116 and the southbound U.S. 101 off-ramp, to Petaluma Boulevard South;
- Reconstruction and widening of 3,920 linear feet of U.S. 101 to meet current freeway design standards and accommodate future high-occupancy vehicle lanes; and
- Relocation of utility lines. The City of Petaluma sanitary sewer force main, AT&T underground lines, and PG&E overhead electric lines would be relocated.

The Project area drains to the Petaluma River. Construction is estimated to start in August 2012, with an estimated completion by August 2015.

Impacts: Project implementation would result in the permanent fill of approximately 0.226 acres of a jurisdictional seasonal freshwater wetland. The wetland is located north of State Route 116 on the east side of U.S. 101, just east of the U.S. 101 northbound on-ramp.

Project implementation would also result in permanent impacts to approximately 0.328 acres of riparian habitat.

Project implementation would result in temporary impacts to approximately 0.019 acres of jurisdictional seasonal freshwater wetlands.

Roadway Pollutant Impacts: Project implementation would result in approximately 4.07 acres of new and 2.20 acres of reworked impervious area. Stormwater runoff from impervious areas may contain hydrocarbons, metals, volatile organic compounds, trash, and sediment at levels that may significantly impact jurisdictional waters if left untreated.

Hydromodification Impacts: Added impervious areas may result in alterations to existing hydrologic regimes, resulting in erosion and/or changes of sediment transport in receiving waters (hydromodification). Because this Project discharges to a tidal portion of the Petaluma River, hydromodification impacts would be insignificant.

Avoidance and Minimization: The Department has avoided and minimized impacts to wetland and waters by incorporating retaining walls and selecting a project alternative with fewer impacts to wetlands and trees.

Mitigation: The Department purchased 0.3 acres of wetland mitigation bank credits from Burdell Ranch Wetland Conservation Bank on December 15, 2010, to mitigate for permanent impacts to approximately 0.226 acres of jurisdictional seasonal freshwater wetlands.

To mitigate for 0.328 acres of permanent impacts to riparian habitat, the Department shall enhance 1.8 acres (349 linear feet) of a tributary to Tolay creek at two locations by providing riparian tree re-vegetation. The property is currently owned by the Sonoma Land Trust. Riparian tree species established shall include a combination of willow, coast live oak, valley oak, California buckeye, blue elderberry, and big-leaf maple. The enhancement locations shall be fenced to exclude cattle from the area. The MSN B1 certification also requires mitigation along a different segment of the same tributary reach. The MSN B3 certification, which may be issued in 2013, shall require completion of the remaining mitigation work along the tributary. Implementation of the tributary enhancement and fencing will occur at a date that would be specified in the MSN B3 certification.

The Department shall also remove a failed grade control structure and restore a stable channel profile to "Tributary 1" of Tolay Creek (T1). T1 drains a large watershed at the southwest quadrant of the mitigation site. Bank erosion is common and the riparian zone is denuded in the lower reaches of T1. The tributary currently includes a failed grade control structure that is exacerbating channel erosion. This certification requires a geomorphic study of the tributary and implementation of measures to remove the grade control structure and restore a stable channel profile to the tributary (see condition nos. 2.d and 3).

To mitigate for temporarily impacted wetlands and waters, the Department shall restore those areas to their original or improved conditions (see condition no. 5).

Roadway Pollutant Mitigation: As mitigation for increased pollutant loads associated with impervious areas, the Department shall provide treatment of stormwater runoff from no less than 6.27 acres of impervious area using three bioretention swales (see Table 1, *Bioretention Swale Summary*, below, for swale information).

The following bioretention swales would mitigate water quality impacts resulting from Project implementation:

Table 1: Bioretention Swale Summary

Location	From Line Post Mile	To Line Post Mile	Treated Impervious Area (acres)
Beneath Petaluma Bridge, north bank, just south of State Route 116	"A" northbound 187+83	"A" northbound 190+35	0.50
Inside northbound 101 to 116 loop off-ramp	"R5" 95+86	"R5" 97+27	1.21
Between 116 to 101 northbound on-ramp and 101 mainline	"R6" 298+92	"R6" 300+84	4.56
		total:	*6.27*

CEQA Compliance: The Department prepared and approved an Environmental Impact Report for this Project pursuant to the provisions of the California Environmental Quality Act. The Department filed a Notice of Determination on July 27, 2009 (SCH No. 2001042115).

California Wetlands Portal: It has been determined through regional, state, and national studies that tracking of mitigation/restoration projects must be improved to better assess the performance of these projects. In addition, to effectively carry out the State's No Net Loss Policy for wetlands, the State needs to closely track wetland losses, gains, and mitigation/restoration project success. Therefore, we require that the Department use the California Wetlands Standard Form to provide Project information related to impacts and mitigation/restoration measures (see Condition Nos. 6 and 7 of this certification). An

electronic copy of the form and instructions can be downloaded at: http://www.waterboards.ca.gov/sanfranciscobay/certs.shtml

Project information concerning impacts and mitigation/restoration will be made available at the web link: http://www.californiawetlands.net

Certification: I hereby issue an order certifying that any discharge from the referenced project will comply with the applicable provisions of sections 301 (Effluent Limitations), 302 (Water Quality Related Effluent Limitations), 303 (Water Quality Standards and Implementation Plans), 306 (National Standards of Performance), and 307 (Toxic and Pretreatment Effluent Standards) of the Clean Water Act, and with other applicable requirements of State law. This discharge is also regulated under State Water Resources Control Board Order No. 2003 - 0017 – DWQ, "General Waste Discharge Requirements for Dredge and Fill Discharges That Have Received State Water Quality Certification" which requires compliance with all conditions of this Water Quality Certification. The following conditions are associated with this certification:

1. As mitigation for increased pollutant loads associated with impervious areas, the Department shall provide treatment of stormwater runoff from no less than 6.27 acres of impervious area using three bioretention swales. The swales shall be installed consistent with the swale summary in Table 1 and Attachment A of this certification. The swales shall be prepared per the soil specifications in Attachment A of this certification. Any change in swale dimension or placement shall be prohibited without prior acceptance by Water Board staff. The swales shall be maintained regularly to ensure optimal performance;

2. The Department shall submit, subject to the acceptance of Water Board staff, a Final Mitigation and Monitoring Plan for restoration and enhancement activities on Sonoma Land Trust property at Tolay Creek (Plan). The Plan shall be submitted not later than September 1, 2012. Project construction is prohibited until a Plan has been found acceptable to Water Board staff. The Plan shall include:

    a. A proposal to re-vegetate 126 linear feet of a tributary to Tolay Creek (both banks) in "Area T1.2" as identified in Attachment B, "Tolay Creek Mitigation Site Map." The proposal shall include a detailed planting plan that includes a combination of willow, coast live oak, valley oak, California buckeye, blue elderberry, and big-leaf maple;

    b. A proposal to re-vegetate 223 linear feet of a tributary to Tolay Creek (both banks) in "Area T1.1" as identified in Attachment B, "Tolay Creek Mitigation Site Map." The proposal shall include a detailed planting plan that includes a combination of willow, coast live oak, valley oak, California buckeye, blue elderberry, and big-leaf maple;

c. A proposal to install cattle exclusion fencing along 426 linear feet of “Area T1.1,” and 252 linear feet of “Area T1.2,” as identified in Attachment B, “Tolay Creek Mitigation Site Map”;

d. A proposal to remove the failed grade control structure and restore a stable channel profile to the Tolay Creek tributary. A person qualified in the principles of fluvial geomorphology shall be consulted to develop the channel restoration plans;

e. An invasive species control plan for Areas T1.1 and T1.2;

f. Success criteria for all plantings;

g. A monitoring period no less than ten years;

h. A plan to provide additional planting, maintenance and monitoring until the success criteria is satisfied, if the required success criteria is not met;

i. A plan to not consider any plantings successful if supplemental watering has been employed at any time during the previous two growing seasons;

j. A plan to submit Annual Reports to the Water Board. At a minimum, mitigation monitoring reports shall be submitted for years 0 (as-built report), 1, 3, 5, 7, and 10. All monitoring reports shall include photo-documentation utilizing consistent photo vantage points. If the monitoring report includes management recommendations, then the report must express whether the Department has the intention to immediately implement those recommendations;

3. The required grade control work at Tolay Creek tributary T1.1 shall be fully implemented prior to Project completion. Riparian enhancement at T1.1 shall be completed within two years of implementation of grade control mitigation. Failure to meet this deadline may result in additional mitigation requirements. The Water Board staff shall be immediately notified if the Department does not seek 401 certification for MSN Contract B3 in 2013. Compensatory mitigation shall be proposed at that time for the required 126 linear feet of enhancement and fencing at tributary T1.2;

4. Mitigation areas at Tolay Creek shall be subject to the terms of the December 21, 2007, Grant Deed of Conservation Easement (Easement), and the November 2009, Tolay Creek Ranch Management Plan (Management Plan). Any subsequent change to the Easement or Management Plan shall be subject to the acceptance of Water Board staff;

5. The Department shall restore all jurisdictional wetlands and waters to their pre-project or improved conditions, within the first growing season following cessation of construction activity in those areas. All temporarily disturbed areas shall be re-vegetated using only native plant species. The Department shall not cause, through

operation of heavy machinery, or any other construction activity, compaction of wetlands or waters. Any compaction of wetlands or waters shall require mitigation;

6. The Department is required to use the California Wetlands Standard Form to provide project information describing impacts and mitigation/restoration measures within 30 days from the date of this certification. An electronic copy of the form can be downloaded at: http://www.waterboards.ca.gov/sanfranciscobay/certs.shtml. The completed California Wetlands form shall be submitted electronically to habitatdata@waterboards.ca.gov or shall be submitted as a hard copy to both: 1) The Water Board, 1515 Clay St., Suite 1400, Oakland, CA 94612, to the attention of California Wetlands Portal; and 2) San Francisco Estuary Institute, 4911 Central Ave., Richmond, CA 94804, to the attention of Mike May;

7. Tolay Creek mitigation monitoring reports shall be submitted to the Water Board by January 1 of each year. Modification of this deadline is subject to the acceptance of Water Board staff. The reports may be submitted by upload to the California Wetlands Portal website at http://www.californiawetlands.net/tracker/ba/list. Select the Tolay Creek restoration project from the Bay Area Project List and then use the "Files & Links" web-link on the mitigation site project page to upload the report. The Department shall immediately notify appropriate Water Board staff once the monitoring report has been uploaded. If the Department cannot, or chooses not to submit the report using the California Wetlands Portal, the report may be submitted directly to Water Board staff electronically, via e-mail;

8. Utility line hydrostatic testing water shall be discharged only to the sanitary sewer;

9. The Project shall be constructed in conformance with the Project Description described in this certification and certification application materials. Any change in the Project may require modification to the certification and shall be reported to the Water Board;

10. The Department shall adhere to the conditions imposed by the Individual Permit issued to the Department by the U.S. Army Corps of Engineers, to the Streambed Alteration Agreement issued to the Department by the California Department of Fish and Game, the Biological Opinion issued to the Department by the National Marine Fisheries Service on January 26, 2009, and to the Biological Opinion issued to the Department by the U.S. Fish and Wildlife Service on April 1, 2009;

11. Regardless of date, erosion control measures shall be utilized throughout all phases of construction where sediment-laden runoff threatens to enter waters of the State. At no time shall sediment-laden runoff be allowed to enter waters of the State;

12. No fueling, cleaning or maintenance of vehicles or equipment shall take place within jurisdictional waters or within any areas where an accidental discharge to waters of the State may occur;

13. Except as expressly allowed in this Certification, the discharge, or creation of the potential for discharge, to waters of the State of any construction wastes and/or soil materials including cement, fresh concrete, or washings thereof, silts, clay, sand, oil or petroleum products and other organic materials to waters of the State is prohibited;

14. This certification does not allow for the take, or incidental take, of any special status species. The Department shall use the appropriate protocols, as approved by the California Department of Fish and Game and the U.S. Fish and Wildlife Service, to ensure that Project activities do not impact the Beneficial Use of the Preservation of Rare and Endangered Species;

15. The Department shall maintain a copy of this water quality certification at the Project site so as to be available at all times to site operating personnel. It is the responsibility of the Department to assure that all personnel (employees, contractors, and subcontractors) are adequately informed and trained regarding the conditions of this certification;

16. This certification action is subject to modification or revocation upon administrative or judicial review, including review and amendment pursuant to Section 13330 of the California Water Code (CWC) and Section 3867 of Title 23 of the California Code of Regulations(23 CCR);

17. This certification action does not apply to any discharge from any activity involving a hydroelectric facility requiring a Federal Energy Regulatory Commission (FERC) license or an amendment to a FERC license, unless the pertinent certification application was filed pursuant to California Code of Regulations (CCR) Title 23, Subsection 3855(b) and that application specifically identified that a FERC license or amendment to a FERC license for a hydroelectric facility was being sought; and

18. Certification is conditioned upon total payment of the full fee required in State regulations (23 CCR Section 3833). Water Board staff received full payment of $1,878.00 on February 29, 2012.

We anticipate your cooperation in implementing these conditions. However, please be advised that any violation of water quality certification conditions is a violation of State law and subject to administrative civil liability pursuant to California Water Code (CWC) section 13350. Failure to respond, inadequate response, late response, or failure to meet any condition of this certification may subject you to civil liability imposed by the Water Board to

a maximum of $5,000 per day per violation or $10 for each gallon of waste discharged in violation of this certification.

Certification condition numbers 2, 3, 6, and 7 are requirements for information and reports. Any requirement for a report made as a condition to this action is a formal requirement pursuant to CWC section 13267, and failure or refusal to provide, or falsification of such required report is subject to civil liability as described in CWC section 13268.

We anticipate no further action on this request. Should new information come to our attention that indicates a water quality problem with this project, the Water Board may issue Waste Discharge Requirements pursuant to 23 CCR Section 3857.

If you have any question, please contact Brendan Thompson at (510) 622-2506, or via e-mail to BThompson@waterboards.ca.gov.

Sincerely,

Bruce H. Wolfe
Executive Officer

Attachments: A- Biofiltration Swale and Strip Design and Soil Specifications
B- Tolay Creek Mitigation Site Map

cc (via e-mail): Mr. Bill Orme SWRCB-DWQ
Ms. Laurie Monarres, USACE
Ms. Jane Hicks, Regulatory Branch, USACE
Mr. Tim Dodson, CDFG
Mr. Bob Neale, Sonoma Land Trust
Ms. Melissa Escaron, Caltrans
Mr. Dale Bowyer, Water Board
Mr. Cyrus Vafai, Caltrans
Mr. Hardeep Takhar, Caltrans
Mr. Jason Brush, USEPA
Ms. Paula Gill, USAC

Attachment A

Biofiltration Swale and Strip Design and Soil Specifications

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	3.4/4.1		

REGISTERED CIVIL ENGINEER 4/05/12 DATE

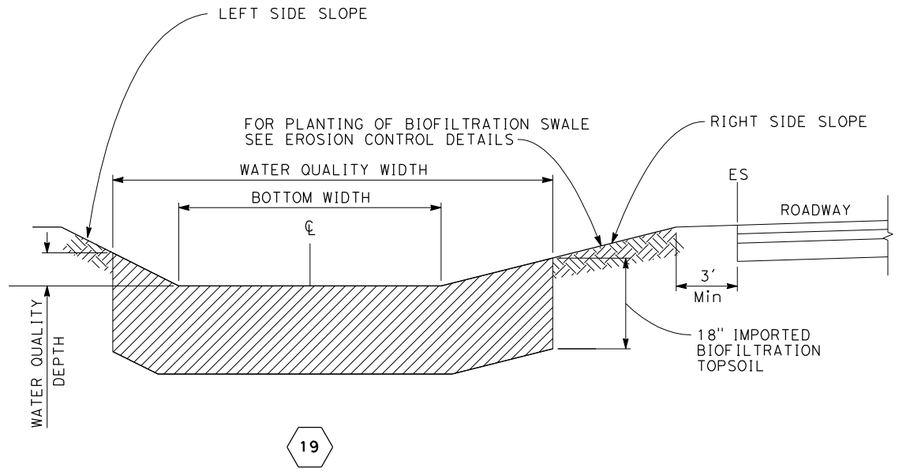
PLANS APPROVAL DATE

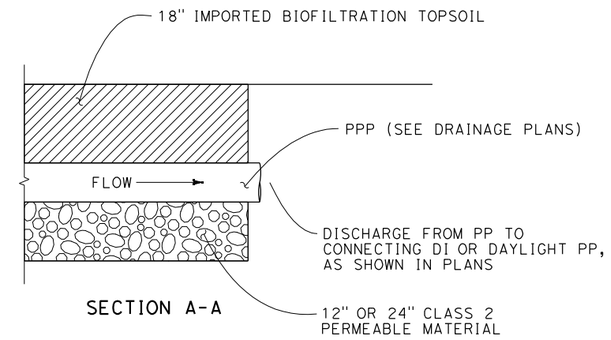
REGISTERED PROFESSIONAL ENGINEER HUEY NHAM No. C65138 Exp. 9/30/13 CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

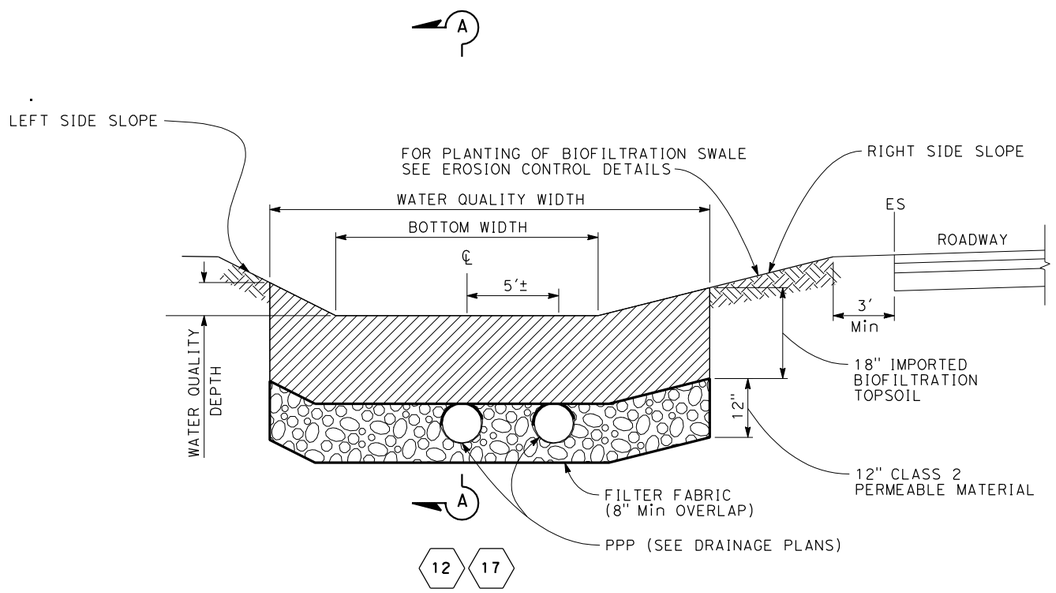
URS CORPORATION
100 W. SAN FERNANDO St
SUITE 200
SAN JOSE, CA 95113

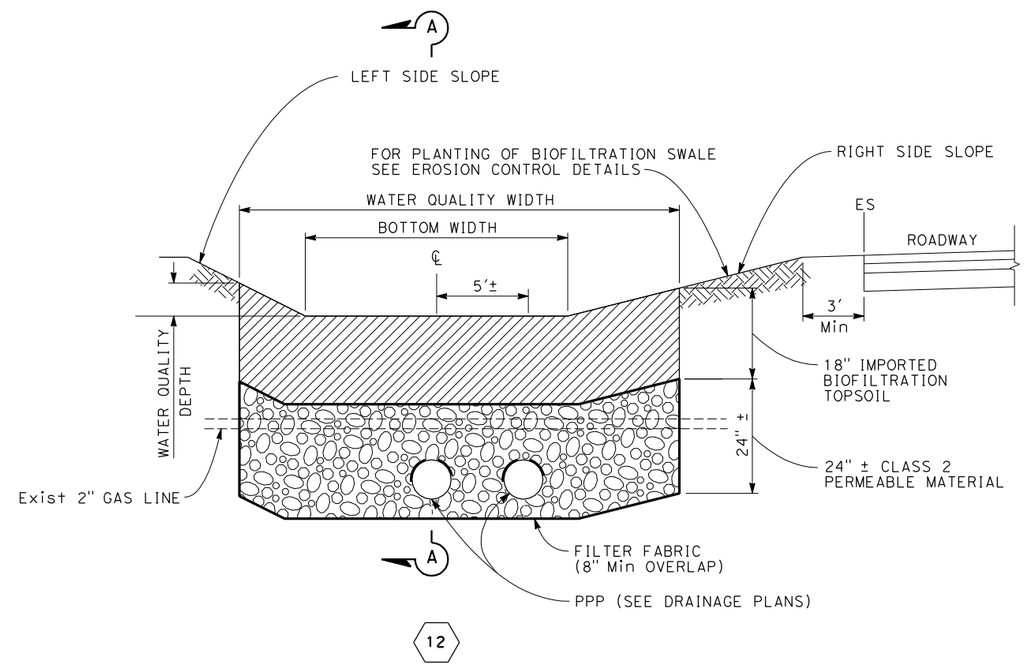
SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401





SECTION A-A





BIOFILTRATION SWALE

DRAINAGE SYSTEM	APPROXIMATE ℄ LOCATION	LENGTH (ft)	BEGIN FLOWLINE (ft)	END FLOWLINE (ft)	LEFT SIDE SLOPE (H:V)	RIGHT SIDE SLOPE (H:V)	BOTTOM WIDTH (ft)	WATER QUALITY DEPTH (ft)	IMPORTED BIOFILTRATION TOPSOIL (CY)	CLASS 2 PERMEABLE MATERIAL (CY)	PPP
12	53.28′ Rt "R6" 300+83.82 TO 51.87′ Rt "R6" 298+91.95	200	9.00	8.74	2:1 OR FLATTER	4:1 OR FLATTER	32	0.50	389	311	6"
17	109.15′ Rt "R5" 97+27.01 TO 104.63′ Rt "R5" 95+86.15	134	15.88	13.55	2:1 OR FLATTER	4:1 OR FLATTER	40	0.40	316	211	8"
19	136.88′ Rt "A" 187+83.27 TO 5.85′ Rt "A" 190+35.24	290	8.20	11.40	4:1 OR FLATTER	2:1 OR FLATTER	5	1	177	N/A	N/A

DRAINAGE DETAILS

NO SCALE

DD-5

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

CALCULATED-DESIGNED BY: HUEY NHAM

CHECKED BY: DAVID WILLIAMS

REVISED BY: JPH

DATE REVISED: 04/05/12

LAST REVISION 04-05-12

DATE PLOTTED => 4/9/2012
TIME PLOTTED => 1:32:33 PM

10-1.__ IMPORTED BIOFILTRATION SOIL

GENERAL

Summary

This work includes furnishing and placing imported biofiltration soil.

Submittals

Compost: Before mixing compost with sand and topsoil, submit:

1. A Certificate of Compliance from the compost supplier in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.
2. A copy of the compost producer's compost technical data sheet. The compost technical data sheet must include:

    2.1. Laboratory analytical test results
    2.2. List of product ingredients

3. A copy of the compost producers Seal of Testing Assurance certification.

Imported biofiltration soil: Imported biofiltration soil must be accompanied by a Certificate of Compliance, from the soil supplier, in conformance with the provisions in Section 6-1.07, “Certificates of Compliance,” of the Standard Specifications.

Quality Control and Assurance

Saturated hydraulic conductivity for imported biofiltration soil must be at least 5 inches per hour.

MATERIAL

Imported biofiltration soil must be a uniform mixture of sand, compost, and topsoil. Volumetric proportion of the mixture must be: four-parts sand; two-parts compost; one-part topsoil.

Sand

Sand must be free of wood, waste, coating such as clay, stone dust, carbonate, or any other deleterious material. All aggregate passing No. 200 sieve size must be non-plastic. Sand must be graded within the following limits:

Sieve Size	Percentage Passing
3/8"	100
No. 4	90 - 100
No. 8	70 - 100
No. 16	40 - 95
No. 30	15 - 70
No. 40	5 - 55
No. 100	0 - 15
No. 200	0 - 5

Grain size analysis results of the sand component must be performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.

Compost

The compost producer must be fully permitted as specified under the California Integrated Waste Management Board, Local Enforcement Agencies, and any other State and Local Agencies that regulate solid waste facilities. If exempt from State permitting requirements, the composting facility must certify that it follows guidelines and procedures for production of compost meeting the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7.

The compost producer must be a participant in the United States Composting Council's Seal of Testing Assurance program.

Compost may be derived from any single or mixture of any of the following feedstock materials:

1. Green material consisting of chipped, shredded, or ground vegetation; or clean processed recycled wood products
2. Biosolids
3. Manure
4. Mixed food waste

Compost feedstock materials in a manner that reduces presence of weed seeds, pathogens and deleterious materials as specified under Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7, Section 17868.3.

Compost must not be derived from mixed municipal solid waste and must be reasonably free of visible contaminants. Compost must not contain paint, petroleum products, pesticides or any other chemical residues harmful to animal life or plant growth. Compost must not possess objectionable odors.

Metal concentrations in compost must not exceed the maximum metal concentrations listed in Title 14, California Code of Regulations, Division 7, Chapter 3.1, Section 17868.2.

Compost must comply with the following:

Physical and Chemical Requirements

Property	Test Method	Requirement
pH	TMECC 04.11-A Elastometric pH 1:5 Slurry Method pH Units	6.5 - 8.0
Soluble Salts	TMECC 04.10-A Electrical Conductivity 1:5 Slurry Method dS/m (mmhos/cm)	0 - 6.0
Moisture Content	TMECC 03.09-A Total Solids & Moisture at 70 +/- 5 deg C % Wet Weight Basis	30 - 60
Organic Matter Content	TMECC 05.07-A Loss-On-Ignition Organic Matter Method (LOI) % Dry Weight Basis	35 - 75
Maturity	TMECC 05.05-A Germination and Vigor Seed Emergence Seedling Vigor % Relative to Positive Control	 80 or Above 80 or Above
Stability	TMECC 05.08-B Carbon Dioxide Evolution Rate mg CO_2-C/g OM per day	8 or below
Particle Size	TMECC 02.02-B Sample Sieving for Aggregate Size Classification % Dry Weight Basis	Inches % Passing 3 100% 1/2 0 - 95% 1/4 0 - 75% Max. Length 4 inches
Pathogen	TMECC 07.01-B Fecal Coliform Bacteria < 1000 MPN/gram dry wt.	Pass
Pathogen	TMECC 07.01-B Salmonella < 3 MPN/4 grams dry wt.	Pass
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Plastic, Glass and Metal % > 4 mm fraction	Combined Total: < 1.0
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Sharps (Sewing needles, straight pins and hypodermic needles) % > 4 mm fraction	None Detected

NOTE: TMECC refers to "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the United States Compost Council (USCC).

Topsoil

Topsoil must be free of wood, waste or other deleterious material. The topsoil texture must be loamy. Overall dry weight percentages must be 60 to 90 percent sand, with less than 20 percent passing the No. 200 sieve, less than 5 percent clay, and no gravel.

CONSTRUCTION

Comply with Section 20-3.02, "Preparation," of the Standard Specifications.

Place imported biofiltration soil in 8 to 12- inch lifts. Do not compact the lifts.

MEASUREMENT AND PAYMENT

Quantity of imported biofiltration soil is measured by the cubic yard.

The contract unit price paid per cubic yard for imported biofiltration soil includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in imported biofiltration soil, complete in place, including testing, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Attachment B

Tolay Creek Mitigation Site Map

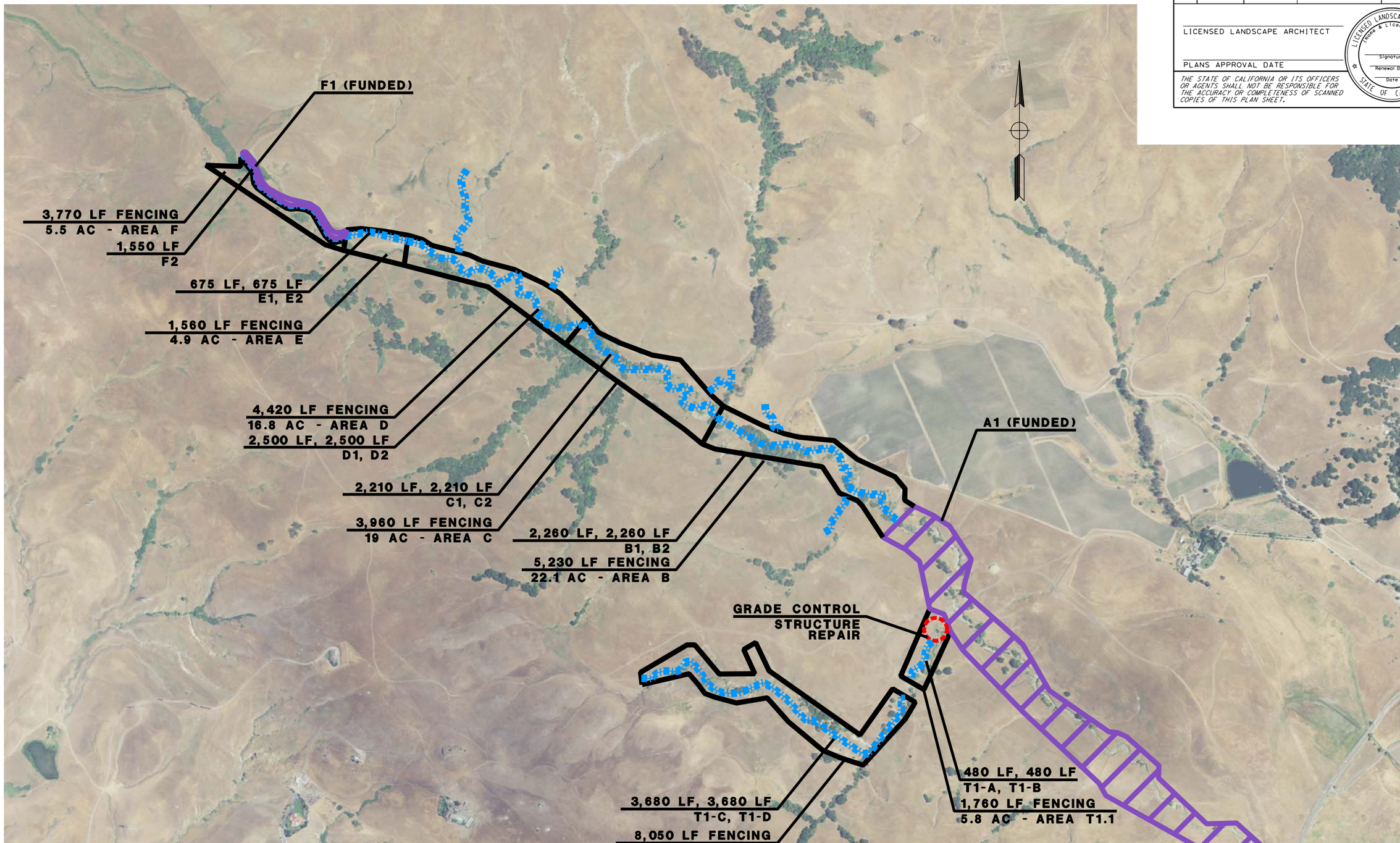
Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

LICENSED LANDSCAPE ARCHITECT

PLANS APPROVAL DATE

LICENSED LANDSCAPE ARCHITECT (Name & License No.) Signature Renewal Date Date STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.



TOLAY CREEK & TRIBUTARY MITIGATION COUNT

0 500 1000 1500

SCALE: 1" = 500'

REVISED BY | DATE REVISED

CALCULATED-DESIGNED BY | CHECKED BY

SENIOR LANDSCAPE ARCHITECT

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 02-29-12 | DATE PLOTTED => $DATE | TIME PLOTTED => $TIME

DEPARTMENT OF THE ARMY PERMIT

PERMITTEE: California Department of Transportation, District 4

PERMIT NO.: SPN-2001-262140 N

ISSUING OFFICE: San Francisco District

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate District or Division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below:

PROJECT DESCRIPTION:

The Marin Sonoma Narrows project will construct high-occupancy vehicle (HOV) lanes on U.S. 101 from just south of State Route 37 in the City of Novato to just north of Corona Road in the City of Petaluma. The MSN project will include construction and modification of interchanges as well as the establishment of new frontage roads.

Phase C3 will include replacing the existing northbound U.S. 101/State Route 116 separation and overhead (SOH) and widening of the southbound U.S. 101/ State Route 116 SOH. Work will specifically include: (1) replacement of the existing four-span northbound U.S. 101/State Route 116 separation and overhead with a new four-span structure; (2) widening of the recently constructed southbound U.S. 101/State Route 116 separation and overhead by 24 feet, along the eastern deck edge; (3) reconstruction of the northbound U.S. 101 on/off-ramp at the State Route 116 interchange; (4) construction of retaining and sound walls along the northbound on-ramp at the State Route 116 interchange; (5) construction of a temporary auxiliary lane along southbound U.S. 101 between the southbound on-ramp, from State Route 116 and the southbound U.S. 101 off-ramp, to Petaluma Boulevard South; and (6) reconstruction and widening of 3,920 linear feet of U.S. 101 to meet current freeway design standards and accommodate future high-occupancy vehicle lanes; and relocation of utility lines including the City of Petaluma sanitary sewer force main, AT&T underground lines, and PG&E overhead electric lines.

All work shall be completed in accordance with the plans and drawings titled "*USACE File #2001-262140N, Marin Sonoma Narrows-Segment C3, May 25, 2012, Figures 1 to 10*", provided as enclosure 1.

The project will result in the discharge of fill material into 0.226 acre of seasonal wetland. Temporary impacts will occur to 0.019 acre of jurisdictional wetlands. Discharge of fill material is depicted in drawings titled, "*USACE File # 2001-262140N, Marin Sonoma Narrows- Phase C3 Impact Maps, May 25, 2012, Figures 1 to 3*" provided as enclosure 2. Permanently impacted jurisdictional seasonal wetlands have been mitigated off site by the purchase of wetland mitigation credits (3 credits, December 10, 1010) from the Burdell Ranch Wetland Conservation Bank.

PROJECT LOCATION: Phase C3 is located along United States Highway 101 (U.S. 101) from just south of State Route (SR) 37 in the City of Novato to just north of Corona Road in the City of Petaluma, Sonoma County, California.

PERMIT CONDITIONS:

GENERAL CONDITIONS:

1. The time limit for completing the work authorized ends on June 15, 2017. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms

and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and State coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. A conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached (enclosure 3).

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

7. You understand and agree that, if future operations by the United States require the removal, relocation or other alteration of the structure or work authorized herein, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, you will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

SPECIAL CONDITIONS:

1. This Corps permit does not authorize you to take an endangered species. In order to legally take a listed species, you must have a separate authorization under the Endangered Species Act (ESA) (e.g., an ESA Section 10 permit or a Biological Opinion (BO) under ESA Section 7 with "incidental take" provisions with which you must comply). The enclosed U.S. Fish and Wildlife Service (USFWS) BO dated April 1, 2009 (see Enclosure 4), contains mandatory terms and conditions to implement the reasonable and prudent measures that are associated with "incidental take" that are also specified in the BO and letter of concurrence. Your authorization under this Corps permit is conditional upon your compliance with all of the mandatory terms and conditions associated with incidental take authorized by the attached BO and letter of concurrence, whose terms and conditions are incorporated by reference in this permit. Failure to comply with the terms and conditions associated with incidental take of the BO or letter of concurrence, where a 'take' of the listed species occurs, would constitute an unauthorized take and it would also constitute non-compliance with this Corps permit. The USFWS and NOAA-Fisheries are the appropriate authorities to determine compliance with the terms and conditions of their BO, letter of concurrence, and with the ESA.

2. You shall employ sediment and erosion control best management practices as needed throughout the project area. No objects or fill shall be placed where they can be eroded or washed into drainage systems in the project area. All debris generated as a result of the project, shall be removed from the site and disposed of at an approved location outside of Corps jurisdiction. All project staging and equipment storage areas shall be located away from areas subject to the jurisdiction of the Corps. After construction, any materials used to dewater areas within the creeks shall be removed in their entirety.

3. Within 1-year of initiation of temporary impact to a jurisdictional feature, you shall re-contour the temporarily impacted area and replant it with appropriate soil-stabilizing native species. You shall monitor each re-vegetated

area for 5 years. At the end of the fifth year, re-vegetated areas shall provide 75% absolute vegetative cover. In re-vegetated wetlands, over half of the cover must be occupied by hydrophytic plants (having a facultative (FAC) or wetter indicator status). You shall submit a monitoring report for the re-vegetated areas at the end of years 1, 3, and 5. The reports shall include representative photos of the re-vegetated areas. If the cover requirements for the re-vegetated areas are not met, the Corps may require further monitoring, re-vegetation, and/or off-site mitigation.

4. You shall comply completely with the conditions established in the *"Memorandum of Agreement Between The Federal Highway Administration and the California State Historic Preservation Officer Regarding Lane Widening of Highway 101, Marin and Sonoma Counties, California"* signed September 11, 2008 (enclosure 5).

FURTHER INFORMATION:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

   ( ) Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. Section 403).
   (x) Section 404 of the Clean Water Act (33 U.S.C. Section 1344).
   ( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. Section 1413).

2. Limits of this authorization:

   a. This permit does not obviate the need to obtain other Federal, State, or local authorizations required by law.

   b. This permit does not grant any property rights or exclusive privileges.

   c. This permit does not authorize any injury to the property or rights of others.

   d. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability: In issuing this permit, the Federal Government does not assume any liability for the following:

   a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

   b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

   c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

   d. Design or construction deficiencies associated with the permitted work.

   e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision: This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

   a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate. (See Item 4 above.)

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 C.F.R. Section 325.7 or enforcement procedures such as those contained in 33 C.F.R. Sections 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 C.F.R. Section 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions: General Condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

Caine S. Montero for JEFFREY G. JENSEN 5/31/12

(PERMITTEE) (DATE)

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

Torrey A. DiCiro 6/6/12

Torrey A. DiCiro, PMP, P.E. (DATE)
Lieutenant Colonel, U.S. Army
District Commander

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

(TRANSFEREE) (DATE)

STATE OF CALIFORNIA EDMUND G. BROWN, JR., Governor

DEPARTMENT OF INDUSTRIAL RELATIONS
DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT
2211 Park Towne Circle, Suite 2
Sacramento, California 95825

Telephone (916) 574-2540
FAX (916) 574-2542

January 20, 2012

URS Corporation
100 W. San Fernando Street
San Jose, CA 95113

Attention: Tyson Tano

Subject: Underground Classification #'s: C097-097-12T thru C098-097-12T

Marin Sonoma Narrows HOV Lane Widening Project

Mr. Tano:

The information provided to this office relative to the above project has been reviewed. On the basis of this analysis, Underground Classification of "Potentially Gassy with Special Conditions" has been assigned to the tunnel(s) and/or shaft(s) identified on your submittal. Please retain the original Classification for your records and deliver a true and correct copy of the Classification to the tunnel/shaft contractor(s) for posting at the job site.

When the contractor who will be performing the work is selected, please advise them to notify this office to schedule the mandated Prejob Conference with the Division prior to commencing any activity associated with boring of the tunnel(s) and/or shaft(s).

Should you have another bore under construction that is not required to have an Underground Classification (i.e.: less than 30 inches in diameter), please contact the Mining and Tunneling Unit prior to any employee entry of such a space.

If you have any questions on this subject, please contact this office at your earliest convenience.

Sincerely,

Douglas Patterson
Senior Engineer

cc: R. Brockman
File

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Underground Classification

C097-097-12T

DEPARTMENT OF TRANSPORTATION
NAME OF TUNNEL OR MINE AND COMPANY NAME

of 111 Grand Avenue, Oakland, CA 94623
MAILING ADDRESS

at MARIN SONOMA NARROWS HOV LANE WIDENING PROJECT
LOCATION

has been classified as ***POTENTIALLY GASSY with Special Conditions***
CLASSIFICATION

as required by the California Labor Code § 7955.

The Division shall be notified if sufficient quantities of flammable gas or vapors have been encountered underground. Classifications are based on the California Labor Code Part 9, Tunnel Safety Orders and Mine Safety Orders.

SPECIAL CONDITIONS

1. A Certified Gas Tester shall perform pre-entry and continuous monitoring of the underground environment to measure Oxygen and detect explosive, flammable, and toxic gasses whenever an employee is working in the underground environment.
2. Mechanical ventilation shall provide for continuous exhaust of fumes and air at any time an employee is working in the underground environment. The primary ventilation fans must be located outside of the underground environment and shall be reversible by a single switch near the fan location.
3. The Division shall be notified immediately if any **Flammable Gas** or **Petroleum Vapor** exceeds 5% of the Lower Explosive Limit.
4. All utilities that may be in conflict with the project shall be identified and physically located (potholed) prior to the start of project operations.

*****IN CLOSE PROXIMITY TO BORE: ONE 36-INCH SANITARY SEWER LINE*****

The 54-inch diameter by 677 feet long bore beneath Sonoma Marin Area Rail (SMART) Railroad tracks approximately 200 feet south of the intersection of Hwy. 101 and Route 116, Petaluma, Sonoma County.

This classification shall be conspicuously posted at the place of employment.

Date January 20, 2012

Douglas Patterson, Senior Engineer

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Underground Classification

C098-097-12T

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2. Mechanical ventilation shall provide for continuous exhaust of fumes and air at any time an employee is working in the underground environment. The primary ventilation fans must be located outside of the underground environment and shall be reversible by a single switch near the fan location.
3. The Division shall be notified immediately if any **Flammable Gas** or **Petroleum Vapor** exceeds 5% of the Lower Explosive Limit.
4. All utilities that may be in conflict with the project shall be identified and physically located (potholed) prior to the start of project operations.

The 5-foot diameter by 25 feet deep shaft located along the right should er of northbound Hwy. 101 approximately 800 feet north of the Caulfield Lane overcrossing, Petaluma, Sonoma County.

This classification shall be conspicuously posted at the place of employment.

Date January 20, 2012

Douglas Patterson, Senior Engineer

STATE OF CALIFORNIA EDMUND G. BROWN, JR., Governor

DEPARTMENT OF INDUSTRIAL RELATIONS
DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT
2211 Park Towne Circle, Suite 2
Sacramento, California 95825

Telephone (916) 574-2540
FAX (916) 574-2542

UNDERGROUND CLASSIFICATION REQUIREMENTS

Under California law, all tunnels, underground chambers, and excavations, and all pipe jacking and boring projects 30 inches or greater in diameter, are required to be Classified by the Division prior to bidding. This requirement is provided for in the California Labor Code, §7955, and Title 8 of the California Code of Regulations, §8422 (which can be reviewed at: http://www.dir.ca.gov/title8/8422.html).

In order to proceed with classifying any underground projects, we require the following information be submitted to the Sacramento Mining and Tunneling District Office (indicated above):

1) The complete name and mailing address of the Owner of the completed facility or structure.
2) The physical location and size (outside diameter and overall length/depth) for each tunnel/shaft.
   - For Example: "The 42-inch diameter by 280 feet long tunnel bore located beneath the Union Pacific Railroad tracks, approximately 1,500 feet northeast of the intersection of Third Street and Highland Avenue, Oakland, Alameda County."
   - **NOTE**: Location should either be a street address or distance from nearest existing street intersection.
3) Two copies of full or half-size plan and profile drawings showing the relationship and identity of any existing utilities.
4) Two copies of any geological information and/or soils reports that are proximate to, or representative of, the conditions existing at the site of the underground construction work, especially as they relate to the presence of flammable gases and hydrocarbons.
5) Any current or past use of the surface area which may have caused contamination of the soils by fuels, oils, solvents, or other chemicals such as: gas stations, auto body and paint shops, industrial and agricultural fuel tanks, chemical manufacturing and processing facilities, etc.
6) Location of any utilities in the area.

Please provide **TWO COPIES** of your plan and profile drawings, pertinent geological reports and logs, a statement on past historical use, and any other factors bearing on the possibility of encountering flammable or toxic gases in the area where the underground activity is being undertaken.

Please ensure contact information is provided; including name, telephone number, and e-mail address.

ANSWERS TO FREQUENTLY ASKED QUESTIONS:

- Optimistic turn-around time is approximately one to two weeks, but may take longer depending on work load.
- Typically the items needed for submittal are too large for electronic submission. They may be mailed or hand-delivered.
- The submission should be addressed to "Whom It May Concern", not a specific individual.
- There is no fee to obtain an Underground Classification. However, if equipment is to be run underground, a Permit to Use Diesel Equipment Underground is required. Please contact this office for further information regarding Diesel Permits.

State of California – The Natural Resources Agency
DEPARTMENT OF FISH AND GAME
Bay Delta Region
7329 Silverado Trail
Napa, CA 94558
(707) 944-5520
www.dfg.ca.gov

EDMUND G. BROWN JR., *Governor*
CHARLTON H. BONHAM, *Director*

June 6, 2012

Jeffrey Jensen
California Department of Transportation
111 Grand Avenue
Oakland, CA 94612

Subject: Final Lake or Streambed Alteration Agreement
Notification No. 1600-2012-0060-R3
U.S. 101-Marin/Sonoma Narrows HOV Widening Contract C3, EA-2640K1

Dear Mr. Jensen:

Enclosed is the final Streambed Alteration Agreement ("Agreement") for the U.S. 101-Marin/Sonoma Narrows HOV Widening Contract C3, EA-2640K1("Project"). Before the Department may issue an Agreement, it must comply with the California Environmental Quality Act ("CEQA"). In this case, the Department, acting as a responsible agency, filed a notice of determination ("NOD") on June 6, 2012, based on information contained in the final Environmental Impact Report the lead agency prepared for the Project.

Under CEQA, filing a NOD starts a 30-day period within which a party may challenge the filing agency's approval of the project. You may begin your project before the 30-day period expires if you have obtained all necessary local, state, and federal permits or other authorizations. However, if you elect to do so, it will be at your own risk.

If you have any questions regarding this matter, please contact Adam McKannay, Environmental Scientist, at (707) 944-5534 or amckannay@dfg.ca.gov.

Sincerely,

Craig J. Weightman
Acting Environmental Program Manager
Bay Delta Region

cc: Stuart Kirkham
Melissa Escaron
Lieutanant Jones
Warden Swaney
Adam McKannay

CALIFORNIA DEPARTMENT OF FISH AND GAME
BAY DELTA REGION
7329 SILVERADO TRAIL
NAPA, CALIFORNIA 94558
(707) 944-5520
WWW.DFG.CA.GOV

STREAMBED ALTERATION AGREEMENT
NOTIFICATION NO. 1600-2012-0060-R3
Unnamed tributary to the Petaluma River; Sonoma County

CALIFORNIA DEPARTMENT OF TRANSPORTATION
U.S. 101-MARIN/SONOMA NARROWS HOV WIDENING CONTRACT C3, EA-2640K1

This Streambed Alteration Agreement (Agreement) is entered into between the California Department of Fish and Game (DFG) and the California Department of Transportation (Permittee) as represented by Jeffrey Jensen.

RECITALS

WHEREAS, pursuant to Fish and Game Code (FGC) section 1602, Permittee notified DFG on March 5, 2012, that Permittee intends to complete the project described herein.

WHEREAS, pursuant to FGC section 1603, DFG has determined that the project could substantially adversely affect existing fish or wildlife resources and has included measures in the Agreement necessary to protect those resources.

WHEREAS, Permittee has reviewed the Agreement and accepts its terms and conditions, including the measures to protect fish and wildlife resources.

NOW THEREFORE, Permittee agrees to complete the project in accordance with the Agreement

PROJECT LOCATION

The project is located at an unnamed tributary to the Petaluma River, in the County of Sonoma, State of California; Latitude N38.233, Longitude W122.6166; Township 5N, Range 7W, U.S. Geological Survey (USGS) Petaluma River 7.5 minute map quadrangle, Mt. Diablo base.

Phase C3 project is located along United States (U.S.) Highway 101 from just north of the Petaluma River Bridge to approximately 0.2 miles north of Caulfield Lane.

PROJECT DESCRIPTION

The project is limited to the following improvements to U.S. 101 from north of the Petaluma River Bridge to north of Caulfield Lane:

- Replace the existing four span northbound (NB) U.S. 101/SR 116 Separation and Overhead (SOH) built in 1955 with a new four span structure.
- Widen the recently constructed southbound (SB) U.S. 101/SR 116 SOH completed in 2007 by approximately 24 feet along the eastern edge of the deck.
- Reconstruct the NB on-ramp and off-ramp at the SR 116 interchange.
- Construct a retaining wall and sound walls along the NB on-ramp at the SR 116 interchange.
- Reconstruct and widen U.S. 101 to meet current freeway design standards and accommodate future HOV lanes.

U.S. 101/SR 116 Separation and Overhead Structures

The NB U.S. 101/SR 116 SOH replacement structure will be constructed east of the existing bridge and will carry four lanes of northbound traffic. The width of the new structure will range from 59 to 80.7 feet and the length will be 562 feet. It will be a four-span structure consisting of a cast-in-place reinforced concrete deck on reinforced concrete pier walls to match the new widened bridge. Two retaining walls are planned at each abutment spanning across the median between the NB replacement structure and the SB widening structure.

As part of the proposed highway widening, the recently constructed SB U.S. 101/SR 116 structure will be widened by 24 feet along the eastern edge of the deck. The bridge carries southbound U.S. 101 traffic over the existing Sonoma Marin Area Rail Transit (SMART) railroad tracks as well as SR 116, at approximately a 39 degree skew. The bridge will have an overall length of approximately 562 feet with a width of 83 feet. The existing structure is a five-span structure consisting of a cast-in-place pre-stressed concrete box girder supported on single-column bents and seat type abutments.

Drainage Features

Project drainage features that function to remove sediment and pollutants from runoff and improve water quality leaving the project site include three biofiltration swales at these locations:

- One biofiltration swale just north of the southern abutment of the U.S. 101/SR 116 Bridge.

- Two biofiltration swales near the north bound U.S. 101 on and off ramps at the SR 116 interchange.

Utilities
To accommodate the project, the following utilities are proposed for relocation:
- City of Petaluma Sanitary Sewer Force Main
- AT&T Underground Fiber Optic and Telephone Line
- PG&E Overhead Electric Transmission and Distribution Line

Approximately 300 feet of City of Petaluma 36 inch sanitary sewer force main will be relocated and connect to the existing 36 inch force main.

Pressure testing of the City of Petaluma sanitary sewer main will involve the use of approximately 20,000 gallons of chlorinated water. Disposal of the chlorinated water from the new sewer main will be accomplished by discharging into the nearby sanitary sewer system.

Approximately 400 feet of fiber optic line will be relocated within SR 116 under the U.S. 101/SR 116 SOH structures.

Approximately one to two PG&E overhead electric transmission/distribution poles near the NB SR 116 off-ramp will be relocated adjacent to their existing locations.

All underground utility work will require temporary ground disturbance to trench, remove utility lines, install utility lines, backfill and restore the site. Relocation of aboveground utilities may require the relocation or installation of utility poles.

Access
Construction crews and equipment will access the construction areas north of the SMART railroad tracks using the existing roadways (SR 116, U.S. 101, etc.). To access areas on the south side of the SMART railroad tracks and construct the southern portions of the U.S. 101/SR 116 SOH structures, an access road beginning at the end of Hopper Street that parallels the railroad tracks to the project site is proposed. The access road will be approximately 12 ft. wide and will be within a temporary construction easement west of U.S. 101.

Staging Areas
The area east side of U.S. 101 inside of the NB U.S. 101/SR 116 off-ramp will be used for staging equipment and personnel for the construction work. The area between the SMART railroad tracks and SR 116 is also a proposed staging location for construction work on the SOH structures.

Construction Schedule
Construction work is estimated to start in August of 2012 with a completion date estimate of August 2015.

Impacts to Bed and Bank

The western bank of the flood control channel on the east side of the NB U.S 101 onramp from SR 116 will be temporarily impacted by the project. The flood control channel spans the length between the culvert underneath SR 116 and the bridge over Caulfield Lane, a distance of over 2,000 feet. The western bank of the flood control channel will be impacted by access needed for construction personnel, equipment and materials to build the retaining wall and sound walls. There will be no impact to the bed of the flood control channel (no impacts below the ordinary high water mark [OHWM]). Approximately 0.295 acres (1,935 linear feet) of the flood control channel bank will be temporarily impacted by the project. Temporary impacts will include work access and the installation of temporary materials such as silt fence, ESA fencing and erosion control BMPs.

Areas of temporary ground disturbance including storage and staging areas and access roads will be restored following construction. These areas will be re-contoured, if appropriate, and revegetated with seeds and/or cuttings of appropriate plant species to promote restoration of the project to pre-project conditions. To the maximum extent practicable, topsoil will be removed, cached, and returned to the site according to successful restoration protocols. Loss of soil from run-off or erosion will be prevented with straw bales, straw wattles, or similar means provided they do not tangle, block escape or dispersal routes of listed animal species. A restoration plan will be developed to provide more detail on how areas of temporary disturbance will be restored.

Impacts to Riparian Area

Approximately 0.328 acre (500 linear feet) of riparian vegetation will be permanently impacted by the MSN C3 project. The impacted riparian area is a single clump of trees along the east side of U.S. 101 freeway where the northbound on-ramp from Lakeville Road (SR 116) merges with the freeway (Riparian Area-1). The riparian area is adjacent to and shades the bank of the flood control channel. Within this riparian area, approximately 59 riparian trees out of a total of 154 trees are expected to be impacted by the proposed project and of those riparian trees, 11 are planted coast redwoods (nonnative), 42 are oak trees and 6 are other native riparian trees. The permanent impacts to the trees will be mitigated by a combination of onsite and offsite planting of replacement trees.

Off-site planting of replacement trees is proposed at the Tolay Creek Ranch Enhancement Project as part of a corridor-wide mitigation plan. On-site planting of replacement trees is proposed at the corner of Lakeville Road (SR 116) and the U.S. 101 on-ramp. Five replacement coast live oak trees will be planted on the west side of the roadside ditch wetland adjacent the NB U.S. 101 freeway on-ramp next to Lakeville Road (SR116). A proposed biofiltration strip will be present at the proposed planting locations and the trees will be approximately 20 feet apart.

PROJECT IMPACTS

Existing fish or wildlife resources the project could substantially adversely affect include:

- Riparian habitat

The adverse effects the project could have on the fish or wildlife resources identified above include:

- loss of natural bed or bank
- change in contour of bed, channel or bank
- loss of bank stability during construction
- Increased turbidity
- soil compaction or other disturbance to soil layer
- increase of bank erosion during construction
- short-term release of contaminants (e.g., incidental from construction) loss or decline of riparian and/or emergent marsh habitat
- decline of vegetative diversity
- loss or impediment of terrestrial animal species travel routes due to temporary structures (e.g., survey tape, sandbags, erosion protection materials etc.)
- cumulative impacts

MEASURES TO PROTECT FISH AND WILDLIFE RESOURCES

1. Administrative Measures

Permittee shall meet each administrative requirement described below.

1.1 Documentation at Project Site. Permittee shall make the Agreement, any extensions and amendments to the Agreement, and all related notification materials and California Environmental Quality Act (CEQA) documents, readily available at the project site at all times and shall be presented to DFG personnel, or personnel from another state, federal, or local agency upon request.

1.2 Providing Agreement to Persons at Project Site. Permittee shall provide copies of the Agreement and any extensions and amendments to the Agreement to all supervisory personel who will be working on the project at the project site on behalf of Permittee, including but not limited to contractors, subcontractors, inspectors, and monitors.

1.3 Notification of Conflicting Provisions. Permittee shall notify DFG if Permittee determines or learns that a provision in the Agreement might conflict with a provision imposed on the project by another local, state, or federal agency. In that event, DFG shall contact Permittee to resolve any conflict.

1.4 Project Site Entry. Permittee agrees that DFG personnel may enter the project site at any time with notification to the Resident Engineer to verify compliance with the Agreement.

1.5 No Trespass. To the extent that any provisions of this Agreement provide for activities that require the Permittee to traverse another owner's property, such provisions are agreed to with the understanding that the Permittee possesses the legal right to so traverse. In the absence of such right, any such provision is void.

2. Avoidance and Minimization Measures

To avoid or minimize adverse impacts to fish and wildlife resources identified above, Permittee shall implement each measure listed below.

Work Periods and Planning

2.1 Instream Work Period. Work within the stream channel below the top of bank shall only occur between June 1 and October 30.

2.2 Instream Work Period Modification. If Permittee needs more time to complete the project activity, the work may be permitted outside of the work period and extended on a day-to-day basis by the DFG representative who reviewed the project. Permittee shall submit a written request for a work period variance to DFG. The work period variance request shall: 1) describe the extent of work already completed; 2) detail the activities that remain to be completed; 3) detail the time required to complete each of the remaining activities; and 4) provide photographs of both the current work completed and the proposed site for continued work. The work period variance request should consider the effects of increased stream flows, rain delays, increased erosion control measures, limited access due to saturated soil conditions, and limited growth of erosion control grasses due to cool weather. Work period variances are issued at the discretion of DFG. DFG will review the written request to work outside of the established work period. DFG reserves the right to require additional measures to protect fish and wildlife resources as a condition for granting the variance. DFG will have five (5) working days to review the proposed work period variance.

2.3 Work According To Plans. Permittee shall conduct all work within DFG jurisdiction according to the project description stated above as well as the plans submitted to DFG in the notification package. Permittee shall notify DFG of any modifications made to the plans

submitted to DFG that pertain to impacts to streams or the riparian corridor.

Wildlife Protection and Prevention - General

2.4 Biological Monitor. A biological monitor is an individual experienced with construction level biological monitoring and who is able to recognize species in the project area and who is familiar with the habits and behavior of those species. Biological monitors shall have academic and professional experience in biological sciences and related resource management activities as it pertains to this project. All biological monitors for the project shall be approved by DFG prior to commencement of covered activities.

2.5 On-site Education. Permittee shall conduct an education program for all supervisory personnel employed or otherwise working on the project site prior to performing any work on-site. The program shall consist of a presentation from the Biological Monitor that includes a discussion of the biology of the habitats and species identified in this Agreement and present at this site. The Biological Monitor shall also include as part of the education program information about the distribution and habitat needs of any special status species that may be present, legal protections for those species, penalties for violations and project-specific protective measures included in this Agreement. Interpretation shall be provided for non-English speaking supervisors, and the same instruction shall be provided for any new supervisors prior to their performing work on-site.

2.6 Environmentally Sensitive Area Fencing. Permittee shall direct the Biological Monitor to delineate areas of sensitive habitat with high visibility Environmentally Sensitive Area fencing.

2.7 Environmentally Sensitive Area Fencing Maintenance. Permittee shall install and maintain Environmentally Sensitive Area fencing.

2.8 Escape Ramp in Trench. At the end of each work day, Permittee shall place an escape ramp at each end of any open trench greater than 6-inches in depth and walls greater then 30 degrees to allow any animals that may have become entrapped in the trench to climb out overnight. The ramp may be constructed of either dirt fill or wood planking or other suitable material that is placed at an angle no greater than 30 degrees.

2.9 No Heavy Equipment in Stream. No heavy equipment shall operate in the portion of the stream bed where flowing water is present or anticipated during the term of this Agreement.

2.10 No Excavation in Stream. No excavation in the portion of the stream bed where flowing water is present or anticipated during the term of this agreement.

Wildlife Protection and Prevention

2.11 Migratory Bird Treaty Act - Permittee shall be in compliance with Migratory Bird Treaty Act (MBTA) and Fish and Game Code 3503. To avoid potential impacts to nesting birds, Permittee shall remove vegetation or install exclusion measures during the time period of August 15 to February 15. If construction activities that have the potential to violate MBTA and Fish and Game Code 3503 are scheduled during the nesting season, focused surveys for active nests shall be conducted within72 hours of said construction activities. If active nests are identified, a 50-foot no-work buffer for non-raptors and a 300-foot no-work buffer for raptors shall be established. If active nests are found, Permittee shall consult with DFG and the United States Fish and Wildlife Service (USFWS) regarding appropriate action to comply with the MBTA of 1918 and the Fish & Game Code of California.

2.12 Allow Wildlife To Leave Unharmed. Permittee shall allow any wildlife encountered during the course of construction to leave the construction area unharmed. This authorization does not allow for the trapping, capture, or relocation of any state or federally listed species.

Erosion and Sediment Control

2.13 Erosion Control Measures. Permittee shall utilize erosion control measures throughout all phases of operation where sediment runoff from exposed slopes threatens to enter a river, stream, or lake.

2.14 Prohibition Against Use of Plastic Netting in Erosion Control Measures. Permittee shall not use temporary or permanent erosions control devices containing plastic netting, including photo- or bio-degradable plastic netting.

2.15 Storm Water Pollution Prevention Plan. At least thirty (30) days prior to beginning work within the stream zone, the Permittee shall submit to DFG a copy of the final Storm Water Pollution Prevention Plan (SWPPP), which will contain Best Management Practices and

monitoring protocol necessary to prevent excessively turbid or contaminated water from entering the stream. The SWPPP shall be entered in this agreement as Exhibit A.

Equipment and Vehicles

2.16 Operating Equipment and Vehicle Leaks. Any equipment or vehicles driven and/or operated within or adjacent to the stream shall be checked and maintained daily to prevent leaks of materials that could be deleterious to aquatic and terrestrial life or riparian habitat.

2.17 Stationary Equipment Leaks. Stationary equipment such as motors, pumps, generators, and welders, located within or adjacent to the stream shall be positioned over drip pans. Stationary heavy equipment shall have suitable containment to handle a catastrophic spill/leak.

2.18 Clean Up Equipment. Clean up equipment such as extra boom, absorbent pads, skimmers, shall be on site prior to the start of work within the stream zone.

2.19 Equipment Storage. Staging and storage areas for equipment, materials, fuels, lubricants and solvents, shall be located outside of the stream channel and banks.

2.20 Stockpiled Materials. Building materials and/or construction equipment shall not be stockpiled or stored where they may be washed into the water or cover aquatic or riparian vegetation. Stockpiles shall be covered when measurable rain is forecasted.

Debris Materials and Waste

2.21 Location of Spoil Sites. Spoil sites shall not be located within a stream or locations that may be subjected to high storm flows, where spoil may be washed back into a stream, or where it may impact streambed habitat, aquatic or riparian vegetation.

2.22 No Dumping. Permittee and all contractors, subcontractors, and employees shall not dump any litter or construction debris within the stream, or where it may pass into the stream.

2.23 Pick Up Debris. Permittee shall pick up all debris and waste daily.

2.24 Wash water. Water containing mud, silt, or other pollutants from equipment washing or other activities, shall not be allowed to enter a

lake or flowing stream or placed in locations that may be subjected to high storm flows.

2.25 Clean-up. All construction debris and associated materials shall be removed from the work site upon completion of this project.

Toxic and Hazardous Materials

2.26 Toxic Materials. Any hazardous or toxic materials that could be deleterious to aquatic life that could be washed into the stream or its tributaries shall be contained in water tight containers or removed from the project site.

2.27 Hazardous Substances. Raw cement/concrete or washings thereof, asphalt, paint or other coating material, oil or other petroleum products, or any other substances which could be hazardous to aquatic life, resulting from project related activities, shall be prevented from contaminating the soil and/or entering the waters of the state. Any of these materials, placed within or where they may enter the stream by Permittee or any party working under contract, or with the permission of Permittee, shall be removed immediately.

Spills and Emergencies

2.28 Emergency Response Plan Required. In accordance with Exhibit B, for all activities performed in or near a stream the Permittee shall have absorbent materials designated for spill containment and clean up activities on-site for use in an accidental spill. The Permittee shall immediately notify the California Emergency Management Agency at 1-800-852-7550 and immediately initiate the clean up activities.

3. Reporting Measures

Permittee shall meet each reporting requirement described below.

3.1 Riparian Mitigation Plan. Permittee shall submit to DFG for approval, a Riparian Mitigation Plan to compensate for linear foot impacts to temporarily (1:1 mitigation to impact ratio) and permanently (3:1 mitigation to impact ratio) disturbed riparian habitat. Native trees shall be replaced at a 3:1 ratio, native oak trees shall be replaced at a 5:1 ratio. Prior to the submission of the Riparian Mitigation Plan, Permittee shall meet with DFG to present refined anticipated impacts, discuss offsite mitigation locations, and appropriate success criteria and reporting. Permittee shall implement the Riparian Mitigation Plan within 1 year of commencement of construction. This

plan may be combined with other mitigation plans proposed for elsewhere within the Marin/Sonoma Narrows project.

3.2 Notification to the California Natural Diversity Database. If any special status species are observed in project surveys, Permittee or designated representative shall submit Natural Diversity Data Base (NDDB) forms to the NDDB for all preconstruction survey data within five (5) working days of the sightings, and provide to DFG's Regional office three (3) copies of the NDDB forms and survey maps.

CONTACT INFORMATION

Any communication that Permittee or DFG submits to the other shall be in writing and any communication or documentation shall be delivered to the address below by U.S. mail, fax, or email, or to such other address as Permittee or DFG specifies by written notice to the other.

To Permittee:

Jeffrey Jensen
California Department of Transportation
111 Grand Avenue
Oakland, CA 94612
Fax: (510) 622-1662
Jeffrey_jensen@dot.ca.gov

To DFG:

Department of Fish and Game
Bay Delta Region
7329 Silverado Trail
Napa, California 94558
Attn: Lake and Streambed Alteration Program – Adam McKannay
Notification #1600-2012-0060-R3
Fax (707) 944-5553
amckannay@dfg.ca.gov

LIABILITY

Permittee shall be solely liable for any violations of the Agreement, whether committed by Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents or contractors and subcontractors, to complete the project or any activity related to it that the Agreement authorizes.

This Agreement does not constitute DFG's endorsement of, or require Permittee to proceed with the project. The decision to proceed with the project is Permittee's alone.

SUSPENSION AND REVOCATION

DFG may suspend or revoke in its entirety the Agreement if it determines that Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, is not in compliance with the Agreement.

Before DFG suspends or revokes the Agreement, it shall provide Permittee written notice by certified or registered mail that it intends to suspend or revoke. The notice shall state the reason(s) for the proposed suspension or revocation, provide Permittee an opportunity to correct any deficiency before DFG suspends or revokes the Agreement, and include instructions to Permittee, if necessary, including but not limited to a directive to immediately cease the specific activity or activities that caused DFG to issue the notice.

ENFORCEMENT

Nothing in the Agreement precludes DFG from pursuing an enforcement action against Permittee instead of, or in addition to, suspending or revoking the Agreement.

Nothing in the Agreement limits or otherwise affects DFG's enforcement authority or that of its enforcement personnel.

OTHER LEGAL OBLIGATIONS

This Agreement does not relieve Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, from obtaining any other permits or authorizations that might be required under other federal, state, or local laws or regulations before beginning the project or an activity related to it.

This Agreement does not relieve Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, from complying with other applicable statutes in the FGC including, but not limited to, FGC sections 2050 et seq. (threatened and endangered species), 3503 (bird nests and eggs), 3503.5 (birds of prey), 5650 (water pollution), 5652 (refuse disposal into water), 5901 (fish passage), 5937 (sufficient water for fish), and 5948 (obstruction of stream).

Nothing in the Agreement authorizes Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, to trespass.

AMENDMENT

DFG may amend the Agreement at any time during its term if DFG determines the amendment is necessary to protect an existing fish or wildlife resource.

Permittee may amend the Agreement at any time during its term, provided the amendment is mutually agreed to in writing by DFG and Permittee. To request an amendment, Permittee shall submit to DFG a completed DFG "Request to Amend Lake or Streambed Alteration" form and include with the completed form payment of the corresponding amendment fee identified in DFG's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5).

TRANSFER AND ASSIGNMENT

This Agreement may not be transferred or assigned to another entity, and any purported transfer or assignment of the Agreement to another entity shall not be valid or effective, unless the transfer or assignment is requested by Permittee in writing, as specified below, and thereafter DFG approves the transfer or assignment in writing.

The transfer or assignment of the Agreement to another entity shall constitute a minor amendment, and therefore to request a transfer or assignment, Permittee shall submit to DFG a completed DFG "Request to Amend Lake or Streambed Alteration" form and include with the completed form payment of the minor amendment fee identified in DFG's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5).

EXTENSIONS

In accordance with FGC section 1605(b), Permittee may request one extension of the Agreement, provided the request is made prior to the expiration of the Agreement's term. To request an extension, Permittee shall submit to DFG a completed DFG "Request to Extend Lake or Streambed Alteration" form and include with the completed form payment of the extension fee identified in DFG's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5). DFG shall process the extension request in accordance with FGC 1605(b) through (e).

If Permittee fails to submit a request to extend the Agreement prior to its expiration, Permittee must submit a new notification and notification fee before beginning or continuing the project the Agreement covers (Fish & G. Code, § 1605, subd. (f)). .

EFFECTIVE DATE

The Agreement becomes effective on the date of DFG's signature, which shall be: 1) after Permittee's signature; 2) after DFG complies with all applicable requirements under the California Environmental Quality Act (CEQA); and 3) after payment of the

applicable FGC section 711.4 filing fee listed at http://www.dfg.ca.gov/habcon/ceqa/ceqa_changes.html.

TERM

This Agreement shall expire on December 31, 2016, unless it is terminated or extended before then. All provisions in the Agreement shall remain in force throughout its term. Permittee shall remain responsible for implementing any provisions specified herein to protect fish and wildlife resources after the Agreement expires or is terminated, as FGC section 1605(a)(2) requires.

EXHIBITS

The documents listed below are included as exhibits to the Agreement and incorporated herein by reference.

A. *Storm Water Pollution Prevention Plan*, California Department of Transportation District 4, 2012.

B. *Spill Identification and Emergency Response Plan,* California Department of Transportation District 4, December 2009.

AUTHORITY

If the person signing the Agreement (signatory) is doing so as a representative of Permittee, the signatory hereby acknowledges that he or she is doing so on Permittee's behalf and represents and warrants that he or she has the authority to legally bind Permittee to the provisions herein.

AUTHORIZATION

This Agreement authorizes only the project described herein. If Permittee begins or completes a project different from the project the Agreement authorizes, Permittee may be subject to civil or criminal prosecution for failing to notify DFG in accordance with FGC section 1602.

CONCURRENCE

The undersigned accepts and agrees to comply with all provisions contained herein.

FOR DEPARTMENT OF TRANSPORTATION

Carina S Montoya for

Jeffrey Jensen
District Office Chief

5/23/12
Date

FOR DEPARTMENT OF FISH AND GAME

C J Weightman

Craig Weightman
Acting Environmental Program Manager

June 6, 2012
Date

Prepared by: Adam McKannay
Environmental Scientist

Date Prepared: March 23, 2012
Date Revised: May 21, 2012

FOR DEPARTMENT USE ONLY				
Date Received	Amount Received	Amount Due	Date Complete	Notification No.
3/5/12	$ 448.75	$		1600-2012-0060-3

CK # 00258346
URS

McIlannay
Swaney
Jones

STATE OF CALIFORNIA
DEPARTMENT OF FISH AND GAME

NOTIFICATION OF LAKE OR STREAMBED ALTERATION

Complete EACH field, unless otherwise indicated, following the enclosed instructions and submit ALL required enclosures. Attach additional pages, if necessary.

Fish & Game
MAR 05 2012
Yountville

1. APPLICANT PROPOSING PROJECT

Name	Jeffrey Jensen		
Business/Agency	California Department of Transportation		
Street Address	111 Grand Avenue		
City, State, Zip	Oakland, CA 94612		
Telephone	(510) 622-8729	Fax	(510) 622-1662
Email	jeffrey_jensen@dot.ca.gov		

2. CONTACT PERSON (*Complete only if different from applicant*)

Name	Stuart Kirkham, Associate Environmental Planner, California Department of Transportation		
Street Address	111 Grand Avenue		
City, State, Zip	Oakland, CA 94612		
Telephone	(510) 286-5602	Fax	
Email	stuart_kirkham@dot.ca.gov		

3. PROPERTY OWNER (*Complete only if different from applicant*)

Name			
Street Address			
City, State, Zip			
Telephone		Fax	
Email			

4. PROJECT NAME AND AGREEMENT TERM

A. Project Name	U.S. 101-Marin/Sonoma Narrows HOV Widening Contract C3, EA-2640K1			
B. Agreement Term Requested	☑ Regular (*5 years or less*) ☐ Long-term (*greater than 5 years*)			
C. Project Term		D. Seasonal Work Period		E. Number of Work Days
Beginning (*year*)	Ending (*year*)	Start Date (*month/day*)	End Date (*month/day*)	
2012	2015	8/1/12	8/31/2015	500.00

Per email dated 3/16/12

NOTIFICATION OF LAKE OR STREAMBED ALTERATION

5. AGREEMENT TYPE

Check the applicable box. If box B, C, D, or E is checked, complete the specified attachment.		
A.	☑ Standard *(Most construction projects, excluding the categories listed below)*	
B.	☐ Gravel/Sand/Rock Extraction (*Attachment A*)	*Mine I.D. Number:* _____
C.	☐ Timber Harvesting (*Attachment B*)	THP *Number:* _____
D.	☐ Water Diversion/Extraction/Impoundment (*Attachment C*)	*SWRCB Number:* _____
E.	☐ Routine Maintenance (*Attachment D*)	
F.	☐ DFG Fisheries Restoration Grant Program (FRGP)	*FRGP Contract Number:* _____
G.	☐ Master	
H.	☐ Master Timber Harvesting	

6. FEES

Please see the current fee schedule to determine the appropriate notification fee. Itemize each project's estimated cost and corresponding fee. ***Note: The Department may not process this notification until the correct fee has been received.***

	A. Project	B. Project Cost	C. Project Fee
1	Construction of U.S. 101 on-ramp, sound walls and retaining wall	$500,000.00	$4,482.75
2			
3			
4			
5			
		D. Base Fee *(if applicable)*	
		E. TOTAL FEE ENCLOSED	$4,482.75

7. PRIOR NOTIFICATION OR ORDER

A. Has a notification previously been submitted to, or a Lake or Streambed Alteration Agreement previously been issued by, the Department for the project described in this notification?

☐ Yes (*Provide the information below*) ☑ No

Applicant: _____ Notification Number: _____ Date: _____

B. Is this notification being submitted in response to an order, notice, or other directive ("order") by a court or administrative agency (including the Department)?

☑ No ☐ Yes (*Enclose a copy of the order, notice, or other directive. If the directive is not in writing, identify the person who directed the applicant to submit this notification and the agency he or she represents, and describe the circumstances relating to the order.*)

☐ *Continued on additional page(s)*

8. PROJECT LOCATION

A. Address or description of project location.

(*Include a map that marks the location of the project with a reference to the nearest city or town, and provide driving directions from a major road or highway*)

The U.S. 101 Marin Sonoma Narrows (MSN) HOV Lanes project will be constructed from just south of State Route (SR) 37 in the City of Novato to just north of Corona Road in the City of Petaluma (see Figure 1). The MSN project will be completed in a series of independently funded phases (see Figure 2). This application/notification is for Phase C3.

Phase C3 project is located along United States (U.S.) Highway 101 from just north of the Petaluma River Bridge to approximately 0.2 miles north of Caulfield Lane. The project area is located between latitude 38°14'26" N and 38°13'47" N and longitude 122°37'18" W and 122°36'58" W. The project is located in Township 5N, Range 7W in the Petaluma River USGS 7.5 minute quadrangle. The elevation ranges from close to mean sea level to about 30 feet above mean sea level. Please see Figure 1 and Figure 2 for determining the project location for MSN Phase C3 Project.

☐ *Continued on additional page(s)*

B. River, stream, or lake affected by the project.	unnamed flood control channel
C. What water body is the river, stream, or lake tributary to?	Petaluma River
D. Is the river or stream segment affected by the project listed in the state or federal Wild and Scenic Rivers Acts?	☐ Yes ☑ No ☐ Unknown
E. County	Sonoma

F. USGS 7.5 Minute Quad Map Name	G. Township	H. Range	I. Section	J. ¼ Section
Petaluma River	5N	7W		

☐ *Continued on additional page(s)*

K. Meridian (*check one*)	☐ Humboldt ☑ Mt. Diablo ☐ San Bernardino

L. Assessor's Parcel Number(s)

☐ *Continued on additional page(s)*

M. Coordinates (*If available, provide at least latitude/longitude or UTM coordinates and check appropriate boxes)*

Latitude/Longitude	*Latitude:* 38°14' N	*Longitude:* 122°37' W	
	☑ Degrees/Minutes/Seconds	☐ Decimal Degrees	☐ Decimal Minutes
UTM	*Easting:*	*Northing:*	☐ Zone 10 ☐ Zone 11
Datum used for Latitude/Longitude or UTM	☐ NAD 27	☑ NAD 83 or WGS 84	

9. PROJECT CATEGORY AND WORK TYPE *(Check each box that applies)*

PROJECT CATEGORY	NEW CONSTRUCTION	REPLACE EXISTING STRUCTURE	REPAIR/MAINTAIN EXISTING STRUCTURE
Bank stabilization – bioengineering/recontouring	☐	☐	☐
Bank stabilization – rip-rap/retaining wall/gabion	☐	☐	☐
Boat dock/pier	☐	☐	☐
Boat ramp	☐	☐	☐
Bridge	☐	☐	☐
Channel clearing/vegetation management	☐	☐	☐
Culvert	☐	☐	☐
Debris basin	☐	☐	☐
Dam	☐	☐	☐
Diversion structure – weir or pump intake	☐	☐	☐
Filling of wetland, river, stream, or lake	☑	☐	☐
Geotechnical survey	☐	☐	☐
Habitat enhancement – revegetation/mitigation	☐	☐	☐
Levee	☐	☐	☐
Low water crossing	☐	☐	☐
Road/trail	☑	☑	☐
Sediment removal – pond, stream, or marina	☐	☐	☐
Storm drain outfall structure	☐	☐	☐
Temporary stream crossing	☐	☐	☐
Utility crossing : Horizontal Directional Drilling	☐	☐	☐
Jack/bore	☐	☐	☐
Open trench	☐	☐	☐
Other *(specify)*:	☐	☐	☐

10. PROJECT DESCRIPTION

A. Describe the project in detail. Photographs of the project location and immediate surrounding area should be included.

- Include any structures (e.g., rip-rap, culverts, or channel clearing) that will be placed, built, or completed in or near the stream, river, or lake.
- Specify the type and volume of materials that will be used.
- If water will be diverted or drafted, specify the purpose or use.

Enclose diagrams, drawings, plans, and/or maps that provide all of the following: site specific construction details; the dimensions of each structure and/or extent of each activity in the bed, channel, bank or floodplain; an overview of the entire project area (i.e., "bird's-eye view") showing the location of each structure and/or activity, significant area features, and where the equipment/machinery will enter and exit the project area.

This notification is for the U.S. 101 MSN Project Phase C3. The MSN C3 Project will consist of the following improvements to U.S. 101 from north of the Petaluma River Bridge to north of Caulfield Lane:

• Replace the existing four span northbound (NB) U.S. 101/SR 116 Separation and Overhead (SOH) built in 1955 with a new four span structure.
• Widen the recently constructed southbound (SB) U.S. 101/SR 116 SOH completed in 2007 by approximately 24 feet along the eastern edge of the deck.
• Reconstruct the NB on-ramp and off-ramp at the SR 116 interchange.
• Construct a retaining wall and sound walls along the NB on-ramp at the SR 116 interchange.
• Reconstruct and widen U.S. 101 to meet current freeway design standards and accommodate future HOV lanes.

More details of the project are provided in the supplement.

☑ *Continued on additional page(s)*

B. Specify the equipment and machinery that will be used to complete the project.

Excavators, cranes, pile drivers, bulldozers, earth movers, compaction equipment, front loader, dump truck, back hoe, paver, graders, mixers, barges

☐ *Continued on additional page(s)*

C. Will water be present during the proposed work period (specified in box 4.D) in the stream, river, or lake (specified in box 8.B).	☑ Yes ☐ No (*Skip to box 11*)
D. Will the proposed project require work in the wetted portion of the channel?	☐ Yes (*Enclose a plan to divert water around work site*) ☑ No

11. PROJECT IMPACTS

A. Describe impacts to the bed, channel, and bank of the river, stream, or lake, and the associated riparian habitat. Specify the dimensions of the modifications in length (linear feet) and area (square feet or acres) and the type and volume of material (cubic yards) that will be moved, displaced, or otherwise disturbed, if applicable.

The proposed project will not impact the bed and bank of the flood control channel east of the northbound U.S. 101 on-ramp from SR 116. However the project will impact a wetland between the flood control channel and the U.S. 101 on-ramp. The project will also impact riparian vegetation along the wetland on the east side U.S. 101. More detail on the impacts is provided in the attached supplement.

☑ *Continued on additional page(s)*

B. Will the project affect any vegetation? ☑ Yes (*Complete the tables below*) ☐ No

Vegetation Type	Temporary Impact	Permanent Impact
Information on impacted vegetation types is provided in the supplement	Linear feet: _____ Total area: _____	Linear feet: _____ Total area: _____
	Linear feet: _____ Total area: _____	Linear feet: _____ Total area: _____

Tree Species	Number of Trees to be Removed	Trunk Diameter (range)
Impacted trees are provided in table 2		
of the attached supplement		

☑ *Continued on additional page(s)*

C. Are any special status animal or plant species, or habitat that could support such species, known to be present on or near the project site?

☑ Yes *(List each species and/or describe the habitat below)* ☐ No ☐ Unknown

Salt marsh harvest mouse potentially occupy the tidal wetland marsh on the east and west side of U.S. 101.

☑ *Continued on additional page(s)*

D. Identify the source(s) of information that supports a "yes" or "no" answer above in Box 11.C.

USFWS Biological Opinion (attached)

☐ *Continued on additional page(s)*

E. Has a biological study been completed for the project site?

☑ Yes (*Enclose the biological study*) ☐ No

The Final Natural Environment Study is attached

Note: A biological assessment or study may be required to evaluate potential project impacts on biological resources.

F. Has a hydrological study been completed for the project or project site?

☐ Yes (*Enclose the hydrological study*) ☑ No

Note: A hydrological study or other information on site hydraulics (e.g., flows, channel characteristics, and/or flood recurrence intervals) may be required to evaluate potential project impacts on hydrology.

12. MEASURES TO PROTECT FISH, WILDIFE, AND PLANT RESOURCES

A. Describe the techniques that will be used to prevent sediment from entering watercourses during and after construction.

A variety of techniques will be implemented for the project to prevent sediment from entering the watercourse and to prevent erosion and degradation of water quality. Biofiltration swales, fiber rolls and erosion control netting will be utilized throughout the construction zone to reduce loose disturbed sediment from entering waters. Temporary silt fences will be set up near riparian areas and throughout the construction zone to reduce sediment loads into waters. Fencing for environmentally sensitive areas (ESA) will be set up around riparian areas and wetlands that are not to be impacted by the project. Construction work will be scheduled to maximize the dry summer months when construction activities are less likely to result in the mobilization of sediment.

☑ *Continued on additional page(s)*

B. Describe project avoidance and/or minimization measures to protect fish, wildlife, and plant resources.

Avoidance and Minimization measures will be implemented as part of construction activities to minimize and avoid impacts to special status species and habitat, as well as common biological resources. The following avoidance and minimization measure will be implemented during construction of the proposed project:

☑ *Continued on additional page(s)*

C. Describe any project mitigation and/or compensation measures to protect fish, wildlife, and plant resources.

Compensatory mitigation will be implemented at an in-kind ratio for all proposed permanent impacts to the Project's affected waters and riparian areas. Permanent impacts to Waters of the U.S. and Waters of the State that are not mitigated for on-site will be mitigated by purchasing mitigation bank credits prior to the start of construction. Cumulatively the MSN C3 project will result in approximately 0.226 acre of unavoidable permanent impacts to wetlands (Waters of the U.S. and Waters of the State). Caltrans and the Sonoma County Transportation Authority (SCTA) purchased wetland credits from Burdell Ranch Mitigation Bank as compensation for the unavoidable permanent impacts of the project to wetlands.

☑ *Continued on additional page(s)*

13. PERMITS

List any local, state, and federal permits required for the project and check the corresponding box(es). Enclose a copy of each permit that has been issued.

A. 401 Clean Water Certification with San Francisco RWQCB ☑ Applied ☐ Issued

B. USACE Clean Water Act 404 Permit Application ☑ Applied ☐ Issued

C. _____ ☐ Applied ☐ Issued

D. Unknown whether ☐ local, ☐ state, or ☐ federal permit is needed for the project. (*Check each box that applies*)

☐ *Continued on additional page(s)*

14. ENVIRONMENTAL REVIEW

A. Has a draft or final document been prepared for the project pursuant to the California Environmental Quality Act (CEQA), National Environmental Protection Act (NEPA), California Endangered Species Act (CESA) and/or federal Endangered Species Act (ESA)?

☑ Yes (*Check the box for each CEQA, NEPA, CESA, and ESA document that has been prepared and enclose a copy of each*)

☐ No (*Check the box for each CEQA, NEPA, CESA, and ESA document listed below that will be or is being prepared*)

☐ Notice of Exemption	☐ Mitigated Negative Declaration	☑ NEPA document (*type*): EIS
☐ Initial Study	☑ Environmental Impact Report	☐ CESA document (*type*):
☐ Negative Declaration	☑ Notice of Determination (*Enclose*)	☑ ESA document (*type*): Biological Opinion
☐ THP/ NTMP	☑ Mitigation, Monitoring, Reporting Plan	

B. State Clearinghouse Number (*if applicable*)	2001042115		
C. Has a CEQA lead agency been determined?	☑ Yes (*Complete boxes D, E, and F*)	☐ No (*Skip to box 14.G*)	
D. CEQA Lead Agency	California Department of Transportation		
E. Contact Person	Melanie Brent	F. Telephone Number	(510) 286-5231

G. If the project described in this notification is part of a larger project or plan, briefly describe that larger project or plan.

The Marin Sonoma Narrows (MSN) HOV Widening Project Phase C3 is one segment of the overall MSN Project that proposes to add High Occupancy Vehicle (HOV) Facilities to United States Highway (US) 101 from State Route (SR) 37 in Novato to north of Corona Road Overcrossing in Petaluma.

☐ *Continued on additional page(s)*

H. Has an environmental filing fee (Fish and Game Code section 711.4) been paid?

☑ Yes (*Enclose proof of payment*) ☐ No (*Briefly explain below the reason a filing fee has not been paid*)

Note: If a filing fee is required, the Department may not finalize a Lake or Streambed Alteration Agreement until the filing fee is paid.

15. SITE INSPECTION

Check one box only.

☐ In the event the Department determines that a site inspection is necessary, I hereby authorize a Department representative to enter the property where the project described in this notification will take place at any reasonable time, and hereby certify that I am authorized to grant the Department such entry.

☑ I request the Department to first contact (*insert name*) Stuart Kirkham at (*insert telephone number*) (510) 286-5602 to schedule a date and time to enter the property where the project described in this notification will take place. I understand that this may delay the Department's determination as to whether a Lake or Streambed Alteration Agreement is required and/or the Department's issuance of a draft agreement pursuant to this notification.

16. DIGITAL FORMAT

Is any of the information included as part of the notification available in digital format (i.e., CD, DVD, etc.)?
☑ Yes (Please enclose the information via digital media with the completed notification form) ☐ No

17. SIGNATURE

I hereby certify that to the best of my knowledge the information in this notification is true and correct and that I am authorized to sign this notification as, or on behalf of, the applicant. I understand that if any information in this notification is found to be untrue or incorrect, the Department may suspend processing this notification or suspend or revoke any draft or final Lake or Streambed Alteration Agreement issued pursuant to this notification. I understand also that if any information in this notification is found to be untrue or incorrect and the project described in this notification has already begun, I and/or the applicant may be subject to civil or criminal prosecution. I understand that this notification applies only to the project(s) described herein and that I and/or the applicant may be subject to civil or criminal prosecution for undertaking any project not described herein unless the Department has been separately notified of that project in accordance with Fish and Game Code section 1602 or 1611.

Signature of Applicant or Applicant's Authorized Representative

Date 02/28/2012

Jeffrey Jensen
Print Name

The Notification is being submitted to the CDFG Bay Delta Region Office:
7329 Silverado Trail
Napa, CA 94558
(707) 944-5500

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

IN REPLY REFER TO:
81420-2008-F-1619-4

APR 0 1 2009

Mr. Walter C. Waidelich Jr.
Federal Highway Administration
U. S. Department of Transportation
650 Capitol Mall, Suite 4-100
Sacramento, California 95814

Subject: Biological Opinion for the State Route 101 Marin-Sonoma Narrows High Occupancy Vehicle Widening Project, Marin and Sonoma Counties, California (Caltrans EA 264000) on the Threatened California Red-legged Frog and the Endangered Salt Marsh Harvest Mouse

Dear Mr. Waidelich:

This is in response to your June 18, 2008, request for formal consultation with the U.S. Fish and Wildlife Service (Service) on the proposed State Route 101 Marin-Sonoma Narrows High Occupancy Vehicle Widening Project, Marin and Sonoma Counties, California. Your request was received in this office via an electronic mail message on June 24, 2008, and included the request for formal consultation on the threatened California red-legged frog (*Rana aurora draytonii*) and the endangered salt marsh harvest mouse (*Reithrodontomys raviventris*). This document represents the Service's biological opinion on the effects of the proposed action on this listed species. This document is issued under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 *et seq.*)(Act).

Protocol level surveys have not been completed in the action area due to scheduling issues and access problems for the soft bird's beak (*Cordylanthus mollis* ssp. *mollis*), endangered Baker's larkspur (*Delphinium bakeri*), endangered Sonoma alopecurus (*Alopecurus aequalis* var. *sonomensis*), endangered showy Indian clover (*Trifolium amoenum*), and endangered Contra Costa goldfields (*Lasthenia conjugens*). Suitable habitat is located within the action area for all of these listed plants. At this time, based on the preliminary and incomplete information provided to the Service, we concur that the proposed project may affect, but is not likely to adversely affect these five listed plant species. At a meeting with the Service on June 5, 2008, and in a letter to the Service dated June 18, 2008, the Federal Highway Administration (FHWA) stated that they will complete protocol level surveys within the action area for all of these listed

species prior to groundbreaking and reinitiate consultation pursuant to section 7 if any or all of these taxa are found, with the understanding that the presence of any or all of these plants could lead to additional conservation measures that will be determined in conjunction with the Service, project delays, project redesign, or other significant effects on the State Route 101 Marin Sonoma Narrows project.

Based on our current knowledge regarding their distribution we have determined the proposed action is not likely to adversely affect the endangered Sebastopol meadowfoam (*Limnanthes vinculans*, endangered Sonoma County Distinct Population Segment of the California tiger salamander (*Ambystoma californiense*), or the endangered California clapper rail (*Rallus longirostris obsoletus*) due to lack of appropriate habitat in the action area.

This biological opinion is based on: (1) May 2008 Biological Assessment; (2) June 19, 2008, field review; (3) additional project information provided by the California Department of Transportation (Caltrans) on August 27, 2008; (4) miscellaneous correspondence and electronic mail concerning the proposed action between the Service and Caltrans, the Transportation Authority of Marin, and the Sonoma County Transportation Authority; and (5) other information available to the Service.

Consultation History

April 21, 2008	The Service received a letter dated April 17, 2008, regarding a tentative meeting agenda and information on a proposed Least Environmentally Damaging Preferred Alternative for the Marin-Sonoma Narrows Project.
June 2, 2008	The Service received a letter dated May 30, 2008, providing a summary of the May 7, 2008, meeting to discuss the proposed Least Environmentally Damaging Preferred Alternative for the Marin-Sonoma Narrows Project.
June 5, 2008	The Service received an advance copy of the Biological Assessment for the proposed State Route 101 Marin-Sonoma Narrows High Occupancy Vehicle (HOV) Widening Project, Marin and Sonoma Counties, California, at a meeting with the FHWA and Caltrans. In the Biological Assessment, Caltrans determined that the proposed project *is likely to adversely affect* Burke's goldfields, Sonoma alopecurus, Contra Costa goldfields, Sebastopol meadowfoam, California red-legged frog, and the salt marsh harvest mouse; but *will not affect* the soft bird's beak, showy Indian clover, California tiger salamander, or the California clapper rail. The Service recommended that FHWA and Caltrans revise their current determinations to a *no effect* for the Sebastopol meadowfoam and a *may affect, not likely to adversely affect* for the five remaining listed plant species given their commitment to reinitiate consultation following completion of protocol surveys for these species within suitable habitat

within the action area prior to construction. The Service also recommended that FHWA/Caltrans consider the presence of upland and aquatic habitat for California red-legged frog on the east side of State Route 101. This was based on the existing east-west connectivity provided by culverts and bridge crossings under State Route 101, particularly in Segment B. During the meeting Caltrans requested that the biological opinion first be issued as a draft for their review.

June 19, 2008 — The Service attended a field review of the project with Caltrans, the Transportation Authority of Marin (TAM), the Sonoma County Transportation Authority (SCTA), and their consultants. Following the field review, the Service met with Caltrans, TAM, and SCTA to summarize the information requests that arose during the visit. The information requests were primarily associated with the need for more complete project description for activities at creek and river crossings.

June 24, 2008 — The Service received a letter dated June 18, 2008, from the Federal Highway Administration (FHWA) requesting formal consultation for the proposed State Route 101 Marin-Sonoma Narrows High Occupancy Vehicle (HOV) Widening Project, Marin and Sonoma Counties, California. The letter was received via an electronic mail message. In the letter, FHWA requested formal consultation on the threatened California red-legged frog, the endangered salt marsh harvest mouse, and seven listed plants. It was noted in the letter that FHWA was requesting formal consultation on seven listed plants due to their incomplete plant surveys of the action area. FHWA also outlined their plan to reinitiate consultation on the individual listed plants following the completion of additional protocol plant surveys within the action area prior to ground disturbing activities.

June 25, 2008 — The Service sent FHWA a request for additional information to adequately review the determination of the effects of the project on listed species (Service File: 81420-2008-I-1619-1). The information requested primarily focused on the need for additional project description information, particularly for those activities associated with drainage crossings. Other issues of particular focus included: the effects to salt marsh harvest mouse potential habitat under the Petaluma River Bridge; the acknowledgement of California red-legged frog habitat on the east side of State Route 101 in Segment B; the potential for California red-legged frog to occur in the more urban drainages of Segments A and C; appropriate compensation ratios to offset effects; and the previously mentioned recommended listed plant species determinations.

August 7, 2008	The Service received additional information dated August 5, 2008, from Caltrans in response to the June 25, 2008, information request and questions asked during the June 19, 2008, field visit. Of note, the Caltrans letter revised the California red-legged frog effects acreage to 206.94 acres (203.78 acres of permanent effects and 3.16 acres of temporary effects) and FHWA and Caltrans revised their effects determination for the Sebastopol meadowfoam to "no effect." Caltrans also revised their determination for soft bird's beak, Baker's larkspur, Sonoma alopecurus, and Contra Costa goldfields to a "may affect, not likely to adversely affect." Caltrans committed to completing protocol level surveys for these four listed plants within the action area prior to construction. FHWA will reinitiate consultation with the Service if a listed species is found in the action area or could otherwise be affected by the project.
August 13, 2008	The Service received a revised project description from Caltrans developed for the formal consultation process with the National Marine Fisheries Service via an electronic mail message.
August 27, 2008	The Service received a revised a complete project description from Caltrans via an electronic mail message.
August 29, 2008	The Service issued a draft biological opinion (file # 81420-2008-F-1619-2).
September 16, 2008	The Service met with FHWA, Caltrans, TAM, and SCTA to discuss the draft biological opinion.
September 19, 2008	The Service received additional project information, comments on the draft biological opinion, and September 16, 2008, meeting notes from Caltrans via an electronic mail message.
September 24, 2008	The Service received elevation contours for action area near the Petaluma Bridge from Caltrans via an electronic mail message.
September 26, 2008	The Service received comments on the draft biological opinion from FHWA.
October 9, 2008	The Service met representatives from Caltrans and CDFG to discuss the proposed geotechnical borings for the Petaluma Bridge portion of the proposed action.
December 2, 2008	The Service received project description information from Caltrans for the proposed geotechnical borings for the Petaluma Bridge portion of the

proposed action via an electronic mail message. A hardcopy of the information was received on December 3, 2008.

December 10, 2008 The Service received an electronic message from Caltrans outlining the proposed compensation language for the biological assessment. The statement proposed the fulfillment of appropriate California red-legged frog compensation through either purchase of credits at a conservation bank, establishment of a conservation easement, or fee title habitat acquisition. As stated in the message, a conservation easement would include a management plan and endowment. Caltrans referenced the Lawson's Landing property as a potential site for compensation through purchase on a conservation easement.

December 11, 2008 The Service received additional project description information from FHWA for the proposed geotechnical borings for the Petaluma Bridge portion of the proposed action and other outstanding Service information requests via an electronic mail message.

December 15, 2008 The Service received a map depicting the mean high water limits in the Petaluma River Bridge portion of the action area attached to an electronic mail message. This map was sent in response to the Service's request for information regarding available upland refuge for the salt marsh harvest mouse during high water events.

December 22, 2008 The Service issued a second draft of the biological opinion (file # 81420-2008-F-1619-3).

December 22, 2008 The Service issued a second draft of the biological opinion (file # 81420-2008-F-1619-3).

December 10, 2009 The Service received comments from Caltrans regarding the second draft of the biological opinion. The comments were attached to an electronic mail message as an undated letter that represented the consolidated comments of the SCTA, TAM, FHWA, and Caltrans.

March 5, 2009 The Service met with Caltrans and FHWA to discuss the second draft of the biological opinion (file # 81420-2008-F-1619-3).

March 27, 2009 The Service received additional information from Caltrans regarding proposed project scheduling and compensation phasing via an electronic message. The correspondence also included language related to contractor actions and compliance with the Act.

March 31, 2009 The Service received project description revisions and requested terms and conditions revisions from Caltrans via an electronic mail message.

BIOLOGICAL OPINION

Description of the Proposed Action

FHWA and Caltrans propose to construct HOV lanes on State Route 101 from just south of State Route 37 in the City of Novato to just north of Corona Road in the City of Petaluma. These transportation improvements also will include construction and modification of interchanges as well as the establishment of a new frontage road. According to Caltrans, the project is intended to reduce congestion and improve mobility while providing an incentive for commuters to use buses, carpools, or vanpools for peak period travel, and to improve freeway operations including providing safe access to and from State Route 101. The project will be referred to in the remainder of this biological opinion as the Marin-Sonoma Narrows Project.

Caltrans is in the process of developing bridge designs for the Marin-Sonoma Narrows Project and not all of the project description has been fully developed. According to the May 2008, Biological Assessment, additional design engineering will be completed for Segments B and C when funding becomes available for those segments. FHWA will reinitiate consultation with the Service if the action is subsequently modified in a manner that causes an effect to the listed species that was not considered in this project description.

Construction Schedule and Funding

The proposed project is divided into three project segments (A, B, and C) that are further divided into sub-segments (such as A1 and B2). The overall project will be completed in two primary construction phases. Construction Phase 1 will include segments A1, B2, and B3. Construction Phase 2 will include all remaining project segments.

Construction in Phase 1 is scheduled to begin in Fiscal Year 2010/2011 (between July 1, 2010, and June 30, 2011). Construction in Phase 2 is scheduled to begin in Fiscal Year 2014/2015 (between July 1, 2014, and June 30, 2015).

The activities associated with the sub-segments are described as follows:

1. A1 consists of constructing approximately 1.5 miles of the southbound HOV lane between State Route 37 and Rowland Boulevard in Novato (Segment A), and approximately 4 miles of the northbound HOV lane between State Route 37 and Atherton Avenue in Segments A and B.

2. B1 consists of converting the existing Redwood Landfill overcrossing to a full interchange, including the construction of associated frontage roads in Segment B.

3. B2 consists of constructing a new Petaluma Boulevard South interchange including associated frontage roads in Segment B.

4. B3 is fully funded as well and consists of constructing a new mainline bridge at San Antonio Creek in Segment B. This segment would shift US-101 traffic to the west and allow the existing highway to be converted to a frontage road.

5. B4, not yet fully funded, would replace the Petaluma River bridges in Segment B and northbound State Route 116 bridge in Segment C. The southbound State Route 116 bridge, also in Segment C, would be widened as part of this phase.

Additional sub-phases are contemplated and will be defined and advanced as funding is identified.

Two upland and two aquatic geotechnical investigation bores under the Petaluma River Bridge will likely occur prior to construction of the three project segments. The bores are expected to be completed in approximately one week. Scheduling will be weather dependent to avoid boring activities and access of equipment in and out of the action area during rain and when the ground is wet. Additional borings will be accessed from the State Route 101 median and performed in areas that are not identified as listed species habitat or having the potential to adversely affect listed species.

Project Components

Caltrans has divided the approximately 16.1 mile long Marin-Sonoma Narrows Project into three segments, based on the activities occurring in each distinct segment and the construction schedule. The segments are labeled from south to north as A, B, and C. Segments A and C consist of the existing freeway in the cities of Novato and Petaluma, respectively. Segment B is the existing expressway between the two cities. The project activities are discussed by segment as follows. Caltrans has characterized the planned activities in each segment as those that will and will not affect aquatic habitat for listed species.

Segment A

<u>HOV Lane Construction</u>. The existing Segment A includes the existing State Route 101 roadway from State Route 101/State Route 37 Interchange and north of the Atherton Avenue Interchange through the City of Novato. The existing Segment A roadway consists of six 12-foot wide lanes (three in each direction) with 10 foot outside shoulders and 5 foot inside shoulders. The existing non-paved median between the opposite lanes of travel vary in width from 28 to 45 feet and include a double thrie-beam barrier.

According to Caltrans, the majority of the existing drainage features in the existing roadway right-of-way will remain with only minor modifications due to a lack of drainage issues.

Caltrans proposes to widen the Segment A roadway by adding a new HOV lane to each direction of travel. These new 12 foot lanes will be added to the median and will separated by a concrete barrier and varying-width inside shoulders. The new median width from the start of the project to the Atherton Avenue interchange will vary between 22 to 28 feet and will be paved. The median between the Atherton Avenue interchange and Olompali State Historic Park will vary between 28 to 44 feet with 10 foot minimum paved shoulders with the remainder unpaved.

To construct the HOV lanes, heavy equipment would be used to excavate the existing material to sub-grade for the proposed structural section. Excavated material would be tested for the presence of aerially deposited lead (ADL) and if high levels are found, Caltrans would require that the material be handled in compliance with state and federal requirements. According to an August 5, 2008 letter from Caltrans, recycled roadbed material will only be placed on areas that are classified as permanently disturbed by project activities, including material that will be used as fill or base material under the roadway. Material that exceeds the threshold for re-use would be hauled off-site to a Service-approved and/or Type 1 facility. Existing soil under the existing roadway will be used as fill. Temporary impact areas will not have stockpiles.

According to their August 5, 2008 letter, Caltrans would not place any stockpiles of material containing ADL near any sources of run-off. The contractor will place and cover stockpiles of ADL material on 0.33 millimeter thickness plastic sheeting. These stockpiles would not be placed in environmentally sensitive areas and in addition to be covered with plastic, they piles would be surrounded by either hay bales or wattles to protect them from runoff.

Dump or haul trucks would transport borrow and aggregate materials for placement and compaction. Water trucks would spray water on excavated material to maintain control of dust. Sub-base and base material would be compacted and leveled using vibratory rollers and other standard compacting equipment. Aggregate material would be placed in multiple lifts set at a maximum depth of 0.5 feet. The concrete median barrier would be placed via a concrete slip form machine. Asphalt concrete material would be hauled onto the site, and the asphalt would then be spread with a paving machine and rolled with a roller for compaction.

<u>Sub-Grade Correction at the Rowland Interchange</u>. According to Caltrans the existing sub-grade at the Rowland Interchange is failing due to poor soil conditions created by soft clay (Bay Mud) that is not able to support the existing roadbed.

Caltrans plans to remove 11 feet of existing fill and replace it with a lightweight fill material to stabilize the roadbed.

Caltrans will correct the sub-grade with a two-stage construction operation. Temporary lanes would be constructed to the outside of the mainline and traffic would be shifted. These new temporary lanes would require a temporary realignment of the northbound onramp at the Rowland Interchange. Once traffic is shifted, one half of the mainline would be dug out with excavation equipment and temporary retaining walls would be put in place to shore the excavation. Lightweight fill material would be placed 0.5 foot lifts and compacted with rollers. After the sub-grade has been reached and compacted, base and sub-base aggregates would be trucked and placed in 0.5 foot lifts and compacted with rollers. Asphalt concrete (AC) material would be hauled onto the site and the asphalt will then be spread with an AC paving machine and rolled with a roller for compaction. After the first stage is complete, traffic would be moved over to the median and the same process would be repeated for the outside lanes and shoulders. After the existing fill has been replaced, centerline and roadway edges would be re-striped.

Roadway Resurfacing and Striping. Caltrans plans to repair deteriorated localized sections of the existing pavement and put down an overlay on all of the existing six lanes of pavement to prevent reflective cracking and extend the service life of the roadway by 20 years. The centerline and roadway edges would be re-striped following rehabilitation.

Damaged roadway would be removed with a grinder or excavation equipment. The excavated material would be recycled and reused as embankment material for the fill section, or removed off-site. The dig-out areas would be patched with material and overlayed and striped during the rehabilitation process.

Culvert Improvements. According to Caltrans, the existing roadway drainage is conveyed by a depressed median to drainage inlets at low points in the median. There are thirty-five cross culverts that convey storm water to swales along the outside which then drain to adjacent water courses.

Caltrans proposes to replace the depressed median with new HOV lanes, shoulders, and a median barrier. The new roadway would sheet flow drainage towards the outside shoulders, away from the median. Through mainline horizontal curves when sheet flow drainage is directed towards the median due to super elevation, 27 existing drainage inlets would be reconfigured at the median. Cross culverts that are not needed would be abandoned in place and plugged. Caltrans determined that some of the cross culverts would need to be replaced due to deterioration or the need for a larger culvert.

After new cross-culvert construction has been completed, repaving methodology will be similar to those described for roadway rehabilitation. Existing cross culverts that are to

be abandoned would be capped with concrete at each end or filled with either a concrete slurry or sand.

California Highway Patrol (CHP) Pullouts, HOV Bypass Lanes, Ramp Metering. The addition of HOV Lanes would require the addition of HOV bypass lanes, CHP pullouts and ramp metering.

Caltrans proposes to widen existing on-ramps for HOV bypass lanes, CHP pullouts, and install ramp-metering infrastructure at all four of the existing interchanges in Segment A (State Route 37, Rowland, DeLong, and Atherton). An additional 12 foot lane would be added to the interchange ramps. The CHP pull outs would be 15 feet wide and 100 feet long. The length of the bypass lane will vary by ramp and all on-ramps within the action area would have HOV bypass lanes, CHP pullouts, and ramp-metering infrastructure.

The ramp widening would consist of importing fill material and placing in multiple lifts set at a maximum depth of 0.5 feet. The fill material would then be compacted between lifts until the sub-grade depth is met. Dump or haul trucks would transport aggregate materials for placement and compaction. Asphalt concrete material would be hauled to the site and then spread with an AC paving machine and rolled with a roller for compaction. Before AC is placed, electrical conduit would be trenched and placed for the ramp metering system infrastructure.

Sound Walls. Caltrans plans to erect sound walls at four locations within Segment A. The combined length of the four walls will be 4,770 feet.

The sound wall locations would be cleared and bulldozed to meet finished grade for the sound wall footing. The foundation type would depend on soil type. After the foundation is complete, a pile cap would be formed up with wood forming, steel would be placed within the cap, and concrete would be poured to complete the pile cap. If the sound wall is within 30 feet of the edge of travel way, the sound wall is required to be placed on a concrete protective barrier. Once the pile cap or the concrete barrier is in place, the concrete masonry blocks would be set and mortared to the top of the barrier or pile cap until the wall is complete.

Retaining Walls. Caltrans plans to construct retaining walls to reduce the widening needed to construct additional lanes at three existing ramps (the State Route 101/State Route 37 Southbound Connector, the DeLong Southbound On-Ramp, and the South of Rowland Southbound On-Ramp).

The retaining wall locations would be cleared and excavated with excavation equipment to reach grade for the retaining wall footing. Once grade is met, the footing would be formed, steel would be placed and the concrete would then be poured for the footing.

After the footing is poured, the same process would be used to build the stem wall. After the wall is complete, the excavated material would be backfilled and compacted.

In instances where a retaining wall is included in the design as a means of reducing the project footprint in the vicinity of sensitive resources, the following construction techniques and equipment will be used:

1. Retaining walls with spread footings: This work involves excavating through the existing shoulder backing to the substrate below using excavators and/or backhoes. The retaining walls would be constructed before the shoulder widening takes place and may involve the use of a crane from the roadway.

2. Retaining walls with pile foundations: This work involves constructing a retaining wall foundation which could include driven concrete or steel piles, cast-in-drilled-hole (CIDH) piles, or cast-in-steel shell (CISS) piles. If CIDH or CISS piles are used, a drill auger would be used to remove soil at the piles location.

3. Mechanically Stabilized Earth (MSE) retaining walls: This work involves constructing a retaining wall without a foundation. Precast concrete panels would be placed at the bottom of the wall to create the wall face. Reinforcing steel would connect to the wall panels and extend behind the wall. Fill would be placed in layers on top of the reinforcing steel and compacted in place. This procedure would be repeated until the wall is built up to the elevation of the highway.

If subsurface water is encountered during the drilling or excavation, the excavation will be de-watered under the direction of their Best Managmeent Practices (BMPs) of the Storm Water Pollution Prevention Plan (SWPPP). Residues may include aerially deposited lead material. If the residue exceeds the level of lead standards, the material would be deposited off-site at an approved location.

Structures. According to Caltrans, roadway widening would require modification to existing structures such as railing, sound walls, deck treatment, and bridges. Caltrans describes the proposed bridge work as follows.

> *Novato Creek Bridge*. There are two existing Novato Creek Bridges that are only wide enough to accommodate the three lanes of north or southbound traffic plus 5 foot inside shoulders and 8 to 10 foot outside shoulders. Both of the existing 192 foot long structures were built in 1974 and consist of a five-span continuous reinforced concrete T-beam superstructures on 18 inch +/- octagonal pre-stressed concrete pile bents (total 44 octagonal bent piles) and diaphragm type abutments on reinforced concrete piles.

Caltrans proposes to widen and connect the Novato Creek Bridges in the median to allow for the two HOV lanes and 10 foot shoulders. It is also proposed to replace the existing bridge barriers with current standard barriers. The widening of the existing bridges would include the construction of a new cast-in-place reinforced concrete T-beam superstructure, including new concrete bent caps and abutments. The substructure would consist of Class 140 driven pre-cast concrete piles at the abutments and driven CISS piles at the bents. The location and bearing for the new abutments and bents would match with the alignments of the existing abutments and bents. It is anticipated that four-2 foot diameter new CISS piles would be required per bent for a total of 16 piles for the 4 bents.

Caltrans would widen the Novato Creek Bridges by constructing and connecting the right and left parallel bridge structures to the median side of each of the existing bridge structures and closing the median gap. The existing bridge barrier would be replaced with current standard barriers. A portion of the existing overhang in the median would be removed. Access to the existing channel would be required for construction. (In Phase A1, the existing northbound structure would be widened to provide for the northbound HOV lane and shoulders. The complete widening and the ultimate connection of the northbound and southbound structures will not be completed until a future project phase.)

The construction of the CISS piles would likely include driving down the steel pipe pile into ground, removing the soil inside the steel pile, inserting bar reinforcing steel (rebar cages) into the steel pipe and filling the remaining void inside the steel pipe with concrete using a concrete pump truck. The piles would extend into the superstructure.

Existing pilings that need to be removed during construction or demolition (e.g. those in conflict with new bridge or falsework) would be removed by commonly practiced methods. These include pulling by crane or through use of vibratory methods. It may also be possible that some existing pilings can be left in place and cut off below ground.

According to Caltrans, temporary supports also known as falsework would be required to construct the superstructure. The falsework is used to support construction loads such as bar reinforcing steel, wet concrete and live loads (construction crew, equipment, etc). According to Caltrans, the falsework system usually consists of a series of falsework bents placed in the creek at certain intervals with steel beams (falsework stringers) spanning across the falsework bents. Plywood deckings are then placed between the steel beams to allow for the placement of bar reinforcing steel and forming/constructing the superstructure. The falsework bents may be constructed using braced steel or timber posts supported on timber pads placed on top of existing ground or supported on timber

or steel piles driven into the ground depending on the bearing capacity of the soil. Falsework piles may be completely removed or cut below the ground elevation and left in place.

Types of hammers used in piling installation would conform to Caltrans Standard Specifications (49-1.05). Impact hammers would be steam, hydraulic, air or diesel hammers sufficient to drive piles at a penetrations rate of not less than 1/8 inches per blow at the specified nominal resistance. Vibratory hammers would not be used for installation of permanent piles unless shown on the plans or specified in the special provisions. Caltrans might use vibratory hammers to install shoring, coffer dam or falsework piles unless otherwise restricted in the Contract Special Provisions or as listed in permits.

Once the falsework is complete the reinforced concrete T-beam superstructure would be constructed. After completion of the structure, all temporary falsework material would be removed, the creek banks would be stabilized and erosion control BMP's would be placed.

The Novato Creek Bridge work will be located approximately 28 meters east of potential salt marsh harvest mouse habitat. In their August 5, 2008 letter, Caltrans maintained that the bridge work will be accessed from the opposite side of the existing bridge and this pickleweed habitat would be effectively avoided.

Storm Water Quality Systems and Construction Site BMPs. The proposed project would incorporate bio-filtration strips, swales, and Austin sand filters to receive storm water discharges from the highway or other impervious surfaces. The project will also likely include off-site storm water treatment.

Bio-filtration strips would be located at the base of fill slopes and graded to flow perpendicular to the mainline. Bio-filtration swales would also be located at the base of fill slope and convey water parallel with the main line. Swales would be a graded trapezoidal channel with side slopes of 4:1 or flatter.

Bio-filtration strips and swales have the same means of construction. A backhoe and excavator would be used to excavate and set grade for the channel. After the channel is graded, it would be planted with a vegetative species that has filtration properties.

An Austin sand filter is a two-chamber device with the first chamber used to settle out larger sediment and meter flow into the second chamber. The second chamber is a sand media filter that removes the finer particulates from the influent. The treated effluent is then discharged back into the drainage system.

Construction Site BMPs. To maintain water quality during construction, Caltrans would implement BMPs to reduce unnecessary water quality impacts. The following methods and practices would be implemented:

1. Earth dikes/drainage swales and lined ditches
2. Outlet protection/velocity dissipation devices
3. Check dams
4. Silt fencing with maintenance openings
5. Fiber rolls
6. Concrete washouts
7. Drainage inlet protection
8. Construction entrance/exit protection

Staging Locations. Staging locations would be used for temporary storage of heavy construction equipment and construction materials, equipment maintenance shops, stockpile areas, and field offices. The primary staging area in Segment A would be located within the interchange at the South Novato overcrossing. According the Caltrans project description, areas that are located within the State Right-of-Way and quantified as within the project area of effect may also be used, subject to approval of the contractor submitted SWPPP. Contractors may independently seek off-site staging locations. Off-site staging locations will be subject to the requirements of resource agencies and permits will be the responsibility of the contractor.

Segment B

Nonstandard Shoulders, Vertical and Horizontal Curves. The existing State Route 101 roadway in Segment B is a four-lane expressway with two 12 foot wide lanes in each direction. Most of the existing roadway in this segment does not meet current horizontal alignment, vertical profile and sight distance requirements for the 70 mile per hour corridor design speed. The shoulders are variable width, with the outside shoulders varying from 5 to 8 feet and the inside shoulders varying from 2 to 4 feet. The non-paved median varies in width from 11 to 51 feet and contains a double thrie-beam barrier.

Caltrans plans to improve the Segment B roadway design by upgrading the existing nonstandard shoulders, constructing a HOV lane in each direction, and bringing vertical and horizontal curves to current standards. The proposed project design would include 10 foot shoulders with a concrete median barrier. Nonstandard vertical and horizontal curves would be brought to current standards to meet stopping sight distance requirements. Within the concrete medians, Type S barriers for wildlife crossing would be installed every 20 feet and Type M wildlife crossings would be installed every 0.25 miles. Type S barriers are a type 60 concrete barrier with a 6 inch diameter opening at the base of the barrier for small animal passage. Type M wildlife crossings are a type 60

concrete barrier with a 2-foot break in the barrier, with the break protected by a thrie-beam guard rail to deflect vehicle traffic.

Caltrans proposes to realign the roadway mainline to correct vertical and horizontal curves throughout Segment B.

The proposed horizontal alignment would shift from the existing alignment throughout Segment B to correct nonstandard curves. Approximately 75% of the existing alignment would be reconstructed with a new structural section. The additional 25% of Segment B would utilize the existing roadway alignment and would be widened in the median for HOV lanes and shoulders.

According to Caltrans, the proposed vertical alignment would correct nonstandard curves. The locations of the profile corrections are from approximately 229 feet south of the Redwood Landfill OC to approximately 3280 feet north of the OC; from approximately 656 feet south of San Antonio Creek to Gambini Road, and from South Kastania Road to the Petaluma River Bridge. Through these areas the proposed profile would shift the new roadway up to 28 feet above or up to 24 feet below the existing roadway.

Due to the rolling terrain in Segment B, Caltrans will use two methods for the construction of the proposed roadway realignment. When the alignment is shifted through a hillside, material would be cut from the hillside until finished grade is met. Typical equipment to be used for this method would include excavators, bulldozers, earth movers, and compaction equipment. Excess fill cut from other locations within the project would be used in areas where the roadway needs to be built up. This material would either be hauled in by trucks for long hauls, or from earth moving equipment for short hauls. Once the fill material is hauled in, it will be placed in multiple lifts set at a maximum depth of 0.5 feet. Fill material would then be compacted between lifts until the sub-grade depth is met. Dump or haul trucks would then transport aggregate materials for placement and compaction. Asphalt concrete material will be hauled to the site and then spread with an AC paving machine and rolled with a roller for compaction.

Upgrade Expressway to Freeway with the Addition of Frontage Roads. Residents, ranches, and other land uses are only directly accessible off of State Route 101 in Segment B. There are currently 31 driveways and seven at-grade intersections that connect directly to State Route 101. Also in Segment B there is no other north-south bicycle passage other than on the shoulder of State Route 101. These conditions make the State Route 101 through Segment B an expressway rather than a freeway. Caltrans proposes to upgrade Segment B to a freeway by constructing off-ramps to new frontage roads. Local access and bicycle traffic will be moved to frontage roads or a dedicated bicycle and pedestrian facility.

Therefore the proposed project will convert the existing expressway in Segment B to an access-controlled freeway. Converting the existing expressway would require reconfiguring the existing Landfill Overcrossing into an interchange, reconfiguring the Petaluma Boulevard South interchange, and building a frontage road system to maintain access to intersecting roadways and adjacent parcels, as well as replacing bicycle and pedestrian access. Bicycle access will be moved to frontage roads or a dedicated bicycle and pedestrian facility.

As previously described, due to the rolling terrain in Segment B, Caltrans will use two methods for the construction of the proposed roadway realignment. When the alignment is shifted through a hillside, material would be cut from the hillside until finished grade is met. Typical equipment to be used for this method would include excavators, bulldozers, earth movers, and compaction equipment. Excess fill cut from other locations within the project would be used in areas where the roadway needs to be built up. This material would either be hauled in by dump trucks for long hauls, or from earth moving equipment for short hauls. Once the fill material is hauled in, it will be placed in multiple lifts set at a maximum depth of 0.5 feet. Fill material would then be compacted between lifts until the sub-grade depth is met. Dump or haul trucks would then transport aggregate materials for placement and compaction. Asphalt concrete material will be hauled to the site and then spread with an AC paving machine and rolled with a roller for compaction.

Culvert Improvements. As described for Segment A, existing drainage in Segment B is conveyed by a depressed median to drainage inlets at low points in the median. Cross culverts convey the storm water to swales along the outside which drain to adjacent water courses.

The roadway realignment would replace the depressed median with new HOV lanes, shoulders, and a median barrier. These improvements would cause the sheet flow to drainage towards the outside shoulders, away from the median. Through mainline horizontal curves, where sheet flow drainage is directed towards the median due to super elevation, existing drainage inlets would be reconfigured at the median. Cross culverts that are no longer needed would be abandoned in place.

Caltrans determined that the majority of culverts are still in a state of good repair and function adequately. Some systems will require replacement due to deteriorated conditions or resizing to handle additional flow.

As described for culvert work in Segment A, Caltrans determined that some of the cross culverts would need to be replaced due to deterioration or the need for a larger culvert.

Caltrans plans to abandon unneeded culverts in place. The extension of existing box culverts may require accessing creeks.

According to an August 5, 2008 Caltrans letter, Caltrans is considering adding cross culverts, where feasible, in Segment B specifically to provide wildlife passage under State Route 101.

After new cross-culvert construction has been completed, repaving methodology will be similar to those described for roadway rehabilitation. Existing cross culverts that are to be abandoned would be capped with concrete at each end and filled with either a concrete slurry or sand.

Recurring Flooding and Culvert Improvements. Caltrans plans to replace or upgrade the majority of the drainage facilities through Segment B due to their age, capacity or condition. There are two locations, San Antonio Creek and Gunn Lane, where roadway flooding has been a problem.

Caltrans plans to realign and raise the road profile through San Antonio Creek and near Gunn Lane to alleviate recurring flooding and replace the majority of the existing culvert systems due to the proposed realignment or deteriorated condition. Cross culverts would be sized to pass design-year flows with a minimum diameter of 24 inches for maintenance and approximately 79 new cross culverts will be added.
Caltrans plans to address the flooding issue by building a fill section with a higher profile through the area. This would be constructed using the previously described methods for constructing nonstandard shoulders, vertical and horizontal curves. During construction of the new fill sections, cross-culverts would be placed as the fill section is being built. Existing drainage systems that only require extensions or reconfigurations would be installed as previously described for Segment A.

Retaining Walls. Caltrans plans to construct retaining walls to avoid a historic residence near Kastania Road, trees on the new frontage road at the Landfill Interchange, and salt marsh harvest mouse habitat near the northbound off-ramp at the Petaluma Boulevard, South Interchange.

The retaining walls near Kastania Road and the Landfill Interchange locations would be one of the three types described for Segment A.

The retaining wall near the Landfill Interchange would be a soil nail or tieback retaining structure. Soil would be excavated from the top of the wall down approximately 5 to 10 feet to the first tieback or soil nail location. Horizontal drill equipment would drill holes along the length of the wall and a post tensioned tieback tendons or soil nails would be installed and grouted in place. If post tensioned tiebacks are used, a reinforced concrete whaler would be constructed at the tieback location horizontally across the wall. Tendons would be post tensioned and locked against the concrete whaler. In either case, reinforcing steel would be placed in front of the excavation and shotcrete would be placed against the excavated hillside. If soil nails are used, they would be locked against steel

plates. The hillside would then be excavated to the next tieback or soil nail location and the process would be repeated to reach the bottom of the wall. A reinforced concrete or shotcrete facing would then be constructed to complete the wall.

Utility Relocations. The project design in Segment B would require a significant number of intricate utility relocations. According to Caltrans, the exact location and condition of the existing facilities would not be determined until positive location (potholing) work has been completed. As the designs of these relocations proceed, the remaining service life of the existing individual facilities would be calculated and a cost/benefit analysis would be performed to determine the feasibility of their retention. If retention appears to be the preferred alternative, encroachment exceptions would be requested on a case-by-case basis. Otherwise, the utility will be relocated at a location within the project footprint. Depending on the nature of the utility relocations, FHWA may reinitiate Section 7 consultation to address any additional effects to listed species not described in this biological opinion.

Structures. The proposed project includes modifications to several bridges. Of these, the San Antonio Creek Bridge (mainline), San Antonio Creek Bridge (frontage road), and the Petaluma River Bridge all cross over bodies of water, and are discussed below. Although bridge designs have not been determined, Caltrans stated in their August 5, 2008, letter that the described action area is based on the alternative with the largest footprint.

San Antonio Creek Bridge (mainline). The existing San Antonio Creek Bridges are located within an area of recurring flooding. The new San Antonio Creek Bridge would be built on a realigned portion of State Route 101, west of the existing highway, with a raised profile. The bridge is proposed as a cast-in-place concrete pre-stressed box girder with reinforced concrete bent caps and abutments. The existing northbound structure would be used for a new frontage road creek crossing and the southbound structure would be removed.

Two structure alternatives are proposed for the new bridge. Alternative 1 is a five-span structure, 634.8 feet long by 115.2 feet wide, with 4 columns per bent for a total of 16 columns for the 4 bents. Alternative 2 is a three-span structure, 428.1 feet long by 115.2 feet wide, with 4 columns per bent for a total of 8 columns for the two bents. The bridge layout for Alternative 1 and Alternative 2 are similar except that Alternative 2 includes a Mechanically Stabilized Earth (MSE) wall at abutment 1 which would result in a shorter bridge. The substructure would consist of reinforced concrete columns and abutments supported on a concrete pile cap with driven pre-cast concrete piles. The column size is expected to be approximately 5.5 feet in diameter. Each column footing size is approximately 22 by 22 by 6 feet deep. There would be approximately 25 piles per column footing. The dimensions of the pre-cast concrete pile are approximately 1.24 x 1.24 feet.

It is anticipated that the construction footprint would extend 50feet beyond each side of the edge of bridge deck. Access to the existing channel would be required for construction.

To construct the new bridge, soil at the abutment locations would be re-graded to raise the profile. If Bridge Alternative 2 is selected, the MSE wall would be constructed as the profile is raised at Abutment 1. After the profile is raised at the abutment locations, the precast concrete piles would be driven into the ground. A reinforced concrete footing would be constructed on top of the piles. Then, a reinforced concrete abutment would be constructed on the pile cap.

The contractor would excavate soil at the column footing locations. If water is anticipated at the footing elevations, cofferdams consisting of driven sheet pilings would be construction around the perimeter of the footings. If needed, cofferdams would be approximately 32 by 32 feet per column footing. After cofferdams are placed, soil would be excavated to the footing elevation. The column footing piles would then be driven with an impact hammer. If water is encountered, it would be pumped from the cofferdam to trucks or a sediment basin permitted by the Water Quality Control Board. A lean concrete seal course might be placed to minimize water intrusion. Reinforced concrete pile caps and columns would be constructed at each column footing.

To construct the new superstructure, temporary supports also known as falsework would be required. The falsework is used to support construction loads such as bar reinforcing steel, wet concrete and live loads (construction crew, equipment, etc.). The falsework system usually consists of a series of falsework bents placed at certain intervals with steel beams spanning across the falsework bents. Plywood decking is then placed between the steel beams to allow for the placement of bar reinforcing steel and forming/constructing the superstructure. The falsework bents might be constructed using steel or braced timber posts supported on timber pads which have been placed on top of existing ground or steel piles that have been driven into the ground depending on the bearing capacity of the soil. Once the falsework is complete the reinforced concrete box girder superstructure would be constructed. After completion of the structure, all temporary cofferdam and falsework material would be removed, the creek banks would be stabilized and erosion control BMP's would be placed. Falsework piles may be completely removed or cut below the ground elevation and left in place.

Bridge removal work would consist of breaking and removing the existing concrete structure. Over land, the bridge would be dropped in sections onto filter fabric or similar material and removed. Over the creek, the contractor would use approved BMP's to protect the creek from falling debris.

San Antonio Creek Bridge (frontage road). The existing historic San Antonio Creek Bridge on San Antonio Road is approximately 101 feet long and 23 feet wide. According to Caltrans the existing structure is not wide enough to provide two new12 foot-wide lanes and 5 foot wide shoulders and the historic nature of the structure does not allow it to be widened. Therefore Caltrans plans to build a new bridge to cross San Antonio Creek. The existing structure will be re-striped for a one-way bridge and a bike lane.

Two structure alternatives are proposed for the new San Antonio Creek bridge. Alternative 1 is proposed as a cast-in-place concrete slab with reinforced concrete bent caps and abutments. This seven-span bridge is approximately 227.5 feet long and 42 feet wide. The substructure would consist of Class 140 driven precast concrete piles at the abutments and driven cast-in-steel shell piles at the bents. Caltrans anticipates that five 2-foot diameter new CISS piles will be required per pier for a total of thirty for the 6-piers. Alternative 2 is proposed as a cast-in-place concrete pre-stressed box girder with reinforced concrete bent caps and abutments. This new two-span bridge would be approximately 235 feet long and 42 feet wide. The substructure would consist of reinforced concrete columns (total two) approximately 4 feet in diameter and abutments that are supported on a concrete pile cap with driven pre-cast concrete piles. The size of the column footings is approximately 28 by 28 by 6 feet. Each column footing would have approximately 25 driven piles. The size of each pile is approximately 15 x 15 inches.

Caltrans anticipates that the area required for construction activities would extend 50 feet beyond each side of the edge of bridge deck. Access to the existing channel would be required for construction.

To construct the new bridge, soil at the abutment locations would be re-graded to raise the profile. After the profile is raised at the abutment locations, the precast concrete piles would be driven into the ground. A reinforced concrete footing would be constructed on top of the piles. Then, a reinforced concrete abutment would be placed on the pile cap.

If Alternative 1 is selected, the contractor would drive CISS piles into the ground at column locations. The soil inside the steel shells would be drilled out, a reinforcing steel cage would be placed inside the shell, and concrete would be placed by a pump. The foundation piles would be extended as columns into the deck slab.

If Alternative 2 is selected, the contractor would excavate soil at the column footing locations. If water is anticipated at the footing elevations, cofferdams consisting of driven sheet pilings would be construction around the perimeter of

the footings. If needed, cofferdams would be approximately 38 by 38 feet per column footing. After cofferdams are placed, soil would be excavated to the footing elevation. The column footing CISS piles would then be driven with an impact hammer. If water is encountered, it would be pumped from the cofferdam to trucks or a sediment basin permitted by the Water Quality Control Board. A lean concrete seal course might be used to minimize water intrusion. The soil inside the steel shells will be dug out, a reinforcing steel cage would be placed inside the shell, and concrete would be placed by a pump. Reinforced concrete pile caps and columns would be constructed at each column footing.

To construct the superstructure, temporary supports also known as falsework would be required. The falsework would be used to support construction loads such as bar reinforcing steel, wet concrete and live loads (construction crew, equipment, etc). According to Caltrans, the falsework system usually consists of a series of falsework bents placed at certain intervals with steel beams spanning across the falsework bents. Plywood decking is then placed between the steel beams to allow for the placement of bar reinforcing steel and forming/constructing of the superstructure. The falsework bents might be constructed using steel or timber posts supported on timber pads which have been placed on top of existing ground or on timber or steel piles that have been driven into ground depending on the bearing capacity of the soil. Access to the existing channel would be required for pile driving, pile cap construction and falsework construction. Once the falsework is complete the reinforced concrete slab or box girder superstructure would be installed. After completion of the structure, all temporary cofferdam and falsework material would be removed, the creek banks would be stabilized and erosion control BMP's would be installed. Falsework piles may be completely removed or cut below the ground elevation and left in place.

Petaluma River Bridge. The existing Petaluma River Bridge on State Route 101 consists of two separate structures, each 885 feet long and 31 feet wide. The bridges were built in 1955.

Due to the age of the existing structures and the costs associated with bringing them up to current standards, it is proposed to replace the two existing bridges with a single bridge. There is an existing fender system protecting the bridge bents at each side of the waterway. This fender system would be removed during construction in order to facilitate bridge construction work. The new bridge would increase the span over the waterway to 210 feet long and the new Pier 3 would be located above the waterway limit. A new bridge fender system would likely be required for Pier 4 even though it would be located closer to the north bank.

Caltrans has proposed two structure alternatives for the new bridge. Both alternatives would include construction of an 855 foot long and 115 foot wide, five-span bridge. Alternative 1 would consist of a reinforced concrete box girder superstructure. Alternative 2 would consist of a Precast/Pre-stressed Concrete Bulb "T" girder superstructure. The substructure for both alternatives consists of reinforced concrete column piers supported on spread footings or on pile caps with either cast-in-drilled hole (CIDH) or cast-in-steel shell (CISS) pilings. Both alternatives would include between 3 to 5 columns per pier for a total of between 12 to 20 columns for the 4 piers. The size of the individual column footings would be approximately 35 by 28 by 7 feet deep. Caltrans anticipates that each column footing would consist of between twenty-five to forty 18-inch to 30-inch diameter CIDH or CISS pilings for each of the twelve to twenty columns.

Geotechnical investigation will be needed prior to construction of the new Petaluma River Bridge. The purpose of the investigation is to characterize the subsurface conditions and to evaluate engineering properties of the soils and/or rock for the design development of the replacement of the Petaluma River Bridge. As part of the geotechnical investigation for the proposed improvements of Segment B4 of the Marin Sonoma Narrows project, four borings, ranging from 50 to 100 feet in depth, are planned to investigate the bents of the proposed Petaluma River Bridge Replacement located north of the Petaluma River. Two of the bore sites will be located in the designated temporary staging areas and the other two will be located in the Petaluma River. Additional borings will be accessed from the State Route 101 median and performed in areas that are not identified as listed species habitat or having the potential to adversely affect listed species.
The drilling will be completed using a track-mounted drill rig, a truck-mounted drill rig, or a potable drill rig may be used to access the slopes along the east side of the freeway between the Petaluma River Bridge and the 101/116 Separation and Overhead, and the banks of the Petaluma River. A skid-mounted drill rig attached to a sectional barge will be used to explore the bent on the river bank and in the river. Drilling will be completed using rotary wash methods; the size of the borehole will be about 5 inches in diameter.

Prior to the start of the field investigation Underground Service Alert (USA) will be contacted at least 48 hours before the start of work to clear underground utilities. All boring locations will also be cleared utilizing the services of a private underground utility locator. Some locations may require that the boring first be advanced using a hand auger to a depth of at least 3 feet to check for underground utilities, and then be advanced with the drill rig.

Boring permits are required by County of Sonoma, Department of Health Services, Environmental Health Division, for completion of the borings. The permit applications will be processed by consultant, URS. The borings will be

completed during daylight hours. Traffic control will be provided during drilling pursuant to Caltrans standards and as specified in the encroachment permit. A traffic control specialty contractor will be retained to provide traffic control for other borings, where required.

Sampling in the borings will be completed at 5-foot intervals or closer intervals at changes in material type as the drilling progresses. Caltrans anticipates that the majority of the sampling will be completed using a Standard Penetration Test (SPT) or Modified California (MC) sampler. If soft cohesive soils are encountered thin-walled Shelby tube samples will also be obtained.

All soil cuttings generated during the drilling of the borings will be placed in drums and stored at an offsite location designated by Caltrans. The soil cuttings in the drums will be sampled for waste characterization (approximately 1 sample for 3 drums) and disposed of at the nearest non-hazardous waste landfill following reception of the analytical testing results and acceptance of the materials for disposal. If analytical results indicate that the soil cuttings cannot be disposed of at the nearest non-hazardous landfill further testing and analysis may be required to dispose of the drums of soil at an appropriate facility.

Waste associated with the drilling operation such as drilling fluid, material containers, and personal trash will be placed in drums or containers and moved offsite for proper disposal.

All drilling equipment and vehicles will access the drill locations using an existing designated road/path. Access will be confined to this designated route to minimize effects to adjacent pickleweed habitat for the salt marsh harvest mouse.

The two upland borings (R-08-005 and R-08-006) will be explored by using a track mounted rig. The exploration for the two borings in the Petaluma River (R-08-005A and R-08-005B) is planned using a skid-mounted CME 45 rotary drill rig attached to a sectional barge that would be floated to the proposed locations at appropriate high tide levels. The remaining proposed borings will be explored with a truck-mounted rotary drill rig.

For rotary drilling, a one-ton service truck equipped with a water tank will support the drill rig. In general, the drill rig will access the site at the beginning the job and be parked over night until drilling is complete. On the other hand, the service truck will access the site in the morning at the beginning of each shift of drilling and leave the site at the end of the day to refill for the next day. It will leave the site during the day only if the drill hole requires more water for the drilling fluid mixture. The service truck will also be used to transport drill waste containers and soil cutting drums.

The new Petaluma River Bridge would be constructed in three stages. During Stage 1, the middle portion of the new bridge would be built in between the two existing structures and the existing median barriers would be removed. During Stage 2, the existing southbound structure would be removed for the new bridge construction. During stage 3, the northbound structure would be removed to allow for the construction of the final portion of the new bridge. Pile driving for the column footings will occur year-round. Other construction activities that will occur year-round on land include: bridge demolition, vegetation clearing and planting, and road construction for site access, removal of existing piles, falsework removal and cleanup, and concrete pouring (which may involve some work over water using appropriately sealed forms).

Access to the existing channel would be required for construction. The contractor would access the north bank of the river from State Route 116 along the east side of State Route 101. The contractor would access the south bank of the river from Petaluma Boulevard South. Piers 2 and 5 are located above the banks of the Petaluma River. Pier 3 is located on land at the edge of the south bank the river. Pier 4 is located in the river, adjacent to the north bank. Caltrans anticipates that the contractor would need to construct a trestle bridge to gain access to Pier 4 and to gain access to the north side of Pier 3. The trestle would also need to be extended around the existing piers for demolition of the existing bridge and towards the center of the channel for falsework, temporary erection tower, and temporary fender pile installation. A navigational opening would be maintained for mariners on the Petaluma River. The size of the opening would be negotiated and subject to approval of the U.S. Coast Guard. At the north and south sides of the opening a temporary fender system consisting of driven piles and steel and timber barriers would be placed to protect the falsework and/or erection towers from being hit from a vessel. The contractor would drive piles in the river and place a timber deck on the pilings to create a work platform or trestle above the river. The maximum trestle size is estimated at 1000 by 36 feet. Trestle and temporary fender piles would be either steel H-piles or steel pipe piles. Pipe would be approximately 20 to 24 inches in diameter. Piles would initially be driven with a vibratory hammer. Bearing would be confirmed with an impact hammer. Caltrans anticipates that a maximum of 300 temporary trestle and fender piles would be needed. Trestle and fender piles would be between 20 to 45 feet deep and would be installed between June 15 and October 31 of any year. Caltrans estimates that the contractor would install approximately 2 to 10 trestle and/or fender piles per day. Trestle and fender piles would be installed on approximately 20 to 75 days over a three year period. When an impact hammer is used to confirm bearing, each pile would receive approximately 5 to 20 strikes. If required for noise reduction, trestle piles would be driven inside a double walled isolation casing when an impact hammer is used.

Cofferdams consisting of sheet pilings will then be installed around the perimeter of Piers 3 and 4 footings. It is anticipated that one large cofferdam approximately 135 by 38 feet would be installed per pier location. Cofferdams might also be used at Piers 2 and 4, if ground water is anticipated. Four additional cofferdams approximately 39 by 22 feet would be used during demolition of the existing column footings in the river. Cofferdams would be constructed of interlocking sheet pilings, which would be driven by a vibratory hammer. If difficult driving is encountered, an impact hammer might be used for the final few feet of installation. Cofferdams would be installed between June 15 and October 31 of any year.

According to the August 5, 2008, Caltrans letter an existing ditch that contains pickleweed and acts as a connector between two pickleweed areas on the east and west sides of the existing Petaluma River Bridges. Caltrans would construct a new bridge pier and footing at the site of the existing ditch. A new ditch would be constructed slightly south of the existing ditch to maintain flow regimes during construction. The new ditch would be culverted for three years so construction equipment can access the area to construct the new pier and footing. Once construction is complete, Caltrans would restore the ditch, which will include removing the culvert and grading it to mimic the current ditch, including the same elevation, topography, and vegetation. This will be done in order to encourage the pickleweed to self-propagate as it has in the existing ditch.

The pickleweed removal would be the first order of work at the Petaluma River Bridge, prior to any heavy equipment being brought onto the site. The pickleweed will be removed by hand and the area is expected to be re-vegetated based on previous pickleweed propagation information. Caltrans makes this assumption based on other projects such as the Guadalcanal Tidal Marsh Restoration Project on State Route 37 in Solano County where a levee was breached and pickleweed self-propagated within several years.

Additionally, the construction access road would require an approximate 25-foot long temporary culvert in the vicinity of the SMART railroad bridge. Currently drainage traverses into the Petaluma River via an open ditch that contains some pickleweed. This culvert will also be in place for approximately 3-years, during construction. At the conclusion of construction, the culvert will be removed and the ditch will be restored to pre-construction conditions

Caltrans has developed minimization and avoidance measures to address potential adverse effects to listed salmonids and will implement those measures according to the separate biological opinion issued by National Marine Fisheries.

After cofferdams are completed and cleared of salmonid issues by the fisheries biologist, the contractor would install permanent foundation piles and the soil would be excavated to the footing elevation. If final design indicates CIDH piles, the contractor would likely use temporary steel casings at pile locations to help prevent caving and control water. CIDH piles would be constructed by drilling holes to the pile tips. Slurry would also likely be placed in the holes to control water and prevent caving. Once drilling is complete, a reinforcing steel cage would be placed in the hole and concrete would be pumped to the bottom of the hole, displacing the slurry, which would be pumped into holding tanks. If final design indicates CISS piles, Caltrans anticipates that the contractor would initially drive the piles with a vibratory hammer and complete driving into bedrock with an impact hammer. Piles at Piers 3 and 4 are estimated to be between 30 to 50 feet long and each pile will receive between 200 to 600 strikes. Piles will extend to bedrock and the contractor would likely install between 2 to 20 CISS piles per day. The contractor would likely be driving piles at Piers 3 and 4 with an impact hammer for up to 60 days over an 18 month period. CISS would be installed year round from completed trestle and cofferdams. If required for noise reduction, bubble curtains would be used around CISS piles, inside of cofferdams at Piers 3 and 4, when driving with an impact hammer. After piles are driven, soil would be excavated from inside the pile shells by drilling. Slurry would likely be pumped inside the shells to displace water. A reinforcing steel cage would be placed inside the shell, and structural concrete would be pumped to the bottom of the shell, displacing the slurry. Slurry would be pumped to holding tanks.

After piles are constructed, a seal course of lean concrete would likely be placed at the bottom of the footing to prevent water intrusion. Water would be pumped from the cofferdam into a baker tanks or a sediment basin permitted by the Water Quality Control Board. Then, a reinforced concrete footing cap and columns would be constructed on top of the pilings.

To construct the superstructure, temporary supports also known as falsework would be required for Alternative 1 and temporary erection towers would be needed for Alternative 2. The falsework would be used to support construction loads such as bar reinforcing steel, wet concrete and live loads (construction crew, equipment, etc). According to Caltrans, the falsework system usually consists of a series of falsework bents placed at certain intervals with steel beams spanning across the falsework bents. Plywood decking is then placed between the steel beams to allow for the placement of bar reinforcing steel and forming/constructing the superstructure. The falsework bents might be constructed using steel or timber posts supported on timber pads which have been placed on top of existing ground or on timber or steel piles that have been driven into ground depending on the bearing capacity of the soil. Temporary erection towers are needed to provide temporary support and a work platform for splicing precast concrete bulb T-

Girders. Erection towers would be supported by piles driven in the water. Steel and/or timber posts, beams, and lateral supports would complete the tower to the bottom of the superstructure elevation. Falsework or temporary erection piles would be either steel H-piles or steel pipe piles. The pipe would be approximately 20 to 24 inches in diameter. Piles would initially be driven with a vibratory hammer. Bearing would be confirmed with an impact hammer. It is estimated that a maximum of 160 falsework or temporary erection piles would need to be driven in Petaluma River. Falsework or temporary erection piles would be between 20 to 45 feet deep and would be installed between June 15 and October 31 of any year. Caltrans estimates that the contractor would install approximately 2 to 20 falsework or temporary erection piles per day. Trestle piles would be installed on approximately 20 to 80 days over a three year period. When an impact hammer is used to confirm bearing, each pile would receive approximately 5 to 20 strikes. If required for noise reduction, falsework or temporary erection piles would be driven inside a double walled isolation casing when an impact hammer is used.

After the completion of the Stage 1 bridge construction, the existing northbound bridge would be removed. After the completion of the Stage 2 bridge construction, the existing southbound bridge would be removed. For the portion of the structure over the waterway, the structure would likely be removed by saw cutting between precast concrete girders and then using crane(s) to lift the girders out of place. Subject to the engineer's approval, the crane(s) would likely be located at the adjacent spans of the bridge or barge cranes would be utilized to remove the girders. Bridge removal protective cover, if necessary, would be attached to the existing bridge soffit/bents. Cofferdams of approximately 39 feet long by 22 feet wide each (total 4) would be required for the removal of the existing columns and/or spread footings at Pier 5 and Pier 6. Access would be gained by using the temporary trestle.

For bridge demolition work on non-waterway areas, the columns would likely be tipped over and demolished on ground or on protective ground cover such as crane mats etc. Existing footings in water and on banks would be removed to a required minimum elevation or distance below original ground.

After completion of the new bridge, all temporary cofferdam, temporary fender system, temporary erection tower, and falsework material would be removed. Piles would be removed by vibrating and/or pulling the piles with a crane. Alternatively, the piles may be cut at an elevation specified by the U.S. Coast Guard and left in place below existing grade. A new permanent pier protective system consisting of either a closed fill system or a fender system of driven piles and barriers would be placed to protect the new bridge Pier 4. The permanent fenders would consist of approximately 60 driven piles. Piles would be made of

steel pipe, steel H, or timber. Pipe would be approximately 20 to 24 inches in diameter. Piles would initially be driven with a vibratory hammer. Bearing would be confirmed with an impact hammer. Permanent fender piles would be between 20 to 45 feet deep and would be installed between June 15 and October 31 of any year. It is estimated that the contractor would install approximately 2 to 20 permanent fender piles per day. Permanent piles would be installed during approximately 3 to 15 days over a three year period. When an impact hammer is used to confirm bearing, each pile would receive approximately 5 to 20 strikes. If required for noise reduction, permanent fender piles would be driven inside a double walled isolation casing when an impact hammer is used.

The creek banks would then be stabilized and erosion control BMP's would be implemented.

Storm Water Quality Systems and Construction Site BMPs. The proposed project would incorporate bio-filtration strips and swales to receive storm water discharges from the highway or other impervious surfaces. The project would also likely include off-site storm water treatment.

The Segment B on-site storm water treatment would include bio-filtration strips, bio-filtration swales, and Austin sand filters. The installation of these features were discussed in the Segment A project description.

Construction Site BMPs. To maintain water quality during construction, Caltrans would implement BMPs to reduce unnecessary water quality impacts. The following methods and practices would be implemented:

1. Earth Dikes/Drainage Swales and Lined Ditches
2. Outlet Protection/Velocity Dissipation Devices
3. Check Dams
4. Silt Fencing with Maintenance Openings
5. Fiber Rolls
6. Concrete Washouts
7. Drainage Inlet Protection
8. Construction Entrance/Exit Protection

Staging Locations. Caltrans would use staging locations for temporary storage of heavy construction equipment and construction materials, equipment maintenance shops, stockpile areas, and field offices. The primary staging areas in Segment B would be located within the new interchange at the Sanitary Landfill Road (Station 1405-1409), at the new interchange off of Kastania Road (Station 2039-2045), and below and along the sides of the Petaluma River Bridge (Station 2053-2055). Caltrans proposes areas that are located within the State Right-of-Way and quantified as within the project area of effect,

subject to approval of the contractor submitted SWPPP. Contractors may independently seek off-site staging locations. Off- site staging locations will be subject to the requirements of resource agencies and permits will be the responsibility of the contractor.

Segment C

HOV Lane Construction. The existing State Route 101 Segment C roadway travels through the City of Petaluma. This segment is classified as a freeway, and includes two 12 foot lanes in each direction, 10 foot outside shoulders and 5 foot inside shoulders. The majority of existing curves in Segment C meet current horizontal alignment, vertical profile and sight distance requirements for the 70 mile per hour corridor design speed with the exception of the Petaluma Overhead. The existing Petaluma Overhead vertical profile is nonstandard and would be brought to current standards with this project. The non-paved median varies in width from 28 to 35 feet and contains a double thrie-beam barrier. The majority of the drainage facilities through Segment C can be utilized with only minor modifications and no historical drainage issues or recurring flooding has been documented.

In Segment C, Caltrans proposes to add a 12 foot wide HOV lane in each direction between south of the Lakeville Highway/State Route 116 Interchange and north of the Corona Road Overcrossing. The new roadway would be separated by a concrete barrier and would include 10 foot-wide inside shoulders. The majority of the widening would be in the median, with some outside widening. The roadway would be reconstructed at the approaches to the North Petaluma Overhead to correct the existing nonstandard vertical alignment. The proposed profile would be a new roadway located up to 17 feet above the existing roadway.

The HOV roadway construction would be completed as described for Segment A.

Vertical Curve Correction at the Petaluma Overhead. Caltrans plans to reconstruct the vertical profile through the Petaluma Overhead to achieve standard specification and replace the structure. The work would be completed in three stages. The first stage would consist of constructing the median portion of the overhead and fill the section leading up to both sides of the structure. Temporary retaining walls would be set in place for the fill section and imported material would be trucked in and placed in 0.5 foot lifts. Each lift would be spread and compacted with grading compacting equipment. The structural section would then be placed and compacted using the same methodology as described for HOV construction. Once the median is constructed, northbound traffic would be shifted to the median, and the same process would be used to construct the northbound portion of the vertical curve correction. Finally, northbound traffic would be moved to the new northbound lanes and southbound traffic would be shifted to the median for construction of the southbound lanes.

Roadway Resurfacing and Striping. Roadway resurfacing and striping for Segment C would use the same methodology as that described for Segment A.

Culvert Improvements. As described for the previous segments existing roadway drainage in Segment C is conveyed by a depressed median to drainage inlets at low points in the median. Segment C includes fifteen cross culverts that convey storm water to swales along the outside of the roadway which drain to adjacent water courses.

Caltrans would replace the depressed median with new HOV lanes, shoulders, and a median barrier. These improvements would result in sheet flow drainage towards the outside shoulders, away from the median. Sixteen existing drainage wells will be reconfigured at the median in Segment C. Cross culverts that are no longer needed would be abandoned in place and plugged. Caltrans has determined that most of the existing culverts are adequate but some would require replacement due to deterioration and improper sizing.

The construction methods for removing, installing, and extending culverts are as described for Segment A.

CHP Pullouts, HOV Bypass Lanes, and Ramp Metering. The addition of CHP pullouts, HOV bypass lanes, and ramp metering in Segment C will be similar to the methodology described for Segment A. These features will be added Landfill, Petaluma Boulevard South, State Route 116/Lakeville, and East Washington interchanges.

Sound Walls. Caltrans will construct new sound walls at four locations within Segment C. These locations include Ponderosa Drive to East Washington, North of Lynch Creek, Napa Drive to Corona Road, and East Washington to north of Lynch Creek. The combined length of the new walls would be approximately 12,230 feet.

Retaining Walls. Caltrans plans to construct three retaining walls for structural reasons in Segment C. The walls will be located north on both sides of the Petaluma Bridge and from McGregor Avenue Drive to East Washington. The combined length of the retaining walls in Segment C would be 3,635 feet long and will vary between 4 and 7 feet high. The walls will be constructed as described in Segment A.

Structures. Six bridges would be modified for the widening and include the structures at Route 101/116, Caulfield Lane, East Washington Street, Washington Creek, Lynch Creek, and North Petaluma. Only the two creek crossings are further described as follows.

Washington Creek Bridge. The existing 67 foot-long Washington Creek Bridges accommodate two 12 foot-wide lanes of traffic and one 2 foot-wide inside shoulder and a 4 foot-wide outside shoulder in each direction.

Caltrans plans to widen both bridges in order to add the 12 foot wide HOV lane along with 10 foot-wide shoulders and HOV bypass. The existing twin bridges will be widened by connecting the right and left bridges and matching the existing structures to make a total width of 139.8 feet. It is also proposed that the existing bridge barriers with current standard barriers be replaced.

Access to the existing channel would be required for construction. Widening would involve the construction of a new cast-in-place reinforced concrete slab superstructure including new concrete bent caps and abutments. The substructure would consist of class 140 driven steel shell piles approximately 1.2 feet in diameter at the abutments and piers. Caltrans anticipates that there would be 11 new driven steel shell piles (pier columns) per pier for a total of 22 for the two piers. The piles would extend into the superstructure.

The Washington Creek Bridge would be constructed using the same methods described for Segment B.

Lynch Creek Bridge. The two Lynch Creek Bridges are only wide enough to accommodate two 12 foot wide lanes along with 2 foot wide inside shoulders and 4 foot wide outside shoulders. Both of the existing bridges were built in 1955 and consist of a three-span continuous reinforced concrete slab superstructure on reinforced concrete pile bents and reinforced concrete "U" open abutments.

As with the Washington Creek Bridge, Caltrans plans to widen the Lynch Creek Bridges to accommodate an additional 12 foot-wide HOV lane, 10 foot wide shoulders, and a ramp taper. Caltrans also plans to replace the existing bridge barriers with current standard barriers.

Access to the existing channel would be required for construction. Caltrans would widen the Lynch Creek Bridge by constructing and connecting parallel bridge structures to the median side of each of the existing bridge structures and closing the median gap as well as constructing and connecting a parallel bridge structure to the northbound side of the existing bridge. Caltrans would construct the widened portions of the bridge similar to the existing structure so that the widened portions match the existing structure in strength, durability, and flexibility.

Caltrans also plans to construct a sound wall on a bridge barrier on the southbound side of the structure. According to Caltrans, the widening of the existing bridge would require the construction of new a cast-in-place reinforced concrete slab superstructure including new concrete bent caps and abutments. The substructure consists of Class 140 (12 by 12 inch) driven precast concrete piles

Caltrans anticipates that there would be 10 new driven precast concrete piles (pier columns) per pier for a total of 20 piles for the 2 piers. The piles would extend into the superstructure.

The location and bearing for the new abutments and bents would match with the alignments of the existing abutments and bents. The use of falsework and erosion control BMPs would be similar to that used for the other bridges in this project.

Storm Water Quality Systems and Construction Site BMPs. Segment C would use the same BMPs as described for Segment B.

Construction Site BMPs. Segment C would use the same BMPs as described for Segment B.

Staging Locations. Caltrans would use staging locations for temporary storage of heavy construction equipment and construction materials, equipment maintenance shops, stockpile areas, and field offices. The primary staging areas in Segment C would be located within the State Route 116 Interchange. Caltrans proposes to use areas that are located within the State Right-of-Way and quantified as within the project area of effect, subject to approval of the contractor submitted SWPPP. Contractors may independently seek off-site staging locations. Off- site staging locations will be subject to the requirements of resource agencies and permits will be the responsibility of the contractor.

Construction Site Restoration

Caltrans plans to restore areas of temporary ground disturbances, including storage and staging areas, and temporary roads. These areas will be re-contoured, if appropriate, and revegetated with seeds and/or cuttings of appropriate plant species to promote restoration of the area to pre-project conditions. Caltrans defines areas of "temporary" disturbance to be any area that is disturbed during the project, but that after project completion will not be subject to further disturbance and has the potential to be revegetated. Caltrans will be developing a restoration plan that will be submitted to the Service for comment prior to initial ground breaking. According to Caltrans, to the maximum extent practicable (i.e., presence of natural lands), topsoil will be removed, cached, and returned to the site according to successful restoration protocols. Loss of soil from run-off or erosion will be prevented with straw bales, straw wattles, or similar means provided they do not entangle, block escape or dispersal routes of listed animal species.

Proposed Avoidance and Minimization Measures

According to the May 2008 Biological Assessment and the revised project description provided by Caltrans on August 27, 2008, FHWA/Caltrans propose to avoid, minimize, and compensate for effects to listed species by implementing the following measures:

Federally Listed Plants

If listed plants may be affected by the project, Caltrans will implement the following:

1. Minor design modifications will be made to avoid effects to listed plant species.

2. Any area where federally listed plants and/or populations have been observed within the temporary work area will be designated an Environmentally Sensitive Area and marked in the field with orange construction fencing.

3. The location of all Environmentally Sensitive Area's will be shown on project construction drawings and noted for monitoring during construction.

4. Preconstruction botanical surveys will be conducted prior to construction during the appropriate time of year (during spring and early summer), by qualified botanists familiar with the regional flora, and will follow Service, California Department of Fish and Game, and CNPS approved protocols.

California Red-Legged Frog

1. To compensate for the potential effects to 203.78 acres of California red-legged frog habitat Caltrans and FHWA will provide compensation at a 1:1 ratio totaling approximately (203.78 acres). This compensation, which is being provided pursuant to CEQA/NEPA and FHWA policies on mitigating effects to natural lands, and which is incorporated as part of the project description, will be achieved using a combination of the following:

    a. Purchasing credits at a resource agency approved mitigation bank servicing the action area;

    b. Purchasing conservation easements at or as close to the project site as practical within Marin and/or Sonoma Counties;

    c. Purchasing fee title and preserving the land for California red-legged frog at or as close to the project site as practical within Marin and/or Sonoma Counties.

Compensation may be provided by Caltrans itself or to the extent feasible with the assistance of a state or local partner such as a park or open space district or a resource conservation district. Compensation for California red-legged frog will be provided before or concurrent with the project effects to California red-legged frog for each project Construction Phase.

2. A Service-approved biologist(s) will be designated for the construction phase activities in Segment B and Segment C that will affect California red-legged frog habitat. The qualified biologist(s) will be on-site during specific construction activities for each construction phase work in potential California red-legged frog habitat. The qualifications of the biologist(s) will be presented to the Service for review and written approval prior to ground-breaking at the project site. The biologist(s) will coordinate through the Resident Engineer, to stop any work that may result in take of the California red-legged frog. If work is stopped, the biologist(s) will notify the Service by telephone and electronic mail within one (1) working day. The Service contact will be Chris Nagano, Division Chief, Endangered Species Program at the Sacramento Field Office at telephone (916) 414-6600.

3. The Resident Engineer will halt work and immediately contact the Service-approved project biologist(s) and the Service in the event that a California red-legged frog gains access to a construction zone. The Resident Engineer will suspend construction activities in the immediate construction zone within Segment B and Segment C for each specific project phase that may affect California red-legged frog habitat until the animal leaves the site voluntarily or is removed by the biologist(s) to a release site using Service-approved handling techniques.

4. All construction supervisory personnel for each specific project phase within Segment B and Segment C that are working in areas of potential endangered species habitat will attend an environmental education program delivered by the Service approved biologist prior to working on the project site. The program will include an explanation as how to best avoid the accidental take of California red-legged frogs. The Service approved biologist(s) will conduct a training session that would be scheduled as a mandatory informational field meeting by the Caltrans Resident Engineer for all construction contractor supervisory personnel. The field meeting will include topics on species identification, life history, descriptions, and habitat requirements during various life stages. Emphasis will be placed on the importance of the habitat and life stage requirements within the context of project maps showing areas where minimization and avoidance measures are being implemented. The program will include an explanation of appropriate federal and state laws protecting endangered species as well as the importance of compliance with Caltrans and various resource agency conditions.

5. To minimize temporary disturbances in areas of potential California red-legged frog habitat, project related vehicle traffic within Segment B and Segment C for construction phases with potential California red-legged frog habitat will be restricted to established roads, construction areas, and other designated areas. These areas also should be included in pre-construction surveys and, to the maximum extent practicable, should be established in locations disturbed by previous activities to prevent further adverse effects. Project related vehicles will observe a 20-mile per hour speed limit within Segment B and Segment C for construction phases with potential California red-legged frog habitat, except on County roads, and State and Federal highways. Off-road traffic outside of designated action areas of Segment B and Segment C for construction phases with potential California red-legged frog habitat will be prohibited.

6. Dust control measures will be implemented within Segment B and Segment C for construction phases with potential California red-legged frog habitat, consisting of regular truck watering of constriction access areas and disturbed soil areas with the use of organic soil stabilizers to minimize airborne dust and soil particles generated from graded areas. Regular truck watering will be a requirement of the construction contract. In addition, for disturbed soil areas, an organic tackifier to control dust emissions blowing off of the right-of-way or out of the construction area during construction will be included in the contract special provisions. Watering guildelines for dewatering will be established to avoid any excessive run-off that may flow into contiguous areas. Any material stockpiles will be watered, sprayed with tackifier or covered, to minimize dust production and wind erosion.

7. Project employees will be provided with written guidance governing vehicle use, speed limits on unpaved roads, fire prevention, and other hazards.

8. To eliminate an attraction to predators of the California red-legged frog, all food-related trash items such as wrappers, cans, bottles, and food scraps will be disposed of in closed containers and removed at least once a day from the action area.

9. To avoid injury or death of a California red-legged frog, no firearms will be allowed in the action area except for those carried by authorized security personnel, or local, State, or Federal law enforcement officials.

10. To prevent harassment, injury or mortality of a California red-legged frog or destruction of their refuge, project personnel will not be permitted to have dogs or cats in the action area.

11. Use of rodenticides and herbicides in the action area will be used in such a manner to prevent primary or secondary poisoning of a California red-legged frog and the depletion of vegetation on which they depend. All uses of such compounds will observe label and other restrictions mandated by the U.S. Environmental Protection Agency, California Department of Food and Agriculture, and other appropriate State and Federal regulations, as well as additional project-related restrictions deemed necessary by the Service or the California Department of Fish and Game.

12. Dedicated fueling and refueling practices will be designated as part of the approved SWPPP. Dedicated fueling areas will be protected from storm water run-on and run-off and will be located at least 50 feet from downslope drainage facilities and water courses. Fueling must be performed on level-grade areas. On site fueling will only be used where it is impractical to send vechicles and equipment off-site for fueling. When fueling must occur on-site, the contractor will designate an area to be used subject to the approval of the Resident Engineer, representing Caltrans. Drip pans or absorbent pads will be used during on-site vehicle and equipment fueling.

13. All grindings and asphaltic-concrete waste will be stored within previously disturbed areas absent of California red-legged frog habitat and at a minimum of 150 feet from any downstream riparian habitat, aquatic habitat, culvert, or drainage feature.

14. For each specific project phase within Segment B and Segment C, and to the extent practicable, areas outside of the construction zones containing suitable habitat for the California red-legged frog will be delineated with high visibility temporary fencing at least 4 feet in height, flagging, or other barrier to prevent encroachment of construction personnel and equipment onto sensitive areas during construction activities. The fencing will be removed only when all construction equipment is removed from the site. No project activities will occur outside the delineated project construction area.

15. If requested, before, during, or upon completion of ground breaking and construction activities, Caltrans will allow access by Service personnel to the action area to inspect project effects to California red-legged frogs and their habitats. Due to safety concerns, Caltrans requests that Service staff check in with the Resident Engineer prior to accessing the construction site.

16. For work on each construction phase within Segment B and Segment C that may affect California red-legged frog habitat, a Service-approved biologist(s) will be on-site to monitor the initial ground disturbance activities for the road construction. The biologist(s) will perform a clearance survey immediately prior

to the initial ground disturbance. Safety permitting, the Service-approved biologist(s) will investigate areas of disturbed soil for signs of listed species within thirty (30) minutes following the initial disturbance of that given area.

17. To prevent inadvertent entrapment of California red-legged frogs during work within construction Phase B4, all excavated, steep-walled holes or trenches more than 2 feet deep will be covered at the close of each working day by plywood or similar materials. Alternatively, an additional 4-foot high vertical barrier, independent of exclusionary fences, may be used to further prevent the inadvertent entrapment of California red-legged frogs. If it is not feasible to cover an excavation or provide an additional 4-foot high vertical barrier, independent of exclusionary fences, one or more escape ramps constructed of earth fill or wooden planks will be installed. Before such holes or trenches are filled, they must be thoroughly inspected for trapped animals. If at any time a trapped listed animal is discovered, the on-site biologist will immediately place escape ramps or other appropriate structures to allow the animal to escape, or the Service will be contacted by telephone for guidance. The Service will be notified of the incident by telephone and electronic mail within one working day.

18. Plastic mono-filament netting (erosion control matting) or similar material will not be used at the project site because California red-legged frogs may become entangled or trapped in it. Acceptable substitutes include coconut coir matting or tackified hydroseeding compounds.

19. Injured California red-legged frogs will be cared for by a licensed veterinarian or other qualified person such as the on-site biologist; dead individuals must be placed in a sealed plastic bag with the date, time, location of discovery, and the name of the person who found the animal; the carcass should be kept in a freezer; and held in a secure location. The Service and the California Department of Fish and Game will be notified within one (1) working day of the discovery of death or injury to a California red-legged frog that occurs due to project related activities or is observed at the project site. Notification will include the date, time, and location of the incident or of the finding of a dead or injured animal clearly indicated on a USGS 7.5 minute quadrangle and other maps at a finer scale, as requested by the Service, and any other pertinent information. The Service contacts are Chris Nagano, Division Chief, Endangered Species Program at the Sacramento Fish and Wildlife Office (916/414-6600), and Dan Crum, Resident Agent-in-Charge of the Service's Law Enforcement Division at 916/414-6660. The California Department of Fish and Game contact is Mr. Scott Wilson at telephone (707) 944-5563. Sightings of any listed or sensitive animal species should be reported to the California Natural Diversity Database of the California Department of Fish and Game

20. Caltrans will submit post-construction compliance reports for each Segment B and Segment C construction phase with potential California red-legged frog habitat, prepared by the on-site biologist, to the Service within sixty (60) calendar days following completion of each phase with potential California red-legged frog habitat or within sixty calendar days of any break in construction activity lasting more than sixty calendar days. This report will detail (1) dates that construction occurred; (2) pertinent information concerning the success of the project in implementing avoidance and minimization measures for listed species; (3) an explanation of failure to meet such measures, if any; (4) known project effects on California red-legged frogs, if any; (5) occurrences of incidental take of any of these species; (6) documentation of employee environmental education; and (7) other pertinent information. The reports will be addressed to the Deputy Assistant Field Supervisor of the Endangered Species Program, Sacramento Field Office of the Service.

Salt Marsh Harvest Mouse

Caltrans stated in their August 5, 2008 letter that the following measures would be implemented during activities associated with the Petaluma Bridge. Caltrans will avoid potential salt marsh harvest mouse habitat adjacent to the action area at other locations.

1. Caltrans will begin restoration of all salt marsh harvest mouse pickleweed and upland habitat associated with the action area to baseline or better conditions following the completion of construction at the Petaluma River Bridge. Successful establishment of baseline or better salt marsh harvest mouse pickleweed habitat should be achieved within three years.

2. A Service and the California Department of Fish and Game approved biologist will be designated for construction activities for Construction Phase B4. The qualified biologist(s) will be on-site during specific construction activities for each project activity that may have adverse effects to the salt marsh harvest mouse. The qualifications of the biologist(s) will be presented to the Service and the California Department of Fish and Game for review and written approval prior to ground-breaking at the project site. The biologist(s) will coordinate through the Resident Engineer, to stop any work that may result in take of these listed animal species. If work is stopped, the biologist(s) will notify the Service and the California Department of Fish and Game by telephone and electronic mail within one working day. The Service contact will be Chris Nagano, Division Chief, Endangered Species Program at the Sacramento Field Office at telephone (916) 414-6600. The California Department of Fish and Game contact is Mr. Scott Wilson at (707) 944-5563.

3. The Resident Engineer will halt work and immediately contact the Service and California Department of Fish and Game approved biologist and the Service and the California Department of Fish and Game in the event that a salt marsh harvest mouse gains access to a construction zone. The Resident Engineer will suspend construction activities in the immediate construction zone for work in Construction Phase B4 that could have adverse effects to the salt marsh harvest mouse until the animal leaves the site voluntarily.

4. All supervisory construction personnel for Construction Phase B4 that are working in areas of potential endangered species habitat will attend an environmental education program delivered by the Service and California Department of Fish and Game approved biologist prior to working on the project site. The program will include an explanation as how to best avoid the accidental take of salt marsh harvest mouse. The Service and California Department of Fish and Game approved biologist(s) will conduct a training session that would be scheduled as a mandatory informational field meeting by the Caltrans Resident Engineer for all construction contractor supervisory personnel. The field meeting will include topics on species identification, life history, descriptions, and habitat requirements during various life stages. Emphasis will be placed on the importance of the habitat and life stage requirements within the context of project maps showing areas where minimization and avoidance measures are being implemented. The program will include an explanation of appropriate federal and state laws protecting endangered species as well as the importance of compliance with Caltrans and various resource agency conditions.

5. To minimize temporary disturbances for work in areas of potential salt marsh harvest mouse habitat, project related vehicle traffic within Construction Phase B4 will be restricted to established roads, construction areas, and other designated areas. These areas also should be included in preconstruction surveys and, to the maximum extent practicable, should be established in locations disturbed by previous activities to prevent further adverse effects. Project related vehicles will observe a 20-mile per hour speed limit within Construction Phase B4, except on County roads, and State and Federal highways. Off-road traffic outside of designated action areas within Construction Phases B2 and B4 will be prohibited.

6. Dust control measures will be implemented within Construction Phase B4, consisting of regular truck watering of constriction access areas and disturbed soil areas with the use of organic soil stabilizers to minimize airborne dust and soil particles generated from graded areas. Regular truck watering will be a requirement of the construction contract. In addition, for disturbed soil areas, an organic tackifier to control dust emissions blowing off of the right-of-way or out of the construction area during construction will be included in the contract special provisions. Watering guildelines for dewatering will be established to

avoid any excessive run-off that may flow into contiguous areas. Any material stockpiles will be watered, sprayed with tackifier or covered, to minimize dust production and wind erosion.

7. Project employees will be provided with written guidance governing vehicle use, speed limits on unpaved roads, fire prevention, and other hazards.

8. To eliminate an attraction to predators of the salt marsh harvest mouse, all food-related trash items such as wrappers, cans, bottles, and food scraps will be disposed of in closed containers and removed at least once a day from the action area.

9. To avoid injury or death of the salt marsh harvest mouse, no firearms will be allowed in the action area except for those carried by authorized security personnel, or local, State, or Federal law enforcement officials.

10. To prevent harassment, injury or mortality of a salt marsh harvest mouse or destruction of their refuge/nesting areas by dogs or cats, project personnel will not be permitted to have dogs or cats in the action area.

11. Rodenticides and herbicides in the action area will be used in such a manner to prevent primary or secondary poisoning of salt marsh harvest mouse and the depletion of vegetation on which they depend. All uses of such compounds will observe label and other restrictions mandated by the U.S. Environmental Protection Agency, California Department of Food and Agriculture, and other appropriate State and Federal regulations, as well as additional project-related restrictions deemed necessary by the Service or the California Department of Fish and Game.

12. Dedicated fueling and refueling practices will be designated as part of the approved SWPPP. Dedicated fueling areas will be protected from storm water run-on and run-off and will be located at least 50 feet from downstream drainage facilities and water courses. Fueling must be performed on level-grade areas. On site fueling will only be used where it is impractical to send vechicles and equipment off-site for fueling. When fueling must occur on-site, the contractor will designate an area to be used subject to the approval of the Resident Engineer, representing Caltrans. Drip pans or absorbent pads will be used during on-site vehicle and equipment fueling.

13. All grindings and asphaltic-concrete waste will be stored within previously disturbed areas absent of salt marsh harvest mouse habitat and at a minimum of 150 feet from any downslope riparian habitat, aquatic habitat, culvert, or drainage feature.

14. To minimize or avoid the loss of individual salt marsh harvest mice from construction activities in the Petaluma River area, pickleweed vegetation will be hand-removed. Following removal, a special 2-foot high fence consisting of plastic sheeting will be placed 20 feet from the boundaries of construction areas in and adjacent to the pickleweed areas after the vegetation is removed. The fence will be held in place with 2-inch wide and 3-foot long stakes and will be buried in a 6 to 8 inch deep trench to prevent mice from pushing under the fence. These methods will occur with the approval of and in coordination with the California Department of Fish and Game.

15. Prior to commencing construction work for Contract Phase B4 that can have adverse effects to salt marsh harvest mouse, and to the extent practicable, areas outside of the construction zones containing suitable habitat for salt marsh harvest mouse will be delineated with high visibility temporary fencing at least 4 feet in height, flagging, or other barrier to prevent encroachment of construction personnel and equipment onto sensitive areas during construction. The fencing will be removed only when all construction equipment is removed from the site. Actions within the action area will be limited to vehicle and equipment operation on existing roads. No construction activities will occur outside the delineated project construction area.

16. Caltrans will minimize effects on potential habitat at Location 4 by restricting construction to within 100 feet of the existing Caltrans ROW. The closest potential habitat for salt marsh harvest mouse was found approximately 150 feet from the existing Caltrans ROW.

17. If requested, before, during, or upon completion of ground breaking and construction activities, Caltrans will allow access by the Service and/or California Department of Fish and Game personnel to the project site to inspect project effects to the salt marsh harvest mouse and their habitats. Due to safety concerns, Caltrans requests that Service staff check in with the Resident Engineer prior to accessing the construction site.

18. For work within Construction Phase B4 that could have adverse effects to salt marsh harvest mouse, a Service and California Department of Fish and Game approved biologist will be on-site to monitor the initial ground disturbance activities for the road construction. The biologist will perform a clearance survey immediately prior to the initial ground disturbance. Safety permitting, the Service and California Department of Fish and Game approved biologist(s) will investigate areas of disturbed soil for signs of listed species within thirty (30) minutes following the initial disturbance of that given area.

19. To prevent inadvertent entrapment of salt marsh harvest mouse during construction, all excavated, steep-walled holes or trenches more than 2 feet deep will be covered at the close of each working day by plywood or similar materials. Alternatively, an additional 2-foot high vertical barrier, independent of exclusionary fences, may be used to further prevent the inadvertent entrapment of salt marsh harvest mice. If it is not feasible to cover an excavation or provide an additional 2-foot high vertical barrier, independent of exclusionary fences, one or more escape ramps constructed of earth fill or wooden planks will be installed. Before such holes or trenches are filled, they must be thoroughly inspected for trapped animals. If at any time a trapped listed animal is discovered, the on-site biologist will immediately place escape ramps or other appropriate structures to allow the animal to escape, or the Service and/or California Department of Fish and Game will be contacted by telephone for guidance. The Service will be notified of the incident by telephone and electronic mail within one working day.

20. Injured salt marsh harvest mice will be cared for by a licensed veterinarian or other qualified person such as the on-site biologist; dead individuals must be placed in a sealed plastic bag in which a piece of paper is placed that contains the date, time, location of discovery, and the name of the person who found the animal; the carcass should be kept in a freezer; and held in a secure location. The Service and the California Department of Fish and Game will be notified within one (1) working day of the discovery of death or injury to a salt marsh harvest mouse that occurs due to project related activities or is observed at the project site. Notification will include the date, time, and location of the incident or of the finding of a dead or injured animal clearly indicated on a USGS 7.5 minute quadrangle and other maps at a finer scale, as requested by the Service, and any other pertinent information. The Service contacts are Chris Nagano, Division Chief, Endangered Species Program at the Sacramento Fish and Wildlife Office (916/414-6600), and Dan Crum, Resident Agent-in-Charge of the Service's Law Enforcement Division at 916/414-6660. The California Department of Fish and Game contact is Mr. Scott Wilson at telephone (707) 944-5563. Sightings of any listed or sensitive animal species should be reported to the California Natural Diversity Database of the California Department of Fish and Game.

21. Caltrans will submit a post-construction compliance report for Construction Phase B4 prepared by the on-site biologist to the Service within sixty (60) calendar days following completion of Construction Phase B4 or within sixty (60) calendar days of any break in construction activity lasting more than sixty calendar days. This report will detail (1) dates that construction occurred; (2) pertinent information concerning the success of the project in implementing avoidance and minimization measures for listed species; (3) an explanation of failure to meet such measures, if any; (4) known project effects on the salt marsh harvest mouse, if any; (5) occurrences of incidental take of this listed species; (6) documentation

of employee environmental education; and (7) other pertinent information. The report will be addressed to the Deputy Assistant Field Supervisor of the Endangered Species Program.

According to the revised project description received by the Service on December 2, 2008, Caltrans plans to implement the following measures during the geotechnical investigation activities associated with construction of the Petaluma Bridge.

1. When accessing the designated temporary staging area, located between the north bank of Petaluma River and the toe of the north approach embankment, a qualified biologist will monitor the site access path taken by the drilling equipment. Along the access path near any salt marsh harvest mouse habitat designated by the biologists, plywood boards (4 feet by 8 feet) will be placed to temporarily form a pathway for the drilling equipment. A steel plate will be used to provide temporary crossing platform of a drainage ditch.

2. Maintain all vehicles and drill rigs will be inspected frequently and maintained to repair leaks.

3. Drip pans or drop cloths will be used to catch drips and spills. Drain and replace motor oil, radiator coolant, or other fluid will be conducted off site. All spent fluids will be collected, stored in labeled separate containers, and recycled whenever possible. All fuels, oils and lubricants will be kept within secondary containment.

4. Perform major maintenance, repair jobs and vehicle and equipment washing will be performed off-site when feasible, or in designated and controlled areas on-site.

5. Vehicles will be washed at an appropriate off-site facility. If equipment must be washed on-site, water will be prevented from entering the storm drain or open channel. Use of soaps, solvents, degreasers, or steam cleaning equipment will be prohibited. Wash water will be directed to an area that will not flow to any storm drain inlets or open channels.

6. Vehicles and heavy equipment will be refueled in one designated location on the site and spills will be cleaned up immediately.

7. A biological monitor will hold daily tail gate meeting prior to start of drilling activities.

8. Plastic sheeting or visqueen will be placed over the drill site to catch spills and drips of drilling fluids.

9. Straw waddle will be placed on top of visqueen to form a temporary dike surrounding the drill hole and circulation tub to contain spills.

10. Absorbents will be made available to clean up any leaks or spills.

Action Area

The action area is defined in 50 CFR § 402.02, as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the proposed action, the action area includes all lands associated with the approximately 786.402 acre project footprint and roads (except for County roads, and State and Federal highways) and other areas accessed by project vehicles.

Status of the Species and Environmental Baseline

California Red-Legged Frog

The California red-legged frog was listed as a threatened species on May 23, 1996 (Service 1996). Please refer to the final rule and the *Recovery Plan for the California Red-Legged Frog (Rana aurora draytonii)* (Service 2002) for additional information on this species.

This threatened species is the largest native frog in the western United States (Wright and Wright 1949), ranging from 1.5 to 5.1 inches in length (Stebbins 2003). The abdomen and hind legs of adults are largely red, while the back is characterized by small black flecks and larger irregular dark blotches with indistinct outlines on a brown, gray, olive, or reddish background color. Dorsal spots usually have lighter centers (Stebbins 2003) and dorsolateral folds are prominent on the back. Larvae (tadpoles) range from 0.6 to 3.1 inches in length, and the background color of the body is dark brown and yellow with darker spots (Storer 1925).

Red-legged frogs have paired vocal sacs and vocalize in air (Hayes and Krempels 1986). Female frogs deposit egg masses on emergent vegetation, allowing the egg mass floats on the surface of the water (Hayes and Miyamoto 1984). Red-legged frogs breed from November through March with earlier breeding records occurring in southern localities (Storer 1925). Individuals occurring in coastal drainages are active year-round (Jennings *et al.* 1992), whereas those found in interior sites are normally less active during the cold season.

The historic range of the red-legged frog extended coastally from the vicinity of Elk Creek in Mendocino County, California, and inland from the vicinity of Redding, Shasta County, California, southward to northwestern Baja California, Mexico (Fellers 2005; Jennings and Hayes 1985; Hayes and Krempels 1986). The species historically was documented in 46 counties but the taxa now remains in 238 streams or drainages within 23 counties. This represents a loss of 70 percent of its former range (Service 2002). Red-legged frogs are still locally abundant within portions of the San Francisco Bay area and the central coast. Within the

remaining distribution of the species, only isolated populations have been documented in the Sierra Nevada, northern Coast, and northern Transverse Ranges. This listed amphibian is believed to be extirpated from the southern Transverse and Peninsular ranges, but is still present in Baja California, Mexico (California Department of Fish and Game 2004).

Adult California red-legged frogs prefer dense, shrubby or emergent riparian vegetation closely associated with deep (>2.3 feet), still, or slow-moving water (Hayes and Jennings 1988). However, frogs also have been found in ephemeral creeks and drainages and in ponds that may or may not have riparian vegetation. The largest densities of red-legged frogs currently are associated with deep pools with dense stands of overhanging willows (*Salix* species) and an intermixed fringe of cattails (*Typha latifolia*) (Jennings 1988). Red-legged frogs disperse upstream and downstream of their breeding habitat to forage and seek sheltering habitat.

California red-legged frogs also can be found in disturbed areas such as channelized creeks and drainage ditches in urban and agricultural areas. An adult California red-legged frog recently was observed in a shallow isolated pool on North Slough Creek in the American Canyon area of Napa County (Christine Gaber/PG&E personal communication with Chris Nagano/Service on October 22, 2008). This frog location was surrounded by vineyard development. Another adult California red-legged frog was observed under debris in an unpaved parking lot in a heavily industrial area of Burlingame (Patrick Kobernus communication with Michelle Havens on October 16, 2008). This Burlingame frog was likely utilizing a nearby drainage ditch. Caltrans has also discovered California red-legged frog adults, tadpoles, and egg masses within a storm drainage system within a major cloverleaf intersection of Millbrae Avenue and State Route 101 in a heavily developed area of San Mateo County (Caltrans 2007). California red-legged frog has the potential to persist in disturbed areas as long as they provide at least one or more of their life history requirements.

According to Feller and Kleeman (2007), non-breeding dry season habitat includes several characteristics: 1) sufficient moisture to allow the frogs to survive throughout the non-breeding season that may be up to 11 months long ; 2) sufficient cover to moderate temperatures during the warmest and coldest times of the year; and 3) protection (e.g., deep pools in a stream, or complex cover such as root masses or thick vegetation) from predators such as hawks and owls, herons, and small carnivores.

During other parts of the year, habitat includes nearly any area within 1-2 miles of a breeding site that stays moist and cool through the summer (Fellers 2005). According to Fellers (2005), this can include vegetated areas with coyote bush (*Baccharis pilularis*), California blackberry thickets (*Rubus ursinus*), and root masses associated with willow (*Salix* species) and California bay trees (*Umbellularia californica*). Sometimes the non-breeding habitat used by red-legged frogs is extremely limited in size. For example, non-breeding red-legged frogs have been found in a 6-foot wide coyote bush thicket growing along a tiny intermittent creek surrounded by heavily grazed grassland (Fellers 2005). Sheltering habitat for red-legged frogs is potentially all aquatic, riparian, and upland areas within the range of the species and includes any landscape features that

provide cover, such as existing animal burrows, boulders or rocks, organic debris such as downed trees or logs, and industrial debris. Agricultural features such as drains, watering troughs, spring boxes, abandoned sheds, or hay stacks may also be used. Incised stream channels with portions narrower and depths greater than 18 inches also may provide important summer sheltering habitat. Accessibility to sheltering habitat is essential for the survival of red-legged frogs within a watershed, and can be a factor limiting frog population numbers and survival.

Red-legged frogs do not have a distinct breeding migration (Fellers 2005). Adult frogs are often associated with permanent bodies of water. Some frogs remain at breeding sites all year while others disperse. Dispersal distances are typically less than 0.5 mile (0.8 kilometers), with records of a few individuals moving up to 1-2 miles (Fellers 2005). Movements are typically along riparian corridors, but some individuals, especially on rainy nights, move directly from one site to another through normally inhospitable habitats, such as heavily grazed pastures or oak-grassland savannas (Fellers 2005). Dispersing frogs in northern Santa Cruz County traveled distances from 0.25 miles to more than 2 miles without apparent regard to topography, vegetation type, or riparian corridors (Bulger *et al.* 2003). Fellers and Kleeman (2007) and Bulger et al. (2003) found that California red-legged frog migration corridors can be less "pristine" (e.g., closely grazed fields, plowed agricultural lands) than breeding or non-breeding habitats. Bulger *et al.* (2003) observed that this listed ranid did not avoid or prefer any landscape feature or vegetation type. They tracked individuals that crossed agricultural land, including recently tilled fields and areas with mature crops. The threats facing migrating California red-legged frogs during their movements include being run over by vehicles on roads (Gibbs 1998; Vos and Chardon 1998), degradation of habitat (Vos and Stumpel 1995; Findlay and Houlahan 1997; Gibbs 1998), predation (Gibbs 1998), and dessication (Rothermel and Semlistch 2002; Mazerolle and Desrochers 2003).

Egg masses contain about 2,000 to 5,000 moderate sized (0.08 to 0.11 inches in diameter), dark reddish brown eggs and are typically attached to vertical emergent vegetation, such as bulrushes (*Scirpus* species) or cattails (Jennings *et al.* 1992). Red-legged frogs are often prolific breeders, laying their eggs during or shortly after large rainfall events in late winter and early spring (Hayes and Miyamoto 1984). Eggs hatch in 6 to 14 days (Jennings 1988). In coastal lagoons, the most significant mortality factor in the pre-hatching stage is water salinity (Jennings *et al.* 1992). Eggs exposed to salinity levels greater than 4.5 parts per thousand results in 100 percent mortality (Jennings and Hayes 1990). Increased siltation during the breeding season can cause asphyxiation of eggs and small larvae. Larvae undergo metamorphosis 3.5 to 7 months after hatching (Storer 1925; Wright and Wright 1949; Jennings and Hayes 1990). Of the various life stages, larvae probably experience the highest mortality rates, with less than 1 percent of eggs laid reaching metamorphosis (Jennings *et al.* 1992). Sexual maturity normally is reached at 3 to 4 years of age (Storer 1925; Jennings and Hayes 1985). Red-legged frogs may live 8 to 10 years (Jennings *et al.* 1992). Populations of red-legged frogs fluctuate from year to year. When conditions are favorable red-legged frogs can experience extremely high rates of reproduction and thus produce large numbers of dispersing young and a concomitant increase in the number of

occupied sites. In contrast, red-legged frogs may temporarily disappear from an area when conditions are stressful (e.g., drought).

The diet of red-legged frogs is highly variable. Hayes and Tennant (1985) found invertebrates to be the most common food items. According to their data, vertebrates, such as Pacific tree frogs and California mice (*Peromyscus californicus*) represent over half the prey mass eaten by larger frogs (Hayes and Tennant 1985). Hayes and Tennant (1985) found juvenile frogs to be active diurnally and nocturnally, whereas adult frogs were largely nocturnal. The diet of red-legged frogs is not well studied, but their diet is likely similar to other ranid frogs that feed on algae, diatoms, and detritus by grazing on the surface of rocks and vegetation (Fellers 2005; Kupferberg 1996a, 1996b).

Several researchers in central California have noted the decline and eventual local disappearance of California and northern red-legged frogs in systems supporting bullfrogs (Jennings and Hayes 1990; Twedt 1993), red swamp crayfish (*Procambarus clarkii*), signal crayfish (*Pacifastacus leniusculus*), and several species of warm water fish including sunfish (*Lepomis* species), goldfish (*Carassius auratus*), common carp (*Cyprinus carpio*), and mosquitofish (L. Hunt, in litt. 1993; S. Barry, in litt. 1992; S. Sweet, in litt. 1993). Habitat loss, non-native species introduction, and urban encroachment are the primary factors that have adversely affected the red-legged frog throughout its range.

Several researchers in central California have noted the decline and eventual disappearance of red-legged frog populations once bullfrogs became established at the same site (L. Hunt, in litt. 1993; S. Barry, in litt. 1992; S. Sweet, in litt. 1993). This has been attributed to predation, competition, and reproduction interference. Twedt (1993) documented bullfrog predation of juvenile northern red-legged frogs (*Rana aurora aurora*), and suggested that bullfrogs could prey on subadult northern red-legged frogs as well. Bullfrogs may also have a competitive advantage over red-legged frogs. For instance, bullfrogs are larger and possess more generalized food habits (Bury and Whelan 1984). In addition, bullfrogs have an extended breeding season (Storer 1933) during which an individual female can produce as many as 20,000 eggs (Emlen 1977). Further more, bullfrog larvae are unpalatable to predatory fish (Kruse and Francis 1977). Bullfrogs also interfere with red-legged frog reproduction. Both California and northern red-legged frogs have been observed in amplexus (mounted on) with both male and female bullfrogs (Jennings and Hayes 1990; Twedt 1993; M. Jennings, in litt.1993; R. Stebbins in litt. 1993). Thus bullfrogs are able to prey upon and out-compete red-legged frogs, especially in sub-optimal habitat.

The urbanization of land within and adjacent to red-legged frog habitat has also adversely affected red-legged frogs. These declines are attributed to channelization of riparian areas, enclosure of the channels by urban development that blocks red-legged frog dispersal, and the introduction of predatory fishes and bullfrogs. The conversion and isolation of perennial pool habitats resulting from urbanization is an ongoing impact to red-legged frogs.

The California red-legged frog may be susceptible to many of the same pathogens, fungi, water mold, bacteria, and viruses have been known to adversely affect tiger salamander species or other amphibians. As with the California tiger salamander, Chytridiomycosis and ranaviruses may be a particular developing concern for California red-legged frog populations. Mao *et al.* (1999 cited in Fellers 2005) reported northern red-legged frogs infected with an iridovirus, which was also presented in sympatric three-spined sticklebacks (*Gasterosteus aculeatus*) in northwestern California. Ingles (1932a, 1932b, and 1933 cited in Fellers 2005) reported four species of trematodes from red-legged frogs, but he later synonymized two of them (found them to be the same as the other two). Nonnative species, such as bullfrogs and nonnative tiger salamanders, are both located within the range of the California red-legged frog and have been identified as potential carriers of these diseases. Human activities can facilitate the spread of disease by encouraging the further introduction of non-native carriers and by acting as carriers themselves (i.e. contaminated boots or fishing equipment). Human activities can also introduce stress by other means, such as habitat fragmentation, that results in red-legged frogs being more susceptible to the effects of disease. Disease will likely become a growing threat because of the relatively small, fragmented remaining California red-legged frog breeding sites, the many stresses on these sites due to habitat losses and alterations, translocation of infected animals, and the many other potential disease-enhancing anthropogenic changes which have occurred both inside and outside the species' range.

The recovery plan for red-legged frogs identifies eight Recovery Units (Service 2002). The establishment of these Recovery Units is based on the Recovery Team's determination that various regional areas of the species' range are essential to its survival and recovery. The status of the red-legged frog will be considered within the smaller scale of Recovery Units as opposed to the overall range. These Recovery Units are delineated by major watershed boundaries as defined by U.S. Geological Survey hydrologic units and the limits of the range of the California red-legged frog. The goal of the draft recovery plan is to protect the long-term viability of all extant populations within each Recovery Unit. Within each Recovery Unit, core areas have been delineated and represent contiguous areas of moderate to high red-legged frog densities that are relatively free of exotic species such as bullfrogs. The goal of designating core areas is to protect metapopulations that, combined with suitable dispersal habitat, will allow for the long term viability within existing populations. This management strategy will allow for the recolonization of habitat within and adjacent to core areas that are naturally subjected to periodic localized extinctions, thus assuring the long-term survival and recovery of red-legged frogs. The Marin-Sonoma Narrows Project is within Recovery Unit 3 (North Coast and North San Francisco Bay) (Service 2002).

Project Segments A and C cross through urbanized area with little potential upland red-legged frog habitat but with urban creek crossing that include degraded riparian habitat and non-native predators of this animal. Although urban, Washington and Lynch creeks in Segment C have well developed riparian cover within their confines and provide habitat for California red-legged frogs.

The habitat in and surrounding the action area of Segment B is rural and characterized by rolling oak grasslands and creeks with well-developed riparian systems. The development in Segment B is primarily limited to several large ranches and the dominate land use is cattle grazing. Based on the habitat conditions it appears likely that there is suitable upland and aquatic red-legged frog habitat throughout Segment B. According to Caltrans assessment, potential California red-legged frog habitat on both sides of the roadway that would be affected in Segment B amounts to 206.94 acres. Therefore, the Service has determined it is reasonable to conclude the California red-legged frog inhabits and has the potential to be encountered within 206.94 acres of the action area, based on the biology and ecology of the species, and the presence of suitable habitat.

Salt Marsh Harvest Mouse

The salt marsh harvest mouse was federally listed as endangered in 1970 (Service 1970). Critical habitat has not been proposed or designated. A detailed account of the taxonomy, ecology, and biology of the salt marsh harvest mouse is presented in the *Salt Marsh Harvest Mouse & California Clapper Rail Recovery Plan* (Service 1984) (Recovery Plan) and the references cited therein. The salt marsh harvest mouse is a Fully Protected Species under California law (See California Fish and Game Code Section 4700).

The salt marsh harvest mouse is a rodent endemic to the salt and brackish marshes of the San Francisco Bay Estuary and adjacent tidally influenced areas. The salt marsh harvest mouse closely resembles the western harvest mouse (*R. megalotis*). The salt marsh harvest mouse typically weighs about 0.35 ounce, has a head and body length ranging from 2.7-2.9 inches, a tail length ranging from 2.6-3.2 inches, and a hind foot length of 0.7 inch (Fisler 1965). As stated in the recovery plan, the salt marsh harvest mouse, when compared to the western harvest mouse, have darker ears, belly and back, and a slightly thicker, less pointed and unicolored tail. The salt marsh harvest mouse is further distinguished taxonomically into the northern and southern subspecies, *R. raviventris halicoetes* and *R. raviventris raviventris*, respectively. Of the two subspecies, *R. r. halicoetes* more closely resembles *R. megalotis*, and can be difficult to differentiate in the field; body color and color of ventral hairs as well as the thickness and shape of the tail have been used to distinguish the two.

The salt marsh harvest mouse has evolved to a life in tidal marshes. Specifically, they have evolved to depend mainly on dense pickleweed as their primary cover and food source. However, salt marsh harvest mice may utilize a broader source of food and cover which includes saltgrass (*Distichlis spicata*) and other vegetation typically found in the salt and brackish marshes of this region. In natural systems, salt marsh harvest mice can be found in the middle tidal marsh and upland transition zones. Upland refugia is an essential habitat component during high tide events. Salt marsh harvest mice are highly dependent on cover, and open areas as small as 33 feet wide may act as barriers to movement (Shellhammer 1978, as cited in Service 1984). The salt marsh harvest mouse does not burrow. It has been noted that the northern subspecies may build nests of loose grasses.

As described by Fisler (1965), male salt marsh harvest mice are reproductively active from April through September, but may appear active throughout the year. Females are reproductively active from March to November, and have a mean litter size of approximately four offspring.

The historic range of the species included tidal marshes within the San Francisco and San Pablo bays, east to the Collinsville-Antioch areas. Agriculture and urbanization has claimed much of the former historic tidal marshes, resulting in a 79 percent reduction in the amount of tidal marshes in these areas (Goals Project 1999). At present, the distribution of the northern subspecies occurs along Suisun and San Pablo Bays north of Point Pinole in Contra Costa County and Point Pedro in Marin County. The southern subspecies is found in marshes in Corte Madera, Richmond, and South San Francisco Bay mostly south of the San Mateo Bridge (Highway 92).

The preservation and growth of existing populations of the salt marsh harvest mouse is considered important to assuring the survival of this species. The Recovery Plan identifies essential habitat areas to be preserved or restored throughout the Estuary to meet the recovery objectives for this species. No essential habitat for the salt marsh harvest mouse is identified within the action area in the Recovery Plan.

Although no surveys for salt marsh harvest mice have been conducted within the action area, pickleweed-vegetated tidal wetlands and other potential habitat areas of suitable for the salt marsh harvest mouse occur within the action area at the Petaluma Bridge crossing. Salt marsh harvest mice have been detected in tidal marshes approximately 0.5 mile downstream of the Petaluma Bridge portion of the action area. Given that the salt marsh harvest mouse recovery plan identified four essential habitat areas on the Petaluma River and the species is known throughout the Petaluma Marsh Wildlife Area downstream of the Petaluma Bridge it is likely that salt marsh harvest mice would be found in pickleweed habitat throughout the tidally influenced portions of the Petaluma River system. As noted in the May 2008 Biological Assessment, California Department of Fish and Game biologist Fred Botti stated that the listed mouse may use the pickleweed habitat at the Petaluma Bridge crossing for migration or dispersal. Therefore, given the biology and ecology of this animal, the presence of occupied habitat in other nearby tidal marshes, and recent records, the salt marsh harvest mouse is likely to inhabit the action area.

Effects of the Proposed Action

California Red-Legged Frog

The proposed project could have adverse effects on the threatened California red-legged frog through mortality, injury, harassment, and harm of individual juveniles and adults. According to the August 5, 2008, Caltrans letter, the proposed actions will adversely affect 206.94 acres of California red-legged frog habitat. According to Caltrans, the affects amount to 203.78 acres of permanent effects and 3.16 acres of temporary effects associated with the creation of bioswales.

The proposed project likely will result in adverse effects to the feeding, resting, aestivation, movement, and other essential behaviors of the California red-legged frog. It will result in the loss and degradation of habitat. The primary east-west habitat connectivity in Segment B is at the existing bridge spanned creek crossings. The bridge widening at these locations is unlikely to present any barriers to those movement corridors. Construction and maintenance of properly sized and located culverts likely will minimize this adverse effect of the threatened California red-legged frog (see Rodriguez *et al.* 1996; Yanes *et al.* 1905).

Construction activities associated with the proposed project would remove vegetation and other materials necessary for cover and aestivation, fill or crush burrows or crevices, and potentially reduce the prey base for the California red-legged frog. Because this listed amphibian uses small mammal burrows and soil crevices for shelter, individuals may be crushed, buried, or otherwise injured during construction activities. California red-legged frogs also may be run over by construction equipment or other vehicles accessing the construction areas. Disturbance caused by construction activities may cause frogs to disperse into areas of unsuitable habitat, increase the risk of predation or other sources of mortality. Siltation, fill, or spill of petroleum products or other chemicals could cause loss of prey items in or adjacent to the project area. Construction activities are likely to result in the direct disturbance, displacement, injury, and/or morality of California red-legged frogs. Individuals likely are to be killed or injured by construction equipment or other vehicles accessing the construction site. There is a likelihood of direct injury or mortality to the animal from injury or death due to pet cats or dogs owned by construction related personnel, poisoning by pesticides, injury or death due to predators attracted to food or trash at the site, and harassment from night-lighting, noise, and vibration. Implementation of certain types of erosion control materials, such as plastic netting, could result in the entanglement and death of California red-legged frogs within these materials due to exposure or predators (Bartin and Kinkead 2005; Stuart *et al.* 2001). Disturbance from construction activities may also cause individuals to move into or across areas of unsuitable habitat where they may be prone to higher rates of mortality from vehicles and predation.

Range-wide habitat loss, fragmentation, and degradation from multiple factors are the primary threats to the California red-legged frog (Service 1996, 2004). Loss of natural lands continues to occur further reducing the habitat available for this listed animal. However, the amount of historical and current habitat loss directly attributable to road loss has not been calculated, but the effect of habitat fragmentation on the California red-legged frog is significant. Fragmentation can reduce access to habitat as well as habitat suitability, increase mortality of animals that are moving between habitat patches due to increased risk of predation, and disrupt movements, dispersal, and gene flow. As barriers to movement for the California red-legged frog, roads create smaller patches of habitat and increase patch isolation. Smaller populations of animals are at greater risk of extinction by chance from demographic, genetic, and environmental stochastic events (Wilcox and Murphy 1985; Schoener and Spiller 1992). Isolated populations also have a higher chance of extinction without the demographic and genetic input of immigrants and a lower chance of colonization after extinction (Lande 1988; Sjogren-Gulve 1994).

The short term temporal effect will occur when suitable habitat is lost when riparian and other vegetation vegetation is removed for construction of the highway, and also due to the improved ability of predators to hunt the listed amphibian. Hilty and Merender (2004) found that, in contrast to native species, non-native mammalian predators were more active in narrow and denuded riparian corridors and in large expanses of agricultural land (vineyards) far from core habitat. The increased width of the highway along with higher numbers of vehicles and speed of the cars and trucks likely will discourage or prevent movement by the California red-legged frog.

The necessity of moving between multiple habitats and breeding ponds means that many amphibian species, such as the California red-legged frog are especially vulnerable to roads in the landscape. Van Gelder (1973) and Cooke (1995) have examined the effect of roads on amphibians; and found that because of their activity patterns, population structure, and preferred habitats, aquatic breeding amphibians are more vulnerable to traffic mortality than some other species.

Fahrig *et al.* (1995) found that high traffic two-lane paved roads had a much larger effect on frog abundance than low traffic two-lane roads. Mortality rates for anurans on high traffic roads are higher than on low traffic roads (Hels and Buchwald 2001). Vos and Chardon (1998) found a significant negative effect of road density on the occupation probability of ponds by the moor frog (*Rana arvalis*) in the Netherlands. In addition, incidences of very large numbers of road-killed frogs are well documented (e.g., Asley and Robinson 1996), and studies have shown strong population level effects of traffic density (Carr and Fahrig 2001) and high traffic roads on these amphibians (Van Gelder 1973; Vos and Chardon 1998). Most studies regularly count road kills from slow moving vehicles (Hansen 1982; Rosen and Lowe 1994; Drews 1995; Mallick *et al.* 1998) or by foot (Munguira and Thomas 1992). These studies assume that every victim is observed, which may be true for large conspicuous mammals, but it certainly is not true for small animals, such as the California red-legged frog. Amphibians appear especially vulnerable to traffic mortality because they readily attempt to cross roads, are slow-moving and small, and thus can not easily be avoided by drivers (Carr and Fahrig 2001).

The direction and type of habitat used by dispersing animals is especially important in fragmented environments (Forys and Humphrey 1996). Models of habitat patch geometry predict that individual animals will exit patches at more "permeable" areas (Buechner 1987; Stamps *et al.* 1987). A landscape corridor may increase the patch-edge permeability by extending patch habitat (La Polla and Barrett 1993), and allow individuals to move from one patch to another. The geometric and habitat features that constitute a "corridor" must be determined from the perspective of the animal (Forys and Humphrey 1996).

State Route 101 from Navato to Petaluma is a formidable barrier to California red-legged frog and general wildlife movement. There are existing bridge and culvert crossings that have the potential to provide wildlife passage under State Route 101. As part of the project, Caltrans plans to upsize the diameter of approximately 36 culvert pipes and one reinforced concrete box (RCB). These replacements will include the installation of two 18-inch pipes, twenty 24-inch

pipes, six 30-inch pipes, one 36-inch pipe, two 42-inch pipes, one 43-inch pipe and a 6 foot by 3 foot RCB. In addition, Caltrans will install approximately 41 new culvert pipes, including one new 7 foot by 7 foot cattle pass. These new structures include five 18-inch pipes, fifteen 24-inch pipes, four 30-inch pipes, three 36-inch pipes, one 42-inch pipe, and two 48-inch double pipes. There are also existing crossing structures in Segment B that are not subject to project alteration. Those include two 7- to 10-foot high cattle crossings and eight 2- to 7-foot high RCBs.

The project will provide more opportunity for wildlife passage under State Route 101, however, it is doubtful if frogs will use long corregated culverts across a 80-foot or wider roadway that are not day-lighted, do not have a natural bottom, and do not have regular maintenance to prevent filling with sediment and debris. The dimension of the tunnels is considered one of the most important variables in the design of passage ways for vertebrates (Yanes *et al.* 1995; Rodriguez *et al.* 1996); although no studies have determined a minimum width for the California red-legged frog, passages made for other small vertebrates, such as salamanders, must be wide and tall enough to enable animals to clearly see to the opposite end of the culvert, or there is lighting along the culvert provided by overhead grates. Ng *et al.* (2004) note that culverts typically are installed to accommodate water flow, the installation of such passage ways solely for listed species and wildlife, especially across major roadways, is justified if no other passages or crossings exist and there is suitable habitat. It is also important that the crossing attract target listed species and wildlife; fencing or other measures be incorporated into a wildlife crossing to guide animals to the preferred crossing; the crossing be placed strategically to enhance habitat connectivity; and that the adjacent land use be conducive to long-term habitat protection (Portland State University 2003). The culverts, RCBs, and cattle crossings proposed by Caltrans may not adequately minimize the reduction or elimination of the movement of the California red-legged frog. The long term viability of any designated wildlife crossing is questionable unless crossing locations and the habitat on both sides of the crossing are permanently set aside as open space or have a conservation easement or some other designation that limits development. In addition, hog wire apparently will not be placed on the bottom one foot of the highway perimeter fence to deter frogs from entering the roadway and guide them towards safe crossings. The culverts may not be high enough to allow the animals to see through them to the other side of the roadway, improper placement in areas where the animals will not use them, and the uncertainty of maintenance and silt removal at drainage-associated crossings could eliminate their potential use by the frogs. The lack of hog wire will result in individuals crossing the roadway where they are more likely to be killed by vehicles.

Larger culverts, e.g. at least 72 inches tall, grates placed midway on the culvert to allow lighting to encourage the animals to use them, placement in areas where the animals are moving through, and appropriate, maintenance and silt removal, and the use of properly sized hog wire along the bottom of the highway perimeter fence to guide the California red-legged frog to the culverts, RCBs, and cattle crossings should increase the potential for these animals to move across the State Route 101 right-of-way in areas other than the bridged creek crossings.

Road studies suggest that properly designed passage can significantly reduce wildlife, including frog mortality (Dodd *et al.* 2004). The Town of Amherst in the State of Massachusetts installed two culverts with guiding fences to facilitate spotted salamander (*Ambystoma maculatum*) migration from their wintering burrows during the spring. Before the placement of these culverts under Henry Street, a two-lane street, salamander mortality was high. After installation, approximately 75.9% of animals that reached the tunnel entrances successfully passed through them (Jackson 1996).

The installation of a concrete median will present a definitive barrier to California red-legged frog movement over the road. Within the concrete medians, Caltrans plans to install Type S barriers for wildlife crossing every 20 feet and Type M wildlife crossings would be installed every 0.25 miles. Type S barriers are a type 60 concrete barrier with a 6 inch diameter opening at the base of the barrier for small animal passage. Type M wildlife crossings are a type 60 concrete barrier with a 2-foot break in the barrier, with the break protected by a thrie-beam guard rail to deflect vehicle traffic. Given the amount of traffic on State Route 101 it is unlikely that frogs will be able to successfully cross the road even if they do manage to find these openings.

Though the intent of wildlife culverts and crossings are to ensure safe passage of listed species and wildlife, they are also a benefit to human safety (Aleshire 2007; Ruediger and DiGiorgio undated; Sherwood 2007). Deer-automobile collisions, estimated by the Insurance Information Institute to occur at a rate of 500,000 per year, result in over $1 billion worth of vehicular damages, 29,000 human injuries, and 200 human fatalities each year (Cornell University). Insurance company, State Farm estimates that there were more than 1.2 million claims for damage in crashes with animals during the last half of 2007 and the first half of 2008 (Highway Loss Data Institute 2008). Although most animal strikes do not result in human injury, human deaths resulting from animal collision is increasing (Highway Loss Data Institute 2008). Culverts large enough to accommodate species such as deer (*Odocoileus* species) and mountain lion (*Felis concolor*), while maintaining substrates for the California red-legged frog and smaller wildlife, could reduce roadway collisions for a variety of species. For example, wildlife crossings of the Trans-Canada Highway in Canada's Banff National Park have reduced wildlife road mortality by 80%, and as much as 96% for ungulates (Robbins 2003).

Because their habitats have been fragmented, many endangered and threatened species exist as metapopulations (Verboom and Apeldom 1990; Verboom *et al.* 1991). A metapopulation is a collection of spatially discrete subpopulations that are connected by the dispersal movements of the individuals (Levins 1970; Hanski 1991). For metapopulations of listed species, a prerequisite to recovery is determining if unoccupied habitat patches are vacant due to the attributes of the habitat patch (food, cover, and patch area) or due to patch context (distance of the patch to other patches and distance of the patch to other features). Subpopulations on patches with higher quality food and cover are more likely to persist because they can support more individuals. Large populations have less of a chance of extinction due to stochastic events (Gilpin and Soule 1986). Similarly, small patches will support fewer individuals, increasing the rate of extinction. Patches that are near occupied patches are more likely to be recolonized when local extinction

occurs and may benefit from emigration of individuals via the "rescue" effect (Hanski 1982; Gotelli 1991; Holt 1993; Fahrig and Merriam 1985). For the metapopulation to persist, the rate of patches being colonized must exceed the rate of patches going extinct (Levins 1970). If some subpopulations go extinct regardless of patch context, recovery actions should be placed on patch attributes. Patches could be managed to increase the availability of food and/or cover. Movements and dispersal corridors likely are critical to California red-legged frog population dynamics, particularly because the animals likely currently persist as metapopulations with disjunct population centers. Movement and dispersal corridors are important for alleviating over-crowding and intraspecific competition, and also they are important for facilitating the recolonization of areas where the animal has been extirpated. Movement between population centers maintains gene flow and reduced genetic isolation. Genetically isolated populations are at greater risk of deleterious genetic effects such as inbreeding, genetic drift, and founder effects. The survival of wildlife species in fragmented habitats may ultimately depend on their ability to move among patches to access necessary resources, retain genetic diversity, and maintain reproductive capacity within populations (Hilty and Merenlender 2004; Petit *et al.* 1995; Buza *et al.* 2000).

Most metapopulation or meta-population-like models of patchy populations do not directly include the effects of dispersal mortality on population dynamics (Hanski 1994; With and Crist 1995; Lindenmayer and Possingham 1996). Based on these models, it has become a widely held notion that more vagile species have a higher tolerance to habitat loss and fragmentation than less vagile species. But models that include dispersal mortality predict exactly the opposite: more vagile species should be more vulnerable to habitat loss and fragmentation becase they are more susceptible to dispersal mortality (Fahrig 1998; Casagrandi and Gatto 1999). This prediction is supported by Gibbs (1998), who examined the presence-absence of five amphibian species across a gradient of habitat loss. He found that species with low dispersal rates are better able than more vagile species top persist in landscapes with low habitat cover. Gibbs (1998) postulated that the land between habitat serves as a demographic "drain" for many amphibians. Furthermore, Bonnet *et al.* (1999) found that snake species that use frequent long-distance movements have higher mortality rates than do sedentary species.

The construction activities at the proposed project could result in the introduction of chemical contaminants to the site. Substances used in road building materials or could leach out or wash out of the soil into adjacent habitat. Vehicles may leak hazardous substances such as motor oil and antifreeze. A variety of substances could be introduced during accidental spills of materials. Such spills can result from leaks in vehicles, small containers falling off vehicles, or from accidents resulting in whole loads being spilled. Large spills may be partially or completely mitigated by clean-up efforts, depending on the substance. California red-legged frogs using these areas could be exposed to any contaminants that are present at the site. Exposure pathways could include inhalation, dermal contact, direct ingestion, or ingestion of contaminated soil or plants. Exposure to contaminants could cause short- or long-term morbidity, possibly resulting in reduced productivity or mortality. Carcinogenic substances could cause genetic damage resulting in sterility, reduced productivity, or reduced fitness among progeny. Little information

is available on the effects of contaminants on the California red-legged frog. The effects may be difficult to detect. Morbidity or mortality likely would occur after the animals had left the contaminated site, and more subtle effects such as genetic damage could only be detected through intensive study and monitoring.

Preconstruction surveys and the relocation of individual red-legged frogs may reduce injury or mortality. However, the capturing and handling of red-legged frogs to remove them from a work area may result in the harassment, mortality or injury of individuals. Stress, injury, and mortality may occur as a result of improper handling, containment, and transport of individuals. Death and injury of individual red-legged frogs could occur at the time of relocation or later in time subsequent to their release. Although survivorship for translocated red-legged frogs has not been estimated, survivorship of translocated wildlife, in general, is lower because of intraspecific competition, lack of familiarity with the location of potential breeding, feeding, and sheltering habitats, risk of contracting disease in foreign environment, and increased risk of predation. Improper handling, containment, or transport of individuals would be reduced or prevented by use of a Service-approved biologist, by limiting the duration of handling, limited the distance of translocation, and requiring the proper transport.

Biologists, construction workers, and construction equipment working in different areas and with different species may transmit diseases by introducing contaminated equipment. The chance of a disease being introduced into a new area is greater today than in the past due to the increasing occurrences of disease throughout amphibian populations in California and the United States. It is possible that chytrid fungus may exacerbate the effects of other diseases on amphibians or increase the sensitivity of the amphibian to environmental changes (e.g., water pH) that reduce normal immune response capabilities (Bosch *et al.* 2001). Implementation of the "Declining Amphibian Populations Task Force Fieldwork Code of Practice" during any aquatic survey activity will likely prevent transfer of diseases through contaminated equipment or clothing.

Construction of roads can facilitate the invasion and establishment by species not native to the area (Gelbard and Belnap 2003) or are native and are better competitors than the California red-legged frog, such as the bullfrog, that could feed on or compete with, the listed amphibian or its food sources. Disturbance and alteration of habitat adjacent to roads may create favorable conditions for non-native plants and animals. These exotic species can spread along roadsides and then into adjacent habitat. Non-native animals may use modified habitats adjacent to road to disperse into California red-legged frog habitat. These animals could compete with the listed ranid for resources such as food or cover, or directly injure or kill the amphibians. Non-native plants and animals may reduce habitat quality for the threatened frog, and reduce the productivity or the local carrying capacity for the animals. Introductions of non-native species could cause California red-legged frogs to alter behavioral patterns by avoiding or abandoning areas near road.

Disturbed areas adjacent to roads provide favorable habitat conditions for a number of non-native plant species. Some of these taxa are aggressively invasive and they can alter natural communities and potentially affect habitat quality. A problematic species within the range of the California red-legged frog is yellow star thistle (*Centaurea melitensis*). Dense stands of this plant can form along roadsides and then spread into adjacent habitat. This plant displaces native vegetation, competes with native plants for resources, and it may be difficult for the animals to move through due the plant's numerous sharp spines. Other species that may disperse along roads and invade adjacent riparian habitats include mustards (*Brassica* species) and Russian thistle (*Salsola tragus*) (Tellman 1997). Disturbed soils and reduced competition from native plants are some of the conditions that facilitate invasion along roads by non-native plant species.

Negative effects to wildlife populations from roads may extend some distance from the actual road, as the proposed project. The phenomenon can result from any of the effects already described in this biological opinion, such as vehicle-related mortality, habitat degradation, and invasive exotic species. Forman and Deblinger (1998) described the area affected as the "road effect" zone. Along a 4-lane road in Massachusetts, they determined that this zone extend for an average of approximately 980 feet to either side of the road for an average total zone width of approximately 1970 feet. However, in places they detected an effect > 0.6 mile from the road. Rudolph *et al* (1999) detected reduced snake abundance up to 2790 feet from roads in Texas. They estimated snake abundance out to 2790 feet, so the effect may have been greater. Extrapolating to a landscape scale, they concluded the effect of roads on snake populations in Texas likely was significant, given that approximately 79% of the land area of the Lone Star State is within 1640 feet of a road. The "road-zone" effects can be subtle. Van der Zandt *et al.* (1980) reported that lapwings (*Vanellus vanellus*) and black-tailed godwits (*Limosa limosa*) feeding at 1575 feet-6560 feet from roads were disturbed by passing vehicles. The heart rate, metabolic rate and energy expenditure of female bighorn sheep (*Ovis canadensis*) increases near roads (MacArthur *et al.* 1979). Trombulak and Frossell (2000) described another type of "road-zone' effect. Heavy metal concentrations from vehicle exhaust were greatest within 66 feet of roads, by elevated levels of metals in both soil and plants were detected at 660 feet of roads. The "road-zone" apparently varies with habitat type and traffic volume. Based on responses by birds, Forman (2000) estimated the effect zone along primary roads of 1000 feet in woodlands, 1197 feet in grasslands, and 2657 feet) in natural lands near urban areas. Along secondary roads with lower traffic volumes, the effect zone was 656 feet. The "road zone" and the California red-legged frog have not been adequately investigated.

The proposed compensation for the effects to 203.78 acres of California red-legged frog habitat will likely be beneficial to this listed species in Marin and/or Sonoma Counties. Caltrans proposes expenditure of the funds to purchase California red-legged frog credits at a Service-approved approved conservation bank, establishment of a Service-approved conservation easement, or obtaining fee title to habitat acquisition.

Caltrans is entertaining the possibility of obtaining a conservation easement at the Lawson's Landing property at Dillon Beach in Marin County. Lawson's Landing property is approximately 940 acres, and is one of the few areas remaining in coastal California with an active dune system that is not under permanent conservation status. The site supports a high proportion of dune slack wetlands with breeding habitat for the California red-legged frog. It has the largest expanse of native coastal scrub vegetation on paleodunes north of Monterey. The beach supports one of the largest wintering populations for the threatened western snowy plover (*Charadrius alexandrinus nivosus*) between San Francisco and the northern end of their range in Washington State. The endangered Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*) has been documented in the past as well as the endangered Tidestrom's lupine (*Lupinus tidestromii*) and the potential exists to repatriate these species for their recovery. The dunes and wetlands host numerous other special status plants and invertebrates that are adapted to shifting sands and coastal wetlands. The site not only offers important biological resources, but geological interest, as well as stunning scenic resources. The area contains important habitat for the California red-legged frog, as well as other listed species. Not all of the Lawson's Landing property provides habitat for the California red-legged frog but the establishment of a conservation easement on the California red-legged frog habitat within the Lawson's Landing property likely will provide benefits to several listed species, as well as native wildlife.
There are also several ranchers in Marin and Sonoma Counties that would be willing to sell conservation easements on their land that would allow them to maintain ecologically sustainable grazing while providing in-perpetuity management for the California red-legged frog. Conservation easements would be especially valuable for this listed frog in areas of designated or proposed California red-legged frog critical habitat.

Salt Marsh Harvest Mouse

Construction and other work activities at the Petaluma River Bridge crossing would permanently eliminate about 0.05 acres of pickleweed-vegetated habitat currently available for salt marsh harvest mice. Construction and other work activities in and around the pickleweed habitat near the Petaluma River Bridge crossing could affect individual salt marsh harvest mice through increased disturbance and habitat destruction. Increased levels of disturbance to salt marsh harvest mice would result from noise and vibrations from equipment and other work activities. Operation of equipment and associated loss of habitat would result in displacement of salt marsh harvest mice from protective cover and their territories/home ranges (through noise and vibrations) and/or direct injury or mortality (through crushing). These disturbances likely would disrupt normal behavior patterns of breeding, foraging, sheltering, and dispersal, and likely result in the displacement of salt marsh harvest mice from their territory/home range in the areas where their habitat is destroyed. Displaced salt marsh harvest mice may have to compete for resources in occupied habitat, and may be more vulnerable to predators. Female salt marsh harvest mice are reproductively active from March through November (Fisler 1965), so disturbance during this period could result in abandonment or failure of their litter. Thus, displaced salt marsh harvest mice may suffer from increased predation, competition, mortality, and reduced reproductive success.

Salt marsh harvest mice could be harmed if the habitat area affected by the proposed action is colonized by non-native, invasive plant species. The proposed action could result in the invasion of non-native plant species in the habitat area off the Petaluma River and subsequently into adjacent habitat areas for the salt marsh harvest mouse and California clapper rail. If established in these habitat areas, these non-native plant species could limit the habitat value of these areas for salt marsh harvest mice and California clapper rails by out competing and preventing or limiting the establishment of native wetland plant species. Successful removal of non-native, invasive plant species could prevent, or at least severely reduce the establishment of these undesirable species and ensure that current habitat values are reestablished or increased.

Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Numerous non-Federal activities continue to negatively affect the California red-legged frog in Marin and Sonoma Counties. Habitats are lost or degraded as a result of road and utility construction and maintenance, overgrazing, agricultural expansion, and water irrigation and storage projects that may not be funded, permitted, or constructed by a Federal agency. Other threats include contamination, poisoning, increased predation, and competition from non-native species associated with human development. Small private actions that may impact listed species, such as conversion of land, small mammal population control, mosquito control, and residential development, may occur without consultation with or authorization by the Service or the California Department of Fish and Game pursuant to their respectively Endangered Species Act.

As urban development continues, it will likely adversely affect upland areas that serve as dispersal and aestivation habitat for red-legged frogs. Continued development and maintenance of roadways to serve expanding urban areas may further fragment and isolate populations of red-legged frogs from other nearby populations. Increased predation associated with domesticated pets or feral animals generally accompanies urban expansion. As urban development encroaches on rural areas, the need increases for mosquito abatement programs that may introduce exotic fish into ponds used for breeding by red-legged frogs, thus impacting the reproductive success of this species.

Increased levels of vehicles and increased vehicle speeds could lead to an increased mortality level for the California red-legged frog. The cumulative local development will result in temporary and permanent habitat fragmentation. The results of fragmentation are inhibition of genetic exchange between populations and impediments to recolonization of habitats from which populations have been extirpated. Small, isolated populations are substantially more vulnerable

to stochastic events (e.g., aberrant weather patterns, fluctuations in availability of food) and may exhibit reduced adaptability to environmental (natural or anthropogenic) changes.

There is a continued demand for new housing and commercial development in Marin and Sonoma Counties and other road and development projects have been recently completed or are planned along the State Route 1, State Route 12, State Route 101, and State Route 116. These developments and further infill will eliminate the habitat connectivity between listed species habitat remaining habitat in the action area vicinity and the local region. Development of adjacent wildlife habitat will continue to result in the loss of not only breeding, resting, and foraging habitat, but the loss of dispersal corridors between breeding populations, thereby further isolating and fragmenting wildlife populations. Additionally, development of small reservoirs or water bodies, such as golf course hazards, and water diversions may occur which may pose further threats such as disruption of dispersal corridors for terrestrial species, and competition or predation from with non-native species such as bullfrogs for aquatic species.

Cumulative effects to the California red-legged frog include continuing and future conversion of suitable breeding, foraging, sheltering, and dispersal habitat resulting from urban development. Additional urbanization can result in road widening and increased traffic on roads that bisect habitat, thereby increasing road-kill while reducing in size and further fragmenting remaining habitats.

Cattle-grazing is a common land use practice in rural Marin and Sonoma Counties. Overgrazing results in degradation and loss of riparian vegetation, increased water temperatures, streambank and upland erosion, and decreased water quality in streams. Livestock operations may also degrade water quality with pesticides and nutrient contamination. However, light to moderate livestock grazing is generally thought to be compatible with continued successful use of rangelands by the red-legged frog and other listed species, provided the grazed areas do not also have intensive burrowing rodent control efforts (T. Jones, in litt. 1993; Shaffer et al. 1993). The shorter vegetation associated with grazed areas may make the habitat more suitable for ground squirrels whose burrows are utilized by red-legged frogs. Rodent control in rural areas in Marin and Sonoma Counties could contribute to the decline of red-legged frogs in the region, as well as other sensitive species that utilize burrows created by burrowing rodents.

Agricultural development, impoundments, and irrigation can reduce stream flows, resulting in the loss of aquatic habitat during the summer for red-legged frogs. Discing is a common practice on agricultural lands which can result in substantial losses of upland habitat for red-legged frogs. Significant conversion of rural, undeveloped land to agricultural land, particularly vineyards, is currently occurring in Sonoma County, resulting in loss of upland habitat for listed species. California red-legged frogs likely are exposed to a variety of pesticides and other chemicals throughout their ranges. This amphibian species could also die from starvation due to the loss of their prey base. Hydrocarbon and other contamination from oil production and road runoff; the application of numerous chemicals for roadside maintenance; urban/suburban landscape maintenance; and rodent and vector control programs may all have negative effects on red-legged

frog populations. In addition, red-legged frogs may be harmed through increased road kill due to the construction and use of new roads and increased traffic in the overall region and collection by amphibian enthusiast and others.

Further habitat fragmentation; additional non-native species introduction; translocation of infected individuals, and increased access to aquatic habitat could facilitate or increase the spread of amphibian diseases within the range of the California red-legged frog. The global mass extinction of amphibians primarily due to chytrid fungus continues to be of significant concern (Norris 2007; Skerratt *et al* 2007).

The global average temperature has risen by approximately 0.6 degrees centigrade during the 20th Century (International Panel on Climate Change 2001, 2007; Adger et al 2007). There is an international scientific consensus that most of the warming observed has been caused by human activities (International Panel on Climate Change 2001, 2007; Adger et al. 2007), and that it is "very likely" that it is largely due to increasing concentrations of greenhouse gases (carbon dioxide, methane, nitrous oxide, and others) in the global atmosphere from burning fossil fuels and other human activities (Cayan et al. 2005, EPA Global Warming webpage http://yosemite.epa.gov; Adger et al. 2007). Eleven of the twelve years between 1995 and 2006 rank among the twelve warmest years since global temperatures began in 1850 (Adger et al. 2007). The warming trend over the last fifty years is nearly twice that for the last 100 years (Adger et al. 2007). Looking forward, under a high emissions scenario, the International Panel on Climate Change estimates that global temperatures will rise another four degrees centigrade by the end of this Century; even under a low emissions growth scenario, the International Panel on Climate Change estimates that the global temperature will go up another 1.8 degrees centigrade (International Panel on Climate Change 2001).

The increase in global average temperatures affects certain areas more than others. The western United States, in general, is experiencing more warming than the rest of the Nation, with the 11 western states averaging 1.7 degrees Fahrenheit warmer temperatures than this region's average over the 20th Century (Saunders et al. 2008). California, in particular, will suffer significant consequences as a result of global warming (California Climate Action Team 2006). In California, reduced snowpack will cause more winter flooding and summer drought, as well as higher temperatures in lakes and coastal areas. The incidence of wildfires in the Golden State also will increase and the amount of increase is highly dependent upon the extent of global warming. No less certain than the fact of global warming itself is the fact that global warming, unchecked, will harm biodiversity generally and cause the extinction of large numbers of species. If the global mean temperatures exceed a warming of two to three degrees centigrade above pre-industrial levels, twenty to thirty percent of plant and animal species will face an increasingly high risk of extinction (International Panel on Climate Change 2001, 2007).

The mechanisms by which global warming may push already imperiled species closer or over the edge of extinction are multiple. Global warming increases the frequency of extreme weather events, such as heat waves, droughts, and storms (International Panel on Climate Change 2001,

2007; California Climate Action Team 2006; Lenihan et al. 2003). Extreme events, in turn may cause mass mortality of individuals and significantly contribute to determining which species will remain or occur in natural habitats. As the global climate warms, terrestrial habitats are moving northward and upward, but in the future, range contractions are more likely than simple northward or upslope shifts. Ongoing global climate change (Anonymous 2007; Inkley et al. 2004; Adger et al. 2007; Kanter 2007) likely imperils the California red-legged frog and the resources necessary for its survival. Since climate change threatens to disrupt annual weather patterns, it may result in a loss of their habitats and/or prey, and/or increased numbers of their predators, parasites, and diseases. Where populations are isolated, a changing climate may result in local extinction, with range shifts precluded by lack of habitat.

Numerous activities continue to eliminate habitats of salt marsh harvest mice. Habitat loss and degradation affecting this species continues as a result of urbanization, freshwater urban run-off, and contaminant inputs. Salt marsh harvest mice are also affected by increased predation associated with human development, and disturbance of breeding and foraging behavior. All of these non-Federal activities are expected to continue to adversely affect listed species considered in this opinion within the action area.

INCIDENTAL TAKE STATEMENT

Section 9(a)(1) of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this Incidental Take Statement.

The measures described below are non-discretionary, and must be implemented by FHWA so that they become binding conditions of any grant or permit issued to FHWA as appropriate, in order for the exemption in section 7(o)(2) to apply. FHWA has a continuing duty to regulate the activity covered by this Incidental Take Statement. If FHWA (1) fails to require Caltrans to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

Amount or Extent of Take

The Service anticipates that incidental take of the California red-legged frog will be difficult to detect because when California red-legged frogs are not in their breeding ponds, they inhabit the burrows of ground squirrels or other rodents; they may be difficult to locate due to their cryptic appearance and behavior; the juvenile and adult animals may be located a distance from the breeding ponds; the migrations occur on a limited period during rainy nights in the fall, winter, or spring; and the finding of an injured or dead individual is unlikely because of their relatively small body size. Recent project monitoring suggests that California red-legged frogs are difficult to find during preconstruction clearance surveys that include excavation of potential upland salamander refugia in close proximity to breeding ponds and other aquatic habitat. Losses of California red-legged frogs may also be difficult to quantify due to seasonal fluctuations in their numbers, random environmental events, changes in water regime at their breeding ponds, or additional environmental disturbances. Due to the difficulty in quantifying the number of California red-legged frogs that will be taken as a result of the proposed action, the Service is quantifying take incidental to the project as all of the California red-legged frogs inhabiting or utilizing the 206.94 acres of habitat identified within Segment B and Washington Creek and Lynch Creek in Segment C. The incidental take is expected to be in the form of harm, harassment, injury, and mortality to adult California red-legged frogs from habitat loss/degradation, construction-related disturbance, and capture and relocation.

The Service anticipates incidental take of the salt marsh harvest mouse will be difficult to detect or quantify because of the variable, unknown size of any resident population over time, and the difficulty of finding killed or injured small mammals. The level of take of salt marsh harvest mice can be anticipated by the loss of available habitat. The Service considers the number of salt marsh harvest mice subject to harassment from noise and vibrations to be impracticable to estimate. Upon implementation of the Reasonable and Prudent Measures, incidental take associated with the proposed project in the form of harm, and harassment of the salt marsh harvest mouse caused by habitat loss and construction activities will become exempt from the prohibitions described under section 9 of the Act.

Upon implementation of the following reasonable and prudent measures incidental take associated with the proposed action described above for the California red-legged frog and salt marsh harvest mouse will become exempt from the prohibitions described under section 9 of the Act.

Effect of the Take

The Service determined that this level of anticipated take is not likely to result in jeopardy to the California red-legged frog or the salt marsh harvest mouse. There is no designated or proposed critical habitat for the listed frog in the action area and critical habitat has not been designated for the salt marsh harvest mouse.

Reasonable and Prudent Measures

The following reasonable and prudent measures are necessary and appropriate to minimize the effect of the proposed action on the California red-legged frog and the salt marsh harvest mouse. FHWA will be responsible for compliance with these measures which they will entrust Caltrans to implement:

1. FHWA will ensure the conservation measures in the project description as described in the May 2008, Biological Assessment, the August 27, 2008 revised project description, and this biological opinion will be implemented.

2. FHWA will ensure adverse effects to the California red-legged frog and the salt marsh harvest mouse will be minimized.

3. FHWA will ensure their compliance with this biological opinion.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, with implementation under the direction of Caltrans, FHWA shall ensure compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.

1. The following Terms and Conditions implement Reasonable and Prudent Measure one (1):

    a. FHWA shall minimize the potential for harm, harassment, or killing of federally listed wildlife species resulting from project related activities by implementation of the conservation measures as described in the May 2008, Biological Assessment, the August 27, 2008 revised project description, and appearing in the *Project Description* of this biological opinion.

    b. FHWA/Caltrans shall include Special Provisions that include the Conservation Measures and the Terms and Conditions of this biological opinion in the solicitation for bid information. In addition, Caltrans shall educate and inform contractors involved in the project as to the requirements of the biological opinion.

    c. Caltrans and FHWA have proposed to provide 1:1 compensation for the effects to 203.78 acres of California red-legged frog habitat. Acceptable compensation shall be satisfied through in-perpetuity preservation of high quality red-legged frog habitat consisting of a breeding and/or significant dispersal habitat between breeding populations or a biological equivalent site similar to Lawson's Landing through

purchase of bank credits and/or acquisition of a conservation easement or fee title. Purchase of the site shall be reviewed and approved by the Service.

If a compensation bank is proposed in lieu of acquisition it shall be a Service-approved bank.

An approved ecologically-based conservation easement shall include restricted public access, a management plan, and an in-perpetuity endowment or other permanent non-wasting management fund based on a property analysis. The management plan shall include a description of the site, management needs (e.g. grazing plan, non-native vegetation and animal control, etc), when the management activities should be implemented, how often and to what level monitoring of the site shall occur, and a action/contingency plan to address potential management issues.

Proposed habitat acquisition shall also be accompanied by a Service-approved conservation easement that shall include restricted public access, a management plan, and an in-perpetuity endowment based on a property analysis.

Caltrans will demonstrate measurable progress in proving the Service approved compensation prior to initiating construction in Segment B in Phase 1, not no later than initiating construction on Phase 2.

d. Wildlife crossings established in Segment B shall be reviewed and approved by the Service.

e. FHWA/Caltrans shall prepare a relocation plan for moving California red-legged frogs that will be submitted to the Service for review and approval at least thirty (30) calendar days prior to the date of groundbreaking.

2. The following Terms and Conditions implement Reasonable and Prudent Measure two (2):

a. The Resident Engineer or their designee shall be responsible for implementing the conservation measures and Terms and Conditions of this biological opinion and shall be the point of contact for the project. The Resident Engineer or their designee shall maintain a copy of this biological opinion onsite whenever construction is taking place. Their name and telephone number shall be provided to the Service at least thirty (30) calendar days prior to groundbreaking at the project. Prior to ground breaking, the Resident Engineer must submit a letter to the Service verifying that they posses a copy of this biological opinion and have read the Terms and Conditions.

b. The Caltrans biologist shall have oversight over implementation of all the Terms and Conditions in this biological opinion, and shall have the authority to stop project

activities, through communication with the Resident Engineer or their designee, if any of the requirements associated with these Terms and Conditions are not being fulfilled. If biologist/construction liaison has requested a stop work due to take of any of the listed species the Service and the California Department of Fish and Game will be notified within one (1) working day via email or telephone.

c. Only Service-approved biologist(s) who are familiar with the biology and ecology of the California red-legged frog shall capture or handle this listed species.

d. To control erosion during and after implementation of the project, the applicant will implement erosion control BMPs. Erosion control measures and BMPs, which retain soil or sediment, runoff from dust control, and hazardous materials on the construction site and prevent these from entering aquatic habitat, will be placed, monitored, and maintained throughout the construction operations. These measures and BMPs may include, but are not limited to, silt fencing, sterile hay bales, vegetative strips, hydroseeding, and temporary sediment disposal.

e. Nets or bare hands may be used to capture California red-legged frogs. Service-approved biologists will not use soaps, oils, creams, lotions, repellents, or solvents of any sort on their hands within two hours before and during periods when they are capturing and relocating red-legged frogs. To avoid transferring disease or pathogens between aquatic habitats during the course of surveys or handling of red-legged frogs, Service-approved biologists will follow the Declining Amphibian Populations Task Force's "Code of Practice." Service-approved biologists will limit the duration of handling and captivity of red-legged frogs. While in captivity, individual frogs shall be kept in a cool, moist, aerated environment, such as a bucket containing a damp sponge. Containers used for holding or transporting adults shall not contain any standing water. California red-legged frogs should not be moved outside their functional population in order to reduce translocation stress and the spread of disease.

f. Biologists shall take precautions to prevent introduction of amphibian diseases to the action area by disinfecting equipment and clothing as directed in the October 2003, California tiger salamander survey protocol titled, Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander and the recommended equipment decontamination procedures within the Service's California Red-Legged Frog Survey Guidance. Both items are available at the Service's Sacramento office website (http://www.fws.gov/sacramento/es/protocol.htm). Disinfecting equipment and clothing is especially important when biologists are coming to the action area to handle salamanders or frogs after working in other aquatic habitats.

g. All California red-legged frogs encountered in the action area should be relocated to a Service-approved location. The relocation site must be approved for the Marin Sonoma Narrows Project prior to ground breaking.

h. An outline of the employee environmental awareness program shall be submitted to the Deputy Assistant Field Supervisor of the Endangered Species Program at the Sacramento Fish and Wildlife Office within twenty (20) working days prior to the start of construction. Documentation of the training, including individual signed affidavits, will be kept of file and available on request.

i. Permanent and temporary disturbances and other types of project-related disturbance to the habitats of the California red-legged frog and the salt marsh harvest mouse shall be minimized to the maximum extent practicable by Caltrans. To minimize temporary disturbances, all project-related vehicle traffic shall be restricted to established roads, construction areas, and other designated areas. These areas also should be included in pre-construction surveys and, to the maximum extent possible, should be established in locations disturbed by previous activities to prevent further adverse effects.

j. Areas disturbed by project activities will be recontoured to pre-project conditions and reseeded with an appropriate erosion-control mixture. The seed mixture will include appropriate native grasses and forbs. Areas that will be subjected to ongoing maintenance are not areas of temporary effects even if they are restored within one year following the initial disturbance.

k. Construction activities shall not occur adjacent to the pickleweed wetland on the north side of the Petaluma River during high tide events of eight feet or greater (as determined by NAVD88 vertical datum) when salt marsh harvest mice might seek refuge outside of the adjacent inundated tidal marsh. Activities shall not resume until the water level has dropped below the eight foot NAVD88 elevation.

3. The following Terms and Conditions implement Reasonable and Prudent Measure three (3):

a. The following shall be implemented for staging, storage sites, vehicle parking, and access associated with the project:

1. Caltrans shall require as part of the construction contract that all contractors comply with the Act in the performance of the work as described in the project description of this biological opinion and conducted within the action area.

2. If a staging, storage, access, or vehicle parking area that is in compliance with the Act is not available, the agency with jurisdiction and the contractor would be responsible for compliance with the Act.

c. Caltrans shall report to the Service any information about take or suspected take of listed wildlife species not authorized by this biological opinion. Caltrans must notify the Service via electronic mail and telephone within 24 hours of receiving such information. Notification must include the date, time, location of the incident or of the finding of a dead or injured animal, and photographs of the specific animal. The individual animal shall be preserved, as appropriate, and held in a secure location until instructions are received from the Service regarding the disposition of the specimen or the Service takes custody of the specimen. The Service contacts are Chris Nagano, Division Chief, Endangered Species Program, Sacramento Fish and Wildlife Office at (916) 414-6600, and Resident Agent-in-Charge Dan Crum of the Service's Law Enforcement Division at (916) 414-6660.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities that can be implemented to further the purposes of the Act, such as preservation of endangered species habitat, implementation of recovery actions, or development of information and data bases.

The Service requests notification of the implementation of any conservation recommendations in order to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats. We propose the following conservation recommendations:

1. FHWA, Caltrans, Transportation Authority of Marin, and Sonoma County Transportation Authority should assist the Service in implementing recovery actions identified in the *Recovery Plan for the California Red-legged Frog* (Service 2002).

2. Caltrans should consider participating in the planning for a regional habitat conservation plan for the California red-legged frog, salt marsh harvest mouse, other listed species, and sensitive species.

3. FHWA, Caltrans, Transportation Authority of Marin, and Sonoma County Transportation Authority should consider establishing functioning preservation and creation conservation banking systems to further the conservation of the California red-legged frog, salt marsh harvest mouse, and other listed species. Such banking systems also could possibly be utilized for other required mitigation (i.e., seasonal wetlands, riparian habitats, etc.) where

appropriate. Efforts should be made to preserve habitat along roadways in association with wildlife crossings.

4. Roadways can constitute a major barrier to critical wildlife movement. Therefore, FHWA, Caltans, Transportation Authority of Marin, and Sonoma County Transportation Authority should incorporate culverts, tunnels, or bridges on highways and other roadways that allow safe passage by California red-legged frog, other listed animals, and wildlife. Photographs, plans, and other information in to the biological assessments if "wildlife friendly" crossings are incorporated into projects. Efforts should be made to establish upland culverts designed specifically for wildlife movement rather than accommodations for hydrology. Transportation agencies should also acknowledge the value of enhancing human safety by providing safe passage for wildlife in their early project design.

5. FHWA and Caltrans should continue to pursue multifaceted compensation packages such as the one developed for the proposed U.S. Interstate 580/Isabel Avenue Interchange Construction Project on future formal consultations with the Service.

6. Caltrans should continue to develop and implement their Early Statewide Biological Mitigation Planning Project that has been developed by the University of California at Davis, Road Ecology Center through Caltrans funding.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed and/or proposed species or their habitats, the Service requests notification of the implementation of these recommendations.

REINITIATION--CLOSING STATEMENT

This concludes formal consultation on the proposed State Route 101 Marin-Sonoma Narrows HOV Widening Project, Marin and Sonoma Counties, California. As provided in 50 CFR §402.16 and in the terms and conditions of this biological opinion, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the final project design exceeds the described action area in the May 2008 Biological Assessment; (2) the amount or extent of incidental take is exceeded; (3) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (4) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (5) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have questions concerning this opinion on the proposed State Route 101 Marin-Sonoma Narrows HOV Widening Project, Marin and Sonoma Counties, California, please contact John Cleckler or Ryan Olah at the letterhead address or at (916) 414-6600.

Sincerely,

for Susan K. Moore
Field Supervisor

cc:
Larry Vinzant, Cesar Perez, Federal Highway Administration, Sacramento, California
Dale Jones, California Department of Transportation, Sacramento, California
Jim Richards, John Yeakel, Kevin Melanephy, California Department of Transportation, Oakland, California
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Scott Wilson, Melissa Escaron, California Department of Fish and Game, Yountville, California
Guy Preston, Preston Engineering Management Consulting, Ashland, Oregon
Bill Gamlen, Transportation Authority of Marin, San Rafael, California
John Maitland, Seana Gause, Sonoma County Transportation Authority, Santa Rosa, California

Literature Cited

Adger, N., P.Aggarwal, S. Agrawala, J.Alcamo, A. Allali, O. Anisimov, N. Arnell, M. Boko, O.Canziani, T. Carter, G. Cassa, U. Confalonieri, R. Cruz, E.de Alba Alcaraz, W. Eastreling, C. Field, A. Fischlin, B. Fitzharris, C.G. Garcia, C. Hanson, H. Harasawa, K. Hennessy, S.Huq, R. Jones, L. K. Bogataj, D. Karoly, R. Kliein, Z. Kundzewicz, M. Lal, R. Lasco, G. Love, X. Lu, G. Magrin, L.J. Mata, R. McLean, B. Menne, G. Midgley, N. Mimura, M.Q. Mirza, J. Moreno, L. Mortsch, I. Niang-Diop, R. Nichols, B. Novaky, L. Nurse, A. Nyon, M. Oppenheimer, J. Palutikof, M. Parry, A. Patwardhan, P. R. Lankao, C. Rosenzweig, S. Schneider, S. Semenov, J. Smith, J. Stone, J van Ypersele, D. Vaughan, C. Vogel, T. Wilbanks, P.Wong, S. Wu, and G. Yohe. 2007. Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report. Climate Change 2007: Climate change impacts, adaptation and vulnerability. Brussels, Belgium.

Aleshire, P. 2007. Safe Crossing. High Country News November 12, 2007.

Anonymous. 2007. Global warming is changing the World. Science 316:188-190.

Buechner, M. 1987. Conservation in insular parks: simulation models of factors affecting the movement of animals across park boundaries. Biological Conservation 41:57-76.

Bulger, J. B., N. J. Scott Jr., and R. B. Seymour. 2003. Terrestrial activity and conservation of adult California red-legged frogs *Rana aurora draytonii* in coastal forests and grasslands. Biological Conservation 110:85-95.

California Department of Transportation (Caltrans). 2007. Biological assessment for the restoration of the hydraulic capacity of the Cowan Storm Drain Canal within the U.S. Highway 101/Millbrae Avenue Interchange. EA 3A0400. December 2007. Caltrans District 4, Oakland, California.

California Climate Action Team. 2006. Climate Action Team Final Report to the Governor and Legislature. http://www.climatechange.ca.gov/climate_action_team/index.html.

Cayan, D.A., L. Leurs, M. Hanemann, G. Franco, and B. Croes. 2006. Sceanrios of climate change in California: an overview. A report from the California Climate Change Center, California Energy Commission and the California Environmental Protection Agency, Sacramento, California.

Carr, L.W., and L. Fahrig. 2001. Effect of road traffic on two amphibian species of differing vagility. Conservation Biology 15: 1071-1078.

Casagrandi, R., and M. Gatto. 1999. A mesoscale approach to extinction in fragmented habitats. Nature 400: 560-562.

Cornell University. Management of Wildlife Damage in Suburban and Rural Landscapes. http://wildlifecontrol.info/ne1005. Accessed December 2007.

Dodd, C. K. Jr., W. J. Barichivich, and L. L. Smith. 2004. Effectiveness of a barrier wall and culverts in reducing wildlife mortality on a heavily traveled highway in Florida. Biological Conservation 118 (2004) 619-631.

Drews, C. 1995. Road kills of animals by public traffic in Mikumi National Park, Tanzania, with notes on baboon mortality. African Journal of Ecology 33: 89-100.

Emlen, S. T. 1977. "Double clutching" and its possible significance in the bullfrog. Copeia 1977(4):749-751.

Fahrig, L. 1998, When does fragmentation of breeding habitat affect population survival? Ecological Modeling 105: 273-292.

Fahrig, L., and G. Merriam. 1985. Habitat patch connectivity and population survival. Ecology 66:1762-1768

Fahrig, L., J.H. Pedlar, S.E. Pope, P.D. Taylor, and J. F. Wegner. 1995. Effect of road traffic on amphibian density. Biological Conservation 73: 177-182.

Fellers, G. 2005. *Rana draytonii* Baird and Girard, 1852b California red-legged frog. Pages 552-554 *in* M. Lannoo (editor). Amphibian declines the conservation status of United States species. University of California Press. Berkeley, California.

Fellers, G. M. and P. M. Kleeman. 2007. California Red-Legged Frog (*Rana draytonii*) movement and habitat use: implications for conservation. Journal of Herpetology 41(2): 271-281

Findlay, C.S. and J. Houlahan. 1997. Anthropogenic correlates of species richness in southeastern Ontario wetlands. Conservation Biology 11: 1000-1009.

Fisler, G. F. 1965. Adaption and speciation in harvest mice of the marshes of San Francisco Bay. Univ. Calif. Publ. Zool. 77:1-108.

Forman, R. T., L.E. Alexander. 1998. Roads and their major ecological effects. Annual Review of Ecology and Systematics 29:207-231.

Gibbs, J.P. 1998. Amphibian movements in response to forest edges, roads, and streambeds in southern New England. Journal of Wildlife Management 62: 584-589.

Goals Project. 1999. Baylands ecosystem habitat goals. A report of habitat recommendations prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. U.S. Environmental Protection Agency, San Francisco, California, and San Francisco Bay Regional Water Quality Control Board, Oakland, California. 209 pp. plus appendices.

Hanski, I. 1982. Dynamics of regional distribution: the core and satellite hypothesis. Oikos 38:210-221.

_____ 1991. Single species metapopulation systematics: concepts, models and observations. Biological Journal of the Linnean Society 42:3-16.

_____ 1994. A practical model of metapopulation dynamics. Journal of Animal Ecology 63: 151-162.

Hayes, M. P., and M. R. Jennings. 1988. Habitat correlates of distribution of the California red-legged frog (*Rana aurora draytonii*) and the foothill yellow-legged frog (*Rana boylii*): implications for management. Pages 144-158 *in* R. Sarzo, K. E. Severson, and D. R. Patton (technical coordinators). Proceedings of the symposium on the management of amphibians, reptiles, and small mammals in North America. United States Department of Agriculture, Forest Service, Rocky Mountain Range and Experiment Station, Fort Collins, Colorado. General Technical Report (RM-166): 1-458.

Hayes, M. P. and D. M. Krempels. 1986. Vocal sac variation among frogs of the genus *Rana* from western North America. Copeia 1986(4):927-936.

Hayes, M. P. and M. M. Miyamoto. 1984. Biochemical, behavioral and body size differences between *Rana aurora aurora* and *R. a. draytonii*. Copeia 1984(4):1018-1022.

Hayes, M. P., and M. R. Tennant. 1985. Diet and feeding behavior of the California red-legged frog, *Rana aurora draytonii* (Ranidae). Southwestern Naturalist 30(4): 601-605.

Hels, T. and E. Buchwald. 2001. The effect of road kills on amphibian populations. Biological Conservation 99: 331-340.

Highway Loss Data Institute. 2008. Collisions with deer and other animals spike in November; fatal crashes up 50% since 2000. October 30, 2008, news release. Available at http://www.iihs.org/news/2008/iihs_news_103008.pdf.

IFPC. 2001. Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change

[Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson (editors)]. Cambridge University Press, Cambridge, United Kingdom and New York, New York. 881 pp. Available at http://www.ipcc.ch/.

_____ 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Alley, R., T. Berntsen, N.L. Bindoff, Z. Chen, A. Chidthaisong, P. Friedlingstein, J. Gregory, G. Hegerl, M. Heimann, B. Hewitson, B. Hoskins, F. Joos, J. Jouzel, V. Kattsov, U. Lohmann, M. Manning, T. Matsuno, M. Molina, N. Nicholls, J. Overpeck, D. Qin, G. Raga, V. Ramaswamy, J. Ren, M. Rusticucci, S. Solomon, R. Somerville, T.F. Stocker, P. Stott, R.F. Stouffer, P. Whetton, R.A. Wood, D. Wratt. 21 pp. Available at http://www.ipcc.ch/.

Ingles, L.G. 1932a. Four new species of *Heamatoloechus* (Trematoda) from California. University of California Publications in Zoology 37: 189-201.

_____ 1932b. *Cephalogonimus brevicirrus*, a new species of trematoda from the intestine of *Rana aurora* from California. University of California Publications in Zoology 37:203-210.

_____ 1933. Studies on the structure and life history of *Ostiolum oxyorchis* (Ingles) from the California red-legged frog *Rana aurora draytonii*. University of California Publication in Zoology 39:135-162.

Inkley, D.B., M.G. Anderson, A.R. Blaustein, V.R. Burkett, B. Felzer, B. Griffin, J. Price, and T.L. Root. 2004. Global climate change and wildlife in North America. Wildlife Society Technical Review 04-2.

Jackson, S.D. 1996. Underpass systems for amphibians. 4 pages. In G.L. Evink, P. Garrett, D. Zeigler and J. Berry (editors) Trends in Addressing Transportation Related Wildlife Mortality, proceedings of the transportation related wildlife mortality seminar. State of Florida Department of Transportation, Tallahassee, Florida. FL-ER-58-96.

Jennings, M. R. 1988. Natural history and decline of native ranids in California. Pages 61-72 *in* H. F. De Lisle, P. R. Brown, B. Kaufman, and B. McGurty (editors). Proceedings of the Conference On California Herpetology. Southwestern Herpetologists Society, Special Publication 4:1-143.

Jennings, M. R., and M. P. Hayes. 1985. Pre-1900 overharvest of California red-legged frogs (*Rana aurora draytonii*): The inducement for bullfrog (*Rana catesbeiana*) introduction. Herpetological Review 31(1):94-103.

_____ 1990. Final report of the status of the California red-legged frog (*Rana aurora draytonii*) in the Pescadero Marsh Natural Preserve. Final report prepared for the California Department of Parks and Recreation, Sacramento, California, through Agreement (4-823-9018). Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California. 30 pages.

Jennings, M. R., M. P. Hayes, and D. C. Holland. 1992. A petition to the U.S. Fish and Wildlife Service to place the California red-legged frog (*Rana aurora draytonii*) and the western pond turtle (*Clemmys marmorata*) on the list of endangered and threatened wildlife and plants. 21 pages.

Kanter, J. 2007. Scientists detail climate changes, Poles to Tropics. New York Times. April 10, 2007.

Kruse, K. C. and M. G. Francis. 1977. A predation deterrent in larvae of the bullfrog, *Rana catesbeiana*. Transactions of the American Fisheries Society 106(3):248-252.

Kupferberg, S. J. 1996a. Hydrologic and geomorphic factors affecting conservation of a river-breeding frog (*Rana boylii*). Ecological Applications 6: 1322-1344.

_____ 1996b. The ecology of native tadpoles (*Rana boylii* and *Hyla regilla*) and the impacts of invading bullfrogs (*Rana catesbeiana*) in a northern California river. PhD dissertation. University of California, Berkeley, California.

Lenihan, J. M., R. Drapek, D. Bachelet, R. P. Neilson. 2003. Climate Change Effects on Vegetation Distribution, Carbon, and Fire in California. Ecological Applications 13(6): 1667-1681.

Lindenmayer, D.B., and H.P. Possingham. 1996. Modeling the interrelationships between habitat patchiness, dispersal capability and metapopulation persistence of the endangered species, Leadbeater's possum, in southeastern Australia. Landscape Ecology 11:79-105.

Mao, J., D. E. Green, G. M. Fellers, and V. G. Chincar. 1999. Molecular characterization of iridoviruses isolated from sympatric amphibians and fish. Virus Research 6: 45-52.

Mallick, S.A., G.J. Hocking, and M.M. Driessen. 1998. Road-kills of the eastern barred bandicoot (*Perameles gunnii*) in Tasmania: an index of abundance. Wildlife Research 25: 139-145.

Munguira, M.L. and J.A. Thomas. 1992. Use of road verges by butterfly and moth populations, and the effect of roads on adult dispersal and mortality. Journal of Applied Ecology 29: 316-329.

Ng, S.J., J.W. Dole, R.M. Savajot, S.R.D. Riley, and T.J. Valone. 2004. Use of highway undercrossings by wildlife in southern California. Biological Conservation 115: 499-507.

Portland State University. 2003. Wildlife crossing, rethinking road design to improve safety and reconnect habitat. Prepared for Metro. Portland State University Planning Workshop. June 2003.

Robbins, E. 2003. No more road kill: What it takes to make highways friendly to animals. Planning 69(2): 33-34.

Rodriguez, A., G. Crema, and M. Delibes. 1996. Use of non-wildlife passages across a high speed railway by terrestrial vertebrates. Journal of Applied Ecology 33: 1527-1540.

Rosen, P.C. and C.H. Lowe. 1994. Highway mortality of snakes in the Sonoran desert of southern Arizona. Biological Conservation 68: 143-148.

Rothermel, R.B. and R. D. Semlitsch. 2002. An experimental investigation of landscape resistance of forest versus old-field habitats to emigrating juvenile amphibians. Conservation Biology 16: 1324-1332.

Rubbo, M.J., and J.M. Kiesecker. 2005. Amphibian breeding distribution in an urbanized landscape. Conservation Biology 19: 504-511.

Ruediger, B., and M. DiGiorgio. Undated. Safe passage. A user's guide to developing effective highway crossings for carnivores and other wildlife. Southern Rockies Ecosystem Project.

Saunders, S., C. Montgomery, and T. Easley. 2008. Hotter and drier: The West's changing climate. The Rocky Mountain Climate Ortganization, and Natural Resources Defense Council. New York, New York.

Schoener, T.W. and D. A. Spiller. 1992. Is extinction rate related to temporal variability in population size? An empirical answer for orb spiders. The American Naturalist 139: 1176-1207.

Sherwood, A. 2007. As cars hit more animals on roads, toll rises. New York Times December 22, 2007.

Sjogren-Gulve, P. 1994. Distribution and extinction patterns within a northern metapopulation of the pool frog, *Rana lessonae*. Ecology 75: 1357-1367.

Stebbins, R. C. 2003. A field guide to western reptiles and amphibians. Houghton Mifflin Company, Boston, Massachusetts.

Storer, T. I. 1925. A synopsis of the amphibia of California. University of California Publications in Zoology 27:1-1-342.

_____ 1933. Frogs and their commercial use. California Department of Fish and Game 19(3)203-213.

Stuart, J. M., M. L. Watson, T. L. Brown, and C. Eustice. 2001. Plastic netting: an entanglement hazard to snakes and other wildlife. Herpetological Review 32(3): 162-164.

Twedt, B. 1993. A comparative ecology of *Rana aurora* Baird and Girard and *Rana catesbeiana* Shaw at Freshwater Lagoon, Humboldt County, California. Unpublished. Master of Science thesis. Humboldt State University, Arcata, California. 53 pages plus appendix.

U.S. Fish and Wildlife Service (Service). 1970. United States List of Endangered Native Fish and Wildlife. October 13, 1970. Fed. Reg. 35(199): 16047-16048

_____ 1984. Salt Marsh Harvest Mouse and California Clapper Rail Recovery Plan. U.S. Fish and Wildlife Service, Portland, Oregon. 141 pages.

_____ 1996. Endangered and threatened wildlife and plants; determination of threatened status for the California red-legged frog. **Federal Register** 61:25813-25833.

_____ 2002. Recovery plan for the California red-legged frog (*Rana aurora draytonii*). Portland, Oregon. 173 pages.

_____ 2004. Endangered and threatened wildlife and plants; proposed designation of critical habitat for the California red-legged frog (*Rana aurora draytonii*), proposed rule. **Federal Register** 69:19620-19642.

Van der Zande, A.N., W.J. ter Keurs, and W.J. Van der Weijden.. 1980. The impact of roads on the densities of four bird species in an open field habitat - evidence of a long-distance effect. Biological Conservation 18: 299-321.

Van Gelder, J.J. 1973. A quantitative approach to the mortality resulting from traffic in a population of *Bufo bufo* L. Oecologia 13:93-95.

Verboom, B., J., K. Lankester, and J.A. Metz. 1991. Linking local and regional dynamics in stochastic metapopulation models. Biological Journal Linnean Society 42:39-55.

Vos, C.C. and J.P. Chardon. 1998. Effects of habitat fragmentation and road density on the distribution pattern of the moor frog, *Rana arvalis*. Journal of Applied Ecology 35: 44-56.

Vos, C.C. and A.H.P. Stumpel. 1995. Comparison of habitat-isolation parameters in relation to fragmentation distribution patterns in the tree frog (*Hyla arborea*). Landscape Ecology 11: 203-214.

Wilcox, B.A. and D.D. Murphy. 1985. Conservation strategy: the effects of fragmentation on extinction. The American Naturalist 125: 879-887.

With, K.A. and T. O. Crist. 1995. Critical thresholds in species' responses to landscape structure. Ecology 76: 2246-2459.

Wright, A. H. and A. A. Wright. 1949. Handbook of frogs and toads of the United States and Canada. Comstock Publishing Company, Inc., Ithaca, New York. 640 pages.

Yanes, M., J.M. Velasco, and Francisco Suarez. 1995. Permeability of roads and railways to vertebrates: the importance of culverts. Biological Conservation 71: 217-222.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

JAN 26 2009

In response refer to:
2007/08320:DHW

Gene K. Fong
Division Administrator
Federal Highway Administration
California Division
650 Capital Mall, Suite 4-100
Sacramento, California 95814

Dear Mr. Fong,

Thank you for your September 24, 2008, letter requesting consultation with NOAA's National Marine Fisheries Service's (NMFS) regarding the California Department of Transportation's (Caltrans) proposed Marin Sonoma Narrows Project (MSN Project) that will widen Highway 101 between State Route 37 in the City of Novato, Marin County, and the Corona Road Overpass in the City of Petaluma, Sonoma County, California. The enclosed biological opinion considers the effects of this proposed project on threatened Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*) Distinct Population Segment (DPS), threatened Southern DPS of North American green sturgeon (*Acipenser medirostris*), designated critical habitat for CCC steelhead, and proposed designated critical habitat for North American green sturgeon in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*). In addition, this letter transmits the result of NMFS' Essential Fish Habitat (EFH) consultation pursuant to section 305(b)(2) of the Magnuson-Stevens Fisheries Conservation and Management Act (MSA).

Endangered Species Act Consultation

NMFS concludes in the biological opinion that the proposed action will not jeopardize the continued existence of CCC steelhead and North American green sturgeon nor adversely modify designated critical habitat for CCC steelhead and the proposed designated critical habitat for North American green sturgeon. However, we anticipate that take of steelhead as a result of this project will occur and, therefore, an incidental take statement with non-discretionary terms and conditions is included.

Essential Fish Habitat Consultation

NMFS has evaluated the proposed project for potential adverse effects to Pacific salmon EFH pursuant to section 305(b)(2) of the MSA. After reviewing the effects of the project on salmonid habitat as described in the enclosed biological opinion, NMFS has determined that the proposed

action will have an adverse effect on the fall run Central Valley (CV) Chinook salmon (*O. tshawytscha*) EFH in Novato and San Antonio creeks, and the Petaluma River. Section 305(b)(4)(A) of the MSA authorizes NMFS to provide EFH Conservation Recommendations that will minimize adverse effects of an activity on EFH. For this project, conservation measures are included in the project description. In addition, the enclosed biological opinion also contains non-discretionary terms and conditions that will minimize adverse effects to EFH. Therefore, NMFS has not provided EFH Conservation Recommendations for this project.

If you have any questions about this section 7 and EFH consultation, or if you require additional information, please contact Mr. Dave Walsh at (707) 575-6016.

Sincerely,

Rodney R. McInnis
Regional Administrator

Enclosure

cc: Russ Strach, NMFS, Sacramento
Korie Schaeffer, NMFS, Santa Rosa
Jeffrey G. Jenson, John Yeakel, Kelly Nelson, Caltrans District 4, Oakland
Jeremiah Puget, North Bay Regional Water Quality Control Board
Melisa Escaron, California Department of Fish and Game
John Cleckler, U.S. Fish and Wildlife Service
Copy to File: 151422SWR2007SR0049

BIOLOGICAL OPINION

ACTION AGENCY: California Department of Transportation

ACTION: Marin Sonoma Narrows Highway 101 High Occupancy Vehicle Lane Widening Project: Novato to Petaluma

CONSULTATION CONDUCTED BY: National Marine Fisheries Service, Southwest Region

TRACKING NUMBER: 2007/08320

DATE ISSUED: January 26, 2009

I. CONSULTATION HISTORY

NOAA's National Marine Fisheries Service (NMFS) has been involved with the Marin Sonoma Narrows (MSN) Highway 101 Lane Widening Project since the 2002 preliminary planning stages. The pre-consultation and technical assistance began in May of 2002. During this time, affected habitat was discussed and salmonid presence was evaluated in the project areas.

In accordance with the National Environmental Policy Act/404 Memorandum of Understanding agreement (April 2006) between the Federal Highways Administration (FHWA) and California Department of Transportation (Caltrans), the MSN Project passed through a Checkpoint and Comment process during its planning inception which allowed other participating agencies to comment on some pivotal decisions regarding environmental and construction issues.

On November 1, 2007, NMFS responded to a Caltrans' request for agreement on the purpose and need and range of alternatives for the MSN Project pursuant to the NEPA/404 MOU with a letter stating that NMFS supported the decisions for project designs that would reduce impacts to aquatic resources; including bridge designs using the least amount of piles in watered channels and recommended free spanning bridges wherever feasible.

On May 7, 2008, NMFS participated in a Caltrans sponsored meeting in Oakland, California, to discuss the Least Environmentally Damaging Preferred Alternative (LEDPA) and conceptual mitigation under the NEPA/404 MOU. These discussions resulted in reducing impacts to wetlands and Highway 101 near the Redwood Landfill, and to incorporate 2:1 grading of slopes in order to further reduce project impacts. NMFS responded to these decisions with a letter that supported the LEDPA 12b, including the realignment and access point control in segment B, as the preferred alternative of reaching the goals set by Caltrans in easing traffic flow. In that letter, NMFS also offered a commitment to work alongside Caltrans staff in developing plans that will meet their construction goals while minimizing impacts to these protected resources.

On August 7, 2008, NMFS received a consultation request letter from Caltrans asking to initiate consultation under section 7 of the Endangered Species Act (ESA) and to concur with Caltran's determination of "May Effect, Not Likely to Adversely Affect" for the threatened Central California Coast (CCC) steelhead (*Onchorynchus Mykiss*) Distinct Population Segment (DPS), the Southern DPS of North American green sturgeon (*Asipenser medirostrius*), CCC steelhead critical habitat, and North American green sturgeon proposed critical habitat. The letter also requested Essential Fish Habitat (EFH) consultation pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSA). Under the MSA, Caltrans determined that there would be minimal adverse affect on fall-run Central Valley Chinook salmon (*O. tshawycha*) EFH in the Petaluma River within the action area, but did not mention the location in the project area where these affects would occur.

On August, 22, 2008, NMFS contacted Caltrans to update the progress made in the consultation process. NMFS reported that some of the project activities would likely involve the capture and relocation of CCC steelhead and that this action would trigger take of a listed species under the ESA, and, therefore, NMFS would not concur with the initial determination and that the determination would need to be changed to "May Affect, Likely to Adversely Affect".

On August 18, 2008, and September 24, 2008, NMFS received written consultation requests from the FHWA for the MSN Project. The August 18th letter stated that the FHWA also determined a "may effect, not likely to adversely affect" for project activity impacts to listed species, and that the project activities would not destroy or adversely modify steelhead critical habitat in the project area. The letter also stated the project would have minimal adverse affect on fall-run Central Valley Chinook salmon EFH and that the informal consultation responsibilities had been previously delegated to Caltrans who would be consulting with NMFS for EFH. In the September 24th letter, the FHWA changed their determination from a "not likely to adversely affect" to a "likely to adversely affect" for section 7 of the ESA. The FHWA did not change the EFH determination for fall-run Chinook in this letter. In an email dated October 28, NMFS confirmed with Caltrans that the FHWA was the lead agency for the MSN Project.

II. DESCRIPTION OF THE PROPOSED ACTION

Under agreement with and funding from the FHWA, Caltrans proposes to fund the building of the MSN Project, which will widen 17.2 miles of Highway 101 in both the southern and northern directions to alleviate severe traffic increase in Marin and Sonoma counties. High Occupancy Vehicle (HOV) lanes and associated structures will be built starting south of State Route 37 in the City of Novato and ending north at the Corona Road overcrossing in the City of Petaluma. The MSN Project will be constructed in multiple phases over consecutive construction seasons with all work below Ordinary High Water (OHW) to occur between the dates of June 15 to October 31 at the creek crossings, with the exception of the proposed year-round pile driving activities in the Petaluma River. Bridge crossings other than the Petaluma River Bridge will likely be completed within one-to-two construction seasons, while the Petaluma River Bridge may take as many as four construction seasons. Construction will occur within the next five years from issuance of this biological opinion.

The MSN Project was initially planned as three separate projects, denoted as segments A, B, and C, with independent utility and logical termini.[1] These segments were combined into a single project area to address cumulative effects in the preliminary Environmental Impact Statement/ Environmental Impact Report. In this biological opinion, NMFS periodically refers to the A, B, and C format to relate the location of project activities within the action area.

In addition to the HOV lane widening, Caltrans has also proposed road improvement activities that include modifying and constructing Highway 101 bridge crossings, constructing new interchanges, upgrading drainage systems, constructing new frontage roads and bikeways, and relocating the flood prone "Segment B" of Highway 101 to the west.

Over the last 15 years, significant commercial and residential growth has led to severe traffic increases through this corridor of Highway 101. The project's intention is to convert Highway 101 from a freeway and partial expressway to a complete freeway in order to alleviate the traffic congestion by improving mobility through this corridor between Marin and Sonoma counties. The conversion will be accomplished by providing additional traffic lanes and interchange ramps.

A. Description of the Proposed Work

The new HOV lanes will be the standard 12 feet in width with 10-foot inside shoulders and a concrete median barrier. Road widening will occur at six bridge crossings over five creeks and one river. Caltrans has determined that the road widening at these six crossings may adversely affect steelhead and green sturgeon, and all other project activities for this project will have no effect to listed species and critical habitat. There are additional project activities in the MSN Project that are not directly over or around waterways, having varying distances between one to four miles from the creeks and river discussed in this biological opinion. Based on NMFS' familiarity with road and bridge projects, all other project activities involve upland road work that are far enough away from the waterways in NMFS' judgment to avoid effects to listed salmonids, green sturgeon, and their habitats. NMFS is concerned with the project activities at the bridge sites that will impact listed species and designated critical habitat and, therefore, will analyze the potential impacts at these six crossings. Widening over these crossings will either be accomplished by creating a center bridge that will effectively "fill in the gap" between north and southbound lanes and extend the outside shoulders, or with the construction of new bridges. As part of the construction in Segment B, two additional bridges will be constructed on San Antonio Road, located to the west of Highway 101.

Modifications to, or construction of, these crossings are to occur at the following five creeks and one river: Novato Creek, Rush Creek, San Antonio Creek, Washington Creek, Lynch Creek, and the Petaluma River. There are also two blind end tide channels off of the Petaluma River that are

[1] Segment A is the southern segment that extends 4.3 miles - from just south of State Route 37 to north to the Atherton Avenue Interchange in the City of Novato in Marin County; Segment B is the central segment, called the "narrows", that extends 8.2 miles between Atherton Avenue Interchange to the south and crossing over the Marin-Sonoma County line and ending at State Route 116 (East) to the north; and Segment C is the northern Segment, extending 4.7 miles from State Route 116 (East) to north of the Corona Overcrossing in the City of Petaluma (Sonoma County).

near construction activities. The two blind end tide channels are connected to the Petaluma River and could potentially provide seasonal rearing habitat for steelhead and green sturgeon; however, the extent of the project activities near the terminus of these channels is limited to equipment staging that, in NMFS' judgment, would not impact steelhead and green sturgeon.

If water is present at creek crossings, construction sites will be isolated from surface flow using temporary cofferdams for constructing bridge supports. The cofferdams will be constructed of interlocking sheet pilings, using a vibratory hammer and an impact hammer if difficult driving is encountered. Cofferdams will only be installed or removed between June 15 to October 31. Any water present in the creeks will be pumped or bypassed through pipes, using fish screens at both pipe ends. Flows in the Petaluma River will remain continuous through the project area via a minimum 60-foot navigable passage and will be maintained at all times under the bridge regardless of project activities. Where water diversion is necessary, the contractor will comply with Caltrans' Storm Water Pollution Prevention Plan (SWPPP), Best Management Plans (BMPs) NS-5, Clear Water Diversion.

Fish relocation activities will be conducted at the Petaluma River, Lynch, and Novato Creek locations.[2] Prior to the dewatering, a biologist will survey the area and seine and dip net for fish, prior to pumping. There are no set number of passes with the seines and dip nets, and the biologist will keep seining until no more fish are captured in several passes. Salmonids are expected to be captured first, with the rest of the time spent catching other fish species (Michael Fawcett, personal communication, October 15, 2007). Water will be drawn down to a level where fish are accessible and can be removed. Multiple draw downs of water and collections may be necessary to effectively remove fish from some of the dewatered areas. Dip nets will be used in the remaining small pools of water. All pumps will be monitored by a biologist to ensure that no fish are impinged on the intake end during the dewatering process. Fish will be located to similar or better suited habitat, either upstream or downstream and away from the construction area.

Temporary falsework will be used to provide structural support during the bridge building process, and will either be hung from the pier walls via metal hook systems or built up from timber pads. Wherever feasible, timber pads will be placed out of the wetted channel, along the banks with the use of construction machinery for setting up and/or dismantling the falsework. If the temporary falsework will require piles for proper support, then all pile driving activities will be conducted out of the channel and completely removed after construction is complete.

The other construction activities in the MSN Project will include the following: replacement of and improvements to the Highway 101 culvert drainage configuration[3]; shifting and straightening the 8.2 miles of Segment B and converting it from an expressway[4] to a freeway; and the construction of and modifications to interchanges, frontage roads, overcrossings (state

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[2] Listed salmonids or green sturgeon are not anticipated to be present at the other bridge locations during in-water construction work as described below in the *Environmental Baseline*.

[3] Stormwater will be directed to existing highway drainage systems and use existing outfalls with updated storm water quality control systems.

[4] The stretch of Segment B is currently an expressway which includes four traffic lanes and narrow shoulders of varying widths, seven locations with limited sight distance, two locations with recurring flooding, and at-grade intersections and driveway access that adversely impact mainline operations.

roads) and undercrossings (county roads) along the entire MSN corridor. These MSN construction activities are in upland areas that are not near any waterways and, therefore, are not expected to affect listed species and critical habitat and therefore will not be analyzed in this biological opinion. For further detailed information on these activities please refer to Caltrans' biological assessment – *Marin Sonoma Narrows Widening Project: Biological Assessment for Central California Coast Steelhead, Southern Distinct Population Segment North American Green Sturgeon and Essential Fish Habitat for Chinook Salmon.*

Following is a discussion of site specific details:

1. Novato Creek Bridge Crossing in Segment A

The existing parallel bridges crossing Novato Creek are two independent five-span continuous reinforced concrete decks that measure 58.5 meters (m) (192 feet) each. The decks are supported by 44 octagonal piles in the center that measure 18 inches in diameter and two diaphragm type abutments at the ends on reinforced concrete piles. The Novato Creek Bridges accommodate six 3.6 m (12 foot) lanes, with 3.6 m (12 foot) inside shoulders and 2.4 m to 3.0 m (8 feet to 10 feet) outside shoulders.

The project would widen the bridge by constructing a center deck in the gap between the Novato Creek bridges - creating an additional 3.6 m (12 foot) lane with 3.0 m (10 foot) shoulders. Lane barriers would also be upgraded to the current standards. Modification of the supporting substructure will require Class 625 driven precast concrete piles at the abutments (end supports) and use Cast in Steel Shell (CISS) piles to construct the columns for the piers (middle supports). The new abutments and piers will match the alignment of the existing abutments and piles.

Four 600 millimeters (mm) (2 foot) diameter CISS piles will be used at each of the four piers; resulting in a total of 16 CISS piles. CISS piles will be driven into the ground, cleared of dirt, reinforced with steel bar, and filled with concrete. All concrete pouring will occur from a concrete pump truck staged on the creek bank. Existing piles in the area will either be removed with vibratory hammers or left in place and cut off below the ground. Cofferdams will be installed and made watertight at the pier locations to dewater the area of surface and subsurface flow.

Two additional platforms will be built within the gap areas on each bank to provide a work surface for the pile rig equipment to drive piles at the Pier 3 and 4 locations. The platforms will employ a closed-fill system to protect it from tidal influences in the creek, and will be constructed from interlocking sheet piles to form an enclosed area that will be back filled with gravel. Sheet piles will be placed with either a vibratory or impact hammer and gravel fill will be washed prior to use.

Both platforms will extend 39 feet at each end of the bridge to the creek banks. The platform on the south bank will use 11,360 cubic feet of backfill to create 1,698 square feet of work surface, and the platform on the north bank will use 12, 285 cubic feet of backfill to create 1,800 square feet of work surface. In the event that the platform does extend into the creek channel then fish

relocation and dewatering plans have been proposed prior to the back filling process and construction of the platforms will be performed no earlier than June 15.

Following construction the closed-fill system and the falsework will be removed. A 20-foot wide road along one side of the bridge at each abutment will be constructed to move materials into and out of the work area. After the construction materials are retrieved, the creek banks will be stabilized and erosion control methods will be employed.

2. San Antonio Creek Bridges (frontage and mainline) in Segment B

Currently there are two bridges crossing San Antonio Creek: a crossing at Highway 101 (or mainline) consisting of two independent parallel bridge crossings; and a crossing at San Antonio Road (or frontage) to the west of Highway 101 consisting of a single bridge with two lanes. As part of the transition from an expressway to a freeway in Segment B, these two bridges will be modified and reassigned to traffic crossings at new frontage roads that will run parallel and flank the east and west sides of Highway 101. The 8.1 miles of Highway 101 will then be moved west, away from its existing configuration which is a flood prone area. Two new bridges will be constructed at the new Highway 101 and San Antonio Road crossing locations – resulting in a total of four bridge crossings over San Antonio Creek. Riparian and non-riparian tree loss will occur at the San Antonio Creek and Highway 101 locations as a result of the two new bridges and access roads.

If subsurface flow is present in the creek then cofferdams will be placed around the footing locations to dewater the area. Steelhead presence is not expected at these locations (as described below in the *Environmental Baseline*), and, therefore, fish relocation activities will not be conducted. Water will be pumped from the cofferdams to a truck or sediment basin and sealed from the inside to make watertight. The precast concrete piles will then be driven inside the cofferdams using an impact hammer, followed by the pouring of concrete over the piles to form the footings.

a. The Current Mainline Crossing (San Antonio Creek)

The southbound Highway 101 crossing will be removed, and the northbound crossing will be reconnected to a new frontage road that will run on the east side parallel to Highway 101. The southbound bridge on Highway 101 will be removed following the construction of the new Highway 101 Bridge to the west, and will involve the breaking and removing of the existing concrete. The bridge section will be dropped over land onto filter fabric or similar materials and removed. BMPs will be employed to prevent falling debris from entering the creek.

b. The New Mainline Crossing (San Antonio Creek)

The new mainline crossing will be built on the raised and realigned portion of Highway 101 that will run west of the existing highway. The bridge will be a cast in place concrete pre-stressed box girder with reinforced pier caps and abutments. The bridge will either be a five span structure at 192.5 m (635 feet) long by 35.11 m (116 feet) wide, or a three span structure at 130.5

m (431 feet) long by 35.11 m (116 feet) wide. The three span bridges would include a Mechanically Stabilized Earth wall at abutment 1 which will result in the shorter bridge.

The five span bridges would use four columns per pier for a total of 16 columns for the four piers, and the three span bridge alternatives would also use four columns per pier for a total of eight columns for the two piers. Each concrete column will measure 1.68 m (5.5 feet) in diameter and placed on a concrete footing measuring 6.7 m by 6.7 m by 1.8 m deep (22 feet by 22 feet by 6 feet). For the five span bridge option, twenty-five precast concrete piles will driven, using vibratory and impact hammers, into the creek bed and banks for each of the four footings - totaling 100 piles. If the three span bridge option is used then 50 concrete piles will be driven for the two footings using the same methods. The precast concrete piles will measure 380 mm by 380 mm (15 inches by 15 inches).

c. The Current Frontage Crossing (San Antonio Creek)

The existing historic San Antonio Creek Bridge is approximately 30.8 m (101 feet) long and 7.0 m (23 feet) wide. The existing structure is not wide enough to provide adequately sized lanes and shoulders, and the historic nature of the bridge does not allow for it to be modified. Therefore, a new bridge crossing will be constructed to service traffic on San Antonio Road, and the current bridge will be reconnected to a frontage road running north from San Antonio Road where it will terminate at a cul-de-sac. There will be no alterations made to this bridge for connecting it to the frontage road.

d. The New Frontage Crossing (San Antonio Road) Creek

The new frontage crossing will be constructed for two-way vehicular and bicycle/pedestrian traffic, and will accommodate traveling to and from destinations to the west of Highway 101. There are two bridge alternatives for the new frontage bridge crossing San Antonio Creek; the first alternative is proposed as a cast-in-place concrete slab with reinforced concrete pier caps and abutments. This bridge will consist of seven spans at approximately 69.3 m (227.5 feet) long and 12.90 m (42 feet) wide. The substructure will use Class 625 driven precast concrete piles at the abutments and driven CISS piles at the piers. Five CISS piles, measuring 600 mm (24 inches) in diameter, will be required per pier for a total of 30 CISS piles for the six piers.

A second alternative proposed is a two span cast-in-place concrete pre-stressed box girder bridge with reinforced concrete pier caps and abutments that would measure 71.5 m (235 feet) long and 12.90 m (42 feet) wide and use two reinforced concrete columns at 1.22 m (4 feet) in diameter and abutments both supported on a concrete pile cap with driven precast concrete piles. The column footings will measure 8.5 by 8.5 by 1.8 m deep (28 feet by 28 feet by 6 feet) with each column footing requiring 25 driven CISS piles to construct – for a total of 50 piles. The pile size required for the footings is 380 mm by 380 mm (15 inches by 15 inches).

For the first alternative, grading of the banks around the abutments will be required to raise the abutment profile followed by pile driving the concrete piles for the abutments and construction of the concrete abutments. CISS piles will be driven into the ground, cleared of dirt, reinforced

with steel bar, and filled with concrete. These foundation piles will extend as columns into the deck slab.

3. Petaluma River Bridge in Segment C

The existing Petaluma River Bridge consists of two separate structures, each measuring 270 m (885 feet) long and 9.6 m (31 feet) wide. The original bridges were built in 1955 and have had been modified over the years to accommodate future traffic conditions, including additional 3.6 m (12 feet) lane and 3.0 m (10 feet) inside and outside shoulders.

The project is scheduled for three to four construction seasons, starting with construction of a new center bridge between the existing bridges in the first season. The following seasons will consist of demolition and removal of the southbound bridge followed by the removal of the northbound bridge, including bridge pilings, followed then by construction of the new bridges within the old bridge footprints. Pile driving for the column footings will occur year-round. Other construction activities that will occur year-round on land include: bridge demolition, vegetation clearing and planting, and road construction for site access, removal of existing piles, falsework removal and cleanup, and concrete pouring (which may involve some work over water using appropriately sealed forms). Access to the work areas will occur from the north using an existing secondary road and from the south using Petaluma Boulevard South.

Two structure alternatives are currently proposed for the new 260.5 m (855 feet) long and 35.110 m (115 feet) wide, five-span bridge: Alternative 1 would consist of a reinforced concrete box girder superstructure; and Alternative 2 would consist of a Precast/Prestressed Concrete Bulb "T" girder superstructure.

The new bridge will be supported on four piers along the spans and two abutments at either bank. The Piers (2, 3, 4, and 5) will be comprised of three-to-five columns seated on a column footing. Each footing will measure 10.67 m (35 feet) by 8.5 m (28 feet) by 2.0 m (7 feet) deep. Either 762 mm (30-inch) diameter Cast In Drilled Hole (CIDH) or CISS piles will be used to construct the footings. The amount of footings and piles required at the center, southbound and northbound decks was determined and summarized below by Caltrans engineers:

1. Center deck - Number of permanent piles will range from 100 piles (1 footing/bent x 4 bents x 25 piles/footing) to 160 piles (1 footing/bent x 4 bents x 40 piles/footing).

2. Southbound deck - Number of permanent piles will range from 160 piles (1 footing/bent x 4 bents x 40 piles/footing) to 200 piles (2 footings/bent x 4 bents x 25 piles/footing).

3. Northbound deck - Number of permanent piles will range from 160 piles (1 footing/bent x 4 bents x 40 piles/footing) to 200 piles (2 footings/bent x 4 bents x 25 piles/footing).

In summary, a final 3-column bent structure will require approximately 480 permanent piles at the bents. A final 5-column bent structure will require approximately 500 permanent piles at the bents.

Piers 3 and 4 are located within the wetted channel below OHW and will require cofferdams for footing construction, while Piers 2 and 5 are located on either bank above OHW, but will use cofferdams if subsurface flows are present during the footing construction.

Two to 20 of the CISS piles can be installed per day, with vibratory and impact hammers, and are estimated to receive from 200 to 600 strikes, with the impact hammer, until they extend into bedrock. Pile driving will be within the confines of the cofferdams and will occur for a minimum of 60 days over an 18-month timeframe.

A 300 m (1000-foot) by 11 m (36 foot) trestle bridge will be built in the river to provide a platform for working on the new piers, removing the old piers, and constructing temporary falsework, temporary erection towers, and fender piles. An 18 m (60-foot) wide channel will be maintained for navigation past the Petaluma River Bridge throughout the entire construction seasons. The trestle and fenders will use either H-piles or steel pipe piles. These piles will be approximately 510 mm (20 inches) to 610 mm (24 inches) in diameter. Piles will initially be driven with a vibratory hammer, followed with between five to 20 strikes with an impact hammer to confirm bearing. Three hundred piles are anticipated for building the trestle and the fenders and will take between 20 and 75 days, at two to ten piles per day, over a three year period, and stay within the June 15 to October 31 timeframe. A barge may be used in lieu of the trestle and consequently reduce some need to pile drive.

Cofferdams will be placed at the old and new locations for Piers 3 and 4. The configuration of the cofferdams will be determined by the contractor and depend on the current conditions in the river and construction season, but it will either be anticipated to be one cofferdam for each pier location that would encompass the old piers and new pier locations, for a total of two cofferdams, or up to one cofferdam per pier for a total of six cofferdams.

Additional cofferdams could also be used at Piers 2 and 5 if ground water is present. The locations for Piers 2 and 5 are out of the flood prone zone and will not require dewatering. Four additional 39-foot long by 22-foot wide cofferdams will be required for the demolition and removal of the existing columns and footings at Piers 5 and 6, resulting in a net dewatered area of 3,432 feet^2 of additional dewatered area.

The total dewatered area including all cofferdams at Piers 3, 4, 2, and 5, regardless of configuration, will result in 26,232 feet^2; however, the 60-foot wide channel requirement will likely determine the number of cofferdams that can be installed at a given time, hence all areas are not likely to be dewatered at once.

Some cofferdams will use intermediate walls that will aid in dewatering particular sections within the cofferdam and mitigate in fish escapement and dewatering activities. All cofferdams that are required for pile driving will be installed from June 15 to October 31, regardless of pile driving schedules, over any of the three to four construction seasons. Once cofferdams are installed, pile driving activities are proposed to occur year-round within the cofferdams. When pile driving is completed, cofferdams will be removed between June 15 and October 31.

4. Lynch Creek Crossing in Segment C

The existing Lynch Creek Bridge is comprised of two independent bridges with four lanes for north and southbound traffic measuring 3.6 m (12 feet) with 0.6 m (2 feet) inside shoulders and a 1.2 m (4 feet) outside shoulders. Both of the existing three spans decks were built in 1955 and are constructed of reinforced concrete slabs measuring 24.1 m (79 feet) in length with reinforced concrete pile piers and reinforced concrete "U" open abutments.

The Lynch Creek Bridge will be widened to accommodate an additional 3.6 m (12 feet) lane, 3.0 m (10 feet) shoulders and ramp taper. Widening will consist of connecting the two existing bridges in the center median and widening both outside shoulders. Caltrans also proposes to replace the existing bridge barriers with current standard barriers.

The location and bearing for the new abutments and piers will match with the alignments of the existing abutments and piers. A sound wall will be constructed on the southbound side of the structure and supported on a bridge barrier. Access to the existing Lynch Creek channel will be required for pile driving and falsework construction. The piles will extend into the superstructure.

The widening of the existing bridge requires the construction of a new cast-in-place reinforced concrete slab superstructure including new concrete pier caps and abutments. The substructure consists of class 625, 305 mm by 305 mm (12 inch by 12 inch) diameter driven precast concrete piles. It is anticipated that there will be 10 new driven precast concrete piles per pier for a total of 20 for the two piers.

Access to the existing channel will be required for construction. It is anticipated that the contractor will primarily access the site from the center median and along the shoulders of the existing highway. A crane will be positioned at the abutment locations and reach out to drive pilings.

Falsework will be used at this location to support construction loads, including falsework bents using braced timber posts supported on timber pads placed on top of existing ground or braced steel piles driven into the ground.

A cofferdam and dewatering system may be constructed for the pier construction using a vibratory hammer if water is present in the area. Following construction the temporary falsework material will be removed.

5. Road Drainage Improvements

Currently, in all three segments of the 17.2 mile project area, water drains to the depressed median between the north and south bound lanes where it enters drainage inlets at low points and is transferred via cross culverts to swales along the outside of Highway 101 and then drains into adjacent water courses. There are currently 35 cross culverts in segment A, and 15 in segment C of Highway 101; all of which will either be reconditioned, decommissioned, or replaced. The

median between the north and southbound lanes will be raised and filled to construct the two HOV lanes and modifications will be made to the current drainage inlets and cross culverts.

Improvements to the current road drainage system will incorporate bio-filtration strips and swales to receive storm water discharges from the highway or other impervious surfaces. The project will also likely include offsite storm water treatment. Other measures to reduce pollutants carried by storm water-runoff include bio-filtration strips, bio-filtration swales, and Austin sand filters.

6. Staging Locations

Staging locations will be used for temporary storage of heavy construction equipment and construction materials, equipment maintenance shops, stockpile areas, and field offices.

The primary staging area in Segment A will be located within the interchange at the South Novato overcrossing. Section B staging will be located within the new interchange at the Sanitary Landfill Road, at the new interchange off of Kastania Road, and below and along the sides of the Petaluma River Bridge. Section C staging will be located within the interchange at State Route 116.

Other staging areas will be located within the State Right-of-Way and subject to approval of the contractor's submitted SWPPP. Contractors may independently seek off-site staging locations. Off-site staging locations will be subject to the requirements of resource agencies and will be the responsibility of the contractor.

7. Best Management Practices (BMPs)

The following BMPs are incorporated into the proposed MSN Project for minimizing effects to federally-listed species and salmon habitat:

1. Work will be restricted in Novato, San Antonio, and Lynch creeks to low-flow periods between June 15 and October 31 to avoid effects to steelhead or green sturgeon or any life stages of steelhead during their migratory seasons. This window can be increased based on creek and river conditions, if approved in writing by NMFS. Work from the banks and from trestle, falsework and inside closed cofferdams can occur year-round.

2. The amount and duration of pile driving will be minimized. For any pile driving occurring in wetted areas that may be occupied by adult and juvenile steelhead (or green sturgeon in the Petaluma River), sound pressure levels generated from pile driving activities will be restricted to levels below thresholds that result in injury to fish.

   Pile-driving activities will be conducted only during daylight hours to allow movement of steelhead or green sturgeon that may be present in the project vicinity to pass the construction area during night time hours. Monitoring of acoustic levels will confirm that pile driving activities are not harmful to steelhead or green sturgeon. Caltrans will monitor underwater sound levels during pile driving that occurs during the steelhead migration season

(November 1 through June 14). A hydrophone device will be used to hydroacoustically monitor sound levels. If the current thresholds (above 206 dB peak Sound Pressure Level (SPL) and 187 accumulated dB Sound Exposure Level (SEL) at 10 m from the pile being installed) that cause death or injury to fish are exceeded, Caltrans will stop the pile driving activities until sound levels can be maintained under the prescribed thresholds. In addition, if pile driving in the Petaluma River begins in the summer, Caltrans will monitor underwater sound levels for a period of two weeks at the beginning of pile driving activities and further attenuate sound if necessary.

3. All equipment will be stored outside of all waterways, including wetlands. Per the SWPPP for the project, a silt fence will be installed around the perimeter of these locations. The staging areas will also be situated 15.2 m (50 feet) from existing drainages.

4. Silt fences will be installed. The silt fencing will be delineated on the final plans and fences will be installed and remain on-site until the project is completed. Silt fences and/or coir rolls will be installed on the slopes adjacent to the work area to prevent silt from entering the watershed.

5. Appropriate temporary cofferdams will be used to dewater the construction sites and divert water through the action area during the construction period to prevent impeding creek flow or water flow through the work areas. If dewatering at a site is required, a qualified Caltrans biologist will be present during the dewatering period to inspect and ensure that sensitive aquatic species will not be trapped within the temporary cofferdams.

   If steelhead or green sturgeon are found within the cofferdams, a NMFS-approved biologist will capture, and relocate these fish to an appropriate area away from the construction site. Caltrans will submit for approval the dewatering and fish capture and relocation plans to NMFS once the design plans are finalized.

6. Erosion controls will be maintained throughout the demolition and construction periods.

7. All construction materials will be removed from the streambed at the completion of the construction project to maintain flow through the action area during the construction period, including cofferdams, pipes, filter fabric, and gravel.

8. All excess soil will be disposed at an approved upland site.

9. All project-introduced material will be removed once the work is complete.

10. Water trucks and dust controlling agents will be used to control dust in excavation and fill areas, rocking temporary access road entrances and exits will be rocked, and temporary stockpiles will be covered.

11. Any disturbed stream channel areas will be recontoured to pre-project conditions to the extent practicable.

12. Potential pollutants will be limited or reduced at their source before they come in contact with project receiving waters during construction. These BMPs are also known as "good housekeeping practices" and will be in place throughout the bridge construction phases.

    The measures include but are not limited to BMPs for: water conservation; vehicle and equipment cleaning, fueling and maintenance; dewatering; paving and grinding; temporary stream crossing; concrete finishing and curing; clear water diversion; and material and equipment use over water.

13. Demolished material will be prevented from entering waterways; water will be away from work areas; construction equipment will use attachments to catch debris; approved covers or platforms will be used to collect debris; accumulated debris and waste generated during demolition will be stockpiled away from watercourses; and wildlife will be ensured safe passage, as necessary.

14. Reflectors on portable light trees will be used to focus the light on the work area and minimize the amount of light spilling over to adjacent areas during any night work. In addition, noise-reducing enclosures will be used around noise-generating equipment. Equipment will be located as far as possible away from noise-sensitive areas, and sound control devices such as mufflers will be used on construction equipment to dampen noise as much as possible.

8. Riparian Enhancement

Caltrans will use the riparian mitigation plan developed by the California Department of Fish and Game. The requirements in this mitigation plan include the following:

> Each native riparian tree greater than 4 inches Diameter at Breast Height (DBH) that is removed or damaged will be replaced with native trees in a riparian area at a minimum 3:1 ratio. For each non-native riparian tree that is removed or damaged, trees will be replaced with native riparian trees at a minimum 1:1 ratio. Temporarily impacted riparian understory will be replaced at a 1:1 ratio. Oak trees in the riparian zone will be replaced at a 5:1 ratio.

Caltrans is also exploring several options for implementing riparian enhancement around the creeks where construction will occur to compensate for effects to riparian habitat. Additional riparian enhancement or compensation may be achieved outside of the project area using a combination of the following:

1. Purchasing of credits at a resource agency-approved mitigation bank servicing the action area.

2. Purchasing of conservation easements at or as close to the project site as practical within Marin and/or Sonoma counties.

3. Purchasing of fee title and preserving the land with riparian vegetation as close to the project site as practical within Marin and/or Sonoma counties.

B. Description of the Action Area

The action area includes "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR § 402.02). The action area includes the lineal extent (upstream to downstream) of bridge crossings (both current and proposed) over five creeks, one river, and two tide channels along the Highway 101 corridor between PM 18.6/27.6 in Marin County and PM 0.0/7.1 in Sonoma County. These areas are located at the following Highway 101 crossings: Novato Creek, Rush Creek, San Antonio Creek, the Petaluma River, Washington Creek, and Lynch Creek. The action area also extends to the east of Highway 101 to include the tide channels stemming from the Petaluma River and terminating at Redwood Landfill to the south, and west of Highway 101 in segment B out to the proposed new bridge crossing at San Antonio Road. The action area also extends 500-feet upstream from the crossing in each creek and river to account for fish relocation and 200 m (656 feet) downstream of each crossing to include temporary effects from equipment staging and turbidity. The action area extends laterally to encompass the riparian corridor to the top of the banks of all creeks and the river.

III. STATUS OF THE SPECIES AND CRITICAL HABITAT

1. Threatened CCC steelhead Distinct Population Segment (DPS) (January 5, 2006; 71 FR 834).

2. Threatened Southern DPS of North American green sturgeon (April 7, 2006; 71 FR 17757).

3. Designated critical habitat for CCC steelhead (September 5, 2005; 70 FR 52488).

4. Proposed designated critical habitat for the southern DPS of North American green sturgeon (September 8, 2008; 73 FR 52084).

Fall-run Central Valley Chinook salmon are not listed under the ESA, but are a species of concern, and use the Petaluma River, and possibly Novato Creek, for part of their life history stages. Provisions are made under the Pacific salmon Fisheries Management Plan for this species and, in accordance with the MSA, project activities were evaluated for impacts to EFH as described in the transmittal letter. Since they are not listed as threatened or endangered under the ESA, fall-run Chinook salmon will not be mentioned further in this biological opinion.

Genetic analysis has identified two DPSs of green sturgeon that qualify as species under the ESA: (1) a northern DPS consisting of populations in coastal watersheds northward of and including the Eel River; and (2) a southern DPS consisting of coastal and Central Valley populations south of the Eel River, with the only known spawning population in the Sacramento River. On April 6, 2005, NMFS reaffirmed its earlier determination that the northern DPS does not warrant an ESA listing (70 FR 17386). Because of substantial loss of spawning habitat, the concentration of a single spawning population in one section of the Sacramento River, and

multiple other risks to the species, NMFS listed as threatened the southern DPS of North American green sturgeon on April 7, 2006 (70 FR 17757).

A. Species Description and Life History

1. CCC Steelhead

Steelhead are anadromous fish, spending some time in both fresh and saltwater. The older juvenile and adult life stages occur in the ocean, until the adults ascend freshwater streams to spawn. Eggs (laid in gravel nests called redds), alevins (gravel dwelling hatchlings), fry (juveniles newly emerged from stream gravels), and young juveniles are all found in freshwater. Juvenile steelhead rear in freshwater until they become large enough to migrate to the ocean to finish rearing and maturing to adults. For detailed information on steelhead life history, see Busby *et al.* (1996). Although variation occurs, steelhead usually live in freshwater for 1 to 2 years in Central California, then spend 2 or 3 years in the ocean before returning to their natal stream to spawn. Steelhead may spawn 1 to 4 times over their life.

Typically, adult steelhead immigrate to Coastal California streams from December through April, peaking in January and February, and juveniles emigrate as smolts to the ocean from January through June, with peak emigration occurring in April and May (Fukushima and Lesh 1998). Steelhead fry rear in edgewater habitats and move gradually into pools and riffles as they grow larger (Busby *et al.* 1996). Cover is an important habitat component for juvenile steelhead, both as a velocity refuge and as a means of avoiding predation. Steelhead, however, tend to use riffles and other habitats not strongly associated with cover during summer rearing more than other salmonids. Young steelhead feed on a wide variety of aquatic and terrestrial insects, and emerging fry are sometimes preyed upon by older juveniles. Rearing steelhead juveniles prefer water temperatures of 7.2-14.4 degrees Celsius (°C) and have an upper lethal limit of 23.9°C. They can survive in water up to 27°C with saturated dissolved oxygen conditions and a plentiful food supply. Fluctuating diurnal water temperatures also aid in survivability of salmonids.

Although variation occurs, CCC steelhead usually live in freshwater for 2 years, then spend 1 or 2 years in the ocean before returning to their natal stream to spawn. Steelhead may spawn 1 to 4 times over their lifespan. Steelhead from the Russian River system typically immigrate to freshwater between October and April, peaking in January and February, and migrate to the ocean from January through June, with peak emigration occurring in April and May (Fukushima and Lesh 1998).

2. Southern DPS of North American Green Sturgeon

The green sturgeon is the most widely distributed and most marine-oriented of the sturgeon species. Like all sturgeon, they are an anadromous, long-lived, and slow growing species (Adams *et al.* 2002). The largest fish have been aged at 42 years, but this is probably an underestimate and maximum ages of 60-70 years or more are likely (Moyle 2002). Green sturgeon are known to range in near shore marine waters from Mexico to the Bering Sea, and are commonly observed in bays and estuaries along the western coast of North America. First spawning occurs at 15 years for males, and 17 years for females.

Adult green sturgeon return to freshwater to spawn every two to five years, and generally show fidelity to their spawning site. Adults typically migrate into freshwater beginning in late February, spawning occurs from March to July, with peak activity from April to June. Confirmed spawning populations in North America occur in the Rogue, Klamath, and Sacramento rivers. Green sturgeon may migrate long distances upstream to reach spawning habitat. Spawning occurs in deep turbulent areas of large rivers. Eggs are likely broadcast over large cobble substrate where they settle into the spaces between the cobbles. Like salmonids, green sturgeon require cool water temperatures for egg and larvae development, with optimal temperatures ranging from 15 °C to 19°C.

Green sturgeon larvae first feed at 10 days, and grow rapidly, reaching 300 mm (12 inches) in one year. Juvenile and adult green sturgeon are benthic feeders (Moyle 2002). Juvenile green sturgeon in the San Francisco Estuary feed on opossum shrimp (*Neomysis mercedie*) and amphipods (*Corophium spp.*) (Moyle 2002). Adults captured in the Sacramento-San Joaquin Delta feed on invertebrates, including shrimp, mollusks, amphipods, and even small fish (Adams *et al.* 2002). Juvenile green sturgeon spend from one to three years in freshwater before they enter the ocean (Adams *et al.* 2002).

The southern DPS of North American green sturgeon spawn in the deep turbulent sections of the upper reaches of the Sacramento River. As juvenile green sturgeon age, they migrate downstream and live in the lower delta and bays, spending from three to four years there before entering the ocean. Adult green sturgeon return from the ocean every one to five years to spawn, and generally show fidelity to their upper Sacramento River spawning sites. Patterns of telemetry data suggest that Southern DPS fish use oversummering grounds in coastal bays and estuaries along northern California, Oregon, and Washington, and overwintering grounds between Vancouver Island, BC and southeast Alaska (Lindley *et al.*, 2008).

B. Status of Species and Critical Habitat

1. CCC Steelhead

Historically, approximately 48 populations[5] of steelhead existed in the CCC steelhead DPS (Bjorkstedt *et al.* 2005). Many of these populations (about 20) were independent, or potentially independent, meaning they had a high likelihood of surviving for 100 years absent anthropogenic impacts. The remaining populations were dependent upon immigration from nearby CCC steelhead DPS populations to ensure their viability (Bjorkstedt *et al.* 2005, McElhaney *et al.* 2000).

While historical and present data on abundance are limited, CCC steelhead numbers are substantially reduced from historical levels. A total of 94,000 adult steelhead were estimated to

[5] Population as defined by Bjorkstedt *et al.* 2005 and McElhaney *et al.* 2000 as, in brief summary, a group of fish of the same species that spawns in a particular locality at a particular season and does not interbreed substantially with fish from any other group. Such fish groups may include more than one stream. These authors use this definition as a starting point from which they define four types of populations (not all of which are mentioned here).

spawn in the rivers of this DPS in the mid-1960s, including 50,000 fish in the Russian River – the largest population within the DPS (Busby *et al.* 1996). Recent estimates for the Russian River are on the order of 4,000 fish (NMFS 1997). Abundance estimates for smaller coastal streams in the DPS indicate low but stable levels with recent estimates for several streams (Lagunitas, Waddell, Scott, San Vincente, Soquel, and Aptos creeks) of individual run sizes of 500 fish or less (62 FR 43937). For more detailed information on trends in CCC steelhead abundance, see: Busby *et al.* 1996, NMFS 1997, and NMFS 2005a.

Some loss of genetic diversity has been documented and attributed to previous among-basin transfers of stock and local hatchery production in interior populations in the Russian River (Bjorkstedt *et al.* 2005). Reduced population sizes and fragmentation of habitat in San Francisco streams has likely also led to loss of genetic diversity in populations from those streams.

CCC steelhead have experienced serious declines in abundance, and long-term population trends suggest a negative growth rate. This indicates the DPS may not be viable in the long term. DPS populations that historically provided enough steelhead strays to support dependent populations may no longer be able to do so, placing dependent populations at increased risk of extirpation. However, because CCC steelhead have maintained a wide distribution throughout the DPS, roughly approximating the known historical distribution, CCC steelhead likely possess a resilience that is likely to slow their decline relative to other salmonid species in worse condition. The most recent status review concludes that steelhead in the CCC steelhead DPS remain "likely to become endangered in the foreseeable future" (NMFS 2005a). On January 5, 2006, NMFS issued a final determination that the CCC steelhead DPS is a threatened species, as previously listed (71 FR 834).

2. Southern DPS of North American Green Sturgeon

The population size of the southern green sturgeon DPS is unknown, but is clearly much smaller than in the northern green sturgeon DPS and is, therefore, more vulnerable to catastrophic events (Adams *et al.* 2002). Recent habitat evaluations conducted in the upper Sacramento and Feather rivers suggest that, as for anadromous salmonids, large amounts of potential spawning habitat were made inaccessible or altered by dams (BRT 2005). Current spawning habitat for green sturgeon has been reduced to a limited area of the upper Sacramento River.

Data on the entrainment of juvenile sturgeon from the Sacramento-San Joaquin Delta pumping facilities of the Central Valley Project and State Water Project provide an indication of how green sturgeon abundance has changed since 1968. The estimated average number of green sturgeon entrained each year at California's John Skinner Fish Facility prior to 1986 was 732; from 1986 on, the average number decreased to 47. At the Federal Tracy Fish Collection Facility, the average prior to 1986 was 889; from 1986 on, the average number also decreased to 47 (April 6, 2005, 70 FR 17386). This substantial decrease in numbers is also consistent with decreases in entrainment of white sturgeon within the same time periods. Decreases in numbers of green sturgeon entrained in these facilities occurred while water export levels at both facilities have increased substantially (*i.e.*, more water was pumped, but fewer green sturgeon were entrained).

The most recent status review update concluded that the southern green sturgeon DPS is likely to become endangered in the foreseeable future due to the substantial loss of spawning habitat, the concentration of a single spawning population in one section of the Sacramento River, and multiple other risks to the species (BRT 2005). Based on this information, the southern population of North American green sturgeon was proposed as threatened on April 6, 2005 (70 FR 17386). NMFS published a final rule on April 7, 2006 (71 FR17757), listing the southern population of North American green sturgeon as threatened, which took effect June 6, 2006.

3. Factors Responsible for Status of Steelhead/Southern DPS of North American Green and Salmonid Critical Habitat/Proposed Green Sturgeon Critical Habitat

Threats to naturally reproducing steelhead and green sturgeon are numerous and varied. Among the most serious and ongoing threats to their survival in these DPSs are changes in hydrology, and habitat degradation and loss. The following discussion provides an overview of the types of activities and conditions that adversely affect steelhead and green sturgeon DPSs and their habitats.

a. Habitat Degradation and Destruction

A major cause of the decline of salmon, steelhead, and green sturgeon is the loss or severe decrease in quality and function of essential freshwater and estuarine habitat. Most of this habitat loss and degradation has resulted from anthropogenic watershed disturbances caused by agriculture, logging, urban development, water diversion, road construction, erosion and flood control, dam building, and grazing. Most of this habitat degradation is associated with the loss of essential habitat components necessary for steelhead and green sturgeon survival. For example, the loss of deep pool habitat as a result of sedimentation and stream flow reductions has reduced rearing and holding habitat for juvenile and adult salmonids. The alteration of the estuaries in conjunction with increased sediment loads in the watersheds from land use activities and lower stream flows due to water diversions and other watershed changes, have delayed sandbar breaching in the fall, delayed adult steelhead migration into streams, reduced and degraded estuary rearing habitat for both juvenile steelhead and green sturgeon, and created a significantly altered freshwater-saltwater transition zone for steelhead smolts (CDFG 1998). North American green sturgeon populations are currently considered to be more susceptible to the quality declines in spawning habitat over other habitat types (September 8, 2008; 73 FR 52084).

b. Natural Stochastic Events

Natural events such as droughts, landslides, floods, and other catastrophes have adversely affected steelhead and green sturgeon populations throughout their evolutionary history. The frequency of, and the resulting effects of these events are now often increased and exacerbated by anthropogenic changes to watersheds such as logging, road building, and water diversion. The ability of these species to rebound from natural stochastic events has been limited as a result of these and other anthropogenic factors which have degraded the freshwater and estuarine habitats upon which these species depend, and thus abundance of these populations have been depressed to critically low levels.

c. Ocean Conditions

Variability in ocean productivity has been shown to affect steelhead and green sturgeon survival both positively and negatively. Beamish and Bouillion (1993) showed a strong correlation between North Pacific salmon production from 1925 to 1989 and their marine environment. Beamish *et al.* (1997) noted decadal-scale changes in the production of Fraser River sockeye salmon (*O. nerka*) that they attributed to changes in the productivity of the marine environment. They (along with many others) also reported the dramatic change in marine conditions occurring in 1976-77, at the beginning of an El Niño event. El Niño conditions, which occur every 3-5 years, negatively affect ocean productivity for salmonids. It is unclear to what extent ocean conditions have played a role in the decline of these species; however, ocean conditions have likely affected steelhead and green sturgeon population abundances throughout their evolutionary history.

d. Water Conveyance

Depletion and storage of natural flows have drastically altered natural hydrological cycles in many California rivers and streams. Alteration of streamflows has increased juvenile salmonid mortality for a variety of reasons: migration delay resulting from insufficient flows or habitat blockages, loss of usable habitat due to dewatering and blockage, stranding of fish resulting from rapid flow fluctuations, entrainment of juveniles into unscreened or poorly screened diversions, and increased juvenile mortality resulting from increased water temperatures (Chapman and Bjornn 1969, Berggren and Filardo 1993, 61 FR 56138). Important elements of water quality include water temperatures within the range that corresponds with migration, rearing, and emergence needs of fish and the aquatic organisms upon which they depend (61 FR 56138). Green sturgeon, which are benthic feeders exposed to high suspended sediment concentrations as they forage on the bottom, would likely not be affected by elevated levels of suspended sediment in the action area. Juvenile green sturgeon have been routinely entrained at pumping facilities along the Sacramento-San Joaquin Delta from rapid changes in flow and are also susceptible to suction dredging practices.

e. Harvest

There are few good historical accounts of the abundance of salmon and steelhead harvested along the California coast (Jensen and Swartzell 1967). Early records did not contain quantitative data by species until the early 1950s. In addition, the confounding effects of habitat destruction, drought, and variable ocean conditions on steelhead survival make it difficult to assess the degree to which recreational and commercial harvest have contributed to the overall decline of salmonids in West Coast rivers. Green sturgeon harvest consists of bycatch that is exclusive to two white sturgeon fisheries – the Klamath tribal and other Tribal salmon gill-net fisheries (Adams *et al.* 2002). The numbers of green sturgeon caught in these fisheries has declined substantially from 6,466 fish in 1985-1989 to 1,218 fish in 1999-2000.

f. Artificial Propagation

Releasing large numbers of hatchery fish can pose a threat to wild salmon and steelhead stocks through genetic impacts, competition for food and other resources, predation of hatchery fish on wild fish, and increased fishing pressure on wild stocks as a result of hatchery production (Waples 1991). The genetic impacts of artificial propagation programs are primarily caused by the straying of hatchery fish and the subsequent hybridization of hatchery and wild fish. Artificial propagation threatens the genetic integrity and diversity that protects overall productivity against changes in environment (61 FR 56138). The potential adverse impacts of artificial propagation programs are well documented (Waples 1991, Waples 1999).

g. Marine Mammal Predation

Predation is not known to be a major factor contributing to the decline of West Coast salmon and steelhead populations relative to the effects of fishing, habitat degradation, and hatchery practices. Predation may have substantial impacts in localized areas. Harbor seal (*Phoca vitulina*) and California sea lion (*Zalophus californianus*) numbers have increased along the Pacific Coast (NMFS 1999).

h. Reduced Marine-derived Nutrient Transport

Reduced marine-derived nutrient (MDN) transport to watersheds is another consequence of the past century of decline in salmon abundance (Gresh *et al.* 2000). Salmon may play a critical role in the survival of their own species in that MDN from salmon carcasses has been shown to be vital for productive invertebrate prey communities in streams providing for the growth of juvenile salmonids (Bilby *et al.* 1996, Bilby and Bisson 1998). The return of salmon to rivers makes a significant contribution to the flora and fauna of both terrestrial and riverine ecosystems (Gresh *et al.* 2000). Evidence of the role of MDN and energy in ecosystems infers this deficit may indicate an ecosystem failure that has contributed to the downward spiral of salmonid abundance (Bilby *et al.* 1996).

i. Invasive Species

A potential major factor affecting the species in the action area is the introduction of non-native or invasive species. As native fishes in the San Francisco Bay estuary became depleted in the late 19th century, non-native fishes were brought to the bay including American shad, striped bass, common carp, and white catfish. As their populations boomed, those of native fishes declined further, due to competition and predation. Introduction of non-native species accelerated in the 20th century through unintended introductions of fish and invertebrates from the release of ballast water from cargo ships entering the estuary from foreign ports. Several invasive species, including the yellowfin goby, shimofuri goby, and the overbite clam are now ubiquitous in San Francisco Bay's tidal marshes; these three species comprised the majority of the fish and invertebrates entrained during 2006 dredging at the mouth of the Petaluma River. Establishment of invasive species was probably facilitated by altered hydrologic regimes and reduction in habitats for native species. The spread of invasive species throughout the San Francisco Bay region has potentially affected many native species, including listed salmonids,

through predation and competition for food and habitat (Cohen and Carlton 1995). Prey selection by green sturgeon, which feed on benthic invertebrates, has likely been affected as well, as the native species populations have been replaced by invasive species. It is not known how well the green sturgeon has adjusted to its available diet in response to the altered benthic community.

IV. ENVIRONMENTAL BASELINE

The environmental baseline is the analysis of the effects of past and ongoing human and natural factors leading to the current status of the species in the action area. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impacts of State or private actions which are contemporaneous with the consultation in process (50 CFR §402.02).

Table 1: Steelhead, Green Sturgeon, and Critical Habitats in the streams and river affected by the proposed project:

Creek or River	Steelhead Present	Steelhead Critical Habitat	Green Sturgeon Present	Proposed Green Sturgeon Critical Habitat
Petaluma	Yes	Yes	Yes**	Yes
Novato	Yes*	No	No	No
Lynch	Yes*	Yes	No	No
San Antonio	No	Yes	No	No
Rush	No	No	No	No
Washington	No	No	No	No

* Steelhead are unlikely to be present in the portion of the action area in Novato and Lynch creeks (see below).
** Green sturgeon are unlikely to be encountered during project construction (see below).

A. Steelhead Critical Habitat and Proposed Green Sturgeon Critical Habitat within the Action Area

The portions of Novato and Lynch creeks, and the Petaluma River, within the action area are corridors for adult steelhead upstream migration to spawning and rearing habitat and corridors for steelhead smolt to rearing habitat and the Pacific Ocean. As shown in Table 1, San Antonio Creek, the Petaluma River, and Lynch Creek are designated critical habitat for CCC steelhead (70 FR 52488). Novato Creek is not designated as critical habitat for CCC steelhead. Rush and Washington creeks are not designated as critical habitat for listed salmonids, nor do they contain steelhead (as described below). All tidally influenced areas in the Petaluma River are proposed as critical habitat for green sturgeon (73 FR 52084). No other waterways within the action area are proposed as critical habitat for green sturgeon.

Critical habitat for CCC steelhead within the Petaluma River Hydrologic Sub-area (HSA) was described by NMFS' Critical Habitat Analytical Review Team (CHART) (NMFS 2005b). The CHART defined critical habitat for CCC steelhead on the stream-reach scale based on the quantity, quality, and distribution of Primary Constituent Elements (PCEs), which are the principle biological or physical constituent elements of habitat needed for the completion of the salmonid life-cycle, and include migration, spawning, rearing, and estuarine. For example, one PCE is spawning habitat; a component of the stream environment that must be present in sufficient quantity, quality, and distribution for salmonids to successfully reproduce.

Essential features of critical habitat in the action area include the estuarine water column, foraging habitat, and food resources used by these salmonids as part of their juvenile downstream migration or adult spawning upstream migration. PCEs of designated critical habitat for CCC steelhead in the action area include migration areas free from obstruction and excessive predation with: (1) water quality, water quantity and salinity conditions supporting juvenile and adult physiological transitions between freshwater and saltwater; (2) natural cover such as submerged and overhanging large wood, and aquatic vegetation; and (3) juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation (69 FR 71880).

1. Novato Creek

The creek reach in the action area is channelized with a generally trapezoidal shape possibly formed by flood control practices. The channel width averages 100 feet in the action area. Riparian canopy is absent on both sides of the Novato Bridge crossing, including the gap, and the riparian undergrowth is regularly removed from the stream banks during flood control maintenance. The portion of channel in this maintained area has a soft and muddy bottom that holds heat during the daytime.

Streamflow in Novato Creek is perennial and typically ranges from one-to-five cubic feet per second (cfs) during the summer months. Most if not all water in the area is tidally influenced; reaching approximately 4,000 feet above the Highway 101 crossing to Diablo Avenue (Caltrans 2008). Also during the summer some water is released from the North Marin Water District facilities upstream of the action area. Novato Creek water temperatures measured in May 1996* ranged from 19-26°C (60-73 degrees Fahrenheit (°F)) and ranged from 19-24°C (60-70°F) in June 1996. Although water temperatures have not been recorded in the period of July through September, Rich (1997) estimates water temperatures are considerably higher than optimal for steelhead during its rearing life stage.

The stream channel is dominated by low gradient areas and the streambed is mostly composed of sand and silt. In general, instream cover for juvenile steelhead is lacking. Some instream cover is provided by undercut banks and walls, concrete, and small amounts of emergent vegetation. Large instream woody debris, boulders, and other features for structural complexity are lacking in this portion of the action area. Overwinter habitat conditions are poor because the channel lacks habitat complexity and velocity refuge. Oversummering conditions are marginal due to the lack of habitat complexity and high water temperatures (Rich 1997).

2. San Antonio Creek

San Antonio Creek is a tributary of the Petaluma River. Overall San Antonio Creek is well-established containing high quality habitat that could potentially provide seasonal rearing habitat for juvenile steelhead (Hamaker, *et al.* 2003). The substrate is predominately large cobble, although the area beneath the Highway 101 crossing contains a deep layer of silt. There is also little to no riparian vegetation under the Highway 101 bridge; however, the upstream reaches contain riparian cover dominated by California buckeye (*Aesculus californica*), red willow (*Salix laevigata*), arroyo willow (*Salix lasiolepis*), California black walnut (*Juglans californica*), coast live oak (*Quercus agrifolia*), valley oak (*Q. lobata Née*), and bay laurel (*Umbellularia californica*).

Most of the creek is ephemeral during the summer with the exception of the tidally influenced lower reach east of Highway 101 where it connects to the Petaluma River. The creek bed within the action area is dry in the summer and into the winter in most years, which creates an effective migration barrier for steelhead between the reach at the Highway 101 crossing and the creek's terminus at the Petaluma River. San Antonio Creek may provide some salmonid habitat at the mouth, where there is a tidal influence from the Petaluma River.

3. The Petaluma River

The Petaluma River, for most of its course, is more of an elongated, tidal estuary than an actual river. It drains and 130-square-mile watershed, extending to the 2,300-foot summit of the Sonoma Mountains. Most of the river's tributaries join around the City of Petaluma. From there the waters flow along a broad, 18-mile long estuary moving past hayfields and an extensive marsh and terminating at the north-west end of San Pablo Bay.

Historically, the tidal marshes located within San Pablo Bay and the tidally-influenced reaches of the Petaluma River provided a highly productive estuarine environment for juvenile anadromous salmonids. During the course of their downstream migration through San Pablo Bay, juvenile salmon and steelhead may still utilize the estuary for seasonal rearing, although recent data suggest that migration to the sea is rapid, as compared with migration in estuaries located at higher latitudes (MacFarlane and Norton 2001). Returning adult salmon and steelhead navigate their way through San Pablo Bay as they seek upstream spawning grounds of their natal streams.

Within the action area the Petaluma River is highly channelized with little habitat complexity. The channel is broad with low summer and high winter flows ranging from zero to 65 cfs (US Geological Survey gage station 11459000). The river is fully tidal 11 miles (18 kilometers) from its mouth. The high range of tidal influence is due in part to the low gradient and low elevation through the marshes below Petaluma

As water velocity in the Petaluma River increases with storm events, adult salmon may use off channel areas, such as the marina and tide channels below the bridge, for refuge. Riparian cover is lacking through the area both upstream and down, likely due to urban encroachment and flood control maintenance. Vegetation persisting along the banks consists predominately of pickleweed and other low lying herbaceous vegetation.

The water depth throughout the Petaluma River has been maintained by annually dredging to a minus eight foot depth for 100 feet of channel width from the river mouth to Western Avenue in Petaluma. The need for dredging is a consequence of the high sedimentation rates, a result of high suspended sediment loads in the Petaluma River and adjacent San Pablo Bay. Water depths around the bridge vary between 20 to 30 feet.

These dredging activities have degraded the benthic habitat by removing prey organisms which form the diet of green sturgeon. NMFS is currently conducting a study to determine the recovery rate of the benthic community in the nearby marina, just south of the Petaluma River Bridge. Although the data have yet to be analyzed, it is likely that the benthic community does not fully recover prior to the subsequent dredging episodes. A reduction in this benthic community has likely resulted in minimal effect regarding loss of prey items for salmonids because benthic organisms at these depths (20-30 feet) are not typically part of their diet. Past dredging activities exposed juvenile salmonids to a risk of potential entrainment to upland disposal sites, from which there are no outlets back to the marina or the Petaluma River.

4. Lynch Creek

Lynch Creek is a small perennial tributary to the Petaluma River. At the Highway 101 crossing, Lynch Creek has been highly modified to a trapezoidal channel with earthen and concrete stabilized banks. The creek is dry during the summer months in the action area. Downstream, it is tidally influenced where it meets the Petaluma River. To either side of Highway 101 and within the gap between the bridge, there is little woody riparian vegetation and reduced shading of the channel, which leads to higher water temperatures during the summer months. Upstream riparian vegetation becomes dense with adequate canopy cover for shade and blackberry that provides some stability to the banks. The substrate throughout Lynch Creek is composed of sand and small gravels contributed by eroding upstream banks.

B. Status of Species within the Action Area

Given the proposed in-water construction period, June 15 through October 31, and the life history of steelhead, only juvenile steelhead are likely to be present in some of the creek portions of the action area during in-water construction. In addition to juvenile steelhead, NMFS also anticipates impacts to steelhead adults and smolts in the Petaluma River as a consequence of proposed year-round pile driving

As shown in Table 1, Rush Creek, Washington Creek, and San Antonio Creek are not currently thought to contain steelhead (Caltrans 2008), due in part to poor habitat quality and ephemeral flow in the reaches at the crossings. San Antonio Creek may provide some habitat at the mouth, where there is a tidal influence from the Petaluma River; however, the reach at the Highway 101 crossing is dry during most of the year, and migration into the creek is blocked as described above. Steelhead are not anticipated to occur in the action area in San Antonio Creek.

1. Novato Creek

NMFS is unaware of any rigorous estimates of steelhead abundance from Novato Creek. However, there have been several limited fish surveys undertaken in Novato Creek in recent years (Rich 1997, Fawcett Environmental Consulting 2000, Leidy *et al.* 2005, Fawcett Environmental Consulting 2006); all of these surveys encountered steelhead. One of the surveys, Fawcett Environmental Consulting (2006), was conducted wholly in the proposed project area. That survey was conducted during a previous sediment removal project; in that survey biologists collected 12 juvenile steelhead from a reach within a larger 6,130 feet area of Novato Creek that included the bridge site. Collections upstream of the project area have encountered steelhead throughout the watershed. More recent surveys conducted by Fawcett on July 9 and 10 of 2008 (Michael Fawcett, personal communication, January 20, 2009) covered a distance of approximately 3 miles, from Diablo Avenue above the Highway 101 crossing to the Northern Pacific Railroad Bridge downstream from the Highway 101 crossing, and caught 63 steelhead in Novato Creek and five in Warner Creek, upstream from the project site. All fish were aged as young of the year and collected from suitable habitat for summer rearing juvenile steelhead. Rearing conditions are absent at the Highway 101 crossing, where the water temperatures and salinity levels are high and little cover is provided from both instream and overwater sources. Based on this information, NMFS believes the current habitat conditions in Novato Creek within the action area are unsuitable for supporting juvenile steelhead and, therefore, they are unlikely to be present in this portion of the action area during construction.

2. San Antonio Creek

Although Skinner (1962) reported that San Antonio Creek was historically used by steelhead; subsequent reports indicated that CCC steelhead are now extirpated from that watershed. In the July 1968 California Department of Fish and Game (CDFG) surveys, San Antonio Creek was visually surveyed from the San Antonio Slough upstream to Chileno Valley Road. No steelhead were observed and the creek's fishery value was deemed poor due to intermittent summer flows, scarce spawning gravel, and suspected dairy effluent (Michaels and Thomson 1968a). In September 1981, Leidy (1984) electrofished three sites on San Antonio Creek between Highway 101 and Chileno Valley Road, and steelhead were not found.

3. Petaluma River

Between 1962 and 2005, the Petaluma River and its tributaries were sampled for steelhead or resident rainbow trout at several locations within the Petaluma River watershed. Skinner (1962) indicated that the mainstem Petaluma River was lightly used as steelhead habitat. Thomson and Michaels (1968) surveyed portions of the Petaluma River accessible by automobile from the upstream limit of tidal influence to the headwaters in July 1968 without observing steelhead. In July 1993, Leidy (2002) electrofished the Petaluma River upstream from the Corona Road crossing and did not find salmonids. Contrary to these findings are reported observations of migrating adult steelhead spawning pairs in the Petaluma River (David Woodbury, NMFS, personal communication, October 2008) with estimates believed to be approximately 60 fish (David Woodbury, NMFS, personal communication, October 2008).

NMFS has determined that green sturgeon presence will not occur in any of the creeks mentioned in this biological opinion due to lack of suitable habitat for this species. Green sturgeon presence is possible in the Petaluma River due to suitable water conditions for this species and its connectivity to the San Pablo Bay. Juvenile green sturgeon are known to inhabit San Pablo Bay, into which the Petaluma River flows.

NMFS was able to find only one account of green sturgeon in the Petaluma River. In 1997, a tagged adult green sturgeon was netted at the mouth of the Petaluma River where it was determined to have been holding for an eleven hour period during its migration to the Sacramento River (David Woodbury, NMFS, personal communication, October 2008). Between 1980 and 1995, stations within San Pablo Bay were sampled each month using midwater and bottom trawls (Baxter *et al.* 1999). The data show that green sturgeon collected by trawls in San Pablo Bay ranged from 328 to 733 mm in length. Given that the trawls are not designed to adequately sample sturgeon, the data cannot be used to accurately estimate green sturgeon abundance. Juvenile green sturgeon are year-round residents in San Pablo Bay and likely forage in the Petaluma River, as their relative, the white sturgeon, are commonly caught there and feed on similar prey.

Local fisheries experts are unaware of any observations of green sturgeon presence in the action area at the Highway 101 crossing upriver to Washington Street (Bill Cox, CDFG, personal communication, October 2, 2008; Michael Fawcett, personal communication, October 3, 2008). Thus, the available information indicates that adult green sturgeon neither spawn in the Petaluma River nor use it as a migratory pathway. Because the lower section of the Petaluma River is tidal, juvenile green sturgeon likely enter the river. Although they are most likely to remain near the mouth because of locality to San Pablo Bay (a known feeding area) it is possible they could be found as far upstream as the Petaluma River crossing. Due to the lack of observations and overall dwindling numbers of the southern DPS of North American green sturgeon, NMFS reasons encountering one in the action area during the construction of the new crossing over the Petaluma River is unlikely.

4. Lynch Creek

A few of the tributaries to the Petaluma River may continue to support small spawning populations of CCC steelhead, including Lynch Creek (Leidy *et al.* 2005). These streams are generally short, low gradient streams that have poor quality summer rearing habitat, but in which a few steelhead may spawn annually.

During the summer months, the habitat conditions at the Lynch Creek Bridge crossing are not conducive for salmonids, and although juvenile steelhead do rear in the watershed during these months, suitable habitat for rearing only exists in the tidally influenced reaches of Lynch Creek downstream from the Highway 101 bridge crossing. Therefore, it is unlikely that steelhead will be present at the project work sites during the instream construction period between June 15 and October 31.

V. EFFECTS OF THE PROPOSED ACTION

Construction of and modifications to bridges and crossings will result in the capture and relocation of juvenile steelhead at the crossings over Novato Creek and the Petaluma River, prior to dewatering the work areas. Steelhead have not been observed in San Antonio Creek for some time and are currently considered to be extirpated from the system as described above.

In Novato Creek and the Petaluma River, steelhead collection and relocation activities will occur during the summer low-flow period after smolts have emigrated and before adults have immigrated to the proposed project site, and NMFS expects that only juvenile steelhead will be present and effected by relocation activities. Those juvenile steelhead that are not collected in Novato Creek and the Petaluma River will be exposed to the effects of dewatering and pile driving. In addition to juvenile steelhead, adults and smolts will also be affected in the Petaluma River by exposure to sound pressure stemming from the year-round pile driving activities.

Both adult and juvenile green sturgeon have access to the Petaluma River Bridge construction site, which is tidally influenced. Although NMFS did not find evidence from prior surveys and literature sources to verify any green sturgeon within the action area of the Petaluma River, there is still the possibility of juvenile presence for at least part of the year due to the river's connection to the San Pablo Bay. The lack of observations in the Petaluma River as a whole would likely make encountering a green sturgeon during the project activities low enough to discount any effect to this species as a result of project activities.

Aquatic habitats and steelhead may also be exposed to turbidity and toxic chemicals. Small areas of aquatic habitat are expected to be permanently lost in the action area once the project is complete. Temporary impacts include turbidity and toxic chemical impacts to water quality and riparian loss. Shading increases from closing gaps between crossings will create permanent impacts, while habitat loss will have both temporary and permanent impacts.

A. Fish Relocation

Fish relocation activities pose a risk of injury or mortality to rearing juvenile salmonids. Any fish collecting gear, whether passive (Hubert 1996) or active (Hayes *et al.* 1996) has some associated risk to fish, including stress, disease transmission, injury, or death. The amount of unintentional injury and mortality attributable to fish capture varies widely, depending on the method used, the ambient conditions, and the expertise and experience of the field crew. Since fish relocation activities will be conducted by qualified fisheries biologists following both CDFG and NMFS guidelines, direct effects to and mortality of juvenile salmonids during capture will be minimized. Based on similar relocation efforts NMFS is familiar with, approximately 1.5 percent of the fish relocated may be injured or killed.

Fish relocation efforts will take place prior to or concurrent with the dewatering of waterways. No areas will be dewatered prior to June 15. The potential does exist for juvenile steelhead injury or mortality to occur during relocation. NMFS has not found evidence of any green sturgeon occupying the action area or reaches above the action area and does not expect any green sturgeon to be encountered during relocation activities. Fish relocation attempts will occur

one time following the construction of each constructed coffer dam at all locations where dewatering is necessary. The amount of fish relocations per crossing is dependant on the number of cofferdams needed at each crossing. Capture and relocation of juvenile steelhead is anticipated for the Petaluma River, where multiple relocations over multiple seasons will occur due to the placement of cofferdams over multiple seasons, from as few as six to as many as ten cofferdams, depending river conditions. Regardless of cofferdam configuration in the Petaluma River, the square footage of dewatered area will remain equal; however, in the scenario where cofferdams will be built for individual piers, there is the possibility that juvenile steelhead that have been previously relocated may enter the action area between relocations and consequently be relocated multiple times.

Based on the recent survey efforts conducted in Novato Creek for sediment removal activities just upstream from the action area, NMFS does not believe that juvenile steelhead will likely to be encountered in this portion of the action area. In the Petaluma River, although there are an estimated 60 adult spawning pairs passing through the action area during the winter and early spring months, there are no recent surveys of juvenile numbers in or near this portion of the action area. Thus, the number of juvenile steelhead in the Petaluma River subject to capture and relocation subsequent to construction of cofferdams cannot be reliably estimated. Given the timing of the project and quality of the habitat within the action area, NMFS anticipates only a small number of juvenile steelhead will likely be present during the proposed action.

Therefore, NMFS will assume that all juvenile steelhead present within the portion of the action area at the bridge site in the Petaluma River will be exposed to capture and relocation efforts that will occur between June 15 and October 31. NMFS expects that juvenile steelhead mortality associated with capturing, handling, and relocation for this project will be equal to 1.5 percent of the fish relocated, and when added with the potential for multiple relocations of the same individual fish, would equate to 3 percent total mortality of juvenile steelhead in the portion of the action area in the Petaluma River.

Caltrans will use qualified fishery biologists who will take appropriate precautions during fish relocation activities to minimize adverse affects to juvenile steelhead. Captured fish are planned to be relocated to areas of similar habitat located either downstream or upstream of the Highway 101 crossings.

Relocated fish may also endure stress from crowding at the relocation sites and increased competition for available resources such as food and habitat. This may reduce the survival chances of some fish. Some of the fish at the relocation sites may leave the site, and move to areas either upstream or downstream that have greater availability of habitat and less fish density. As each fish moves, competition remains either localized to a small area or quickly diminishes as fish disperse. NMFS does not believe this impact will cascade through the watershed population of steelhead based on the small area that will likely be affected. Fish relocation efforts are expected to minimize project impacts to steelhead in both locations by removing them from areas where they would have experienced high rates of injury and mortality. Furthermore, fish will be relocated to areas that possess similar habitat and water quality parameters (*e.g.*, temperature) to their original locations, and will be distributed appropriately to prevent overcrowding.

B. Dewatering

Cofferdams installed in Novato Creek and the Petaluma River will narrow the water flow through the areas. Flow is not expected at the San Antonio Creek or Lynch Creek locations, but if cofferdams are required for these creeks, only subsurface flow would be pumped out. The streamflow within the project vicinity is expected to be close to normal seasonal conditions except through the areas where cofferdams are installed. The cofferdam footprint in the Petaluma River will be much greater than other locations, although these dewatered areas will not be expected to cause volatile fluctuations in the flow regime. Maintaining the minimum 60-foot passage in the Petaluma River through the cofferdams will further suppress any flow effects associated with dewatering.

All cofferdams will be installed between June 15 and October 31 for all of the three to four construction seasons in the Petaluma River and over one season at the other creek locations and likely be placed during the lowest tide levels. Most fish are anticipated to follow receding tides out of the construction area. Some cofferdams will be left in place for extended periods of time in the Petaluma River. These cofferdams are not expected to hinder or prevent passage of salmonids due to the maintained 60-foot area of passage described in the *Description of the Proposed Action*. However, cofferdams will reduce rearing habitat for steelhead in the action area. Based on the project information available to date, NMFS assumes that any cofferdams in the creeks will be installed and removed during one summer construction season (June 15 to October 31), although not all cofferdams in the creeks will be installed during the same construction season. In the Petaluma River, NMFS assumes that once cofferdams are installed, they will be left in the river until completion of pile driving in the Petaluma River, which may occur outside of the summer construction season. NMFS assumes that whenever pile driving ends in the Petaluma River, cofferdams will only be removed between June 15 and October 31.

Stream flow diversion and work space dewatering is also expected to cause temporary loss, alteration, and reduction of aquatic habitat within the action area. Stream flow diversions could harm individual steelhead by concentrating or stranding them in residual wetted areas (Cushman 1985) before they are relocated, or causing them to move to adjacent habitats (Clothier 1953, Clothier 1954, Kraft 1972, Campbell and Scott 1984).

Steelhead could be killed or injured if crushed beneath the cofferdams during installation, though direct mortality is expected to be minimal because of the small number of steelhead in the action area and due to relocation efforts prior to installation of the diversion system. In addition to the initial fish capture and relocation at each cofferdam, a fisheries biologist will remain in the cofferdam to net and rescue any additional fish that may become stranded throughout the dewatering process at each coffer dam.

Steelhead not removed from the work area will die during dewatering activities. However, NMFS anticipates the number of juvenile steelhead killed as a result desiccation from the dewatering activities to be very low due to the low numbers of steelhead expected to be present within the action area. NMFS has not found evidence of any juvenile green sturgeon occupying the action area or reaches above the action area and does not expect any juvenile or adult green

sturgeon to be encountered during dewatering activities. NMFS expects that juvenile steelhead mortality associated with dewatering for this project will be similar to the unintentional mortality rate from capturing, handling, and relocation procedures. This amount of mortality would equate to 1.5 percent of juvenile steelhead that are encountered in the Petaluma River during capture and relocation efforts between the months of June 15 and October 31. In the Petaluma River, relocation mortality (3 percent described above) is likely higher than dewatering mortality because of the potential of capturing a steelhead juvenile multiple times, which would increase the stress levels and the likelihood of death.

Benthic macroinvertebrates may be temporarily lost or their abundance reduced when individual organisms are stranded or when creek habitats are dewatered (Cushman 1985). Effects to macroinvertebrates resulting from stream flow diversions and dewatering will be temporary because construction activities will be relatively short-lived, and rapid recolonization (about one to two months) of disturbed areas by macroinvertebrates (Cushman 1985, Thomas 1985, Harvey 1986) is expected following rewatering. In addition, the effect of macroinvertebrate loss on juvenile steelhead is likely to be negligible because food from upstream sources (via drift on the water surface) would be available downstream of the dewatered areas since stream flows will be maintained outside of the cofferdam. Based on the foregoing, the loss of aquatic macroinvertebrates as a result of dewatering activities is not expected to adversely affect salmonids.

C. Turbidity

Increased turbidity is anticipated to occur during the construction and removal of the cofferdams and dewatering. Research with salmonids has shown that high turbidity concentrations can reduce feeding efficiency, decrease food availability, reduce dissolved oxygen in the water column, result in reduced respiratory functions, reduce tolerance to diseases, and also cause fish mortality (Berg and Northcote 1985, Gregory and Northcote 1993, Velagic 1995, Waters 1995). Mortality of very young coho salmon and steelhead fry due to increased turbidity has been reported by Sigler *et al.* (1984). Even small pulses of turbid water will cause salmonids to disperse from established territories (Waters 1995), which can displace fish into less suitable habitat and/or increase competition and predation, decreasing chances of survival.

Based on the effects described above, it is anticipated that rearing juvenile steelhead downstream of the work areas may be affected by short-term increases in turbidity caused during the construction and removal of the cofferdams, dewatering, bank grading, and the addition and removal of gravel fill. These pulses of turbidity may cause fish to move downstream to avoid the turbidity. Pulses of increased turbidity are not anticipated to reach lethal levels with preventative BMPs in place. However, pulses of increased turbidity may result in juvenile steelhead temporarily vacating preferred habitat areas and/or temporarily reducing their feeding efficiency. This impact will extend into the beginning of the first storm events of each construction year. However, due to the timing of the project and the limited habitat within the action area, only low numbers of juvenile steelhead are anticipated to be affected and the minimal nature of the turbidity levels are not expected to have a detectable impact on the survival of individual fish. Road drainage improvements will lower future turbidity levels by incorporating new catchment devices into their design. New cross culverts will be incorporated with the existing culverts to

prevent severe flooding in wet years and to compensate for the increase of impermeable surface area created by the HOV lanes. The storm water shedding from the road surface will be drained in the existing swales on to the sides of Highway 101. While the volume of water draining the swales will increase, the storm water treatment structures incorporated into the system will improve the overall quality of water discharged from the roads and drainage system.

As a benthic dwelling species, green sturgeon are adapted to living in areas with fine sediment bottoms and, thus, are tolerant of high levels of turbidity. The project design and best management practices avoid or minimize localized turbidity; therefore, short-term impacts associated with turbidity during implementation of this project are expected to be insignificant for any green sturgeon within the action area of the Petaluma River.

D. Toxic Chemicals

Heavy construction equipment will be utilized within the dewatered creek channels during construction activities. Oils and similar substances from construction equipment can contain a wide variety of hydrocarbons, some of which evaporate rapidly while others adsorb to sediments and may persist for long periods of time. These polynuclear aromatic hydrocarbons can prove harmful to benthic communities (EPA 1993) which are a salmonid food source. Fluid leaking from construction equipment can also contain metals, which do not degrade in the environment. Some metals (*e.g.*, mercury, cadmium, lead, chromium) bioaccumulate in aquatic organisms inhabiting metals contaminated environments. Some of the sub-lethal effects that metals can cause in salmonids include: immobilization and impaired locomotion, reduced growth, reduced reproduction, and impairment of olfactory and brain functions (Eisler 2000).

Fluid leakage can occur during operation, refueling and during maintenance activities. There is a potential for leakage of toxic chemicals to occur during the project that may have the potential to affect salmonids. In order to minimize the potential adverse affects associated with using heavy equipment, heavy equipment will be operated primarily within the dewatered reach of the creek. NMFS anticipates that if there is a leak and Caltrans BMPs are followed, it will be contained and cleaned up prior to entering the flowing water, making it unlikely that salmonids will be adversely affected.

In addition to toxic chemicals associated with the heavy equipment, water that comes into contact with wet cement during construction of the new bridges can also adversely affect water quality and steelhead downstream of the work area. Water that comes in contact with wet cement can result in an imbalance of pH levels. Many authors have reported that an imbalance in pH can cause as much as 75 percent mortality of salmonids (Thut and Schmiege 1991). However, the work areas will be sufficiently isolated from watered areas making a contamination scenario unlikely.

E. Pile Driving Activities

As described above in the *Description of the Proposed Action*, pile driving will be restricted in Novato, San Antonio, and Lynch creeks to low-flow periods between June 15 and October 31 to

avoid effects to migrating steelhead (adults or smolts). Pile driving may occur year-round in the Petaluma River.

Available information indicates that fish may be injured or killed when exposed to elevated levels of underwater sound pressure generated from driving steel piles with impact hammers (Hastings and Popper 2005). Pathologies associated with very high sound levels are collectively know as barotraumas. These include hemorrhage and rupture of internal organs, including the swimbladder and kidneys in fish. Death can be instantaneous, occur within minutes after exposure, or occur several days later. High sound pressure levels can also result in hearing damage to fish. Dual metric criteria are currently used to correlate physical injury to fish from underwater sound pressure produced during the installation of piles (Agreement in Principal between NMFS and FHWA/Caltrans, June 2008). If either accumulated Sound Exposure Level (SEL) of 187 dB re one micropascal squared-second (183 dB for fish less than 2 grams) or a single strike peak sound pressure level (SPL) of 206 dB re one micropascal is received by a fish, then physical injury may occur. NMFS and FHWA/Caltrans are currently discussing updating the criterion used by NMFS (root mean squared of 150 dB re one micropascal) to assess potential sub-injurious levels of impact.

The degree to which an individual fish exposed to underwater sound from pile driving may be affected is dependent on a number of variables, including, but not limited to, size of the fish, hearing ability of fish, presence of swimbladder, lifestage, fish behavior, presence of predators, sound amplitude and frequency, and effectiveness of any sound attenuation technology. Also, sound wave forms are affected by the size and type of pile and installation equipment.

Caltrans is proposing to install piles for this project year-round in the Petaluma River. The installation of CISS piles with an impact hammer in the Petaluma River would be expected to result in adverse effects to listed adult, juvenile, and smolt steelhead present in the impact area during pile driving operations due to high levels of underwater sound that would be produced. In order to minimize potential effects to steelhead from exposure to elevated levels of underwater sound produced during pile driving at the other creek locations, Caltrans will only conduct pile driving with an impact hammer from June 15 to October 31 and also proposes to attenuate sound by using all means possible while pile driving within the cofferdams. All pile driving outside of the above mentioned timeframe in the Petaluma River will use a hydrophone device to monitor sound levels. If the current thresholds (above 206 dB peak SPL and 187 accumulated dB SEL at 10 m from the pile being installed) that cause death or injury to fish are exceeded, Caltrans will stop the pile driving activities until sound levels can be maintained under the prescribed thresholds.

Caltrans proposes a year-round pile driving schedule for the new Petaluma Bridge. The first construction season will result in the installation of approximately 100 to 160 CISS piles for the center deck of the bridge and 160 to 200 piles for each of the new southbound and northbound decks that will be built the over the following three to four construction seasons. The use of a vibratory hammer to set the CISS piles will not result in injury to fish in the surrounding area since this type of hammer produces sound waves that differ from those of impact hammers and are considered to not produce physical injuries. The estimated number of strikes needed to drive each CISS pile with the impact hammer to depth is 200 to 600 per pile for a maximum total of

4,000 to 12,000 strikes per day, if 20 piles are installed per day and 400 to 1,200 strikes if two piles are installed per day.

The underwater sound produced from driving CISS piles for this project was evaluated using the total number of hammer strikes per pile and an estimate of the single strike peak SPL and SEL at a given distance. This information was used in a mathematical model that estimates the distance from the pile where physical injury to exposed fish may occur. The distance to where physical injury may occur from 762 mm (30-inch) diameter CISS piles in the Petaluma River was determined to be 1,000 m (3,281 feet) for fish weighing over two grams, given a worst case scenario of 12,000 strikes per day. The "over two gram" criterion was used as juvenile steelhead in the action area are more likely to weigh more than two grams. Therefore, under the worst case open water pile driving scenario, without sound attenuation, any fish within 1,000 m of the piles driven in a given day could be physically injured.

Caltrans has incorporated several measures to minimize exposure of fish, and attenuate high levels of underwater sound during pile driving, such as pile driving within cofferdams and using wood blocks between the piles and the impact hammer.[6] Pile driving near water causes sound energy to radiate indirectly into the water as a result of ground borne vibration at the bottom beneath the river. The low-frequency ground borne vibration can cause localized sound pressure waves in the water that are radiated from the bottom of the river. A minimum water depth is required to allow sound to propagate through water in an area. For pile driving sounds, the minimum depth for this propagation is 3 to 6 feet, depending on frequency. Sound waves do not propagate through air as readily as water. All CISS pile driving will occur within dewatered cofferdams which will provide a source of attenuation by creating an air space between the pile and the water column. Hydroacoustic monitoring outside of the cofferdams will certify the attenuation and all pile driving activities will stop if sound levels are exceeded. Based on these measures that will be used for pile driving outside of the June 15 to October 31 timeframe in the Petaluma River, NMFS believes injury or mortality to migrating steelhead is unlikely.

Steelhead migrating through the action area in late December through mid-May may experience minimal delays during exposure to elevated levels of underwater sound produced during pile driving. The delays are expected to last less than 12 hours since pile driving will occur only during daylight hours. These delays are unlikely to affect spawning success because they are short and spawning grounds are within five miles of this portion of the action area. Adult steelhead may hold below the action area in response to noise levels and, as a consequence, may increase their chances to predation; however, adult steelhead predators (*e.g.*, seals and sea lions) have not been observed in the Petaluma River and are not expected in the area during adult migration. Smolts that may be delayed during migration would likely find cover if they do hold above the bridge, and then continue migration during the evening hours after pile driving has stopped. Nevertheless, a small number of these delayed smolts may be exposed to increased predation from birds or other fish. Overall, few smolts are likely to be delayed, and even fewer are likely to experience increased predation. Smolts rely on tidal cues during outmigration and prefer migration at night. Depending on the amount of sound produced and time intervals between pile driving activities in a given day of pile driving there may be no delays in adult and

[6] As stated above, if current thresholds that cause injury to fish are exceeded, Caltrans will stop the pile driving activities until sound levels can be maintained under the prescribed thresholds.

smolt migrations. The use of effective attenuation devices and hydroacoustic monitoring during pile driving activities will likely prevent physical injuries to steelhead while they are delayed from migrating through the area as levels will not exceed those thresholds that result in injuries or mortality to salmonids.

As described above, green sturgeon are unlikely to be present in the action area. NMFS notes that even if one was present, the proposed project would not likely result in physically injure to a green sturgeon if exposed to underwater sound pressure produced during pile driving due to the attenuation devices.

The trestle platforms at the Petaluma River Bridge will only be constructed between June 15 and October 31 and use H-piles that will be placed mainly with the use of a vibratory hammer. Sound levels produced by vibratory hammers are not only lower, but generate different sound wave forms and lower sound frequencies that are believed to be less injurious than those produced by impact hammers. Injuries or mortalities to salmonids are not anticipated. Driving of piles with an impact hammer for trestle platforms in all waterways will be limited to 5-20 strikes per pile to confirm the strength of the pile to support the trestle platforms. This limited number of strikes is not expected to exceed injury thresholds.

Sheet piles will be used to construct the cofferdams and small piles will be used to construct falsework in all waterways. Only vibratory hammers will be used to construct the cofferdams and falsework. Based on data collected during the installation of steel sheet piles with a vibratory hammer at the Port of Oakland (Anderson and Reyff, 2006), peak sound pressure levels generated during this project are not expected to exceed thresholds for physical injury.

A small number of juvenile steelhead may be present in and around the portions of action area outside of the cofferdams in the Petaluma River. These fish will be foraging and rearing prior to outmigration as smolts. In the Petaluma River, most juvenile steelhead are expected to inhabit areas upstream of the bridge where freshwater and better habitat conditions are available. This would be especially true during the winter seasons when storm events occur and water quality and quantity increase. Nevertheless, a very small number of juvenile steelhead may be present near the cofferdams in the Petaluma River in the summer. Because Caltrans will monitor during the first two weeks of pile driving during the summer as noted in the *Description of the Proposed Action*, and take the necessary steps to further attenuate sound levels if necessary, NMFS expects that injury or mortality to juvenile steelhead is unlikely. NMFS assumes that pile driving during the summer that occurs after Caltrans has monitored sound levels during the adult and smolt migration seasons would incorporate any additional sound attenuation that may have been found necessary during this monitoring. Therefore, pile driving in the summers after the first season of pile driving during adult and smolt migration is not expected to injure or kill juvenile salmonids near the cofferdams in the Petaluma River.

NMFS cannot precisely quantify the small number of juvenile steelhead that may be present in the Petaluma River near pile driving activities during the summer but expects that the number will be small based on habitat conditions in the Petaluma River at this location.

The pile driving schedule in Novato Creek is expected to take one season (June 15 – October 31) and will use 16 – 600 mm (24-inch) CISS piles, with each pile requiring between 200 to 600 hammer strikes to achieve proper depth. Using the upper limit of 600 strikes each to drive 16 piles would result in 9,600 strikes if all the CISS piles were installed in a single day. Analysis using the same approach, as described in the above Petaluma River pile driving scenario, would require a minimum safe distance of 736 m (2,429 feet) for fish weighing over two grams from the impact site without the use of attenuation devices. This distance exceeds the size of cofferdams in Novato Creek; however, it is unlikely that this level of impact will be realized, given the small amount of piles that will be driven at this location and the amount of days available to conduct pile driving. The safe distance calculation is dependant on the number of strikes per day and it is unlikely that all 16 piles will be driven in a single day. The safe distance required from the impact site will also be reduced because Caltrans will drive piles within cofferdams, which NMFS expects will provide some sound attenuation.

Because of the uncertainty regarding the level of sound attenuation, NMFS will use the worst case scenario above to determine the maximum distance that could result in injury or death to juvenile steelhead in Novato Creek. With a safe distance of 736 meters (2,429 feet) upstream and downstream of piles being driven, NMFS has determined that juvenile steelhead are not likely to be found inside of this area.[7] Juvenile steelhead in Novato Creek are expected to be farther up in the watershed where water quality conditions are suitable for rearing over the summer months. The reaches where steelhead have been found in the summer were well beyond the distance determined for sound impacts that can injure or kill fish during pile driving, and based on the limited amount of pile driving needed at this crossing and the few amount of days that will be needed to finish this construction element of the project, NMFS does not believe there will be any pile driving related impacts to juvenile steelhead in Novato Creek.

Twenty pre-cast concrete piles will be driven into Lynch Creek. Available information indicates that the installation of concrete piles generates sound wave forms that are less injurious than steel piles of similar size. A study conducted at the Port of Oakland (Abbott *et al.* 2005) revealed that several species of fish which were held in cages 10 meters from the pile were not physically injured when exposed to several hundred underwater sound pulses during the installation of 24-inch octagonal concrete piles with an impact hammer. Based on these observations and the dry conditions over the summer months, impacts to steelhead are not anticipated from driving concrete piles at the Lynch Creek crossing.

A small number of Juvenile steelhead in the Petaluma River may experience sound levels due to pile driving that affect their behavior; however, NMFS expects these levels will be attenuated enough to not significantly disrupt normal behavior patterns, which include feeding and sheltering for juvenile steelhead, and are therefore discountable.

[7] This result is based on the habitat conditions in Novato Creek near the pile driving location, and recent surveys indicating steelhead have not been found within this distance of the bridge.

F. Habitat Impacts

1. Instream Habitat Loss

The installment of piers in the Petaluma River, Novato Creek, San Antonio Creek, Lynch Creek will result in instream habitat losses of 0.22 acres (9,583 square feet (ft^2)), 0.0012 acres (52 $feet^2$), 0.0023 acres (100 $feet^2$), 0.0222 acres (967 $feet^2$) respectively. This overall loss of instream habitat is small relative to the overall action area in these reaches. Lynch Creek will experience a greater loss of habitat than the other creek crossings relative to its size; however, steelhead do not use this portion of the action area; having only been found in Lynch Creek below the Highway 101 crossing, where habitat is limited and tidally influenced. The habitat area that will be lost in San Antonio Creek is also not utilized by steelhead. The portion of the action area that is impacted by this habitat loss in Novato Creek and the Petaluma River is used predominantly for adult and juvenile steelhead migration with some marginal rearing. The new piers are not expected to slow or prevent steelhead migrations through any of these waterways and can provide velocity refuge for steelhead during particularly high winter flows.

2. Shading

The combined amount of permanent impacts due to shading between the bridge spans will be 0.7403 acres (32,247 $feet^2$). The riparian cover located within the bridge gaps will likely wither and eventually die from the lack of sunlight as a consequence of shading. This amount of riparian cover in the gaps is minimal at all crossings with the exception of Lynch Creek and the new San Antonio Creek bridge crossings; however, steelhead use only the lower portion of Lynch Creek and have not been observed in San Antonio Creek at any of the bridge crossings. There is currently a lack of shade at the bridge crossings that likely results in higher water temperatures and any additional shading could potentially benefit salmonids by lowering water temperatures at or below these areas.

The reaches at the bridge crossings are used by steelhead migration and are deficient in the PCEs associated with other stages in the salmonid life-cycle. Salmonid species are attracted to shaded areas that provide an ambient light source. This additional shade from the new bridges would result in conditions that are expected to leave enough ambient light for successful salmonid navigation through the area.

3. Riparian

The dominant plant species found in the riparian corridors within the action area include California bay laurel (*Umbellularia californica*), California buckeye (*Aesculus californica*), red willow (*Salix laevigata*), arroyo willow (*Salix lasiolepis*), valley oak (*Quercus lobata*), Himalayan blackberry (*Rubus discolor*), poison oak (*Toxicodendron diversilobum*), and stinging nettle (*Urtica dioica*).

Riparian vegetation removal for this project will result in both temporary and permanent loss. Permanent impacts include loss of habitat due to shading and placement of bridge abutments and

approach roads. Temporary impact numbers include bioswale areas, designated staging areas, and areas in between the cut and fill line and the project footprint.

Riparian habitat loss will result from the clearing of banks to allow access to the construction sites and the placement of new crossings and connecting road. The riparian corridor along the banks of San Antonio Creek is better established than the corridors at the other locations, due to the two smaller crossings at San Antonio Road and Highway 101, and the overall limited land use in the area. Trees along the banks that provide overhanging canopy will be removed along with low lying brush and herbaceous vegetation along the creek banks. At the San Antonio Creek locations, Caltrans expects the 2.39 acres (104,138 ft^2) of permanent riparian removal and 0.64 acres (42,989ft^2) of temporary removal. The amount of riparian removal along San Antonio Creek is greater than in the other locations; however, the amount is relative to the riparian vegetation remaining in the area, which is ample enough to continue providing shade and cover within the area. Both temporary and permanent effects will also be mitigated should steelhead population re-establish within the San Antonio Creek.

Riparian removal at the Petaluma River and the Novato Creek locations consists of ground vegetation only and will result in a permanent loss of 0.34 acres (14,868ft^2) and 0.40 acres (17,372ft^2), and a temporary loss of 0.99 acres (42,989ft^2) and 0.47 acres (20,546ft^2) respectively. The impacts associated with this loss can result in an increase of sediment from eroding banks. Much of the Petaluma River vegetation is low ground cover, consisting mainly of pickle weed that while providing some bank support, does not support good quality habitat for fish. Ground cover will be re-vegetated with native plants after completing construction in these areas. BMPs for erosion control will be in place during all phases of construction to control erosion.

The Lynch Creek crossing has sparse riparian vegetation in the gap and along the banks. The amount of permanent riparian loss in this area is expected to be 0.28 acres (12,227ft^2) and a temporary riparian loss of 0.22 acres (9,391ft^2). The current amount of riparian cover at the bridge crossing does not contribute to lower water temperatures or provide cover for steelhead. Steelhead would use this reach for a migration corridor to habitat farther upstream, but have only been known to use the lower reaches of Lynch Creek, that are tidally influenced by the Petaluma River. Steelhead migrations through the area are more associated with flow than riparian cover in Lynch Creek and would still able to navigate through the reach at the crossing to more suitable habitat farther upstream unimpeded during wetter years.

Riparian habitat providing instream cover and food resources for salmonids will be temporarily impacted by the removal of bank cover and over-hanging canopy along creek banks. Although it may take 10 to 50 years to restore the full function of this component of salmonid habitat where vegetation clearing will occur on banks, the proposed restoration of planting riparian vegetation prescription in accordance with CDFG guidelines, over time will restore the function of the riparian habitat lost due to the construction activities. Habitat will be degraded during this riparian growth recovery period. Rearing juvenile and smolt steelhead will have less cover and potential prey resources for food. Migrating fish moving through the area will be more susceptible to predation. The riparian areas other than San Antonio Creek are sparse and do not provide much cover as would a riparian area with dense, mature vegetation.

4. Instream Habitat Loss

Temporary instream habitat loss will result from dewatering operations in the Petaluma River and Novato Creek. Temporary loss of habitat in the San Antonio and Lynch creeks will not be significant because steelhead are not anticipated to be present in these areas during or after construction. Instream work at a minimal level of intensity would require diverting channel flow from the pathways of equipment and the construction of falsework on timber pads. If in-channel construction is conducted in these creeks during a wet year or in early June, water will need to be diverted from the construction areas using cofferdams and associated equipment. The areas that will need dewatering would occur under existing and newly constructed bridges during the construction of the center decks and new bridges. The predicted cofferdam locations are between the north and southbound lanes at the Highway 101 crossing and these areas are narrow and the work space needed in the dewatered areas is on a small scale, therefore, the amount of temporary habitat loss is predicted to be small.

VI. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Impacts from urbanization, such as increased runoff from new areas of impervious surfaces, and sediment and turbidity associated with road repair and construction, are likely to continue to occur in the action area. Some degradation of water quality in the Petaluma River is likely contributed by boat traffic and marina activities near the bridge crossing. The pace of such development fluctuates based on economic conditions, and has currently slowed. In recent years, additional aquatic habitat protections have been applied by State and Federal agencies to development projects. Based on these factors, NMFS concludes that the level of habitat degradation in the action area resulting from cumulative effects is expected to remain fairly constant or somewhat reduced during the next several years when the project is implemented.

VII. INTEGRATION AND SYNTHESIS OF EFFECTS

Steelhead in the CCC DPS are suffering severe and long-term declines, both range-wide and within the action area. Across the region, significant destruction and degradation of spawning and rearing habitat has occurred. Threats to naturally reproducing steelhead are numerous, varied, and ongoing. NMFS listed as threatened the southern DPS of North American green sturgeon on April 7, 2006, (70 FR 17757) because of substantial loss of spawning habitat, the concentration of a single spawning population in one section of the Sacramento River, and multiple other risks to the species.

The MSN Project activities will directly affect steelhead and steelhead critical habitat. NMFS anticipates that take in the Petaluma River of listed juvenile steelhead as a result of this project

will be in the nature of injury, mortality and temporary capture and harassment. Some juvenile steelhead that were not captured and relocated from the cofferdams will perish from desiccation resulting from dewatering the cofferdam. A small number of juvenile steelhead may be injured or killed during relocation. This level of injury and mortality is expected to be small based on the results of other similar relocation efforts, the thoroughness of relocation efforts and the low steelhead numbers anticipated in the action area

Other take is expected in the form of harassment of steelhead from sound levels resulting from year-round pile driving in the Petaluma River. This take is expected to harass fish as they pass through the area and could result in migration delays both up and down river. Sound attenuation devices will be used and sound levels will be monitored to keep impacts below the sound thresholds for tissue injury and mortality. A small number of smolts are likely to experience increased predation due to delay.

The temporary capture and harassment will be of limited duration and mortality numbers due to relocation, dewatering, and delay in the Petaluma River will be low. BMPs incorporated into the project will avoid and minimize the impacts associated with these activities. Therefore, the summed amount of the steelhead take is not expected to have any long-term effects on the survival of the affected steelhead population that should be able to replace their lost numbers once fish return to their normal behavior patterns. Due to the small number of juveniles and smolts lost, adult returns are likely to be only minimally affected, if at all. There will be enough returning adults to populate the Petaluma River watershed with steelhead juveniles in numbers equivalent to those currently found in the watershed, including the action area.

NMFS has determined that it is unlikely that North American green sturgeon will occur in the action area due to the lack of observations of this species in the Petaluma River. Green sturgeon do have access to this reach of the Petaluma River, but there is minimal to no risk that they will be in this area during construction. There they are unlikely to be adversely affected.

The amount of permanent habitat loss is minimal when compared to the overall migratory corridor above and below the modified and new bridges and is not expected to create a migration barrier (at most or all flows). PCE's within the action area also include some marginal rearing habitat for steelhead. Short-term impacts from construction activities will be minimal and localized at the project site, and are unlikely to affect critical habitat up or downstream. Long-term impacts to the rearing PCE from construction will be limited to the actual footprint of the new bridge crossing. Much larger areas in the creeks and river will remain undisturbed, as will the higher quality rearing and spawning habitats up and downstream of the action area. Therefore, the project is not expected to affect the value critical habitat for species conservation.

VIII. CONCLUSION

After reviewing the best available scientific and commercial information, the current status of the species and critical habitat, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is NMFS' biological opinion that the MSN Project

is not likely to jeopardize the continued existence of threatened CCC steelhead or the southern DPS of North American green sturgeon.

After reviewing the best available scientific and commercial information, the current status of critical habitat, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is NMFS' biological opinion that the MSN Project is not likely to destroy or adversely modify designated critical habitat or proposed critical habitat for CCC steelhead or the southern DPS of North American green sturgeon, respectively.

IX. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS as an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not the purpose of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by Caltrans, as appropriate, for the exemption in section 7(o)(2) to apply. Caltrans has a continuing duty to regulate the activity covered by this incidental take statement. If Caltrans: (1) fails to assume and implement the terms and conditions or (2) fails to require their designee(s) to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Caltrans must report the progress of the action and its impact on the species to NMFS as specified in the incidental take statement (50 CFR §402.14(i)(3)).

A. Amount or Extent of Take

The MSN Project is expected to result in minimal incidental take of threatened CCC steelhead. As described above in the biological opinion, juvenile steelhead are expected to be subject to capture for relocation efforts. A small number of fish are likely to be killed as a result of relocation efforts in the Petaluma River during dewatering. A few fish may avoid relocation efforts and be killed when the work area is dewatered. The number of threatened CCC steelhead that may be incidentally taken during fish collection and relocation cannot be precisely quantified in the Petaluma River, but is expected to be a small amount.

Therefore, take is quantified as: all fish present in the cofferdams installed in the Petaluma River may be captured by dewatering and relocation activities. NMFS anticipates a small number of these juvenile steelhead will either avoid relocation efforts and be killed during dewatering, or be injured or killed during capture and relocation. No more than 4.5 percent of juvenile steelhead within the proposed cofferdams in the Petaluma River will be injured or killed.

Take from pile driving is quantified as: all steelhead (adult, smolts, and juveniles) present in the Petaluma River portion of the action area during pile driving. These fish are likely to experience disruption in normal behavior patterns when pile driving is done using an impact hammer. For example, adults and smolts may experience migration delays due to the sound pressure waves generated by pile driving in the Petaluma River; however, spawning habitat used by steelhead is not far upstream from the action area and spawning success is not expected to be compromised by short-term migration delays. Outmigrating smolts in the spring are expected to be able to pass the short distance trough the action area via the 60-foot navigation channel that Caltrans has proposed to maintain in the Petaluma River. Smolts migrating during the day may experience short-term disruption during migrations as they may hold above the action area during pile driving activities. During the holding times, smolts would likely seek cover until the pile driving activities have stopped then continued migration through the area under the cover of night. Nevertheless, a small number of these smolts may experience increased predation.

Because the precise number of steelhead delayed or exposed to increased predation cannot be determined, NMFS will use the underwater sound thresholds described above in the biological opinion as surrogates for incidental take. If underwater sound produced during five or more strikes on a single day exceeds the anticipated levels of 206 dB peak SPL and 187 accumulated dB SEL at 10 m from the pile being installed, incidental take is likely to be exceeded.

B. Effect of the Take

In the accompanying biological opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to CCC steelhead.

C. Reasonable and Prudent Measures

Pursuant to section 7(b)(4) of the ESA, the following reasonable and prudent measures are necessary and appropriate to minimize incidental take of threatened CCC steelhead:

1. Measures shall be taken to minimize injury and mortality to listed steelhead from fish relocation activities, dewatering activities, and bridge construction.

2. Measures shall be taken to minimize injury and mortality to listed steelhead from pile driving activities.

3. FHWA and Caltrans shall provide reports to NMFS on the effectiveness of the project's incidental take minimization measures.

D. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, Caltrans and their designee(s) must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary. Monitoring requirements are included below, as per 50 CFR 402.12(i)(3): "In order to monitor the impacts of incidental take, the Federal agency or any applicant must report the progress of the action and its impact on the species to the Service [NMFS] as specified in the incidental take statement."

The following terms and conditions implement Reasonable and Prudent Measure 1.

1. Caltrans shall provide NMFS with a "Fish Relocation Plan" and a "Dewatering Plan" for review 30 days prior to the start of dewatering and fish relocation activities. The Fish Relocation Plan shall outline all fish collection and relocation methods and materials. The plan shall be submitted to NMFS' Santa Rosa Area Office (see address below). The Dewatering Plan shall outline all dewatering methods, including dewatering timeframes before and after pile driving within the cofferdams. Plans for storing and cleaning water pumped from the river and creeks prior to discharge must be described. The plan shall be submitted to NMFS' Santa Rosa Area Office (see address below).

2. Caltrans shall retain a qualified biologist with expertise in the areas of anadromous salmonid biology, including handling, collecting, and relocating salmonids; salmonid/habitat relationships; and biological monitoring of salmonids. Electrofishing, if used, shall be performed by a qualified biologist and conducted according to the "NOAA Fisheries Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act", June 2000. A Statement of Qualifications for all biologists who will be employed on the project shall be provided to NMFS for review 30 days prior to any onsite project construction (or demolition) related activities.

3. The biologist shall monitor the construction site during fish relocation and dewatering activities to minimize or avoid take of salmonids. The biologist shall be on site during all these events to ensure that all listed salmonids are captured, handled, and relocated safely. The biologist shall notify NMFS biologist Dave Walsh (707) 575-6016 or dave.walsh@noaa.gov one week prior to relocation activities in order to provide an opportunity for NMFS staff to observe the activities.

4. Listed salmonids shall be handled with extreme care and kept in water to the maximum extent possible during relocation activities. All captured fish shall be kept in cool, shaded, aerated water protected from excessive noise, jostling, or overcrowding any time they are not in the stream and fish shall not be removed from this water except when released. To avoid predation, the biologist shall have at least two containers and segregate young-of-year salmonids from older salmonids and other potential aquatic predators. Captured salmonids shall be relocated, as soon as possible, to a location out of the project's impact area, which has suitable habitat conditions, and which allows for maximum survival of the transported salmonids.

5. Caltrans shall provide NMFS with an annual summary report within 90 days of the completion of fish relocation and monitoring activities. The report shall include the methods used during the fish relocation and monitoring efforts, location, number and species captured, number of mortalities by species, and other pertinent information related to the monitoring and fish relocation activities. Reports shall be submitted to NMFS Santa Rosa Area Office (see address below).

6. All pumps used in the work area shall be equipped with screens that meet the following NMFS fish screening criteria:

a. Perforated plate: screen openings shall not exceed 3/32 inches (2.38 mm), measured in diameter.
b. Woven Wire: screen openings shall not exceed 3/32 inches (2.38 mm measured diagonally).
c. Screen material shall provide a minimum of 27 percent open area.
d. Approach velocity shall not exceed 0.33 feet per second.

7. Caltrans shall provide written notification to NMFS at least 14 days prior to commencement of in-channel bridge construction, or over-channel bridge demolition. Written notification shall be sent to NMFS' Santa Rosa Area Office (see address below).

8. All cofferdams must be inspected and maintained on a daily basis to ensure its integrity for the duration of the work schedule below OHW.

<u>The following terms and conditions implement Reasonable and Prudent Measure 2.</u>

9. Pile driving of the CISS piles in wetted channels (or within cofferdams in wetted channels) shall occur only during daylight hours with the sun above the horizon. This is to ensure that pile driving does not occur at dawn or dusk, which can be peak movement times for juveniles.

10. FHWA and Caltrans shall monitor underwater sound during all impact hammer pile driving activities on land or in water for CISS piles used in the construction of the Petaluma River Bridge footings. If underwater sound produced during five or more strikes on a single day exceeds the anticipated levels of 206 dB peak SPL and 187 accumulated dB SEL at 10 m from the pile being installed, then pile driving must cease and NMFS must be contacted within 24 hours: Dave Walsh (707) 575-6016 or dave.walsh@noaa.gov, or the NMFS Santa Rosa Office (707) 575-6050. The purpose of the contact is for Caltrans to describe the measures that will be taken to reduce underwater sound levels. Once NMFS agrees to the measures to reduce underwater sound, pile driving may proceed unless monitoring detects underwater sound levels greater than those specified above. If sound levels exceed those specified above, Term and Condition 10 repeats until sound levels are below the levels specified above.

11. An environmental noise technician shall monitor the construction site during pile driving activities to monitor sound impact avoidance measures and record the outcomes of each pile driving event. The technician shall be on site during all these events to ensure that all sound attenuation devices are being used and that sound impact avoidance protocols are adhered to.

12. Each pile driving incident shall be monitored and recorded in a log that includes the sound levels at the stopping time and the sound levels at the starting time. If sound levels are above SPL and SEL, actions will be taken to lower the sound level to a level that will not produce injurious sound pressure levels to salmonids.

13. Sound attenuation devices will be used for all pile driving activities.

14. If Caltrans is unable to meet these sound attenuation criteria then impact driving of CISS pile shall only occur from May 15 through November 30 in any given construction season to allow adult and smolt steelhead migration to their natal streams and the ocean.

15. At the Petaluma River location, if pile driving of CISS piles commences within the June 15 to October 31 timeframe in the first work season, Caltrans shall monitor these activities, using the hydroacoustic equipment, for a period of no less than two weeks. If the sound levels fall below the sound thresholds of 206 dB peak SPL and 187 accumulated dB SEL at 10 m from the pile being installed, then Caltrans may continue to drive CISS piles with an impact hammer until November 1. Otherwise, Caltrans may continue to pile drive as long as additional sound attenuation can reduce underwater sound below the thresholds above.

<u>The following terms and conditions implement Reasonable and Prudent Measure 3.</u>

16. FHWA and Caltrans shall provide reports to NMFS on the effectiveness of the project's incidental take minimization measures no later than 90 days following the end of each construction season, including an annual minimization measure effectiveness report for the Petaluma River activities.

17. FHWA and Caltrans shall provide annual reports to NMFS with the results of the hydroacoustic monitoring program. The first report shall be submitted to NMFS no later than January 31, following the first year of construction, and shall provide year-round results of the previous construction season. The second annual hydroacoustic report, covering the second year monitoring period, shall be provided to NMFS by January 31 in the year following the second year of construction (see address below).

18. FHWA and Caltrans shall provide NMFS with an annual summary report within 90 days of the completion of fish relocation and monitoring activities each year. The report of relocation shall include the methods used during the fish relocation and monitoring efforts, location, number and species captured, number of mortalities by species, and other pertinent information related to the monitoring and fish relocation activities. Reports shall be submitted to NMFS Santa Rosa Area Office (see address below).

19. FHWA, Caltrans, or contractor shall allow any NMFS employee(s) or any other person(s) designated by NMFS, to access the MSN Project work areas during the construction period for the purpose of observing monitoring activities, evaluating fish and stream conditions, performance of Caltrans' BMPs, or perform other monitoring/studies. NMFS will notify Caltrans

Resident Engineer 48 hours prior to plan site visits and will contact Caltrans personnel prior to entering the construction site.

20. All reports or plans required for the above terms and conditions shall be sent to:

NMFS Santa Rosa Area Office
Supervisor, Protected Resources Division
Southwest Region
National Marine Fisheries Service
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404

X. REINITIATION NOTICE

This concludes formal consultation on the proposed Marin Sonoma Narrows High Occupancy Vehicle Widening Project. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

XI. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on listed species, to minimize or avoid adverse modification of critical habitat, or develop additional information.

1. NMFS recommends that piles not be installed during steelhead migration - December through mid-May in the Petaluma River.

2. NMFS recommends that FHWA and Caltrans consult with NMFS to develop a long range planning approach that seeks to minimize and avoid the impacts of road-related projects on listed salmonids.

3. Caltrans should identify and prioritize any maintenance and construction projects which, if implemented, can improve ESA-listed salmonid migration or in-stream environmental conditions.

4. Caltrans in coordination with NMFS should use this project to initiate studies to acquire empirical data for establishing criteria for the cumulative effects to fish from exposure to underwater sound produced during multiple pile driving strikes.

XII. LITERATURE CITED

Abbott, R., J. Reyff, and G. Marty. 2005. Monitoring the effects of conventional pile driving on three species of fish. Final report submitted to Manson Construction Co. April 8, 2005.

Adams, P.B., C.B. Grimes, S.T. Lindley, and M.L. Moser. 2002. Status Review for North American Green Sturgeon, *Acipenser medirostris*.

Anderson, C.R., and J.A. Reyff. 2006. Underwater sound measurement data for the driving of steel sheet piles and square concrete piles. Port of Oakland, Berth 23. Vortex Marine Construction. Oakland, CA.

Baxter, R., K. Hieb, S. DeLeon, K. Flemmingm, and J. Orsi. 1999. Report on the 1980-1995 fish, shrimp, and crab sampling in the San Francisco Estuary, California. Edited by J. Orsi. California Dept. of Fish and Game, Tech. Rpt. 63, November 1999. 503 pp.

Beamish, R.J., and D.R. Bouillion. 1993. Pacific salmon production trends in relation to climate. Canadian Journal of Fisheries and Aquatic Sciences 50:1002-1016.

Beamish, R.J., C.M. Neville, and A.J. Cass. 1997. Production of Fraser River sockeye salmon (*Oncorhynchus nerka*) in relation to decadal-scale changes in the climate and the ocean. Canadian Journal of Fisheries and Aquatic Sciences 54:543-554.

Berg, L., and T. G. Northcote. 1985. Changes in territorial, gill-flaring, and feeding behavior in juvenile coho salmon (*Oncorhynchus kisutch*) following short-term pulses of suspended sediment. Canadian Journal of Fisheries and Aquatic Sciences 42:1410-1417.

Berggren, T.J. and M.J. Filardo. 1993. An analysis of variables influencing the migration of juvenile salmonids in the Columbia River Basin. North American Journal of Fisheries Management 13:48-63.

Bilby, R.E., and B.R. Fransen *et al.* 1996. Incorporation of nitrogen and carbon from spawning coho salmon into the trophic system of small streams: evidence of stable isotopes. Canadian Journal of Fisheries and Aquatic Sciences. 53:164-173.

Bilby, R.E., and P.A. Bisson. 1998. Function and Distribution of Large Woody Debris. Pages 324-346. *In*: Naiman, R.J. and R.E. Bilby, editors. River Ecology and Management: Lessons from the Pacific Coastal Ecoregion. Springer-Verlag. New York. 705 pages.

Bjorkstedt E.P., B.C. Spence, J.C. Garza, D.G. Hankin, D. Fuller, W.E. Jones, J.J. Smith, and R. Macedo. 2005. An Analysis of Historical Population Structure for Evolutionarily

BRT (Biological Review Team). 2005. Green Sturgeon (*Acipenser medirostris*) Status Review Update. National Marine Fisheries Southwest Fisheries Science Center, Santa Cruz, California.

Busby, P.J., T.C. Wainwright, G.J. Bryant, L. Lierheimer, R.S. Waples, F.W. Waknitz, and I.V. Lagomarsino. 1996. Status review of west coast steelhead from Washington, Idaho, Oregon, and California. United States Department of Commerce, National Oceanic and Atmospheric Administration Technical Memorandum NOAA Fisheries-NWFSC-27. 261 pages.

California Department of Transportation (Caltrans). July 2008. Biological Assessment for the Marin Sonoma Narrows Project.

Campbell, R.N.B., and D. Scott. 1984. The determination of minimum discharge for 0+ brown trout (*Salmo trutta L.*) using a velocity response. New Zealand Journal of Marine and Freshwater Research. 18:1-11.

Chapman, D.W., and T.C. Bjornn. 1969. Distribution of salmonids in streams, with special reference to food and feeding. *In* T.G. Northcote, ed., Symposium on salmon and trout in streams, pgs. 153-176. H.R. MacMillan Lectures in Fisheries, University of British Columbia, Institute of Fisheries, Vancouver.

Clothier, W.D. 1953. Fish loss and movement in irrigation diversions from the west Gallatin River, Montana. Journal of Wildlife Management. 17:144-158.

Clothier, W.D. 1954. Effect of water reductions on fish movement in irrigation diversions. Journal of Wildlife Management. 18: 150-160.

Cushman, R.M. 1985. Review of ecological effects of rapidly varying flows downstream from hydroelectric facilities. North American Journal of Fisheries Management. 5:330 339.

Eisler, Ronald. 2000. Handbook of Chemical Risk Assessment: Health Hazards to Humans, Plants, and Animals. Volume 1, Metals. Lewis Press, Boca Raton, Florida EPA (Environmental Protection Agency). 1993. Office of Water. Guidance Specifying Management Measures of Sources of Nonpoint Pollution in Coastal Waters. EPA-840-B-93-001c. January 1993.

EPA (Environmental Protection Agency). 1993. Office of Water. Guidance Specifying Management Measures of Sources of Nonpoint Pollution in Coastal Waters. EPA-840-B-93-001c. January 1993.

Fawcett Environmental Consulting. 2000. Brief summary of aquatic species captured and relocated from the Novato Creek Flood Control Project site, August 2000. Report

Fawcett Environmental Consulting. 2006. Brief summary of aquatic species captured and relocated from the Novato Flood Control Project, Phase VIII, June 2006. Report

Fukushima L., and E.W. Lesh. 1998. Adult and juvenile anadromous salmonid migration timing in California streams. California Department of Fish and Game 84(3):133- 145.

Furrer, T. Website: United Anglers of Casa Grande. Accessed September 15, 2007. http://www.uacg.org/.

Gregory, R. S., and T. G. Northcote. 1993. Surface, planktonic, and benthic foraging by juvenile Chinook salmon (*Oncorhynchus tshawytscha*) in turbid laboratory conditions. Canadian Journal of Fisheries and Aquatic Sciences 50:233-240.

Gresh, T., J. Lichatowich, and P. Schoonmaker. 2000. An estimation of historic and current levels of salmon production in the northeast pacific ecosystem. Fisheries 15(1):15-21.

Hamaker T., Hiss A., and Kettley, L. 2003. *Special-Status Fish Habitat Surveys for the State Route 101 Novato Narrows Project*. Technical Memorandum. CH2M HILL. 8 pp.

Hanson, L.C. 1993. The foraging ecology of Harbor Seals, *Phoca vitulina*, and California Sea Lions, *Zalophus californianus*, at the mouth of the Russian River, California. Master of Science thesis, Sonoma State University, Rohnert Park, California.

Harvey, B.C. 1986. Effects of suction gold dredging on fish and invertebrates in two California streams. North American Journal of Fisheries Management 6:401-409.

Hastings, M.C., and A. N. Popper. 2005. Effects of Sound on Fish. Prepared for the California Department of Transportation. January 28, 2005. http://www.dot.ca.gov/hq/env/bio/files/Effects_of_Sound_on_Fish23Aug05.pdf.

Hayes, D.B., C.P. Ferreri, and W.W. Taylor. 1996. Active fish capture methods. Pages 193-220 *in* B.R. Murphy and D.W. Willis, editors. Fisheries Techniques, 2nd edition. American Fisheries Society. Bethesda, Maryland. 732 pages.

Hubert, W.A. 1996. Passive capture techniques. Pages 157-192 *in* B.R. Murphy and D.W. Willis, editors. Fisheries Techniques. Second Edition. American Fisheries Society. Bethesda, Maryland. 732 pages.

Jensen, P.T., and P.G. Swartzell. 1967. California salmon landings 1952 through 1965. California Department of Fish and Game, Fish Bulletin 135:1-57.

Johnson, S.L. 1988. The effects of the 1983 El Niño on Oregon's coho (*Oncorhynchus kisutch*) and Chinook (*O. tshawytscha*) salmon. Fisheries Research 6:105-123.

Kraft, M.E. 1972. Effects of controlled flow reduction on a trout stream. Journal of Fisheries Research. Board of Canada 29:1405-1411.

Leidy, R.A. 1984. Distribution and Ecology of Stream Fishes in the San Francisco Bay Drainage (and associated unpublished data, 1981-1984). Hilgardia 52(8).

Leidy, R.A. 2002. Unpublished stream survey data 1992-2002. U.S. Environmental Protection Agency.

Leidy, R.A., G.S. Becker, and B.N. Harvey. 2005. Historical Distribution and Current Status of Steelhead/Rainbow Trout (*Oncorhynchus mykiss*) in Streams of the San Francisco Estuary, California. Center for Ecosystem Management and Restoration, Oakland, California.

Lindley, S.T., M.L. Moser, D.L. Erickson, M. Belchik, D.W. Welch, E. Rechisky, J.T. Kelly, J. Heublein, A.P. Klimley. 2008. Marine migration of North American green sturgeon. Trans. Am. Fish. Soc. Accepted for publication.

MacFarlane, R.B., and E.C. Norton. 2001. Physiological ecology of juvenile Chinook salmon (*Oncorhynchus tshawytscha*) at the southern end of their distribution, the San Francisco Estuary and Gulf of the Farallones, California. Fish. Bull. 100:244-257.

McElhany, P., M.H. Ruckelshaus, M.J. Ford, T.C. Wainwright, and E.P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, NOAA Technical Memorandum NMFS-NWFSC-42. 156 pages.

Moyle, P.B. 2002. Inland Fishes of California. University of California Press. Berkeley, California.

NMFS (National Marine Fisheries Service). 1997. Status review update for West Coast steelhead from Washington, Idaho, Oregon, and California. United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. 68 pages. Conditions. Prepared for Environmental Science Assoc., June 19, 1997.

NMFS (National Marine Fisheries Service). 1999. Status review update for four deferred ESUs of Chinook salmon from Washington, Oregon, California, and Idaho. National Marine Fisheries Service, Northwest Fisheries Science Center. 100 pages, plus appendixes.

NMFS (National Marine Fisheries Service). 2005a. Updated Status of Federally Listed ESUs of West Coast Salmon and Steelhead. United States Department of Commerce, National

Oceanic and Atmospheric Administration, National Marine Fisheries Service. June 2005. 512 pages.

NMFS (National Marine Fisheries Service). 2005b. Final assessment of the National Marine Fisheries Service's Critical Habitat Review Teams (CHARTs) for seven salmon and steelhead evolutionarily significant units (ESUs) in California. July 2005. 23 pages, plus appendices.

Pile Driving Compendium. 2007. The Compendium of Pile Driving Sound Data. Prepared by Illinworth and Rodkin for the California Department of Transportation. http://www.dot.ca.gov/hq/env/bio/files/pile_driving_snd_comp9_27_07.pdf.

Reiser, D.W., and T.C. Bjornn. 1979. Habitat requirements of anadromous salmonids. United States Department of Agriculture Forest Service General Technical Report PNW-96. 54 pages.

Rich, A.A. 1997. Novato Creek Flood Control Project, Marin County, Fishery Resources

Sigler, J.W., T.C. Bjornn, and F.H. Everest. 1984. Effects of chronic turbidity on density and growth of steelhead and coho salmon. Transactions of the American Fisheries Society 113:142-150.

Skinner, J.E. 1962. Fish and Wildlife Resources of the San Francisco Bay Area.

Thomas, V. G. 1985. Experimentally determined impacts of a small, suction gold dredge on a Montana stream. North American Journal of Fisheries Management 5:480- 488.

Thomson, B., and J. Michaels. 1968a. Stream Survey Petaluma Creek. CDFG report submitted to Marin County Public Works Department. 2 pages.

Thomson, B., and J. Michaels. 1968b. Stream Survey Adobe Creek. CDFG report submitted to Marin County Public Works Department. 2 pages.

Thut, R. N., and D.C. Schmiege. 1991. Processing Mills. Pages 369-387 *in* Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats. W.R. Meehan, editor. American Fisheries Society Special Publication 19. American Fisheries Society, Bethesda, Maryland.

Velagic, E. 1995. Turbidity study: a literature review. Prepared for Delta planning branch, California Department of Water Resources by Centers for Water and Wildland Resources, University of California, Davis.

Waples, R.S. 1991. Definition of "Species" Under the Endangered Species Act: Application to Pacific Salmon. United States Department of Commerce, National Oceanic and Atmospheric Administration Technical Memorandum NMFS F/NWC-194. 15 pages.

Waples, R.S. 1999. Dispelling some myths about hatcheries. Fisheries 24(2):12-21.

Waters, T. F. 1995. Sediment in Streams: Sources, Biological Effects, and Control. American Fisheries Society Monograph 7.

XIII. FEDERAL REGISTER NOTICES CITED

61 FR 56138: Endangered and Threatened Species; Threatened Status for Central California Coast Coho Salmon Evolutionarily Significant Unit (ESU). National Marine Fisheries Service, National Oceanic and Atmospheric Administration, United States Department of Commerce. Final Rule. Federal Register, Volume 61, No. 212, October 31, 1996. pages 56138-56149.

62 FR 43937: National Marine Fisheries Service. Final Rule: Listing of Several Evolutionary Significant Units of West Coast Steelhead. Federal Register, Volume 62 pages 43937-43954. August 18, 1997.

69 FR 71880: Endangered and Threatened Species; Designation of Critical Habitat for Seven Evolutionary Significant Units of Pacific Salmon and Steelhead in California; Final Rule. Federal Register 70, No 170: 52488-52586. September 2, 2005.

70 FR 17386. April 6, 2005. Proposed Rule: Endangered and Threatened Wildlife and Plants: Proposed Threatened Status for Southern Distinct Population Segment of North American Green Sturgeon. United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Federal Register, Volume 70 pages 17386-17401.

70 FR 52488: National Marine Fisheries Service. Final Rule: Endangered and Threatened Species; Designation of Critical Habitat for Seven Evolutionary Significant Units of Pacific Salmon and Steelhead in California. Federal Register, Volume 70 pages 52488-52586. September 2, 2005.

71 FR 17757. April 7, 2006. Final Rule: Endangered and Threatened Wildlife and Plants: Threatened Status for Southern Distinct Population Segment of North American Green Sturgeon. United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Federal Register, Volume 71 pages 17757-17766.

71 FR 834: National Marine Fisheries Service. Final Listing Determinations for Ten Distinct Population Segments of West Coast Steelhead; Final Rule. Federal Register, Volume 71 pages 834-862. January 5, 2006.

73 FR 52084: National Marine Fisheries Service. Proposed Rulemaking To Designate Critical Habitat for the Threatened Southern Distinct Population Segment of North American

Green Sturgeon; Proposed Rule. Federal Register, Volume 73 pages 52084-52110. September 8, 2008.

XIV. PERSONAL COMMUNICATIONS

Michael Fawcett, Fawcett Consulting, personal communication with Dave Walsh, October 15, 2007, and October 3, 2008.

Michael Fawcett, Fawcett Consulting, email communication with Dave Walsh, January 20, 2009.

David Woodbury, NMFS, personal communication with Dave Walsh, October 2008.

Bill Cox, California Department of Fish and Game, personal communication with Caltrans on June 29, 2002.

Bill Cox, California Department of Fish and Game, personal communication with Dave Walsh via email, October 2, 2008.

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SITE INVESTIGATION REPORT ROUTE 101-MARIN/SONOMA NARROWS HOV WIDENING PROJECT CONTRACT B4: PETALUMA RIVER BRIDGE

Prepared for
Sonoma County Transportation Agency

February 10, 2011

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California-Registered Professional Engineer Statement

I, Patrick Walz, state:

- That the work herein was prepared by me and/or under my supervision;
- That I attest to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based, subject to the limitations noted within the document.

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EXECUTIVE SUMMARY

Project B4 of the Marin Sonoma Narrows (MSN) Highway 101 High Occupancy Vehicle (HOV) Widening Project (the MSN B4 Project) consists of the segment of U. S. 101 from just south of the Petaluma Boulevard South overcrossing to just north of the Caulfield Lane overcrossing, or post-miles 2.5 to 4.1, located in the southern portion of Sonoma County, California. The project is within District 4 of the State of California Department of Transportation and within the Sonoma County Transportation Authority (SCTA) planning area. The project area is referred to herein as "the Site" (Figure 1).

The purpose of this Site Investigation Report is to evaluate the soil conditions for on-site use, off-site disposal of site soils, assess the bridges and culverts that will need to be widened, replaced or removed for the presence of asbestos or lead-based paint and to assess soil and groundwater to identify work safety issues for construction site workers. The following summarizes URS' conclusions and recommendations.

Soil Reuse/Disposal

With the exception of aerially-deposited lead, no constituent was detected at a concentration limiting soil reuse or requiring disposal of soil as a hazardous waste. The detected concentrations of aerially-deposited lead were typically low enough that the Caltrans Variance is not applicable for the majority of soil within the project limits, which can therefore be reused on-site without restriction, and is not considered a California or federal hazardous waste. The exceptions are two hotspots, located at sample N-15 (top 1.0 foot only) and sample S-9 (to the maximum depth of excavation of 1 foot), which had detected concentrations of aerially-deposited lead that require restrictions on the reuse and/or disposal of soil from these specific areas. The attached Figures ENV-1 through ENV-8 and the following table summarize the reuse restrictions and disposal requirements of project soil.

Table ES-1 - Soil Reuse/Disposal Requirements

Sample	Southern Limit Station	Northern Limit Station	Depth*	Reuse Restriction	Disposal Requirement
N-15	206+00	210+50	0-1 ft	Below > 1' non-haz cover, > 5' above the groundwater table	Cal-Hazardous, or out-of-state
S-9	150+50	155+00	0-1 ft	Below pavement, > 5' above the groundwater table	Cal-Hazardous, or out-of-state
All others* (except hotspots above)	Southern Project Limit	Northern Project Limit	All depths	None	Non-Hazardous

* Note that samples associated with the southern on-bound ramp from the proposed Petaluma Blvd. South overcrossing (S-1, S-2, S-3 and S-4) were removed prior to statistical analysis of the soil data, as this ramp is not to be constructed at this time.

Structures Scheduled for Retrofit or Demolition

Six structures within the project limits are scheduled for replacement or widening, which will involve the partial demolition of all or parts of each structure. Accordingly, an asbestos and lead-based paint inspection was conducted for the following structures:

- Petaluma Blvd. South Undercrossing (northbound and southbound): - the proposed improvements will include demolishing the existing structures.
- Petaluma River Bridge (northbound and southbound), and Route 101N/116 Bridge: - the proposed improvements will include demolishing the existing structures and replacing them with new structures.
- Route 101S/116 Bridge - the proposed improvements will include widening the existing structure.

Asbestos-containing materials were detected on the South Petaluma Bridge Undercrossing in bedrock materials. Lead-based paint was detected at all bridge structures. In addition, hexavalent chromium was detected at elevated levels on all bridge structures. Hexavalent chromium is a known carcinogen, therefore health and safety plans for workers must address hexavalent chromium and lead-based paint, as well as asbestos (where applicable). Applicable regulations regarding the demolition and disposal of debris from these bridges must be followed.

Impacts from Off-Site Contamination

In preparing the workplan, URS reviewed the *Marin-Sonoma Narrows HOV Widening Project Final Environmental Impact Report/Final Environmental Impact Statement*, prepared by Caltrans, July 2009, leaking underground storage tanks (LUSTs) were identified near the 101N/116 Overcrossing. To confirm whether there are potential impacts to groundwater on the project site from these LUSTs, groundwater grab samples were collected at this interchange. The workplan also discussed a LUST at 4550 Redwood Highway. URS has further evaluated this LUST site and found that it is located approximately 1/2 mile south of the southern project limits, at the corner of Kastania Road and US 101. The groundwater gradient at the LUST site is to the east and the northern extent of the plume is well defined and not within the boundaries of the MSN B4 project.

URS' investigation did not identify evidence that these potential off-Site sources impacted the project corridor.

Groundwater

URS' investigation of groundwater did not reveal the presence of contamination that would require disposal as a hazardous waste. In general, groundwater was detected at depths varying from 5 to 10 feet below ground surface. Based on the terms of the Caltrans variance, these shallow depths could reduce the areas at which Aerial Deposited Lead contaminated soil may be reused.

Worker Health and Safety

Lead and nickel were detected in soil at concentrations exceeding the Regional Water Quality Control Board's Direct Exposure Soil Screening Levels for construction/trench workers. These and all other detections should be considered by the contractor in preparation of their site specific health and safety plan.

Project B4 of the Marin Sonoma Narrows (MSN) Highway 101 High Occupancy Vehicle (HOV) Widening Project (the MSN B4 Project) consists of the segment of U. S. 101 from just south of the Petaluma Boulevard South overcrossing to just north of the Caulfield Lane overcrossing, or post-miles 2.5 to 4.1, located in the southern portion of Sonoma County, California. The project is within District 4 of the State of California Department of Transportation and within the Sonoma County Transportation Authority (SCTA) planning area. The project area is referred to herein as "the Site" (Figure 1).

This project involves the proposed construction of central HOV lanes as part of the region-wide continuous HOV network. The project will include improvements to outside shoulders, construction of new ramps, bridge demolition, widening, or replacements, and installation of soundwalls and retaining walls. As a result of these proposed improvements soil will be excavated along US 101, at interchanges, and at a river crossing.

The purpose of this Hazardous Materials Site Investigation Report is to evaluate the soil conditions for on-site use, off-site disposal of site soils, assess the bridges and culverts that will need to be widened for the presence of asbestos or lead-based paint and to assess soil and groundwater to identify work safety issues for construction site workers. URS submitted the Hazardous Materials investigation workplan to SCTA, Sonoma County Department of Environmental Health, and Caltrans on January 20, 2010. Sampling and resulting laboratory analysis activities were performed between March 18 and July 19, 2010.

This Report has been prepared in accordance with the most recently issued Caltrans District 4 lead-impacted soil handling variance by DTSC. This variance describes reuse restrictions and disposal requirements for soils impacted by lead at various concentrations. These criteria and the corresponding regulatory restrictions are described in Section 3.1.

Soil samples were collected at a total of 53 locations, as described in the workplan included as Appendix A. Two additional boring locations (M-11 and M-15) were not drilled due to accessibility and drill refusal issues, therefore no samples were collected at these locations. Soil samples were collected at intervals perpendicular to the US 101 mainline and ramps. In general, two borings were advanced approximately every 300-400 feet. At each location, one boring was placed in the median (where the majority of excavation work will occur), and the second boring was placed adjacent to the northbound or southbound edge of the shoulder (or, where ramp construction is planned, the second boring was placed adjacent to the outside edge of the shoulder of the ramp). The location of these shoulder/ramp samples, relative to the traveled way, alternated along the project corridor between the edge of pavement, the midpoint between the edge of pavement and the limit of excavation, and the limit of excavation.

Of the 53 locations, 17 were from adjacent to the northbound direction mainline or ramp lanes, 17 from adjacent to the southbound direction mainline or ramp lanes and 19 were from within or adjacent to the median. A secondary, duplicate boring was advanced at five of the locations. Two additional boring locations were planned within the median (M-11 and M-15) but could not be drilled due to accessibility issues and drilling refusal, respectively, and boring M-10 could not be located within the median and was therefore shifted to be adjacent to the southbound direction mainline.

Samples were generally collected to the maximum depth of excavation, which ranged from 1 foot in the south to 3 feet in the north of the project area. Samples were generally collected at 0-0.5 ft, 0.5-1 ft, 1.0-1.5 ft, 1.5-2 ft, and 2.5-3.0 ft below ground surface (bgs); though isolated samples were collected to deeper depths where excavation was expected to be deeper than 3 feet, or where groundwater samples were collected. Borings at areas where fill will be placed, where excavation of topsoil is expected to be only 12 inches deep were sampled at the 0 to 0.5 ft and 0.5 ft to 1 ft intervals. A total of 188187 soil samples were collected.

Groundwater samples were collected from the first encountered groundwater zone, typically about 10 feet bgs. Two groundwater samples were collected. Groundwater samples were collected where deeper excavation is planned – at bridge construction areas and at the northern end of the project where signs may be installed.

A total of 62 samples of potentially-asbestos-containing materials, and 14 samples of potential lead-based paint, were collected from the following structures requiring demolition, modification or widening. This report provides analytical data of these materials for the following existing structures:

- US 101 northbound bridge at Hwy 116.
- US 101 southbound bridge at Hwy 116.
- US 101 northbound bridge at Petaluma Blvd South.
- US 101 southbound bridge at Petaluma Blvd South.
- US 101 northbound Petaluma River Bridge.
- US 101 northbound Petaluma River Bridge.

2.1 DESCRIPTION OF SAMPLING AND ANALYSIS ACTIVITIES

This section describes the sampling and resulting laboratory analysis activities performed for the project.

2.1.1 Project Limits

The MSN B4 Project consists of the segment of U. S. 101 from just south of the Petaluma Boulevard South overcrossing to just north of the Caulfield Lane overcrossing, or post-miles 2.5 to 4.1, located in the southern portion of Sonoma County, California. The project is within District 4 of the State of California Department of Transportation and within the Sonoma County Transportation Authority (SCTA) planning area.

2.1.2 Sampling Locations

Figure 1 shows the location of the site. Sheets ENV-1 through ENV-8 shows the sampling locations. Sampling locations were placed in the field using a Trimble ProXH Global Positioning System (GPS) instrument. Soil samples were collected at a total of 53 locations from the median, northbound or southbound areas. Approximately ⅓ of the northbound and southbound samples were collected each at the outer pavement edge, at the outer edge of the proposed widening area, or in the midpoint of the proposed widening area. A secondary, duplicate boring was advanced at five of the locations. A total of 188187 soil and 2 groundwater samples were collected, and all samples (except for deep samples from three borings) were analyzed for one or more constituents as described in Table 1.

2.1.3 Sampling Depths

Samples were generally collected to the maximum depth of excavation, at half-foot intervals (0.5, 1.0, 1.5, 2.0, and 3.0 feet bgs), though isolated samples were collected to deeper depths where excavation was expected to be deeper than 3 feet, or where groundwater samples were to be collected.

2.1.4 Sampling at Bents West of Hwy 116

URS collected three soil samples during potholing activities intended to clear the locations of future bents associated with the widening of the US 101 overcrossing and analyzed the samples for TPH-g, TPH-d and TPH-mo. Each sample was collected from spoils generated during the potholing activities.

2.1.5 Pre-Field Activities

2.1.5.1 Permits

URS used the existing encroachment permit for access to the Caltrans ROW. A copy of this permit is shown in Appendix B. A permit was also obtained from the Sonoma County Department of Environmental Health; a copy of this permit is also included in Appendix B.

2.1.5.2 Health and Safety Plan

A Site specific Health and Safety Plan was prepared for the project's field activities and was implemented by personnel working on-Site. Daily tailgate safety meetings were held before initiation of fieldwork with field personnel and subcontractors to discuss each day's activities and related safety precautions.

2.1.5.3 Utility Clearance

URS reviewed utility records to place borings away from known utility lines. URS also reviewed ongoing potholing operations results to further determine optimal boring locations. Additionally, utility clearance at each sampling location was conducted through notification of Underground Services Alert (USA) and with the assistance of a private underground utility locator. In several cases, sample locations were moved slightly in the field to avoid utilities.

2.1.5.4 Traffic Control

Cal-Safety Inc., a Caltrans-certified traffic control subcontractor was retained to divert traffic away from the field crew and sampling rig when working along roadways. Median work was performed between the hours of 9 PM to 5 AM, at which time URS was permitted to close the innermost lane of traffic. Outside shoulder work was performed between the hours of 9 AM and 3 PM at which time URS was permitted to close the outside shoulder.

2.1.6 Sample Collection Methods

A direct push (DPT) geoprobe soil sampling system operated by ECA, Inc. of Aptos, California (State of California Drilling Contractor License No. C57-695970) was used to collect soil cores for logging purposes and collect soil samples at discrete depths from geoprobe borings. In each of the DPT borings, samples were collected by driving an approximately 4-foot long, 2-inch diameter sample barrel equipped with clean plastic liners. Due to access issues or proximity to potential utilities, samples were collected at many locations using a hand auger. Additionally, URS collected three soil samples during potholing activities intended to clear the locations of future bents associated with the widening of the US 101 overcrossing and analyzed the samples for TPH-g, TPH-d and TPH-mo. Each sample was collected from spoils generated during the potholing activities.

All geoprobe borings were logged by a geologist or environmental engineer familiar with soil sampling procedures. Geoprobe boring logs are included in Appendix C.

For samples collected using the Geoprobe, sections of the plastic liner containing soil intervals intended for possible laboratory analysis were cut from the 4-foot long soil core, sealed with Teflon® tape, plastic end caps and masking tape, labeled with Site specific designations, and placed on ice in an ice-chest pending transport to Torrent Analytical Laboratory in Milpitas, California, a State of California certified laboratory, under URS Chain-of-Custody procedures.

Sampling equipment was cleaned after each use. Before leaving each sampling location, boring locations were filled to the surface grade with a mixture of Portland cement and bentonite grout; samples deeper than 3 ft were backfilled using a Tremie pipe. The limited cuttings related to the environmental investigation filled less than one drum, and were consolidated with cuttings resulting from the concurrent geotechnical investigation within a bin stored at the intersection of Highway 116 and US 101. These investigation-derived soils were sampled, characterized, and are scheduled to be disposed of off-Site in accordance with applicable regulations. Limited volumes of decontamination water were generated and handled by the drilling contractor.

2.1.7 Changes to the Field Program

Minor modifications were made to the Field Program during the course of the investigation. These changes fall into one of the following categories:

- Eleven of the boring locations were moved slightly (typically less than 10 feet) because the original locations were at an inaccessible point or soil was not exposed in this area. The total number of boring locations was not reduced (except for the two mentioned below).
- One boring (M-11) was not drilled due to accessibility issues. One boring (M-15) encountered drilling refusal at the surface, therefore no samples were collected.
- Three borings (M-6, S-14 and N-7) encountered drilling refusal before reaching the planned drilling depth, therefore limited samples were collected. At the M-6 boring, an additional sample was collected at 4.5ft.
- Four borings (S-1 through S-4) were advanced within a southbound on-ramp at the proposed Petaluma Blvd. South overcrossing which was removed from the project design between the time the samples were collected and the preparation of this report. The results of these samples are included in the report discussion and in the tables and figures, however these results were not incorporated into the statistical analysis as the soil represented by them will not be excavated or reused.
- One boring (S-1) encountered groundwater before reaching the planned drilling depth, therefore soil samples were only collected to a depth of 3 ft. At this location, a groundwater sample was intended to be collected, but due to a laboratory error the sample was not analyzed. See Section 2.1.8 for additional information regarding this boring.
- One boring (M-10) was relocated to the northbound shoulder area due to access issues in the median, and was drilled to 30 feet before hitting refusal, and no groundwater was encountered. Therefore, no groundwater sample was collected though one was originally

planned for this boring. Based on URS' workplan, the maximum depth a boring would be drilled was 28 feet, therefore this item is noted for information only as it is not a modification from the field workplan.

- One boring (M-16) was drilled to groundwater instead of an adjacent boring (M-17), due to the presence of shallow bedrock.
- Subsequent to URS' field investigation and the submittal of the draft Site Investigation Report, construction specifications related to the recent replacement of the US 101 overcrossing at Highway 116 were reviewed. These specifications noted that elevated concentrations of TPH-mo were detected at future locations of bents, west of Highway 116. After discussing these findings with Mr. Chris Wilson, URS decided to collect additional soil samples during upcoming potholing activities intended to clear the locations of future bents associated with the widening of the US 101 overcrossing and analyze the samples for TPH-g, TPH-d and TPH-mo. The results of these analyses are discussed in Section 3.2.3.5.

2.1.8 Soil Laboratory Analysis

Table 1 provides details of the soil analytical program, including soil sampling intervals and soil analyses conducted at each sampling location. Sixteen of the soil samples were duplicated in the field for quality control purposes.

All the soil samples included in the analytical program were analyzed for total lead by EPA Method 6010B, except the deepest samples from three of the borings, which were held by the laboratory pending results of the shallower samples. Approximately 5-20% of samples collected at various intervals were analyzed for additional soil analytes. The number of soil samples analyzed for each analyte for the Site follows:

- 178 soil samples were analyzed for lead (Pb) by EPA 6010B
- 21 soil samples were analyzed for California Assessment Manual heavy metals (CAM 17 Metals) which includes lead, by EPA Methods 6010B and 7471
- 21 soil samples were analyzed for pH by EPA Method 9045C
- 12 soil samples were analyzed for total petroleum hydrocarbons (TPH) as diesel and motor oil (TPH-d/mo) by EPA Method 8015B
- 6 soil samples were analyzed for organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs) by EPA Method 8081A
- 12 soil samples collected at intervals below the top 6 inches were analyzed for TPH as gasoline (TPH-g) by GC-MS and 9 were analyzed for MTBE and benzene, toluene, ethylbenzene, and xylenes (BTEX), using EPA Method 8260B
- 6 soil samples collected at intervals below the top 6 inches were analyzed for MTBE, TAME, t-Butanol, ETBE, and DIPE (5 Gas Oxygenates) using EPA Method 8260B
- 3 soil samples were analyzed for volatile organic compounds (VOCs) by EPA Method 8260B

- 9 soil samples were collected and analyzed for asbestos using the Polarized Light Microscopy (PLM) method

When total concentration of any metal (except Chromium) exceeded ten times its respective Soluble Threshold Limit Concentration (STLC) a sample was extracted with the Standard Waste Extraction Tests (WET) and, if the metal was lead, was extracted with the De-ionized Water Waste Extraction Test (DI-WET) and the extracts were analyzed for that metal. The WET test results were used for comparison with California hazardous waste criteria and the DI-WET test results were used to evaluate soils for on-Site use based on the DTSC variance governing soil reuse (a copy Variance V09HQSCD006 is included as Appendix D). Samples in which the total concentration of any metal exceeded 20 times the STLC criteria were extracted using the (federal) Toxicity Characteristic Leaching Procedure (TCLP) and analyzed for the metal of concern, for further comparison with federal hazardous waste criteria. For Chromium only, select samples with total Chromium exceeding ten times the STLC concentration for Chromium VI (50 mg/Kg) were extracted and analyzed for Chromium VI and/or WET Chromium.

The number of soil samples analyzed for various metals using WET, DI-WET, and TCLP methods for each project area are as follows:

Lead

- 43 soil samples tested using WET
- 43 soil samples tested using DI WET
- 20 soil samples tested using TCLP

Chromium:

- 3 soil samples tested using WET
- 6 soil samples tested for Chromium VI speciation

Nickel:

- 3 soil samples tested using WET

A complete set of the analytical results, including Chain of Custody forms, are presented in electronic format in Appendix E.

The following analytical quality control procedures were used to comply with Caltrans procedures. Sixteen samples were duplicated in the field for quality control purposes. In the laboratory QC, one sample in ten field samples was spiked with lead to ten times the detection limit or at the analyte level. (Approximately one sample in 20 was spiked and a spike duplicate was also run on each spiked sample. This is equivalent to one spike for every ten samples).

A calibration blank sample was run for every ten samples, or per batch, whichever was more frequent.

2.1.9 Groundwater Laboratory Analysis

In the course of this hazardous materials investigation, URS collected two groundwater samples: one in the vicinity of the northernmost project limits (N-17); and the other in the vicinity of known LUSTs near the 101N/116 Overcrossing (M-16). Two other groundwater samples (M-10 and S-1) originally intended to be collected were not collected. Sample M-10, located adjacent to the Petaluma River Bridge, was not collected due to no groundwater being encountered, despite drilling to 30ft which exceeded the maximum depth to groundwater established in the workplan. Sample S-1, located at the south end of the project, was not analyzed due to laboratory error. However, the on ramp where this sample (and soil samples S-2, S-3 and S-4) was located is no longer to be constructed, therefore the lack of a groundwater sample at this location is not of concern.

Table 1 provides details of the groundwater analytical program. The number of groundwater samples analyzed for each analyte for the Site follows:

- 2 groundwater samples were analyzed for TPH-d and TPH-mo by EPA Method 8015B
- 1 groundwater sample was analyzed for TPH-g by GC-MS
- 1 groundwater sample was analyzed for BTEX, using EPA Method 8260B
- 1 groundwater sample was analyzed for MTBE, TAME, t-Butanol, ETBE, and DIPE (5 Gas Oxygenates) using EPA Method 8260B
- 1 groundwater sample was analyzed for VOCs by EPA Method 8260B.

Analyte concentrations in soil are presented in Tables 2 through 5. The analytical results are presented in the following sections, separated into discussions on soil and groundwater, and by analyte. Complete soil and groundwater analytical data are presented in the Analytical Laboratory Reports, attached in electronic format as **Appendix E**.

3.1 REGULATORY OVERVIEW

Based upon URS' Hazardous Materials Investigation Workplan, and the DTSC Lead Variance for Caltrans, the following soil criteria have been used to evaluate the condition of soil at the Site:

- Soil considered a hazardous waste due to any criteria other than lead may not be reused.
- Soil with total lead <50 mg/kg or extractable lead <5 mg/L with the standard waste extraction test (WET) test, are not considered hazardous waste and are not subject to the reuse restrictions of the Caltrans ADL variance.
- Soil meeting hazardous waste criteria for lead only, with total lead <1411 mg/kg, with <1.5 mg/L extractable lead with the deionized waste extraction test (DI-WET) can be used for fill on-Site as long as it is more than five feet above the water table and must be covered with at least 1.0 foot of non-hazardous cover.
- Soil meeting hazardous waste criteria for lead only, with <3397 mg/kg total lead and >0.5 mg/L and between 1.5 mg/L and 150 mg/L extractable lead with the DI WET can be used within the Right of Way (ROW) on-Site as long as it is more than five feet above the water table and must be covered with a pavement structure which will be maintained by Caltrans.
- Soil with >3397 mg/kg total lead cannot be reused and must be disposed off-Site as a California or Federal Hazardous waste.
- Soil with >5 mg/L extractable lead with TCLP cannot be reused and must be disposed off-Site as a Federal RCRA hazardous waste.
- For soil that must be disposed off-Site if removed from the Caltrans ROW:
    - Soil with <5.0 mg/L extractable lead with the standard WET test is a non-hazardous waste and can be disposed in a non-hazardous waste landfill if removed from the Caltrans ROW.
    - Soil with >5.0 mg/L extractable lead with the standard WET and <5.0 mg/L extractable lead with the TCLP test is a California hazardous waste and must be disposed off-Site in a hazardous waste landfill if removed from the Caltrans ROW, or alternatively can be disposed of out of state, as non-hazardous soil.
    - Soil with >5.0 mg/L extractable lead with the TCLP test is a Federal RCRA waste and must be disposed off-Site in a hazardous waste landfill.

Soil analytical results from the soil samples are discussed below.

3.2 SOIL SAMPLES

3.2.1 Lead

ADL was the primary focus of the soil investigation and the data in Table 2 presents the resulting lead data from the soil samples analyzed for lead as part of this investigation.

Total lead results varied from less than the detection limit of 1 mg/kg in multiple soil samples to 1,000 mg/kg in soil sample N-17@1.5 ft.

Forty-three of the soil total lead results were above 50 mg/kg. These detections were greater than ten times the STLC criteria of 5 mg/kg (50 mg/kg) for lead, requiring that the WET and DI-WET test be conducted on these samples (limited sample volume prevented DI-WET testing for two of these samples). Twenty-five of the total lead results were equal to or greater than 20 times the STLC criteria of 5.0 mg/L (100 mg/kg) for lead. The TCLP test was conducted on the twenty of these samples with the highest concentrations. Table 3 lists results of all soil samples concentrations using the WET, DI-WET and TCLP tests, if applicable.

3.2.2 CAM 17 Metals

A total of 21 soil samples (including duplicates) were submitted for CAM 17 Metals analysis, which includes antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium and zinc. Analytical results for metals and laboratory reporting limits are presented in Tables 2 and 3.

With the exception of chromium and nickel, no metal was detected at a concentration that requires leachability testing. The results for these metals are discussed in more detail in the following section.

3.2.2.1 Chromium

Chromium concentrations in soil ranged from 12 mg/kg (N-2@0.5 ft) to 320 mg/kg (M-19@1.0 ft).

Twelve of the total soil chromium results were greater than ten times the STLC criteria for total chromium (5 mg/L). Three soil chromium results were greater than 20 times the STLC criteria for chromium. The WET test was conducted on these three samples, and the concentrations of WET chromium indicate that they did not exceed the criteria for hazardous waste of 5 mg/L, therefore the TCLP test was not conducted on any samples. Six of 12 soil samples with total chromium detected at concentrations greater than 50 mg/Kg were analyzed for hexavalent chromium. Hexavalent chromium was not detected in any sample above the detection limit. Analytical results for leachate tests and hexavalent chromium are presented in Table 3.

3.2.2.2 Nickel

Nickel concentrations in soil ranged from 28 mg/kg (S-1@1.0 ft) to 530 mg/kg (M-19@1.0 ft). Two total soil nickel results were greater than 10 times the STLC criteria for nickel (20 mg/L). The WET test was conducted on these samples, and on one additional sample (M-19@1.5 ft), and the concentrations of WET nickel indicated that they did not exceed the criteria for hazardous waste of 20 mg/L. Analytical results for the leachate tests are presented in Table 3.

3.2.3 Other Constituents of Concern

Various other chemical analyses were conducted on soil samples collected adjacent to the northbound lanes. These analyses are discussed below. Results and detection limits are tabulated in Table 4.

3.2.3.1 pH

Twenty-one samples were analyzed for pH. Results ranged from 5.91 (Sample S-1@1.0') to 8.81 (Sample S-11@1.0'). These pH detections are within the range considered non-hazardous. Therefore, levels of pH are not considered further in this soils evaluation.

3.2.3.2 Organochlorine Pesticides (OCPs)

Six samples were analyzed for OCPs. The OCP Gamma-Chlordane was detected in sample N-6@0.5'at a concentration of 17 ug/Kg. While the EPA has not established a level at which gamma chloride constitutes a hazardous waste, based on URS' experience this concentration does not warrant performance of additional toxicity tests or the analysis of samples collected from deeper intervals. No other OCPs were detected above the laboratory reporting limits. Therefore, OCPs are not considered further in this soils evaluation.

3.2.3.3 MTBE and Benzene/Toleune/Ethylbenzene/Xylenes, 5 Gas Oxygenates and Volatile Organic Compounds

Nine samples were analyzed for MTBE and Benzene/Toleune/Ethylbenzene/Xylenes (BTEX), six samples were analyzed for the constituents MTBE, TAME, DIPE, ETBE and t-Butanol (5 Gas Oxygenates) and three samples were analyzed for Volatile Organic Compounds (VOCs). These chemicals were not detected at or above the laboratory detection limit in any soil sample. Therefore, they are not considered further in this soils evaluation. Detection limits for analysis of these constituents are included in Appendix E.

3.2.3.4 Polychlorinated Biphenyls (PCBs)

Six samples were analyzed for PCBs. The PCB Archlor 1260 was detected in one sample at a concentration of 0.89 mg/Kg, below the California hazardous waste criteria of 50 mg/Kg. PCBs were not detected in any other samples at concentrations exceeding laboratory detection limits.

Detection limits for analysis of these constituents are included in Appendix E. Therefore, PCBs are not considered further in this soils evaluation.

3.2.3.5 Total Petroleum Hydrocarbon as gasoline (TPH-g), diesel (TPH-d) and motor oil (TPH-mo)

During URS' initial site investigation, nine samples were analyzed for TPH-g, TPH-d and TPH-mo. TPH-g and TPH-d were not detected at or above the laboratory detection limits of 17 ug/Kg or 0.759 mg/Kg (respectively) in any soil sample. Therefore, TPH-g and TPH-d are not considered further in this soils evaluation.

TPH-mo was detected in six of the nine samples, at concentrations ranging from 6.7 mg/Kg (M-10@3.0') to 1300 mg/Kg (S-12@0.5'). While the EPA has not established a level at which TPH-mo constitutes a hazardous waste, based on URS' experience these concentrations do not warrant performance of additional toxicity tests or the analysis of samples collected from deeper intervals. Therefore, the presence of TPH-mo is not considered further in this soils evaluation. However, the presence of TPH-mo in soil may need to be considered for health and safety purposes in the construction contract documents.

Subsequent to URS' field investigation and the submittal of the draft Site Investigation Report, construction specifications related to the recent replacement of the US 101 overcrossing at Highway 116 were reviewed. These specifications noted that elevated concentrations of TPH-d and TPH-mo were detected at future locations of bents, west of Highway 116. To evaluate soil in this area, on October 15, 2010, URS collected three additional soil samples during potholing activities intended to evaluate the locations of future bents associated with the widening of the US 101 overcrossing. These samples were analyzed for TPH-g, TPH-d and TPH-mo. TPH-g and TPH-d were not detected in any sample; concentrations of TPH-mo were detected in all three samples at concentrations ranging from 99 to 300 mg/Kg. While the EPA has not established a level at which TPH-mo constitutes a hazardous waste, based on URS' experience these concentrations do not warrant performance of additional toxicity tests or the analysis of samples collected from deeper intervals. Therefore, TPH-g, TPH-d, and TPH-mo are not considered further in this soils evaluation. However, the presence of TPH-mo in soil may need to be considered for health and safety purposes in the construction contract documents.

3.2.3.6 Asbestos in Soil

Eight samples were analyzed for asbestos using the PLM method. The results of this analysis indicated that asbestos was not present in any of these samples. Therefore, asbestos is not considered further in this soils evaluation.

3.3 GROUNDWATER

In the course of this hazardous materials investigation, URS collected two groundwater samples. Analytical results from the groundwater samples are discussed below.

3.3.1 Constituents of Concern

3.3.1.1 BTEX, 5 Gas Oxygenates and VOCs

One sample was analyzed for BTEX, 5 Gas Oxygenates and VOCs. None of these analytes were detected at concentrations above the laboratory reporting limits. Therefore, BTEX, 5 Gas Oxygenates and VOCs are not considered further in this groundwater evaluation.

3.3.1.2 Total Petroleum Hydrocarbon as gasoline (TPH-g), diesel (TPH-d) and motor oil (TPH-mo)

Two samples were analyzed for TPH-g, TPH-d and TPH-mo. TPH-g, TPH-d and TPH-mo were not detected at or above the laboratory detection limits in any sample, therefore these constituents are not considered further in this groundwater evaluation. Detection limits for analysis of these constituents are included in Appendix E and analytical results are included in Table 5.

3.3.2 Groundwater Elevation

In the course of this investigation, four samples were advanced for the purpose of collecting groundwater samples. Groundwater was encountered a minimum depth of 4 feet bgs at sample location S-1 at the southern project extent; at location M-10 (near the Petaluma River Bridge) groundwater was not encountered at a depth of 30 feet bgs. Based on these results the reuse of soil may be slightly constrained, however as the project is a ‘fill’ project with final elevation to be increased by up to 25 feet it is expected that all soil will be able to be reused on-Site.

This section provides our evaluation of the data presented in previous sections. The evaluation includes statistical analysis and comparisons to various regulation criteria and guidelines. A summary of statistical evaluations for total and leachable quantities of lead for the Site is included as Table 6. The boring logs for the soil borings are presented in Appendix C.

4.1 SOIL

To perform a statistical evaluation of total lead, WET lead, DI-WET lead, and TCLP lead, samples from two areas with high detections of STLC lead ("hotspots") were removed from the rest of the samples and will be handled as unique soil areas. These two hotspots are:

- Sample N-15 (top 1.0 foot only)
- Sample S-9 (all depths)

In addition, samples S-1, S-2, S-3 and S-4 (at all depths) were removed from the group prior to statistical evaluation, as the southbound on-ramp and the new Petaluma Blvd. South overcrossing associated with these samples is no longer to be constructed as part of this project. Sample S-5, which was placed approximately 50 feet south of the new southernmost project limit, was kept within the statistical set to evaluate soil at the southernmost project reach; while this sample is technically outside the limits of construction in URS' opinion based on its location away from the freeway it accurately describes soil conditions in this area.

All other soil samples were grouped together for the purposes of the statistical evaluation, described below. These soil samples are considered to be fully representative of the soil to be excavated at the Site.

Statistical Evaluation Methodology

A statistical evaluation of the analytical sample results was conducted to assess whether there is a need for special handling of excavated soils, based on criteria set forth for total lead and leachable lead using WET and DI-WET extraction techniques. To accomplish this, representative soil concentrations were compared to relevant and applicable threshold concentrations. This representative concentration term was estimated by the 95% Upper Confidence Limit of the Mean (95% UCL) of the concentration for materials to be sent off-Site for disposal, and the 95% UCL for soils that may be managed on-Site (for comparison only). The ProUCL software version 4.00.04 was used to calculate the 95% UCL (Singh et al., 2009a).

The use of 95% UCL concurs with USEPA statistical guidance in developing a conservative estimator of the mean concentration of soil constituents or contaminants (USEPA, 2002b). The estimated 95% UCL was used to evaluate whether the soil concentrations of total lead and leachable lead exceeded the appropriate threshold criteria. If non-detects were present, the summary statistics (mean and standard deviation) and the 95% UCL were estimated based on the Kaplan-Meier (KM) method (Singh et al., 2009a) in this analysis. Also, the results of primary and duplicate samples were averaged in order to obtain a single value. Samples collected from various depths of the same boring location were considered to be independent data points in this statistical evaluation.

In general, total lead soil samples in which the respective concentrations did not exceed ten times the STLC criteria (50 mg/kg) were not extracted/analyzed with the WET and DI-WET techniques, and soil samples in which the respective concentrations did not exceed twenty times the STLC criteria (100 mg/kg) were not extracted/analyzed with the TCLP technique. As a result, this greatly reduced the number of data points which could be included in the statistical analysis for leachable lead and would also skew the 95% UCL results high (for WET, DI-WET, and TCLP estimates), as only the samples with high total lead concentrations would be included. Therefore, to estimate WET, DI-WET, and TCLP lead concentrations in locations where the samples were not extracted and analyzed, regression equations were developed between existing total and WET, DI-WET, and TCLP lead results. Using the regression equations, WET, DI-WET, and TCLP lead concentrations for samples which were not analyzed for them were estimated. The 95% UCLs for leachable lead, using these estimated WET, DI-WET, and TCLP lead concentrations, in combination with those analyzed by the laboratory, were then obtained as discussed below.

The Site representative concentrations were evaluated by first performing an exploratory data analysis. The objective of the exploratory data analysis was to discover trends and patterns in the data so that appropriate approaches and limitations in using the datasets could be identified. Both numerical and graphical methods of exploratory data analysis were performed.

For the numerical method, a table of basic summary statistics, including mean, standard deviation, minimum and maximum detected values, for raw data (i.e., no logarithmic transformation) was prepared. For WET and DI-WET lead, the summary statistics were also calculated for the combined dataset including both laboratory-reported values and regression-estimated values. These statistics are presented in Table 6 of this report and can be used to make inferences concerning the population from which the sample data were drawn.

The next step involved a test of distributional assumption for the dataset, and the ProUCL software was used in this process. The purpose of this step was to check whether the data (raw or log-transformed) could be assumed to be normally distributed and/or the data (raw only) could be assumed to follow a gamma distribution. Based on the results of this evaluation, an appropriate probability distribution could be assumed for the data to be used in the calculation of the 95% UCL in the next step.

The Shapiro-Wilk W test was used to test the normality of the dataset at a 5% significance level (i.e., 95% confidence level), as described in the USEPA guidance document titled *Data Quality Assessment: Statistical Methods for Practitioners* (USEPA 2006). The test was first applied to raw data. If the raw dataset passed the normality test, the raw data were assumed to be normally distributed. If the raw data did not pass the normality test, a gamma distribution goodness-of-fit test (at a 5% significance level) was then applied to the data, and if the dataset passed the gamma distribution goodness-of-fit test, the data were assumed to follow a gamma distribution. Otherwise, the Shapiro-Wilk W test (at a 5% significance level) was applied to the log-transformed data. If the log-transformed data passed the normality test, the data were assumed to be lognormally distributed. If the data failed all three tests, the data were assumed to be non-parametric. In all cases, visual inspection of the shape of histograms and normal probability plots was performed to confirm the distributional assumption. The results of this distributional test are presented under the column heading “Goodness-of-Fit Test” “Distribution” in Table 6.

For datasets without nondetect:

If the data were determined to be normally distributed, the 95% UCL was calculated as follows (USEPA, 2002b):

$$UCL = \bar{x} + t_{1-\alpha,n-1}\frac{s}{\sqrt{n}}$$

where $\bar{x}$ = sample mean

t = the Student t value at α significance level, with n-1 degree of freedom

α = 0.05 (one-tailed)

n = sample size

s = sample standard deviation

Otherwise, if the data were determined to follow a gamma or lognormal distribution, or if non-parametric assumption was used, the 95% UCL was determined based on the recommendation of the ProUCL software, which takes into account sample size and data skewness and ensures adequate coverage of the 95% UCL (Singh et al., 2009b). Depending on the sample statistics, the ProUCL software generally recommended one of the following methods:

- For gamma distribution, Approximate Gamma UCL or Adjusted Gamma UCL.
- For lognormal distribution, Chebyshev Theorem using the minimum variance unbiased estimator (MVUE) of the parameters for a lognormal distribution, or Land's H-statistic.
- For a non-parametric assumption, Chebyshev Theorem using the sample arithmetic mean and standard deviation, or the Hall's bootstrap method.

For datasets with nondetect(s):

For total lead datasets, data were censored at the laboratory reporting limit of <1 mg/kg. For WET and DI-WET lead datasets, because a combined laboratory-reported values and regression-estimated values were used, in addition to the laboratory-reporting censoring <0.1 mg/L, all regression-estimated values fell below 0.1 mg/L were also assigned to be <0.1 mg/L.

If the data were normally distributed and/or if the data were symmetric or approximately symmetric, the KM (t) method (i.e., Kaplan-Meier estimates using the Student's t-distribution cutoff value) was used to calculate the 95% UCL. The equation to compute UCL was the same as the one illustrated above, except that the sample mean and sample standard deviation were substituted by KM estimates of mean and standard deviation.

If the data were assessed to follow a gamma or lognormal distribution, or if the data were assumed to be non-parametric with moderate and high skewness, one of the following methods, in general, was recommended by the ProUCL software for the calculation of UCL:

- UCL based upon KM estimates using the Chebyshev inequality.
- UCL based upon KM estimates using the bias-corrected accelerated (BCA) bootstrap method.

The detailed statistical steps of the various methods described above are documented in the ProUCL software technical guide (Singh et al., 2009b). The recommended calculation methods and UCL results, by the ProUCL software, are presented under the column heading "Method of UCL Calculation" and "Assessed 95% UCL" in Table 6.

If all samples were nondetects, or if there was only one single detected result, the UCL was not calculated because of inadequate information on data distribution, and estimates of summary statistics, such as mean and variance, were unreliable. If the recommended UCL was greater than the maximum detected value, an alternative UCL may be selected from the ProUCL report (instead of the recommendation) to better and realistically represent the mean concentration term.

Statistical Evaluation Limitation

Statistical evaluations described below have been prepared for the entire Site, except for the two hotspots described at the beginning of Section 4.1 above (sample N-15 from 0 to 1.0 ft and sample S-9 to the maximum depth of excavation of 1ft), and the samples associated with the southbound on-ramp and the new Petaluma Blvd. South overcrossing (samples S-1, S-2, S-3 and S-4 at all depths). Performing statistical evaluations on a specified segment of the project reduces the negative impacts of isolated areas with high concentrations of lead.

URS performed an initial visual review of analytical data throughout the project site. Outside of hotspots noted, only 14 of 181 soil samples collected were at concentrations considered a California Hazardous Waste and thus requiring management per the terms of the variance. Based on the spread of these results at various depths and throughout the project site (i.e they were not located near each other) URS determined that the specific excavation plan was unlikely influence the statistical results. Therefore URS considers the overall statistical analysis appropriate.

4.1.1 Initial Soil Disposal Assumptions

No soil samples exceeded the maximum concentration of total lead or DI-STLC lead at which reuse is permitted. However, samples from two "hotspot" areas (Sample N-15 from 0 to 1 ft bgs; and Sample S-9 to the maximum depth of excavation of 1ft) were removed from the statistical evaluation as they exhibited atypically high STLC lead concentrations and these two areas will be managed separately. Reuse and disposal recommendations for these "hotspot" areas are discussed in Sections 7.1.1 and 7.1.2. Samples associated with the southbound on-ramp and the new Petaluma Blvd. South overcrossing (samples S-1, S-2, S-3 and S-4) were also removed from the statistical evaluation, as this ramp is no longer to be constructed as part of this project.

4.1.2 Results for Project Area (except hotspots and southern on bound ramp)

The 95% UCLM/Maximum Detection for total lead in soil are shown in Table 6; in summary the results were as follows:

- Total Lead: 135 mg/Kg

The 95% UCLM/Maximum Detection for WET lead in this Group's soils are shown in Table 6; in summary the result was as follows:

- WET Lead: 4.41 mg/L

The 95% UCLM/Maximum Detection for DI-WET lead in soil are shown in Table 6; in summary the results were as follows:

- DI-WET Lead: 0.307 mg/L

Based on the Caltrans variance, the results for total lead and for WET lead indicate that soil from the project area is not considered hazardous waste due to lead, and is therefore not subject to the reuse restrictions of the Caltrans variance. The MSNB4 project is a net fill project. It is thought that all soil can be reused on-site.

Statistical analysis of TCLP results was not undertaken, as no individual TCLP lead result was greater than 5 mg/L. Therefore the material is not considered a Federal hazardous waste.

The MSN B4 Project proposes to demolish or widen six bridges to add Central HOV lanes in both directions of US 101. An investigation was performed at each of these structures to determine the presence or absence of asbestos-containing materials (ACM) or lead-based paint (LBP) and identify work safety issues for site construction workers.

On May 4, 2010 certified asbestos and lead based paint inspector Mr. Derrik Quach of Kellco-Macs Labs of Hayward, California collected potential asbestos-containing material (P-ACM) samples and potential lead-based paint (P-LBP) and other metal based-paint samples at the structures as South Petaluma Bridge and Route 101/116. On June 18, 2010 Mr. Quach performed limited inspection for the same materials at the concrete column, base, and mortar of the north and south edges of the Petaluma River Bridge. Please note that the central span of this bridge, crossing the river, was not inspected. The results of these investigations are discussed in this section. Copies of the Kellco-Macs Lab laboratory reports are included as Appendix G. Analytical results related to the investigations are included as Tables 8, 9, and 10.

5.1 INSPECTED STRUCTURES

This project proposes to construct central HOV lanes as part of the region-wide continuous HOV network. The project will involve widening or demolition of six bridge structures:

- Petaluma Boulevard Bridge Undercrossing (northbound and southbound) - the proposed improvements will include demolishing the existing structure.
- Petaluma River Bridge (northbound and southbound) - the proposed improvements will include demolishing the existing structure and replacing it with a new structure. Please note that the inspection described in this report did not include an evaluation of the central span that crosses the river, as inspecting this portion of the bridge would have required closing the bridge to traffic, which was not permitted by Caltrans.
- Route 101/116 Bridges (northbound and southbound) - the proposed improvements will include demolishing the northbound structure and replacing it with a new structure, and widening the southbound structure.

5.2 POTENTIAL ASBESTOS-CONTAINING MATERIALS (P-ACM) INSPECTION

The EPA defines Asbestos-Containing Material as any material that contains greater than 1% asbestos. Materials containing greater than 1% asbestos must be removed prior to demolition or renovation. Materials containing less than 10% can be submitted for further analysis by the Point Count method as described in Appendix G. If the Point Count method (and only the point count method) determines that the material contains less than 1% asbestos, it can be disposed of as non-hazardous asbestos-containing construction waste. If materials containing less than 10% asbestos by Polarized Light Microscopy are not submitted for point counting, they must be presumed to be asbestos-containing material and disposed of as hazardous asbestos waste.

5.2.1 Asbestos Inspection Details

URS provided consulting oversight services for the inspection and analysis of P-ACM within the Site. Samples of P-ACM were collected from the exterior of the structures as shown in the

figures in Appendix G. Each collected sample was stored in a Zip-Loc® bag, with its original location marked and photographed. The number of samples collected was judged sufficient to provide adequate characterization of these materials.

Samples of P-ACM were analyzed by a certified laboratory using Polarized Light Microscopy (PLM), the recommended method of the U.S. Environmental Protection Agency (EPA). A brief description of the analytical procedures is included in Appendix G. A summary of the laboratory analyses of sampled P-ACMs (positive and non-detect results) is included in the attached tables. Detailed analytical results for sampled materials are included in Appendix G. The determination of a material to be an ACM was made either by direct sample testing or by homogeneity with at least one positive sample of the same material. Kellco-Mac's laboratory credentials are included in Appendix G.

In the event that non-sampled P-ACM is uncovered during future renovation/demolition activities, these materials should be sampled and submitted for asbestos analysis.

P-ACM samples were collected from each structure as follows:

- 10 samples were collected from the US 101 northbound bridge at Hwy 116.
- 11 samples were collected from the US 101 southbound bridge at Hwy 116.
- 7 samples were collected from the US 101 northbound bridge at Petaluma Blvd. South.
- 13 samples were collected from the US 101 southbound bridge at Petaluma Blvd. South.
- 11 samples were collected from the US 101 northbound Petaluma River Bridge (one was taken from between the northbound and southbound bridges).
- 10 samples were collected from the US 101 northbound Petaluma River Bridge.

5.2.2 Asbestos Analytical Quality Control

For every ten field samples, the laboratory performs a Quality Control (QC) duplicate sample. These samples were submitted and analyzed and compared to the original results. The QC analytical results are available on request.

5.2.3 Asbestos Analytical Results

Copies of KellcoMacs Labs analytical report, including figures and pictures displaying the locations of the samples collected and full analytical results, are included in Appendix G.

Laboratory analysis indicated that none of the bulk samples collected from the structures at any bridge were ACM with at least 1% asbestos content. However, one sample collected from bedrock at the base of the column at the southbound bridge at Petaluma Blvd. South was tested positive using the point-count method with 1.9% Chrysotile. Based on the observations of the certified asbestos inspector, the material appears to be a category II 'non-friable' native serpentine bedrock material. Table 7 and 8 list the sampled materials that tested detect and non-detect, respectively, for ACM.

5.3 POTENTIAL LEAD-BASED PAINT (P-LBP) AND METAL-BASED PAINT INSPECTION

The EPA and Cal-OSHA define LBP as paint or other surface coatings that contain lead greater than 1 milligram per square centimeter (mg/cm^2) which is equivalent to 50 parts per million (ppm), or that having a lead content at least 0.5% by weight. The regulations on lead exposure require that a Negative Initial Determination for lead exposure be made for paint that contains greater than 0.06% (600 ppm) of lead, and a worker protection program that incorporates elements such as work practices, training, personal protection equipment and respiratory protection be implemented pursuant to OSHA regulatory requirements. Removal or disturbance of material with any detectable amount of lead paint must be handled in accordance with OSHA regulations. Structural components with intact lead paint and no other hazardous materials can be disposed of as non-hazardous construction waste. Paint chips and debris must be disposed of as lead-containing hazardous waste.

5.3.1 Lead- and Metal-Based Paint Inspection Details

URS provided consulting oversight services for the inspection and analysis of P-LBP and metal-based paint within the Site. Paint samples were collected from the exterior of the structures. Each collected sample was stored in a sealed plastic container, its original location marked and photographed.

Samples were analyzed by a certified laboratory using ICP/MS, Extraction Method SW3050B TTLC. A brief description of the analytical procedures is included in Appendix G. A summary of the laboratory analyses of sampled metals are included in Table 9.

In the event that non-sampled paint is uncovered during future demolition activities, these materials should be sampled and submitted for lead analysis.

Copies of KellcoMacs Labs analytical report, including figures and pictures displaying the locations of the samples collected and full analytical results, are included in Appendix G.

Paint samples were collected from each structure as follows:

- 2 samples were collected from the US 101 northbound bridge at Hwy 116.
- 1 sample was collected from the US 101 southbound bridge at Hwy 116.
- 2 samples were collected from the US 101 northbound bridge at Petaluma Blvd. South.
- 2 samples were collected from the US 101 southbound bridge at Petaluma Blvd. South.
- 4 samples were collected from the US 101 northbound Petaluma River Bridge.
- 3 samples were collected from the US 101 southbound Petaluma River Bridge.

5.3.2 Lead- and Metal-Based Paint Analytical Quality Control

For every ten field samples, the laboratory performs a Quality Control (QC) duplicate sample. These samples were submitted and analyzed and compared to the original results. The QC analytical results are available on request.

5.3.3 Lead-Based Paint Analytical Results

US 101 at Petaluma Boulevard South

Laboratory analysis indicated that all samples collected from the northbound and southbound bridges at Petaluma Blvd. South were LBP, having at least 1 mg/cm^2 (50 ppm). The highest detected lead concentration at the Petaluma Blvd. South bridges was 17,432 ppm from a yellow stripe on the northbound bridge. A brief synopsis of LBP found in tested materials follows:

- Cream and Grey paint on concrete beam of southbound bridge.
- Grey paint on wood and yellow paint stripe on the northwest railing of the northbound bridge.

US 101 at Highway 116

Laboratory analysis indicated that all samples collected from the northbound and southbound bridges at Highway 116 were LBP having at least 1 mg/cm^2 (50 ppm). The highest detected lead concentration at the Highway 116 bridges was 2,008 ppm from a yellow stripe on the northbound bridge. A brief synopsis of LBP found in tested materials follows:

- Grey paint on concrete on the northeast end of the barrier wall of the of the southbound bridge.
- Yellow paint stripe on Hwy 116 below bridge.
- Multiple colored paint on column adjacent to railroad tracks of southbound bridge.

US 101 at Petaluma River

Laboratory analysis indicated that six of seven samples collected from Petaluma River Bridge were LBP having at least 1 mg/cm^2 (50 ppm). The highest detected lead concentration at the Petaluma River Bridge was 202,917 ppm from a white stripe on metal barrier near the column southeast of the river. A brief synopsis of LBP found in tested materials follows:

- Grey paint on wood on the base of the southbound bridge south of the river.
- Grey paint on concrete on the barrier wall for the southbound bridge north of the river.
- White paint on asphalt shoulder of the southbound bridge north of the river.
- Yellow stripe on asphalt on the road below the bridge south of the river.

- White paint on metal and on the wood pole on at the barrier fence below the southbound bridge north of the river

Paint of the same color on the same bridges as those noted above, should be considered positive unless proven otherwise by direct sampling with results of non-detect (at or above the detection limit of 1.0 mg/cm^2. Disposal requirements for materials containing LBP are discussed in Section 7.2.2.

5.3.4 Metal-Based Paint Analytical Results

Paint samples were analyzed for CAM 17 Metals to provide the contractor with information to comply with OSHA requirements regarding disturbance of other metals-based paints.

Laboratory analysis indicated that all samples collected from the northbound and southbound bridges at Petaluma Blvd. South contained paint with multiple heavy metals. The sample of grey paint on wood on the northbound bridge had detected concentrations of arsenic, copper, and zinc of 13,752, 14,686, and 4,356 ppm, respectively. The yellow paint on the northbound bridge had detected concentrations of chromium of 4,055 ppm; this sample was subsequently analyzed for Chromium VI and had a detected concentration of 180 ppm. See Table 9 for a complete list of analytical results.

Laboratory analysis indicated that all samples collected from the northbound and southbound bridges at Highway 116 contained paint with multiple heavy metals. The yellow paint on the northbound bridge had detected concentrations of chromium of 502.97 ppm; this sample was subsequently analyzed for Chromium VI and had a detected concentration of 33 ppm. See Table 9 for a complete list of analytical results.

Laboratory analysis indicated that all samples collected from the northbound and southbound Petaluma River bridges contained paint with multiple heavy metals. Metals were detected in paint at this bridge at various concentrations. The highest detected concentrations of arsenic, chromium, copper, mercury, and zinc were 14,636 ppm, 3,129 ppm, 47,207 ppm, 466.86 ppm, and 12,727.67 ppm, respectively. The white stripe on metal barrier near the column southeast of the river had detected concentrations of chromium of 3,129 ppm; this sample was subsequently analyzed for Chromium VI and had a detected concentration of 180 ppm.

In addition to the general soils investigation performed to determine soil reuse or disposal requirements, primarily due to the presence of ADL, two borings were advanced with soil and/or groundwater samples collected to preliminarily evaluate areas which were identified in the ISA as having been potentially impacted due to off-Site contamination. These areas are discussed in this Section.

6.1 POTENTIAL IMPACTS DUE TO OFF-SITE CONTAMINATION

In preparing the URS workplan, we reviewed the *Marin-Sonoma Narrows HOV Widening Project Final Environmental Impact Report/Final Environmental Impact Statement*, prepared by Caltrans, July 2009, leaking underground storage tanks (LUSTs) were identified near the 101N/116 Overcrossing. To confirm whether there are potential impacts to groundwater on the project site from these LUSTs, groundwater grab samples were collected at this interchange. The workplan also discussed a LUST at 4550 Redwood Highway. URS has further evaluated this LUST site and found that it is located approximately ¼ mile south of the southern project limits, at the corner of Kastania Road and US 101. The groundwater gradient at the LUST site is to the east and the northern extent of the plume is well defined and not within the boundaries of the MSNB4 project.

URS' investigation did not identify evidence that these potential off-Site sources impacted the project corridor.

Based upon URS' Hazardous Materials Investigation Workplan, and the DTSC Lead Variance for Caltrans, the soil criteria soil criteria discussed in Section 3.1.1 have been used to evaluate the condition of soil at the Site.

7.1 CONCLUSIONS

No soil samples exceeded the maximum concentration of total lead or DI-STLC lead at which reuse is permitted. However, samples from two "hotspot" areas (Sample N-15 from 0 to 1 ft bgs; and Sample S-9 to the maximum depth of excavation of 1ft) were removed from the statistical evaluation as they exhibited higher than typical lead concentrations. Reuse and disposal recommendations for these "hotspot" areas are discussed in Sections 7.1.1 and 7.1.2 below.

All other samples were grouped together into one group for statistical evaluation, however samples associated with a ramp that is no longer being constructed (Samples S-1, S-2, S-3 and S-4) were removed prior to statistical evaluation.

URS performed an initial visual review of analytical data throughout the project site. Outside of hotspots noted, only 14 of 181 soil samples collected were at concentrations considered a California Hazardous Waste and thus requiring management per the terms of the variance. Based on the spread of these results at various depths and throughout the project site (i.e they were not located near each other) URS determined that the specific excavation plan was unlikely influence the statistical results. Therefore URS considers the overall statistical analysis appropriate.

7.1.1 Lead – Soil Reuse

Soil reuse opportunities were summarized in Table ES-1, and shown on the attached Figures. Per the terms of the Caltrans variance, Caltrans may move lead-contaminated soil from one Caltrans project to another Caltrans project so long as it remains in the same Caltrans corridor, in this case US 101. This movement must comply with the terms of the variance. This Site Investigation Report has not evaluated the potential reuse of soil outside a Caltrans Corridor.

Project Area (excluding hotspots and southern on bound ramp)

Soil excavated from the project area (excluding the two hotspots and southern on bound ramp area described below) exhibit lead and other constituents at concentrations which are not considered hazardous and therefore reuse of this soil will not be restricted.

Hotspots

Due to high concentrations of total lead and DI-WET lead, soil from around Sample N-15 at depths shallower than 1 foot may be reused on-Site only at locations more than 5 feet above the water table and must be covered with a pavement structure that will be maintained by Caltrans.

Due to high concentrations of total lead and DI-WET lead, soil from around Sample S-9 at all depths may be reused on-Site only at locations more than 5 feet above the water table and must be covered with a pavement structure that will be maintained by Caltrans.

Southern On Bound Ramp

Project changes after soil sample collection meant that four borings (S-1, S-2, S-3 and S-4) were advanced and samples collected from an on bound ramp area that is no longer being constructed as part of this project. Soil samples from these four locations were therefore removed from the group prior to statistical evaluation, and no reuse recommendations have been developed for soil from this area.

7.1.2 Lead – Soil Disposal

In the event that soils must be disposed of off-Site, the following conclusions apply.

Project Area (excluding hotspots and southbound on-ramp)

Soil excavated from the project area (excluding the two hotspots and the southbound on-ramp from the proposed Petaluma Blvd. South overcrossing described below) exhibit lead and other constituents at concentrations which are not considered hazardous. Soil removed from the Caltrans ROW can therefore be disposed of as non-hazardous waste.

Hotspots

Due to high concentrations of WET lead, soil excavated from the following hotspot areas, if removed from the Caltrans ROW, must be disposed of as a California hazardous waste, or disposed of out-of-state, due to the presence of lead. The affected areas are as follows:

- the top 1.0 ft of soil from Sample N-15
- Soil to the maximum depth of excavation of 1 foot at Sample S-9

Soil in the vicinity of these samples should be excavated and properly managed and disposed, prior to initiating soil reuse. For each sample, excavation and disposal should be performed prior to initiating excavation for stockpiling and reuse. Excavation for disposal should be performed along the entire width of excavation, for each area, and from the sample location to the midpoint between the sample and the nearest lateral samples. Excavation for disposal should be performed to the depth of sample for each area. Disposal of soil from these areas will be governed by California and/or RCRA hazardous waste regulations. Per the terms of the Caltrans variance, Caltrans may move lead-contaminated soil from one Caltrans project to another Caltrans project so long as it remains in the same Caltrans corridor, in this case US 101. This movement must comply with the terms of the variance.

Proposed Petaluma Blvd. South Overcrossing and Southbound On Bound Ramp

Project changes after soil sample collection meant that four borings (S-1, S-2, S-3 and S-4) were advanced and samples collected from an on bound ramp area that is no longer being constructed as part of this project. Soil samples from these four locations were therefore removed from the group prior to statistical evaluation, and no disposal recommendations have been developed for soil from this area.

7.1.3 Other Contaminants of Concern in Soil

As described in detail in Sections 3.1.3, various numbers of samples were analyzed for pH, asbestos, OCPs, PCBs, TPH-g, TPH-d, TPH-mo, BTEX, VOCs, and for the 5 Gas Oxygenates. None of these constituents were detected at a value or concentration which exceeded applicable State or Federal hazardous waste criteria, or for constituents for which no specific criteria has been established, require additional testing or evaluation, in the opinion of URS. Therefore, these constituents do not restrict reuse of soil or require disposal of soil as a California or RCRA hazardous waste. Results are included as Table 4, and raw analytical reports are included on CD as Appendix E.

7.1.4 Groundwater

In the course of this investigation, four samples were advanced for the purpose of collecting groundwater samples. Groundwater was encountered a minimum depth of 4 feet bgs at sample location S-1 at the former southern project extent; at location M-10 (near the Petaluma River Bridge) groundwater was not encountered at a depth of 30 feet bgs. Based on these results the reuse of soil may be slightly constrained, however as the project is a 'fill' project with final elevation to be increased by up to 25 feet it is expected that all soil will be able to be reused on-Site.

Groundwater samples associated with the environmental investigation were collected the locations of the Highway 116 bridges where the deepest excavations might be expected and at the northern project extent. As discussed in Section 3.2, no constituent of concern was detected at a concentration which exceed State or Federal hazardous waste criteria, or for constituents for which no specific criteria has been established, require additional testing or evaluation, in the opinion of URS. Therefore, these constituents do not require disposal of groundwater as a California or RCRA hazardous waste.

7.1.5 Asbestos and Lead/Metal Based Paint

The following subject structures are scheduled for demolition as part of the widening improvements and were surveyed for asbestos and lead and metal-based paint.

- Petaluma Boulevard South Bridge Undercrossing (northbound and southbound)
- US 101/116 Bridges (northbound and southbound)
- Petaluma River Bridge (northbound and southbound) – Note that only the columns, base, and barrier rails on the southern and northern approaches were inspected in this report. The central span, at the river crossing, is not included.

Asbestos was not detected in any sample, in the structure of any bridge. However, asbestos was detected in what appears to be serpentine rock near the columns at the southbound Petaluma River Bridge.

All paint samples exhibited concentrations of CAM 17 Metals at various concentrations, including Chromium and Chromium VI. Lead based paint was detected in all but one sample

collected from the bridges. See Section 5.3.3 and 5.3.4 for details and Table 9 for full analytical results.

7.1.6 Worker Health and Safety

Lead and nickel were detected in soil at concentrations exceeding the Regional Water Quality Control Board's Direct Exposure Soil Screening Levels for construction/trench workers.

7.2 RECOMMENDATIONS

URS makes the following recommendations relating to soil, groundwater, and demolition debris handling during construction:

7.2.1 Soil

If soil is to be excavated and removed from the Caltrans ROW, the disposal location should be reviewed and approved by the SCTA and Caltrans prior to granting approval for the contractor to move the soil. The investigation data results reported herein are considered sufficient to characterize the soil for reuse or disposal.

If soils of unusual color or odorous soils are encountered during the project excavations or soil management activities, those soils should be stockpiled separately and subjected to additional sampling and analysis to further evaluate potential contamination.

URS performed an initial visual review of analytical data throughout the project site. Outside of hotspots noted, only 14 of 181 soil samples collected were at concentrations considered a California Hazardous Waste and thus requiring management per the terms of the variance. Based on the spread of these results at various depths and throughout the project site (i.e they were not located near each other) URS determined that the specific excavation plan was unlikely influence the statistical results. Therefore URS considers the overall statistical analysis appropriate.

Reuse and disposal of soil for the Site is discussed in detail in Sections 7.1.1 and 7.1.2. In the course of this investigation, four samples were advanced for the purpose of collecting groundwater samples. Groundwater was encountered a minimum depth of 4 feet bgs at sample location S-1 at the former southern project extent; at location M-10 (near the Petaluma River Bridge) groundwater was not encountered at a depth of 30 feet bgs. Based on these results the reuse of soil may be slightly constrained, however as the project is a 'fill' project with final elevation to be increased by up to 25 feet it is expected that all soil will be able to be reused on-Site.

Because of high concentrations of total lead throughout the project site, URS recommends development and implementation of a site-specific health and safety plan to protect workers and the public from exposure risks due to lead. This health and safety plan will likely require workers to receive HAZWOPER 24 or 40 hour training prior to beginning field work. The

health and safety plan should consider concentrations of all detected constituents, and in particular the presence of arsenic, nickel, chromium, lead, asbestos, OCPs, and TPH-mo in soil.

7.2.2 Groundwater

In the course of this investigation, groundwater was encountered a minimum depth of 4 feet bgs at sample location S-1 at the former southern project extent; at location M-10 (near the Petaluma River Bridge) groundwater was not encountered at a depth of 30 feet bgs. Based upon URS' groundwater investigation, groundwater at the Site may be disposed of as a non-hazardous waste.

If groundwater observed in excavations or during dewatering exhibit odors or sheen, this groundwater should be stored separately additional sampling and analysis to further evaluate potential contamination, prior to continued worker contact or disposal.

URS recommends development and implementation of a site-specific health and safety plan to protect workers and the public from exposure risks due to contact with groundwater.

7.2.3 Structural Demolition Debris

Due to access restrictions, the central span of the Petaluma River Bridge has not been sampled for asbestos and lead/metal based paint. This span should be appropriately sampled prior to demolition to ensure compliance with applicable health and safety, abatement, and disposal regulations.

Asbestos has not been detected in any sample within the structures of any of the bridges scheduled for demolition and replacement as part of the Project. However, asbestos was detected in serpentine bedrock at the southbound bridge at Petaluma Blvd South. Therefore, URS recommends that all appropriate OSHA requirements be observed. Anyone coming in contact with ACM should be advised not to disturb it without taking precautionary measures appropriate to avoid ACM exposure. During any excavation of bedrock, all impacted ACM material will need to be profiled for proper management. All personnel performing demolition on ACM should be trained in accordance with the Cal-OSHA and Cal-DHS regulations for ACM hazard. In the event that non-sampled P-ACM is uncovered during demolition activities, these materials should be sampled and submitted for analysis.

Lead based paint has been detected in samples collected from all bridges. URS recommends that all paint from all bridges be considered lead-containing. No observed paint samples were identified as flaking, however if identified during demolition, any flaking paint identified as lead-containing must be scraped to the concrete substrate and properly managed and disposed as a lead-containing hazardous waste. Provided that the remainder of the paint remains in good condition (no chipping and peeling), it may be disposed of by the disposal contractor with the demolition debris as non-hazardous construction waste, following all proper waste profiling procedures, and all proper procedures and disposal regulations for demolition of a structure. Lead removal and demolition activities should be performed in compliance with all federal, state and local regulations under proper engineering control procedures. If abatement is necessary, abatement supervision, environmental area, and clearance air monitoring should be performed

during the lead removal and demolition by a third party environmental firm employed by the property owner or owner's representative. The abatement contractor, per Cal-OSHA requirements, should conduct employee exposure monitoring of individuals working in proximity of the lead containing material during abatement and/or demolition activities.

7.2.4 Worker Health and Safety

Paint containing heavy metals other than lead, including but not limited to arsenic, copper, chromium, chromium VI, mercury, and zinc, were detected in all samples taken from the bridges at various concentrations. Lead and nickel were also detected in soil at concentrations exceeding the Regional Water Quality Control Board's Direct Exposure Soil Screening Levels for construction/trench workers. These and all other detections should be considered by the contractor in preparation of their site specific health and safety plan.

This report was prepared for the Sonoma County Transportation Agency and any use by third parties is at the third parties sole risk. No investigation is sufficient enough to explore the presence of hazardous material at every location on the site. It is assumed that the samples collected and analyzed in accordance with the agreed scope of work are representative of conditions at the Site at the time of the planned construction. If soil or groundwater conditions are observed that differ from those in this report, URS Corporation should be notified so that additional recommendations can be made.

It would be extremely expensive, and perhaps impossible, to conduct a Site reconnaissance or investigation that would ensure detection of all materials at the subject property that might be considered hazardous now or in the future. URS' failure to discover hazardous materials through a reasonable and mutually agreed-upon limited scope of work does not guarantee that hazardous materials do not exist in an area. Similarly, an area that is unaffected by hazardous materials at the time of our assessment may later, due to natural phenomena or human intervention, become contaminated.

ADL	aerially deposited lead
ASTM	American Society for Testing and Materials
bgs	below ground surface
Caltrans	California Department of Transportation
CAM 17	California Assessment Manual Metals
CCR	California Code of Regulations
DI-WET	Deionized-Water Waste Extraction Test
DPT	direct-push technology
DTSC	(California) Department of Toxic Substances Control
Ft	Feet
HAZWOPER	Hazardous Waste Operations and Emergency Response
in.	Inch
ISA	Initial Site Assessment
ug/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
OCPs	organochlorine pesticides
PCBs	polychlorinated biphenyls
PID	photo-ionization detector
PRG	(USEPA Region IX) Preliminary Remediation Goal
QA/QC	quality assurance / quality control
RCRA	Resource Conservation and Recovery Act
RFI	Remedial Facility Investigation
ROW	ROW
RPD	relative percent differences

RWQCB	San Francisco Bay Area Region Water Quality Control Board
STLC	(California) Soluble Threshold Limit Concentration
TPH	total petroleum hydrocarbons
TTLC	(California) Total Threshold Limit Concentration
TCLP	(Federal USEPA RCRA) Toxicity Characteristic Leaching Procedure
USEPA	United States Environmental Protection Agency
UCL	upper confidence limit
UCLM	upper confidence limit of the mean
URS	URS Corporation
Variance	DTSC Variance No. V09HQSCD006,
SCTA	Sonoma County Transportation Agency
VOC	volatile organic compounds
WET	(California) Waste Extraction Test

Department of Toxic Substances Control (DTSC), 2009. Variance No. V09HQSCD006, July 1.

Singh, A., R. Maichle, A.K. Singh, S.E. Lee, and N. Armbya. (2009a) *ProUCL Version 4.00.04 User Guide*. Office of Research and Development, U.S. Environmental Protection Agency, Report No. EPA/600/R-07/038.

Singh, A., and A.K. Singh. (2009b) *ProUCL Version 4.00.04 Technical Guide*. Office of Research and Development, U.S. Environmental Protection Agency, Report No. EPA/600/R-07/041.

URS, 20010. Hazardous Materials Investigation Workplan, MSN B4Central HOV Lanes Project, January 20.

USEPA, 2006. Data Quality Assessment: Statistical Methods for Practitioners (EPA QA/G-9S). Office of Environmental Information, U.S. Environmental Protection Agency, Report No. EPA/240/B-06/003.

USEPA, 2002b. Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Report No. OSWER 9285.6-10.

FIGURES

URS	HAZARDOUS MATERIALS **SITE INVESTIGATION** SAN JOSE, CA 95134	SITE VICINITY MAP	NTS Figure 1 07/19/10

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RAMSEY J. HISSEN No. C-39608 Exp. 12-31-11 CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

URS CORPORATION
100 W. SAN FERNANDO St
SUITE 200
SAN JOSE, CA 95113

SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401

NOTE

FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.

LEGEND:

ENVIRONMENTAL SAMPLE LOCATION

SOIL REUSE RETRICTED TO AREA >5' ABOVE GROUNDWATER AND COVERED BY A PAVEMENT STRUCTURE MAINTAINED BY CALTRANS

SOIL REUSE RETRICTED TO AREA >5' ABOVE GROUNDWATER AND COVERED BY 1' OF CLEAN SOIL

FOR NOTES, ABBREVIATIONS AND/OR LEGEND SEE SHEET L-1.

ENVIRONMENTAL SAMPLING PLAN AND SOIL REUSE RESTRICTIONS

SCALE: 1" = 50'

ENV-1

		TT	10/31/10
		REVISED BY	DATE REVISED
TYSON TANO	ELIE ABI-JAOUDE	CALCULATED-DESIGNED BY	CHECKED BY
CONSULTANT FUNCTIONAL SUPERVISOR	RAMSEY HISSEN		

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 11-22-10 | DATE PLOTTED => 1/26/2011 TIME PLOTTED => 2:46:36 PM

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RAMSEY J. HISSEN No. C-39608 Exp. 12-31-11 CIVIL STATE OF CALIFORNIA

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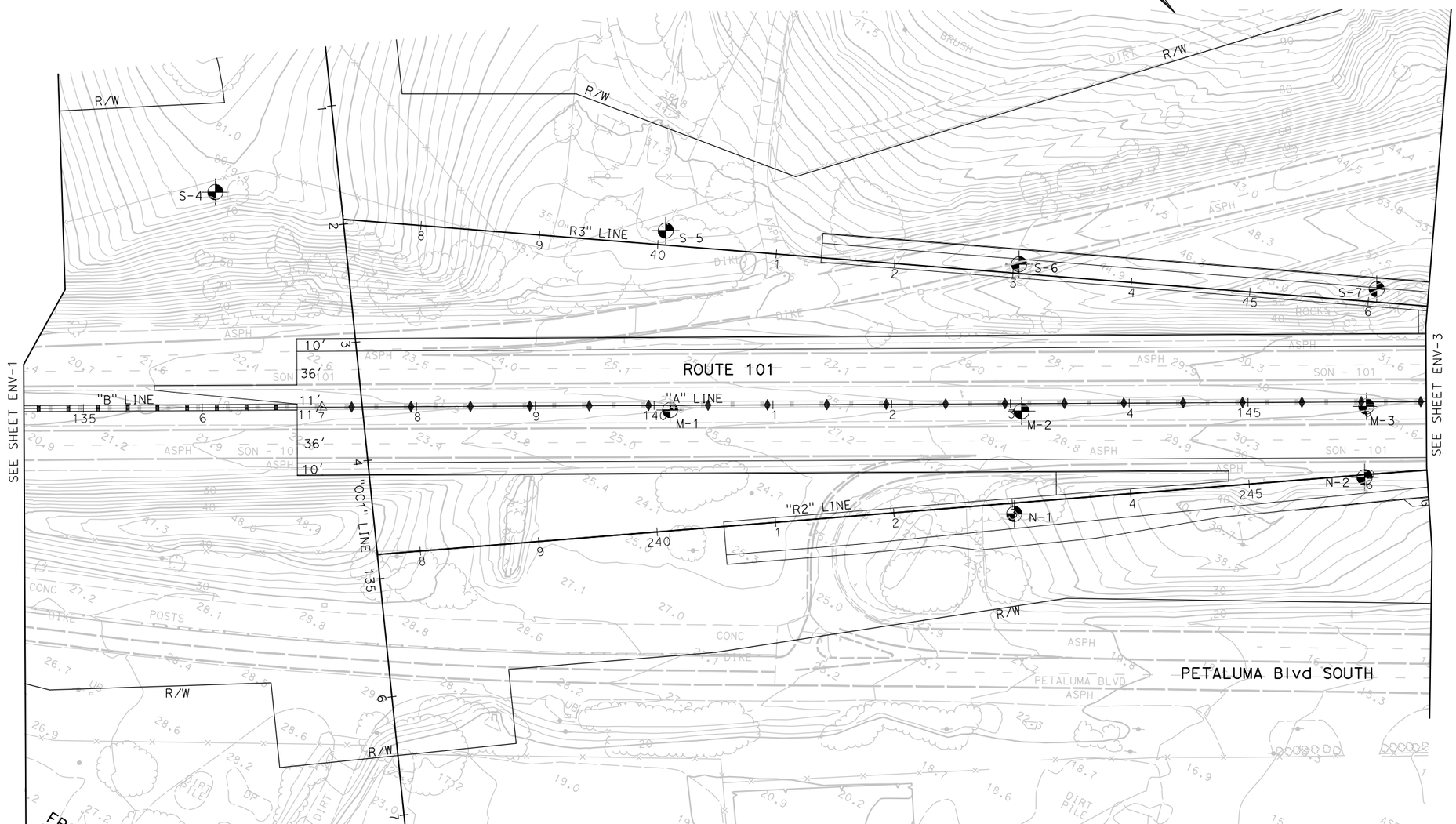
SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401

NOTE

FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.

SOIL REUSE RETRICTED TO AREA >5' ABOVE GROUNDWATER AND COVERED BY A PAVEMENT STRUCTURE MAINTAINED BY CALTRANS

SOIL REUSE RETRICTED TO AREA >5' ABOVE GROUNDWATER AND COVERED BY 1' OF CLEAN SOIL



FOR NOTES, ABBREVIATIONS AND/OR LEGEND SEE SHEET L-1.

ENVIRONMENTAL SAMPLING PLAN AND SOIL REUSE RESTRICTIONS

SCALE: 1" = 50'

ENV-2

REVISED BY	DATE REVISED
TT	10/31/10

CALCULATED-DESIGNED BY: TYSON TANO
CHECKED BY: ELIE ABI-JAOUDE
CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

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DATE PLOTTED => 1/26/2011
TIME PLOTTED => 2:46:50 PM

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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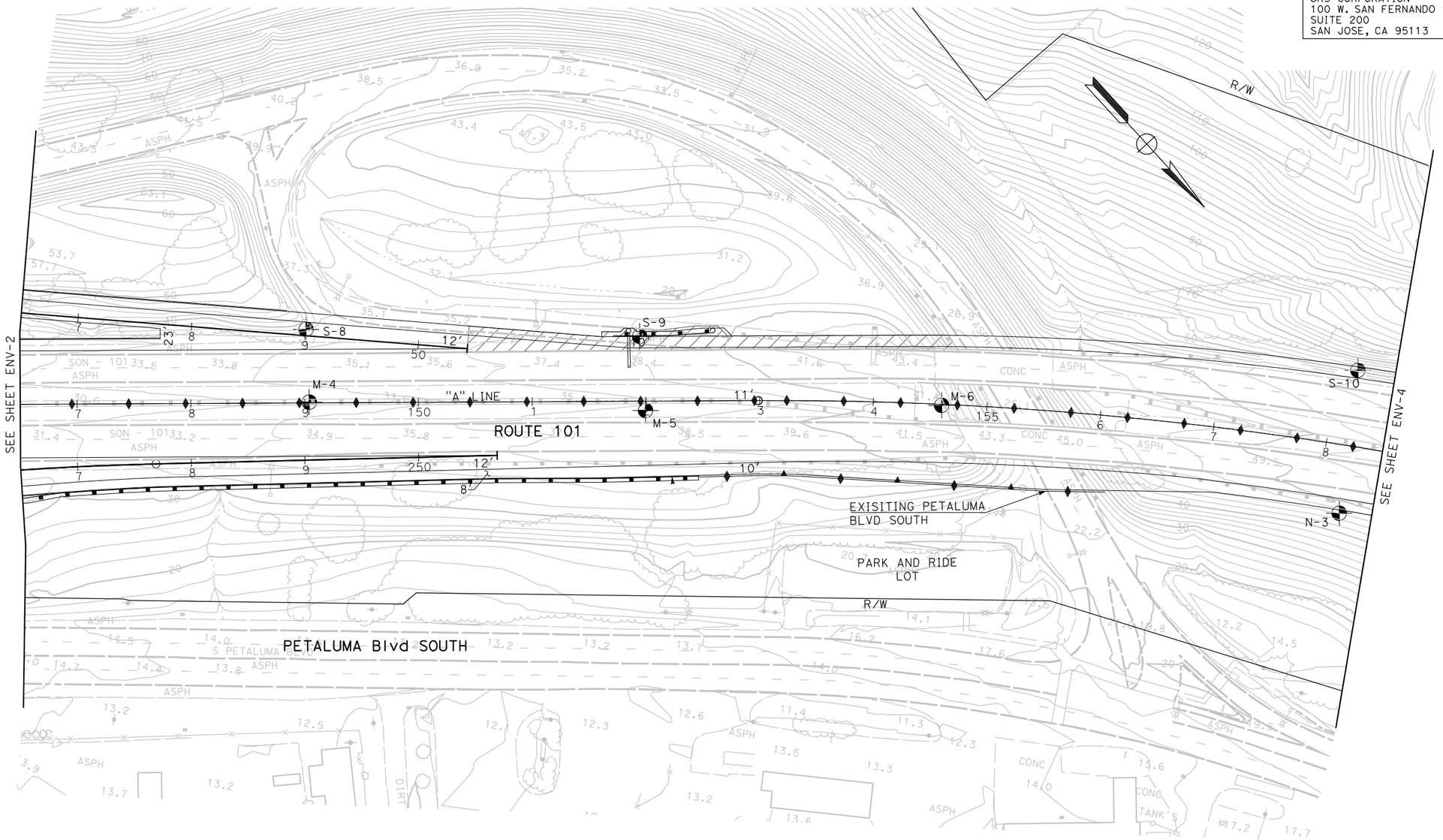

ENVIRONMENTAL SAMPLING PLAN AND SOIL REUSE RESTRICTIONS

SCALE: 1" = 50'

ENV-3

FOR NOTES, ABBREVIATIONS AND/OR LEGEND SEE SHEET L-1.

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

CALCULATED-DESIGNED BY: TYSON TANO

CHECKED BY: ELIE ABI-JAOUDE

REVISED BY: TT

DATE REVISED: 10/31/10

LAST REVISION 11-22-10

DATE PLOTTED => 1/26/2011
TIME PLOTTED => 2:47:07 PM

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RAMSEY J. HISSEN No. C-39608 Exp. 12-31-11 CIVIL STATE OF CALIFORNIA

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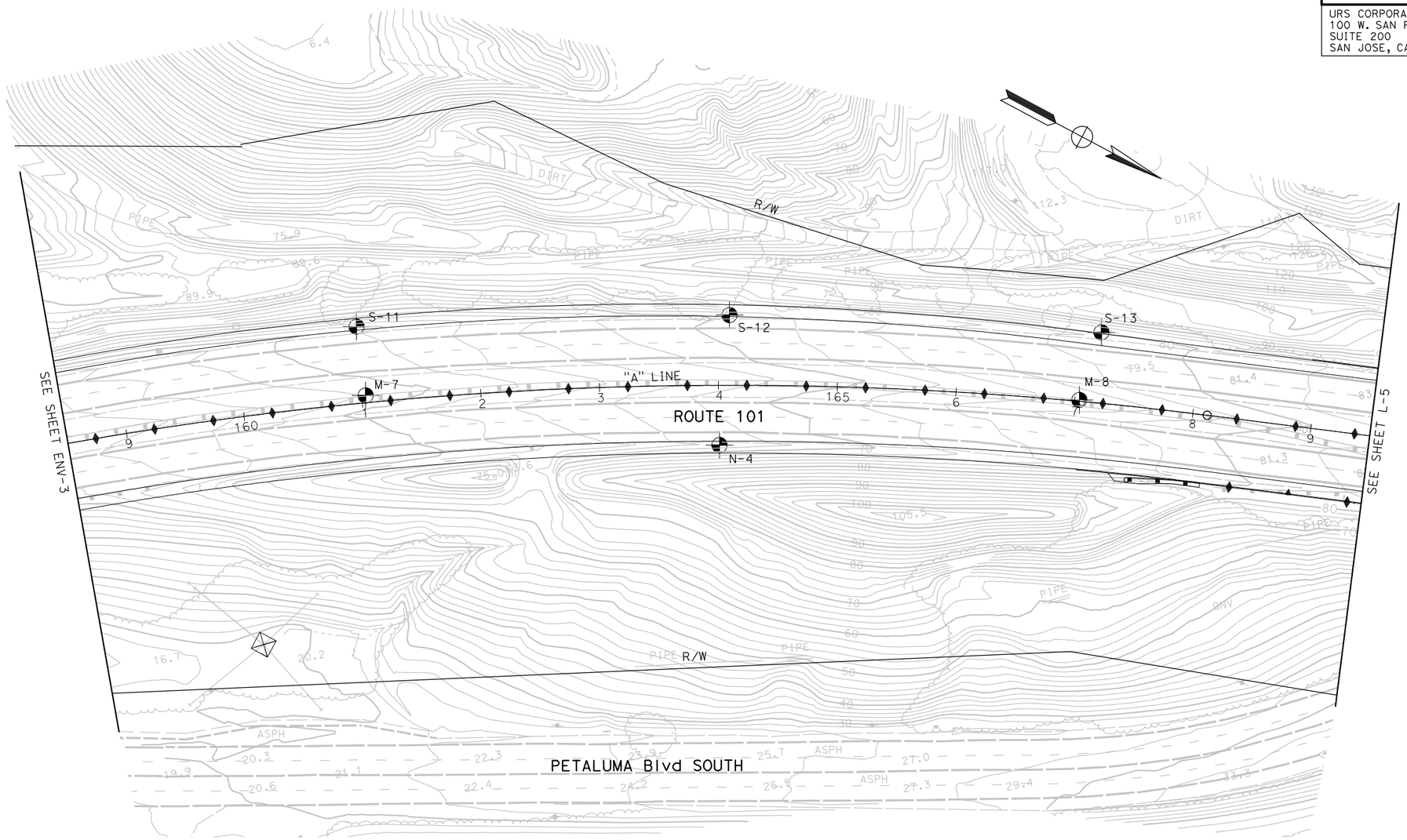
SOIL REUSE RETRICTED TO AREA >5' ABOVE GROUNDWATER AND COVERED BY 1' OF CLEAN SOIL



FOR NOTES, ABBREVIATIONS AND/OR LEGEND SEE SHEET L-1.

ENVIRONMENTAL SAMPLING PLAN AND SOIL REUSE RESTRICTIONS

SCALE: 1" = 50'

ENV-4

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

CALCULATED-DESIGNED BY: TYSON TANO

CHECKED BY: ELIE ABI-JAOUDE

REVISED BY: TT

DATE REVISED: 10/31/10

LAST REVISION 11-22-10

DATE PLOTTED => 1/26/2011
TIME PLOTTED => 2:47:23 PM

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RAMSEY J. HISSEN No. C-39608 Exp. 12-31-11 CIVIL STATE OF CALIFORNIA

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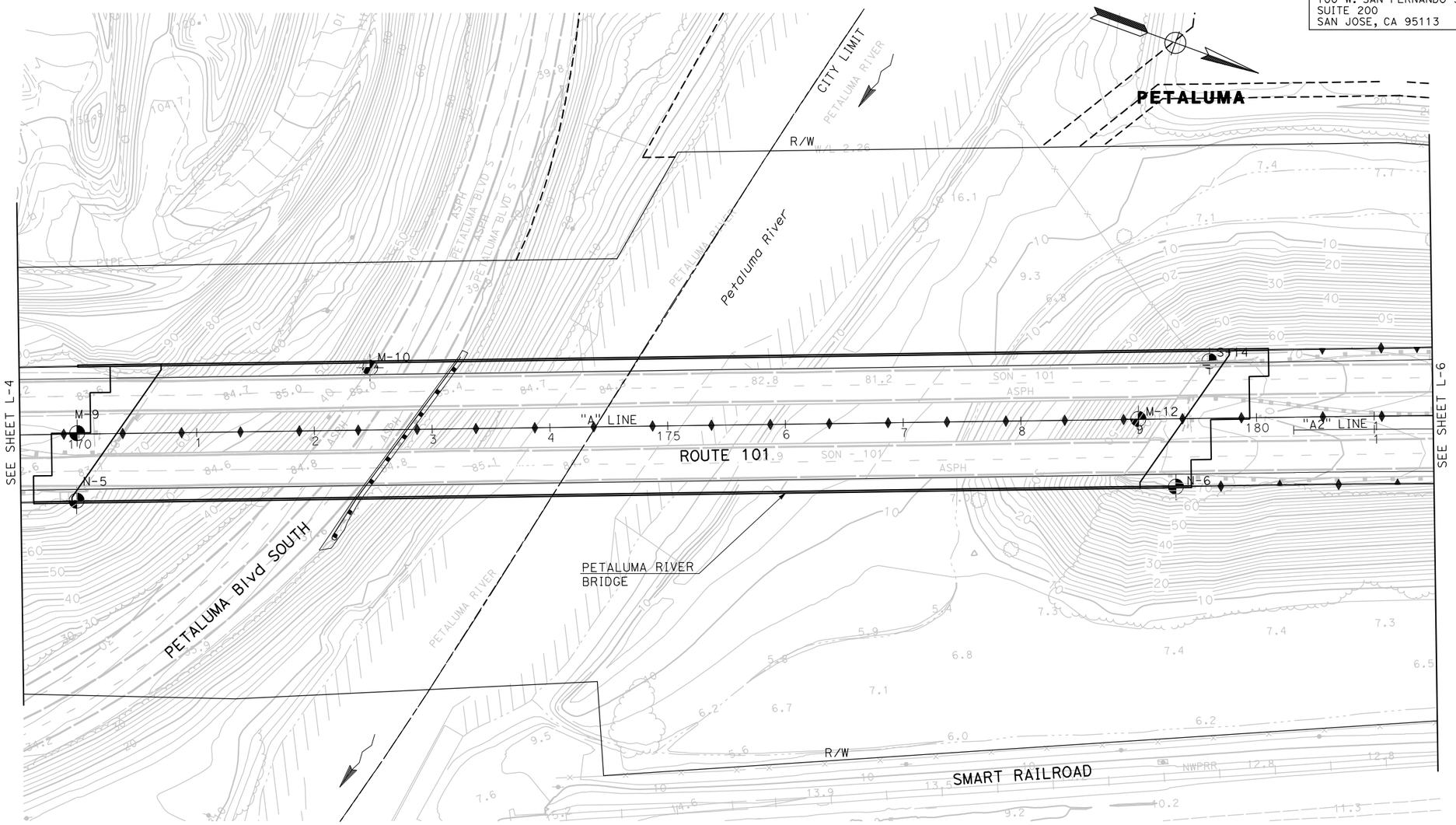

FOR NOTES, ABBREVIATIONS AND/OR LEGEND SEE SHEET L-1.

ENVIRONMENTAL SAMPLING PLAN AND SOIL REUSE RESTRICTIONS

SCALE: 1" = 50'

ENV-5

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

CALCULATED-DESIGNED BY: TYSON TANO

CHECKED BY: ELIE ABI-JAOUDE

REVISED BY: TT

DATE REVISED: 10/31/10

LAST REVISION 11-22-10

DATE PLOTTED => 1/26/2011
TIME PLOTTED => 2:47:37 PM

BORDER LAST REVISED 7/2/2010

USERNAME => andrew_cheung
DGN FILE => ...\env_bor_location_b4\ENV-05.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0714

PROJECT NUMBER & PHASE 04000007361

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RAMSEY J. HISSEN No. C-39608 Exp. 12-31-11 CIVIL STATE OF CALIFORNIA

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SANTA ROSA, CA 95401

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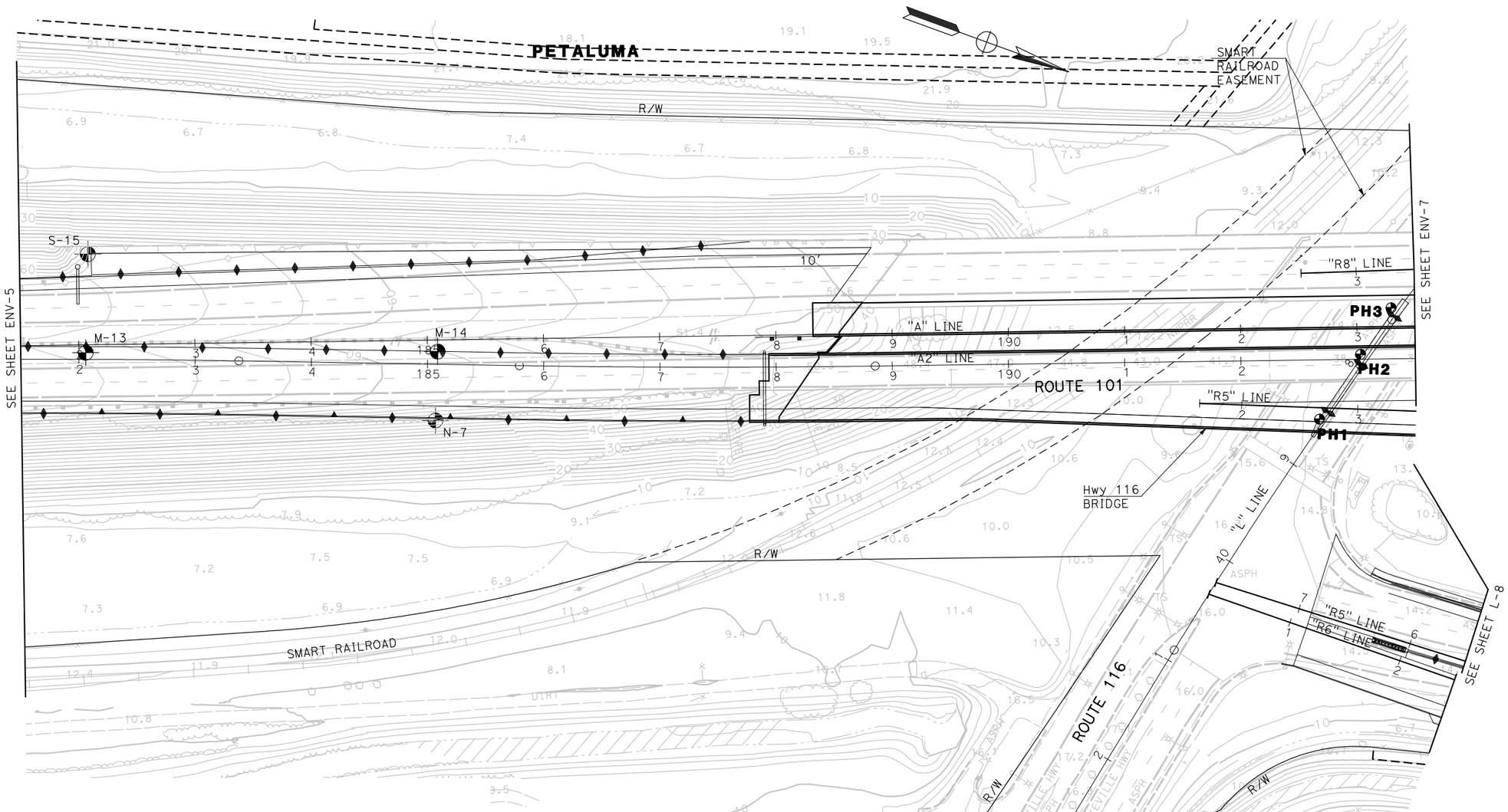

FOR NOTES, ABBREVIATIONS AND/OR LEGEND SEE SHEET L-1.

ENVIRONMENTAL SAMPLING PLAN AND SOIL REUSE RESTRICTIONS

SCALE: 1" = 50'

ENV-6

REVISED BY	TT		
DATE REVISED	10/31/10		
TYSON TANO			
ELIE ABI-JAOUDE			
CALCULATED-DESIGNED BY			
CHECKED BY			
CONSULTANT FUNCTIONAL SUPERVISOR			
RAMSEY HISSEN			

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RAMSEY J. HISSEN No. C-39608 Exp. 12-31-11 CIVIL STATE OF CALIFORNIA

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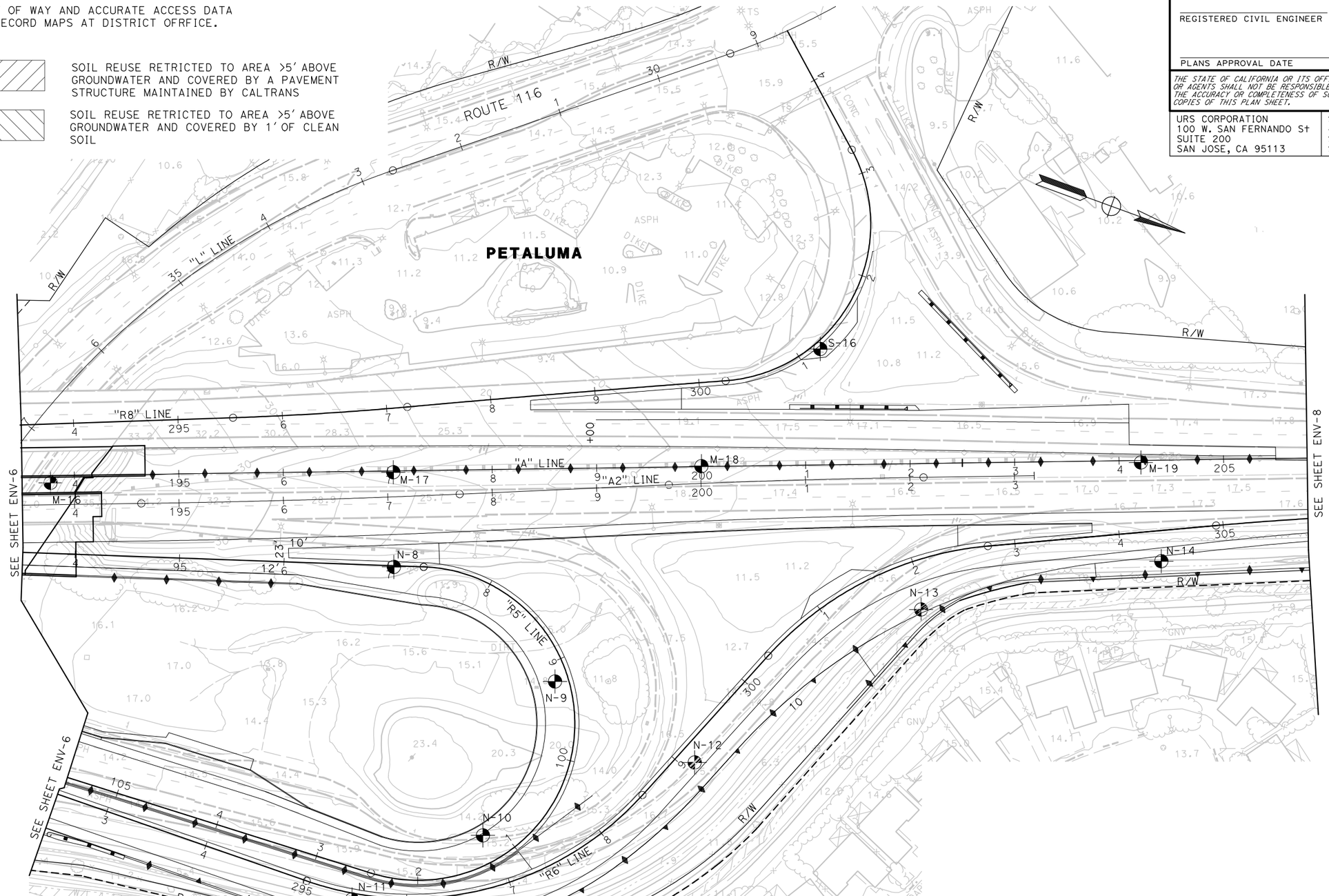

FOR NOTES, ABBREVIATIONS AND/OR LEGEND SEE SHEET L-1.

ENVIRONMENTAL SAMPLING PLAN AND SOIL REUSE RESTRICTIONS

SCALE: 1" = 50'

ENV-7

TT	REVISED BY	10/31/10 DATE REVISED
TYSON TANO	CALCULATED-DESIGNED BY	ELIE ABI-JAOUDE CHECKED BY
RAMSEY HISSEN	CONSULTANT FUNCTIONAL SUPERVISOR	

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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BORDER LAST REVISED 7/2/2010 | USERNAME => andrew_cheung DGN FILE => ...\env_bor_location_b4\ENV-07.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0714 | PROJECT NUMBER & PHASE 04000007361

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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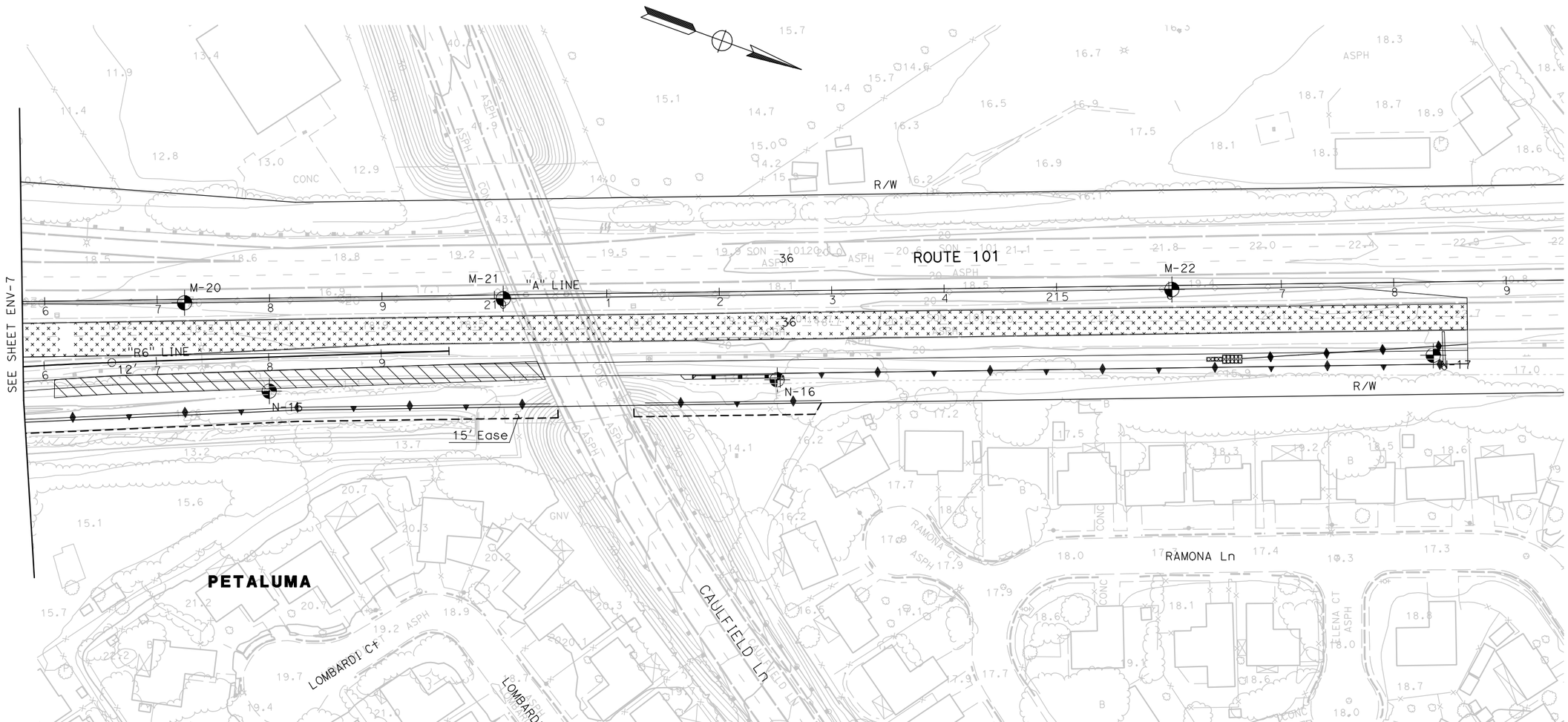

FOR NOTES, ABBREVIATIONS AND/OR LEGEND SEE SHEET L-1.

ENVIRONMENTAL SAMPLING PLAN AND SOIL REUSE RESTRICTIONS

SCALE: 1" = 50'

ENV-8

REVISED BY	DATE REVISED
TT	10/31/10

CALCULATED-DESIGNED BY: TYSON TANO
CHECKED BY: ELIE ABI-JAOUDE
CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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TABLES

Table 1
Sampling and Analysis Summary
HWY 101 MSN B4 Project

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	CAM 17 Metals	Lead (Total)	Lead (DI-STLC)	Lead (STLC)	Lead (TCLP)	Chromium (STLC)	Hexavalent Chromium	Nickel (STLC)	TPH-g	TPH-d	TPH-mo	pH	PCBs	Pesticides	Asbestos	MTBE/BTEX	5 Gas Oxygenates	VOCs
SOIL SAMPLES																					
Petaluma Boulevard South Interchange																					
S-1	0-0.5	1004091-001A	4/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004091-002A	4/19/2010	X	X	--	--	--	--	--	--	X	X	X	X	--	--	--	X	X	X
	1.0-1.5	1004091-003A	4/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004091-004A	4/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004091-005A	4/19/2010	--	X	--	--	--	--	--	--	X	X	X	--	--	--	--	X	--	--
	3.0-6.0	NOT COLLECTED - GW Encountered at 4t																			
	6.0-9.0	NOT COLLECTED - GW Encountered at 4t																			
	9.0-12.0	NOT COLLECTED - GW Encountered at 4t																			
S-2	0-0.5	1003116-016A	3/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-017A	3/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S-3	0-0.5	1003116-018A	3/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-019A	3/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S-4	0-0.5	1003116-020A	3/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-021A	3/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S-5	0-0.5	1003111-019A	3/18/2010	X	X	--	--	--	--	X	--	--	--	--	X	--	--	X	--	--	--
	0.5-1.0	1003111-020A	3/18/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S-5-d	0-0.5	1003111-021A	3/18/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003111-022A	3/18/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S-6	0-0.5	1003116-022A	3/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-023A	3/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S-7	0-0.5	1003116-024A	3/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-025A	3/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S-8	0-0.5	1004070-013A	4/15/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004070-014A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-1	0-0.5	1003116-027A	3/19/2010	--	X	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-028A	3/19/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	CAM 17 Metals	Lead (Total)	Lead (DI-STLC)	Lead (STLC)	Lead (TCLP)	Chromium (STLC)	Hexavalent Chromium	Nickel (STLC)	TPH-g	TPH-d	TPH-mo	pH	PCBs	Pesticides	Asbestos	MTBE/BTEX	5 Gas Oxygenates	VOCs
N-2	0-0.5	1004070-001A	4/15/2010	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004070-002A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--
Mainline 101 Construction South																					
M-1	0-0.5	1004009-001A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-002A	4/2/2010	X	X	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--
M-1-d	0-0.5	1004009-003A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-004A	4/2/2010	X	X	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--
M-2	0-0.5	1004009-005A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-006A	4/2/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--
M-3	0-0.5	1004009-007A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-008A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
M-4	0-0.5	1004009-009A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-010A	4/2/2010	--	X	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--
M-5	0-0.5	1004009-011A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-012A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
M-7	0-0.5	1004009-013A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-014A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
M-8	0-0.5	1004009-015A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-016A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
M-9	0-0.5	1004009-025A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-026A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
M-12	0-0.5	1004010-001A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	X	X	--	--	--	--
	0.5-1.0	1004010-002A	4/2/2010	--	X	--	--	--	--	--	--	X	X	X	--	--	--	--	X	X	--
M-12-d	0-0.5	1004010-003A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	X	X	--	--	--	--
	0.5-1.0	1004010-004A	4/2/2010	--	X	--	--	--	--	--	--	X	X	X	--	--	--	--	X	X	--
M-13	0-0.5	1004010-005A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004010-006A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	CAM 17 Metals	Lead (Total)	Lead (DI-STLC)	Lead (STLC)	Lead (TCLP)	Chromium (STLC)	Hexavalent Chromium	Nickel (STLC)	TPH-g	TPH-d	TPH-mo	pH	PCBs	Pesticides	Asbestos	MTBE/BTEX	5 Gas Oxygenates	VOCs
M-14	0-0.5	1004010-007A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004010-008A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S-9	0-0.5	1004070-011A	4/15/2010	--	X	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004070-012A	4/15/2010	--	X	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--
S-10	0-0.5	1004072-009A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004072-010A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S-11	0-0.5	1004072-007A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004072-008A	4/15/2010	X	X	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--
S-12	0-0.5	1004072-005A	4/15/2010	--	X	X	X	--	--	--	--	X	X	X	--	--	--	--	X	X	--
	0.5-1.0	1004072-006A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S-13	0-0.5	1004072-003A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004072-004A	4/15/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S-14	0-0.5	1003116-026A	3/19/2010	--	X	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	REFUSED																			
S-15	0-0.5	1003116-007A	3/19/2010	X	X	--	--	--	--	--	--	--	--	--	X	--	--	X	--	--	--
	0.5-1.0	1003116-008A	3/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1003116-009A	3/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1003116-010A	3/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1003116-011A	3/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-3	0-0.5	1003116-012A	3/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1006116-013A	3/19/2010	X	X	--	--	--	--	--	--	--	--	--	X	--	--	X	--	--	--
N-4	0-0.5	1004070-003A	4/15/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004070-004A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-5	0-0.5	1003116-014A	3/19/2010	--	X	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-015A	3/19/2010	X	X	X	X	X	--	X	--	--	--	--	X	--	--	X	--	--	--
	1.0-1.5	1003116-001A	3/19/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	CAM 17 Metals	Lead (Total)	Lead (DI-STLC)	Lead (STLC)	Lead (TCLP)	Chromium (STLC)	Hexavalent Chromium	Nickel (STLC)	TPH-g	TPH-d	TPH-mo	pH	PCBs	Pesticides	Asbestos	MTBE/BTEX	5 Gas Oxygenates	VOCs
N-6	0-0.5	1003116-002A	3/19/2010	--	X	X	X	X	--	--	--	--	--	--	--	X	X	--	--	--	--
	0.5-1.0	1003116-003A	3/19/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1003116-004A	3/19/2010	--	X	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1003116-005A	3/19/2010	--	X	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1003116-006A	3/19/2010	X	X	--	--	--	--	--	--	--	--	--	X	--	--	X	--	--	--
N-7	0-0.5	1004091-011A	4/19/2010	--	X	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004091-012A	4/19/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004091-013A	4/19/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004091-014A	4/19/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	REFUSED																			
Construction of new on- and off- ramps for Northbound 101 at SR 116																					
N-8	0-0.5	1003111-001A	3/18/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003111-002A	3/18/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-9	0-0.5	1003111-003A	3/18/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003111-004A	3/18/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-10	0-0.5	1003111-005A	3/18/2010	X	X	--	--	--	--	--	--	--	--	--	X	--	--	X	--	--	--
	0.5-1.0	1003111-006A	3/18/2010	X	X	--	--	--	--	--	--	--	--	--	X	--	--	X	--	--	--
N-11	0-0.5	1003111-012A	3/18/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003111-013A	3/18/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-12	0-0.5	1004070-005A	4/15/2010	--	X	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004070-006A	4/15/2010	--	X	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004070-007A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004070-008A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004070-009A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-13	0-0.5	1003111-014A	3/18/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003111-015A	3/18/2010	X	X	--	--	--	--	--	--	--	--	--	X	--	--	X	--	--	--
	1.0-1.5	1003111-016A	3/18/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1003111-017A	3/18/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1003111-018A	3/18/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	CAM 17 Metals	Lead (Total)	Lead (DI-STLC)	Lead (STLC)	Lead (TCLP)	Chromium (STLC)	Hexavalent Chromium	Nickel (STLC)	TPH-g	TPH-d	TPH-mo	pH	PCBs	Pesticides	Asbestos	MTBE/BTEX	5 Gas Oxygenates	VOCs
N-13-d	0-0.5	1003111-007A	3/18/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003111-008A	3/18/2010	X	X	--	--	--	--	--	--	--	--	--	X	--	--	X	--	--	--
	1.0-1.5	1003111-009A	3/18/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1003111-010A	3/18/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1003111-011A	3/18/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-14	0-0.5	1004070-010A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	X	X	--	--	--	--
	0.5-1.0	1004072-011A	4/15/2010	--	X	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004072-012A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004072-013A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004072-014A	4/15/2010	X	X	--	--	--	X	X	--	--	--	--	X	--	--	--	--	--	--
Mainline 101 Construction North																					
M-18	0-0.5	1004011-001A	4/2/2010	--	X	X	X	X	--	--	--	--	--	--	--	X	X	--	--	--	--
	0.5-1.0	1004011-002A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004011-003A	4/2/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004011-004A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004011-005A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
M-19	0-0.5	1004011-006A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004011-007A	4/2/2010	X	X	--	--	--	X	X	X	--	--	--	X	--	--	--	--	--	--
	1.0-1.5	1004011-008A	4/2/2010	--	X	X	X	--	--	--	X	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004011-009A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004011-010A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
M-19-d	0-0.5	1004011-011A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004011-012A	4/2/2010	X	X	--	--	--	X	X	X	--	--	--	X	--	--	--	--	--	--
	1.0-1.5	100411-013A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004011-014A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004011-015A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	CAM 17 Metals	Lead (Total)	Lead (DI-STLC)	Lead (STLC)	Lead (TCLP)	Chromium (STLC)	Hexavalent Chromium	Nickel (STLC)	TPH-g	TPH-d	TPH-mo	pH	PCBs	Pesticides	Asbestos	MTBE/BTEX	5 Gas Oxygenates	VOCs
M-20	0-0.5	1004011-016A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004011-017A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004011-018A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004011-019A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004011-020A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
M-21	0-0.5	1004011-021A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004011-022A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004011-023A	4/2/2010	--	X	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004011-024A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004011-025A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
M-22	0-0.5	1004011-026A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004011-027A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	X	X	--	--	--	--
	1.0-1.5	1004011-028A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004011-029A	4/2/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004011-030A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S-16	0-0.5	1003116-029A	3/19/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-030A	3/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1003116-031A	3/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1003116-032A	3/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1003116-033A	3/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-15	0-0.5	1004067-003A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004067-004A	4/15/2010	--	X	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004067-005A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004067-006A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004067-007A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-16	0-0.5	1004067-009A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004067-010A	4/15/2010	--	X	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004067-011A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004067-012A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004067-013A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	CAM 17 Metals	Lead (Total)	Lead (DI-STLC)	Lead (STLC)	Lead (TCLP)	Chromium (STLC)	Hexavalent Chromium	Nickel (STLC)	TPH-g	TPH-d	TPH-mo	pH	PCBs	Pesticides	Asbestos	MTBE/BTEX	5 Gas Oxygenates	VOCs
N-17	0-0.5	1004072-015A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004072-016A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004072-017A	4/15/2010	--	X	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004072-018A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004072-019A	4/15/2010	X	X	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--
	3.0-6.0	1004072-020A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6.0-9.0	1004072-001A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	9.0-12.0	1004072-002A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bridge Replacement																					
M-6	0-0.5	1004009-017A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-018A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004009-019A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004009-020A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004009-021A	4/2/2010	X	X	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--
	3.0-4.5	1004009-024A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	3.0-6.0	1004009-022A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6.0-8.0	1004009-023A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	9.0-12.0	REFUSED																			
M-10	0-0.5	1004091-006A	4/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004091-007A	4/19/2010	X	X	--	--	--	--	--	--	X	X	X	X	--	--	--	X	X	X
	1.0-1.5	1004091-008A	4/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004091-009A	4/19/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004091-010A	4/19/2010	--	X	--	--	--	--	--	--	X	X	X	--	--	--	--	X	--	--
	3.0-6.0	REFUSED	4/19/2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6.0-9.0	REFUSED	4/19/2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	9.0-12.0	REFUSED	4/19/2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	CAM 17 Metals	Lead (Total)	Lead (DI-STLC)	Lead (STLC)	Lead (TCLP)	Chromium (STLC)	Hexavalent Chromium	Nickel (STLC)	TPH-g	TPH-d	TPH-mo	pH	PCBs	Pesticides	Asbestos	MTBE/BTEX	5 Gas Oxygenates	VOCs
M-16	0-0.5	1004070-015A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004070-016A	4/15/2010	X	X	X	X	--	--	X	--	X	X	X	X	--	--	--	X	X	X
	1.0-1.5	1004070-017A	4/15/2010	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004070-018A	4/15/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004070-019A	4/15/2010	--	X	X	X	X	--	--	--	X	X	X	--	--	--	--	X	--	--
	3.0-6.0	1004070-020A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6.0-9.0	1004067-001A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	9.0-10.5	1004067-002A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
M-17	0-0.5	1004010-009A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004010-010A	4/2/2010	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
US 101/Hwy 116 Overcrossing Pothole Sampling																					
PH-1	--	1010193-001	10/15/2010	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PH-2	--	1010193-002	10/15/2010	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PH-3	--	1010193-003	10/15/2010	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GROUNDWATER SAMPLES																					
Mainline 101 Construction North																					
N-17-GW	15	1004067-015A	4/15/2010	--	--	--	--	--	--	--	--	--	X	X	--	--	--	--	--	--	--
Bridge Replacement at Hwy 116																					
M-10-GW	30	No Groundwater Encountered																			
M-16-GW	9	1004067-017A	4/15/2010	--	--	--	--	--	--	--	--	X	X	X	--	--	--	--	X	X	X

Notes:

X = sample analyzed for specified analyte

-- = sample not analyzed for specified analyte

No samples were collected from boring locations M-11 and M-15, due to accessibility issues and drilling refusal respectively.

Table 2
Soil Results - Total Metals
HWY 101 MSN B4 Project

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead (Total)	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
		EPA Method		6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B
		Units		mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
		10 x STLC		150	50	1,000	7.5	10	50	800	250	50	2	3,500	200	10	50	70	240	2,500
		20 x TCLP		NE	100	2,000	NE	20	100	NE	NE	100	4	NE	NE	20	100	NE	NE	NE
		ESLs		310	15	2600	98	39	1200000 (III) 0.53 (VI)	94	310000	750	58	3900	260	3900	3900	62	770	230000
Petaluma Boulevard South Interchange																				
S-1	0-0.5	1004091-001A	4/19/2010	--	--	--	--	--	--	--	--	42	--	--	--	--	--	--	--	--
	0.5-1.0	1004091-002A	4/19/2010	<0.20	3	79	<0.0840	<0.0590	35	12	15	22	<0.01	<0.0590	28	<0.29	<0	<0.12	33	30
	1.0-1.5	1004091-003A	4/19/2010	--	--	--	--	--	--	--	--	6.1	--	--	--	--	--	--	--	--
	1.5-2.0	1004091-004A	4/19/2010	--	--	--	--	--	--	--	--	6.2	--	--	--	--	--	--	--	--
	2.0-3.0	1004091-005A	4/19/2010	--	--	--	--	--	--	--	--	6.6	--	--	--	--	--	--	--	--
S-2	0-0.5	1003116-016A	3/19/2010	--	--	--	--	--	--	--	--	18	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-017A	3/19/2010	--	--	--	--	--	--	--	--	7.5	--	--	--	--	--	--	--	--
S-3	0-0.5	1003116-018A	3/19/2010	--	--	--	--	--	--	--	--	12	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-019A	3/19/2010	--	--	--	--	--	--	--	--	5.5	--	--	--	--	--	--	--	--
S-4	0-0.5	1003116-020A	3/19/2010	--	--	--	--	--	--	--	--	14	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-021A	3/19/2010	--	--	--	--	--	--	--	--	9.2	--	--	--	--	--	--	--	--
S-5	0-0.5	1003111-019A	3/18/2010	<0.20	2.3	82	<0.0840	<0.0590	**78**	23	33	17	<0.01	<0.0590	78	<0.29	2	<0.12	66	51
	0.5-1.0	1003111-020A	3/18/2010	--	--	--	--	--	--	--	--	7.4	--	--	--	--	--	--	--	--
S-5-d	0-0.5	1003111-021A	3/18/2010	--	--	--	--	--	--	--	--	17	--	--	--	--	--	--	--	--
	0.5-1.0	1003111-022A	3/18/2010	--	--	--	--	--	--	--	--	7.5	--	--	--	--	--	--	--	--
S-6	0-0.5	1003116-022A	3/19/2010	--	--	--	--	--	--	--	--	11	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-023A	3/19/2010	--	--	--	--	--	--	--	--	8.1	--	--	--	--	--	--	--	--
S-7	0-0.5	1003116-024A	3/19/2010	--	--	--	--	--	--	--	--	17	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-025A	3/19/2010	--	--	--	--	--	--	--	--	14	--	--	--	--	--	--	--	--
S-8	0-0.5	1004070-013A	4/15/2010	--	--	--	--	--	--	--	--	**64**	--	--	--	--	--	--	--	--
	0.5-1.0	1004070-014A	4/15/2010	--	--	--	--	--	--	--	--	9.3	--	--	--	--	--	--	--	--
N-1	0-0.5	1003116-027A	3/19/2010	--	--	--	--	--	--	--	--	**270**	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-028A	3/19/2010	--	--	--	--	--	--	--	--	**53**	--	--	--	--	--	--	--	--
N-2	0-0.5	1004070-001A	4/15/2010	<0.20	<0.28	17	<0.0840	<0.0590	12	17	35	5.1	<0.01	<0.0590	58	<0.29	<0	<0.12	27	26
	0.5-1.0	1004070-002A	4/15/2010	--	--	--	--	--	--	--	--	22	--	--	--	--	--	--	--	--
Mainline 101 Construction South																				
M-1	0-0.5	1004009-001A	4/2/2010	--	--	--	--	--	--	--	--	5.3	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-002A	4/2/2010	<0.20	3.2	77	<0.0840	<0.0590	**76**	23	34	41	<0.01	<0.0590	85	<0.29	<0	<0.12	55	68
M-1-d	0-0.5	1004009-003A	4/2/2010	--	--	--	--	--	--	--	--	4.5	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-004A	4/2/2010	<0.20	2.9	64	<0.0840	<0.0590	**54**	16	25	14	<0.01	<0.0590	53	<0.29	<0	<0.12	40	35
M-2	0-0.5	1004009-005A	4/2/2010	--	--	--	--	--	--	--	--	7.1	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-006A	4/2/2010	--	--	--	--	--	--	--	--	**80**	--	--	--	--	--	--	--	--
M-3	0-0.5	1004009-007A	4/2/2010	--	--	--	--	--	--	--	--	11	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-008A	4/2/2010	--	--	--	--	--	--	--	--	7.6	--	--	--	--	--	--	--	--
M-4	0-0.5	1004009-009A	4/2/2010	--	--	--	--	--	--	--	--	2.7	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-010A	4/2/2010	--	--	--	--	--	--	--	--	**830**	--	--	--	--	--	--	--	--
M-5	0-0.5	1004009-011A	4/2/2010	--	--	--	--	--	--	--	--	2.8	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-012A	4/2/2010	--	--	--	--	--	--	--	--	2.3	--	--	--	--	--	--	--	--
M-7	0-0.5	1004009-013A	4/2/2010	--	--	--	--	--	--	--	--	5.4	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-014A	4/2/2010	--	--	--	--	--	--	--	--	6.2	--	--	--	--	--	--	--	--

Table 2
Soil Results - Total Metals
HWY 101 MSN B4 Project

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead (Total)	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
		EPA Method		6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B
		Units		mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
		10 x STLC		150	50	1,000	7.5	10	50	800	250	50	2	3,500	200	10	50	70	240	2,500
		20 x TCLP		NE	100	2,000	NE	20	100	NE	NE	100	4	NE	NE	20	100	NE	NE	NE
		ESLs		310	15	2600	98	39	1200000 (III) 0.53 (VI)	94	310000	750	58	3900	260	3900	3900	62	770	230000
M-8	0-0.5	1004009-015A	4/2/2010	--	--	--	--	--	--	--	--	5.8	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-016A	4/2/2010	--	--	--	--	--	--	--	--	11	--	--	--	--	--	--	--	--
M-9	0-0.5	1004009-025A	4/2/2010	--	--	--	--	--	--	--	--	2.5	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-026A	4/2/2010	--	--	--	--	--	--	--	--	3.3	--	--	--	--	--	--	--	--
M-12	0-0.5	1004010-001A	4/2/2010	--	--	--	--	--	--	--	--	7.7	--	--	--	--	--	--	--	--
	0.5-1.0	1004010-002A	4/2/2010	--	--	--	--	--	--	--	--	7.7	--	--	--	--	--	--	--	--
M-12-d	0-0.5	1004010-003A	4/2/2010	--	--	--	--	--	--	--	--	7.2	--	--	--	--	--	--	--	--
	0.5-1.0	1004010-004A	4/2/2010	--	--	--	--	--	--	--	--	8.6	--	--	--	--	--	--	--	--
M-13	0-0.5	1004010-005A	4/2/2010	--	--	--	--	--	--	--	--	22	--	--	--	--	--	--	--	--
	0.5-1.0	1004010-006A	4/2/2010	--	--	--	--	--	--	--	--	24	--	--	--	--	--	--	--	--
M-14	0-0.5	1004010-007A	4/2/2010	--	--	--	--	--	--	--	--	7.1	--	--	--	--	--	--	--	--
	0.5-1.0	1004010-008A	4/2/2010	--	--	--	--	--	--	--	--	3.2	--	--	--	--	--	--	--	--
S-9	0-0.5	1004070-011A	4/15/2010	--	--	--	--	--	--	--	--	**140**	--	--	--	--	--	--	--	--
	0.5-1.0	1004070-012A	4/15/2010	--	--	--	--	--	--	--	--	**170**	--	--	--	--	--	--	--	--
S-10	0-0.5	1004072-009A	4/15/2010	--	--	--	--	--	--	--	--	25	--	--	--	--	--	--	--	--
	0.5-1.0	1004072-010A	4/15/2010	--	--	--	--	--	--	--	--	9.9	--	--	--	--	--	--	--	--
S-11	0-0.5	1004072-007A	4/15/2010	--	--	--	--	--	--	--	--	27	--	--	--	--	--	--	--	--
	0.5-1.0	1004072-008A	4/15/2010	<0.20	2.4	82	<0.0840	<0.0590	38	9.1	20	2.7	<0.01	<0.0590	54	<0.29	1.1	<0.12	27	39
S-12	0-0.5	1004072-005A	4/15/2010	--	--	--	--	--	--	--	--	**89**	--	--	--	--	--	--	--	--
	0.5-1.0	1004072-006A	4/15/2010	--	--	--	--	--	--	--	--	21	--	--	--	--	--	--	--	--
S-13	0-0.5	1004072-003A	4/15/2010	--	--	--	--	--	--	--	--	13	--	--	--	--	--	--	--	--
	0.5-1.0	1004072-004A	4/15/2010	--	--	--	--	--	--	--	--	**65**	--	--	--	--	--	--	--	--
S-14	0-0.5	1003116-026A	3/19/2010	--	--	--	--	--	--	--	--	**450**	--	--	--	--	--	--	--	--
S-15	0-0.5	1003116-007A	3/19/2010	<0.20	5.2	120	<0.0840	<0.0590	**50**	13	29	16	0.41	5.3	55	<0.29	1.1	<0.12	41	59
	0.5-1.0	1003116-008A	3/19/2010	--	--	--	--	--	--	--	--	14	--	--	--	--	--	--	--	--
	1.0-1.5	1003116-009A	3/19/2010	--	--	--	--	--	--	--	--	14	--	--	--	--	--	--	--	--
	1.5-2.0	1003116-010A	3/19/2010	--	--	--	--	--	--	--	--	13	--	--	--	--	--	--	--	--
	2.0-3.0	1003116-011A	3/19/2010	--	--	--	--	--	--	--	--	15	--	--	--	--	--	--	--	--
N-3	0-0.5	1003116-012A	3/19/2010	--	--	--	--	--	--	--	--	43	--	--	--	--	--	--	--	--
	0.5-1.0	1006116-013A	3/19/2010	<0.20	2.6	53	<0.0840	<0.0590	25	12	27	48	<0.01	<0.0590	46	<0.29	<0	<0.12	32	74
N-4	0-0.5	1004070-003A	4/15/2010	--	--	--	--	--	--	--	--	**130**	--	--	--	--	--	--	--	--
	0.5-1.0	1004070-004A	4/15/2010	--	--	--	--	--	--	--	--	3	--	--	--	--	--	--	--	--
N-5	0-0.5	1003116-014A	3/19/2010	--	--	--	--	--	--	--	--	**370**	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-015A	3/19/2010	<0.20	4.3	68	<0.0840	<0.0590	**56**	24	41	**280**	<0.01	<0.0590	59	<0.29	<0	<0.12	68	90
	1.0-1.5	1003116-001A	3/19/2010	--	--	--	--	--	--	--	--	**65**	--	--	--	--	--	--	--	--
N-6	0-0.5	1003116-002A	3/19/2010	--	--	--	--	--	--	--	--	**320**	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-003A	3/19/2010	--	--	--	--	--	--	--	--	**120**	--	--	--	--	--	--	--	--
	1.0-1.5	1003116-004A	3/19/2010	--	--	--	--	--	45	--	--	**210**	--	--	--	--	--	--	--	--
	1.5-2.0	1003116-005A	3/19/2010	--	--	--	--	--	--	--	--	**140**	--	--	--	--	--	--	--	--
	2.0-3.0	1003116-006A	3/19/2010	<0.20	1.8	69	<0.0840	<0.0590	**67**	22	25	12	<0.01	<0.0590	66	<0.29	<0	<0.12	81	46

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead (Total)	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
		EPA Method		6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B
		Units		mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
		10 x STLC		150	50	1,000	7.5	10	50	800	250	50	2	3,500	200	10	50	70	240	2,500
		20 x TCLP		NE	100	2,000	NE	20	100	NE	NE	100	4	NE	NE	20	100	NE	NE	NE
		ESLs		310	15	2600	98	39	1200000 (III) 0.53 (VI)	94	310000	750	58	3900	260	3900	3900	62	770	230000
N-7	0-0.5	1004091-011A	4/19/2010	--	--	--	--	--	--	--	--	**230**	--	--	--	--	--	--	--	--
	0.5-1.0	1004091-012A	4/19/2010	--	--	--	--	--	--	--	--	**59**	--	--	--	--	--	--	--	--
	1.0-1.5	1004091-013A	4/19/2010	--	--	--	--	--	--	--	--	**100**	--	--	--	--	--	--	--	--
	1.5-2.0	1004091-014A	4/19/2010	--	--	--	--	--	--	--	--	**81**	--	--	--	--	--	--	--	--
Construction of new on- and off- ramps for Northbound 101 at SR 116																				
N-8	0-0.5	1003111-001A	3/18/2010	--	--	--	--	--	--	--	--	**77**	--	--	--	--	--	--	--	--
	0.5-1.0	1003111-002A	3/18/2010	--	--	--	--	--	--	--	--	**110**	--	--	--	--	--	--	--	--
N-9	0-0.5	1003111-003A	3/18/2010	--	--	--	--	--	--	--	--	17	--	--	--	--	--	--	--	--
	0.5-1.0	1003111-004A	3/18/2010	--	--	--	--	--	--	--	--	10	--	--	--	--	--	--	--	--
N-10	0-0.5	1003111-005A	3/18/2010	<0.20	7.2	99	<0.0840	<0.0590	43	14	27	40	0.29	<0.0590	47	<0.29	<0	<0.12	44	84
	0.5-1.0	1003111-006A	3/18/2010	<0.20	6.3	140	<0.0840	<0.0590	42	19	28	32	0.13	<0.0590	62	<0.29	<0	<0.12	43	70
N-11	0-0.5	1003111-012A	3/18/2010	--	--	--	--	--	--	--	--	**80**	--	--	--	--	--	--	--	--
	0.5-1.0	1003111-013A	3/18/2010	--	--	--	--	--	--	--	--	**56**	--	--	--	--	--	--	--	--
N-12	0-0.5	1004070-005A	4/15/2010	--	--	--	--	--	--	--	--	**230**	--	--	--	--	--	--	--	--
	0.5-1.0	1004070-006A	4/15/2010	--	--	--	--	--	--	--	--	**130**	--	--	--	--	--	--	--	--
	1.0-1.5	1004070-007A	4/15/2010	--	--	--	--	--	--	--	--	10	--	--	--	--	--	--	--	--
	1.5-2.0	1004070-008A	4/15/2010	--	--	--	--	--	--	--	--	1.8	--	--	--	--	--	--	--	--
	2.0-3.0	1004070-009A	4/15/2010	--	--	--	--	--	--	--	--	3.4	--	--	--	--	--	--	--	--
N-13	0-0.5	1003111-014A	3/18/2010	--	--	--	--	--	--	--	--	**90**	--	--	--	--	--	--	--	--
	0.5-1.0	1003111-015A	3/18/2010	<0.20	3	140	<0.0840	<0.0590	32	22	17	46	<0.01	<0.0590	38	<0.29	<0	<0.12	38	59
	1.0-1.5	1003111-016A	3/18/2010	--	--	--	--	--	--	--	--	11	--	--	--	--	--	--	--	--
	1.5-2.0	1003111-017A	3/18/2010	--	--	--	--	--	--	--	--	5.8	--	--	--	--	--	--	--	--
	2.0-3.0	1003111-018A	3/18/2010	--	--	--	--	--	--	--	--	6.2	--	--	--	--	--	--	--	--
N-13-d	0-0.5	1003111-007A	3/18/2010	--	--	--	--	--	--	--	--	**99**	--	--	--	--	--	--	--	--
	0.5-1.0	1003111-008A	3/18/2010	<0.20	2.7	73	<0.0840	<0.0590	28	14	16	44	<0.01	<0.0590	34	<0.29	<0	<0.12	37	50
	1.0-1.5	1003111-009A	3/18/2010	--	--	--	--	--	--	--	--	8.5	--	--	--	--	--	--	--	--
	1.5-2.0	1003111-010A	3/18/2010	--	--	--	--	--	--	--	--	10	--	--	--	--	--	--	--	--
	2.0-3.0	1003111-011A	3/18/2010	--	--	--	--	--	--	--	--	17	--	--	--	--	--	--	--	--
N-14	0-0.5	1004070-010A	4/15/2010	--	--	--	--	--	--	--	--	19	--	--	--	--	--	--	--	--
	0.5-1.0	1004072-011A	4/15/2010	--	--	--	--	--	--	--	--	**140**	--	--	--	--	--	--	--	--
	1.0-1.5	1004072-012A	4/15/2010	--	--	--	--	--	--	--	--	8.3	--	--	--	--	--	--	--	--
	1.5-2.0	1004072-013A	4/15/2010	--	--	--	--	--	--	--	--	7	--	--	--	--	--	--	--	--
	2.0-3.0	1004072-014A	4/15/2010	5.5	2.1	190	<0.0840	<0.0590	**180**	19	29	5.7	<0.01	<0.0590	180	<029	<0	<0.12	51	38
Mainline 101 Construction North																				
M-18	0-0.5	1004011-001A	4/2/2010	--	--	--	--	--	--	--	--	**590**	--	--	--	--	--	--	--	--
	0.5-1.0	1004011-002A	4/2/2010	--	--	--	--	--	--	--	--	34	--	--	--	--	--	--	--	--
	1.0-1.5	1004011-003A	4/2/2010	--	--	--	--	--	--	--	--	**58**	--	--	--	--	--	--	--	--
	1.5-2.0	1004011-004A	4/2/2010	--	--	--	--	--	--	--	--	5.3	--	--	--	--	--	--	--	--
	2.0-3.0	1004011-005A	4/2/2010	--	--	--	--	--	--	--	--	1.5	--	--	--	--	--	--	--	--

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead (Total)	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
		EPA Method		6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B
		Units		mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
		10 x STLC		150	50	1,000	7.5	10	50	800	250	50	2	3,500	200	10	50	70	240	2,500
		20 x TCLP		NE	100	2,000	NE	20	100	NE	NE	100	4	NE	NE	20	100	NE	NE	NE
		ESLs		310	15	2600	98	39	1200000 (III) 0.53 (VI)	94	310000	750	58	3900	260	3900	3900	62	770	230000
M-19	0-0.5	1004011-006A	4/2/2010	--	--	--	--	--	--	--	--	1.1	--	--	--	--	--	--	--	--
	0.5-1.0	1004011-007A	4/2/2010	7.8	<0.28	53	<0.0840	<0.0590	**320**	31	23	35	0.34	<0.0590	**530**	<0.29	2.1	<0.12	50	42
	1.0-1.5	1004011-008A	4/2/2010	--	--	--	--	--	--	--	--	**55**	--	--	--	--	--	--	--	--
	1.5-2.0	1004011-009A	4/2/2010	--	--	--	--	--	--	--	--	19	--	--	--	--	--	--	--	--
	2.0-3.0	1004011-010A	4/2/2010	--	--	--	--	--	--	--	--	3	--	--	--	--	--	--	--	--
M-19-d	0-0.5	1004011-011A	4/2/2010	--	--	--	--	--	--	--	--	14	--	--	--	--	--	--	--	--
	0.5-1.0	1004011-012A	4/2/2010	7.2	<0.28	61	<0.0840	<0.0590	**260**	39	34	38	<0.01	<0.0590	**470**	<0.29	1.7	<0.12	58	45
	1.0-1.5	100411-013A	4/2/2010	--	--	--	--	--	--	--	--	36	--	--	--	--	--	--	--	--
	1.5-2.0	1004011-014A	4/2/2010	--	--	--	--	--	--	--	--	30	--	--	--	--	--	--	--	--
	2.0-3.0	1004011-015A	4/2/2010	--	--	--	--	--	--	--	--	5.4	--	--	--	--	--	--	--	--
M-20	0-0.5	1004011-016A	4/2/2010	--	--	--	--	--	--	--	--	7.5	--	--	--	--	--	--	--	--
	0.5-1.0	1004011-017A	4/2/2010	--	--	--	--	--	--	--	--	11	--	--	--	--	--	--	--	--
	1.0-1.5	1004011-018A	4/2/2010	--	--	--	--	--	--	--	--	30	--	--	--	--	--	--	--	--
	1.5-2.0	1004011-019A	4/2/2010	--	--	--	--	--	--	--	--	15	--	--	--	--	--	--	--	--
	2.0-3.0	1004011-020A	4/2/2010	--	--	--	--	--	--	--	--	2	--	--	--	--	--	--	--	--
M-21	0-0.5	1004011-021A	4/2/2010	--	--	--	--	--	--	--	--	18	--	--	--	--	--	--	--	--
	0.5-1.0	1004011-022A	4/2/2010	--	--	--	--	--	--	--	--	12	--	--	--	--	--	--	--	--
	1.0-1.5	1004011-023A	4/2/2010	--	--	--	--	--	--	--	--	**490**	--	--	--	--	--	--	--	--
	1.5-2.0	1004011-024A	4/2/2010	--	--	--	--	--	--	--	--	8.4	--	--	--	--	--	--	--	--
	2.0-3.0	1004011-025A	4/2/2010	--	--	--	--	--	--	--	--	2.1	--	--	--	--	--	--	--	--
M-22	0-0.5	1004011-026A	4/2/2010	--	--	--	--	--	--	--	--	11	--	--	--	--	--	--	--	--
	0.5-1.0	1004011-027A	4/2/2010	--	--	--	--	--	--	--	--	8.3	--	--	--	--	--	--	--	--
	1.0-1.5	1004011-028A	4/2/2010	--	--	--	--	--	--	--	--	17	--	--	--	--	--	--	--	--
	1.5-2.0	1004011-029A	4/2/2010	--	--	--	--	--	--	--	--	**110**	--	--	--	--	--	--	--	--
	2.0-3.0	1004011-030A	4/2/2010	--	--	--	--	--	--	--	--	9	--	--	--	--	--	--	--	--
S-16	0-0.5	1003116-029A	3/19/2010	--	--	--	--	--	--	--	--	**74**	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-030A	3/19/2010	--	--	--	--	--	--	--	--	23	--	--	--	--	--	--	--	--
	1.0-1.5	1003116-031A	3/19/2010	--	--	--	--	--	--	--	--	11	--	--	--	--	--	--	--	--
	1.5-2.0	1003116-032A	3/19/2010	--	--	--	--	--	--	--	--	14	--	--	--	--	--	--	--	--
	2.0-3.0	1003116-033A	3/19/2010	--	--	--	--	--	--	--	--	6.1	--	--	--	--	--	--	--	--
N-15	0-0.5	1004067-003A	4/15/2010	--	--	--	--	--	--	--	--	18	--	--	--	--	--	--	--	--
	0.5-1.0	1004067-004A	4/15/2010	--	--	--	--	--	--	--	--	**920**	--	--	--	--	--	--	--	--
	1.0-1.5	1004067-005A	4/15/2010	--	--	--	--	--	--	--	--	39	--	--	--	--	--	--	--	--
	1.5-2.0	1004067-006A	4/15/2010	--	--	--	--	--	--	--	--	5.4	--	--	--	--	--	--	--	--
	2.0-3.0	1004067-007A	4/15/2010	--	--	--	--	--	--	--	--	6.3	--	--	--	--	--	--	--	--
N-16	0-0.5	1004067-009A	4/15/2010	--	--	--	--	--	--	--	--	31	--	--	--	--	--	--	--	--
	0.5-1.0	1004067-010A	4/15/2010	--	--	--	--	--	--	--	--	**310**	--	--	--	--	--	--	--	--
	1.0-1.5	1004067-011A	4/15/2010	--	--	--	--	--	--	--	--	2.3	--	--	--	--	--	--	--	--
	1.5-2.0	1004067-012A	4/15/2010	--	--	--	--	--	--	--	--	7.3	--	--	--	--	--	--	--	--
	2.0-3.0	1004067-013A	4/15/2010	--	--	--	--	--	--	--	--	7	--	--	--	--	--	--	--	--

Table 2
Soil Results - Total Metals
HWY 101 MSN B4 Project

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead (Total)	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
		EPA Method		6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B	6010B
		Units		mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
		10 x STLC		150	50	1,000	7.5	10	50	800	250	50	2	3,500	200	10	50	70	240	2,500
		20 x TCLP		NE	100	2,000	NE	20	100	NE	NE	100	4	NE	NE	20	100	NE	NE	NE
		ESLs		310	15	2600	98	39	1200000 (III) 0.53 (VI)	94	310000	750	58	3900	260	3900	3900	62	770	230000
N-17	0-0.5	1004072-015A	4/15/2010	--	--	--	--	--	--	--	--	31	--	--	--	--	--	--	--	--
	0.5-1.0	1004072-016A	4/15/2010	--	--	--	--	--	--	--	--	49	--	--	--	--	--	--	--	--
	1.0-1.5	1004072-017A	4/15/2010	--	--	--	--	--	--	--	--	**1000**	--	--	--	--	--	--	--	--
	1.5-2.0	1004072-018A	4/15/2010	--	--	--	--	--	--	--	--	5.3	--	--	--	--	--	--	--	--
	2.0-3.0	1004072-019A	4/15/2010	<0.20	3.3	150	<0.0840	<0.0590	33	8.6	19	7.7	<0.01	<0.0590	32	<0.29	<0	<0.12	36	24
	3.0-6.0	1004072-020A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6.0-9.0	1004072-001A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	9.0-12.0	1004072-002A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bridge Replacement																				
M-6	0-0.5	1004009-017A	4/2/2010	--	--	--	--	--	--	--	--	2	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-018A	4/2/2010	--	--	--	--	--	--	--	--	2.1	--	--	--	--	--	--	--	--
	1.0-1.5	1004009-019A	4/2/2010	--	--	--	--	--	--	--	--	4.3	--	--	--	--	--	--	--	--
	1.5-2.0	1004009-020A	4/2/2010	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--
	2.0-3.0	1004009-021A	4/2/2010	<0.20	<0.28	34	<0.0840	<0.0590	**62**	17	21	20	<0.01	<0.0590	36	<0.29	1.4	<0.12	81	42
	3.0-4.5	1004009-024A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	3.0-6.0	1004009-022A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6.0-8.0	1004009-023A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
M-10	0-0.5	1004091-006A	4/19/2010	--	--	--	--	--	--	--	--	21	--	--	--	--	--	--	--	--
	0.5-1.0	1004091-007A	4/19/2010	<0.20	1.8	74	<0.0840	<0.0590	**100**	25	36	17	0.14	<0.0590	63	<0.29	<0	<0.12	93	63
	1.0-1.5	1004091-008A	4/19/2010	--	--	--	--	--	--	--	--	28	--	--	--	--	--	--	--	--
	1.5-2.0	1004091-009A	4/19/2010	--	--	--	--	--	--	--	--	25	--	--	--	--	--	--	--	--
	2.0-3.0	1004091-010A	4/19/2010	--	--	--	--	--	--	--	--	8.4	--	--	--	--	--	--	--	--
M-16	0-0.5	1004070-015A	4/15/2010	--	--	--	--	--	--	--	--	18	--	--	--	--	--	--	--	--
	0.5-1.0	1004070-016A	4/15/2010	<0.20	2.3	80	<0.0840	<0.0590	**76**	19	35	**61**	0.13	<0.0590	94	<0.29	<0	<0.12	48	59
	1.0-1.5	1004070-017A	4/15/2010	--	--	--	--	--	--	--	--	**93**	--	--	--	--	--	--	--	--
	1.5-2.0	1004070-018A	4/15/2010	--	--	--	--	--	--	--	--	25	--	--	--	--	--	--	--	--
	2.0-3.0	1004070-019A	4/15/2010	--	--	--	--	--	--	--	--	**180**	--	--	--	--	--	--	--	--
	3.0-6.0	1004070-020A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
M-17	0-0.5	1004010-009A	4/2/2010	--	--	--	--	--	--	--	--	5.3	--	--	--	--	--	--	--	--
	0.5-1.0	1004010-010A	4/2/2010	--	--	--	--	--	--	--	--	6.8	--	--	--	--	--	--	--	--

Notes:
EPA = US Environmental Protection Agency
mg/Kg = milligrams per kilogram
STLC = Soluble Threshold Limits Concentrations
TCLP = Toxicity Characteristic Leaching Procedure
ESL = RWQCB Direct Exposure Soil Screening Levels for Construction/Trench Workers
NE = Not Established
-- = sample not analyzed for specified analyte
Bold indicates value exceeds 10 x STLC
The symbol "<" (less than) indicates that the analyte was not detected at a concentration above the laboratory detection limit specified.
No samples were collected from boring locations M-11 and M-15, due to accessibility issues and drilling refusal respectively.

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	Lead (Total)	Lead (DI-STLC)	Lead (STLC)	Lead (TCLP)	Chromium (STLC)	Hexavalent Chromium	Nickel (STLC)
		EPA Method		6010B	6010B	6010B	6010B	6010B	7199M	6010B
		Units		mg/Kg	mg/L	mg/L	mg/L	mg/L	mg/Kg	mg/L
		10 X STLC/20 X TCLP Limit[1]		50	--	--	--	--	50	--
		Hazardous Waste Limit[2]		--	--	5.0	5.0	560	--	20
		Reuse Restrictions[3]		1411/3397	0.5/1.5/150	--	--	--	--	--
Petaluma Boulevard South Interchange										
S-1	0-0.5	1004091-001A	4/19/2010	42	--	--	--	--	--	--
	0.5-1.0	1004091-002A	4/19/2010	22	--	--	--	--	--	--
	1.0-1.5	1004091-003A	4/19/2010	6.1	--	--	--	--	--	--
	1.5-2.0	1004091-004A	4/19/2010	6.2	--	--	--	--	--	--
	2.0-3.0	1004091-005A	4/19/2010	6.6	--	--	--	--	--	--
S-2	0-0.5	1003116-016A	3/19/2010	18	--	--	--	--	--	--
	0.5-1.0	1003116-017A	3/19/2010	7.5	--	--	--	--	--	--
S-3	0-0.5	1003116-018A	3/19/2010	12	--	--	--	--	--	--
	0.5-1.0	1003116-019A	3/19/2010	5.5	--	--	--	--	--	--
S-4	0-0.5	1003116-020A	3/19/2010	14	--	--	--	--	--	--
	0.5-1.0	1003116-021A	3/19/2010	9.2	--	--	--	--	--	--
S-5	0-0.5	1003111-019A	3/18/2010	17	--	--	--	--	<0.015	--
	0.5-1.0	1003111-020A	3/18/2010	7.4	--	--	--	--	--	--
S-5-d	0-0.5	1003111-021A	3/18/2010	17	--	--	--	--	--	--
	0.5-1.0	1003111-022A	3/18/2010	7.5	--	--	--	--	--	--
S-6	0-0.5	1003116-022A	3/19/2010	11	--	--	--	--	--	--
	0.5-1.0	1003116-023A	3/19/2010	8.1	--	--	--	--	--	--
S-7	0-0.5	1003116-024A	3/19/2010	17	--	--	--	--	--	--
	0.5-1.0	1003116-025A	3/19/2010	14	--	--	--	--	--	--
S-8	0-0.5	1004070-013A	4/15/2010	64	0.80	7.0	--	--	--	--
	0.5-1.0	1004070-014A	4/15/2010	9.3	--	--	--	--	--	--
N-1	0-0.5	1003116-027A	3/19/2010	270	<0.0500	12	<0.05	--	--	--
	0.5-1.0	1003116-028A	3/19/2010	53	0.17	0.91	--	--	--	--
N-2	0-0.5	1004070-001A	4/15/2010	5.1	--	--	--	--	--	--
	0.5-1.0	1004070-002A	4/15/2010	22	--	--	--	--	--	--
Mainline 101 Construction South										
M-1	0-0.5	1004009-001A	4/2/2010	5.3	--	--	--	--	--	--
	0.5-1.0	1004009-002A	4/2/2010	41	--	--	--	--	--	--
M-1-d	0-0.5	1004009-003A	4/2/2010	4.5	--	--	--	--	--	--
	0.5-1.0	1004009-004A	4/2/2010	14	--	--	--	--	--	--
M-2	0-0.5	1004009-005A	4/2/2010	7.1	--	--	--	--	--	--
	0.5-1.0	1004009-006A	4/2/2010	80	<0.0500	0.53	--	--	--	--
M-3	0-0.5	1004009-007A	4/2/2010	11	--	--	--	--	--	--
	0.5-1.0	1004009-008A	4/2/2010	7.6	--	--	--	--	--	--
M-4	0-0.5	1004009-009A	4/2/2010	2.7	--	--	--	--	--	--
	0.5-1.0	1004009-010A	4/2/2010	830	<0.0500	14	0.24	--	--	--
M-5	0-0.5	1004009-011A	4/2/2010	2.8	--	--	--	--	--	--
	0.5-1.0	1004009-012A	4/2/2010	2.3	--	--	--	--	--	--
M-7	0-0.5	1004009-013A	4/2/2010	5.4	--	--	--	--	--	--
	0.5-1.0	1004009-014A	4/2/2010	6.2	--	--	--	--	--	--
M-8	0-0.5	1004009-015A	4/2/2010	5.8	--	--	--	--	--	--
	0.5-1.0	1004009-016A	4/2/2010	11	--	--	--	--	--	--
M-9	0-0.5	1004009-025A	4/2/2010	2.5	--	--	--	--	--	--
	0.5-1.0	1004009-026A	4/2/2010	3.3	--	--	--	--	--	--
M-12	0-0.5	1004010-001A	4/2/2010	7.7	--	--	--	--	--	--
	0.5-1.0	1004010-002A	4/2/2010	7.7	--	--	--	--	--	--
M-12-d	0-0.5	1004010-003A	4/2/2010	7.2	--	--	--	--	--	--
	0.5-1.0	1004010-004A	4/2/2010	8.6	--	--	--	--	--	--
M-13	0-0.5	1004010-005A	4/2/2010	22	--	--	--	--	--	--
	0.5-1.0	1004010-006A	4/2/2010	24	--	--	--	--	--	--
M-14	0-0.5	1004010-007A	4/2/2010	7.1	--	--	--	--	--	--

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	Lead (Total)	Lead (DI-STLC)	Lead (STLC)	Lead (TCLP)	Chromium (STLC)	Hexavalent Chromium	Nickel (STLC)
		EPA Method		6010B	6010B	6010B	6010B	6010B	7199M	6010B
		Units		mg/Kg	mg/L	mg/L	mg/L	mg/L	mg/Kg	mg/L
		10 X STLC/20 X TCLP Limit[1]		50	--	--	--	--	50	--
		Hazardous Waste Limit[2]		--	--	5.0	5.0	560	--	20
		Reuse Restrictions[3]		1411/3397	0.5/1.5/150	--	--	--	--	--
N-14	0.5-1.0	1004010-008A	4/2/2010	3.2	--	--	--	--	--	--
S-9	0-0.5	1004070-011A	4/15/2010	140	0.16	16	0.66	--	--	--
	0.5-1.0	1004070-012A	4/15/2010	170	2.9	60	3.7	--	--	--
S-10	0-0.5	1004072-009A	4/15/2010	25	--	--	--	--	--	--
	0.5-1.0	1004072-010A	4/15/2010	9.9	--	--	--	--	--	--
S-11	0-0.5	1004072-007A	4/15/2010	27	--	--	--	--	--	--
	0.5-1.0	1004072-008A	4/15/2010	2.7	--	--	--	--	--	--
S-12	0-0.5	1004072-005A	4/15/2010	89	<0.0500	0.93	--	--	--	--
	0.5-1.0	1004072-006A	4/15/2010	21	--	--	--	--	--	--
S-13	0-0.5	1004072-003A	4/15/2010	13	--	--	--	--	--	--
	0.5-1.0	1004072-004A	4/15/2010	65	<0.0500	0.53	--	--	--	--
S-14	0-0.5	1003116-026A	3/19/2010	450	0.15	15	0.12	--	--	--
S-15	0-0.5	1003116-007A	3/19/2010	16	--	--	--	--	--	--
	0.5-1.0	1003116-008A	3/19/2010	14	--	--	--	--	--	--
	1.0-1.5	1003116-009A	3/19/2010	14	--	--	--	--	--	--
	1.5-2.0	1003116-010A	3/19/2010	13	--	--	--	--	--	--
	2.0-3.0	1003116-011A	3/19/2010	15	--	--	--	--	--	--
N-3	0-0.5	1003116-012A	3/19/2010	43	--	--	--	--	--	--
	0.5-1.0	1006116-013A	3/19/2010	48	--	--	--	--	--	--
N-4	0-0.5	1004070-003A	4/15/2010	130	5.2	29	--	--	--	--
	0.5-1.0	1004070-004A	4/15/2010	3	--	--	--	--	--	--
N-5	0-0.5	1003116-014A	3/19/2010	370	<0.0500	18	0.26	--	--	--
	0.5-1.0	1003116-015A	3/19/2010	280	<0.0500	11	0.10	--	<0.015	--
	1.0-1.5	1003116-001A	3/19/2010	65	<0.0500	1.2	--	--	--	--
N-6	0-0.5	1003116-002A	3/19/2010	320	<0.0500	2.9	<0.05	--	--	--
	0.5-1.0	1003116-003A	3/19/2010	120	<0.0500	4.8	--	--	--	--
	1.0-1.5	1003116-004A	3/19/2010	210	<0.0500	10	0.31	--	--	--
	1.5-2.0	1003116-005A	3/19/2010	140	<0.0500	1.3	<0.05	--	--	--
	2.0-3.0	1003116-006A	3/19/2010	12	--	--	--	--	--	--
N-7	0-0.5	1004091-011A	4/19/2010	230	0.76	8.3	0.17	--	--	--
	0.5-1.0	1004091-012A	4/19/2010	59	0.11	4.6	--	--	--	--
	1.0-1.5	1004091-013A	4/19/2010	100	<0.0500	4.2	--	--	--	--
	1.5-2.0	1004091-014A	4/19/2010	81	<0.0500	1.5	--	--	--	--
Construction of new on- and off- ramps for Northbound 101 at SR 116										
N-8	0-0.5	1003111-001A	3/18/2010	77	<0.0500	3.6	--	--	--	--
	0.5-1.0	1003111-002A	3/18/2010	110	<0.0500	6.1	--	--	--	--
N-9	0-0.5	1003111-003A	3/18/2010	17	--	--	--	--	--	--
	0.5-1.0	1003111-004A	3/18/2010	10	--	--	--	--	--	--
N-10	0-0.5	1003111-005A	3/18/2010	40	--	--	--	--	--	--
	0.5-1.0	1003111-006A	3/18/2010	32	--	--	--	--	--	--
N-11	0-0.5	1003111-012A	3/18/2010	80	<0.0500	3.1	--	--	--	--
	0.5-1.0	1003111-013A	3/18/2010	56	<0.0500	1.3	--	--	--	--
N-12	0-0.5	1004070-005A	4/15/2010	230	<0.0500	9.0	<0.05	--	--	--
	0.5-1.0	1004070-006A	4/15/2010	130	<0.0500	2.1	<0.05	--	--	--
	1.0-1.5	1004070-007A	4/15/2010	10	--	--	--	--	--	--
	1.5-2.0	1004070-008A	4/15/2010	1.8	--	--	--	--	--	--
	2.0-3.0	1004070-009A	4/15/2010	3.4	--	--	--	--	--	--

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	Lead (Total)	Lead (DI-STLC)	Lead (STLC)	Lead (TCLP)	Chromium (STLC)	Hexavalent Chromium	Nickel (STLC)
		EPA Method		6010B	6010B	6010B	6010B	6010B	7199M	6010B
		Units		mg/Kg	mg/L	mg/L	mg/L	mg/L	mg/Kg	mg/L
		10 X STLC/20 X TCLP Limit[1]		50	--	--	--	--	50	--
		Hazardous Waste Limit[2]		--	--	5.0	5.0	560	--	20
		Reuse Restrictions[3]		1411/3397	0.5/1.5/150	--	--	--	--	--
N-13	0-0.5	1003111-014A	3/18/2010	90	<0.0500	3.5	--	--	--	--
	0.5-1.0	1003111-015A	3/18/2010	46	--	--	--	--	--	--
	1.0-1.5	1003111-016A	3/18/2010	11	--	--	--	--	--	--
	1.5-2.0	1003111-017A	3/18/2010	5.8	--	--	--	--	--	--
	2.0-3.0	1003111-018A	3/18/2010	6.2	--	--	--	--	--	--
N-13-d	0-0.5	1003111-007A	3/18/2010	99	<0.0500	3.7	--	--	--	--
	0.5-1.0	1003111-008A	3/18/2010	44	--	--	--	--	--	--
	1.0-1.5	1003111-009A	3/18/2010	8.5	--	--	--	--	--	--
	1.5-2.0	1003111-010A	3/18/2010	10	--	--	--	--	--	--
	2.0-3.0	1003111-011A	3/18/2010	17	--	--	--	--	--	--
N-14	0-0.5	1004070-010A	4/15/2010	19	--	--	--	--	--	--
	0.5-1.0	1004072-011A	4/15/2010	140	0.12	15	0.14	--	--	--
	1.0-1.5	1004072-012A	4/15/2010	8.3	--	--	--	--	--	--
	1.5-2.0	1004072-013A	4/15/2010	7	--	--	--	--	--	--
	2.0-3.0	1004072-014A	4/15/2010	5.7	--	--	--	0.14	<0.015	--
Mainline 101 Construction North										
M-18	0-0.5	1004011-001A	4/2/2010	590	1.1	24	0.13	--	--	--
	0.5-1.0	1004011-002A	4/2/2010	34	--	--	--	--	--	--
	1.0-1.5	1004011-003A	4/2/2010	58	<0.0500	<0.0500	--	--	--	--
	1.5-2.0	1004011-004A	4/2/2010	5.3	--	--	--	--	--	--
	2.0-3.0	1004011-005A	4/2/2010	1.5	--	--	--	--	--	--
M-19	0-0.5	1004011-006A	4/2/2010	1.1	--	--	--	--	--	--
	0.5-1.0	1004011-007A	4/2/2010	35	--	--	--	0.26	<0.015	2.7
	1.0-1.5	1004011-008A	4/2/2010	55	<0.0500	0.20	--	--	--	5.9
	1.5-2.0	1004011-009A	4/2/2010	19	--	--	--	--	--	--
	2.0-3.0	1004011-010A	4/2/2010	3	--	--	--	--	--	--
M-19-d	0-0.5	1004011-011A	4/2/2010	14	--	--	--	--	--	--
	0.5-1.0	1004011-012A	4/2/2010	38	--	--	--	0.23	<0.015	2.7
	1.0-1.5	100411-013A	4/2/2010	36	--	--	--	--	--	--
	1.5-2.0	1004011-014A	4/2/2010	30	--	--	--	--	--	--
	2.0-3.0	1004011-015A	4/2/2010	5.4	--	--	--	--	--	--
M-20	0-0.5	1004011-016A	4/2/2010	7.5	--	--	--	--	--	--
	0.5-1.0	1004011-017A	4/2/2010	11	--	--	--	--	--	--
	1.0-1.5	1004011-018A	4/2/2010	30	--	--	--	--	--	--
	1.5-2.0	1004011-019A	4/2/2010	15	--	--	--	--	--	--
	2.0-3.0	1004011-020A	4/2/2010	2	--	--	--	--	--	--
M-21	0-0.5	1004011-021A	4/2/2010	18	--	--	--	--	--	--
	0.5-1.0	1004011-022A	4/2/2010	12	--	--	--	--	--	--
	1.0-1.5	1004011-023A	4/2/2010	490	6.2	21	<0.05	--	--	--
	1.5-2.0	1004011-024A	4/2/2010	8.4	--	--	--	--	--	--
	2.0-3.0	1004011-025A	4/2/2010	2.1	--	--	--	--	--	--
M-22	0-0.5	1004011-026A	4/2/2010	11	--	--	--	--	--	--
	0.5-1.0	1004011-027A	4/2/2010	8.3	--	--	--	--	--	--
	1.0-1.5	1004011-028A	4/2/2010	17	--	--	--	--	--	--
	1.5-2.0	1004011-029A	4/2/2010	110	1.4	6.6	--	--	--	--
	2.0-3.0	1004011-030A	4/2/2010	9	--	--	--	--	--	--
S-16	0-0.5	1003116-029A	3/19/2010	74	0.13	3.6	--	--	--	--
	0.5-1.0	1003116-030A	3/19/2010	23	--	--	--	--	--	--
	1.0-1.5	1003116-031A	3/19/2010	11	--	--	--	--	--	--
	1.5-2.0	1003116-032A	3/19/2010	14	--	--	--	--	--	--
	2.0-3.0	1003116-033A	3/19/2010	6.1	--	--	--	--	--	--

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	Lead (Total)	Lead (DI-STLC)	Lead (STLC)	Lead (TCLP)	Chromium (STLC)	Hexavalent Chromium	Nickel (STLC)
		EPA Method		6010B	6010B	6010B	6010B	6010B	7199M	6010B
		Units		mg/Kg	mg/L	mg/L	mg/L	mg/L	mg/Kg	mg/L
		10 X STLC/20 X TCLP Limit[1]		50	--	--	--	--	50	--
		Hazardous Waste Limit[2]		--	--	5.0	5.0	560	--	20
		Reuse Restrictions[3]		1411/3397	0.5/1.5/150	--	--	--	--	--
N-15	0-0.5	1004067-003A	4/15/2010	18	--	--	--	--	--	--
	0.5-1.0	1004067-004A	4/15/2010	920	<0.0500	39	4.9	--	--	--
	1.0-1.5	1004067-005A	4/15/2010	39	--	--	--	--	--	--
	1.5-2.0	1004067-006A	4/15/2010	5.4	--	--	--	--	--	--
	2.0-3.0	1004067-007A	4/15/2010	6.3	--	--	--	--	--	--
N-16	0-0.5	1004067-009A	4/15/2010	31	--	--	--	--	--	--
	0.5-1.0	1004067-010A	4/15/2010	310	<0.0500	4.7	<0.05	--	--	--
	1.0-1.5	1004067-011A	4/15/2010	2.3	--	--	--	--	--	--
	1.5-2.0	1004067-012A	4/15/2010	7.3	--	--	--	--	--	--
	2.0-3.0	1004067-013A	4/15/2010	7	--	--	--	--	--	--
N-17	0-0.5	1004072-015A	4/15/2010	31	--	--	--	--	--	--
	0.5-1.0	1004072-016A	4/15/2010	49	--	--	--	--	--	--
	1.0-1.5	1004072-017A	4/15/2010	1000	<0.0500	10	0.44	--	--	--
	1.5-2.0	1004072-018A	4/15/2010	5.3	--	--	--	--	--	--
	2.0-3.0	1004072-019A	4/15/2010	7.7	--	--	--	--	--	--
	3.0-6.0	1004072-020A	4/15/2010	--	--	--	--	--	--	--
	6.0-9.0	1004072-001A	4/15/2010	--	--	--	--	--	--	--
	9.0-12.0	1004072-002A	4/15/2010	--	--	--	--	--	--	--
Bridge Replacement										
M-6	0-0.5	1004009-017A	4/2/2010	2	--	--	--	--	--	--
	0.5-1.0	1004009-018A	4/2/2010	2.1	--	--	--	--	--	--
	1.0-1.5	1004009-019A	4/2/2010	4.3	--	--	--	--	--	--
	1.5-2.0	1004009-020A	4/2/2010	1	--	--	--	--	--	--
	2.0-3.0	1004009-021A	4/2/2010	20	--	--	--	--	--	--
	3.0-4.5	1004009-024A	4/2/2010	--	--	--	--	--	--	--
	3.0-6.0	1004009-022A	4/2/2010	--	--	--	--	--	--	--
	6.0-8.0	1004009-023A	4/2/2010	--	--	--	--	--	--	--
M-10	0-0.5	1004091-006A	4/19/2010	21	--	--	--	--	--	--
	0.5-1.0	1004091-007A	4/19/2010	17	--	--	--	--	--	--
	1.0-1.5	1004091-008A	4/19/2010	28	--	--	--	--	--	--
	1.5-2.0	1004091-009A	4/19/2010	25	--	--	--	--	--	--
	2.0-3.0	1004091-010A	4/19/2010	8.4	--	--	--	--	--	--
M-16	0-0.5	1004070-015A	4/15/2010	18	--	--	--	--	--	--
	0.5-1.0	1004070-016A	4/15/2010	61	<0.0500	1.5	--	--	<15	--
	1.0-1.5	1004070-017A	4/15/2010	93	<0.0500	1.8	--	--	--	--
	1.5-2.0	1004070-018A	4/15/2010	25	--	--	--	--	--	--
	2.0-3.0	1004070-019A	4/15/2010	180	<0.0500	1.9	<0.05	--	--	--
	3.0-6.0	1004070-020A	4/15/2010	--	--	--	--	--	--	--
M-17	0-0.5	1004010-009A	4/2/2010	5.3	--	--	--	--	--	--
	0.5-1.0	1004010-010A	4/2/2010	6.8	--	--	--	--	--	--

Notes:

1: Samples with total metal concentrations exceeding these limits were tested using DI-STLC and STLC, and TCLP, methods based on potentia reuse or hazardous waste considerations.

2: Samples exceeding these concentrations would exceed California (STLC) or Federal (TCLP) Hazardous Waste Criteria

3: Samples exceeding these concentrations would fall into one of several reuse restrictions described in the Caltrans DTSC Variance V09HQSCD006

EPA = US Environmental Protection Agency
mg/Kg = milligrams per kilogram
mg/L = milligrams per liter
DI-STLC = De-Ionized Soluble Threshold Limits Concentrations
STLC = Soluble Threshold Limits Concentrations
TCLP = Toxicity Characteristic Leaching Procedure
NE = Not Established
ND = No Detection. See analytical report for reporting limits.
-- = sample not analyzed for specified analyte
The symbol "<" (less than) indicates that the analyte was not detected at a concentration above the laboratory detection limit specified.

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	TPH-g	TPH-d	TPH-mo	pH	Aroclor 1260	Other PCBs	Gamma Chlordane	Other Pesticides	MTBE/BTEX	5 Gas Oxygenates	VOCs	Asbestos
		EPA Method		8260B	8015B	8015B	9045C	8082	8082	8081A	8081A	8260B	8260B	8260B	PLM
		Units		ug/Kg	mg/Kg	mg/Kg	S.U.	mg/Kg	mg/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	Presence/ Absence
		ESLs		4200	4200	12000	NE	NE	varies	NE	varies	varies	varies	varies	NE
Petaluma Boulevard South Interchange															
S-1	0-0.5	1004091-001A	4/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004091-002A	4/19/2010	<17	<0.759	<1.65	5.91	--	--	--	--	ND	ND	ND	--
	1.0-1.5	1004091-003A	4/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004091-004A	4/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004091-005A	4/19/2010	<17	<0.759	<1.65	--	--	--	--	--	ND	--	--	--
S-2	0-0.5	1003116-016A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-017A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
S-3	0-0.5	1003116-018A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-019A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
S-4	0-0.5	1003116-020A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-021A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
S-5	0-0.5	1003111-019A	3/18/2010	--	--	--	6.63	--	--	--	--	--	--	--	ND
	0.5-1.0	1003111-020A	3/18/2010	--	--	--	--	--	--	--	--	--	--	--	--
S-5-d	0-0.5	1003111-021A	3/18/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003111-022A	3/18/2010	--	--	--	--	--	--	--	--	--	--	--	--
S-6	0-0.5	1003116-022A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-023A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
S-7	0-0.5	1003116-024A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-025A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
S-8	0-0.5	1004070-013A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004070-014A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
N-1	0-0.5	1003116-027A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-028A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
N-2	0-0.5	1004070-001A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004070-002A	4/15/2010	--	--	--	8.56	--	--	--	--	--	--	--	--
Mainline 101 Construction South															
M-1	0-0.5	1004009-001A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-002A	4/2/2010	--	--	--	7.25	--	--	--	--	--	--	--	--
M-1-d	0-0.5	1004009-003A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-004A	4/2/2010	--	--	--	7.57	--	--	--	--	--	--	--	--
M-2	0-0.5	1004009-005A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-006A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
M-3	0-0.5	1004009-007A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-008A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
M-4	0-0.5	1004009-009A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-010A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
M-5	0-0.5	1004009-011A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-012A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	TPH-g	TPH-d	TPH-mo	pH	Aroclor 1260	Other PCBs	Gamma Chlordane	Other Pesticides	MTBE/BTEX	5 Gas Oxygenates	VOCs	Asbestos
		EPA Method		8260B	8015B	8015B	9045C	8082	8082	8081A	8081A	8260B	8260B	8260B	PLM
		Units		ug/Kg	mg/Kg	mg/Kg	S.U.	mg/Kg	mg/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	Presence/ Absence
		ESLs		4200	4200	12000	NE	NE	varies	NE	varies	varies	varies	varies	NE
M-7	0-0.5	1004009-013A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-014A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
M-8	0-0.5	1004009-015A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-016A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
M-9	0-0.5	1004009-025A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-026A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
M-12	0-0.5	1004010-001A	4/2/2010	--	--	--	--	ND	ND	ND	ND	--	--	--	--
	0.5-1.0	1004010-002A	4/2/2010	<17	<0.759	<1.65	--	--	--	--	--	ND	ND	--	--
M-12-d	0-0.5	1004010-003A	4/2/2010	--	--	--	--	ND	ND	ND	ND	--	--	--	--
	0.5-1.0	1004010-004A	4/2/2010	<17	<0.759	78	--	--	--	--	--	ND	ND	--	--
M-13	0-0.5	1004010-005A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004010-006A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
M-14	0-0.5	1004010-007A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004010-008A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
S-9	0-0.5	1004070-011A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004070-012A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
S-10	0-0.5	1004072-009A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004072-010A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
S-11	0-0.5	1004072-007A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004072-008A	4/15/2010	--	--	--	8.81	--	--	--	--	--	--	--	--
S-12	0-0.5	1004072-005A	4/15/2010	<17	<15.2	1300	--	--	--	--	--	ND	ND	--	--
	0.5-1.0	1004072-006A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
S-13	0-0.5	1004072-003A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004072-004A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
S-14	0-0.5	1003116-026A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	REFUSED													
S-15	0-0.5	1003116-007A	3/19/2010	--	--	--	8.16	--	--	--	--	--	--	--	ND
	0.5-1.0	1003116-008A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1003116-009A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1003116-010A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1003116-011A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
N-3	0-0.5	1003116-012A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1006116-013A	3/19/2010	--	--	--	7.68	--	--	--	--	--	--	--	ND
N-4	0-0.5	1004070-003A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004070-004A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
N-5	0-0.5	1003116-014A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-015A	3/19/2010	--	--	--	7.19	--	--	--	--	--	--	--	ND
	1.0-1.5	1003116-001A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	TPH-g	TPH-d	TPH-mo	pH	Aroclor 1260	Other PCBs	Gamma Chlordane	Other Pesticides	MTBE/BTEX	5 Gas Oxygenates	VOCs	Asbestos
		EPA Method		8260B	8015B	8015B	9045C	8082	8082	8081A	8081A	8260B	8260B	8260B	PLM
		Units		ug/Kg	mg/Kg	mg/Kg	S.U.	mg/Kg	mg/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	Presence/ Absence
		ESLs		4200	4200	12000	NE	NE	varies	NE	varies	varies	varies	varies	NE
N-6	0-0.5	1003116-002A	3/19/2010	--	--	--	--	0.86	ND	17	ND	--	--	--	--
	0.5-1.0	1003116-003A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1003116-004A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1003116-005A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1003116-006A	3/19/2010	--	--	--	7.75	--	--	--	--	--	--	--	ND
N-7	0-0.5	1004091-011A	4/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004091-012A	4/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004091-013A	4/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004091-014A	4/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
Construction of new on- and off- ramps for Northbound 101 at SR 116															
N-8	0-0.5	1003111-001A	3/18/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003111-002A	3/18/2010	--	--	--	--	--	--	--	--	--	--	--	--
N-9	0-0.5	1003111-003A	3/18/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003111-004A	3/18/2010	--	--	--	--	--	--	--	--	--	--	--	--
N-10	0-0.5	1003111-005A	3/18/2010	--	--	--	7.06	--	--	--	--	--	--	--	ND
	0.5-1.0	1003111-006A	3/18/2010	--	--	--	7.25	--	--	--	--	--	--	--	ND
N-11	0-0.5	1003111-012A	3/18/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003111-013A	3/18/2010	--	--	--	--	--	--	--	--	--	--	--	--
N-12	0-0.5	1004070-005A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004070-006A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004070-007A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004070-008A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004070-009A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
N-13	0-0.5	1003111-014A	3/18/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003111-015A	3/18/2010	--	--	--	7.18	--	--	--	--	--	--	--	ND
	1.0-1.5	1003111-016A	3/18/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1003111-017A	3/18/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1003111-018A	3/18/2010	--	--	--	--	--	--	--	--	--	--	--	--
N-13-d	0-0.5	1003111-007A	3/18/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003111-008A	3/18/2010	--	--	--	7.10	--	--	--	--	--	--	--	ND
	1.0-1.5	1003111-009A	3/18/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1003111-010A	3/18/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1003111-011A	3/18/2010	--	--	--	--	--	--	--	--	--	--	--	--
N-14	0-0.5	1004070-010A	4/15/2010	--	--	--	--	ND	ND	ND	ND	--	--	--	--
	0.5-1.0	1004072-011A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004072-012A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004072-013A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004072-014A	4/15/2010	--	--	--	8.24	--	--	--	--	--	--	--	--

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	TPH-g	TPH-d	TPH-mo	pH	Aroclor 1260	Other PCBs	Gamma Chlordane	Other Pesticides	MTBE/BTEX	5 Gas Oxygenates	VOCs	Asbestos
		EPA Method		8260B	8015B	8015B	9045C	8082	8082	8081A	8081A	8260B	8260B	8260B	PLM
		Units		ug/Kg	mg/Kg	mg/Kg	S.U.	mg/Kg	mg/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	Presence/ Absence
		ESLs		4200	4200	12000	NE	NE	varies	NE	varies	varies	varies	varies	NE
Mainline 101 Construction North															
M-18	0-0.5	1004011-001A	4/2/2010	--	--	--	--	ND	ND	ND	ND	--	--	--	--
	0.5-1.0	1004011-002A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004011-003A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004011-004A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004011-005A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
M-19	0-0.5	1004011-006A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004011-007A	4/2/2010	--	--	--	8.07	--	--	--	--	--	--	--	--
	1.0-1.5	1004011-008A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004011-009A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004011-010A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
M-19-d	0-0.5	1004011-011A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004011-012A	4/2/2010	--	--	--	7.84	--	--	--	--	--	--	--	--
	1.0-1.5	100411-013A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004011-014A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004011-015A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
M-20	0-0.5	1004011-016A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004011-017A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004011-018A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004011-019A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004011-020A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
M-21	0-0.5	1004011-021A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004011-022A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004011-023A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004011-024A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004011-025A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
M-22	0-0.5	1004011-026A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004011-027A	4/2/2010	--	--	--	--	ND	ND	ND	ND	--	--	--	--
	1.0-1.5	1004011-028A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004011-029A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004011-030A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
S-16	0-0.5	1003116-029A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1003116-030A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1003116-031A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1003116-032A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1003116-033A	3/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
N-15	0-0.5	1004067-003A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004067-004A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004067-005A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004067-006A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004067-007A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	TPH-g	TPH-d	TPH-mo	pH	Aroclor 1260	Other PCBs	Gamma Chlordane	Other Pesticides	MTBE/BTEX	5 Gas Oxygenates	VOCs	Asbestos
		EPA Method		8260B	8015B	8015B	9045C	8082	8082	8081A	8081A	8260B	8260B	8260B	PLM
		Units		ug/Kg	mg/Kg	mg/Kg	S.U.	mg/Kg	mg/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	Presence/ Absence
		ESLs		4200	4200	12000	NE	NE	varies	NE	varies	varies	varies	varies	NE
N-16	0-0.5	1004067-009A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004067-010A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004067-011A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004067-012A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004067-013A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
N-17	0-0.5	1004072-015A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004072-016A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004072-017A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004072-018A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004072-019A	4/15/2010	--	--	--	7.41	--	--	--	--	--	--	--	--
	3.0-6.0	1004072-020A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	6.0-9.0	1004072-001A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	9.0-12.0	1004072-002A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
Bridge Replacement															
M-6	0-0.5	1004009-017A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004009-018A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.0-1.5	1004009-019A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004009-020A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004009-021A	4/2/2010	--	--	--	8.30	--	--	--	--	--	--	--	--
	3.0-4.5	1004009-024A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	3.0-6.0	1004009-022A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	6.0-8.0	1004009-023A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
M-10	0-0.5	1004091-006A	4/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004091-007A	4/19/2010	<17	<0.759	11	7.43	--	--	--	--	ND	ND	ND	--
	1.0-1.5	1004091-008A	4/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004091-009A	4/19/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004091-010A	4/19/2010	<17	<0.759	6.7	--	--	--	--	--	ND	--	--	--
M-16	0-0.5	1004070-015A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004070-016A	4/15/2010	<17	<3.04	100	8.27	--	--	--	--	ND	ND	ND	--
	1.0-1.5	1004070-017A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	1.5-2.0	1004070-018A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
	2.0-3.0	1004070-019A	4/15/2010	<17	<3.04	180	--	--	--	--	--	ND	--	--	--
	3.0-6.0	1004070-020A	4/15/2010	--	--	--	--	--	--	--	--	--	--	--	--
M-17	0-0.5	1004010-009A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--
	0.5-1.0	1004010-010A	4/2/2010	--	--	--	--	--	--	--	--	--	--	--	--

Boring Sample Location ID	Sample Depth (feet)	Lab Sample ID	Sample Date	TPH-g	TPH-d	TPH-mo	pH	Aroclor 1260	Other PCBs	Gamma Chlordane	Other Pesticides	MTBE/BTEX	5 Gas Oxygenates	VOCs	Asbestos
		EPA Method		8260B	8015B	8015B	9045C	8082	8082	8081A	8081A	8260B	8260B	8260B	PLM
		Units		ug/Kg	mg/Kg	mg/Kg	S.U.	mg/Kg	mg/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	Presence/ Absence
		ESLs		4200	4200	12000	NE	NE	varies	NE	varies	varies	varies	varies	NE
US 101/Hwy 116 Overcrossing Pothole Sampling															
PH-1	--	1010193-001	10/15/2010	<17	<3.0	99	--	--	--	--	--	--	--	--	--
PH-2	--	1010193-002	10/15/2010	<17	<3.0	280	--	--	--	--	--	--	--	--	--
PH-3	--	1010193-003	10/15/2010	<17	<3.0	300	--	--	--	--	--	--	--	--	--

Notes:
EPA = US Environmental Protection Agency
mg/Kg = milligrams per kilogram
ug/Kg = micrograms per kilogram
NE = Not Established
ND = No Detection. See analytical report for reporting limits.
-- = sample not analyzed for specified analyte
The symbol "<" (less than) indicates that the analyte was not detected at a concentration above the laboratory detection limit specified.
PLM: Polarized Light Microscopy

Boring Sample Location ID	Lab Sample ID	Sample Date	TPH-g	TPH-d	TPH-mo	BTEX/MTBE	5 Gas Oxygenates	Other VOCs
	EPA Method		8260B (TPH	8015B	8015B	8260B	8260B	8260B
	Units		ug/L	mg/L	mg/L	ug/L	ug/L	ug/L
	STLC		NE	NE	NE	500	NE	NE
	TCLP		NE	NE	NE	varies	varies	NE
N-17-GW	1004067-015A	4/15/2010	--	<0.0400	<0.0900	--	--	--
M-16-GW	1004067-017A	4/15/2010	<22	<0.0400	<0.0900	ND	ND	ND

Notes:
EPA = US Environmental Protection Agency
mg/L = milligrams per liter
ug/L = micrograms per liter
STLC = Soluble Threshold Limits Concentrations
TCLP = Toxicity Characteristic Leaching Procedure
NE = Not Established
ND = No Detection. See analytical report for reporting limits.
-- = sample not analyzed for specified analyte
The symbol "<" (less than) indicates that the analyte was not detected at a concentration above the laboratory detection limit specified.

			Summary Statistics - Raw Data				Detected and Nondetect Values			Summary Statistics - Data Included Predicted Values from Regression			Goodness-of-Fit Test	Upper Confidence Limit (UCL)		
Parameter	Unit	Group	No. of Samples	Detection Rate	Mean	Std Dev	Min Detected	Max Detected	Reporting Limit of NDs	No. of Samples	Mean	Std Dev	Distribution	Method of UCL Calculation	Assessed 95% UCL	Notes
Lead (DI-STLC)	mg/L	All	39	28%	0.493	1.249	0.11	6.2	0.05	147	0.212	0.665	Gamma	95% KM (t) UCL	**0.307**	
Lead (STLC)	mg/L	All	39	97%	6.85	7.00	0.2	29	0.05	147	2.02	4.63	Non-parametric	97.5% KM (Chebyshev) UCL	**4.41**	
Lead (Total)	mg/kg	All	147	100%	64.1	138.2	1	1000	-	147	64.1	138.2	Non-parametric	97.5% Chebyshev (Mean, Sd) UCL	**135**	

Notes:

(1) If duplicates exist, the average of the duplicate results is used as a single data point.

(2) All samples collected at various depths at the same location are considered independent data points.

(3) If the dataset contains nondetects, summary statistics and UCLs are estimated by the Kaplan-Meier (KM) method when possible.

(4) Goodness-of-Fit Test at 5% significance level is used to test for distributional assumption.

(5) The distributional assumption from (4) is used to select the appropriate UCL calculation method. For normal distribution, the UCL is based on the t-statistics. For lognormal distribution, gamma distribution, and non-parametric assumption, the UCL is based on the recommendations from USEPA (2002) and Singh (2009).

(6) References:

USEPA. 2002. *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites.* Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Report No. OSWER 9285.6-10.
Singh, A., R. Maichle, A.K. Singh, S.E. Lee, and N. Armbya. 2009a. *ProUCL Version 4.00.04 User Guide.* Office of Research and Development, U.S. Environmental Protection Agency, Report No. EPA/600/R-07/038.
Singh, A., and A.K. Singh. 2009b. *ProUCL Version 4.00.04 Technical Guide.* Office of Research and Development, U.S. Environmental Protection Agency, Report No. EPA/600/R-07/041.

(7) The following locations are excluded:

S-1 thru S-4 (all depths), S-9 (0-0.5 & 0.5-1.0), N-15 (0-0.5 & 0.5-1.0)

Table 7
Summary of Materials with Detected Asbestos
Highway 101 MSN B4 Project

Petaluma Blvd. South Southbound Bridge

LAB LOGIN #	FIELD SAMPLE #	LOCATION	MATERIAL	COLOR	Asbestos Detected
LD203229-1	URS-S-20	South 101, S. End	Soil/Rock (Bedrock)	Gray	1.90% Chrysotile

Table 8
Summary of Materials without Detected Asbestos
Highway 101 MSN B4 Project

LAB LOGIN #	FIELD SAMPLE #	LOCATION	MATERIAL	COLOR
Southbound 101 Bridge at Petaluma Blvd. South				
L203179-1	URS-B-01	South 101, SE Base	Compact Board	Brown
L203179-2	URS-B-02	South 101, SE Base	Concrete	Grey
L203179-3	URS-C-03	South 101, SE Column	Concrete	Grey
L203179-4	URS-B-04	South 101, SW Base	Concrete	Grey
L203179-5	URS-R-05	South 101, SW Rail	Concrete	Grey
L203179-6	URS-B-06	South 101, SW Base	Concrete	Grey
L203179-15	URS-B-15	South 101, NE Base	Compact Board	Brown
L203179-7	URS-W-07	South 101, SW Wall	Paint	Grey
L203179-16	URS-B-16	South 101, NE Base	Concrete Patch	Grey
L203179-17	URS-C-17	South 101, N End	Concrete	Grey
L203179-18	URS-C-18	South 101, NE Bridges	Concrete	Grey
L203179-19	URS-C-19	South 101, NE Column	Concrete	Grey
Northbound 101 Bridge at Petaluma Blvd.				
L203179-8	URS-W-08	North 101, SW Wall	Concrete Patch	Grey
L203179-9	URS-B-09	North 101, SE Base	Compact Board	Brown
L203179-10	URS-C-10	North 101, SE Column	Concrete	Grey
L203179-11	URS-B-11	North 101, N Base	Concrete	Grey
L203179-12	URS-B-12	North 101, NW Base	Concrete	Grey
L203179-13	URS-R-13	North 101, NW Rail	Concrete	Grey
L203179-14	URS-S-14	North 101, NW Reflex Sign	Sealant	Grey

LAB LOGIN #	FIELD SAMPLE #	LOCATION	MATERIAL	COLOR
Southbound 101 Bridge at Hwy 116.				
L203237-6	URS-B-06	101 South, barrier wall décor, NE	Concrete	Grey
L203237-7	URS-B-07	101 South, barrier wall, NE	Concrete	Grey
L203237-8	URS-B-08	101 South, base at NE	Concrete	Grey
L203237-9	URS-A-09	101 South, asphalt at NE	Asphalt	Black
L203237-10	URS-S-10	101 South, reflexer, debris	Sealant (mastic)	Grey
L203237-16	URS-A-16	101 South, asphalt southwest	Asphalt	Black
L203237-17	URS-R-17	101 South rail/barrier décor, SW	Concrete	Grey
L203237-18	URS-M-18	101 South, board, SW	Compact Board	Brown
L203237-19	URS-B-19	101 South, bridge, SW	Concrete	Grey
L203237-20	URS-C-20	101 South, 2nd column, SW	Cork	Brown
L203237-21	URS-B-21	101 South, column base adjacent to railroad	Concrete	Grey
Northbound 101 Bridge at Hwy 116				
L203237-1	URS-R-01	101 North, rail NE	Concrete	Grey
L203237-2	URS-B-02	101 North, barrier wall at NE	Concrete	Grey
L203237-3	URS-B-03	101 North, board at NE	Compact Board	Brown
L203237-4	URS-B-04	10 North, base at NE	Concrete	Grey
L203237-5	URS-C-05	101 North, column, North	Concrete	Grey
L203237-11	URS-R-11	101 North, rail at SW	Concrete	Grey
L203237-12	URS-B-12	101 North, board at SW	Compact Board	Brown
L203237-13	URS-B-13	101 North, bridge at SW	Concrete	Grey
L203237-14	URS-C-14	101 North, 2nd column to south end	Concrete	Grey
L203237-15	URS-M-15	101 North, rock/soil between bridges	Rock/Soil	Purple/Brown

LAB LOGIN #	FIELD SAMPLE #	LOCATION	MATERIAL	COLOR
Petaluma River Bridge				
L205017-1	PRB-B-01	South bound, base, 3rd column	Concrete	Grey
L205017-2	PRB-C-02	South bound, 3rd column	Concrete	Grey
L205017-3	PRB-B-03	South bound, bridge	Concrete	Grey
L205017-4	PRB-C-04	South bound, column base	Concrete	Grey
L205017-5	PRB-B-05	South bound, column base	Concrete	Grey
L205017-6	PRB-B-06	North bound, southwest bridge	Joint Cork	Black
L205017-7	PRB-C-07	North bound, southwest bridge	Concrete	Grey
L205017-8	PRB-D-08	Between north bound and south bound	Concrete	Grey
L205017-9	PRB-B-09	North bound, southeast barrier	Concrete	Grey
L205017-10	PRB-R-10	North bound, southeast rail	Concrete	Grey
L205017-11	PRB-C-11	North bound, 2nd column	Mastic	Black
L205017-12	PRB-C-12	South bound, 2nd column	Mastic	Black
L205017-13	PRB-B-13	North bound, north column	Concrete	Grey
L205017-14	PRB-C-14	North bound, north column	Concrete	Grey
L205017-15	PRB-B-15	North barrier wall, northwest wall	Joint Cork	Black
L205017-16	PRB-M-16	North bound, north base	Asphalt	Black
L205017-17	PRB-M-17-1	South bound, northwest barrier wall	Pipe	Black
L205017-18	RPB-M-17-2	South bound, northwest barrier wall	Concrete	Grey
L205017-19	RPB-B-18	South bound, southwest barrier wall	Concrete	Grey
L205017-20	RPB-R-19	South bound, southwest rail	Concrete	Grey
L205017-21	RPB-B-17-20	North bound, southwest barrier wall	Concrete	Grey

Table 9
Summary of Metals Results in Paint
Highway 101 MSN B4 Project

US 101 at Petaluma Boulevard South Bridges

Lab Sample Number:	**203141-1**	**203141-2**	**203141-3**	**203141-4**
Client Sample Number:	**URS-1**	**URS-2**	**URS-3**	**URS-4**
Matrix:	**BULK**	**BULK**	**BULK**	**BULK**
Extraction Type:	**Acid**	**Acid**	**Acid**	**Acid**
Units:	**mg/kg (PPM)**	**mg/kg (PPM)**	**mg/kg (PPM)**	**mg/kg (PPM)**
Sb Antimony	29.22	17.76	84.79	39.69
As Arsenic	21.17	17.00	13,752.68	13.47
Ba Barium	223.98	183.16	16.13	655.31
Be Beryllium	0.98	0.38	<0.01	0.16
Cd Cadmium	4.73	2.15	4.15	2.65
Cr Chromium (CrVI)	115.27	32.41	24.40	4,055.37 (180)
Co Cobalt	12.23	6.67	2.30	8.48
Cu Copper	68.59	32.28	14,686.26	20.70
Pb Lead	1,511.72	661.60	660.24	17,432.18
Hg Mercury	4.49	5.36	0.11	3.98
Mo Molybdenum	7.42	4.43	10.19	6.02
Ni Nickel	40.00	32.66	2.11	10.20
Se Selenium	1,764.84	1,083.12	533.52	388.19
Ag Silver	1.52	0.68	1.56	1.02
Tl Thallium	25.63	15.11	3.67	15.49
V Vanadium	30.82	26.67	0.37	8.92
Zn Zinc	327.38	153.71	4,346.50	716.02

Table 9, Continued
Summary of Metals Results in Paint
Highway 101 MSN B4 Project

US 101 at Petaluma River Bridges

Lab Sample Number:	205528-1	205528-2	205528-3	205528-4	205528-5	205528-6	205528-7
Client Sample Number:	Pb-1	Pb-2	Pb-3	Pb-4	Pb-5	Pb-6	Pb-7
Matrix:	BULK	BULK	BULK	BULK	BULK	BULK	BULK
Extraction Type:	Acid	Acid	Acid	Acid	Acid	Acid	Acid
Units:	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)
Sb Antimony	15.81	55.00	6.00	3.72	10.85	105.61	85.29
As Arsenic	22.94	14,635.14	7.14	4.47	5.25	20.25	833.06
Ba Barium	81.54	174.41	2,270.00	121.10	3,606.14	33.55	103.69
Be Beryllium	<0.01	0.09	0.09	0.14	0.31	0.31	2.82
Cd Cadmium	0.80	7.39	1.41	0.69	1.44	23.08	27.30
Cr Chromium (CrVI)	<0.01	10.36	15.00	<0.01	293.62	3,129.97 (180)	0.21
Co Cobalt	1.22	7.88	27.68	5.23	5.29	278.87	345.65
Cu Copper	72.15	47,207.21	9.68	8.98	10.61	34.04	811.93
Pb Lead	<0.01	2,350.45	58.45	112.37	1,839.42	202,917.77	17,763.05
Hg Mercury	466.86	183.60	66.68	54.64	44.36	49.87	34.38
Mo Molybdenum	6.88	16.94	3.82	4.47	9.49	35.94	49.42
Ni Nickel	3.02	16.89	17.95	4.97	15.05	9.37	9.78
Se Selenium	434.56	760.36	402.95	244.05	254.32	1,014.59	675.64
Ag Silver	<0.01	4.19	0.27	1.78	0.78	2.87	6.09
Tl Thallium	9.23	7.34	5.55	13.62	5.83	88.68	45.98
V Vanadium	1.80	14.28	9.77	8.06	12.36	7.07	10.44
Zn Zinc	5,654.36	10,184.66	<0.01	24.04	24.04	12727.67	11,719.14

Table 9, Continued
Summary of Metals Results in Paint
Highway 101 MSN B4 Project

US 101 at Hwy 116 Bridges

Lab Sample Number:	**203235-1**	**203235-2**	**203235-3**
Client Sample Number:	**URS-1**	**URS-2**	**URS-3**
Matrix:	**BULK**	**BULK**	**BULK**
Extraction Type:	**Acid**	**Acid**	**Acid**
Units:	**mg/kg (PPM)**	**mg/kg (PPM)**	**mg/kg (PPM)**
Sb Antimony	27.59	9.45	7.22
As Arsenic	7.54	4.97	1.61
Ba Barium	45.62	1,493.00	2,937.92
Be Beryllium	0.25	0.16	1.20
Cd Cadmium	1.47	0.93	2.28
Cr Chromium (CrVI)	13.14	502.97 (33)	17.20
Co Cobalt	2.61	3.02	69.71
Cu Copper	10.28	12.10	210.13
Pb Lead	518.53	2,008.70	127.67
Hg Mercury	6.82	3.00	2.84
Mo Molybdenum	5.31	4.06	5.57
Ni Nickel	6.70	5.37	6.62
Se Selenium	1,597.73	157.68	342.74
Ag Silver	<0.01	0.87	1.80
Tl Thallium	18.28	4.21	6.17
V Vanadium	17.10	6.48	12.57
Zn Zinc	131.59	1,452.67	1,229.62

APPENDICES

APPENDIX A

HAZARDOUS MATERIALS INVESTIGATION WORK PLAN

SONOMA COUNTY TRANSPORTATION AUTHORITY

Project B4 of the Marin Sonoma Narrows Highway 101 High Occupancy Vehicle Widening and Associated Ramps Project-Hwy 101/SR 116 Connection to north of Corona Road Overcrossing

PM 2.2/4.1

Prepared by

URS Corporation

55 S. Market Street, Suite 1500
San Jose, CA 95113
January 20, 2010

BACKGROUND INFORMATION AND PROJECT DESCRIPTION

Project B4 of the Marin Sonoma Narrows (MSN) Highway 101 High Occupancy Vehicle (HOV) Widening Project (the MSN B4 Project) consists of the segment of U. S. 101 from just south of the Petaluma Boulevard South overcrossing to just north of the Caulfield Lane overcrossing (post-miles 2.2 to 4.1) located in the southern portion of Sonoma County, California. The project is within District 4 of the State of California Department of Transportation (Caltrans) and within the Sonoma County Transportation Authority (SCTA) planning area. The project area is referred to herein as "the Site".

This project involves the proposed construction of central HOV lanes as part of the region-wide continuous HOV network. The project will include improvements to outside shoulders, construction of new ramps, bridge widening or replacements, and installation of soundwalls and retaining walls.

Four bridge structures are planned to be widened or demolished:

- South Petaluma Bridge Undercrossing, Petaluma River Bridge, and Route 101N/116 Bridge: - the proposed improvements will include demolishing the existing structures and replacing them with new structures.
- Route 101S/116 Bridge - the proposed improvements will include widening the existing structure.

This Hazardous Materials Investigation Work Plan describes the procedures for completing the hazardous materials soil and groundwater investigations and the Asbestos/Lead Based Paint Investigation included in the MSN B4 Project Scope. The overall purposes of Hazardous Materials Investigation is to evaluate the soil conditions for on-site use or off-site disposal of site soils, assess groundwater for potential contamination prior to potential worker contact or dewatering, assess the bridges and river crossings scheduled for demolition or retrofit for the presence of asbestos or lead-based paint and identify work safety issues for site construction workers.

A site and project specific Health and Safety Plan for personnel completing field activities will be prepared for the hazardous materials and geotechnical investigations during this project.

CONTACT INFORMATION

The following table lists URS' contacts for this task.

Contact	Function	Office Phone
Patrick Walz	URS Hazardous Materials Manager	(408) 297-9585
Joe Morgan	URS Technical Expert/QA-QC	(510) 874-3201
Susie Vedantham	URS Environmental Manager	(408) 297-9585
Ben Razeghi	URS Project Manager	(408) 297-9585
Lisa Griggs	URS Health & Safety Manager	(408) 297-9585
Stephen Huang	URS Geotechnical Task Leader	(408) 297-9585

INITIAL HAZARDOUS MATERIALS INVESTIGATION

URS will conduct a hazardous materials investigation study on the 1.9-mile segment of U. S. 101 from just south of the Petaluma Boulevard South overcrossing to just north of the Caulfield Lane overcrossing (post-miles 2.2 to 4.1) located in the southern portion of Sonoma County, California. The primary focus of the investigation will be Aerial Deposited Lead (ADL) within the top 3 feet soil, historically deposited from leaded gasoline automotive emissions. The investigation will also include testing for other potential contaminants commonly present adjacent to freeways. These constituents include California Assessment Manual (CAM 17) Metals, Total Petroleum Hydrocarbons as Diesel and Motor oil (TPH-d/mo), TPH as Gasoline (TPH-g), Benzene/Toluene/Ethylbenzene/Xylene (BTEX), methyl-tert-butyl-ether (MTBE), Volatile Organic Compounds (VOCs) and 5 Gasoline Oxygenates, Polychlorinated Biphenyl (PCBs) and Organo-chlorine Pesticides (OCPs), pH, and Asbestos. Additionally, groundwater samples will be collected at select locations and analyzed for selected constituents.

Soil sampling will be performed within the median, adjacent to the outside shoulders, at sections of associated ramps, at sections of proposed future ramps, at the South Petaluma Undercrossing, the Petaluma River Bridge, the Route 101S/116 Bridge, and the Route 101N/116 Bridge.

URS understands that the following general project description applies, and is using this description to develop the proposed sampling plan:

(1) Petaluma Blvd. South Interchange: Construction of Southbound off- and on-ramps, and Northbound on-ramps. Construction will be primarily fill, as the existing grade is to be increased in elevation by 1-5 feet.
(2) Mainline 101 Construction south of approximately station 190+00: Construction of central HOV lane and outside shoulder improvements. Construction will be primarily fill as the existing grade is to be raised by up to 25 feet.
(3) Construction of new on- and off-ramps for Northbound 101 at SR 116.
(4) Mainline 101 Construction north of approximately station 190+00: Construction of central HOV lane and outside shoulder improvements. Existing grade will be maintained. Existing pavement sections will be removed and replaced with new concrete. Cut will generally be to approximately 3 feet below ground surface. North of approximately station 205+00, construction will be only in the northbound direction.
(5) Replacement of the South Petaluma Undercrossing, the Petaluma River Bridge, and the Route 101N/116 Bridge, and widening of the Route 101S/116 Bridge.

Significant potential for burial of ADL-impacted materials below pavement material is available within the corridor south of approximately station 190+00. It is anticipated that this will be a fill project, assuming that the existing soils to be excavated can be used on the project. If some existing soils cannot be used due to the presence of contaminants or soil compaction characteristics, those soils will require off-site use or disposal at an

appropriate landfill in compliance with regulatory requirements, and corresponding amounts of additional clean imported soils will be needed.

URS will collect soil samples to evaluate potential soil uses on the project, disposal options off-site, and to evaluate potential construction worker exposure to lead impacted dust or groundwater. The ADL in soil analytical results will be evaluated statistically using Caltrans approved statistical methods. Additionally, URS will collect groundwater samples at selected locations for groundwater quality purposes.

URS reviewed the following documents in developing this Work Plan.

- *Marin-Sonoma Narrows HOV Widening Project Final Environmental Impact Report/Final Environmental Impact Statement*, prepared by Caltrans, July 2009.

REGULATORY ISSUES

Hazardous Waste Regulatory Criteria

The total concentrations of prescribed elements or compounds are regulated as hazardous waste in California if they exceed the Total Threshold Limit Concentration (TTLC) criteria, which can be found in Title 22 of the California Code of Regulations (CCR).

Leachable elements or compounds are also regulated in California based on the Soluble Threshold Leaching Characteristic (STLC) criteria, which can also be found in Title 22 of the CCR. URS will analyze samples for total suspected contaminant concentrations and subsequently evaluate the leachable components for select samples.

The California Waste Extraction Test (WET) is used to evaluate contaminant leachability from soils and other potential wastes for disposal in landfills. The Standard WET uses a citric acid solution as the extracting medium. The De-ionized (DI) WET version uses DI water as the extraction medium and is used to evaluate soil leachability for reuse on-site. Analytical results of the WET extracts will be analyzed and compared to the California STLC criteria for hazardous waste characterization or potential reuse. Analytical results for the DI-WET extracts will be compared to the Maximum Concentration Limits (MCLs) for evaluation of potential impacts to groundwater, if the soils are left in place. The Toxicity Characteristic Leaching Procedure (TCLP) is the Federal Resource Conservation and Recovery Act (RCRA) leaching procedure and is also used to evaluate contaminant leachability for hazardous waste characterization. The TCLP test is not as stringent as the California WET.

These tests will be run iteratively in the following order: WET, DI-WET, and TCLP based on the total metal concentrations in the samples. Samples with total lead concentrations exceeding 50 mg/kg will be extracted with the WET and the DI-WET and analyzed for lead. Samples with lead concentrations exceeding 100 mg/kg will be extracted with the TCLP and analyzed for lead. Evaluation of other contaminants may also require WET and TCLP leachability testing and evaluation if they exceed 10 or 20 times the STLC or TCLP criteria, respectively.

Lead in soil analytical results will be evaluated against the existing DTSC variance (described below), and California and Federal hazardous waste criteria.

Soils that exceed the TTLC and/or the STLC criteria must be managed, transported, and disposed of off-site as a California hazardous waste, if disposed of in California. Alternatively, California hazardous waste can also be disposed of in other states as non-hazardous. Soils that exceed RCRA criteria must be managed, transported, and disposed of off-site as Federal RCRA waste.

Department of Toxic Substances Control (DTSC) Variance for Aerially Deposited Lead (ADL) in Soil on Caltrans Right of Way

The following paragraphs outline the soil handling requirements in the statewide lead-impacted soil handling variance by DTSC. If the soil contaminants exceed the prescribed criteria, the soil must be handled as a hazardous waste.

The following bullet points describe potential lead in soil concentrations and the corresponding regulatory restrictions that apply.

- Soil with total lead <50 mg/kg, are not subject to the reuse restrictions of the Caltrans ADL variance.
- Soil with total lead > 50 mg/kg and < 1,000 mg/k, but <0.5 mg/L extractable lead with the standard waste extraction test, is not a hazardous waste and is therefore not subject to the reuse restrictions of the Caltrans ADL variance.
- Soil with total lead >50 mg/kg and <1411 mg/kg, with <1.5 mg/L extractable lead with the deionized waste extraction test (DI-WET) can be used for fill on-Site as long as it is more than five feet above the water table and must be covered with at least 1.0 foot of non-hazardous cover.
- Soil with >50 mg/kg and <3397 mg/kg total lead and between 1.5 mg/L and 150 mg/L of extractable lead with the DI WET can be used on the Right of Way (ROW) on-Site as long as it is more than five feet above the water table and must be covered with a pavement structure which will be maintained by Caltrans.
- Soil with >3397 mg/kg total lead must be disposed off-Site if removed from the Caltrans ROW.
- Soil with >5 mg/L extractable lead with TCLP cannot be reused and must be disposed off-Site as a Federal RCRA hazardous waste.
- For soil that must be disposed off-Site if removed from the Caltrans ROW:

– Soil with <5.0 mg/L extractable lead with the standard waste extraction test (WET) is a non-hazardous waste and can be disposed in a non-hazardous waste landfill if removed from the Caltrans ROW.

– Soil with >5.0 mg/L extractable lead with the standard WET and <5.0 mg/L extractable lead with the TCLP test is a California hazardous waste and must be disposed off-Site in a hazardous waste landfill if removed from the Caltrans ROW, or alternatively can be disposed of out of state, as non-hazardous soil.

– Soil with >5.0 mg/L extractable lead with the TCLP test is a Federal RCRA waste and must be disposed off-Site in a hazardous waste landfill.

- Soil with pH between 5.0 and 5.5 may be reused only below a paved structure, and soil with a pH <5.0 must be managed as a hazardous waste.
- Soil may not be reused on the Caltrans ROW if it is considered hazardous due to the presence of any material other than lead.

PROPOSED INVESTIGATION

The purpose of the screening level investigation is to conduct sampling, chemical analysis, and evaluation of the chemical characteristics of soil to be excavated from the site and groundwater at select locations at the Site.

The evaluation results for soil will be used for the following identification purposes:

- Soil that is not subject to reuse restrictions to be used on-site or off-site for fill.
- Restricted soil to be used on-site for fill under the Caltrans ADL impacted soil variance, from the DTSC, in force during the construction period.
- Hazardous waste that must be removed from the site for off-site disposal at a hazardous waste landfill.
- Non-hazardous soils to be taken off-site for disposal due to excess soils generated by the project or because the geotechnical report indicates that the soils cannot be used for fill due to their poor compaction characteristics.
- Notification and potential required training of on-site workers, if potential contaminant levels warrant it.
- Guidance for development of follow-up soil investigations, if needed.

Based on the above factors, URS proposes to conduct a soil investigation at the Site. Soil will be evaluated for ADL, CAM 17 Metals, TPH-d/mo, TPH-g, BTEX, MTBE, 5 Gasoline Oxygenates, PCBs and OCPs, pH, and Asbestos. Select samples will be analyzed for VOCs.

The groundwater investigation will be used to evaluate groundwater quality for the following purposes:

- To confirm potential impact to groundwater at locations known to be contaminated due to nearby leaking underground storage tanks, at the far southern edge of the project corridor and near the 101N/116 Overcrossing. Grab groundwater samples will be collected at these locations and analyzed for one or more of TPH-g/BTEX/MTBE, TPH-d/mo, 5 Gas Oxygenates, and VOCs.
- To evaluate the suitability of dewatering system designs at one additional bridge location and at the northern edge of the project corridor. Grab groundwater samples will be collected at these locations and analyzed for one or more of TPH-g/BTEX/MTBE, TPH-d/mo, 5 Gas Oxygenates, and VOCs.

Sample locations are shown in the attached drawings.

HEALTH AND SAFETY PLAN

Safety of our staff is a priority. URS personnel has developed a site and project specific Health & Safety Plan (HASP) for personnel conducting fieldwork for this project. The plan has been reviewed and signed by an office Health & Safety Officer based in San Jose, California. A copy of this HASP has been included in the workplan.

PERMITS

URS will assist in preparing applications for an encroachment permit from Caltrans. During previous similar projects, Caltrans has granted encroachment permits, allowing entry to the State Right of Way including US 101. These encroachment permits typically allows along US 101 shoulder closures between the hours of 9 AM and 4 PM, and lane closures along US 101 between the hours of 10 PM and 5 AM on weekdays. The permits specify additional requirements, including work notification, shoulder and lane closure procedures, and personal protective equipment requirements.

URS will mark and conduct utility surveys on all proposed sampling locations before the start of field sampling efforts. An underground utility location contractor will be retained to evaluate the location of underground utilities at each boring location. Underground Service Alert (USA) will be notified of the planned boring locations so participating public utilities can provide the location of underground utilities in the area of the borings.

A Caltrans-certified traffic control subcontractor will be retained to divert traffic away from the field crew and sampling rig when working along roadways. Shoulder closures, at minimum, will be required for all work adjacent to the outside lanes of US 101 and all work adjacent to entrance and exit ramps. Lane closures on the number one lane of the highway will be required for work within the median. The encroachment permit will regulate lane and shoulder closure times.

Sampling locations may be marked and surveyed using a Global Positioning System (GPS) during sampling operations to limit lane and shoulder closures. Sampling locations shown on the attached figures (Figures ENV-1 through ENV -9) are approximate and may be moved based upon further preliminary data review and/or due to field conditions identified during the utility location fieldwork, accessibility, and crew safety considerations.

SAMPLING

URS will retain direct push drilling subcontractor Environmental Control Associates of Aptos, California to assist in the fieldwork sampling, including both direct push and hand auger. URS personnel will supervise all fieldwork conducted under this Work Plan and will collect and ship the samples. URS proposes to use direct push sampling techniques to minimize cuttings collection and disposal. Where the direct push equipment cannot be used due to physical or other constraints, we will use hand auger sampling methods.

Sample Locations

URS will collect representative soil samples of the excavation area at intervals perpendicular to the US 101 mainline and ramps. in general, two borings will be advanced approximately every 300-400 feet. At most of these locations one boring will be placed in the median, where the majority of excavation work will occur, and the second boring will be placed adjacent to the northbound or southbound edge of shoulder. Where ramp construction is planned, the second boring will be placed adjacent to the

outside edge of the shoulder of the ramp. The location of these shoulder/ramp soil samples relative to the edge of the traveled way will alternate along the project corridor between the following areas: the edge of the pavement, midpoint between edge of pavement and limit of excavation, and at the limit of excavation.

As shown on the attached sheets, approximately 30 soil sampling locations have been selected, for a total of 60 borings. In addition approximately 10% of borings will have a duplicate boring advanced for quality control purposes. The exact number of samples collected, the sample locations, and the actual interval distances may change slightly based on field observations, access issues and available space at each location. Up to a total of four groundwater samples will be collected in the highway excavation area. Two of these groundwater samples will be located near identified groundwater contamination areas near the southern edge of the project corridor and at the intersection of S.H. 116 and US 101; the other two groundwater samples will be located at one additional bridge, and at the northern edge of the project corridor.

Each sampling location will be recorded by GPS. All samples collected will be submitted for laboratory analysis. The analytical suite is discussed in the Laboratory Analysis section of this Work Plan.

Sampling Depths

In general, this is a fill project, and south of the 116/101 interchange, elevations will generally be increased by between at least 1 foot and up to 25 feet. North of that interchange, current elevation will be approximately maintained, and in that area, most excavation will be between 2 and 3 feet below existing grade, although excavations associated with bridge construction may be deeper. Additionally, it is URS' experience that ADL impacts are not expected at depths greater than 3 feet below ground surface (bgs). Therefore, most borings will be advanced to maximum depth of 12 inches bgs in fill areas, and 3 feet bgs in cut areas. The sampling plan has been influenced by the proposed project design discussed previously. Table 1 describes the sampling plan, including the proposed depth, rationale, and analytical suite for each boring. The following is a general guide to the sampling plan:

At each sampling location URS will collect soil samples at 0 to 0.5 ft, 0.5 ft to 1 ft, 1.0 ft. to 1.5 ft, 1.5 ft to 2 ft, and 2.5 ft. to 3.0 ft; and then every 3 feet to the maximum depth of boring. Borings that are only 12 inches deep will only be sampled at the 0 to 0.5 ft and 0.5 ft to 1 ft intervals. Samples deeper than 3.0' will not be evaluated initially pending results of the upper layer results. Therefore approximately 205 soil samples and 4 groundwater samples will be collected and all analyzed samples will be analyzed for, at minimum, lead, as further discussed below.

(1) Petaluma Blvd. South Interchange:

a. Advance 11 borings, including one duplicate boring, to a depth of 1.0'. The southernmost boring will be advanced to first encountered groundwater to evaluate potential impacts due to a known LUST release at 4550 Redwood Highway. Collect two soil samples from each 1.0' boring and approximately eight soil samples from the boring advanced to groundwater, for a total of about 30 soil samples and one groundwater sample.

(2) Mainline 101 Construction south of approximately station 190+00:
    a. Advance 24 borings, including two duplicate borings, to a depth of 1.0'. Collect a total of 48 samples from these borings.
    b. Advance 4 borings at proposed sound or retaining wall locations, to a depth of 3.0'. Collect five samples per boring for a total of 20 soil samples from these borings.
(3) Construction of new on- and off-ramps for Northbound 101 at SR 116:
    a. Advance 4 borings, to a depth of 1.0'. Collect a total of 8 samples from these borings.
    b. Advance 4 borings, including one duplicate boring, at proposed sound or retaining wall locations, to a depth of 3.0'. Collect five samples per boring for a total of 20 soil samples from these borings.
(4) Mainline 101 Construction north of approximately station 190+00:
    a. Advance 9 borings, including one duplicate boring, to a depth of 3.0'. Collect five samples per boring for a total of 45 samples from these borings.
    b. Advance 2 borings, at proposed sound or retaining wall locations, to a depth of 6.0'. The northernmost boring will be advanced to first encountered groundwater to evaluate groundwater at the northernmost edge of the project corridor. Collect six soil samples at the two 6.0' borings and eight soil samples from the boring advanced to groundwater, for a total of approximately 20 soil samples and one groundwater sample.
(5) Replacement of the South Petaluma Undercrossing, the Petaluma River Bridge, and the Route 101N/116 Bridge, and widening of the Route 101S/116 Bridge.
    a. Advance 3 borings, one at each bridge scheduled for replacement, to a depth of 12.0'. Collect eight samples per boring for a total of 24 soil samples from these borings.
    b. One groundwater sample will be collected from the first encountered groundwater zone at two bridge boring locations if groundwater is encountered less than 28' below ground surface.
    c. One of the two groundwater samples will be collected from the boring advanced near the 101/116 bridges to evaluate soil and groundwater on-Site for potential impacts of fuel leaks due to a known LUST at 1051 Lakeville Highway.

Sample Collection Methods

Soil samples will be collected using three different sampling methods:

- Direct-push borings samples will be collected at those locations where no access problems are expected. This sample collection method can be advanced quickly and is intended to be the primary sample collection method. These samples will be collected by driving an approximately 2-inch diameter sampler equipped with clean acrylic tube liners provided by the drilling subcontractor. Drive sampling equipment will be pressure-washed after each use.

- Hand auger samples will be collected at those locations where access problems are encountered.

- Geotechnical borings using Cone Penetrometer Test Rigs may be used at those locations where geotechnical and environmental representative samples may be collected jointly.

Soil samples will be collected in clean soil sampling tubes and/or laboratory provided bottles. Each soil sample tube will be sealed with Teflon and plastic end caps. All samples will be labeled with site-specific unique numbers, placed on ice and shipped daily to a State of California certified analytical laboratory under URS chain of custody procedures.

Groundwater samples will be collected from direct-push or geotechnical borings using disposable bailers. Temporary screened PVC wells may be constructed to facilitate sampling at each location. No permanent installation, development, or surveying of the temporary wells are proposed. Temporary screened PVC will be left up to 4 hours to allow for sample collection. If no groundwater is present after that time boring will be closed and the groundwater sample not collected.

At the end of each sampling day, the borings will be backfilled to the surface elevation with neat cement grout. Any boring deeper than 3' will be backfilled using a Tremie pipe. The limited cuttings and decontamination water derived during the investigation activities will be drummed, sampled and analyzed separately for off-site disposal purposes. The investigation-derived waste (IDW) will be properly labeled and stored at a site, on the Right of Way, approved by Caltrans, until it can be analyzed and characterized for disposal. URS has assumes that no more than two drums of IDW will be generated during this phase of work.

Laboratory Analyses and Analytical Methodology

All the soil samples will be submitted for analysis and analyzed for total lead by EPA Method 6010. Up to 10 percent of these will also be analyzed for CAM 17 metals by EPA Method 6010 (which includes lead), for asbestos using PLM, and for pH. Up to 10 percent of the samples collected from the second sampling interval (0.5-1.0 ft) will be analyzed for TPH-d/mo by EPA Test Method 8015B, TPH-G/BTEX by EPA Test Method 8015B, and 5 Gas Oxygenates by EPA method 8260. Up to 10 percent of samples collected from the topmost 0.5 ft interval will be analyzed for PCBs and pesticides by EPA Test Method 8081/8082. Up to two soil samples collected in the vicinity of the LUST releases will be analyzed for VOCs using EPA Test Methods 8082/8260 .

Based upon a variety of considerations including the presence or absence of known groundwater contamination and results of the soil sampling events, groundwater samples will be for select constituents including CAM 17 metals by EPA Method 6010 (which includes lead), pH, TPH-d/mo by EPA Test Method 8015B, TPH-G/BTEX by EPA Test Method 8015B, 5 Gas Oxygenates by EPA method 8260, PCBs and pesticides by EPA Test Method 8081/8082, and for VOCs using EPA Test Methods 8082/8260.

All TPH-d and TPH-mo sample extracts will be first extracted with silica gel to remove biogenic sources that could result in false positive results during analysis.

Soil samples with a total lead content exceeding 50 mg/kg will be extracted with the Standard WET and analyzed for lead. Soils with WET lead exceeding 5 mg/Kg will be extracted with the De-ionized Water WET and analyzed for lead. Soils with total lead

content over 100 mg/kg may be extracted with the TCLP test and analyzed for lead. According to URS' experience in similar projects, it is estimated that up to 30 percent of the samples initially analyzed for lead may have to be analyzed for lead using WET and DI-WET procedures. The samples with the 20 highest total lead concentrations (exceeding 100 mg/Kg) will analyzed for lead using the TCLP procedure. Other constituents may also need leachability testing. If so, URS will notify SCTA and Caltrans of such samples before ordering the additional leachability testing. All samples will be analyzed on standard turn around time (TAT) of 10 business days. Each iteration of leachability testing will add another 5-10 business days to the analytical schedule.

The goal of this analytical program is to obtain representative information of the quality of the soil to be excavated and groundwater. Therefore, the specific initial analytical suite for each sample may be modified during the field work depending on the actual number of samples collected, their distribution and field observations.

Following this initial soil sampling, additional sampling, testing, and statistics may be needed to reduce the volume of hazardous waste identified during the proposed round of investigation.

STATISTICAL ANALYSIS

The following analytical quality control procedures will be used to comply with Caltrans procedures. A calibration blank sample will be run for every ten samples or per batch, which ever is more frequent. One boring in ten will be duplicated in the field for quality control purposes. In the laboratory QC, one in ten field samples will be spiked with lead to ten times the detection limit or at the analyte level.

URS personnel trained in laboratory data review will review each data package submitted by the laboratory for data quality control. The data will then be tabulated and evaluated.

The evaluation will include comparison to the Caltrans District 4/DTSC variance, California's Title 22 hazardous waste regulations, Federal Resource Conservation and Recovery Act (RCRA) regulations, EPA Region IX Preliminary Remediation Goals (PRGs) and the San Francisco Bay Regional Water Quality Control Board (RWQCB) Environmental Screening Levels (ESLs). The 90% Upper Confidence Limit for lead in soil concentrations will be calculated for soil left on site for all soils and layers of soils. The 95% Upper Confidence Limit for lead in soil concentrations will be calculated for soils to be taken off-site. An additional statistical iteration will be conducted to evaluate "hotspot" soil removal, if needed. Recommendations will be made on handling the soil to comply with the regulations. Additional statistical iterations, sample analysis, or sample collection, if needed, can be conducted to evaluate other handling methods under a separate Work Plan.

STRUCTURE INVESTIGATION – ASBESTOS/LEAD BASED PAINT

The outside walls of bridges scheduled for demolition or widening will be visually surveyed for potential Asbestos Containing Materials and Lead-Based Paint (ACMs and LBP). If potential ACMs or LBPs are identified, samples will be collected and analyzed to allow for characterization of these portions of bridges prior to demolition or disposal. Examples of materials that will be included in our visual survey for potential ACMs are abrasion pads between the bridge decks and the support structures and caulking/filler between the

intersection of the bridge decks and the adjoining roadway surface. Up to 90 samples for ACM and 20 for LBP will be initially analyzed by Polarized Light Microscopy (PLM) and 6010B, respectively. Samples with asbestos will be further analyzed by the Point Count Method to refine the asbestos content (this analysis is not included in this scope of services). URS will subcontract these sample collection and analysis activities to Kellco Macs Laboratory, a State of California certified asbestos analytical laboratory.

The following bridges will be assessed for potential Asbestos Containing Materials: South Petaluma Undercrossing, the Petaluma River Bridge, the Route 101S/116 Bridge, and the Route 101N/116 Bridge.

LIMITATIONS

This Work Plan includes soil and groundwater sampling primarily to evaluate soil within these areas for reuse and/or disposal. Workplan development and investigation services will be performed by URS in a manner consistent with that level of care and skill ordinarily exercised by members of the same profession currently practicing in the same locality under similar conditions. No expressed or implied representation or warranty is included or intended in our reports, except that our services were performed, within the limits prescribed by our client, with the customary thoroughness and competence of our profession.

URS cannot warrant or guarantee that not finding indicators of hazardous materials means that hazardous materials do not exist on the Site. There is no investigation that is thorough enough to preclude the presence of materials on the Site that presently, or in the future, may be considered hazardous. Because regulatory evaluation criteria are constantly changing, concentrations of contaminants present and considered to be acceptable may, in the future, become subject to different regulatory standards and require remediation.

Our Work Plan does not include the following.

- Sampling and analysis in parcels to be acquired by SCTA and Caltrans outside of the existing ROW.
- Additional and/or follow-up investigations for contaminants discovered during our planned soil characterization activities or for associated remediation.
- Additional leachability testing.
- Additional statistical data evaluation iterations.
- Additional mobilizations by our subcontractors.
- Risk assessment for the ROW soils and/or groundwater.
- Testing of imported soils coming onto the ROW as fill.
- ACM/LBP testing of additional structures.

SIGNATURES

This Work Plan was prepared under the contract provisions between Sonoma County Transportation Authority and URS Corporation. It will be done in accordance with the State of California, Department of Transportation guidelines and policies. By signature below, (draft work plan will not be signed) Sonoma County and URS hereby approve the Work Plan and Health and Safety Plan.

Consultant Project Manager

Ramsey Hissen, PE
URS Corporation

Consultant Environmental Task Leader

Patrick Walz, PE
URS Corporation

Sonoma County Transportation Agency Engineer

Sonoma County Transportation Agency

Attachments:
Table 1 – Soil Sample Descriptions
ENV-1 through 9 –Proposed Environmental Boring Location Plan Sheets
Site-Specific Health And Safety Plan

Table 1
Draft Sampling Plan
Hazardous Material Investigation
Project B4 of the MSN US 101 Central HOV Lanes Project
Sonoma County California

Boring Location	Sample Collection System*	Sample Depth (ft)	Analysis	Groundwater	Comments
Petaluma BLVD. South Interchange					
S-1	Geoprobe	0.5	Lead	Yes: VOCs, TPH-g/BTEX/MTBE, TPH-d/mo, and 5 Gas Oxygenates	Boring located near a site with leaking underground storage tank
		1	CAM17 Metals, TPH-d/mo, TPH-g/BTEX/MTBE, Asbestos, pH, 5 Gas Oxygenates, and VOCs		
		1.5	Lead		
		2	Lead		
		3	Lead, TPH-d/mo, TPH-g/BTEX/MTBE		
		6	Hold		
		9	Hold		
		12	Hold		
S-2	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
S-3	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
S-4	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
S-5	Hand or Geoprobe	0.5	CAM17 Metals, Asbestos, and pH	No	
		1	Lead		
S-5-d	Hand or Geoprobe	0.5	Lead	No	Duplicate sample
		1	Lead		
S-6	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
S-7	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
S-8	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
N-1	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
N-2	Hand or Geoprobe	0.5	CAM17 Metals, Asbestos, and pH	No	
		1	Lead		
Mainline 101 Construction South					
M-1	Hand or Geoprobe	0.5	Lead	No	
		1	CAM17 Metals, Asbestos, and pH		
M-1-d	Hand or Geoprobe	0.5	Lead	No	Duplicate sample
		1	CAM17 Metals, Asbestos, and pH		
M-2	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
M-3	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
M-4	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
M-5	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
M-7	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
M-8	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
M-9	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		

Table 1
Draft Sampling Plan
Hazardous Material Investigation
Project B4 of the MSN US 101 Central HOV Lanes Project
Sonoma County California

Boring Location	Sample Collection System*	Sample Depth (ft)	Analysis	Groundwater	Comments
M-11	Hand or Geoprobe	0.5	Lead	No	
		1	CAM17 Metals, Asbestos, and pH		
M-12	Hand or Geoprobe	0.5	Lead, PCBs and Pesticides	No	
		1	Lead, TPH-d/mo, TPH-g/BTEX, and 5 Gas Oxygenates		
M-12	Hand or Geoprobe	0.5	Lead, PCBs and Pesticides	No	Duplicate sample
		1	Lead, TPH-d/mo, TPH-g/BTEX, and 5 Gas Oxygenates		
M-13	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
M-14	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
M-15	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
M-16	Hand or Geoprobe	0.5	CAM17 Metals, Asbestos, and pH	No	
		1	Lead, TPH-d/mo, TPH-g/BTEX, and 5 Gas Oxygenates		
S-9	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
S-10	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
S-11	Hand or Geoprobe	0.5	Lead	No	
		1	CAM17 Metals, Asbestos, and pH		
S-12	Hand or Geoprobe	0.5	Lead	No	
		1	Lead, TPH-d/mo, TPH-g/BTEX, and 5 Gas Oxygenates		
S-13	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
S-14	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
S-15	Geoprobe	0.5	CAM17 Metals, Asbestos, and pH	No	Boring Location next to Retaining Wall
		1	Lead		
		1.5	Lead		
		2	Lead		
		3	Lead		
N-3	Hand or Geoprobe	0.5	Lead	No	
		1	CAM17 Metals, Asbestos, and pH		
N-4	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
		0.5	Lead		

Table 1
Draft Sampling Plan
Hazardous Material Investigation
Project B4 of the MSN US 101 Central HOV Lanes Project
Sonoma County California

Boring Location	Sample Collection System*	Sample Depth (ft)	Analysis	Groundwater	Comments
N-5	Geoprobe	1	CAM17 Metals, Asbestos, and pH	No	Boring Location next to Retaining Wall
		1.5	Lead		
		2	Lead		
		3	Lead		
N-6	Geoprobe	0.5	Lead, PCBs and pesticide	No	Boring Location next to Retaining Wall
		1	Lead		
		1.5	Lead		
		2	Lead		
		3	CAM17 Metals, Asbestos, and pH		
N-7	Geoprobe	0.5	Lead	No	Boring Location next to Retaining Wall
		1	Lead		
		1.5	Lead		
		2	Lead		
		3	Lead		
Construction of new on- and off-ramps for Northbound 101 at SR 116					
N-8	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
N-9	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
N-10	Hand or Geoprobe	0.5	CAM17 Metals, Asbestos, and pH	No	
		1	CAM17 Metals, Asbestos, and pH		
N-11	Hand or Geoprobe	0.5	Lead	No	
		1	Lead		
N-12	Geoprobe	0.5	Lead	No	Boring Location next to Sound Wall
		1	Lead		
		1.5	Lead		
		2	Lead		
		3	Lead		
N-13	Geoprobe	0.5	Lead	No	Boring Location next to Sound Wall
		1	CAM17 Metals, Asbestos, and pH		
		1.5	Lead		
		2	Lead		
		3	Lead		
N-13-d	Geoprobe	0.5	Lead	No	Boring Location next to Sound Wall
		1	CAM17 Metals, Asbestos, and pH		
		1.5	Lead		
		2	Lead		
		3	Lead		
N-14	Geoprobe	0.5	Lead, PCBs and pesticide	No	Boring Location next to Sound Wall
		1	Lead		
		1.5	Lead		
		2	Lead		
		3	CAM17 Metals, Asbestos, and pH		
Mainline 101 Construction North					
M-18	Geoprobe	0.5	Lead, PCBs and pesticide	No	
		1	Lead		
		1.5	Lead		
		2	Lead		
		3	Lead		
		0.5	Lead		

Table 1
Draft Sampling Plan
Hazardous Material Investigation
Project B4 of the MSN US 101 Central HOV Lanes Project
Sonoma County California

Boring Location	Sample Collection System*	Sample Depth (ft)	Analysis	Groundwater	Comments
M-19	Geoprobe	1	CAM17 Metals, Asbestos, pH	No	
		1.5	Lead		
		2	Lead		
		3	Lead		
M-19-d	Geoprobe	0.5	Lead	No	Duplicate sample
		1	CAM17 Metals, Asbestos, pH		
		1.5	Lead		
		2	Lead		
		3	Lead		
M-20	Geoprobe	0.5	Lead	No	
		1	Lead		
		1.5	Lead		
		2	Lead		
		3	Lead		
M-21	Geoprobe	0.5	Lead	No	
		1	Lead		
		1.5	Lead		
		2	Lead		
		3	Lead		
M-22	Geoprobe	0.5	Lead, PCBs and pesticide	No	
		1	Lead		
		1.5	Lead		
		2	Lead		
		3	Lead		
M-23	Geoprobe	0.5	CAM17 Metals, Asbestos, and pH	No	
		1	Lead		
		1.5	Lead		
		2	Lead		
		3	Lead		
S-16	Geoprobe	0.5	Lead	No	
		1	Lead		
		1.5	Lead		
		2	Lead		
		3	Lead		
N-15	Geoprobe	0.5	Lead	No	Boring Location next to Sound Wall
		1	Lead		
		1.5	Lead		
		2	Lead		
		3	Lead		
		6	Hold		
N-16	Geoprobe	0.5	Lead	No	Boring Location next to Sound Wall
		1	Lead		
		1.5	Lead		
		2	Lead		
		3	Lead		
		6	Hold		
		0.5	Lead		Boring location near
		1	Lead		
		1.5	Lead		

Table 1
Draft Sampling Plan
Hazardous Material Investigation
Project B4 of the MSN US 101 Central HOV Lanes Project
Sonoma County California

Boring Location	Sample Collection System*	Sample Depth (ft)	Analysis	Groundwater	Comments
N-17	Geoprobe	2	Lead	Yes: TPH-d/mo	Sound Wall, and groundwater sample to evaluate groundwater at the northernmost edge of the project corridor.
		3	CAM17 Metals, Asbestos, and pH		
		6	Hold		
		9	Lead		
		12	Lead		
Bridge Replacement					
M-6	Geoprobe	0.5	Lead	No	
		1	Lead		
		1.5	Lead		
		2	Lead		
		3	CAM17 Metals, Asbestos, and pH		
		6	Hold		
		9	Hold		
		12	Hold		
M-10	Geoprobe	0.5	Lead	Yes: VOCs, TPH-g/BTEX, TPH-d/mo, MTBE, and 5 Gas Oxygenates	Boring located near a site with leaking underground storage tank and at bridge crossing
		1	CAM17 Metals, TPH-d/mo, TPH-g/BTEX/MTBE, Asbestos, pH, 5 Gas Oxygenates, and VOCs		
		1.5	Lead		
		2	Lead		
		3	Lead, TPH-d/mo, TPH-g/BTEX/MTBE		
		6	Hold		
		9	Hold		
		12	Hold		
M-16	Geoprobe	0.5	CAM17 Metals, Asbestos, and pH	No	
		1	Lead, TPH-d/mo, TPH-g/BTEX, and 5 Gas Oxygenates		
M-17	Geoprobe	0.5	Lead	Yes: VOCs, TPH-g/ BTEX/MTBE, 5 Gas Oxygenates	Boring location near bridge crossing
		1	Lead		
		1.5	Lead		
		2	Lead		
		3	Lead		
		6	Hold		
		9	Hold		
		12	Hold		

Note:
* Drilling system may vary base on field condition.

APPENDIX B

COUNTY OF SONOMA — DEPARTMENT OF HEALTH SERVICES
ENVIRONMENTAL HEALTH DIVISION
475 Aviation Blvd., Suite 220, Santa Rosa, CA 95403
Phone (707) 565-6565 Fax (707) 565-6525 www.sonoma-county.org

APPLICATION FOR DRILLING PERMIT
for Regional Board Lead/Environmental Assessment / LOP Lead

For Office Use Only
Amount paid $538
Receipt number 0526
Payment date 2/19/10 Rev. code 1348
Site ID#
Permit # SR0008919

Well type: [ ] Monitoring well [ ] Recovery extraction well [ ] Boring [ ] Injection well [ ] Destruct [x] Environmental assessment
[ ] Soil gas survey [ ] Direct push [ ] Air sparging/venting [ ] Remediation well [ ] Other

DEPT. OF HEALTH SERVICES
FEB 22 2010
ENVIRONMENTAL HEALTH DIVISION

Well depth Boring depth

On-site well/boring 60 Borings ID # See Work Plan # Off-site well/boring ID

Submit legal right-of-entry/off-site well address/encroachment permit

On-site Address 8 HIGHWAY 101 U.S. Highway 101 (post-miles 2.2-4.1) AP#

Facility Name U.S. Highway 101 (post-miles 2.2-4.1)

On-site Owner Caltrans Phone 510-286-4923
Street 111 Grand Ave City Oakland State CA Zip 94623

Responsible Party Ramsey Hissen, URS Phone 408-297-9585
Street 100 W. San Fernando St., Suite 200 City San Jose State CA Zip 95113

Consultant URS Patrick Walz & Susie Vedantham Phone 408-297-9585
Street 100 W. San Fernando St., Suite 200 City San Jose State CA Zip 95113
License #/Type Environmental Consultants

Drilling Contractor Environmental Control Associates (ECA) Phone 831-662-8178
Street 3011 Twin Palms Drive City Aptos State CA Zip 95003
C-57 License # 695970

Type of work: [ ] Initial investigation # Wells [ ] Subsequent investigation # Wells [ ] Destruct # Wells

Groundwater investigation due to: [ ] Underground tank [ ] Surface impoundment [ ] Environmental assessment
[ ] Surface disposal practice—specify involved industry
[ ] Other

Perforated intervals N/A Chemical constituents

Disposal method for soil cuttings Store in drums on-site Disposal method for development water None

Drilling method 2" Direct push Method of drill equip. rinsate containment

If destroying a well, abandonment method N/A

Submit plot plan of wells in relation to all sewer or septic lines.

Is well to be constructed within: 100 feet of a septic tank or leachfield? [ ] Yes [ ] No
50 feet of any sanitary sewer line? [ ] Yes [ ] No
25 feet of any private sanitary sewer line? [ ] Yes [ ] No

COPY

In addition, all monitoring wells must include ***identification system*** affixed to interior surface:
1) Well identification 2) Well type 3) Well depth 4) Well casing diameter 5) Perforated intervals

Well identification number and well type shall be ***affixed*** to the ***exterior surface*** security structure.

RECEIVED
MAR 01 2010

For Office Use Only

Address 8 HIGHWAY 101

Site ID# —

Permit # SR0008919

I hereby agree to comply with all laws and regulations of the County of Sonoma and State of California pertaining to water well construction. I will telephone (707) 565-6565, 48 hours in advance, to notify the Environmental Health Specialist when completing or destroying a well. I will furnish the Director of Health Services and the owner a legible copy of the State Water Well Driller's Report within 15 days; and a copy of the Summary Report, including sample results, should be received by this Department within 90 days in order to obtain final approval on this well permit. I acknowledge that the application will become a permit ***only*** after site approval and payment of fee. I understand that this permit is not transferable and expires one year from date of issuance.

T. B. H. FOR ECA Date 2-8-10

Signature of Well Driller—***no proxies***

Insurance Carrier The Hartford Expiration Date 5-1-10

Once all wells/borings are installed, submit a Well Driller's Log and/or Summary Report to complete permit process.

Indicate on attached plot plan the exact location of well(s) with respect to the following items: property lines, water bodies or water courses drainage pattern, roads, existing wells, sewer main and laterals and private sewage disposal systems or other sources of contamination or pollution. INCLUDE DIMENSIONS. The validity of this permit depends upon the accuracy of the information provided by the applicant.

Conditions of permit:

A SUMMARY REPORT MUST BE SUBMITTED TO THIS OFFICE WITHIN 30 DAYS of Completion. THE REPORT MUST INCLUDE BORING LOGS AND SAMPLE RESULTS

FOR OFFICE USE ONLY – ENVIRONMENTAL HEALTH DIVISION

ENTERED MSM

Permit approved by John Anderson Date 2/23/10

Constr. approved by _____ Observed? [ ] Yes [ ] No Well # _____ Date ___/___/___

RWQCB / LOP approval _____ Date ___/___/___

drilling permit.doc (Revised August 2006) Copies: White—File Yellow—Driller Pink—Consultant Gold—Owner/Resp. Party

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

ENCROACHMENT PERMIT

TR-0120

Permit No. 0408-NSV1342	
Dist/Co/Rte/PM 04-Son-101 1.0/4.0	
Date September 8, 2008	
Fee Paid $	Deposit $
Performance Bond Amount (1)	Payment Bond Amount (2)
Bond Company	
Bond Number (1)	Bond Number (2)

In compliance with (*Check one*):

☒ Your application of July 29, 2008

☐ Utility Notice No. _____ of _____

☐ Agreement No. _____ of _____

☐ R/W Contract No. _____ of _____

TO: Sonoma County Transportation Authority
490 Mendocino Avenue, Suite 206
Santa Rosa, CA 95401

Attn: Mr. John Maitland
Phone: (707) 565-5373

, **PERMITTEE**

and subject to the following, **PERMISSION IS HEREBY GRANTED** to:

Perform project site investigations for developing PS&E for the Petaluma Blvd. South and Petaluma River Projects (EA 264081 and 2640C1) on State Highway 04-Son-101, Post Miles 1.0/4.0, in the County of Sonoma.

A minimum of one week prior to start of work under this permit, notice shall be given and advance approval of construction detail, operations, public safety and traffic control shall be obtained from State Representative Jack Free, (707) 762-5540, 611 Payran Street, Petaluma, CA 94952, weekdays between the hours of 8:00 AM and 4:30 PM, holidays excluded.

All permitted work requires the permittee to apply for and obtain a work authorization number prior to start of work. See the attached "Encroachment Permit Work Scheduling Procedures" and the attached "Encroachment Permit Work Scheduling Request Form". Additional time beyond the minimum seven-day advance notice required in the above paragraph may be required for obtaining the traffic control approval.

Immediately following completion of the work permitted herein, the permittee shall fill out and mail the Notice of Completion attached to this permit.

The following attachments are also included as part of this permit (*Check applicable*):

☒ Yes	☐ No	General Provisions
☐ Yes	☒ No	Utility Maintenance Provisions
☐ Yes	☒ No	Special Provisions
☐ Yes	☒ No	A Cal-OSHA permit required prior to beginning work: # _____

In addition to fee, the permittee will be billed actual costs for:

☐ Yes	☒ No	Review
☒ Yes	☐ No	Inspection
☒ Yes	☐ No	Field Work

(If any Caltrans effort expended)

☐ Yes ☒ No The information in the environmental documentation has been reviewed and considered prior to approval of this permit.

This permit is void unless the work is completed before December 31, 2010.

This permit is to be strictly construed and no other work other than specifically mentioned is hereby authorized.
No project work shall be commenced until all other necessary permits and environmental clearances have been obtained.

DAC
cc: DRivers(2), JFree
DTM-PChan
TMC-JRichardson
County of Sonoma

APPROVED:

BIJAN SARTIPI, District Director

BY:

MICHAEL D. CONDIE, District Permit Engineer

NAME: Sonoma County Transportation Authority
PERMIT #: 0408-NSV1342
DATE: September 8, 2008

When approved, traffic control performed under this permit shall be in accordance with the appropriate State Standard Plan Sheets T-10 through T-14. Where required by the plan, the use of a flashing arrow-board is MANDATORY.

For shoulder closure, see attached State Standard Plan Sheet T-10. Parking may be restricted, as needed. Traffic control is restricted to shoulder closure from 9:00 AM to 3:00 PM, Monday through Friday, holidays excepted. No lane closure on the highway is allowed without prior approval from the State Representative.

When operations are conducted, permittee shall furnish, place and maintain signs and safety equipment in accordance with "Part 6 of the MUTCD and of the MUTCD California Supplement", which can be located at
http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/pdf/MUTCD2003CASupp.pdf

If an accident or other incident (related to or not related to the permitted activity) occurs within, or close to the permitted activity, the permittee shall immediately stop work and remove traffic controls from the highway unless public health, welfare and safety is endangered by unfinished work. Only traffic control to protect open excavations may remain in place. After free traffic flow is restored, work in accordance with the conditions of the permit may be returned.

Excavations made within the limits of the highway shall be backfilled before leaving the work for the night unless otherwise authorized by State's representative. After backfilling the trench, temporary surfacing shall be placed if required by State's representative. Excavating holes in paved surfacing is prohibited.

Permittee shall be responsible to remove gauging equipment upon completion of the monitoring work and restore facilities to original state to the satisfaction of the State Representative. Electromagnetic and radioactive equipment must be operated by certified personnel and shall not interfere with radio communications or be directed toward the traveling public.

The permittee shall ensure that all drilling fluids and earthly material are disposed of in a manner acceptable to the appropriate local, state, or federal regulatory agencies. Excess drilling material shall be tested for contamination and disposed of in accordance with local, state, and federal requirements.

SURVEY WORK IS PROHIBITED ON FREEWAYS. All survey operations shall be conducted off the traveled way except where necessary to cross pavements and medians. Survey vehicles may be parked in State highway right of way off paved shoulders. Auxiliary support and employee vehicles shall remain outside the State right of way.

All permittee's personnel shall wear appropriate personal protective equipment, including hard hats and bright-colored vests, shirts or jackets with retro-reflective material while on State highway right of way.

Markings within State right of way shall be temporary. Paint used for markings shall be water soluble and other markers shall be removed upon completion of the work.

Survey information and assistance may be obtained upon request to: Survey Section, Department of Transportation, P. O. Box 23660, Oakland, CA 94623.

A copy of all collected survey data shall be sent, at no cost, to: Mr. Michael D. Condie, District Permit Engineer, Department of Transportation, P. O. Box 23660, Oakland, CA 94623-0660. Any collected data requested by Caltrans shall be furnished to Caltrans without charge.

Any change or damage to any existing facilities, landscaping, irrigation or drainage pattern, whether occasioned by increase or diversion, and the cost of any damage, repairs or restoration within the State's right of way shall be the responsibility of the permittee.

The permittee's contractor shall apply for a duplicate Encroachment Permit for the work authorized therein, and the application shall be accompanied by a $164.00 check to cover the permit processing fee. Permittee shall be billed for any required inspection cost at the current rate of $82.00 per hour after work has been completed.

Changes to the Plans, Specifications, and Permit Provisions are not allowed without prior approval from the State Representative.

APPENDIX C

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	3-19-10	3-19-10		N-1
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY (CL); soft; dark brown; moist; medium plasticity fines.		1										N-1@0.5
			Fat CLAY (CH); soft; dark brown to gray; moist; high plasticity fines.		2										N-1@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

URS BORING RECORD 022008 28645045-101 MSN SEG B4(ENV).GPJ 7/17/10

URS

URS Corporation

100 W San Fernando St, Ste 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				N-1
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	5-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-15-10	4-15-10		N-2
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
ECA, Inc.			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Continuous Push			Geoprobe 5410	2"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
sleeve			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement Grout			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY (CL); stiff; light yellowish brown; moist.		1										N-2@0.5
					2										N-2@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

URS

URS Corporation

100 W San Fernando St, Ste 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				N-2
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	7-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	3-19-10	3-19-10		N-3
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SILTY SAND (SM); medium dense; dark brown; moist; trace GRAVEL; fine SAND.		1										N-3@0.5
			At 0.5 ft, with coarse SAND.		2										N-3@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

URS BORING RECORD 022008 28645045-101 MSN SEG B4(ENV).GPJ 7/17/10

URS

URS Corporation

100 W San Fernando St, Ste 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				N-3
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	4-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-15-10	4-15-10		N-4
DRILLING CONTRACTOR: N/A			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION
DRILLING METHOD: N/A			DRILL RIG: Hand Auger	BOREHOLE DIAMETER: 4"
SAMPLER TYPE(S) AND SIZE(S) (ID): Jars			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: N/A			GROUNDWATER READINGS: DURING DRILLING N/A; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SILTY, CLAYEY SAND (SC-SM); loose; reddish brown; moist.		1										N-4@0.5
					2										N-4@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

URS BORING RECORD 022008 28645045-101 MSN SEG B4(ENV).GPJ 7/17/10

URS

URS Corporation

100 W San Fernando St, Ste 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				N-4
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	3-19-10	3-19-10		N-5
DRILLING CONTRACTOR: N/A			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION
DRILLING METHOD: N/A			DRILL RIG: Hand Auger	BOREHOLE DIAMETER: 4"
SAMPLER TYPE(S) AND SIZE(S) (ID): Jars			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: N/A			GROUNDWATER READINGS: DURING DRILLING N/A; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 1.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SILTY SAND (SM); medium dense; dark brown; moist; fine SAND.		1										N-5@0.5
			At 0.5 ft, with coarse SAND.		2										N-5@1.0
	1				3										N-5@1.5
			Bottom of Borehole at 1.5 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

URS BORING RECORD 022008 28645045-101 MSN SEG B4(ENV).GPJ 7/17/10

URS

URS Corporation

100 W San Fernando St, Ste 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				N-5
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 4-17-10	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	3-19-10	3-19-10		N-6
DRILLING CONTRACTOR: N/A			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION:
DRILLING METHOD: N/A			DRILL RIG: Hand Auger	BOREHOLE DIAMETER: 4"
SAMPLER TYPE(S) AND SIZE(S) (ID): Jars			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: N/A			GROUNDWATER READINGS: DURING DRILLING N/A; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 3.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		CLAYEY SAND (SC); very dense; brownish yellow; moist; fine to medium SAND.		1										N-6@0.5
					2										N-6@1.0
	1				3										N-6@1.5
					4										N-6@2.0
	2				5										N-6@3.0
	3		Bottom of Borehole at 3.0 ft.												
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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100 W San Fernando St, Ste 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				N-6
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 4-17-10	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	3-19-10	3-19-10		N-7
DRILLING CONTRACTOR: N/A			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION
DRILLING METHOD: N/A			DRILL RIG: Hand Auger	BOREHOLE DIAMETER: 4"
SAMPLER TYPE(S) AND SIZE(S) (ID): Jars			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: N/A			GROUNDWATER READINGS: DURING DRILLING N/A; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 2.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		CLAYEY SAND (SC); very dense; brownish yellow; moist; fine to medium SAND.		1										N-7@0.5
					2										N-7@1.0
	1				3										N-7@1.5
					4										N-7@2.0
	2		Bottom of Borehole at 2.0 ft.												
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				N-7
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 4-17-10	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	3-18-10	3-18-10		N-8
DRILLING CONTRACTOR: N/A			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION
DRILLING METHOD: N/A			DRILL RIG: Hand Auger	BOREHOLE DIAMETER: 4"
SAMPLER TYPE(S) AND SIZE(S) (ID): Jars			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: N/A			GROUNDWATER READINGS: DURING DRILLING N/A; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); light yellowish brown; moist.		1										N-8@0.5
					2										N-8@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

URS BORING RECORD 022008 28645045-101 MSN SEG B4(ENV).GPJ 7/17/10

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REPORT TITLE				HOLE ID
BORING RECORD				N-8
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	3-18-10	3-18-10		N-9
DRILLING CONTRACTOR: N/A			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION
DRILLING METHOD: N/A			DRILL RIG: Hand Auger	BOREHOLE DIAMETER: 4"
SAMPLER TYPE(S) AND SIZE(S) (ID): Jars			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: N/A			GROUNDWATER READINGS: DURING DRILLING N/A; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SILTY SAND with GRAVEL (SM); reddish brown; moist; fine GRAVEL.		1										N-9@0.5
					2										N-9@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

URS BORING RECORD 022008 28645045-101 MSN SEG B4(ENV).GPJ 7/17/10

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San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				N-9
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	3-18-10	3-18-10		N-10
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); light yellowish brown; moist.		1										N-10@0.5
					2										N-10@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

URS BORING RECORD 022008 28645045-101 MSN SEG B4(ENV).GPJ 7/17/10

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REPORT TITLE				HOLE ID
BORING RECORD				N-10
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	7-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	3-18-10	3-18-10		N-11
DRILLING CONTRACTOR: N/A			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION
DRILLING METHOD: N/A			DRILL RIG: Hand Auger	BOREHOLE DIAMETER: 4"
SAMPLER TYPE(S) AND SIZE(S) (ID): Jars			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: N/A			GROUNDWATER READINGS: DURING DRILLING N/A; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); light yellowish brown; moist.		1										N-11@0.5
					2										N-11@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				N-11
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-15-10	4-15-10		N-12
DRILLING CONTRACTOR: ECA, Inc.			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION
DRILLING METHOD: Continuous Push			DRILL RIG: Geoprobe 5410	BOREHOLE DIAMETER: 2"
SAMPLER TYPE(S) AND SIZE(S) (ID): sleeve			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: Cement Grout			GROUNDWATER READINGS: DURING DRILLING N/A; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 3.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); light yellowish brown; moist.		1										N-12@0.5
					2										N-12@1.0
	1		SILTY SAND (SM); medium dense; light brown; moist.		3										N-12@1.5
			Lean CLAY (CL); medium stiff; dark brown; wet.		4										N-12@2.0
	2														
					5										N-12@3.0
	3		Bottom of Borehole at 3.0 ft.												
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				N-12
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	3-18-10	3-18-10		N-13
DRILLING CONTRACTOR: N/A			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION
DRILLING METHOD: N/A			DRILL RIG: Hand Auger	BOREHOLE DIAMETER: 4"
SAMPLER TYPE(S) AND SIZE(S) (ID): Jars			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: N/A			GROUNDWATER READINGS: DURING DRILLING N/A; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 3.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); light yellowish brown; moist.		1										N-13@0.5
					2										N-13@1.0
	1		Lean CLAY (CL); medium stiff; dark brown; wet.		3										N-13@1.5
					4										N-13@2.0
	2														
					5										N-13@3.0
	3		Bottom of Borehole at 3.0 ft.												
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				N-13
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 1	

URS BORING RECORD 022008 28645045-101 MSN SEG B4(ENV).GPJ 7/17/10

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-15-10	4-15-10		N-14
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
ECA, Inc.			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Continuous Push			Geoprobe 5410	2"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
sleeve			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement Grout			N/A	N/A	3.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); light yellowish brown; moist.		1										N-14@0.5
					2										N-14@1.0
	1		Lean CLAY (CL); medium stiff; dark brown; wet.		3										N-14@1.5
					4										N-14@2.0
	2														
					5										N-14@3.0
	3		Bottom of Borehole at 3.0 ft.												
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				N-14
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-15-10	4-15-10		N-15
DRILLING CONTRACTOR: ECA, Inc.			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION
DRILLING METHOD: Continuous Push			DRILL RIG: Geoprobe 5410	BOREHOLE DIAMETER: 2"
SAMPLER TYPE(S) AND SIZE(S) (ID): sleeve			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: Cement Grout			GROUNDWATER READINGS: DURING DRILLING N/A; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 6.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); light yellowish brown; moist.		1										N-15@0.5
					2										N-15@1.0
	1		Lean CLAY (CL); medium stiff; dark brown; wet.		3										N-15@1.5
					4										N-15@2.0
	2														
					5										N-15@3.0
	3														
	4														
	5		Fat CLAY (CH); stiff; dark gray; moist.												
					6										N-15@6.0
	6		Bottom of Borehole at 6.0 ft.												
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				N-15
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 1	

URS BORING RECORD 022008 28645045-101 MSN SEG B4(ENV).GPJ 7/17/10

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-15-10	4-15-10		N-16
DRILLING CONTRACTOR: ECA, Inc.			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION
DRILLING METHOD: Continuous Push			DRILL RIG: Geoprobe 5410	BOREHOLE DIAMETER: 2"
SAMPLER TYPE(S) AND SIZE(S) (ID): sleeve			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: Cement Grout			GROUNDWATER READINGS: DURING DRILLING N/A; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 6.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); light yellowish brown; moist.		1										N-16@0.5
					2										N-16@1.0
	1		SILTY SAND (SM); medium dense; light brown; moist.		3										N-16@1.5
			Lean CLAY (CL); medium stiff; dark brown; wet.		4										N-16@2.0
	2		Fat CLAY (CH); stiff; dark gray; moist.												
					5										N-16@3.0
	3														
	4														
	5														
					6										N-16@6.0
	6		Bottom of Borehole at 6.0 ft.												
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				N-16
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 1	

URS BORING RECORD 022008 28645045-101 MSN SEG B4(ENV).GPJ 7/17/10

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-15-10	4-15-10		N-17
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
ECA, Inc.			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Continuous Push			Geoprobe 5410	2"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
sleeve			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING 15 ft; AFTER DRILLING (DATE) 9 ft on	TOTAL DEPTH OF BORING
Cement Grout				15.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SILTY, CLAYEY SAND medium dense; yellowish brown; moist.		1										N-17@0.5
					2										N-17@1.0
	1				3										N-17@1.5
					4										N-17@2.0
	2				5										N-17@3.0
	3		Fat CLAY (CH); stiff; dark gray; moist.												
	4														
	5														
					6										N-17@6.0
	6														
	7														
	8		Lean CLAY (CL); stiff; light brown; moist.												
					7										N-17@9.0
	9														
	10														

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				N-17
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 2	

URS BORING RECORD 022008 28645045-101 MSN SEG B4(ENV).GPJ 7/17/10

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	10		Lean CLAY (CL) *(continued)*.												
	11														
					8										N-17@12.0
	12														
	13														
	14														
	15		Poorly graded SAND (SP); loose; light yellowish brown; wet.												
			Bottom of Borehole at 15.5 ft.												
	16														
	17														
	18														
	19														
	20														
	21														
	22														

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100 W San Fernando St, Ste 200
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REPORT TITLE				HOLE ID
BORING RECORD				**N-17**
DIST. **04**	COUNTY **Sonoma**	ROUTE	POSTMILE	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101 MSN Segment B4 Petaluma**				
BRIDGE NUMBER	PREPARED BY **M.Thummaluru**	DATE **7-17-10**	SHEET **2 of 2**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-2-10	4-2-10		M-1
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY with GRAVEL (CL); light yellowish brown; moist.		1										M-1@0.5
					2										M-1@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				M-1
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	7-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-2-10	4-2-10		M-2
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		CLAYEY SAND (SC); light reddish brown; moist.		1										M-2@0.5
					2										M-2@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				M-2
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	7-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-2-10	4-2-10		M-3
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SILTY SAND (SM); light yellowish brown; moist.		1										M-3@0.5
					2										M-3@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

URS BORING RECORD 022008 28645045-101 MSN SEG B4(ENV).GPJ 7/17/10

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REPORT TITLE				HOLE ID
BORING RECORD				M-3
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	7-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-2-10	4-2-10		M-4
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY (CL); light brown; moist.		1										M-4@0.5
					2										M-4@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				M-4
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	7-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-1-10	4-1-10		M-5
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY (CL); light reddish brown; moist.		1										M-5@0.5
					2										M-5@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				M-5
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	7-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-1-10	4-1-10		M-6
DRILLING CONTRACTOR: ECA, Inc.			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION
DRILLING METHOD: Continuous Push			DRILL RIG: Geoprobe 5410	BOREHOLE DIAMETER: 2"
SAMPLER TYPE(S) AND SIZE(S) (ID): sleeve			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: Cement Grout			GROUNDWATER READINGS: DURING DRILLING N/A; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 8.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY (CL); brown; moist.		1										M-6@0.5
					2										M-6@1.0
	1				3										M-6@1.5
					4										M-6@2.0
	2				5										M-6@3.0
	3														
	4		SILT with GRAVEL (ML); light yellowish brown; moist.		6										M-6@4.5
	5														
					7										M-6@6.0
	6														
	7														
					8										M-6@8.0
	8		Bottom of Borehole at 8.0 ft.												
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				M-6
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 5-17-10	SHEET 1 of 1	

URS BORING RECORD 022008 28645045-101 MSN SEG B4(ENV).GPJ 7/17/10

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-1-10	4-1-10		M-7
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); light brown; moist.		1										M-7@0.5
					2										M-7@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				M-7
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	7-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-1-10	4-1-10		M-8
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); dark brown; moist.		1										M-8@0.5
					2										M-8@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				M-8
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	7-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-1-10	4-1-10		M-9
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY (CL); light reddish brown; moist; some GRAVEL.		1										M-9@0.5
					2										M-9@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				M-9
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	7-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-19-10	4-19-10		M-10
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
ECA, Inc.			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Continuous Push			Geoprobe 5410	2"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
sleeve			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement Grout			N/A	N/A	30.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SILTY CLAY (CL-ML); soft; brown; moist.		1										M-10@.5
					2										M-10@1.0
	1				3										M-10@1.5
					4										M-10@2.0
	2				5										M-10@3.0
	3														
	4														
	5														
	6		SILTY CLAY with GRAVEL (CL-ML); soft; yellowish brown; moist.												
	7														
	8														
	9		SILTY CLAY (CL-ML); soft; brown; moist.												
	10														

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				M-10
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 3	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	10		SILTY CLAY (CL-ML) *(continued)*.												
	11														
	12														
	13														
	14														
	15														
	16														
	17														
	18														
	19														
	20														
	21														
	22														

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				**M-10**
DIST. **04**	COUNTY **Sonoma**	ROUTE	POSTMILE	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101 MSN Segment B4 Petaluma**				
BRIDGE NUMBER	PREPARED BY **M.Thummaluru**	DATE **7-17-10**	SHEET **2 of 3**	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	22														
	23														
	24														
	25														
	26														
	27														
	28														
	29														
	30		Bottom of Borehole at 30.0 ft.												
	31														
	32														
	33														
	34														

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REPORT TITLE				HOLE ID
BORING RECORD				**M-10**
DIST. **04**	COUNTY **Sonoma**	ROUTE	POSTMILE	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101 MSN Segment B4 Petaluma**				
BRIDGE NUMBER	PREPARED BY **M.Thummaluru**	DATE **7-17-10**	SHEET **3 of 3**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-2-10	4-2-10		M-12
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY (CL); dark reddish brown; moist.		1										M-12@0.5
					2										M-12@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				M-12
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	7-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-2-10	4-2-10		M-13
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		Lean CLAY with GRAVEL (CL); dark brown; moist.		1										M-13@0.5
					2										M-13@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

URS BORING RECORD 022008 28645045-101 MSN SEG B4(ENV).GPJ 7/17/10

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REPORT TITLE				HOLE ID
BORING RECORD				M-13
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	7-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-2-10	4-2-10		M-14
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		Lean CLAY (CL); light brown; moist; trace GRAVEL.		1										M-14@0.5
					2										M-14@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				M-14
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	7-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-15-10	4-15-10		M-16
DRILLING CONTRACTOR: ECA, Inc.			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION
DRILLING METHOD: Continuous Push			DRILL RIG: Geoprobe 5410	BOREHOLE DIAMETER: 2"
SAMPLER TYPE(S) AND SIZE(S) (ID): sleeve			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: Cement Grout			GROUNDWATER READINGS: DURING DRILLING 9 ft; AFTER DRILLING (DATE) 7.5 ft on	TOTAL DEPTH OF BORING: 10.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SILTY SAND with GRAVEL (SM); reddish brown; moist; fine GRAVEL.		1										M-16@.5
					2										M-16@1.0
	1				3										M-16@1.5
					4										M-16@2.0
	2				5										M-16@3.0
	3														
	4		SANDY lean CLAY (CL); stiff; yellowish brown; moist.												
	5														
					6										M-16@6.0
	6														
	7														
	8				7										M-16@9.0
	9														
	10														

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				M-16
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 2	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	10		SANDY lean CLAY (CL) *(continued)*.		8										M-16@10.5
			Bottom of Borehole at 10.5 ft.												
	11														
	12														
	13														
	14														
	15														
	16														
	17														
	18														
	19														
	20														
	21														
	22														

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San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				**M-16**
DIST. **04**	COUNTY **Sonoma**	ROUTE	POSTMILE	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101 MSN Segment B4 Petaluma**				
BRIDGE NUMBER	PREPARED BY **M.Thummaluru**	DATE **7-17-10**	SHEET **2 of 2**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-2-10	4-2-10		M-17
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); light yellowish brown mottled with gray; moist.		1										M-17@0.5
					2										M-17@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				M-17
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	7-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-2-10	4-2-10		M-18
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	3.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY (CL); light yellowish brown; moist.		1										M-18@0.5
					2										M-18@1.0
	1				3										M-18@1.5
					4										M-18@2.0
	2		SANDY SILT (ML); light brown; moist.												
					5										M-18@3.0
	3		Bottom of Borehole at 3.0 ft.												
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				M-18
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	7-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-2-10	4-2-10		M-19
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	3.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); light yellowish brown; moist; trace GRAVEL.		1										M-19@0.5
					2										M-19@1.0
	1		CLAYEY SAND (SC); reddish brown; moist; little GRAVEL.		3										M-19@1.5
					4										M-19@2.0
	2														
					5										M-19@3.0
	3		Bottom of Borehole at 3.0 ft.												
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				M-19
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 1	

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LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-2-10	4-2-10		M-20
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	3.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); light yellowish brown; moist; trace GRAVEL.		1										M-20@0.5
					2										M-20@1.0
	1		CLAYEY SAND (SC); reddish brown; moist; little GRAVEL.		3										M-20@1.5
					4										M-20@2.0
	2				5										M-20@3.0
	3		Bottom of Borehole at 3.0 ft.												
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				M-20
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-2-10	4-2-10		M-21
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	3.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); light yellowish brown; moist; trace GRAVEL.		1										M-21@0.5
					2										M-21@1.0
	1		CLAYEY SAND (SC); reddish brown; moist; little GRAVEL.		3										M-21@1.5
					4										M-21@2.0
	2				5										M-21@3.0
	3		Bottom of Borehole at 3.0 ft.												
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				M-21
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	7-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-2-10	4-2-10		M-22
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	3.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); light yellowish brown; moist; trace GRAVEL.		1										M-22@0.5
					2										M-22@1.0
	1		CLAYEY SAND (SC); reddish brown; moist; little GRAVEL.		3										M-22@1.5
					4										M-22@2.0
	2				5										M-22@3.0
	3		Bottom of Borehole at 3.0 ft.												
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				M-22
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-19-10	4-19-10		S-1
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
ECA, Inc.			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Continuous Push			Geoprobe 5410	2"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
sleeve			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING 4 ft; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING
Cement Grout				12.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		Fat CLAY (CH); reddish brown; wet; high plasticity fines.		1										S-1@.5
					2										S-1@1
	1				3										S-1@1.5
					4										S-1@2.0
	2				5										S-1@3.0
	3														
	4														
	5														
	6		Lean CLAY (CL); brown.												
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				S-1
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 2	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	10		Lean CLAY (CL) *(continued)*.												
	11														
	12		Bottom of Borehole at 12.0 ft.												
	13														
	14														
	15														
	16														
	17														
	18														
	19														
	20														
	21														
	22														

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REPORT TITLE				HOLE ID
BORING RECORD				**S-1**
DIST. **04**	COUNTY **Sonoma**	ROUTE	POSTMILE	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101 MSN Segment B4 Petaluma**				
BRIDGE NUMBER	PREPARED BY **M.Thummaluru**	DATE **7-17-10**	SHEET **2 of 2**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	3-19-10	3-19-10		S-2
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		Fat CLAY (CH); medium stiff; dark brown; moist.		1										S-2@0.5
					2										S-2@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				S-2
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	4-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	3-19-10	3-19-10		S-3
DRILLING CONTRACTOR: N/A			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION
DRILLING METHOD: N/A			DRILL RIG: Hand Auger	BOREHOLE DIAMETER: 4"
SAMPLER TYPE(S) AND SIZE(S) (ID): Jars			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: N/A			GROUNDWATER READINGS: DURING DRILLING N/A; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		Fat CLAY (CH); medium stiff; dark brown; moist; high plasticity fines.		1										S-3@0.5
					2										S-3@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				S-3
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 4-17-10	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	3-19-10	3-19-10		S-4
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); medium stiff; dark brown; moist; low plasticity fines.		1										S-4@0.5
					2										S-4@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				S-4
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	4-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	3-18-10	3-18-10		S-5
DRILLING CONTRACTOR: N/A			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION
DRILLING METHOD: N/A			DRILL RIG: Hand Auger	BOREHOLE DIAMETER: 4"
SAMPLER TYPE(S) AND SIZE(S) (ID): Jars			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: N/A			GROUNDWATER READINGS: DURING DRILLING N/A; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		Lean CLAY (CL); stiff; dark brown; moist.		1										S-5@0.5
					2										S-5@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				S-5
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	3-19-10	3-19-10		S-6
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		Lean CLAY (CL); stiff; dark brown; moist; medium plasticity fines.		1										S-6@0.5
					2										S-6@0.75
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				S-6
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	4-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	3-19-10	3-19-10		S-7
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		Lean to fat CLAY (CL/CH); medium stiff; dark brown; medium to high plasticity fines.		1										S-7@0.5
					2										S-7@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				S-7
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	4-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-15-10	4-15-10		S-10
DRILLING CONTRACTOR: ECA, Inc.			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION:
DRILLING METHOD: Continuous Push			DRILL RIG: Geoprobe 5410	BOREHOLE DIAMETER: 2"
SAMPLER TYPE(S) AND SIZE(S) (ID): sleeve			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: Cement Grout			GROUNDWATER READINGS: DURING DRILLING N/A; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SILTY SAND with GRAVEL (SM); loose; light yellowish brown; moist.		1										S-10@0.5
					2										S-10@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				S-10
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-15-10	4-15-10		S-11
DRILLING CONTRACTOR: ECA, Inc.			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION:
DRILLING METHOD: Continuous Push			DRILL RIG: Geoprobe 5410	BOREHOLE DIAMETER: 2"
SAMPLER TYPE(S) AND SIZE(S) (ID): sleeve			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: Cement Grout			GROUNDWATER READINGS: DURING DRILLING N/A; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SILTY SAND with GRAVEL (SM); loose; light yellowish brown; moist.		1										S-11@0.5
					2										S-11@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				S-11
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-15-10	4-15-10		S-12
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
ECA, Inc.			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Continuous Push			Geoprobe 5410	2"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
sleeve			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement Grout			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SILTY SAND (SM); loose; light yellowish brown; moist.		1										S-12@0.5
					2										S-12@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				S-12
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	7-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-15-10	4-15-10		S-13
DRILLING CONTRACTOR: ECA, Inc.			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION
DRILLING METHOD: Continuous Push			DRILL RIG: Geoprobe 5410	BOREHOLE DIAMETER: 2"
SAMPLER TYPE(S) AND SIZE(S) (ID): sleeve			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: Cement Grout			GROUNDWATER READINGS: DURING DRILLING N/A; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SILTY SAND with GRAVEL (SM); loose; light yellowish brown; moist.		1										S-13@0.5
					2										S-13@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				S-13
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	3-19-10	3-19-10		S-14
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	0.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); medium stiff; dark brown; moist.		1										S-14@0.5
			Bottom of Borehole at 0.5 ft.												Refusal at 0.5 ft
	1														
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				S-14
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	4-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	3-19-10	3-19-10		S-15
DRILLING CONTRACTOR: N/A			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION
DRILLING METHOD: N/A			DRILL RIG: Hand Auger	BOREHOLE DIAMETER: 4"
SAMPLER TYPE(S) AND SIZE(S) (ID): Jars			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: N/A			GROUNDWATER READINGS: DURING DRILLING N/A; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 3.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY (CL); dark brown; moist.		1										S-15@.5
					2										S-15@1.0
	1				3										S-15@1.5
			Fat CLAY (CH); dark brown; moist.		4										S-15@2.0
	2														
					5										S-15@3.0
	3		Bottom of Borehole at 3.0 ft.												
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				S-15
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 4-17-10	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	3-19-10	3-19-10		S-16
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
N/A			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
N/A			Hand Auger	4"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Jars			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
N/A			N/A	N/A	3.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY (CL); dark brown; moist.		1										S-16@.5
					2										S-16@1.0
	1				3										S-16@1.5
			Fat CLAY (CH); dark brown; moist.		4										S-16@2.0
	2														
					5										S-16@3.0
	3		Bottom of Borehole at 3.0 ft.												
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				S-16
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 4-17-10	SHEET 1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-15-10	4-15-10		S-8
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
ECA, Inc.			Offset L	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Continuous Push			Geoprobe 5410	2"
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
sleeve			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement Grout			N/A	N/A	1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY with GRAVEL (CL); medium stiff; yellowish brown; moist.		1										S-8@0.5
					2										S-8@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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REPORT TITLE				HOLE ID
BORING RECORD				S-8
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma			04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	7-17-10	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J.Ripple	4-15-10	4-15-10		S-9
DRILLING CONTRACTOR: ECA, Inc.			BOREHOLE LOCATION (Station, Offset, Line): Offset L	SURFACE ELEVATION:
DRILLING METHOD: Continuous Push			DRILL RIG: Geoprobe 5410	BOREHOLE DIAMETER: 2"
SAMPLER TYPE(S) AND SIZE(S) (ID): sleeve			SPT HAMMER TYPE: N/A	HAMMER EFFICIENCY, ERi: N/A
BOREHOLE BACKFILL AND COMPLETION: Cement Grout			GROUNDWATER READINGS: DURING DRILLING N/A; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 1.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SILTY SAND with GRAVEL (SM); loose; light yellowish brown; moist.		1										S-9@0.5
					2										S-9@1.0
	1		Bottom of Borehole at 1.0 ft.												
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														

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URS Corporation

100 W San Fernando St, Ste 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				S-9
DIST. 04	COUNTY Sonoma	ROUTE	POSTMILE	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101 MSN Segment B4 Petaluma				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 7-17-10	SHEET 1 of 1	

APPENDIX D

California Environmental Protection Agency
Department of Toxic Substances Control

VARIANCE

Applicant Names:

State of California
Department of Transportation
(Caltrans)
1120 N Street
Sacramento, California 95814

Variance No. V09HQSCD006

Effective Date: July 1, 2009

Expiration Date: July 1, 2014

Modification History:

Pursuant to California Health and Safety Code, Section 25143, the Department of Toxic Substances Control hereby issues the attached Variance consisting of 9 pages to the Department of Transportation.

Beverly Rikala
Team Leader, Operating Facilities Team
Department of Toxic Substances Control

Date:

1. INTRODUCTION.

a) Pursuant to Health and Safety Code, section 25143, the California Department of Toxic Substances Control (DTSC) grants this variance to the applicant below for waste considered to be hazardous solely because of its lead concentrations and as further specified herein.

b) DTSC hereby grants this variance only from the requirements specified herein and only in accordance with all terms and conditions specified herein.

2. IDENTIFYING INFORMATION.

APPLICANT/OWNER/OPERATOR

State of California
Department of Transportation, (Caltrans)
All Districts

3. TYPE OF VARIANCE.

Generation, Manifest, Transportation, Storage and Disposal.

4. ISSUANCE AND EXPIRATION DATES.

DATE ISSUED: July 1, 2009 EXPIRATION DATE: July 1, 2014

5. APPLICABLE STATUTES AND REGULATIONS. The hazardous waste that is the subject of this variance is fully regulated under Health and Safety Code, section 25100, et seq. and California Code of Regulations, title 22, division 4.5 except as specifically identified in Section 8 of this variance.

6. DEFINITION. For purposes of this variance, “lead-contaminated soil(s)” shall mean soil that meets the criteria for hazardous waste but contains less than 3397 mg/kg total lead and is hazardous primarily because of aerially-deposited lead contamination associated with exhaust emissions from the operation of motor vehicles.

7. FINDINGS/DETERMINATIONS. DTSC has determined that the variance applicant meets the requirements set forth in Health and Safety Code, section 25143 for a variance from specific regulatory requirements as outlined in Section 8 of this variance. The specific determinations and findings made by DTSC are as follows:

a) Caltrans intends to excavate, stockpile, transport, bury and cover large volumes of soil associated with highway construction projects. In the more urbanized highway corridors around the State this soil is contaminated with lead, primarily due to historic emissions from automobile exhausts. In situ sampling and laboratory testing has shown that some of the soil contains concentrations of lead in excess of State

regulatory thresholds, and thus any generated waste from disturbance of the soil would be regulated as hazardous waste. Such soil contains a Total Threshold Limit Concentration (TTLC) of 1000 milligrams per kilogram (mg/kg) or more lead and/or it meets or exceeds the Soluble Threshold Limit Concentration (STLC) for lead of 5 milligrams per liter (mg/l). A Human Health Risk Assessment prepared for this variance concludes that soil contaminated with elevated concentrations of lead can be managed in a way that presents no significant risk to human health.

b) The lead-contaminated soil will be placed only in Caltrans' right-of-way. Depending on concentration levels, the wastes will be covered with a minimum thickness of one (1) foot of non-hazardous soil or asphalt/concrete cover and will always be at least five (5) feet above the highest groundwater elevation. Caltrans will assure that proper health and safety procedures will be followed for workers, including any persons engaged in maintenance work in areas where the waste has been buried and covered.

c) DTSC finds and requires that the lead-contaminated soil excavated, stockpiled, transported, buried and covered pursuant to this variance is a non-RCRA hazardous waste, and that the waste management activity is insignificant as a potential hazard to human health and safety and the environment, when managed in accordance with the conditions, limitations and other requirements specified in this variance.

8. PROVISIONS WAIVED.

Provided Caltrans meets the terms and conditions of this variance, DTSC waives the hazardous waste management requirements of Health and Safety Code, Chapter 6.5 and California Code of Regulations, title 22 for the lead-contaminated soil that Caltrans reuses in projects that would require Caltrans to obtain a permit for a disposal facility and any other generator requirements that concern the transportation, manifesting, storage and land disposal of hazardous waste.

9. SPECIFIC CONDITIONS, LIMITATIONS AND OTHER REQUIREMENTS.

In order for the provisions discussed in section 8 to be waived, lead-contaminated soil must not exceed the contaminant concentrations discussed below and Caltrans management practices must meet all the following conditions:

a) Caltrans implementation of this variance shall comply with all applicable state laws and regulations for water quality control, water quality control plans, waste discharge requirements (including storm water permits), and others issued by the State Water Resources Control Board (SWRCB) and/or a California Regional Water Quality Control Board (RWQCB). Caltrans shall provide written notification to the appropriate RWQCB at least 30 days prior to advertisement for bids of projects that involve invocation of this variance, or as otherwise negotiated with the SWRCB or appropriate RWQCB.

b) The waivers in this variance shall only be applied to lead-contaminated soil that is

not a RCRA hazardous waste and is hazardous primarily because of aerially-deposited lead contamination associated with exhaust emissions from the operation of motor vehicles. The variance is not applicable to any other hazardous waste.

c) Soil containing 1.5 mg/l extractable lead or less (based on a modified waste extraction test using deionized water as the extractant) and 1411 mg/kg or less total lead may be used as fill provided that the lead-contaminated soil is placed a minimum of five (5) feet above the maximum historic water table elevation and covered with at least one (1) foot of nonhazardous soil that will be maintained by Caltrans to prevent future erosion.

d) Soil containing 150 mg/L extractable lead or less (based on a modified waste extraction test using deionized water as the extractant) and 3397 mg/kg or less total lead may be used as fill provided that the lead-contaminated soils are placed a minimum of five (5) feet above the maximum historic water table elevation and protected from infiltration by a pavement structure which will be maintained by Caltrans.

e) Lead-contaminated soil with a pH less than 5.5 but greater than 5.0 shall only be used as fill material under the paved portion of the roadway. Lead-contaminated soil with a pH at or less than 5.0 shall be managed as a hazardous waste.

f) For each project that has the potential to generate waste by disturbing lead-contaminated soil (as defined in 6), Caltrans shall conduct sampling and analysis to adequately characterize the soils containing aerially deposited lead in the areas of planned excavation along the project route. Such sampling and analysis shall include the Toxicity Characteristic Leaching Procedure (TCLP) as prescribed by the United States Environmental Protection Agency to determine whether concentrations of contaminants in soil exceed federal criteria for classification as a hazardous waste.

g) Lead-contaminated soil managed pursuant to this variance shall not be moved outside the designated corridor boundaries (see paragraph t) below. All lead-contaminated soil not buried and covered within the same Caltrans corridor where it originated is not eligible for management under this variance and shall be managed as a hazardous waste.

h) Lead-contaminated soil managed pursuant to this variance shall not be placed in areas where it would become in contact with groundwater or surface water (such as streams and rivers).

i) Lead-contaminated soil managed pursuant to this variance shall be buried and covered only in locations that are protected from erosion that may result from storm water run-on and run-off.

j) The lead-contaminated soil shall be buried and covered in a manner that will prevent accidental or deliberate breach of the asphalt, concrete, and/or cover soil.

k) The presence of lead-contaminated soil shall be incorporated into the projects' as-built drawings. The as-built drawings shall be annotated with the location, representative analytical data, and volume of lead-contaminated soil. The as-built drawings shall also state the depth of the cover. These as-built drawings shall be retained by Caltrans.

l) Caltrans shall ensure that no other hazardous wastes, other than the lead-contaminated hazardous waste soil, are placed in the burial areas.

m) Lead-contaminated soil shall not be buried within ten (10) feet of culverts or locations subject to frequent worker exposure.

n) Excavated lead-contaminated soil not placed into the designated area (fill area, roadbed area) by the end of the working day shall be stockpiled and covered with sheets of polyethylene or at least one foot of non-hazardous soil. The lead-contaminated soil, while stockpiled or under transport, shall be protected from contacting surface water and from being dislodged or transported by wind or storm water. The stockpile covers shall be inspected at least once a week and within 24 hours after rainstorms. If the lead-contaminated soil is stockpiled for more than 4 days from the time of excavation, Caltrans shall restrict public access to the stockpile by using barriers that meet the safety requirements of the construction zone. The lead-contaminated soil shall be stockpiled for no more than 90 days from the time the soil is first excavated. If the contaminated soil is stockpiled beyond the 90 day limit Caltrans shall:

1. notify DTSC in writing of the 90 day exceedance and expected date of removal;
2. perform weekly inspections of the stockpiled material to ensure that there is adequate protection from run-on, runoff, public access, and wind dispersion; and
3. notify DTSC on weekly basis of the stockpile status until the stockpile is removed.

The lead-contaminated soil shall be stockpiled for no more than 180 days from the time the soil is first excavated.

o) Caltrans shall ensure that all stockpiling of lead-contaminated soil remains within the project area of the specified corridor. Stockpiling of lead-contaminated soil within the specified corridor, but outside the project area, is prohibited.

p) Caltrans shall conduct confirmatory sampling of any stockpile area in areas not known or expected to contain lead-contaminated soil after removal of the lead-contaminated soil to ensure that contamination has not been left behind or has not migrated from the stockpiled material to the surrounding soils.

q) Caltrans shall stockpile lead-contaminated soil only on high ground (i.e. no sump

areas or low points) so that stockpiled soil will not come in contact with surface water run-on or run-off.

r) Caltrans shall not stockpile lead-contaminated soil in environmentally and ecologically sensitive areas.

s) Caltrans shall ensure that storm/rain run-off that has come into contact with stockpiled lead-contaminated soil will not flow to storm drains, inlets, or waters of the State.

t) Caltrans may dispose of the lead-contaminated soil only within the operating right-of-way of an existing highway, as defined in Streets and Highways Code, section 23. Caltrans may move lead-contaminated soil from one Caltrans project to another Caltrans project only if the lead-contaminated soil remains within the same designated corridor.

Caltrans shall record any movement of lead-contaminated soil by using a bill of lading. The bill of lading must contain: 1) the US DOT description including shipping name, hazard class and ID number; 2) handling codes; 3) quantity of material; 4) volume of material; 5) date of shipment; 6) origin and destination of shipment; and 7) any specific handling instructions. The bill of lading shall be referenced in and kept on file with the project's as-built drawings. The lead-contaminated soil must be kept covered during transportation.

u) For each specific corridor where this variance is to be implemented, all of the following information shall be submitted in writing to DTSC at least five (5) days before construction of any project begins:

1. plan drawing designating the boundaries of the corridor where lead-contaminated soils will be excavated, stockpiled, buried and covered;

2. a list of the Caltrans projects that the corridor encompasses;

3. a list of Caltrans contractors that will be conducting any phase of work on any project affected by this variance;

4. duration of corridor construction;

5. location where sampling and analytical data used to make lead concentration level determinations are kept (e.g. a particular Caltrans project file);

6. name and phone number (including area code) of project resident engineer and project manager;

7. location where Caltrans and contractor health and safety plan and records are kept;

8. location of project special provisions (including page or section number) for soil excavation, transportation, stockpile, burial and placement of cover material;

9. location of project drawings (including drawing page number) for soil excavation, burial and placement of cover in plan and cross section (for example, "The project plans are located at the resident engineer's office located at 5th and Main Streets, City of Fresno, See pages xxxxx of contract xxxx");

10. updated information if a Caltrans project within the corridor is added, changed or deleted; and

11. type of environmental document prepared for each project, date of adoption, document title, Clearing House number and where the document is available for review. A copy of the Caltrans Categorical Exemption, Categorical Exclusion Form, or if filed, the Notice of Exemption for any project shall be submitted to the DTSC Headquarters Project Manager.

v) Changes in location of lead-contaminated soil placement, quantities or protection measures (field changes) shall be noted in the resident engineer's project log within five (5) days of the field change.

w) Caltrans shall ensure that field changes are in compliance with the requirements of this variance.

x) Operational procedures described in the California Environmental Quality Act (CEQA) Special Initial Study shall be followed by Caltrans for activities conducted under this variance.

y) Caltrans shall implement appropriate health and safety procedures to protect its employees and the public, and to prevent or minimize exposure to potentially hazardous wastes. A project-specific health and safety plan must be prepared and implemented. The monitoring and exposure standards shall be based on construction standards for exposure to lead in California Code of Regulations, title 8, section 1532.1.

z) Caltrans shall provide a district Coordinator for this variance. This Coordinator will be the primary point of contact for information flowing to, or received from, DTSC regarding any matter or submission under this variance. Caltrans shall promptly notify DTSC of the name of Coordinator and any change in the Coordinator.

aa) Caltrans shall conduct regular inspections, consistent with Caltrans' Maintenance Division's current Pavement Inspection and Slope Inspection programs, of the locations where lead-contaminated soil has been buried and/or covered pursuant to this variance. If site inspection reveals deterioration of cover so

that conditions in the variance are not met, Caltrans shall repair or replace the cover.

bb) Caltrans shall develop and implement a record keeping mechanisms to record and retain permanent records of all locations where lead-contaminated soil has been buried per this variance. The records shall be made available to DTSC.

cc) If areas subject to the terms of this variance are sold, relinquished or abandoned (including roadways), all future property owners shall be notified in writing in advance by Caltrans of the requirements of this variance, and Caltrans shall provide the owner with a copy of the variance. A copy of such a notice shall be sent to DTSC and contain the corridor location and project. Caltrans shall also disclose to DTSC and the new owner the location of areas where lead-contaminated soil has been buried. Future property owners shall be subject to the same requirements as Caltrans.

dd) For the purposes of informing the public about instances where the variance is implemented, Caltrans shall:

1. maintain current fact sheets at all Caltrans resident engineer offices and the Caltrans District office. Caltrans shall make the fact sheets available to anyone expressing an interest in variance-related work.

2. maintain a binder(s) containing copies of all reports submitted to DTSC at the District office. Caltrans shall ensure that the binders are readily accessible to the public.

3. carry out the following actions when it identifies additional projects:

(A) notify the public via a display advertisement in a newspaper of general circulation in that area.

(B) update and distribute the fact sheet to the mailing list and repository locations.

ee) Lead-contaminated soil may be buried only in areas where access is limited or where lead-contaminated soil is covered and contained by a pavement structure.

ff) Dust containing lead-contaminated soil must be controlled. Water or dust palliative may be applied to control dust. If visible dust migration occurs, all excavation, stockpiling and truck loading and burying must be stopped. The granting of this variance confers no relief on Caltrans from compliance with the laws, regulations and requirements enforced by any local air district or the California Air Resources Board.

gg) Sampling and analysis is required to show the lead-contaminated soil meets the variance criteria. All sampling and analysis must be conducted in

accordance with the appropriate methods specified in U.S. EPA SW-846.

hh) DTSC retains the right to require Caltrans or any future owner to remove, and properly dispose of, lead-contaminated soil in the event DTSC determines it is necessary for protection of public health, safety or the environment.

ii) DTSC finds that some projects involving lead-contaminated soil are joint projects between Caltrans and other government entities. In these joint projects, Caltrans may not be the lead agency implementing the project although Caltrans is still involved if the project occurs on its right-of-way.

Caltrans may invoke this variance for joint projects where Caltrans and local government entity are involved provided that 1) the project is within the Caltrans Right-of-Way; 2) Caltrans reviews/ oversees all phases of the project including design, contracting, environmental assessment, construction, operation, and maintenance; and 3) Caltrans oversees the project to verify all variance conditions are complied with. Caltrans will be fully responsible for the variance notification and implementation in these joint projects.

jj) All correspondence shall be directed to the following office:

Hazardous Waste Permitting
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, CA 95826

Attn: Caltrans Lead Variance Notification Unit

10. DISCLAIMER.

a) The issuance of this variance does not relieve Caltrans of the responsibility for compliance with Health and Safety Code, chapter 6.5, or the regulations adopted thereunder, and any other laws and regulations other than those specifically identified in Section 8 of this variance. Caltrans is subject to all terms and conditions herein. The granting of this variance confers no relief from compliance with any federal, State or local requirements other than those specifically provided herein.

b) The issuance of this variance does not release Caltrans from any liability associated with the handling of hazardous waste, except as specifically provided herein and subject to all terms and conditions of this variance.

11. VARIANCE MODIFICATION OR REVOCATION. This variance is subject to review at the discretion of DTSC and may be modified or revoked by DTSC upon change of ownership and at any other time pursuant to Health and Safety Code, section 25143.

12. CEQA DETERMINATION. DTSC adopted a Negative Declaration on June 30, 2009.

Approved:

_____	_____
Date	Beverly Rikala Operating Facilities Team Department of Toxic Substances Control

APPENDIX E

URS (San Jose)
100 W San Fernando St, Suite200
San Jose, California 95113
Tel: 4082979585
Fax: 4082976962

RE: Petaluma,CA

Work Order No.: 1005065

Dear James Ripple:

Torrent Laboratory, Inc. received 7 sample(s) on May 11, 2010 for the analyses presented in the following Report.

All data for associated QC met EPA or laboratory specification(s) except where noted in the case narrative.

Torrent Laboratory, Inc. is certified by the State of California, ELAP #1991. If you have any questions regarding these test results, please feel free to contact the Project Management Team at (408)263-5258; ext 204.

Patti Sandrock

May 18, 2010
Date

Date: 5/18/2010

Client: URS (San Jose)

Project: Petaluma,CA

Work Order: 1005065

CASE NARRATIVE

No issues encountered with the receiving, preparation, analysis or reporting of the results associated with this work order.

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 05/11/10
Date Reported: 05/18/10

S-1GW 1005065-007

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit

All compounds were non-detectable for this sample.

483 Sinclair Frontage Rd., Milpitas, CA 95035 | tel: 408.263.5258 | fax: 408.263.8293 | www.torrentlab.com

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 05/11/10
Date Reported: 05/18/10

Client Sample ID:	S-1GW	**Lab Sample ID:**	1005065-007A
Project Name/Location:	Petaluma,CA	**Sample Matrix:**	Groundwater
Project Number:			
Date/Time Sampled:	05/11/10 / 10:58		
Tag Number:	Petaluma,CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Dichlorodifluoromethane	SW8260B	NA	05/17/10	1.22	0.50	0.61	ND		ug/L	400918	NA
Chloromethane	SW8260B	NA	05/17/10	1.22	0.50	0.61	ND		ug/L	400918	NA
Vinyl Chloride	SW8260B	NA	05/17/10	1.22	0.45	0.61	ND		ug/L	400918	NA
Bromomethane	SW8260B	NA	05/17/10	1.22	0.46	0.61	ND		ug/L	400918	NA
Trichlorofluoromethane	SW8260B	NA	05/17/10	1.22	0.42	0.61	ND		ug/L	400918	NA
1,1-Dichloroethene	SW8260B	NA	05/17/10	1.22	0.35	0.61	ND		ug/L	400918	NA
Freon 113	SW8260B	NA	05/17/10	1.22	0.46	0.61	ND		ug/L	400918	NA
Methylene Chloride	SW8260B	NA	05/17/10	1.22	0.21	6.1	ND		ug/L	400918	NA
trans-1,2-Dichloroethene	SW8260B	NA	05/17/10	1.22	0.38	0.61	ND		ug/L	400918	NA
MTBE	SW8260B	NA	05/17/10	1.22	0.46	0.61	ND		ug/L	400918	NA
tert-Butanol	SW8260B	NA	05/17/10	1.22	1.8	6.1	ND		ug/L	400918	NA
Diisopropyl ether (DIPE)	SW8260B	NA	05/17/10	1.22	0.44	0.61	ND		ug/L	400918	NA
1,1-Dichloroethane	SW8260B	NA	05/17/10	1.22	0.34	0.61	ND		ug/L	400918	NA
ETBE	SW8260B	NA	05/17/10	1.22	0.48	0.61	ND		ug/L	400918	NA
cis-1,2-Dichloroethene	SW8260B	NA	05/17/10	1.22	0.40	0.61	ND		ug/L	400918	NA
2,2-Dichloropropane	SW8260B	NA	05/17/10	1.22	0.46	0.61	ND		ug/L	400918	NA
Bromochloromethane	SW8260B	NA	05/17/10	1.22	0.42	0.61	ND		ug/L	400918	NA
Chloroform	SW8260B	NA	05/17/10	1.22	0.36	0.61	ND		ug/L	400918	NA
Carbon Tetrachloride	SW8260B	NA	05/17/10	1.22	0.32	0.61	ND		ug/L	400918	NA
1,1,1-Trichloroethane	SW8260B	NA	05/17/10	1.22	0.39	0.61	ND		ug/L	400918	NA
1,1-Dichloropropene	SW8260B	NA	05/17/10	1.22	0.48	0.61	ND		ug/L	400918	NA
Benzene	SW8260B	NA	05/17/10	1.22	0.41	0.61	ND		ug/L	400918	NA
TAME	SW8260B	NA	05/17/10	1.22	0.39	0.61	ND		ug/L	400918	NA
1,2-Dichloroethane	SW8260B	NA	05/17/10	1.22	0.34	0.61	ND		ug/L	400918	NA
Trichloroethylene	SW8260B	NA	05/17/10	1.22	0.46	0.61	ND		ug/L	400918	NA
Dibromomethane	SW8260B	NA	05/17/10	1.22	0.26	0.61	ND		ug/L	400918	NA
1,2-Dichloropropane	SW8260B	NA	05/17/10	1.22	0.45	0.61	ND		ug/L	400918	NA
Bromodichloromethane	SW8260B	NA	05/17/10	1.22	0.28	0.61	ND		ug/L	400918	NA
2-Chloroethyl vinyl ether	SW8260B	NA	05/17/10	1.22	1.1	2.4	ND		ug/L	400918	NA
cis-1,3-Dichloropropene	SW8260B	NA	05/17/10	1.22	0.37	0.61	ND		ug/L	400918	NA
Toluene	SW8260B	NA	05/17/10	1.22	0.23	0.61	ND		ug/L	400918	NA
Tetrachloroethylene	SW8260B	NA	05/17/10	1.22	0.18	0.61	ND		ug/L	400918	NA
trans-1,3-Dichloropropene	SW8260B	NA	05/17/10	1.22	0.25	0.61	ND		ug/L	400918	NA
1,1,2-Trichloroethane	SW8260B	NA	05/17/10	1.22	0.25	0.61	ND		ug/L	400918	NA
Dibromochloromethane	SW8260B	NA	05/17/10	1.22	0.26	0.61	ND		ug/L	400918	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 05/11/10
Date Reported: 05/18/10

Client Sample ID:	S-1GW	**Lab Sample ID:**	1005065-007A
Project Name/Location:	Petaluma,CA	**Sample Matrix:**	Groundwater
Project Number:			
Date/Time Sampled:	05/11/10 / 10:58		
Tag Number:	Petaluma,CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
1,3-Dichloropropane	SW8260B	NA	05/17/10	1.22	0.22	0.61	ND		ug/L	400918	NA
1,2-Dibromoethane	SW8260B	NA	05/17/10	1.22	0.24	0.61	ND		ug/L	400918	NA
Chlorobenzene	SW8260B	NA	05/17/10	1.22	0.17	0.61	ND		ug/L	400918	NA
Ethyl Benzene	SW8260B	NA	05/17/10	1.22	0.19	0.61	ND		ug/L	400918	NA
1,1,1,2-Tetrachloroethane	SW8260B	NA	05/17/10	1.22	0.12	0.61	ND		ug/L	400918	NA
m,p-Xylene	SW8260B	NA	05/17/10	1.22	0.24	1.2	ND		ug/L	400918	NA
o-Xylene	SW8260B	NA	05/17/10	1.22	0.16	0.61	ND		ug/L	400918	NA
Styrene	SW8260B	NA	05/17/10	1.22	0.24	0.61	ND		ug/L	400918	NA
Bromoform	SW8260B	NA	05/17/10	1.22	0.55	1.2	ND		ug/L	400918	NA
Isopropyl Benzene	SW8260B	NA	05/17/10	1.22	0.34	0.61	ND		ug/L	400918	NA
Bromobenzene	SW8260B	NA	05/17/10	1.22	0.48	0.61	ND		ug/L	400918	NA
1,1,2,2-Tetrachloroethane	SW8260B	NA	05/17/10	1.22	0.31	0.61	ND		ug/L	400918	NA
n-Propylbenzene	SW8260B	NA	05/17/10	1.22	0.36	0.61	ND		ug/L	400918	NA
2-Chlorotoluene	SW8260B	NA	05/17/10	1.22	0.40	0.61	ND		ug/L	400918	NA
1,3,5-Trimethylbenzene	SW8260B	NA	05/17/10	1.22	0.24	0.61	ND		ug/L	400918	NA
4-Chlorotoluene	SW8260B	NA	05/17/10	1.22	0.40	0.61	ND		ug/L	400918	NA
tert-Butylbenzene	SW8260B	NA	05/17/10	1.22	0.35	0.61	ND		ug/L	400918	NA
1,2,3-Trichloropropane	SW8260B	NA	05/17/10	1.22	0.72	1.2	ND		ug/L	400918	NA
1,2,4-Trimethylbenzene	SW8260B	NA	05/17/10	1.22	0.40	0.61	ND		ug/L	400918	NA
sec-Butyl Benzene	SW8260B	NA	05/17/10	1.22	0.30	0.61	ND		ug/L	400918	NA
p-Isopropyltoluene	SW8260B	NA	05/17/10	1.22	0.30	0.61	ND		ug/L	400918	NA
1,3-Dichlorobenzene	SW8260B	NA	05/17/10	1.22	0.38	0.61	ND		ug/L	400918	NA
1,4-Dichlorobenzene	SW8260B	NA	05/17/10	1.22	0.45	0.61	ND		ug/L	400918	NA
n-Butylbenzene	SW8260B	NA	05/17/10	1.22	0.39	0.61	ND		ug/L	400918	NA
1,2-Dichlorobenzene	SW8260B	NA	05/17/10	1.22	0.48	0.61	ND		ug/L	400918	NA
1,2-Dibromo-3-Chloropropane	SW8260B	NA	05/17/10	1.22	0.55	1.2	ND		ug/L	400918	NA
Hexachlorobutadiene	SW8260B	NA	05/17/10	1.22	0.27	0.61	ND		ug/L	400918	NA
1,2,4-Trichlorobenzene	SW8260B	NA	05/17/10	1.22	0.59	1.2	ND		ug/L	400918	NA
Naphthalene	SW8260B	NA	05/17/10	1.22	0.70	1.2	ND		ug/L	400918	NA
1,2,3-Trichlorobenzene	SW8260B	NA	05/17/10	1.22	0.64	1.2	ND		ug/L	400918	NA
(S) Dibromofluoromethane	SW8260B	NA	05/17/10	1.22	61.2	131	113		%	400918	NA
(S) Toluene-d8	SW8260B	NA	05/17/10	1.22	75.1	127	118		%	400918	NA
(S) 4-Bromofluorobenzene	SW8260B	NA	05/17/10	1.22	64.1	120	108		%	400918	NA

NOTE: Reporting limit raised due to sediment in all voas.

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 05/11/10
Date Reported: 05/18/10

Client Sample ID:	S-1GW	**Lab Sample ID:**	1005065-007A
Project Name/Location:	Petaluma,CA	**Sample Matrix:**	Groundwater
Project Number:			
Date/Time Sampled:	05/11/10 / 10:58		
Tag Number:	Petaluma,CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH(Gasoline)	8260TPH	NA	05/18/10	1.25	27	63	ND		ug/L	400919	NA
(S) 4-Bromofluorobenzene	8260TPH	NA	05/18/10	1.25	58.4	133	81.2		%	400919	NA

NOTE: Reporting limit raised due to sediment in all voas.

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH as Diesel	SW8015B(M)	5/17/10	05/17/10	1	0.0727	0.18	ND		mg/L	400913	0440
TPH as Motor Oil	SW8015B(M)	5/17/10	05/17/10	1	0.164	0.36	ND		mg/L	400913	0440
Pentacosane (S)	SW8015B(M)	5/17/10	05/17/10	1	64.2	123	94.3		%	400913	0440

NOTE: Note: Reporting limits are incresed due to limited sample available (sediment present).

MB Summary Report

Work Order:	1005065	**Prep Method:**	3510_TPH	**Prep Date:**	05/17/10	**Prep Batch:**	0440
Matrix:	Water	**Analytical Method:**	SW8015B	**Analyzed Date:**	05/17/10	**Analytical Batch:**	400913
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.
DRO	0.0287	0.10	ND
TPH as Bunker Oil	0.0920	0.20	ND
TPH as Cutting Oil	0.0920	0.20	ND
TPH as Diesel	0.0287	0.10	ND
TPH as Heating Oil	0.0920	0.20	ND
TPH as Hydraulic Oil	0.0920	0.20	ND
TPH as Jet A	0.0287	0.10	ND
TPH as Jet Fuel	0.0287	0.10	ND
TPH as JP-4	0.0287	0.10	ND
TPH as JP-5	0.0287	0.10	ND
TPH as JP-7	0.0287	0.10	ND
TPH as JP-8	0.0287	0.10	ND
TPH as Kerosene	0.0287	0.10	ND
TPH as Mineral Oil	0.0287	0.10	ND
TPH as Motor Oil	0.0920	0.20	0.16
TPH as Naphtha	0.0287	0.10	ND
TPH as Oil	0.0920	0.20	ND
TPH as Stoddard	0.0287	0.10	ND
TPH as Transformer Oil	0.0920	0.20	ND
Pentacosane (S)			107

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MB Summary Report

Work Order:	1005065	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	05/17/10	**Analytical Batch:**	400918
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.
Dichlorodifluoromethane	0.41	0.50	ND
Chloromethane	0.41	0.50	ND
Vinyl Chloride	0.37	0.50	ND
Bromomethane	0.37	0.50	ND
Trichlorofluoromethane	0.34	0.50	ND
1,1-Dichloroethene	0.29	0.50	ND
Freon 113	0.38	0.50	ND
Methylene Chloride	0.18	5.0	ND
trans-1,2-Dichloroethene	0.31	0.50	ND
MTBE	0.38	0.50	ND
tert-Butanol	1.5	5.0	ND
Diisopropyl ether (DIPE)	0.36	0.50	ND
1,1-Dichloroethane	0.28	0.50	ND
ETBE	0.40	0.50	ND
cis-1,2-Dichloroethene	0.33	0.50	ND
2,2-Dichloropropane	0.37	0.50	ND
Bromochloromethane	0.34	0.50	ND
Chloroform	0.29	0.50	ND
Carbon Tetrachloride	0.26	0.50	ND
1,1,1-Trichloroethane	0.32	0.50	ND
1,1-Dichloropropene	0.40	0.50	ND
Benzene	0.33	0.50	ND
TAME	0.32	0.50	ND
1,2-Dichloroethane	0.28	0.50	ND
Trichloroethylene	0.38	0.50	ND
Dibromomethane	0.21	0.50	ND
1,2-Dichloropropane	0.37	0.50	ND
Bromodichloromethane	0.23	0.50	ND
2-Chloroethyl vinyl ether	0.91	2.0	ND
cis-1,3-Dichloropropene	0.30	0.50	ND
Toluene	0.19	0.50	ND
Tetrachloroethylene	0.15	0.50	ND
trans-1,3-Dichloropropene	0.20	0.50	ND
1,1,2-Trichloroethane	0.20	0.50	ND
Dibromochloromethane	0.21	0.50	ND
1,3-Dichloropropane	0.18	0.50	ND
1,2-Dibromoethane	0.19	0.50	ND
Chlorobenzene	0.14	0.50	ND
Ethyl Benzene	0.15	0.50	ND
1,1,1,2-Tetrachloroethane	0.10	0.50	ND
m,p-Xylene	0.20	1.0	ND

MB Summary Report

Work Order:	1005065	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	05/17/10	**Analytical Batch:**	400918
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.
o-Xylene	0.13	0.50	ND
Styrene	0.20	0.50	ND
Bromoform	0.45	1.0	ND
Isopropyl Benzene	0.28	0.50	ND
Bromobenzene	0.39	0.50	ND
1,1,2,2-Tetrachloroethane	0.26	0.50	ND
n-Propylbenzene	0.30	0.50	ND
2-Chlorotoluene	0.33	0.50	ND
1,3,5-Trimethylbenzene	0.20	0.50	ND
4-Chlorotoluene	0.32	0.50	ND
tert-Butylbenzene	0.29	0.50	ND
1,2,3-Trichloropropane	0.59	1.0	ND
1,2,4-Trimethylbenzene	0.33	0.50	ND
sec-Butyl Benzene	0.24	0.50	ND
p-Isopropyltoluene	0.25	0.50	ND
1,3-Dichlorobenzene	0.31	0.50	ND
1,4-Dichlorobenzene	0.37	0.50	ND
n-Butylbenzene	0.32	0.50	ND
1,2-Dichlorobenzene	0.39	0.50	ND
1,2-Dibromo-3-Chloropropane	0.45	1.0	ND
Hexachlorobutadiene	0.22	0.50	ND
1,2,4-Trichlorobenzene	0.48	1.0	ND
Naphthalene	0.57	1.0	0.80
1,2,3-Trichlorobenzene	0.52	1.0	ND
(S) Dibromofluoromethane			96.7
(S) Toluene-d8			103
(S) 4-Bromofluorobenzene			110

Work Order:	1005065	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Water	**Analytical Method:**	8260TPH	**Analyzed Date:**	05/18/10	**Analytical Batch:**	400919
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.
TPH(Gasoline)	22	50	ND
(S) 4-Bromofluorobenzene			116

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1005065	**Prep Method:**	3510_TPH	**Prep Date:**	05/17/10	**Prep Batch:**	0440
Matrix:	Water	**Analytical Method:**	SW8015B	**Analyzed Date:**	05/17/10	**Analytical Batch:**	400913
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
TPH as Diesel	0.0287	0.1		1	76.5965	0.989	25.4	46.2 - 109	30	
Pentacosane (S)				100	98.669	104		53.3 - 124		

Work Order:	1005065	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	05/17/10	**Analytical Batch:**	400918
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
1,1-Dichloroethene	0.29	0.50		17.04	105	18.4	2.86	61.4 - 129	30	
Benzene	0.33	0.50		17.04	121	18.9	8.55	66.9 - 140	30	
Trichloroethylene	0.38	0.50		17.04	83.0	16.5	15.4	69.3 - 144	30	
Toluene	0.19	0.50		17.04	98.2	17.7	5.98	76.6 - 123	30	
Chlorobenzene	0.14	0.50		17.04	104	18.6	4.23	73.9 - 137	30	
(S) Dibromofluoromethane				11.36	105	93.0		61.2 - 131		
(S) Toluene-d8				11.36	103	105		75.1 - 127		
(S) 4-Bromofluorobenzene				11.36	98.6	110		64.1 - 120		

Work Order:	1005065	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Water	**Analytical Method:**	8260TPH	**Analyzed Date:**	05/18/10	**Analytical Batch:**	400919
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
TPH(Gasoline)	22	50		227.27	94.6	193	10.9	52.4 - 127		
(S) 4-Bromofluorobenzene				11.36	94.4	86.7		58.4 - 133		

Laboratory Qualifiers and Definitions

DEFINITIONS:

Accuracy/Bias (% Recovery) - The closeness of agreement between an observed value and an accepted reference value.
Blank (Method/Preparation Blank) -MB/PB - An analyte-free matrix to which all reagents are added in the same volumes/proportions as used in sample processing. The method blank is used to document contamination resulting from the analytical process.
Duplicate - a field sample and/or laboratory QC sample prepared in duplicate following all of the same processes and procedures used on the original sample (sample duplicate, LCSD, MSD)
Laboratory Control Sample (LCS ad LCSD) - A known matrix spiked with compounds representative of the target analyte(s). This is used to document laboratory performance.
Matrix - the component or substrate that contains the analyte of interest (e.g., - groundwater, sediment, soil, waste water, etc)
Matrix Spike (MS/MSD) - Client sample spiked with identical concentrations of target analyte (s). The spiking occurs prior to the sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.
Method Detection Limit (MDL) - the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero
Practical Quantitation Limit (PQL) - a laboratory determined value at 2 to 5 times above the MDL that can be reproduced in a manner that results in a 99% confidence level that the result is both accurate and precise. PQLs reflect all preparation factors and/or dilution factors that have been applied to the sample during the preparation and/or analytical processes.
Precision (%RPD) - The agreement among a set of replicate/duplicate measurements without regard to known value of the replicates
Surrogate (S) or (Surr) - An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are used in most organic analysis to demonstrate matrix compatibility with the chosen method of analysis
Tentatively Identified Compound (TIC) - A compound not contained within the analytical calibration standards but present in the GCMS library of defined compounds. When the library is searched for an unknown compound, it can frequently give a tentative identification to the compound based on retention time and primary and secondary ion match. TICs are reported as estimates and are candidates for further investigation.
Units: the unit of measure used to express the reported result - **mg/L** and ***mg/Kg*** (equivalent to PPM - parts per million in **liquid** and ***solid***), **ug/L** and ***ug/Kg*** (equivalent to PPB - parts per billion in **liquid** and ***solid***), **ug/m3**, ***mg.m3***, **ppbv** and ***ppmv*** (all units of measure for reporting concentrations in air), **%** (equivalent to 10000 ppm or 1,000,000 ppb), **ug/Wipe** (concentration found on the surface of a single Wipe usually taken over a 100cm2 surface)

LABORATORY QUALIFIERS:

B - Indicates when the anlayte is found in the associated method or preparation blank
D - Surrogate is not recoverable due to the necessary dilution of the sample
E - Indicates the reportable value is outside of the calibration range of the instrument but within the linear range of the instrument (unless otherwise noted) Values reported with an E qualifier should be considered as estimated.
H- Indicates that the recommended holding time for the analyte or compound has been exceeded
J- Indicates a value between the method MDL and PQL and that the reported concentration should be considered as estimated rather the quantitative
NA - Not Analyzed
N/A - Not Applicable
NR - Not recoverable - a matrix spike concentration is not recoverable due to a concentration within the original sample that is greater than four times the spike concentration added
R- The % RPD between a duplicate set of samples is outside of the absolute values established by laboratory control charts
S- Spike recovery is outside of established method and/or laboratory control limits. Further explanation of the use of this qualifier should be included within a case narrative
X -Used to indicate that a value based on pattern identification is within the pattern range but not typical of the pattern found in standards. Further explanation may or may not be provided within the sample footnote and/or the case narrative.

Sample Receipt Checklist

Client Name: URS (San Jose)

Project Name: Petaluma,CA

Work Order No.: 1005065

Date and Time Received: 5/11/2010 17:20

Received By: nutan

Physically Logged By:

Checklist Completed By: lorna

Carrier Name: Hi-Speed Courier

Chain of Custody (COC) Information

Chain of custody present?	Yes
Chain of custody signed when relinquished and received?	Yes
Chain of custody agrees with sample labels?	Yes
Custody seals intact on sample bottles?	Not Present

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Not Present
Shipping Container/Cooler In Good Condition?	Yes
Samples in proper container/bottle?	Yes
Samples containers intact?	Yes
Sufficient sample volume for indicated test?	Yes

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes			
Container/Temp Blank temperature in compliance?	Yes	Temperature:	3	°C
Water-VOA vials have zero headspace?	Yes			
Water-pH acceptable upon receipt?				

pH Checked by: pH Adjusted by:

Login Summary Report

Client ID: TL5174 URS (San Jose)

Project Name: Petaluma,CA

Project # :

Report Due Date: 5/18/2010

QC Level:

TAT Requested: 5+ day:0

Date Received: 5/11/2010

Time Received: 17:20

Comments:

Work Order # : ***1005065***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1005065-001A	M-10 @6.0	05/11/10 8:05	Soil	11/07/10	On-Hold		S_TPHDO	
1005065-002A	M-10 @9.0	05/11/10 8:12	Soil	11/07/10	On-Hold		S_TPHDO	
1005065-003A	M-10 @12.0	05/11/10 8:22	Soil	11/07/10	On-Hold		S_TPHDO	
1005065-004A	S-1 @6.0	05/11/10 9:48	Soil	11/07/10	On-Hold		S_TPHDO	
1005065-005A	S-1 @9.0	05/11/10 10:01	Soil	11/07/10	On-Hold		S_TPHDO	
1005065-006A	S-1 @8.5	05/11/10 10:01	Soil	11/07/10	On-Hold		S_TPHDO	
1005065-007A	S-1GW	05/11/10 10:58	Water	11/07/10			W_GCMS-GRO W_8260Full W_TPHDO	
1005065-007A1.2 2x	S-1GW	05/11/10 10:58	Water	11/07/10			W_8260Full	

Torrent LABORATORY, INC.

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RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1005065

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: [x] 10 Work Days [ ] 3 Work Days [ ] Noon - Nxt Day [ ] 7 Work Days [ ] 2 Work Days [ ] 2 - 8 Hours [ ] 5 Work Days [ ] 1 Work Day [ ] Other

SAMPLE TYPE: [ ] Storm Water [ ] Air [ ] Waste Water [ ] Other [x] Ground Water [x] Soil

REPORT FORMAT: [ ] QC Level IV [ ] EDF [ ] Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead	PCBs	REMARKS
-001A	M-10@6.0	5/11/10/0805	Soil	1	Sleeve										Hold
-002A	M-10@9.0	5/11/10/0812	Soil	1	Sleeve										Hold
-003A	M-10@12.0	5/11/10/0822	Soil	1	Sleeve										Hold
	~~M-10-GW~~ Refusal @ 30.01'	NO GW	~~GW~~	~~5~~	~~2-Amber 3-Vials~~		✓	✓			✓	✓			
-004A	S-1@6.0	5/11/10/0948	Soil	1	Sleeve										Hold
-005A	S-1@9.0	5/11/10/1001	Soil	1	Sleeve										Hold
-006A	S-1@~~12.0~~ 8.5	5/11/10/1103	Soil	1	Sleeve										Hold
-007A	S-1-GW	5/11/10/1058	GW	5	2-Amber 3-Vials		✓	✓			✓	✓			Temp 3°C

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1	James Ripple		5/11/10	2:30	[illegible]	Stephen Gaudin	5/11/10	4:20
2	[illegible]		5/11/10	5:02	[illegible]		5/11/10	5:00pm

Were Samples Received in Good Condition? [ ] Yes [ ] NO Samples on Ice? [ ] Yes [ ] NO Method of Shipment: Hi Speed Sample seals intact? [ ] Yes [ ] NO [ ] N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page ____ of ____

Log In By: ____ Date: ____ Log In Reviewed By: ____ Date: ____

URS (San Jose)
100 W San Fernando St, Suite200
San Jose, California 95113
Tel: 4082979585
Fax: 4082976962

RE: Petaluma CA

Work Order No.: 1004091

Dear James Ripple:

Torrent Laboratory, Inc. received 14 sample(s) on April 20, 2010 for the analyses presented in the following Report.

All data for associated QC met EPA or laboratory specification(s) except where noted in the case narrative.

Torrent Laboratory, Inc. is certified by the State of California, ELAP #1991. If you have any questions regarding these test results, please feel free to contact the Project Management Team at (408)263-5258; ext 204.

Patti Sandrock

April 27, 2010
Date

Date: 4/27/2010

Client: URS (San Jose)

Project: Petaluma CA

Work Order: 1004091

CASE NARRATIVE

No issues encountered with the receiving, preparation, analysis or reporting of the results associated with this work order.

Analytical Comments for Asbestos, Note: Analysis performed by sub-contract laboratory EMSL, Inc NVLAP Certification # 101048-3. Results to follow under separate cover.

Analytical Comments for Method S_6010B, 1004091-002A, MS,Note:The % recovery for Barium is outside of laboratory control limits but within % RPD and LCS/LCSD % recovery limits. No corrective action required.

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/20/10
Date Reported: 04/27/10

S-1 @ 0.5 1004091-001A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	42	mg/Kg

S-1 @ 1.0 1004091-002A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Arsenic	SW6010B	1	0.28	1.7	3.0	mg/Kg
Barium	SW6010B	1	1	5.0	79	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	35	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	12	mg/Kg
Copper	SW6010B	1	0.0900	5.0	15	mg/Kg
Lead	SW6010B	1	0.13	1.0	22	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	28	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	33	mg/Kg
Zinc	SW6010B	1	0.59	5.0	30	mg/Kg
pH	SW9045C	1	0.10	2.0	5.91	S.U.

S-1 @ 1.5 1004091-003A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	6.1	mg/Kg

S-1 @ 2.0 1004091-004A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	6.2	mg/Kg

S-1 @ 3.0 1004091-005A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	6.6	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/20/10
Date Reported: 04/27/10

M-10 @ 0.5 1004091-006A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	21	mg/Kg

M-10 @ 1.0 1004091-007A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Arsenic	SW6010B	1	0.28	1.7	1.8	mg/Kg
Barium	SW6010B	1	1	5.0	74	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	100	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	25	mg/Kg
Copper	SW6010B	1	0.0900	5.0	36	mg/Kg
Lead	SW6010B	1	0.13	1.0	17	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	63	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	93	mg/Kg
Zinc	SW6010B	1	0.59	5.0	63	mg/Kg
Mercury	7471B	1	0.01	0.10	0.14	mg/Kg
pH	SW9045C	1	0.10	2.0	7.43	S.U.
TPH as Motor Oil	SW8015B(M)	1	1.65	4.0	11	mg/Kg

M-10 @ 1.5 1004091-008A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	28	mg/Kg

M-10 @ 2.0 1004091-009A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	25	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/20/10
Date Reported: 04/27/10

M-10 @ 3.0 1004091-010A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	8.4	mg/Kg
TPH as Motor Oil	SW8015B(M)	1	1.65	4.0	6.7	mg/Kg

N-7 @ 0.5 1004091-011A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	230	mg/Kg

N-7 @1.0 1004091-012A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	59	mg/Kg

N-7 @ 1.5 1004091-013A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	100	mg/Kg

N-7 @ 2.0 1004091-014A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	81	mg/Kg

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/20/10
Date Reported: 04/27/10

Client Sample ID:	S-1 @ 0.5	**Lab Sample ID:**	1004091-001A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 13:59		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/22/10	04/22/10	1	0.13	1.0	42		mg/Kg	400647	0319

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/20/10
Date Reported: 04/27/10

Client Sample ID:	S-1 @ 1.0	**Lab Sample ID:**	1004091-002A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 14:04		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	4/22/10	04/22/10	1	0.20	5.0	ND		mg/Kg	400647	0319
Arsenic	SW6010B	4/22/10	04/22/10	1	0.28	1.7	3.0		mg/Kg	400647	0319
Barium	SW6010B	4/22/10	04/22/10	1	1	5.0	79		mg/Kg	400647	0319
Beryllium	SW6010B	4/22/10	04/22/10	1	0.0840	2.0	ND		mg/Kg	400647	0319
Cadmium	SW6010B	4/22/10	04/22/10	1	0.0590	1.0	ND		mg/Kg	400647	0319
Chromium	SW6010B	4/22/10	04/22/10	1	0.0590	5.0	35		mg/Kg	400647	0319
Cobalt	SW6010B	4/22/10	04/22/10	1	0.14	5.0	12		mg/Kg	400647	0319
Copper	SW6010B	4/22/10	04/22/10	1	0.0900	5.0	15		mg/Kg	400647	0319
Lead	SW6010B	4/22/10	04/22/10	1	0.13	1.0	22		mg/Kg	400647	0319
Molybdenum	SW6010B	4/22/10	04/22/10	1	0.0590	5.0	ND		mg/Kg	400647	0319
Nickel	SW6010B	4/22/10	04/22/10	1	0.0590	5.0	28		mg/Kg	400647	0319
Selinium	SW6010B	4/22/10	04/22/10	1	0.29	5.0	ND		mg/Kg	400647	0319
Silver	SW6010B	4/22/10	04/22/10	1	0	1.0	ND		mg/Kg	400647	0319
Thallium	SW6010B	4/22/10	04/22/10	1	0.12	5.0	ND		mg/Kg	400647	0319
Vanadium	SW6010B	4/22/10	04/22/10	1	0.12	5.0	33		mg/Kg	400647	0319
Zinc	SW6010B	4/22/10	04/22/10	1	0.59	5.0	30		mg/Kg	400647	0319

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	4/21/10	04/22/10	1	0.01	0.10	ND		mg/Kg	400631	0315

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/20/10
Date Reported: 04/27/10

Client Sample ID:	S-1 @ 1.0	**Lab Sample ID:**	1004091-002A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 14:04		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Dichlorodifluoromethane	SW8260B	NA	04/21/10	1	4.4	10	ND		ug/Kg	400642	NA
Chloromethane	SW8260B	NA	04/21/10	1	4.6	10	ND		ug/Kg	400642	NA
Vinyl Chloride	SW8260B	NA	04/21/10	1	2.6	10	ND		ug/Kg	400642	NA
Bromomethane	SW8260B	NA	04/21/10	1	4.7	10	ND		ug/Kg	400642	NA
Trichlorofluoromethane	SW8260B	NA	04/21/10	1	2.9	10	ND		ug/Kg	400642	NA
1,1-Dichloroethene	SW8260B	NA	04/21/10	1	1.5	10	ND		ug/Kg	400642	NA
Freon 113	SW8260B	NA	04/21/10	1	3.7	10	ND		ug/Kg	400642	NA
Methylene Chloride	SW8260B	NA	04/21/10	1	2.0	10	ND		ug/Kg	400642	NA
trans-1,2-Dichloroethene	SW8260B	NA	04/21/10	1	1.1	10	ND		ug/Kg	400642	NA
MTBE	SW8260B	NA	04/21/10	1	2.6	10	ND		ug/Kg	400642	NA
tert-Butanol	SW8260B	NA	04/21/10	1	21	50	ND		ug/Kg	400642	NA
Diisopropyl ether (DIPE)	SW8260B	NA	04/21/10	1	2.2	10	ND		ug/Kg	400642	NA
1,1-Dichloroethane	SW8260B	NA	04/21/10	1	1.3	10	ND		ug/Kg	400642	NA
ETBE	SW8260B	NA	04/21/10	1	2.4	10	ND		ug/Kg	400642	NA
cis-1,2-Dichloroethene	SW8260B	NA	04/21/10	1	1.8	10	ND		ug/Kg	400642	NA
2,2-Dichloropropane	SW8260B	NA	04/21/10	1	1.2	10	ND		ug/Kg	400642	NA
Bromochloromethane	SW8260B	NA	04/21/10	1	2.3	10	ND		ug/Kg	400642	NA
Chloroform	SW8260B	NA	04/21/10	1	1.2	10	ND		ug/Kg	400642	NA
Carbon Tetrachloride	SW8260B	NA	04/21/10	1	1.6	10	ND		ug/Kg	400642	NA
1,1,1-Trichloroethane	SW8260B	NA	04/21/10	1	1.2	10	ND		ug/Kg	400642	NA
1,1-Dichloropropene	SW8260B	NA	04/21/10	1	1.4	10	ND		ug/Kg	400642	NA
Benzene	SW8260B	NA	04/21/10	1	1.5	10	ND		ug/Kg	400642	NA
TAME	SW8260B	NA	04/21/10	1	2.1	10	ND		ug/Kg	400642	NA
1,2-Dichloroethane	SW8260B	NA	04/21/10	1	1.9	10	ND		ug/Kg	400642	NA
Trichloroethylene	SW8260B	NA	04/21/10	1	3.9	10	ND		ug/Kg	400642	NA
Dibromomethane	SW8260B	NA	04/21/10	1	2.2	10	ND		ug/Kg	400642	NA
1,2-Dichloropropane	SW8260B	NA	04/21/10	1	1.3	10	ND		ug/Kg	400642	NA
Bromodichloromethane	SW8260B	NA	04/21/10	1	1.1	10	ND		ug/Kg	400642	NA
2-Chloroethyl vinyl ether	SW8260B	NA	04/21/10	1	4.5	10	ND		ug/Kg	400642	NA
cis-1,3-Dichloropropene	SW8260B	NA	04/21/10	1	1.4	10	ND		ug/Kg	400642	NA
Toluene	SW8260B	NA	04/21/10	1	0.98	10	ND		ug/Kg	400642	NA
Tetrachloroethylene	SW8260B	NA	04/21/10	1	1.8	10	ND		ug/Kg	400642	NA
trans-1,3-Dichloropropene	SW8260B	NA	04/21/10	1	1.2	10	ND		ug/Kg	400642	NA
1,1,2-Trichloroethane	SW8260B	NA	04/21/10	1	1.8	10	ND		ug/Kg	400642	NA
Dibromochloromethane	SW8260B	NA	04/21/10	1	1.1	10	ND		ug/Kg	400642	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/20/10
Date Reported: 04/27/10

Client Sample ID:	S-1 @ 1.0	**Lab Sample ID:**	1004091-002A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 14:04		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
1,3-Dichloropropane	SW8260B	NA	04/21/10	1	2.1	10	ND		ug/Kg	400642	NA
1,2-Dibromoethane	SW8260B	NA	04/21/10	1	1.7	10	ND		ug/Kg	400642	NA
Ethyl Benzene	SW8260B	NA	04/21/10	1	0.86	10	ND		ug/Kg	400642	NA
Chlorobenzene	SW8260B	NA	04/21/10	1	4.2	10	ND		ug/Kg	400642	NA
1,1,1,2-Tetrachloroethane	SW8260B	NA	04/21/10	1	0.86	10	ND		ug/Kg	400642	NA
m,p-Xylene	SW8260B	NA	04/21/10	1	1.9	10	ND		ug/Kg	400642	NA
o-Xylene	SW8260B	NA	04/21/10	1	0.66	5.0	ND		ug/Kg	400642	NA
Styrene	SW8260B	NA	04/21/10	1	0.77	10	ND		ug/Kg	400642	NA
Bromoform	SW8260B	NA	04/21/10	1	1.9	10	ND		ug/Kg	400642	NA
Isopropyl Benzene	SW8260B	NA	04/21/10	1	1.2	10	ND		ug/Kg	400642	NA
n-Propylbenzene	SW8260B	NA	04/21/10	1	1.4	10	ND		ug/Kg	400642	NA
Bromobenzene	SW8260B	NA	04/21/10	1	1.2	10	ND		ug/Kg	400642	NA
1,1,2,2-Tetrachloroethane	SW8260B	NA	04/21/10	1	3.0	10	ND		ug/Kg	400642	NA
1,3,5-Trimethylbenzene	SW8260B	NA	04/21/10	1	1.1	10	ND		ug/Kg	400642	NA
1,2,3-Trichloropropane	SW8260B	NA	04/21/10	1	3.3	10	ND		ug/Kg	400642	NA
4-Chlorotoluene	SW8260B	NA	04/21/10	1	1.6	10	ND		ug/Kg	400642	NA
2-Chlorotoluene	SW8260B	NA	04/21/10	1	1.6	10	ND		ug/Kg	400642	NA
tert-Butylbenzene	SW8260B	NA	04/21/10	1	1.4	10	ND		ug/Kg	400642	NA
1,2,4-Trimethylbenzene	SW8260B	NA	04/21/10	1	1.1	10	ND		ug/Kg	400642	NA
sec-Butyl Benzene	SW8260B	NA	04/21/10	1	1.6	10	ND		ug/Kg	400642	NA
p-Isopropyltoluene	SW8260B	NA	04/21/10	1	1.5	10	ND		ug/Kg	400642	NA
1,3-Dichlorobenzene	SW8260B	NA	04/21/10	1	1.8	10	ND		ug/Kg	400642	NA
1,4-Dichlorobenzene	SW8260B	NA	04/21/10	1	1.5	10	ND		ug/Kg	400642	NA
n-Butylbenzene	SW8260B	NA	04/21/10	1	2.2	10	ND		ug/Kg	400642	NA
1,2-Dichlorobenzene	SW8260B	NA	04/21/10	1	1.3	10	ND		ug/Kg	400642	NA
1,2-Dibromo-3-Chloropropane	SW8260B	NA	04/21/10	1	4.2	10	ND		ug/Kg	400642	NA
Hexachlorobutadiene	SW8260B	NA	04/21/10	1	2.6	10	ND		ug/Kg	400642	NA
1,2,4-Trichlorobenzene	SW8260B	NA	04/21/10	1	2.1	10	ND		ug/Kg	400642	NA
Naphthalene	SW8260B	NA	04/21/10	1	2.8	10	ND		ug/Kg	400642	NA
1,2,3-Trichlorobenzene	SW8260B	NA	04/21/10	1	2.9	10	ND		ug/Kg	400642	NA
(S) Dibromofluoromethane	SW8260B	NA	04/21/10	1	59.8	148	93.6		%	400642	NA
(S) Toluene-d8	SW8260B	NA	04/21/10	1	55.2	133	105		%	400642	NA
(S) 4-Bromofluorobenzene	SW8260B	NA	04/21/10	1	55.8	141	118		%	400642	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/20/10
Date Reported: 04/27/10

Client Sample ID:	S-1 @ 1.0	**Lab Sample ID:**	1004091-002A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 14:04		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH(Gasoline)	8260TPH	NA	04/21/10	1	17	100	ND		ug/Kg	400645	NA
(S) 4-Bromofluorobenzene	8260TPH	NA	04/21/10	1	57	127	67.3		%	400645	NA

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	4/21/10	04/21/10	1	0.10	2.0	5.91		S.U.	400639	0318

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH as Diesel	SW8015B(M)	4/23/10	04/26/10	1	0.759	2.0	ND		mg/Kg	400667	0326
TPH as Motor Oil	SW8015B(M)	4/23/10	04/26/10	1	1.65	4.0	ND		mg/Kg	400667	0326
Pentacosane (S)	SW8015B(M)	4/23/10	04/26/10	1	59.7	129	96.9		mg/Kg	400667	0326

NOTE: Note: Silica Gel cleanup employed.

Client Sample ID:	S-1 @ 1.5	**Lab Sample ID:**	1004091-003A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 14:09		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/22/10	04/22/10	1	0.13	1.0	6.1		mg/Kg	400647	0319

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/20/10
Date Reported: 04/27/10

Client Sample ID:	S-1 @ 2.0	**Lab Sample ID:**	1004091-004A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 14:13		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/22/10	04/22/10	1	0.13	1.0	6.2		mg/Kg	400647	0319

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/20/10
Date Reported: 04/27/10

Client Sample ID:	S-1 @ 3.0	**Lab Sample ID:**	1004091-005A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 14:16		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/22/10	04/22/10	1	0.13	1.0	6.6		mg/Kg	400647	0319

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
MTBE	SW8260B	NA	04/21/10	1	2.6	10	ND		ug/Kg	400642	NA
Benzene	SW8260B	NA	04/21/10	1	1.5	10	ND		ug/Kg	400642	NA
Toluene	SW8260B	NA	04/21/10	1	0.98	10	ND		ug/Kg	400642	NA
Ethyl Benzene	SW8260B	NA	04/21/10	1	0.86	10	ND		ug/Kg	400642	NA
m,p-Xylene	SW8260B	NA	04/21/10	1	1.9	10	ND		ug/Kg	400642	NA
o-Xylene	SW8260B	NA	04/21/10	1	0.66	5.0	ND		ug/Kg	400642	NA
(S) Dibromofluoromethane	SW8260B	NA	04/21/10	1	59.8	148	100		%	400642	NA
(S) Toluene-d8	SW8260B	NA	04/21/10	1	55.2	133	98.8		%	400642	NA
(S) 4-Bromofluorobenzene	SW8260B	NA	04/21/10	1	55.8	141	106		%	400642	NA

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH(Gasoline)	8260TPH	NA	04/21/10	1	17	100	ND		ug/Kg	400645	NA
(S) 4-Bromofluorobenzene	8260TPH	NA	04/21/10	1	57	127	77.0		%	400645	NA

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH as Diesel	SW8015B(M)	4/23/10	04/26/10	1	0.759	2.0	ND		mg/Kg	400667	0326
TPH as Motor Oil	SW8015B(M)	4/23/10	04/26/10	1	1.65	4.0	ND		mg/Kg	400667	0326
Pentacosane (S)	SW8015B(M)	4/23/10	04/26/10	1	59.7	129	95.7		mg/Kg	400667	0326

NOTE: Note: Silica Gel cleanup employed.

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/20/10
Date Reported: 04/27/10

Client Sample ID:	M-10 @ 0.5	**Lab Sample ID:**	1004091-006A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 13:25		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/22/10	04/22/10	1	0.13	1.0	21		mg/Kg	400647	0319

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/20/10
Date Reported: 04/27/10

Client Sample ID:	M-10 @ 1.0	**Lab Sample ID:**	1004091-007A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 13:29		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	4/22/10	04/22/10	1	0.20	5.0	ND		mg/Kg	400647	0319
Arsenic	SW6010B	4/22/10	04/22/10	1	0.28	1.7	1.8		mg/Kg	400647	0319
Barium	SW6010B	4/22/10	04/22/10	1	1	5.0	74		mg/Kg	400647	0319
Beryllium	SW6010B	4/22/10	04/22/10	1	0.0840	2.0	ND		mg/Kg	400647	0319
Cadmium	SW6010B	4/22/10	04/22/10	1	0.0590	1.0	ND		mg/Kg	400647	0319
Chromium	SW6010B	4/22/10	04/22/10	1	0.0590	5.0	100		mg/Kg	400647	0319
Cobalt	SW6010B	4/22/10	04/22/10	1	0.14	5.0	25		mg/Kg	400647	0319
Copper	SW6010B	4/22/10	04/22/10	1	0.0900	5.0	36		mg/Kg	400647	0319
Lead	SW6010B	4/22/10	04/22/10	1	0.13	1.0	17		mg/Kg	400647	0319
Molybdenum	SW6010B	4/22/10	04/22/10	1	0.0590	5.0	ND		mg/Kg	400647	0319
Nickel	SW6010B	4/22/10	04/22/10	1	0.0590	5.0	63		mg/Kg	400647	0319
Selinium	SW6010B	4/22/10	04/22/10	1	0.29	5.0	ND		mg/Kg	400647	0319
Silver	SW6010B	4/22/10	04/22/10	1	0	1.0	ND		mg/Kg	400647	0319
Thallium	SW6010B	4/22/10	04/22/10	1	0.12	5.0	ND		mg/Kg	400647	0319
Vanadium	SW6010B	4/22/10	04/22/10	1	0.12	5.0	93		mg/Kg	400647	0319
Zinc	SW6010B	4/22/10	04/22/10	1	0.59	5.0	63		mg/Kg	400647	0319

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	4/21/10	04/22/10	1	0.01	0.10	0.14		mg/Kg	400631	0315

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/20/10
Date Reported: 04/27/10

Client Sample ID:	M-10 @ 1.0	**Lab Sample ID:**	1004091-007A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 13:29		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Dichlorodifluoromethane	SW8260B	NA	04/21/10	1	4.4	10	ND		ug/Kg	400642	NA
Chloromethane	SW8260B	NA	04/21/10	1	4.6	10	ND		ug/Kg	400642	NA
Vinyl Chloride	SW8260B	NA	04/21/10	1	2.6	10	ND		ug/Kg	400642	NA
Bromomethane	SW8260B	NA	04/21/10	1	4.7	10	ND		ug/Kg	400642	NA
Trichlorofluoromethane	SW8260B	NA	04/21/10	1	2.9	10	ND		ug/Kg	400642	NA
1,1-Dichloroethene	SW8260B	NA	04/21/10	1	1.5	10	ND		ug/Kg	400642	NA
Freon 113	SW8260B	NA	04/21/10	1	3.7	10	ND		ug/Kg	400642	NA
Methylene Chloride	SW8260B	NA	04/21/10	1	2.0	10	ND		ug/Kg	400642	NA
trans-1,2-Dichloroethene	SW8260B	NA	04/21/10	1	1.1	10	ND		ug/Kg	400642	NA
MTBE	SW8260B	NA	04/21/10	1	2.6	10	ND		ug/Kg	400642	NA
tert-Butanol	SW8260B	NA	04/21/10	1	21	50	ND		ug/Kg	400642	NA
Diisopropyl ether (DIPE)	SW8260B	NA	04/21/10	1	2.2	10	ND		ug/Kg	400642	NA
1,1-Dichloroethane	SW8260B	NA	04/21/10	1	1.3	10	ND		ug/Kg	400642	NA
ETBE	SW8260B	NA	04/21/10	1	2.4	10	ND		ug/Kg	400642	NA
cis-1,2-Dichloroethene	SW8260B	NA	04/21/10	1	1.8	10	ND		ug/Kg	400642	NA
2,2-Dichloropropane	SW8260B	NA	04/21/10	1	1.2	10	ND		ug/Kg	400642	NA
Bromochloromethane	SW8260B	NA	04/21/10	1	2.3	10	ND		ug/Kg	400642	NA
Chloroform	SW8260B	NA	04/21/10	1	1.2	10	ND		ug/Kg	400642	NA
Carbon Tetrachloride	SW8260B	NA	04/21/10	1	1.6	10	ND		ug/Kg	400642	NA
1,1,1-Trichloroethane	SW8260B	NA	04/21/10	1	1.2	10	ND		ug/Kg	400642	NA
1,1-Dichloropropene	SW8260B	NA	04/21/10	1	1.4	10	ND		ug/Kg	400642	NA
Benzene	SW8260B	NA	04/21/10	1	1.5	10	ND		ug/Kg	400642	NA
TAME	SW8260B	NA	04/21/10	1	2.1	10	ND		ug/Kg	400642	NA
1,2-Dichloroethane	SW8260B	NA	04/21/10	1	1.9	10	ND		ug/Kg	400642	NA
Trichloroethylene	SW8260B	NA	04/21/10	1	3.9	10	ND		ug/Kg	400642	NA
Dibromomethane	SW8260B	NA	04/21/10	1	2.2	10	ND		ug/Kg	400642	NA
1,2-Dichloropropane	SW8260B	NA	04/21/10	1	1.3	10	ND		ug/Kg	400642	NA
Bromodichloromethane	SW8260B	NA	04/21/10	1	1.1	10	ND		ug/Kg	400642	NA
2-Chloroethyl vinyl ether	SW8260B	NA	04/21/10	1	4.5	10	ND		ug/Kg	400642	NA
cis-1,3-Dichloropropene	SW8260B	NA	04/21/10	1	1.4	10	ND		ug/Kg	400642	NA
Toluene	SW8260B	NA	04/21/10	1	0.98	10	ND		ug/Kg	400642	NA
Tetrachloroethylene	SW8260B	NA	04/21/10	1	1.8	10	ND		ug/Kg	400642	NA
trans-1,3-Dichloropropene	SW8260B	NA	04/21/10	1	1.2	10	ND		ug/Kg	400642	NA
1,1,2-Trichloroethane	SW8260B	NA	04/21/10	1	1.8	10	ND		ug/Kg	400642	NA
Dibromochloromethane	SW8260B	NA	04/21/10	1	1.1	10	ND		ug/Kg	400642	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/20/10
Date Reported: 04/27/10

Client Sample ID:	M-10 @ 1.0	**Lab Sample ID:**	1004091-007A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 13:29		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
1,3-Dichloropropane	SW8260B	NA	04/21/10	1	2.1	10	ND		ug/Kg	400642	NA
1,2-Dibromoethane	SW8260B	NA	04/21/10	1	1.7	10	ND		ug/Kg	400642	NA
Ethyl Benzene	SW8260B	NA	04/21/10	1	0.86	10	ND		ug/Kg	400642	NA
Chlorobenzene	SW8260B	NA	04/21/10	1	4.2	10	ND		ug/Kg	400642	NA
1,1,1,2-Tetrachloroethane	SW8260B	NA	04/21/10	1	0.86	10	ND		ug/Kg	400642	NA
m,p-Xylene	SW8260B	NA	04/21/10	1	1.9	10	ND		ug/Kg	400642	NA
o-Xylene	SW8260B	NA	04/21/10	1	0.66	5.0	ND		ug/Kg	400642	NA
Styrene	SW8260B	NA	04/21/10	1	0.77	10	ND		ug/Kg	400642	NA
Bromoform	SW8260B	NA	04/21/10	1	1.9	10	ND		ug/Kg	400642	NA
Isopropyl Benzene	SW8260B	NA	04/21/10	1	1.2	10	ND		ug/Kg	400642	NA
n-Propylbenzene	SW8260B	NA	04/21/10	1	1.4	10	ND		ug/Kg	400642	NA
Bromobenzene	SW8260B	NA	04/21/10	1	1.2	10	ND		ug/Kg	400642	NA
1,1,2,2-Tetrachloroethane	SW8260B	NA	04/21/10	1	3.0	10	ND		ug/Kg	400642	NA
1,3,5-Trimethylbenzene	SW8260B	NA	04/21/10	1	1.1	10	ND		ug/Kg	400642	NA
1,2,3-Trichloropropane	SW8260B	NA	04/21/10	1	3.3	10	ND		ug/Kg	400642	NA
4-Chlorotoluene	SW8260B	NA	04/21/10	1	1.6	10	ND		ug/Kg	400642	NA
2-Chlorotoluene	SW8260B	NA	04/21/10	1	1.6	10	ND		ug/Kg	400642	NA
tert-Butylbenzene	SW8260B	NA	04/21/10	1	1.4	10	ND		ug/Kg	400642	NA
1,2,4-Trimethylbenzene	SW8260B	NA	04/21/10	1	1.1	10	ND		ug/Kg	400642	NA
sec-Butyl Benzene	SW8260B	NA	04/21/10	1	1.6	10	ND		ug/Kg	400642	NA
p-Isopropyltoluene	SW8260B	NA	04/21/10	1	1.5	10	ND		ug/Kg	400642	NA
1,3-Dichlorobenzene	SW8260B	NA	04/21/10	1	1.8	10	ND		ug/Kg	400642	NA
1,4-Dichlorobenzene	SW8260B	NA	04/21/10	1	1.5	10	ND		ug/Kg	400642	NA
n-Butylbenzene	SW8260B	NA	04/21/10	1	2.2	10	ND		ug/Kg	400642	NA
1,2-Dichlorobenzene	SW8260B	NA	04/21/10	1	1.3	10	ND		ug/Kg	400642	NA
1,2-Dibromo-3-Chloropropane	SW8260B	NA	04/21/10	1	4.2	10	ND		ug/Kg	400642	NA
Hexachlorobutadiene	SW8260B	NA	04/21/10	1	2.6	10	ND		ug/Kg	400642	NA
1,2,4-Trichlorobenzene	SW8260B	NA	04/21/10	1	2.1	10	ND		ug/Kg	400642	NA
Naphthalene	SW8260B	NA	04/21/10	1	2.8	10	ND		ug/Kg	400642	NA
1,2,3-Trichlorobenzene	SW8260B	NA	04/21/10	1	2.9	10	ND		ug/Kg	400642	NA
(S) Dibromofluoromethane	SW8260B	NA	04/21/10	1	59.8	148	103		%	400642	NA
(S) Toluene-d8	SW8260B	NA	04/21/10	1	55.2	133	105		%	400642	NA
(S) 4-Bromofluorobenzene	SW8260B	NA	04/21/10	1	55.8	141	117		%	400642	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/20/10
Date Reported: 04/27/10

Client Sample ID:	M-10 @ 1.0	**Lab Sample ID:**	1004091-007A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 13:29		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH(Gasoline)	8260TPH	NA	04/21/10	1	17	100	ND		ug/Kg	400645	NA
(S) 4-Bromofluorobenzene	8260TPH	NA	04/21/10	1	57	127	63.7		%	400645	NA

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	4/21/10	04/21/10	1	0.10	2.0	7.43		S.U.	400639	0318

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH as Diesel	SW8015B(M)	4/23/10	04/26/10	1	0.759	2.0	ND		mg/Kg	400667	0326
TPH as Motor Oil	SW8015B(M)	4/23/10	04/26/10	1	1.65	4.0	11		mg/Kg	400667	0326
Pentacosane (S)	SW8015B(M)	4/23/10	04/26/10	1	59.7	129	81.0		mg/Kg	400667	0326

NOTE: Note: Silica Gel cleanup employed.

Client Sample ID:	M-10 @ 1.5	**Lab Sample ID:**	1004091-008A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 13:35		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/22/10	04/22/10	1	0.13	1.0	28		mg/Kg	400647	0319

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/20/10
Date Reported: 04/27/10

Client Sample ID:	M-10 @ 2.0	**Lab Sample ID:**	1004091-009A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 13:40		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/22/10	04/22/10	1	0.13	1.0	25		mg/Kg	400647	0319

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/20/10
Date Reported: 04/27/10

Client Sample ID:	M-10 @ 3.0	**Lab Sample ID:**	1004091-010A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 13:44		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/22/10	04/22/10	1	0.13	1.0	8.4		mg/Kg	400647	0319

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
MTBE	SW8260B	NA	04/21/10	1	2.6	10	ND		ug/Kg	400642	NA
Benzene	SW8260B	NA	04/21/10	1	1.5	10	ND		ug/Kg	400642	NA
Toluene	SW8260B	NA	04/21/10	1	0.98	10	ND		ug/Kg	400642	NA
Ethyl Benzene	SW8260B	NA	04/21/10	1	0.86	10	ND		ug/Kg	400642	NA
m,p-Xylene	SW8260B	NA	04/21/10	1	1.9	10	ND		ug/Kg	400642	NA
o-Xylene	SW8260B	NA	04/21/10	1	0.66	5.0	ND		ug/Kg	400642	NA
(S) Dibromofluoromethane	SW8260B	NA	04/21/10	1	59.8	148	95.7		%	400642	NA
(S) Toluene-d8	SW8260B	NA	04/21/10	1	55.2	133	106		%	400642	NA
(S) 4-Bromofluorobenzene	SW8260B	NA	04/21/10	1	55.8	141	118		%	400642	NA

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH(Gasoline)	8260TPH	NA	04/21/10	1	17	100	ND		ug/Kg	400645	NA
(S) 4-Bromofluorobenzene	8260TPH	NA	04/21/10	1	57	127	69.4		%	400645	NA

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH as Diesel	SW8015B(M)	4/23/10	04/26/10	1	0.759	2.0	ND		mg/Kg	400667	0326
TPH as Motor Oil	SW8015B(M)	4/23/10	04/26/10	1	1.65	4.0	6.7		mg/Kg	400667	0326
Pentacosane (S)	SW8015B(M)	4/23/10	04/26/10	1	59.7	129	89.4		mg/Kg	400667	0326

NOTE: Note: Silica Gel cleanup employed.

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/20/10
Date Reported: 04/27/10

Client Sample ID:	N-7 @ 0.5	**Lab Sample ID:**	1004091-011A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 14:37		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/22/10	04/22/10	1	0.13	1.0	230		mg/Kg	400647	0319

Client Sample ID:	N-7 @1.0	**Lab Sample ID:**	1004091-012A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 14:40		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/22/10	04/22/10	1	0.13	1.0	59		mg/Kg	400647	0319

Client Sample ID:	N-7 @ 1.5	**Lab Sample ID:**	1004091-013A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 14:42		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/22/10	04/22/10	1	0.13	1.0	100		mg/Kg	400647	0319

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/20/10
Date Reported: 04/27/10

Client Sample ID:	N-7 @ 2.0	**Lab Sample ID:**	1004091-014A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/19/10 / 14:45		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/22/10	04/22/10	1	0.13	1.0	81		mg/Kg	400647	0319

MB Summary Report

Work Order:	1004091	**Prep Method:**	7471	**Prep Date:**	04/21/10	**Prep Batch:**	0315
Matrix:	Soil	**Analytical Method:**	7471AB	**Analyzed Date:**	04/22/10	**Analytical Batch:**	400631
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.
Mercury	0.01	0.10	ND

Work Order:	1004091	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Soil	**Analytical Method:**	SW8260B	**Analyzed Date:**	04/21/10	**Analytical Batch:**	400642
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.
Dichlorodifluoromethane	4.4	10	ND
Chloromethane	4.6	10	ND
Vinyl Chloride	2.6	10	ND
Bromomethane	4.7	10	ND
Trichlorofluoromethane	2.9	10	ND
1,1-Dichloroethene	1.5	10	ND
Freon 113	3.7	10	ND
Methylene Chloride	2.0	10	ND
trans-1,2-Dichloroethene	1.1	10	ND
MTBE	2.6	10	ND
tert-Butanol	21	50	ND
Diisopropyl ether (DIPE)	2.2	10	ND
1,1-Dichloroethane	1.3	10	ND
ETBE	2.4	10	ND
cis-1,2-Dichloroethene	1.8	10	ND
2,2-Dichloropropane	1.2	10	ND
Bromochloromethane	2.3	10	ND
Chloroform	1.2	10	ND
Carbon Tetrachloride	1.6	10	ND
1,1,1-Trichloroethane	1.2	10	ND
1,1-Dichloropropene	1.4	10	ND
Benzene	1.5	10	ND
TAME	2.1	10	ND
1,2-Dichloroethane	1.9	10	ND
Trichloroethylene	3.9	10	ND
Dibromomethane	2.2	10	ND
1,2-Dichloropropane	1.3	10	ND
Bromodichloromethane	1.1	10	ND
2-Chloroethyl vinyl ether	4.5	10	ND
cis-1,3-Dichloropropene	1.4	10	ND

MB Summary Report

Work Order:	1004091	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Soil	**Analytical Method:**	SW8260B	**Analyzed Date:**	04/21/10	**Analytical Batch:**	400642
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.
Toluene	0.98	10	ND
Tetrachloroethylene	1.8	10	ND
trans-1,3-Dichloropropene	1.2	10	ND
1,1,2-Trichloroethane	1.8	10	ND
Dibromochloromethane	1.1	10	ND
1,3-Dichloropropane	2.1	10	ND
1,2-Dibromoethane	1.7	10	ND
Ethyl Benzene	0.86	10	ND
Chlorobenzene	4.2	10	ND
1,1,1,2-Tetrachloroethane	0.86	10	ND
m,p-Xylene	1.9	10	ND
o-Xylene	0.66	5.0	ND
Styrene	0.77	10	ND
Bromoform	1.9	10	ND
Isopropyl Benzene	1.2	10	ND
n-Propylbenzene	1.4	10	ND
Bromobenzene	1.2	10	ND
1,1,2,2-Tetrachloroethane	3.0	10	ND
1,3,5-Trimethylbenzene	1.1	10	ND
1,2,3-Trichloropropane	3.3	10	ND
4-Chlorotoluene	1.6	10	ND
2-Chlorotoluene	1.6	10	ND
tert-Butylbenzene	1.4	10	ND
1,2,4-Trimethylbenzene	1.1	10	ND
sec-Butyl Benzene	1.6	10	ND
p-Isopropyltoluene	1.5	10	ND
1,3-Dichlorobenzene	1.8	10	ND
1,4-Dichlorobenzene	1.5	10	ND
n-Butylbenzene	2.2	10	ND
1,2-Dichlorobenzene	1.3	10	ND
1,2-Dibromo-3-Chloropropane	4.2	10	ND
Hexachlorobutadiene	2.6	10	ND
1,2,4-Trichlorobenzene	2.1	10	ND
Naphthalene	2.8	10	ND
1,2,3-Trichlorobenzene	2.9	10	ND
(S) Dibromofluoromethane			102 %
(S) Toluene-d8			97.0 %
(S) 4-Bromofluorobenzene			108 %

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MB Summary Report

Work Order:	1004091	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Soil	**Analytical Method:**	8260TPH	**Analyzed Date:**	04/21/10	**Analytical Batch:**	400645
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.
TPH(Gasoline)	17	100	ND
(S) 4-Bromofluorobenzene			88.2 %

Work Order:	1004091	**Prep Method:**	3050	**Prep Date:**	04/22/10	**Prep Batch:**	0319
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/22/10	**Analytical Batch:**	400647
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.
Antimony	0.20	5.0	ND
Arsenic	0.28	1.7	ND
Barium	1	5.0	ND
Beryllium	0.0840	2.0	ND
Cadmium	0.059	1.0	ND
Chromium	0.059	5.0	0.10
Cobalt	0.14	5.0	ND
Copper	0.090	5.0	0.35
Lead	0.13	1.0	0.20
Molybdenum	0.059	5.0	ND
Nickel	0.059	5.0	0.15
Selinium	0.29	5.0	0.35
Silver	1.0	1.0	ND
Thallium	0.12	5.0	ND
Vanadium	0.12	5.0	ND
Zinc	0.59	5.0	ND

Torrent LABORATORY, INC.

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004091	**Prep Method:**	7471	**Prep Date:**	04/21/10	**Prep Batch:**	0315
Matrix:	Soil	**Analytical Method:**	7471B	**Analyzed Date:**	04/22/10	**Analytical Batch:**	400631
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Mercury	0.01	0.10		1.25	99.3	100	0.936	80.5 - 133	30	

Work Order:	1004091	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Soil	**Analytical Method:**	SW8260B	**Analyzed Date:**	04/21/10	**Analytical Batch:**	400642
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
1,1-Dichloroethene	1.5	10		50	88.1	97.3	9.83	53.7 - 139	30	
Benzene	1.5	10		50	83.8	96.8	14.4	66.5 - 135	30	
Trichloroethylene	3.9	10		50	82.7	74.0	11.2	57.5 - 150	30	
Toluene	0.98	10		50	75.4	84.9	11.9	56.8 - 134	30	
Chlorobenzene	4.2	10		50	77.7	82.9	6.35	57.4 - 134	30	
(S) Dibromofluoromethane				50	117	105		59.8 - 148		
(S) Toluene-d8				50	93.2	92.7		55.2 - 133		
(S) 4-Bromofluorobenzene				50	110	106		55.8 - 141		

Work Order:	1004091	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Soil	**Analytical Method:**	8260TPH	**Analyzed Date:**	04/21/10	**Analytical Batch:**	400645
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
TPH(Gasoline)	17	100		1000	88.1	85.5	2.97	48.2 - 132	30	
(S) 4-Bromofluorobenzene				50	92.8	85.5		57 - 127		

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004091	**Prep Method:**	3050	**Prep Date:**	04/22/10	**Prep Batch:**	0319
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/22/10	**Analytical Batch:**	400647
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Antimony	0.2	5		50	91.4	91.8	0.437	30.7 - 130	30	
Arsenic	0.28	1.7		50	89.2	89.5	0.336	71 - 121	30	
Barium	1.1	5		50	94.3	91.3	3.23	70.2 - 130	30	
Beryllium	0.084	2		50	91.7	93.5	1.94	73.3 - 115	30	
Cadmium	0.059	1		50	90.3	87.5	3.15	68.7 - 110	30	
Chromium	0.059	5		50	101	91.1	10.3	76 - 116	30	
Cobalt	0.14	5		50	92.9	88.9	4.40	57.4 - 122	30	
Copper	0.09	5		50	94.6	91.6	3.22	74.8 - 119	30	
Lead	0.13	1		50	92.9	93.2	0.322	67.9 - 118	30	
Molybdenum	0.059	5		50	95.7	95.3	0.419	62.9 - 123	30	
Nickel	0.059	5		50	98.6	89.4	9.79	61.5 - 122	30	
Selinium	0.29	5		50	83.8	84.0	0.238	62 - 111	30	
Silver	1	1		50	92.1	89.0	3.42	81.1 - 109	30	
Thallium	0.12	5		50	89.3	90.4	1.22	39.2 - 125	30	
Vanadium	0.12	5		50	94.2	91.3	3.13	65.8 - 122	30	
Zinc	0.59	5		50	92.2	89.9	2.53	59.9 - 122	30	

MS/MSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004091	**Prep Method:**	7471	**Prep Date:**	04/21/10	**Prep Batch:**	0315
Matrix:	**Soil**	**Analytical Method:**	7471B	**Analyzed Date:**	04/22/10	**Analytical Batch:**	400631
Spiked Sample:	1004091-002A						
Units:	mg/Kg						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Mercury	0.01	0.10	0.0003	1.25	93.9	95.5	1.65	80.5 - 133	30	

Work Order:	1004091	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	**Soil**	**Analytical Method:**	SW8260B	**Analyzed Date:**	04/21/10	**Analytical Batch:**	400642
Spiked Sample:	1004091-002A						
Units:	ug/Kg						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
1,1-Dichloroethene	1.5	10	0	50	81.5	95.2	15.5	53.7 - 139	30	
Benzene	1.5	10	0	50	80.9	96.9	18.1	66.5 - 135	30	
Trichloroethylene	3.9	10	0	50	81.9	99.0	19.0	57.5 - 150	30	
Toluene	0.98	10	0	50	77.2	88.1	13.1	56.8 - 134	30	
Chlorobenzene	4.2	10	0	50	73.8	83.1	11.9	57.4 - 134	30	
(S) Dibromofluoromethane				50	109	89.8		59.8 - 148		
(S) Toluene-d8				50	101	101		55.2 - 133		
(S) 4-Bromofluorobenzene				50	120	125		55.8 - 141		

MS/MSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004091	**Prep Method:**	3050	**Prep Date:**	04/22/10	**Prep Batch:**	0319
Matrix:	**Soil**	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/22/10	**Analytical Batch:**	400647
Spiked Sample:	1004091-002A						
Units:	mg/Kg						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Antimony	0.20	5.0	0.024	50	75.3	73.8	1.95	30.7 - 130	30	
Arsenic	0.28	1.7	0.060	50	81.8	81.8	0.000	71 - 121	30	
Barium	1	5.0	1.6	50	69.0	87.9	7.93	70.2 - 130	30	S
Beryllium	0.0840	2.0	0.00100	50	85.6	88.5	3.33	73.3 - 115	30	
Cadmium	0.059	1.0	0.0040	50	82.3	83.8	1.80	68.7 - 110	30	
Chromium	0.059	5.0	0.70	50	78.2	87.6	6.28	76 - 116	30	
Cobalt	0.14	5.0	0.25	50	79.1	87.8	8.12	57.4 - 122	30	
Copper	0.090	5.0	0.31	50	83.3	87.4	3.79	74.8 - 119	30	
Lead	0.13	1.0	0.44	50	73.4	78.2	4.35	67.9 - 118	30	
Molybdenum	0.059	5.0	-0.0040	50	85.5	86.2	0.819	62.9 - 123	30	
Nickel	0.059	5.0	0.56	50	79.2	86.8	5.62	61.5 - 122	30	
Selinium	0.29	5.0	0.016	50	80.6	77.0	4.48	62 - 111	30	
Silver	1.0	1.0	-0.0090	50	84.4	86.7	2.72	81.1 - 109	30	
Thallium	0.12	5.0	-0.015	50	82.3	82.0	0.372	39.2 - 125	30	
Vanadium	0.12	5.0	0.67	50	77.8	85.1	4.78	65.8 - 122	30	
Zinc	0.59	5.0	0.60	50	70.0	82.2	8.96	59.9 - 122	30	

Work Order:	1004091	**Prep Method:**	3545_TPHSG	**Prep Date:**	04/23/10	**Prep Batch:**	0326
Matrix:	**Soil**	**Analytical Method:**	SW8015B(M)	**Analyzed Date:**	04/26/10	**Analytical Batch:**	400667
Spiked Sample:	1004091-007A						
Units:	mg/Kg						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
TPH as Diesel	0.76	2.0	6.8546	33.33		73.4	9.30	50.3 - 125	30	NR
Pentacosane (S)				100	85.5	94.7		57.9 - 125		

Duplicate Summary Report

Work Order:	1004091	**Prep Method:**	9045C	**Prep Date:**	4/21/2010	**Prep Batch:**	0318
Matrix:	**Soil**	**Analytical Method:**	SW9045C	**Analyzed Date:**	04/21/10	**Analytical Batch:**	400639
Units:						**Lab Sample ID:**	1004091-002A-Dup

Parameters	**MDL**	**PQL**	**Sample Result**	**Duplicate Result**	**% RPD**
pH	0.100	2.00	5.91	5.90	-0.0423

Raw values are used in quality control assessment.

Laboratory Qualifiers and Definitions

DEFINITIONS:

Accuracy/Bias (% Recovery) - The closeness of agreement between an observed value and an accepted reference value.
Blank (Method/Preparation Blank) -MB/PB - An analyte-free matrix to which all reagents are added in the same volumes/proportions as used in sample processing. The method blank is used to document contamination resulting from the analytical process.
Duplicate - a field sample and/or laboratory QC sample prepared in duplicate following all of the same processes and procedures used on the original sample (sample duplicate, LCSD, MSD)
Laboratory Control Sample (LCS ad LCSD) - A known matrix spiked with compounds representative of the target analyte(s). This is used to document laboratory performance.
Matrix - the component or substrate that contains the analyte of interest (e.g., - groundwater, sediment, soil, waste water, etc)
Matrix Spike (MS/MSD) - Client sample spiked with identical concentrations of target analyte (s). The spiking occurs prior to the sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.
Method Detection Limit (MDL) - the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero
Practical Quantitation Limit (PQL) - a laboratory determined value at 2 to 5 times above the MDL that can be reproduced in a manner that results in a 99% confidence level that the result is both accurate and precise. PQLs reflect all preparation factors and/or dilution factors that have been applied to the sample during the preparation and/or analytical processes.
Precision (%RPD) - The agreement among a set of replicate/duplicate measurements without regard to known value of the replicates
Surrogate (S) or (Surr) - An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are used in most organic analysis to demonstrate matrix compatibility with the chosen method of analysis
Tentatively Identified Compound (TIC) - A compound not contained within the analytical calibration standards but present in the GCMS library of defined compounds. When the library is searched for an unknown compound, it can frequently give a tentative identification to the compound based on retention time and primary and secondary ion match. TICs are reported as estimates and are candidates for further investigation.
Units: the unit of measure used to express the reported result - **mg/L** and ***mg/Kg*** (equivalent to PPM - parts per million in **liquid** and ***solid***), **ug/L** and ***ug/Kg*** (equivalent to PPB - parts per billion in **liquid** and ***solid***), **ug/m3**, ***mg.m3***, **ppbv** and ***ppmv*** (all units of measure for reporting concentrations in air), **%** (equivalent to 10000 ppm or 1,000,000 ppb), **ug/Wipe** (concentration found on the surface of a single Wipe usually taken over a 100cm2 surface)

LABORATORY QUALIFIERS:

B - Indicates when the anlayte is found in the associated method or preparation blank
D - Surrogate is not recoverable due to the necessary dilution of the sample
E - Indicates the reportable value is outside of the calibration range of the instrument but within the linear range of the instrument (unless otherwise noted) Values reported with an E qualifier should be considered as estimated.
H- Indicates that the recommended holding time for the analyte or compound has been exceeded
J- Indicates a value between the method MDL and PQL and that the reported concentration should be considered as estimated rather the quantitative
NA - Not Analyzed
N/A - Not Applicable
NR - Not recoverable - a matrix spike concentration is not recoverable due to a concentration within the original sample that is greater than four times the spike concentration added
R- The % RPD between a duplicate set of samples is outside of the absolute values established by laboratory control charts
S- Spike recovery is outside of established method and/or laboratory control limits. Further explanation of the use of this qualifier should be included within a case narrative
X -Used to indicate that a value based on pattern identification is within the pattern range but not typical of the pattern found in standards. Further explanation may or may not be provided within the sample footnote and/or the case narrative.

Sample Receipt Checklist

Client Name: URS (San Jose)

Project Name: Petaluma CA

Work Order No.: 1004091

Date and Time Received: 4/20/2010 13:10

Received By: raj

Physically Logged By:

Checklist Completed By: lorna

Carrier Name: Hi-Speed Courier

Chain of Custody (COC) Information

Chain of custody present?	Yes
Chain of custody signed when relinquished and received?	Yes
Chain of custody agrees with sample labels?	Yes
Custody seals intact on sample bottles?	Not Present

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Not Present
Shipping Container/Cooler In Good Condition?	Yes
Samples in proper container/bottle?	Yes
Samples containers intact?	Yes
Sufficient sample volume for indicated test?	Yes

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes			
Container/Temp Blank temperature in compliance?	No	Temperature:	3	°C
Water-VOA vials have zero headspace?	No VOA vials submitted			
Water-pH acceptable upon receipt?				

pH Checked by: pH Adjusted by:

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	
Project Name:	Petaluma CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/20/2010
Report Due Date:	4/27/2010		**Time Received:**	13:10

Comments: 5 day TAT! Received 14soils. Asbestos subbed to EMSL.

Work Order # : ***1004091***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1004091-001A	S-1 @ 0.5	04/19/10 13:59	Soil	10/17/10				
							S_6010BCAM17	
Sample Note:	Metals-Pb only.							
1004091-002A	S-1 @ 1.0	04/19/10 14:04	Soil	10/17/10				
							S_pH9045C	
							S_7471BHG	
							S_GCMS-GRO	
							SUB_AsbestosCARB 435	Yes
							S_8260Full	
							S_TPHDO	
							S_6010BCAM17	
1004091-003A	S-1 @ 1.5	04/19/10 14:09	Soil	10/17/10				
							S_6010BCAM17	
Sample Note:	Metals-Pb only.							
1004091-004A	S-1 @ 2.0	04/19/10 14:13	Soil	10/17/10				
							S_6010BCAM17	
Sample Note:	Metals-Pb only.							
1004091-005A	S-1 @ 3.0	04/19/10 14:16	Soil	10/17/10				
							S_GCMS-GRO	
							S_8260MBTEX	
							S_6010BCAM17	
							S_TPHDO	
Sample Note:	Metals-Pb only.							
1004091-006A	M-10 @ 0.5	04/19/10 13:25	Soil	10/17/10				
							S_6010BCAM17	
Sample Note:	Metals-Pb only.							
1004091-007A	M-10 @ 1.0	04/19/10 13:29	Soil	10/17/10				
							S_pH9045C	
							SUB_AsbestosCARB 435	Yes
							S_7471BHG	
							S_TPHDO	
							S_6010BCAM17	

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	
Project Name:	Petaluma CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/20/2010
Report Due Date:	4/27/2010		**Time Received:**	13:10

Comments: 5 day TAT! Received 14soils. Asbestos subbed to EMSL.

Work Order # : ***1004091***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
							S_8260Full S_GCMS-GRO	
1004091-008A	M-10 @ 1.5	04/19/10 13:35	Soil	10/17/10				
							S_6010BCAM17	
Sample Note:	Metals-Pb only.							
1004091-009A	M-10 @ 2.0	04/19/10 13:40	Soil	10/17/10				
							S_6010BCAM17	
Sample Note:	Metals-Pb only.							
1004091-010A	M-10 @ 3.0	04/19/10 13:44	Soil	10/17/10				
							S_GCMS-GRO S_8260MBTEX S_TPHDO S_6010BCAM17	
Sample Note:	Metals-Pb only.							
1004091-011A	N-7 @ 0.5	04/19/10 14:37	Soil	10/17/10				
							S_6010BCAM17	
Sample Note:	Metals-Pb only.							
1004091-012A	N-7 @1.0	04/19/10 14:40	Soil	10/17/10				
							S_6010BCAM17	
Sample Note:	Metals-Pb only.							
1004091-013A	N-7 @ 1.5	04/19/10 14:42	Soil	10/17/10				
							S_6010BCAM17	
Sample Note:	Metals-Pb only.							
1004091-014A	N-7 @ 2.0	04/19/10 14:45	Soil	10/17/10				
							S_6010BCAM17	
Sample Note:	Metals-Pb only.							

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004091

Company Name: URS Corporation
Address: 100 W San Fernando Street, Suite 200
City: San Jose | State: CA | Zip Code: 95113
Telephone: 408-297-9585 | FAX: 408-297-6962
REPORT TO: J Ripple | SAMPLER: J Ripple/M Thummaluru

Location of Sampling: Petaluma, CA
Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
Special Instructions / Comments:
P.O. #: 28645045.03200 | EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead	PCBs	REMARKS
001A	S-1@0.5	04/19/10 13:59	Soil	1	Jar								✓		
002A	S-1@1.0	04/19/10 14:04	Soil	1	Jar	✓	✓	✓	✓	✓	✓	✓			
003A	S-1@1.5	04/19/10 14:09	Soil	1	Jar								✓		
004A	S-1@2.0	04/19/10 14:13	Soil	1	Jar								✓		
005A	S-1@3.0	04/19/10 14:16	Soil	1	Jar		✓	✓					✓		
006A	M-10@0.5	04/19/10 13:25	Soil	1	Jar								✓		
007A	M-10@1.0	04/19/10 13:29	Soil	1	Jar	✓	✓	✓	✓	✓	✓	✓			
008A	M-10@1.5	04/19/10 13:35	Soil	1	Jar								✓		Temp 3°C
009A	M-10@2.0	04/19/10 13:40	Soil	1	Jar								✓		
010A	M-10@3.0	04/19/10 13:44	Soil	1	Jar		✓	✓					✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		Crystal Harvin	4/20	12:25	C Moore	C Moore	4/20	12:25
2	C Moore	C Moore	4/20	13:05	Raj Kaur		4/20/10	1:10 pm

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment HS Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrangements are made.

Page 1 of 2

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

483 Sinclair Frontage Rd., Milpitas, CA 95035 | tel: 408.263.5258 | fax: 408.263.8293 | www.torrentlab.com

Torrent LABORATORY, INC.

483 Sinclair Frontage Road
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Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004091

Company Name: URS Corporation
Address: 100 W San Fernando Street, Suite 200
City: San Jose | State: CA | Zip Code: 95113
Telephone: 408-297-9585 | FAX: 408-297-6962
REPORT TO: J Ripple | SAMPLER: J Ripple/M Thummaluru

Location of Sampling: Petaluma, CA
Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
Special Instructions / Comments:
P.O. #: 28645045.03200 | EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: [x] 10 Work Days [ ] 3 Work Days [ ] Noon - Nxt Day [ ] 7 Work Days [ ] 2 Work Days [ ] 2 - 8 Hours [x] 5 Work Days [ ] 1 Work Day [ ] Other

SAMPLE TYPE: [ ] Storm Water [ ] Air [ ] Waste Water [ ] Other [ ] Ground Water [x] Soil

REPORT FORMAT: [ ] QC Level IV [ ] EDF [ ] Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead	PCBs	REMARKS
011A	N-7@0.5	04/19/10 14:37	Soil	1	Jar								✓		
012A	N-7@1.0	04/19/10 14:40	Soil	1	Jar								✓		
013A	N-7@1.5	04/19/10 14:42	Soil	1	Jar								✓		
014A	N-7@2.0	04/19/10 14:45	Soil	1	Jar								✓		
	N-7@3.0		Soil	1	Jar										

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		MAD HV	04/19/10	5:00pm	C Moore	C Moore	4.20.10	12:25
2	C Moore	C Moore	4.20	13:05	Raj Kaur	HS	4-20-2010	1:10 pm

Were Samples Received in Good Condition? [ ] Yes [ ] NO Samples on Ice? [ ] Yes [ ] NO Method of Shipment HS Sample seals intact? [ ] Yes [ ] NO [ ] N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date:

Page 1 of 2

URS (San Jose)
100 W San Fernando St, Suite200
San Jose, California 95113
Tel: 4082979585
Fax: 4082976962

RE: Petaluma CA

Work Order No.: 1004072 Rev: 1

Dear James Ripple:

Torrent Laboratory, Inc. received 20 sample(s) on April 19, 2010 for the analyses presented in the following Report.

All data for associated QC met EPA or laboratory specification(s) except where noted in the case narrative.

Torrent Laboratory, Inc. is certified by the State of California, ELAP #1991. If you have any questions regarding these test results, please feel free to contact the Project Management Team at (408)263-5258; ext 204.

Patti Sandrock

May 18, 2010
Date

Date: 5/18/2010

Client: URS (San Jose)

Project: Petaluma CA

Work Order: 1004072

CASE NARRATIVE

No issues encountered with the receiving, preparation, analysis or reporting of the results associated with this work order.

Analytical Comments for Asbestos, Note: Analysis performed by sub-contract laboratory EMSL, Inc NVLAP Certification # 101048-3. Results to follow under separate cover.

Analytical Comments for Method S_6010B, 1004072-008A MS/MSD Note:The % recoveries for Barium are outside of laboratory control limits but within % RPD and LCS/LCSD % recovery limits. No corrective action required.

REVISIONS:

Per client request, additional TCLP, STLC and DI-STLC anlaysis was performed on specified samples (see attachment at end of report).

Note: Extraction of 50 g sample / 500g 0.2M Sodium Citrate Solution was performed according to wet extraction procedure (WET) which was rotated in a rotary shaker for 48 hours.

Date Prepared: 5/9/10 @ 1PM to 5/11/10 @ 1PM

Note: Extraction of 100 g sample / 2000g TCLP Fluid # 1 was performed according to Toxicity Characteristic Leaching Procedure (TCLP) which was rotated in a rotary shaker for 18 hours.

Date Prepared: 5/6/10 @ 3:50PM to 5/7/10 @ 9:50AM.

Note: Extraction of 50 g sample with DI water was performed according to wet extraction procedure (WET) which was rotated in a rotary shaker for 48 hours.

Date Prepared: 5/11/10 @ 11:20AM to 5/3/10 @ 11:20AM.

Rev1 5/17/10

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

S-13 @ 0.5 1004072-003A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	13	mg/Kg

S-13 @ 1.0 1004072-004A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	0.53	mg/L
Lead	SW6010B	1	0.13	1.0	65	mg/Kg

S-12 @ 0.5 1004072-005A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	0.93	mg/L
Lead	SW6010B	1	0.13	1.0	89	mg/Kg

S-12 @ 1.0 1004072-006A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	21	mg/Kg
TPH as Motor Oil	SW8015B(M)	20	33.0	79	1300	mg/Kg

S-11 @ 0.5 1004072-007A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	27	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

S-11 @ 1.0 1004072-008A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Arsenic	SW6010B	1	0.28	1.7	2.4	mg/Kg
Barium	SW6010B	1	1	5.0	82	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	38	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	9.1	mg/Kg
Copper	SW6010B	1	0.0900	5.0	20	mg/Kg
Lead	SW6010B	1	0.13	1.0	2.7	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	54	mg/Kg
Silver	SW6010B	1	0	1.0	1.1	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	27	mg/Kg
Zinc	SW6010B	1	0.59	5.0	39	mg/Kg
pH	SW9045C	1	0.10	2.0	8.81	S.U.

S-10 @ 0.5 1004072-009A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	25	mg/Kg

S-10 @ 1.0 1004072-010A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	9.9	mg/Kg

N-14 @1.0 1004072-011A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	15	mg/L
Lead (TCLP)	SW6010B	1	0.05	0.10	0.14	mg/L
Lead	SW6010B	1	0.13	1.0	140	mg/Kg
Lead (DI-STLC)	SW6010B	1	0.0500	0.10	0.12	mg/L

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

N-14 @ 1.5 1004072-012A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	8.3	mg/Kg

N-14 @ 2.0 1004072-013A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	7.0	mg/Kg

N-14 @ 3.0 1004072-014A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Chromium (STLC)	SW6010B	1	0.0200	0.10	0.14	mg/L
Antimony	SW6010B	1	0.20	5.0	5.5	mg/Kg
Arsenic	SW6010B	1	0.28	1.7	2.1	mg/Kg
Barium	SW6010B	1	1	5.0	190	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	180	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	19	mg/Kg
Copper	SW6010B	1	0.0900	5.0	29	mg/Kg
Lead	SW6010B	1	0.13	1.0	5.7	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	180	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	51	mg/Kg
Zinc	SW6010B	1	0.59	5.0	38	mg/Kg
pH	SW9045C	1	0.10	2.0	8.24	S.U.

N-17 @ 0.5 1004072-015A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	31	mg/Kg

N-17 @1.0 1004072-016A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	49	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

N-17 @1.5 1004072-017A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	10	mg/L
Lead (TCLP)	SW6010B	1	0.05	0.10	0.44	mg/L
Lead	SW6010B	1	0.13	1.0	1000	mg/Kg

N-17 @2.0 1004072-018A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	5.3	mg/Kg

N-17 @ 3.0 1004072-019A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Arsenic	SW6010B	1	0.28	1.7	3.3	mg/Kg
Barium	SW6010B	1	1	5.0	150	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	33	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	8.6	mg/Kg
Copper	SW6010B	1	0.0900	5.0	19	mg/Kg
Lead	SW6010B	1	0.13	1.0	7.7	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	32	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	36	mg/Kg
Zinc	SW6010B	1	0.59	5.0	24	mg/Kg
pH	SW9045C	1	0.10	2.0	7.41	S.U.

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

Client Sample ID:	S-13 @ 0.5	**Lab Sample ID:**	1004072-003A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 12:57		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/20/10	04/20/10	1	0.13	1.0	13		mg/Kg	400617	0311

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

Client Sample ID:	S-13 @ 1.0	**Lab Sample ID:**	1004072-004A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 12:59		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	0.53		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/20/10	04/20/10	1	0.13	1.0	65		mg/Kg	400617	0311

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

Client Sample ID:	S-12 @ 0.5	**Lab Sample ID:**	1004072-005A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 13:08		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/12/10	05/12/10	1	0.0500	0.10	0.93		mg/L	400849	0411

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/20/10	04/20/10	1	0.13	1.0	89		mg/Kg	400617	0311

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

Client Sample ID:	S-12 @ 1.0	**Lab Sample ID:**	1004072-006A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 13:10		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/20/10	04/20/10	1	0.13	1.0	21		mg/Kg	400617	0311

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
MTBE	SW8260B	NA	04/20/10	1	2.6	10	ND		ug/Kg	400628	NA
tert-Butanol	SW8260B	NA	04/20/10	1	21	50	ND		ug/Kg	400628	NA
Diisopropyl ether (DIPE)	SW8260B	NA	04/20/10	1	2.2	10	ND		ug/Kg	400628	NA
ETBE	SW8260B	NA	04/20/10	1	2.4	10	ND		ug/Kg	400628	NA
Benzene	SW8260B	NA	04/20/10	1	1.5	10	ND		ug/Kg	400628	NA
TAME	SW8260B	NA	04/20/10	1	2.1	10	ND		ug/Kg	400628	NA
Toluene	SW8260B	NA	04/20/10	1	0.98	10	ND		ug/Kg	400628	NA
Ethyl Benzene	SW8260B	NA	04/20/10	1	0.86	10	ND		ug/Kg	400628	NA
m,p-Xylene	SW8260B	NA	04/20/10	1	1.9	10	ND		ug/Kg	400628	NA
o-Xylene	SW8260B	NA	04/20/10	1	0.66	5.0	ND		ug/Kg	400628	NA
(S) Dibromofluoromethane	SW8260B	NA	04/20/10	1	59.8	148	117		%	400628	NA
(S) Toluene-d8	SW8260B	NA	04/20/10	1	55.2	133	105		%	400628	NA
(S) 4-Bromofluorobenzene	SW8260B	NA	04/20/10	1	55.8	141	117		%	400628	NA

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH(Gasoline)	8260TPH	NA	04/20/10	1	17	100	ND		ug/Kg	400629	NA
(S) 4-Bromofluorobenzene	8260TPH	NA	04/20/10	1	57	127	47.4	S	%	400629	NA

NOTE: S-Low surrogate recovery; analyzed twice.

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH as Diesel	SW8015B(M)	4/19/10	04/20/10	20	15.2	40	ND		mg/Kg	400634	0305
TPH as Motor Oil	SW8015B(M)	4/19/10	04/20/10	20	33.0	79	1300		mg/Kg	400634	0305
Pentacosane (S)	SW8015B(M)	4/19/10	04/20/10	20	59.7	129	102		mg/Kg	400634	0305

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

Client Sample ID:	S-11 @ 0.5	**Lab Sample ID:**	1004072-007A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 13:19		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/20/10	04/20/10	1	0.13	1.0	27		mg/Kg	400617	0311

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

Client Sample ID:	S-11 @ 1.0	**Lab Sample ID:**	1004072-008A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 13:21		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	4/20/10	04/20/10	1	0.20	5.0	ND		mg/Kg	400617	0311
Arsenic	SW6010B	4/20/10	04/20/10	1	0.28	1.7	2.4		mg/Kg	400617	0311
Barium	SW6010B	4/20/10	04/20/10	1	1	5.0	82		mg/Kg	400617	0311
Beryllium	SW6010B	4/20/10	04/20/10	1	0.0840	2.0	ND		mg/Kg	400617	0311
Cadmium	SW6010B	4/20/10	04/20/10	1	0.0590	1.0	ND		mg/Kg	400617	0311
Chromium	SW6010B	4/20/10	04/20/10	1	0.0590	5.0	38		mg/Kg	400617	0311
Cobalt	SW6010B	4/20/10	04/20/10	1	0.14	5.0	9.1		mg/Kg	400617	0311
Copper	SW6010B	4/20/10	04/20/10	1	0.0900	5.0	20		mg/Kg	400617	0311
Lead	SW6010B	4/20/10	04/20/10	1	0.13	1.0	2.7		mg/Kg	400617	0311
Molybdenum	SW6010B	4/20/10	04/20/10	1	0.0590	5.0	ND		mg/Kg	400617	0311
Nickel	SW6010B	4/20/10	04/20/10	1	0.0590	5.0	54		mg/Kg	400617	0311
Selenium	SW6010B	4/20/10	04/20/10	1	0.29	5.0	ND		mg/Kg	400617	0311
Silver	SW6010B	4/20/10	04/20/10	1	0	1.0	1.1		mg/Kg	400617	0311
Thallium	SW6010B	4/20/10	04/20/10	1	0.12	5.0	ND		mg/Kg	400617	0311
Vanadium	SW6010B	4/20/10	04/20/10	1	0.12	5.0	27		mg/Kg	400617	0311
Zinc	SW6010B	4/20/10	04/20/10	1	0.59	5.0	39		mg/Kg	400617	0311

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	4/19/10	04/20/10	1	0.01	0.10	ND		mg/Kg	400608	0301

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	4/19/10	04/19/10	1	0.10	2.0	8.81		S.U.	400609	0302

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

Client Sample ID:	S-10 @ 0.5	**Lab Sample ID:**	1004072-009A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 13:30		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/20/10	04/20/10	1	0.13	1.0	25		mg/Kg	400617	0311

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

Client Sample ID:	S-10 @ 1.0	**Lab Sample ID:**	1004072-010A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 13:32		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/20/10	04/20/10	1	0.13	1.0	9.9		mg/Kg	400617	0311

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

Client Sample ID:	N-14 @1.0	**Lab Sample ID:**	1004072-011A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 10:19		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/12/10	05/12/10	1	0.0500	0.10	15		mg/L	400849	0411

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	0.14		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/20/10	04/20/10	1	0.13	1.0	140		mg/Kg	400617	0311

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	0.12		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

Client Sample ID:	N-14 @ 1.5	**Lab Sample ID:**	1004072-012A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 10:21		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/20/10	04/20/10	1	0.13	1.0	8.3		mg/Kg	400617	0311

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

Client Sample ID:	N-14 @ 2.0	**Lab Sample ID:**	1004072-013A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 10:23		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/20/10	04/20/10	1	0.13	1.0	7.0		mg/Kg	400617	0311

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

Client Sample ID:	N-14 @ 3.0	**Lab Sample ID:**	1004072-014A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 10:25		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Chromium (STLC)	SW6010B	5/12/10	05/12/10	1	0.0200	0.10	0.14		mg/L	400849	0411

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	4/20/10	04/20/10	1	0.20	5.0	5.5		mg/Kg	400617	0311
Arsenic	SW6010B	4/20/10	04/20/10	1	0.28	1.7	2.1		mg/Kg	400617	0311
Barium	SW6010B	4/20/10	04/20/10	1	1	5.0	190		mg/Kg	400617	0311
Beryllium	SW6010B	4/20/10	04/20/10	1	0.0840	2.0	ND		mg/Kg	400617	0311
Cadmium	SW6010B	4/20/10	04/20/10	1	0.0590	1.0	ND		mg/Kg	400617	0311
Chromium	SW6010B	4/20/10	04/20/10	1	0.0590	5.0	180		mg/Kg	400617	0311
Cobalt	SW6010B	4/20/10	04/20/10	1	0.14	5.0	19		mg/Kg	400617	0311
Copper	SW6010B	4/20/10	04/20/10	1	0.0900	5.0	29		mg/Kg	400617	0311
Lead	SW6010B	4/20/10	04/20/10	1	0.13	1.0	5.7		mg/Kg	400617	0311
Molybdenum	SW6010B	4/20/10	04/20/10	1	0.0590	5.0	ND		mg/Kg	400617	0311
Nickel	SW6010B	4/20/10	04/20/10	1	0.0590	5.0	180		mg/Kg	400617	0311
Selenium	SW6010B	4/20/10	04/20/10	1	0.29	5.0	ND		mg/Kg	400617	0311
Silver	SW6010B	4/20/10	04/20/10	1	0	1.0	ND		mg/Kg	400617	0311
Thallium	SW6010B	4/20/10	04/20/10	1	0.12	5.0	ND		mg/Kg	400617	0311
Vanadium	SW6010B	4/20/10	04/20/10	1	0.12	5.0	51		mg/Kg	400617	0311
Zinc	SW6010B	4/20/10	04/20/10	1	0.59	5.0	38		mg/Kg	400617	0311

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	4/19/10	04/20/10	1	0.01	0.10	ND		mg/Kg	400608	0301

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Hexavalent Chromium	SW7199M	5/11/10	05/11/10	1	0.015	0.10	ND		mg/Kg	400887	0436

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	4/19/10	04/19/10	1	0.10	2.0	8.24		S.U.	400609	0302

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

Client Sample ID:	N-17 @ 0.5	**Lab Sample ID:**	1004072-015A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 11:28		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/20/10	04/20/10	1	0.13	1.0	31		mg/Kg	400617	0311

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

Client Sample ID:	N-17 @1.0	**Lab Sample ID:**	1004072-016A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 11:30		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/20/10	04/20/10	1	0.13	1.0	49		mg/Kg	400617	0311

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

Client Sample ID:	N-17 @1.5	**Lab Sample ID:**	1004072-017A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 11:32		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/12/10	05/12/10	1	0.0500	0.10	10		mg/L	400849	0411

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	0.44		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/20/10	04/20/10	1	0.13	1.0	1000		mg/Kg	400617	0311

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400866	0425

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

Client Sample ID:	N-17 @2.0	**Lab Sample ID:**	1004072-018A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 11:34		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/20/10	04/20/10	1	0.13	1.0	5.3		mg/Kg	400617	0311

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/19/10
Date Reported: 05/18/10

Client Sample ID:	N-17 @ 3.0	**Lab Sample ID:**	1004072-019A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 11:36		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	4/20/10	04/20/10	1	0.20	5.0	ND		mg/Kg	400617	0311
Arsenic	SW6010B	4/20/10	04/20/10	1	0.28	1.7	3.3		mg/Kg	400617	0311
Barium	SW6010B	4/20/10	04/20/10	1	1	5.0	150		mg/Kg	400617	0311
Beryllium	SW6010B	4/20/10	04/20/10	1	0.0840	2.0	ND		mg/Kg	400617	0311
Cadmium	SW6010B	4/20/10	04/20/10	1	0.0590	1.0	ND		mg/Kg	400617	0311
Chromium	SW6010B	4/20/10	04/20/10	1	0.0590	5.0	33		mg/Kg	400617	0311
Cobalt	SW6010B	4/20/10	04/20/10	1	0.14	5.0	8.6		mg/Kg	400617	0311
Copper	SW6010B	4/20/10	04/20/10	1	0.0900	5.0	19		mg/Kg	400617	0311
Lead	SW6010B	4/20/10	04/20/10	1	0.13	1.0	7.7		mg/Kg	400617	0311
Molybdenum	SW6010B	4/20/10	04/20/10	1	0.0590	5.0	ND		mg/Kg	400617	0311
Nickel	SW6010B	4/20/10	04/20/10	1	0.0590	5.0	32		mg/Kg	400617	0311
Selenium	SW6010B	4/20/10	04/20/10	1	0.29	5.0	ND		mg/Kg	400617	0311
Silver	SW6010B	4/20/10	04/20/10	1	0	1.0	ND		mg/Kg	400617	0311
Thallium	SW6010B	4/20/10	04/20/10	1	0.12	5.0	ND		mg/Kg	400617	0311
Vanadium	SW6010B	4/20/10	04/20/10	1	0.12	5.0	36		mg/Kg	400617	0311
Zinc	SW6010B	4/20/10	04/20/10	1	0.59	5.0	24		mg/Kg	400617	0311

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	4/19/10	04/20/10	1	0.01	0.10	ND		mg/Kg	400608	0301

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	4/19/10	04/19/10	1	0.10	2.0	7.41		S.U.	400609	0302

MB Summary Report

Work Order:	1004072	**Prep Method:**	7471	**Prep Date:**	04/19/10	**Prep Batch:**	0301
Matrix:	Soil	**Analytical Method:**	7471AB	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400608
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Mercury	0.01	0.10	ND	

Work Order:	1004072	**Prep Method:**	3050	**Prep Date:**	04/20/10	**Prep Batch:**	0311
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400617
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Antimony	0.20	5.0	ND	
Arsenic	0.28	1.7	ND	
Barium	1	5.0	ND	
Beryllium	0.0840	2.0	ND	
Cadmium	0.059	1.0	ND	
Chromium	0.059	5.0	0.10	
Cobalt	0.14	5.0	ND	
Copper	0.090	5.0	0.35	
Lead	0.13	1.0	0.20	
Molybdenum	0.059	5.0	0.15	
Nickel	0.059	5.0	1.1	
Selenium	0.29	5.0	ND	
Silver	1.0	1.0	ND	
Thallium	0.12	5.0	ND	
Vanadium	0.12	5.0	ND	
Zinc	0.59	5.0	ND	

Work Order:	1004072	**Prep Method:**	3545_TPH	**Prep Date:**	04/19/10	**Prep Batch:**	0305
Matrix:	Soil	**Analytical Method:**	SW8015B(M)	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400634
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
TPH as Diesel	0.758	2.0	ND	
TPH as Motor Oil	1.78	4.0	ND	
Pentacosane (S)			95.8 %	

MB Summary Report

Work Order:	1004072	**Prep Method:**	1311/3010B	**Prep Date:**	05/07/10	**Prep Batch:**	0392
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/07/10	**Analytical Batch:**	400786
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead (TCLP)	0.0500	0.10	ND	

Work Order:	1004072	**Prep Method:**	WET/3010B	**Prep Date:**	05/12/10	**Prep Batch:**	0411
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400849
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Chromium (STLC)	0.0200	0.10	ND	
Copper (STLC)	0.0300	0.10	ND	
Lead (STLC)	0.0500	0.10	ND	

Work Order:	1004072	**Prep Method:**	WET/3010B	**Prep Date:**	05/11/10	**Prep Batch:**	0413
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400854
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Chromium (STLC)	0.0200	0.10	ND	
Lead (STLC)	0.0500	0.10	ND	

Work Order:	1004072	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0424
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400865
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	ND	

MB Summary Report

Work Order:	1004072	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0425
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400866
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	ND	

Work Order:	1004072	**Prep Method:**	7199M	**Prep Date:**	05/11/10	**Prep Batch:**	0436
Matrix:	Soil	**Analytical Method:**	SW7199	**Analyzed Date:**	05/11/10	**Analytical Batch:**	400887
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Hexavalent Chromium	0.015	0.10	ND	

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004072	**Prep Method:**	7471	**Prep Date:**	04/19/10	**Prep Batch:**	0301
Matrix:	Soil	**Analytical Method:**	7471B	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400608
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Mercury	0.01	0.10	0.00167	1.25	108	107	1.37	80.5 - 133	30	

Work Order:	1004072	**Prep Method:**	3050	**Prep Date:**	04/20/10	**Prep Batch:**	0311
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400617
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Antimony	0.2	5	-0.10	50	96.4	95.6	0.833	30.7 - 130	30	
Arsenic	0.28	1.7	0.050	50	93.3	92.5	0.861	71 - 121	30	
Barium	1.1	5	0.15	50	95.8	96.9	1.14	70.2 - 130	30	
Beryllium	0.084	2	0.00	50	92.3	93.2	0.970	73.3 - 115	30	
Cadmium	0.059	1	0.00	50	92.8	93.8	1.07	68.7 - 110		
Chromium	0.059	5	0.10	50	96.6	96.2	0.415	76 - 116	30	
Cobalt	0.14	5	0.050	50	95.9	95.7	0.209	57.4 - 122	30	
Copper	0.09	5	0.35	50	97.8	100	2.32	74.8 - 119	30	
Lead	0.13	1	0.20	50	95.7	95.1	0.629	67.9 - 118	30	
Molybdenum	0.059	5	0.15	50	98.3	97.6	0.715	62.9 - 123	30	
Nickel	0.059	5	1.1	50	95.9	96.9	1.04	61.5 - 122	30	
Selenium	0.29	5	0.10	50	88.9	88.1	0.904	62 - 111	30	
Silver	1	1	0.00	50	94	95.3	1.37	81.1 - 109	30	
Thallium	0.12	5	0.050	50	92	91.5	0.545	39.2 - 125	30	
Vanadium	0.12	5	0.00	50	96.7	97.0	0.310	65.8 - 122	30	
Zinc	0.59	5	0.20	50	91.7	92.7	1.08	59.9 - 122	30	

Work Order:	1004072	**Prep Method:**	3545_TPH	**Prep Date:**	04/19/10	**Prep Batch:**	0305
Matrix:	Soil	**Analytical Method:**	SW8015B(M)	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400634
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
TPH as Diesel	0.758	2	0.32	33.33	80.7	80.1	0.757	52.7 - 115	30	
TPH as Motor Oil			-3.2	100				59.7 - 129		

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004072	**Prep Method:**	1311/3010B	**Prep Date:**	05/07/10	**Prep Batch:**	0392
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/07/10	**Analytical Batch:**	400786
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (TCLP)	0.05	0.1	0.000	10	92.8	93.4	0.644	80 - 120	20	

Work Order:	1004072	**Prep Method:**	WET/3010B	**Prep Date:**	05/12/10	**Prep Batch:**	0411
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400849
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Chromium (STLC)	0.0200	0.10	0.0100	10	84.8	84.1	0.829	80 - 120	20	
Copper (STLC)	0.0300	0.10	-0.0600	10	88.2	89.0	0.903	80 - 120	20	
Lead (STLC)	0.0500	0.10	0.0100	10	81.4	82.0	0.734	80 - 120	20	

Work Order:	1004072	**Prep Method:**	WET/3010B	**Prep Date:**	05/11/10	**Prep Batch:**	0413
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400854
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Chromium (STLC)	0.0200	0.10	0.0100	10	93.4	92.8	0.644	80 - 120	20	,
Lead (STLC)	0.0500	0.10	0.000	10	91.1	90.7	0.440	80 - 120	20	,

Work Order:	1004072	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0424
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400865
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	0.000	10	98.5	98.7	0.203	80 - 120	20	,

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004072	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0425
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400866
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	0.0100	10	93.8	91.8	2.16	80 - 120	20	,

Work Order:	1004072	**Prep Method:**	7199M	**Prep Date:**	05/11/10	**Prep Batch:**	0436
Matrix:	Soil	**Analytical Method:**	SW7199	**Analyzed Date:**	05/11/10	**Analytical Batch:**	400887
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Hexavalent Chromium	0.015	0.10	0.0006	0.1	95.9	90.2	6.16	65 - 135	30	,

MS/MSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004072	**Prep Method:**	3050	**Prep Date:**	04/20/10	**Prep Batch:**	0311
Matrix:	**Soil**	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400617
Spiked Sample:	1004072-008A						
Units:	mg/Kg						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Antimony	0.20	5.0	0.00	50	85.2	82.6	3.10	30.7 - 130	30	
Arsenic	0.28	1.7	0.048	50	85.4	86.8	1.54	71 - 121	30	
Barium	1	5.0	1.6	50	26.2	50.3	12.3	70.2 - 130	30	S
Beryllium	0.0840	2.0	0.00	50	78.2	79.9	2.15	73.3 - 115	30	
Cadmium	0.059	1.0	0.00	50	85.8	85.7	0.117	68.7 - 110	30	
Chromium	0.059	5.0	0.77	50	76.2	89.7	8.57	76 - 116	30	
Cobalt	0.14	5.0	0.18	50	82.5	80.3	2.71	57.4 - 122	30	
Copper	0.090	5.0	0.40	50	85.3	86.9	1.51	74.8 - 119	30	
Lead	0.13	1.0	0.054	50	77.9	78.9	1.19	67.9 - 118	30	
Molybdenum	0.059	5.0	0.00	50	86.9	82.6	5.07	62.9 - 123	30	
Nickel	0.059	5.0	1.1	50	77.1	82.7	3.00	61.5 - 122	30	
Selenium	0.29	5.0	0.00	50	76.2	78.6	3.10	62 - 111	30	
Silver	1.0	1.0	0.00	50	93.6	94.6	1.06	81.1 - 109	30	
Thallium	0.12	5.0	0.00	50	63.2	63.6	0.631	39.2 - 125	30	
Vanadium	0.12	5.0	0.55	50	95.9	92.9	2.07	65.8 - 122	30	
Zinc	0.59	5.0	0.78	50	62.1	76.0	9.52	59.9 - 122	30	

Work Order:	1004072	**Prep Method:**	WET/3010B	**Prep Date:**	05/12/10	**Prep Batch:**	0411
Matrix:	**Soil**	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400849
Spiked Sample:	1004072-005A						
Units:	mg/L						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Chromium (STLC)	0.0200	0.10	0.000	10	78.3	80.2	2.40	75 - 125	20	
Copper (STLC)	0.0300	0.10	0.000	10	82.2	84.8	3.11	75 - 125	20	
Lead (STLC)	0.0500	0.10	0.0930	10	80.8	80.1	0.780	75 - 125	20	

Work Order:	1004072	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0425
Matrix:	**Soil**	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400866
Spiked Sample:	1004072-017A						
Units:	mg/L						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	0.00600	10	93.6	94.1	0.529	75 - 125	20	

Duplicate Summary Report

Work Order:	1004072	**Prep Method:**	9045C	**Prep Date:**	4/19/2010	**Prep Batch:**	0302
Matrix:	**Soil**	**Analytical Method:**	SW9045C	**Analyzed Date:**	04/19/10	**Analytical Batch:**	400609
Units:						**Lab Sample ID:**	1004070-001A-Dup

Parameters	**MDL**	**PQL**	**Sample Result**	**Duplicate Result**	**% RPD**
pH	0.100	2.00	8.56	8.58	0.0583

Raw values are used in quality control assessment.

Laboratory Qualifiers and Definitions

DEFINITIONS:

Accuracy/Bias (% Recovery) - The closeness of agreement between an observed value and an accepted reference value.
Blank (Method/Preparation Blank) -MB/PB - An analyte-free matrix to which all reagents are added in the same volumes/proportions as used in sample processing. The method blank is used to document contamination resulting from the analytical process.
Duplicate - a field sample and/or laboratory QC sample prepared in duplicate following all of the same processes and procedures used on the original sample (sample duplicate, LCSD, MSD)
Laboratory Control Sample (LCS ad LCSD) - A known matrix spiked with compounds representative of the target analyte(s). This is used to document laboratory performance.
Matrix - the component or substrate that contains the analyte of interest (e.g., - groundwater, sediment, soil, waste water, etc)
Matrix Spike (MS/MSD) - Client sample spiked with identical concentrations of target analyte (s). The spiking occurs prior to the sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.
Method Detection Limit (MDL) - the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero
Practical Quantitation Limit (PQL) - a laboratory determined value at 2 to 5 times above the MDL that can be reproduced in a manner that results in a 99% confidence level that the result is both accurate and precise. PQLs reflect all preparation factors and/or dilution factors that have been applied to the sample during the preparation and/or analytical processes.
Precision (%RPD) - The agreement among a set of replicate/duplicate measurements without regard to known value of the replicates
Surrogate (S) or (Surr) - An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are used in most organic analysis to demonstrate matrix compatibility with the chosen method of analysis
Tentatively Identified Compound (TIC) - A compound not contained within the analytical calibration standards but present in the GCMS library of defined compounds. When the library is searched for an unknown compound, it can frequently give a tentative identification to the compound based on retention time and primary and secondary ion match. TICs are reported as estimates and are candidates for further investigation.
Units: the unit of measure used to express the reported result - **mg/L** and ***mg/Kg*** (equivalent to PPM - parts per million in **liquid** and ***solid***), **ug/L** and ***ug/Kg*** (equivalent to PPB - parts per billion in **liquid** and ***solid***), **ug/m3**, ***mg.m3***, **ppbv** and ***ppmv*** (all units of measure for reporting concentrations in air), **%** (equivalent to 10000 ppm or 1,000,000 ppb), **ug/Wipe** (concentration found on the surface of a single Wipe usually taken over a 100cm2 surface)

LABORATORY QUALIFIERS:

B - Indicates when the anlayte is found in the associated method or preparation blank
D - Surrogate is not recoverable due to the necessary dilution of the sample
E - Indicates the reportable value is outside of the calibration range of the instrument but within the linear range of the instrument (unless otherwise noted) Values reported with an E qualifier should be considered as estimated.
H- Indicates that the recommended holding time for the analyte or compound has been exceeded
J- Indicates a value between the method MDL and PQL and that the reported concentration should be considered as estimated rather the quantitative
NA - Not Analyzed
N/A - Not Applicable
NR - Not recoverable - a matrix spike concentration is not recoverable due to a concentration within the original sample that is greater than four times the spike concentration added
R- The % RPD between a duplicate set of samples is outside of the absolute values established by laboratory control charts
S- Spike recovery is outside of established method and/or laboratory control limits. Further explanation of the use of this qualifier should be included within a case narrative
X -Used to indicate that a value based on pattern identification is within the pattern range but not typical of the pattern found in standards. Further explanation may or may not be provided within the sample footnote and/or the case narrative.

Sample Receipt Checklist

Client Name: URS (San Jose)

Project Name: Petaluma CA

Work Order No.: 1004072

Date and Time Received: 4/19/2010 14:55

Received By: lorna

Physically Logged By:

Checklist Completed By: lorna

Carrier Name: Hi-Speed Courier

Chain of Custody (COC) Information

Chain of custody present?	Yes
Chain of custody signed when relinquished and received?	Yes
Chain of custody agrees with sample labels?	Yes
Custody seals intact on sample bottles?	Not Present

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Not Present
Shipping Container/Cooler In Good Condition?	Yes
Samples in proper container/bottle?	Yes
Samples containers intact?	Yes
Sufficient sample volume for indicated test?	Yes

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes			
Container/Temp Blank temperature in compliance?	Yes	Temperature:	3	°C
Water-VOA vials have zero headspace?	No VOA vials submitted			
Water-pH acceptable upon receipt?				

pH Checked by: pH Adjusted by:

483 Sinclair Frontage Rd., Milpitas, CA 95035 | tel: 408.263.5258 | fax: 408.263.8293 | www.torrentlab.com

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	II
Project Name:	Petaluma CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/19/2010
Report Due Date:	5/14/2010		**Time Received:**	14:55

Comments: 5 day TAT!

Work Order # : ***1004072***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1004072-001A	N-17 @ 9.0	04/15/10 11:40	Soil		On-Hold			
							S_6010BCAM17	
Sample Note:	HOLD							
1004072-002A	N-17 @ 12.0	04/15/10 11:42	Soil		On-Hold			
							S_6010BCAM17	
Sample Note:	HOLD							
1004072-003A	S-13 @ 0.5	04/15/10 12:57	Soil					
							S_6010BCAM17	
Sample Note:	Metals Pb only for samples 003A-007A, 009A-013A, 015A-018A.							
1004072-004A	S-13 @ 1.0	04/15/10 12:59	Soil					
							S_6010B(STLC)	
							S_6010BDI-STLC	
							S_6010BCAM17	
1004072-005A	S-12 @ 0.5	04/15/10 13:08	Soil					
							S_6010B(STLC)	
							S_6010BCAM17	
							S_6010BDI-STLC	
1004072-006A	S-12 @ 1.0	04/15/10 13:10	Soil					
							S_6010BCAM17	
							S_GCMS-GRO	
							S_8260Pet	
							S_TPHDO	
1004072-007A	S-11 @ 0.5	04/15/10 13:19	Soil					
							S_6010BCAM17	
1004072-008A	S-11 @ 1.0	04/15/10 13:21	Soil					
							S_pH9045C	
							S_7471BHG	
							SUB_AsbestosCARB 435	
							S_6010BCAM17	
1004072-009A	S-10 @ 0.5	04/15/10 13:30	Soil					
							S_6010BCAM17	
1004072-010A	S-10 @ 1.0	04/15/10 13:32	Soil					
							S_6010BCAM17	
1004072-011A	N-14 @1.0	04/15/10 10:19	Soil					

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	II
Project Name:	Petaluma CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/19/2010
Report Due Date:	5/14/2010		**Time Received:**	14:55

Comments: 5 day TAT!

Work Order # : ***1004072***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
							S_6010B(STLC) S_6010BDI-STLC S_6010BCAM17 S_6010B(TCLP)	
1004072-012A	N-14 @ 1.5	04/15/10 10:21	Soil					
							S_6010BCAM17	
1004072-013A	N-14 @ 2.0	04/15/10 10:23	Soil					
							S_6010BCAM17	
1004072-014A	N-14 @ 3.0	04/15/10 10:25	Soil					
							S_CrVI7199 S_pH9045C SUB_AsbestosCARB 435 S_7471BHG S_6010BCAM17 S_6010B(STLC)	Yes
1004072-015A	N-17 @ 0.5	04/15/10 11:28	Soil					
							S_6010BCAM17	
1004072-016A	N-17 @1.0	04/15/10 11:30	Soil					
							S_6010BCAM17	
1004072-017A	N-17 @1.5	04/15/10 11:32	Soil					
							S_6010B(STLC) S_6010BDI-STLC S_6010B(TCLP) S_6010BCAM17	
1004072-018A	N-17 @2.0	04/15/10 11:34	Soil					
							S_6010BCAM17	
1004072-019A	N-17 @ 3.0	04/15/10 11:36	Soil					
							S_pH9045C S_6010BCAM17 SUB_AsbestosCARB 435 S_7471BHG	
1004072-020A	N-17 @ 6.0	04/15/10 11:38	Soil		On-Hold			
							S_6010BCAM17	

Sample Note: HOLD

Torrent LABORATORY, INC.

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004072

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: [x] 10 Work Days [ ] 3 Work Days [ ] Noon - Nxt Day [ ] 7 Work Days [ ] 2 Work Days [ ] 2 - 8 Hours [ ] 5 Work Days [ ] 1 Work Day [ ] Other

SAMPLE TYPE: [ ] Storm Water [ ] Air [ ] Waste Water [ ] Other [ ] Ground Water [x] Soil

REPORT FORMAT: [ ] QC Level IV [ ] EDF [ ] Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	Pesticide	Lead	PCBs	REMARKS
011A	N-14@1.0	04/15/10 10:19	Soil	1	Sleeve								✓		
012A	N-14@1.5	04/15/10 10:21	Soil	1	Sleeve								✓		
013A	N-14@2.0	04/15/10 10:23	Soil	1	Sleeve								✓		
014A	N-14@3.0	04/15/10 10:25	Soil	1	Sleeve	✓			✓	✓					
015A	N-17@0.5	04/15/10 11:28	Soil	1	Sleeve								✓		
016A	N-17@1.0	04/15/10 11:30	Soil	1	Sleeve								✓		
017A	N-17@1.5	04/15/10 11:32	Soil	1	Sleeve								✓		
018A	N-17@2.0	04/15/10 11:34	Soil	1	Sleeve								✓		
019A	N-17@3.0	04/15/10 11:36	Soil	1	Sleeve	✓			✓	✓					Temp 3°C
020A	N-17@6.0	04/15/10 11:38	Soil	1	Sleeve										Hold

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	4/15/10	1830		Shawn Green	4/16	2:25
2			4/16	2155	Lorna	L-D-Inesal	4-16-10	1455

Were Samples Received in Good Condition? [ ] Yes [ ] NO Samples on Ice? [ ] Yes [ ] NO Method of Shipment: Hi-speed Sample seals intact? [ ] Yes [ ] NO [ ] N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 2 of 2

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

Torrent LABORATORY, INC.

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004072

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	Pesticide	Lead	PCBs	REMARKS
-001A	N-17@9.0	04/15/10 11:40	Soil	1	Sleeve										Hold
-002A	N-17@12.0	04/15/10 11:42	Soil	1	Sleeve										Hold
-003A	S-13@0.5	04/15/10 12:57	Soil	1	Sleeve								✓		
-004A	S-13@1.0	04/15/10 12:59	Soil	1	Sleeve								✓		
-005A	S-12@0.5	04/15/10 13:08	Soil	1	Sleeve								✓		
-006A	S-12@1.0	04/15/10 13:10	Soil	1	Sleeve		✓	✓			✓		✓		
-007A	S-11@0.5	04/15/10 13:19	Soil	1	Sleeve								✓		
-008A	S-11@1.0	04/15/10 13:21	Soil	1	Sleeve	✓			✓	✓					
-009	S-10@0.5	04/15/10 13:30	Soil	1	Sleeve								✓		Temp 3°C
-010A	S-10@1.0	04/15/10 13:32	Soil	1	Sleeve								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1	[signature]	James Ripple	4/15/10	1830	[signature]	Shaun Garcia	4/16/10	2:25
2	[signature]		4/16	2:55	[signature]		4-16-10	1455

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment Hi Speed Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrangements are made.

Page 1 of 2

Log In By: Date: Log In Reviewed By: Date:

EMSL Analytical, Inc
2235 Polvorosa Ave , Suite 230, San Leandro, CA 94577
Phone: (510) 895-3675 Fax: (510) 895-3680 Email: milpitaslab@emsl.com

Attn: **Nutan Kabir**
Torrent Laboratory, Inc.
483 Sinclair Frontage Rd.
Milpitas, CA 95035

Fax: (408) 263-8293 Phone: (408) 263-5258
Project: **CoC100419001**

Customer ID: TORR80
Customer PO:
Received: 04/20/10 10:45 AM
EMSL Order: 091003566

EMSL Proj:
Analysis Date: 5/4/2010

Test Report: Qualitative asbestos analysis of soils using the EPA 600/R-93/116 method

Sample	Description	Appearance	Result	Notes
1004072-008A *091003566-0001*			**None Detected**	
1004072-014A *091003566-0002*			**None Detected**	
1004072-019A *091003566-0003*			**None Detected**	

Analyst(s)

Rui Cindy Geng (3)

Baojia Ke, Laboratory Manager
or other approved signatory

EMSL recommends that soil samples reported as "ND" be tested by the EPA Screening Method/Qualitative. The above report relates only to the items tested. This report may not be reproduced, except in full, without written approval by EMSL Analytical, Inc. The above test must not be used by the client to claim product endorsement by NVLAP nor any agency of the United States Government. Unless otherwise noted, the results in this report have not been blank corrected.Samples received in good condition unless otherwise noted.
Samples analyzed by EMSL Analytical, Inc 2235 Polvorosa Ave , Suite 230, San LeandroCA

THIS IS THE LAST PAGE OF THE REPORT.

IRS Sample I					
Boring ID	Chromium 6	Chromium STLC	Lead STLC	Lead DI-STLC	Lead TCLP
# of samples to be tested	6	3	43	43	20
S-5	1003111-019A				
S-8			1004070-013A	1004070-013A	
N-1			1003116-027A	1003116-027A	1003116-027A
			1003116-028A	1003116-028A	
M-1					
M-1D					
M-2			1004009-006A	1004009-006A	
M-4			1004009-010A	1004009-010A	1004009-010A
S-9			1004070-011A	1004070-011A	1004070-011A
			1004070-012A	1004070-012A	1004070-012A
S-12			1004072-005A	1004072-005A	
S-13			1004072-004A	1004072-004A	
S-14			1003116-026A	1003116-026A	1003116-026A
S-15					
N-4			1004070-003A	1004070-003A	
N-5			1003116-014A	1003116-014A	1003116-014A
	1003116-015A		1003116-015A	1003116-015A	1003116-015A
			1003116-001A	1003116-001A	
N-6			1003116-002A	1003116-002A	1003116-002A
			1003116-003A	1003116-003A	
			1003116-004A	1003116-004A	1003116-004A
			1003116-005A	1003116-005A	1003116-005A
N-7			1004091-011A	1004091-011A	1004091-011A
			1004091-012A	1004091-012A	
			1004091-013A	1004091-013A	
			1004091-014A	1004091-014A	
N-8			1003111-001A	1003111-001A	
			1003111-002A	1003111-002A	
N-11			1003111-012A	1003111-012A	
			1003111-013A	1003111-013A	
N-12			1004070-005A	1004070-005A	1004070-005A
			1004070-006A	1004070-006A	1004070-006A
N-13			1003111-014A	1003111-014A	
N-13-d			1003111-007A	1003111-007A	
N-14			1004072-011A	1004072-011A	1004072-011A
	1004072-014A	1004072-014A			
M-18			1004011-001A	1004011-001A	1004011-001A
			1004011-003A	1004011-003A	
M-19	1004011-007A	1004011-007A			
			1004011-008A	1004011-008A	
M-19-d	1004011-012A	1004011-012A			
M-21			1004011-023A	1004011-023A	1004011-023A
M-22			1004011-029A	1004011-029A	
S-16			1003116-029A	1003116-029A	
N-15			1004067-004A	1004067-004A	1004067-004A
N-16			1004067-010A	1004067-010A	1004067-010A
N-17			1004072-017A	1004072-017A	1004072-017A
M-6					
M-10					
M-16	1004070-016A		1004070-016A	1004070-016A	
			1004070-017A	1004070-017A	
			1004070-019A	1004070-019A	1004070-019A

URS (San Jose)
100 W San Fernando St, Suite200
San Jose, California 95113
Tel: 4082979585
Fax: 4082976962

RE: Petaluma CA

Work Order No.: 1004070 Rev: 1

Dear James Ripple:

Torrent Laboratory, Inc. received 20 sample(s) on April 16, 2010 for the analyses presented in the following Report.

All data for associated QC met EPA or laboratory specification(s) except where noted in the case narrative.

Torrent Laboratory, Inc. is certified by the State of California, ELAP #1991. If you have any questions regarding these test results, please feel free to contact the Project Management Team at (408)263-5258; ext 204.

Patti Sandrock

May 18, 2010
Date

Date: 5/18/2010

Client: URS (San Jose)

Project: Petaluma CA

Work Order: 1004070

CASE NARRATIVE

Analytical Comments for Asbestos, Note: Analysis performed by sub-contract laboratory EMSL, Inc NVLAP Certification # 101048-3. Results to follow under separate cover.

Analytical Comments for Method 6010B, Note:The % recoveries for Lead are outside of laboratory control limits but within % RPD and LCS/LCSD % recovery limits. No corrective action required.

REVISIONS:

Per client request, additional TCLP, STLC and DI-STLC anlaysis was performed on specified samples (see attachment at end of report).

Note: Extraction of 50 g sample / 500g 0.2M Sodium Citrate Solution was performed according to wet extraction procedure (WET) which was rotated in a rotary shaker for 48 hours.

Date Prepared: 5/9/10 @ 1PM to 5/11/10 @ 1PM

Note: Extraction of 100 g sample / 2000g TCLP Fluid # 1 was performed according to Toxicity Characteristic Leaching Procedure (TCLP) which was rotated in a rotary shaker for 18 hours.

Date Prepared: 5/6/10 @ 3:50PM to 5/7/10 @ 9:50AM.

Note: Extraction of 50 g sample with DI water was performed according to wet extraction procedure (WET) which was rotated in a rotary shaker for 48 hours.

Date Prepared: 5/11/10 @ 11:20AM to 5/3/10 @ 11:20AM.

Rev1 5/17/10

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

N-2 @0.5 1004070-001A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
pH	SW9045C	1	0.10	2.0	8.56	S.U.

N-2 @ 1.0 1004070-002A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	22	mg/Kg

N-4 @0.5 1004070-003A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	29	mg/L
Lead	SW6010B	1	0.13	1.0	130	mg/Kg
Lead (DI-STLC)	SW6010B	1	0.0500	0.10	5.2	mg/L

N-4 @ 1.0 1004070-004A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	3.0	mg/Kg

N-12 @ 0.5 1004070-005A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	9.0	mg/L
Lead	SW6010B	1	0.13	1.0	230	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

N-12 @ 1.0 1004070-006A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	2.1	mg/L
Lead	SW6010B	1	0.13	1.0	130	mg/Kg

N-12 @1.5 1004070-007A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	10	mg/Kg

N-12 @ 2.0 1004070-008A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	1.8	mg/Kg

N-12 @ 3.0 1004070-009A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	3.4	mg/Kg

N-14 @ 0.5 1004070-010A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	19	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

S-9 @ 0.5 1004070-011A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	16	mg/L
Lead (TCLP)	SW6010B	1	0.05	0.10	0.66	mg/L
Lead	SW6010B	1	0.13	1.0	140	mg/Kg
Lead (DI-STLC)	SW6010B	1	0.0500	0.10	0.16	mg/L

S-9 @ 1.0 1004070-012A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	60	mg/L
Lead (TCLP)	SW6010B	1	0.05	0.10	3.7	mg/L
Lead	SW6010B	1	0.13	1.0	170	mg/Kg
Lead (DI-STLC)	SW6010B	1	0.0500	0.10	2.9	mg/L

S-8 @ 0.5 1004070-013A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	7.0	mg/L
Lead	SW6010B	1	0.13	1.0	64	mg/Kg
Lead (DI-STLC)	SW6010B	1	0.0500	0.10	0.80	mg/L

S-8 @ 1.0 1004070-014A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	9.3	mg/Kg

M-16 @ 0.5 1004070-015A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	18	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

M-16 @ 1.0 1004070-016A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	1.5	mg/L
Arsenic	SW6010B	1	0.28	1.7	2.3	mg/Kg
Barium	SW6010B	1	1	5.0	80	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	76	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	19	mg/Kg
Copper	SW6010B	1	0.0900	5.0	35	mg/Kg
Lead	SW6010B	1	0.13	1.0	61	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	94	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	48	mg/Kg
Zinc	SW6010B	1	0.59	5.0	59	mg/Kg
Mercury	7471B	1	0.01	0.10	0.13	mg/Kg
pH	SW9045C	1	0.10	2.0	8.27	S.U.
TPH as Motor Oil	SW8015B(M)	4	6.60	16	100	mg/Kg

M-16 @ 1.5 1004070-017A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	1.8	mg/L
Lead	SW6010B	1	0.13	1.0	93	mg/Kg

M-16 @ 2.0 1004070-018A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	25	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

M-16 @ 3.0 1004070-019A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	1.9	mg/L
Lead	SW6010B	1	0.13	1.0	180	mg/Kg
TPH as Motor Oil	SW8015B(M)	4	6.60	16	180	mg/Kg

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-2 @0.5	**Lab Sample ID:**	1004070-001A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 9:22		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	4/19/10	04/19/10	1	0.20	5.0	ND		mg/Kg	400610	0304
Arsenic	SW6010B	4/19/10	04/19/10	1	0.28	1.7	ND		mg/Kg	400610	0304
Barium	SW6010B	4/19/10	04/19/10	1	1	5.0	17		mg/Kg	400610	0304
Beryllium	SW6010B	4/19/10	04/19/10	1	0.0840	2.0	ND		mg/Kg	400610	0304
Cadmium	SW6010B	4/19/10	04/19/10	1	0.0590	1.0	ND		mg/Kg	400610	0304
Chromium	SW6010B	4/19/10	04/19/10	1	0.0590	5.0	12		mg/Kg	400610	0304
Cobalt	SW6010B	4/19/10	04/19/10	1	0.14	5.0	17		mg/Kg	400610	0304
Copper	SW6010B	4/19/10	04/19/10	1	0.0900	5.0	35		mg/Kg	400610	0304
Lead	SW6010B	4/19/10	04/19/10	1	0.13	1.0	5.1		mg/Kg	400610	0304
Molybdenum	SW6010B	4/19/10	04/19/10	1	0.0590	5.0	ND		mg/Kg	400610	0304
Nickel	SW6010B	4/19/10	04/19/10	1	0.0590	5.0	58		mg/Kg	400610	0304
Selenium	SW6010B	4/19/10	04/19/10	1	0.29	5.0	ND		mg/Kg	400610	0304
Silver	SW6010B	4/19/10	04/19/10	1	0	1.0	ND		mg/Kg	400610	0304
Thallium	SW6010B	4/19/10	04/19/10	1	0.12	5.0	ND		mg/Kg	400610	0304
Vanadium	SW6010B	4/19/10	04/19/10	1	0.12	5.0	27		mg/Kg	400610	0304
Zinc	SW6010B	4/19/10	04/19/10	1	0.59	5.0	26		mg/Kg	400610	0304

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	4/19/10	04/20/10	1	0.01	0.10	ND		mg/Kg	400608	0301

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	4/19/10	04/19/10	1	0.10	2.0	8.56		S.U.	400609	0302

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-2 @ 1.0	**Lab Sample ID:**	1004070-002A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 9:25		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/20/10	1	0.13	1.0	22		mg/Kg	400611	0306

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-4 @0.5	**Lab Sample ID:**	1004070-003A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 9:37		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	29		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/20/10	1	0.13	1.0	130		mg/Kg	400611	0306

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	5.2		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-4 @ 1.0	**Lab Sample ID:**	1004070-004A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 9:39		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/20/10	1	0.13	1.0	3.0		mg/Kg	400611	0306

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-12 @ 0.5	**Lab Sample ID:**	1004070-005A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 10:01		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	9.0		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	ND		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/20/10	1	0.13	1.0	230		mg/Kg	400611	0306

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-12 @ 1.0	**Lab Sample ID:**	1004070-006A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 10:03		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	2.1		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	ND		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/20/10	1	0.13	1.0	130		mg/Kg	400611	0306

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-12 @1.5	**Lab Sample ID:**	1004070-007A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 10:05		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/20/10	1	0.13	1.0	10		mg/Kg	400611	0306

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-12 @ 2.0	**Lab Sample ID:**	1004070-008A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 10:07		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/20/10	1	0.13	1.0	1.8		mg/Kg	400611	0306

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-12 @ 3.0	**Lab Sample ID:**	1004070-009A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 10:09		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/20/10	1	0.13	1.0	3.4		mg/Kg	400611	0306

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-14 @ 0.5	**Lab Sample ID:**	1004070-010A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 10:17		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/20/10	1	0.13	1.0	19		mg/Kg	400611	0306

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
The results shown below are reported using their MDL.											
alpha-BHC	SW8081A	4/20/10	04/22/10	40	18	80	ND		ug/Kg	400649	0308
gamma-BHC	SW8081A	4/20/10	04/22/10	40	16	80	ND		ug/Kg	400649	0308
beta-BHC	SW8081A	4/20/10	04/22/10	40	15	80	ND		ug/Kg	400649	0308
delta-BHC	SW8081A	4/20/10	04/22/10	40	20	80	ND		ug/Kg	400649	0308
Heptachlor	SW8081A	4/20/10	04/22/10	40	44	80	ND		ug/Kg	400649	0308
Aldrin	SW8081A	4/20/10	04/22/10	40	18	80	ND		ug/Kg	400649	0308
Heptachlor epoxide	SW8081A	4/20/10	04/22/10	40	13	80	ND		ug/Kg	400649	0308
gamma-Chlordane	SW8081A	4/20/10	04/22/10	40	17	80	ND		ug/Kg	400649	0308
alpha-Chlordane	SW8081A	4/20/10	04/22/10	40	14	80	ND		ug/Kg	400649	0308
Endosulfan I	SW8081A	4/20/10	04/22/10	40	24	80	ND		ug/Kg	400649	0308
4,4'-DDE	SW8081A	4/20/10	04/22/10	40	19	80	ND		ug/Kg	400649	0308
Dieldrin	SW8081A	4/20/10	04/22/10	40	17	80	ND		ug/Kg	400649	0308
Endrin	SW8081A	4/20/10	04/22/10	40	23	80	ND		ug/Kg	400649	0308
4,4'-DDD	SW8081A	4/20/10	04/22/10	40	19	80	ND		ug/Kg	400649	0308
Endosulfan II	SW8081A	4/20/10	04/22/10	40	61	80	ND		ug/Kg	400649	0308
4,4'-DDT	SW8081A	4/20/10	04/22/10	40	32	80	ND		ug/Kg	400649	0308
Endrin aldehyde	SW8081A	4/20/10	04/22/10	40	41	80	ND		ug/Kg	400649	0308
Endosulfan sulfate	SW8081A	4/20/10	04/22/10	40	20	80	ND		ug/Kg	400649	0308
Methoxychlor	SW8081A	4/20/10	04/22/10	40	25	200	ND		ug/Kg	400649	0308
Endrin Ketone	SW8081A	4/20/10	04/22/10	40	16	80	ND		ug/Kg	400649	0308
Chlordane	SW8081A	4/20/10	04/22/10	40	400	800	ND		ug/Kg	400649	0308
Toxaphene	SW8081A	4/20/10	04/22/10	40	400	4000	ND		ug/Kg	400649	0308
TCMX (S)	SW8081A	4/20/10	04/22/10	40	52.5	139	156	S,D	%	400649	0308
DCBP (S)	SW8081A	4/20/10	04/22/10	40	50.2	139	181	S,D	%	400649	0308

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-14 @ 0.5	**Lab Sample ID:**	1004070-010A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 10:17		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Aroclor1016	SW8082	4/20/10	04/21/10	1	0.0230	0.10	ND		mg/Kg	400641	0309
Aroclor1221	SW8082	4/20/10	04/21/10	1	0.0920	0.20	ND		mg/Kg	400641	0309
Aroclor1232	SW8082	4/20/10	04/21/10	1	0.0460	0.10	ND		mg/Kg	400641	0309
Aroclor1242	SW8082	4/20/10	04/21/10	1	0.0430	0.10	ND		mg/Kg	400641	0309
Aroclor1248	SW8082	4/20/10	04/21/10	1	0.0360	0.10	ND		mg/Kg	400641	0309
Aroclor1254	SW8082	4/20/10	04/21/10	1	0.0240	0.10	ND		mg/Kg	400641	0309
Aroclor1260	SW8082	4/20/10	04/21/10	1	0.0270	0.10	ND		mg/Kg	400641	0309
TCMX (S)	SW8082	4/20/10	04/21/10	1	51.7	128	88.5		%	400641	0309
DCBP (S)	SW8082	4/20/10	04/21/10	1	55.1	113	85.9		%	400641	0309

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	S-9 @ 0.5	**Lab Sample ID:**	1004070-011A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 13:47		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	16		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	0.66		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/20/10	1	0.13	1.0	140		mg/Kg	400611	0306

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	0.16		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	S-9 @ 1.0	**Lab Sample ID:**	1004070-012A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 13:49		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	60		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	3.7		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/20/10	1	0.13	1.0	170		mg/Kg	400611	0306

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	2.9		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	S-8 @ 0.5	**Lab Sample ID:**	1004070-013A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 14:01		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	7.0		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/20/10	1	0.13	1.0	64		mg/Kg	400611	0306

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	0.80		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	S-8 @ 1.0	**Lab Sample ID:**	1004070-014A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 14:03		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/20/10	1	0.13	1.0	9.3		mg/Kg	400611	0306

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	M-16 @ 0.5	**Lab Sample ID:**	1004070-015A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 15:26		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/20/10	1	0.13	1.0	18		mg/Kg	400611	0306

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	M-16 @ 1.0	**Lab Sample ID:**	1004070-016A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 15:28		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	1.5		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	4/19/10	04/19/10	1	0.20	5.0	ND		mg/Kg	400610	0304
Arsenic	SW6010B	4/19/10	04/19/10	1	0.28	1.7	2.3		mg/Kg	400610	0304
Barium	SW6010B	4/19/10	04/19/10	1	1	5.0	80		mg/Kg	400610	0304
Beryllium	SW6010B	4/19/10	04/19/10	1	0.0840	2.0	ND		mg/Kg	400610	0304
Cadmium	SW6010B	4/19/10	04/19/10	1	0.0590	1.0	ND		mg/Kg	400610	0304
Chromium	SW6010B	4/19/10	04/19/10	1	0.0590	5.0	76		mg/Kg	400610	0304
Cobalt	SW6010B	4/19/10	04/19/10	1	0.14	5.0	19		mg/Kg	400610	0304
Copper	SW6010B	4/19/10	04/19/10	1	0.0900	5.0	35		mg/Kg	400610	0304
Lead	SW6010B	4/19/10	04/19/10	1	0.13	1.0	61		mg/Kg	400610	0304
Molybdenum	SW6010B	4/19/10	04/19/10	1	0.0590	5.0	ND		mg/Kg	400610	0304
Nickel	SW6010B	4/19/10	04/19/10	1	0.0590	5.0	94		mg/Kg	400610	0304
Selenium	SW6010B	4/19/10	04/19/10	1	0.29	5.0	ND		mg/Kg	400610	0304
Silver	SW6010B	4/19/10	04/19/10	1	0	1.0	ND		mg/Kg	400610	0304
Thallium	SW6010B	4/19/10	04/19/10	1	0.12	5.0	ND		mg/Kg	400610	0304
Vanadium	SW6010B	4/19/10	04/19/10	1	0.12	5.0	48		mg/Kg	400610	0304
Zinc	SW6010B	4/19/10	04/19/10	1	0.59	5.0	59		mg/Kg	400610	0304

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400865	0424

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	4/19/10	04/20/10	1	0.01	0.10	0.13		mg/Kg	400608	0301

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	M-16 @ 1.0	**Lab Sample ID:**	1004070-016A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 15:28		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Dichlorodifluoromethane	SW8260B	NA	04/19/10	1	4.4	10	ND		ug/Kg	400613	NA
Chloromethane	SW8260B	NA	04/19/10	1	4.6	10	ND		ug/Kg	400613	NA
Vinyl Chloride	SW8260B	NA	04/19/10	1	2.6	10	ND		ug/Kg	400613	NA
Bromomethane	SW8260B	NA	04/19/10	1	4.7	10	ND		ug/Kg	400613	NA
Trichlorofluoromethane	SW8260B	NA	04/19/10	1	2.9	10	ND		ug/Kg	400613	NA
1,1-Dichloroethene	SW8260B	NA	04/19/10	1	1.5	10	ND		ug/Kg	400613	NA
Freon 113	SW8260B	NA	04/19/10	1	3.7	10	ND		ug/Kg	400613	NA
Methylene Chloride	SW8260B	NA	04/19/10	1	2.0	10	ND		ug/Kg	400613	NA
trans-1,2-Dichloroethene	SW8260B	NA	04/19/10	1	1.1	10	ND		ug/Kg	400613	NA
MTBE	SW8260B	NA	04/19/10	1	2.6	10	ND		ug/Kg	400613	NA
tert-Butanol	SW8260B	NA	04/19/10	1	21	50	ND		ug/Kg	400613	NA
Diisopropyl ether (DIPE)	SW8260B	NA	04/19/10	1	2.2	10	ND		ug/Kg	400613	NA
1,1-Dichloroethane	SW8260B	NA	04/19/10	1	1.3	10	ND		ug/Kg	400613	NA
ETBE	SW8260B	NA	04/19/10	1	2.4	10	ND		ug/Kg	400613	NA
cis-1,2-Dichloroethene	SW8260B	NA	04/19/10	1	1.8	10	ND		ug/Kg	400613	NA
2,2-Dichloropropane	SW8260B	NA	04/19/10	1	1.2	10	ND		ug/Kg	400613	NA
Bromochloromethane	SW8260B	NA	04/19/10	1	2.3	10	ND		ug/Kg	400613	NA
Chloroform	SW8260B	NA	04/19/10	1	1.2	10	ND		ug/Kg	400613	NA
Carbon Tetrachloride	SW8260B	NA	04/19/10	1	1.6	10	ND		ug/Kg	400613	NA
1,1,1-Trichloroethane	SW8260B	NA	04/19/10	1	1.2	10	ND		ug/Kg	400613	NA
1,1-Dichloropropene	SW8260B	NA	04/19/10	1	1.4	10	ND		ug/Kg	400613	NA
Benzene	SW8260B	NA	04/19/10	1	1.5	10	ND		ug/Kg	400613	NA
TAME	SW8260B	NA	04/19/10	1	2.1	10	ND		ug/Kg	400613	NA
1,2-Dichloroethane	SW8260B	NA	04/19/10	1	1.9	10	ND		ug/Kg	400613	NA
Trichloroethylene	SW8260B	NA	04/19/10	1	3.9	10	ND		ug/Kg	400613	NA
Dibromomethane	SW8260B	NA	04/19/10	1	2.2	10	ND		ug/Kg	400613	NA
1,2-Dichloropropane	SW8260B	NA	04/19/10	1	1.3	10	ND		ug/Kg	400613	NA
Bromodichloromethane	SW8260B	NA	04/19/10	1	1.1	10	ND		ug/Kg	400613	NA
2-Chloroethyl vinyl ether	SW8260B	NA	04/19/10	1	4.5	10	ND		ug/Kg	400613	NA
cis-1,3-Dichloropropene	SW8260B	NA	04/19/10	1	1.4	10	ND		ug/Kg	400613	NA
Toluene	SW8260B	NA	04/19/10	1	0.98	10	ND		ug/Kg	400613	NA
Tetrachloroethylene	SW8260B	NA	04/19/10	1	1.8	10	ND		ug/Kg	400613	NA
trans-1,3-Dichloropropene	SW8260B	NA	04/19/10	1	1.2	10	ND		ug/Kg	400613	NA
1,1,2-Trichloroethane	SW8260B	NA	04/19/10	1	1.8	10	ND		ug/Kg	400613	NA
Dibromochloromethane	SW8260B	NA	04/19/10	1	1.1	10	ND		ug/Kg	400613	NA
1,3-Dichloropropane	SW8260B	NA	04/19/10	1	2.1	10	ND		ug/Kg	400613	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	M-16 @ 1.0	**Lab Sample ID:**	1004070-016A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 15:28		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
1,2-Dibromoethane	SW8260B	NA	04/19/10	1	1.7	10	ND		ug/Kg	400613	NA
Ethyl Benzene	SW8260B	NA	04/19/10	1	0.86	10	ND		ug/Kg	400613	NA
Chlorobenzene	SW8260B	NA	04/19/10	1	4.2	10	ND		ug/Kg	400613	NA
1,1,1,2-Tetrachloroethane	SW8260B	NA	04/19/10	1	0.86	10	ND		ug/Kg	400613	NA
m,p-Xylene	SW8260B	NA	04/19/10	1	1.9	10	ND		ug/Kg	400613	NA
o-Xylene	SW8260B	NA	04/19/10	1	0.66	5.0	ND		ug/Kg	400613	NA
Styrene	SW8260B	NA	04/19/10	1	0.77	10	ND		ug/Kg	400613	NA
Bromoform	SW8260B	NA	04/19/10	1	1.9	10	ND		ug/Kg	400613	NA
Isopropyl Benzene	SW8260B	NA	04/19/10	1	1.2	10	ND		ug/Kg	400613	NA
n-Propylbenzene	SW8260B	NA	04/19/10	1	1.4	10	ND		ug/Kg	400613	NA
Bromobenzene	SW8260B	NA	04/19/10	1	1.2	10	ND		ug/Kg	400613	NA
1,1,2,2-Tetrachloroethane	SW8260B	NA	04/19/10	1	3.0	10	ND		ug/Kg	400613	NA
1,3,5-Trimethylbenzene	SW8260B	NA	04/19/10	1	1.1	10	ND		ug/Kg	400613	NA
1,2,3-Trichloropropane	SW8260B	NA	04/19/10	1	3.3	10	ND		ug/Kg	400613	NA
4-Chlorotoluene	SW8260B	NA	04/19/10	1	1.6	10	ND		ug/Kg	400613	NA
2-Chlorotoluene	SW8260B	NA	04/19/10	1	1.6	10	ND		ug/Kg	400613	NA
tert-Butylbenzene	SW8260B	NA	04/19/10	1	1.4	10	ND		ug/Kg	400613	NA
1,2,4-Trimethylbenzene	SW8260B	NA	04/19/10	1	1.1	10	ND		ug/Kg	400613	NA
sec-Butyl Benzene	SW8260B	NA	04/19/10	1	1.6	10	ND		ug/Kg	400613	NA
p-Isopropyltoluene	SW8260B	NA	04/19/10	1	1.5	10	ND		ug/Kg	400613	NA
1,3-Dichlorobenzene	SW8260B	NA	04/19/10	1	1.8	10	ND		ug/Kg	400613	NA
1,4-Dichlorobenzene	SW8260B	NA	04/19/10	1	1.5	10	ND		ug/Kg	400613	NA
n-Butylbenzene	SW8260B	NA	04/19/10	1	2.2	10	ND		ug/Kg	400613	NA
1,2-Dichlorobenzene	SW8260B	NA	04/19/10	1	1.3	10	ND		ug/Kg	400613	NA
1,2-Dibromo-3-Chloropropane	SW8260B	NA	04/19/10	1	4.2	10	ND		ug/Kg	400613	NA
Hexachlorobutadiene	SW8260B	NA	04/19/10	1	2.6	10	ND		ug/Kg	400613	NA
1,2,4-Trichlorobenzene	SW8260B	NA	04/19/10	1	2.1	10	ND		ug/Kg	400613	NA
Naphthalene	SW8260B	NA	04/19/10	1	2.8	10	ND		ug/Kg	400613	NA
1,2,3-Trichlorobenzene	SW8260B	NA	04/19/10	1	2.9	10	ND		ug/Kg	400613	NA
(S) Dibromofluoromethane	SW8260B	NA	04/19/10	1	59.8	148	113		%	400613	NA
(S) Toluene-d8	SW8260B	NA	04/19/10	1	55.2	133	98.6		%	400613	NA
(S) 4-Bromofluorobenzene	SW8260B	NA	04/19/10	1	55.8	141	118		%	400613	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	M-16 @ 1.0	**Lab Sample ID:**	1004070-016A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 15:28		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Hexavalent Chromium	SW7199M	5/11/10	05/11/10	1	15	100	ND		mg/Kg	400887	0436

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH(Gasoline)	8260TPH	NA	04/19/10	1	17	100	ND		ug/Kg	400614	NA
(S) 4-Bromofluorobenzene	8260TPH	NA	04/19/10	1	57	127	78.3		%	400614	NA

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	4/19/10	04/19/10	1	0.10	2.0	8.27		S.U.	400609	0302

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH as Diesel	SW8015B(M)	4/19/10	04/20/10	4	3.04	7.9	ND		mg/Kg	400634	0305
TPH as Motor Oil	SW8015B(M)	4/19/10	04/20/10	4	6.60	16	100		mg/Kg	400634	0305
Pentacosane (S)	SW8015B(M)	4/19/10	04/20/10	4	59.7	129	89.1		mg/Kg	400634	0305

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	M-16 @ 1.5	**Lab Sample ID:**	1004070-017A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 15:30		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	1.8		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/20/10	1	0.13	1.0	93		mg/Kg	400611	0306

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	M-16 @ 2.0	**Lab Sample ID:**	1004070-018A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 15:32		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/20/10	1	0.13	1.0	25		mg/Kg	400611	0306

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	M-16 @ 3.0	**Lab Sample ID:**	1004070-019A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 15:34		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	1.9		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	ND		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/20/10	1	0.13	1.0	180		mg/Kg	400611	0306

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400865	0424

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
MTBE	SW8260B	NA	04/19/10	1	2.6	10	ND		ug/Kg	400613	NA
Benzene	SW8260B	NA	04/19/10	1	1.5	10	ND		ug/Kg	400613	NA
Toluene	SW8260B	NA	04/19/10	1	0.98	10	ND		ug/Kg	400613	NA
Ethyl Benzene	SW8260B	NA	04/19/10	1	0.86	10	ND		ug/Kg	400613	NA
m,p-Xylene	SW8260B	NA	04/19/10	1	1.9	10	ND		ug/Kg	400613	NA
o-Xylene	SW8260B	NA	04/19/10	1	0.66	5.0	ND		ug/Kg	400613	NA
(S) Dibromofluoromethane	SW8260B	NA	04/19/10	1	59.8	148	115		%	400613	NA
(S) Toluene-d8	SW8260B	NA	04/19/10	1	55.2	133	101		%	400613	NA
(S) 4-Bromofluorobenzene	SW8260B	NA	04/19/10	1	55.8	141	129		%	400613	NA

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH(Gasoline)	8260TPH	NA	04/19/10	1	17	100	ND		ug/Kg	400614	NA
(S) 4-Bromofluorobenzene	8260TPH	NA	04/19/10	1	57	127	64.6		%	400614	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	M-16 @ 3.0	**Lab Sample ID:**	1004070-019A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 15:34		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH as Diesel	SW8015B(M)	4/19/10	04/20/10	4	3.04	7.9	ND		mg/Kg	400634	0305
TPH as Motor Oil	SW8015B(M)	4/19/10	04/20/10	4	6.60	16	180		mg/Kg	400634	0305
Pentacosane (S)	SW8015B(M)	4/19/10	04/20/10	4	59.7	129	96.2		mg/Kg	400634	0305

MB Summary Report

Work Order:	1004070	**Prep Method:**	7471	**Prep Date:**	04/19/10	**Prep Batch:**	0301
Matrix:	Soil	**Analytical Method:**	7471AB	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400608
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Mercury	0.01	0.10	ND	

Work Order:	1004070	**Prep Method:**	3050	**Prep Date:**	04/19/10	**Prep Batch:**	0304
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/19/10	**Analytical Batch:**	400610
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Antimony	0.20	5.0	ND	
Arsenic	0.28	1.7	ND	
Barium	1	5.0	ND	
Beryllium	0.0840	2.0	ND	
Cadmium	0.059	1.0	ND	
Chromium	0.059	5.0	0.10	
Cobalt	0.14	5.0	ND	
Copper	0.090	5.0	0.60	
Lead	0.13	1.0	0.25	
Molybdenum	0.059	5.0	ND	
Nickel	0.059	5.0	3.1	
Selenium	0.29	5.0	0.45	
Silver	1.0	1.0	ND	
Thallium	0.12	5.0	ND	
Vanadium	0.12	5.0	ND	
Zinc	0.59	5.0	1.0	

Work Order:	1004070	**Prep Method:**	3050	**Prep Date:**	04/19/10	**Prep Batch:**	0306
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400611
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Arsenic	0.28	1.7	ND	
Lead	0.13	1.0	0.20	

MB Summary Report

Work Order:	1004070	**Prep Method:**	3545_TPH	**Prep Date:**	04/19/10	**Prep Batch:**	0305
Matrix:	Soil	**Analytical Method:**	SW8015B(M)	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400634
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
TPH as Diesel	0.758	2.0	ND	
TPH as Motor Oil	1.78	4.0	ND	
Pentacosane (S)			95.8 %	

Work Order:	1004070	**Prep Method:**	3545_PCB	**Prep Date:**	04/20/10	**Prep Batch:**	0309
Matrix:	Soil	**Analytical Method:**	SW8082	**Analyzed Date:**	04/21/10	**Analytical Batch:**	400641
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Aroclor1016	0.0230	0.10	ND	
Aroclor1221	0.0920	0.20	ND	
Aroclor1232	0.0460	0.10	ND	
Aroclor1242	0.0430	0.10	ND	
Aroclor1248	0.0360	0.10	ND	
Aroclor1254	0.0240	0.10	ND	
Aroclor1260	0.0270	0.10	ND	
TCMX (S)			92.6 %	
DCBP (S)			86.7 %	

MB Summary Report

Work Order:	1004070	**Prep Method:**	3545_OCP	**Prep Date:**	04/20/10	**Prep Batch:**	0308
Matrix:	Soil	**Analytical Method:**	SW8081A	**Analyzed Date:**	04/22/10	**Analytical Batch:**	400649
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
alpha-BHC	0.44	2.0	ND	
gamma-BHC	0.40	2.0	ND	
beta-BHC	0.36	2.0	ND	
delta-BHC	0.49	2.0	ND	
Heptachlor	1.1	2.0	ND	
Aldrin	0.44	2.0	ND	
Heptachlor epoxide	0.32	2.0	ND	
gamma-Chlordane	0.42	2.0	ND	
alpha-Chlordane	0.36	2.0	ND	
Endosulfan I	0.59	2.0	ND	
4,4'-DDE	0.48	2.0	ND	
Dieldrin	0.43	2.0	ND	
Endrin	0.57	2.0	ND	
4,4'-DDD	0.47	2.0	ND	
Endosulfan II	1.5	2.0	ND	
4,4'-DDT	0.81	2.0	ND	
Endrin aldehyde	1.0	2.0	ND	
Endosulfan sulfate	0.49	2.0	ND	
Methoxychlor	0.62	5.0	ND	
Endrin Ketone	0.40	2.0	ND	
Chlordane	10	20	ND	
Toxaphene	10	100	ND	
TCMX (S)			91.0 %	
DCBP (S)			95.4 %	

Work Order:	1004070	**Prep Method:**	1311/3010B	**Prep Date:**	05/07/10	**Prep Batch:**	0392
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/07/10	**Analytical Batch:**	400786
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead (TCLP)	0.0500	0.10	ND	

MB Summary Report

Work Order:	1004070	**Prep Method:**	WET/3010B	**Prep Date:**	05/11/10	**Prep Batch:**	0413
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400854
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Chromium (STLC)	0.0200	0.10	ND	
Lead (STLC)	0.0500	0.10	ND	

Work Order:	1004070	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0424
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400865
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	ND	

Work Order:	1004070	**Prep Method:**	7199M	**Prep Date:**	05/11/10	**Prep Batch:**	0436
Matrix:	Soil	**Analytical Method:**	SW7199	**Analyzed Date:**	05/11/10	**Analytical Batch:**	400887
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Hexavalent Chromium	0.015	0.10	ND	

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004070	**Prep Method:**	7471	**Prep Date:**	04/19/10	**Prep Batch:**	0301
Matrix:	Soil	**Analytical Method:**	7471B	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400608
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Mercury	0.01	0.10	0.00167	1.25	108	107	1.37	80.5 - 133	30	

Work Order:	1004070	**Prep Method:**	3050	**Prep Date:**	04/19/10	**Prep Batch:**	0304
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/19/10	**Analytical Batch:**	400610
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Antimony	0.2	5	0.00	50	94	93.5	0.533	30.7 - 130	30	
Arsenic	0.28	1.7	0.00	50	91	90.1	0.994	71 - 121	30	
Barium	1.1	5	0.20	50	100.9	94.9	6.23	70.2 - 130	30	
Beryllium	0.084	2	0.00	50	103.6	100	3.62	73.3 - 115	30	
Cadmium	0.059	1	0.00	50	97.3	91.2	6.47	68.7 - 110		
Chromium	0.059	5	0.10	50	101.4	95.2	5.91	76 - 116	30	
Cobalt	0.14	5	0.050	50	99.3	94.7	4.74	57.4 - 122	30	
Copper	0.09	5	0.60	50	103.5	97.4	6.55	74.8 - 119	30	
Lead	0.13	1	0.25	50	94.2	93.4	0.853	67.9 - 118	30	
Molybdenum	0.059	5	0.050	50	96.1	95.4	0.731	62.9 - 123	30	
Nickel	0.059	5	3.1	50	103.8	98.1	5.84	61.5 - 122	30	
Selenium	0.29	5	0.45	50	86.7	85.5	1.39	62 - 111	30	
Silver	1	1	-0.15	50	98.2	92.9	5.55	81.1 - 109	30	
Thallium	0.12	5	0.10	50	90.2	89.9	0.333	39.2 - 125	30	
Vanadium	0.12	5	-0.10	50	101.1	95.8	5.28	65.8 - 122	30	
Zinc	0.59	5	1.0	50	97.9	90.2	8.19	59.9 - 122	30	

Work Order:	1004070	**Prep Method:**	3050	**Prep Date:**	04/19/10	**Prep Batch:**	0306
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400611
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Arsenic	0.28	1.7	0.00	50	91.4	91.4	0.000	71 - 121	30	
Lead	0.13	1	0.20	50	93.2	93.6	0.428	67.9 - 118	30	

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004070	**Prep Method:**	3545_TPH	**Prep Date:**	04/19/10	**Prep Batch:**	0305
Matrix:	Soil	**Analytical Method:**	SW8015B(M)	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400634
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
TPH as Diesel	0.758	2	0.32	33.33	80.7	80.1	0.757	52.7 - 115	30	
TPH as Motor Oil			-3.2	100				59.7 - 129		

Work Order:	1004070	**Prep Method:**	3545_PCB	**Prep Date:**	04/20/10	**Prep Batch:**	0309
Matrix:	Soil	**Analytical Method:**	SW8082	**Analyzed Date:**	04/21/10	**Analytical Batch:**	400641
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Aroclor1016	0.0230	0.10	0.0047	1	94.2	105	10.6	55.6 - 135	30	
Aroclor1260	0.0270	0.10	0.00	0.5	93.2	95.2	2.06	65.6 - 132	30	
TCMX (S)			0.00	0.25	89.4	90.2		51.7 - 128		
DCBP (S)			0.00	0.250	87.3	89.7		55.1 - 113		

Work Order:	1004070	**Prep Method:**	3545_OCP	**Prep Date:**	04/20/10	**Prep Batch:**	0308
Matrix:	Soil	**Analytical Method:**	SW8081A	**Analyzed Date:**	04/22/10	**Analytical Batch:**	400649
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
gamma-BHC	0.40	2.0	0.068	20	95.5	103	7.57	56.9 - 120	30	
Heptachlor	1.1	2.0	0.084	20	101	109	6.99	63.6 - 117	30	
Aldrin	0.44	2.0	0.00	20	97.5	105	7.86	53 - 123	30	
Dieldrin	0.43	2.0	0.19	20	102	110	8.12	44 - 130	30	
Endrin	0.57	2.0	0.060	20	102	111	8.15	44.1 - 121	30	
4,4'-DDT	0.81	2.0	0.00	20	120	126	4.71	52.8 - 134	30	
TCMX (S)			0.00	350	84.6	83.3		52.5 - 139		,
DCBP (S)			0.00	350	87.8	93.4		50.2 - 139		,

Work Order:	1004070	**Prep Method:**	1311/3010B	**Prep Date:**	05/07/10	**Prep Batch:**	0392
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/07/10	**Analytical Batch:**	400786
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (TCLP)	0.05	0.1	0.000	10	92.8	93.4	0.644	80 - 120	20	,

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004070	**Prep Method:**	WET/3010B	**Prep Date:**	05/11/10	**Prep Batch:**	0413
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400854
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Chromium (STLC)	0.0200	0.10	0.0100	10	93.4	92.8	0.644	80 - 120	20	,
Lead (STLC)	0.0500	0.10	0.000	10	91.1	90.7	0.440	80 - 120	20	,

Work Order:	1004070	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0424
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400865
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	0.000	10	98.5	98.7	0.203	80 - 120	20	,

Work Order:	1004070	**Prep Method:**	7199M	**Prep Date:**	05/11/10	**Prep Batch:**	0436
Matrix:	Soil	**Analytical Method:**	SW7199	**Analyzed Date:**	05/11/10	**Analytical Batch:**	400887
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Hexavalent Chromium	0.015	0.10	0.0006	0.1	95.9	90.2	6.16	65 - 135	30	,

MS/MSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004070	**Prep Method:**	3050	**Prep Date:**	04/19/10	**Prep Batch:**	0306
Matrix:	**Soil**	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400611
Spiked Sample:	1004070-002A						
Units:	mg/Kg						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Arsenic	0.28	1.7	0.012	50	87.2	84.4	3.22	71 - 121	30	
Lead	0.13	1	0.44	50	62.4	67.0	4.61	67.9 - 118	30	S

Duplicate Summary Report

Work Order:	1004070	**Prep Method:**	9045C	**Prep Date:**	4/19/2010	**Prep Batch:**	0302
Matrix:	**Soil**	**Analytical Method:**	SW9045C	**Analyzed Date:**	04/19/10	**Analytical Batch:**	400609
Units:						**Lab Sample ID:**	1004070-001A-Dup

Parameters	**MDL**	**PQL**	**Sample Result**	**Duplicate Result**	**% RPD**
pH	0.100	2.00	8.56	8.58	0.0583

Raw values are used in quality control assessment.

Laboratory Qualifiers and Definitions

DEFINITIONS:

Accuracy/Bias (% Recovery) - The closeness of agreement between an observed value and an accepted reference value.
Blank (Method/Preparation Blank) -MB/PB - An analyte-free matrix to which all reagents are added in the same volumes/proportions as used in sample processing. The method blank is used to document contamination resulting from the analytical process.
Duplicate - a field sample and/or laboratory QC sample prepared in duplicate following all of the same processes and procedures used on the original sample (sample duplicate, LCSD, MSD)
Laboratory Control Sample (LCS ad LCSD) - A known matrix spiked with compounds representative of the target analyte(s). This is used to document laboratory performance.
Matrix - the component or substrate that contains the analyte of interest (e.g., - groundwater, sediment, soil, waste water, etc)
Matrix Spike (MS/MSD) - Client sample spiked with identical concentrations of target analyte (s). The spiking occurs prior to the sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.
Method Detection Limit (MDL) - the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero
Practical Quantitation Limit (PQL) - a laboratory determined value at 2 to 5 times above the MDL that can be reproduced in a manner that results in a 99% confidence level that the result is both accurate and precise. PQLs reflect all preparation factors and/or dilution factors that have been applied to the sample during the preparation and/or analytical processes.
Precision (%RPD) - The agreement among a set of replicate/duplicate measurements without regard to known value of the replicates
Surrogate (S) or (Surr) - An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are used in most organic analysis to demonstrate matrix compatibility with the chosen method of analysis
Tentatively Identified Compound (TIC) - A compound not contained within the analytical calibration standards but present in the GCMS library of defined compounds. When the library is searched for an unknown compound, it can frequently give a tentative identification to the compound based on retention time and primary and secondary ion match. TICs are reported as estimates and are candidates for further investigation.
Units: the unit of measure used to express the reported result - **mg/L** and ***mg/Kg*** (equivalent to PPM - parts per million in **liquid** and ***solid***), **ug/L** and ***ug/Kg*** (equivalent to PPB - parts per billion in **liquid** and ***solid***), **ug/m3**, ***mg.m3***, **ppbv** and ***ppmv*** (all units of measure for reporting concentrations in air), **%** (equivalent to 10000 ppm or 1,000,000 ppb), **ug/Wipe** (concentration found on the surface of a single Wipe usually taken over a 100cm2 surface)

LABORATORY QUALIFIERS:

B - Indicates when the anlayte is found in the associated method or preparation blank
D - Surrogate is not recoverable due to the necessary dilution of the sample
E - Indicates the reportable value is outside of the calibration range of the instrument but within the linear range of the instrument (unless otherwise noted) Values reported with an E qualifier should be considered as estimated.
H- Indicates that the recommended holding time for the analyte or compound has been exceeded
J- Indicates a value between the method MDL and PQL and that the reported concentration should be considered as estimated rather the quantitative
NA - Not Analyzed
N/A - Not Applicable
NR - Not recoverable - a matrix spike concentration is not recoverable due to a concentration within the original sample that is greater than four times the spike concentration added
R- The % RPD between a duplicate set of samples is outside of the absolute values established by laboratory control charts
S- Spike recovery is outside of established method and/or laboratory control limits. Further explanation of the use of this qualifier should be included within a case narrative
X -Used to indicate that a value based on pattern identification is within the pattern range but not typical of the pattern found in standards. Further explanation may or may not be provided within the sample footnote and/or the case narrative.

Sample Receipt Checklist

Client Name: URS (San Jose)

Project Name: Petaluma CA

Work Order No.: 1004070

Date and Time Received: 4/16/2010 14:55

Received By: lorna

Physically Logged By:

Checklist Completed By: lorna

Carrier Name: Hi-Speed Courier

Chain of Custody (COC) Information

Chain of custody present?	Yes
Chain of custody signed when relinquished and received?	Yes
Chain of custody agrees with sample labels?	Yes
Custody seals intact on sample bottles?	Not Present

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Not Present
Shipping Container/Cooler In Good Condition?	Yes
Samples in proper container/bottle?	Yes
Samples containers intact?	Yes
Sufficient sample volume for indicated test?	Yes

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes	
Container/Temp Blank temperature in compliance?	Temperature: 3	°C
Water-VOA vials have zero headspace?	No VOA vials submitted	
Water-pH acceptable upon receipt?		

pH Checked by:

pH Adjusted by:

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	II
Project Name:	Petaluma CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/16/2010
Report Due Date:	5/14/2010		**Time Received:**	14:55

Comments: 5 day TAT! Received 20 soils.

Work Order # : ***1004070***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1004070-001A	N-2 @0.5	04/15/10 9:22	Soil	10/13/10				
							S_pH9045C	
							S_7471BHG	
							SUB_AsbestosCARB 435	Yes
							S_6010BCAM17	
1004070-002A	N-2 @ 1.0	04/15/10 9:25	Soil	10/13/10				
							S_6010BCAM17	
Sample Note:	Metals Pb only for samples 002A-019A.							
1004070-003A	N-4 @0.5	04/15/10 9:37	Soil	10/13/10				
							S_6010B(STLC)	
							S_6010BDI-STLC	
							S_6010BCAM17	
1004070-004A	N-4 @ 1.0	04/15/10 9:39	Soil	10/13/10				
							S_6010BCAM17	
1004070-005A	N-12 @ 0.5	04/15/10 10:01	Soil	10/13/10				
							S_6010B(STLC)	
							S_6010BDI-STLC	
							S_6010BCAM17	
							S_6010B(TCLP)	
1004070-006A	N-12 @ 1.0	04/15/10 10:03	Soil	10/13/10				
							S_6010B(STLC)	
							S_6010BCAM17	
							S_6010B(TCLP)	
							S_6010BDI-STLC	
1004070-007A	N-12 @1.5	04/15/10 10:05	Soil	10/13/10				
							S_6010BCAM17	
1004070-008A	N-12 @ 2.0	04/15/10 10:07	Soil	10/13/10				
							S_6010BCAM17	
1004070-009A	N-12 @ 3.0	04/15/10 10:09	Soil	10/13/10				
							S_6010BCAM17	
1004070-010A	N-14 @ 0.5	04/15/10 10:17	Soil	10/13/10				
							S_8081AOCP	
							S_8082PCB	
							S_6010BCAM17	
1004070-011A	S-9 @ 0.5	04/15/10 13:47	Soil	10/13/10				

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	II
Project Name:	Petaluma CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/16/2010
Report Due Date:	5/14/2010		**Time Received:**	14:55

Comments: 5 day TAT! Received 20 soils.

Work Order # : ***1004070***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
							S_6010B(STLC) S_6010B(TCLP) S_6010BCAM17 S_6010BDI-STLC	
Sample Note:	STLC,DI STLC,TCLP-Pb							
1004070-012A	S-9 @ 1.0	04/15/10 13:49	Soil	10/13/10				
							S_6010B(STLC) S_6010BCAM17 S_6010BDI-STLC S_6010B(TCLP)	
1004070-013A	S-8 @ 0.5	04/15/10 14:01	Soil	10/13/10				
							S_6010B(STLC) S_6010BCAM17 S_6010BDI-STLC CO	
Sample Note:	STLC, DI-STLC-Pb							
1004070-014A	S-8 @ 1.0	04/15/10 14:03	Soil	10/13/10				
							S_6010BCAM17	
1004070-015A	M-16 @ 0.5	04/15/10 15:26	Soil	10/13/10				
							S_6010BCAM17	
1004070-016A	M-16 @ 1.0	04/15/10 15:28	Soil	10/13/10				
							S_CrVI7199 SUB_AsbestosCARB 435 S_pH9045C S_6010BDI-STLC S_6010BCAM17 S_TPHDO S_8260Full S_GCMS-GRO S_6010B(STLC) S_7471BHG	Yes
1004070-017A	M-16 @ 1.5	04/15/10 15:30	Soil	10/13/10				
							S_6010B(STLC) S_6010BDI-STLC S_6010BCAM17	

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	II
Project Name:	Petaluma CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/16/2010
Report Due Date:	5/14/2010		**Time Received:**	14:55

Comments: 5 day TAT! Received 20 soils.

Work Order # : ***1004070***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1004070-018A	M-16 @ 2.0	04/15/10 15:32	Soil	10/13/10			S_6010BCAM17	
1004070-019A	M-16 @ 3.0	04/15/10 15:34	Soil	10/13/10			S_6010B(STLC) S_6010BDI-STLC S_GCMS-GRO S_TPHDO S_6010BCAM17 S_8260MBTEX S_6010B(TCLP)	
1004070-020A	M-16 @ 6.0	04/15/10 15:36	Soil	10/13/10	On-Hold		S_6010BCAM17	

Sample Note: HOLD

Torrent LABORATORY, INC.

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004070

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	Pesticide	Lead	PCBs	REMARKS
-001A	N-2@0.5	04/15/10 9:22	Soil	1	Sleeve	✓			✓	✓					
-002A	N-2@1.0	04/15/10 9:25	Soil	1	Sleeve								✓		
-003A	N-4@0.5	04/15/10 9:37	Soil	1	Sleeve								✓		
-004A	N-4@1.0	04/15/10 9:39	Soil	1	Sleeve								✓		
-005A	N-12@0.5	04/15/10 10:01	Soil	1	Sleeve								✓		
-006A	N-12@1.0	04/15/10 10:03	Soil	1	Sleeve								✓		
-007A	N-12@1.5	04/15/10 10:05	Soil	1	Sleeve								✓		
-008A	N-12@2.0	04/15/10 10:07	Soil	1	Sleeve								✓		
-009A	N-12@3.0	04/15/10 10:09	Soil	1	Sleeve								✓		Temp 3°C
-010A	N-14@0.5	04/15/10 10:17	Soil	1	Sleeve							✓	✓	✓	

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	4/15/10	1830			4/16	2:25
2			4/16	2:55		L-D-Imbat	4-16-10	1655

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment ~~gov~~ Hi-speed Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 1 of 2

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

Torrent LABORATORY, INC.

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004070

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead	PCBs	REMARKS
011A	S-9@0.5	04/15/10 13:47	Soil	1	Sleeve								✓		
012A	S-9@1.0	04/15/10 13:49	Soil	1	Sleeve								✓		
013A	S-8@0.5	04/15/10 14:01	Soil	1	Sleeve								✓		
014A	S-8@1.0	04/15/10 14:03	Soil	1	Sleeve								✓		
015A	M-16 ~~S-4~~@0.5	04/15/10 15:26	Soil	1	Sleeve								✓		
016A	M-16 ~~S-4~~@1.0	04/15/10 15:28	Soil	1	Sleeve	✓	✓	✓	✓	✓	✓	✓			
017A	M-16 ~~S-4~~@1.5	04/15/10 15:30	Soil	1	Sleeve								✓		
018A	M-16 ~~S-4~~@2.0	04/15/10 15:32	Soil	1	Sleeve								✓		
019A	M-16 ~~S-4~~@3.0	04/15/10 15:34	Soil	1	Sleeve		✓	✓					✓		Temp 36
020A	M-16 ~~S-4~~@6.0	04/15/10 15:36	Soil	1	Sleeve										Hold

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	4/15/10	1830			4/16	2:25
2			4/16	2:55		L. D. Imbat	4-16-10	1455

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment Hi-Speed Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 2 of 2

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

EMSL Analytical, Inc
2235 Polvorosa Ave , Suite 230, San Leandro, CA 94577
Phone: (510) 895-3675 Fax: (510) 895-3680 Email: milpitaslab@emsl.com

Attn: **Nutan Kabir**
Torrent Laboratory, Inc.
483 Sinclair Frontage Rd.
Milpitas, CA 95035

Fax: (408) 263-8293 Phone: (408) 263-5258
Project: **CoC100419002**

Customer ID: TORR80
Customer PO:
Received: 04/20/10 10:45 AM
EMSL Order: 091003567

EMSL Proj:
Analysis Date: 4/26/2010

Test Report: Qualitative asbestos analysis of soils using the EPA 600/R-93/116 method

Sample	Description	Appearance	Result	Notes
1004070-001A *091003567-0001*			**None Detected**	
1004070-016A *091003567-0002*			**Chrysotile**	

Analyst(s)

Grant Mays (2)

Baojia Ke, Laboratory Manager
or other approved signatory

EMSL recommends that soil samples reported as "ND" be tested by the EPA Screening Method/Qualitative. The above report relates only to the items tested. This report may not be reproduced, except in full, without written approval by EMSL Analytical, Inc. The above test must not be used by the client to claim product endorsement by NVLAP nor any agency of the United States Government. Unless otherwise noted, the results in this report have not been blank corrected.Samples received in good condition unless otherwise noted.
Samples analyzed by EMSL Analytical, Inc 2235 Polvorosa Ave , Suite 230, San LeandroCA

THIS IS THE LAST PAGE OF THE REPORT.

IRS Sample I					
Boring ID	Chromium 6	Chromium STLC	Lead STLC	Lead DI-STLC	Lead TCLP
# of samples to be tested	6	3	43	43	20
S-5	1003111-019A				
S-8			1004070-013A	1004070-013A	
N-1			1003116-027A	1003116-027A	1003116-027A
			1003116-028A	1003116-028A	
M-1					
M-1D					
M-2			1004009-006A	1004009-006A	
M-4			1004009-010A	1004009-010A	1004009-010A
S-9			1004070-011A	1004070-011A	1004070-011A
			1004070-012A	1004070-012A	1004070-012A
S-12			1004072-005A	1004072-005A	
S-13			1004072-004A	1004072-004A	
S-14			1003116-026A	1003116-026A	1003116-026A
S-15					
N-4			1004070-003A	1004070-003A	
N-5			1003116-014A	1003116-014A	1003116-014A
	1003116-015A		1003116-015A	1003116-015A	1003116-015A
			1003116-001A	1003116-001A	
N-6			1003116-002A	1003116-002A	1003116-002A
			1003116-003A	1003116-003A	
			1003116-004A	1003116-004A	1003116-004A
			1003116-005A	1003116-005A	1003116-005A
N-7			1004091-011A	1004091-011A	1004091-011A
			1004091-012A	1004091-012A	
			1004091-013A	1004091-013A	
			1004091-014A	1004091-014A	
N-8			1003111-001A	1003111-001A	
			1003111-002A	1003111-002A	
N-11			1003111-012A	1003111-012A	
			1003111-013A	1003111-013A	
N-12			1004070-005A	1004070-005A	1004070-005A
			1004070-006A	1004070-006A	1004070-006A
N-13			1003111-014A	1003111-014A	
N-13-d			1003111-007A	1003111-007A	
N-14			1004072-011A	1004072-011A	1004072-011A
	1004072-014A	1004072-014A			
M-18			1004011-001A	1004011-001A	1004011-001A
			1004011-003A	1004011-003A	
M-19	1004011-007A	1004011-007A			
			1004011-008A	1004011-008A	
M-19-d	1004011-012A	1004011-012A			
M-21			1004011-023A	1004011-023A	1004011-023A
M-22			1004011-029A	1004011-029A	
S-16			1003116-029A	1003116-029A	
N-15			1004067-004A	1004067-004A	1004067-004A
N-16			1004067-010A	1004067-010A	1004067-010A
N-17			1004072-017A	1004072-017A	1004072-017A
M-6					
M-10					
M-16	1004070-016A		1004070-016A	1004070-016A	
			1004070-017A	1004070-017A	
			1004070-019A	1004070-019A	1004070-019A

URS (San Jose)
100 W San Fernando St, Suite200
San Jose, California 95113
Tel: 4082979585
Fax: 4082976962

RE: Petaluma CA

Work Order No.: 1004067 Rev: 1

Dear James Ripple:

Torrent Laboratory, Inc. received 14 sample(s) on April 16, 2010 for the analyses presented in the following Report.

All data for associated QC met EPA or laboratory specification(s) except where noted in the case narrative.

Torrent Laboratory, Inc. is certified by the State of California, ELAP #1991. If you have any questions regarding these test results, please feel free to contact the Project Management Team at (408)263-5258; ext 204.

Patti Sandrock

May 18, 2010
Date

Date: 5/18/2010

Client: URS (San Jose)

Project: Petaluma CA

Work Order: 1004067

CASE NARRATIVE

No issues encountered with the receiving, preparation, analysis or reporting of the results associated with this work order.

REVISIONS:

Per client request, additional TCLP, STLC and DI-STLC anlaysis was performed on specified samples (see attachment at end of report).

Note: Extraction of 50 g sample / 500g 0.2M Sodium Citrate Solution was performed according to wet extraction procedure (WET) which was rotated in a rotary shaker for 48 hours.

Date Prepared: 5/9/10 @ 1PM to 5/11/10 @ 1PM

Note: Extraction of 100 g sample / 2000g TCLP Fluid # 1 was performed according to Toxicity Characteristic Leaching Procedure (TCLP) which was rotated in a rotary shaker for 18 hours.

Date Prepared: 5/6/10 @ 3:50PM to 5/7/10 @ 9:50AM.

Note: Extraction of 50 g sample with DI water was performed according to wet extraction procedure (WET) which was rotated in a rotary shaker for 48 hours.

Date Prepared: 5/11/10 @ 11:20AM to 5/3/10 @ 11:20AM.

Rev1 5/17/10

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

N-15 @0.5 1004067-003A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	18	mg/Kg

N-15 @1.0 1004067-004A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	39	mg/L
Lead (TCLP)	SW6010B	1	0.05	0.10	4.9	mg/L
Lead	SW6010B	1	0.13	1.0	920	mg/Kg

N-15 @ 1.5 1004067-005A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	39	mg/Kg

N-15 @ 2.0 1004067-006A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	5.4	mg/Kg

N-15 @ 3.0 1004067-007A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	6.3	mg/Kg

N-16 @ 0.5 1004067-009A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	31	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

N-16 @ 1.0 1004067-010A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	4.7	mg/L
Lead	SW6010B	1	0.13	1.0	310	mg/Kg

N-16 @ 1.5 1004067-011A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	2.3	mg/Kg

N-16 @ 2.0 1004067-012A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	7.3	mg/Kg

N-16 @ 3.0 1004067-013A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	7.0	mg/Kg

N17-GW 1004067-015A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit

All compounds were non-detectable for this sample.

M-16GW 1004067-017A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit

All compounds were non-detectable for this sample.

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-15 @0.5	**Lab Sample ID:**	1004067-003A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 10:33		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/19/10	1	0.13	1.0	18		mg/Kg	400610	0304

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-15 @1.0	**Lab Sample ID:**	1004067-004A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 10:35		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	39		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	4.9		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/19/10	1	0.13	1.0	920		mg/Kg	400610	0304

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-15 @ 1.5	**Lab Sample ID:**	1004067-005A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 10:37		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/19/10	1	0.13	1.0	39		mg/Kg	400610	0304

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-15 @ 2.0	**Lab Sample ID:**	1004067-006A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 10:39		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/19/10	1	0.13	1.0	5.4		mg/Kg	400610	0304

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-15 @ 3.0	**Lab Sample ID:**	1004067-007A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 10:41		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/19/10	1	0.13	1.0	6.3		mg/Kg	400610	0304

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-16 @ 0.5	**Lab Sample ID:**	1004067-009A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 11:02		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/19/10	1	0.13	1.0	31		mg/Kg	400610	0304

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-16 @ 1.0	**Lab Sample ID:**	1004067-010A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 11:04		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	4.7		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	ND		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/19/10	1	0.13	1.0	310		mg/Kg	400610	0304

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-16 @ 1.5	**Lab Sample ID:**	1004067-011A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 11:06		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/19/10	1	0.13	1.0	2.3		mg/Kg	400610	0304

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-16 @ 2.0	**Lab Sample ID:**	1004067-012A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 11:08		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/19/10	1	0.13	1.0	7.3		mg/Kg	400610	0304

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N-16 @ 3.0	**Lab Sample ID:**	1004067-013A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/15/10 / 11:10		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/19/10	04/19/10	1	0.13	1.0	7.0		mg/Kg	400610	0304

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	N17-GW	**Lab Sample ID:**	1004067-015A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Groundwater
Project Number:			
Date/Time Sampled:	04/15/10 / 11:53		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH as Diesel	SW8015B(M)	4/19/10	04/20/10	1	0.0400	0.10	ND		mg/L	400630	0310
TPH as Motor Oil	SW8015B(M)	4/19/10	04/20/10	1	0.0900	0.20	ND		mg/L	400630	0310
Pentacosane (S)	SW8015B(M)	4/19/10	04/20/10	1	64.2	123	96.0		%	400630	0310

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	M-16GW	**Lab Sample ID:**	1004067-017A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Groundwater
Project Number:			
Date/Time Sampled:	04/15/10 / 15:38		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Dichlorodifluoromethane	SW8260B	NA	04/20/10	1	0.41	0.50	ND		ug/L	400621	NA
Chloromethane	SW8260B	NA	04/20/10	1	0.41	0.50	ND		ug/L	400621	NA
Vinyl Chloride	SW8260B	NA	04/20/10	1	0.37	0.50	ND		ug/L	400621	NA
Bromomethane	SW8260B	NA	04/20/10	1	0.37	0.50	ND		ug/L	400621	NA
Trichlorofluoromethane	SW8260B	NA	04/20/10	1	0.34	0.50	ND		ug/L	400621	NA
1,1-Dichloroethene	SW8260B	NA	04/20/10	1	0.29	0.50	ND		ug/L	400621	NA
Freon 113	SW8260B	NA	04/20/10	1	0.38	0.50	ND		ug/L	400621	NA
Methylene Chloride	SW8260B	NA	04/20/10	1	0.18	5.0	ND		ug/L	400621	NA
trans-1,2-Dichloroethene	SW8260B	NA	04/20/10	1	0.31	0.50	ND		ug/L	400621	NA
MTBE	SW8260B	NA	04/20/10	1	0.38	0.50	ND		ug/L	400621	NA
tert-Butanol	SW8260B	NA	04/20/10	1	1.5	5.0	ND		ug/L	400621	NA
Diisopropyl ether (DIPE)	SW8260B	NA	04/20/10	1	0.36	0.50	ND		ug/L	400621	NA
1,1-Dichloroethane	SW8260B	NA	04/20/10	1	0.28	0.50	ND		ug/L	400621	NA
ETBE	SW8260B	NA	04/20/10	1	0.40	0.50	ND		ug/L	400621	NA
cis-1,2-Dichloroethene	SW8260B	NA	04/20/10	1	0.33	0.50	ND		ug/L	400621	NA
2,2-Dichloropropane	SW8260B	NA	04/20/10	1	0.37	0.50	ND		ug/L	400621	NA
Bromochloromethane	SW8260B	NA	04/20/10	1	0.34	0.50	ND		ug/L	400621	NA
Chloroform	SW8260B	NA	04/20/10	1	0.29	0.50	ND		ug/L	400621	NA
Carbon Tetrachloride	SW8260B	NA	04/20/10	1	0.26	0.50	ND		ug/L	400621	NA
1,1,1-Trichloroethane	SW8260B	NA	04/20/10	1	0.32	0.50	ND		ug/L	400621	NA
1,1-Dichloropropene	SW8260B	NA	04/20/10	1	0.40	0.50	ND		ug/L	400621	NA
Benzene	SW8260B	NA	04/20/10	1	0.33	0.50	ND		ug/L	400621	NA
TAME	SW8260B	NA	04/20/10	1	0.32	0.50	ND		ug/L	400621	NA
1,2-Dichloroethane	SW8260B	NA	04/20/10	1	0.28	0.50	ND		ug/L	400621	NA
Trichloroethylene	SW8260B	NA	04/20/10	1	0.38	0.50	ND		ug/L	400621	NA
Dibromomethane	SW8260B	NA	04/20/10	1	0.21	0.50	ND		ug/L	400621	NA
1,2-Dichloropropane	SW8260B	NA	04/20/10	1	0.37	0.50	ND		ug/L	400621	NA
Bromodichloromethane	SW8260B	NA	04/20/10	1	0.23	0.50	ND		ug/L	400621	NA
2-Chloroethyl vinyl ether	SW8260B	NA	04/20/10	1	0.91	2.0	ND		ug/L	400621	NA
cis-1,3-Dichloropropene	SW8260B	NA	04/20/10	1	0.30	0.50	ND		ug/L	400621	NA
Toluene	SW8260B	NA	04/20/10	1	0.19	0.50	ND		ug/L	400621	NA
Tetrachloroethylene	SW8260B	NA	04/20/10	1	0.15	0.50	ND		ug/L	400621	NA
trans-1,3-Dichloropropene	SW8260B	NA	04/20/10	1	0.20	0.50	ND		ug/L	400621	NA
1,1,2-Trichloroethane	SW8260B	NA	04/20/10	1	0.20	0.50	ND		ug/L	400621	NA
Dibromochloromethane	SW8260B	NA	04/20/10	1	0.21	0.50	ND		ug/L	400621	NA
1,3-Dichloropropane	SW8260B	NA	04/20/10	1	0.18	0.50	ND		ug/L	400621	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	M-16GW	**Lab Sample ID:**	1004067-017A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Groundwater
Project Number:			
Date/Time Sampled:	04/15/10 / 15:38		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
1,2-Dibromoethane	SW8260B	NA	04/20/10	1	0.19	0.50	ND		ug/L	400621	NA
Chlorobenzene	SW8260B	NA	04/20/10	1	0.14	0.50	ND		ug/L	400621	NA
Ethyl Benzene	SW8260B	NA	04/20/10	1	0.15	0.50	ND		ug/L	400621	NA
1,1,1,2-Tetrachloroethane	SW8260B	NA	04/20/10	1	0.10	0.50	ND		ug/L	400621	NA
m,p-Xylene	SW8260B	NA	04/20/10	1	0.20	1.0	ND		ug/L	400621	NA
o-Xylene	SW8260B	NA	04/20/10	1	0.13	0.50	ND		ug/L	400621	NA
Styrene	SW8260B	NA	04/20/10	1	0.20	0.50	ND		ug/L	400621	NA
Bromoform	SW8260B	NA	04/20/10	1	0.45	1.0	ND		ug/L	400621	NA
Isopropyl Benzene	SW8260B	NA	04/20/10	1	0.28	0.50	ND		ug/L	400621	NA
Bromobenzene	SW8260B	NA	04/20/10	1	0.39	0.50	ND		ug/L	400621	NA
1,1,2,2-Tetrachloroethane	SW8260B	NA	04/20/10	1	0.26	0.50	ND		ug/L	400621	NA
n-Propylbenzene	SW8260B	NA	04/20/10	1	0.30	0.50	ND		ug/L	400621	NA
2-Chlorotoluene	SW8260B	NA	04/20/10	1	0.33	0.50	ND		ug/L	400621	NA
1,3,5-Trimethylbenzene	SW8260B	NA	04/20/10	1	0.20	0.50	ND		ug/L	400621	NA
4-Chlorotoluene	SW8260B	NA	04/20/10	1	0.32	0.50	ND		ug/L	400621	NA
tert-Butylbenzene	SW8260B	NA	04/20/10	1	0.29	0.50	ND		ug/L	400621	NA
1,2,3-Trichloropropane	SW8260B	NA	04/20/10	1	0.59	1.0	ND		ug/L	400621	NA
1,2,4-Trimethylbenzene	SW8260B	NA	04/20/10	1	0.33	0.50	ND		ug/L	400621	NA
sec-Butyl Benzene	SW8260B	NA	04/20/10	1	0.24	0.50	ND		ug/L	400621	NA
p-Isopropyltoluene	SW8260B	NA	04/20/10	1	0.25	0.50	ND		ug/L	400621	NA
1,3-Dichlorobenzene	SW8260B	NA	04/20/10	1	0.31	0.50	ND		ug/L	400621	NA
1,4-Dichlorobenzene	SW8260B	NA	04/20/10	1	0.37	0.50	ND		ug/L	400621	NA
n-Butylbenzene	SW8260B	NA	04/20/10	1	0.32	0.50	ND		ug/L	400621	NA
1,2-Dichlorobenzene	SW8260B	NA	04/20/10	1	0.39	0.50	ND		ug/L	400621	NA
1,2-Dibromo-3-Chloropropane	SW8260B	NA	04/20/10	1	0.45	1.0	ND		ug/L	400621	NA
Hexachlorobutadiene	SW8260B	NA	04/20/10	1	0.22	0.50	ND		ug/L	400621	NA
1,2,4-Trichlorobenzene	SW8260B	NA	04/20/10	1	0.48	1.0	ND		ug/L	400621	NA
Naphthalene	SW8260B	NA	04/20/10	1	0.57	1.0	ND		ug/L	400621	NA
1,2,3-Trichlorobenzene	SW8260B	NA	04/20/10	1	0.52	1.0	ND		ug/L	400621	NA
(S) Dibromofluoromethane	SW8260B	NA	04/20/10	1	61.2	131	111		%	400621	NA
(S) Toluene-d8	SW8260B	NA	04/20/10	1	75.1	127	110		%	400621	NA
(S) 4-Bromofluorobenzene	SW8260B	NA	04/20/10	1	64.1	120	92.1		%	400621	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/16/10
Date Reported: 05/18/10

Client Sample ID:	M-16GW	**Lab Sample ID:**	1004067-017A
Project Name/Location:	Petaluma CA	**Sample Matrix:**	Groundwater
Project Number:			
Date/Time Sampled:	04/15/10 / 15:38		
Tag Number:	Petaluma CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH(Gasoline)	8260TPH	NA	04/20/10	1	22	50	ND		ug/L	400624	NA
(S) 4-Bromofluorobenzene	8260TPH	NA	04/20/10	1	58.4	133	76.4		%	400624	NA

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH as Diesel	SW8015B(M)	4/19/10	04/20/10	1	0.0400	0.10	ND		mg/L	400630	0310
TPH as Motor Oil	SW8015B(M)	4/19/10	04/20/10	1	0.0900	0.20	ND		mg/L	400630	0310
Pentacosane (S)	SW8015B(M)	4/19/10	04/20/10	1	64.2	123	98.1		%	400630	0310

MB Summary Report

Work Order:	1004067	**Prep Method:**	3050	**Prep Date:**	04/19/10	**Prep Batch:**	0304
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/19/10	**Analytical Batch:**	400610
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Antimony	0.20	5.0	ND	
Arsenic	0.28	1.7	ND	
Barium	1	5.0	ND	
Beryllium	0.0840	2.0	ND	
Cadmium	0.059	1.0	ND	
Chromium	0.059	5.0	0.10	
Cobalt	0.14	5.0	ND	
Copper	0.090	5.0	0.60	
Lead	0.13	1.0	0.25	
Molybdenum	0.059	5.0	ND	
Nickel	0.059	5.0	3.1	
Selenium	0.29	5.0	0.45	
Silver	1.0	1.0	ND	
Thallium	0.12	5.0	ND	
Vanadium	0.12	5.0	ND	
Zinc	0.59	5.0	1.0	

MB Summary Report

Work Order:	1004067	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400621
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Dichlorodifluoromethane	0.41	0.50	ND	
Chloromethane	0.41	0.50	ND	
Vinyl Chloride	0.37	0.50	ND	
Bromomethane	0.37	0.50	ND	
Trichlorofluoromethane	0.34	0.50	ND	
1,1-Dichloroethene	0.29	0.50	ND	
Freon 113	0.38	0.50	ND	
Methylene Chloride	0.18	5.0	ND	
trans-1,2-Dichloroethene	0.31	0.50	ND	
MTBE	0.38	0.50	ND	
tert-Butanol	1.5	5.0	ND	
Diisopropyl ether (DIPE)	0.36	0.50	ND	
1,1-Dichloroethane	0.28	0.50	ND	
ETBE	0.40	0.50	ND	
cis-1,2-Dichloroethene	0.33	0.50	ND	
2,2-Dichloropropane	0.37	0.50	ND	
Bromochloromethane	0.34	0.50	ND	
Chloroform	0.29	0.50	ND	
Carbon Tetrachloride	0.26	0.50	ND	
1,1,1-Trichloroethane	0.32	0.50	ND	
1,1-Dichloropropene	0.40	0.50	ND	
Benzene	0.33	0.50	ND	
TAME	0.32	0.50	ND	
1,2-Dichloroethane	0.28	0.50	ND	
Trichloroethylene	0.38	0.50	ND	
Dibromomethane	0.21	0.50	ND	
1,2-Dichloropropane	0.37	0.50	ND	
Bromodichloromethane	0.23	0.50	ND	
2-Chloroethyl vinyl ether	0.91	2.0	ND	
cis-1,3-Dichloropropene	0.30	0.50	ND	
Toluene	0.19	0.50	ND	
Tetrachloroethylene	0.15	0.50	ND	
trans-1,3-Dichloropropene	0.20	0.50	ND	
1,1,2-Trichloroethane	0.20	0.50	ND	
Dibromochloromethane	0.21	0.50	ND	
1,3-Dichloropropane	0.18	0.50	ND	
1,2-Dibromoethane	0.19	0.50	ND	

MB Summary Report

Work Order:	1004067	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400621
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Chlorobenzene	0.14	0.50	ND	
Ethyl Benzene	0.15	0.50	ND	
1,1,1,2-Tetrachloroethane	0.10	0.50	ND	
m,p-Xylene	0.20	1.0	0.38	
o-Xylene	0.13	0.50	ND	
Styrene	0.20	0.50	ND	
Bromoform	0.45	1.0	ND	
Isopropyl Benzene	0.28	0.50	ND	
Bromobenzene	0.39	0.50	ND	
1,1,2,2-Tetrachloroethane	0.26	0.50	ND	
n-Propylbenzene	0.30	0.50	ND	
2-Chlorotoluene	0.33	0.50	ND	
1,3,5-Trimethylbenzene	0.20	0.50	ND	
4-Chlorotoluene	0.32	0.50	ND	
tert-Butylbenzene	0.29	0.50	ND	
1,2,3-Trichloropropane	0.59	1.0	ND	
1,2,4-Trimethylbenzene	0.33	0.50	ND	
sec-Butyl Benzene	0.24	0.50	ND	
p-Isopropyltoluene	0.25	0.50	ND	
1,3-Dichlorobenzene	0.31	0.50	ND	
1,4-Dichlorobenzene	0.37	0.50	ND	
n-Butylbenzene	0.32	0.50	ND	
1,2-Dichlorobenzene	0.39	0.50	ND	
1,2-Dibromo-3-Chloropropane	0.45	1.0	ND	
Hexachlorobutadiene	0.22	0.50	ND	
1,2,4-Trichlorobenzene	0.48	1.0	ND	
Naphthalene	0.57	1.0	ND	
1,2,3-Trichlorobenzene	0.52	1.0	ND	
(S) Dibromofluoromethane			113 %	
(S) Toluene-d8			108 %	
(S) 4-Bromofluorobenzene			79.7 %	

MB Summary Report

Work Order:	1004067	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Water	**Analytical Method:**	8260TPH	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400624
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
TPH(Gasoline)	22	50	ND	
(S) 4-Bromofluorobenzene			72.1 %	

Work Order:	1004067	**Prep Method:**	3510_TPH	**Prep Date:**	04/19/10	**Prep Batch:**	0310
Matrix:	Water	**Analytical Method:**	SW8015B(M)	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400630
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
TPH as Diesel	0.0440	0.10	ND	
TPH as Motor Oil	0.0920	0.20	ND	
Pentacosane (S)			93.6 %	

Work Order:	1004067	**Prep Method:**	3510_TPH	**Prep Date:**	04/19/10	**Prep Batch:**	0310
Matrix:	Water	**Analytical Method:**	SW8015B(M)	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400630
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
TPH as Diesel	0.0440	0.10	ND	
TPH as Motor Oil	0.0920	0.20	ND	
Pentacosane (S)			105 %	

Work Order:	1004067	**Prep Method:**	1311/3010B	**Prep Date:**	05/07/10	**Prep Batch:**	0392
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/07/10	**Analytical Batch:**	400786
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead (TCLP)	0.0500	0.10	ND	

MB Summary Report

Work Order:	1004067	**Prep Method:**	WET/3010B	**Prep Date:**	05/11/10	**Prep Batch:**	0413
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400854
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Chromium (STLC)	0.0200	0.10	ND	
Lead (STLC)	0.0500	0.10	ND	

Work Order:	1004067	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0424
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400865
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	ND	

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004067	**Prep Method:**	3050	**Prep Date:**	04/19/10	**Prep Batch:**	0304
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/19/10	**Analytical Batch:**	400610
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Antimony	0.2	5	0.00	50	94	93.5	0.533	30.7 - 130	30	
Arsenic	0.28	1.7	0.00	50	91	90.1	0.994	71 - 121	30	
Barium	1.1	5	0.20	50	100.9	94.9	6.23	70.2 - 130	30	
Beryllium	0.084	2	0.00	50	103.6	100	3.62	73.3 - 115	30	
Cadmium	0.059	1	0.00	50	97.3	91.2	6.47	68.7 - 110		
Chromium	0.059	5	0.10	50	101.4	95.2	5.91	76 - 116	30	
Cobalt	0.14	5	0.050	50	99.3	94.7	4.74	57.4 - 122	30	
Copper	0.09	5	0.60	50	103.5	97.4	6.55	74.8 - 119	30	
Lead	0.13	1	0.25	50	94.2	93.4	0.853	67.9 - 118	30	
Molybdenum	0.059	5	0.050	50	96.1	95.4	0.731	62.9 - 123	30	
Nickel	0.059	5	3.1	50	103.8	98.1	5.84	61.5 - 122	30	
Selenium	0.29	5	0.45	50	86.7	85.5	1.39	62 - 111	30	
Silver	1	1	-0.15	50	98.2	92.9	5.55	81.1 - 109	30	
Thallium	0.12	5	0.10	50	90.2	89.9	0.333	39.2 - 125	30	
Vanadium	0.12	5	-0.10	50	101.1	95.8	5.28	65.8 - 122	30	
Zinc	0.59	5	1.0	50	97.9	90.2	8.19	59.9 - 122	30	

Work Order:	1004067	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Water	**Analytical Method:**	SW8260B	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400621
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
1,1-Dichloroethene	0.29	0.50	0.00	17.04	109	115	5.93	61.4 - 129	30	
Benzene	0.33	0.50	0.00	17.04	104	114	9.47	66.9 - 140	30	
Trichloroethylene	0.38	0.50	0.00	17.04	103	114	10.1	69.3 - 144	30	
Toluene	0.19	0.50	0.00	17.04	109	119	8.40	76.6 - 123	30	
Chlorobenzene	0.14	0.50	0.00	17.04	110	117	6.27	73.9 - 137	30	
(S) Dibromofluoromethane			0.00	11.36	116	111		61.2 - 131		
(S) Toluene-d8			0.00	11.36	110	114		75.1 - 127		
(S) 4-Bromofluorobenzene			0.070	11.36	117	114		64.1 - 120		

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004067	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Water	**Analytical Method:**	8260TPH	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400624
Units:	ug/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
TPH(Gasoline)	22	50	0.00	227.27	101	99.4	1.70	52.4 - 127		
(S) 4-Bromofluorobenzene			72.1	11.36	84.6	79.1		58.4 - 133		

Work Order:	1004067	**Prep Method:**	3510_TPH	**Prep Date:**	04/19/10	**Prep Batch:**	0310
Matrix:	Water	**Analytical Method:**	SW8015B(M)	**Analyzed Date:**	04/20/10	**Analytical Batch:**	400630
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
TPH as Diesel	0.0440	0.10	0.014	1	80.5	72.1	11.0	50.3 - 125	30	
Pentacosane (S)			0.062	100	96.3	82.6		57.9 - 125		

Work Order:	1004067	**Prep Method:**	1311/3010B	**Prep Date:**	05/07/10	**Prep Batch:**	0392
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/07/10	**Analytical Batch:**	400786
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (TCLP)	0.05	0.1	0.000	10	92.8	93.4	0.644	80 - 120	20	

Work Order:	1004067	**Prep Method:**	WET/3010B	**Prep Date:**	05/11/10	**Prep Batch:**	0413
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400854
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Chromium (STLC)	0.0200	0.10	0.0100	10	93.4	92.8	0.644	80 - 120	20	,
Lead (STLC)	0.0500	0.10	0.000	10	91.1	90.7	0.440	80 - 120	20	,

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004067	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0424
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400865
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	0.000	10	98.5	98.7	0.203	80 - 120	20	,

Laboratory Qualifiers and Definitions

DEFINITIONS:

Accuracy/Bias (% Recovery) - The closeness of agreement between an observed value and an accepted reference value.
Blank (Method/Preparation Blank) -MB/PB - An analyte-free matrix to which all reagents are added in the same volumes/proportions as used in sample processing. The method blank is used to document contamination resulting from the analytical process.
Duplicate - a field sample and/or laboratory QC sample prepared in duplicate following all of the same processes and procedures used on the original sample (sample duplicate, LCSD, MSD)
Laboratory Control Sample (LCS ad LCSD) - A known matrix spiked with compounds representative of the target analyte(s). This is used to document laboratory performance.
Matrix - the component or substrate that contains the analyte of interest (e.g., - groundwater, sediment, soil, waste water, etc)
Matrix Spike (MS/MSD) - Client sample spiked with identical concentrations of target analyte (s). The spiking occurs prior to the sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.
Method Detection Limit (MDL) - the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero
Practical Quantitation Limit (PQL) - a laboratory determined value at 2 to 5 times above the MDL that can be reproduced in a manner that results in a 99% confidence level that the result is both accurate and precise. PQLs reflect all preparation factors and/or dilution factors that have been applied to the sample during the preparation and/or analytical processes.
Precision (%RPD) - The agreement among a set of replicate/duplicate measurements without regard to known value of the replicates
Surrogate (S) or (Surr) - An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are used in most organic analysis to demonstrate matrix compatibility with the chosen method of analysis
Tentatively Identified Compound (TIC) - A compound not contained within the analytical calibration standards but present in the GCMS library of defined compounds. When the library is searched for an unknown compound, it can frequently give a tentative identification to the compound based on retention time and primary and secondary ion match. TICs are reported as estimates and are candidates for further investigation.
Units: the unit of measure used to express the reported result - **mg/L** and ***mg/Kg*** (equivalent to PPM - parts per million in **liquid** and ***solid***), **ug/L** and ***ug/Kg*** (equivalent to PPB - parts per billion in **liquid** and ***solid***), **ug/m3**, ***mg.m3***, **ppbv** and ***ppmv*** (all units of measure for reporting concentrations in air), **%** (equivalent to 10000 ppm or 1,000,000 ppb), **ug/Wipe** (concentration found on the surface of a single Wipe usually taken over a 100cm2 surface)

LABORATORY QUALIFIERS:

B - Indicates when the anlayte is found in the associated method or preparation blank
D - Surrogate is not recoverable due to the necessary dilution of the sample
E - Indicates the reportable value is outside of the calibration range of the instrument but within the linear range of the instrument (unless otherwise noted) Values reported with an E qualifier should be considered as estimated.
H- Indicates that the recommended holding time for the analyte or compound has been exceeded
J- Indicates a value between the method MDL and PQL and that the reported concentration should be considered as estimated rather the quantitative
NA - Not Analyzed
N/A - Not Applicable
NR - Not recoverable - a matrix spike concentration is not recoverable due to a concentration within the original sample that is greater than four times the spike concentration added
R- The % RPD between a duplicate set of samples is outside of the absolute values established by laboratory control charts
S- Spike recovery is outside of established method and/or laboratory control limits. Further explanation of the use of this qualifier should be included within a case narrative
X -Used to indicate that a value based on pattern identification is within the pattern range but not typical of the pattern found in standards. Further explanation may or may not be provided within the sample footnote and/or the case narrative.

Sample Receipt Checklist

Client Name: URS (San Jose)

Project Name: Petaluma CA

Work Order No.: 1004067

Date and Time Received: 4/16/2010 14:25

Received By: lorna

Physically Logged By:

Checklist Completed By: lorna

Carrier Name: Gold Bullet Courier

Chain of Custody (COC) Information

Chain of custody present?	Yes
Chain of custody signed when relinquished and received?	Yes
Chain of custody agrees with sample labels?	Yes
Custody seals intact on sample bottles?	Not Present

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Not Present
Shipping Container/Cooler In Good Condition?	Yes
Samples in proper container/bottle?	Yes
Samples containers intact?	Yes
Sufficient sample volume for indicated test?	Yes

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes			
Container/Temp Blank temperature in compliance?	Yes	Temperature:	3	°C
Water-VOA vials have zero headspace?	No VOA vials submitted			
Water-pH acceptable upon receipt?				

pH Checked by:

pH Adjusted by:

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	II
Project Name:	Petaluma CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/16/2010
Report Due Date:	5/14/2010		**Time Received:**	14:25

Comments: 5 day TAT! Received 15 soils, 4 On hold and 2 waters.

Work Order # : ***1004067***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1004067-001A	M-16 @9.0	04/15/10 15:38	Soil	10/13/10	On-Hold			
							S_6010BCAM17	
Sample Note:	HOLD							
1004067-002A	M-16 @10.5'	04/15/10 15:40	Soil	10/13/10	On-Hold			
							S_6010BCAM17	
Sample Note:	HOLD							
1004067-003A	N-15 @0.5	04/15/10 10:33	Soil	10/13/10				
							S_6010BCAM17	
Sample Note:	Metals- Pb only for samples 003A-013A.							
1004067-004A	N-15 @1.0	04/15/10 10:35	Soil	10/13/10				
							S_6010B(STLC)	
							S_6010BDI-STLC	
							S_6010BCAM17	
							S_6010B(TCLP)	
1004067-005A	N-15 @ 1.5	04/15/10 10:37	Soil	10/13/10				
							S_6010BCAM17	
1004067-006A	N-15 @ 2.0	04/15/10 10:39	Soil	10/13/10				
							S_6010BCAM17	
1004067-007A	N-15 @ 3.0	04/15/10 10:41	Soil	10/13/10				
							S_6010BCAM17	
1004067-008A	N-15 @ 6.0	04/15/10 10:43	Soil	10/13/10	On-Hold			
							S_6010BCAM17	
1004067-009A	N-16 @ 0.5	04/15/10 11:02	Soil	10/13/10				
							S_6010BCAM17	
1004067-010A	N-16 @ 1.0	04/15/10 11:04	Soil	10/13/10				
							S_6010B(STLC)	
							S_6010BCAM17	
							S_6010BDI-STLC	
							S_6010B(TCLP)	
1004067-011A	N-16 @ 1.5	04/15/10 11:06	Soil	10/13/10				
							S_6010BCAM17	
1004067-012A	N-16 @ 2.0	04/15/10 11:08	Soil	10/13/10				
							S_6010BCAM17	
1004067-013A	N-16 @ 3.0	04/15/10 11:10	Soil	10/13/10				
							S_6010BCAM17	

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	II
Project Name:	Petaluma CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/16/2010
Report Due Date:	5/14/2010		**Time Received:**	14:25

Comments: 5 day TAT! Received 15 soils, 4 On hold and 2 waters.

Work Order # : ***1004067***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1004067-014A	N-16 @ 6.0	04/15/10 11:12	Soil	10/13/10	On-Hold			
							S_6010BCAM17	
Sample Note:	HOLD							
1004067-015A	N17-GW	04/15/10 11:53	Water	10/13/10				
							W_TPHDO	
1004067-016A	N-17 @ 15.0	04/15/10 11:45	Soil	10/13/10	On-Hold			
							S_6010BCAM17	
1004067-017A	M-16GW	04/15/10 15:38	Water	10/13/10				
							W_8260Full W_GCMS-GRO W_TPHDO	

Sample Note: Per client request TPHD/MO added to sample M-16 GW on 4/20/10.

Torrent LABORATORY, INC.

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004067

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead	PCBs	REMARKS
-001A	M-16 ~~S1~~@9.0	04/15/10 15:38	Soil	1	Sleeve										Hold
-002A	M-16 ~~S1~~@~~12.0~~ 10.5'	04/15/10 15:40	Soil	1	Sleeve										Hold
-003A	N-15 @ 0.5	04/15/10 10:33											✓		
-004A	N-15 @ 1.0	04/15/10 10:35											✓		
-005A	N-15 @ 1.5	04/15/10 10:37											✓		
-006A	N-15 @ 2.0	04/15/10 10:39											✓		
-007A	N-15 @ 3.0	04/15/10 10:41											✓		
-008A	N-15 @ 6.0	04/15/10 10:43											✓		HOLD
-009A	N-16 @ 0.5	04/15/10 11:02											✓		Temp 3°C
-010A	N-16 @ 1.0	04/15/10 11:04											✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	4/15/10	1830			4/16	2:25
2			4/16	2:55	Gold Coast	L.D. Imbat	4-16-10	1455

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment Gold Coast Hot-Speed Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrangements are made.

Page 1 of 2

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

Torrent LABORATORY, INC.

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 100 4067

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: [x] 10 Work Days [ ] 3 Work Days [ ] Noon - Nxt Day [ ] 7 Work Days [ ] 2 Work Days [ ] 2 - 8 Hours [ ] 5 Work Days [ ] 1 Work Day [ ] Other

SAMPLE TYPE: [ ] Storm Water [ ] Air [ ] Waste Water [ ] Other [ ] Ground Water [x] Soil

REPORT FORMAT: [ ] QC Level IV [ ] EDF [ ] Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead	PCBs	REMARKS
011A	N-16@1.5 ~~11:06~~	04/15/10 11:06	SOIL	1	Sleeve								✓		
012A	N-16@2.0 ~~11:08~~	04/15/10 11:08	SOIL	1	SLEEVE								✓		
013A	N-16@3.0 ~~11:10~~	04/15/10 11:10	SOIL	1	SLEEVE								✓		
014A	N-16@6.0 ~~11:12~~	04/15/10 11:12	SOIL	1	SLEEVE										HOLD
015A	N-17 GW	04/15/10 11:53 11:59	GW	5	2-Amber 3-Voas		✓								
016A	N-17 @15.0	04/15/10 11:45	SOIL	1	SLEEVE										HOLD
017A	M-16 GW	04/15/10	GW	5	2 Amber 3 VOCs			✓			✓	✓			
															Temp 3°C

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	4/15/10	1830			4/16	2225
2			4/16	2155		L.D. Zuccato		1455

Were Samples Received in Good Condition? [ ] Yes [ ] NO Samples on Ice? [ ] Yes [ ] NO Method of Shipment: Sprint Sample seals intact? [ ] Yes [ ] NO [ ] N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrangements are made.

Page 2 of 2

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

IRS Sample I					
Boring ID	Chromium 6	Chromium STLC	Lead STLC	Lead DI-STLC	Lead TCLP
# of samples to be tested	6	3	43	43	20
S-5	1003111-019A				
S-8			1004070-013A	1004070-013A	
N-1			1003116-027A	1003116-027A	1003116-027A
			1003116-028A	1003116-028A	
M-1					
M-1D					
M-2			1004009-006A	1004009-006A	
M-4			1004009-010A	1004009-010A	1004009-010A
S-9			1004070-011A	1004070-011A	1004070-011A
			1004070-012A	1004070-012A	1004070-012A
S-12			1004072-005A	1004072-005A	
S-13			1004072-004A	1004072-004A	
S-14			1003116-026A	1003116-026A	1003116-026A
S-15					
N-4			1004070-003A	1004070-003A	
N-5			1003116-014A	1003116-014A	1003116-014A
	1003116-015A		1003116-015A	1003116-015A	1003116-015A
			1003116-001A	1003116-001A	
N-6			1003116-002A	1003116-002A	1003116-002A
			1003116-003A	1003116-003A	
			1003116-004A	1003116-004A	1003116-004A
			1003116-005A	1003116-005A	1003116-005A
N-7			1004091-011A	1004091-011A	1004091-011A
			1004091-012A	1004091-012A	
			1004091-013A	1004091-013A	
			1004091-014A	1004091-014A	
N-8			1003111-001A	1003111-001A	
			1003111-002A	1003111-002A	
N-11			1003111-012A	1003111-012A	
			1003111-013A	1003111-013A	
N-12			1004070-005A	1004070-005A	1004070-005A
			1004070-006A	1004070-006A	1004070-006A
N-13			1003111-014A	1003111-014A	
N-13-d			1003111-007A	1003111-007A	
N-14			1004072-011A	1004072-011A	1004072-011A
	1004072-014A	1004072-014A			
M-18			1004011-001A	1004011-001A	1004011-001A
			1004011-003A	1004011-003A	
M-19	1004011-007A	1004011-007A			
			1004011-008A	1004011-008A	
M-19-d	1004011-012A	1004011-012A			
M-21			1004011-023A	1004011-023A	1004011-023A
M-22			1004011-029A	1004011-029A	
S-16			1003116-029A	1003116-029A	
N-15			1004067-004A	1004067-004A	1004067-004A
N-16			1004067-010A	1004067-010A	1004067-010A
N-17			1004072-017A	1004072-017A	1004072-017A
M-6					
M-10					
M-16	1004070-016A		1004070-016A	1004070-016A	
			1004070-017A	1004070-017A	
			1004070-019A	1004070-019A	1004070-019A

URS (San Jose)
100 W San Fernando St, Suite200
San Jose, California 95113
Tel: 4082979585
Fax: 4082976962

RE: Petaluma, CA

Work Order No.: 1004011 Rev: 3

Dear James Ripple:

Torrent Laboratory, Inc. received 30 sample(s) on April 02, 2010 for the analyses presented in the following Report.

All data for associated QC met EPA or laboratory specification(s) except where noted in the case narrative.

Torrent Laboratory, Inc. is certified by the State of California, ELAP #1991. If you have any questions regarding these test results, please feel free to contact the Project Management Team at (408)263-5258; ext 204.

N. S. Kabir

Nutan Kabir

July 19, 2010

Date

Date: 7/19/2010

Client: URS (San Jose)

Project: Petaluma, CA

Work Order: 1004011

CASE NARRATIVE

No issues encountered with the receiving, preparation, analysis or reporting of the results associated with this work order.

Analytical Comments for Asbestos, Note: Analysis performed by sub-contract laboratory EMSL, Inc NVLAP Certification # 101048-3. Results to follow under separate cover.

REVISIONS:

Per client request, additional TCLP, STLC and DI-STLC anlaysis was performed on specified samples (see attachment at end of report).

Note: Extraction of 50 g sample / 500g 0.2M Sodium Citrate Solution was performed according to wet extraction procedure (WET) which was rotated in a rotary shaker for 48 hours.

Date Prepared: 5/9/10 @ 1PM to 5/11/10 @ 1PM

Note: Extraction of 100 g sample / 2000g TCLP Fluid # 1 was performed according to Toxicity Characteristic Leaching Procedure (TCLP) which was rotated in a rotary shaker for 18 hours.

Date Prepared: 5/6/10 @ 3:50PM to 5/7/10 @ 9:50AM.

Note: Extraction of 50 g sample with DI water was performed according to wet extraction procedure (WET) which was rotated in a rotary shaker for 48 hours.

Date Prepared: 5/11/10 @ 11:20AM to 5/3/10 @ 11:20AM.

Analytical Comments for method 6010B(STLC),For MS/MSDNote:The % recoveries for MS for Pb and MSD for Cr are outside of laboratory control limits but are within % RPD limits. The associated LCS/LCSD % recoveries and % RPD are within limits. No corrective action required.

Rev1 5/17/10

Per Client request STLC for Nickel reported for samples 008A and 012A.

Rev2 7/19/10

Per client request, STLC for Nickel reported for 007A.

Rev 3

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

M-18@0.5 1004011-001

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (DI-STLC)	SW6010B	1	0.0500	0.10	1.1	mg/L
Lead (TCLP)	SW6010B	1	0.05	0.10	0.13	mg/L
Lead (STLC)	SW6010B	1	0.0500	0.10	24	mg/L

M-18@1.0 1004011-002

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	34	mg/Kg

M-18@1.5 1004011-003

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	58	mg/Kg

M-18@2.0 1004011-004

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	5.3	mg/Kg

M-18@3.0 1004011-005

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	1.5	mg/Kg

M-19@0.5 1004011-006

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	1.1	mg/Kg

Torrent LABORATORY, INC.

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

M-19@1.0 1004011-007

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Antimony	SW6010B	1	0.20	5.0	7.8	mg/Kg
Barium	SW6010B	1	1	5.0	53	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	320	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	31	mg/Kg
Copper	SW6010B	1	0.0900	5.0	23	mg/Kg
Lead	SW6010B	1	0.13	1.0	35	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	530	mg/Kg
Silver	SW6010B	1	0	1.0	2.1	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	50	mg/Kg
Zinc	SW6010B	1	0.59	5.0	42	mg/Kg
Mercury	7471B	1	0.01	0.10	0.34	mg/Kg
pH	SW9045C	1	0.10	2.0	8.07	S.U.
Chromium (STLC)	SW6010B	1	0.0200	0.10	0.26	mg/L
NIckel (STLC)	SW6010B	1	0.0200	0.10	2.7	mg/L

M-19@1.5 1004011-008

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	55	mg/Kg
Lead (STLC)	SW6010B	1	0.0500	0.10	0.20	mg/L
NIckel (STLC)	SW6010B	1	0.0200	0.10	5.9	mg/L

M-19@2.0 1004011-009

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	19	mg/Kg

M-19@3.0 1004011-010

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	3.0	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

M-19d@0.5 1004011-011

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	14	mg/Kg

M-19d@1.0 1004011-012

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Antimony	SW6010B	1	0.20	5.0	7.2	mg/Kg
Barium	SW6010B	1	1	5.0	61	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	260	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	39	mg/Kg
Copper	SW6010B	1	0.0900	5.0	34	mg/Kg
Lead	SW6010B	1	0.13	1.0	38	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	470	mg/Kg
Silver	SW6010B	1	0	1.0	1.7	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	58	mg/Kg
Zinc	SW6010B	1	0.59	5.0	45	mg/Kg
pH	SW9045C	1	0.10	2.0	7.84	S.U.
Chromium (STLC)	SW6010B	1	0.0200	0.10	0.23	mg/L
NIckel (STLC)	SW6010B	1	0.0200	0.10	2.7	mg/L

M-19d@1.5 1004011-013

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	36	mg/Kg

M-19d@2.0 1004011-014

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	30	mg/Kg

M-19d@3.0 1004011-015

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	5.4	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

M-20@0.5 1004011-016

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	7.5	mg/Kg

M-20@1.0 1004011-017

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	11	mg/Kg

M-20@1.5 1004011-018

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	30	mg/Kg

M-20@2.0 1004011-019

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	15	mg/Kg

M-20@3.0 1004011-020

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	2.0	mg/Kg

M-21@0.5 1004011-021

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	18	mg/Kg

M-21@1.0 1004011-022

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	12	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

M-21@1.5 1004011-023

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	490	mg/Kg
Lead (DI-STLC)	SW6010B	1	0.0500	0.10	6.2	mg/L
Lead (STLC)	SW6010B	1	0.0500	0.10	21	mg/L

M-21@2.0 1004011-024

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	8.4	mg/Kg

M-21@3.0 1004011-025

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	2.1	mg/Kg

M-22@0.5 1004011-026

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	11	mg/Kg

M-22@1.0 1004011-027

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	8.3	mg/Kg

M-22@1.5 1004011-028

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	17	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

M-22@2.0 1004011-029

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	110	mg/Kg
Lead (DI-STLC)	SW6010B	1	0.0500	0.10	1.4	mg/L
Lead (STLC)	SW6010B	1	0.0500	0.10	6.6	mg/L

M-22@3.0 1004011-030

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	9.0	mg/Kg

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-18@0.5	**Lab Sample ID:**	1004011-001A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:02		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	24		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	0.13		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	590		mg/Kg	400497	0253

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	1.1		mg/L	400865	0424

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
The results shown below are reported using their MDL.											
alpha-BHC	SW8081A	4/6/10	04/08/10	40	18	80	ND		ug/Kg	400514	0241
gamma-BHC	SW8081A	4/6/10	04/08/10	40	16	80	ND		ug/Kg	400514	0241
beta-BHC	SW8081A	4/6/10	04/08/10	40	15	80	ND		ug/Kg	400514	0241
delta-BHC	SW8081A	4/6/10	04/08/10	40	20	80	ND		ug/Kg	400514	0241
Heptachlor	SW8081A	4/6/10	04/08/10	40	44	80	ND		ug/Kg	400514	0241
Aldrin	SW8081A	4/6/10	04/08/10	40	18	80	ND		ug/Kg	400514	0241
Heptachlor epoxide	SW8081A	4/6/10	04/08/10	40	13	80	ND		ug/Kg	400514	0241
gamma-Chlordane	SW8081A	4/6/10	04/08/10	40	17	80	ND		ug/Kg	400514	0241
alpha-Chlordane	SW8081A	4/6/10	04/08/10	40	14	80	ND		ug/Kg	400514	0241
Endosulfan I	SW8081A	4/6/10	04/08/10	40	24	80	ND		ug/Kg	400514	0241
4,4'-DDE	SW8081A	4/6/10	04/08/10	40	19	80	ND		ug/Kg	400514	0241
Dieldrin	SW8081A	4/6/10	04/08/10	40	17	80	ND		ug/Kg	400514	0241
Endrin	SW8081A	4/6/10	04/08/10	40	23	80	ND		ug/Kg	400514	0241
4,4'-DDD	SW8081A	4/6/10	04/08/10	40	19	80	ND		ug/Kg	400514	0241
Endosulfan II	SW8081A	4/6/10	04/08/10	40	61	80	ND		ug/Kg	400514	0241
4,4'-DDT	SW8081A	4/6/10	04/08/10	40	32	80	ND		ug/Kg	400514	0241
Endrin aldehyde	SW8081A	4/6/10	04/08/10	40	41	80	ND		ug/Kg	400514	0241

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-18@0.5	**Lab Sample ID:**	1004011-001A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:02		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
The results shown below are reported using their MDL.											
Endosulfan sulfate	SW8081A	4/6/10	04/08/10	40	20	80	ND		ug/Kg	400514	0241
Methoxychlor	SW8081A	4/6/10	04/08/10	40	25	200	ND		ug/Kg	400514	0241
Endrin Ketone	SW8081A	4/6/10	04/08/10	40	16	80	ND		ug/Kg	400514	0241
Chlordane	SW8081A	4/6/10	04/08/10	40	400	800	ND		ug/Kg	400514	0241
Toxaphene	SW8081A	4/6/10	04/08/10	40	400	4000	ND		ug/Kg	400514	0241
TCMX (S)	SW8081A	4/6/10	04/08/10	40	52.5	139	175	S,D	%	400514	0241
DCBP (S)	SW8081A	4/6/10	04/08/10	40	50.2	139	114	D	%	400514	0241

NOTE: Note: D - Surrogates diluted out. Reporting limits increased due to the nature of the sample matrix (dark color extract). All compounds reported to the MDL.

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Aroclor1016	SW8082	4/6/10	04/07/10	1	0.0230	0.10	ND		mg/Kg	400515	0242
Aroclor1221	SW8082	4/6/10	04/07/10	1	0.0920	0.20	ND		mg/Kg	400515	0242
Aroclor1232	SW8082	4/6/10	04/07/10	1	0.0460	0.10	ND		mg/Kg	400515	0242
Aroclor1242	SW8082	4/6/10	04/07/10	1	0.0430	0.10	ND		mg/Kg	400515	0242
Aroclor1248	SW8082	4/6/10	04/07/10	1	0.0360	0.10	ND		mg/Kg	400515	0242
Aroclor1254	SW8082	4/6/10	04/07/10	1	0.0240	0.10	ND		mg/Kg	400515	0242
Aroclor1260	SW8082	4/6/10	04/07/10	1	0.0270	0.10	ND		mg/Kg	400515	0242
TCMX (S)	SW8082	4/6/10	04/07/10	1	51.7	128	101		%	400515	0242
DCBP (S)	SW8082	4/6/10	04/07/10	1	55.1	113	99.3		%	400515	0242

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-18@1.0	**Lab Sample ID:**	1004011-002A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:04		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	34		mg/Kg	400497	0253

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-18@1.5	**Lab Sample ID:**	1004011-003A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:06		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	ND		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	58		mg/Kg	400497	0253

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-18@2.0	**Lab Sample ID:**	1004011-004A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:08		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	5.3		mg/Kg	400497	0253

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-18@3.0	**Lab Sample ID:**	1004011-005A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:10		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	1.5		mg/Kg	400497	0253

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-19@0.5	**Lab Sample ID:**	1004011-006A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:18		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	1.1		mg/Kg	400497	0253

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-19@1.0	**Lab Sample ID:**	1004011-007A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:20		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Chromium (STLC)	SW6010B	5/11/10	05/12/10	1	0.0200	0.10	0.26		mg/L	400854	0413
NIckel (STLC)	SW6010B	5/11/10	05/12/10	1	0.0200	0.10	2.7		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	4/5/10	04/07/10	1	0.20	5.0	7.8		mg/Kg	400481	0246
Arsenic	SW6010B	4/5/10	04/07/10	1	0.28	1.7	ND		mg/Kg	400481	0246
Barium	SW6010B	4/5/10	04/07/10	1	1	5.0	53		mg/Kg	400481	0246
Beryllium	SW6010B	4/5/10	04/07/10	1	0.0840	2.0	ND		mg/Kg	400481	0246
Cadmium	SW6010B	4/5/10	04/07/10	1	0.0590	1.0	ND		mg/Kg	400481	0246
Chromium	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	320		mg/Kg	400481	0246
Cobalt	SW6010B	4/5/10	04/07/10	1	0.14	5.0	31		mg/Kg	400481	0246
Copper	SW6010B	4/5/10	04/07/10	1	0.0900	5.0	23		mg/Kg	400481	0246
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	35		mg/Kg	400481	0246
Molybdenum	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	ND		mg/Kg	400481	0246
Nickel	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	530		mg/Kg	400481	0246
Selenium	SW6010B	4/5/10	04/07/10	1	0.29	5.0	ND		mg/Kg	400481	0246
Silver	SW6010B	4/5/10	04/07/10	1	0	1.0	2.1		mg/Kg	400481	0246
Thallium	SW6010B	4/5/10	04/07/10	1	0.12	5.0	ND		mg/Kg	400481	0246
Vanadium	SW6010B	4/5/10	04/07/10	1	0.12	5.0	50		mg/Kg	400481	0246
Zinc	SW6010B	4/5/10	04/07/10	1	0.59	5.0	42		mg/Kg	400481	0246

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	4/5/10	04/06/10	1	0.01	0.10	0.34		mg/Kg	400476	0239

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Hexavalent Chromium	SW7199M	5/11/10	05/11/10	1	0.015	0.10	ND		mg/Kg	400887	0436

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	NA	04/06/10	1	0.10	2.0	8.07		S.U.	400508	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-19@1.5	**Lab Sample ID:**	1004011-008A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:22		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	0.20		mg/L	400854	0413
NIckel (STLC)	SW6010B	5/11/10	05/12/10	1	0.0200	0.10	5.9		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	55		mg/Kg	400497	0253

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-19@2.0	**Lab Sample ID:**	1004011-009A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:24		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	19		mg/Kg	400497	0253

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-19@3.0	**Lab Sample ID:**	1004011-010A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:26		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	3.0		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-19d@0.5	**Lab Sample ID:**	1004011-011A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:32		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	14		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-19d@1.0	**Lab Sample ID:**	1004011-012A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:34		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Chromium (STLC)	SW6010B	5/11/10	05/12/10	1	0.0200	0.10	0.23		mg/L	400854	0413
NIckel (STLC)	SW6010B	5/11/10	05/12/10	1	0.0200	0.10	2.7		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	4/5/10	04/07/10	1	0.20	5.0	7.2		mg/Kg	400481	0246
Arsenic	SW6010B	4/5/10	04/07/10	1	0.28	1.7	ND		mg/Kg	400481	0246
Barium	SW6010B	4/5/10	04/07/10	1	1	5.0	61		mg/Kg	400481	0246
Beryllium	SW6010B	4/5/10	04/07/10	1	0.0840	2.0	ND		mg/Kg	400481	0246
Cadmium	SW6010B	4/5/10	04/07/10	1	0.0590	1.0	ND		mg/Kg	400481	0246
Chromium	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	260		mg/Kg	400481	0246
Cobalt	SW6010B	4/5/10	04/07/10	1	0.14	5.0	39		mg/Kg	400481	0246
Copper	SW6010B	4/5/10	04/07/10	1	0.0900	5.0	34		mg/Kg	400481	0246
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	38		mg/Kg	400481	0246
Molybdenum	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	ND		mg/Kg	400481	0246
Nickel	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	470		mg/Kg	400481	0246
Selenium	SW6010B	4/5/10	04/07/10	1	0.29	5.0	ND		mg/Kg	400481	0246
Silver	SW6010B	4/5/10	04/07/10	1	0	1.0	1.7		mg/Kg	400481	0246
Thallium	SW6010B	4/5/10	04/07/10	1	0.12	5.0	ND		mg/Kg	400481	0246
Vanadium	SW6010B	4/5/10	04/07/10	1	0.12	5.0	58		mg/Kg	400481	0246
Zinc	SW6010B	4/5/10	04/07/10	1	0.59	5.0	45		mg/Kg	400481	0246

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	4/5/10	04/06/10	1	0.01	0.10	ND		mg/Kg	400476	0239

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Hexavalent Chromium	SW7199M	5/11/10	05/11/10	1	0.015	0.10	ND		mg/Kg	400887	0436

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	NA	04/06/10	1	0.10	2.0	7.84		S.U.	400508	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-19d@1.5	**Lab Sample ID:**	1004011-013A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:36		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	36		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-19d@2.0	**Lab Sample ID:**	1004011-014A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:38		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	30		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-19d@3.0	**Lab Sample ID:**	1004011-015A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:40		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	5.4		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-20@0.5	**Lab Sample ID:**	1004011-016A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:44		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	7.5		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-20@1.0	**Lab Sample ID:**	1004011-017A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:46		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	11		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-20@1.5	**Lab Sample ID:**	1004011-018A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:48		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	30		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-20@2.0	**Lab Sample ID:**	1004011-019A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:50		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	15		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-20@3.0	**Lab Sample ID:**	1004011-020A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:52		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	2.0		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-21@0.5	**Lab Sample ID:**	1004011-021A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:00		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	18		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-21@1.0	**Lab Sample ID:**	1004011-022A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:02		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	12		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-21@1.5	**Lab Sample ID:**	1004011-023A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:04		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	21		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	ND		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	490		mg/Kg	400496	0252

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	6.2		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-21@2.0	**Lab Sample ID:**	1004011-024A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:06		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	8.4		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-21@3.0	**Lab Sample ID:**	1004011-025A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:08		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	2.1		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-22@0.5	**Lab Sample ID:**	1004011-026A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:16		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	11		mg/Kg	400496	0252

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
The results shown below are reported using their MDL.											
alpha-BHC	SW8081A	4/6/10	04/08/10	20	18	80	ND		ug/Kg	400514	0241
gamma-BHC	SW8081A	4/6/10	04/08/10	20	16	80	ND		ug/Kg	400514	0241
beta-BHC	SW8081A	4/6/10	04/08/10	20	15	80	ND		ug/Kg	400514	0241
delta-BHC	SW8081A	4/6/10	04/08/10	20	20	80	ND		ug/Kg	400514	0241
Heptachlor	SW8081A	4/6/10	04/08/10	20	44	80	ND		ug/Kg	400514	0241
Aldrin	SW8081A	4/6/10	04/08/10	20	18	80	ND		ug/Kg	400514	0241
Heptachlor epoxide	SW8081A	4/6/10	04/08/10	20	13	80	ND		ug/Kg	400514	0241
gamma-Chlordane	SW8081A	4/6/10	04/08/10	20	17	80	ND		ug/Kg	400514	0241
alpha-Chlordane	SW8081A	4/6/10	04/08/10	20	14	80	ND		ug/Kg	400514	0241
Endosulfan I	SW8081A	4/6/10	04/08/10	20	24	80	ND		ug/Kg	400514	0241
4,4'-DDE	SW8081A	4/6/10	04/08/10	20	19	80	ND		ug/Kg	400514	0241
Dieldrin	SW8081A	4/6/10	04/08/10	20	17	80	ND		ug/Kg	400514	0241
Endrin	SW8081A	4/6/10	04/08/10	20	23	80	ND		ug/Kg	400514	0241
4,4'-DDD	SW8081A	4/6/10	04/08/10	20	19	80	ND		ug/Kg	400514	0241
Endosulfan II	SW8081A	4/6/10	04/08/10	20	61	80	ND		ug/Kg	400514	0241
4,4'-DDT	SW8081A	4/6/10	04/08/10	20	32	80	ND		ug/Kg	400514	0241
Endrin aldehyde	SW8081A	4/6/10	04/08/10	20	41	80	ND		ug/Kg	400514	0241
Endosulfan sulfate	SW8081A	4/6/10	04/08/10	20	20	80	ND		ug/Kg	400514	0241
Methoxychlor	SW8081A	4/6/10	04/08/10	20	25	200	ND		ug/Kg	400514	0241
Endrin Ketone	SW8081A	4/6/10	04/08/10	20	16	80	ND		ug/Kg	400514	0241
Chlordane	SW8081A	4/6/10	04/08/10	20	400	800	ND		ug/Kg	400514	0241
Toxaphene	SW8081A	4/6/10	04/08/10	20	400	4000	ND		ug/Kg	400514	0241
TCMX (S)	SW8081A	4/6/10	04/08/10	20	52.5	139	133		%	400514	0241
DCBP (S)	SW8081A	4/6/10	04/08/10	20	50.2	139	124		%	400514	0241

NOTE: Note: Reporting limits increased due to the nature of the sample matrix (dark color extract). All compounds reported to the MDL.

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-22@0.5	**Lab Sample ID:**	1004011-026A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:16		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Aroclor1016	SW8082	4/6/10	04/07/10	1	0.0460	0.20	ND		mg/Kg	400515	0242
Aroclor1221	SW8082	4/6/10	04/07/10	1	0.184	0.40	ND		mg/Kg	400515	0242
Aroclor1232	SW8082	4/6/10	04/07/10	1	0.0920	0.20	ND		mg/Kg	400515	0242
Aroclor1242	SW8082	4/6/10	04/07/10	1	0.0860	0.20	ND		mg/Kg	400515	0242
Aroclor1248	SW8082	4/6/10	04/07/10	1	0.0720	0.20	ND		mg/Kg	400515	0242
Aroclor1254	SW8082	4/6/10	04/07/10	1	0.0480	0.20	ND		mg/Kg	400515	0242
Aroclor1260	SW8082	4/6/10	04/07/10	1	0.0540	0.20	ND		mg/Kg	400515	0242
TCMX (S)	SW8082	4/6/10	04/07/10	1	51.7	128	93.1		%	400515	0242
DCBP (S)	SW8082	4/6/10	04/07/10	1	55.1	113	91.8		%	400515	0242

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-22@1.0	**Lab Sample ID:**	1004011-027A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:18		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	8.3		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-22@1.5	**Lab Sample ID:**	1004011-028A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:20		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	17		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-22@2.0	**Lab Sample ID:**	1004011-029A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:22		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	6.6		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	110		mg/Kg	400496	0252

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	1.4		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 07/19/10

Client Sample ID:	M-22@3.0	**Lab Sample ID:**	1004011-030A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:24		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	9.0		mg/Kg	400496	0252

MB Summary Report

Work Order:	1004011	**Prep Method:**	7471	**Prep Date:**	04/05/10	**Prep Batch:**	0239
Matrix:	Soil	**Analytical Method:**	7471AB	**Analyzed Date:**	04/06/10	**Analytical Batch:**	400476
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Mercury	0.01	0.10	ND	

Work Order:	1004011	**Prep Method:**	3050	**Prep Date:**	04/05/10	**Prep Batch:**	0246
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/07/10	**Analytical Batch:**	400481
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Antimony	0.20	5.0	ND	
Arsenic	0.28	1.7	ND	
Barium	1	5.0	ND	
Beryllium	0.0840	2.0	ND	
Cadmium	0.059	1.0	ND	
Chromium	0.059	5.0	0.10	
Cobalt	0.14	5.0	ND	
Copper	0.090	5.0	0.50	
Lead	0.13	1.0	0.25	
Molybdenum	0.059	5.0	ND	
Nickel	0.059	5.0	0.10	
Selenium	0.29	5.0	ND	
Silver	1.0	1.0	ND	
Thallium	0.12	5.0	ND	
Vanadium	0.12	5.0	ND	
Zinc	0.59	5.0	0.95	

Work Order:	1004011	**Prep Method:**	3050	**Prep Date:**	04/06/10	**Prep Batch:**	0252
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400496
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead	0.13	1.0	0.30	

MB Summary Report

Work Order:	1004011	**Prep Method:**	3050	**Prep Date:**	04/06/10	**Prep Batch:**	0253
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400497
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead	0.13	1.0	0.25	

Work Order:	1004011	**Prep Method:**	3545_OCP	**Prep Date:**	04/06/10	**Prep Batch:**	0241
Matrix:	Soil	**Analytical Method:**	SW8081A	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400514
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
alpha-BHC	0.44	2.0	ND	
gamma-BHC	0.40	2.0	ND	
beta-BHC	0.36	2.0	ND	
delta-BHC	0.49	2.0	ND	
Heptachlor	1.1	2.0	ND	
Aldrin	0.44	2.0	ND	
Heptachlor epoxide	0.32	2.0	ND	
gamma-Chlordane	0.42	2.0	ND	
alpha-Chlordane	0.36	2.0	ND	
Endosulfan I	0.59	2.0	ND	
4,4'-DDE	0.48	2.0	ND	
Dieldrin	0.43	2.0	ND	
Endrin	0.57	2.0	ND	
4,4'-DDD	0.47	2.0	ND	
Endosulfan II	1.5	2.0	ND	
4,4'-DDT	0.81	2.0	ND	
Endrin aldehyde	1.0	2.0	ND	
Endosulfan sulfate	0.49	2.0	ND	
Methoxychlor	0.62	5.0	ND	
Endrin Ketone	0.40	2.0	ND	
Chlordane	10	20	ND	
Toxaphene	10	100	ND	
TCMX (S)			80.3	
DCBP (S)			78.3	

MB Summary Report

Work Order:	1004011	**Prep Method:**	3545_OCP	**Prep Date:**	04/06/10	**Prep Batch:**	0241
Matrix:	Soil	**Analytical Method:**	SW8081A	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400514
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
alpha-BHC	0.44	2.0	ND	
gamma-BHC	0.40	2.0	ND	
beta-BHC	0.36	2.0	ND	
delta-BHC	0.49	2.0	ND	
Heptachlor	1.1	2.0	ND	
Aldrin	0.44	2.0	ND	
Heptachlor epoxide	0.32	2.0	ND	
gamma-Chlordane	0.42	2.0	ND	
alpha-Chlordane	0.36	2.0	ND	
Endosulfan I	0.59	2.0	ND	
4,4'-DDE	0.48	2.0	ND	
Dieldrin	0.43	2.0	ND	
Endrin	0.57	2.0	ND	
4,4'-DDD	0.47	2.0	ND	
Endosulfan II	1.5	2.0	ND	
4,4'-DDT	0.81	2.0	ND	
Endrin aldehyde	1.0	2.0	ND	
Endosulfan sulfate	0.49	2.0	ND	
Methoxychlor	0.62	5.0	ND	
Endrin Ketone	0.40	2.0	ND	
Chlordane	10	20	ND	
Toxaphene	10	100	ND	
TCMX (S)			86.6	
DCBP (S)			85.0	

MB Summary Report

Work Order:	1004011	**Prep Method:**	3545_PCB	**Prep Date:**	04/06/10	**Prep Batch:**	0242
Matrix:	Soil	**Analytical Method:**	SW8082	**Analyzed Date:**	04/07/10	**Analytical Batch:**	400515
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Aroclor1016	0.0230	0.10	ND	
Aroclor1221	0.0920	0.20	ND	
Aroclor1232	0.0460	0.10	ND	
Aroclor1242	0.0430	0.10	ND	
Aroclor1248	0.0360	0.10	ND	
Aroclor1254	0.0240	0.10	ND	
Aroclor1260	0.0270	0.10	ND	
TCMX (S)			88.8	
DCBP (S)			88.6	

Work Order:	1004011	**Prep Method:**	3545_PCB	**Prep Date:**	04/06/10	**Prep Batch:**	0242
Matrix:	Soil	**Analytical Method:**	SW8082	**Analyzed Date:**	04/07/10	**Analytical Batch:**	400515
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Aroclor1016	0.0230	0.10	ND	
Aroclor1221	0.0920	0.20	ND	
Aroclor1232	0.0460	0.10	ND	
Aroclor1242	0.0430	0.10	ND	
Aroclor1248	0.0360	0.10	ND	
Aroclor1254	0.0240	0.10	ND	
Aroclor1260	0.0270	0.10	ND	
TCMX (S)			91.6	
DCBP (S)			90.0	

Work Order:	1004011	**Prep Method:**	1311/3010B	**Prep Date:**	05/07/10	**Prep Batch:**	0392
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/07/10	**Analytical Batch:**	400786
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead (TCLP)	0.0500	0.10	ND	

MB Summary Report

Work Order:	1004011	**Prep Method:**	WET/3010B	**Prep Date:**	05/11/10	**Prep Batch:**	0413
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400854
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Chromium (STLC)	0.0200	0.10	ND	
Lead (STLC)	0.0500	0.10	ND	

Work Order:	1004011	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0424
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400865
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	ND	

Work Order:	1004011	**Prep Method:**	7199M	**Prep Date:**	05/11/10	**Prep Batch:**	0436
Matrix:	Soil	**Analytical Method:**	SW7199	**Analyzed Date:**	05/11/10	**Analytical Batch:**	400887
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Hexavalent Chromium	0.015	0.10	ND	

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004011	**Prep Method:**	7471	**Prep Date:**	04/05/10	**Prep Batch:**	0239
Matrix:	Soil	**Analytical Method:**	7471B	**Analyzed Date:**	04/06/10	**Analytical Batch:**	400476
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Mercury	0.01	0.10		1.25	119	116	1.93	80.5 - 133	30	

Work Order:	1004011	**Prep Method:**	3050	**Prep Date:**	04/05/10	**Prep Batch:**	0246
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/07/10	**Analytical Batch:**	400481
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Antimony	0.20	5.0		50	95.9	95.9	0.000	30.7 - 130	30	
Arsenic	0.28	1.7		50	93.9	94.2	0.319	71 - 121	30	
Barium	1	5.0		50	103	96.9	6.10	70.2 - 130	30	
Beryllium	0.0840	2.0		50	92.3	92.3	0.000	73.3 - 115	30	
Cadmium	0.059	1.0		50	98.6	92.6	6.28	68.7 - 110		
Chromium	0.059	5.0		50	103	96.3	6.72	76 - 116	30	
Cobalt	0.14	5.0		50	101	95.1	6.02	57.4 - 122	30	
Copper	0.090	5.0		50	104	97.9	6.04	74.8 - 119	30	
Lead	0.13	1.0		50	95.7	96.0	0.313	67.9 - 118	30	
Molybdenum	0.059	5.0		50	98.2	97.8	0.408	62.9 - 123	30	
Nickel	0.059	5.0		50	99.5	93.4	6.32	61.5 - 122	30	
Selenium	0.29	5.0		50	86.8	87.3	0.574	62 - 111	30	
Silver	1.0	1.0		50	99.5	94.4	5.26	81.1 - 109	30	
Thallium	0.12	5.0		50	92.0	92.1	0.109	39.2 - 125	30	
Vanadium	0.12	5.0		50	103	96.9	6.10	65.8 - 122	30	
Zinc	0.59	5.0		50	101	95.0	6.12	59.9 - 122	30	

Work Order:	1004011	**Prep Method:**	3050	**Prep Date:**	04/06/10	**Prep Batch:**	0252
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400496
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead	0.13	1		50	93.7	93.1	0.642	67.9 - 118	30	

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004011	**Prep Method:**	3050	**Prep Date:**	04/06/10	**Prep Batch:**	0253
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400497
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead	0.13	1		50	91.7	92.3	0.652	67.9 - 118	30	

Work Order:	1004011	**Prep Method:**	3545_OCP	**Prep Date:**	04/06/10	**Prep Batch:**	0241
Matrix:	Soil	**Analytical Method:**	SW8081A	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400514
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
gamma-BHC	0.40	2.0		20	92.0	90.7	1.44	56.9 - 120	30	
Heptachlor	1.1	2.0		20	93.7	95.2	1.60	63.6 - 117	30	
Aldrin	0.44	2.0		20	91.3	92.2	0.955	53 - 123	30	
Dieldrin	0.43	2.0		20	95.3	94.1	1.34	44 - 130	30	
Endrin	0.57	2.0		20	96.2	95.5	0.726	44.1 - 121	30	
4,4'-DDT	0.81	2.0		20	96.2	92.9	3.47	52.8 - 134	30	
TCMX (S)				350	89.1	86.3		52.5 - 139		
DCBP (S)				350	86.5	85.1		50.2 - 139		

Work Order:	1004011	**Prep Method:**	3545_PCB	**Prep Date:**	04/06/10	**Prep Batch:**	0242
Matrix:	Soil	**Analytical Method:**	SW8082	**Analyzed Date:**	04/07/10	**Analytical Batch:**	400515
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Aroclor1016	0.0230	0.10		1	88.3	88.4	0.160	55.6 - 135	30	
Aroclor1260	0.0270	0.10		0.5	94.6	94.0	0.679	65.6 - 132	30	
TCMX (S)				0.25	90.3	88.7		51.7 - 128		
DCBP (S)				0.250	92.2	90.4		55.1 - 113		

Work Order:	1004011	**Prep Method:**	1311/3010B	**Prep Date:**	05/07/10	**Prep Batch:**	0392
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/07/10	**Analytical Batch:**	400786
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (TCLP)	0.05	0.1		10	92.8	93.4	0.644	80 - 120	20	

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004011	**Prep Method:**	WET/3010B	**Prep Date:**	05/11/10	**Prep Batch:**	0413
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400854
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Chromium (STLC)	0.0200	0.10		10	93.4	92.8	0.644	80 - 120	20	
Lead (STLC)	0.0500	0.10		10	91.1	90.7	0.440	80 - 120	20	

Work Order:	1004011	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0424
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400865
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10		10	98.5	98.7	0.203	80 - 120	20	

Work Order:	1004011	**Prep Method:**	7199M	**Prep Date:**	05/11/10	**Prep Batch:**	0436
Matrix:	Soil	**Analytical Method:**	SW7199	**Analyzed Date:**	05/11/10	**Analytical Batch:**	400887
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Hexavalent Chromium	0.015	0.10		0.1	95.9	90.2	6.16	65 - 135	30	

MS/MSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004011	**Prep Method:**	3050	**Prep Date:**	04/06/10	**Prep Batch:**	0252
Matrix:	**Soil**	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400496
Spiked Sample:	1004011-010A						
Units:	mg/Kg						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead	0.13	1	0.059	50	79.1	78.4	0.827	67.9 - 118	30	

Work Order:	1004011	**Prep Method:**	WET/3010B	**Prep Date:**	05/11/10	**Prep Batch:**	0413
Matrix:	**Soil**	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400854
Spiked Sample:	1004011-001A						
Units:	mg/L						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Chromium (STLC)	0.0200	0.10	0.0130	10	81.1	73.3	8.35	75 - 125	20	S
Lead (STLC)	0.0500	0.10	2.38	10	296	67.7	0.424	75 - 125	20	S

Work Order:	1004011	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0424
Matrix:	**Soil**	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400865
Spiked Sample:	1004011-001A						
Units:	mg/L						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	0.109	10	105	108	2.54	75 - 125	20	

Duplicate QC Summary Report

Work Order:	1004011	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	**Soil**	**Analytical Method:**	SW9045C	**Analyzed Date:**	04/06/10	**Analytical Batch:**	400508
Units:						**Lab Sample ID:**	1004011-012A-Dup

Parameters	MDL	PQL	Sample Result	Duplicate Result	% RPD
pH	0.100	2.00	7.84	7.87	0.0955

Raw values are used in quality control assessment.

Laboratory Qualifiers and Definitions

DEFINITIONS:

Accuracy/Bias (% Recovery) - The closeness of agreement between an observed value and an accepted reference value.
Blank (Method/Preparation Blank) -MB/PB - An analyte-free matrix to which all reagents are added in the same volumes/proportions as used in sample processing. The method blank is used to document contamination resulting from the analytical process.
Duplicate - a field sample and/or laboratory QC sample prepared in duplicate following all of the same processes and procedures used on the original sample (sample duplicate, LCSD, MSD)
Laboratory Control Sample (LCS ad LCSD) - A known matrix spiked with compounds representative of the target analyte(s). This is used to document laboratory performance.
Matrix - the component or substrate that contains the analyte of interest (e.g., - groundwater, sediment, soil, waste water, etc)
Matrix Spike (MS/MSD) - Client sample spiked with identical concentrations of target analyte (s). The spiking occurs prior to the sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.
Method Detection Limit (MDL) - the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero
Practical Quantitation Limit (PQL) - a laboratory determined value at 2 to 5 times above the MDL that can be reproduced in a manner that results in a 99% confidence level that the result is both accurate and precise. PQLs reflect all preparation factors and/or dilution factors that have been applied to the sample during the preparation and/or analytical processes.
Precision (%RPD) - The agreement among a set of replicate/duplicate measurements without regard to known value of the replicates
Surrogate (S) or (Surr) - An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are used in most organic analysis to demonstrate matrix compatibility with the chosen method of analysis
Tentatively Identified Compound (TIC) - A compound not contained within the analytical calibration standards but present in the GCMS library of defined compounds. When the library is searched for an unknown compound, it can frequently give a tentative identification to the compound based on retention time and primary and secondary ion match. TICs are reported as estimates and are candidates for further investigation.
Units: the unit of measure used to express the reported result - **mg/L** and ***mg/Kg*** (equivalent to PPM - parts per million in **liquid** and ***solid***), **ug/L** and ***ug/Kg*** (equivalent to PPB - parts per billion in **liquid** and ***solid***), **ug/m3**, ***mg.m3***, **ppbv** and ***ppmv*** (all units of measure for reporting concentrations in air), **%** (equivalent to 10000 ppm or 1,000,000 ppb), **ug/Wipe** (concentration found on the surface of a single Wipe usually taken over a 100cm2 surface)

LABORATORY QUALIFIERS:

B - Indicates when the anlayte is found in the associated method or preparation blank
D - Surrogate is not recoverable due to the necessary dilution of the sample
E - Indicates the reportable value is outside of the calibration range of the instrument but within the linear range of the instrument (unless otherwise noted) Values reported with an E qualifier should be considered as estimated.
H- Indicates that the recommended holding time for the analyte or compound has been exceeded
J- Indicates a value between the method MDL and PQL and that the reported concentration should be considered as estimated rather the quantitative
NA - Not Analyzed
N/A - Not Applicable
NR - Not recoverable - a matrix spike concentration is not recoverable due to a concentration within the original sample that is greater than four times the spike concentration added
R- The % RPD between a duplicate set of samples is outside of the absolute values established by laboratory control charts
S- Spike recovery is outside of established method and/or laboratory control limits. Further explanation of the use of this qualifier should be included within a case narrative
X -Used to indicate that a value based on pattern identification is within the pattern range but not typical of the pattern found in standards. Further explanation may or may not be provided within the sample footnote and/or the case narrative.

Sample Receipt Checklist

Client Name: URS (San Jose)

Project Name: Petaluma, CA

Work Order No.: 1004011

Date and Time Received: 4/2/2010 10:04

Received By: NG

Physically Logged By: NG

Checklist Completed By: NG

Carrier Name: Hi-Speed Courier

Chain of Custody (COC) Information

Chain of custody present?	Yes
Chain of custody signed when relinquished and received?	Yes
Chain of custody agrees with sample labels?	Yes
Custody seals intact on sample bottles?	Not Present

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Not Present
Shipping Container/Cooler In Good Condition?	Yes
Samples in proper container/bottle?	Yes
Samples containers intact?	Yes
Sufficient sample volume for indicated test?	Yes

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes			
Container/Temp Blank temperature in compliance?	Yes	Temperature:	5	°C
Water-VOA vials have zero headspace?	No VOA vials submitted			
Water-pH acceptable upon receipt?				

pH Checked by:

pH Adjusted by:

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	II
Project Name:	Petaluma, CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/2/2010
Report Due Date:	5/14/2010		**Time Received:**	10:04

Comments: 5 day TAT! Asbestos subbed to EMSL.

Work Order # : ***1004011***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1004011-001A	M-18@0.5	04/02/10 2:02	Soil	09/29/10				
							S_6010B(STLC)	
							S_6010BDI-STLC	
							S_8081AOCP	
							S_6010B(TCLP)	
							S_8082PCB	
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-002A	M-18@1.0	04/02/10 2:04	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-003A	M-18@1.5	04/02/10 2:06	Soil	09/29/10				
							S_6010B(STLC)	
							S_6010BDI-STLC	
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-004A	M-18@2.0	04/02/10 2:08	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-005A	M-18@3.0	04/02/10 2:10	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-006A	M-19@0.5	04/02/10 2:18	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-007A	M-19@1.0	04/02/10 2:20	Soil	09/29/10				
							S_CrVI7199	
							S_6010BCAM17	
							S_7471BHG	
							SUB_AsbestosCARB 435	Yes
							S_6010B(STLC)	
							S_pH9045C	
1004011-008A	M-19@1.5	04/02/10 2:22	Soil	09/29/10				

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	II
Project Name:	Petaluma, CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/2/2010
Report Due Date:	5/14/2010		**Time Received:**	10:04

Comments: 5 day TAT! Asbestos subbed to EMSL.

Work Order # : ***1004011***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
							S_6010B(STLC) S_6010BDI-STLC S_6010BCAM17	
Sample Note:	Pb only.							
1004011-009A	M-19@2.0	04/02/10 2:24	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-010A	M-19@3.0	04/02/10 2:26	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-011A	M-19d@0.5	04/02/10 2:32	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-012A	M-19d@1.0	04/02/10 2:34	Soil	09/29/10				
							S_CrVI7199 S_7471BHG S_6010BCAM17 SUB_AsbestosCARB 435 S_6010B(STLC) S_pH9045C	Yes
1004011-013A	M-19d@1.5	04/02/10 2:36	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-014A	M-19d@2.0	04/02/10 2:38	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-015A	M-19d@3.0	04/02/10 2:40	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-016A	M-20@0.5	04/02/10 2:44	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	II
Project Name:	Petaluma, CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/2/2010
Report Due Date:	5/14/2010		**Time Received:**	10:04

Comments: 5 day TAT! Asbestos subbed to EMSL.

Work Order # : ***1004011***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1004011-017A	M-20@1.0	04/02/10 2:46	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-018A	M-20@1.5	04/02/10 2:48	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-019A	M-20@2.0	04/02/10 2:50	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-020A	M-20@3.0	04/02/10 2:52	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-021A	M-21@0.5	04/02/10 3:00	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-022A	M-21@1.0	04/02/10 3:02	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-023A	M-21@1.5	04/02/10 3:04	Soil	09/29/10				
							S_6010B(STLC) S_6010B(TCLP) S_6010BCAM17 S_6010BDI-STLC	
Sample Note:	Pb only.							
1004011-024A	M-21@2.0	04/02/10 3:06	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-025A	M-21@3.0	04/02/10 3:08	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-026A	M-22@0.5	04/02/10 3:16	Soil	09/29/10				
							S_8081AOCP	

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	II
Project Name:	Petaluma, CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/2/2010
Report Due Date:	5/14/2010		**Time Received:**	10:04

Comments: 5 day TAT! Asbestos subbed to EMSL.

Work Order # : ***1004011***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
							S_8082PCB S_6010BCAM17	
Sample Note:	Pb only.							
1004011-027A	M-22@1.0	04/02/10 3:18	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-028A	M-22@1.5	04/02/10 3:20	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-029A	M-22@2.0	04/02/10 3:22	Soil	09/29/10				
							S_6010B(STLC) S_6010BDI-STLC S_6010BCAM17	
Sample Note:	Pb only.							
1004011-030A	M-22@3.0	04/02/10 3:24	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004011

Torrent LABORATORY, INC.

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: [x] 10 Work Days [ ] 3 Work Days [ ] Noon - Nxt Day [ ] 7 Work Days [ ] 2 Work Days [ ] 2 - 8 Hours [ ] 5 Work Days [ ] 1 Work Day [ ] Other

SAMPLE TYPE: [ ] Storm Water [ ] Air [ ] Waste Water [ ] Other [ ] Ground Water [x] Soil

REPORT FORMAT: [ ] QC Level IV [ ] EDF [ ] Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	Pesticides	Lead	PCBs	REMARKS
021A	M-21@0.5	04/02/10 03:00	Soil	1	Sleeve								✓		
022A	M-21@1.0	04/02/10 03:02	Soil	1	Sleeve								✓		
023A	M-21@1.5	04/02/10 03:04	Soil	1	Sleeve								✓		
024A	M-21@2.0	04/02/10 03:06	Soil	1	Sleeve								✓		
025A	M-21@3.0	04/02/10 03:08	Soil	1	Sleeve								✓		
026A	M-22@0.5	04/02/10 03:16	Soil	1	Sleeve							✓	✓	✓	Temp: 5°C
027A	M-22@1.0	04/02/10 03:18	Soil	1	Sleeve								✓		
028A	M-22@1.5	04/02/10 03:20	Soil	1	Sleeve								✓		
029A	M-22@2.0	04/02/10 03:22	Soil	1	Sleeve								✓		
030A	M-22@3.0	04/02/10 03:24	Soil	1	Sleeve								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	4/2/10	05:30			4/2	9:25
2			4/2	10:04				

Were Samples Received in Good Condition? [x] Yes [ ] NO Samples on Ice? [x] Yes [ ] NO Method of Shipment Hi Speed Sample seals intact? [ ] Yes [ ] NO [x] N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 3 of 3

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004011

Company Name: URS Corporation
Address: 100 W San Fernando Street, Suite 200
City: San Jose | State: CA | Zip Code: 95113
Telephone: 408-297-9585 | FAX: 408-297-6962
REPORT TO: J Ripple | SAMPLER: J Ripple/M Thummaluru

Location of Sampling: Petaluma, CA
Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
Special Instructions / Comments:
P.O. #: 28645045.03200 | EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	Pesticides	Lead	PCBs	REMARKS
011A	M-19d@0.5	04/02/10 02:32	Soil	1	Sleeve								✓		
012A	M-19d@1.0	04/02/10 02:34	Soil	1	Sleeve	✓			✓	✓					
013A	M-19d@1.5	04/02/10 02:36	Soil	1	Sleeve								✓		
014A	M-19d@2.0	04/02/10 02:38	Soil	1	Sleeve								✓		
015A	M-19d@3.0	04/02/10 02:40	Soil	1	Sleeve								✓		
016A	M-20@0.5	04/02/10 02:44	Soil	1	Sleeve								✓		
017A	M-20@1.0	04/02/10 02:46	Soil	1	Sleeve								✓		
018A	M-20@1.5	04/02/10 02:48	Soil	1	Sleeve								✓		Temp 5°C
019A	M-20@2.0	04/02/10 0250	Soil	1	Sleeve								✓		
020A	M-20@3.0	04/02/10 02:52	Soil	1	Sleeve								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	4/2/10	05:30			4/2	7:25
2			4/2	10:04				

Were Samples Received in Good Condition? ☒ Yes ☐ NO Samples on Ice? ☒ Yes ☐ NO Method of Shipment Hi Speed Sample seals intact? ☐ Yes ☐ NO ☒ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 2 of 3

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

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RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004011

Company Name: URS Corporation
Address: 100 W San Fernando Street, Suite 200
City: San Jose | State: CA | Zip Code: 95113
Telephone: 408-297-9585 | FAX: 408-297-6962
REPORT TO: J Ripple | SAMPLER: J Ripple/M Thummaluru

Location of Sampling: Petaluma, CA
Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
Special Instructions / Comments:
P.O. #: 28645045.03200 | EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: [x] 10 Work Days [ ] 3 Work Days [ ] Noon - Nxt Day [ ] 7 Work Days [ ] 2 Work Days [ ] 2 - 8 Hours [ ] 5 Work Days [ ] 1 Work Day [ ] Other

SAMPLE TYPE: [ ] Storm Water [ ] Air [ ] Waste Water [ ] Other [ ] Ground Water [x] Soil

REPORT FORMAT: [ ] QC Level IV [ ] EDF [ ] Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	Pesticides	Lead	PCBs	REMARKS
001A	M-18@0.5	04/02/10 02:02	Soil	1	Sleeve							✓	✓	✓	
002A	M-18@1.0	04/02/10 02:04	Soil	1	Sleeve								✓		
003A	M-18@1.5	04/02/10 02:06	Soil	1	Sleeve								✓		
004A	M-18@2.0	04/02/10 02:08	Soil	1	Sleeve								✓		
005A	M-18@3.0	04/02/10 02:10	Soil	1	Sleeve								✓		
006A	M-19@0.5	04/02/10 02:18	Soil	1	Sleeve								✓		5°C
007A	M-19@1.0	04/02/10 02:20	Soil	1	Sleeve	✓			✓	✓					Temp.
008A	M-19@1.5	04/02/10 02:22	Soil	1	Sleeve								✓		
009A	M-19@2.0	04/02/10 02:24	Soil	1	Sleeve								✓		
010A	M-19@3.0	04/02/10 02:26	Soil	1	Sleeve								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	4/2/10	05:30		Shawn Bailey	4/2/10	9:25
2			4/2/10	10:04	HS Fedex		4/2/10	10:04

Were Samples Received in Good Condition? [x] Yes [ ] NO Samples on Ice? [ ] Yes [x] NO Method of Shipment Hi Speed Sample seals intact? [ ] Yes [ ] NO [x] N/A

Samples are discarded by the laboratory 30 days from date of receipt unless other arrangements are made.

Date: _____ Log In Reviewed By: _____ Date: _____

Page 1 of 3

URS (San Jose)
100 W San Fernando St, Suite200
San Jose, California 95113
Tel: 4082979585
Fax: 4082976962

RE: Petaluma, CA

Work Order No.: 1004011 Rev: 1

Dear James Ripple:

Torrent Laboratory, Inc. received 30 sample(s) on April 02, 2010 for the analyses presented in the following Report.

All data for associated QC met EPA or laboratory specification(s) except where noted in the case narrative.

Torrent Laboratory, Inc. is certified by the State of California, ELAP #1991. If you have any questions regarding these test results, please feel free to contact the Project Management Team at (408)263-5258; ext 204.

Patti Sandrock

May 18, 2010
Date

Date: 5/18/2010

Client: URS (San Jose)

Project: Petaluma, CA

Work Order: 1004011

CASE NARRATIVE

No issues encountered with the receiving, preparation, analysis or reporting of the results associated with this work order.

Analytical Comments for Asbestos, Note: Analysis performed by sub-contract laboratory EMSL, Inc NVLAP Certification # 101048-3. Results to follow under separate cover.

REVISIONS:

Per client request, additional TCLP, STLC and DI-STLC anlaysis was performed on specified samples (see attachment at end of report).

Note: Extraction of 50 g sample / 500g 0.2M Sodium Citrate Solution was performed according to wet extraction procedure (WET) which was rotated in a rotary shaker for 48 hours.

Date Prepared: 5/9/10 @ 1PM to 5/11/10 @ 1PM

Note: Extraction of 100 g sample / 2000g TCLP Fluid # 1 was performed according to Toxicity Characteristic Leaching Procedure (TCLP) which was rotated in a rotary shaker for 18 hours.

Date Prepared: 5/6/10 @ 3:50PM to 5/7/10 @ 9:50AM.

Note: Extraction of 50 g sample with DI water was performed according to wet extraction procedure (WET) which was rotated in a rotary shaker for 48 hours.

Date Prepared: 5/11/10 @ 11:20AM to 5/3/10 @ 11:20AM.

Analytical Comments for method 6010B(STLC),For MS/MSDNote:The % recoveries for MS for Pb and MSD for Cr are outside of laboratory control limits but are within % RPD limits. The associated LCS/LCSD % recoveries and % RPD are within limits. No corrective action required.

Rev1 5/17/10

Torrent LABORATORY, INC.

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

M-18@0.5 1004011-001A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	24	mg/L
Lead (TCLP)	SW6010B	1	0.05	0.10	0.13	mg/L
Lead (DI-STLC)	SW6010B	1	0.0500	0.10	1.1	mg/L

M-18@1.0 1004011-002A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	34	mg/Kg

M-18@1.5 1004011-003A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	58	mg/Kg

M-18@2.0 1004011-004A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	5.3	mg/Kg

M-18@3.0 1004011-005A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	1.5	mg/Kg

M-19@0.5 1004011-006A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	1.1	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

M-19@1.0 1004011-007A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Chromium (STLC)	SW6010B	1	0.0200	0.10	0.26	mg/L
Antimony	SW6010B	1	0.20	5.0	7.8	mg/Kg
Barium	SW6010B	1	1	5.0	53	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	320	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	31	mg/Kg
Copper	SW6010B	1	0.0900	5.0	23	mg/Kg
Lead	SW6010B	1	0.13	1.0	35	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	530	mg/Kg
Silver	SW6010B	1	0	1.0	2.1	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	50	mg/Kg
Zinc	SW6010B	1	0.59	5.0	42	mg/Kg
Mercury	7471B	1	0.01	0.10	0.34	mg/Kg
pH	SW9045C	1	0.10	2.0	8.07	S.U.

M-19@1.5 1004011-008A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	0.20	mg/L
Lead	SW6010B	1	0.13	1.0	55	mg/Kg

M-19@2.0 1004011-009A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	19	mg/Kg

M-19@3.0 1004011-010A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	3.0	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

M-19d@0.5 1004011-011A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	14	mg/Kg

M-19d@1.0 1004011-012A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Chromium (STLC)	SW6010B	1	0.0200	0.10	0.23	mg/L
Antimony	SW6010B	1	0.20	5.0	7.2	mg/Kg
Barium	SW6010B	1	1	5.0	61	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	260	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	39	mg/Kg
Copper	SW6010B	1	0.0900	5.0	34	mg/Kg
Lead	SW6010B	1	0.13	1.0	38	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	470	mg/Kg
Silver	SW6010B	1	0	1.0	1.7	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	58	mg/Kg
Zinc	SW6010B	1	0.59	5.0	45	mg/Kg
pH	SW9045C	1	0.10	2.0	7.84	S.U.

M-19d@1.5 1004011-013A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	36	mg/Kg

M-19d@2.0 1004011-014A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	30	mg/Kg

M-19d@3.0 1004011-015A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	5.4	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

M-20@0.5 1004011-016A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	7.5	mg/Kg

M-20@1.0 1004011-017A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	11	mg/Kg

M-20@1.5 1004011-018A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	30	mg/Kg

M-20@2.0 1004011-019A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	15	mg/Kg

M-20@3.0 1004011-020A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	2.0	mg/Kg

M-21@0.5 1004011-021A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	18	mg/Kg

M-21@1.0 1004011-022A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	12	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

M-21@1.5 1004011-023A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	21	mg/L
Lead	SW6010B	1	0.13	1.0	490	mg/Kg
Lead (DI-STLC)	SW6010B	1	0.0500	0.10	6.2	mg/L

M-21@2.0 1004011-024A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	8.4	mg/Kg

M-21@3.0 1004011-025A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	2.1	mg/Kg

M-22@0.5 1004011-026A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	11	mg/Kg

M-22@1.0 1004011-027A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	8.3	mg/Kg

M-22@1.5 1004011-028A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	17	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

M-22@2.0 1004011-029A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	6.6	mg/L
Lead	SW6010B	1	0.13	1.0	110	mg/Kg
Lead (DI-STLC)	SW6010B	1	0.0500	0.10	1.4	mg/L

M-22@3.0 1004011-030A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	9.0	mg/Kg

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-18@0.5	**Lab Sample ID:**	1004011-001A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:02		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	24		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	0.13		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	590		mg/Kg	400497	0253

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	1.1		mg/L	400865	0424

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
The results shown below are reported using their MDL.											
alpha-BHC	SW8081A	4/6/10	04/08/10	40	18	80	ND		ug/Kg	400514	0241
gamma-BHC	SW8081A	4/6/10	04/08/10	40	16	80	ND		ug/Kg	400514	0241
beta-BHC	SW8081A	4/6/10	04/08/10	40	15	80	ND		ug/Kg	400514	0241
delta-BHC	SW8081A	4/6/10	04/08/10	40	20	80	ND		ug/Kg	400514	0241
Heptachlor	SW8081A	4/6/10	04/08/10	40	44	80	ND		ug/Kg	400514	0241
Aldrin	SW8081A	4/6/10	04/08/10	40	18	80	ND		ug/Kg	400514	0241
Heptachlor epoxide	SW8081A	4/6/10	04/08/10	40	13	80	ND		ug/Kg	400514	0241
gamma-Chlordane	SW8081A	4/6/10	04/08/10	40	17	80	ND		ug/Kg	400514	0241
alpha-Chlordane	SW8081A	4/6/10	04/08/10	40	14	80	ND		ug/Kg	400514	0241
Endosulfan I	SW8081A	4/6/10	04/08/10	40	24	80	ND		ug/Kg	400514	0241
4,4'-DDE	SW8081A	4/6/10	04/08/10	40	19	80	ND		ug/Kg	400514	0241
Dieldrin	SW8081A	4/6/10	04/08/10	40	17	80	ND		ug/Kg	400514	0241
Endrin	SW8081A	4/6/10	04/08/10	40	23	80	ND		ug/Kg	400514	0241
4,4'-DDD	SW8081A	4/6/10	04/08/10	40	19	80	ND		ug/Kg	400514	0241
Endosulfan II	SW8081A	4/6/10	04/08/10	40	61	80	ND		ug/Kg	400514	0241
4,4'-DDT	SW8081A	4/6/10	04/08/10	40	32	80	ND		ug/Kg	400514	0241
Endrin aldehyde	SW8081A	4/6/10	04/08/10	40	41	80	ND		ug/Kg	400514	0241

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-18@0.5	**Lab Sample ID:**	1004011-001A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:02		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
The results shown below are reported using their MDL.											
Endosulfan sulfate	SW8081A	4/6/10	04/08/10	40	20	80	ND		ug/Kg	400514	0241
Methoxychlor	SW8081A	4/6/10	04/08/10	40	25	200	ND		ug/Kg	400514	0241
Endrin Ketone	SW8081A	4/6/10	04/08/10	40	16	80	ND		ug/Kg	400514	0241
Chlordane	SW8081A	4/6/10	04/08/10	40	400	800	ND		ug/Kg	400514	0241
Toxaphene	SW8081A	4/6/10	04/08/10	40	400	4000	ND		ug/Kg	400514	0241
TCMX (S)	SW8081A	4/6/10	04/08/10	40	52.5	139	175	S,D	%	400514	0241
DCBP (S)	SW8081A	4/6/10	04/08/10	40	50.2	139	114	D	%	400514	0241

NOTE: Note: D - Surrogates diluted out. Reporting limits increased due to the nature of the sample matrix (dark color extract). All compounds reported to the MDL.

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Aroclor1016	SW8082	4/6/10	04/07/10	1	0.0230	0.10	ND		mg/Kg	400515	0242
Aroclor1221	SW8082	4/6/10	04/07/10	1	0.0920	0.20	ND		mg/Kg	400515	0242
Aroclor1232	SW8082	4/6/10	04/07/10	1	0.0460	0.10	ND		mg/Kg	400515	0242
Aroclor1242	SW8082	4/6/10	04/07/10	1	0.0430	0.10	ND		mg/Kg	400515	0242
Aroclor1248	SW8082	4/6/10	04/07/10	1	0.0360	0.10	ND		mg/Kg	400515	0242
Aroclor1254	SW8082	4/6/10	04/07/10	1	0.0240	0.10	ND		mg/Kg	400515	0242
Aroclor1260	SW8082	4/6/10	04/07/10	1	0.0270	0.10	ND		mg/Kg	400515	0242
TCMX (S)	SW8082	4/6/10	04/07/10	1	51.7	128	101		%	400515	0242
DCBP (S)	SW8082	4/6/10	04/07/10	1	55.1	113	99.3		%	400515	0242

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-18@1.0	**Lab Sample ID:**	1004011-002A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:04		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	34		mg/Kg	400497	0253

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-18@1.5	**Lab Sample ID:**	1004011-003A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:06		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	ND		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	58		mg/Kg	400497	0253

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-18@2.0	**Lab Sample ID:**	1004011-004A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:08		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	5.3		mg/Kg	400497	0253

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-18@3.0	**Lab Sample ID:**	1004011-005A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:10		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	1.5		mg/Kg	400497	0253

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-19@0.5	**Lab Sample ID:**	1004011-006A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:18		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	1.1		mg/Kg	400497	0253

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-19@1.0	**Lab Sample ID:**	1004011-007A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:20		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Chromium (STLC)	SW6010B	5/11/10	05/12/10	1	0.0200	0.10	0.26		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	4/5/10	04/07/10	1	0.20	5.0	7.8		mg/Kg	400481	0246
Arsenic	SW6010B	4/5/10	04/07/10	1	0.28	1.7	ND		mg/Kg	400481	0246
Barium	SW6010B	4/5/10	04/07/10	1	1	5.0	53		mg/Kg	400481	0246
Beryllium	SW6010B	4/5/10	04/07/10	1	0.0840	2.0	ND		mg/Kg	400481	0246
Cadmium	SW6010B	4/5/10	04/07/10	1	0.0590	1.0	ND		mg/Kg	400481	0246
Chromium	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	320		mg/Kg	400481	0246
Cobalt	SW6010B	4/5/10	04/07/10	1	0.14	5.0	31		mg/Kg	400481	0246
Copper	SW6010B	4/5/10	04/07/10	1	0.0900	5.0	23		mg/Kg	400481	0246
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	35		mg/Kg	400481	0246
Molybdenum	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	ND		mg/Kg	400481	0246
Nickel	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	530		mg/Kg	400481	0246
Selenium	SW6010B	4/5/10	04/07/10	1	0.29	5.0	ND		mg/Kg	400481	0246
Silver	SW6010B	4/5/10	04/07/10	1	0	1.0	2.1		mg/Kg	400481	0246
Thallium	SW6010B	4/5/10	04/07/10	1	0.12	5.0	ND		mg/Kg	400481	0246
Vanadium	SW6010B	4/5/10	04/07/10	1	0.12	5.0	50		mg/Kg	400481	0246
Zinc	SW6010B	4/5/10	04/07/10	1	0.59	5.0	42		mg/Kg	400481	0246

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	4/5/10	04/06/10	1	0.01	0.10	0.34		mg/Kg	400476	0239

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Hexavalent Chromium	SW7199M	5/11/10	05/11/10	1	0.015	0.10	ND		mg/Kg	400887	0436

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	NA	04/06/10	1	0.10	2.0	8.07		S.U.	400508	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-19@1.5	**Lab Sample ID:**	1004011-008A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:22		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	0.20		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	55		mg/Kg	400497	0253

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-19@2.0	**Lab Sample ID:**	1004011-009A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:24		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	19		mg/Kg	400497	0253

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-19@3.0	**Lab Sample ID:**	1004011-010A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:26		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	3.0		mg/Kg	400496	0252

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-19d@0.5	**Lab Sample ID:**	1004011-011A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:32		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	14		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-19d@1.0	**Lab Sample ID:**	1004011-012A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:34		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Chromium (STLC)	SW6010B	5/11/10	05/12/10	1	0.0200	0.10	0.23		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	4/5/10	04/07/10	1	0.20	5.0	7.2		mg/Kg	400481	0246
Arsenic	SW6010B	4/5/10	04/07/10	1	0.28	1.7	ND		mg/Kg	400481	0246
Barium	SW6010B	4/5/10	04/07/10	1	1	5.0	61		mg/Kg	400481	0246
Beryllium	SW6010B	4/5/10	04/07/10	1	0.0840	2.0	ND		mg/Kg	400481	0246
Cadmium	SW6010B	4/5/10	04/07/10	1	0.0590	1.0	ND		mg/Kg	400481	0246
Chromium	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	260		mg/Kg	400481	0246
Cobalt	SW6010B	4/5/10	04/07/10	1	0.14	5.0	39		mg/Kg	400481	0246
Copper	SW6010B	4/5/10	04/07/10	1	0.0900	5.0	34		mg/Kg	400481	0246
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	38		mg/Kg	400481	0246
Molybdenum	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	ND		mg/Kg	400481	0246
Nickel	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	470		mg/Kg	400481	0246
Selenium	SW6010B	4/5/10	04/07/10	1	0.29	5.0	ND		mg/Kg	400481	0246
Silver	SW6010B	4/5/10	04/07/10	1	0	1.0	1.7		mg/Kg	400481	0246
Thallium	SW6010B	4/5/10	04/07/10	1	0.12	5.0	ND		mg/Kg	400481	0246
Vanadium	SW6010B	4/5/10	04/07/10	1	0.12	5.0	58		mg/Kg	400481	0246
Zinc	SW6010B	4/5/10	04/07/10	1	0.59	5.0	45		mg/Kg	400481	0246

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	4/5/10	04/06/10	1	0.01	0.10	ND		mg/Kg	400476	0239

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Hexavalent Chromium	SW7199M	5/11/10	05/11/10	1	0.015	0.10	ND		mg/Kg	400887	0436

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	NA	04/06/10	1	0.10	2.0	7.84		S.U.	400508	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-19d@1.5	**Lab Sample ID:**	1004011-013A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:36		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	36		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-19d@2.0	**Lab Sample ID:**	1004011-014A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:38		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	30		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-19d@3.0	**Lab Sample ID:**	1004011-015A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:40		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	5.4		mg/Kg	400496	0252

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-20@0.5	**Lab Sample ID:**	1004011-016A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:44		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	7.5		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-20@1.0	**Lab Sample ID:**	1004011-017A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:46		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	11		mg/Kg	400496	0252

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-20@1.5	**Lab Sample ID:**	1004011-018A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:48		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	30		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-20@2.0	**Lab Sample ID:**	1004011-019A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:50		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	15		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-20@3.0	**Lab Sample ID:**	1004011-020A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 2:52		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	2.0		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-21@0.5	**Lab Sample ID:**	1004011-021A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:00		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	18		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-21@1.0	**Lab Sample ID:**	1004011-022A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:02		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	12		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-21@1.5	**Lab Sample ID:**	1004011-023A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:04		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	21		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	ND		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	490		mg/Kg	400496	0252

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	6.2		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-21@2.0	**Lab Sample ID:**	1004011-024A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:06		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	8.4		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-21@3.0	**Lab Sample ID:**	1004011-025A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:08		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	2.1		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-22@0.5	**Lab Sample ID:**	1004011-026A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:16		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	11		mg/Kg	400496	0252

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
The results shown below are reported using their MDL.											
alpha-BHC	SW8081A	4/6/10	04/08/10	20	18	80	ND		ug/Kg	400514	0241
gamma-BHC	SW8081A	4/6/10	04/08/10	20	16	80	ND		ug/Kg	400514	0241
beta-BHC	SW8081A	4/6/10	04/08/10	20	15	80	ND		ug/Kg	400514	0241
delta-BHC	SW8081A	4/6/10	04/08/10	20	20	80	ND		ug/Kg	400514	0241
Heptachlor	SW8081A	4/6/10	04/08/10	20	44	80	ND		ug/Kg	400514	0241
Aldrin	SW8081A	4/6/10	04/08/10	20	18	80	ND		ug/Kg	400514	0241
Heptachlor epoxide	SW8081A	4/6/10	04/08/10	20	13	80	ND		ug/Kg	400514	0241
gamma-Chlordane	SW8081A	4/6/10	04/08/10	20	17	80	ND		ug/Kg	400514	0241
alpha-Chlordane	SW8081A	4/6/10	04/08/10	20	14	80	ND		ug/Kg	400514	0241
Endosulfan I	SW8081A	4/6/10	04/08/10	20	24	80	ND		ug/Kg	400514	0241
4,4'-DDE	SW8081A	4/6/10	04/08/10	20	19	80	ND		ug/Kg	400514	0241
Dieldrin	SW8081A	4/6/10	04/08/10	20	17	80	ND		ug/Kg	400514	0241
Endrin	SW8081A	4/6/10	04/08/10	20	23	80	ND		ug/Kg	400514	0241
4,4'-DDD	SW8081A	4/6/10	04/08/10	20	19	80	ND		ug/Kg	400514	0241
Endosulfan II	SW8081A	4/6/10	04/08/10	20	61	80	ND		ug/Kg	400514	0241
4,4'-DDT	SW8081A	4/6/10	04/08/10	20	32	80	ND		ug/Kg	400514	0241
Endrin aldehyde	SW8081A	4/6/10	04/08/10	20	41	80	ND		ug/Kg	400514	0241
Endosulfan sulfate	SW8081A	4/6/10	04/08/10	20	20	80	ND		ug/Kg	400514	0241
Methoxychlor	SW8081A	4/6/10	04/08/10	20	25	200	ND		ug/Kg	400514	0241
Endrin Ketone	SW8081A	4/6/10	04/08/10	20	16	80	ND		ug/Kg	400514	0241
Chlordane	SW8081A	4/6/10	04/08/10	20	400	800	ND		ug/Kg	400514	0241
Toxaphene	SW8081A	4/6/10	04/08/10	20	400	4000	ND		ug/Kg	400514	0241
TCMX (S)	SW8081A	4/6/10	04/08/10	20	52.5	139	133		%	400514	0241
DCBP (S)	SW8081A	4/6/10	04/08/10	20	50.2	139	124		%	400514	0241

NOTE: Note: Reporting limits increased due to the nature of the sample matrix (dark color extract). All compounds reported to the MDL.

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-22@0.5	**Lab Sample ID:**	1004011-026A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:16		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Aroclor1016	SW8082	4/6/10	04/07/10	1	0.0460	0.20	ND		mg/Kg	400515	0242
Aroclor1221	SW8082	4/6/10	04/07/10	1	0.184	0.40	ND		mg/Kg	400515	0242
Aroclor1232	SW8082	4/6/10	04/07/10	1	0.0920	0.20	ND		mg/Kg	400515	0242
Aroclor1242	SW8082	4/6/10	04/07/10	1	0.0860	0.20	ND		mg/Kg	400515	0242
Aroclor1248	SW8082	4/6/10	04/07/10	1	0.0720	0.20	ND		mg/Kg	400515	0242
Aroclor1254	SW8082	4/6/10	04/07/10	1	0.0480	0.20	ND		mg/Kg	400515	0242
Aroclor1260	SW8082	4/6/10	04/07/10	1	0.0540	0.20	ND		mg/Kg	400515	0242
TCMX (S)	SW8082	4/6/10	04/07/10	1	51.7	128	93.1		%	400515	0242
DCBP (S)	SW8082	4/6/10	04/07/10	1	55.1	113	91.8		%	400515	0242

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-22@1.0	**Lab Sample ID:**	1004011-027A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:18		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	8.3		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-22@1.5	**Lab Sample ID:**	1004011-028A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:20		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	17		mg/Kg	400496	0252

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-22@2.0	**Lab Sample ID:**	1004011-029A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:22		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	6.6		mg/L	400854	0413

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	110		mg/Kg	400496	0252

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	1.4		mg/L	400865	0424

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-22@3.0	**Lab Sample ID:**	1004011-030A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 3:24		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	9.0		mg/Kg	400496	0252

MB Summary Report

Work Order:	1004011	**Prep Method:**	7471	**Prep Date:**	04/05/10	**Prep Batch:**	0239
Matrix:	Soil	**Analytical Method:**	7471AB	**Analyzed Date:**	04/06/10	**Analytical Batch:**	400476
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Mercury	0.01	0.10	ND	

Work Order:	1004011	**Prep Method:**	3050	**Prep Date:**	04/05/10	**Prep Batch:**	0246
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/07/10	**Analytical Batch:**	400481
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Antimony	0.20	5.0	ND	
Arsenic	0.28	1.7	ND	
Barium	1	5.0	ND	
Beryllium	0.0840	2.0	ND	
Cadmium	0.059	1.0	ND	
Chromium	0.059	5.0	0.10	
Cobalt	0.14	5.0	ND	
Copper	0.090	5.0	0.50	
Lead	0.13	1.0	0.25	
Molybdenum	0.059	5.0	ND	
Nickel	0.059	5.0	0.10	
Selenium	0.29	5.0	ND	
Silver	1.0	1.0	ND	
Thallium	0.12	5.0	ND	
Vanadium	0.12	5.0	ND	
Zinc	0.59	5.0	0.95	

Work Order:	1004011	**Prep Method:**	3050	**Prep Date:**	04/06/10	**Prep Batch:**	0252
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400496
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead	0.13	1.0	0.30	

MB Summary Report

Work Order:	1004011	**Prep Method:**	3050	**Prep Date:**	04/06/10	**Prep Batch:**	0253
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400497
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead	0.13	1.0	0.25	

Work Order:	1004011	**Prep Method:**	3545_OCP	**Prep Date:**	04/06/10	**Prep Batch:**	0241
Matrix:	Soil	**Analytical Method:**	SW8081A	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400514
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
alpha-BHC	0.44	2.0	ND	
gamma-BHC	0.40	2.0	ND	
beta-BHC	0.36	2.0	ND	
delta-BHC	0.49	2.0	ND	
Heptachlor	1.1	2.0	ND	
Aldrin	0.44	2.0	ND	
Heptachlor epoxide	0.32	2.0	ND	
gamma-Chlordane	0.42	2.0	ND	
alpha-Chlordane	0.36	2.0	ND	
Endosulfan I	0.59	2.0	ND	
4,4'-DDE	0.48	2.0	ND	
Dieldrin	0.43	2.0	ND	
Endrin	0.57	2.0	ND	
4,4'-DDD	0.47	2.0	ND	
Endosulfan II	1.5	2.0	ND	
4,4'-DDT	0.81	2.0	ND	
Endrin aldehyde	1.0	2.0	ND	
Endosulfan sulfate	0.49	2.0	ND	
Methoxychlor	0.62	5.0	ND	
Endrin Ketone	0.40	2.0	ND	
Chlordane	10	20	ND	
Toxaphene	10	100	ND	
TCMX (S)			80.3 %	
DCBP (S)			78.3 %	

MB Summary Report

Work Order:	1004011	**Prep Method:**	3545_OCP	**Prep Date:**	04/06/10	**Prep Batch:**	0241
Matrix:	Soil	**Analytical Method:**	SW8081A	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400514
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
alpha-BHC	0.44	2.0	ND	
gamma-BHC	0.40	2.0	ND	
beta-BHC	0.36	2.0	ND	
delta-BHC	0.49	2.0	ND	
Heptachlor	1.1	2.0	ND	
Aldrin	0.44	2.0	ND	
Heptachlor epoxide	0.32	2.0	ND	
gamma-Chlordane	0.42	2.0	ND	
alpha-Chlordane	0.36	2.0	ND	
Endosulfan I	0.59	2.0	ND	
4,4'-DDE	0.48	2.0	ND	
Dieldrin	0.43	2.0	ND	
Endrin	0.57	2.0	ND	
4,4'-DDD	0.47	2.0	ND	
Endosulfan II	1.5	2.0	ND	
4,4'-DDT	0.81	2.0	ND	
Endrin aldehyde	1.0	2.0	ND	
Endosulfan sulfate	0.49	2.0	ND	
Methoxychlor	0.62	5.0	ND	
Endrin Ketone	0.40	2.0	ND	
Chlordane	10	20	ND	
Toxaphene	10	100	ND	
TCMX (S)			86.6 %	
DCBP (S)			85.0 %	

MB Summary Report

Work Order:	1004011	**Prep Method:**	3545_PCB	**Prep Date:**	04/06/10	**Prep Batch:**	0242
Matrix:	Soil	**Analytical Method:**	SW8082	**Analyzed Date:**	04/07/10	**Analytical Batch:**	400515
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Aroclor1016	0.0230	0.10	ND	
Aroclor1221	0.0920	0.20	ND	
Aroclor1232	0.0460	0.10	ND	
Aroclor1242	0.0430	0.10	ND	
Aroclor1248	0.0360	0.10	ND	
Aroclor1254	0.0240	0.10	ND	
Aroclor1260	0.0270	0.10	ND	
TCMX (S)			88.8 %	
DCBP (S)			88.6 %	

Work Order:	1004011	**Prep Method:**	3545_PCB	**Prep Date:**	04/06/10	**Prep Batch:**	0242
Matrix:	Soil	**Analytical Method:**	SW8082	**Analyzed Date:**	04/07/10	**Analytical Batch:**	400515
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Aroclor1016	0.0230	0.10	ND	
Aroclor1221	0.0920	0.20	ND	
Aroclor1232	0.0460	0.10	ND	
Aroclor1242	0.0430	0.10	ND	
Aroclor1248	0.0360	0.10	ND	
Aroclor1254	0.0240	0.10	ND	
Aroclor1260	0.0270	0.10	ND	
TCMX (S)			91.6 %	
DCBP (S)			90.0 %	

Work Order:	1004011	**Prep Method:**	1311/3010B	**Prep Date:**	05/07/10	**Prep Batch:**	0392
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/07/10	**Analytical Batch:**	400786
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead (TCLP)	0.0500	0.10	ND	

MB Summary Report

Work Order:	1004011	**Prep Method:**	WET/3010B	**Prep Date:**	05/11/10	**Prep Batch:**	0413
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400854
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Chromium (STLC)	0.0200	0.10	ND	
Lead (STLC)	0.0500	0.10	ND	

Work Order:	1004011	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0424
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400865
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	ND	

Work Order:	1004011	**Prep Method:**	7199M	**Prep Date:**	05/11/10	**Prep Batch:**	0436
Matrix:	Soil	**Analytical Method:**	SW7199	**Analyzed Date:**	05/11/10	**Analytical Batch:**	400887
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Hexavalent Chromium	0.015	0.10	ND	

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004011	**Prep Method:**	7471	**Prep Date:**	04/05/10	**Prep Batch:**	0239
Matrix:	Soil	**Analytical Method:**	7471B	**Analyzed Date:**	04/06/10	**Analytical Batch:**	400476
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Mercury	0.01	0.10	0.000833	1.25	119	116	1.93	80.5 - 133	30	

Work Order:	1004011	**Prep Method:**	3050	**Prep Date:**	04/05/10	**Prep Batch:**	0246
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/07/10	**Analytical Batch:**	400481
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Antimony	0.20	5.0	0.050	50	95.9	95.9	0.000	30.7 - 130	30	
Arsenic	0.28	1.7	0.00	50	93.9	94.2	0.319	71 - 121	30	
Barium	1	5.0	0.20	50	103	96.9	6.10	70.2 - 130	30	
Beryllium	0.0840	2.0	0.00	50	92.3	92.3	0.000	73.3 - 115	30	
Cadmium	0.059	1.0	0.050	50	98.6	92.6	6.28	68.7 - 110		
Chromium	0.059	5.0	0.10	50	103	96.3	6.72	76 - 116	30	
Cobalt	0.14	5.0	0.050	50	101	95.1	6.02	57.4 - 122	30	
Copper	0.090	5.0	0.50	50	104	97.9	6.04	74.8 - 119	30	
Lead	0.13	1.0	0.25	50	95.7	96.0	0.313	67.9 - 118	30	
Molybdenum	0.059	5.0	0.00	50	98.2	97.8	0.408	62.9 - 123	30	
Nickel	0.059	5.0	0.10	50	99.5	93.4	6.32	61.5 - 122	30	
Selenium	0.29	5.0	0.10	50	86.8	87.3	0.574	62 - 111	30	
Silver	1.0	1.0	0.00	50	99.5	94.4	5.26	81.1 - 109	30	
Thallium	0.12	5.0	0.050	50	92.0	92.1	0.109	39.2 - 125	30	
Vanadium	0.12	5.0	-0.050	50	103	96.9	6.10	65.8 - 122	30	
Zinc	0.59	5.0	0.95	50	101	95.0	6.12	59.9 - 122	30	

Work Order:	1004011	**Prep Method:**	3050	**Prep Date:**	04/06/10	**Prep Batch:**	0252
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400496
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead	0.13	1	0.30	50	93.7	93.1	0.642	67.9 - 118	30	

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004011	**Prep Method:**	3050	**Prep Date:**	04/06/10	**Prep Batch:**	0253
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400497
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead	0.13	1	0.25	50	91.7	92.3	0.652	67.9 - 118	30	

Work Order:	1004011	**Prep Method:**	3545_OCP	**Prep Date:**	04/06/10	**Prep Batch:**	0241
Matrix:	Soil	**Analytical Method:**	SW8081A	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400514
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
gamma-BHC	0.40	2.0	0.00	20	92.0	90.7	1.44	56.9 - 120	30	
Heptachlor	1.1	2.0	0.15	20	93.7	95.2	1.60	63.6 - 117	30	
Aldrin	0.44	2.0	0.00	20	91.3	92.2	0.955	53 - 123	30	
Dieldrin	0.43	2.0	0.00	20	95.3	94.1	1.34	44 - 130	30	
Endrin	0.57	2.0	0.00	20	96.2	95.5	0.726	44.1 - 121	30	
4,4'-DDT	0.81	2.0	0.24	20	96.2	92.9	3.47	52.8 - 134	30	
TCMX (S)			0.00	350	89.1	86.3		52.5 - 139		
DCBP (S)			0.00	350	86.5	85.1		50.2 - 139		
4,4'-DDE			0.00					-		
4,4'-DDD			0.11					-		
4,4'-DDT			0.00					-		

Work Order:	1004011	**Prep Method:**	3545_PCB	**Prep Date:**	04/06/10	**Prep Batch:**	0242
Matrix:	Soil	**Analytical Method:**	SW8082	**Analyzed Date:**	04/07/10	**Analytical Batch:**	400515
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Aroclor1016	0.0230	0.10	0.0068	1	88.3	88.4	0.160	55.6 - 135	30	
Aroclor1260	0.0270	0.10	0.00	0.5	94.6	94.0	0.679	65.6 - 132	30	
TCMX (S)			0.00	0.25	90.3	88.7		51.7 - 128		
DCBP (S)			0.00	0.250	92.2	90.4		55.1 - 113		

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004011	**Prep Method:**	1311/3010B	**Prep Date:**	05/07/10	**Prep Batch:**	0392
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/07/10	**Analytical Batch:**	400786
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (TCLP)	0.05	0.1	0.000	10	92.8	93.4	0.644	80 - 120	20	

Work Order:	1004011	**Prep Method:**	WET/3010B	**Prep Date:**	05/11/10	**Prep Batch:**	0413
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400854
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Chromium (STLC)	0.0200	0.10	0.0100	10	93.4	92.8	0.644	80 - 120	20	,
Lead (STLC)	0.0500	0.10	0.000	10	91.1	90.7	0.440	80 - 120	20	,

Work Order:	1004011	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0424
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400865
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	0.000	10	98.5	98.7	0.203	80 - 120	20	,

Work Order:	1004011	**Prep Method:**	7199M	**Prep Date:**	05/11/10	**Prep Batch:**	0436
Matrix:	Soil	**Analytical Method:**	SW7199	**Analyzed Date:**	05/11/10	**Analytical Batch:**	400887
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Hexavalent Chromium	0.015	0.10	0.0006	0.1	95.9	90.2	6.16	65 - 135	30	,

MS/MSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004011	**Prep Method:**	3050	**Prep Date:**	04/06/10	**Prep Batch:**	0252
Matrix:	**Soil**	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400496
Spiked Sample:	1004011-010A						
Units:	mg/Kg						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead	0.13	1	0.059	50	79.1	78.4	0.827	67.9 - 118	30	

Work Order:	1004011	**Prep Method:**	WET/3010B	**Prep Date:**	05/11/10	**Prep Batch:**	0413
Matrix:	**Soil**	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400854
Spiked Sample:	1004011-001A						
Units:	mg/L						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Chromium (STLC)	0.0200	0.10	0.0130	10	81.1	73.3	8.35	75 - 125	20	S
Lead (STLC)	0.0500	0.10	2.38	10	296	67.7	0.424	75 - 125	20	S

Work Order:	1004011	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0424
Matrix:	**Soil**	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400865
Spiked Sample:	1004011-001A						
Units:	mg/L						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	0.109	10	105	108	2.54	75 - 125	20	

Duplicate Summary Report

Work Order:	1004011	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	**Soil**	**Analytical Method:**	SW9045C	**Analyzed Date:**	04/06/10	**Analytical Batch:**	400508
Units:						**Lab Sample ID:**	1004011-012A-Dup

Parameters	MDL	PQL	Sample Result	Duplicate Result	% RPD
pH	0.100	2.00	7.84	7.87	0.0955

Raw values are used in quality control assessment.

Laboratory Qualifiers and Definitions

DEFINITIONS:

Accuracy/Bias (% Recovery) - The closeness of agreement between an observed value and an accepted reference value.
Blank (Method/Preparation Blank) -MB/PB - An analyte-free matrix to which all reagents are added in the same volumes/proportions as used in sample processing. The method blank is used to document contamination resulting from the analytical process.
Duplicate - a field sample and/or laboratory QC sample prepared in duplicate following all of the same processes and procedures used on the original sample (sample duplicate, LCSD, MSD)
Laboratory Control Sample (LCS ad LCSD) - A known matrix spiked with compounds representative of the target analyte(s). This is used to document laboratory performance.
Matrix - the component or substrate that contains the analyte of interest (e.g., - groundwater, sediment, soil, waste water, etc)
Matrix Spike (MS/MSD) - Client sample spiked with identical concentrations of target analyte (s). The spiking occurs prior to the sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.
Method Detection Limit (MDL) - the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero
Practical Quantitation Limit (PQL) - a laboratory determined value at 2 to 5 times above the MDL that can be reproduced in a manner that results in a 99% confidence level that the result is both accurate and precise. PQLs reflect all preparation factors and/or dilution factors that have been applied to the sample during the preparation and/or analytical processes.
Precision (%RPD) - The agreement among a set of replicate/duplicate measurements without regard to known value of the replicates
Surrogate (S) or (Surr) - An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are used in most organic analysis to demonstrate matrix compatibility with the chosen method of analysis
Tentatively Identified Compound (TIC) - A compound not contained within the analytical calibration standards but present in the GCMS library of defined compounds. When the library is searched for an unknown compound, it can frequently give a tentative identification to the compound based on retention time and primary and secondary ion match. TICs are reported as estimates and are candidates for further investigation.
Units: the unit of measure used to express the reported result - **mg/L** and ***mg/Kg*** (equivalent to PPM - parts per million in **liquid** and ***solid***), **ug/L** and ***ug/Kg*** (equivalent to PPB - parts per billion in **liquid** and ***solid***), **ug/m3**, ***mg.m3***, **ppbv** and ***ppmv*** (all units of measure for reporting concentrations in air), **%** (equivalent to 10000 ppm or 1,000,000 ppb), **ug/Wipe** (concentration found on the surface of a single Wipe usually taken over a 100cm2 surface)

LABORATORY QUALIFIERS:

B - Indicates when the anlayte is found in the associated method or preparation blank
D - Surrogate is not recoverable due to the necessary dilution of the sample
E - Indicates the reportable value is outside of the calibration range of the instrument but within the linear range of the instrument (unless otherwise noted) Values reported with an E qualifier should be considered as estimated.
H- Indicates that the recommended holding time for the analyte or compound has been exceeded
J- Indicates a value between the method MDL and PQL and that the reported concentration should be considered as estimated rather the quantitative
NA - Not Analyzed
N/A - Not Applicable
NR - Not recoverable - a matrix spike concentration is not recoverable due to a concentration within the original sample that is greater than four times the spike concentration added
R- The % RPD between a duplicate set of samples is outside of the absolute values established by laboratory control charts
S- Spike recovery is outside of established method and/or laboratory control limits. Further explanation of the use of this qualifier should be included within a case narrative
X -Used to indicate that a value based on pattern identification is within the pattern range but not typical of the pattern found in standards. Further explanation may or may not be provided within the sample footnote and/or the case narrative.

Sample Receipt Checklist

Client Name: URS (San Jose)

Project Name: Petaluma, CA

Work Order No.: 1004011

Date and Time Received: 4/2/2010 10:04

Received By: NG

Physically Logged By: NG

Checklist Completed By: NG

Carrier Name: Hi-Speed Courier

Chain of Custody (COC) Information

Chain of custody present?	Yes
Chain of custody signed when relinquished and received?	Yes
Chain of custody agrees with sample labels?	Yes
Custody seals intact on sample bottles?	Not Present

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Not Present
Shipping Container/Cooler In Good Condition?	Yes
Samples in proper container/bottle?	Yes
Samples containers intact?	Yes
Sufficient sample volume for indicated test?	Yes

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes			
Container/Temp Blank temperature in compliance?	Yes	Temperature:	5	°C
Water-VOA vials have zero headspace?	No VOA vials submitted			
Water-pH acceptable upon receipt?				

pH Checked by:

pH Adjusted by:

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	II
Project Name:	Petaluma, CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/2/2010
Report Due Date:	5/14/2010		**Time Received:**	10:04

Comments: 5 day TAT! Asbestos subbed to EMSL.

Work Order # : ***1004011***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1004011-001A	M-18@0.5	04/02/10 2:02	Soil	09/29/10				
							S_6010B(STLC)	
							S_6010BDI-STLC	
							S_8081AOCP	
							S_6010B(TCLP)	
							S_8082PCB	
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-002A	M-18@1.0	04/02/10 2:04	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-003A	M-18@1.5	04/02/10 2:06	Soil	09/29/10				
							S_6010B(STLC)	
							S_6010BDI-STLC	
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-004A	M-18@2.0	04/02/10 2:08	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-005A	M-18@3.0	04/02/10 2:10	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-006A	M-19@0.5	04/02/10 2:18	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-007A	M-19@1.0	04/02/10 2:20	Soil	09/29/10				
							S_CrVI7199	
							S_7471BHG	
							S_6010BCAM17	
							SUB_AsbestosCARB 435	Yes
							S_6010B(STLC)	
							S_pH9045C	
1004011-008A	M-19@1.5	04/02/10 2:22	Soil	09/29/10				

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	II
Project Name:	Petaluma, CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/2/2010
Report Due Date:	5/14/2010		**Time Received:**	10:04

Comments: 5 day TAT! Asbestos subbed to EMSL.

Work Order # : ***1004011***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
							S_6010B(STLC) S_6010BCAM17 S_6010BDI-STLC	
Sample Note:	Pb only.							
1004011-009A	M-19@2.0	04/02/10 2:24	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-010A	M-19@3.0	04/02/10 2:26	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-011A	M-19d@0.5	04/02/10 2:32	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-012A	M-19d@1.0	04/02/10 2:34	Soil	09/29/10				
							S_CrVI7199 SUB_AsbestosCARB 435 S_7471BHG S_6010BCAM17 S_6010B(STLC) S_pH9045C	Yes
1004011-013A	M-19d@1.5	04/02/10 2:36	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-014A	M-19d@2.0	04/02/10 2:38	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-015A	M-19d@3.0	04/02/10 2:40	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-016A	M-20@0.5	04/02/10 2:44	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	II
Project Name:	Petaluma, CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/2/2010
Report Due Date:	5/14/2010		**Time Received:**	10:04

Comments: 5 day TAT! Asbestos subbed to EMSL.

Work Order # : ***1004011***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1004011-017A	M-20@1.0	04/02/10 2:46	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-018A	M-20@1.5	04/02/10 2:48	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-019A	M-20@2.0	04/02/10 2:50	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-020A	M-20@3.0	04/02/10 2:52	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-021A	M-21@0.5	04/02/10 3:00	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-022A	M-21@1.0	04/02/10 3:02	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-023A	M-21@1.5	04/02/10 3:04	Soil	09/29/10				
							S_6010B(STLC) S_6010BDI-STLC S_6010B(TCLP) S_6010BCAM17	
Sample Note:	Pb only.							
1004011-024A	M-21@2.0	04/02/10 3:06	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-025A	M-21@3.0	04/02/10 3:08	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004011-026A	M-22@0.5	04/02/10 3:16	Soil	09/29/10				
							S_8081AOCP	

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	II
Project Name:	Petaluma, CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/2/2010
Report Due Date:	5/14/2010		**Time Received:**	10:04

Comments: 5 day TAT! Asbestos subbed to EMSL.

Work Order # : ***1004011***

WO Sample ID	Client Sample ID	Collection Date/Time		Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
								S_8082PCB S_6010BCAM17	
Sample Note:	Pb only.								
1004011-027A	M-22@1.0	04/02/10	3:18	Soil	09/29/10				
								S_6010BCAM17	
Sample Note:	Pb only.								
1004011-028A	M-22@1.5	04/02/10	3:20	Soil	09/29/10				
								S_6010BCAM17	
Sample Note:	Pb only.								
1004011-029A	M-22@2.0	04/02/10	3:22	Soil	09/29/10				
								S_6010B(STLC) S_6010BCAM17 S_6010BDI-STLC	
Sample Note:	Pb only.								
1004011-030A	M-22@3.0	04/02/10	3:24	Soil	09/29/10				
								S_6010BCAM17	
Sample Note:	Pb only.								

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004011

Torrent LABORATORY, INC.

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: [x] 10 Work Days [ ] 3 Work Days [ ] Noon - Nxt Day [ ] 7 Work Days [ ] 2 Work Days [ ] 2 - 8 Hours [ ] 5 Work Days [ ] 1 Work Day [ ] Other

SAMPLE TYPE: [ ] Storm Water [ ] Air [ ] Waste Water [ ] Other [ ] Ground Water [x] Soil

REPORT FORMAT: [ ] QC Level IV [ ] EDF [ ] Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	Pesticides	Lead	PCBs	REMARKS
021A	M-21@0.5	04/02/10 03:00	Soil	1	Sleeve								✓		
022A	M-21@1.0	04/02/10 03:02	Soil	1	Sleeve								✓		
023A	M-21@1.5	04/02/10 03:04	Soil	1	Sleeve								✓		
024A	M-21@2.0	04/02/10 03:06	Soil	1	Sleeve								✓		
025A	M-21@3.0	04/02/10 03:08	Soil	1	Sleeve								✓		
026A	M-22@0.5	04/02/10 03:16	Soil	1	Sleeve							✓	✓	✓	Temp: 5°C
027A	M-22@1.0	04/02/10 03:18	Soil	1	Sleeve								✓		
028A	M-22@1.5	04/02/10 03:20	Soil	1	Sleeve								✓		
029A	M-22@2.0	04/02/10 03:22	Soil	1	Sleeve								✓		
030A	M-22@3.0	04/02/10 03:24	Soil	1	Sleeve								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	4/2/10	05:30			4/2	9:25
2			4/2	10:04				

Were Samples Received in Good Condition? [x] Yes [ ] NO Samples on Ice? [x] Yes [ ] NO Method of Shipment Hi Speed Sample seals intact? [ ] Yes [ ] NO [x] N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 3 of 3

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004011

Company Name: URS Corporation
Address: 100 W San Fernando Street, Suite 200
City: San Jose | State: CA | Zip Code: 95113
Telephone: 408-297-9585 | FAX: 408-297-6962
REPORT TO: J Ripple | SAMPLER: J Ripple/M Thummaluru

Location of Sampling: Petaluma, CA
Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
Special Instructions / Comments:
P.O. #: 28645045.03200 | EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	Pesticides	Lead	PCBs	REMARKS
011A	M-19d@0.5	04/02/10 02:32	Soil	1	Sleeve								✓		
012A	M-19d@1.0	04/02/10 02:34	Soil	1	Sleeve	✓			✓	✓					
013A	M-19d@1.5	04/02/10 02:36	Soil	1	Sleeve								✓		
014A	M-19d@2.0	04/02/10 02:38	Soil	1	Sleeve								✓		
015A	M-19d@3.0	04/02/10 02:40	Soil	1	Sleeve								✓		
016A	M-20@0.5	04/02/10 02:44	Soil	1	Sleeve								✓		
017A	M-20@1.0	04/02/10 02:46	Soil	1	Sleeve								✓		
018A	M-20@1.5	04/02/10 02:48	Soil	1	Sleeve								✓		Temp 5°C
019A	M-20@2.0	04/02/10 0250	Soil	1	Sleeve								✓		
020A	M-20@3.0	04/02/10 02:52	Soil	1	Sleeve								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	4/2/10	05:30			4/2	7:25
2			4/2	10:04				

Were Samples Received in Good Condition? ☒ Yes ☐ NO Samples on Ice? ☒ Yes ☐ NO Method of Shipment Hi Speed Sample seals intact? ☐ Yes ☐ NO ☒ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 2 of 3

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004011

Company Name: URS Corporation
Address: 100 W San Fernando Street, Suite 200
City: San Jose | State: CA | Zip Code: 95113
Telephone: 408-297-9585 | FAX: 408-297-6962
REPORT TO: J Ripple | SAMPLER: J Ripple/M Thummaluru

Location of Sampling: Petaluma, CA
Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
Special Instructions / Comments:
P.O. #: 28645045.03200 | EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: [x] 10 Work Days [ ] 3 Work Days [ ] Noon - Nxt Day [ ] 7 Work Days [ ] 2 Work Days [ ] 2 - 8 Hours [ ] 5 Work Days [ ] 1 Work Day [ ] Other

SAMPLE TYPE: [ ] Storm Water [ ] Air [ ] Waste Water [ ] Other [ ] Ground Water [x] Soil

REPORT FORMAT: [ ] QC Level IV [ ] EDF [ ] Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	Pesticides	Lead	PCBs	REMARKS
001A	M-18@0.5	04/02/10 02:02	Soil	1	Sleeve							✓	✓	✓	
002A	M-18@1.0	04/02/10 02:04	Soil	1	Sleeve								✓		
003A	M-18@1.5	04/02/10 02:06	Soil	1	Sleeve								✓		
004A	M-18@2.0	04/02/10 02:08	Soil	1	Sleeve								✓		
005A	M-18@3.0	04/02/10 02:10	Soil	1	Sleeve								✓		
006A	M-19@0.5	04/02/10 02:18	Soil	1	Sleeve								✓		5°C
007A	M-19@1.0	04/02/10 02:20	Soil	1	Sleeve	✓			✓	✓					Temp.
008A	M-19@1.5	04/02/10 02:22	Soil	1	Sleeve								✓		
009A	M-19@2.0	04/02/10 02:24	Soil	1	Sleeve								✓		
010A	M-19@3.0	04/02/10 02:26	Soil	1	Sleeve								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	4/2/10	05:30		Shawn Bailey	4/2/10	9:25
2			4/2/10	10:04	HS Fedex		4/2/10	10:04

Were Samples Received in Good Condition? [x] Yes [ ] NO Samples on Ice? [ ] Yes [x] NO Method of Shipment Hi Speed Sample seals intact? [ ] Yes [ ] NO [x] N/A

Samples are discarded by the laboratory 30 days from date of receipt unless other arrangements are made.

Date: _____ Log In Reviewed By: _____ Date: _____

Page 1 of 3

EMSL Analytical, Inc
2235 Polvorosa Ave , Suite 230, San Leandro, CA 94577
Phone: (510) 895-3675 Fax: (510) 895-3680 Email: milpitaslab@emsl.com

Attn: **Patti Sandrock**
Torrent Laboratory, Inc.
483 Sinclair Frontage Rd.
Milpitas, CA 95035

Fax: (408) 263-8293 Phone: (408) 263-5258
Project: **CoC100405003**

Customer ID: TORR80
Customer PO: CoC100405003
Received: 04/06/10 10:30 AM
EMSL Order: 091003195

EMSL Proj:
Analysis Date: 4/14/2010

Test Report: Asbestos Analysis via Polarized Light Microscopy, Qualitative

Sample	Description	Appearance	Result	Notes
1004011-007A *091003195-0001*			**Chrysotile**	
1004011-012A *091003195-0002*			**Chrysotile**	

Analyst(s)

Grant Mays (2)

Baojia Ke, Laboratory Manager
or other approved signatory

EMSL recommends that soil samples reported as "ND" be tested by the EPA Screening Method/Qualitative. The above report relates only to the items tested. This report may not be reproduced, except in full, without written approval by EMSL Analytical, Inc. The above test must not be used by the client to claim product endorsement by NVLAP nor any agency of the United States Government. Unless otherwise noted, the results in this report have not been blank corrected.Samples received in good condition unless otherwise noted.
Samples analyzed by EMSL Analytical, Inc 2235 Polvorosa Ave , Suite 230, San LeandroCA

THIS IS THE LAST PAGE OF THE REPORT.

IRS Sample I					
Boring ID	Chromium 6	Chromium STLC	Lead STLC	Lead DI-STLC	Lead TCLP
# of samples to be tested	6	3	43	43	20
S-5	1003111-019A				
S-8			1004070-013A	1004070-013A	
N-1			1003116-027A	1003116-027A	1003116-027A
			1003116-028A	1003116-028A	
M-1					
M-1D					
M-2			1004009-006A	1004009-006A	
M-4			1004009-010A	1004009-010A	1004009-010A
S-9			1004070-011A	1004070-011A	1004070-011A
			1004070-012A	1004070-012A	1004070-012A
S-12			1004072-005A	1004072-005A	
S-13			1004072-004A	1004072-004A	
S-14			1003116-026A	1003116-026A	1003116-026A
S-15					
N-4			1004070-003A	1004070-003A	
N-5			1003116-014A	1003116-014A	1003116-014A
	1003116-015A		1003116-015A	1003116-015A	1003116-015A
			1003116-001A	1003116-001A	
N-6			1003116-002A	1003116-002A	1003116-002A
			1003116-003A	1003116-003A	
			1003116-004A	1003116-004A	1003116-004A
			1003116-005A	1003116-005A	1003116-005A
N-7			1004091-011A	1004091-011A	1004091-011A
			1004091-012A	1004091-012A	
			1004091-013A	1004091-013A	
			1004091-014A	1004091-014A	
N-8			1003111-001A	1003111-001A	
			1003111-002A	1003111-002A	
N-11			1003111-012A	1003111-012A	
			1003111-013A	1003111-013A	
N-12			1004070-005A	1004070-005A	1004070-005A
			1004070-006A	1004070-006A	1004070-006A
N-13			1003111-014A	1003111-014A	
N-13-d			1003111-007A	1003111-007A	
N-14			1004072-011A	1004072-011A	1004072-011A
	1004072-014A	1004072-014A			
M-18			1004011-001A	1004011-001A	1004011-001A
			1004011-003A	1004011-003A	
M-19	1004011-007A	1004011-007A			
			1004011-008A	1004011-008A	
M-19-d	1004011-012A	1004011-012A			
M-21			1004011-023A	1004011-023A	1004011-023A
M-22			1004011-029A	1004011-029A	
S-16			1003116-029A	1003116-029A	
N-15			1004067-004A	1004067-004A	1004067-004A
N-16			1004067-010A	1004067-010A	1004067-010A
N-17			1004072-017A	1004072-017A	1004072-017A
M-6					
M-10					
M-16	1004070-016A		1004070-016A	1004070-016A	
			1004070-017A	1004070-017A	
			1004070-019A	1004070-019A	1004070-019A

URS (San Jose)
100 W San Fernando St, Suite200
San Jose, California 95113
Tel: 4082979585
Fax: 4082976962

RE: Petaluma, CA

Work Order No.: 1004010

Dear James Ripple:

Torrent Laboratory, Inc. received 10 sample(s) on April 02, 2010 for the analyses presented in the following Report.

All data for associated QC met EPA or laboratory specification(s) except where noted in the case narrative.

Torrent Laboratory, Inc. is certified by the State of California, ELAP #1991. If you have any questions regarding these test results, please feel free to contact the Project Management Team at (408)263-5258; ext 204.

Patti Sandrock

April 09, 2010
Date

Date: 4/9/2010

Client: URS (San Jose)

Project: Petaluma, CA

Work Order: 1004010

CASE NARRATIVE

No issues encountered with the receiving, preparation, analysis or reporting of the results associated with this work order.

Analytical Comments for Asbestos, Note: Analysis performed by sub-contract laboratory EMSL, Inc NVLAP Certification # 101048-3. Results to follow under separate cover.

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 04/09/10

M-12@0.5 1004010-001A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	7.7	mg/Kg

M-12@1.0 1004010-002A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	7.7	mg/Kg

M-12d@0.5 1004010-003A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	7.2	mg/Kg

M-12d@1.0 1004010-004A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	8.6	mg/Kg
TPH as Motor Oil	SW8015B(M)	1	1.65	4.0	78	mg/Kg

M-13@0.5 1004010-005A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	22	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 04/09/10

M-13@1.0 1004010-006A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	24	mg/Kg

M-14@0.5 1004010-007A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	7.1	mg/Kg

M-14@1.0 1004010-008A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	3.2	mg/Kg

M-17@0.5 1004010-009A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	5.3	mg/Kg

M-17@1.0 1004010-010A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	6.8	mg/Kg

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 04/09/10

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 04/09/10

Client Sample ID:	M-12@0.5	**Lab Sample ID:**	1004010-001A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 1:22		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	7.7		mg/Kg	400497	0253

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
alpha-BHC	SW8081A	4/6/10	04/08/10	1	0.44	2.0	ND		ug/Kg	400514	0241
gamma-BHC	SW8081A	4/6/10	04/08/10	1	0.40	2.0	ND		ug/Kg	400514	0241
beta-BHC	SW8081A	4/6/10	04/08/10	1	0.36	2.0	ND		ug/Kg	400514	0241
delta-BHC	SW8081A	4/6/10	04/08/10	1	0.49	2.0	ND		ug/Kg	400514	0241
Heptachlor	SW8081A	4/6/10	04/08/10	1	1.1	2.0	ND		ug/Kg	400514	0241
Aldrin	SW8081A	4/6/10	04/08/10	1	0.44	2.0	ND		ug/Kg	400514	0241
Heptachlor epoxide	SW8081A	4/6/10	04/08/10	1	0.32	2.0	ND		ug/Kg	400514	0241
gamma-Chlordane	SW8081A	4/6/10	04/08/10	1	0.42	2.0	ND		ug/Kg	400514	0241
alpha-Chlordane	SW8081A	4/6/10	04/08/10	1	0.36	2.0	ND		ug/Kg	400514	0241
Endosulfan I	SW8081A	4/6/10	04/08/10	1	0.59	2.0	ND		ug/Kg	400514	0241
4,4'-DDE	SW8081A	4/6/10	04/08/10	1	0.48	2.0	ND		ug/Kg	400514	0241
Dieldrin	SW8081A	4/6/10	04/08/10	1	0.43	2.0	ND		ug/Kg	400514	0241
Endrin	SW8081A	4/6/10	04/08/10	1	0.57	2.0	ND		ug/Kg	400514	0241
4,4'-DDD	SW8081A	4/6/10	04/08/10	1	0.47	2.0	ND		ug/Kg	400514	0241
Endosulfan II	SW8081A	4/6/10	04/08/10	1	1.5	2.0	ND		ug/Kg	400514	0241
4,4'-DDT	SW8081A	4/6/10	04/08/10	1	0.81	2.0	ND		ug/Kg	400514	0241
Endrin aldehyde	SW8081A	4/6/10	04/08/10	1	1.0	2.0	ND		ug/Kg	400514	0241
Endosulfan sulfate	SW8081A	4/6/10	04/08/10	1	0.49	2.0	ND		ug/Kg	400514	0241
Methoxychlor	SW8081A	4/6/10	04/08/10	1	0.62	5.0	ND		ug/Kg	400514	0241
Endrin Ketone	SW8081A	4/6/10	04/08/10	1	0.40	2.0	ND		ug/Kg	400514	0241
Chlordane	SW8081A	4/6/10	04/08/10	1	10	20	ND		ug/Kg	400514	0241
Toxaphene	SW8081A	4/6/10	04/08/10	1	10	100	ND		ug/Kg	400514	0241
TCMX (S)	SW8081A	4/6/10	04/08/10	1	52.5	139	77.8		%	400514	0241
DCBP (S)	SW8081A	4/6/10	04/08/10	1	50.2	139	79.5		%	400514	0241

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 04/09/10

Client Sample ID:	M-12@0.5	**Lab Sample ID:**	1004010-001A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 1:22		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Aroclor1016	SW8082	4/6/10	04/07/10	1	0.0230	0.10	ND		mg/Kg	400515	0242
Aroclor1221	SW8082	4/6/10	04/07/10	1	0.0920	0.20	ND		mg/Kg	400515	0242
Aroclor1232	SW8082	4/6/10	04/07/10	1	0.0460	0.10	ND		mg/Kg	400515	0242
Aroclor1242	SW8082	4/6/10	04/07/10	1	0.0430	0.10	ND		mg/Kg	400515	0242
Aroclor1248	SW8082	4/6/10	04/07/10	1	0.0360	0.10	ND		mg/Kg	400515	0242
Aroclor1254	SW8082	4/6/10	04/07/10	1	0.0240	0.10	ND		mg/Kg	400515	0242
Aroclor1260	SW8082	4/6/10	04/07/10	1	0.0270	0.10	ND		mg/Kg	400515	0242
TCMX (S)	SW8082	4/6/10	04/07/10	1	51.7	128	88.4		%	400515	0242
DCBP (S)	SW8082	4/6/10	04/07/10	1	55.1	113	89.8		%	400515	0242

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 04/09/10

Client Sample ID:	M-12@1.0	**Lab Sample ID:**	1004010-002A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 1:24		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	7.7		mg/Kg	400497	0253

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
MTBE	SW8260B	NA	04/02/10	1	2.6	10	ND		ug/Kg	400471	NA
tert-Butanol	SW8260B	NA	04/02/10	1	21	50	ND		ug/Kg	400471	NA
Diisopropyl ether (DIPE)	SW8260B	NA	04/02/10	1	2.2	10	ND		ug/Kg	400471	NA
ETBE	SW8260B	NA	04/02/10	1	2.4	10	ND		ug/Kg	400471	NA
Benzene	SW8260B	NA	04/02/10	1	1.5	10	ND		ug/Kg	400471	NA
TAME	SW8260B	NA	04/02/10	1	2.1	10	ND		ug/Kg	400471	NA
Toluene	SW8260B	NA	04/02/10	1	0.98	10	ND		ug/Kg	400471	NA
Ethyl Benzene	SW8260B	NA	04/02/10	1	0.86	10	ND		ug/Kg	400471	NA
m,p-Xylene	SW8260B	NA	04/02/10	1	1.9	10	ND		ug/Kg	400471	NA
o-Xylene	SW8260B	NA	04/02/10	1	0.66	5.0	ND		ug/Kg	400471	NA
(S) Dibromofluoromethane	SW8260B	NA	04/02/10	1	59.8	148	100		%	400471	NA
(S) Toluene-d8	SW8260B	NA	04/02/10	1	55.2	133	85.2		%	400471	NA
(S) 4-Bromofluorobenzene	SW8260B	NA	04/02/10	1	55.8	141	107		%	400471	NA

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH(Gasoline)	8260TPH	NA	04/02/10	1	17	100	ND		ug/Kg	400472	NA
(S) 4-Bromofluorobenzene	8260TPH	NA	04/02/10	1	57	127	41.3	S	%	400472	NA

NOTE: S-Matrix effect suspected.

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH as Diesel	SW8015B(M)	4/5/10	04/05/10	1	0.759	2.0	ND		mg/Kg	400503	0235
TPH as Motor Oil	SW8015B(M)	4/5/10	04/05/10	1	1.65	4.0	ND		mg/Kg	400503	0235
Pentacosane (S)	SW8015B(M)	4/5/10	04/05/10	1	59.7	129	91.4		mg/Kg	400503	0235

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 04/09/10

Client Sample ID:	M-12d@0.5	**Lab Sample ID:**	1004010-003A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 1:26		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	7.2		mg/Kg	400497	0253

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
alpha-BHC	SW8081A	4/6/10	04/08/10	1	0.44	2.0	ND		ug/Kg	400514	0241
gamma-BHC	SW8081A	4/6/10	04/08/10	1	0.40	2.0	ND		ug/Kg	400514	0241
beta-BHC	SW8081A	4/6/10	04/08/10	1	0.36	2.0	ND		ug/Kg	400514	0241
delta-BHC	SW8081A	4/6/10	04/08/10	1	0.49	2.0	ND		ug/Kg	400514	0241
Heptachlor	SW8081A	4/6/10	04/08/10	1	1.1	2.0	ND		ug/Kg	400514	0241
Aldrin	SW8081A	4/6/10	04/08/10	1	0.44	2.0	ND		ug/Kg	400514	0241
Heptachlor epoxide	SW8081A	4/6/10	04/08/10	1	0.32	2.0	ND		ug/Kg	400514	0241
gamma-Chlordane	SW8081A	4/6/10	04/08/10	1	0.42	2.0	ND		ug/Kg	400514	0241
alpha-Chlordane	SW8081A	4/6/10	04/08/10	1	0.36	2.0	ND		ug/Kg	400514	0241
Endosulfan I	SW8081A	4/6/10	04/08/10	1	0.59	2.0	ND		ug/Kg	400514	0241
4,4'-DDE	SW8081A	4/6/10	04/08/10	1	0.48	2.0	ND		ug/Kg	400514	0241
Dieldrin	SW8081A	4/6/10	04/08/10	1	0.43	2.0	ND		ug/Kg	400514	0241
Endrin	SW8081A	4/6/10	04/08/10	1	0.57	2.0	ND		ug/Kg	400514	0241
4,4'-DDD	SW8081A	4/6/10	04/08/10	1	0.47	2.0	ND		ug/Kg	400514	0241
Endosulfan II	SW8081A	4/6/10	04/08/10	1	1.5	2.0	ND		ug/Kg	400514	0241
4,4'-DDT	SW8081A	4/6/10	04/08/10	1	0.81	2.0	ND		ug/Kg	400514	0241
Endrin aldehyde	SW8081A	4/6/10	04/08/10	1	1.0	2.0	ND		ug/Kg	400514	0241
Endosulfan sulfate	SW8081A	4/6/10	04/08/10	1	0.49	2.0	ND		ug/Kg	400514	0241
Methoxychlor	SW8081A	4/6/10	04/08/10	1	0.62	5.0	ND		ug/Kg	400514	0241
Endrin Ketone	SW8081A	4/6/10	04/08/10	1	0.40	2.0	ND		ug/Kg	400514	0241
Chlordane	SW8081A	4/6/10	04/08/10	1	10	20	ND		ug/Kg	400514	0241
Toxaphene	SW8081A	4/6/10	04/08/10	1	10	100	ND		ug/Kg	400514	0241
TCMX (S)	SW8081A	4/6/10	04/08/10	1	52.5	139	73.0		%	400514	0241
DCBP (S)	SW8081A	4/6/10	04/08/10	1	50.2	139	76.5		%	400514	0241

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 04/09/10

Client Sample ID:	M-12d@0.5	**Lab Sample ID:**	1004010-003A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 1:26		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Aroclor1016	SW8082	4/6/10	04/07/10	1	0.0230	0.10	ND		mg/Kg	400515	0242
Aroclor1221	SW8082	4/6/10	04/07/10	1	0.0920	0.20	ND		mg/Kg	400515	0242
Aroclor1232	SW8082	4/6/10	04/07/10	1	0.0460	0.10	ND		mg/Kg	400515	0242
Aroclor1242	SW8082	4/6/10	04/07/10	1	0.0430	0.10	ND		mg/Kg	400515	0242
Aroclor1248	SW8082	4/6/10	04/07/10	1	0.0360	0.10	ND		mg/Kg	400515	0242
Aroclor1254	SW8082	4/6/10	04/07/10	1	0.0240	0.10	ND		mg/Kg	400515	0242
Aroclor1260	SW8082	4/6/10	04/07/10	1	0.0270	0.10	ND		mg/Kg	400515	0242
TCMX (S)	SW8082	4/6/10	04/07/10	1	51.7	128	78.8		%	400515	0242
DCBP (S)	SW8082	4/6/10	04/07/10	1	55.1	113	85.3		%	400515	0242

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 04/09/10

Client Sample ID:	M-12d@1.0	**Lab Sample ID:**	1004010-004A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 1:28		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	8.6		mg/Kg	400497	0253

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
MTBE	SW8260B	NA	04/02/10	1	2.6	10	ND		ug/Kg	400471	NA
tert-Butanol	SW8260B	NA	04/02/10	1	21	50	ND		ug/Kg	400471	NA
Diisopropyl ether (DIPE)	SW8260B	NA	04/02/10	1	2.2	10	ND		ug/Kg	400471	NA
ETBE	SW8260B	NA	04/02/10	1	2.4	10	ND		ug/Kg	400471	NA
Benzene	SW8260B	NA	04/02/10	1	1.5	10	ND		ug/Kg	400471	NA
TAME	SW8260B	NA	04/02/10	1	2.1	10	ND		ug/Kg	400471	NA
Toluene	SW8260B	NA	04/02/10	1	0.98	10	ND		ug/Kg	400471	NA
Ethyl Benzene	SW8260B	NA	04/02/10	1	0.86	10	ND		ug/Kg	400471	NA
m,p-Xylene	SW8260B	NA	04/02/10	1	1.9	10	ND		ug/Kg	400471	NA
o-Xylene	SW8260B	NA	04/02/10	1	0.66	5.0	ND		ug/Kg	400471	NA
(S) Dibromofluoromethane	SW8260B	NA	04/02/10	1	59.8	148	105		%	400471	NA
(S) Toluene-d8	SW8260B	NA	04/02/10	1	55.2	133	82.1		%	400471	NA
(S) 4-Bromofluorobenzene	SW8260B	NA	04/02/10	1	55.8	141	106		%	400471	NA

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH(Gasoline)	8260TPH	NA	04/02/10	1	17	100	ND		ug/Kg	400472	NA
(S) 4-Bromofluorobenzene	8260TPH	NA	04/02/10	1	57	127	48.3	S	%	400472	NA

NOTE: S-Duplicate analysis yielded similar result indicating a matrix effect.

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH as Diesel	SW8015B(M)	4/5/10	04/05/10	1	0.759	2.0	ND		mg/Kg	400503	0235
TPH as Motor Oil	SW8015B(M)	4/5/10	04/05/10	1	1.65	4.0	78		mg/Kg	400503	0235
Pentacosane (S)	SW8015B(M)	4/5/10	04/05/10	1	59.7	129	85.7		mg/Kg	400503	0235

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 04/09/10

Client Sample ID: M-13@0.5
Lab Sample ID: 1004010-005A
Project Name/Location: Petaluma, CA
Sample Matrix: Soil
Project Number:
Date/Time Sampled: 04/02/10 / 1:35

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	22		mg/Kg	400497	0253

Client Sample ID: M-13@1.0
Lab Sample ID: 1004010-006A
Project Name/Location: Petaluma, CA
Sample Matrix: Soil
Project Number:
Date/Time Sampled: 04/02/10 / 1:37

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	24		mg/Kg	400497	0253

Client Sample ID: M-14@0.5
Lab Sample ID: 1004010-007A
Project Name/Location: Petaluma, CA
Sample Matrix: Soil
Project Number:
Date/Time Sampled: 04/02/10 / 1:40

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	7.1		mg/Kg	400497	0253

Client Sample ID: M-14@1.0
Lab Sample ID: 1004010-008A
Project Name/Location: Petaluma, CA
Sample Matrix: Soil
Project Number:
Date/Time Sampled: 04/02/10 / 1:42

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	3.2		mg/Kg	400497	0253

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 04/09/10

Client Sample ID:	M-17@0.5	**Lab Sample ID:**	1004010-009A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 1:53		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	5.3		mg/Kg	400497	0253

Client Sample ID:	M-17@1.0	**Lab Sample ID:**	1004010-010A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 1:55		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	6.8		mg/Kg	400497	0253

MB Summary Report

Work Order:	1004010	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Soil	**Analytical Method:**	SW8260B	**Analyzed Date:**	04/02/10	**Analytical Batch:**	400471
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.
Dichlorodifluoromethane	4.4	10	ND
Chloromethane	4.6	10	ND
Vinyl Chloride	2.6	10	ND
Bromomethane	4.7	10	ND
Trichlorofluoromethane	2.9	10	ND
1,1-Dichloroethene	1.5	10	ND
Freon 113	3.7	10	ND
Methylene Chloride	2.0	10	ND
trans-1,2-Dichloroethene	1.1	10	ND
MTBE	2.6	10	ND
tert-Butanol	21	50	ND
Diisopropyl ether (DIPE)	2.2	10	ND
1,1-Dichloroethane	1.3	10	ND
ETBE	2.4	10	ND
cis-1,2-Dichloroethene	1.8	10	ND
2,2-Dichloropropane	1.2	10	ND
Bromochloromethane	2.3	10	ND
Chloroform	1.2	10	ND
Carbon Tetrachloride	1.6	10	ND
1,1,1-Trichloroethane	1.2	10	ND
1,1-Dichloropropene	1.4	10	ND
Benzene	1.5	10	ND
TAME	2.1	10	ND
1,2-Dichloroethane	1.9	10	ND
Trichloroethylene	3.9	10	ND
Dibromomethane	2.2	10	ND
1,2-Dichloropropane	1.3	10	ND
Bromodichloromethane	1.1	10	ND
2-Chloroethyl vinyl ether	4.5	10	ND
cis-1,3-Dichloropropene	1.4	10	ND
Toluene	0.98	10	ND
Tetrachloroethylene	1.8	10	ND
trans-1,3-Dichloropropene	1.2	10	ND
1,1,2-Trichloroethane	1.8	10	ND
Dibromochloromethane	1.1	10	ND
1,3-Dichloropropane	2.1	10	ND
1,2-Dibromoethane	1.7	10	ND
Ethyl Benzene	0.86	10	ND
Chlorobenzene	4.2	10	ND
1,1,1,2-Tetrachloroethane	0.86	10	ND

MB Summary Report

Work Order:	1004010	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Soil	**Analytical Method:**	SW8260B	**Analyzed Date:**	04/02/10	**Analytical Batch:**	400471
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.
m,p-Xylene	1.9	10	ND
o-Xylene	0.66	5.0	ND
Styrene	0.77	10	ND
Bromoform	1.9	10	ND
Isopropyl Benzene	1.2	10	ND
n-Propylbenzene	1.4	10	ND
Bromobenzene	1.2	10	ND
1,1,2,2-Tetrachloroethane	3.0	10	ND
1,3,5-Trimethylbenzene	1.1	10	ND
1,2,3-Trichloropropane	3.3	10	ND
4-Chlorotoluene	1.6	10	ND
2-Chlorotoluene	1.6	10	ND
tert-Butylbenzene	1.4	10	ND
1,2,4-Trimethylbenzene	1.1	10	ND
sec-Butyl Benzene	1.6	10	ND
p-Isopropyltoluene	1.5	10	ND
1,3-Dichlorobenzene	1.8	10	ND
1,4-Dichlorobenzene	1.5	10	ND
n-Butylbenzene	2.2	10	ND
1,2-Dichlorobenzene	1.3	10	ND
1,2-Dibromo-3-Chloropropane	4.2	10	ND
Hexachlorobutadiene	2.6	10	ND
1,2,4-Trichlorobenzene	2.1	10	ND
Naphthalene	2.8	10	ND
1,2,3-Trichlorobenzene	2.9	10	ND
(S) Dibromofluoromethane			114
(S) Toluene-d8			78.0
(S) 4-Bromofluorobenzene			84.7

Work Order:	1004010	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Soil	**Analytical Method:**	8260TPH	**Analyzed Date:**	04/02/10	**Analytical Batch:**	400472
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.
TPH(Gasoline)	17	100	ND
(S) 4-Bromofluorobenzene			63.2

MB Summary Report

Work Order:	1004010	**Prep Method:**	3050	**Prep Date:**	04/06/10	**Prep Batch:**	0253
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400497
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.
Lead	0.13	1.0	0.25

Work Order:	1004010	**Prep Method:**	3545_TPH	**Prep Date:**	04/05/10	**Prep Batch:**	0235
Matrix:	Soil	**Analytical Method:**	SW8015B(M)	**Analyzed Date:**	04/05/10	**Analytical Batch:**	400503
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.
TPH as Diesel	0.758	2.0	ND
TPH as Motor Oil	1.78	4.0	ND
Pentacosane (S)			94.3

MB Summary Report

Work Order:	1004010	**Prep Method:**	3545_OCP	**Prep Date:**	04/06/10	**Prep Batch:**	0241
Matrix:	Soil	**Analytical Method:**	SW8081A	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400514
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.
alpha-BHC	0.44	2.0	ND
gamma-BHC	0.40	2.0	ND
beta-BHC	0.36	2.0	ND
delta-BHC	0.49	2.0	ND
Heptachlor	1.1	2.0	ND
Aldrin	0.44	2.0	ND
Heptachlor epoxide	0.32	2.0	ND
gamma-Chlordane	0.42	2.0	ND
alpha-Chlordane	0.36	2.0	ND
Endosulfan I	0.59	2.0	ND
4,4'-DDE	0.48	2.0	ND
Dieldrin	0.43	2.0	ND
Endrin	0.57	2.0	ND
4,4'-DDD	0.47	2.0	ND
Endosulfan II	1.5	2.0	ND
4,4'-DDT	0.81	2.0	ND
Endrin aldehyde	1.0	2.0	ND
Endosulfan sulfate	0.49	2.0	ND
Methoxychlor	0.62	5.0	ND
Endrin Ketone	0.40	2.0	ND
Chlordane	10	20	ND
Toxaphene	10	100	ND
TCMX (S)			80.3
DCBP (S)			78.3

MB Summary Report

Work Order:	1004010	**Prep Method:**	3545_OCP	**Prep Date:**	04/06/10	**Prep Batch:**	0241
Matrix:	Soil	**Analytical Method:**	SW8081A	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400514
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.
alpha-BHC	0.44	2.0	ND
gamma-BHC	0.40	2.0	ND
beta-BHC	0.36	2.0	ND
delta-BHC	0.49	2.0	ND
Heptachlor	1.1	2.0	ND
Aldrin	0.44	2.0	ND
Heptachlor epoxide	0.32	2.0	ND
gamma-Chlordane	0.42	2.0	ND
alpha-Chlordane	0.36	2.0	ND
Endosulfan I	0.59	2.0	ND
4,4'-DDE	0.48	2.0	ND
Dieldrin	0.43	2.0	ND
Endrin	0.57	2.0	ND
4,4'-DDD	0.47	2.0	ND
Endosulfan II	1.5	2.0	ND
4,4'-DDT	0.81	2.0	ND
Endrin aldehyde	1.0	2.0	ND
Endosulfan sulfate	0.49	2.0	ND
Methoxychlor	0.62	5.0	ND
Endrin Ketone	0.40	2.0	ND
Chlordane	10	20	ND
Toxaphene	10	100	ND
TCMX (S)			86.6
DCBP (S)			85.0

MB Summary Report

Work Order:	1004010	**Prep Method:**	3545_PCB	**Prep Date:**	04/06/10	**Prep Batch:**	0242
Matrix:	Soil	**Analytical Method:**	SW8082	**Analyzed Date:**	04/07/10	**Analytical Batch:**	400515
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.
Aroclor1016	0.0230	0.10	ND
Aroclor1221	0.0920	0.20	ND
Aroclor1232	0.0460	0.10	ND
Aroclor1242	0.0430	0.10	ND
Aroclor1248	0.0360	0.10	ND
Aroclor1254	0.0240	0.10	ND
Aroclor1260	0.0270	0.10	ND
TCMX (S)			88.8
DCBP (S)			88.6

Work Order:	1004010	**Prep Method:**	3545_PCB	**Prep Date:**	04/06/10	**Prep Batch:**	0242
Matrix:	Soil	**Analytical Method:**	SW8082	**Analyzed Date:**	04/07/10	**Analytical Batch:**	400515
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.
Aroclor1016	0.0230	0.10	ND
Aroclor1221	0.0920	0.20	ND
Aroclor1232	0.0460	0.10	ND
Aroclor1242	0.0430	0.10	ND
Aroclor1248	0.0360	0.10	ND
Aroclor1254	0.0240	0.10	ND
Aroclor1260	0.0270	0.10	ND
TCMX (S)			91.6
DCBP (S)			90.0

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004010	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Soil	**Analytical Method:**	SW8260B	**Analyzed Date:**	04/02/10	**Analytical Batch:**	400471
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
1,1-Dichloroethene	1.5	10		50	103	86.8	16.7	53.7 - 139	30	
Benzene	1.5	10		50	99.9	83.8	17.4	66.5 - 135	30	
Trichloroethylene	3.9	10		50	89.8	86.1	4.16	57.5 - 150	30	
Toluene	0.98	10		50	72.6	68.4	5.90	56.8 - 134	30	
Chlorobenzene	4.2	10		50	80.3	70.6	12.7	57.4 - 134	30	
(S) Dibromofluoromethane				50	116			59.8 - 148		
(S) Toluene-d8				50	74.1			55.2 - 133		
(S) 4-Bromofluorobenzene				50	75.4			55.8 - 141		

Work Order:	1004010	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	Soil	**Analytical Method:**	8260TPH	**Analyzed Date:**	04/02/10	**Analytical Batch:**	400472
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
TPH(Gasoline)	17	100		1000	80.8	80.3	0.633	48.2 - 132	30	
(S) 4-Bromofluorobenzene				50	63.6			57 - 127		

Work Order:	1004010	**Prep Method:**	3050	**Prep Date:**	04/06/10	**Prep Batch:**	0253
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400497
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead	0.13	1		50	91.7	92.3	0.652	67.9 - 118	30	

Work Order:	1004010	**Prep Method:**	3545_TPH	**Prep Date:**	04/05/10	**Prep Batch:**	0235
Matrix:	Soil	**Analytical Method:**	SW8015B(M)	**Analyzed Date:**	04/05/10	**Analytical Batch:**	400503
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
TPH as Diesel	0.758	2		33.33	79.5	78.3	1.61	52.7 - 115	30	
Pentacosane (S)				100	93.9			59.7 - 129		

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004010	**Prep Method:**	3545_OCP	**Prep Date:**	04/06/10	**Prep Batch:**	0241
Matrix:	Soil	**Analytical Method:**	SW8081A	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400514
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
gamma-BHC	0.40	2.0		20	92.0	90.7	1.44	56.9 - 120	30	
Heptachlor	1.1	2.0		20	93.7	95.2	1.60	63.6 - 117	30	
Aldrin	0.44	2.0		20	91.3	92.2	0.955	53 - 123	30	
Dieldrin	0.43	2.0		20	95.3	94.1	1.34	44 - 130	30	
Endrin	0.57	2.0		20	96.2	95.5	0.726	44.1 - 121	30	
4,4'-DDT	0.81	2.0		20	96.2	92.9	3.47	52.8 - 134	30	
TCMX (S)				350	89.1			52.5 - 139		
DCBP (S)				350	86.5			50.2 - 139		

Work Order:	1004010	**Prep Method:**	3545_PCB	**Prep Date:**	04/06/10	**Prep Batch:**	0242
Matrix:	Soil	**Analytical Method:**	SW8082	**Analyzed Date:**	04/07/10	**Analytical Batch:**	400515
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Aroclor1016	0.0230	0.10		1	88.3	88.4	0.160	55.6 - 135	30	
Aroclor1260	0.0270	0.10		0.5	94.6	94.0	0.679	65.6 - 132	30	
TCMX (S)				0.25	90.3			51.7 - 128		
DCBP (S)				0.250	92.2			55.1 - 113		

MS/MSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004010	**Prep Method:**	3050	**Prep Date:**	04/06/10	**Prep Batch:**	0253
Matrix:	**Soil**	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400497
Spiked Sample:	1004010-001A						
Units:	mg/Kg						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead	0.13	1.0	0.15	50	78.3	77.4	0.969	67.9 - 118	30	

Work Order:	1004010	**Prep Method:**	3545_OCP	**Prep Date:**	04/06/10	**Prep Batch:**	0241
Matrix:	**Soil**	**Analytical Method:**	SW8081A	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400514
Spiked Sample:	1004010-003A						
Units:	ug/Kg						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Aldrin	0.44	2.0	0	20	81.3	96.1	16.7	53 - 123	30	
gamma-BHC	0.40	2.0	0	20	82.2	94.9	14.4	56.9 - 120	30	
Heptachlor	1.1	2.0	0.0425	20	83.6	96.8	14.6	63.6 - 117	30	
Dieldrin	0.43	2.0	0	20	83.8	100	17.8	44 - 130	30	
Endrin	0.57	2.0	0	20	85.2	101	16.5	44.1 - 121	30	
4,4'-DDT	0.81	2.0	0	20	88.3	103	15.9	52.8 - 134	30	
TCMX (S)				350	77.0	84.0		52.5 - 139		
DCBP (S)				350	75.2	85.1		50.2 - 139		

Work Order:	1004010	**Prep Method:**	3545_PCB	**Prep Date:**	04/06/10	**Prep Batch:**	0242
Matrix:	**Soil**	**Analytical Method:**	SW8082	**Analyzed Date:**	04/07/10	**Analytical Batch:**	400515
Spiked Sample:	1004010-001A						
Units:	mg/Kg						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Aroclor1016	0.0230	0.10	0	1	94.3	97.3	3.06	55.6 - 135	30	
Aroclor1260	0.0270	0.10	0	0.5	102	107	4.41	65.6 - 132	30	
TCMX (S)				0.25	94.2	95.9		51.7 - 128		
DCBP (S)				0.250	98.8	100		55.1 - 113		

Laboratory Qualifiers and Definitions

DEFINITIONS:

Accuracy/Bias (% Recovery) - The closeness of agreement between an observed value and an accepted reference value.
Blank (Method/Preparation Blank) -MB/PB - An analyte-free matrix to which all reagents are added in the same volumes/proportions as used in sample processing. The method blank is used to document contamination resulting from the analytical process.
Duplicate - a field sample and/or laboratory QC sample prepared in duplicate following all of the same processes and procedures used on the original sample (sample duplicate, LCSD, MSD)
Laboratory Control Sample (LCS ad LCSD) - A known matrix spiked with compounds representative of the target analyte(s). This is used to document laboratory performance.
Matrix - the component or substrate that contains the analyte of interest (e.g., - groundwater, sediment, soil, waste water, etc)
Matrix Spike (MS/MSD) - Client sample spiked with identical concentrations of target analyte (s). The spiking occurs prior to the sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.
Method Detection Limit (MDL) - the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero
Practical Quantitation Limit (PQL) - a laboratory determined value at 2 to 5 times above the MDL that can be reproduced in a manner that results in a 99% confidence level that the result is both accurate and precise. PQLs reflect all preparation factors and/or dilution factors that have been applied to the sample during the preparation and/or analytical processes.
Precision (%RPD) - The agreement among a set of replicate/duplicate measurements without regard to known value of the replicates
Surrogate (S) or (Surr) - An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are used in most organic analysis to demonstrate matrix compatibility with the chosen method of analysis
Tentatively Identified Compound (TIC) - A compound not contained within the analytical calibration standards but present in the GCMS library of defined compounds. When the library is searched for an unknown compound, it can frequently give a tentative identification to the compound based on retention time and primary and secondary ion match. TICs are reported as estimates and are candidates for further investigation.
Units: the unit of measure used to express the reported result - **mg/L** and ***mg/Kg*** (equivalent to PPM - parts per million in **liquid** and ***solid***), **ug/L** and ***ug/Kg*** (equivalent to PPB - parts per billion in **liquid** and ***solid***), **ug/m3**, ***mg.m3***, **ppbv** and ***ppmv*** (all units of measure for reporting concentrations in air), **%** (equivalent to 10000 ppm or 1,000,000 ppb), **ug/Wipe** (concentration found on the surface of a single Wipe usually taken over a 100cm2 surface)

LABORATORY QUALIFIERS:

B - Indicates when the anlayte is found in the associated method or preparation blank
D - Surrogate is not recoverable due to the necessary dilution of the sample
E - Indicates the reportable value is outside of the calibration range of the instrument but within the linear range of the instrument (unless otherwise noted) Values reported with an E qualifier should be considered as estimated.
H- Indicates that the recommended holding time for the analyte or compound has been exceeded
J- Indicates a value between the method MDL and PQL and that the reported concentration should be considered as estimated rather the quantitative
NA - Not Analyzed
N/A - Not Applicable
NR - Not recoverable - a matrix spike concentration is not recoverable due to a concentration within the original sample that is greater than four times the spike concentration added
R- The % RPD between a duplicate set of samples is outside of the absolute values established by laboratory control charts
S- Spike recovery is outside of established method and/or laboratory control limits. Further explanation of the use of this qualifier should be included within a case narrative
X -Used to indicate that a value based on pattern identification is within the pattern range but not typical of the pattern found in standards. Further explanation may or may not be provided within the sample footnote and/or the case narrative.

Sample Receipt Checklist

Client Name: URS (San Jose)

Project Name: Petaluma, CA

Work Order No.: 1004010

Date and Time Received: 4/2/2010 10:04

Received By: NG

Physically Logged By: NG

Checklist Completed By: NG

Carrier Name: Hi-Speed Courier

Chain of Custody (COC) Information

Chain of custody present?	Yes
Chain of custody signed when relinquished and received?	Yes
Chain of custody agrees with sample labels?	Yes
Custody seals intact on sample bottles?	Not Present

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Not Present
Shipping Container/Cooler In Good Condition?	Yes
Samples in proper container/bottle?	Yes
Samples containers intact?	Yes
Sufficient sample volume for indicated test?	Yes

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes			
Container/Temp Blank temperature in compliance?	Yes	Temperature:	5	°C
Water-VOA vials have zero headspace?	No VOA vials submitted			
Water-pH acceptable upon receipt?				

pH Checked by:

pH Adjusted by:

483 Sinclair Frontage Rd., Milpitas, CA 95035 | tel: 408.263.5258 | fax: 408.263.8293 | www.torrentlab.com

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	
Project Name:	Petaluma, CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/2/2010
Report Due Date:	4/9/2010		**Time Received:**	10:04

Comments: 5 day TAT! Received 10 soils.

Work Order # : ***1004010***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1004010-001A	M-12@0.5	04/02/10 1:22	Soil	09/29/10			S_6010BCAM17 S_8081AOCP S_8082PCB	
Sample Note:	Metal- Pb only.							
1004010-002A	M-12@1.0	04/02/10 1:24	Soil	09/29/10			S_GCMS-GRO S_8260Pet S_TPHDO S_6010BCAM17	
Sample Note:	Metal- Pb only.							
1004010-003A	M-12d@0.5	04/02/10 1:26	Soil	09/29/10			S_6010BCAM17 S_8082PCB S_8081AOCP	
Sample Note:	Pb only.							
1004010-004A	M-12d@1.0	04/02/10 1:28	Soil	09/29/10			S_GCMS-GRO S_8260Pet S_6010BCAM17 S_TPHDO	
Sample Note:	Pb only.							
1004010-005A	M-13@0.5	04/02/10 1:35	Soil	09/29/10			S_6010BCAM17	
Sample Note:	Pb only.							
1004010-006A	M-13@1.0	04/02/10 1:37	Soil	09/29/10			S_6010BCAM17	
Sample Note:	Pb only.							
1004010-007A	M-14@0.5	04/02/10 1:40	Soil	09/29/10			S_6010BCAM17	
Sample Note:	Pb only.							
1004010-008A	M-14@1.0	04/02/10 1:42	Soil	09/29/10			S_6010BCAM17	

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	
Project Name:	Petaluma, CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/2/2010
Report Due Date:	4/9/2010		**Time Received:**	10:04

Comments: 5 day TAT! Received 10 soils.

Work Order # : ***1004010***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
Sample Note:	Pb only.							
1004010-009A	M-17@0.5	04/02/10 1:53	Soil	09/29/10			S_6010BCAM17	
Sample Note:	Pb only.							
1004010-010A	M-17@1.0	04/02/10 1:55	Soil	09/29/10			S_6010BCAM17	
Sample Note:	Pb only.							

Torrent LABORATORY, INC.

483 Sinclair Frontage Road
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FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004010

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose / State: CA / Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585 / FAX: 408-297-6962	
REPORT TO: J Ripple / SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200 / EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: [x] 10 Work Days [ ] 3 Work Days [ ] Noon - Nxt Day [ ] 7 Work Days [ ] 2 Work Days [ ] 2 - 8 Hours [ ] 5 Work Days [ ] 1 Work Day [ ] Other

SAMPLE TYPE: [ ] Storm Water [ ] Air [ ] Waste Water [ ] Other [ ] Ground Water [x] Soil

REPORT FORMAT: [ ] QC Level IV [ ] EDF [ ] Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	Pesticides	Lead	PCBs	REMARKS
001A	M-12@0.5	04/02/10 01:22	Soil	1	Sleeve							✓	✓	✓	
002A	M-12@1.0	04/02/10 01:24	Soil	1	Sleeve		✓	✓			✓		✓		
003A	M-12d@0.5	04/02/10 01:26	Soil	1	Sleeve							✓	✓	✓	
004A	M-12d@1.0	04/02/10 01:28	Soil	1	Sleeve		✓	✓			✓		✓		
005A	M-13@0.5	04/02/10 01:35	Soil	1	Sleeve								✓		
006A	M-13@1.0	04/02/10 01:37	Soil	1	Sleeve								✓		
007A	M-14@0.5	04/02/10 01:40	Soil	1	Sleeve								✓		5 °C
008A	M-14@1.0	04/02/10 01:42	Soil	1	Sleeve								✓		Torrent
009A	M-17@0.5	04/02/10 01:53	Soil	1	Sleeve								✓		
010A	M-17@1.0	04/02/10 01:55	Soil	1	Sleeve								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	4/2/10	05:30			4/2	9:25
2			4/2	10:04	N.K. Khodasara	NAVIN G.	4-2-10	10:04 Am

Were Samples Received in Good Condition? [x] Yes [ ] NO Samples on Ice? [x] Yes [ ] NO Method of Shipment Hi Speed Sample seals intact? [ ] Yes [ ] NO [x] N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made. Page 1 of 1

Log In By: Date: Log In Reviewed By: Date:

URS (San Jose)
100 W San Fernando St, Suite200
San Jose, California 95113
Tel: 4082979585
Fax: 4082976962

RE: Petaluma, CA

Work Order No.: 1004009 Rev: 1

Dear James Ripple:

Torrent Laboratory, Inc. received 26 sample(s) on April 02, 2010 for the analyses presented in the following Report.

All data for associated QC met EPA or laboratory specification(s) except where noted in the case narrative.

Torrent Laboratory, Inc. is certified by the State of California, ELAP #1991. If you have any questions regarding these test results, please feel free to contact the Project Management Team at (408)263-5258; ext 204.

Patti Sandrock

May 18, 2010
Date

Date: 5/18/2010

Client: URS (San Jose)

Project: Petaluma, CA

Work Order: 1004009

CASE NARRATIVE

Analytical Comments for Asbestos, Note: Analysis performed by sub-contract laboratory EMSL, Inc NVLAP Certification # 101048-3. Results to follow under separate cover.

No issues encountered with the receiving, preparation, analysis or reporting of the results associated with this work order.

REVISIONS:

Per client request, additional TCLP, STLC and DI-STLC anlaysis was performed on specified samples (see attachment at end of report).

Note: Extraction of 50 g sample / 500g 0.2M Sodium Citrate Solution was performed according to wet extraction procedure (WET) which was rotated in a rotary shaker for 48 hours.

Date Prepared: 5/9/10 @ 1PM to 5/11/10 @ 1PM

Note: Extraction of 100 g sample / 2000g TCLP Fluid # 1 was performed according to Toxicity Characteristic Leaching Procedure (TCLP) which was rotated in a rotary shaker for 18 hours.

Date Prepared: 5/6/10 @ 3:50PM to 5/7/10 @ 9:50AM.

Note: Extraction of 50 g sample with DI water was performed according to wet extraction procedure (WET) which was rotated in a rotary shaker for 48 hours.

Date Prepared: 5/11/10 @ 11:20AM to 5/3/10 @ 11:20AM.

Rev1 5/17/10

Torrent LABORATORY, INC.

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

M-1@0.5 1004009-001A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	5.3	mg/Kg

M-1@1.0 1004009-002A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Arsenic	SW6010B	1	0.28	1.7	3.2	mg/Kg
Barium	SW6010B	1	1	5.0	77	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	76	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	23	mg/Kg
Copper	SW6010B	1	0.0900	5.0	34	mg/Kg
Lead	SW6010B	1	0.13	1.0	41	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	85	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	55	mg/Kg
Zinc	SW6010B	1	0.59	5.0	68	mg/Kg
pH	SW9045C	1	0.10	2.0	7.25	S.U.

M-1d@0.5 1004009-003A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	4.5	mg/Kg

M-1d@1.0 1004009-004A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Arsenic	SW6010B	1	0.28	1.7	2.9	mg/Kg
Barium	SW6010B	1	1	5.0	64	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	54	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	16	mg/Kg
Copper	SW6010B	1	0.0900	5.0	25	mg/Kg
Lead	SW6010B	1	0.13	1.0	14	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	53	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	40	mg/Kg
Zinc	SW6010B	1	0.59	5.0	35	mg/Kg
pH	SW9045C	1	0.10	2.0	7.57	S.U.

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

M-2@0.5 1004009-005A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	7.1	mg/Kg

M-2@1.0 1004009-006A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	0.53	mg/L
Lead	SW6010B	1	0.13	1.0	80	mg/Kg

M-3@0.5 1004009-007A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	11	mg/Kg

M-3@1.0 1004009-008A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	7.6	mg/Kg

M-4@0.5 1004009-009A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	2.7	mg/Kg

M-4@1.0 1004009-010A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	14	mg/L
Lead (TCLP)	SW6010B	1	0.05	0.10	0.24	mg/L
Lead	SW6010B	1	0.13	1.0	830	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

M-5@0.5 1004009-011A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	2.8	mg/Kg

M-5@1.0 1004009-012A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	2.3	mg/Kg

M-7@0.5 1004009-013A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	5.4	mg/Kg

M-7@1.0 1004009-014A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	6.2	mg/Kg

M-8@0.5 1004009-015A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	5.8	mg/Kg

M-8@1.0 1004009-016A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	11	mg/Kg

M-6@0.5 1004009-017A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	2.0	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

M-6@1.0 1004009-018A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	2.1	mg/Kg

M-6@1.5 1004009-019A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	4.3	mg/Kg

M-6@2.0 1004009-020A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	1.0	mg/Kg

M-6@3.0 1004009-021A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Barium	SW6010B	1	1	5.0	34	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	62	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	17	mg/Kg
Copper	SW6010B	1	0.0900	5.0	21	mg/Kg
Lead	SW6010B	1	0.13	1.0	20	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	36	mg/Kg
Silver	SW6010B	1	0	1.0	1.4	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	81	mg/Kg
Zinc	SW6010B	1	0.59	5.0	42	mg/Kg
pH	SW9045C	1	0.10	2.0	8.30	S.U.

M-9@0.5 1004009-025A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	2.5	mg/Kg

M-9@1.0 1004009-026A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	3.3	mg/Kg

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-1@0.5	**Lab Sample ID:**	1004009-001A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 0:30		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	5.3		mg/Kg	400484	0249

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-1@1.0	**Lab Sample ID:**	1004009-002A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 0:32		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	4/5/10	04/07/10	1	0.20	5.0	ND		mg/Kg	400481	0246
Arsenic	SW6010B	4/5/10	04/07/10	1	0.28	1.7	3.2		mg/Kg	400481	0246
Barium	SW6010B	4/5/10	04/07/10	1	1	5.0	77		mg/Kg	400481	0246
Beryllium	SW6010B	4/5/10	04/07/10	1	0.0840	2.0	ND		mg/Kg	400481	0246
Cadmium	SW6010B	4/5/10	04/07/10	1	0.0590	1.0	ND		mg/Kg	400481	0246
Chromium	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	76		mg/Kg	400481	0246
Cobalt	SW6010B	4/5/10	04/07/10	1	0.14	5.0	23		mg/Kg	400481	0246
Copper	SW6010B	4/5/10	04/07/10	1	0.0900	5.0	34		mg/Kg	400481	0246
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	41		mg/Kg	400481	0246
Molybdenum	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	ND		mg/Kg	400481	0246
Nickel	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	85		mg/Kg	400481	0246
Selenium	SW6010B	4/5/10	04/07/10	1	0.29	5.0	ND		mg/Kg	400481	0246
Silver	SW6010B	4/5/10	04/07/10	1	0	1.0	ND		mg/Kg	400481	0246
Thallium	SW6010B	4/5/10	04/07/10	1	0.12	5.0	ND		mg/Kg	400481	0246
Vanadium	SW6010B	4/5/10	04/07/10	1	0.12	5.0	55		mg/Kg	400481	0246
Zinc	SW6010B	4/5/10	04/07/10	1	0.59	5.0	68		mg/Kg	400481	0246

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	4/5/10	04/06/10	1	0.01	0.10	ND		mg/Kg	400476	0239

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	NA	04/06/10	1	0.10	2.0	7.25		S.U.	400508	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-1d@0.5	**Lab Sample ID:**	1004009-003A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 0:34		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	4.5		mg/Kg	400484	0249

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-1d@1.0	**Lab Sample ID:**	1004009-004A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 0:36		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	4/5/10	04/07/10	1	0.20	5.0	ND		mg/Kg	400481	0246
Arsenic	SW6010B	4/5/10	04/07/10	1	0.28	1.7	2.9		mg/Kg	400481	0246
Barium	SW6010B	4/5/10	04/07/10	1	1	5.0	64		mg/Kg	400481	0246
Beryllium	SW6010B	4/5/10	04/07/10	1	0.0840	2.0	ND		mg/Kg	400481	0246
Cadmium	SW6010B	4/5/10	04/07/10	1	0.0590	1.0	ND		mg/Kg	400481	0246
Chromium	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	54		mg/Kg	400481	0246
Cobalt	SW6010B	4/5/10	04/07/10	1	0.14	5.0	16		mg/Kg	400481	0246
Copper	SW6010B	4/5/10	04/07/10	1	0.0900	5.0	25		mg/Kg	400481	0246
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	14		mg/Kg	400481	0246
Molybdenum	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	ND		mg/Kg	400481	0246
Nickel	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	53		mg/Kg	400481	0246
Selenium	SW6010B	4/5/10	04/07/10	1	0.29	5.0	ND		mg/Kg	400481	0246
Silver	SW6010B	4/5/10	04/07/10	1	0	1.0	ND		mg/Kg	400481	0246
Thallium	SW6010B	4/5/10	04/07/10	1	0.12	5.0	ND		mg/Kg	400481	0246
Vanadium	SW6010B	4/5/10	04/07/10	1	0.12	5.0	40		mg/Kg	400481	0246
Zinc	SW6010B	4/5/10	04/07/10	1	0.59	5.0	35		mg/Kg	400481	0246

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	4/5/10	04/06/10	1	0.01	0.10	ND		mg/Kg	400476	0239

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	NA	04/06/10	1	0.10	2.0	7.57		S.U.	400508	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-2@0.5	**Lab Sample ID:**	1004009-005A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 0:25		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	7.1		mg/Kg	400484	0249

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-2@1.0	**Lab Sample ID:**	1004009-006A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 0:27		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	0.53		mg/L	400853	0412

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	80		mg/Kg	400484	0249

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400864	0423

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-3@0.5	**Lab Sample ID:**	1004009-007A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 0:16		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	11		mg/Kg	400484	0249

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-3@1.0	**Lab Sample ID:**	1004009-008A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 0:18		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	7.6		mg/Kg	400484	0249

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-4@0.5	**Lab Sample ID:**	1004009-009A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 0:06		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	2.7		mg/Kg	400484	0249

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-4@1.0	**Lab Sample ID:**	1004009-010A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 0:08		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	14		mg/L	400853	0412

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	0.24		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	830		mg/Kg	400484	0249

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400864	0423

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-5@0.5	**Lab Sample ID:**	1004009-011A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 23:57		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	2.8		mg/Kg	400484	0249

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-5@1.0	**Lab Sample ID:**	1004009-012A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 23:59		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	2.3		mg/Kg	400484	0249

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-7@0.5	**Lab Sample ID:**	1004009-013A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 23:35		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	5.4		mg/Kg	400484	0249

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-7@1.0	**Lab Sample ID:**	1004009-014A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 23:38		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	6.2		mg/Kg	400484	0249

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-8@0.5	**Lab Sample ID:**	1004009-015A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 23:25		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	5.8		mg/Kg	400484	0249

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-8@1.0	**Lab Sample ID:**	1004009-016A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 23:28		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	11		mg/Kg	400484	0249

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-6@0.5	**Lab Sample ID:**	1004009-017A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 22:42		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	2.0		mg/Kg	400484	0249

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-6@1.0	**Lab Sample ID:**	1004009-018A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 22:46		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	2.1		mg/Kg	400484	0249

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-6@1.5	**Lab Sample ID:**	1004009-019A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 22:49		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	4.3		mg/Kg	400484	0249

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-6@2.0	**Lab Sample ID:**	1004009-020A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 22:51		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	1.0		mg/Kg	400484	0249

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-6@3.0	**Lab Sample ID:**	1004009-021A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 22:54		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	4/5/10	04/07/10	1	0.20	5.0	ND		mg/Kg	400481	0246
Arsenic	SW6010B	4/5/10	04/07/10	1	0.28	1.7	ND		mg/Kg	400481	0246
Barium	SW6010B	4/5/10	04/07/10	1	1	5.0	34		mg/Kg	400481	0246
Beryllium	SW6010B	4/5/10	04/07/10	1	0.0840	2.0	ND		mg/Kg	400481	0246
Cadmium	SW6010B	4/5/10	04/07/10	1	0.0590	1.0	ND		mg/Kg	400481	0246
Chromium	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	62		mg/Kg	400481	0246
Cobalt	SW6010B	4/5/10	04/07/10	1	0.14	5.0	17		mg/Kg	400481	0246
Copper	SW6010B	4/5/10	04/07/10	1	0.0900	5.0	21		mg/Kg	400481	0246
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	20		mg/Kg	400481	0246
Molybdenum	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	ND		mg/Kg	400481	0246
Nickel	SW6010B	4/5/10	04/07/10	1	0.0590	5.0	36		mg/Kg	400481	0246
Selenium	SW6010B	4/5/10	04/07/10	1	0.29	5.0	ND		mg/Kg	400481	0246
Silver	SW6010B	4/5/10	04/07/10	1	0	1.0	1.4		mg/Kg	400481	0246
Thallium	SW6010B	4/5/10	04/07/10	1	0.12	5.0	ND		mg/Kg	400481	0246
Vanadium	SW6010B	4/5/10	04/07/10	1	0.12	5.0	81		mg/Kg	400481	0246
Zinc	SW6010B	4/5/10	04/07/10	1	0.59	5.0	42		mg/Kg	400481	0246

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	4/5/10	04/06/10	1	0.01	0.10	ND		mg/Kg	400476	0239

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	NA	04/06/10	1	0.10	2.0	8.30		S.U.	400508	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-9@0.5	**Lab Sample ID:**	1004009-025A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 11:49		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/5/10	04/07/10	1	0.13	1.0	2.5		mg/Kg	400484	0249

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 04/02/10
Date Reported: 05/18/10

Client Sample ID:	M-9@1.0	**Lab Sample ID:**	1004009-026A
Project Name/Location:	Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	04/02/10 / 11:52		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	4/6/10	04/08/10	1	0.13	1.0	3.3		mg/Kg	400497	0253

MB Summary Report

Work Order:	1004009	**Prep Method:**	7471	**Prep Date:**	04/05/10	**Prep Batch:**	0239
Matrix:	Soil	**Analytical Method:**	7471AB	**Analyzed Date:**	04/06/10	**Analytical Batch:**	400476
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Mercury	0.01	0.10	ND	

Work Order:	1004009	**Prep Method:**	3050	**Prep Date:**	04/05/10	**Prep Batch:**	0246
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/07/10	**Analytical Batch:**	400481
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Antimony	0.20	5.0	ND	
Arsenic	0.28	1.7	ND	
Barium	1	5.0	ND	
Beryllium	0.0840	2.0	ND	
Cadmium	0.059	1.0	ND	
Chromium	0.059	5.0	0.10	
Cobalt	0.14	5.0	ND	
Copper	0.090	5.0	0.50	
Lead	0.13	1.0	0.25	
Molybdenum	0.059	5.0	ND	
Nickel	0.059	5.0	0.10	
Selenium	0.29	5.0	ND	
Silver	1.0	1.0	ND	
Thallium	0.12	5.0	ND	
Vanadium	0.12	5.0	ND	
Zinc	0.59	5.0	0.95	

Work Order:	1004009	**Prep Method:**	3050	**Prep Date:**	04/05/10	**Prep Batch:**	0249
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/07/10	**Analytical Batch:**	400484
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead	0.13	1.0	0.25	

MB Summary Report

Work Order:	1004009	**Prep Method:**	3050	**Prep Date:**	04/06/10	**Prep Batch:**	0253
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400497
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead	0.13	1.0	0.25	

Work Order:	1004009	**Prep Method:**	1311/3010B	**Prep Date:**	05/07/10	**Prep Batch:**	0392
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/07/10	**Analytical Batch:**	400786
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead (TCLP)	0.0500	0.10	ND	

Work Order:	1004009	**Prep Method:**	WET/3010B	**Prep Date:**	05/11/10	**Prep Batch:**	0412
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400853
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead (STLC)	0.0500	0.10	ND	

Work Order:	1004009	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0423
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400864
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	ND	

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004009	**Prep Method:**	7471	**Prep Date:**	04/05/10	**Prep Batch:**	0239
Matrix:	Soil	**Analytical Method:**	7471B	**Analyzed Date:**	04/06/10	**Analytical Batch:**	400476
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Mercury	0.01	0.10	0.000833	1.25	119	116	1.93	80.5 - 133	30	

Work Order:	1004009	**Prep Method:**	3050	**Prep Date:**	04/05/10	**Prep Batch:**	0246
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/07/10	**Analytical Batch:**	400481
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Antimony	0.20	5.0	0.050	50	95.9	95.9	0.000	30.7 - 130	30	
Arsenic	0.28	1.7	0.00	50	93.9	94.2	0.319	71 - 121	30	
Barium	1	5.0	0.20	50	103	96.9	6.10	70.2 - 130	30	
Beryllium	0.0840	2.0	0.00	50	92.3	92.3	0.000	73.3 - 115	30	
Cadmium	0.059	1.0	0.050	50	98.6	92.6	6.28	68.7 - 110		
Chromium	0.059	5.0	0.10	50	103	96.3	6.72	76 - 116	30	
Cobalt	0.14	5.0	0.050	50	101	95.1	6.02	57.4 - 122	30	
Copper	0.090	5.0	0.50	50	104	97.9	6.04	74.8 - 119	30	
Lead	0.13	1.0	0.25	50	95.7	96.0	0.313	67.9 - 118	30	
Molybdenum	0.059	5.0	0.00	50	98.2	97.8	0.408	62.9 - 123	30	
Nickel	0.059	5.0	0.10	50	99.5	93.4	6.32	61.5 - 122	30	
Selenium	0.29	5.0	0.10	50	86.8	87.3	0.574	62 - 111	30	
Silver	1.0	1.0	0.00	50	99.5	94.4	5.26	81.1 - 109	30	
Thallium	0.12	5.0	0.050	50	92.0	92.1	0.109	39.2 - 125	30	
Vanadium	0.12	5.0	-0.050	50	103	96.9	6.10	65.8 - 122	30	
Zinc	0.59	5.0	0.95	50	101	95.0	6.12	59.9 - 122	30	

Work Order:	1004009	**Prep Method:**	3050	**Prep Date:**	04/05/10	**Prep Batch:**	0249
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/07/10	**Analytical Batch:**	400484
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead	0.13	1	0.25	50	99	100	1.30	67.9 - 118	30	

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004009	**Prep Method:**	3050	**Prep Date:**	04/06/10	**Prep Batch:**	0253
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/08/10	**Analytical Batch:**	400497
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead	0.13	1	0.25	50	91.7	92.3	0.652	67.9 - 118	30	

Work Order:	1004009	**Prep Method:**	1311/3010B	**Prep Date:**	05/07/10	**Prep Batch:**	0392
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/07/10	**Analytical Batch:**	400786
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (TCLP)	0.05	0.1	0.000	10	92.8	93.4	0.644	80 - 120	20	

Work Order:	1004009	**Prep Method:**	WET/3010B	**Prep Date:**	05/11/10	**Prep Batch:**	0412
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400853
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (STLC)	0.0500	0.10	0.0100	10	101	102	0.789	80 - 120	20	

Work Order:	1004009	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0423
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400864
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	0.000	10	103	103	0.0970	80 - 120	20	,

MS/MSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1004009	**Prep Method:**	3050	**Prep Date:**	04/05/10	**Prep Batch:**	0249
Matrix:	**Soil**	**Analytical Method:**	SW6010B	**Analyzed Date:**	04/07/10	**Analytical Batch:**	400484
Spiked Sample:	1004009-001A						
Units:	mg/Kg						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead	0.13	1	0.11	50	88.6	84.0	4.73	67.9 - 118	30	

Duplicate Summary Report

Work Order:	1004009	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	**Soil**	**Analytical Method:**	SW9045C	**Analyzed Date:**	04/06/10	**Analytical Batch:**	400508
Units:						**Lab Sample ID:**	1004011-012A-Dup

Parameters	MDL	PQL	Sample Result	Duplicate Result	% RPD
pH	0.100	2.00	7.84	7.87	0.0955

Raw values are used in quality control assessment.

Laboratory Qualifiers and Definitions

DEFINITIONS:

Accuracy/Bias (% Recovery) - The closeness of agreement between an observed value and an accepted reference value.
Blank (Method/Preparation Blank) -MB/PB - An analyte-free matrix to which all reagents are added in the same volumes/proportions as used in sample processing. The method blank is used to document contamination resulting from the analytical process.
Duplicate - a field sample and/or laboratory QC sample prepared in duplicate following all of the same processes and procedures used on the original sample (sample duplicate, LCSD, MSD)
Laboratory Control Sample (LCS ad LCSD) - A known matrix spiked with compounds representative of the target analyte(s). This is used to document laboratory performance.
Matrix - the component or substrate that contains the analyte of interest (e.g., - groundwater, sediment, soil, waste water, etc)
Matrix Spike (MS/MSD) - Client sample spiked with identical concentrations of target analyte (s). The spiking occurs prior to the sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.
Method Detection Limit (MDL) - the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero
Practical Quantitation Limit (PQL) - a laboratory determined value at 2 to 5 times above the MDL that can be reproduced in a manner that results in a 99% confidence level that the result is both accurate and precise. PQLs reflect all preparation factors and/or dilution factors that have been applied to the sample during the preparation and/or analytical processes.
Precision (%RPD) - The agreement among a set of replicate/duplicate measurements without regard to known value of the replicates
Surrogate (S) or (Surr) - An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are used in most organic analysis to demonstrate matrix compatibility with the chosen method of analysis
Tentatively Identified Compound (TIC) - A compound not contained within the analytical calibration standards but present in the GCMS library of defined compounds. When the library is searched for an unknown compound, it can frequently give a tentative identification to the compound based on retention time and primary and secondary ion match. TICs are reported as estimates and are candidates for further investigation.
Units: the unit of measure used to express the reported result - **mg/L** and ***mg/Kg*** (equivalent to PPM - parts per million in **liquid** and ***solid***), **ug/L** and ***ug/Kg*** (equivalent to PPB - parts per billion in **liquid** and ***solid***), **ug/m3**, ***mg.m3***, **ppbv** and ***ppmv*** (all units of measure for reporting concentrations in air), **%** (equivalent to 10000 ppm or 1,000,000 ppb), **ug/Wipe** (concentration found on the surface of a single Wipe usually taken over a 100cm2 surface)

LABORATORY QUALIFIERS:

B - Indicates when the anlayte is found in the associated method or preparation blank
D - Surrogate is not recoverable due to the necessary dilution of the sample
E - Indicates the reportable value is outside of the calibration range of the instrument but within the linear range of the instrument (unless otherwise noted) Values reported with an E qualifier should be considered as estimated.
H- Indicates that the recommended holding time for the analyte or compound has been exceeded
J- Indicates a value between the method MDL and PQL and that the reported concentration should be considered as estimated rather the quantitative
NA - Not Analyzed
N/A - Not Applicable
NR - Not recoverable - a matrix spike concentration is not recoverable due to a concentration within the original sample that is greater than four times the spike concentration added
R- The % RPD between a duplicate set of samples is outside of the absolute values established by laboratory control charts
S- Spike recovery is outside of established method and/or laboratory control limits. Further explanation of the use of this qualifier should be included within a case narrative
X -Used to indicate that a value based on pattern identification is within the pattern range but not typical of the pattern found in standards. Further explanation may or may not be provided within the sample footnote and/or the case narrative.

Sample Receipt Checklist

Client Name: URS (San Jose)

Project Name: Petaluma, CA

Work Order No.: 1004009

Date and Time Received: 4/2/2010 10:04

Received By: NG

Physically Logged By: NG

Checklist Completed By: NG

Carrier Name: Hi-Speed Courier

Chain of Custody (COC) Information

Chain of custody present?	Yes
Chain of custody signed when relinquished and received?	Yes
Chain of custody agrees with sample labels?	Yes
Custody seals intact on sample bottles?	Not Present

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Not Present
Shipping Container/Cooler In Good Condition?	Yes
Samples in proper container/bottle?	Yes
Samples containers intact?	Yes
Sufficient sample volume for indicated test?	Yes

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes			
Container/Temp Blank temperature in compliance?	Yes	Temperature:	5	°C
Water-VOA vials have zero headspace?	No VOA vials submitted			
Water-pH acceptable upon receipt?				

pH Checked by:

pH Adjusted by:

483 Sinclair Frontage Rd., Milpitas, CA 95035 | tel: 408.263.5258 | fax: 408.263.8293 | www.torrentlab.com

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	II
Project Name:	Petaluma, CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/2/2010
Report Due Date:	5/14/2010		**Time Received:**	10:04

Comments: 5 day TAT! Received 26 soils, 3 soils ON hold.Asbestos subbed to EMSL.

Work Order # : ***1004009***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1004009-001A	M-1@0.5	04/02/10 0:30	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004009-002A	M-1@1.0	04/02/10 0:32	Soil	09/29/10				
							S_7471BHG	
							S_pH9045C	
							SUB_AsbestosCARB 435	Yes
							S_6010BCAM17	
1004009-003A	M-1d@0.5	04/02/10 0:34	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004009-004A	M-1d@1.0	04/02/10 0:36	Soil	09/29/10				
							S_7471BHG	
							SUB_AsbestosCARB 435	Yes
							S_6010BCAM17	
							S_pH9045C	
1004009-005A	M-2@0.5	04/02/10 0:25	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004009-006A	M-2@1.0	04/02/10 0:27	Soil	09/29/10				
							S_6010B(STLC)	
							S_6010BDI-STLC	
							S_6010BCAM17	
Sample Note:	Pb only.Additional STLC/DI-STLC for Lead.							
1004009-007A	M-3@0.5	04/02/10 0:16	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004009-008A	M-3@1.0	04/02/10 0:18	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004009-009A	M-4@0.5	04/02/10 0:06	Soil	09/29/10				
							S_6010BCAM17	

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	II
Project Name:	Petaluma, CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/2/2010
Report Due Date:	5/14/2010		**Time Received:**	10:04

Comments: 5 day TAT! Received 26 soils, 3 soils ON hold.Asbestos subbed to EMSL.

Work Order # : ***1004009***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
Sample Note:	Pb only.							
1004009-010A	M-4@1.0	04/02/10 0:08	Soil	09/29/10				
							S_6010B(STLC) S_6010BDI-STLC S_6010BCAM17 S_6010B(TCLP)	
Sample Note:	Pb only.							
1004009-011A	M-5@0.5	04/02/10 23:57	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004009-012A	M-5@1.0	04/02/10 23:59	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004009-013A	M-7@0.5	04/02/10 23:35	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004009-014A	M-7@1.0	04/02/10 23:38	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004009-015A	M-8@0.5	04/02/10 23:25	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004009-016A	M-8@1.0	04/02/10 23:28	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004009-017A	M-6@0.5	04/02/10 22:42	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004009-018A	M-6@1.0	04/02/10 22:46	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004009-019A	M-6@1.5	04/02/10 22:49	Soil	09/29/10				

Login Summary Report

Client ID:	TL5174	URS (San Jose)	**QC Level:**	II
Project Name:	Petaluma, CA		**TAT Requested:**	5+ day:0
Project # :			**Date Received:**	4/2/2010
Report Due Date:	5/14/2010		**Time Received:**	10:04

Comments: 5 day TAT! Received 26 soils, 3 soils ON hold.Asbestos subbed to EMSL.

Work Order # : ***1004009***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
							S_6010BCAM17	
Sample Note:	Pb only.							
1004009-020A	M-6@2.0	04/02/10 22:51	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004009-021A	M-6@3.0	04/02/10 22:54	Soil	09/29/10				
							S_7471BHG	
							SUB_AsbestosCARB 435	Yes
							S_6010BCAM17	
							S_pH9045C	
1004009-022A	M-6@6.0	04/02/10 23:02	Soil	09/29/10	On-Hold			
							S_6010BCAM17	
1004009-023A	M-6@8.0	04/02/10 23:05	Soil	09/29/10	On-Hold			
							S_6010BCAM17	
1004009-024A	M-6@4.5	04/02/10 10:57	Soil	09/29/10	On-Hold			
							S_6010BCAM17	
1004009-025A	M-9@0.5	04/02/10 11:49	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							
1004009-026A	M-9@1.0	04/02/10 11:52	Soil	09/29/10				
							S_6010BCAM17	
Sample Note:	Pb only.							

Torrent LABORATORY, INC.

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004009

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	Pesticides	Lead	PCBs	REMARKS
001A	M-1@0.5	04/02/10 00:30	Soil	1	Sleeve								✓		
002A	M-1@1.0	04/02/10 00:32	Soil	1	Sleeve	✓			✓	✓					
003A	M-1d@0.5	04/02/10 00:34	Soil	1	Sleeve								✓		
004A	M-1d@1.0	04/02/10 00:36	Soil	1	Sleeve	✓			✓	✓					
005A	M-2@0.5	04/02/10 00:25	Soil	1	Sleeve								✓		
006A	M-2@1.0	04/02/10 00:27	Soil	1	Sleeve								✓		
007A	M-3@0.5	04/02/10 00:16	Soil	1	Sleeve								✓		
008A	M-3@1.0	04/02/10 00:18	Soil	1	Sleeve								✓		Temp. 5°C
009A	M-4@0.5	04/02/10 00:06	Soil	1	Sleeve								✓		
010A	M-4@1.0	04/02/10 00:08	Soil	1	Sleeve								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	4/2/10	0530			4/2	9:25
2			4/2	10:04		Print: NAVIN G.	4-2-10	10:04 AM.

Were Samples Received in Good Condition? ☑ Yes ☐ NO Samples on Ice? ☑ Yes ☐ NO Method of Shipment Hi Speed Sample seals intact? ☐ Yes ☐ NO ☑ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 1 of 3

Log In By: Date: Log In Reviewed By: Date:

Torrent LABORATORY, INC.

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004009

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: [x] 10 Work Days [ ] 3 Work Days [ ] Noon - Nxt Day [ ] 7 Work Days [ ] 2 Work Days [ ] 2 - 8 Hours [ ] 5 Work Days [ ] 1 Work Day [ ] Other

SAMPLE TYPE: [ ] Storm Water [ ] Air [ ] Waste Water [ ] Other [ ] Ground Water [x] Soil

REPORT FORMAT: [ ] QC Level IV [ ] EDF [ ] Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	Pesticides	Lead	PCBs	REMARKS
011A	M-5@0.5	04/01/10 23:57	Soil	1	Sleeve								✓		
012A	M-5@1.0	04/01/10 23:59	Soil	1	Sleeve								✓		
013A	M-7@0.5	04/01/10 23:35	Soil	1	Sleeve								✓		
014A	M-7@1.0	04/01/10 23:38	Soil	1	Sleeve								✓		
015A	M-8@0.5	04/01/10 23:25	Soil	1	Sleeve								✓		
016A	M-8@1.0	04/01/10 23:28	Soil	1	Sleeve								✓		
017A	M-6@0.5	04/01/10 22:42	Soil	1	Sleeve								✓		Temp 5°C
018A	M-6@1.0	04/01/10 22:46	Soil	1	Sleeve								✓		
019A	M-6@1.5	04/01/10 22:49	Soil	1	Sleeve								✓		
020A	M-6@2.0	04/01/10 22:51	Soil	1	Sleeve								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	4/2/10	05 30			4/2	9:25
2			4/2	10:04		Print: NAVIN G.	4-2-10	10:04 Am.

Were Samples Received in Good Condition? [x] Yes [ ] NO Samples on Ice? [x] Yes [ ] NO Method of Shipment Hi Speed Sample seals intact? [ ] Yes [ ] NO [x] N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 2 of 3

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

Torrent LABORATORY, INC.

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004009

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	Pesticides	Lead	PCBs	REMARKS
021A	M-6@3.0	04/01/2010 22:34	Soil	1	Sleeve	✓			✓	✓					
022A	M-6@6.0	04/01/10 23:02	Soil	1	Sleeve										Hold
023A	M-6@~~4.0~~ 8.0	04/01/10 23:05	Soil	1	Sleeve										Hold
024A	M-6@~~12.0~~ 4.5'	04/01/10 22:57	Soil	1	Sleeve										Hold
025A	M-9@0.5	04/01/10 23:49	Soil	1	Sleeve								✓		
026A	M-9@1.0	04/01/10 23:52	Soil	1	Sleeve								✓		
			Soil	1	Sleeve										5°C
			Soil	1	Sleeve										Temp
			Soil	1	Sleeve										
			Soil	1	Sleeve										

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	4/2/10	0530			4/2	9:25
2			4/2	10:04	N.L. Khodasara	Print: NAVIN G.	4-2-10	10:04 Am

Were Samples Received in Good Condition? ☑ Yes ☐ NO Samples on Ice? ☒ Yes ☐ NO Method of Shipment Hi Speed Sample seals intact? ☐ Yes ☐ NO ☒ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 3 of 3

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

EMSL Analytical, Inc
2235 Polvorosa Ave , Suite 230, San Leandro, CA 94577
Phone: (510) 895-3675 Fax: (510) 895-3680 Email: milpitaslab@emsl.com

Attn: **Patti Sandrock**
Torrent Laboratory, Inc.
483 Sinclair Frontage Rd.
Milpitas, CA 95035

Fax: (408) 263-8293 Phone: (408) 263-5258
Project: **CoC100405002**

Customer ID: TORR80
Customer PO: CoC100405002
Received: 04/06/10 10:30 AM
EMSL Order: 091003196

EMSL Proj:
Analysis Date: 4/14/2010

Test Report: Asbestos Analysis via Polarized Light Microscopy, Qualitative

Sample	Description	Appearance	Result	Notes
1004009-002A *091003196-0001*			**None Detected**	
1004009-004A *091003196-0002*			**None Detected**	
1004009-021A *091003196-0003*			**None Detected**	

Analyst(s)

Grant Mays (3)

Baojia Ke, Laboratory Manager
or other approved signatory

EMSL recommends that soil samples reported as "ND" be tested by the EPA Screening Method/Qualitative. The above report relates only to the items tested. This report may not be reproduced, except in full, without written approval by EMSL Analytical, Inc. The above test must not be used by the client to claim product endorsement by NVLAP nor any agency of the United States Government. Unless otherwise noted, the results in this report have not been blank corrected.Samples received in good condition unless otherwise noted.
Samples analyzed by EMSL Analytical, Inc 2235 Polvorosa Ave , Suite 230, San LeandroCA

THIS IS THE LAST PAGE OF THE REPORT.

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004009

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose / State: CA / Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585 / FAX: 408-297-6962	
REPORT TO: J Ripple / SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200 / EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	Pesticides	Lead	PCBs	REMARKS
001A	M-1@0.5	04/02/10 00:30	Soil	1	Sleeve								✓		
002A	M-1@1.0	04/02/10 00:32	Soil	1	Sleeve	✓			✓	✓					
003A	M-1d@0.5	04/02/10 00:34	Soil	1	Sleeve								✓		
004A	M-1d@1.0	04/02/10 00:36	Soil	1	Sleeve	✓			✓	✓					
005A	M-2@0.5	04/02/10 00:25	Soil	1	Sleeve								✓		
006A	M-2@1.0	04/02/10 00:27	Soil	1	Sleeve								✓		
007A	M-3@0.5	04/02/10 00:16	Soil	1	Sleeve								✓		
008A	M-3@1.0	04/02/10 00:18	Soil	1	Sleeve								✓		Temp. 5°C
009A	M-4@0.5	04/02/10 00:06	Soil	1	Sleeve								✓		
010A	M-4@1.0	04/02/10 00:08	Soil	1	Sleeve								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	4/2/10	0530			4/2	9:25
2			4/2	10:04		Print: NAVIN G.	4-2-10	10:04 AM.

Were Samples Received in Good Condition? ☑ Yes ☐ NO Samples on Ice? ☑ Yes ☐ NO Method of Shipment Hi Speed Sample seals intact? ☐ Yes ☐ NO ☑ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 1 of 3

Log In By: Date: Log In Reviewed By: Date:

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
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www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004009

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	Pesticides	Lead	PCBs	REMARKS
011A	M-5@0.5	04/01/10 23:57	Soil	1	Sleeve								✓		
012A	M-5@1.0	04/01/10 23:59	Soil	1	Sleeve								✓		
013A	M-7@0.5	04/01/10 23:35	Soil	1	Sleeve								✓		
014A	M-7@1.0	04/01/10 23:38	Soil	1	Sleeve								✓		
015A	M-8@0.5	04/01/10 23:25	Soil	1	Sleeve								✓		
016A	M-8@1.0	04/01/10 23:28	Soil	1	Sleeve								✓		
017A	M-6@0.5	04/01/10 22:42	Soil	1	Sleeve								✓		Temp 5°C
018A	M-6@1.0	04/01/10 22:46	Soil	1	Sleeve								✓		
019A	M-6@1.5	04/01/10 22:49	Soil	1	Sleeve								✓		
020A	M-6@2.0	04/01/10 22:51	Soil	1	Sleeve								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	4/2/10	05 30			4/2	9:25
2			4/2	10:04	N. G. Ghodasara	NAVIN G.	4-2-10	10:04 Am

Were Samples Received in Good Condition? ☑ Yes ☐ NO Samples on Ice? ☑ Yes ☐ NO Method of Shipment Hi Speed Sample seals intact? ☐ Yes ☐ NO ☑ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1004009

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	Pesticides	Lead	PCBs	REMARKS
021A	M-6@3.0	04/01/2010 22:54	Soil	1	Sleeve	✓			✓	✓					
022A	M-6@6.0	04/01/10 23:02	Soil	1	Sleeve										Hold
023A	M-6@~~9.0~~ 8.0	04/01/10 23:05	Soil	1	Sleeve										Hold
024A	M-6@~~12.0~~ 4.5'	04/01/10 22:57	Soil	1	Sleeve										Hold
025A	M-9@0.5	04/01/10 23:49	Soil	1	Sleeve								✓		
026A	M-9@1.0	04/01/10 23:52	Soil	1	Sleeve								✓		
			Soil	1	Sleeve										5°C
			Soil	1	Sleeve										Temp
			Soil	1	Sleeve										
			Soil	1	Sleeve										

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	4/2/10	0530			4/2	9:25
2			4/2	10:04	N.G. Ghodasara	NAVIN G.	4-2-10	10:04 Am

Were Samples Received in Good Condition? ☒ Yes ☐ NO Samples on Ice? ☒ Yes ☐ NO Method of Shipment Hi Speed Sample seals intact? ☐ Yes ☐ NO ☒ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Log In By: Date: Log In Reviewed By: Date:

IRS Sample I					
Boring ID	Chromium 6	Chromium STLC	Lead STLC	Lead DI-STLC	Lead TCLP
# of samples to be tested	6	3	43	43	20
S-5	1003111-019A				
S-8			1004070-013A	1004070-013A	
N-1			1003116-027A	1003116-027A	1003116-027A
			1003116-028A	1003116-028A	
M-1					
M-1D					
M-2			1004009-006A	1004009-006A	
M-4			1004009-010A	1004009-010A	1004009-010A
S-9			1004070-011A	1004070-011A	1004070-011A
			1004070-012A	1004070-012A	1004070-012A
S-12			1004072-005A	1004072-005A	
S-13			1004072-004A	1004072-004A	
S-14			1003116-026A	1003116-026A	1003116-026A
S-15					
N-4			1004070-003A	1004070-003A	
N-5			1003116-014A	1003116-014A	1003116-014A
	1003116-015A		1003116-015A	1003116-015A	1003116-015A
			1003116-001A	1003116-001A	
N-6			1003116-002A	1003116-002A	1003116-002A
			1003116-003A	1003116-003A	
			1003116-004A	1003116-004A	1003116-004A
			1003116-005A	1003116-005A	1003116-005A
N-7			1004091-011A	1004091-011A	1004091-011A
			1004091-012A	1004091-012A	
			1004091-013A	1004091-013A	
			1004091-014A	1004091-014A	
N-8			1003111-001A	1003111-001A	
			1003111-002A	1003111-002A	
N-11			1003111-012A	1003111-012A	
			1003111-013A	1003111-013A	
N-12			1004070-005A	1004070-005A	1004070-005A
			1004070-006A	1004070-006A	1004070-006A
N-13			1003111-014A	1003111-014A	
N-13-d			1003111-007A	1003111-007A	
N-14			1004072-011A	1004072-011A	1004072-011A
	1004072-014A	1004072-014A			
M-18			1004011-001A	1004011-001A	1004011-001A
			1004011-003A	1004011-003A	
M-19	1004011-007A	1004011-007A			
			1004011-008A	1004011-008A	
M-19-d	1004011-012A	1004011-012A			
M-21			1004011-023A	1004011-023A	1004011-023A
M-22			1004011-029A	1004011-029A	
S-16			1003116-029A	1003116-029A	
N-15			1004067-004A	1004067-004A	1004067-004A
N-16			1004067-010A	1004067-010A	1004067-010A
N-17			1004072-017A	1004072-017A	1004072-017A
M-6					
M-10					
M-16	1004070-016A		1004070-016A	1004070-016A	
			1004070-017A	1004070-017A	
			1004070-019A	1004070-019A	1004070-019A

EMSL Analytical, Inc
2235 Polvorosa Ave , Suite 230, San Leandro, CA 94577
Phone: (510) 895-3675 Fax: (510) 895-3680 Email: milpitaslab@emsl.com

Attn: **Nutan Kabir**
Torrent Laboratory, Inc.
483 Sinclair Frontage Rd.
Milpitas, CA 95035

Fax: (408) 263-8293 Phone: (408) 263-5258
Project: **COC100322002**

Customer ID: TORR80
Customer PO: COC100322002
Received: 03/23/10 9:30 AM
EMSL Order: 091002644

EMSL Proj:
Analysis Date: 3/30/2010

Test Report: Qualitative asbestos analysis of soils using the EPA 600/R-93/116 method

Sample	Description	Appearance	Result	Notes
1003116-006A *091002644-0001*			**None Detected**	
1003116-007A *091002644-0002*			**None Detected**	
1003116-013A *091002644-0003*			**None Detected**	
1003116-015A *091002644-0004*			**None Detected**	

Analyst(s)

Nonette Patron (4)

Baojia Ke, Laboratory Manager
or other approved signatory

EMSL recommends that soil samples reported as "ND" be tested by the EPA Screening Method/Qualitative. The above report relates only to the items tested. This report may not be reproduced, except in full, without written approval by EMSL Analytical, Inc. The above test must not be used by the client to claim product endorsement by NVLAP nor any agency of the United States Government. Unless otherwise noted, the results in this report have not been blank corrected.Samples received in good condition unless otherwise noted.
Samples analyzed by EMSL Analytical, Inc 2235 Polvorosa Ave , Suite 230, San LeandroCA

THIS IS THE LAST PAGE OF THE REPORT.

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO 1003116

Company Name: **URS Corporation**	Location of Sampling: **Petaluma, CA**
Address: **100 W San Fernando Street, Suite 200**	Purpose: **Hazardous Materials Investigation for HWY 101 MSN B4 Project**
City: **San Jose** State: **CA** Zip Code: **95113**	Special Instructions / Comments:
Telephone: **408-297-9585** FAX: **408-297-6962**	
REPORT TO: **J Ripple** SAMPLER: **J Ripple/M Thummaluru**	P.O. #: **28645045.03200** EMAIL: **james_ripple@urscorp.com**

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	Pesticide	VOCs	Lead	PCBs	REMARKS
001A	N-5@1.5	03/19/10 11:40	Soil	1	Jar								✓		
~~002A~~	~~N-5@2.0~~		~~Soil~~	~~1~~	~~Jar~~								✓		
~~003A~~	~~N-5@3.0~~		~~Soil~~	~~1~~	~~Jar~~								✓		
002A ~~004A~~	N-6@0.5	03/19/10 11:50	Soil	1	Jar						✓		✓	✓	
003A ~~005A~~	N-6@1.0	03/19/10 11:59	Soil	1	Jar								✓		
004A ~~006A~~	N-6@1.5	03/19/10 12:03	Soil	1	Jar								✓		
005A ~~007A~~	N-6@2.0	03/19/10 12:08	Soil	1	Jar								✓		
006A ~~008A~~	N-6@3.0	03/19/10 12:14	Soil	1	Jar	✓			✓	✓					Temp 5°C
~~007A~~	~~N-7@0.5~~		~~Soil~~	~~1~~	~~Jar~~								✓		
	~~N-7@1.0~~		~~Soil~~	~~1~~	~~Jar~~								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	10/19/10	6:20 PM	M. L. Ghadebara		3-19-10	6:20 p.m
2								

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 1 of 5

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1003116

Company Name: **URS Corporation**	Location of Sampling: **Petaluma, CA**
Address: **100 W San Fernando Street, Suite 200**	Purpose: **Hazardous Materials Investigation for HWY 101 MSN B4 Project**
City: **San Jose** State: **CA** Zip Code: **95113**	Special Instructions / Comments:
Telephone: **408-297-9585** FAX: **408-297-6962**	
REPORT TO: **J Ripple** SAMPLER: **J Ripple/M Thummaluru**	P.O. #: **28645045.03200** EMAIL: **james_ripple@urscorp.com**

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
022A	S-6@0.5	03/19/10 15:22	Soil	1	Jar								✓		
023A	S-6@1.0	03/19/10 15:25	Soil	1	Jar								✓		
024A	S-7@0.5	03/19/10 15:05	Soil	1	Jar								✓		
025A	S-7@1.0	03/19/10 15:09	Soil	1	Jar								✓		
	~~M-15@0.5~~	~~3/18/10 14:16~~	~~Soil~~	~~1~~	~~Jar~~	✓			✓	✓					
	~~M-15@1.0~~		~~Soil~~	~~2~~	~~Jar~~		✓	✓			✓	✓	✓		
	~~M-15@1.5~~	Could not hand auger		~~Soil~~	~~1~~	~~Jar~~							✓		Temp 5°C
	~~M-15@2.0~~			~~Soil~~	~~1~~	~~Jar~~							✓		
	~~M-15@3.0~~			~~Soil~~	~~1~~	~~Jar~~							✓		
026A	S-14@0.5	3/19/10 14:55	Soil	1	Jar								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	10/19/10	6:20PM	D. L. Ghodasara		3-19-10	6:20 P.m
2								

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

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RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1003116

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
016A	S-2@0.5	03/19/10 15:45	Soil	1	Jar								✓		
017A	S-2@1.0	03/19/10 15:50	Soil	1	Jar								✓		
018A	S-3@0.5	03/19/10 ~~15:05~~ 16:05	Soil	1	Jar								✓		
019A	S-3@1.0	03/19/10 ~~15:50~~ 16:08	Soil	1	Jar								✓		
020A	S-4@0.5	03/19/10 15:26	Soil	1	Jar								✓		
021A	S-4@1.0	03/19/10 15:30	Soil	1	Jar								✓		
	~~S-5@0.5~~	03/18/10 15:52	Soil	1	Jar	✓			✓	✓					
	~~S-5@1.0~~	03/18/10 15:55	Soil	1	Jar								✓		Temp 5°C
	~~S-5d@0.5~~	03/18/10 15:52	Soil	1	Jar								✓		
	~~S-5d@1.0~~	03/18/10 15:55	Soil	1	Jar								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	10/19/10	6:20 PM	D. G. Ghodasara		3-19-10	6:20 P.M.
2								

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

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RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1003116

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: [x] 10 Work Days [ ] 3 Work Days [ ] Noon - Nxt Day [ ] 7 Work Days [ ] 2 Work Days [ ] 2 - 8 Hours [ ] 5 Work Days [ ] 1 Work Day [ ] Other

SAMPLE TYPE: [ ] Storm Water [ ] Air [ ] Waste Water [ ] Other [ ] Ground Water [x] Soil

REPORT FORMAT: [ ] QC Level IV [ ] EDF [ ] Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
	~~S-14@1.0~~ - Removed	~~3/19/10~~	~~Soil~~	~~1~~	~~Jar~~								✓		
007A	S-15@0.5	03/19/10 1403	Soil	1	Jar	✓			✓	✓					
008A	S-15@1.0	03/19/10 1404	Soil	1	Jar								✓		
009A	S-15@1.5	03/19/10 1408	Soil	1	Jar								✓		
010A	S-15@2.0	03/19/10 1415	Soil	1	Jar								✓		
011A	S-15@3.0	03/19/10 1422	Soil	1	Jar								✓		
012A	N-3@0.5	03/19/10 11:12	Soil	1	Jar								✓		
013A	N-3@1.0	03/19/10 11:15 ~~11:12~~	Soil	1	Jar	✓			✓	✓					Temp 3°C
014A	N-5@0.5	03/19/10 11:26	Soil	1	Jar								✓		
015A	N-5@1.0	03/19/10 11:35	Soil	1	Jar	✓			✓	✓					

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	10/19/10	6:20 PM			3-19-10	6:20 P.M.
2								

Were Samples Received in Good Condition? [ ] Yes [ ] NO Samples on Ice? [ ] Yes [ ] NO Method of Shipment _____ Sample seals intact? [ ] Yes [ ] NO [ ] N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

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Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
	~~N-13 @ 3.0~~	~~03/18/10 15:23~~	~~soil~~	~~1~~	~~Jar~~								✓		
027A	N-1 @ 0.5	03/19/10 10:53	soil	1	Jar								✓		
028A	N-1 @ 1.0	03/19/10 10:58	soil	1	Jar								✓		
029A	S-16 @ 0.5	03/19/10 1331	soil	1	Jar								✓		
030A	S-16 @ 1.0	03/19/10 13:34	↓	↓	↓								✓		
031A	S-16 @ 1.5	03/19/10 13:36											✓		
032A	S-16 @ 2.0	03/19/10 13:40											✓		Temp 5°C
033A	S-16 @ 3.0	03/19/10 13:49											✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	10/19/10	6:20 PM		D. G. Khodesara	3-19-10	6:20 P.m.
2								

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

URS (San Jose)
100 W San Fernando St, Suite200
San Jose, California 95113
Tel: 4082979585
Fax: 4082976962

RE: HWY 101 MSN B4 project,Petaluma, CA,

Work Order No.: 1003116 Rev: 1

Dear James Ripple:

Torrent Laboratory, Inc. received 33 sample(s) on March 19, 2010 for the analyses presented in the following Report.

All data for associated QC met EPA or laboratory specification(s) except where noted in the case narrative.

Torrent Laboratory, Inc. is certified by the State of California, ELAP #1991. If you have any questions regarding these test results, please feel free to contact the Project Management Team at (408)263-5258; ext 204.

N. S. Kabir

Nutan Kabir

May 25, 2010

Date

Date: 5/25/2010

Client: URS (San Jose)

Project: HWY 101 MSN B4 project,Petaluma, CA,

Work Order: 1003116

CASE NARRATIVE

Analytical Comments for Asbestos, Note: Analysis performed by sub-contract laboratory EMSL, Inc NVLAP Certification # 101048-3. Results to follow under separate cover.

No issues encountered with the receiving, preparation, analysis or reporting of the results associated with this work order.

Revisions:

Per client request, addtional anlaysis on specified samples for STLC, SI-STLC and TCLP were performed

Note: Extraction of 50 g sample / 500g 0.2M Sodium Citrate Solution was performed according to wet extraction procedure (WET) which was rotated in a rotary shaker for 48 hours.

Date Prepared: 5/9/10 @ 1PM to 5/11/10 @ 1PM

Note: Extraction of 50 g sample with DI water was performed according to wet extraction procedure (WET) which was rotated in a rotary shaker for 48 hours.

Date Prepared: 5/11/10 @ 11:20AM to 5/3/10 @ 11:20AM.

Rev1 5/17/10

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

N-5@1.5 1003116-001A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	1.2	mg/L
Lead	SW6010B	1	0.13	1.0	65	mg/Kg

N-6@0.5 1003116-002A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	2.9	mg/L
Lead	SW6010B	1	0.13	1.0	320	mg/Kg
gamma-Chlordane	SW8081A	40	17	80	17	ug/Kg
Aroclor1260	SW8082	10	0.270	1.0	0.86	mg/Kg

N-6@1.0 1003116-003A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	4.8	mg/L
Lead	SW6010B	1	0.13	1.0	120	mg/Kg

N-6@1.5 1003116-004A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	10	mg/L
Lead (TCLP)	SW6010B	1	0.05	0.10	0.31	mg/L
Chromium	SW6010B	1	0.0590	5.0	45	mg/Kg
Lead	SW6010B	1	0.13	1.0	210	mg/Kg

Torrent LABORATORY, INC.

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

N-6@2.0 1003116-005A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	1.3	mg/L
Lead	SW6010B	1	0.13	1.0	140	mg/Kg

N-6@3.0 1003116-006A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Arsenic	SW6010B	1	0.28	1.7	1.8	mg/Kg
Barium	SW6010B	1	1	5.0	69	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	67	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	22	mg/Kg
Copper	SW6010B	1	0.0900	5.0	25	mg/Kg
Lead	SW6010B	1	0.13	1.0	12	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	66	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	81	mg/Kg
Zinc	SW6010B	1	0.59	5.0	46	mg/Kg
pH	SW9045C	1	0.10	2.0	7.75	S.U.

S-15@0.5 1003116-007A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Arsenic	SW6010B	1	0.28	1.7	5.2	mg/Kg
Barium	SW6010B	1	1	5.0	120	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	50	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	13	mg/Kg
Copper	SW6010B	1	0.0900	5.0	29	mg/Kg
Lead	SW6010B	1	0.13	1.0	16	mg/Kg
Molybdenum	SW6010B	1	0.0590	5.0	5.3	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	55	mg/Kg
Silver	SW6010B	1	0	1.0	1.1	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	41	mg/Kg
Zinc	SW6010B	1	0.59	5.0	59	mg/Kg
Mercury	7471B	1	0.01	0.10	0.41	mg/Kg
pH	SW9045C	1	0.10	2.0	8.16	S.U.

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

S-15@1.0 1003116-008A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	14	mg/Kg

S-15@1.5 1003116-009A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	14	mg/Kg

S-15@2.0 1003116-010A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	13	mg/Kg

S-15@3.0 1003116-011A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	15	mg/Kg

N-3@0.5 1003116-012A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	43	mg/Kg

N-3@1.0 1003116-013A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Arsenic	SW6010B	1	0.28	1.7	2.6	mg/Kg
Barium	SW6010B	1	1	5.0	53	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	25	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	12	mg/Kg
Copper	SW6010B	1	0.0900	5.0	27	mg/Kg
Lead	SW6010B	1	0.13	1.0	48	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	46	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	32	mg/Kg
Zinc	SW6010B	1	0.59	5.0	74	mg/Kg
pH	SW9045C	1	0.10	2.0	7.68	S.U.

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

N-5@0.5 1003116-014A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	18	mg/L
Lead (TCLP)	SW6010B	1	0.05	0.10	0.26	mg/L
Lead	SW6010B	1	0.13	1.0	370	mg/Kg

N-5@1.0 1003116-015A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	11	mg/L
Lead (TCLP)	SW6010B	1	0.05	0.10	0.10	mg/L
Arsenic	SW6010B	1	0.28	1.7	4.3	mg/Kg
Barium	SW6010B	1	1	5.0	68	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	56	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	24	mg/Kg
Copper	SW6010B	1	0.0900	5.0	41	mg/Kg
Lead	SW6010B	1	0.13	1.0	280	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	59	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	68	mg/Kg
Zinc	SW6010B	1	0.59	5.0	90	mg/Kg
pH	SW9045C	1	0.10	2.0	7.19	S.U.

S-2@0.5 1003116-016A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	18	mg/Kg

S-2@1.0 1003116-017A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	7.5	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

S-3@0.5 1003116-018A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	12	mg/Kg

S-3@1.0 1003116-019A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	5.5	mg/Kg

S-4@0.5 1003116-020A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	14	mg/Kg

S-4@1.0 1003116-021A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	9.2	mg/Kg

S-6@0.5 1003116-022A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	11	mg/Kg

S-6@1.0 1003116-023A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	8.1	mg/Kg

S-7@0.5 1003116-024A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	17	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

S-7@1.0 1003116-025A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	14	mg/Kg

S-14@0.5 1003116-026A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	15	mg/L
Lead (TCLP)	SW6010B	1	0.05	0.10	0.12	mg/L
Lead	SW6010B	1	0.13	1.0	450	mg/Kg
Lead (DI-STLC)	SW6010B	1	0.0500	0.10	0.15	mg/L

N-1@0.5 1003116-027A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	12	mg/L
Lead	SW6010B	1	0.13	1.0	270	mg/Kg

N-1@1.0 1003116-028A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	0.91	mg/L
Lead	SW6010B	1	0.13	1.0	53	mg/Kg
Lead (DI-STLC)	SW6010B	1	0.0500	0.10	0.17	mg/L

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

S-16@0.5 1003116-029A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	3.6	mg/L
Lead	SW6010B	1	0.13	1.0	74	mg/Kg
Lead (DI-STLC)	SW6010B	1	0.0500	0.10	0.13	mg/L

S-16@1.0 1003116-030A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	23	mg/Kg

S-16@1.5 1003116-031A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	11	mg/Kg

S-16@2.0 1003116-032A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	14	mg/Kg

S-16@3.0 1003116-033A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	6.1	mg/Kg

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	N-5@1.5	**Lab Sample ID:**	1003116-001A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 11:40		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	1.2		mg/L	400853	0412

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	65		mg/Kg	400355	0185

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400864	0423

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	N-6@0.5	**Lab Sample ID:**	1003116-002A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 11:50		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	2.9		mg/L	400853	0412

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	ND		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	320		mg/Kg	400355	0185

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400864	0423

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
The results shown below are reported using their MDL.											
alpha-BHC	SW8081A	3/25/10	03/25/10	40	18	80	ND		ug/Kg	400369	0191
gamma-BHC	SW8081A	3/25/10	03/25/10	40	16	80	ND		ug/Kg	400369	0191
beta-BHC	SW8081A	3/25/10	03/25/10	40	15	80	ND		ug/Kg	400369	0191
delta-BHC	SW8081A	3/25/10	03/25/10	40	20	80	ND		ug/Kg	400369	0191
Heptachlor	SW8081A	3/25/10	03/25/10	40	44	80	ND		ug/Kg	400369	0191
Aldrin	SW8081A	3/25/10	03/25/10	40	18	80	ND		ug/Kg	400369	0191
Heptachlor epoxide	SW8081A	3/25/10	03/25/10	40	13	80	ND		ug/Kg	400369	0191
gamma-Chlordane	SW8081A	3/25/10	03/25/10	40	17	80	17		ug/Kg	400369	0191
alpha-Chlordane	SW8081A	3/25/10	03/25/10	40	14	80	ND		ug/Kg	400369	0191
Endosulfan I	SW8081A	3/25/10	03/25/10	40	24	80	ND		ug/Kg	400369	0191
4,4'-DDE	SW8081A	3/25/10	03/25/10	40	19	80	ND		ug/Kg	400369	0191
Dieldrin	SW8081A	3/25/10	03/25/10	40	17	80	ND		ug/Kg	400369	0191
Endrin	SW8081A	3/25/10	03/25/10	40	23	80	ND		ug/Kg	400369	0191
4,4'-DDD	SW8081A	3/25/10	03/25/10	40	19	80	ND		ug/Kg	400369	0191
Endosulfan II	SW8081A	3/25/10	03/25/10	40	61	80	ND		ug/Kg	400369	0191
4,4'-DDT	SW8081A	3/25/10	03/25/10	40	32	80	ND		ug/Kg	400369	0191
Endrin aldehyde	SW8081A	3/25/10	03/25/10	40	41	80	ND		ug/Kg	400369	0191

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	N-6@0.5	**Lab Sample ID:**	1003116-002A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 11:50		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
The results shown below are reported using their MDL.											
Endosulfan sulfate	SW8081A	3/25/10	03/25/10	40	20	80	ND		ug/Kg	400369	0191
Methoxychlor	SW8081A	3/25/10	03/25/10	40	25	200	ND		ug/Kg	400369	0191
Endrin Ketone	SW8081A	3/25/10	03/25/10	40	16	80	ND		ug/Kg	400369	0191
Chlordane	SW8081A	3/25/10	03/25/10	40	400	800	ND		ug/Kg	400369	0191
Toxaphene	SW8081A	3/25/10	03/25/10	40	400	4000	ND		ug/Kg	400369	0191
TCMX (S)	SW8081A	3/25/10	03/25/10	40	52.5	139	92.9	D	%	400369	0191
DCBP (S)	SW8081A	3/25/10	03/25/10	40	50.2	139	80.9	D	%	400369	0191

NOTE: Note: D - Surrogates diluted out. Reporting limits increased due to the nature of the sample matrix (dark color extract). All compounds reported to the MDL.

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
The results shown below are reported using their MDL.											
Aroclor1016	SW8082	3/24/10	03/25/10	10	0.230	1.0	ND		mg/Kg	400377	0195
Aroclor1221	SW8082	3/24/10	03/25/10	10	0.920	2.0	ND		mg/Kg	400377	0195
Aroclor1232	SW8082	3/24/10	03/25/10	10	0.460	1.0	ND		mg/Kg	400377	0195
Aroclor1242	SW8082	3/24/10	03/25/10	10	0.430	1.0	ND		mg/Kg	400377	0195
Aroclor1248	SW8082	3/24/10	03/25/10	10	0.360	1.0	ND		mg/Kg	400377	0195
Aroclor1254	SW8082	3/24/10	03/25/10	10	0.240	1.0	ND		mg/Kg	400377	0195
Aroclor1260	SW8082	3/24/10	03/25/10	10	0.270	1.0	0.86	J	mg/Kg	400377	0195
TCMX (S)	SW8082	3/24/10	03/25/10	10	51.7	128	139	S,D	%	400377	0195
DCBP (S)	SW8082	3/24/10	03/25/10	10	55.1	113	149	S,D	%	400377	0195

NOTE: Note: Reporting limits increased due to the nature of the sample matrix (dark color extract). D - Surrogates diluted out. All compounds reported to the MDL. Values detected between the MDL and RL should be considered as estimated and would be flagged

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	N-6@1.0	**Lab Sample ID:**	1003116-003A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 11:59		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	4.8		mg/L	400853	0412

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	120		mg/Kg	400357	0187

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400864	0423

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	N-6@1.5	**Lab Sample ID:**	1003116-004A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 12:03		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	10		mg/L	400853	0412

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	0.31		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Chromium	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	45		mg/Kg	400357	0187
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	210		mg/Kg	400357	0187

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400864	0423

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	N-6@2.0	**Lab Sample ID:**	1003116-005A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 12:08		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	1.3		mg/L	400853	0412

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	ND		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	140		mg/Kg	400357	0187

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400864	0423

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	N-6@3.0	**Lab Sample ID:**	1003116-006A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 12:14		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	3/22/10	03/23/10	1	0.20	5.0	ND		mg/Kg	400357	0187
Arsenic	SW6010B	3/22/10	03/23/10	1	0.28	1.7	1.8		mg/Kg	400357	0187
Barium	SW6010B	3/22/10	03/23/10	1	1	5.0	69		mg/Kg	400357	0187
Beryllium	SW6010B	3/22/10	03/23/10	1	0.0840	2.0	ND		mg/Kg	400357	0187
Cadmium	SW6010B	3/22/10	03/23/10	1	0.0590	1.0	ND		mg/Kg	400357	0187
Chromium	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	67		mg/Kg	400357	0187
Cobalt	SW6010B	3/22/10	03/23/10	1	0.14	5.0	22		mg/Kg	400357	0187
Copper	SW6010B	3/22/10	03/23/10	1	0.0900	5.0	25		mg/Kg	400357	0187
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	12		mg/Kg	400357	0187
Molybdenum	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	ND		mg/Kg	400357	0187
Nickel	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	66		mg/Kg	400357	0187
Selenium	SW6010B	3/22/10	03/23/10	1	0.29	5.0	ND		mg/Kg	400357	0187
Silver	SW6010B	3/22/10	03/23/10	1	0	1.0	ND		mg/Kg	400357	0187
Thallium	SW6010B	3/22/10	03/23/10	1	0.12	5.0	ND		mg/Kg	400357	0187
Vanadium	SW6010B	3/22/10	03/23/10	1	0.12	5.0	81		mg/Kg	400357	0187
Zinc	SW6010B	3/22/10	03/23/10	1	0.59	5.0	46		mg/Kg	400357	0187

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	3/22/10	03/23/10	1	0.01	0.10	ND		mg/Kg	400337	0181

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	NA	03/23/10	1	0.10	2.0	7.75		S.U.	400354	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-15@0.5	**Lab Sample ID:**	1003116-007A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 14:03		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	3/22/10	03/23/10	1	0.20	5.0	ND		mg/Kg	400357	0187
Arsenic	SW6010B	3/22/10	03/23/10	1	0.28	1.7	5.2		mg/Kg	400357	0187
Barium	SW6010B	3/22/10	03/23/10	1	1	5.0	120		mg/Kg	400357	0187
Beryllium	SW6010B	3/22/10	03/23/10	1	0.0840	2.0	ND		mg/Kg	400357	0187
Cadmium	SW6010B	3/22/10	03/23/10	1	0.0590	1.0	ND		mg/Kg	400357	0187
Chromium	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	50		mg/Kg	400357	0187
Cobalt	SW6010B	3/22/10	03/23/10	1	0.14	5.0	13		mg/Kg	400357	0187
Copper	SW6010B	3/22/10	03/23/10	1	0.0900	5.0	29		mg/Kg	400357	0187
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	16		mg/Kg	400357	0187
Molybdenum	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	5.3		mg/Kg	400357	0187
Nickel	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	55		mg/Kg	400357	0187
Selenium	SW6010B	3/22/10	03/23/10	1	0.29	5.0	ND		mg/Kg	400357	0187
Silver	SW6010B	3/22/10	03/23/10	1	0	1.0	1.1		mg/Kg	400357	0187
Thallium	SW6010B	3/22/10	03/23/10	1	0.12	5.0	ND		mg/Kg	400357	0187
Vanadium	SW6010B	3/22/10	03/23/10	1	0.12	5.0	41		mg/Kg	400357	0187
Zinc	SW6010B	3/22/10	03/23/10	1	0.59	5.0	59		mg/Kg	400357	0187

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	3/22/10	03/23/10	1	0.01	0.10	0.41		mg/Kg	400337	0181

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	NA	03/23/10	1	0.10	2.0	8.16		S.U.	400354	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-15@1.0	**Lab Sample ID:**	1003116-008A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 14:04		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	14		mg/Kg	400357	0187

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-15@1.5	**Lab Sample ID:**	1003116-009A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 14:08		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	14		mg/Kg	400357	0187

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-15@2.0	**Lab Sample ID:**	1003116-010A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 14:15		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	13		mg/Kg	400357	0187

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-15@3.0	**Lab Sample ID:**	1003116-011A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 14:22		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	15		mg/Kg	400357	0187

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	N-3@0.5	**Lab Sample ID:**	1003116-012A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 11:12		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	43		mg/Kg	400357	0187

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	N-3@1.0	**Lab Sample ID:**	1003116-013A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 11:15		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	3/22/10	03/23/10	1	0.20	5.0	ND		mg/Kg	400357	0187
Arsenic	SW6010B	3/22/10	03/23/10	1	0.28	1.7	2.6		mg/Kg	400357	0187
Barium	SW6010B	3/22/10	03/23/10	1	1	5.0	53		mg/Kg	400357	0187
Beryllium	SW6010B	3/22/10	03/23/10	1	0.0840	2.0	ND		mg/Kg	400357	0187
Cadmium	SW6010B	3/22/10	03/23/10	1	0.0590	1.0	ND		mg/Kg	400357	0187
Chromium	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	25		mg/Kg	400357	0187
Cobalt	SW6010B	3/22/10	03/23/10	1	0.14	5.0	12		mg/Kg	400357	0187
Copper	SW6010B	3/22/10	03/23/10	1	0.0900	5.0	27		mg/Kg	400357	0187
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	48		mg/Kg	400357	0187
Molybdenum	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	ND		mg/Kg	400357	0187
Nickel	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	46		mg/Kg	400357	0187
Selenium	SW6010B	3/22/10	03/23/10	1	0.29	5.0	ND		mg/Kg	400357	0187
Silver	SW6010B	3/22/10	03/23/10	1	0	1.0	ND		mg/Kg	400357	0187
Thallium	SW6010B	3/22/10	03/23/10	1	0.12	5.0	ND		mg/Kg	400357	0187
Vanadium	SW6010B	3/22/10	03/23/10	1	0.12	5.0	32		mg/Kg	400357	0187
Zinc	SW6010B	3/22/10	03/23/10	1	0.59	5.0	74		mg/Kg	400357	0187

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	3/22/10	03/23/10	1	0.01	0.10	ND		mg/Kg	400337	0181

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	NA	03/23/10	1	0.10	2.0	7.68		S.U.	400354	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	N-5@0.5	**Lab Sample ID:**	1003116-014A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 11:26		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	18		mg/L	400853	0412

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	0.26		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	370		mg/Kg	400357	0187

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400864	0423

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	N-5@1.0	**Lab Sample ID:**	1003116-015A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 11:35		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	11		mg/L	400853	0412

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	0.10		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	3/22/10	03/23/10	1	0.20	5.0	ND		mg/Kg	400357	0187
Arsenic	SW6010B	3/22/10	03/23/10	1	0.28	1.7	4.3		mg/Kg	400357	0187
Barium	SW6010B	3/22/10	03/23/10	1	1	5.0	68		mg/Kg	400357	0187
Beryllium	SW6010B	3/22/10	03/23/10	1	0.0840	2.0	ND		mg/Kg	400357	0187
Cadmium	SW6010B	3/22/10	03/23/10	1	0.0590	1.0	ND		mg/Kg	400357	0187
Chromium	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	56		mg/Kg	400357	0187
Cobalt	SW6010B	3/22/10	03/23/10	1	0.14	5.0	24		mg/Kg	400357	0187
Copper	SW6010B	3/22/10	03/23/10	1	0.0900	5.0	41		mg/Kg	400357	0187
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	280		mg/Kg	400357	0187
Molybdenum	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	ND		mg/Kg	400357	0187
Nickel	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	59		mg/Kg	400357	0187
Selenium	SW6010B	3/22/10	03/23/10	1	0.29	5.0	ND		mg/Kg	400357	0187
Silver	SW6010B	3/22/10	03/23/10	1	0	1.0	ND		mg/Kg	400357	0187
Thallium	SW6010B	3/22/10	03/23/10	1	0.12	5.0	ND		mg/Kg	400357	0187
Vanadium	SW6010B	3/22/10	03/23/10	1	0.12	5.0	68		mg/Kg	400357	0187
Zinc	SW6010B	3/22/10	03/23/10	1	0.59	5.0	90		mg/Kg	400357	0187

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400864	0423

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	3/22/10	03/23/10	1	0.01	0.10	ND		mg/Kg	400337	0181

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	N-5@1.0	**Lab Sample ID:**	1003116-015A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 11:35		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Hexavalent Chromium	SW7199M	5/11/10	05/11/10	1	0.015	0.10	ND		mg/Kg	400887	0436

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	NA	03/23/10	1	0.10	2.0	7.19		S.U.	400354	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-2@0.5	**Lab Sample ID:**	1003116-016A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 15:45		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/24/10	03/26/10	1	0.13	1.0	18		mg/Kg	400391	0205

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-2@1.0	**Lab Sample ID:**	1003116-017A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 15:50		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/24/10	03/26/10	1	0.13	1.0	7.5		mg/Kg	400391	0205

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-3@0.5	**Lab Sample ID:**	1003116-018A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 16:05		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/24/10	03/26/10	1	0.13	1.0	12		mg/Kg	400391	0205

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-3@1.0	**Lab Sample ID:**	1003116-019A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 16:08		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/24/10	03/26/10	1	0.13	1.0	5.5		mg/Kg	400391	0205

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-4@0.5	**Lab Sample ID:**	1003116-020A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 15:26		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/24/10	03/26/10	1	0.13	1.0	14		mg/Kg	400391	0205

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-4@1.0	**Lab Sample ID:**	1003116-021A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 15:30		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/24/10	03/26/10	1	0.13	1.0	9.2		mg/Kg	400391	0205

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-6@0.5	**Lab Sample ID:**	1003116-022A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 15:22		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/24/10	03/26/10	1	0.13	1.0	11		mg/Kg	400391	0205

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-6@1.0	**Lab Sample ID:**	1003116-023A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 15:25		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/24/10	03/26/10	1	0.13	1.0	8.1		mg/Kg	400391	0205

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-7@0.5	**Lab Sample ID:**	1003116-024A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 15:05		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/24/10	03/26/10	1	0.13	1.0	17		mg/Kg	400391	0205

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-7@1.0	**Lab Sample ID:**	1003116-025A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 15:09		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/24/10	03/26/10	1	0.13	1.0	14		mg/Kg	400391	0205

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-14@0.5	**Lab Sample ID:**	1003116-026A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 14:55		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	15		mg/L	400853	0412

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	0.12		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/24/10	03/26/10	1	0.13	1.0	450		mg/Kg	400391	0205

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	0.15		mg/L	400864	0423

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	N-1@0.5	**Lab Sample ID:**	1003116-027A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 10:53		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	12		mg/L	400853	0412

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (TCLP)	SW6010B	5/7/10	05/07/10	1	0.05	0.10	ND		mg/L	400786	0392

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/24/10	03/26/10	1	0.13	1.0	270		mg/Kg	400391	0205

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400864	0423

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	N-1@1.0	**Lab Sample ID:**	1003116-028A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 10:58		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	0.91		mg/L	400853	0412

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/24/10	03/26/10	1	0.13	1.0	53		mg/Kg	400391	0205

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	0.17		mg/L	400864	0423

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-16@0.5	**Lab Sample ID:**	1003116-029A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 13:31		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	3.6		mg/L	400853	0412

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/24/10	03/26/10	1	0.13	1.0	74		mg/Kg	400391	0205

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	0.13		mg/L	400864	0423

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-16@1.0	**Lab Sample ID:**	1003116-030A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 13:34		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/24/10	03/26/10	1	0.13	1.0	23		mg/Kg	400391	0205

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-16@1.5	**Lab Sample ID:**	1003116-031A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 13:36		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/24/10	03/26/10	1	0.13	1.0	11		mg/Kg	400391	0205

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-16@2.0	**Lab Sample ID:**	1003116-032A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 13:40		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/24/10	03/26/10	1	0.13	1.0	14		mg/Kg	400391	0205

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 05/25/10

Client Sample ID:	S-16@3.0	**Lab Sample ID:**	1003116-033A
Project Name/Location:	HWY 101 MSN B4 project,Petaluma, CA,	**Sample Matrix:**	Soil
Project Number:	28645045.03200		
Date/Time Sampled:	03/19/10 / 13:49		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/24/10	03/26/10	1	0.13	1.0	6.1		mg/Kg	400391	0205

MB Summary Report

Work Order:	1003116	**Prep Method:**	7471	**Prep Date:**	03/22/10	**Prep Batch:**	0181
Matrix:	Soil	**Analytical Method:**	7471AB	**Analyzed Date:**	03/23/10	**Analytical Batch:**	400337
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Mercury	0.01	0.10	ND	

Work Order:	1003116	**Prep Method:**	3050	**Prep Date:**	03/22/10	**Prep Batch:**	0185
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	03/23/10	**Analytical Batch:**	400355
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead	0.13	1.0	0.35	

Work Order:	1003116	**Prep Method:**	3050	**Prep Date:**	03/22/10	**Prep Batch:**	0187
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	03/23/10	**Analytical Batch:**	400357
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Antimony	0.20	5.0	ND	
Arsenic	0.28	1.7	ND	
Barium	1	5.0	ND	
Beryllium	0.0840	2.0	ND	
Cadmium	0.059	1.0	ND	
Chromium	0.059	5.0	0.10	
Cobalt	0.14	5.0	ND	
Copper	0.090	5.0	0.50	
Lead	0.13	1.0	0.25	
Molybdenum	0.059	5.0	ND	
Nickel	0.059	5.0	0.10	
Selenium	0.29	5.0	ND	
Silver	1.0	1.0	ND	
Thallium	0.12	5.0	ND	
Vanadium	0.12	5.0	ND	
Zinc	0.59	5.0	1.1	

MB Summary Report

Work Order:	1003116	**Prep Method:**	3545_OCP	**Prep Date:**	03/25/10	**Prep Batch:**	0191
Matrix:	Soil	**Analytical Method:**	SW8081A	**Analyzed Date:**	03/25/10	**Analytical Batch:**	400369
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
alpha-BHC	0.44	2.0	ND	
gamma-BHC	0.40	2.0	ND	
beta-BHC	0.36	2.0	ND	
delta-BHC	0.49	2.0	ND	
Heptachlor	1.1	2.0	ND	
Aldrin	0.44	2.0	ND	
Heptachlor epoxide	0.32	2.0	ND	
gamma-Chlordane	0.42	2.0	ND	
alpha-Chlordane	0.36	2.0	ND	
Endosulfan I	0.59	2.0	ND	
4,4'-DDE	0.48	2.0	ND	
Dieldrin	0.43	2.0	ND	
Endrin	0.57	2.0	ND	
4,4'-DDD	0.47	2.0	ND	
Endosulfan II	1.5	2.0	ND	
4,4'-DDT	0.81	2.0	ND	
Endrin aldehyde	1.0	2.0	ND	
Endosulfan sulfate	0.49	2.0	ND	
Methoxychlor	0.62	5.0	ND	
Endrin Ketone	0.40	2.0	ND	
Chlordane	10	20	ND	
Toxaphene	10	100	ND	
TCMX (S)			96.4 %	
DCBP (S)			99.2 %	

MB Summary Report

Work Order:	1003116	**Prep Method:**	3545_PCB	**Prep Date:**	03/24/10	**Prep Batch:**	0195
Matrix:	Soil	**Analytical Method:**	SW8082	**Analyzed Date:**	03/25/10	**Analytical Batch:**	400377
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Aroclor1016	0.0230	0.10	ND	
Aroclor1221	0.0920	0.20	ND	
Aroclor1232	0.0460	0.10	ND	
Aroclor1242	0.0430	0.10	ND	
Aroclor1248	0.0360	0.10	ND	
Aroclor1254	0.0240	0.10	ND	
Aroclor1260	0.0270	0.10	ND	
TCMX (S)			94.1 %	
DCBP (S)			95.9 %	

Work Order:	1003116	**Prep Method:**	3050	**Prep Date:**	03/24/10	**Prep Batch:**	0205
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	03/26/10	**Analytical Batch:**	400391
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead	0.13	1.0	0.25	

Work Order:	1003116	**Prep Method:**	1311/3010B	**Prep Date:**	05/07/10	**Prep Batch:**	0392
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/07/10	**Analytical Batch:**	400786
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead (TCLP)	0.0500	0.10	ND	

Work Order:	1003116	**Prep Method:**	WET/3010B	**Prep Date:**	05/11/10	**Prep Batch:**	0412
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400853
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead (STLC)	0.0500	0.10	ND	

MB Summary Report

Work Order:	1003116	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0423
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400864
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	ND	

Work Order:	1003116	**Prep Method:**	7199M	**Prep Date:**	05/11/10	**Prep Batch:**	0436
Matrix:	Soil	**Analytical Method:**	SW7199	**Analyzed Date:**	05/11/10	**Analytical Batch:**	400887
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Hexavalent Chromium	0.015	0.10	ND	

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1003116	**Prep Method:**	7471	**Prep Date:**	03/22/10	**Prep Batch:**	0181
Matrix:	Soil	**Analytical Method:**	7471B	**Analyzed Date:**	03/23/10	**Analytical Batch:**	400337
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Mercury	0.01	0.10	0.00333	1.25	106	108	1.93	80.5 - 133	30	

Work Order:	1003116	**Prep Method:**	3050	**Prep Date:**	03/22/10	**Prep Batch:**	0185
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	03/23/10	**Analytical Batch:**	400355
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead	0.13	1	0.35	50	99.6	98.9	0.705	67.9 - 118	30	,

Work Order:	1003116	**Prep Method:**	3050	**Prep Date:**	03/22/10	**Prep Batch:**	0187
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	03/23/10	**Analytical Batch:**	400357
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Antimony	0.2	5	-0.050	50	99.2	98.9	0.303	30.7 - 130	30	,
Arsenic	0.28	1.7	0.00	50	99	98.7	0.303	71 - 121	30	,
Barium	1.1	5	0.25	50	99.9	102	1.88	70.2 - 130	30	,
Beryllium	0.084	2	0.00	50	101.1	97.3	3.73	73.3 - 115	30	,
Cadmium	0.059	1	0.00	50	94.3	96.2	1.99	68.7 - 110		,
Chromium	0.059	5	0.10	50	99.9	102	1.69	76 - 116	30	,
Cobalt	0.14	5	0.050	50	97	99.8	2.85	57.4 - 122	30	,
Copper	0.09	5	0.50	50	100	102	1.69	74.8 - 119	30	,
Lead	0.13	1	0.25	50	99.6	99.4	0.201	67.9 - 118	30	,
Molybdenum	0.059	5	0.00	50	102.3	102	0.196	62.9 - 123	30	,
Nickel	0.059	5	0.10	50	97.6	99.3	1.73	61.5 - 122	30	,
Selenium	0.29	5	-0.20	50	94.3	93.7	0.638	62 - 111	30	,
Silver	1	1	-0.050	50	96.2	97.7	1.55	81.1 - 109	30	,
Thallium	0.12	5	-0.10	50	94.4	94.8	0.423	39.2 - 125	30	,
Vanadium	0.12	5	0.050	50	99.9	101	1.49	65.8 - 122	30	,
Zinc	0.59	5	1.1	50	100.5	102	1.08	59.9 - 122	30	,

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1003116	**Prep Method:**	3545_OCP	**Prep Date:**	03/25/10	**Prep Batch:**	0191
Matrix:	Soil	**Analytical Method:**	SW8081A	**Analyzed Date:**	03/25/10	**Analytical Batch:**	400369
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
gamma-BHC	0.40	2.0	0.00	20	91.7	82.0	11.2	56.9 - 120	30	,
Heptachlor	1.1	2.0	0.00	20	98.7	89.1	10.2	63.6 - 117	30	,
Aldrin	0.44	2.0	0.00	20	99.2	88.8	11.1	53 - 123	30	,
Dieldrin	0.43	2.0	0.00	20	105	92.2	13.4	44 - 130	30	,
Endrin	0.57	2.0	0.00	20	104	91.1	13.5	44.1 - 121	30	,
4,4'-DDT	0.81	2.0	0.00	20	105	94.3	11.0	52.8 - 134	30	,
TCMX (S)			0.00	350	92.2	82.3		52.5 - 139		,
DCBP (S)			0.00	350	94.5	82.7		50.2 - 139		,

Work Order:	1003116	**Prep Method:**	3545_PCB	**Prep Date:**	03/24/10	**Prep Batch:**	0195
Matrix:	Soil	**Analytical Method:**	SW8082	**Analyzed Date:**	03/25/10	**Analytical Batch:**	400377
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Aroclor1016	0.023	0.1	0.00072	1	90.002	94.7	5.09	55.6 - 135	30	,
Aroclor1260	0.027	0.1	0.00	0.5	94.478	97.4	3.01	65.6 - 132	30	,
TCMX (S)			0.00	0.25	86.82	93.9		51.7 - 128		,
DCBP (S)			0.00	0.250	91.08	93.8		55.1 - 113		,

Work Order:	1003116	**Prep Method:**	3050	**Prep Date:**	03/24/10	**Prep Batch:**	0205
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	03/26/10	**Analytical Batch:**	400391
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead	0.13	1.0	0.25	50	94.2	94.0	0.213	67.9 - 118	30	,

Work Order:	1003116	**Prep Method:**	1311/3010B	**Prep Date:**	05/07/10	**Prep Batch:**	0392
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/07/10	**Analytical Batch:**	400786
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (TCLP)	0.05	0.1	0.000	10	92.8	93.4	0.644	80 - 120	20	,

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1003116	**Prep Method:**	WET/3010B	**Prep Date:**	05/11/10	**Prep Batch:**	0412
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400853
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (STLC)	0.0500	0.10	0.0100	10	101	102	0.789	80 - 120	20	,

Work Order:	1003116	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0423
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400864
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	0.000	10	103	103	0.0970	80 - 120	20	,

Work Order:	1003116	**Prep Method:**	7199M	**Prep Date:**	05/11/10	**Prep Batch:**	0436
Matrix:	Soil	**Analytical Method:**	SW7199	**Analyzed Date:**	05/11/10	**Analytical Batch:**	400887
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Hexavalent Chromium	0.015	0.10	0.0006	0.1	95.9	90.2	6.16	65 - 135	30	,

MS/MSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1003116	**Prep Method:**	3050	**Prep Date:**	03/24/10	**Prep Batch:**	0205
Matrix:	**Soil**	**Analytical Method:**	SW6010B	**Analyzed Date:**	03/26/10	**Analytical Batch:**	400391
Spiked Sample:	1003116-016A						
Units:	mg/Kg						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead	0.13	1.0	0.36	50	90.5	82.5	6.92	67.9 - 118	30	

Work Order:	1003116	**Prep Method:**	1311/3010B	**Prep Date:**	05/07/10	**Prep Batch:**	0392
Matrix:	**Soil**	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/07/10	**Analytical Batch:**	400786
Spiked Sample:	1003116-002A						
Units:	mg/L						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (TCLP)	0.0500	0.10	0.000	10	92.5	91.1	1.53	75 - 125	20	

Duplicate QC Summary Report

Work Order:	1003116	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	**Soil**	**Analytical Method:**	SW9045C	**Analyzed Date:**	03/23/10	**Analytical Batch:**	400354
Units:						**Lab Sample ID:**	1003116-015A-Dup

Parameters	MDL	PQL	Sample Result	Duplicate Result	% RPD
pH	0.100	2.00	7.19	7.22	0.104

Raw values are used in quality control assessment.

Laboratory Qualifiers and Definitions

DEFINITIONS:

Accuracy/Bias (% Recovery) - The closeness of agreement between an observed value and an accepted reference value.
Blank (Method/Preparation Blank) -MB/PB - An analyte-free matrix to which all reagents are added in the same volumes/proportions as used in sample processing. The method blank is used to document contamination resulting from the analytical process.
Duplicate - a field sample and/or laboratory QC sample prepared in duplicate following all of the same processes and procedures used on the original sample (sample duplicate, LCSD, MSD)
Laboratory Control Sample (LCS ad LCSD) - A known matrix spiked with compounds representative of the target analyte(s). This is used to document laboratory performance.
Matrix - the component or substrate that contains the analyte of interest (e.g., - groundwater, sediment, soil, waste water, etc)
Matrix Spike (MS/MSD) - Client sample spiked with identical concentrations of target analyte (s). The spiking occurs prior to the sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.
Method Detection Limit (MDL) - the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero
Practical Quantitation Limit (PQL) - a laboratory determined value at 2 to 5 times above the MDL that can be reproduced in a manner that results in a 99% confidence level that the result is both accurate and precise. PQLs reflect all preparation factors and/or dilution factors that have been applied to the sample during the preparation and/or analytical processes.
Precision (%RPD) - The agreement among a set of replicate/duplicate measurements without regard to known value of the replicates
Surrogate (S) or (Surr) - An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are used in most organic analysis to demonstrate matrix compatibility with the chosen method of analysis
Tentatively Identified Compound (TIC) - A compound not contained within the analytical calibration standards but present in the GCMS library of defined compounds. When the library is searched for an unknown compound, it can frequently give a tentative identification to the compound based on retention time and primary and secondary ion match. TICs are reported as estimates and are candidates for further investigation.
Units: the unit of measure used to express the reported result - **mg/L** and ***mg/Kg*** (equivalent to PPM - parts per million in **liquid** and ***solid***), **ug/L** and ***ug/Kg*** (equivalent to PPB - parts per billion in **liquid** and ***solid***), **ug/m3**, ***mg.m3***, **ppbv** and ***ppmv*** (all units of measure for reporting concentrations in air), **%** (equivalent to 10000 ppm or 1,000,000 ppb), **ug/Wipe** (concentration found on the surface of a single Wipe usually taken over a 100cm2 surface)

LABORATORY QUALIFIERS:

B - Indicates when the anlayte is found in the associated method or preparation blank
D - Surrogate is not recoverable due to the necessary dilution of the sample
E - Indicates the reportable value is outside of the calibration range of the instrument but within the linear range of the instrument (unless otherwise noted) Values reported with an E qualifier should be considered as estimated.
H- Indicates that the recommended holding time for the analyte or compound has been exceeded
J- Indicates a value between the method MDL and PQL and that the reported concentration should be considered as estimated rather the quantitative
NA - Not Analyzed
N/A - Not Applicable
NR - Not recoverable - a matrix spike concentration is not recoverable due to a concentration within the original sample that is greater than four times the spike concentration added
R- The % RPD between a duplicate set of samples is outside of the absolute values established by laboratory control charts
S- Spike recovery is outside of established method and/or laboratory control limits. Further explanation of the use of this qualifier should be included within a case narrative
X -Used to indicate that a value based on pattern identification is within the pattern range but not typical of the pattern found in standards. Further explanation may or may not be provided within the sample footnote and/or the case narrative.

Sample Receipt Checklist

Client Name: URS (San Jose)

Project Name: HWY 101 MSN B4 project,Petaluma, CA,

Work Order No.: 1003116

Date and Time Received: 3/19/2010 18:20

Received By: NG

Physically Logged By: NG

Checklist Completed By: NG

Carrier Name: Client Droped off

Chain of Custody (COC) Information

Chain of custody present?	Yes
Chain of custody signed when relinquished and received?	Yes
Chain of custody agrees with sample labels?	Yes
Custody seals intact on sample bottles?	Not Present

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Not Present
Shipping Container/Cooler In Good Condition?	Yes
Samples in proper container/bottle?	Yes
Samples containers intact?	Yes
Sufficient sample volume for indicated test?	Yes

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes			
Container/Temp Blank temperature in compliance?	Yes	Temperature:	5	°C
Water-VOA vials have zero headspace?	No VOA vials submitted			
Water-pH acceptable upon receipt?				

pH Checked by:

pH Adjusted by:

Login Summary Report

Client ID:	TL5174 URS (San Jose)	**QC Level:**	II
Project Name:	HWY 101 MSN B4 project,Petaluma, CA,	**TAT Requested:**	5+ day:0
Project # :	28645045.03200	**Date Received:**	3/19/2010
Report Due Date:	5/14/2010	**Time Received:**	18:20

Comments: Received 33 soils. Asbestos PLM subbed to EMSL.

Work Order # : ***1003116***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1003116-001A	N-5@1.5	03/19/10 11:40	Soil	09/15/10				
							S_6010B(STLC)	
							S_6010BDI-STLC	
							S_6010BCAM17	
1003116-002A	N-6@0.5	03/19/10 11:50	Soil	09/15/10				
							S_6010B(STLC)	
							S_6010BDI-STLC	
							S_8082PCB	
							S_6010BCAM17	
							S_8081AOCP	
							S_6010B(TCLP)	
1003116-003A	N-6@1.0	03/19/10 11:59	Soil	09/15/10				
							S_6010B(STLC)	
							S_6010BCAM17	
							S_6010BDI-STLC	
1003116-004A	N-6@1.5	03/19/10 12:03	Soil	09/15/10				
							S_6010B(STLC)	
							S_6010BDI-STLC	
							S_6010B(TCLP)	
							S_6010BCAM17	
1003116-005A	N-6@2.0	03/19/10 12:08	Soil	09/15/10				
							S_6010B(STLC)	
							S_6010BDI-STLC	
							S_6010B(TCLP)	
							S_6010BCAM17	
1003116-006A	N-6@3.0	03/19/10 12:14	Soil	09/15/10				
							S_pH9045C	
							S_6010BCAM17	
							S_7471BHG	
							SUB_AsbestosCARB 435	Yes
1003116-007A	S-15@0.5	03/19/10 14:03	Soil	09/15/10				
							S_pH9045C	
							SUB_AsbestosCARB 435	Yes
							S_7471BHG	
							S_6010BCAM17	

Login Summary Report

Client ID:	TL5174 URS (San Jose)	**QC Level:**	II
Project Name:	HWY 101 MSN B4 project,Petaluma, CA,	**TAT Requested:**	5+ day:0
Project # :	28645045.03200	**Date Received:**	3/19/2010
Report Due Date:	5/14/2010	**Time Received:**	18:20

Comments: Received 33 soils. Asbestos PLM subbed to EMSL.

Work Order # : ***1003116***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1003116-008A	S-15@1.0	03/19/10 14:04	Soil	09/15/10			S_6010BCAM17	
1003116-009A	S-15@1.5	03/19/10 14:08	Soil	09/15/10			S_6010BCAM17	
1003116-010A	S-15@2.0	03/19/10 14:15	Soil	09/15/10			S_6010BCAM17	
1003116-011A	S-15@3.0	03/19/10 14:22	Soil	09/15/10			S_6010BCAM17	
1003116-012A	N-3@0.5	03/19/10 11:12	Soil	09/15/10			S_6010BCAM17	
1003116-013A	N-3@1.0	03/19/10 11:15	Soil	09/15/10			S_pH9045C S_7471BHG S_6010BCAM17 SUB_AsbestosCARB 435	Yes
1003116-014A	N-5@0.5	03/19/10 11:26	Soil	09/15/10			S_6010B(STLC) S_6010B(TCLP) S_6010BDI-STLC S_6010BCAM17	
1003116-015A	N-5@1.0	03/19/10 11:35	Soil	09/15/10			S_CrVI7199 S_pH9045C SUB_AsbestosCARB 435 S_7471BHG S_6010BCAM17 S_6010B(TCLP) S_6010BDI-STLC S_6010B(STLC)	Yes
1003116-016A	S-2@0.5	03/19/10 15:45	Soil	09/15/10			S_6010BCAM17	
1003116-017A	S-2@1.0	03/19/10 15:50	Soil	09/15/10			S_6010BCAM17	
1003116-018A	S-3@0.5	03/19/10 16:05	Soil	09/15/10			S_6010BCAM17	

Login Summary Report

Client ID:	TL5174 URS (San Jose)	**QC Level:**	II
Project Name:	HWY 101 MSN B4 project,Petaluma, CA,	**TAT Requested:**	5+ day:0
Project # :	28645045.03200	**Date Received:**	3/19/2010
Report Due Date:	5/14/2010	**Time Received:**	18:20

Comments: Received 33 soils. Asbestos PLM subbed to EMSL.

Work Order # : ***1003116***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1003116-019A	S-3@1.0	03/19/10 16:08	Soil	09/15/10				
							S_6010BCAM17	
1003116-020A	S-4@0.5	03/19/10 15:26	Soil	09/15/10				
							S_6010BCAM17	
1003116-021A	S-4@1.0	03/19/10 15:30	Soil	09/15/10				
							S_6010BCAM17	
1003116-022A	S-6@0.5	03/19/10 15:22	Soil	09/15/10				
							S_6010BCAM17	
1003116-023A	S-6@1.0	03/19/10 15:25	Soil	09/15/10				
							S_6010BCAM17	
1003116-024A	S-7@0.5	03/19/10 15:05	Soil	09/15/10				
							S_6010BCAM17	
1003116-025A	S-7@1.0	03/19/10 15:09	Soil	09/15/10				
							S_6010BCAM17	
1003116-026A	S-14@0.5	03/19/10 14:55	Soil	09/15/10				
							S_6010B(STLC)	
							S_6010BDI-STLC	
							S_6010BCAM17	
							S_6010B(TCLP)	
1003116-027A	N-1@0.5	03/19/10 10:53	Soil	09/15/10				
							S_6010B(STLC)	
							S_6010BCAM17	
							S_6010B(TCLP)	
							S_6010BDI-STLC	
Sample Note:	Additional analyses for Pb / STLC ; DI-STLC and TCLP							
1003116-028A	N-1@1.0	03/19/10 10:58	Soil	09/15/10				
							S_6010B(STLC)	
							S_6010BCAM17	
							S_6010BDI-STLC	
Sample Note:	Additional analyses for Pb / STLC and DI STLC.							
1003116-029A	S-16@0.5	03/19/10 13:31	Soil	09/15/10				
							S_6010B(STLC)	
							S_6010BDI-STLC	
							S_6010BCAM17	
1003116-030A	S-16@1.0	03/19/10 13:34	Soil	09/15/10				
							S_6010BCAM17	

Login Summary Report

Client ID:	TL5174 URS (San Jose)	**QC Level:**	II
Project Name:	HWY 101 MSN B4 project,Petaluma, CA,	**TAT Requested:**	5+ day:0
Project # :	28645045.03200	**Date Received:**	3/19/2010
Report Due Date:	5/14/2010	**Time Received:**	18:20

Comments: Received 33 soils. Asbestos PLM subbed to EMSL.

Work Order # : ***1003116***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1003116-031A	S-16@1.5	03/19/10 13:36	Soil	09/15/10			S_6010BCAM17	
1003116-032A	S-16@2.0	03/19/10 13:40	Soil	09/15/10			S_6010BCAM17	
1003116-033A	S-16@3.0	03/19/10 13:49	Soil	09/15/10			S_6010BCAM17	

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FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1003116

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
022A	S-6@0.5	03/19/10 15:22	Soil	1	Jar								✓		
023A	S-6@1.0	03/19/10 15:25	Soil	1	Jar								✓		
024A	S-7@0.5	03/19/10 15:05	Soil	1	Jar								✓		
025A	S-7@1.0	03/19/10 15:09	Soil	1	Jar								✓		
	~~M-15@0.5~~	~~3/18/10 1416~~	~~Soil~~	~~1~~	~~Jar~~	✓			✓	✓			✓		
	~~M-15@1.0~~		~~Soil~~	~~2~~	~~Jar~~		✓	✓			✓	✓	✓		
	~~M-15@1.5~~	Could not hand auger		~~Soil~~	~~1~~	~~Jar~~							✓		Temp 5°C
	~~M-15@2.0~~			~~Soil~~	~~1~~	~~Jar~~							✓		
	~~M-15@3.0~~			~~Soil~~	~~1~~	~~Jar~~							✓		
026A	S-14@0.5	3/19/10 14:35	Soil	1	Jar								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	10/19/10	6:20PM	M. L. Ghodasara		3-19-10	6:20 P.m
2								

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 4 of 5

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

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CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1003116

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose State: CA Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585 FAX: 408-297-6962	
REPORT TO: J Ripple SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200 EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	Pesticide	VOCs	Lead	PCBs	REMARKS
001A	N-5@1.5	03/19/10 11:40	Soil	1	Jar								✓		
~~002A~~	~~N-5@2.0~~		~~Soil~~	~~1~~	~~Jar~~								✓		
~~003A~~	~~N-5@3.0~~		~~Soil~~	~~1~~	~~Jar~~								✓		
002A ~~004A~~	N-6@0.5	03/19/10 11:50	Soil	1	Jar						✓		✓	✓	
003A ~~005A~~	N-6@1.0	03/19/10 11:59	Soil	1	Jar								✓		
004A ~~006A~~	N-6@1.5	03/19/10 12:03	Soil	1	Jar								✓		
005A ~~007A~~	N-6@2.0	03/19/10 12:08	Soil	1	Jar								✓		Temp 5°C
006A ~~008A~~	N-6@3.0	03/19/10 12:14	Soil	1	Jar	✓			✓	✓					
~~009A~~	~~N-7@0.5~~		~~Soil~~	~~1~~	~~Jar~~								✓		
	~~N-7@1.0~~		~~Soil~~	~~1~~	~~Jar~~								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	10/19/10	6:20 PM	M. G. Ghadasara		3-19-10	6:20 p.m
2								

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made. Page 1 of 5

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

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CHAIN OF CUSTODY

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LAB WORK ORDER NO: 1003116

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
	~~N-13 @ 3.0~~	~~03/18/10 15:23~~	~~soil~~	~~1~~	~~Jar~~								✓		
027A	N-1 @ 0.5	03/19/10 10:53	soil	1	Jar								✓		
028A	N-1 @ 1.0	03/19/10 10:58	soil	1	Jar								✓		
029A	S-16 @ 0.5	03/19/10 1331	soil	1	Jar								✓		
030A	S-16 @ 1.0	03/19/10 13:34	↓	↓	↓								✓		
031A	S-16 @ 1.5	03/19/10 13:36											✓		
032A	S-16 @ 2.0	03/19/10 13:40											✓		
033A	S-16 @ 3.0	03/19/10 13:49	↓	↓	↓								✓		Temp 5°C

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	10/19/10	6:20 PM			3-19-10	6:20 P.m.
2								

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

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Page 5 of 5

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SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
	~~S-14@1.0~~ - Refused	~~3/19/10~~	~~Soil~~	~~1~~	~~Jar~~								✓		
007A	S-15@0.5	03/19/10 1403	Soil	1	Jar	✓			✓	✓					
008A	S-15@1.0	03/19/10 1404	Soil	1	Jar								✓		
009A	S-15@1.5	03/19/10 1408	Soil	1	Jar								✓		
010A	S-15@2.0	03/19/10 1415	Soil	1	Jar								✓		
011A	S-15@3.0	03/19/10 1422	Soil	1	Jar								✓		
012A	N-3@0.5	03/19/10 11:12	Soil	1	Jar								✓		
013A	N-3@1.0	03/19/10 11:15	Soil	1	Jar	✓			✓	✓					
014A	N-5@0.5	03/19/10 11:26	Soil	1	Jar								✓		Temp 3°C
015A	N-5@1.0	03/19/10 11:35	Soil	1	Jar	✓			✓	✓					

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	10/19/10	6:20 PM	T. G. Ghadesara		3-19-10	6:20 P.M.
2								

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 2 of 5

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

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CHAIN OF CUSTODY

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LAB WORK ORDER NO: 1003116

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

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SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
016A	S-2@0.5	03/19/10 15:45	Soil	1	Jar								✓		
017A	S-2@1.0	03/19/10 15:50	Soil	1	Jar								✓		
018A	S-3@0.5	03/19/10 16:08	Soil	1	Jar								✓		
019A	S-3@1.0	03/19/10 16:08	Soil	1	Jar								✓		
020A	S-4@0.5	03/19/10 15:26	Soil	1	Jar								✓		
021A	S-4@1.0	03/19/10 15:30	Soil	1	Jar								✓		
	~~S-5@0.5~~	~~03/18/10 15:52~~	~~Soil~~	~~1~~	~~Jar~~	✓			✓	✓					Temp 6°C
	~~S-5@1.0~~	~~03/18/10 15:55~~	~~Soil~~	~~1~~	~~Jar~~								✓		
	~~S-5d@0.5~~	~~03/18/10 15:52~~	~~Soil~~	~~1~~	~~Jar~~								✓		
	~~S-5d@1.0~~	~~03/18/10 15:55~~	~~Soil~~	~~1~~	~~Jar~~								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	10/19/10	6:20 PM	D. G. Ghodasara		3-19-10	6:20 P.M.
2								

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 3 of 5

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

EMSL Analytical, Inc
2235 Polvorosa Ave , Suite 230, San Leandro, CA 94577
Phone: (510) 895-3675 Fax: (510) 895-3680 Email: milpitaslab@emsl.com

Attn: **Nutan Kabir**
Torrent Laboratory, Inc.
483 Sinclair Frontage Rd.
Milpitas, CA 95035

Fax: (408) 263-8293 Phone: (408) 263-5258
Project: **COC100322002**

Customer ID: TORR80
Customer PO: COC100322002
Received: 03/23/10 9:30 AM
EMSL Order: 091002644

EMSL Proj:
Analysis Date: 3/30/2010

Test Report: Qualitative asbestos analysis of soils using the EPA 600/R-93/116 method

Sample	Description	Appearance	Result	Notes
1003116-006A *091002644-0001*			**None Detected**	
1003116-007A *091002644-0002*			**None Detected**	
1003116-013A *091002644-0003*			**None Detected**	
1003116-015A *091002644-0004*			**None Detected**	

Analyst(s)

Nonette Patron (4)

Baojia Ke, Laboratory Manager
or other approved signatory

EMSL recommends that soil samples reported as "ND" be tested by the EPA Screening Method/Qualitative. The above report relates only to the items tested. This report may not be reproduced, except in full, without written approval by EMSL Analytical, Inc. The above test must not be used by the client to claim product endorsement by NVLAP nor any agency of the United States Government. Unless otherwise noted, the results in this report have not been blank corrected.Samples received in good condition unless otherwise noted.
Samples analyzed by EMSL Analytical, Inc 2235 Polvorosa Ave , Suite 230, San LeandroCA

THIS IS THE LAST PAGE OF THE REPORT.

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FAX: 408.263.8293
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RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO 1003116

Company Name: **URS Corporation**	Location of Sampling: **Petaluma, CA**
Address: **100 W San Fernando Street, Suite 200**	Purpose: **Hazardous Materials Investigation for HWY 101 MSN B4 Project**
City: **San Jose** State: **CA** Zip Code: **95113**	Special Instructions / Comments:
Telephone: **408-297-9585** FAX: **408-297-6962**	
REPORT TO: **J Ripple** SAMPLER: **J Ripple/M Thummaluru**	P.O. #: **28645045.03200** EMAIL: **james_ripple@urscorp.com**

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	Pesticide	VOCs	Lead	PCBs	REMARKS
001A	N-5@1.5	03/19/10 11:40	Soil	1	Jar								✓		
~~002A~~	~~N-5@2.0~~		~~Soil~~	~~1~~	~~Jar~~								✓		
~~003A~~	~~N-5@3.0~~		~~Soil~~	~~1~~	~~Jar~~								✓		
002A ~~004A~~	N-6@0.5	03/19/10 11:50	Soil	1	Jar						✓		✓	✓	
003A ~~005A~~	N-6@1.0	03/19/10 11:59	Soil	1	Jar								✓		
004A ~~006A~~	N-6@1.5	03/19/10 12:03	Soil	1	Jar								✓		
005A ~~007A~~	N-6@2.0	03/19/10 12:08	Soil	1	Jar								✓		
006A ~~008A~~	N-6@3.0	03/19/10 12:14	Soil	1	Jar	✓			✓	✓					Temp 5°C
~~007A~~	~~N-7@0.5~~		~~Soil~~	~~1~~	~~Jar~~								✓		
	~~N-7@1.0~~		~~Soil~~	~~1~~	~~Jar~~								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	10/19/10	6:20 PM	M. L. Ghadebara		3-19-10	6:20 p.m
2								

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 1 of 5

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1003116

Company Name: **URS Corporation**	Location of Sampling: **Petaluma, CA**
Address: **100 W San Fernando Street, Suite 200**	Purpose: **Hazardous Materials Investigation for HWY 101 MSN B4 Project**
City: **San Jose** State: **CA** Zip Code: **95113**	Special Instructions / Comments:
Telephone: **408-297-9585** FAX: **408-297-6962**	
REPORT TO: **J Ripple** SAMPLER: **J Ripple/M Thummaluru**	P.O. #: **28645045.03200** EMAIL: **james_ripple@urscorp.com**

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
022A	S-6@0.5	03/19/10 15:22	Soil	1	Jar								✓		
023A	S-6@1.0	03/19/10 15:25	Soil	1	Jar								✓		
024A	S-7@0.5	03/19/10 15:05	Soil	1	Jar								✓		
025A	S-7@1.0	03/19/10 15:09	Soil	1	Jar								✓		
	~~M-15@0.5~~	~~3/18/10 14:16~~	~~Soil~~	~~1~~	~~Jar~~	✓			✓	✓					
	~~M-15@1.0~~		~~Soil~~	~~2~~	~~Jar~~		✓	✓			✓	✓	✓		
	~~M-15@1.5~~	Could not hand auger		~~Soil~~	~~1~~	~~Jar~~							✓		Temp 5°C
	~~M-15@2.0~~			~~Soil~~	~~1~~	~~Jar~~							✓		
	~~M-15@3.0~~			~~Soil~~	~~1~~	~~Jar~~							✓		
026A	S-14@0.5	3/19/10 14:55	Soil	1	Jar								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	10/19/10	6:20PM	D. L. Ghodasara		3-19-10	6:20 P.m
2								

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

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RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1003116

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
016A	S-2@0.5	03/19/10 15:45	Soil	1	Jar								✓		
017A	S-2@1.0	03/19/10 15:50	Soil	1	Jar								✓		
018A	S-3@0.5	03/19/10 ~~15:05~~ 16:05	Soil	1	Jar								✓		
019A	S-3@1.0	03/19/10 ~~15:50~~ 16:08	Soil	1	Jar								✓		
020A	S-4@0.5	03/19/10 15:26	Soil	1	Jar								✓		
021A	S-4@1.0	03/19/10 15:30	Soil	1	Jar								✓		
	~~S-5@0.5~~	03/18/10 15:52	Soil	1	Jar	✓			✓	✓					
	~~S-5@1.0~~	03/18/10 15:55	Soil	1	Jar								✓		Temp 5°C
	~~S-5d@0.5~~	03/18/10 15:52	Soil	1	Jar								✓		
	~~S-5d@1.0~~	03/18/10 15:55	Soil	1	Jar								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	10/19/10	6:20 PM	D. G. Ghodasara		3-19-10	6:20 P.M.
2								

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

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FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1003116

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: [x] 10 Work Days [ ] 3 Work Days [ ] Noon - Nxt Day [ ] 7 Work Days [ ] 2 Work Days [ ] 2 - 8 Hours [ ] 5 Work Days [ ] 1 Work Day [ ] Other

SAMPLE TYPE: [ ] Storm Water [ ] Air [ ] Waste Water [ ] Other [ ] Ground Water [x] Soil

REPORT FORMAT: [ ] QC Level IV [ ] EDF [ ] Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
	~~S-14@1.0~~ - Removed	~~3/19/10~~	~~Soil~~	~~1~~	~~Jar~~								✓		
007A	S-15@0.5	03/19/10 1403	Soil	1	Jar	✓			✓	✓					
008A	S-15@1.0	03/19/10 1404	Soil	1	Jar								✓		
009A	S-15@1.5	03/19/10 1408	Soil	1	Jar								✓		
010A	S-15@2.0	03/19/10 1415	Soil	1	Jar								✓		
011A	S-15@3.0	03/19/10 1422	Soil	1	Jar								✓		
012A	N-3@0.5	03/19/10 11:12	Soil	1	Jar								✓		
013A	N-3@1.0	03/19/10 11:15 ~~11:12~~	Soil	1	Jar	✓			✓	✓					Temp 3°C
014A	N-5@0.5	03/19/10 11:26	Soil	1	Jar								✓		
015A	N-5@1.0	03/19/10 11:35	Soil	1	Jar	✓			✓	✓					

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	10/19/10	6:20 PM			3-19-10	6:20 P.M.
2								

Were Samples Received in Good Condition? [ ] Yes [ ] NO Samples on Ice? [ ] Yes [ ] NO Method of Shipment _____ Sample seals intact? [ ] Yes [ ] NO [ ] N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

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CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1003116

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
	~~N-13 @ 3.0~~	~~03/18/10 15:23~~	~~soil~~	~~1~~	~~Jar~~								✓		
027A	N-1 @ 0.5	03/19/10 10:53	soil	1	Jar								✓		
028A	N-1 @ 1.0	03/19/10 10:58	soil	1	Jar								✓		
029A	S-16 @ 0.5	03/19/10 1331	soil	1	Jar								✓		
030A	S-16 @ 1.0	03/19/10 13:34	↓	↓	↓								✓		
031A	S-16 @ 1.5	03/19/10 13:36											✓		
032A	S-16 @ 2.0	03/19/10 13:40											✓		Temp 5°C
033A	S-16 @ 3.0	03/19/10 13:49											✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	10/19/10	6:20 PM		D. G. Khodesara	3-19-10	6:20 P.m.
2								

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

URS (San Jose)
100 W San Fernando St, Suite200
San Jose, California 95113
Tel: 4082979585
Fax: 4082976962

RE: HWY 101 MSN B4 project, Petaluma, CA

Work Order No.: 1003111 Rev: 1

Dear James Ripple:

Torrent Laboratory, Inc. received 22 sample(s) on March 19, 2010 for the analyses presented in the following Report.

All data for associated QC met EPA or laboratory specification(s) except where noted in the case narrative.

Torrent Laboratory, Inc. is certified by the State of California, ELAP #1991. If you have any questions regarding these test results, please feel free to contact the Project Management Team at (408)263-5258; ext 204.

N. S. Kabir

Nutan Kabir

March 26, 2010

Date

Date: 3/26/2010

Client: URS (San Jose)

Project: HWY 101 MSN B4 project, Petaluma, CA

Work Order: 1003111

CASE NARRATIVE

No issues encountered with the receiving, preparation, analysis or reporting of the results associated with this work order.

Revisions:

Per client request, addtional anlaysis on specified samples for STLC, SI-STLC and TCLP were performed

Note: Extraction of 50 g sample / 500g 0.2M Sodium Citrate Solution was performed according to wet extraction procedure (WET) which was rotated in a rotary shaker for 48 hours.

Date Prepared: 5/9/10 @ 1PM to 5/11/10 @ 1PM

Note: Extraction of 50 g sample with DI water was performed according to wet extraction procedure (WET) which was rotated in a rotary shaker for 48 hours.

Date Prepared: 5/11/10 @ 11:20AM to 5/3/10 @ 11:20AM.

Rev1 5/17/10

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

N-8@0.5 1003111-001A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	3.6	mg/L
Lead	SW6010B	1	0.13	1.0	77	mg/Kg

N-8@1.0 1003111-002A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	6.1	mg/L
Lead	SW6010B	1	0.13	1.0	110	mg/Kg

N-9@0.5 1003111-003A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	17	mg/Kg

N-9@1.0 1003111-004A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	10	mg/Kg

Torrent LABORATORY, INC.

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

N-10@0.5 1003111-005A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Arsenic	SW6010B	1	0.28	1.7	7.2	mg/Kg
Barium	SW6010B	1	1	5.0	99	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	43	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	14	mg/Kg
Copper	SW6010B	1	0.0900	5.0	27	mg/Kg
Lead	SW6010B	1	0.13	1.0	40	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	47	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	44	mg/Kg
Zinc	SW6010B	1	0.59	5.0	84	mg/Kg
Mercury	7471B	1	0.01	0.10	0.29	mg/Kg
pH	SW9045C	1	0.10	2.0	7.06	S.U.

N-10@1.0 1003111-006A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Arsenic	SW6010B	1	0.28	1.7	6.3	mg/Kg
Barium	SW6010B	1	1	5.0	140	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	42	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	19	mg/Kg
Copper	SW6010B	1	0.0900	5.0	28	mg/Kg
Lead	SW6010B	1	0.13	1.0	32	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	62	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	43	mg/Kg
Zinc	SW6010B	1	0.59	5.0	70	mg/Kg
Mercury	7471B	1	0.01	0.10	0.13	mg/Kg
pH	SW9045C	1	0.10	2.0	7.25	S.U.

N-13d@0.5 1003111-007A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	3.7	mg/L
Lead	SW6010B	1	0.13	1.0	99	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

N-13d@1.0 1003111-008A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Arsenic	SW6010B	1	0.28	1.7	2.7	mg/Kg
Barium	SW6010B	1	1	5.0	73	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	28	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	14	mg/Kg
Copper	SW6010B	1	0.0900	5.0	16	mg/Kg
Lead	SW6010B	1	0.13	1.0	44	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	34	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	37	mg/Kg
Zinc	SW6010B	1	0.59	5.0	50	mg/Kg
pH	SW9045C	1	0.10	2.0	7.10	S.U.

N-13d@1.5 1003111-009A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	8.5	mg/Kg

N-13d@2.0 1003111-010A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	10	mg/Kg

N-13d@3.0 1003111-011A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	17	mg/Kg

N-11@0.5 1003111-012A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	3.1	mg/L
Lead	SW6010B	1	0.13	1.0	80	mg/Kg

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

N-11@1.0 1003111-013A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	1.3	mg/L
Lead	SW6010B	1	0.13	1.0	56	mg/Kg

N-13@0.5 1003111-014A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead (STLC)	SW6010B	1	0.0500	0.10	3.5	mg/L
Lead	SW6010B	1	0.13	1.0	90	mg/Kg

N-13@1.0 1003111-015A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Arsenic	SW6010B	1	0.28	1.7	3.0	mg/Kg
Barium	SW6010B	1	1	5.0	140	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	32	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	22	mg/Kg
Copper	SW6010B	1	0.0900	5.0	17	mg/Kg
Lead	SW6010B	1	0.13	1.0	46	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	38	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	38	mg/Kg
Zinc	SW6010B	1	0.59	5.0	59	mg/Kg
pH	SW9045C	1	0.10	2.0	7.18	S.U.

N-13@1.5 1003111-016A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	11	mg/Kg

N-13@2.0 1003111-017A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	5.8	mg/Kg

Torrent LABORATORY, INC.

Sample Result Summary

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

N-13@3.0 1003111-018A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	6.2	mg/Kg

S-5@0.5 1003111-019A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Arsenic	SW6010B	1	0.28	1.7	2.3	mg/Kg
Barium	SW6010B	1	1	5.0	82	mg/Kg
Chromium	SW6010B	1	0.0590	5.0	78	mg/Kg
Cobalt	SW6010B	1	0.14	5.0	23	mg/Kg
Copper	SW6010B	1	0.0900	5.0	33	mg/Kg
Lead	SW6010B	1	0.13	1.0	17	mg/Kg
Nickel	SW6010B	1	0.0590	5.0	78	mg/Kg
Silver	SW6010B	1	0	1.0	2.0	mg/Kg
Vanadium	SW6010B	1	0.12	5.0	66	mg/Kg
Zinc	SW6010B	1	0.59	5.0	51	mg/Kg
pH	SW9045C	1	0.10	2.0	6.63	S.U.

S-5@1.0 1003111-020A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	7.4	mg/Kg

S-5d@0.5 1003111-021A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	17	mg/Kg

S-5d@1.0 1003111-022A

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
Lead	SW6010B	1	0.13	1.0	7.5	mg/Kg

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	N-8@0.5	**Lab Sample ID:**	1003111-001A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 12:27		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	3.6		mg/L	400853	0412

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	77		mg/Kg	400355	0185

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400864	0423

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	N-8@1.0	**Lab Sample ID:**	1003111-002A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 12:32		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	6.1		mg/L	400853	0412

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	110		mg/Kg	400355	0185

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400864	0423

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	N-9@0.5	**Lab Sample ID:**	1003111-003A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 11:40		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	17		mg/Kg	400355	0185

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	N-9@1.0	**Lab Sample ID:**	1003111-004A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 11:47		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	10		mg/Kg	400355	0185

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	N-10@0.5	**Lab Sample ID:**	1003111-005A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 12:06		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	3/22/10	03/23/10	1	0.20	5.0	ND		mg/Kg	400357	0187
Arsenic	SW6010B	3/22/10	03/23/10	1	0.28	1.7	7.2		mg/Kg	400357	0187
Barium	SW6010B	3/22/10	03/23/10	1	1	5.0	99		mg/Kg	400357	0187
Beryllium	SW6010B	3/22/10	03/23/10	1	0.0840	2.0	ND		mg/Kg	400357	0187
Cadmium	SW6010B	3/22/10	03/23/10	1	0.0590	1.0	ND		mg/Kg	400357	0187
Chromium	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	43		mg/Kg	400357	0187
Cobalt	SW6010B	3/22/10	03/23/10	1	0.14	5.0	14		mg/Kg	400357	0187
Copper	SW6010B	3/22/10	03/23/10	1	0.0900	5.0	27		mg/Kg	400357	0187
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	40		mg/Kg	400357	0187
Molybdenum	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	ND		mg/Kg	400357	0187
Nickel	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	47		mg/Kg	400357	0187
Selenium	SW6010B	3/22/10	03/23/10	1	0.29	5.0	ND		mg/Kg	400357	0187
Silver	SW6010B	3/22/10	03/23/10	1	0	1.0	ND		mg/Kg	400357	0187
Thallium	SW6010B	3/22/10	03/23/10	1	0.12	5.0	ND		mg/Kg	400357	0187
Vanadium	SW6010B	3/22/10	03/23/10	1	0.12	5.0	44		mg/Kg	400357	0187
Zinc	SW6010B	3/22/10	03/23/10	1	0.59	5.0	84		mg/Kg	400357	0187

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	3/22/10	03/23/10	1	0.01	0.10	0.29		mg/Kg	400337	0181

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	NA	03/23/10	1	0.10	2.0	7.06		S.U.	400354	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	N-10@1.0	**Lab Sample ID:**	1003111-006A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 12:10		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	3/22/10	03/23/10	1	0.20	5.0	ND		mg/Kg	400357	0187
Arsenic	SW6010B	3/22/10	03/23/10	1	0.28	1.7	6.3		mg/Kg	400357	0187
Barium	SW6010B	3/22/10	03/23/10	1	1	5.0	140		mg/Kg	400357	0187
Beryllium	SW6010B	3/22/10	03/23/10	1	0.0840	2.0	ND		mg/Kg	400357	0187
Cadmium	SW6010B	3/22/10	03/23/10	1	0.0590	1.0	ND		mg/Kg	400357	0187
Chromium	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	42		mg/Kg	400357	0187
Cobalt	SW6010B	3/22/10	03/23/10	1	0.14	5.0	19		mg/Kg	400357	0187
Copper	SW6010B	3/22/10	03/23/10	1	0.0900	5.0	28		mg/Kg	400357	0187
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	32		mg/Kg	400357	0187
Molybdenum	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	ND		mg/Kg	400357	0187
Nickel	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	62		mg/Kg	400357	0187
Selenium	SW6010B	3/22/10	03/23/10	1	0.29	5.0	ND		mg/Kg	400357	0187
Silver	SW6010B	3/22/10	03/23/10	1	0	1.0	ND		mg/Kg	400357	0187
Thallium	SW6010B	3/22/10	03/23/10	1	0.12	5.0	ND		mg/Kg	400357	0187
Vanadium	SW6010B	3/22/10	03/23/10	1	0.12	5.0	43		mg/Kg	400357	0187
Zinc	SW6010B	3/22/10	03/23/10	1	0.59	5.0	70		mg/Kg	400357	0187

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	3/22/10	03/23/10	1	0.01	0.10	0.13		mg/Kg	400337	0181

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	NA	03/23/10	1	0.10	2.0	7.25		S.U.	400354	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	N-13d@0.5	**Lab Sample ID:**	1003111-007A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 15:00		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	3.7		mg/L	400853	0412

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	99		mg/Kg	400355	0185

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400864	0423

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	N-13d@1.0	**Lab Sample ID:**	1003111-008A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 15:05		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	3/22/10	03/23/10	1	0.20	5.0	ND		mg/Kg	400357	0187
Arsenic	SW6010B	3/22/10	03/23/10	1	0.28	1.7	2.7		mg/Kg	400357	0187
Barium	SW6010B	3/22/10	03/23/10	1	1	5.0	73		mg/Kg	400357	0187
Beryllium	SW6010B	3/22/10	03/23/10	1	0.0840	2.0	ND		mg/Kg	400357	0187
Cadmium	SW6010B	3/22/10	03/23/10	1	0.0590	1.0	ND		mg/Kg	400357	0187
Chromium	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	28		mg/Kg	400357	0187
Cobalt	SW6010B	3/22/10	03/23/10	1	0.14	5.0	14		mg/Kg	400357	0187
Copper	SW6010B	3/22/10	03/23/10	1	0.0900	5.0	16		mg/Kg	400357	0187
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	44		mg/Kg	400357	0187
Molybdenum	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	ND		mg/Kg	400357	0187
Nickel	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	34		mg/Kg	400357	0187
Selenium	SW6010B	3/22/10	03/23/10	1	0.29	5.0	ND		mg/Kg	400357	0187
Silver	SW6010B	3/22/10	03/23/10	1	0	1.0	ND		mg/Kg	400357	0187
Thallium	SW6010B	3/22/10	03/23/10	1	0.12	5.0	ND		mg/Kg	400357	0187
Vanadium	SW6010B	3/22/10	03/23/10	1	0.12	5.0	37		mg/Kg	400357	0187
Zinc	SW6010B	3/22/10	03/23/10	1	0.59	5.0	50		mg/Kg	400357	0187

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	3/22/10	03/23/10	1	0.01	0.10	ND		mg/Kg	400337	0181

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	NA	03/23/10	1	0.10	2.0	7.10		S.U.	400354	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	N-13d@1.5	**Lab Sample ID:**	1003111-009A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 15:10		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	8.5		mg/Kg	400355	0185

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	N-13d@2.0	**Lab Sample ID:**	1003111-010A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 15:19		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	10		mg/Kg	400355	0185

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	N-13d@3.0	**Lab Sample ID:**	1003111-011A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 15:23		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	17		mg/Kg	400355	0185

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	N-11@0.5	**Lab Sample ID:**	1003111-012A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 14:42		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	3.1		mg/L	400853	0412

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	80		mg/Kg	400355	0185

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400864	0423

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	N-11@1.0	**Lab Sample ID:**	1003111-013A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 14:46		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	1.3		mg/L	400853	0412

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	56		mg/Kg	400355	0185

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400864	0423

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	N-13@0.5	**Lab Sample ID:**	1003111-014A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 15:00		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (STLC)	SW6010B	5/11/10	05/12/10	1	0.0500	0.10	3.5		mg/L	400853	0412

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	90		mg/Kg	400355	0185

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead (DI-STLC)	SW6010B	5/13/10	05/13/10	1	0.0500	0.10	ND		mg/L	400864	0423

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	N-13@1.0	**Lab Sample ID:**	1003111-015A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 15:05		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	3/22/10	03/23/10	1	0.20	5.0	ND		mg/Kg	400357	0187
Arsenic	SW6010B	3/22/10	03/23/10	1	0.28	1.7	3.0		mg/Kg	400357	0187
Barium	SW6010B	3/22/10	03/23/10	1	1	5.0	140		mg/Kg	400357	0187
Beryllium	SW6010B	3/22/10	03/23/10	1	0.0840	2.0	ND		mg/Kg	400357	0187
Cadmium	SW6010B	3/22/10	03/23/10	1	0.0590	1.0	ND		mg/Kg	400357	0187
Chromium	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	32		mg/Kg	400357	0187
Cobalt	SW6010B	3/22/10	03/23/10	1	0.14	5.0	22		mg/Kg	400357	0187
Copper	SW6010B	3/22/10	03/23/10	1	0.0900	5.0	17		mg/Kg	400357	0187
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	46		mg/Kg	400357	0187
Molybdenum	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	ND		mg/Kg	400357	0187
Nickel	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	38		mg/Kg	400357	0187
Selenium	SW6010B	3/22/10	03/23/10	1	0.29	5.0	ND		mg/Kg	400357	0187
Silver	SW6010B	3/22/10	03/23/10	1	0	1.0	ND		mg/Kg	400357	0187
Thallium	SW6010B	3/22/10	03/23/10	1	0.12	5.0	ND		mg/Kg	400357	0187
Vanadium	SW6010B	3/22/10	03/23/10	1	0.12	5.0	38		mg/Kg	400357	0187
Zinc	SW6010B	3/22/10	03/23/10	1	0.59	5.0	59		mg/Kg	400357	0187

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	3/22/10	03/23/10	1	0.01	0.10	ND		mg/Kg	400337	0181

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	NA	03/23/10	1	0.10	2.0	7.18		S.U.	400354	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	N-13@1.5	**Lab Sample ID:**	1003111-016A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 15:10		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	11		mg/Kg	400355	0185

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	N-13@2.0	**Lab Sample ID:**	1003111-017A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 15:19		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	5.8		mg/Kg	400355	0185

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	N-13@3.0	**Lab Sample ID:**	1003111-018A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 15:23		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	6.2		mg/Kg	400355	0185

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	S-5@0.5	**Lab Sample ID:**	1003111-019A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 15:52		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Antimony	SW6010B	3/22/10	03/23/10	1	0.20	5.0	ND		mg/Kg	400357	0187
Arsenic	SW6010B	3/22/10	03/23/10	1	0.28	1.7	2.3		mg/Kg	400357	0187
Barium	SW6010B	3/22/10	03/23/10	1	1	5.0	82		mg/Kg	400357	0187
Beryllium	SW6010B	3/22/10	03/23/10	1	0.0840	2.0	ND		mg/Kg	400357	0187
Cadmium	SW6010B	3/22/10	03/23/10	1	0.0590	1.0	ND		mg/Kg	400357	0187
Chromium	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	78		mg/Kg	400357	0187
Cobalt	SW6010B	3/22/10	03/23/10	1	0.14	5.0	23		mg/Kg	400357	0187
Copper	SW6010B	3/22/10	03/23/10	1	0.0900	5.0	33		mg/Kg	400357	0187
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	17		mg/Kg	400357	0187
Molybdenum	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	ND		mg/Kg	400357	0187
Nickel	SW6010B	3/22/10	03/23/10	1	0.0590	5.0	78		mg/Kg	400357	0187
Selenium	SW6010B	3/22/10	03/23/10	1	0.29	5.0	ND		mg/Kg	400357	0187
Silver	SW6010B	3/22/10	03/23/10	1	0	1.0	2.0		mg/Kg	400357	0187
Thallium	SW6010B	3/22/10	03/23/10	1	0.12	5.0	ND		mg/Kg	400357	0187
Vanadium	SW6010B	3/22/10	03/23/10	1	0.12	5.0	66		mg/Kg	400357	0187
Zinc	SW6010B	3/22/10	03/23/10	1	0.59	5.0	51		mg/Kg	400357	0187

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Mercury	7471B	3/22/10	03/23/10	1	0.01	0.10	ND		mg/Kg	400337	0181

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Hexavalent Chromium	SW7199M	5/11/10	05/11/10	1	0.015	0.10	ND		mg/Kg	400887	0436

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
pH	SW9045C	NA	03/23/10	1	0.10	2.0	6.63		S.U.	400354	NA

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	S-5@1.0	**Lab Sample ID:**	1003111-020A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 15:55		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	7.4		mg/Kg	400355	0185

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	S-5d@0.5	**Lab Sample ID:**	1003111-021A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 15:52		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	17		mg/Kg	400355	0185

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: James Ripple
URS (San Jose)

Date Received: 03/19/10
Date Reported: 03/26/10

Client Sample ID:	S-5d@1.0	**Lab Sample ID:**	1003111-022A
Project Name/Location:	HWY 101 MSN B4 project, Petaluma, CA	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	03/18/10 / 15:55		
Tag Number:	Petaluma, CA		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
Lead	SW6010B	3/22/10	03/23/10	1	0.13	1.0	7.5		mg/Kg	400355	0185

MB Summary Report

Work Order:	1003111	**Prep Method:**	7471	**Prep Date:**	03/22/10	**Prep Batch:**	0181
Matrix:	Soil	**Analytical Method:**	7471AB	**Analyzed Date:**	03/23/10	**Analytical Batch:**	400337
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Mercury	0.01	0.10	ND	

Work Order:	1003111	**Prep Method:**	3050	**Prep Date:**	03/22/10	**Prep Batch:**	0185
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	03/23/10	**Analytical Batch:**	400355
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead	0.13	1.0	0.35	

Work Order:	1003111	**Prep Method:**	3050	**Prep Date:**	03/22/10	**Prep Batch:**	0187
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	03/23/10	**Analytical Batch:**	400357
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Antimony	0.20	5.0	ND	
Arsenic	0.28	1.7	ND	
Barium	1	5.0	ND	
Beryllium	0.0840	2.0	ND	
Cadmium	0.059	1.0	ND	
Chromium	0.059	5.0	0.10	
Cobalt	0.14	5.0	ND	
Copper	0.090	5.0	0.50	
Lead	0.13	1.0	0.25	
Molybdenum	0.059	5.0	ND	
Nickel	0.059	5.0	0.10	
Selenium	0.29	5.0	ND	
Silver	1.0	1.0	ND	
Thallium	0.12	5.0	ND	
Vanadium	0.12	5.0	ND	
Zinc	0.59	5.0	1.1	

MB Summary Report

Work Order:	1003111	**Prep Method:**	WET/3010B	**Prep Date:**	05/11/10	**Prep Batch:**	0412
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400853
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead (STLC)	0.0500	0.10	ND	

Work Order:	1003111	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0423
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400864
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	ND	

Work Order:	1003111	**Prep Method:**	7199M	**Prep Date:**	05/11/10	**Prep Batch:**	0436
Matrix:	Soil	**Analytical Method:**	SW7199	**Analyzed Date:**	05/11/10	**Analytical Batch:**	400887
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
Hexavalent Chromium	0.015	0.10	ND	

Torrent LABORATORY, INC.

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1003111	**Prep Method:**	7471	**Prep Date:**	03/22/10	**Prep Batch:**	0181
Matrix:	Soil	**Analytical Method:**	7471B	**Analyzed Date:**	03/23/10	**Analytical Batch:**	400337
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Mercury	0.01	0.10	0.00333	1.25	106	108	1.93	80.5 - 133	30	

Work Order:	1003111	**Prep Method:**	3050	**Prep Date:**	03/22/10	**Prep Batch:**	0185
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	03/23/10	**Analytical Batch:**	400355
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead	0.13	1	0.35	50	99.6	98.9	0.705	67.9 - 118	30	,

Work Order:	1003111	**Prep Method:**	3050	**Prep Date:**	03/22/10	**Prep Batch:**	0187
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	03/23/10	**Analytical Batch:**	400357
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Antimony	0.2	5	-0.050	50	99.2	98.9	0.303	30.7 - 130	30	,
Arsenic	0.28	1.7	0.00	50	99	98.7	0.303	71 - 121	30	,
Barium	1.1	5	0.25	50	99.9	102	1.88	70.2 - 130	30	,
Beryllium	0.084	2	0.00	50	101.1	97.3	3.73	73.3 - 115	30	,
Cadmium	0.059	1	0.00	50	94.3	96.2	1.99	68.7 - 110		,
Chromium	0.059	5	0.10	50	99.9	102	1.69	76 - 116	30	,
Cobalt	0.14	5	0.050	50	97	99.8	2.85	57.4 - 122	30	,
Copper	0.09	5	0.50	50	100	102	1.69	74.8 - 119	30	,
Lead	0.13	1	0.25	50	99.6	99.4	0.201	67.9 - 118	30	,
Molybdenum	0.059	5	0.00	50	102.3	102	0.196	62.9 - 123	30	,
Nickel	0.059	5	0.10	50	97.6	99.3	1.73	61.5 - 122	30	,
Selenium	0.29	5	-0.20	50	94.3	93.7	0.638	62 - 111	30	,
Silver	1	1	-0.050	50	96.2	97.7	1.55	81.1 - 109	30	,
Thallium	0.12	5	-0.10	50	94.4	94.8	0.423	39.2 - 125	30	,
Vanadium	0.12	5	0.050	50	99.9	101	1.49	65.8 - 122	30	,
Zinc	0.59	5	1.1	50	100.5	102	1.08	59.9 - 122	30	,

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1003111	**Prep Method:**	WET/3010B	**Prep Date:**	05/11/10	**Prep Batch:**	0412
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400853
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (STLC)	0.0500	0.10	0.0100	10	101	102	0.789	80 - 120	20	,

Work Order:	1003111	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0423
Matrix:	Soil	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400864
Units:	mg/L						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	0.000	10	103	103	0.0970	80 - 120	20	,

Work Order:	1003111	**Prep Method:**	7199M	**Prep Date:**	05/11/10	**Prep Batch:**	0436
Matrix:	Soil	**Analytical Method:**	SW7199	**Analyzed Date:**	05/11/10	**Analytical Batch:**	400887
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Hexavalent Chromium	0.015	0.10	0.0006	0.1	95.9	90.2	6.16	65 - 135	30	,

MS/MSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1003111	**Prep Method:**	7471	**Prep Date:**	03/22/10	**Prep Batch:**	0181
Matrix:	**Soil**	**Analytical Method:**	7471B	**Analyzed Date:**	03/23/10	**Analytical Batch:**	400337
Spiked Sample:	1003111-005A						
Units:	mg/Kg						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Mercury	0.01	0.10	0.00344	1.25	88.8	94.7	5.12	80.5 - 133	30	

Work Order:	1003111	**Prep Method:**	3050	**Prep Date:**	03/22/10	**Prep Batch:**	0185
Matrix:	**Soil**	**Analytical Method:**	SW6010B	**Analyzed Date:**	03/23/10	**Analytical Batch:**	400355
Spiked Sample:	1003111-001A						
Units:	mg/Kg						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead	0.13	1	1.5	50	91.9		4.39	67.9 - 118	30	NR

Work Order:	1003111	**Prep Method:**	3050	**Prep Date:**	03/22/10	**Prep Batch:**	0187
Matrix:	**Soil**	**Analytical Method:**	SW6010B	**Analyzed Date:**	03/23/10	**Analytical Batch:**	400357
Spiked Sample:	1003111-005A						
Units:	mg/Kg						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Antimony	0.20	5.0	0.032	50	70.1	63.7	9.13	30.7 - 130	30	
Arsenic	0.28	1.7	0.14	50	89.8	84.8	5.13	71 - 121	30	
Barium	1	5.0	2.0	50	126	100	8.21	70.2 - 130	30	
Beryllium	0.0840	2.0	-0.0030	50	91.6	91.1	0.549	73.3 - 115	30	
Cadmium	0.059	1.0	0.0100	50	89.8	86.6	3.59	68.7 - 110	30	
Chromium	0.059	5.0	0.87	50	89.1	86.3	1.55	76 - 116	30	
Cobalt	0.14	5.0	0.28	50	88.1	88.3	0.258	57.4 - 122	30	
Copper	0.090	5.0	0.55	50	97.7	90.0	5.37	74.8 - 119	30	
Lead	0.13	1.0	0.80	50	93.0	80.9	7.25	67.9 - 118	30	
Molybdenum	0.059	5.0	-0.0050	50	87.6	84.3	3.86	62.9 - 123	30	
Nickel	0.059	5.0	0.94	50	81.4	87.8	3.81	61.5 - 122	30	
Selenium	0.29	5.0	0.016	50	86.5	84.4	2.41	62 - 111	30	
Silver	1.0	1.0	0.0020	50	94.9	91.3	3.86	81.1 - 109	30	
Thallium	0.12	5.0	-0.029	50	78.9	76.2	3.62	39.2 - 125	30	
Vanadium	0.12	5.0	0.88	50	85.9	82.6	1.97	65.8 - 122	30	
Zinc	0.59	5.0	1.7	50	122	63.5	22.3	59.9 - 122	30	

MS/MSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1003111	**Prep Method:**	WET/3010B	**Prep Date:**	05/11/10	**Prep Batch:**	0412
Matrix:	**Soil**	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/12/10	**Analytical Batch:**	400853
Spiked Sample:	1003111-001A						
Units:	mg/L						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (STLC)	0.0500	0.10	0.356	10	78.6	77.7	0.616	75 - 125	20	

Work Order:	1003111	**Prep Method:**	WET-DI/3010B	**Prep Date:**	05/13/10	**Prep Batch:**	0423
Matrix:	**Soil**	**Analytical Method:**	SW6010B	**Analyzed Date:**	05/13/10	**Analytical Batch:**	400864
Spiked Sample:	1003111-001A						
Units:	mg/L						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Lead (DI-STLC)	0.0500	0.10	0.000	10	103	101	1.66	75 - 125	20	

Work Order:	1003111	**Prep Method:**	7199M	**Prep Date:**	05/11/10	**Prep Batch:**	0436
Matrix:	**Soil**	**Analytical Method:**	SW7199	**Analyzed Date:**	05/11/10	**Analytical Batch:**	400887
Spiked Sample:	1003111-019A						
Units:	mg/Kg						

Parameters	MDL	PQL	Sample Conc.	Spike Conc.	MS % Recovery	MSD % Recovery	MS/MSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
Hexavalent Chromium	0.015	0.10	0.021	0.1	112	93.1	-4.11	65 - 125	30	

Duplicate QC Summary Report

Work Order:	1003111	**Prep Method:**	NA	**Prep Date:**	NA	**Prep Batch:**	NA
Matrix:	**Soil**	**Analytical Method:**	SW9045C	**Analyzed Date:**	03/23/10	**Analytical Batch:**	400354
Units:						**Lab Sample ID:**	1003116-015A-Dup

Parameters	MDL	PQL	Sample Result	Duplicate Result	% RPD
pH	0.100	2.00	7.19	7.22	0.104

Raw values are used in quality control assessment.

Laboratory Qualifiers and Definitions

DEFINITIONS:

Accuracy/Bias (% Recovery) - The closeness of agreement between an observed value and an accepted reference value.
Blank (Method/Preparation Blank) -MB/PB - An analyte-free matrix to which all reagents are added in the same volumes/proportions as used in sample processing. The method blank is used to document contamination resulting from the analytical process.
Duplicate - a field sample and/or laboratory QC sample prepared in duplicate following all of the same processes and procedures used on the original sample (sample duplicate, LCSD, MSD)
Laboratory Control Sample (LCS ad LCSD) - A known matrix spiked with compounds representative of the target analyte(s). This is used to document laboratory performance.
Matrix - the component or substrate that contains the analyte of interest (e.g., - groundwater, sediment, soil, waste water, etc)
Matrix Spike (MS/MSD) - Client sample spiked with identical concentrations of target analyte (s). The spiking occurs prior to the sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.
Method Detection Limit (MDL) - the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero
Practical Quantitation Limit (PQL) - a laboratory determined value at 2 to 5 times above the MDL that can be reproduced in a manner that results in a 99% confidence level that the result is both accurate and precise. PQLs reflect all preparation factors and/or dilution factors that have been applied to the sample during the preparation and/or analytical processes.
Precision (%RPD) - The agreement among a set of replicate/duplicate measurements without regard to known value of the replicates
Surrogate (S) or (Surr) - An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are used in most organic analysis to demonstrate matrix compatibility with the chosen method of analysis
Tentatively Identified Compound (TIC) - A compound not contained within the analytical calibration standards but present in the GCMS library of defined compounds. When the library is searched for an unknown compound, it can frequently give a tentative identification to the compound based on retention time and primary and secondary ion match. TICs are reported as estimates and are candidates for further investigation.
Units: the unit of measure used to express the reported result - **mg/L** and ***mg/Kg*** (equivalent to PPM - parts per million in **liquid** and ***solid***), **ug/L** and ***ug/Kg*** (equivalent to PPB - parts per billion in **liquid** and ***solid***), **ug/m3**, ***mg.m3***, **ppbv** and ***ppmv*** (all units of measure for reporting concentrations in air), **%** (equivalent to 10000 ppm or 1,000,000 ppb), **ug/Wipe** (concentration found on the surface of a single Wipe usually taken over a 100cm2 surface)

LABORATORY QUALIFIERS:

B - Indicates when the anlayte is found in the associated method or preparation blank
D - Surrogate is not recoverable due to the necessary dilution of the sample
E - Indicates the reportable value is outside of the calibration range of the instrument but within the linear range of the instrument (unless otherwise noted) Values reported with an E qualifier should be considered as estimated.
H- Indicates that the recommended holding time for the analyte or compound has been exceeded
J- Indicates a value between the method MDL and PQL and that the reported concentration should be considered as estimated rather the quantitative
NA - Not Analyzed
N/A - Not Applicable
NR - Not recoverable - a matrix spike concentration is not recoverable due to a concentration within the original sample that is greater than four times the spike concentration added
R- The % RPD between a duplicate set of samples is outside of the absolute values established by laboratory control charts
S- Spike recovery is outside of established method and/or laboratory control limits. Further explanation of the use of this qualifier should be included within a case narrative
X -Used to indicate that a value based on pattern identification is within the pattern range but not typical of the pattern found in standards. Further explanation may or may not be provided within the sample footnote and/or the case narrative.

Sample Receipt Checklist

Client Name: URS (San Jose)

Project Name: HWY 101 MSN B4 project, Petaluma, CA

Work Order No.: 1003111

Date and Time Received: 3/19/2010 17:00

Received By: LI

Physically Logged By: NG

Checklist Completed By: NG

Carrier Name: Client Droped off

Chain of Custody (COC) Information

Chain of custody present?	Yes
Chain of custody signed when relinquished and received?	Yes
Chain of custody agrees with sample labels?	Yes
Custody seals intact on sample bottles?	Not Present

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Not Present
Shipping Container/Cooler In Good Condition?	Yes
Samples in proper container/bottle?	Yes
Samples containers intact?	Yes
Sufficient sample volume for indicated test?	Yes

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes			
Container/Temp Blank temperature in compliance?	Yes	Temperature:	4	°C
Water-VOA vials have zero headspace?	No VOA vials submitted			
Water-pH acceptable upon receipt?				

pH Checked by:

pH Adjusted by:

Login Summary Report

Client ID: TL5174 URS (San Jose)

Project Name: HWY 101 MSN B4 project, Petaluma, CA

Project # :

Report Due Date: 5/14/2010

QC Level: II

TAT Requested: 5+ day:0

Date Received: 3/19/2010

Time Received: 17:00

Comments: 5 day TAT! Received 22 soils. Asbestos PLM subbed to EMSL.

Work Order # : ***1003111***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1003111-001A	N-8@0.5	03/18/10 12:27	Soil	09/15/10			S_6010B(STLC) S_6010BDI-STLC S_6010BCAM17	
1003111-002A	N-8@1.0	03/18/10 12:32	Soil	09/15/10			S_6010B(STLC) S_6010BDI-STLC S_6010BCAM17	
1003111-003A	N-9@0.5	03/18/10 11:40	Soil	09/15/10			S_6010BCAM17	
1003111-004A	N-9@1.0	03/18/10 11:47	Soil	09/15/10			S_6010BCAM17	
1003111-005A	N-10@0.5	03/18/10 12:06	Soil	09/15/10			S_pH9045C S_7471BHG S_6010BCAM17 SUB_AsbestosCARB 435	Yes
1003111-006A	N-10@1.0	03/18/10 12:10	Soil	09/15/10			S_pH9045C S_6010BCAM17 S_7471BHG SUB_AsbestosCARB 435	Yes
1003111-007A	N-13d@0.5	03/18/10 15:00	Soil	09/15/10			S_6010B(STLC) S_6010BDI-STLC S_6010BCAM17	
1003111-008A	N-13d@1.0	03/18/10 15:05	Soil	09/15/10			S_pH9045C S_7471BHG SUB_AsbestosCARB 435 S_6010BCAM17	Yes
1003111-009A	N-13d@1.5	03/18/10 15:10	Soil	09/15/10			S_6010BCAM17	
1003111-010A	N-13d@2.0	03/18/10 15:19	Soil	09/15/10				

Login Summary Report

Client ID:	TL5174 URS (San Jose)	**QC Level:**	II
Project Name:	HWY 101 MSN B4 project, Petaluma, CA	**TAT Requested:**	5+ day:0
Project # :		**Date Received:**	3/19/2010
Report Due Date:	5/14/2010	**Time Received:**	17:00

Comments: 5 day TAT! Received 22 soils. Asbestos PLM subbed to EMSL.

Work Order # : ***1003111***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1003111-011A	N-13d@3.0	03/18/10 15:23	Soil	09/15/10			S_6010BCAM17	
1003111-012A	N-11@0.5	03/18/10 14:42	Soil	09/15/10			S_6010BCAM17	
1003111-013A	N-11@1.0	03/18/10 14:46	Soil	09/15/10			S_6010B(STLC) S_6010BDI-STLC S_6010BCAM17	
1003111-014A	N-13@0.5	03/18/10 15:00	Soil	09/15/10			S_6010B(STLC) S_6010BCAM17 S_6010BDI-STLC	
1003111-015A	N-13@1.0	03/18/10 15:05	Soil	09/15/10			S_6010B(STLC) S_6010BCAM17 S_6010BDI-STLC	
1003111-016A	N-13@1.5	03/18/10 15:10	Soil	09/15/10			S_pH9045C SUB_AsbestosCARB 435 S_6010BCAM17 S_7471BHG	Yes
1003111-017A	N-13@2.0	03/18/10 15:19	Soil	09/15/10			S_6010BCAM17	
1003111-018A	N-13@3.0	03/18/10 15:23	Soil	09/15/10			S_6010BCAM17	
1003111-019A	S-5@0.5	03/18/10 15:52	Soil	09/15/10			S_6010BCAM17	
1003111-020A	S-5@1.0	03/18/10 15:55	Soil	09/15/10			S_CrVI7199 CO S_6010BCAM17 SUB_AsbestosCARB 435 S_pH9045C S_7471BHG	Yes
							S_6010BCAM17	

Login Summary Report

Client ID:	TL5174 URS (San Jose)	**QC Level:**	II
Project Name:	HWY 101 MSN B4 project, Petaluma, CA	**TAT Requested:**	5+ day:0
Project # :		**Date Received:**	3/19/2010
Report Due Date:	5/14/2010	**Time Received:**	17:00

Comments: 5 day TAT! Received 22 soils. Asbestos PLM subbed to EMSL.

Work Order # : ***1003111***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1003111-021A	S-5d@0.5	03/18/10 15:52	Soil	09/15/10			S_6010BCAM17	
1003111-022A	S-5d@1.0	03/18/10 15:55	Soil	09/15/10			S_6010BCAM17	

Torrent LABORATORY, INC.

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483 Sinclair Frontage Road
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www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1003111

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
001A	N-8@0.5	3/18/10 / 1227	Soil	1	Jar								✓		
002A	N-8@1.0	1232	Soil	1	Jar								✓		
003A	N-9@0.5	1140	Soil	1	Jar								✓		
004A	N-9@1.0	1147	Soil	1	Jar								✓		
005A	N-10@0.5	1206	Soil	1	Jar	✓			✓	✓					
006A	N-10@1.0	1210	Soil	1	Jar	✓			✓	✓					
007A	N-13d@0.5	1500	Soil	1	Jar								✓		
008A	N-13d@1.0	1505	Soil	1	Jar	✓			✓	✓					Temp 4 °C
009A	N-13d@1.5	1510	Soil	1	Jar								✓		
010A	N-13d@2.0	1519	Soil	1	Jar								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	3/18/10	6:25 PM		L.D. Imlay	3-19-10	
2			3/19/10	5:00		L.D. Imlay	3-19-10	5:00

Were Samples Received in Good Condition? ☐ Yes ☐ NO / Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 1 of 3

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

Torrent LABORATORY, INC.

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483 Sinclair Frontage Road
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FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1003111

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
011A	N-13d@3.0	3/18/10 / 1523	Soil	1	Jar								✓		
012A	N-11@0.5	1442	Soil	1	Jar								✓		
013A	N-11@1.0	1446	Soil	1	Jar								✓		
014A	N-13@0.5	1500	Soil	1	Jar								✓		
015A	N-13@1.0	1505	Soil	1	Jar	✓			✓	✓					
016A	N-13@1.5	1510	Soil	1	Jar								✓		
017A	N-13@2.0	1519	Soil	1	Jar								✓		Temp 4°C
018A	N-13@3.0	1523	Soil	1	Jar								✓		
019A	S-5@0.5	1552	Soil	1	Jar	✓			✓	✓					
020A	S-5@1.0	1555	Soil	1	Jar								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	3/18/10	6:25 PM				
2	[signature]		3		[signature]	L-D. Dubat	3-19-10	1500

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 2 of 3

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

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www.torrentlab.com

RESET

CHAIN OF CUSTODY

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LAB WORK ORDER NO: 1003111

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose / State: CA / Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585 / FAX: 408-297-6962	
REPORT TO: J Ripple / SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200 / EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
021A	S-5d@0.5	3/18/10 / 1552	Soil	1	Jar								✓		
022A	S-5d@1.0	↓ 1555	Soil	1	Jar								✓		
															Temp. 4°C

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	3/18/10	6:25 PM				
2	[signature]		3/19/10		[signature]	L. D. Imbat	3-19-10	5:00

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 3 of 3

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

EMSL Analytical, Inc
2235 Polvorosa Ave , Suite 230, San Leandro, CA 94577
Phone: (510) 895-3675 Fax: (510) 895-3680 Email: milpitaslab@emsl.com

Attn: **Nutan Kabir**
Torrent Laboratory, Inc.
483 Sinclair Frontage Rd.
Milpitas, CA 95035

Fax: (408) 263-8293 Phone: (408) 263-5258
Project: **COC100322001**

Customer ID: TORR80
Customer PO: COC100322001
Received: 03/23/10 9:30 AM
EMSL Order: 091002645

EMSL Proj:
Analysis Date: 3/30/2010

Test Report: Qualitative asbestos analysis of soils using the EPA 600/R-93/116 method

Sample	Description	Appearance	Result	Notes
1003111-005A *091002645-0001*			**None Detected**	
1003111-006A *091002645-0002*			**None Detected**	
1003111-008A *091002645-0003*			**None Detected**	
1003111-015A *091002645-0004*			**None Detected**	
1003111-019A *091002645-0005*			**None Detected**	

Analyst(s)

Rui Cindy Geng (5)

Baojia Ke, Laboratory Manager
or other approved signatory

EMSL recommends that soil samples reported as "ND" be tested by the EPA Screening Method/Qualitative. The above report relates only to the items tested. This report may not be reproduced, except in full, without written approval by EMSL Analytical, Inc. The above test must not be used by the client to claim product endorsement by NVLAP nor any agency of the United States Government. Unless otherwise noted, the results in this report have not been blank corrected.Samples received in good condition unless otherwise noted.
Samples analyzed by EMSL Analytical, Inc 2235 Polvorosa Ave , Suite 230, San LeandroCA

THIS IS THE LAST PAGE OF THE REPORT.

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FAX: 408.263.8293
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CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1003111

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose / State: CA / Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585 / FAX: 408-297-6962	
REPORT TO: J Ripple / SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200 / EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
001A	N-8@0.5	3/18/10 / 1227	Soil	1	Jar								✓		
002A	N-8@1.0	1232	Soil	1	Jar								✓		
003A	N-9@0.5	1140	Soil	1	Jar								✓		
004A	N-9@1.0	1147	Soil	1	Jar								✓		
005A	N-10@0.5	1206	Soil	1	Jar	✓			✓	✓					
006A	N-10@1.0	1210	Soil	1	Jar	✓			✓	✓					
007A	N-13d@0.5	1500	Soil	1	Jar								✓		
008A	N-13d@1.0	1505	Soil	1	Jar	✓			✓	✓					Temp 4 °C
009A	N-13d@1.5	1510	Soil	1	Jar								✓		
010A	N-13d@2.0	1519	Soil	1	Jar								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1	James Ripple		3/18/10	6:25 PM	[signature]	L-D Imbert	3-19-10	
2	Rachel Blan		3/19/10	5:00	[signature]	L-D Imbert	3-19-10	5:00

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

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CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1003111

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
011A	N-13d@3.0	3/18/10 / 1523	Soil	1	Jar								✓		
012A	N-11@0.5	1442	Soil	1	Jar								✓		
013A	N-11@1.0	1446	Soil	1	Jar								✓		
014A	N-13@0.5	1500	Soil	1	Jar								✓		
015A	N-13@1.0	1505	Soil	1	Jar	✓			✓	✓					
016A	N-13@1.5	1510	Soil	1	Jar								✓		
017A	N-13@2.0	1519	Soil	1	Jar								✓		Temp 4°C
018A	N-13@3.0	1523	Soil	1	Jar								✓		
019A	S-5@0.5	1552	Soil	1	Jar	✓			✓	✓					
020A	S-5@1.0	1555	Soil	1	Jar								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	3/18/10	6:25 PM				
2	Richard M. Bro		3			L-D. Dubost	3-19-10	1100

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrangements are made.

Page 2 of 3

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

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CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1003111

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose / State: CA / Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585 / FAX: 408-297-6962	
REPORT TO: J Ripple / SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200 / EMAIL: james_ripple@urscorp.com

TURNAROUND TIME:
- [x] 10 Work Days
- [ ] 3 Work Days
- [ ] Noon - Nxt Day
- [ ] 7 Work Days
- [ ] 2 Work Days
- [ ] 2 - 8 Hours
- [ ] 5 Work Days
- [ ] 1 Work Day
- [ ] Other

SAMPLE TYPE:
- [ ] Storm Water
- [ ] Air
- [ ] Waste Water
- [ ] Other
- [ ] Ground Water
- [x] Soil

REPORT FORMAT:
- [ ] QC Level IV
- [ ] EDF
- [ ] Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
021A	S-5d@0.5	3/18/10 / 1552	Soil	1	Jar								✓		
022A	S-5d@1.0	↓ 1555	Soil	1	Jar								✓		
															Temp. 4°C

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	3/18/10	6:25 PM				
2	Robert Blaz		3/19/10			L. D. Imsat	3-19-10	5:00

Were Samples Received in Good Condition? [ ] Yes [ ] NO Samples on Ice? [ ] Yes [ ] NO Method of Shipment _____ Sample seals intact? [ ] Yes [ ] NO [ ] N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrangements are made.

Page 3 of 3

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

EMSL Analytical, Inc
2235 Polvorosa Ave , Suite 230, San Leandro, CA 94577
Phone: (510) 895-3675 Fax: (510) 895-3680 Email: milpitaslab@emsl.com

Attn: **Nutan Kabir**
Torrent Laboratory, Inc.
483 Sinclair Frontage Rd.
Milpitas, CA 95035

Fax: (408) 263-8293 Phone: (408) 263-5258
Project: **COC100322001**

Customer ID: TORR80
Customer PO: COC100322001
Received: 03/23/10 9:30 AM
EMSL Order: 091002645

EMSL Proj:
Analysis Date: 3/30/2010

Test Report: Qualitative asbestos analysis of soils using the EPA 600/R-93/116 method

Sample	Description	Appearance	Result	Notes
1003111-005A *091002645-0001*			**None Detected**	
1003111-006A *091002645-0002*			**None Detected**	
1003111-008A *091002645-0003*			**None Detected**	
1003111-015A *091002645-0004*			**None Detected**	
1003111-019A *091002645-0005*			**None Detected**	

Analyst(s)

Rui Cindy Geng (5)

Baojia Ke, Laboratory Manager
or other approved signatory

EMSL recommends that soil samples reported as "ND" be tested by the EPA Screening Method/Qualitative. The above report relates only to the items tested. This report may not be reproduced, except in full, without written approval by EMSL Analytical, Inc. The above test must not be used by the client to claim product endorsement by NVLAP nor any agency of the United States Government. Unless otherwise noted, the results in this report have not been blank corrected.Samples received in good condition unless otherwise noted.
Samples analyzed by EMSL Analytical, Inc 2235 Polvorosa Ave , Suite 230, San LeandroCA

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RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1003111

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose / State: CA / Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585 / FAX: 408-297-6962	
REPORT TO: J Ripple / SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200 / EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
001A	N-8@0.5	3/18/10 / 1227	Soil	1	Jar								✓		
002A	N-8@1.0	1232	Soil	1	Jar								✓		
003A	N-9@0.5	1140	Soil	1	Jar								✓		
004A	N-9@1.0	1147	Soil	1	Jar								✓		
005A	N-10@0.5	1206	Soil	1	Jar	✓			✓	✓					
006A	N-10@1.0	1210	Soil	1	Jar	✓			✓	✓					
007A	N-13d@0.5	1500	Soil	1	Jar								✓		
008A	N-13d@1.0	1505	Soil	1	Jar	✓			✓	✓					Temp 4 °C
009A	N-13d@1.5	1510	Soil	1	Jar								✓		
010A	N-13d@2.0	1519	Soil	1	Jar								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1	James Ripple		3/18/10	6:25 PM	[signature]	L-D Imbert	3-19-10	
2	Rachel Blan		3/19/10	5:00	[signature]	L-D Imbert	3-19-10	5:00

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
Milpitas, CA 95035
Phone: 408.263.5258
FAX: 408.263.8293
www.torrentlab.com

RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1003111

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose; State: CA; Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585; FAX: 408-297-6962	
REPORT TO: J Ripple; SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200; EMAIL: james_ripple@urscorp.com

TURNAROUND TIME: ☑ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours ☐ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE: ☐ Storm Water ☐ Air ☐ Waste Water ☐ Other ☐ Ground Water ☑ Soil

REPORT FORMAT: ☐ QC Level IV ☐ EDF ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
011A	N-13d@3.0	3/18/10 / 1523	Soil	1	Jar								✓		
012A	N-11@0.5	1442	Soil	1	Jar								✓		
013A	N-11@1.0	1446	Soil	1	Jar								✓		
014A	N-13@0.5	1500	Soil	1	Jar								✓		
015A	N-13@1.0	1505	Soil	1	Jar	✓			✓	✓					
016A	N-13@1.5	1510	Soil	1	Jar								✓		
017A	N-13@2.0	1519	Soil	1	Jar								✓		Temp 4°C
018A	N-13@3.0	1523	Soil	1	Jar								✓		
019A	S-5@0.5	1552	Soil	1	Jar	✓			✓	✓					
020A	S-5@1.0	1555	Soil	1	Jar								✓		

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	3/18/10	6:25 PM				
2	Richard M. Bro		3			L-D. Dubost	3-19-10	1100

Were Samples Received in Good Condition? ☐ Yes ☐ NO Samples on Ice? ☐ Yes ☐ NO Method of Shipment _____ Sample seals intact? ☐ Yes ☐ NO ☐ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrangements are made.

Page 2 of 3

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

Torrent LABORATORY, INC.
483 Sinclair Frontage Road
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Phone: 408.263.5258
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RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1003111

Company Name: URS Corporation	Location of Sampling: Petaluma, CA
Address: 100 W San Fernando Street, Suite 200	Purpose: Hazardous Materials Investigation for HWY 101 MSN B4 Project
City: San Jose / State: CA / Zip Code: 95113	Special Instructions / Comments:
Telephone: 408-297-9585 / FAX: 408-297-6962	
REPORT TO: J Ripple / SAMPLER: J Ripple/M Thummaluru	P.O. #: 28645045.03200 / EMAIL: james_ripple@urscorp.com

TURNAROUND TIME:
- [x] 10 Work Days
- [ ] 3 Work Days
- [ ] Noon - Nxt Day
- [ ] 7 Work Days
- [ ] 2 Work Days
- [ ] 2 - 8 Hours
- [ ] 5 Work Days
- [ ] 1 Work Day
- [ ] Other

SAMPLE TYPE:
- [ ] Storm Water
- [ ] Air
- [ ] Waste Water
- [ ] Other
- [ ] Ground Water
- [x] Soil

REPORT FORMAT:
- [ ] QC Level IV
- [ ] EDF
- [ ] Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	CAM 17 Metals	TPH-d/mo	TPH-g/BTEX/MTBE	Asbestos by PLM	pH	5 Gas Oxygenates	VOCs	Lead		REMARKS
021A	S-5d@0.5	3/18/10 / 1552	Soil	1	Jar								✓		
022A	S-5d@1.0	↓ 1555	Soil	1	Jar								✓		
															Temp. 4°C

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1		James Ripple	3/18/10	6:25 PM				
2	Robert Blaz		3/19/10			L. D. Imsat	3-19-10	5:00

Were Samples Received in Good Condition? [ ] Yes [ ] NO Samples on Ice? [ ] Yes [ ] NO Method of Shipment _____ Sample seals intact? [ ] Yes [ ] NO [ ] N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrangements are made.

Page 3 of 3

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date: _____

URS (San Jose)
100 W San Fernando St, Suite200
San Jose, California 95113
Tel: 4082979585
Fax: 4082976962

RE: Petaluma River Bridge

Work Order No.: 1010193

Dear Patrick Walz:

Torrent Laboratory, Inc. received 3 sample(s) on October 22, 2010 for the analyses presented in the following Report.

All data for associated QC met EPA or laboratory specification(s) except where noted in the case narrative.

Torrent Laboratory, Inc. is certified by the State of California, ELAP #1991. If you have any questions regarding these test results, please feel free to contact the Project Management Team at (408)263-5258; ext 204.

Mukesh Jani

October 29, 2010
Date

Date: 10/29/2010

Client: URS (San Jose)

Project: Petaluma River Bridge

Work Order: 1010193

CASE NARRATIVE

No issues encountered with the receiving, preparation, analysis or reporting of the results associated with this work order.

Sample Result Summary

Report prepared for: Patrick Walz
URS (San Jose)

Date Received: 10/22/10
Date Reported: 10/29/10

PH-1 1010193-001

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
TPH as Motor Oil (SG)	SW8015B(M)	1	1.8	4.0	99	mg/Kg

PH-2 1010193-002

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
TPH as Motor Oil (SG)	SW8015B(M)	4	7.1	16	280	mg/Kg

PH-3 1010193-003

Parameters:	Analysis Method	DF	MDL	PQL	Results	Unit
TPH as Motor Oil (SG)	SW8015B(M)	4	7.1	16	300	mg/Kg

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Patrick Walz
URS (San Jose)

Date Received: 10/22/10
Date Reported: 10/29/10

Client Sample ID:	PH-1	**Lab Sample ID:**	1010193-001A
Project Name/Location:	Petaluma River Bridge	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	10/15/10 / 10:00		
Tag Number:	Petaluma River Bridge		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH(Gasoline)	8260TPH	10/26/10	10/26/10	1	17	100	ND		ug/Kg	402800	1440
(S) 4-Bromofluorobenzene	8260TPH	10/26/10	10/26/10	1	43.9	127	47.7		%	402800	1440

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH as Diesel (SG)	SW8015B(M)	10/29/10	10/29/10	1	0.76	2.0	ND		mg/Kg	402820	1446
TPH as Motor Oil (SG)	SW8015B(M)	10/29/10	10/29/10	1	1.8	4.0	99		mg/Kg	402820	1446
Pentacosane (S)	SW8015B(M)	10/29/10	10/29/10	1	61.5	133	80.9		%	402820	1446

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Patrick Walz
URS (San Jose)

Date Received: 10/22/10
Date Reported: 10/29/10

Client Sample ID:	PH-2	**Lab Sample ID:**	1010193-002A
Project Name/Location:	Petaluma River Bridge	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	10/15/10 / 11:00		
Tag Number:	Petaluma River Bridge		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH(Gasoline)	8260TPH	10/26/10	10/26/10	1	17	100	ND		ug/Kg	402800	1440
(S) 4-Bromofluorobenzene	8260TPH	10/26/10	10/26/10	1	43.9	127	76.9		%	402800	1440

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH as Diesel (SG)	SW8015B(M)	10/29/10	10/29/10	4	3.0	7.9	ND		mg/Kg	402820	1446
TPH as Motor Oil (SG)	SW8015B(M)	10/29/10	10/29/10	4	7.1	16	280		mg/Kg	402820	1446
Pentacosane (S)	SW8015B(M)	10/29/10	10/29/10	4	61.5	133	90.4		%	402820	1446

Torrent LABORATORY, INC.

SAMPLE RESULTS

Report prepared for: Patrick Walz
URS (San Jose)

Date Received: 10/22/10
Date Reported: 10/29/10

Client Sample ID:	PH-3	**Lab Sample ID:**	1010193-003A
Project Name/Location:	Petaluma River Bridge	**Sample Matrix:**	Soil
Project Number:			
Date/Time Sampled:	10/15/10 / 12:10		
Tag Number:	Petaluma River Bridge		

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH(Gasoline)	8260TPH	10/26/10	10/26/10	1	17	100	ND		ug/Kg	402800	1440
(S) 4-Bromofluorobenzene	8260TPH	10/26/10	10/26/10	1	43.9	127	86.1		%	402800	1440

Parameters:	Analysis Method	Prep Date	Date Analyzed	DF	MDL	PQL	Results	Lab Qualifier	Unit	Analytical Batch	Prep Batch
TPH as Diesel (SG)	SW8015B(M)	10/29/10	10/29/10	4	3.0	7.9	ND		mg/Kg	402820	1446
TPH as Motor Oil (SG)	SW8015B(M)	10/29/10	10/29/10	4	7.1	16	300		mg/Kg	402820	1446
Pentacosane (S)	SW8015B(M)	10/29/10	10/29/10	4	61.5	133	105		%	402820	1446

MB Summary Report

Work Order:	1010193	**Prep Method:**	5035	**Prep Date:**	10/26/10	**Prep Batch:**	1440
Matrix:	Soil	**Analytical Method:**	8260TPH	**Analyzed Date:**	10/26/10	**Analytical Batch:**	402800
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
TPH(Gasoline)	17	100	82	
(S) 4-Bromofluorobenzene			104	

Work Order:	1010193	**Prep Method:**	3545_TPHSG	**Prep Date:**	10/29/10	**Prep Batch:**	1446
Matrix:	Soil	**Analytical Method:**	SW8015B(M)	**Analyzed Date:**	10/29/10	**Analytical Batch:**	402820
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Lab Qualifier
TPH as Diesel (SG)	0.76	2.0	ND	
TPH as Motor Oil (SG)	1.8	4.0	ND	
Pentacosane (S)			97.6	

Torrent LABORATORY, INC.

LCS/LCSD Summary Report

Raw values are used in quality control assessment.

Work Order:	1440	**Prep Method:**	5035	**Prep Date:**	10/26/10	**Prep Batch:**	1440
Matrix:	Soil	**Analytical Method:**	8260TPH	**Analyzed Date:**	10/26/10	**Analytical Batch:**	402800
Units:	ug/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
TPH(Gasoline)	17	100	82	1000	118	108	9.17	48.2 - 132	30	
(S) 4-Bromofluorobenzene			104	50	97.5	105		57 - 127		

Work Order:	1446	**Prep Method:**	3545_TPHSG	**Prep Date:**	10/29/10	**Prep Batch:**	1446
Matrix:	Soil	**Analytical Method:**	SW8015B(M)	**Analyzed Date:**	10/29/10	**Analytical Batch:**	402820
Units:	mg/Kg						

Parameters	MDL	PQL	Method Blank Conc.	Spike Conc.	LCS % Recovery	LCSD % Recovery	LCS/LCSD % RPD	% Recovery Limits	% RPD Limits	Lab Qualifier
TPH as Diesel (SG)	0.76	2.0	ND	33.33	79.1	71.6	10.0	50.8 - 111	30	
TPH as Motor Oil (SG)			ND	100				61.5 - 133		

Laboratory Qualifiers and Definitions

DEFINITIONS:

Accuracy/Bias (% Recovery) - The closeness of agreement between an observed value and an accepted reference value.
Blank (Method/Preparation Blank) -MB/PB - An analyte-free matrix to which all reagents are added in the same volumes/proportions as used in sample processing. The method blank is used to document contamination resulting from the analytical process.
Duplicate - a field sample and/or laboratory QC sample prepared in duplicate following all of the same processes and procedures used on the original sample (sample duplicate, LCSD, MSD)
Laboratory Control Sample (LCS ad LCSD) - A known matrix spiked with compounds representative of the target analyte(s). This is used to document laboratory performance.
Matrix - the component or substrate that contains the analyte of interest (e.g., - groundwater, sediment, soil, waste water, etc)
Matrix Spike (MS/MSD) - Client sample spiked with identical concentrations of target analyte (s). The spiking occurs prior to the sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.
Method Detection Limit (MDL) - the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero
Practical Quantitation Limit (PQL) - a laboratory determined value at 2 to 5 times above the MDL that can be reproduced in a manner that results in a 99% confidence level that the result is both accurate and precise. PQLs reflect all preparation factors and/or dilution factors that have been applied to the sample during the preparation and/or analytical processes.
Precision (%RPD) - The agreement among a set of replicate/duplicate measurements without regard to known value of the replicates
Surrogate (S) or (Surr) - An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are used in most organic analysis to demonstrate matrix compatibility with the chosen method of analysis
Tentatively Identified Compound (TIC) - A compound not contained within the analytical calibration standards but present in the GCMS library of defined compounds. When the library is searched for an unknown compound, it can frequently give a tentative identification to the compound based on retention time and primary and secondary ion match. TICs are reported as estimates and are candidates for further investigation.
Units: the unit of measure used to express the reported result - **mg/L** and ***mg/Kg*** (equivalent to PPM - parts per million in **liquid** and ***solid***), **ug/L** and ***ug/Kg*** (equivalent to PPB - parts per billion in **liquid** and ***solid***), **ug/m3**, ***mg.m3***, **ppbv** and ***ppmv*** (all units of measure for reporting concentrations in air), **%** (equivalent to 10000 ppm or 1,000,000 ppb), **ug/Wipe** (concentration found on the surface of a single Wipe usually taken over a 100cm2 surface)

LABORATORY QUALIFIERS:

B - Indicates when the anlayte is found in the associated method or preparation blank
D - Surrogate is not recoverable due to the necessary dilution of the sample
E - Indicates the reportable value is outside of the calibration range of the instrument but within the linear range of the instrument (unless otherwise noted) Values reported with an E qualifier should be considered as estimated.
H- Indicates that the recommended holding time for the analyte or compound has been exceeded
J- Indicates a value between the method MDL and PQL and that the reported concentration should be considered as estimated rather the quantitative
NA - Not Analyzed
N/A - Not Applicable
NR - Not recoverable - a matrix spike concentration is not recoverable due to a concentration within the original sample that is greater than four times the spike concentration added
R- The % RPD between a duplicate set of samples is outside of the absolute values established by laboratory control charts
S- Spike recovery is outside of established method and/or laboratory control limits. Further explanation of the use of this qualifier should be included within a case narrative
X -Used to indicate that a value based on pattern identification is within the pattern range but not typical of the pattern found in standards. Further explanation may or may not be provided within the sample footnote and/or the case narrative.

Sample Receipt Checklist

Client Name: URS (San Jose)

Project Name: Petaluma River Bridge

Work Order No.: 1010193

Date and Time Received: 10/22/2010 11:25

Received By: NG

Physically Logged By: NG

Checklist Completed By: NG

Carrier Name: Hi-Speed Courier

Chain of Custody (COC) Information

Chain of custody present?	Yes
Chain of custody signed when relinquished and received?	Yes
Chain of custody agrees with sample labels?	Yes
Custody seals intact on sample bottles?	Not Present

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Not Present
Shipping Container/Cooler In Good Condition?	Yes
Samples in proper container/bottle?	Yes
Samples containers intact?	Yes
Sufficient sample volume for indicated test?	Yes

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes		
Container/Temp Blank temperature in compliance?		Temperature:	°C
Water-VOA vials have zero headspace?	No VOA vials submitted		
Water-pH acceptable upon receipt?			
pH Checked by:	pH Adjusted by:		

Samples received @ room temperature.

Login Summary Report

Client ID: TL5174 URS (San Jose)

Project Name: Petaluma River Bridge

Project # :

Report Due Date: 10/29/2010

QC Level:

TAT Requested: 5+ day:0

Date Received: 10/22/2010

Time Received: 11:25

Comments: 5 Day TAT!! Report to Patrick! TPHGas, THD/O with SiO2

Work Order # : ***1010193***

WO Sample ID	Client Sample ID	Collection Date/Time	Matrix	Scheduled Disposal	Sample On Hold	Test On Hold	Requested Tests	Subbed
1010193-001A	PH-1	10/15/10 10:00	Soil	04/20/11			S_GCMS-GRO S_TPHDOSG	
Sample Note:	Silica Gel for d/mo, TPHg for all samples.							
1010193-002A	PH-2	10/15/10 11:00	Soil	04/20/11			S_GCMS-GRO S_TPHDOSG	
1010193-003A	PH-3	10/15/10 12:10	Soil	04/20/11			S_GCMS-GRO S_TPHDOSG	

Torrent LABORATORY, INC.

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RESET

CHAIN OF CUSTODY

• NOTE: SHADED AREAS ARE FOR TORRENT LAB USE ONLY •

LAB WORK ORDER NO: 1010193

Company Name: URS	Location of Sampling: Petaluma River Bridge
Address: 100 West San Fernando Street Suite 200	Purpose: Sample Soil at Bents
City: San Jose / State: CA / Zip Code: 95113	Special Instructions / Comments: Silica Gel for d/mo
Telephone: 408-297-9585 / FAX: 408-297-6962	
REPORT TO: / SAMPLER:	P.O. #: 28645045.03200 / EMAIL:

TURNAROUND TIME:
- ☐ 10 Work Days ☐ 3 Work Days ☐ Noon - Nxt Day
- ☐ 7 Work Days ☐ 2 Work Days ☐ 2 - 8 Hours
- ☑ 5 Work Days ☐ 1 Work Day ☐ Other

SAMPLE TYPE:
- ☐ Storm Water ☐ Air
- ☐ Waste Water ☐ Other
- ☐ Ground Water
- ☑ Soil

REPORT FORMAT:
- ☐ QC Level IV
- ☐ EDF
- ☐ Excel / EDD

ANALYSIS REQUESTED

LAB ID	CLIENT'S SAMPLE I.D.	DATE / TIME SAMPLED	MATRIX	# OF CONT	CONT TYPE	TPH-g	TPH-d/mo								REMARKS
001A	PH-1	10/15/10 1000	Soil	1	8oz	✓	✓								
002A	PH-2	10/15/10 1100	Soil	1	8oz	✓	✓								
003A	PH-3	10/15/10 1210	Soil	1	8oz	✓	✓								

	Relinquished By:	Print:	Date:	Time:	Received By:	Print:	Date:	Time:
1	[illegible]	PWALL	10-22-10	1000	C Moore	CMoore	10-22-10	10:55
2	C Moore	CMoore	10-22-10	11:25	N. G. Thodasara		10-22-10	11:25

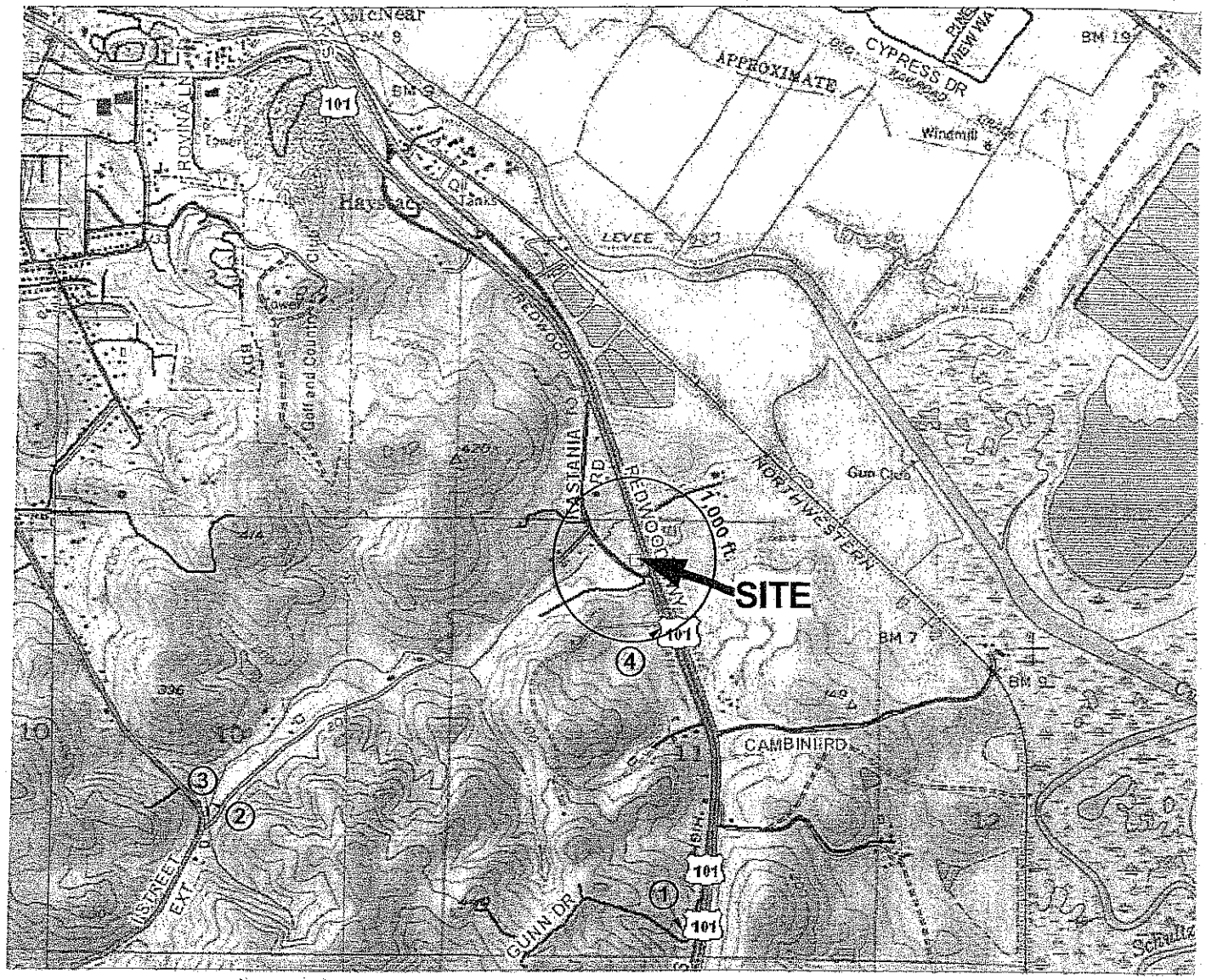
Were Samples Received in Good Condition? ☑ Yes ☐ NO Samples on Ice? ☐ Yes ☑ NO Method of Shipment Hispeed. courier Sample seals intact? ☐ Yes ☐ NO ☑ N/A

NOTE: Samples are discarded by the laboratory 30 days from date of receipt unless other arrange -ments are made.

Page 1 of 1

Log In By: _____ Date: _____ Log In Reviewed By: _____ Date:

APPENDIX F



EXPLANATION

Addresses of known water supply wells:

1. 5200 Redwood Hwy South
2. 4900 Redwood Hwy South
3. 4871 Redwood Hwy South
4. 600 Kastania Road

NORTH

0 1/2 1

SCALE IN MILES

GAS N SHOP
4550 REDWOOD HIGHWAY
PETALUMA, CALIFORNIA

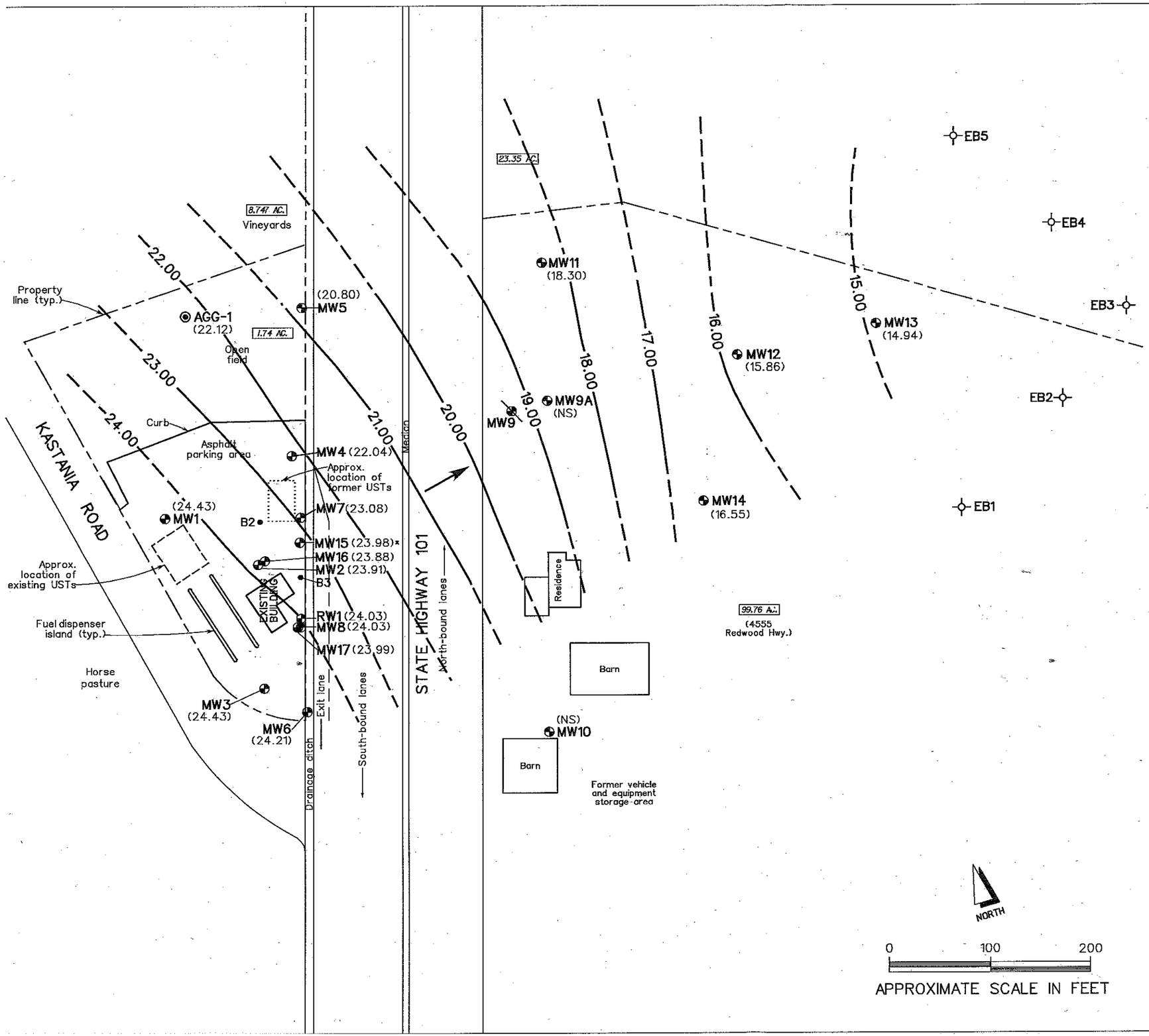
Client: SELF-SERVE PETROLEUM, INC. Project No.: SJ001-05

FREY ENVIRONMENTAL, INC.

NOTE:

1) All locations and dimensions are approximate.
2) Base map from USGS 7.5 minute Petaluma River (1954, photorevised 1980), California topographic quadrangle.

SITE LOCATION MAP WITH 1,000 FOOT RADIUS



EXPLANATION

● B1	SOIL BORING LOCATION
EB1	EXPLORATION SOIL BORING LOCATION
MW9	DESTROYED GROUNDWATER MONITORING WELL LOCATION
AGG-1	ABANDONED GROUNDWATER SUPPLY WELL LOCATION
RW1	REMEDIATION WELL LOCATION
MW1	GROUNDWATER MONITORING WELL LOCATION
(24.43)	With groundwater elevation in feet MSL, on July 29, 2008; NS=not surveyed; *=deep screened wells not used for contours
24.00	CONTOUR OF EQUAL GROUNDWATER ELEVATION (in feet MSL, on July 29, 2008)
→	ESTIMATED GROUNDWATER FLOW DIRECTION

NOTES:

1) All locations and dimensions are approximate.
2) Base map from Meridian Surveying Engineering, Inc., titled Monitor Wells, site notes by FREY Environmental, Inc. personnel, and County Assessor's Parcel Map Bk. 19 Pg. 31, County of Sonoma, CA.
3) Groundwater monitoring well and vapor extraction well locations were surveyed by McGregor Land Surveys on 11/27/02, 03/04/04, 05/14/05, and 02/23/06.

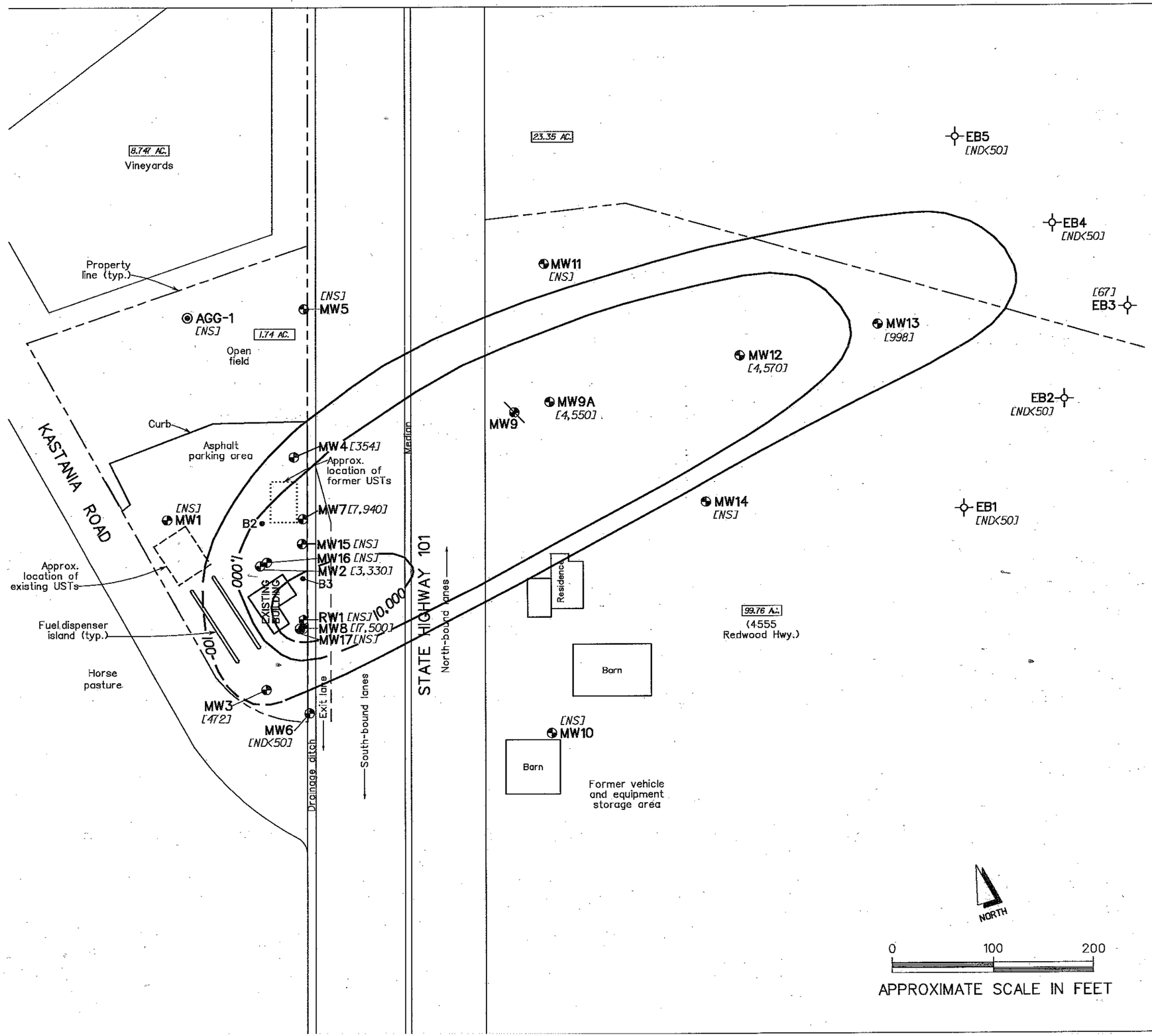
GAS N SHOP
4550 REDWOOD HIGHWAY
PETALUMA, CALIFORNIA

Client: SELF-SERV PETROLEUM Project No.: SJ001-05

FREY ENVIRONMENTAL, INC.

SITE SKETCH
SHOWING GROUNDWATER ELEVATIONS AND ESTIMATED DIRECTION OF GROUNDWATER FLOW ON JULY 29, 2008

Date: DECEMBER 2008 Figure 2



EXPLANATION

B1	SOIL BORING LOCATION
EB1	EXPLORATION SOIL BORING LOCATION
MW9	DESTROYED GROUNDWATER MONITORING WELL LOCATION
AGG-1	ABANDONED GROUNDWATER SUPPLY WELL LOCATION
RW1	REMEDIATION WELL LOCATION
MW1	GROUNDWATER MONITORING WELL LOCATION
[7,500]	With TPH-G concentration in groundwater (in µg/l, on July 29 and 30, 2008, ND=not detected above the indicated detection limit; NS=not sampled)
10,000	CONTOUR OF EQUAL TPH-G CONCENTRATION IN GROUNDWATER (in µg/l, on July 29 and 30, 2008)

NOTES:

1) All locations and dimensions are approximate.
2) Base map from Meridian Surveying Engineering, Inc., titled Monitor Wells, site notes by FREY Environmental, Inc. personnel, and County Assessor's Parcel Map Bk. 19 Pg. 31, County of Sonoma, CA.
3) Groundwater monitoring well and vapor extraction well locations were surveyed by McGregor Land Surveys on 11/27/02, 03/04/04, 05/14/05, and 02/23/06.

GAS N SHOP
4550 REDWOOD HIGHWAY
PETALUMA, CALIFORNIA

Client: SELF-SERV PETROLEUM

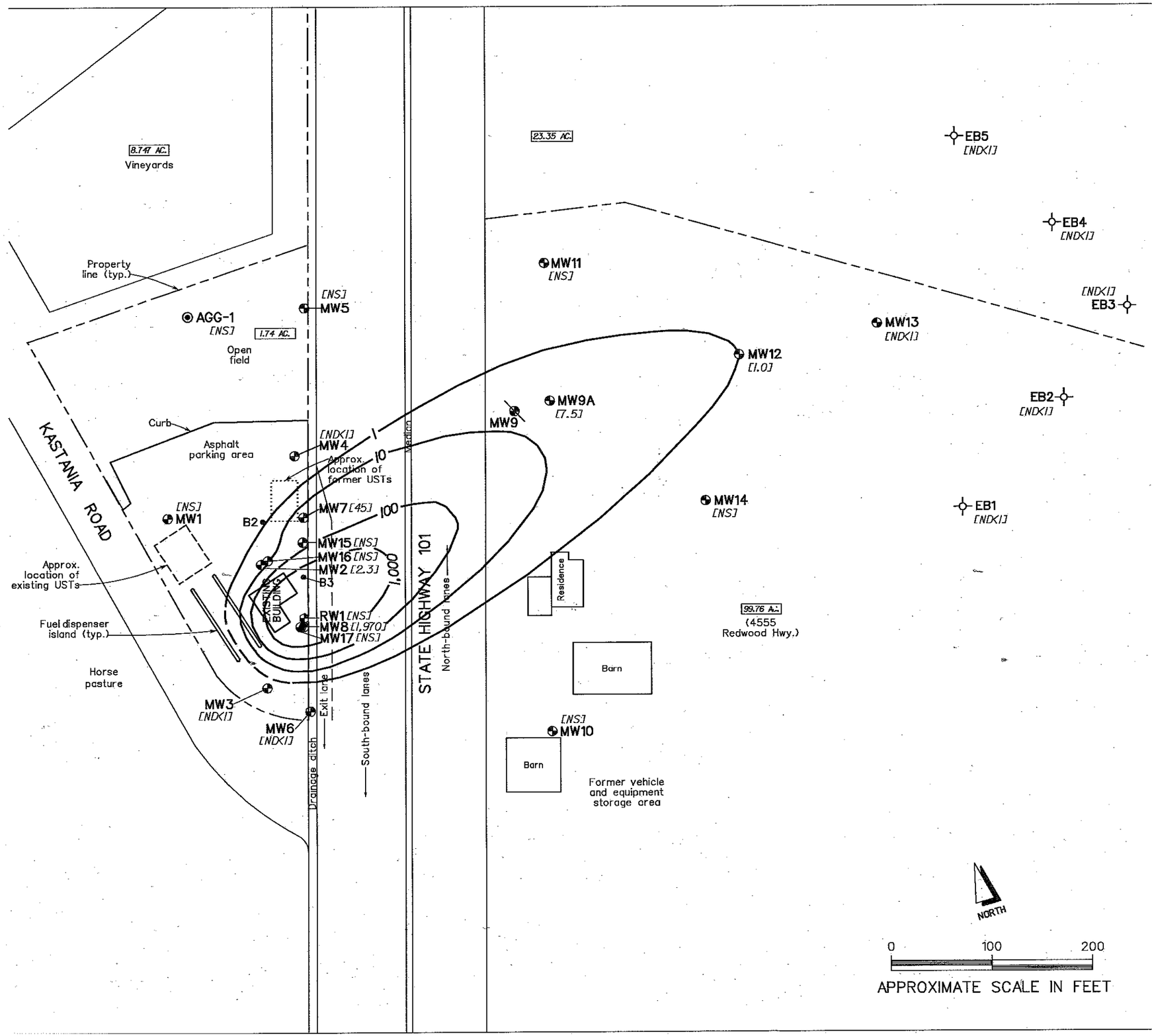
Project No.: SJ001-05

FREY ENVIRONMENTAL, INC.

SITE SKETCH SHOWING
TPH-G CONCENTRATIONS IN GROUNDWATER
ON JULY 29 AND 30, 2008

Date: DECEMBER 2008

Figure 3



EXPLANATION

B1	SOIL BORING LOCATION
EB1	EXPLORATION SOIL BORING LOCATION
MW9	DESTROYED GROUNDWATER MONITORING WELL LOCATION
AGG-1	ABANDONED GROUNDWATER SUPPLY WELL LOCATION
RW1	REMEDIATION WELL LOCATION
MW1	GROUNDWATER MONITORING WELL LOCATION
[1,970]	With benzene concentration in groundwater (in µg/l, on July 29 and 30, 2008, ND=not detected above the indicated detection limit; NS=not sampled)
1,000	CONTOUR OF EQUAL BENZENE CONCENTRATION IN GROUNDWATER (in µg/l, on July 29 and 30, 2008)

NOTES:

1) All locations and dimensions are approximate.
2) Base map from Meridian Surveying Engineering, Inc., titled Monitor Wells, site notes by FREY Environmental, Inc. personnel, and County Assessor's Parcel Map Bk. 19 Pg. 31, County of Sonoma, CA.
3) Groundwater monitoring well and vapor extraction well locations were surveyed by McGregor Land Surveys on 11/27/02, 03/04/04, 05/14/05, and 02/23/06.

GAS N SHOP
4550 REDWOOD HIGHWAY
PETALUMA, CALIFORNIA

Client: SELF-SERV PETROLEUM

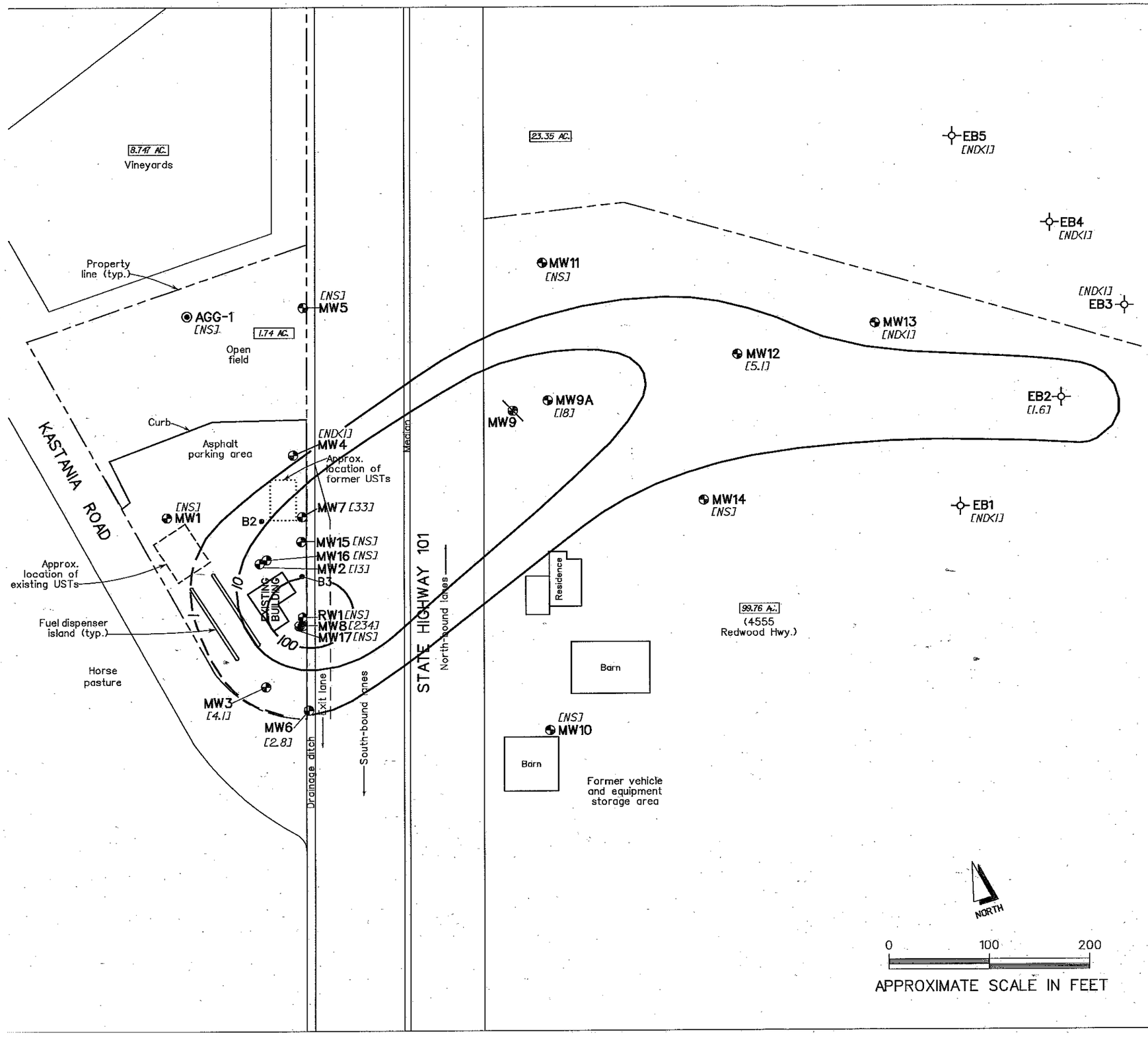
Project No.: SJ001-05

FREY ENVIRONMENTAL, INC.

SITE SKETCH
SHOWING BENZENE CONCENTRATIONS IN GROUNDWATER ON JULY 29 AND 30, 2008

Date: DECEMBER 2008

Figure 4



EXPLANATION

● B1	SOIL BORING LOCATION
EB1	EXPLORATION SOIL BORING LOCATION
MW9	DESTROYED GROUNDWATER MONITORING WELL LOCATION
AGG-1	ABANDONED GROUNDWATER SUPPLY WELL LOCATION
RW1	REMEDIATION WELL LOCATION
MW1	GROUNDWATER MONITORING WELL LOCATION
[234]	With MTBE concentration in groundwater (in µg/l, on July 29 and 30, 2008, ND=not detected above the indicated detection limit; NS=not sampled)
100	CONTOUR OF EQUAL MTBE CONCENTRATION IN GROUNDWATER (in µg/l, on July 29 and 30, 2008)

NOTES:

1) All locations and dimensions are approximate.
2) Base map from Meridian Surveying Engineering, Inc., titled Monitor Wells, site notes by FREY Environmental, Inc. personnel, and County Assessor's Parcel Map Bk. 19 Pg. 31, County of Sonoma, CA.
3) Groundwater monitoring well and vapor extraction well locations were surveyed by McGregor Land Surveys on 11/27/02, 03/04/04, 05/14/05, and 02/23/06.

GAS N SHOP
4550 REDWOOD HIGHWAY
PETALUMA, CALIFORNIA

Client: SELF-SERV PETROLEUM

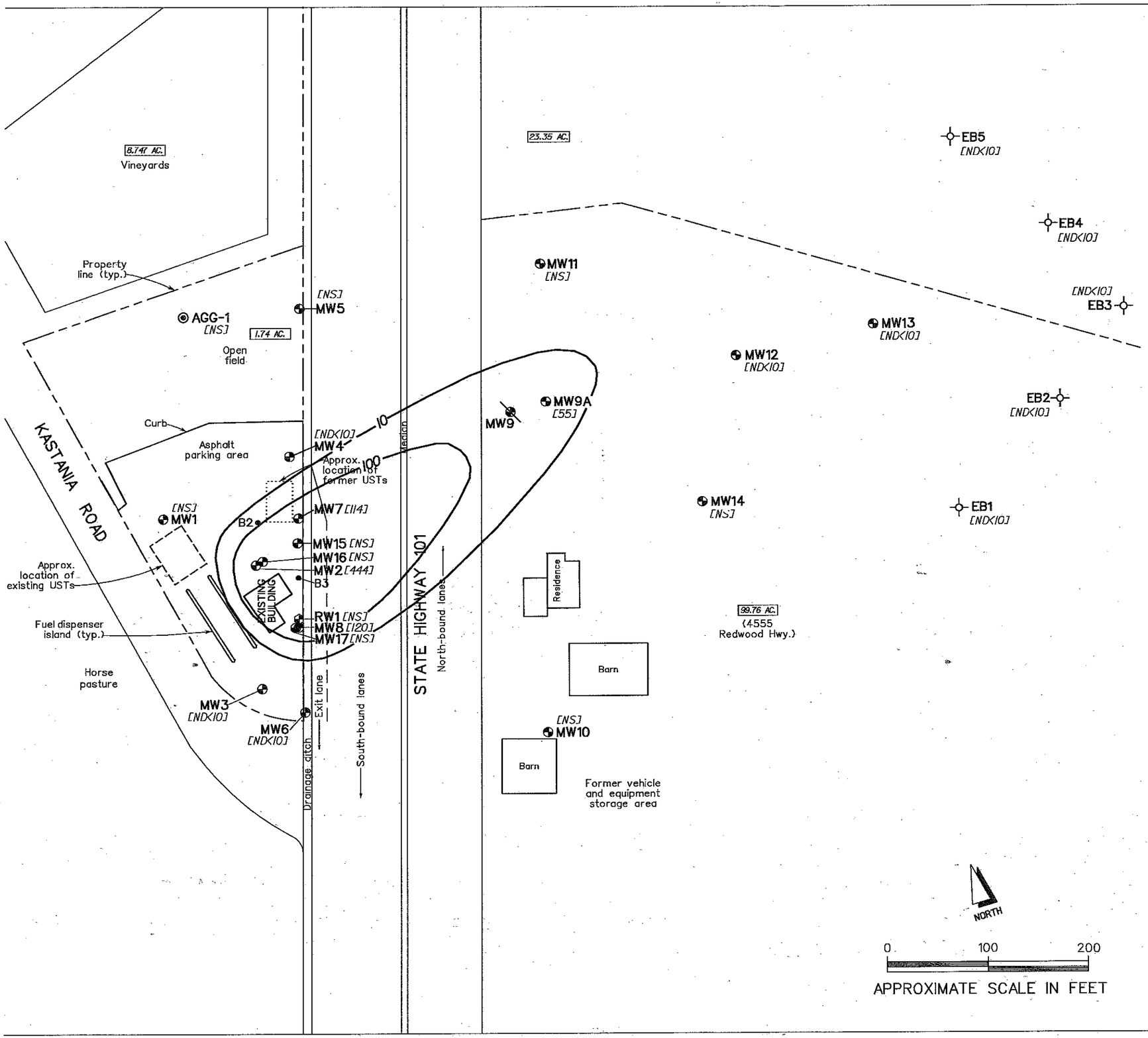
Project No.: SJ001-05

FREY ENVIRONMENTAL, INC.

SITE SKETCH
SHOWING MTBE CONCENTRATIONS IN GROUNDWATER ON JULY 29 AND 30, 2008

Date: DECEMBER 2008

Figure 5



EXPLANATION

● B1	SOIL BORING LOCATION
EB1	EXPLORATION SOIL BORING LOCATION
MW9	DESTROYED GROUNDWATER MONITORING WELL LOCATION
AGG-1	ABANDONED GROUNDWATER SUPPLY WELL LOCATION
RW1	REMEDIATION WELL LOCATION
MW1	GROUNDWATER MONITORING WELL LOCATION
[444]	With TBA concentration in groundwater (in µg/l, on July 29 and 30, 2008; ND=not detected above the indicated detection limit; NS=not sampled)
100	CONTOUR OF EQUAL TBA CONCENTRATION IN GROUNDWATER (in µg/l, on July 29 and 30, 2008)

NOTES:

1) All locations and dimensions are approximate.
2) Base map from Meridian Surveying Engineering, Inc., titled Monitor Wells, site notes by FREY Environmental, Inc. personnel, and County Assessor's Parcel Map Bk. 19 Pg. 31, County of Sonoma, CA.
3) Groundwater monitoring well and vapor extraction well locations were surveyed by McGregor Land Surveys on 11/27/02, 03/04/04, 05/14/05, and 02/23/06.

GAS N SHOP
4550 REDWOOD HIGHWAY
PETALUMA, CALIFORNIA

Client: SELF-SERV PETROLEUM

Project No.: SJ001-05

FREY ENVIRONMENTAL, INC.

SITE SKETCH
SHOWING TBA CONCENTRATIONS IN GROUNDWATER ON JULY 29 AND 30, 2008

Date: DECEMBER 2008

Figure 6

APPENDIX G

A Creative Joint Venture For Better Environmental Solutions

Petaluma Boulevard North & South Bridges
Petaluma, CA

KELLCO-MACS Job #1004-28

Pre-Demolition
Asbestos and CAM 17 Heavy Metals Report

for

URS Corporation
55 South Market Street
Suite #1500
San Jose, CA 95113

June 8, 2010

A Creative Joint Venture For Better Environmental Solutions

Pre-Demolition
Asbestos & CAM 17 Heavy Metals Report

Date:	June 8, 2010
KELLCO-MACS Job #:	1004-28
Client:	Mr. Patrick Waltz URS Corporation 55 South Market Street Suite #1500 San Jose, CA 95113
Location:	Petaluma Boulevard North & South Bridges Petaluma, CA
Date of Inspection:	May 4, 2010
Inspectors:	Derrik Quach SST #02-3214, CDPH Lead #2280 Tim Cannard CAC #94-1395, CDPH Lead #764
Description Of The Inspected Area:	The inspection was conducted on a bridge located in Petaluma, CA.

Background

This is a pre-demolition asbestos and CAM 17 Heavy Metals inspection located in Petaluma, CA.

Synopsis

Asbestos was found in the following tested materials;

- Grey Soil / Rock

CAM 17 Heavy Metals were elevated in **ALL** of the paint samples taken.

Sample #203141-4 came back with elevated levels of Chromium. It was further analyzed by an accredited laboratory for Hexachrome (Chrome 6) by EPA 218.6 method. The result from this test was 180 PPM (mg/kg).

Chrome 6 is a listed carcinogen and **ALL** of the sample results should be shared with any contractor and personnel working within this area in order to be OSHA Compliant.

About the Inspection

The inspection performed was both visual and tactile. Samples were taken of suspect materials located at the exterior of the survey area.

The inspection was at the direction of the client. If any non-sampled materials are uncovered, these should be submitted for analysis.

The following numbering convention was used for this inspection:

LETTER	STANDS FOR	EXAMPLE	MEANING
XX	Building DESIGNATION based on information provided on drawings provided to us prior to inspection	URS	URS (Client Name)
Y & *Optional Z*	Building SYSTEM (W: wall; F: Flooring; C: Ceiling; T: TSI; M: Misc)	R B C	Rail Sample Barrier Sample Column Sample
xx	Sample number and layer	01 02	First Sample & Layer Second Sample & Layer

- ***Asbestos Findings***

Asbestos samples were analyzed in the KELLCO-MACS laboratory, by Polarized Light Microscopy, the EPA's recommended method. Copies of the full laboratory reports are attached. These valuable reports can be utilized as future reference to determine if a particular material was tested.

Photographs of sampled materials are included. Sample locations are noted on the attached not-to-scale drawing.

The determination of a material to be Asbestos Containing Material (ACM) was made either by direct sampling or by homogeneity with at least one positive sample of the same material.

Materials that tested **positive** for asbestos are:

Lab Sample #	Field Sample #	Field Description	Asbestos %
LD203229-1	URS-S-20	South 101, S. End - Grey - Soil / Rock	1.90% Chrysotile

Tested materials that were **none detected** for asbestos are:

Lab Sample #	Field Sample #	Field Description
L203179-1	URS-B-01	South 101, SE Base - Brown - Compact Board
L203179-2	URS-B-02	South 101, SE Base - Grey - Concrete
L203179-3	URS-C-03	South 101, SE Column - Grey - Concrete
L203179-4	URS-B-04	South 101, SW Base - Grey - Concrete
L203179-5	URS-R-05	South 101, SW Rail - Grey - Concrete
L203179-6	URS-B-06	South 101, SW Base - Grey - Concrete
L203179-7	URS-W-07	South 101, SW Wall - Grey - Paint
L203179-8	URS-W-08	North 101, SW Wall - Grey - Concrete Patch
L203179-9	URS-B-09	North 101, SE Base - Brown - Compact Board
L203179-10	URS-C-10	North 101, SE Column - Grey - Concrete
L203179-11	URS-B-11	North 101, N Base - Grey - Concrete
L203179-12	URS-B-12	North 101, NW Base - Grey - Concrete
L203179-13	URS-R-13	North 101, NW Rail - Grey - Concrete
L203179-14	URS-S-14	North 101, NW Reflex Sign - Grey - Sealant
L203179-15	URS-B-15	South 101, NE Base - Brown - Compact Board
L203179-16	URS-B-16	South 101, NE Base - Grey - Concrete Patch
L203179-17	URS-C-17	South 101, N End - Grey - Concrete
L203179-18	URS-C-18	South 101, NE Bridges - Grey - Concrete
L203179-19	URS-C-19	South 101, NE Column - Grey - Concrete

- ***CAM 17 Heavy Metals Findings***

Eight (4) paint samples were collected and submitted for CAM 17 Heavy Metals analysis to Macs Lab, Inc. using the EPA 6010B/3050 method.

CAM 17 paint samples were taken for the purpose of notifying the general contractor about the existence of heavy metals in the paint. This was done so the contractor, when choosing their work methods, could use proper engineering controls, properly trained personnel and proper personnel protective equipment (PPE) to perform the work.

These samples were analyzed using an ICP/MS, Extraction Method SW3050B TTLC. This method is **not** for the purpose of profiling any waste streams from this project. Profiling the waste streams (TCLP & STLC) will be the responsibility of the contractor performing the work.

A copy of the CAM 17 heavy metals analysis in paint and pertinent information relative to it is appended to this report.

	Lab Sample Number:	203141 -1	203141 -2	203141 -3	203141 -4
	Client Sample Number:	URS-1	URS-2	URS-3	URS-4
	Matrix:	Bulk	Bulk	Bulk	Bulk
	Extraction Type:	Acid	Acid	Acid	Acid
	Units:	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)
Sb	Antimony	29.22	17.76	84.79	39.69
As	Arsenic	21.17	17.00	13,752.68	13.47
Ba	Barium	223.98	183.16	16.13	655.31
Be	Beryllium	0.98	0.38	<0.01	0.16
Cd	Cadmium	4.73	2.15	4.15	2.65
Cr	Chromium	115.27	32.41	24.40	4,055.37
Co	Cobalt	12.23	6.67	2.30	8.48
Cu	Copper	68.59	32.28	14,686.26	20.70
Pb	Lead	1,511.72	661.60	660.24	17,432.18
Hg	Mercury	4.49	5.36	0.11	3.98
Mo	Molybdenum	7.42	4.43	10.19	6.02
Ni	Nickel	40.00	32.66	2.11	10.20
Se	Selenium	1,764.84	1,083.12	533.52	388.19
Ag	Silver	1.52	0.68	1.56	1.02
Tl	Thallium	25.63	15.11	3.67	15.49
V	Vanadium	30.82	26.67	0.37	8.92
Zn	Zinc	327.38	153.71	4,346.50	716.02

- ***Hexavalent Chrome (Chrome 6) Findings***

Sample #203141-4 a total of one (1) paint sample was submitted for Hexachrome analysis to McCampbell Analytical Laboratory the EPA 218.6 method.

A copy of this laboratory analytical report is appended to this report.

Lab ID #	Client ID #	Matrix	Extraction Type	Hexachrome PPM (mg/kg)
1005703-001A	203141-4	S	TOTAL	180 PPM

Regulatory Requirements

The Environmental Protection Agency (EPA) defines Asbestos Containing Material as any material that contains greater than 1% asbestos. Materials containing greater than 1% asbestos must be removed prior to demolition or renovation if they will be disturbed.

Friable asbestos containing material is any material that can be crushed or pulverized by hand pressure when dry, or materials that can be rendered to a crumbled, pulverized, or powdered state when dry by crushing, sanding, sawing, shot blasting, or through demolition or renovation activities.

As stated by NESHAP regulations, any material that contains less than 10% asbestos using the visual estimation method can be point counted with gravimetric reduction. The Point Counting method is a much more accurate analytical method for determining the percent of asbestos in a particular material. If the Point Count method determines that the material contains less than 1% asbestos, the material being analyzed can be disposed of as non-hazardous asbestos containing construction waste.

Removal or disturbance of material with any detectable amount of asbestos must be handled in accordance with OSHA regulations. Cal-OSHA registration is required if the material contains more than .1% asbestos (1/10th of a percent). If there is more than 100 feet (linear or square) of an asbestos containing material that will be abated or disturbed, a California State registered and licensed asbestos abatement contractor must perform the work. If there is less than 100 feet, the work does not require a licensed asbestos abatement contractor, but must still conform to Cal-OSHA regulations.

Removal or disturbance of any amount of lead paint requires adherence to the Cal-OSHA and CDPH regulations, including proper training and certification for workers and supervisors

The OSHA lead (1532) regulations require that a Negative Initial Determination for lead exposure be made with paint that contains greater than 0.06% (600 ppm) of lead.

Paint with less than 0.06% lead should still be treated within the OSHA guidelines, but with reasonable work practices should not generate OSHA action levels of lead exposure.

Building components with intact lead paint and no other hazardous materials can be disposed of as non-hazardous construction waste. Paint chips and debris must be disposed of as lead containing hazardous waste.

Comment Regarding All Asbestos Containing Materials:

Asbestos containing materials in good condition do not necessarily need to be removed unless they will be disturbed; they should however be respected.

Employees, contract workers and others should be advised not to drill, saw, scrape or otherwise disturb this material without taking precautionary measures appropriate to asbestos containing material.

Asbestos containing material should be removed prior to the renovation and must be removed prior to demolition.

Comment Regarding All Lead Containing Materials:

Lead is a known health hazard. Lead containing materials in good condition do not necessarily need to be removed if they are not disturbed; they should however be respected.

Painted surfaces that contain lead should be made known to contractors who may disturb them during their work. OSHA guidelines for workers in contact with lead paint apply if ANY detectable lead is found.

Anyone coming in contact with leaded paint should be advised not to disturb it without taking precautionary measures appropriate to avoid lead contamination or lead exposure.

Areas Needing Immediate Corrective Action

Asbestos (in any condition) and should be removed prior to renovation and must be removed prior to demolition of the survey site.

Analytical Procedures

- ***POLARIZED LIGHT MICROSCOPY (PLM)***

  Bulk samples were analyzed in accordance with U.S. EPA "Test Method for Determination of Asbestos in Bulk Building Materials, 1993," with inclusion of area percent estimates of the sample components. The use of the McCrone Color Dispersion Staining Technique supplements the analysis when considered useful by the analyst. The samples are prepared with refractive immersion oil and are examined under Polarized Light Microscopy (PLM). The accuracy of the visual estimate method is 1%.

  As per the standard "...The accuracy in the determination of the presence or absence of asbestos of greater than 1 area percent asbestos is greater than 99%." ASTM Committee D22.05, 1/18/88, Standard *Method of Testing for Asbestos Containing Materials by Polarized Light Microscopy*. If the sample matrix is reduced to minimize non-asbestos components, the detection limit can be mathematically enhanced, based on the amount of material remaining after matrix reduction. This method is called gravimetric reduction. This method involves ashing and chemical dissolution of the sample.

- ***ATOMIC ABSORPTION FOR LEAD***

  Paint samples were collected for atomic absorption (AA) analysis. The detection limit for each sample depends upon many factors including the sensitivity of the instrument and the sample size. In the KELLCO-MACS laboratory utilizing flame AA, the detection limit is normally .01% or 100 parts per million (ppm).

- ***CAM 17 Testing***

  CAM 17 Metals were tested by Macs Lab, Inc. using ICP-MS, Extraction Method SW3050B and Analytical Method 6010B/3050.

- ***Hexavalent Chrome (Chrome 6) Testing***

  Hexavalent Chrome was tested by McCampbell Analytical Laboratory using the TTLC Hexachrome by EPA 218.6 Analytical Method.

KELLCO-MACS Qualifications

KELLCO-MACS is a creative joint venture offering hazardous materials and AIHA laboratory analyses. Our credentials include:

- The KELLCO-MACS asbestos inspector is licensed with the State of California Department of Occupational Safety and Health (CAL-OSHA).

- The KELLCO-MACS lead inspector is licensed by the California Department of Public Health (CDPH)

- The laboratory accreditations include:

    - **NVLAP PLM** for Asbestos: NIST National Voluntary Laboratory Accreditation Program certificate of accreditation for bulk **asbestos** analysis by polarized light microscopy (Accreditation #101948-1).
    - **AIHA** Accreditation for **Industrial Hygiene** Analytical Laboratory for PCM, and AA for lead (Accreditation #101786).
    - **AIHA Analyst Proficiency (NIOSH PAT)** (Accreditation # 11172)
    - **AIHA ELLAP** Accreditation for Lead: Accreditation for the **Environmental Lead** Laboratory recognized by the EPA as meeting the requirements of the National Lead Laboratory Accreditation Program established under Title X (Lab ID #11109).
    - **ELAP PLM** for Asbestos: California Department of Health Services, Environmental Laboratory Accreditation Program, certificate for bulk asbestos analysis (Certificate #2027)
    - **USDA Soil** permit #39484

The following supporting documents are attached to this report:

- Laboratory analytical reports
- Photographs of sample locations
- Floor plan or sketch showing sample locations

Please call KELLCO if there are any questions and/or clarifications regarding this report. We look forward to working with you in the future.

Sincerely,

KELLCO-MACS

Tim C. Cannard CAC #94-1395, CDPH Lead #764
Senior Project Manager

Asbestos Definitions and Classifications

ACM	(Asbestos Containing Material) - Material containing more than 1% asbestos. ACM must be disposed as hazardous waste. Note: Federal OSHA and Cal-OSHA control materials containing any amount of asbestos.
ACBM	(Asbestos Containing Building Material) – AHERA/ASHARA term for material containing more than 1% asbestos in or on interior structural members or other structural components. Exceptions: Covered walkways, porticos and exterior HVAC TSI.
ACCM	(Asbestos Containing Construction Material) – California term for a manufactured construction material containing greater than .1% (one tenth of one percent) asbestos.
PACM	(Presumed Asbestos Containing Material) OSHA considers all TSI and surfacing materials installed prior to1980 to be ACM unless proven otherwise.
Friable	Asbestos Containing Material that can be crumbled pulverized or reduced to powder by hand pressure when dry.
NOA	Naturally Occurring Asbestos. CARB defines as having >.25% by point counting.

Categories of Asbestos Used BY EPA AHERA/ASHARA and OSHA/Cal-OSHA

TSI	(Thermal System Insulation) - "Thermal system insulation (TSI)" means ACM applied to pipes, fittings, boilers, breeching, tanks, ducts or other structural components to prevent heat loss or gain. "Thermal system insulation ACM" is thermal system insulation which contains more than 1% asbestos.
SURFACING (usually mixed on site at time of application)	"Surfacing material" means material that is sprayed, troweled-on or otherwise applied to surfaces (such as acoustical plaster on ceilings and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, and other purposes). "Surfacing ACM" means surfacing material which contains more than 1% asbestos. NOTE: OSHA/Cal-OSHA do not classify taping mud, floor tile mastic, stucco, leveling compound, and hard wall plasters or wall texturing as surfacing.
MISC.	All other ACM, including classify taping mud, floor tile mastic, stucco, leveling compound, and hard wall plasters or wall texturing as surfacing.

NESHAPS Categories for Asbestos (used by Air Quality Management Districts)

Category I	Cat I Non-friable Asbestos Containing Material refers to asbestos containing packing, gaskets, resilient floor covering, Galbestos, and asphalt roofing products containing more than 1% asbestos.
Category II	Cat II Non-friable Asbestos-Containing Material is any material that is not Cat I that contains greater than 1% asbestos.
RACM	"Regulated Asbestos-Containing Material." – Friable asbestos material (ACM) or a Category I non-friable ACM that has become friable OR a Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting or abrading OR Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations. RACM should be removed prior to renovation or demolition.

Characterization of Asbestos Containing Materials

Material	Estimated Quantity	TSI	Surfacing	Misc	RACM	Cat I	Cat II
Grey Rock / Soil	Unknown		X				X

MACS Lab, Inc.
3137 Diablo Ave
Hayward, CA 94545-2701

510-786-9751

Bulk Asbestos Analysis

Report

Method: EPA-600/M4-82-020

KELLCO Services
3137 Diablo Ave

Hayward CA 94545

Person to contact: Tim Cannard
Contact phone: 510-786-9751
FAX phone: 510-786-9625
Sampled by: Derrik
Sampled on: May 3, 2010
Analyzed on: May 5, 2010 at: 15:33
Corresponding invoice number: 203179

Analyst: _____
JPL (signature)

Laboratory manager: _____
(signature)

Job Number: 1004-28

Job Description: Bridges - Petaluma Blvd N. & S. Bridges - Petaluma, CA

Lab Sample Number	Client Sample Number and Description	Asbestos detected?	Fibers present	Remarks
L203179-1	URS-B-01 South 101, SE Base - Brown - Compact Board	**N.D.**	45%Cellulose	Brown compact board. Balance of sample is unspecified non-fibrous material.
L203179-2	URS-B-02 South 101, SE Base - Grey - Concrete	**N.D.**	< 1%Cellulose	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203179-3	URS-C-03 South 101, SE Column - Grey - Concrete	**N.D.**	< 1%Cellulose	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203179-4	URS-B-04 South 101, SW Base - Grey - Concrete	**N.D.**	< 1%Cellulose	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203179-5	URS-R-05 South 101, SW Rail - Grey - Concrete	**N.D.**	< 1%Cellulose	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203179-6	URS-B-06 South 101, SW Base - Grey - Concrete	**N.D.**	< 1%Cellulose	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203179-7	URS-W-07 South 101, SW Wall - Grey - Paint	**N.D.**	< 1%Cellulose	Gray paint. Balance of sample is unspecified non-fibrous material.

MACS Lab, Inc.
3137 Diablo Ave
Hayward, CA 94545-2701

510-786-9751

Bulk Asbestos Analysis

Report

Lab Sample Number	Client Sample Number and Description	Asbestos detected?	Fibers present	Remarks
L203179-8	URS-W-08 North 101, SW Wall - Grey - Concrete Patch	**N.D.**	< 1%Cellulose	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203179-9	URS-B-09 North 101, SE Base - Brown - Compact Board	**N.D.**	45%Cellulose	Brown compact board. Balance of sample is unspecified non-fibrous material.
L203179-10	URS-C-10 North 101, SE Column - Grey - Concrete	**N.D.**	< 1%Cellulose	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203179-11	URS-B-11 North 101, N Base - Grey - Concrete	**N.D.**	< 1%Cellulose	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203179-12	URS-B-12 North 101, NW Base - Grey - Concrete	**N.D.**	< 1%Cellulose	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203179-13	URS-R-13 North 101, NW Rail - Grey - Concrete	**N.D.**	< 1%Cellulose	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203179-14	URS-S-14 North 101, NW Reflex Sign - Grey - Sealant	**N.D.**	< 1%Cellulose	Gray sealant. Balance of sample is unspecified non-fibrous material.
L203179-15	URS-B-15 South 101, NE Base - Brown - Compact Board	**N.D.**	45%Cellulose	Brown compact board. Balance of sample is unspecified non-fibrous material.
L203179-16	URS-B-16 South 101, NE Base - Grey - Concrete Patch	**N.D.**	< 1%Cellulose	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203179-17	URS-C-17 South 101, N End - Grey - Concrete	**N.D.**	< 1%Cellulose	Gray concrete. Balance of sample is unspecified non-fibrous material.

MACS Lab, Inc.
3137 Diablo Ave
Hayward, CA 94545-2701

510-786-9751

Bulk Asbestos Analysis

Report

Lab Sample Number	Client Sample Number and Description	Asbestos detected?	Fibers present	Remarks
L203179-18	URS-C-18 South 101, NE Bridges - Grey - Concrete	**N.D.**	< 1% Cellulose	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203179-19	URS-C-19 South 101, NE Column - Grey - Concrete	**N.D.**	< 1% Cellulose	Gray concrete. Balance of sample is unspecified non-fibrous material.

MACS Lab, Inc.
3137 Diablo Ave
Hayward, CA 94545-2701

510-786-9751

Bulk Asbestos Analysis

QA Report

Method: EPA-600/M

KELLCO Services
3137 Diablo Ave

Hayward CA 94545

Laboratory manager: _____
(signature)

Lab Sample Number	Client Sample Number and Description	Asbestos detected?	Fibers present	Remarks
Blank sample		**N.D.**	No fibers	
		PC*		
L203179-17	URS-C-17 South 101, N End - Grey - Concrete	**N.D.**	No Fibers	Concrete. Balance of sample is unspecified non-fibrous material.

End of report.

CLIENT	JOBSITE
URS Corporation 55 South Market Street 1500 San Jose CA 95113	Bridges Petaluma Blvd N. & S. Bridges Petaluma CA

KELLCO-MACS JOB#: **1004-28** LAB LOGIN # L203179

COLLECTED BY: Derrik

COLLECTED DATE 5·3·10

TURN AROUND TIME: Normal 4 8 24 48 5-DAY

RESULTS NEEDED BY

CIRCLE TYPE OF BULK ANALYSIS

PLM **LEAD PAINT** **LEAD WIPE** **NON VIABLE MOLD** **VIABLE MOLD** **eCOLI** **OTHER**

SAMPLES REC'D 19 ANALYZE TO FIRST POSITIVE YES NO

REPORT RESULTS TO PROJECT MANAGER: Tim Cannard

NOTES & COMMENTS:

CHAIN OF CUSTODY & SAMPLE SUBMITAL FORM PAGE____ OF ____ KELLCO-MACS JOB#: **1004-28** Bridges

FIELD NUMBER	LOCATION (bldg, rm#, area)	COLOR	MATERIAL or SUBSTRATE (ft w/ size, mastic, tjc, etc.)	NOTES: Like condition, damage, quantity, inside what, beneath what? direction in building (N,S,E,W) etc.)
URS-B-01	South 101. SE base	brown	compact board	
B-02	|	grey	concrete	
C-03	South 101. SE column	grey	concrete	
B-04	South 101. SW base	grey	concrete	
R-05	SW rail	grey	concrete	
B-06	SW base	grey	concrete	
W-07	SW wall	grey	paint	
W-08	North 101. SE wall	grey	concrete patch	
B-09	SE base	brown	compact board	

RELEASED BY	DATE	TIME	RECEIVED BY	DATE	TIME
[signature]	5·3·10		Danielle Nichols	5/4/10	3:55

CHAIN OF CUSTODY & SAMPLE SUBMITAL FORM PAGE_____ OF ____

KELLCO-MACS JOB#: **1004-28** L203179
Bridges

FIELD NUMBER	LOCATION (bldg, rm#, area)	COLOR	MATERIAL or SUBSTRATE (ft w/ size, mastic, tjc, etc.)	NOTES: Like condition, damage, quantity, inside what, beneath what? direction in building (N,S,E,W) etc.)
URS - C-10	North 101. SE column	grey	concrete	
B-11	N. base	grey	concrete	
B-12	NW base	grey	concrete	
R-13	NW rail	grey	concrete	
S-14	NW. reflex sign	grey	sealant	
B-15	south 101. NE. base	brown	compact board	
B-16	NE. base	grey	concrete patch	
C-17	N. end	grey	concrete	
C-18	NE. ~~column~~ bridges	grey	concrete	
C-19	NE. column	grey	concrete	
S-20	south 101. S. end	grey	Soil / Rock	

RELEASED BY	DATE	TIME	RECEIVED BY	DATE	TIME
[illegible]	5-3-10		Danille Nichols	5/4/10	3:55

MACS Lab, Inc.
3137 Diablo Ave
Hayward, CA 94545-2701

510-786-9751

Bulk Asbestos Analysis

Report

CARB Method 435

KELLCO Services
3137 Diablo Ave

Hayward CA 94545

Person to contact: Tim Cannard
Contact phone: 510-786-9751
FAX phone: 510-786-9625
Sampled by: Derrik Quach
Sampled on: May 3, 2010
Analyzed on: May 10, 2010 at: 09:17
Corresponding invoice number: 203229

Analyst: _____ (signature)

Laboratory manager: _____ (signature)

Job Number: 1004-28

Job Description: Bridges - Petaluma Blvd N. & S. Bridges, Petaluma, CA

Lab Sample Number	Client Sample Number and Description	Asbestos detected?	Fibers present	Remarks
LD203229-1	URS-S-20 South 101, S. End - Grey - Soil / Rock	**Yes**	1.90% Chrysotile* 9.00% Picrolite/Anti PC*	Gray/green rock. 435 CARB 1000 Point Counted Sample Analysis.

* Chrysotile, Amosite, Crocidolite, Tremolite, Actinolite, and Anthophyllite are asbestos fibers. N.D.=None Detected PC =Point Counted

This report shall not be reproduced except in full without written approval of MACS Lab, Inc. This report relates only to the items tested. Samples will be destroyed after one month. Test per California Air Resources Board method 435 "Determination of Asbestos Content of Serpentine Aggregate June 6, 1991". Percentages by 400 point count. MACS Lab is an accredited laboratory of the National Voluntary Laboratory Accreditation Program (NVLAP) and is laboratory number 101948. No product endorsement by NVLAP or any agency of the U.S. Government may be claimed as a result of this analysis. Calif Dept of Health ELAP #2027. This method is not reliable for analysis of materials when fiber size is less than 10μ. Method Detection limit for asbestos is 0.25% per CA law. See QC page attached to this page for blank and retest data .

LD203229

CLIENT	JOBSITE
URS Corporation 55 South Market Street 1500 San Jose CA 95113	Bridges Petaluma Blvd N. & S. Bridges Petaluma CA

KELLCO-MACS JOB#: **1004-28** LAB LOGIN # ~~1203179~~

COLLECTED BY: Derrik

COLLECTED DATE 5·3·10

TURN AROUND TIME: Normal 4 8 24 48 5-DAY

RESULTS NEEDED BY

CIRCLE TYPE OF BULK ANALYSIS

RLM LEAD PAINT LEAD WIPE NON VIABLE MOLD VIABLE MOLD eCOLI OTHER

SAMPLES REC'D 19 ANALYZE TO FIRST POSITIVE YES NO

REPORT RESULTS TO PROJECT MANAGER: Tim Cannard

NOTES & COMMENTS:

CHAIN OF CUSTODY & SAMPLE SUBMITAL FORM PAGE ____ OF ____

KELLCO-MACS JOB#: **1004-28**
Bridges

FIELD NUMBER	LOCATION (bldg, rm#, area)	COLOR	MATERIAL or SUBSTRATE (ft w/ size, mastic, tjc, etc.)	NOTES: Like condition, damage, quantity, inside what, beneath what? direction in building (N,S,E,W) etc.)
URS-B-01	South 101. SE base	brown	compact board	
B-02	|	grey	concrete	
C-03	South 101. SE column	grey	concrete	
B-04	South 101. SW base	grey	concrete	
R-05	| SW rail	grey	concrete	
B-06	| SW base	grey	concrete	
W-07	| SW wall	grey	paint	
W-08	North 101. ~~SW~~ SE wall	grey	concrete patch	
B-09	| SE base	brown	compact board	

RELEASED BY	DATE	TIME	RECEIVED BY	DATE	TIME
[signature]	5·3·10		Danielle Nichols	5/4/10	3:55

LD 203229

CHAIN OF CUSTODY & SAMPLE SUBMITAL FORM PAGE_____ OF _____

KELLCO-MACS JOB#: **1004-28** ~~L203179~~
Bridges

FIELD NUMBER	LOCATION (bldg, rm#, area)	COLOR	MATERIAL or SUBSTRATE (ft w/ size, mastic, tjc, etc.)	NOTES: Like condition, damage, quantity, inside what, beneath what? direction in building (N,S,E,W) etc.)
URS - C-10	North 101. SE column	grey	concrete	
B-11	N. base	grey	concrete	
B-12	NW base	grey	concrete	
R-13	NW rail	grey	concrete	
S-14	NW. reflex sign	grey	sealant	
B-15	south 101. NE. base	brown	compact board	
B-16	NE. base	grey	concrete patch	
C-17	N. end	grey	concrete	
C-18	NE. ~~column~~ bridges	grey	concrete	
C-19	NE. column	grey	concrete	
S-20	south 101. S. end	grey	Soil / Rock	

RELEASED BY	DATE	TIME	RECEIVED BY	DATE	TIME
[illegible]	5.3.10		Danille Nichols	5/4/10	3:55

MACS Lab Incorporated
Analytical and Environmental Services
3137 Diablo Avenue, Hayward, Ca 94545-2701 (510) 786-9751 * (510) 786-9625 Fax * www.macslab.com

CAM-17 Bulk Materials Analysis Report - Method: EPA 6010B/3050

KELLCO Services
3137 Diablo Avenue
Hayward, CA 94545

Contact: Tim Cannard
Phone: (510) 786-9751
Email: mailbox3137@kellcomacs.com
Job #: 1004-28

Laboratory Number: 203141
Sampled By: Derick
Sampled On: May 3, 2010
Submitted On: May 4, 2010
Analyzed On: May 7, 2010
Reported On: May 7, 2010
SOP: CAM17
Sample Type: Bulk

Job Description: Bridges-Petaluma Blvd N. & S. Bridges- Petaluma, CA

	Lab Sample Number:	203141 -1	203141 -2	203141 -3	203141 -4	
	Client Sample Number:	URS-1	URS-2	URS-3	URS-4	
	Matrix:	Bulk	Bulk	Bulk	Bulk	
	Extraction Type:	Acid	Acid	Acid	Acid	
	Units:	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)	
Sb	Antimony	29.22	17.76	84.79	39.69	
As	Arsenic	21.17	17.00	13,752.68	13.47	
Ba	Barium	223.98	183.16	16.13	655.31	
Be	Beryllium	0.98	0.38	<0.01	0.16	
Cd	Cadmium	4.73	2.15	4.15	2.65	
Cr	Chromium	115.27	32.41	24.40	4,055.37	
Co	Cobalt	12.23	6.67	2.30	8.48	
Cu	Copper	68.59	32.28	14,686.26	20.70	
Pb	Lead	1,511.72	661.60	660.24	17,432.18	
Hg	Mercury	4.49	5.36	0.11	3.98	
Mo	Molybdenum	7.42	4.43	10.19	6.02	
Ni	Nickel	40.00	32.66	2.11	10.20	
Se	Selenium	1,764.84	1,083.12	533.52	388.19	
Ag	Silver	1.52	0.68	1.56	1.02	
Tl	Thallium	25.63	15.11	3.67	15.49	
V	Vanadium	30.82	26.67	0.37	8.92	
Zn	Zinc	327.38	153.71	4,346.50	716.02	

Analyst: _____ (Signature)

Laboratory Manager: _____ (Signature)

NOTICE

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CLIENT	JOBSITE
URS Corporation 55 South Market Street 1500 San Jose CA 95113	Bridges Petaluma Blvd N. & S. Bridges Petaluma CA

KELLCO-MACS JOB#: **1004-28** LAB LOGIN # I203141

COLLECTED BY: Derek

COLLECTED DATE 5·5·10

TURN AROUND TIME: Normal 4 8 24 48 5-DAY

RESULTS NEEDED BY

CIRCLE TYPE OF BULK ANALYSIS

PLM LEAD PAINT LEAD WIPE NON VIABLE MOLD VIABLE MOLD eCOLI OTHER Cam-17

SAMPLES REC'D 4 ANALYZE TO FIRST POSITIVE YES NO

REPORT RESULTS TO PROJECT MANAGER: Tim Cannard

NOTES & COMMENTS:

CHAIN OF CUSTODY & SAMPLE SUBMITAL FORM PAGE____ OF ____ KELLCO-MACS JOB#: **1004-28** Bridges

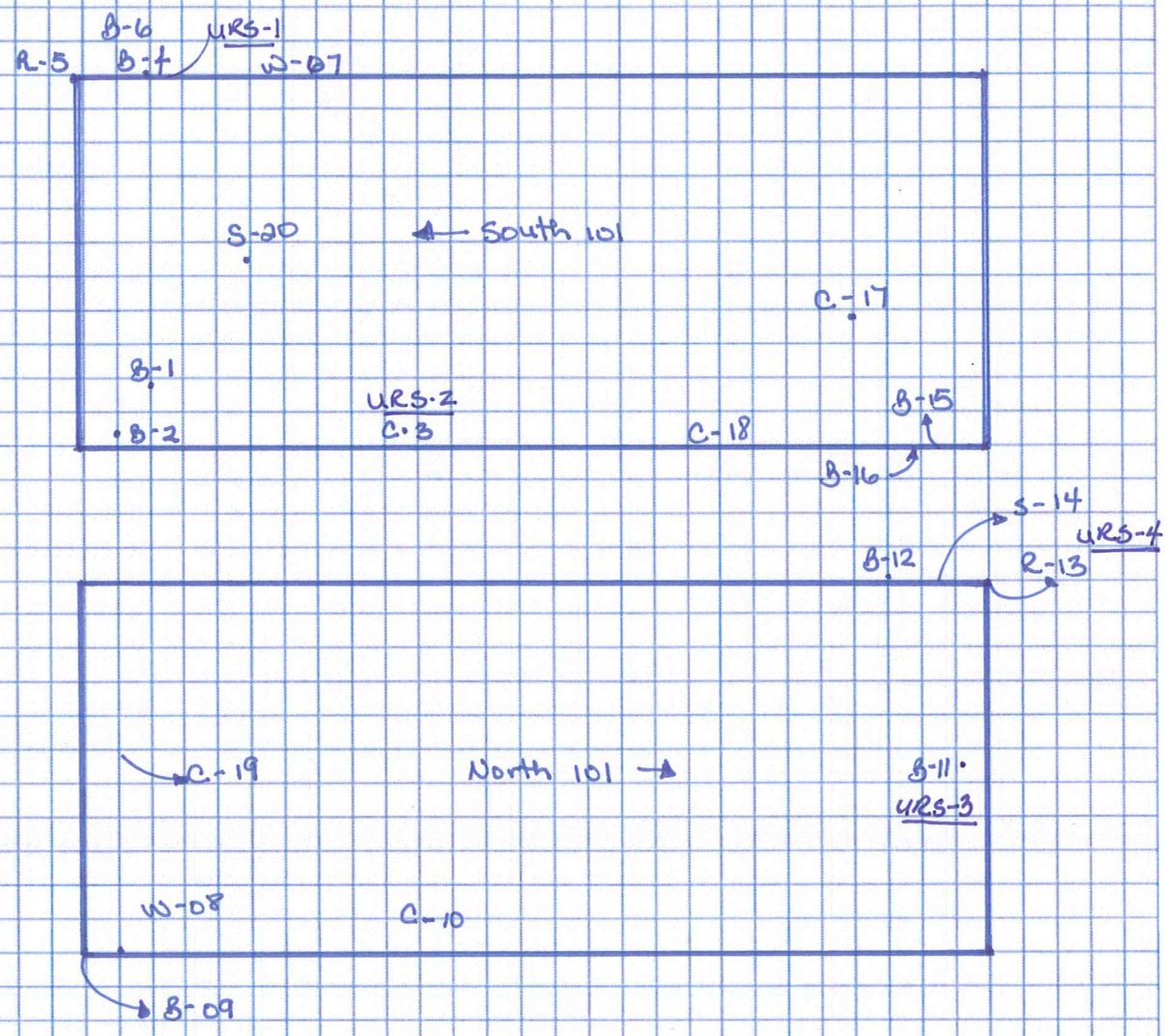
FIELD NUMBER	LOCATION (bldg, rm#, area)	COLOR	MATERIAL or SUBSTRATE (ft w/ size, mastic, tjc, etc.)	NOTES: Like condition, damage, quantity, inside what, beneath what? direction in building (N,S,E,W) etc.)
URS-1	South 101 - SW corner	Cream	paint on ~~cement~~	
-2	South 101 - SE column	grey	"	
-3	North 101 - N base	green	wood	
-4	North 101 - NW end	yell	paint stipe	

RELEASED BY	DATE	TIME	RECEIVED BY	DATE	TIME
[signature]	5·3·10		Danielle Nichols	5/4/10	8:00

KELLCO Job # 1004-28
Client: URS

Jobsite: Petaluma Blvd S & Bridges

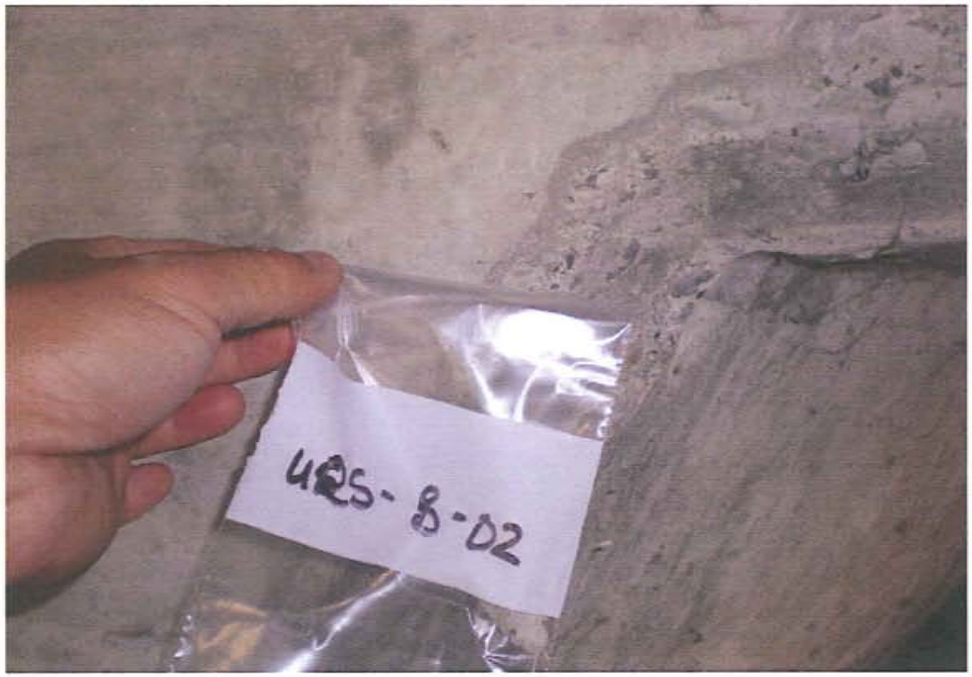
K E L L C O



URS- CAM 17 location

15FT 5IN

AHEAD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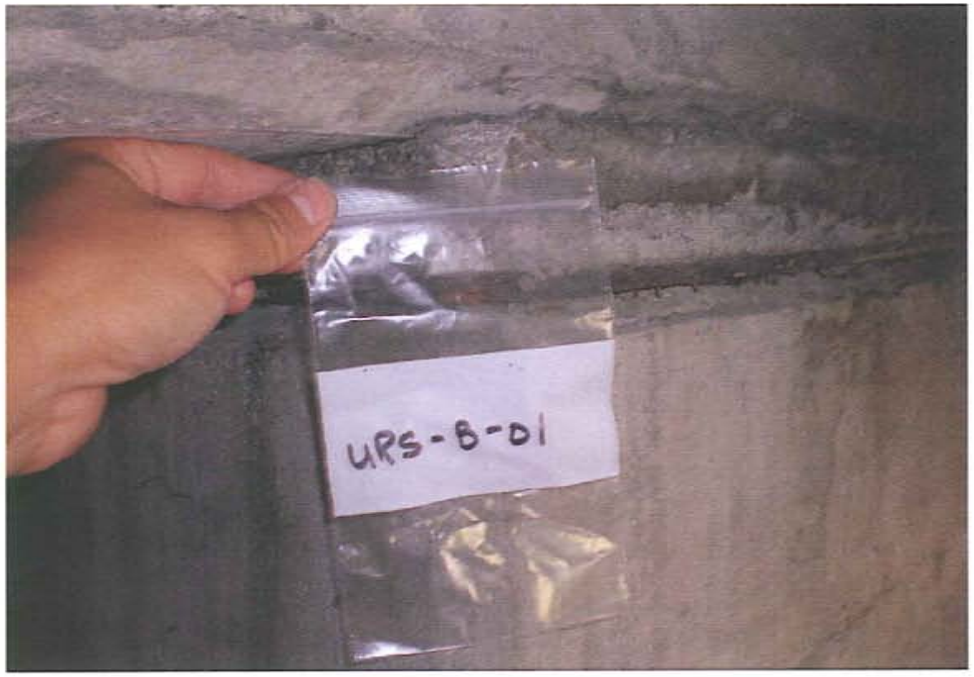
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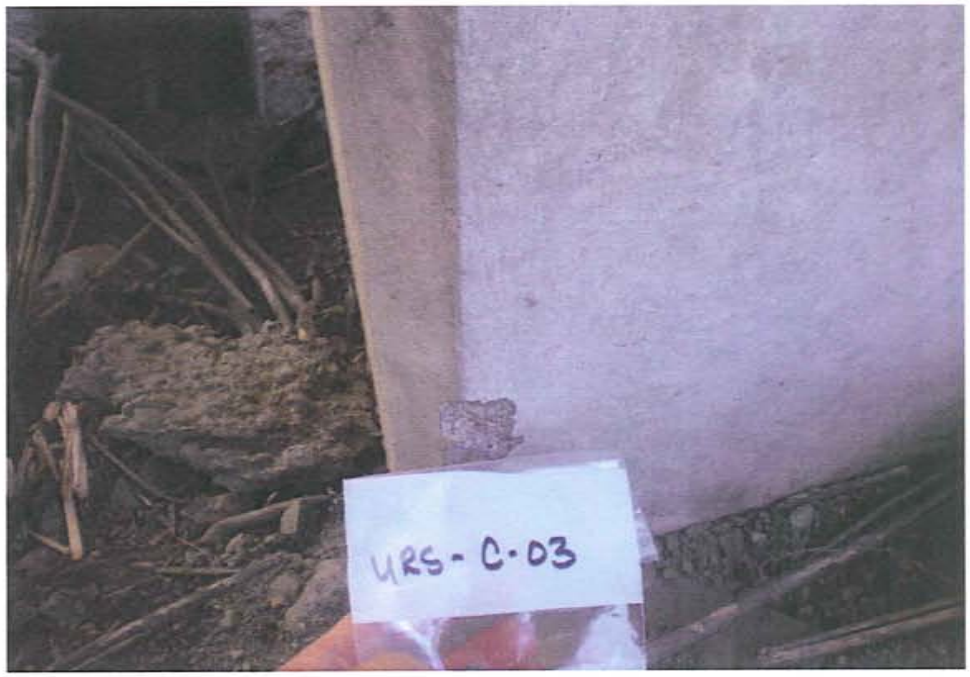
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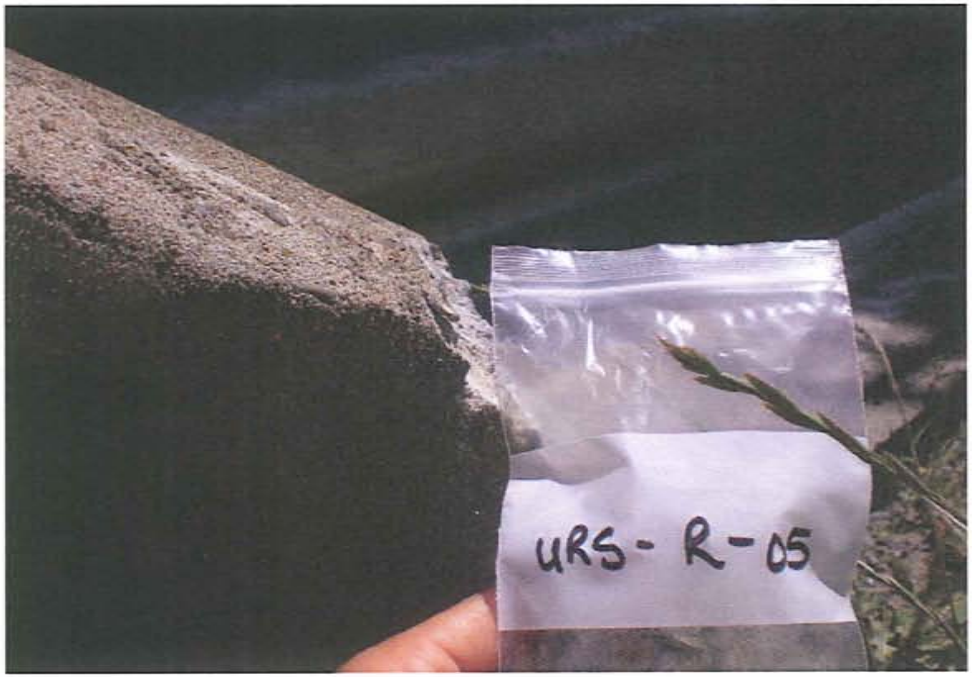
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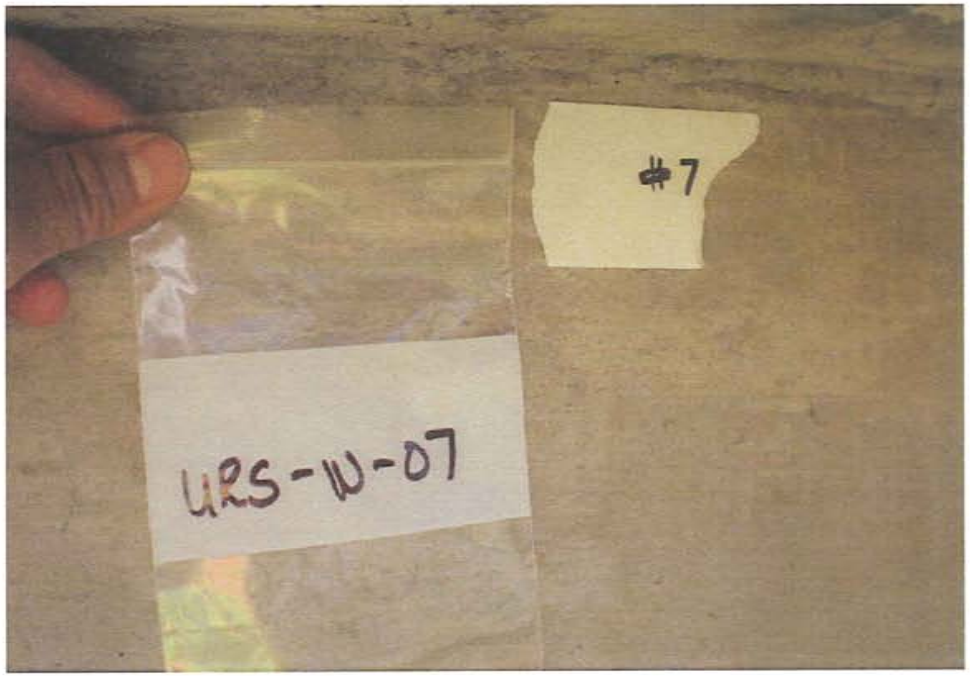

#7
URS-W-07

URS-B-04

URS-B-06

URS-W-08

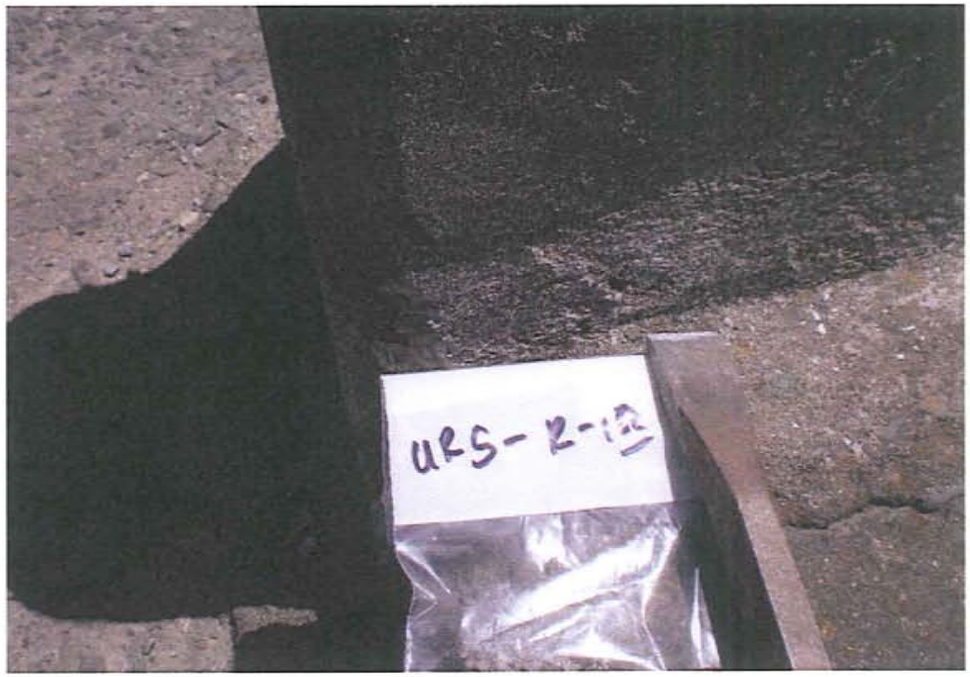
URS-C-10

URS-1

URS-B-09

URS-B-11

URS-2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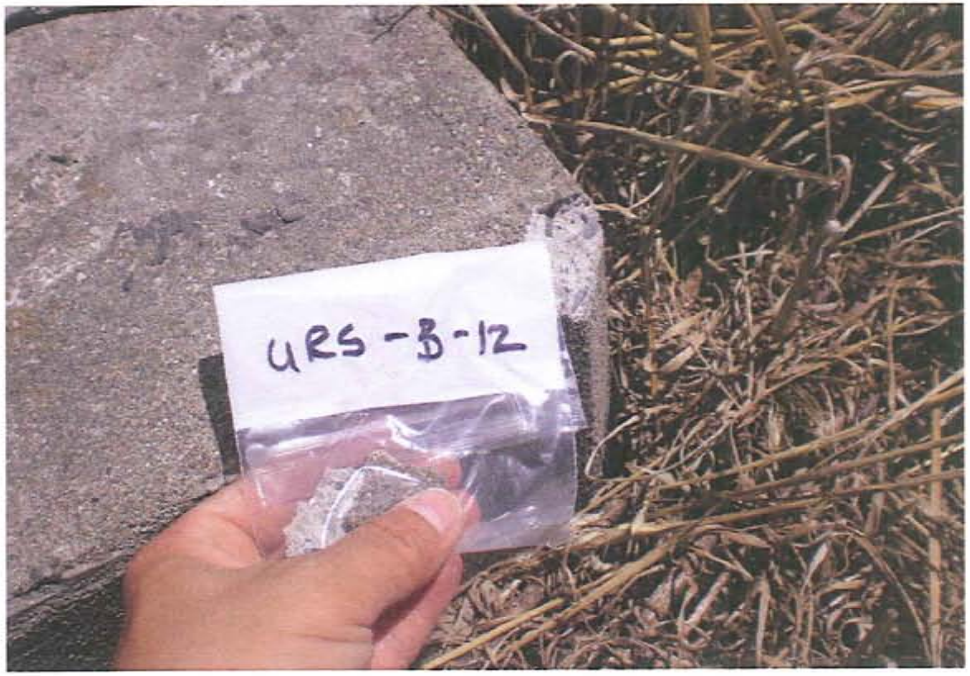
URS-3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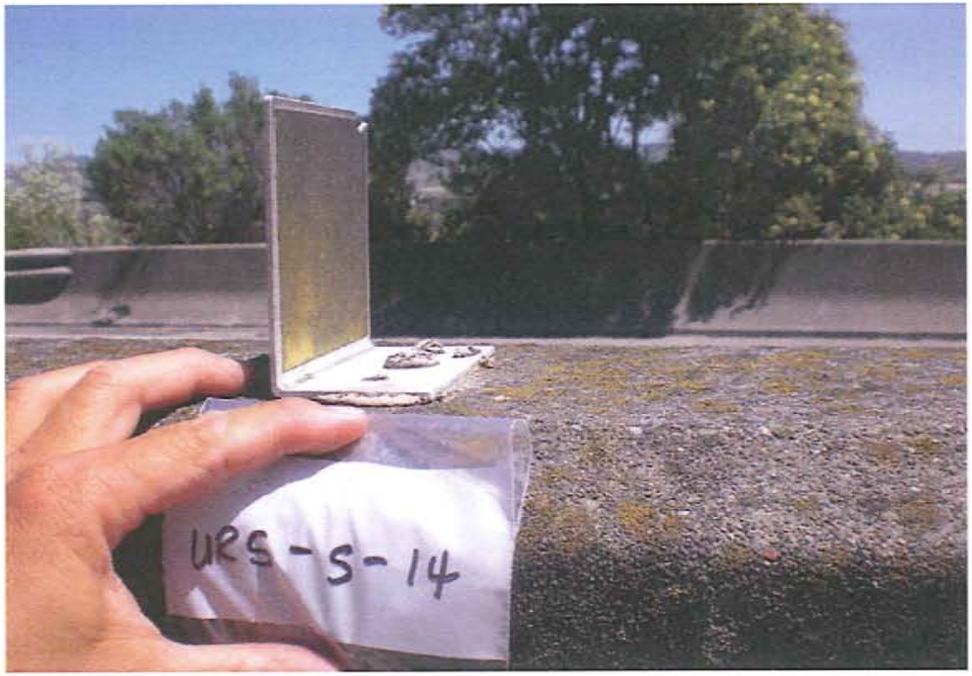
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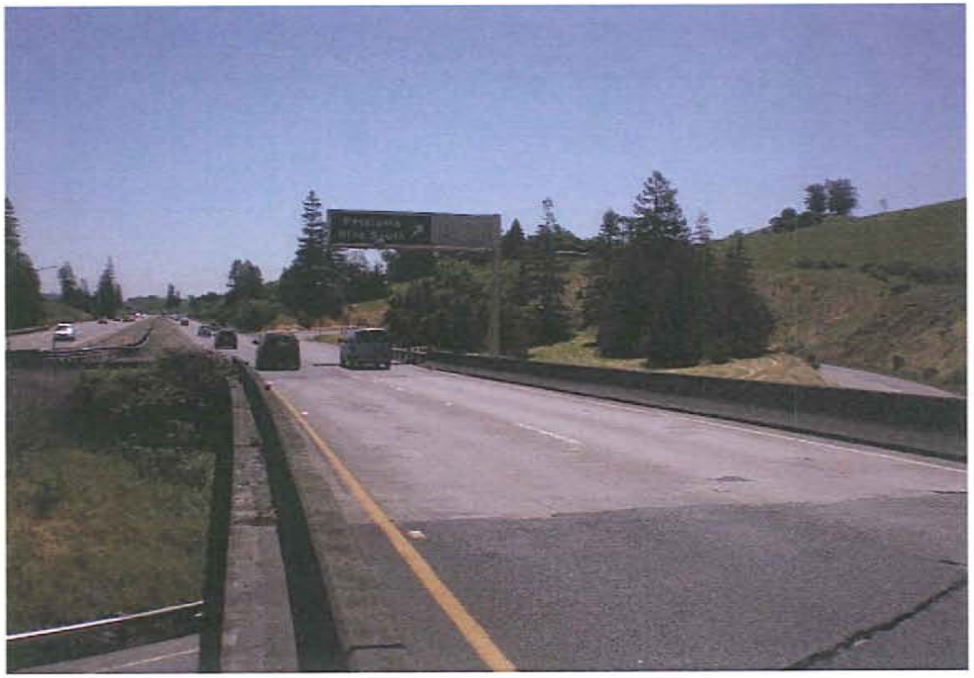

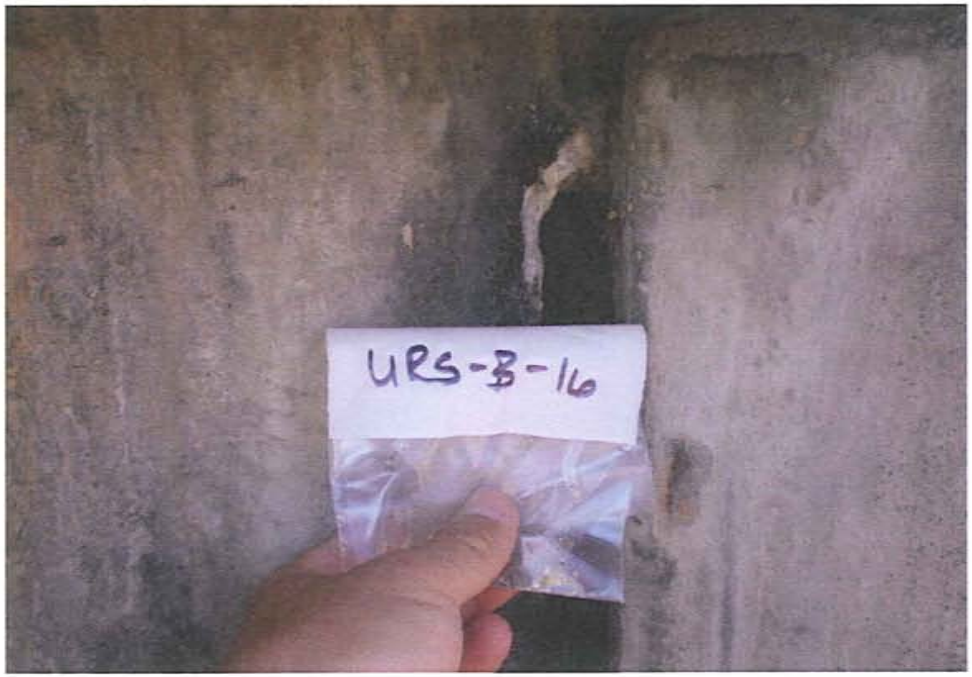
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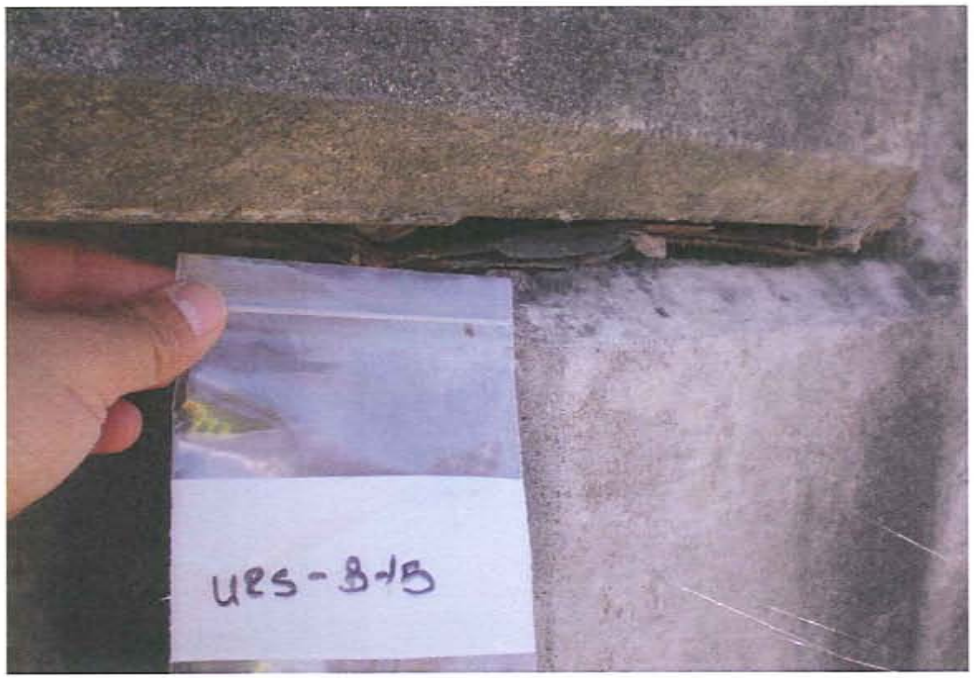
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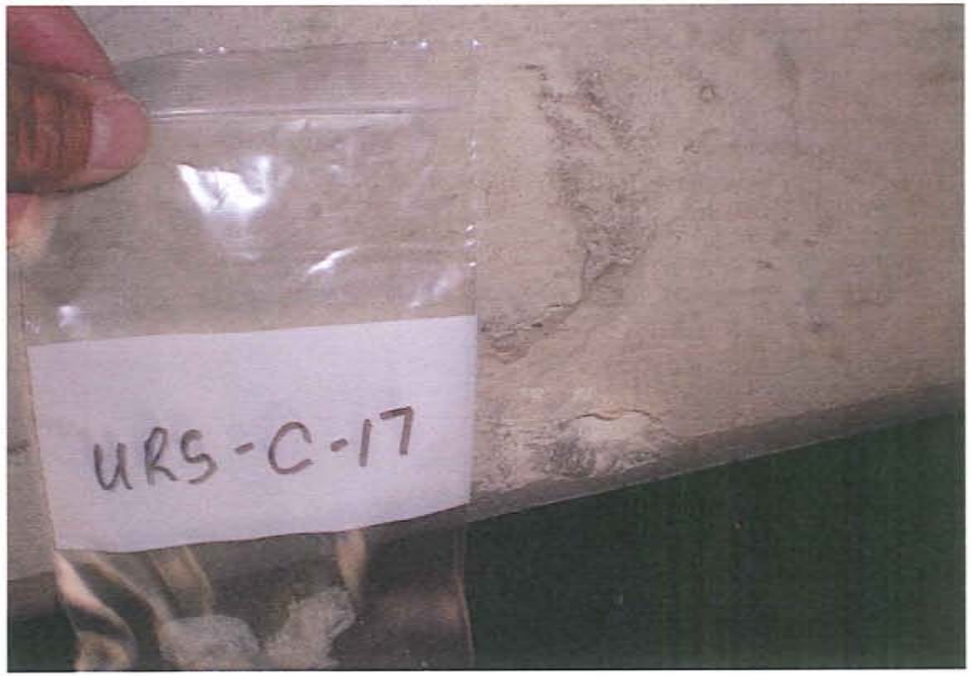
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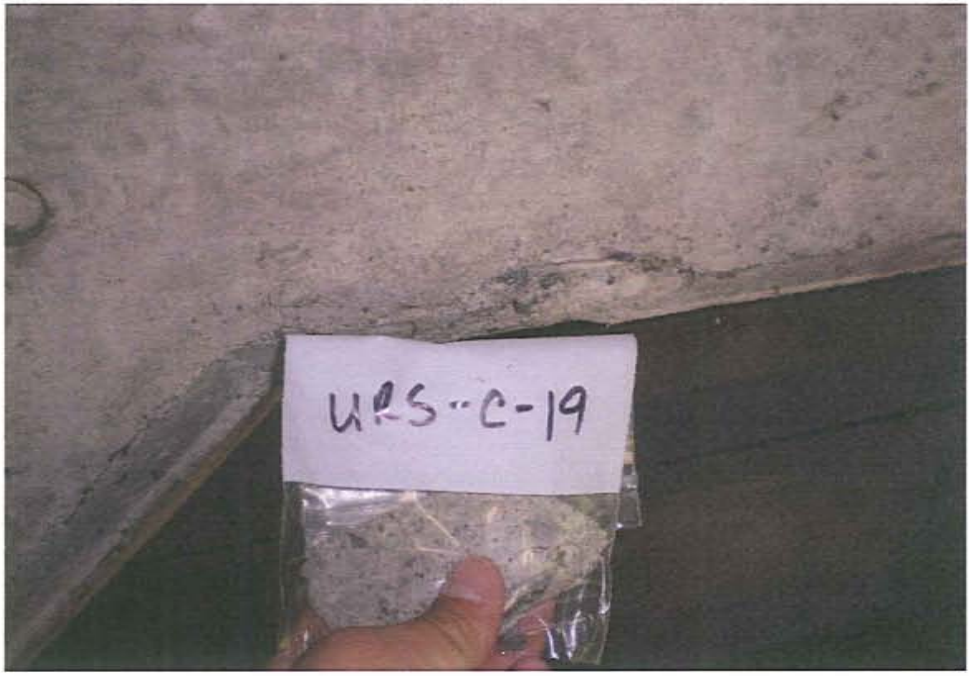
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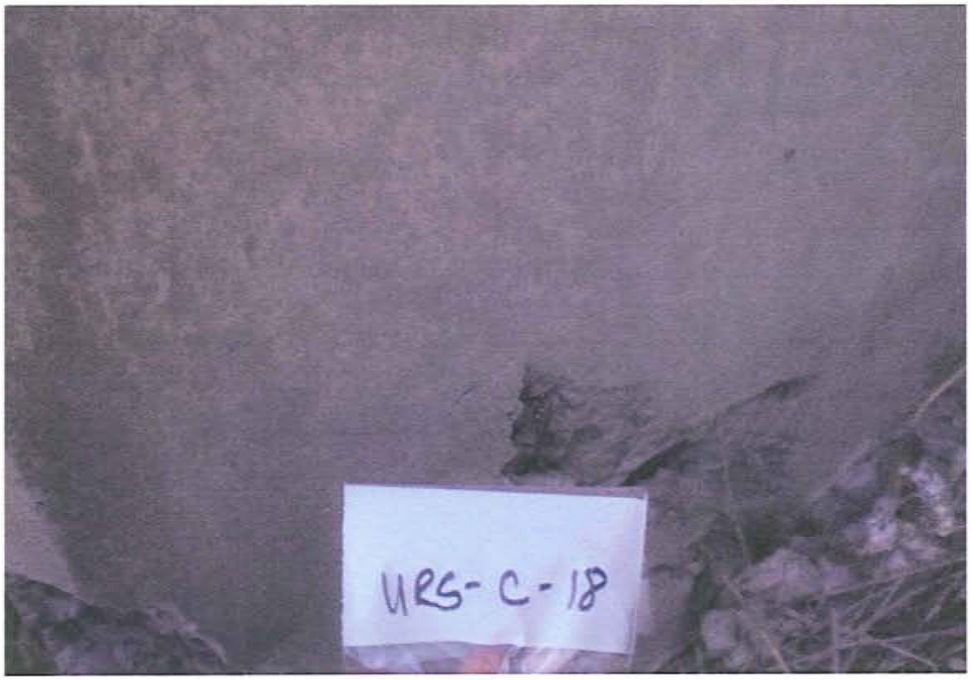
URS-C-18

A Creative Joint Venture For Better Environmental Solutions

US 101 and SH 116 Bridge
Petaluma, CA

KELLCO-MACS Job #1004-29

Pre-Demolition
Asbestos and CAM 17 Heavy Metals Report

for

URS Corporation
55 South Market Street
Suite #1500
San Jose, CA 95113

June 8, 2010

A Creative Joint Venture For Better Environmental Solutions

Pre-Demolition
Asbestos & CAM 17 Heavy Metals Report

Date:	June 8, 2010
KELLCO-MACS Job #:	1004-29
Client:	Mr. Patrick Waltz URS Corporation 55 South Market Street Suite #1500 San Jose, CA 95113
Location:	US 101 and SH 116 Bridge Petaluma, CA
Date of Inspection:	May 4, 2010
Inspectors:	Derrik Quach SST #02-3214, CDPH Lead #2280 Tim Cannard CAC #94-1395, CDPH Lead #764
Description Of The Inspected Area:	The inspection was conducted on a bridge located in Petaluma, CA.

Background

This is a pre-demolition asbestos and CAM 17 Heavy Metals inspection located in Petaluma, CA.

Synopsis

Asbestos was **NOT** found in the tested materials.

CAM 17 Heavy Metals were elevated in **ALL** of the paint samples taken.

Sample #203235-2 came back with elevated levels of Chromium. It was further analyzed by an accredited laboratory for Hexachrome (Chrome 6) by EPA 218.6 method. The result from this test was 33 PPM (mg/kg).

Chrome 6 is a listed carcinogen and **ALL** of the sample results should be shared with any contractor and personnel working within this area in order to be OSHA Compliant.

About the Inspection

The inspection performed was both visual and tactile. Samples were taken of suspect materials located at the exterior of the survey area.

The inspection was at the direction of the client. If any non-sampled materials are uncovered, these should be submitted for analysis.

The following numbering convention was used for this inspection:

LETTER	STANDS FOR	EXAMPLE	MEANING
XX	Building DESIGNATION based on information provided on drawings provided to us prior to inspection	URS	URS (Client Name)
Y & *Optional Z*	Building SYSTEM (W: wall; F: Flooring; C: Ceiling; T: TSI; M: Misc)	R B C	Rail Sample Barrier Sample Column Sample
xx	Sample number and layer	01 02	First Sample & Layer Second Sample & Layer

- ***Asbestos Findings***

Asbestos samples were analyzed in the KELLCO-MACS laboratory, by Polarized Light Microscopy, the EPA's recommended method. Copies of the full laboratory reports are attached. These valuable reports can be utilized as future reference to determine if a particular material was tested.

Photographs of sampled materials are included. Sample locations are noted on the attached not-to-scale drawing.

The determination of a material to be Asbestos Containing Material (ACM) was made either by direct sampling or by homogeneity with at least one positive sample of the same material.

Materials that tested **positive** for asbestos are: **NONE**

Tested materials that were **none detected** for asbestos are:

Lab Sample #	Field Sample #	Field Description
L203237-1	URS-R-01	101 North, rail at northeast / grey concrete
L203237-2	URS-B-02	101 North, barrier wall at northeast / grey concrete
L203237-3	URS-B-03	101 North, board at northeast / brown compact board
L203237-4	URS-B-04	101 North, base at northeast / grey concrete
L203237-5	URS-C-05	101 North, column, north / grey concrete
L203237-6	URS-B-06	101 South, barrier wall decor, northeast / grey concrete
L203237-7	URS-B-07	101 South, barrier wall, northeast / grey concrete
L203237-8	URS-B-08	101 South, base at northeast / grey concrete
L203237-9	URS-A-09	101 South, asphalt at northeast / black asphalt
L203237-10	URS-S-10	101 South, reflexer, debris / grey sealant (mastic)
L203237-11	URS-R-11	101 North, rail at southwest / grey concrete
L203237-12	URS-B-12	101 North, board at southwest / brown compact board
L203237-13	URS-B-13	101 North, bridge at southwest / grey concrete
L203237-14	URS-C-14	101 North, 2nd column to south end / concrete
L203237-15	URS-M-15	101 North, rock/soil between bridges / purple/brown rock/soil
L203237-16	URS-A-16	101 South, asphalt southwest / black asphalt
L203237-17	URS-R-17	101 South, rail/barrier decor, southwest / grey concrete
L203237-18	URS-M-18	101 South, board, southwest / brown compact board
L203237-19	URS-B-19	101 South, bridge, southwest / grey concrete
L203237-20	URS-C-20	101 South, 2nd column, southwest / grey concrete
L203237-21	URS-B-21	101 South, column base adjacent to railroad / grey concrete

- ***CAM 17 Heavy Metals Findings***

Eight (3) paint samples were collected and submitted for CAM 17 Heavy Metals analysis to Macs Lab, Inc. using the EPA 6010B/3050 method.

CAM 17 paint samples were taken for the purpose of notifying the general contractor about the existence of heavy metals in the paint. This was done so the contractor, when choosing their work methods, could use proper engineering controls, properly trained personnel and proper personnel protective equipment (PPE) to perform the work.

These samples were analyzed using an ICP/MS, Extraction Method SW3050B TTLC. This method is **not** for the purpose of profiling any waste streams from this project. Profiling the waste streams (TCLP & STLC) will be the responsibility of the contractor performing the work.

A copy of the CAM 17 heavy metals analysis in paint and pertinent information relative to it is appended to this report.

	Lab Sample Number:	203235 -1	203235 -2	203235 -3
	Client Sample Number:	URS-1	URS-2	URS-3
	Matrix:	Bulk	Bulk	Bulk
	Extraction Type:	Acid	Acid	Acid
	Units:	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)
Sb	Antimony	27.59	9.45	7.22
As	Arsenic	7.54	4.97	1.61
Ba	Barium	45.62	1,493.00	2,937.92
Be	Beryllium	0.25	0.16	1.20
Cd	Cadmium	1.47	0.93	2.28
Cr	Chromium	13.14	502.97	17.20
Co	Cobalt	2.61	3.02	69.71
Cu	Copper	10.28	12.10	210.13
Pb	Lead	518.53	2,008.70	127.67
Hg	Mercury	6.82	3.00	2.84
Mo	Molybdenum	5.31	4.06	5.57
Ni	Nickel	6.70	5.37	6.62
Se	Selenium	1,597.73	157.68	342.74
Ag	Silver	<0.01	0.87	1.80
Tl	Thallium	18.28	4.21	6.17
V	Vanadium	17.10	6.48	12.57
Zn	Zinc	131.59	1,452.67	1,229.62

- ***Hexavalent Chrome (Chrome 6) Findings***

Sample #203235-2 a total of one (1) paint sample was submitted for Hexachrome analysis to McCampbell Analytical Laboratory the EPA 218.6 method.

A copy of this laboratory analytical report is appended to this report.

Lab ID #	Client ID #	Matrix	Extraction Type	Hexachrome PPM (mg/kg)
1005704-001A	203235-2	S	TOTAL	33 PPM

Regulatory Requirements

The Environmental Protection Agency (EPA) defines Asbestos Containing Material as any material that contains greater than 1% asbestos. Materials containing greater than 1% asbestos must be removed prior to demolition or renovation if they will be disturbed.

Friable asbestos containing material is any material that can be crushed or pulverized by hand pressure when dry, or materials that can be rendered to a crumbled, pulverized, or powdered state when dry by crushing, sanding, sawing, shot blasting, or through demolition or renovation activities.

As stated by NESHAP regulations, any material that contains less than 10% asbestos using the visual estimation method can be point counted with gravimetric reduction. The Point Counting method is a much more accurate analytical method for determining the percent of asbestos in a particular material. If the Point Count method determines that the material contains less than 1% asbestos, the material being analyzed can be disposed of as non-hazardous asbestos containing construction waste.

Removal or disturbance of material with any detectable amount of asbestos must be handled in accordance with OSHA regulations. Cal-OSHA registration is required if the material contains more than .1% asbestos ($1/10^{th}$ of a percent). If there is more than 100 feet (linear or square) of an asbestos containing material that will be abated or disturbed, a California State registered and licensed asbestos abatement contractor must perform the work. If there is less than 100 feet, the work does not require a licensed asbestos abatement contractor, but must still conform to Cal-OSHA regulations.

Removal or disturbance of any amount of lead paint requires adherence to the Cal-OSHA and CDPH regulations, including proper training and certification for workers and supervisors

The OSHA lead (1532) regulations require that a Negative Initial Determination for lead exposure be made with paint that contains greater than 0.06% (600 ppm) of lead. Paint with less than 0.06% lead should still be treated within the OSHA guidelines, but with reasonable work practices should not generate OSHA action levels of lead exposure.

Building components with intact lead paint and no other hazardous materials can be disposed of as non-hazardous construction waste. Paint chips and debris must be disposed of as lead containing hazardous waste.

Comment Regarding All Asbestos Containing Materials:

Asbestos containing materials in good condition do not necessarily need to be removed unless they will be disturbed; they should however be respected.

Employees, contract workers and others should be advised not to drill, saw, scrape or otherwise disturb this material without taking precautionary measures appropriate to asbestos containing material.

Asbestos containing material should be removed prior to the renovation and must be removed prior to demolition.

Comment Regarding All Lead Containing Materials:

Lead is a known health hazard. Lead containing materials in good condition do not necessarily need to be removed if they are not disturbed; they should however be respected.

Painted surfaces that contain lead should be made known to contractors who may disturb them during their work. OSHA guidelines for workers in contact with lead paint apply if ANY detectable lead is found.

Anyone coming in contact with leaded paint should be advised not to disturb it without taking precautionary measures appropriate to avoid lead contamination or lead exposure.

Areas Needing Immediate Corrective Action

Asbestos (in any condition) and should be removed prior to renovation and must be removed prior to demolition of the survey site.

Analytical Procedures

- ***POLARIZED LIGHT MICROSCOPY (PLM)***

  Bulk samples were analyzed in accordance with U.S. EPA "Test Method for Determination of Asbestos in Bulk Building Materials, 1993," with inclusion of area percent estimates of the sample components. The use of the McCrone Color Dispersion Staining Technique supplements the analysis when considered useful by the analyst. The samples are prepared with refractive immersion oil and are examined under Polarized Light Microscopy (PLM). The accuracy of the visual estimate method is 1%.

  As per the standard "...The accuracy in the determination of the presence or absence of asbestos of greater than 1 area percent asbestos is greater than 99%." ASTM Committee D22.05, 1/18/88, Standard *Method of Testing for Asbestos Containing Materials by Polarized Light Microscopy*. If the sample matrix is reduced to minimize non-asbestos components, the detection limit can be mathematically enhanced, based on the amount of material remaining after matrix reduction. This method is called gravimetric reduction. This method involves ashing and chemical dissolution of the sample.

- ***POINT COUNTING***

  The Point Counting method is a much more accurate analytical method for determining the percent of asbestos in a particular material. KELLCO-MACS uses a muffle furnace to ash the sample and remove organic compounds. Hydrochloric acid is used to dissolve some of the non-asbestos minerals. Under this method a minimum of 125 points are counted from each of 8 different slide preparations of the same sample (total of 1000 points min.) If the **Point Count Method** determines that the material contains less than 1% asbestos, the material being analyzed can be treated as non-hazardous asbestos containing construction waste**. Note: ONLY the Point Count Method can be used for this determination.**

- ***ATOMIC ABSORPTION FOR LEAD***

  Paint samples were collected for atomic absorption (AA) analysis. The detection limit for each sample depends upon many factors including the sensitivity of the instrument and the sample size. In the KELLCO-MACS laboratory utilizing flame AA, the detection limit is normally .01% or 100 parts per million (ppm).

- ***CAM 17 Testing***

  CAM 17 Metals were tested by Macs Lab, Inc. using ICP-MS, Extraction Method SW3050B and Analytical Method 6010B/3050.

- ***Hexavalent Chrome (Chrome 6) Testing***
  Hexavalent Chrome was tested by McCampbell Analytical Laboratory using the TTLC Hexachrome by EPA 218.6 Analytical Method.

KELLCO-MACS Qualifications

KELLCO-MACS is a creative joint venture offering hazardous materials and AIHA laboratory analyses. Our credentials include:

- The KELLCO-MACS asbestos inspector is licensed with the State of California Department of Occupational Safety and Health (CAL-OSHA).

- The KELLCO-MACS lead inspector is licensed by the California Department of Public Health (CDPH)

- The laboratory accreditations include:

  - **NVLAP PLM** for Asbestos: NIST National Voluntary Laboratory Accreditation Program certificate of accreditation for bulk **asbestos** analysis by polarized light microscopy (Accreditation #101948-1).
  - **AIHA** Accreditation for **Industrial Hygiene** Analytical Laboratory for PCM, and AA for lead (Accreditation #101786).
  - **AIHA Analyst Proficiency (NIOSH PAT)** (Accreditation # 11172)
  - **AIHA ELLAP** Accreditation for Lead: Accreditation for the **Environmental Lead** Laboratory recognized by the EPA as meeting the requirements of the National Lead Laboratory Accreditation Program established under Title X (Lab ID #11109).
  - **ELAP PLM** for Asbestos: California Department of Health Services, Environmental Laboratory Accreditation Program, certificate for bulk asbestos analysis (Certificate #2027)
  - **USDA Soil** permit #39484

The following supporting documents are attached to this report:

- Laboratory analytical reports
- Photographs of sample locations
- Floor plan or sketch showing sample locations

Please call KELLCO if there are any questions and/or clarifications regarding this report. We look forward to working with you in the future.

Sincerely,

KELLCO-MACS

Tim C. Cannard CAC #94-1395, CDPH Lead #764
Senior Project Manager

MACS Lab, Inc.
3137 Diablo Ave
Hayward, CA 94545-2701

510-786-9751

Bulk Asbestos Analysis

Report

Method: EPA-600/M4-82-020

KELLCO Services
3137 Diablo Ave

Hayward CA 94545

Person to contact: Tim Cannard
Contact phone: 510-786-9751
FAX phone: 510-786-9625
Sampled by: Derrik Quach
Sampled on: May 4, 2010
Analyzed on: May 10, 2010 at: 15:28
Corresponding invoice number: 203237

Analyst: JPL (signature)

Laboratory manager: (signature)

Job Number: 1004-29

Job Description: US 101 and SH 116 Bridges - Petaluma, CA

Lab Sample Number	Client Sample Number and Description	Asbestos detected?	Fibers present	Remarks
L203237-1	URS-R-01 101 North, rail at northeast / grey concrete	**N.D.**	No Fibers	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203237-2	URS-B-02 101 North, barrier wall at northeast / grey concrete	**N.D.**	No Fibers	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203237-3	URS-B-03 101 North, board at northeast / brown compact board	**N.D.**	45% Fiberglass	Brown compact board. Balance of sample is organic binders and unspecified non-fibrous material.
L203237-4	URS-B-04 101 North, base at northeast / grey concrete	**N.D.**	No Fibers	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203237-5	URS-C-05 101 North, column, north / grey concrete	**N.D.**	No Fibers	Gray concrete. Balance of sample is unspecified non-fibrous material.

* Chrysotile, Amosite, Crocidolite, Tremolite, Actinolite, and Anthophyllite are asbestos fibers. N.D.=None Detected PC =Point Counted

NVLAP®
NVLAP Lab Code 101948-0

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MACS Lab, Inc.
3137 Diablo Ave
Hayward, CA 94545-2701

510-786-9751

Bulk Asbestos Analysis

Report

Lab Sample Number	Client Sample Number and Description	Asbestos detected?	Fibers present	Remarks
L203237-6	URS-B-06 101 South, barrier wall decor, northeast / grey concrete	**N.D.**	No Fibers	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203237-7	URS-B-07 101 South, barrier wall, northeast / grey concrete	**N.D.**	No Fibers	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203237-8	URS-B-08 101 South, base at northeast / grey concrete	**N.D.**	No Fibers	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203237-9	URS-A-09 101 South, asphalt at northeast / black asphalt	**N.D.**	< 1% Cellulose	Black asphalt. Balance of sample is unspecified non-fibrous material.
L203237-10	URS-S-10 101 South, reflexer, debris / grey sealant (mastic)	**N.D.**	< 1% Cellulose	Gray sealant. Balance of sample is unspecified non-fibrous material.
L203237-11	URS-R-11 101 North, rail at southwest / grey concrete	**N.D.**	No Fibers	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203237-12	URS-B-12 101 North, board at southwest / brown compact board	**N.D.**	45% Cellulose	Brown compact board. Balance of sample is unspecified non-fibrous material.
L203237-13	URS-B-13 101 North, bridge at southwest / grey concrete	**N.D.**	No Fibers	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203237-14	URS-C-14 101 North, 2nd column to south end / concrete	**N.D.**	No Fibers	Gray concrete. Balance of sample is unspecified non-fibrous material.

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MACS Lab, Inc.
3137 Diablo Ave
Hayward, CA 94545-2701

510-786-9751

Bulk Asbestos Analysis

Report

Lab Sample Number	Client Sample Number and Description	Asbestos detected?	Fibers present	Remarks
L203237-15	URS-M-15 101 North, rock/soil between bridges / purple/brown rock/soil	**N.D.**	< 1% Cellulose	Brown soil. Balance of sample is unspecified non-fibrous material.
L203237-16	URS-A-16 101 South, asphalt southwest / black asphalt	**N.D.**	< 1% Cellulose	Black asphalt. Balance of sample is organic binders and unspecified non-fibrous material.
L203237-17	URS-R-17 101 South, rail/barrier decor, southwest / grey concrete	**N.D.**	No Fibers	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203237-18	URS-M-18 101 South, board, southwest / brown compact board	**N.D.**	45% Cellulose	Brown compact board. Balance of sample is unspecified non-fibrous material.
L203237-19	URS-B-19 101 South, bridge, southwest / grey concrete	**N.D.**	< 1% Cellulose	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203237-20	URS-C-20 101 South, 2nd column, southwest / grey concrete	**N.D.**	< 1% Cellulose	Gray concrete. Balance of sample is unspecified non-fibrous material.
L203237-21	URS-B-21 101 South, column base adjacent to railroad / grey concrete	**N.D.**	< 1% Cellulose	Gray concrete. Balance of sample is unspecified non-fibrous material.

* Chrysotile, Amosite, Crocidolite, Tremolite, Actinolite, and Anthophyllite are asbestos fibers. N.D.=None Detected PC =Point Counted

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MACS Lab, Inc.
3137 Diablo Ave
Hayward, CA 94545-2701

510-786-9751

Bulk Asbestos Analysis

QA Report

Method: EPA-600/M

KELLCO Services
3137 Diablo Ave

Hayward CA 94545

Laboratory manager: _____ (signature)

Lab Sample Number	Client Sample Number and Description	Asbestos detected?	Fibers present	Remarks
Blank sample		**N.D.**	No fibers	
		PC*		
L203237-20	URS-C-20	**N.D.**	< 1% Cellulose	Concrete. Balance of sample is unspecified non-fibrous material.
101 South, 2nd column, southwest / grey concrete				

End of report.

* Chrysotile, Amosite, Crocidolite, Tremolite, Actinolite, and Anthophyllite are asbestos fibers. N.D.=None Detected PC =Point Counted

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NVLAP®
NVLAP Lab Code 101948-0

CLIENT	JOBSITE
URS Corporation 55 South Market Street 1500 San Jose CA 95113	US 101 and SH 116 Bridges US 101 and SH 116 Bridges Petaluma CA

KELLCO-MACS JOB#: **1004-29** LAB LOGIN # L203237

COLLECTED BY: Derrik

COLLECTED DATE 5·4·10

TURN AROUND TIME: Normal 4 8 24 48 5-DAY

RESULTS NEEDED BY

CIRCLE TYPE OF BULK ANALYSIS

(PLM) **LEAD PAINT** **LEAD WIPE** **NON VIABLE MOLD** **VIABLE MOLD** **eCOLI** **OTHER**

SAMPLES REC'D _____ ANALYZE TO FIRST POSITIVE YES NO

REPORT RESULTS TO PROJECT MANAGER: Tim Cannard

NOTES & COMMENTS:

CHAIN OF CUSTODY & SAMPLE SUBMITAL FORM PAGE 1 OF ____

KELLCO-MACS JOB#: **1004-29**
US 101 and SH 116 Bridges

FIELD NUMBER	LOCATION (bldg, rm#, area)	COLOR	MATERIAL or SUBSTRATE (ft w/ size, mastic, tjc, etc.)	NOTES: Like condition, damage, quantity, inside what, beneath what? direction in building (N,S,E,W) etc.)
URS-R-01	101 North - rail at NE	grey	concrete	
B-02	- Barrier Wall at NE			
B-03	- board at NE	brown	compact board	
B-04	- base at NE	grey	concrete	
C-05	- Column - N			
B-06	101 South - barrier wall near - NE			
B-07	- barrier wall - NE			
B-08	- base at - NE			
A-09	- Asphalt at NE	blk	asphalt	

RELEASED BY	DATE	TIME	RECEIVED BY	DATE	TIME
[illegible]	5·4·10		[illegible]	05/05/10	16:00

L203237

CHAIN OF CUSTODY & SAMPLE SUBMITAL FORM PAGE 2 OF 2

KELLCO-MACS JOB#: **1004-29**
US 101 and SH 116 Bridges

FIELD NUMBER	LOCATION (bldg, rm#, area)	COLOR	MATERIAL or SUBSTRATE (ft w/ size, mastic, tjc, etc.)	NOTES: Like condition, damage, quantity, inside what, beneath what? direction in building (N,S,E,W) etc.)
URS - S - 10	101 South - reflexer	grey	sealant (mastic)	debris
R - 11	101 North - rail at SW	grey	concrete	
B - 12	- board at SW	brown	compact board	
B - 13	- bridge at SW	grey	concrete	
C - 14	- 2nd column to S end		|	
M - 15	- Rock / Soil bet. bridges	purple/brown	rock / soil	
A - 16	101 south - Asphalt SW	blk	Asphalt	
R - 17	- Rail/Barrier decor - SW	grey	concrete	
M - 18	- board - SW	brown	compact board	
B - 19	- bridge - SW	grey	concrete	
C - 20	- 2nd column - SW	|	|	
B - 21	- column base adjacent to Rail Road	|	|	

RELEASED BY	DATE	TIME	RECEIVED BY	DATE	TIME
[signature]	5-4-10		[signature]	05/05/10	16:00

MACS Lab Incorporated
Analytical and Environmental Services
3137 Diablo Avenue, Hayward, Ca 94545-2701 (510) 786-9751 * (510) 786-9625 Fax * www.macslab.com

CAM-17 Bulk Materials Analysis Report - Method: EPA 6010B/3050

KELLCO Services
3137 Diablo Avenue
Hayward, CA 94545

Contact: Tim Cannard
Phone: (510) 786-9751
Email: mailbox3137@kellcomacs.com
Job #: 1004-29

Laboratory Number: 203235
Sampled By: Derick
Sampled On: May 4, 2010
Submitted On: May 5, 2010
Analyzed On: May 7, 2010
Reported On: May 7, 2010
SOP: CAM17
Sample Type: Bulk

Job Description: US 101 and SH 116 Bridges- Petaluma, CA

	Lab Sample Number:	203235 -1	203235 -2	203235 -3		
	Client Sample Number:	URS-1	URS-2	URS-3		
	Matrix:	Bulk	Bulk	Bulk		
	Extraction Type:	Acid	Acid	Acid		
	Units:	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)		
Sb	Antimony	27.59	9.45	7.22		
As	Arsenic	7.54	4.97	1.61		
Ba	Barium	45.62	1,493.00	2,937.92		
Be	Beryllium	0.25	0.16	1.20		
Cd	Cadmium	1.47	0.93	2.28		
Cr	Chromium	13.14	502.97	17.20		
Co	Cobalt	2.61	3.02	69.71		
Cu	Copper	10.28	12.10	210.13		
Pb	Lead	518.53	2,008.70	127.67		
Hg	Mercury	6.82	3.00	2.84		
Mo	Molybdenum	5.31	4.06	5.57		
Ni	Nickel	6.70	5.37	6.62		
Se	Selenium	1,597.73	157.68	342.74		
Ag	Silver	<0.01	0.87	1.80		
Tl	Thallium	18.28	4.21	6.17		
V	Vanadium	17.10	6.48	12.57		
Zn	Zinc	131.59	1,452.67	1,229.62		

Analyst: _____ (Signature)

Laboratory Manager: _____ (Signature)

NOTICE

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CLIENT	JOBSITE
URS Corporation	US 101 and SH 116 Bridges
55 South Market Street	US 101 and SH 116 Bridges
1500	
San Jose	Petaluma
CA 95113	CA

KELLCO-MACS JOB#: **1004-29** LAB LOGIN # I203235

COLLECTED BY: Derrik

COLLECTED DATE 5·4·10

TURN AROUND TIME: Normal 4 8 24 48 5-DAY

RESULTS NEEDED BY

CIRCLE TYPE OF BULK ANALYSIS

PLM **LEAD PAINT** **LEAD WIPE** **NON VIABLE MOLD** **VIABLE MOLD** **eCOLI** **OTHER** CAH-17

SAMPLES REC'D _____ ANALYZE TO FIRST POSITIVE YES NO

REPORT RESULTS TO PROJECT MANAGER: Tim Cannard

NOTES & COMMENTS:

CHAIN OF CUSTODY & SAMPLE SUBMITAL FORM PAGE____ OF ____

KELLCO-MACS JOB#: **1004-29**
US 101 and SH 116 Bridges

FIELD NUMBER	LOCATION (bldg, rm#, area)	COLOR	MATERIAL or SUBSTRATE (ft w/ size, mastic, tjc, etc.)	NOTES: Like condition, damage, quantity, inside what, beneath what? direction in building (N,S,E,W) etc.)
URS-1	101 North - bridge at NE	grey	paint on concrete	
-2	- stripe at SW	yell	paint on Asphalt	
-3	101 South - Col. base adjacent to Rail Road	Mult.	paint on concrete	

RELEASED BY	DATE	TIME	RECEIVED BY	DATE	TIME
[illegible]	5·4·10		D. Knuth	05/05/10	16:00

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Web: www.mccampbell.com E-mail: main@mccampbell.com
Telephone: 877-252-9262 Fax: 925-252-9269

Kellco Services, Inc.	Client Project ID: #1004-29; US 101 + SH 116 Bridge	Date Sampled: 05/27/10
3137 Diablo Avenue		Date Received: 05/27/10
	Client Contact: Tim Cannard	Date Reported: 06/02/10
Hayward, CA 94545	Client P.O.:	Date Completed: 06/02/10

WorkOrder: 1005704

June 02, 2010

Dear Tim:

Enclosed within are:

1) The results of the **1** analyzed sample from your project: **#1004-29; US 101 + SH 116 Bridge,**
2) A QC report for the above sample,
3) A copy of the chain of custody, and
4) An invoice for analytical services.

All analyses were completed satisfactorily and all QC samples were found to be within our control limits.

If you have any questions or concerns, please feel free to give me a call. Thank you for choosing

McCampbell Analytical Laboratories for your analytical needs.

Best regards,

Angela Rydelius
Laboratory Manager
McCampbell Analytical, Inc.

1005704

McCAMPBELL ANALYTICAL, INC.

1534 WILLOW PASS ROAD
PITTSBURG, CA 94565-1701
Website: www.mccampbell.com Email: main@mccampbell.com
Telephone: (877) 252-9262 Fax: (925) 252-9269

CHAIN OF CUSTODY RECORD

TURN AROUND TIME ☐ RUSH ☐ 24 HR ☐ 48 HR ☐ 72 HR ☒ 5 DAY

GeoTracker EDF ☐ PDF ☐ Excel ☐ Write On (DW) ☐

☐ Check if sample is effluent and "J" flag is required

Report To: Tim Cannard
Bill To:
Company: Kellco Services
3137 Diablo Ave
Hayward CA 94545
E-Mail:
Tele: (510) 7869751
Fax: (510) 7869625
Project #: 1004-29
Project Name: US 101 + SH 116 Bridge
Project Location: Petaluma, CA
Sampler Signature:

SAMPLE ID	LOCATION/ Field Point Name	SAMPLING Date	SAMPLING Time	# Containers	Type Containers	MATRIX Water	MATRIX Soil	MATRIX Air	MATRIX Sludge	MATRIX Other	METHOD PRESERVED ICE	HCL	HNO_3	Other	BTEX & TPH as Gas (602 / 8021 / 8015) / MTBE	TPH as Diesel (8015)	Total Petroleum Oil & Grease (1664 / 5520 E/B&F)	Total Petroleum Hydrocarbons (418.1)	EPA 502.2 / 601 / 8010 / 8021 (HVOCs)	MTBE / BTEX ONLY (EPA 602 / 8021)	EPA 505/ 608 / 8081 (Cl Pesticides)	EPA 608 / 8082 PCB's ONLY; Aroclors / Congeners	EPA 507 / 8141 (NP Pesticides)	EPA 515 / 8151 (Acidic Cl Herbicides)	EPA 524.2 / 624 / 8260 (VOCs)	EPA 525.2 / 625 / 8270 (SVOCs)	EPA 8270 SIM / 8310 (PAHs / PNAs)	CAM 17 Metals (200.7 / 200.8 / 6010 / 6020)	LUFT 5 Metals (200.7 / 200.8 / 6010 / 6020)	Lead (200.7 / 200.8 / 6010 / 6020)	Other: Hexavalent chrome			Comments: Filter Samples for Metals analysis: Yes / No
203235-2	UPS-02	5/27		1										X																		+			

Relinquished By:	Date:	Time:	Received By:
Hernandez	5/27	1345	

ICE/t° nA
GOOD CONDITION ✓
HEAD SPACE ABSENT
DECHLORINATED IN LAB
APPROPRIATE CONTAINERS ✓
PRESERVED IN LAB

COMMENTS:

PRESERVATION VOAS O&G METALS OTHER pH<2

McCampbell Analytical, Inc.
1534 Willow Pass Rd
Pittsburg, CA 94565-1701
(925) 252-9262

CHAIN-OF-CUSTODY RECORD

WorkOrder: 1005704 **ClientCode: KSH**

☐ WaterTrax ☐ WriteOn ☐ EDF ☐ Excel ☐ Fax ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag

Report to:
Tim Cannard
Kellco Services, Inc.
3137 Diablo Avenue
Hayward, CA 94545
(510) 786-9751 FAX (510) 786-9625

Email: mailbox3137@kellcomacs.com
cc:
PO:
ProjectNo: #1004-29; US 101 + SH 116 Bridge

Bill to:
Accounts Payable
Kellco Services, Inc.
3137 Diablo Avenue
Hayward, CA 94545
christine@kellcomacs.com; jrichards

Requested TAT: 5 days

Date Received: 05/27/2010
Date Printed: 05/27/2010

Lab ID	Client ID	Matrix	Collection Date	Hold	Requested Tests (See legend below) 1	2	3	4	5	6	7	8	9	10	11	12
1005704-001	203235-2	Solid	5/27/2010	☐	A											

Test Legend:

1	218_6-TTLC_Solid	2		3		4		5	
6		7		8		9		10	
11		12							

Prepared by: Melissa Valles

Comments:

NOTE: Soil samples are discarded 60 days after results are reported unless other arrangements are made (Water samples are 30 days).
Hazardous samples will be returned to client or disposed of at client expense.

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Web: www.mccampbell.com E-mail: main@mccampbell.com
Telephone: 877-252-9262 Fax: 925-252-9269

Sample Receipt Checklist

Client Name: **Kellco Services, Inc.**

Date and Time Received: **5/27/2010 5:51:59 PM**

Project Name: **#1004-29; US 101 + SH 116 Bridge**

Checklist completed and reviewed by: Melissa Valles

WorkOrder N°: **1005704** Matrix Solid

Carrier: Rob Pringle (MAI Courier)

Chain of Custody (COC) Information

Chain of custody present?	Yes ☑	No ☐
Chain of custody signed when relinquished and received?	Yes ☑	No ☐
Chain of custody agrees with sample labels?	Yes ☑	No ☐
Sample IDs noted by Client on COC?	Yes ☑	No ☐
Date and Time of collection noted by Client on COC?	Yes ☑	No ☐
Sampler's name noted on COC?	Yes ☐	No ☑

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	NA ☑
Shipping container/cooler in good condition?	Yes ☑	No ☐	
Samples in proper containers/bottles?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature	Cooler Temp:		NA ☑
Water - VOA vials have zero headspace / no bubbles?	Yes ☐	No ☐	No VOA vials submitted ☑
Sample labels checked for correct preservation?	Yes ☑	No ☐	
Metal - pH acceptable upon receipt (pH<2)?	Yes ☐	No ☐	NA ☑
Samples Received on Ice?	Yes ☐	No ☑	

** NOTE: If the "No" box is checked, see comments below.*

Client contacted: Date contacted: Contacted by:

Comments:

McCampbell Analytical, Inc.
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Web: www.mccampbell.com E-mail: main@mccampbell.com
Telephone: 877-252-9262 Fax: 925-252-9269

Kellco Services, Inc. 3137 Diablo Avenue Hayward, CA 94545	Client Project ID: #1004-29; US 101 + SH 116 Bridge	Date Sampled: 05/27/10
		Date Received: 05/27/10
	Client Contact: Tim Cannard	Date Extracted: 05/27/10
	Client P.O.:	Date Analyzed: 05/28/10

TTLC Hexachrome by Alkaline Digestion and IC-UV Analysis*

Extraction method: SW3060A Analytical methods: E218.6m Work Order: 1005704

Lab ID	Client ID	Matrix	Extraction Type	Hexachrome	DF	% SS	Comments
1005704-001A	203235-2	S	TOTAL	33	1	N/A	

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	TOTAL	NA	µg/L
	S	TOTAL	0.8	mg/Kg

* All samples are reported in mg/kg unless otherwise requested. All samples and QC were cleaned up prior to analysis.

DHS ELAP Certification 1644

Angela Rydelius, Lab Manager

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Web: www.mccampbell.com E-mail: main@mccampbell.com
Telephone: 877-252-9262 Fax: 925-252-9269

QC SUMMARY REPORT FOR E218.6m

W.O. Sample Matrix: Solid QC Matrix: Soil BatchID: 50907 WorkOrder 1005704

EPA Method E218.6m **Extraction SW3060A** **Spiked Sample ID: N/A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
Hexachrome	N/A	40	N/A	N/A	N/A	90.8	91.2	0.440	N/A	N/A	80 - 120	10

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:
NONE

BATCH 50907 SUMMARY

Lab ID	Date Sampled	Date Extracted	Date Analyzed	Lab ID	Date Sampled	Date Extracted	Date Analyzed
1005704-001A	05/27/10	05/27/10	05/28/10 7:37 PM				

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not applicable to this method.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

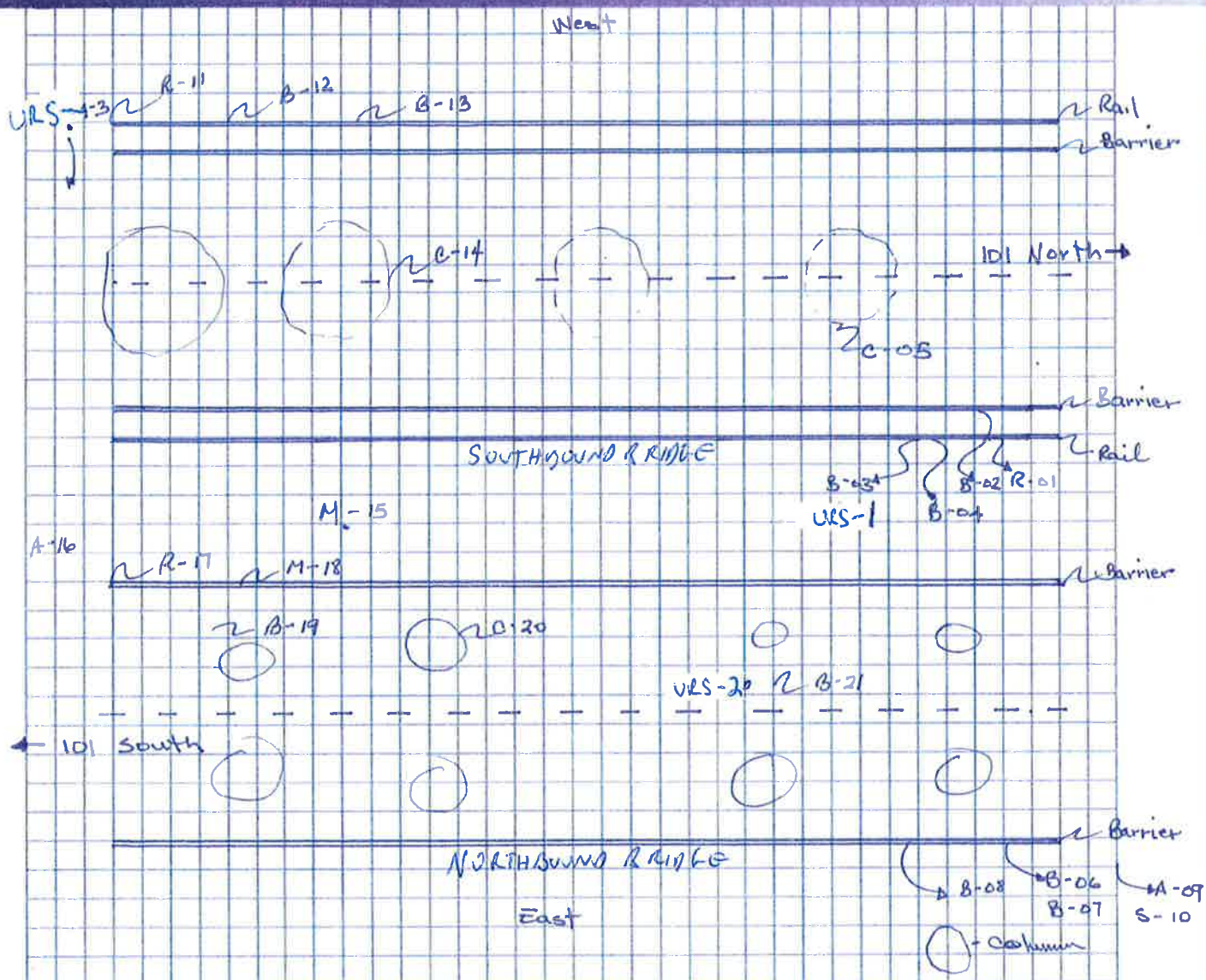
DHS ELAP Certification 1644

JR QA/QC Officer

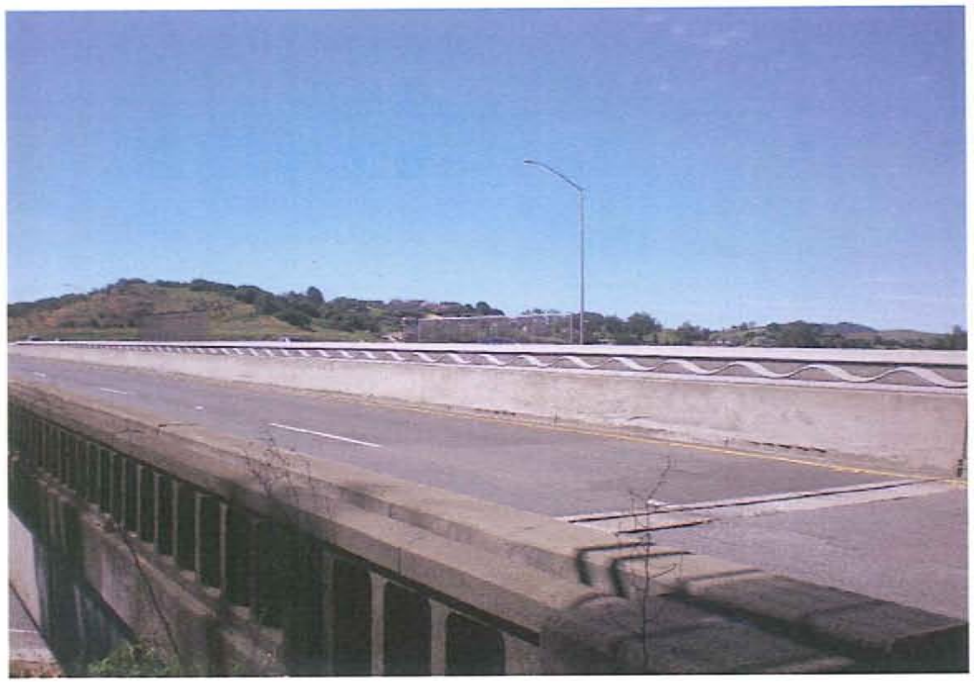
KELLCO Job # 1004-29
Client: URS

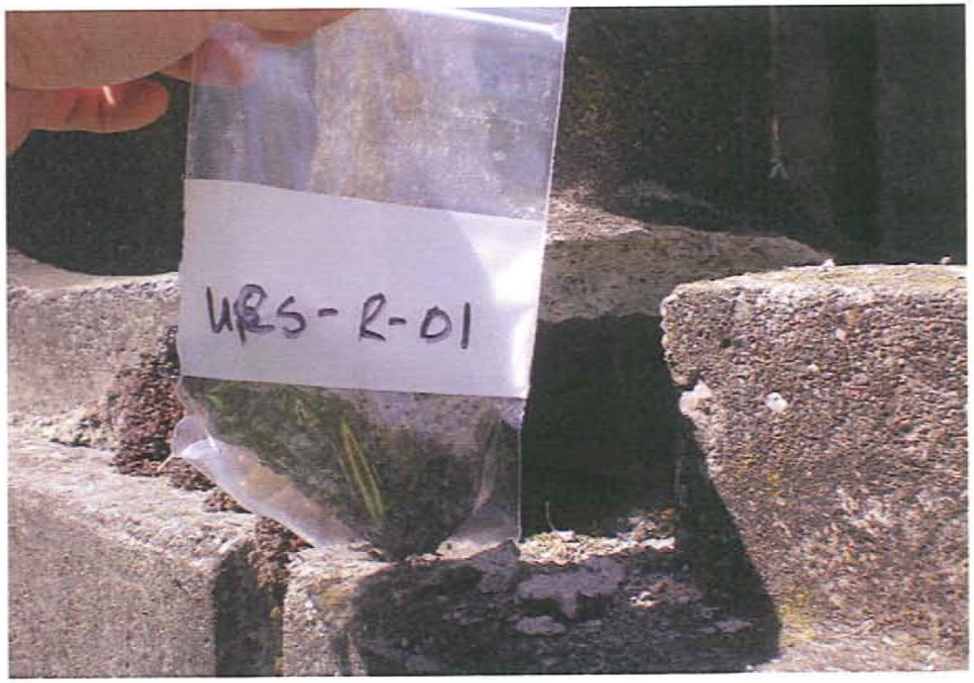
Jobsite: US 101 and SH 116 bridges

K E L L C O



Sonoma EAST

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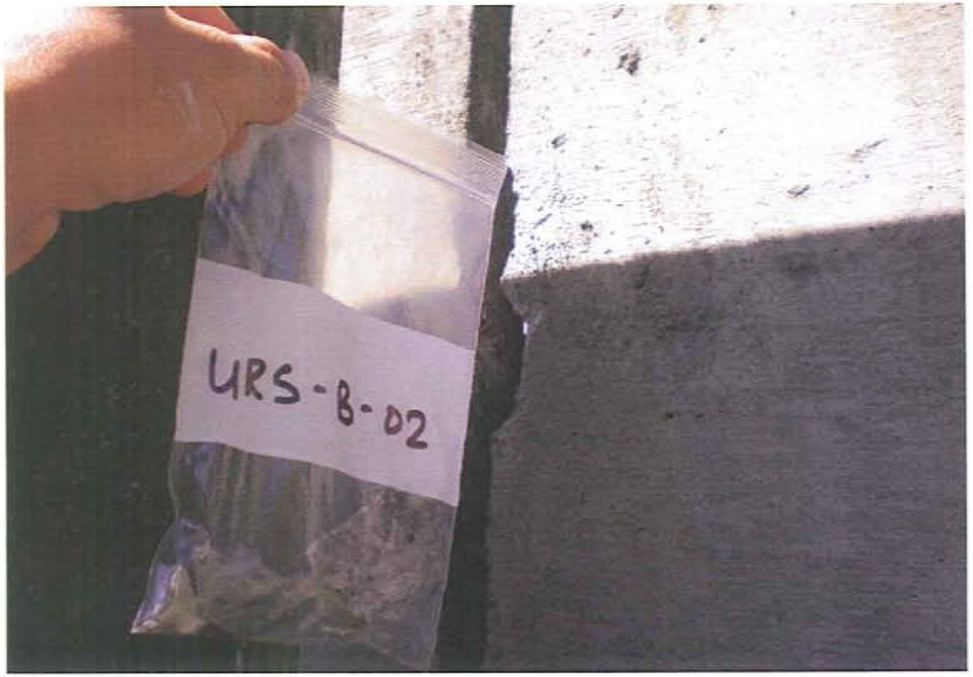
URS-01

URS-B-03

URS-C-05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URS-B-06

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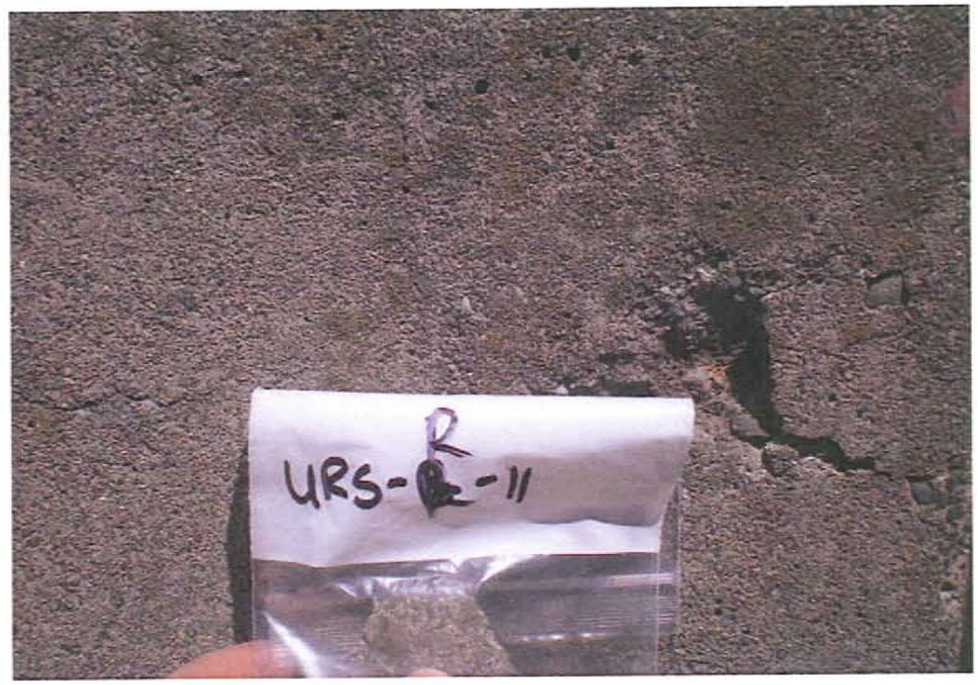
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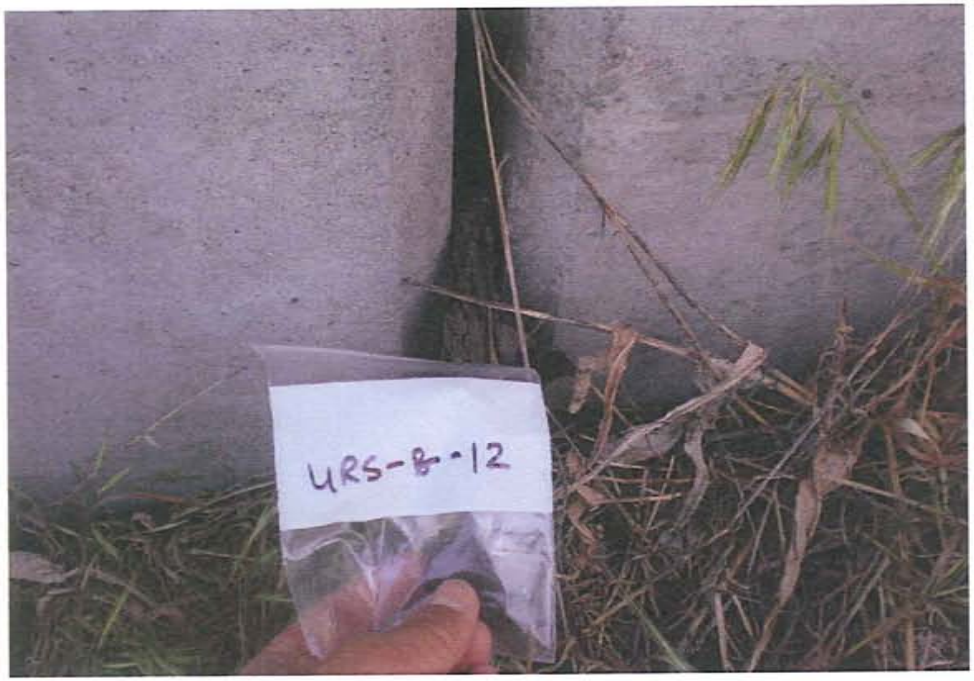
URS-A-09

URS-S-10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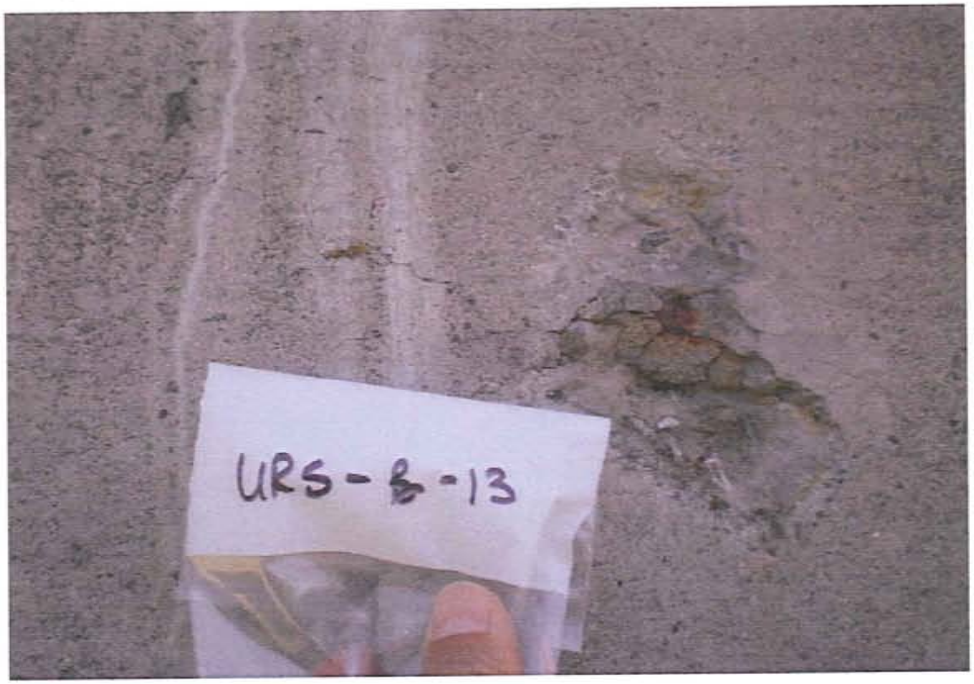
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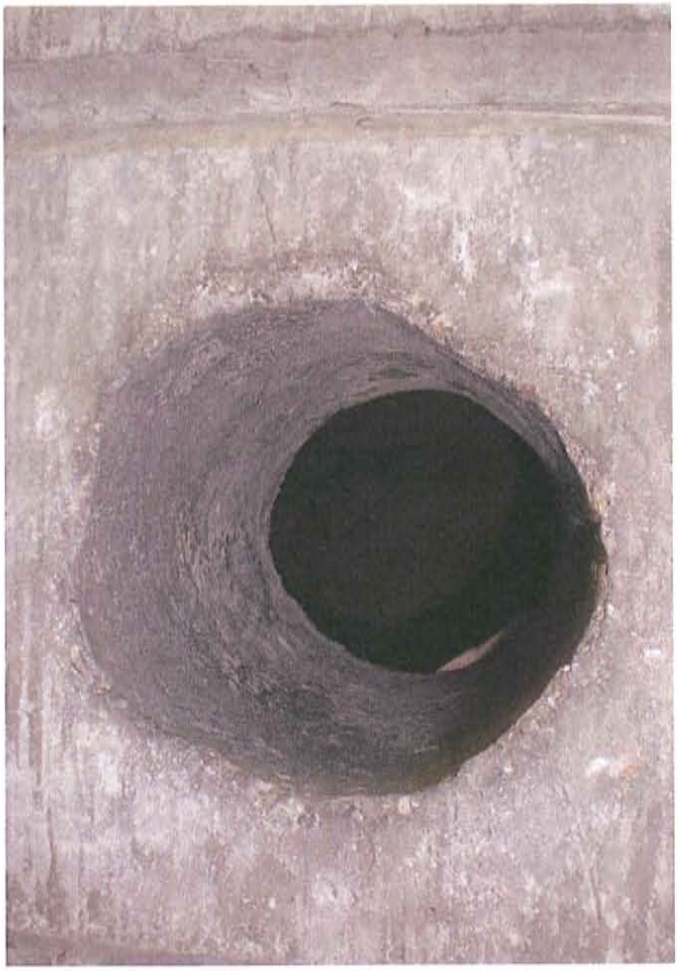
URS-02



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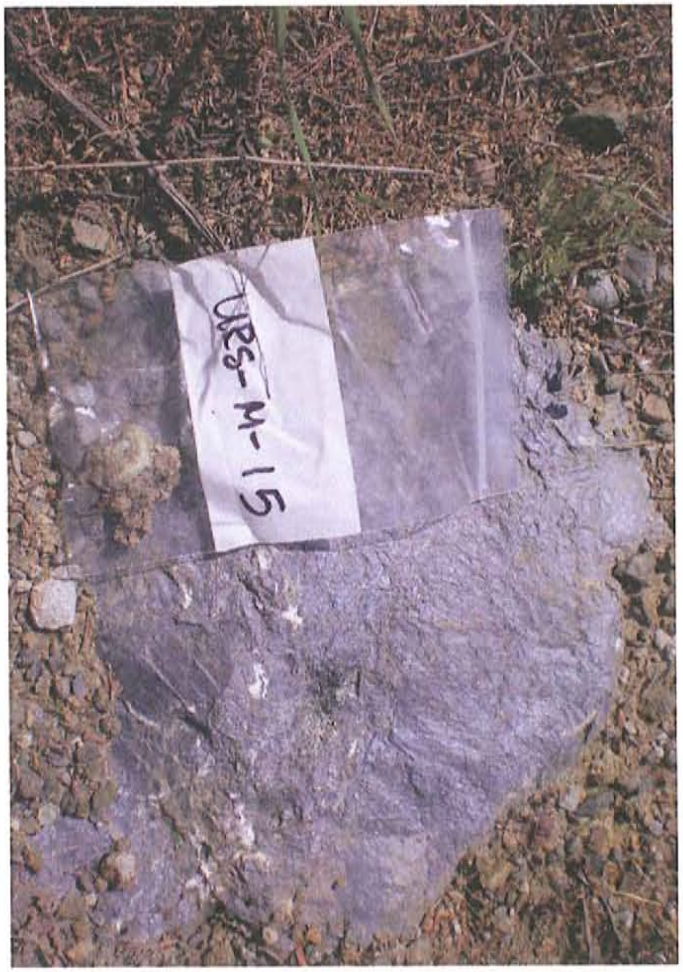
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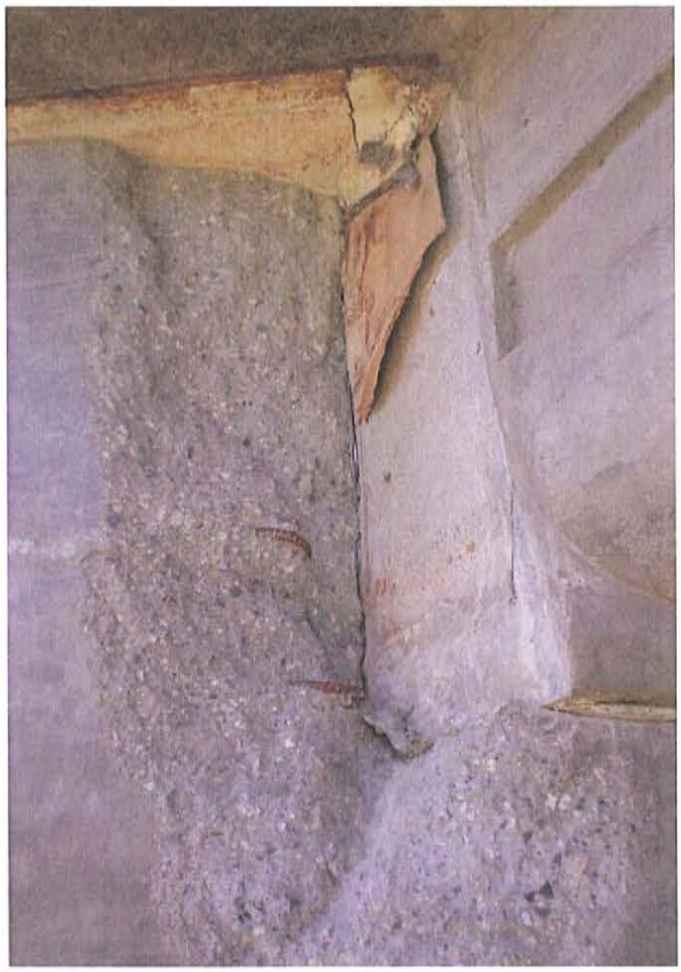

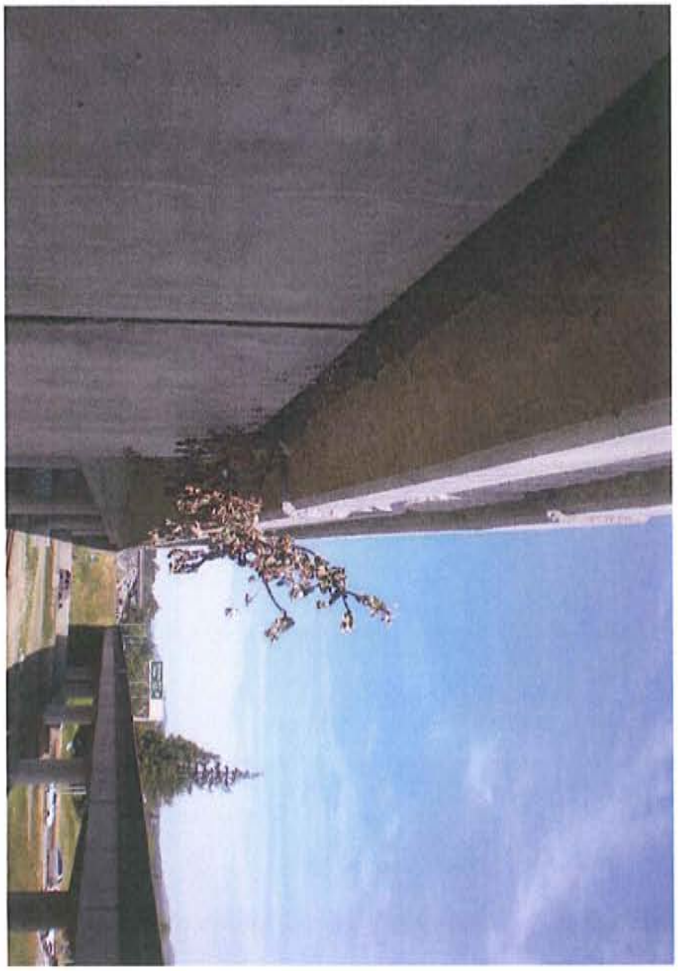

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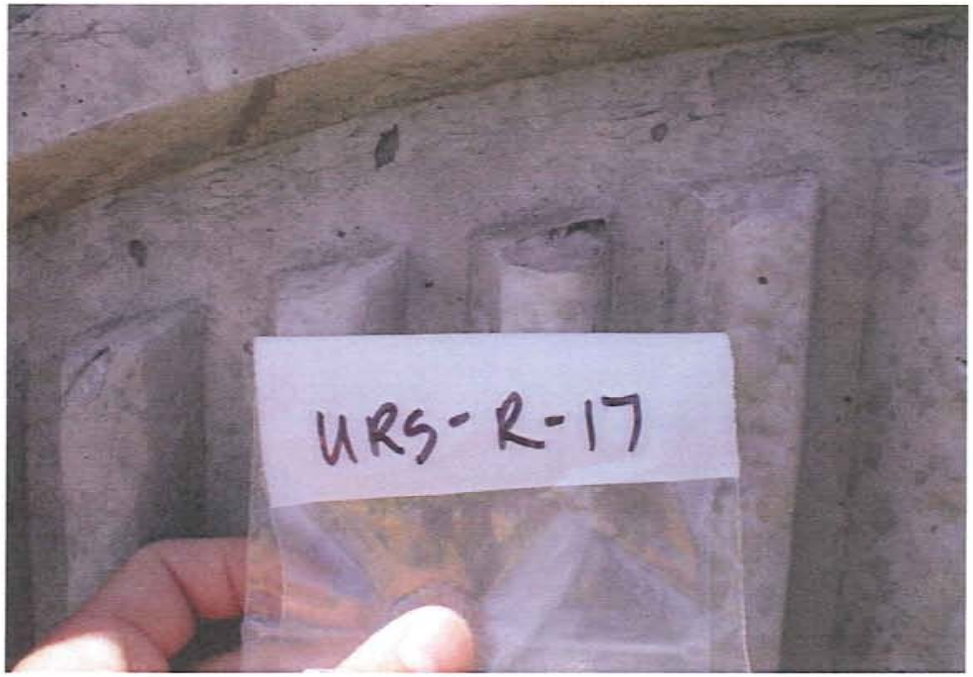
URS-M-18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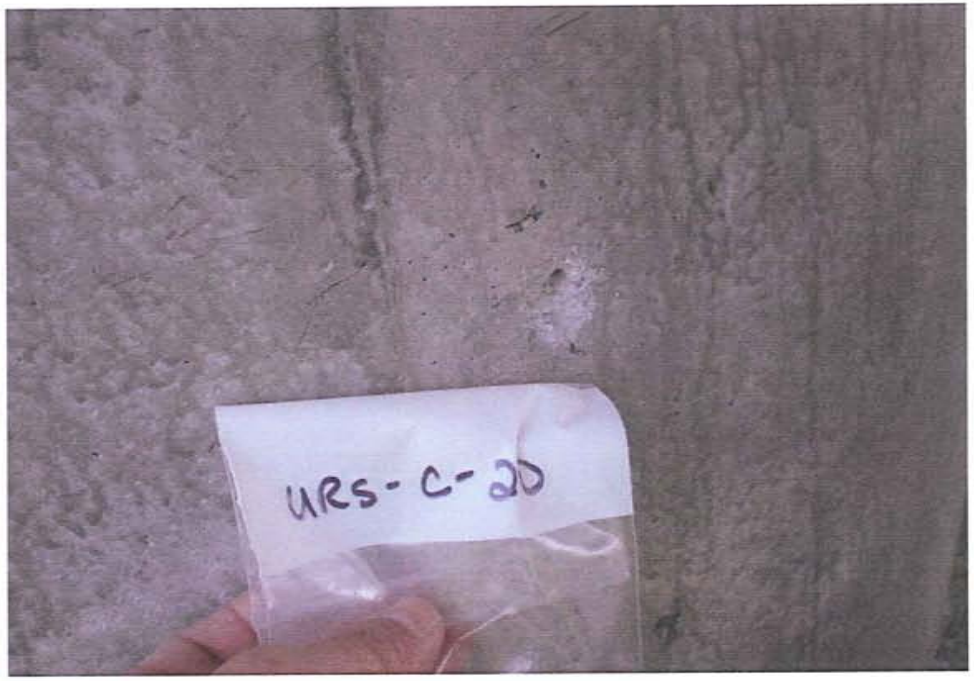
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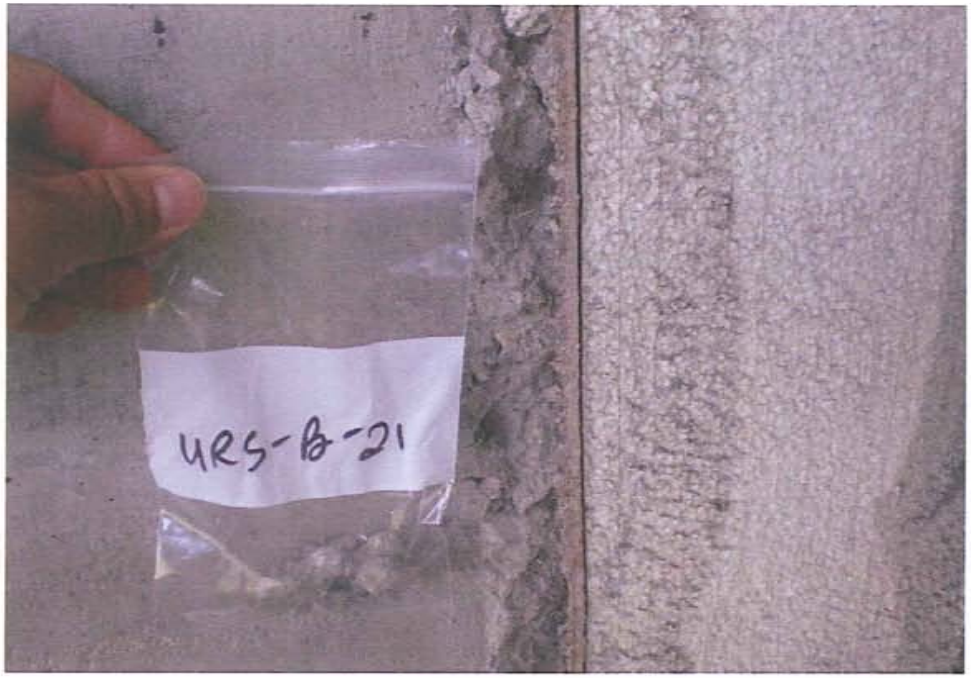
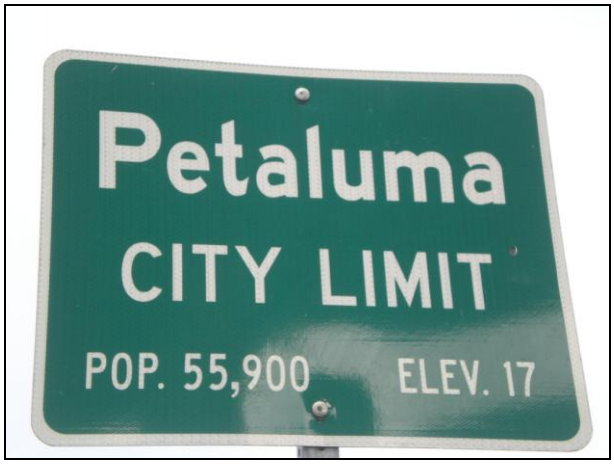
URS-B-19

URS-3


URS-B-21

A Creative Joint Venture For Better Environmental Solutions

Petaluma River Bridge
Petaluma, CA



KELLCO-MACS Job #1006-20

Sample Acquisition As Directed By the Client
Limited Asbestos and Lead Paint Inspection Report

for

URS Corporation
55 South Market Street
Suite # 1500
San Jose, CA 95113

July 14, 2010

3137 Diablo Avenue • Hayward, CA 94545-2701• (510) 786-9751 • fax (510) 786-9625
http://www.kellcomacs.com email: mailbox3137@kellcomacs.com

A Creative Joint Venture For Better Environmental Solutions

Sample Acquisition As Directed By the Client
Limited Asbestos and Lead Paint Inspection Report

Date:	July 14, 2010
KELLCO-MACS Job #:	1006-20
Client:	Mr. Patrick Waltz URS Corporation 55 South Market Street Suite # 1500 San Jose, CA 95113
Location:	Petaluma River Bridge Petaluma, CA
Date of Inspection:	June 18, 2010
Inspectors:	Derrick Quach SST # 02-3214 Tim Cannard CAC # 94-1395
Description Of The Inspected Area:	This is a limited client directed asbestos bulk and lead paint sampling on the Petaluma River Bridge located in Petaluma, CA. The sampling was limited to the concrete column, column base, mortar, rail, black mastic, joint cork, asphalt, and black pipe of the North and South Edges.

Background

This is a limited client directed asbestos and CAM 17 Heavy Metals inspection located in Petaluma, CA.

Synopsis

Asbestos was found in the following materials: None

Lead paint was found in the following tested materials:

- Grey paint on wall barrier

- White paint on asphalt and barrier fence
- Yellow paint on asphalt

Hexavalent Chrome (Chrome 6) was present.

CAM 17 Heavy Metals were found in ALL of the paint samples submitted.

Samples #205528-5 came back with elevated levels of Chromium. These samples were further analyzed by an accredited laboratory for Hexachrome (Chrome 6) by EPA 218.6 method.

Chrome 6 is a listed carcinogen and **ALL** of the sample results should be shared with any contractor and personnel working within this area in order to be OSHA Compliant.

About the Inspection

The inspection performed was both visual and tactile. Samples were taken of suspect materials located at exterior of the survey area.

The inspection was limited to those materials readily discerned in a reasonable inspection by a competent inspector. Materials that are hidden within walls, behind structures, in vertical shafts or in areas that make them not readily available to our inspector were not sampled. If future work uncovers any non-sampled materials, these should be submitted for asbestos and/or lead paint analysis.

The following numbering convention was used for this inspection:

LETTER	STANDS FOR	EXAMPLE	MEANING
XX	Building DESIGNATION based on information provided on drawings provided to us prior to inspection	PRB	Petaluma River Bridge
Y & *Optional Z*	EITHER building SYSTEM (W: wall; F: Flooring; C: Ceiling; T: TSI; M: Misc) OR Further designation of sample location as Unit # within building	B C R	Base Column Rail
xx	Sample number and layer	01 02 03	First Sample, First Layer Second Sample, First Layer Third Sample, First Layer

Asbestos Findings

Asbestos samples were analyzed in the KELLCO-MACS laboratory, by Polarized Light Microscopy, the EPA's recommended method. Copies of the full laboratory reports are attached. These valuable reports can be utilized as future reference to determine if a particular material was tested.

Photographs of sampled materials are included. Sample locations are noted on the attached not-to-scale drawing.

The determination of a material to be Asbestos Containing Material (ACM) was made either by direct sampling or by homogeneity with at least one positive sample of the same material.

Materials that tested **positive** for asbestos are: **None**

Tested materials that were **none detected** for asbestos are:

Lab Sample #	Field Sample #	Field Description
L205017-1	PRB-B-01	South bound, base, 3rd column / grey concrete
L205017-2	PRB-C-02	South bound, 3rd column / grey mortar
L205017-3	PRB-B-03	South bound, bridge / grey concrete
L205017-4	PRB-C-04	Sough bound, column base / grey concrete
L205017-5	PRB-B-05	South bound, column base / grey concrete
L205017-6	PRB-B-06	North bound, southwest bridge / black joint cork
L205017-7	PRB-C-07	North bound, southwest bridge / grey concrete
L205017-8	PRB-D-08	Between north bound & south bound / grey concrete
L205017-9	PRB-B-09	North bound, southeast barrier / grey concrete
L205017-10	PRB-R-10	North bound, southeast rail / grey concrete
L205017-11	PRB-C-11	North bound, 2nd column / black mastic/barriers
L205017-12	PRB-C-12	South bound, 2nd column / black mastic/barriers
L205017-13	PRB-B-13	North bound, northeast barriers / grey concrete
L205017-14	PRB-C-14	North bound, north column / grey concrete
L205017-15	PRB-B-15	North barriers wall, northwest wall / black joint cork
L205017-16	PRB-M-16	North bound, north base / black asphalt
L205017-17	PRB-M-17-1	South bound, northwest barrier wall / black pipe
L205017-18	RPB-M-17-2	South bound, northwest barrier wall / grey concrete
L205017-19	RPB-B-18	South bound, southwest barrier wall / grey concrete
L205017-20	RPB-R-19	South bound, southwest rail / grey concrete
L205017-21	RPB-B-20	North bound, southwest barrier wall / grey concrete

Paint Findings

Lead samples were analyzed by Atomic Absorption in the KELLCO-MACS laboratory. OSHA requires protection of workers from exposure to any lead. Paint should be considered as containing lead if it is the same color as any positive tested material, unless it has specifically been tested and shown to be **none detected** for lead.

The following materials tested **positive** for lead:

Lab Sample #	Field Sample #	Field Description	PPM	Wt %
P205016-3	PRB-Pb-03	South bound bridge, southwest bound (barrier wall) / grey paint on concrete	118	0.0118
P205016-4	PRB-Pb-04	North bound bridge, southeast stripe / white paint on asphalt	101	0.0101
P205016-5	PRB-Pb-04	North bound bridge, southwest stripe / yellow paint on asphalt	1,490	0.149
P205016-6	PRB-Pb-05	North bound, southeast barriers fence / white paint on metal	114,000	11.4
P205016-7	PRB-Pb-06	North bound, wood pole, southeast barrier / white paint on wood	11,800	1.18

Paint of the same color as the above samples should be considered positive unless proven otherwise by direct sampling with results of "None Detected."

The following are materials for which the lead was **none detected**:

Lab Sample #	Field Sample #	Field Description
P205016-1	PRBC-Pb-01	South bound bridge, 3rd column / grey paint on metal
P205016-2	PRB-Pb-02	South bound bridge, south base / grey wood

Although there are some materials that are negative for lead paint, for the purposes of demolition it is recommended that all painted materials be considered as lead containing.

- ***CAM 17 Heavy Metals Findings***

Seven paint samples were collected and submitted for CAM 17 Heavy Metals analysis to Macs Lab, Inc. using the EPA 6010B/3050 method.

CAM 17 paint samples were taken for the purpose of notifying the general contractor about the existence of heavy metals in the paint. This was done so the contractor, when choosing their work methods, could use proper engineering controls, properly trained personnel and proper personnel protective equipment (PPE) to perform the work.

These samples were analyzed using an ICP/MS, Extraction Method SW3050B TTLC. This method is **not** for the purpose of profiling any waste streams from this project. Profiling the waste streams (TCLP & STLC) will be the responsibility of the contractor performing the work.

A copy of the CAM 17 heavy metals analysis in paint and pertinent information relative to it is appended to this report.

	Lab Sample Number:	205528 -1	205528 -2	205528 -3	205528 -4
	Client Sample Number:	1	2	3	4
	Matrix:	Bulk	Bulk	Bulk	Bulk
	Extraction Type:	Acid	Acid	Acid	Acid
	Units:	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)
Sb	Antimony	15.81	55.00	6.00	3.72
As	Arsenic	22.94	14,635.14	7.14	4.47
Ba	Barium	81.54	174.41	2,270.00	121.10
Be	Beryllium	<0.01	0.09	0.09	0.14
Cd	Cadmium	0.80	7.39	1.41	0.69
Cr	Chromium	<0.01	10.36	15.00	<0.01
Co	Cobalt	1.22	7.88	27.68	5.23
Cu	Copper	72.15	47,207.21	9.68	8.98
Pb	Lead	<0.01	2,350.45	58.45	112.37
Hg	Mercury	466.86	183.60	66.68	54.64
Mo	Molybdenum	6.88	16.94	3.82	4.47
Ni	Nickel	3.02	16.89	17.95	4.97
Se	Selenium	434.56	760.36	402.95	244.05
Ag	Silver	<0.01	4.19	0.27	1.78
0.76	Thallium	9.23	7.34	5.55	13.62
V	Vanadium	1.80	14.28	9.77	8.06
12.36	Zinc	5,654.36	10,184.68	<0.01	24.04

	Lab Sample Number:	205528 -5	205528 -6	205528 -7
	Client Sample Number:	5	6	7
	Matrix:	Bulk	Bulk	Bulk
	Extraction Type:	Acid	Acid	Acid
	Units:	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)
Sb	Antimony	10.85	105.61	85.29
As	Arsenic	5.25	20.25	833.06
Ba	Barium	3,606.14	33.55	103.69
Be	Beryllium	0.31	0.31	2.82
Cd	Cadmium	1.44	23.08	27.30
Cr	Chromium	293.62	3,129.97	0.21
Co	Cobalt	5.29	278.87	345.65
Cu	Copper	10.61	34.04	811.93
Pb	Lead	1,839.42	202,917.77	17,763.05
Hg	Mercury	44.36	49.87	34.38
Mo	Molybdenum	9.49	35.94	49.42
Ni	Nickel	15.05	9.37	9.78
Se	Selenium	254.32	1,014.59	675.64
Ag	Silver	0.78	2.87	6.09
0.76	Thallium	5.83	88.68	45.98
V	Vanadium	12.36	7.07	10.44
12.36	Zinc	3,560.65	12,727.67	11,719.14

- ***Hexavalent Chrome (Chrome 6) Findings***

Sample #205528-5, a total of one (1) paint sample was submitted for Hexachrome analysis to McCampbell Analytical Laboratory the EPA 218.6 method.

A copy of this laboratory analytical report is appended to this report.

Lab ID	Client ID	Matrix	Type	Hexachrome PPM (mg/kg
1007064-001A	205528	S	TOTAL	180 PPM

Sample numbers 205528 was considered to have elevated levels of Chromium. Such results will require special training and handling to be OSHA compliant.

Regulatory Requirements

The Environmental Protection Agency (EPA) defines Asbestos Containing Material as any material that contains greater than 1% asbestos. Materials containing greater than 1% asbestos must be removed prior to demolition or renovation if they will be disturbed.

Friable asbestos containing material is any material that can be crushed or pulverized by hand pressure when dry, or materials that can be rendered to a crumbled, pulverized, or powdered state when dry by crushing, sanding, sawing, shot blasting, or through demolition or renovation activities.

As stated by NESHAP regulations, any material that contains less than 10% asbestos using the visual estimation method can be point counted with gravimetric reduction. The Point Counting method is a much more accurate analytical method for determining the percent of asbestos in a particular material. If the Point Count method determines that the material contains less than 1% asbestos, the material being analyzed can be disposed of as a non-hazardous asbestos containing construction waste.

Removal or disturbance of material with any detectable amount of asbestos must be handled in accordance with OSHA regulations. Cal-OSHA registration is required if the material contains more than .1% asbestos ($1/10^{th}$ of a percent). If there is more than 100 feet (linear or square) of an asbestos containing material that will be abated or disturbed, a California State registered and licensed asbestos abatement contractor must perform the work. If there is less than 100 feet, the work does not require a licensed asbestos abatement contractor, but must still conform to Cal-OSHA regulations.

Removal or disturbance of any amount of lead paint requires adherence to the Cal-OSHA and CDPH regulations, including proper training and certification for workers and supervisors

The OSHA lead (1532) regulations require that a Negative Initial Determination for lead exposure be made with paint that contains greater than 0.06% (600 ppm) of lead. Paint with less than 0.06% lead should still be treated within the OSHA guidelines, but with reasonable work practices should not generate OSHA action levels of lead exposure.

Building components with intact lead paint and no other hazardous materials can be disposed of as non-hazardous construction waste. Paint chips and debris must be disposed of as lead containing hazardous waste.

Comment Regarding All Asbestos Containing Materials:

Asbestos containing materials in good condition do not necessarily need to be removed unless they will be disturbed; they should however be respected.

Employees, contract workers and others should be advised not to drill, saw, scrape or otherwise disturb this material without taking precautionary measures appropriate to asbestos containing material.

Asbestos containing material should be removed prior to the renovation and must be removed prior to demolition.

Comment Regarding All Lead Containing Materials:

Lead is a known health hazard. Lead containing materials in good condition do not necessarily need to be removed if they are not disturbed; they should however be respected.

Painted surfaces that contain lead should be made known to contractors who may disturb them during their work. OSHA guidelines for workers in contact with lead paint apply if ANY detectable lead is found.

Anyone coming in contact with leaded paint should be advised not to disturb it without taking precautionary measures appropriate to avoid lead contamination or lead exposure.

Areas Needing Immediate Corrective Action

Asbestos (in any condition) and chipping and peeling lead paint should be removed prior to renovation and must be removed prior to demolition of the survey site.

Analytical Procedures

POLARIZED LIGHT MICROSCOPY (PLM)

Bulk samples were analyzed in accordance with U.S. EPA "Test Method for Determination of Asbestos in Bulk Building Materials, 1993," with inclusion of area percent estimates of the sample components. The use of the McCrone Color Dispersion Staining Technique supplements the analysis when considered useful by the analyst. The samples are prepared with refractive immersion oil and are examined under Polarized Light Microscopy (PLM). The accuracy of the visual estimate method is 1%.

As per the standard "...The accuracy in the determination of the presence or absence of asbestos of greater than 1 area percent asbestos is greater than 99%." ASTM Committee D22.05, 1/18/88, Standard *Method of Testing for Asbestos Containing Materials by Polarized Light Microscopy*. If the sample matrix is reduced to minimize non-asbestos components, the

detection limit can be mathematically enhanced, based on the amount of material remaining after matrix reduction. This method is called gravimetric reduction. This method involves ashing and chemical dissolution of the sample.

POINT COUNTING

The Point Counting method is a much more accurate analytical method for determining the percent of asbestos in a particular material. KELLCO-MACS uses a muffle furnace to ash the sample and remove organic compounds. Hydrochloric acid is used to dissolve some of the non-asbestos minerals. Under this method a minimum of 125 points are counted from each of 8 different slide preparations of the same sample (total of 1000 points min.) If the **Point Count Method** determines that the material contains less than 1% asbestos, the material being analyzed can be treated as non-hazardous asbestos containing construction waste**. Note: ONLY the Point Count Method can be used for this determination.**

ATOMIC ABSORPTION FOR LEAD

Paint samples were collected for atomic absorption (AA) analysis. The detection limit for each sample depends upon many factors including the sensitivity of the instrument and the sample size. In the KELLCO-MACS laboratory utilizing flame AA, the detection limit is normally .01% or 100 parts per million (ppm).

CAM 17 TESTING

CAM 17 Metals were tested by Macs Lab, Inc. using ICP-MS, Extraction Method SW3050B and Analytical Method 6010B/3050.

HEXAVALENT CHROME (Chrome 6) TESTING

Hexavalent Chrome was tested by McCampbell Analytical Laboratory using the TTLC Hexachrome by EPA 218.6 Analytical Method.

KELLCO-MACS Qualifications

KELLCO-MACS is a creative joint venture offering hazardous materials and AIHA laboratory analyses. Our credentials include:

- The KELLCO-MACS asbestos inspector is licensed with the State of California Department of Occupational Safety and Health (CAL-OSHA).
- The KELLCO-MACS lead inspector is licensed by the California Department of Public Health (CDPH)
- The laboratory accreditations include:

- **NVLAP PLM** for Asbestos: NIST National Voluntary Laboratory Accreditation Program certificate of accreditation for bulk **asbestos** analysis by polarized light microscopy (Accreditation #101948-1).
- **AIHA** Accreditation for **Industrial Hygiene** Analytical Laboratory for PCM, and AA for lead (Accreditation #101786).
- **AIHA Analyst Proficiency (NIOSH PAT)** (Accreditation # 11172)
- **AIHA ELLAP** Accreditation for Lead: Accreditation for the **Environmental Lead** Laboratory recognized by the EPA as meeting the requirements of the National Lead Laboratory Accreditation Program established under Title X (Lab ID #11109).
- **ELAP PLM** for Asbestos: California Department of Health Services, Environmental Laboratory Accreditation Program, certificate for bulk asbestos analysis (Certificate #2027)
- **USDA Soil** permit #39484

The following supporting documents are attached to this report:

- Laboratory analytical reports
- Photographs of sample locations
- Floor plan or sketch showing sample locations

Please call KELLCO if there are any questions and/or clarifications regarding this report. We look forward to working with you in the future.

Sincerely,

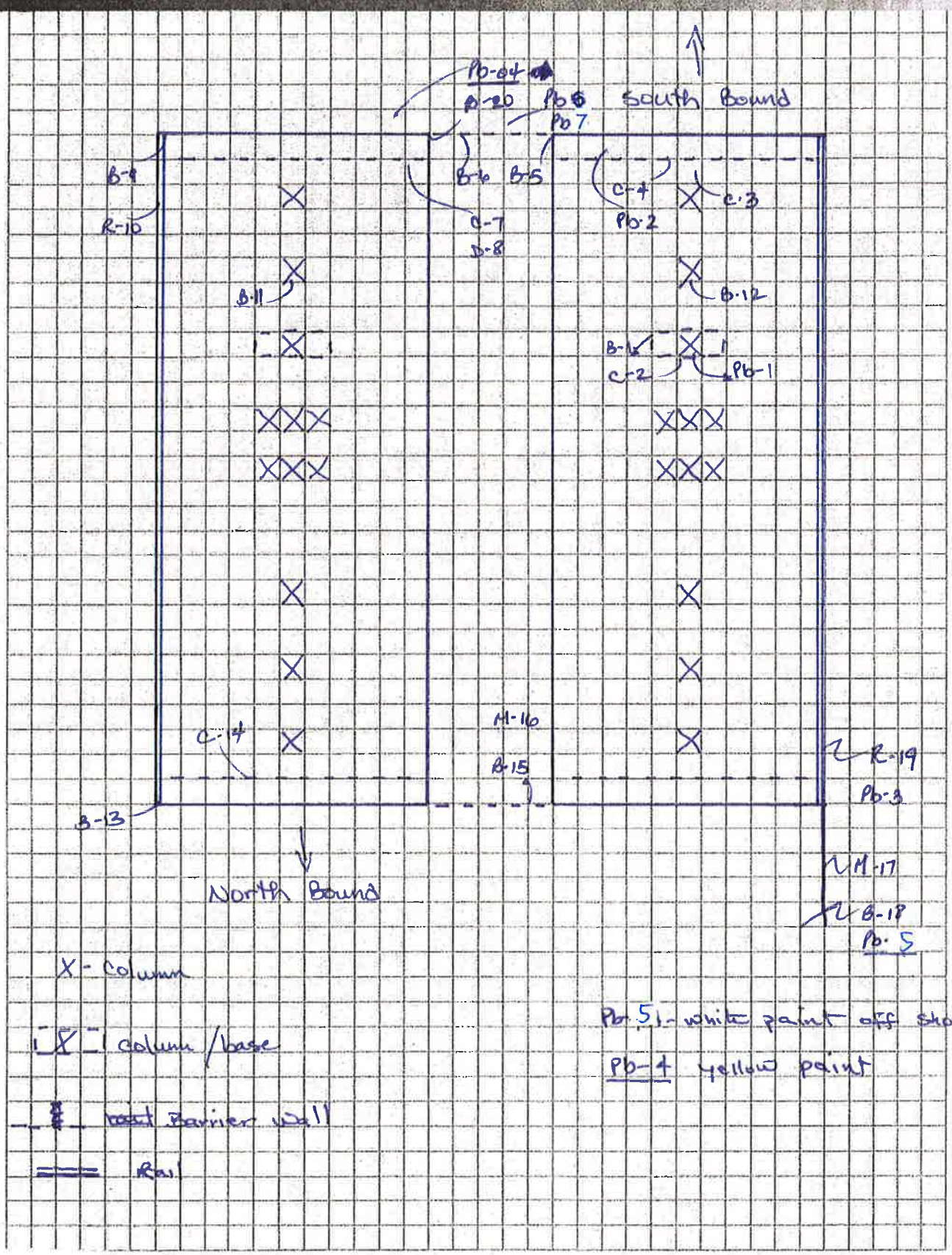
KELLCO-MACS

Tim C. Cannard CAC #94-1395, CDPH Lead #764
Senior Project Manager

KELLCO Job # 1006.20
Client: URS

Jobsite: Petaluma River Bridge

K E L L C O



X - Column

|X| column / base

Pb-5 - white paint off shoulder

Pb-4 yellow paint

[illegible] Barrier wall

=== Rail

MACS Lab Incorporated
Analytical and Environmental Services
3137 Diablo Avenue, Hayward, Ca 94545-2701 (510) 786-9751 * (510) 786-9625 Fax * www.macslab.com

CAM-17 Bulk Materials Analysis Report - Method: EPA 6010B/3050

KELLCO Services
3137 Diablo Avenue
Hayward, CA 94545

Contact: Tim Cannard
Phone: (510) 786-9751
Email: mailbox3137@kellcomacs.com
Job #: 1006-20

Laboratory Number: 205528
Sampled By: Derrik
Sampled On: June 18, 2010
Submitted On: June 30, 2010
Analyzed On: July 1, 2010
Reported On: July 1, 2010
SOP: CAM17
Sample Type: Bulk

Job Description: Petaluma River Bridge-Petaluma, CA

	Lab Sample Number:	205528 -1	205528 -2	205528 -3	205528 -4	205528 -5
	Client Sample Number:	1	2	3	4	5
	Matrix:	Bulk	Bulk	Bulk	Bulk	Bulk
	Extraction Type:	Acid	Acid	Acid	Acid	Acid
	Units:	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)	mg/kg (PPM)
Sb	Antimony	15.81	55.00	6.00	3.72	10.85
As	Arsenic	22.94	14,635.14	7.14	4.47	5.25
Ba	Barium	81.54	174.41	2,270.00	121.10	3,606.14
Be	Beryllium	<0.01	0.09	0.09	0.14	0.31
Cd	Cadmium	0.80	7.39	1.41	0.69	1.44
Cr	Chromium	<0.01	10.36	15.00	<0.01	293.62
Co	Cobalt	1.22	7.88	27.68	5.23	5.29
Cu	Copper	72.15	47,207.21	9.68	8.98	10.61
Pb	Lead	<0.01	2,350.45	58.45	112.37	1,839.42
Hg	Mercury	466.86	183.60	66.68	54.64	44.36
Mo	Molybdenum	6.88	16.94	3.82	4.47	9.49
Ni	Nickel	3.02	16.89	17.95	4.97	15.05
Se	Selenium	434.56	760.36	402.95	244.05	254.32
Ag	Silver	<0.01	4.19	0.27	1.78	0.78
Tl	Thallium	9.23	7.34	5.55	13.62	5.83
V	Vanadium	1.80	14.28	9.77	8.06	12.36
Zn	Zinc	5,654.36	10,184.68	<0.01	24.04	3,560.65

Analyst: _____ (Signature)

Laboratory Manager: _____ (Signature)

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MACS Lab Incorporated
Analytical and Environmental Services
3137 Diablo Avenue, Hayward, Ca 94545-2701 (510) 786-9751 * (510) 786-9625 Fax * www.macslab.com

CAM-17 Bulk Materials Analysis Report - Method: EPA 6010B/3050

KELLCO Services
3137 Diablo Avenue
Hayward, CA 94545

Contact: Tim Cannard
Phone: (510) 786-9751
Email: mailbox3137@kellcomacs.com
Job #: 1006-20

Laboratory Number: 205528
Sampled By: Derrik
Sampled On: June 18, 2010
Submitted On: June 30, 2010
Analyzed On: July 1, 2010
Reported On: July 1, 2010
SOP: CAM17
Sample Type: Bulk

Job Description: Petaluma River Bridge-Petaluma, CA

	Lab Sample Number:	205528 -6	205528 -7			
	Client Sample Number:	6	7			
	Matrix:	Bulk	Bulk			
	Extraction Type:	Acid	Acid			
	Units:	mg/kg (PPM)	mg/kg (PPM)			
Sb	Antimony	105.61	85.29			
As	Arsenic	20.25	833.06			
Ba	Barium	33.55	103.69			
Be	Beryllium	0.31	2.82			
Cd	Cadmium	23.08	27.30			
Cr	Chromium	3,129.97	0.21			
Co	Cobalt	278.87	345.65			
Cu	Copper	34.04	811.93			
Pb	Lead	202,917.77	17,763.05			
Hg	Mercury	49.87	34.38			
Mo	Molybdenum	35.94	49.42			
Ni	Nickel	9.37	9.78			
Se	Selenium	1,014.59	675.64			
Ag	Silver	2.87	6.09			
Tl	Thallium	88.68	45.98			
V	Vanadium	7.07	10.44			
Zn	Zinc	12,727.67	11,719.14			

Analyst: _____ (Signature)

Laboratory Manager: _____ (Signature)

NOTICE

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I205528

CLIENT	JOBSITE
URS Corporation	Petaluma River Bridge
55 South Market Street	Please refer to pictures
1500	
San Jose	Petaluma
CA 95113	CA

KELLCO-MACS JOB#: **1006-20** LAB LOGIN #

COLLECTED BY: Derrik

COLLECTED DATE 6.18.10

TURN AROUND TIME: Normal 4 8 24 48 5-DAY

RESULTS NEEDED BY

CIRCLE TYPE OF BULK ANALYSIS

PLM **LEAD PAINT** LEAD WIPE NON VIABLE MOLD VIABLE MOLD eCOLI OTHER

SAMPLES REC'D 7 ANALYZE TO FIRST POSITIVE YES NO

REPORT RESULTS TO PROJECT MANAGER: Tim Cannard

NOTES & COMMENTS:

CHAIN OF CUSTODY & SAMPLE SUBMITAL FORM PAGE____ OF ____

KELLCO-MACS JOB#: **1006-20**
Petaluma River Bridge

FIELD NUMBER	LOCATION (bldg, rm#, area)	COLOR	MATERIAL or SUBSTRATE (ft w/ size, mastic, tjc, etc.)	NOTES: Like condition, damage, quantity, inside what, beneath what? direction in building (N,S,E,W) etc.)
PRB-C-Pb-01	South Bound Bridge · column	grey	paint on metal	3rd column 0837
Pb-02	South Bound Bridge · base	grey	wood	south base 0850
Pb-03	South Bound Bridge · Bound	grey	paint on concrete	SW bound (barrier wall) 11
Pb-04	North Bound Bridge · Stripe	wht	paint on Asphalt	(SE) stripe 1132
Pb-05	" " - Stripe	yell	" "	(SW) Stripe 1228
Pb-06	" " - Barriers Fence	wht	paint on metal	(SE) barrier 1231
Pb-07	" " - Wood pole	wht	paint on wood	(SE) " 1231

RELEASED BY	DATE	TIME	RECEIVED BY	DATE	TIME
[signature]	6.18.10	1530	[signature]	7/1/10	

MACS Lab, Inc.
3137 Diablo Ave
Hayward, CA 94545-2701

510-786-9751

Bulk Asbestos Analysis

Report

Method: EPA-600/M4-82-020

KELLCO Services
3137 Diablo Ave

Hayward CA 94545

Person to contact: Tim Cannard
Contact phone: 510-786-9751
FAX phone: 510-786-9625
Sampled by: Derrik Quach
Sampled on: June 18, 2010
Analyzed on: June 24, 2010 at: 14:21
Corresponding invoice number: 205017

Analyst: MCB
HCB (signature)

Laboratory manager: _____
(signature)

Job Number: 1006-20

Job Description: Petaluma River Bridge - Petaluma, CA

Lab Sample Number	Client Sample Number and Description	Asbestos detected?	Fibers present	Remarks
L205017-1	PRB-B-01 South bound, base, 3rd column / grey concrete	**N.D.**	< 1% Cellulose	Gray/brown concrete. Balance of sample is silicate and cementitious.
L205017-2	PRB-C-02 South bound, 3rd column / grey mortar	**N.D.**	No Fibers	Gray/brown concrete. Balance of sample is silicate and cementitious.
L205017-3	PRB-B-03 South bound, bridge / grey concrete	**N.D.**	1% Cellulose	Gray/brown concrete. Balance of sample is silicate and cementitious.
L205017-4	PRB-C-04 Sough bound, column base / grey concrete	**N.D.**	No Fibers	Gray/brown concrete. Balance of sample is silicate and cementitious.
L205017-5	PRB-B-05 South bound, column base / grey concrete	**N.D.**	< 1% Cellulose	Gray/brown concrete. Balance of sample is silicate and cementitious.

* Chrysotile, Amosite, Crocidolite, Tremolite, Actinolite, and Anthophyllite are asbestos fibers. N.D.=None Detected PC =Point Counted

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NVLAP Lab Code 101948-0

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MACS Lab, Inc.
3137 Diablo Ave
Hayward, CA 94545-2701

510-786-9751

Bulk Asbestos Analysis

Report

Lab Sample Number	Client Sample Number and Description	Asbestos detected?	Fibers present	Remarks
L205017-6	PRB-B-06 North bound, southwest bridge / black joint cork	**N.D.**	62% Cellulose	Black tar fiber board. Balance of sample is organic binders and unspecified non-fibrous material.
L205017-7	PRB-C-07 North bound, southwest brige / grey concrete	**N.D.**	No Fibers	Gray/brown concrete. Balance of sample is silicate and cementitious.
L205017-8	PRB-D-08 Between north bound & south bound / grey concrete	**N.D.**	< 1% Cellulose	Gray/brown concrete. Balance of sample is silicate and cementitious.
L205017-9	PRB-B-09 North bound, southeast barrier / grey concrete	**N.D.**	No Fibers	Gray/brown concrete. Balance of sample is silicate and cementitious.
L205017-10	PRB-R-10 North bound, southeast rail / grey concrete	**N.D.**	< 1% Cellulose	Gray/brown concrete. Balance of sample is silicate and cementitious.
L205017-11	PRB-C-11 North bound, 2nd column / black mastic/ barriers	**N.D.**	1% Cellulose < 1% Polyethylene	Gray/black mastic. Balance of sample is polymer and organic binders.
L205017-12	PRB-C-12 South bound, 2nd column / black mastic/barriers	**N.D.**	< 1% Cellulose	Black mastic. Balance of sample is organic binders.
L205017-13	PRB-B-13 North bound, northeast barriers / grey concrete	**N.D.**	No Fibers	Gray/brown concrete. Balance of sample is silicate and cementitious.
L205017-14	PRB-C-14 North bound, north column / grey concrete	**N.D.**	< 1% Cellulose	Gray/brown concrete. Balance of sample is silicate and cementitious.

* Chrysotile, Amosite, Crocidolite, Tremolite, Actinolite, and Anthophyllite are asbestos fibers. N.D.=None Detected PC =Point Counted

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MACS Lab, Inc.
3137 Diablo Ave
Hayward, CA 94545-2701

510-786-9751

Bulk Asbestos Analysis

Report

Lab Sample Number	Client Sample Number and Description	Asbestos detected?	Fibers present	Remarks
L205017-15	PRB-B-15 North barriers wall, northwest wall / black joint cork	**N.D.**	59% Cellulose	Black tar fiber board. Balance of sample is organic binders and unspecified non-fibrous material.
L205017-16	PRB-M-16 North bound, north base / black asphalt	**N.D.**	1% Cellulose	Black asphalt aggregate. Balance of sample is silicate and organic binders.
L205017-17	PRB-M-17-1 South bound, northwest barrier wall / black pipe	**N.D.**	< 1% Cellulose < 1% Polyethylene	Black mastic. Balance of sample is organic binders.
L205017-18	RPB-M-17-2 South bound, northwest barrier wall / grey concrete	**N.D.**	< 1% Cellulose	Gray/brown concrete. Balance of sample is silicate and cementitious.
L205017-19	RPB-B-18 South bound, southwest barrier wall / grey concrete	**N.D.**	No Fibers	Gray/brown concrete. Balance of sample is silicate and cementitious.
L205017-20	RPB-R-19 South bound, southwest rail / grey concrete	**N.D.**	No Fibers	Gray/brown concrete. Balance of sample is silicate and cementitious.
L205017-21	RPB-B-20 North bound, southwest barrier wall / grey concrete	**N.D.**	No Fibers	Gray/brown concrete. Balance of sample is silicate and cementitious.

* Chrysotile, Amosite, Crocidolite, Tremolite, Actinolite, and Anthophyllite are asbestos fibers. N.D.=None Detected PC =Point Counted

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NVLAP Lab Code 101948-0

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MACS Lab, Inc.
3137 Diablo Ave
Hayward, CA 94545-2701

510-786-9751

Bulk Asbestos Analysis

QA Report

Method: EPA-600/M

KELLCO Services
3137 Diablo Ave

Hayward CA 94545

Laboratory manager: _____ (signature)

Lab Sample Number	Client Sample Number and Description	Asbestos detected?	Fibers present	Remarks
Blank sample		**N.D.** PC*	No fibers	
L205017-21	RPB-B-20 North bound, southwest barrier wall / grey concrete	**N.D.**	No Fibers	Gray/brown concrete. Balance of sample is silicate and cementitious.

End of report.

* Chrysotile, Amosite, Crocidolite, Tremolite, Actinolite, and Anthophyllite are asbestos fibers. N.D.=None Detected PC =Point Counted

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NVLAP®
NVLAP Lab Code 101948-0

CLIENT	JOBSITE
URS Corporation 55 South Market Street 1500 San Jose CA 95113	Petaluma River Bridge Please refer to pictures Petaluma CA

KELLCO-MACS JOB#: **1006-20** LAB LOGIN # L205017

COLLECTED BY: Derrik

COLLECTED DATE 6.18.10

TURN AROUND TIME: (Normal) 4 8 24 48 5-DAY

RESULTS NEEDED BY

CIRCLE TYPE OF BULK ANALYSIS

(PLM) **LEAD PAINT** **LEAD WIPE** **NON VIABLE MOLD** **VIABLE MOLD** **eCOLI** **OTHER** _____

SAMPLES REC'D 20 ANALYZE TO FIRST POSITIVE YES NO

REPORT RESULTS TO PROJECT MANAGER: Tim Cannard

NOTES & COMMENTS:

CHAIN OF CUSTODY & SAMPLE SUBMITAL FORM PAGE ____ OF ____

KELLCO-MACS JOB#: **1006-20**
Petaluma River Bridge

FIELD NUMBER	LOCATION (bldg, rm#, area)	COLOR	MATERIAL or SUBSTRATE (ft w/ size, mastic, tjc, etc.)	NOTES: Like condition, damage, quantity, inside what, beneath what? direction in building (N,S,E,W) etc.)
PRB-B-01	South Bound · Base 3rd column	grey	concrete	
C-02	· 3rd column	"	mortar	
B-03	· Bridge	"	concrete	
C-04	· column base	"	concrete	
B-05	·	"	concrete	
B-06	North Bound · (SW) barriers	blk	~~barrier divide panel~~ joint cork	
C-07	" · SW bridge	grey	concrete	
D-08	bet. N. Bound and S. Bound	grey	concrete	
B-09	North Bound · (SE) Barrier	grey	concrete	

RELEASED BY	DATE	TIME	RECEIVED BY	DATE	TIME
[signature]	6.18.10		[signature]	06/18/10	15:30

L205017

CHAIN OF CUSTODY & SAMPLE SUBMITAL FORM PAGE_____ OF _____

KELLCO-MACS JOB#: **1006-20**
Petaluma River Bridge

FIELD NUMBER	LOCATION (bldg, rm#, area)	COLOR	MATERIAL or SUBSTRATE (ft w/ size, mastic, tjc, etc.)	NOTES: Like condition, damage, quantity, inside what, beneath what? direction in building (N,S,E,W) etc.)
PRB-R-10	N. Bound · SE Rail	grey	concrete	
C-11	" - 2nd column	blk	mastic / barriers	
C-12	S. Bound - 2nd column	blk	" "	
B-13	N. Bound - (NE) barriers	grey	concrete	
C-14	N. Bound - (N) column	grey	concrete	
B-15	N. Barriers wall · (NW) wall	blk	joint cork	
M-16	N. Bound · (N) base	blk	asphalt	
M-17.1	S. Bound · (NW) Barrier wall	blk	pipe	
17.2	" "	grey	concrete	
B-18	~~N~~ S. Bound · (SW) Barrier wall	"	"	
R-19	S. Bound (SW) Rail	"	"	
B-20	N. Bound (SW) Barrier wall	grey	concrete	

RELEASED BY	DATE	TIME	RECEIVED BY	DATE	TIME
[illegible]	6·18·10		D. Kinsch	06/18/10	15:30

CLIENT	JOBSITE
URS Corporation 55 South Market Street 1500 San Jose CA 95113	Petaluma River Bridge Please refer to pictures Petaluma CA

KELLCO-MACS JOB#: **1006-20** LAB LOGIN #_____

COLLECTED BY: Derrik

COLLECTED DATE 6.18.10

TURN AROUND TIME: (Normal) 4 8 24 48 5-DAY

RESULTS NEEDED BY

CIRCLE TYPE OF BULK ANALYSIS

(PLM) LEAD PAINT LEAD WIPE NON VIABLE MOLD VIABLE MOLD eCOLI OTHER_____

SAMPLES REC'D 20 ANALYZE TO FIRST POSITIVE YES NO

REPORT RESULTS TO PROJECT MANAGER: Tim Cannard

NOTES & COMMENTS:

CHAIN OF CUSTODY & SAMPLE SUBMITAL FORM PAGE_____ OF ____

KELLCO-MACS JOB#: **1006-20**
Petaluma River Bridge

FIELD NUMBER	LOCATION (bldg, rm#, area)	COLOR	MATERIAL or SUBSTRATE (ft w/ size, mastic, tjc, etc.)	NOTES: Like condition, damage, quantity, inside what, beneath what? direction in building (N,S,E,W) etc.)
PRB-B-01	South Bound · Base 3rd column	grey	concrete	0834
C-02	· 3rd column	"	mortar	0838
B-03	· Bridge	"	concrete	0845
C-04	· column base	"	concrete	0847
B-05	·	"	concrete	0855
B-06	North Bound · (SW) barriers	blk	~~barrier divide panel~~ joint cork	0900
C-07	" · SW bridge	grey	concrete	0902
D-08	bet. N. Bound and S. Bound	grey	concrete	0903
B-09	North Bound · (SE) Barrier	grey	concrete	0908

RELEASED BY	DATE	TIME	RECEIVED BY	DATE	TIME
[signature]	6.18.10	1530			

CHAIN OF CUSTODY & SAMPLE SUBMITAL FORM PAGE_____ OF _____

KELLCO-MACS JOB#: **1006-20**
Petaluma River Bridge

FIELD NUMBER	LOCATION (bldg, rm#, area)	COLOR	MATERIAL or SUBSTRATE (ft w/ size, mastic, tjc, etc.)	NOTES: Like condition, damage, quantity, inside what, beneath what? direction in building (N,S,E,W) etc.)
PRB-R-10	N. Bound · SE Rail	grey	concrete	0910
C-11	" - 2nd column	blk	mastic / barriers	0916
C-12	S. Bound - 2nd column	blk	" "	0922
B-13	N. Bound -(NE) barriers	grey	concrete	1107
C-14	N. Bound-(N) column	grey	concrete	1110
B-15	N. Barriers wall (NW) wall	blk	joint cork	1113
M-16	N. Bound (N) base	blk	asphalt	1116
M-17.1	S. Bound (NW) Barrier wall	blk	pipe	1121
17.2	" "	grey	concrete	
B-18	~~N~~ S. Bound (SW) Barrier wall	"	"	1126
R-19	S. Bound (SW) Rail	"	"	1127
B-20	N. Bound (SW) Barrier wall	grey	concrete	1229

RELEASED BY	DATE	TIME	RECEIVED BY	DATE	TIME
[signature]	6·18·10	1530			

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Web: www.mccampbell.com E-mail: main@mccampbell.com
Telephone: 877-252-9262 Fax: 925-252-9269

Kellco Services, Inc.	Client Project ID: #1006-20; Petaluma	Date Sampled: 07/01/10
3137 Diablo Avenue		Date Received: 07/02/10
	Client Contact: Tim Cannard	Date Reported: 07/09/10
Hayward, CA 94545	Client P.O.:	Date Completed: 07/09/10

WorkOrder: 1007064

July 09, 2010

Dear Tim:

Enclosed within are:

1) The results of the **1** analyzed sample from your project: **#1006-20; Petaluma,**
2) A QC report for the above sample,
3) A copy of the chain of custody, and
4) An invoice for analytical services.

All analyses were completed satisfactorily and all QC samples were found to be within our control limits.

If you have any questions or concerns, please feel free to give me a call. Thank you for choosing McCampbell Analytical Laboratories for your analytical needs.

Best regards,

Angela Rydelius
Laboratory Manager
McCampbell Analytical, Inc.

1007064

McCAMPBELL ANALYTICAL, INC.

1534 WILLOW PASS ROAD
PITTSBURG, CA 94565-1701
Website: www.mccampbell.com Email: main@mccampbell.com
Telephone: (877) 252-9262 Fax: (925) 252-9269

CHAIN OF CUSTODY RECORD

TURN AROUND TIME ☐ RUSH ☐ 24 HR ☐ 48 HR ☐ 72 HR ☒ 5 DAY

GeoTracker EDF ☐ PDF ☐ Excel ☐ Write On (DW) ☐

☐ Check if sample is effluent and "J" flag is required

Report To: Tim Cannard Bill To: same
Company: Kelco Services
3137 Diablo ave
Hayward CA 94545 E-Mail:
Tele: (510) 786 9751 Fax: ( )
Project #: 1006-20 Project Name: Petaluma
Project Location: Petaluma, CA Binder
Sampler Signature: Hernandez

SAMPLE ID	LOCATION/ Field Point Name	SAMPLING Date	SAMPLING Time	# Containers	Type Containers	MATRIX Water	MATRIX Soil	MATRIX Air	MATRIX Sludge	MATRIX Other	METHOD PRESERVED ICE	HCL	HNO_3	Other	BTEX & TPH as Gas (602 / 8021 + 8015) / MTBE	TPH as Diesel (8015)	Total Petroleum Oil & Grease (1664 / 5520 E/B&F)	Total Petroleum Hydrocarbons (418.1)	EPA 502.2 / 601 / 8010 / 8021 (HVOCs)	MTBE / BTEX ONLY (EPA 602 / 8021)	EPA 505/ 608 / 8081 (Cl Pesticides)	EPA 608 / 8082 PCB's ONLY; Aroclors / Congeners	EPA 507 / 8141 (NP Pesticides)	EPA 515 / 8151 (Acidic Cl Herbicides)	EPA 524.2 / 624 / 8260 (VOCs)	EPA 525.2 / 625 / 8270 (SVOCs)	EPA 8270 SIM / 8310 (PAHs / PNAs)	CAM 17 Metals (200.7 / 200.8 / 6010 / 6020)	LUFT 5 Metals (200.7 / 200.8 / 6010 / 6020)	Lead (200.7 / 200.8 / 6010 / 6020)	Other: Hexa valent chromium			Comments
205528	PRB-05	7/1												X																	X				Filter Samples for Metals analysis: Yes / No

Relinquished By:	Date:	Time:	Received By:
Hernandez	7/1	11:10	Dakta
Henklark	7/1/10	1400	[illegible]
Relinquished By:	Date:	Time:	Received By:

ICE/t° yes 8.9 °C
GOOD CONDITION ✓
HEAD SPACE ABSENT N/A
DECHLORINATED IN LAB N/A
APPROPRIATE CONTAINERS ✓
PRESERVED IN LAB N/A

COMMENTS:

	VOAS	O&G	METALS	OTHER
PRESERVATION			pH<2	

McCAMPBELL ANALYTICAL, INC.

1534 WILLOW PASS ROAD
PITTSBURG, CA 94565-1701
Website: www.mccampbell.com Email: main@mccampbell.com
Telephone: (877) 252-9262 Fax: (925) 252-9269

CHAIN OF CUSTODY RECORD

TURN AROUND TIME ☐ RUSH ☐ 24 HR ☐ 48 HR ☐ 72 HR ☒ 5 DAY

GeoTracker EDF ☐ PDF ☐ Excel ☐ Write On (DW) ☐

☐ Check if sample is effluent and "J" flag is required

Report To: Tim Cannard Bill To: same
Company: Kelco Services
3137 Diablo ave
Hayward ca 94545 E-Mail:
Tele: (510) 7869751 Fax: ( )
Project #: 1006-20 Project Name: Petaluma
Project Location: Petaluma, ca Bndgr
Sampler Signature: Hernandez

SAMPLE ID	LOCATION/ Field Point Name	SAMPLING Date	SAMPLING Time	# Containers	Type Containers	MATRIX Water	MATRIX Soil	MATRIX Air	MATRIX Sludge	MATRIX Other	METHOD PRESERVED ICE	HCL	HNO_3	Other	BTEX & TPH as Gas (602 / 8021 + 8015) / MTBE	TPH as Diesel (8015)	Total Petroleum Oil & Grease (1664 / 5520 E/B&F)	Total Petroleum Hydrocarbons (418.1)	EPA 502.2 / 601 / 8010 / 8021 (HVOCs)	MTBE / BTEX ONLY (EPA 602 / 8021)	EPA 505/ 608 / 8081 (Cl Pesticides)	EPA 608 / 8082 PCB's ONLY; Aroclors / Congeners	EPA 507 / 8141 (NP Pesticides)	EPA 515 / 8151 (Acidic Cl Herbicides)	EPA 524.2 / 624 / 8260 (VOCs)	EPA 525.2 / 625 / 8270 (SVOCs)	EPA 8270 SIM / 8310 (PAHs / PNAs)	CAM 17 Metals (200.7 / 200.8 / 6010 / 6020)	LUFT 5 Metals (200.7 / 200.8 / 6010 / 6020)	Lead (200.7 / 200.8 / 6010 / 6020)	Other: Hexa Valent Chrome			Comments: Filter Samples for Metals analysis: Yes / No
205528	PRB-05	7/1												X																	X				

Relinquished By:	Date:	Time:	Received By:
Hernandez	7/1	11:10	Dek Ta
Relinquished By:	Date:	Time:	Received By:
Relinquished By:	Date:	Time:	Received By:

ICE/t°_____
GOOD CONDITION_____
HEAD SPACE ABSENT_____
DECHLORINATED IN LAB_____
APPROPRIATE CONTAINERS_____
PRESERVED IN LAB_____

COMMENTS:

	VOAS	O&G	METALS	OTHER
PRESERVATION			pH<2	

McCampbell Analytical, Inc.
1534 Willow Pass Rd
Pittsburg, CA 94565-1701
(925) 252-9262

CHAIN-OF-CUSTODY RECORD

WorkOrder: 1007064 **ClientCode: KSH**

☐ WaterTrax ☐ WriteOn ☐ EDF ☐ Excel ☐ Fax ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag

Report to:
Tim Cannard
Kellco Services, Inc.
3137 Diablo Avenue
Hayward, CA 94545
(510) 786-9751 FAX (510) 786-9625

Email: mailbox3137@kellcomacs.com
cc:
PO:
ProjectNo: #1006-20; Petaluma

Bill to:
Accounts Payable
Kellco Services, Inc.
3137 Diablo Avenue
Hayward, CA 94545
christine@kellcomacs.com; jrichards

Requested TAT: 5 days

Date Received: 07/02/2010
Date Printed: 07/02/2010

Lab ID	Client ID	Matrix	Collection Date	Hold	Requested Tests (See legend below) 1	2	3	4	5	6	7	8	9	10	11	12
1007064-001	205528	Solid	7/1/2010	☐	A											

Test Legend:

1	218_6-TTLC_Solid	2		3		4		5	
6		7		8		9		10	
11		12							

Prepared by: Samantha Arbuckle

Comments:

NOTE: Soil samples are discarded 60 days after results are reported unless other arrangements are made (Water samples are 30 days).
Hazardous samples will be returned to client or disposed of at client expense.

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Web: www.mccampbell.com E-mail: main@mccampbell.com
Telephone: 877-252-9262 Fax: 925-252-9269

Sample Receipt Checklist

Client Name: **Kellco Services, Inc.**

Date and Time Received: **7/2/2010 2:17:16 PM**

Project Name: **#1006-20; Petaluma**

Checklist completed and reviewed by: Samantha Arbuckle

WorkOrder N°: **1007064** Matrix Solid

Carrier: Derik Cartan (MAI Courier)

Chain of Custody (COC) Information

Chain of custody present?	Yes ☑	No ☐
Chain of custody signed when relinquished and received?	Yes ☑	No ☐
Chain of custody agrees with sample labels?	Yes ☑	No ☐
Sample IDs noted by Client on COC?	Yes ☑	No ☐
Date and Time of collection noted by Client on COC?	Yes ☑	No ☐
Sampler's name noted on COC?	Yes ☑	No ☐

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	NA ☑
Shipping container/cooler in good condition?	Yes ☑	No ☐	
Samples in proper containers/bottles?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature	Cooler Temp: 8.9°C		NA ☐
Water - VOA vials have zero headspace / no bubbles?	Yes ☐	No ☐	No VOA vials submitted ☑
Sample labels checked for correct preservation?	Yes ☑	No ☐	
Metal - pH acceptable upon receipt (pH<2)?	Yes ☐	No ☐	NA ☑
Samples Received on Ice?	Yes ☑	No ☐	

(Ice Type: WET ICE)

** NOTE: If the "No" box is checked, see comments below.*

Client contacted: Date contacted: Contacted by:

Comments:

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Web: www.mccampbell.com E-mail: main@mccampbell.com
Telephone: 877-252-9262 Fax: 925-252-9269

Kellco Services, Inc.	Client Project ID: #1006-20; Petaluma	Date Sampled: 07/01/10
3137 Diablo Avenue		Date Received: 07/02/10
	Client Contact: Tim Cannard	Date Extracted: 07/02/10
Hayward, CA 94545	Client P.O.:	Date Analyzed: 07/09/10

TTLC Hexachrome by Alkaline Digestion and IC-UV Analysis*

Extraction method: SW3060A Analytical methods: E218.6m Work Order: 1007064

Lab ID	Client ID	Matrix	Extraction Type	Hexachrome	DF	% SS	Comments
1007064-001A	205528	S	TOTAL	180	1	N/A	

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	TOTAL	NA	µg/L
	S	TOTAL	0.8	mg/Kg

* All samples are reported in mg/kg unless otherwise requested. All samples and QC were cleaned up prior to analysis.

%SS = Percent Recovery of Surrogate Standard
DF = Dilution Factor

DHS ELAP Certification 1644

AR Angela Rydelius, Lab Manager

McCampbell Analytical, Inc.
"When Quality Counts"

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Web: www.mccampbell.com E-mail: main@mccampbell.com
Telephone: 877-252-9262 Fax: 925-252-9269

QC SUMMARY REPORT FOR E218.6m

W.O. Sample Matrix: Solid QC Matrix: Soil BatchID: 51599 WorkOrder 1007064

EPA Method E218.6m **Extraction SW3060A** **Spiked Sample ID: 1007099-001a**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
Hexachrome	ND	40	98.7	104	5.42	85.6	86	0.466	70 - 130	20	80 - 120	10

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:
NONE

BATCH 51599 SUMMARY

Lab ID	Date Sampled	Date Extracted	Date Analyzed	Lab ID	Date Sampled	Date Extracted	Date Analyzed
1007064-001A	07/01/10	07/02/10	07/09/10 1:08 AM				

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

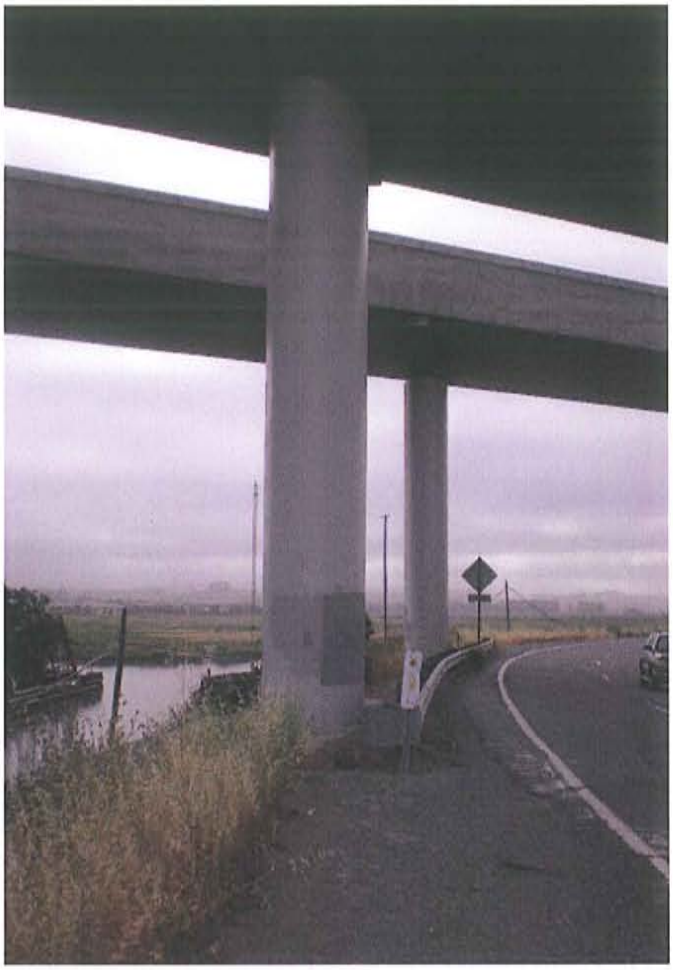
MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

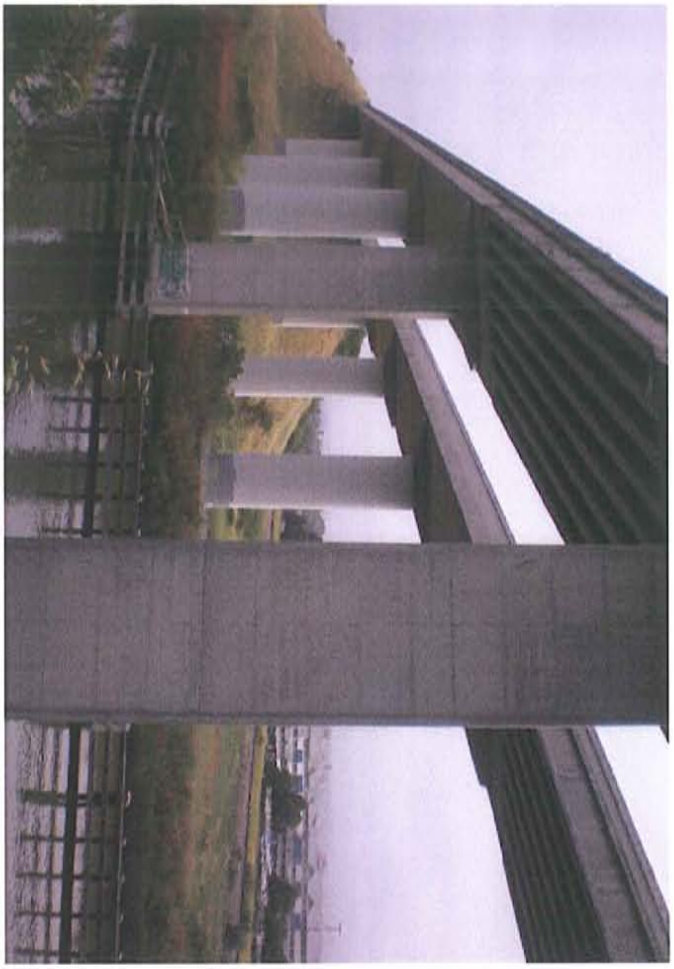
N/A = not applicable to this method.

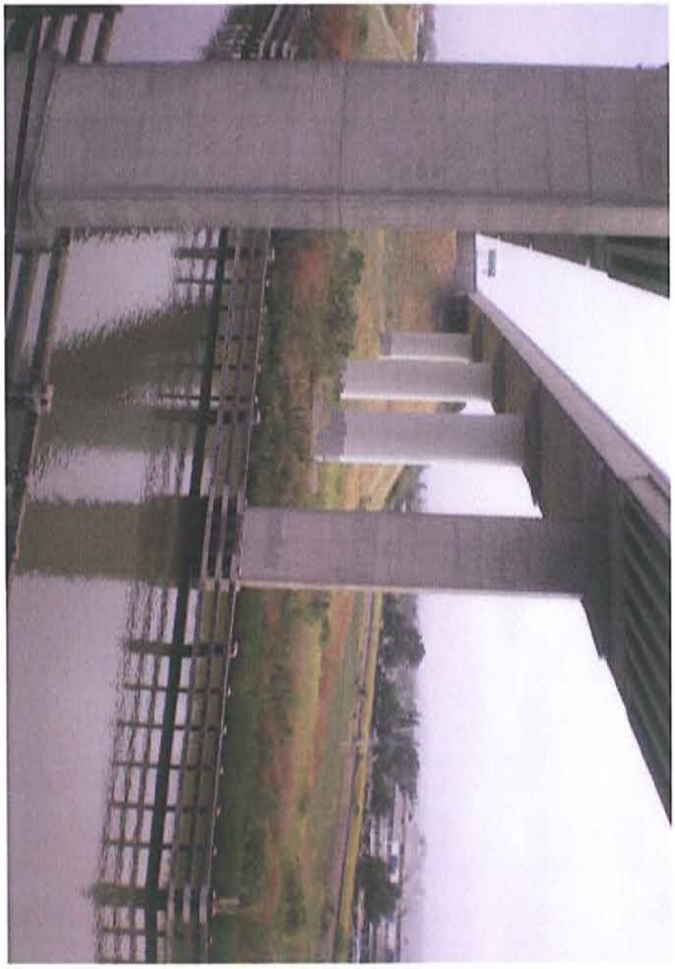
NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

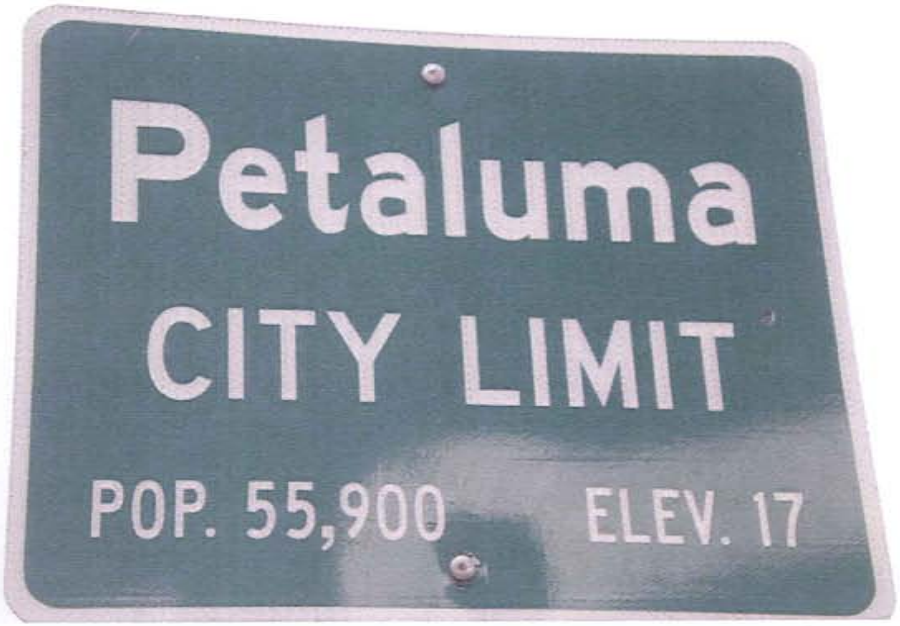
DHS ELAP Certification 1644

AR QA/QC Officer





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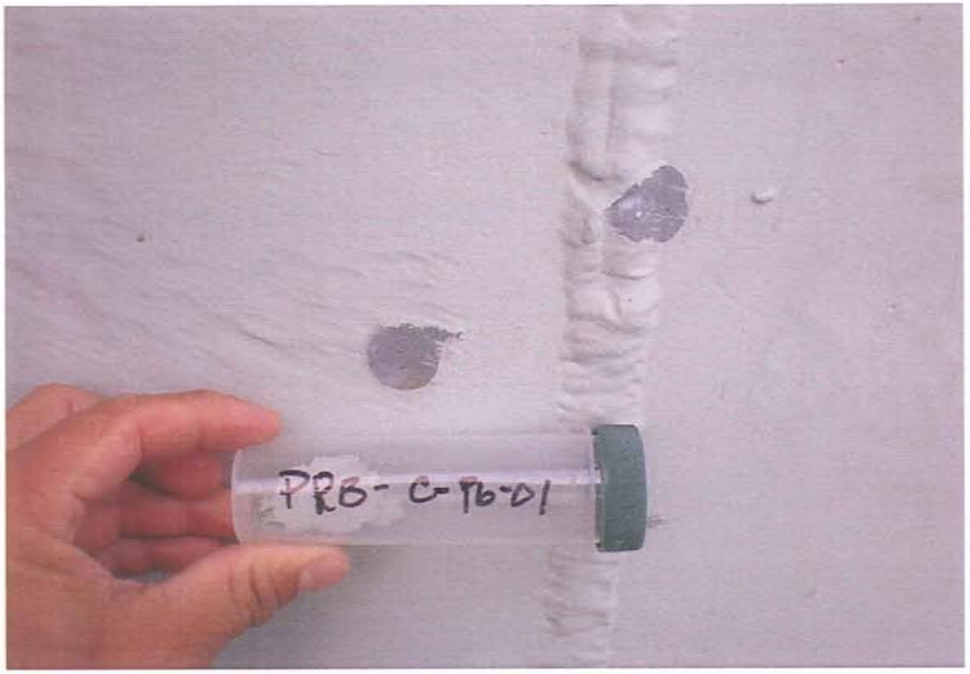
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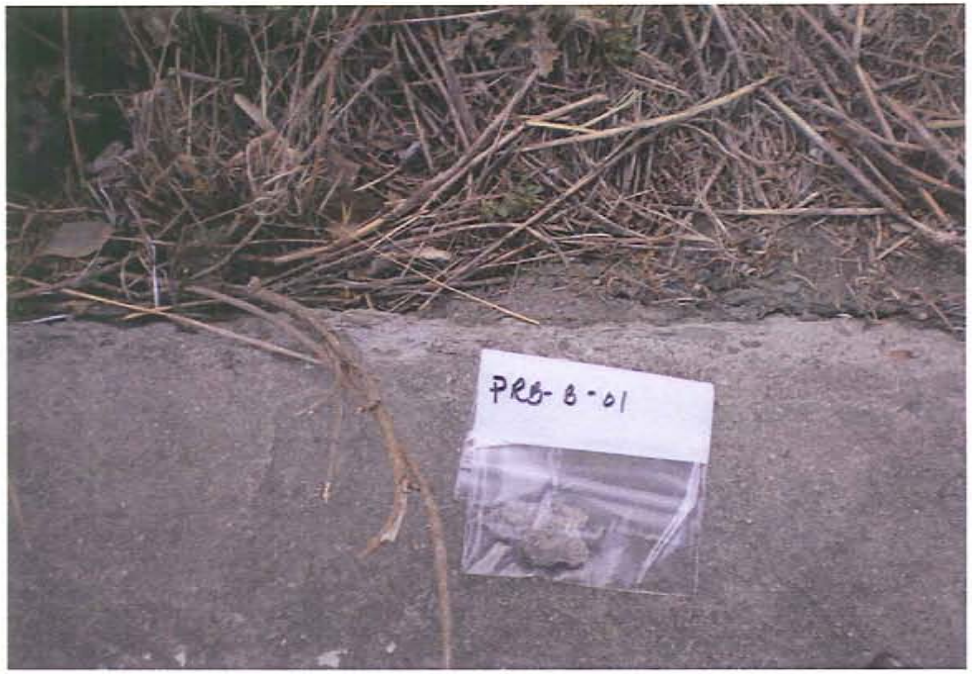
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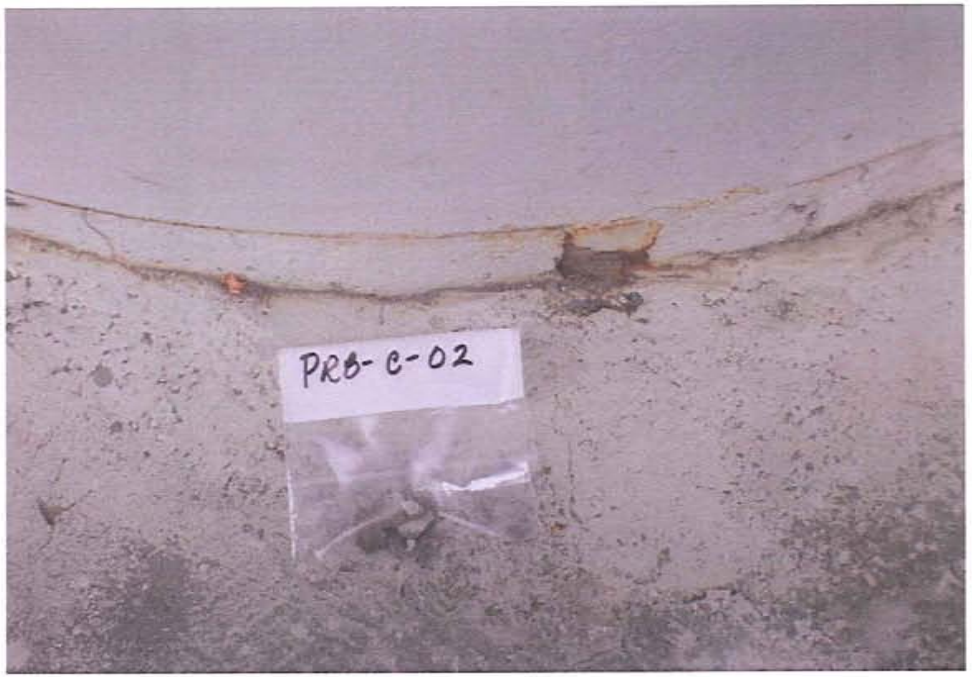
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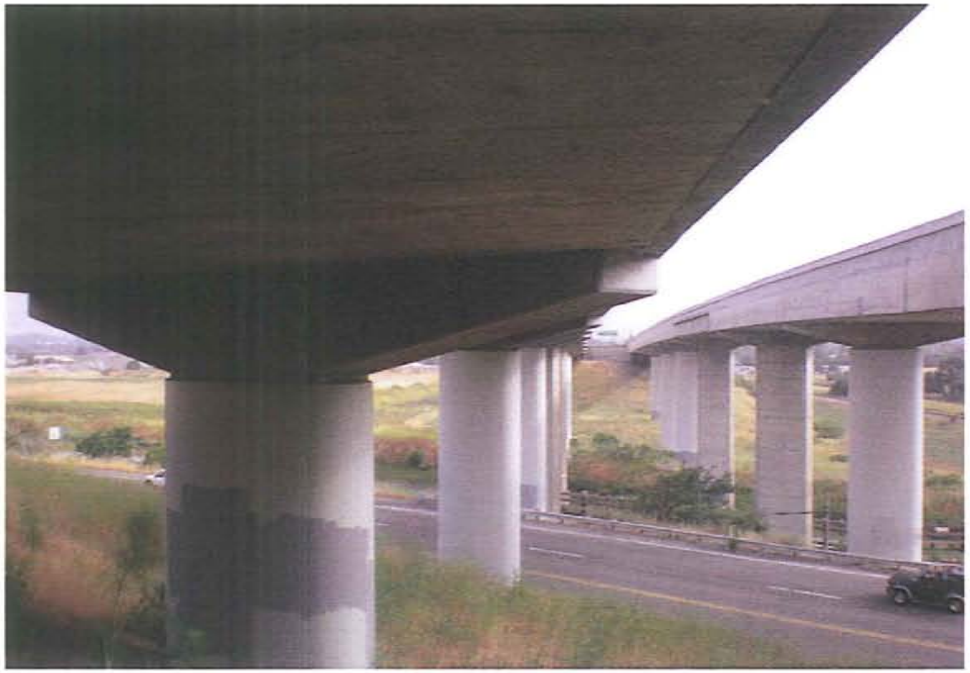

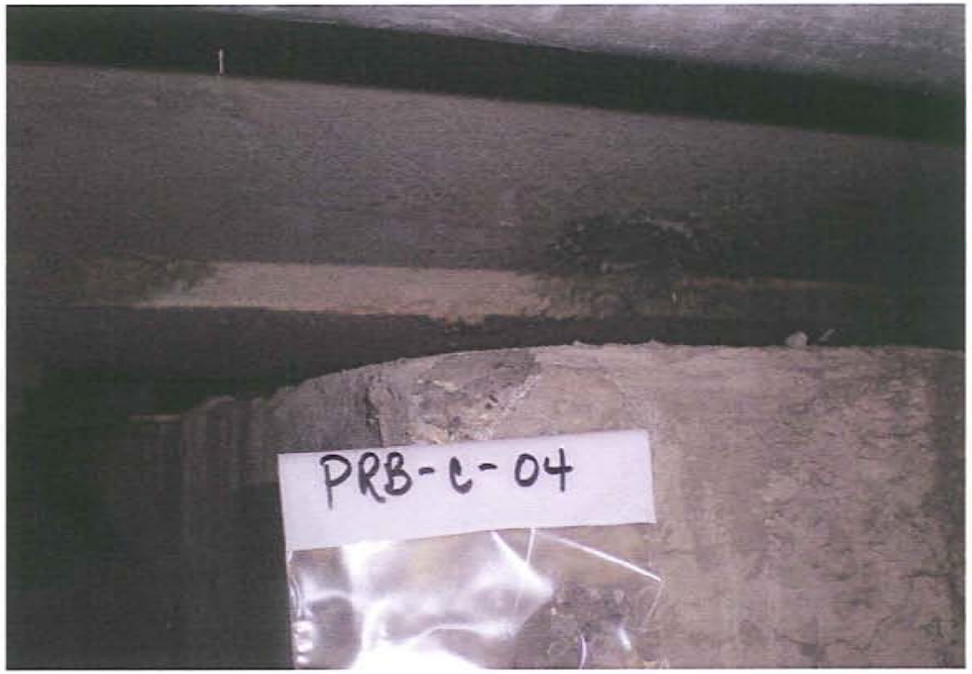
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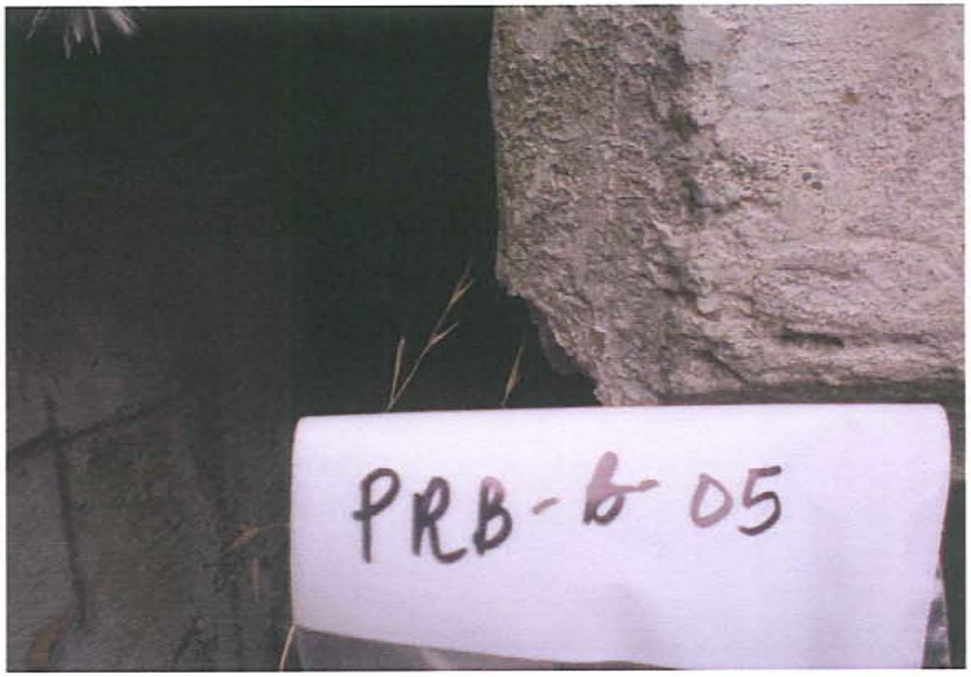
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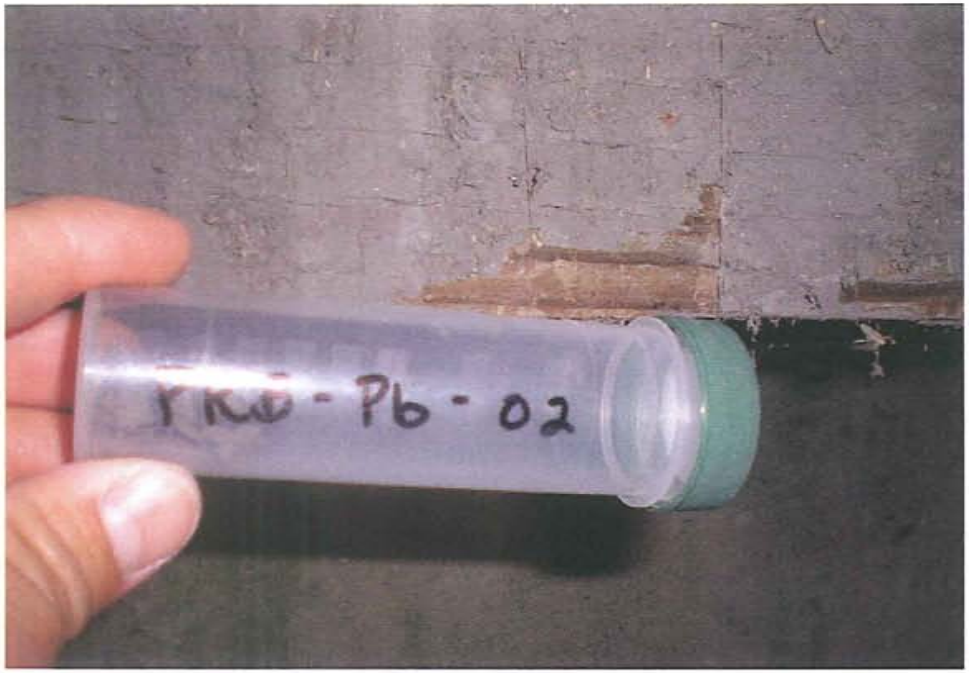
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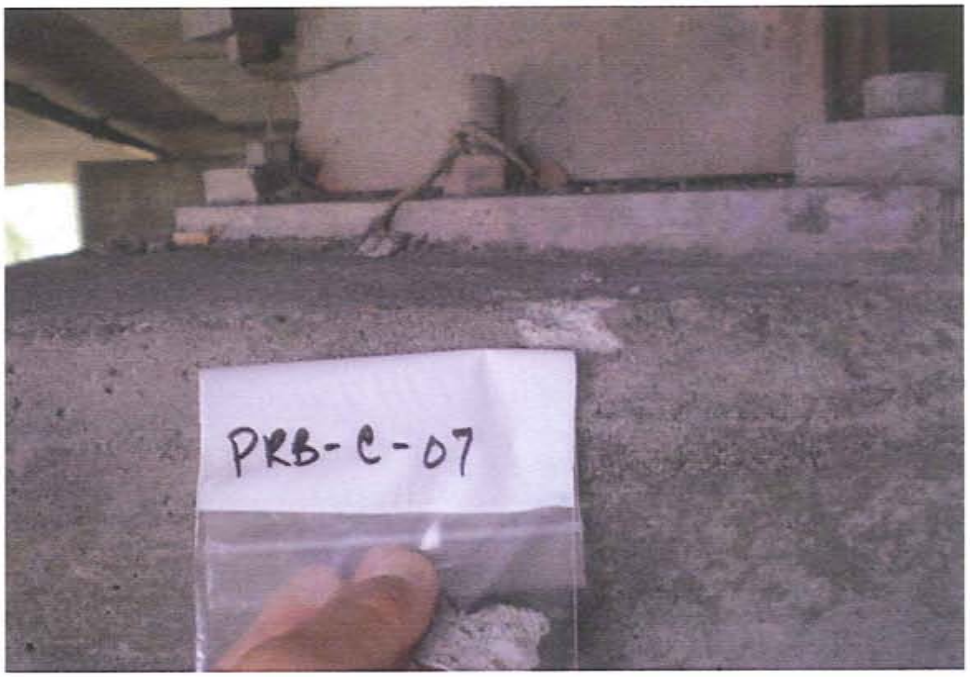
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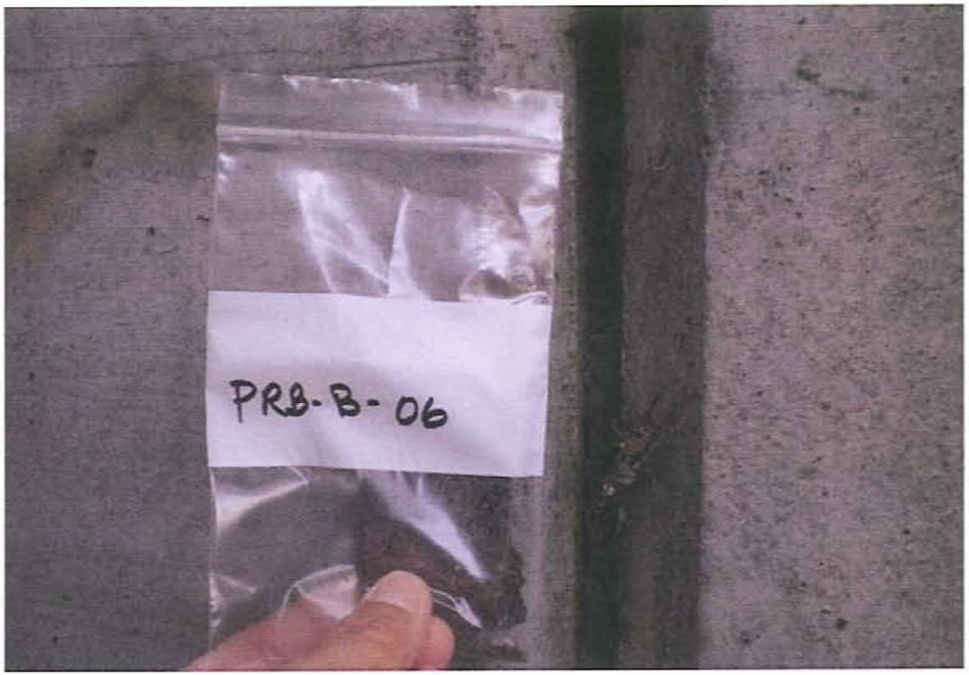
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PRB-7-08

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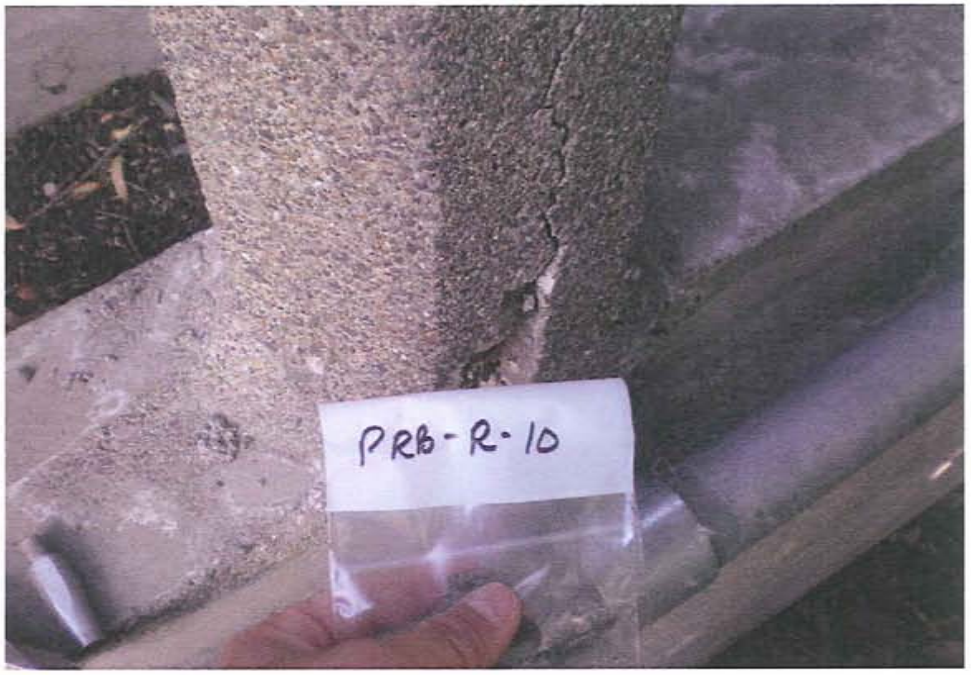
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TESCO
CONTROL PANEL

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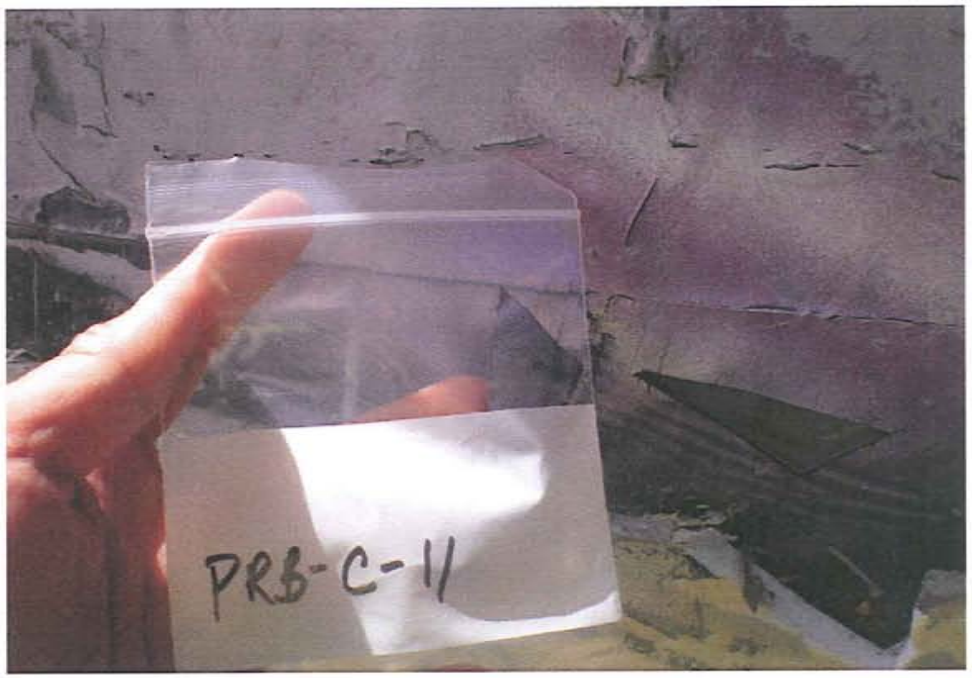
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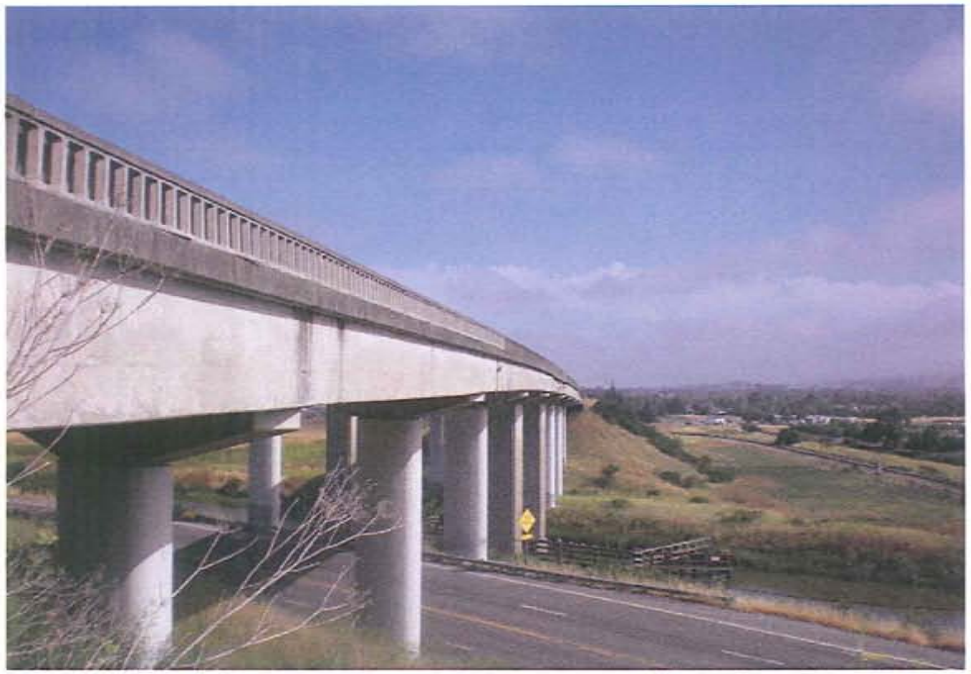

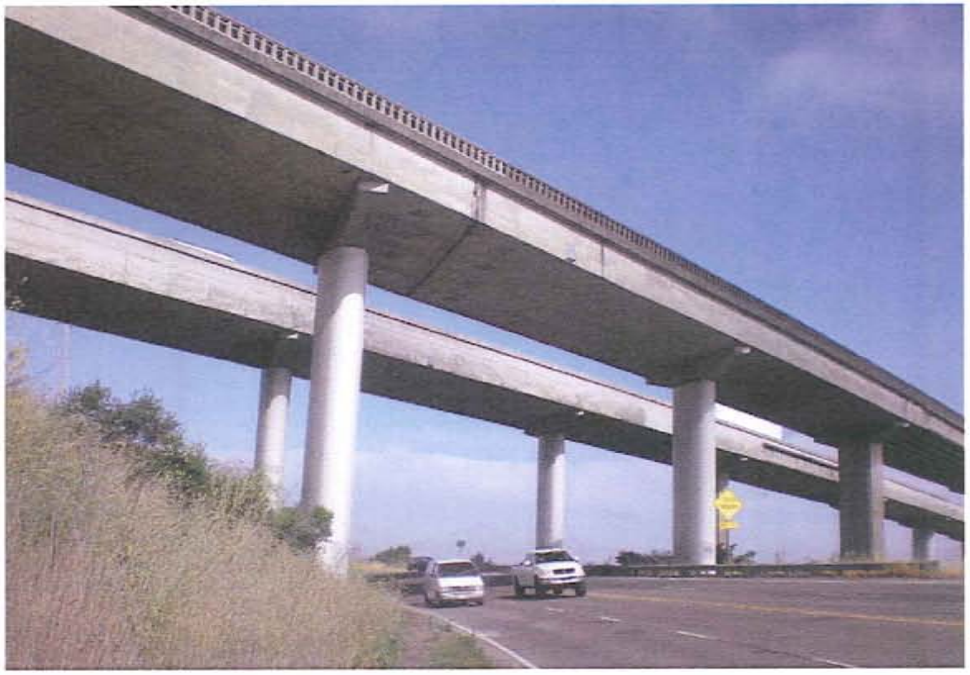

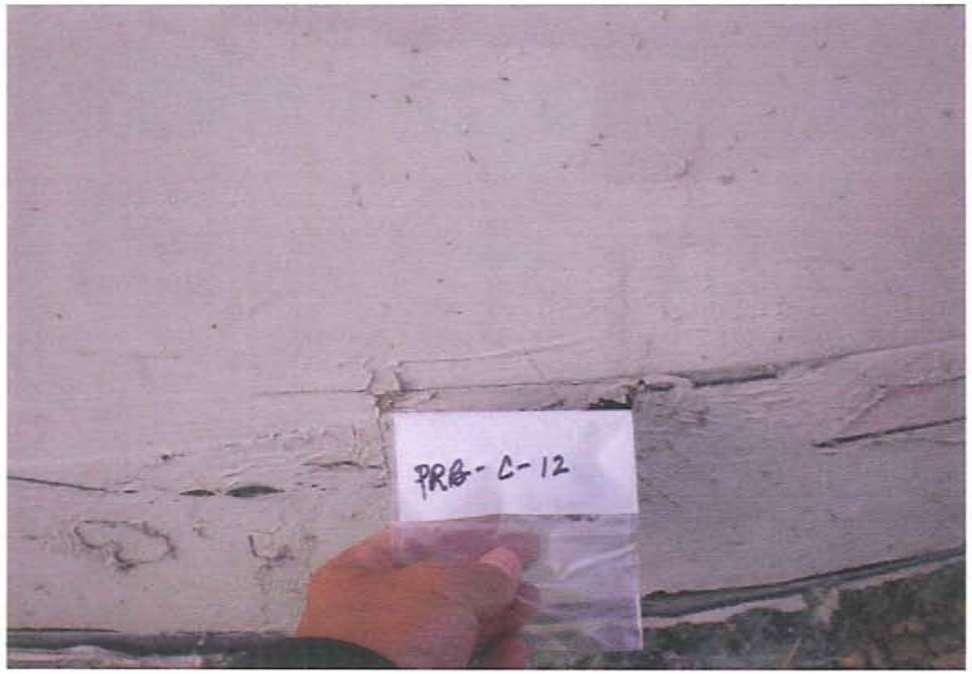
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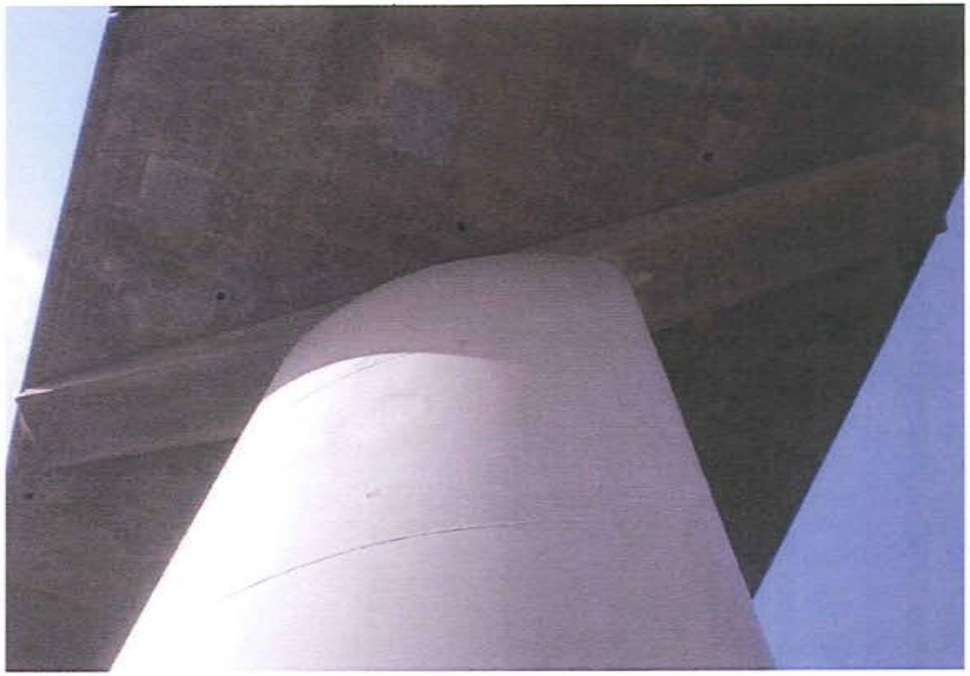

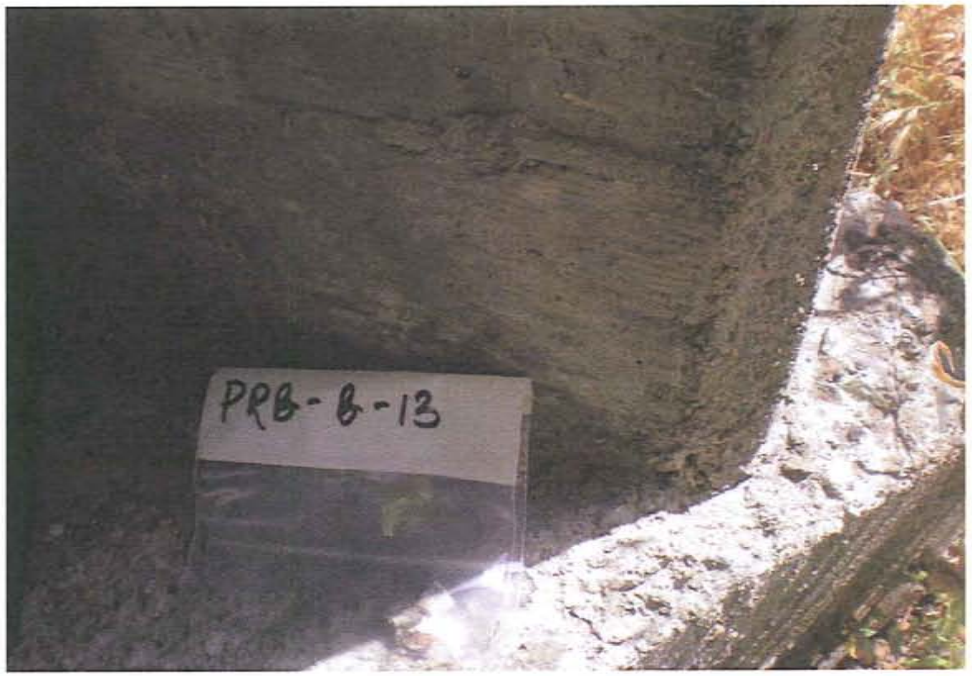
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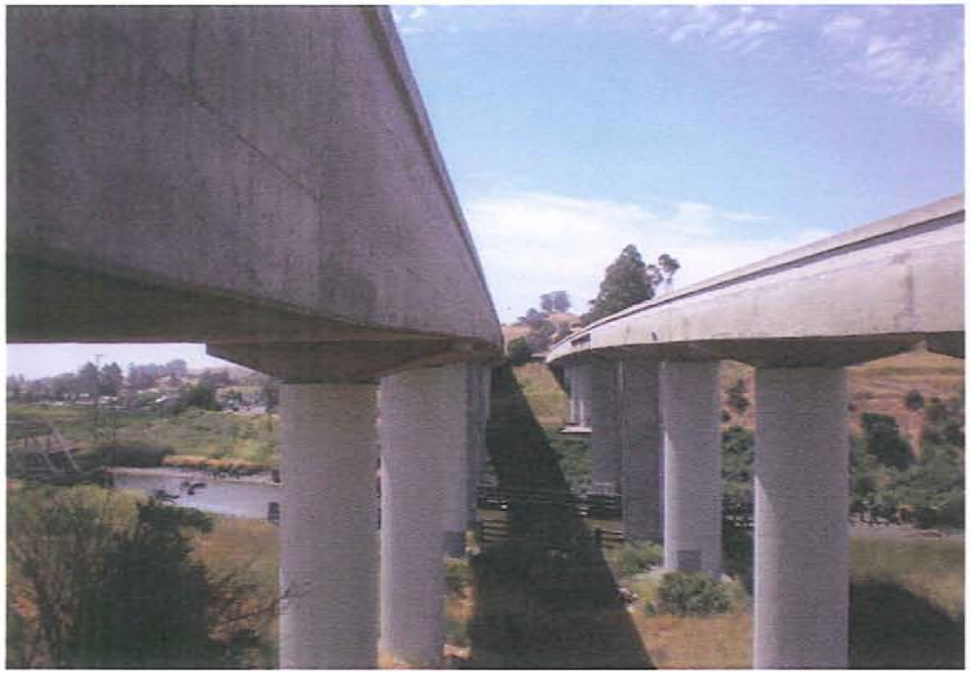

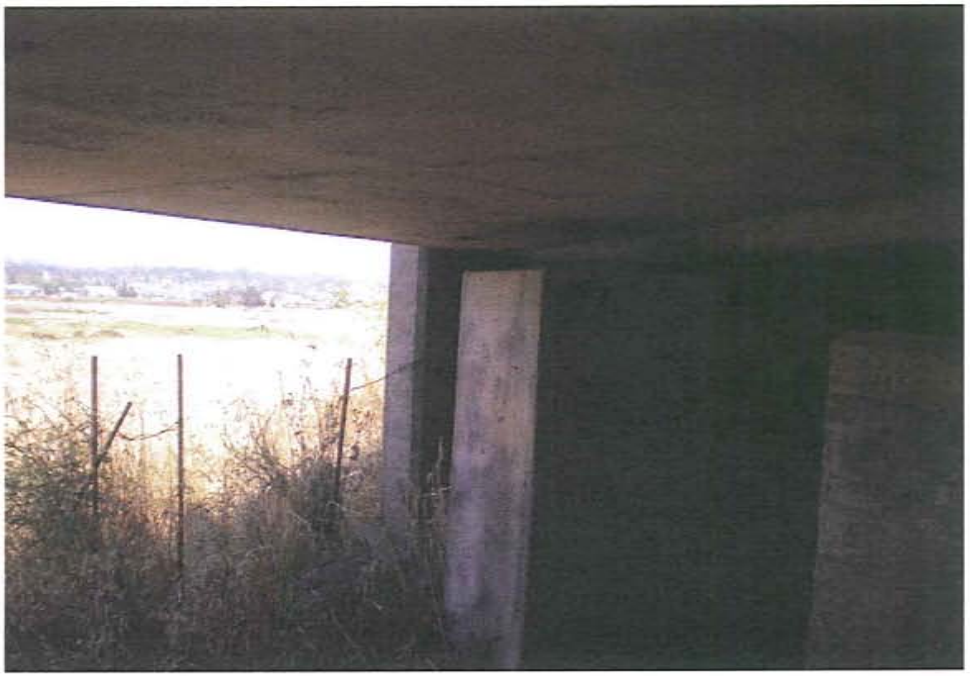

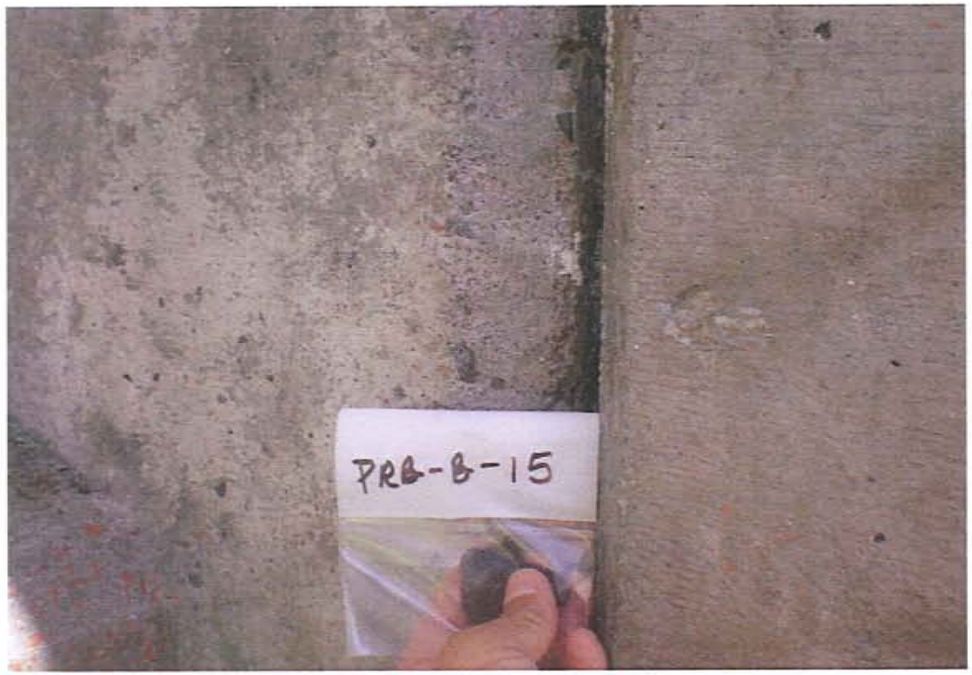
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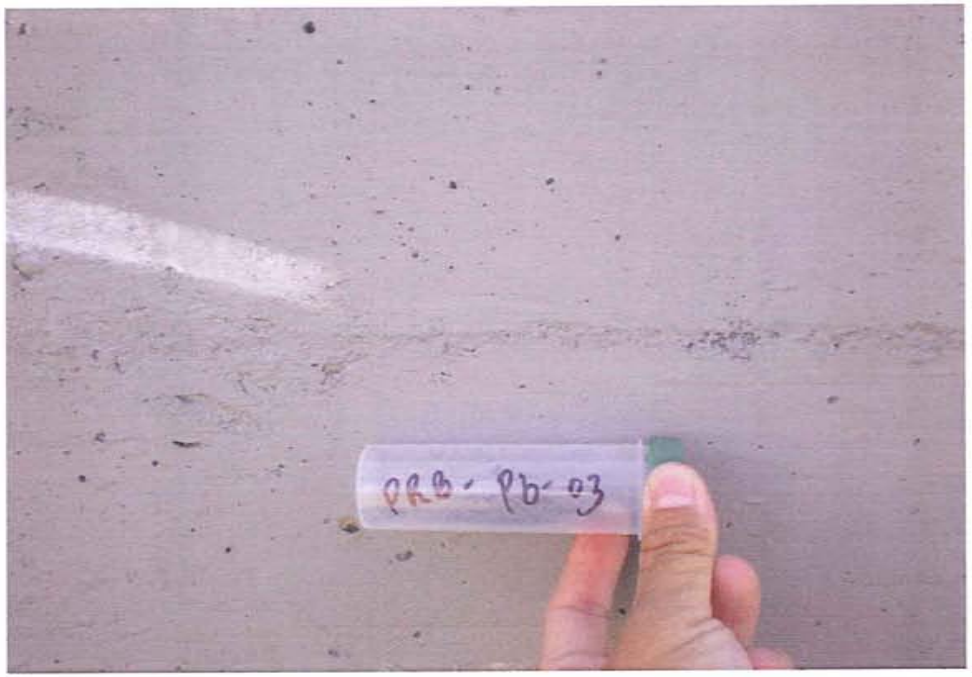
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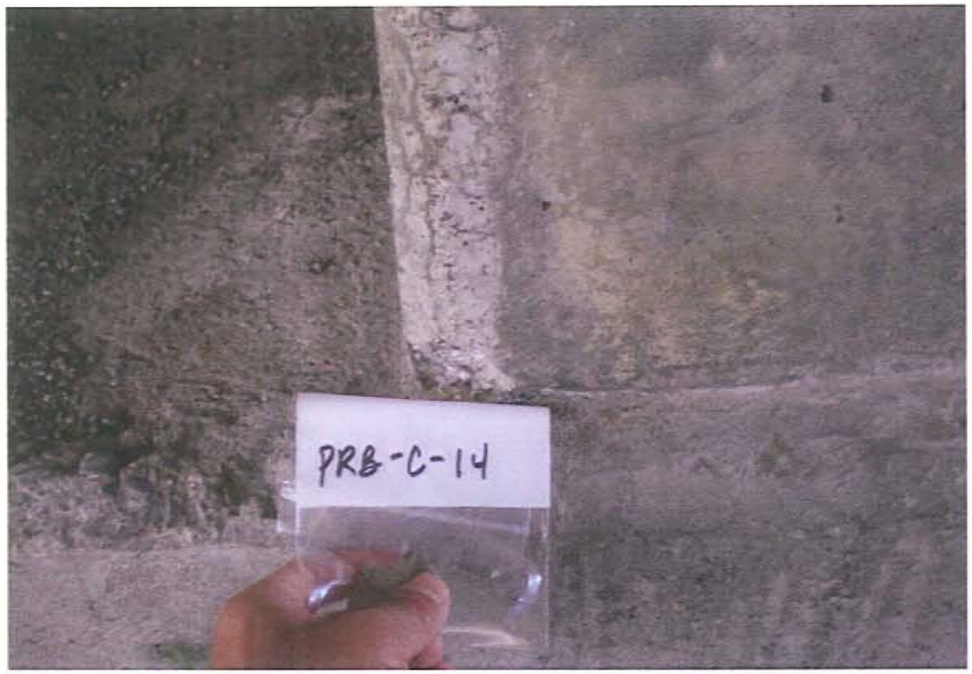
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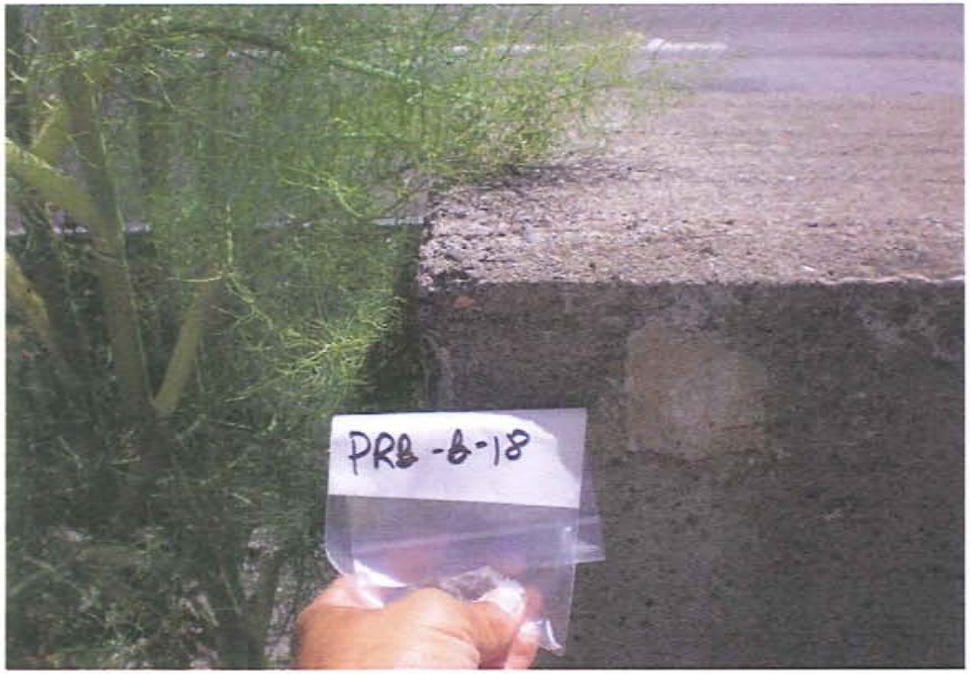
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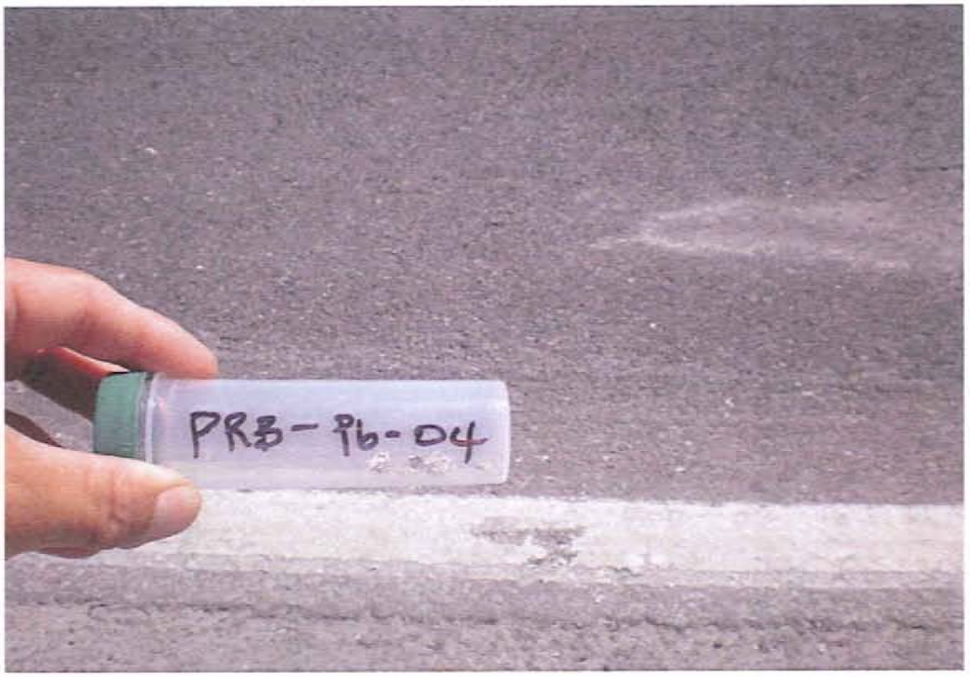
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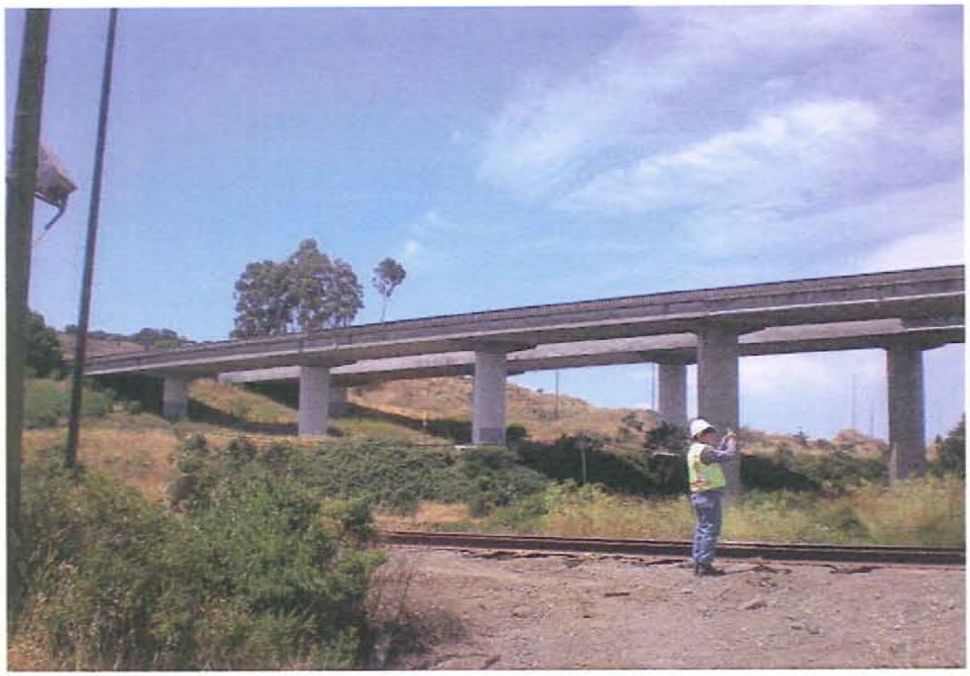
PRB-M-17

PRB-R-19



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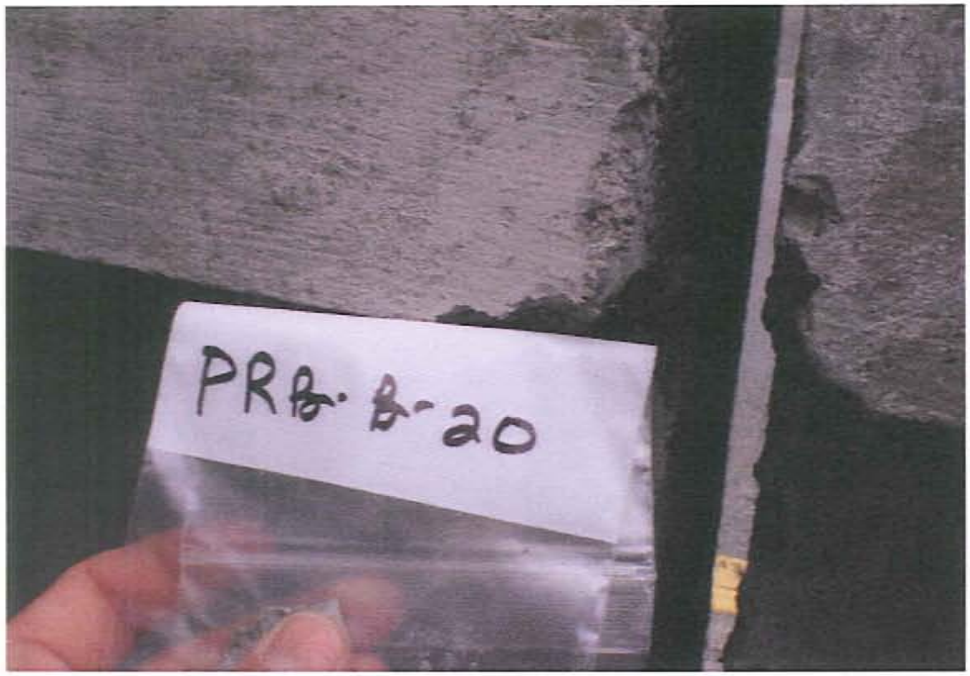
PRB-B-20

PRB-Pb-06

04-SON-101-PM2.5/4.1

EA04-2640C1
MARCH 12, 2012

GEOTECHNICAL DESIGN REPORT

ROUTE 101-MARIN/SONOMA NARROWS
CONTRACTS B4 AND C3
PETALUMA, CALIFORNIA

Prepared for
Sonoma County Transportation Authority
490 Mendocino Avenue, Suite 240
Santa Rosa, CA 95401

URS

100 West San Fernando, Suite 200
San Jose, California 95113

`

March12, 2012
URS Project 28645045

File No.04-Son-101-PM 2.5/4.1
EA04-2640C1

Mr. Guy Preston
Project Manager
Sonoma County Transportation Authority (SCTA)
490 Mendocino Avenue, Suite 240
Santa Rosa, CA 95401

Subject: **Geotechnical Design Report (GDR)**
Route 101 - Marin / Sonoma Narrows-Contracts B4 and C3
Petaluma, California

Dear Mr. Preston:

URS has completed a geotechnical investigation and the Geotechnical Design Report (GDR) for the subject improvements to Route 101 in Petaluma, California. The accompanying report has been prepared in accordance with Caltrans GDR Guidelines, dated December 2006.

The report presents our engineering opinions and recommendations regarding the geotechnical factors influencing the design and construction of the proposed overhead sign structures and standard plan retaining walls. The opinions and recommendations have been based upon the results of our field investigation, laboratory testing, engineering judgment and local experience. Mr. Madhu Thummaluru, Staff Engineer, performed engineering calculations and Mr. Stephen Huang, Geotechnical Engineer, assisted in preparation of this report. Mr. Mark Schmoll, Certified Engineering Geologist, contributed to the seismic source characterization and the evaluation of geologic conditions along the project alignment. Mr. Michael Larson, G.E. provided technical review and guidance to the URS project team over the course of the investigation.

Since our last report dated September 30, 2011 was issued, we received review comments from Caltrans dated February 17, 2012. These comments are included in Appendix F of this report.

If any questions should arise, or if we can be of further service, please contact the undersigned at (408) 297-9585.

Sincerely,

REGISTERED PROFESSIONAL ENGINEER
JOSE L. LANDAZURI
No. 501
Exp. 3/31/14
GEOTECHNICAL
STATE OF CALIFORNIA

Jose Landazuri, GE 501
Geotechnical Task Leader

URS Corporation
100 W. San Fernando Street
Suite 200
San Jose, CA 95113-2254
Tel: 408.297.9585
Fax: 408.297.6962
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1.1 DESCRIPTION OF PROJECT

1.1.1 Location and Route Description

The Marin Sonoma Narrows (MSN) HOV Widening project proposes to add high occupancy vehicle (HOV) facilities to Route 101 from the junction of State Route (SR) 37 in the City of Navato to just north of the Corona Road Overcrossing in the City of Petaluma, a distance of approximately 16 miles. The project has been divided into three main segments. Segments A and C consist of the existing freeway in the cities of Navato and Petaluma, respectively. Segment B is the existing expressway between the two cities. The focus of this report is segment B4 (see Figure 1-1), which is a part of Segment B.

The planned improvements in segment B4 include the following structures:

- Route 101/SR116 SOH Left (Widen) – recently constructed (completed in 2007) five span structure will be widened by 24 feet along the eastern edge of the deck
- Route 101/SR116 SOH Right (Replace) – existing four span structure (constructed in 1955) will be replaced
- Petaluma River (Replace) – existing nine span twin-structure (constructed in 1955) will be replaced
- Retaining wall along SB of Route 101 – new retaining wall along the western edge of SB 101 will span from the new Petaluma River Bridge to the end of existing retaining wall
- Retaining wall along NB of Route 101 – new retaining wall along the eastern edge of NB 101 will connect the new Petaluma River Bridge with the new Route 101/SR116 SOH Right structure
- Retaining wall adjacent to park and ride lot, southeast quadrant of existing South Petaluma Undercrossing (to be removed under another contract)
- Retaining wall and sound wall along NB on-ramp at Route 101/SR 116 Interchange

The control line reference station locations are shown on Figures 1-1, 1-2 and 1-3.

1.1.2 Retaining Walls

Four (4) retaining walls are planned as shown on Figure 1-2 and as summarized in the following table.

Table 1-1 Planned Retaining Walls

Wall No.	Alignment	Begin Station (Approximately)	End Station (Approximately)	Length (ft)	Design Wall Height (ft)
152	"A" Rt.	152+45	155+56	358	10 – 24
168	"A" Rt.	168+30	169+61	148	10 - 12
179	"A2" Rt.	179+45	187+77	833	14 - 28
180	"A2" Lt.	180+11	182+12	201	12 – 14

Lt. = Offset to the left direction
Rt. = Offset to the right direction

These 4 retaining walls are envisioned to be standard plan walls. Another retaining wall No. 293 is considered to be a non-standard plan wall because of excessive settlement and bearing capacity issues with spread footing foundations. The geotechnical design parameters and aspects of these walls are presented in the Retaining Wall Foundation Report, under a separate cover.

1.1.3 Sound Walls

Sound walls are planned along a portion of the on-ramp from southbound SR 116 to NB Route101. It will extend into the southern portion of the next segment, Segment C, toward Caulfield Lane. These walls are required to mitigate traffic noise impact. The sound walls are designated as 5 separate walls: 1) Retaining Wall No. 293 (with sound wall above the retaining wall), 2) Sound Wall No. 297, 3) Sound Wall No. 300, 4) Sound Wall No. 211, and 5) Sound Wall No. 212. The geotechnical analysis and design of Retaining Wall No. 293 will be addressed in a separate foundation report. The design heights and approximate length of the sound walls are presented in Table 1-2.

Table 1-2 Planned Sound Walls

Wall No.	Alignment	Begin Station (Approximately)	End Station (Approximately)	Length (ft)	Design Wall Height (ft)
297	"R6" Rt.	297+13	301+35	422	12
300	"R6" Rt.	300+51	310+08 (97 feet Rt. "A1" 210+48)	957	16
211	"A" Rt.	211+33	212+89	156	16
212	"A" Rt.	212+53	218+65	612	12

The approximate locations of the planned sound walls are shown on Figure 1-3.

1.2 PHYSICAL SETTING

1.2.1 Climate

Climatologically, the area is classified as Mediterranean with dry summers and mild winters. There are two nearby weather stations (Western Regional Climate Center, 2006), including one at Petaluma (P) and one at Santa Rosa (SR); the following discussion includes records at both weather stations. The mean annual temperature is 58° F (P and SR). Extremes of temperatures expected range from an average daily maximum of 82.5° F (P) and 83.2° F (SR) in August to average daily lows of 38.1° F (P) and 37.1° F (SR) in January. The highest and lowest temperatures on record in Petaluma are 110° F and 18° F and in Santa Rosa are 110° F and 15° F, respectively. Freezing temperatures should only be expected to occur on an average of 23.6 days (P) and 30.2 days (SR) per year, so freeze-thaw conditions should not be a factor.

Precipitation in Petaluma averages about 25 inches per year and in Santa Rosa about 30 inches per year, primarily confined to the months of October through April. December and January usually have the most precipitation accumulation, averaging about 4-¾ to 5-½ inches per month in Petaluma and 5-¾ to 6-¼ inches per month in Santa Rosa. Thunderstorms are rare.

1.2.2 Terrain

The topography along the existing roadways from S. Petaluma Boulevard Overcrossing to just south of Caulfield Lane Overcrossing, ranges in elevation from approximately 50 feet, rising to 70 feet and then descending to approximately 17 to 18 feet. Between the Petaluma River, UPRR tracks and SR 116, the roadway is elevated on an existing embankment with fill height ranging from 40 to 62 feet.

Development within the project limits is primarily commercial and industrial.

1.2.3 Surface Drainage

Watershed

The Project is located within the San Pablo Hydrologic Unit (HU) of the San Francisco Bay Basin, and specifically within the San Pablo Bay Watershed. This watershed falls within the jurisdiction of the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB).

Within the San Pablo HU, the Project is in the Petaluma River Hydrologic Area (HA). The nearest receiving water body is Petaluma River, which crosses Route 101 within the Project limits at PM 3.2. The river flows from northwest to southeast and empties into San Pablo Bay approximately 9 miles from the Project area.

Off-site watersheds were determined using USGS mapping, topographic survey information provided by URS Corporation, and field verification. Watersheds are shown for all of the existing cross culverts. See Appendix C of the Draft Drainage Report (DR) for the off-site watershed delineations.

Flood Sources

According to the Flood Insurance Rate Map (FIRM) for Sonoma County Panels 1001 and 1005 from Federal Emergency Management Agency (FEMA), the base flood areas are mostly distributed to the east of Petaluma Boulevard South with base flood elevation of 9 feet (Zone AE, see Appendix I of the Draft DR). Along the Petaluma River is the floodway area in Zone AE which must be kept free of encroachment. There are also small areas with no base flood elevation determined (Zone A), and areas of 500-year flood (Zone X) along Hopper Street within the project limit.

The reference datum for this elevation is the North American Vertical Datum of 1988 (NAVD 88). The FIRMs covering the Project limits can be found in Appendix I of the Draft DR.

1.2.4 Regional Geology

The project is located along the western margins of the Petaluma Valley within the central portion of the Coast Ranges geomorphic province of California. Northwest-southeast-trending

valleys and ridges characterize the regional morphology of the Coast Ranges province. These topographic features are controlled by folds and faults that resulted from the collision of the Farallon and North American plates and subsequent predominantly strike-slip faulting along the San Andreas fault system between the Pacific and North American plates. Regional geologic mapping shows the project alignment to be underlain by manmade fill, Holocene Bay Mud deposits, Holocene alluvial fan deposits, Tertiary age volcanic rocks, and Jurassic-Cretaceous age Franciscan Complex rocks (Wagner et al, 2000; Armstrong, 1980). The regional geologic map (Figure 1-4) shows the approximate areal extent of these various geologic units.

1.2.5 Site Geology

The north abutment of the Petaluma River Bridge and both abutments of the SR 116 bridges are composed of manmade fill constructed on the underlying bay mud and alluvial fan deposits. Manmade fill also underlies the Northwestern Pacific railroad tracks and SR 116, including the on-ramps and off-ramps to Route 101. Holocene Bay Mud deposits underlie the south margins of the Petaluma River below about Elevation 10 feet and extend to just north of SR 116. Holocene alluvial fan deposits underlie portions of the Bay Mud deposits and occur at ground surface in the area generally north of SR 116. The “bedrock” that underlies the alluvial fan deposits and portions of the Bay Mud is the Jurassic-Cretaceous age Franciscan Complex. This unit is mapped by Wagner et al (2000) as schist and phyllite, however based on review of the current URS borings (2009), the existing Caltrans Log of Test Borings (LOTBs) and site geologic mapping, this unit appears to be mainly of mélange consisting of tectonic mixtures of sheared shale, greenstone, greywacke and serpentinite with scattered blocks of blueschist. A geologic map of the site by Wentworth (1997) shows this area as mélange. The only surface outcrops of the Franciscan Complex rocks occur near the south abutment of the Petaluma River Bridge.

1.3 PREVIOUS INVESTIGATIONS NEAR SITE

Existing Foundation Investigation references obtained from Caltrans’ files include the following:

Table 1-2 Existing Foundation Information

Bridge Number	Name	Caltrans File No / Contract No..	Date
20-0155	101 /116 Separation	Contract 04-276004	March 2004
20-0154	Petaluma River Bridge	54-4TL19	April 1953
		04-147204	October 1996

2.1 FIELD EXPLORATION

To supplement available data, URS drilled six hollow stem auger borings (A-09-009, A-09-010, A-09-101, A-09-103, A-09-105 and A-09-106), and thirteen rotary wash borings (R-09-001 to R-09-008, R-09-011 to R-09-015), and advanced two CPTs (CPT-09-003 and CPT-09-114). Hollow stem auger borings ranged in depths from 30 to 52 feet, whereas the rotary borings were drilled to depths about 19 to 120 feet. Borings R-09-005 and R-09-006 were located in the Petaluma River channel, and were drilled with a rig mounted on a barge. The field explorations were performed in three separate periods from June 10 to 17, August 11 to September 2, and on October 28 and 29, 2009. The locations of the explorations are shown on Figures 2-1 through 2-4.

A representative of URS supervised the drilling operations and soil sampling. The soil samples collected were labeled and sealed immediately to preserve their natural moisture content. At completion of the exploration, samples were delivered to the laboratory for further examination and testing. Descriptions of individual laboratory tests and results are presented in Appendix B, "Laboratory Tests," and on the Boring Records in Appendix A. A summary of laboratory test results is presented in Table 2-1.

Comprehensive descriptions of the soils encountered at each boring, together with field and laboratory test data are presented on the Boring Records (Appendix A).

2.2 SUBSURFACE CONDITIONS

2.2.1 Soil and Rock Conditions

2.2.1.1 Fill

Borings drilled in existing embankments included R-09-008, R-09-011 and R-09-015 that were located at the top of the existing embankment near the north abutment of Petaluma Bridge, the south and north abutments of the Route 101/116 Separation Overhead (SOH), respectively. These borings encountered fill soil to depths of 76 feet (Elevation -4.0) at the Petaluma Bridge, and 54 feet (Elevation -3.0) to 23 feet (Elevation +11.0) at the Route 101/116 SOH. Fill soil ranging in depth from 5 to 18 feet thick was also encountered in Borings R-09-002, R-09-003 and R-09-007 located along both the north and south edge of Petaluma Boulevard and the north bank of the river channel as shown on Figure 2-2. The fill consists primarily of granular soils (clayey gravel, clayey gravel with sand, clayey sand with gravel and clayey sand) with cohesive interbeds (lean clay, gravelly lean clay and sandy lean clay with gravel). The granular soils are medium dense to dense in relative density, whereas the cohesive layers are judged to be medium stiff to stiff in consistency. In Borings R-09-002 and R-09-003, a 7 inch thick asphalt concrete (AC) pavement was encountered overlying 8 inches of aggregate base (AB).

Borings R-09-012 and -013 were drilled on the south and north sides of the railroad tracks, respectively, between the north and south bridge abutment fill embankments. About 2.5 to 5 feet of sandy to clayey gravel fill were encountered. Boring R-09-014 was drilled in the Route 116 pavement median where an 8 inch thick AC layer was encountered overlying 6 inches of AB; the pavement section was underlain by silty sand with gravel fill extending to a depth of 11 feet.

2.2.1.2 Native

Native soils encountered in the exploratory borings consist of Bay Mud, colluvium, alluvial fan deposits (alluvium) and Franciscan Complex mélange. The Bay Mud deposits encountered in Boring R-09-005 and R-09-006 extend to depths of 18 and 13 feet (about Elevation –11.5 to –17 feet), respectively; the very soft blue to dark gray fat clay includes traces of peat and occasional sand interbeds.

Encountered in boring R-09-002, located on the lower south abutment slope, just south of Petaluma Boulevard, the colluvium consists of very stiff lean clay with sand and gravel. It is composed of weathered rock and soil that has been transported down slope under the influence of gravity. The colluvium is estimated to be about 10 to 15 feet in thickness.

Alluvial fan deposits (alluvium) were encountered in borings R-09-005 and -006 underlying the Bay Mud, in borings R-09-007 and -008, and R-09-011 through R-09-015. The alluvium consists of interbedded sands and clays with gravel. The cohesive deposits (lean clay, fat clay, sandy lean clay and gravelly lean clay) are generally medium stiff to very stiff and high in moisture content (as much as 46 percent). Fat clay layers with thickness ranging from 13.5 to 30 feet thick were encountered in Borings R-09-008, R-09-012 and R-09-014 at Elevation -4, +5 and -41 feet, respectively. The granular interbeds include medium dense to very dense silty sand, clayey sand, poorly graded sand, and silty, clayey sand. However, the silty sand layer is loose in Boring R-09-013, at a depth of 26 feet. Boring R-09-008 terminated in lean clay at a depth of 112 feet, whereas R-09-015 terminated in sandy lean clay alluvium at a depth of 108.5 feet; these two borings did not encounter the underlying Franciscan Complex bedrock. The remaining 11 borings terminated in bedrock, as summarized in the following table.

Table 2-2 Summary of Bedrock Elevations Encountered in Borings

Boring	Depth to Top of Bedrock (feet)	Elevation of Top of Bedrock (feet)	Length of Sampled Bedrock (feet)
R-09-001	0	84	21.5
R-09-002	34	23	15.5
R-09-003	11.5	27.5	50
R-09-004	2	9	16.5
R-09-005	20.5	-19.5	18
R-09-006	21.5	-20	10
R-09-007	29	-18	51
R-09-011	98.5	-47.5	21.0
R-09-012	55.0	-44.0	30.0
R-09-013	59.0	-49.0	27.5
R-09-014	91.5	-77.5	5.0

Underlying the fill and colluvium south to the Petaluma River and the alluvium beneath the river channel and north of the channel, Franciscan Complex bedrock was encountered. The Franciscan Complex consists of mélange, a tectonic mixture of highly sheared metamorphic rock consisting of black shale and serpentinite with greenstone, greywacke, talc and scattered blocks of blueschist. The bedrock is highly to completely weathered clay near ground surface in the

south abutment and becomes moderately weathered and very dense below a depth of about 10 to as much as 50 feet.

2.2.2 Groundwater

All of the previous borings were completed using rotary wash drilling methods, nevertheless, groundwater levels were measured in a few of the borings at Elevation -0.1 to +4 feet. These water level measurements (see Appendix C) were made in June 1952 and September 2002; the 1952 Elevations have been converted by using the conversion: Elevation 0 NGVD29 = Elevation + 2.28 NAVD88.

All of the 2009 borings except R-09-005 and R-09-006 were initially started with hollow stem auger and then completed using the rotary wash drilling method. Borings were dry to the depth where method of drilling was switched from hollow stem auger to rotary wash; depths at which the drilling methods were switched are summarized as follows:

Table 2-3 Summary of Drilling Method Changes

Boring Number	Depth Where Hollow Stem Auger Switched to Rotary Wash (feet)	Corresponding Approximate Elevation (feet)
R-09-001	5	+78.5
R-09-002	5	+29
R-09-003	5	+34
R-09-004	5	+8
R-09-007	1	+6
R-09-008	5	+67
R-09-011	19	+32
R-09-012	21	-10
R-09-013	19	-9
R-09-014	18	-4

Groundwater was encountered in Boring R-09-014 at a depth of 18 feet (Elevation -4). In addition, groundwater was encountered in Borings A-09-101 and A-09-103 at depths of 10 feet (Elevation -3) and 26 feet (Elevation -10), respectively. No groundwater springs or seeps were observed on or near the project alignment. The Petaluma River is subject to tidal variations. A recent topographic map of the site dated April 2008 shows the river level at Elevation 0.65 feet and the 1952 LOTB sheet recorded the high tide river level at Elevation 7.5 feet. The 1952 LOTB sheet for the 101/116 SOH (former Route 1/104 Separation) revealed that groundwater was encountered around Elevation +4 and +5 feet, except that Boring B-3 (1952) encountered groundwater at approximately Elevation 1.8 feet.

Considering the previous measurements, expected tidal fluctuation and proximity to the Petaluma River, we recommend a design groundwater level at Elevation 5.0 feet for portions of the site near the Petaluma River. For locations north of Abut 5 of Route 101N/116 SOH (Replace) and Abut 6 of Route 101S/116 SOH (Widen), a slightly lower design groundwater level at Elevation 0.0 feet is recommended.

3.1 PROJECT SITE SEISMICITY

The closest active faults to the project alignment are the Rodgers Creek-Healdsburg fault, San Andreas (north) fault, the northern end of the Hayward fault and the Maacama-Brush fault (Merriam and Shantz, 2007). The nearest potentially active fault is the Late Quaternary Tolay fault located 2.3 miles (3.7 km) northeast of the site. The California Geological Survey (2000) has produced maps showing Alquist-Priolo Earthquake Fault Zones along faults with known Holocene activity that pose a potential surface faulting hazard. With the exception of the Tolay fault, all of these faults are included as Alquist-Priolo (A-P) zoned faults. The Rodgers Creek-Healdsburg fault is located about 4.6 miles (7.4 km) northeast of the site and the San Andreas (north) fault is located about 15.8 miles (25.4 km) southwest of the project alignment. More distant active faults include the north end of Hayward fault located about 18.6 miles (30.0 km) southeast of the site, and the Maacama-Brush fault located about 21.5 miles (34.6 km) northeast of the site. Figure 3-1 shows active faults within the site region relative to the project. The project alignment does not cross any mapped A-P zoned faults.

Table 3-1: Seismic Source Parameters

Fault	Type	M_{Max}	Distance (mile)*	Near Field Effects ?	Design PGA (g) Vs30=2,500 ft/sec
Rodgers Creek-Healdsburg	strike-slip	7.1	4.6	Yes	0.6
San Andreas (north)	strike-slip	7.9	15.8	No	-
Hayward	strike-slip	7.3	18.6	No	-

*The distances are based on Caltrans ARS Online (2009).

For design, a site PGA of 0.6 g (earthquake moment magnitude of **M**7.0) was estimated using Caltrans ARS Online tool; this value of PGA corresponds to a site specific average shear wave velocity of 1,000 fps.

3.2 POTENTIAL GEOLOGIC HAZARDS

3.2.1 Surface Fault Displacement and Ground Shaking

The project alignment does not cross any Alquist-Priolo Earthquake Fault Zones (Hart, 1975). Therefore, surface rupture due to faulting along the alignment is not expected to occur. However, the short distance to nearby active faults including the Rodgers Creek-Healdsburg fault, San Andreas (north) fault, and the northern end of the Hayward fault does create a high risk for ground shaking from fault movement. The intensity of the ground shaking is dependent upon the size of the earthquake, the distance of the epicenter from the site, the direction that the earthquake propagates along the fault, and the site geologic conditions.

3.2.2 Landslides

With the exception of the manmade bridge abutment fills, the project alignment is on relatively flat ground and is not subject to landsliding. Regional geologic maps by Wagner et al (2000) and

Wentworth (1997), as well as the landslide hazard area maps in the Sonoma County Hazard Mitigation Plan (2006), do not show any mapped landslides on the hills at or near the project. Furthermore, no evidence of landslide scarps or slumping of the manmade fill embankments was observed during site reconnaissance.

3.2.3 Settlement and Seismic Compaction

Subsidence typically occurs as a result of subsurface fluid extraction (e.g. groundwater or petroleum) or compression of soft, geologically young sediments. Groundwater extraction for high volume municipal and agricultural use has the potential to cause future ground subsidence in the region. However, we are not aware of subsidence in the area. No active petroleum wells are present within many miles of the site (California Division of Oil, Gas, and Geothermal Resources, 2001).

Settlement can occur quickly when soil is loaded by a structure or by the placement of fill on top of soil; it can also occur gradually when soil pore pressures, increased by vertical loading, gradually dissipate over time. This second type is termed consolidation settlement. The Bay Mud soils are susceptible to consolidation settlement if loaded by structures and placement of fill.

Compaction settlement, or seismic densification, occurs when loose granular soils above the water table increase in density as a result of earthquake shaking. The soil densification can result in differential settlement because of variations in soil composition, thickness, and initial density. As previously mentioned, occasional layers of medium dense granular soils were encountered in a few of the borings. At Boring R-09-012, the soils above the groundwater table are primarily sandy lean to fat clay. For design, we estimated the potential post-earthquake settlement at Borings R-09-011 and R-09-013 through R-09-015 due to seismic compaction using the computer program LIQUEFY PRO[1]. In our analyses we used a peak ground acceleration (PGA) of 0.6g and a design earthquake moment magnitude (**M**) of 7.0. The results of these studies indicated that the magnitude seismic compaction settlement at R-09-013 through R-09-015 is ranged from negligible to ¼ inch. Seismic compaction is ½ inch for the soils encountered at R-09-011. Copies of these calculations are included in Appendix D.

3.2.4 Scour

No creeks or active channels cross the alignment at the proposed Route 101/116 SOH Right (Replace). Therefore, scour is not a potential hazard at the site. At the Petaluma River Bridge site, the existing channel is presently unlined; bedrock is exposed on the south bank. Based on the project bridge design hydraulic report (WRECO, September 2009), we understand the total scour depth of 12.0 feet is based on boundary conditions of Stillwater Elevation and 500 years

[1] LIQUEFY PRO is a software program that evaluates liquefaction potential and calculates settlement of a soil deposit due to seismic loads. The program is based on methods recommended in the 2001 NCEER Workshop and 2008 Edition of SP117 Implementation. The seismic load is estimated with Seed's simplified method (Seed, 1971), which gives a Cyclic Stress Ratio (CSR) that is compared with the Cyclic Resistance Ratio (CRR) of the soil. The CRR calculation is based upon input data from common in-situ tests such as SPT and CPT. Because the BPT-test is more appropriate for gravel type soils the user can also use BPT data as input for the liquefaction analysis. The program finally makes an estimate of the earthquake-induced settlements using the results from the liquefaction evaluation. The software was developed by CivilTech Software, located in the Seattle-Bellevue area.

recurrence interval. More detailed discussions on the impact of scour to the foundation design are presented in the foundation report for the Petaluma River Bridge.

3.2.5 Flooding

The Petaluma River Channel is within a floodplain. The FEMA defines the area as Zone AE. Zone AE is defined as an area with a 1% annual chance of flooding. With the exception of the active channel of the Petaluma River and the low lying area south of SR 116 below about Elevation +9 feet, the project alignment is located outside of Zone AE.

3.2.6 Liquefaction Potential

Liquefaction is a phenomenon whereby sediments temporarily lose shear strength and collapse. This condition is caused by cyclic loading during earthquake shaking that generates high pore water pressures within the sediments. The soil type most susceptible to liquefaction is loose, cohesionless, granular soil below the water table and within about 50 feet of the ground surface. Liquefaction can result in loss of foundation support and settlement of overlying structures, ground subsidence and translation due to lateral spreading, lurch cracking, and differential settlement of affected deposits. Lateral spreading occurs when a layer liquefies at depth and causes horizontal movement or displacement of the overburden mass toward a free face such as a stream bank or excavation, or toward an open body of water.

In a regional study of the nine-county San Francisco Bay region for the U.S. Geological Survey, Witter et al. (2006) mapped the liquefaction susceptibility of the site soils along the project alignment. The alluvial fan and Bay Mud deposits found from the south bank of the Petaluma River and extending north past SR 116 have been mapped as having a “moderate” liquefaction susceptibility (see Figure 3-2). The thin fill embankments that underlie the railroad tracks are shown as having "very high" liquefaction susceptibility. The Sonoma County Hazard Mitigation Plan (2006) shows these deposits as having a “high” liquefaction hazard. The Franciscan Complex bedrock mapped south of the river is not subject to liquefaction.

Based on a review of the borings completed for this study, potentially liquefiable sand layers were encountered at few of the borings. We analyzed post-liquefaction settlement of the medium dense sand layers encountered in Borings R-09-012 through R-09-015 for the peak ground acceleration (PGA) of 0.6g and design earthquake moment magnitude, **M** 7.0, adjusting the measured driving resistance (blow counts) in the field for hammer type, sampler size, overburden pressure, rod length, and fines content; the magnitude of settlement at these boring locations is estimated to range from 0.1 inch to 0.9 inch. Copies of these calculations are included in Appendix D.

Table 3-2: Estimated Post Liquefaction Ground Surface Settlement

Boring / CPT Number	Depth Ranges of Liquefiable Layers (feet)	Estimated Ground Surface Settlement (inch)
R-09-005	3 - 4½	0.4
R-09-012	29 - 36	0.9
R-09-013	26 - 29	0.5
R-09-014	41½ - 44	0.4
R-09-015	35 - 36	0.1
A-09-101	15 - 24	2.5
A-09-103	28 - 31½, 3½ - 38	1.4
CPT-09-102	15 - 23, 48 - 50	1.3
CPT-09-104	13 - 19	0.3

4.1 FOUNDATION TREATMENT

4.1.1 Clearing and Grubbing

Before any grading begins, all locations to be filled should be cleared of existing improvements (rails, posts, curbs, pavements, etc.), all debris, vegetation, and any soils containing roots or other vegetative matter in accordance with Section 16 of Caltrans Standard Specifications. A stripping depth of 4 to 6 inches is estimated. The entire root ball of large shrubs should be removed, including all roots greater than 1 inch in diameter.

4.1.2 Subgrade Preparation

Immediately after existing guardrail posts have been removed, the resulting voids should be backfilled with slurry cement up to present ground surface in accordance with Caltrans Standard Specifications Section 19-3.062 “Slurry Cement Backfill”.

All subgrades should be prepared in accordance with Caltrans Standard Specifications Section 25-1.03 “Subgrade”. After the areas to receive fill have been cleared and stripped, the exposed subgrade soil should be scarified, moisture conditioned to near the optimum moisture content, and compacted to the requirements of fill to a minimum depth of 6 inches. When the subgrade has been compacted and approved by the Engineer, fill can be placed to provide the desired finished grades.

4.1.3 Fill Material

In general, materials intended for use as fill materials should be a soil or soil/rock mixture that is free of organic matter and other deleterious substances in accordance with Section 19 of Caltrans Standard Specifications. In addition, these materials should have an R-value greater than 15 to be consistent with the design R-value used in pavement structural design. All import material should meet these requirements and should be approved by the Engineer prior to construction. Asphalt concrete and aggregate base that are pulverized to meet the size requirements for fill material detailed above, could be reused as fill. In our opinion, the fat clays excavated from the project site should not be reused as engineered fill due to their expansive nature, i.e. potential to shrink and swell with moisture changes. A detailed discussion about the reuse of onsite soils is provided in Section 4.3 “Cuts and Excavations”.

4.1.4 Fill Placement

All fill should be constructed in accordance with Caltrans Standard Specifications Section 19, entitled “Earthwork.” Relative compaction of not less than 90 percent should be achieved in all fill materials, except where 95 percent is required.

4.2 ESTIMATED SETTLEMENT

4.2.1 General

Based on the profile sheets developed for the South Petaluma UC (Remove), Petaluma River Bridge, Route 101/116 SOH (Replace) and Route 101/116 SOH (Widen), new fills ranging from

5 to 38 feet in height are planned. We evaluated settlement of the approach embankment and the ramps due to placement of new fill. A summary of the settlement analysis results is presented in Table 4-1.

Table 4-1 Retaining Wall/Embankment Settlement Analysis

Structure	Control Line	New Fill Height* (feet)	Consolidation Settlement (inch)	Time for 90% Consolidation Settlement
RW 152	A	20 to 38**	< ½	N/A
RW 168	A	6 to 7	< ¼	N/A
RW 179	A	8 to 21	< ½	N/A
RW 180	A	5 to 8	< ½	N/A
Route 101/116 SOH North Abutment Fill	A	5 to 21	½ to 4½	9 months
Route 101/116 SOH South Abutment Fill	A	< 5	< ½	N/A
RW 293	R	6 to 12	2 to 4	3 months

*New Fill Height = Future Finished Grade Elevation – Original Ground Elevation
**RW152 to be founded on new fill; i.e. wall height will be less than new fill height.

The settlement analysis results indicate that standard plan retaining walls (RW 152, 168, 179 and 180) should have less than 1 inch long term settlement and should therefore perform as designed. Detailed discussions of the settlement analysis and impact to foundation considerations for the other structures are presented in the corresponding foundation reports. For the Route 101/116 SOH north abutment fill, the settlement period could be reduced by applying a surcharge. With a surcharge fill height of 5 feet, the time to reach 90% consolidation settlement due to the abutment fill is estimated to be 5 months; a surcharge fill height of 10 feet would reduce the time to reach 90% consolidation to 3-½ months.

For new embankments associated with the retaining walls, the closest existing utilities are located approximately about 50 feet from the toe of new embankment fill. Therefore, it is our opinion that the embankment fill should post no adverse effect on existing utilities.

4.2.2 Settlement Monitoring

To assist the Resident Engineer in determining whether to increase or decrease the duration of settlement periods, we recommend the embankment construction at the north abutment [Abut 5 of the Route 101N/116 SOH (Replace)] be monitored in accordance with California Test 112, "Method for Installation and Use of Embankment Settlement Devices." As a minimum, two settlement monitoring devices should be installed on the abutment along "A" Station 194+50. One device should be installed near the toe of existing embankment slope, and the second one near the toe of the planned approach embankment at Abut 5. Similarly, the settlement should be monitored along RW 293. As a minimum, we recommend 3 settlement monitoring devices be

installed along the wall alignment where the fill height exceeds 10 feet. The approximate locations of these devices should be near RW 293 LOL Stations 194+30, 195+50 and 196+50.

4.3 RETAINING WALLS

As discussed previously in Section 1.1.2 "Retaining Walls", five (5) retaining walls are planned. Foundation design concepts and preliminary geotechnical recommendations for special wall (non-standard) RW 293 are summarized in a separate Foundation Investigation Report. Drawings and details of the remaining four (4) retaining walls are presented in Appendix E. Table 4-2 presents a summary of wall configurations of the four proposed standard Type 1 walls.

Table 4-2 Summary of Wall Configurations

Wall	Length (feet)	Wall Design Height (feet)	Approximate Fill Height from Original Ground (feet)
152	358	10 to 24	20 to 38
168	148	10 to 12	6 to 7
179	833	14 to 28	8 to 21
180	201	12 to 14	5 to 8

Based on the project quantity estimates, it is planned to have about 7% of the embankment fills to be generated from onsite cuts. Therefore, it is assumed that all embankment fill and wall backfill would be imported from offsite. We recommend the imported fill materials should be a soil or soil/rock mixture that is free of organic matter and other deleterious substances in accordance with Section 19 of Caltrans Standard Specifications. We anticipate the imported fill with an average as compacted moist unit weight of 130 pcf and friction angle, ϕ', to be greater than 34 degrees; thus, the resulting equivalent fluid pressure of the wall backfill should be equal to or less than 36 psf per lineal foot. Therefore, the standard plan Type 1 wall soil design parameters are applicable.

Based on subsurface conditions revealed in borings presented in the LOTB sheets for each of the walls (Appendix A), the bearing resistance for these walls were analyzed. Table 4-3 below presents a summary of the estimated allowable pressures and toe pressures at the maximum wall height location of each of the four standard plan Type 1 walls.

Table 4-3 Type 1 Wall Soil Parameters

Wall	Maximum Wall Height (feet)	Ultimate Bearing Pressure (psf)	Allowable Bearing Pressure (psf)	Equivalent Fluid Pressure (psf per lineal foot)	Standard Plan B3-1 Toe Pressure (psf)
152	24	24,000	8,000	36	4,900
168	12	30,000	10,000	36	2,800
179	28	18,000	6,000	36	5,700
180	14	10,000	3,300	36	3,300

The global stability of RW152, RW179 and RW180 was evaluated using a limit equilibrium method based on Spencer's procedure of slices as coded in the program SLOPE/W (Version

6-19). The global stability of RW168 was not evaluated as the wall footing will be placed on top of bedrock and no stability issues are anticipated with the 2:1 side slopes. In Spencer's procedure, all forces are assumed to have the same inclination, and all requirements for static equilibrium are satisfied. We performed the analyses using the maximum wall heights, which in our opinion, represents the critical section for each retaining wall. On this basis, the cross sections were selected at Stations "A" 154+40 (RW152), "A" 187+20 (RW179) and "A" 180+20 (RW180). A design groundwater at Elevation 5 was selected for RW152, RW179, and RW 180.

Caltrans requires minimum factors of safety of 1.3 for retaining walls under static loading conditions (Bridge Design Specifications, Section 5.2.2.3, August 2004). The results of our analyses are summarized in the following paragraphs and include the following cases: (1) static and (2) pseudo-static condition. A copy of our global slope stability calculations is presented in Appendix D.

For static analysis undrained conditions were assumed for impervious clay soils, whereas drained strengths were used for granular soils. Soil strength parameters from laboratory unconfined compressive strength tests were used for the fine grained soils and the estimated friction angle was used for the granular soils.

To compute the factor of safety of the slope during earthquake loading, we applied a pseudo-static seismic coefficient of 0.2g to the center of the slice for the slip surface having the minimum computed static factor of safety. This pseudo-static seismic coefficient is equal to approximately one-third of the peak horizontal ground acceleration, 0.6g, anticipated at the site. The seismic stability screening approach is consistent with Section 3.10 of the March 2006 Guidelines for Structure Foundation Reports.

The results of our analyses for the three retaining walls are summarized in the following table.

Table 4-4 Results of Global Slope Stability Calculations

Loading Conditions	Minimum Calculated Factor of Safety			Minimum Required Factor of Safety
	RW152	RW179	RW180	
Static	1.5	1.3	1.5	1.3
Pseudo Static Seismic	1.1	1.1	1.1	1.1

Based on our analyses, the computed minimum (critical) factors of safety for static condition for the three walls ranges from 1.3 to 1.5, all of which exceed or equal the minimum required value of 1.3.

Based on our analyses, the computed minimum (critical) factor of safety for the pseudo-static condition for all three walls equals the minimum required value of 1.1 (See guidelines for Structures Foundation Reports, March 2006, Version 2.0, Section 3.10).

4.4 SOUND WALLS

4.4.1 Sound Wall Description

Sound Wall 297

Sound Wall 297 is planned along a portion of the off-ramp from southbound Route101 to Old Redwood Highway. SW 297 begins about 36 feet right of "R6" line Station 297+92. The wall will have a design height of 12 feet and a total length about 424 feet. It will be placed on a Type 736SV concrete barrier. The concrete barrier will be supported on 16 feet long, 16-inch diameter CIDH piles. Plans of this wall are presented in Appendix E as reference.

Sound Wall 300

Sound Wall 300 is planned along the northbound Route101 between the end of northbound Route 101 on-ramp from Route 116 to Caufield Lane Overcrossing. SW 300 begins about 89 feet right of "R6" line Station 300+51. The wall will have a design height 16 feet and a total length about 957 feet. It will be placed on a Type 736SV concrete barrier. The concrete barrier will be supported on 16 feet long, 16-inch diameter CIDH piles. Plans of this wall are presented in Appendix E as reference.

Sound Wall 211

Sound Wall 211 is planned east side of Route 101 northbound shoulder, just north of the Caulfield Lane Overcrossing. This sound wall begins about 98 feet right of "A" line Station 211+33. The wall will have a design height of 16 feet and a total length about 156 feet. It will be placed engineered fill and supported on 16 feet long, 16-inch diameter CIDH piles. Refer to Appendix E for plans for this sound wall.

Sound Wall 212

Sound Wall 212 is planned east side of Route 101 northbound shoulder, north of the Caulfield Lane Overcrossing. This sound wall begins about 73 feet right of "A" line Station 212+53. The wall will have a design height of 12 feet and a total length about 612 feet. It will be placed engineered fill and supported on 16 feet long, 16-inch diameter CIDH piles. Refer to Appendix E for plans for this sound wall.

4.4.2 Subsurface Conditions

Two (2) exploratory borings (A-09-101 and A-09-103) and two CPTs (CPT-09-102 and CPT-09-104) were performed along the proposed alignment of both sound walls. The borings were drilled on June 8 and 9, 2006 to a terminal depth of 51½ feet below existing ground surface (bgs), whereas the CPTs were conducted on June 22, 2009, extending to a depth of 80 feet.

Fill was encountered in Boring A-09-103 to a depth of 2½ feet bgs. The fill consists of very dense silty sand and gravel.

Underlying the fill are alluvial soils which generally consist of loose sand and medium stiff to stiff fat clay and lean clay and sandy lean clay to terminal boring depths of 50 to 80 feet bgs.

Granular interbeds 5 to 7 feet thick were observed in both borings beginning at Elevation -8 to -10 feet. These granular deposits were classified as loose to medium dense silty sand and clayey sand.

Groundwater was encountered at depths of 10 feet and 26 feet bgs (Elevation -3 and -10) in Borings A-09-101 and A-09-103, respectively.

4.4.3 Design Considerations

Recommended Design Parameters

Segments of the sound wall will be placed in level ground. We recommend that cast-in-drilled hole (CIDH) piles be used as foundations to resist both vertical and horizontal wall design loads. The sound walls will consist of reinforced concrete masonry blocks.

Based on our analysis of the boring logs and laboratory test results, we have estimated the friction angle ϕ' for this sound wall. We then compared this value to the ϕ' value used in the Caltrans Standard Plans. The comparison is summarized in the following table for sound wall on Type 736SV concrete barrier.

Table 4-5 Comparison of Design Parameters to Standard Plan Assumptions

Estimated ϕ' (degrees)	Caltrans Standard Sheet Name	Recommended ϕ' on Caltrans Standard Sheet (degrees)
30	Sound Wall-Masonry Block on Type 736 SV Barrier, Details No. 3	30
30	Sound Wall-Masonry Block on Pile Cap, Details No. 2 and 3	30

We also recommend the following:

- Isolation Factor
  - 3.0 for ground surface level on both sides of wall
  - 2.0 for ground surface sloped on either side of wall
- Minimum Pier Length = 5 feet
- Minimum Pile Diameter = 16 inches

Specified pile to pile spacing should be determined in accordance with Caltrans Memo to Designer 22-1, “Pile Embedment.”

Post Liquefaction Settlement

Table 4-6 presents a summary of the estimated post-liquefaction ground surface settlement at sound wall.

Table 4-6 Estimated Post Liquefaction Ground Surface Settlement at Sound Wall

Boring/CPT Number	Depth to Top of Layer (feet)	Layer Thickness (feet)	Estimated Ground Surface Settlement (inch)
CPT-09-102	19	2	1
A-09-103	28, 33½	3, 4½	1½
CPT-09-104	14	5	<½

Although, CPT-09-102 is estimated to have post liquefaction settlement about 1 inch, the planned CIDH pile tip should be above the liquefiable layer and thus downdrag on the piles is unlikely. Similarly for A-09-103, the likelihood of liquefaction induced downdrag on the piles is low. The estimated ground settlement is less than ½ inch at CPT-09-104; therefore, downdrag due to liquefaction induced settlement is unlikely to be mobilized. It is concluded that the risk of downdrag due to liquefaction is relatively low along SW 297 and SW 211

4.4.4 Construction Considerations for Sound Walls

Fill was encountered in Boring A-09-103 to a depth of 2½ feet bgs. Underlying the fill, the conditions encountered in these borings consist of layers of lean clay and fat clay with granular interbeds. Groundwater was encountered at Elevation -3 to -10 feet at the time of drilling. In addition, planned depth of CIDH-piles is 16 feet, with tip ranging between Elevation -7 to +1.

The conditions encountered in borings consist primarily of layers of fat clay and lean clay with granular interbeds. Groundwater was encountered in borings at variable elevations (-3 to -10) at the time of drilling. In cohesive soils as generally encountered, a fairly long time would be required for the groundwater to seep into the borehole and attain an equilibrium position with the long-term hydrostatic groundwater table. Thus, the immediate readings obtained may or may not be representative of the actual groundwater table level. Furthermore, seasonal fluctuations in groundwater levels should be anticipated throughout the year. While the cohesive deposits will help to keep the holes open during construction, some sloughing and caving can be expected in the cohesionless deposits. Therefore, it is recommended that the Contractor have casing on site, should it be needed to minimize the risk of caving in either clay or sand soils. Casing should be withdrawn from the hole slowly as the concrete is being placed; a minimum head of concrete of 3 feet should be maintained in the casing at all times. All CIDH piles should be installed under the direct observation of the Geotechnical Engineer.

4.5 NEW OVERHEAD SIGNS

4.5.1 Description

Four new overhead signs are planned; the locations and other details are summarized in the following table.

Table 4-7 New Overhead Sign Locations and Types

Overhead Sign			Approximate Station Location (feet)	Closest Boring (s)		Post Type
Contract B4 Sign Number	Revised Contract	Sign Number		Number	"A" Line Station Location	
A	B2 & B4	SS11-D	151+84 Lt	A-09-123	153+00	VIII
B	C3	SS2-A	187+90 Rt FNBT	R-09-011	NA	VIII
D	C3	SS4-C	218+44 Rt FNBT	B-2 (1972)	210+50	IX
E	B2 & B4	SS14-E	182+00 Lt FSBT	A-09-009 CPT-03 (2004)	182+69 183+00	VIII

*FNBT = Facing Northbound traffic
**FSBT = Facing Southbound traffic

For the combined B2 and B4 contract, Signs A and E have been re-numbered to Signs SS11-D and SS14-E, respectively. Signs B and D are planned for the northern segment of the original B4 contract and have been excluded from the combined B2 and B4 contract.

An overhead sign with a drilled pier type foundation is planned for Signs SS11-D (former A), SS4-C (former D) and SS14-E (former E). Sign SS2-A is to be placed just south of the new 101N/116 SOH (Replace) (see Sheets S-11 and S-14 of the July 2011 plan set and Sheets S-3 and S-6 of the November 2010 plan set presented in Appendix E). The "SD" Plan Sheets indicate Signs SS11-D, SS14-E and SS4-C are to be supported by a single CIDH pile having a diameter of 60 inches, with varying depths. The support of SS2-A will be incorporated into the bridge abutment return wall along the eastern edge of the northbound shoulder. In accordance with Caltrans 2006 Standard Plan S7 (Figure 4-1), the foundation design is based on an internal friction angle of 30 degrees and a unit weight of 120 pcf. The LOTBs for these signs are presented in Appendix A. Sign details are included in Appendix E, Plan Sheet SD-1.

4.5.2 Subsurface Conditions

At Station 151+84, the nearest boring is A-09-123. Boring A-09-123 reveals that the near surface lean clay is very stiff which overlies sandy lean clay and clayey sand with gravel. Then, the boring met refusal at the terminal depth of 26 feet. No groundwater was encountered during drilling. A more detailed description of the subsurface conditions is shown on the LOTB prepared by Caltrans in Appendix A.

At Station 187+90, the subsurface conditions in nearby Boring R-09-011 were reviewed for this study. Dense silty sand and clayey gravel fill (depth of 27 feet bgs) overlying alternating layers of sandy lean clay and clayey sand fill to a total depth of 54 feet bgs were encountered. Below the fill, underlying native soils consisted of very stiff lean clay with interbedded layers of very dense silty sand and poorly graded sand to a depth of 97 feet bgs. Occurring below the lean clay are about 2 feet of very dense clayey gravel founded on intensely weathered metamorphic rock

(serpentinite) extending to the terminal depth of the boring at 120 feet. A more detailed description of the subsurface conditions is shown on the Boring Records, Appendix A.

At Station 218+44, the subsurface conditions were reviewed in nearby as-built Boring B-2 (Contract No. 04-358714, 1971). Dense silty sand gravel fill was found to a depth of 4 feet bgs. Below the fill, underlying native soils consisted of soft clay and loose silty sand to a depth of 16 feet bgs that in turn is underlain by stiff lean clay to a depth of 48 feet. Occurring directly below the lean clay is a deposit of medium dense silty sand extending to about 62 feet bgs. Dense to very dense gravel deposits were encountered below the sand, extending to the terminal depth of the boring about 98 feet bgs. Groundwater was encountered at a depth of 18 feet bgs (Elevation 4.4) at time of drilling in B-2. A more detailed description of the subsurface conditions is shown on the LOTB, Appendix A.

At Station 182+00, the subsurface conditions in nearby Boring A-09-009 and as-built CPT-03 (Contract No. 04-276004, 2004) were reviewed for this study. Dense clayey gravel fill was encountered in the entire Boring A-09-009 (terminal depth at 51 feet bgs). CPT-03 (2004) encountered refusal in shallow depth of less than 1 foot which was indicative of dense clayey gravel consistent with the findings of Boring A-09-009. A more detailed description of the subsurface conditions is shown on the Boring Records, Appendix A.

4.5.3 Geotechnical Design Parameters

It is our opinion that the design lateral soil pressure estimated for an angle of internal friction of 30 degrees and unit weight of soils of 120 pcf is appropriate for Signs SS11-D and SS14-E assuming the ground surface is no steeper than 2:1 (horizontal to vertical). However, due to the shallow groundwater encountered at Sign SS4-C the unit weight is reduced considerably to the submerged unit weight below the groundwater level. Based on preliminary analysis of lateral pile capacities, we estimate that the standard depth for the CIDH piles should be capable to resist the shear and moment at Sign SS11-D. However, the potential of liquefaction induced settlement at Sign SS4-C necessitates pile embedment be deepened to resist downdrag loads due to negative skin friction developed on the pile shaft. For Sign SS14-E, it is recommended that the pile length be extended to 30 feet to account for potential influence of retaining wall, RW 180, foundation bearing pressure. Sign structure foundations are summarized in Table 4-8.

Table 4-8 Pile Data at Overhead Sign Structures

Sign Number	Pile Data		Remarks	Extend Pile Depth Due to	
	Diameter (ft)	Depth (ft)		Liquefaction Induced Settlement	Lateral Load/Adjacent Structure
SS11-D	5	25		No	No
SS2-A	NA	NA	Supported on return wall	NA	NA
SS4-C	5	40	Non-standard length	Yes	No
SS14-E	5	30	Non-standard length	No	Yes

4.5.4 Construction Considerations

At Sign SS11-D, the subsurface conditions consist of about 13 feet of stiff lean clay overlying weathered bedrock. Groundwater was not encountered during exploration. Drilling in the lean clay layer and the weathered bedrock is expected to be dry. Some hard drilling should be expected in the lower 5 to 7 feet of the specified depth of the drilled shaft as the corresponding weathered bedrock becomes less fractured and having higher penetration resistance.

At Sign SS2-A, the subsurface conditions and construction considerations should be referred to the foundation report of the Route 101N/116 SOH (Replace).

At Sign SS4-C, the subsurface conditions consist of layers of lean clays with granular seams. Groundwater is anticipated at a depth of about 10 feet below ground surface. In cohesive soils as generally encountered a fairly long time would be required for the groundwater to seep into the bore hole and attain an equilibrium position with long-term hydrostatic groundwater table. Thus, the immediate readings obtained may or may not be representative of the actual groundwater table level. Furthermore, seasonal fluctuations in groundwater levels should be anticipated throughout the year. While the cohesive deposits will help keep the holes open during construction, some sloughing and caving can be expected in the cohesionless deposits. Therefore, it is recommended that the Contractor should have a minimum length of 10 feet of casing on site. If temporary casing is used, the casing should be withdrawn from the hole slowly as the concrete is being placed; a minimum head of concrete of 3 feet should be maintained in the casing at all times.

At Sign SS14-E, the subsurface conditions consist of 3 feet of medium dense clayey gravel fill overlying dense clayey gravel fill to more than 50 feet bgs. Groundwater is not anticipated in the fill; therefore, drilling is expected to be dry. While clayey gravel should keep the hole open during construction, some sloughing and caving can be expected in the upper 3 feet of medium dense gravel fill. Therefore, it is recommended that the Contractor have casing of a minimum length of 5 feet on site, should it be needed to minimize the risk of caving in the medium dense gravel fill. If temporary casing is used, the casing should be withdrawn from the hole slowly as the concrete is being placed; a minimum head of concrete of 3 feet should be maintained in the casing at all times.

All CIDH piles should be installed under the direct observation of the Geotechnical Engineer.

4.6 GEOTECHNICAL CALCULATIONS

Our geotechnical engineering calculations are presented in Appendix D. These calculations include retaining wall bearing capacities, slope stability, estimated settlement, parameter selections for sound walls and sign structures, pile analysis for sign foundations and liquefaction analyses.

5.1 EARTHWORK

Earthwork should conform to the applicable portions of Section 19 of the Standard Specifications and to current Special Provisions.

5.2 STRUCTURE BACKFILL

Structure backfill should conform to the provisions in Section 19-3 of the Standard Specifications.

5.3 EMBANKMENT CONSTRUCTION

Embankment material for at least 4 feet below the grading plane should conform to the requirements noted in the Special Provisions. All imported borrow should conform to the provisions of Section 19-7.02 of the Standard Specifications and to current Special Provisions.

The opinions, conclusions and recommendations contained in this Geotechnical Design Report are based upon the information obtained from explorations made at widely separated locations, geologic reconnaissance, review of available geologic and topographic information and historic data, and upon local experience and engineering judgment.

The recommendations presented in this report are based on the assumption that the soil and geologic conditions do not deviate substantially from those encountered in the exploratory borings. If any variations are encountered during construction, URS should be consulted so that supplementary recommendations can be made.

If the planned construction is changed from that presently conceived, URS should be retained to review the changes and make modifications to the original recommendations presented in this report in order to meet the project needs.

Geotechnical issues may arise during construction which are not apparent at this time. We should be retained during construction to review the soil conditions encountered and the construction procedures. All testing should be done under the direct observation of a representative of our firm.

The elevations shown on the logs of new borings are based on interpolation from spot and contour elevations shown on available topographic maps.

A specific review related to environmental and hazardous waste issues and an investigation for subsurface environmental contamination is being performed by URS and will be presented in a separate report.

As-built drawings pertinent only to the geotechnical investigation are included.

The recommendations presented in this Geotechnical Design Report were developed with the standard of care commonly used as state of the practice in the profession. No other warranties are included, either express or implied, as to the professional advice presented in this report.

ABAG, 2007, Floodplain Maps, abag.ca.gov/bayarea/eqmaps/eqfloods/floods

Armstrong, C.F. and Huffman, M.E., 1980, Geology for planning in Sonoma County, California Division of Mines and Geology Special Report 120, Plate 2b and 3B, scale 1:62,500.

California Division of Mines and Geology, 1982, Alquist-Priolo Special Studies Zone revised official map of the Petaluma River quadrangle, scale 1: 24,000, January 1.

California Division of Oil, Gas, and Geothermal Resources, 2001, Oil, Gas, & Geothermal Fields in California, scale 1: 1,500,000: ftp://ftp.consrv.ca.gov/pub/oil/maps/Map_S-1, accessed 7-17-09

California Geological Survey [Tianqing Cao and others], 2003, The revised 2002 California probabilistic seismic hazard maps, June 2003: CGS online publication at www.consrv.ca.gov/cgs/rghm/psha/fault_parameters/pdf/2002_CA_Hazard_Maps.pdf

California Department of Transportation: Caltrans ARS Online, 2009: Web-based tool calculates both deterministic and probabilistic acceleration response spectra: http://dap3.dot.ca.gov/shake_stable/

Campbell-Bozorgnia (2008) and Chiou-Youngs (2008) ground motion prediction equations: "Next Generation Attenuation" project: PEER-Lifelines program: http://peer.berkeley.edu/products/nga_project.html

City of Petaluma, 2008, Final General Plan 2025, May, http://cityofpetaluma.net/genplan/finalgp2025.html, accessed 7-15-09

Hart, E.W., 1975 (revised 1997), Fault-rupture hazard zones in California: California Division of Mines and Geology Special Publication 42.

Jennings, C.W., 1994, Fault activity map of California and adjacent areas with locations and ages of recent volcanic eruptions: California Division of Mines and Geology Geologic Data Map No. 6, scale 1: 750,000.

Merriam, M. and Shantz, T., 2007, Caltrans Deterministic PGA Map, California Department of Transportation.

http://dap3.dot.ca.gov/shake_stable/references/Deterministic_PGA_Map_8-12-09.pdf

Sonoma County Hazard Mitigation Plan, 2006 Landslide hazard areas, September 19, http://www.sonoma-county.org/PRMD/docs/hmp/fig_2-04.pdf, accessed 7-17-09.

Wagner, D.L., Rice, S.R., Bezore, S., Randolph-Loar, C.E., Allen, J., and Witter, R.C., 2002, Geologic map of the Petaluma River 7 ½' quadrangle, Marin and Sonoma counties, California, a digital database: California Geological Survey.

Wentworth, C.M., 1997, Geologic materials of the San Francisco Bay Region, U. S. Geological Survey OFR 97-744, compiled from the work of Brabb (1989) , Ellen and Wentworth (1995) and Helley and Lajoie (1979) a digital database

Witter, R.C., Knudsen, K.L., Sowers, J.M., Wentworth, C.M., Koehler, R.D., and Randolph, C.E., 2006, Maps of Quaternary deposits and liquefaction susceptibility in the central San Francisco Bay region, California, in cooperation with the California Geological Survey: A digital database, U.S. Geological Survey, Open-File Report 2006-1037.

TABLE 2-1
SUMMARY OF LABORATORY TEST RESULTS

Boring or Sample No.	Date Sampled	Station	Line	Distance from Line (feet)	Depth (feet)	Sieve Analysis Results (Percent Passing)												R-value	Atterberg Limits			Unconfined Compressive Strength (psf)	In-Place Conditions	
						%<1.5-in	%<1-in	%<3/4-in	%<1/2-in	%<3/8-in	%<#4	%<#8	%<#16	%<#30	%<#50	%<#100	%<#200		Liquid Limit	Plastic Limit	Plasticity Index		Water Content (%)	Dry Unit Weight (pcf)
A-09-009	26-Aug-09	182+52	A	Rt. 43	1																		25.4	95
A-09-009	26-Aug-09	182+52	A	Rt. 43	20	77	63	59	38	33	24	18	14	11	9	8	7						4.9	125
A-09-009	26-Aug-09	182+52	A	Rt. 43	25																		10.4	131
A-09-010	27-Aug-09	186+35	A	Rt. 45	30																		18.7	105
A-09-101	8-Jun-09	195+36	A	Rt. 398	1																	2,530	33.6	86
A-09-101	8-Jun-09	195+36	A	Rt. 398	5																	2,650	31.6	88
A-09-101	8-Jun-09	195+36	A	Rt. 398	15				100	100	95	83	67	56	38	22	17						20.5	104
A-09-101	8-Jun-09	195+36	A	Rt. 398	25																		19.3	105
A-09-101	8-Jun-09	195+36	A	Rt. 398	35																	5,940	21.4	106
A-09-101	8-Jun-09	195+36	A	Rt. 398	40																	6,500	23.9	102
A-09-101	8-Jun-09	195+36	A	Rt. 398	50																	3,760	21.2	105
A-09-103	9-Jun-09	204+93	A	Rt. 66	5																	5,140	21.1	102
A-09-103	9-Jun-09	204+93	A	Rt. 66	15																	3,390	28.2	96
A-09-103	9-Jun-09	204+93	A	Rt. 66	20																	4,440	28.9	94
A-09-103	9-Jun-09	204+93	A	Rt. 66	35																		16.3	113
A-09-103	9-Jun-09	204+93	A	Rt. 66	50																	3,030	50.3	72
A-09-105	18-Oct-09	152+77	A	Rt. 62	40																	3,820	16.9	110
A-09-105	18-Oct-09	152+77	A	Rt. 62	40																	3,000	22.6	98
A-09-105	18-Oct-09	152+77	A	Rt. 62	40																	7,530	17.6	116
A-09-105	18-Oct-09	152+77	A	Rt. 62	40																	3,880	15.3	118
A-09-106	19-Oct-09	154+58	A	Rt. 49	30																	3,740	15.2	116
A-09-106	19-Oct-09	154+58	A	Rt. 49	30																	2,300	18.0	106
A-09-106	19-Oct-09	154+58	A	Rt. 49	30																	3,060	20.2	109
A-09-106	19-Oct-09	154+58	A	Rt. 49	30																	4,010	28.0	94
R-09-002	18-Aug-09	171+62	A	Rt. 56	1.5																		18.8	116
R-09-002	18-Aug-09	171+62	A	Rt. 56	5																	5,720	20.2	110
R-09-003	19-Aug-09	172+80	A	Lt. 33	10																	1,610	24.3	100
R-09-005	11-Aug-09	175+42	A	Lt. 20	1																	90	36.8	83
R-09-005	11-Aug-09	175+42	A	Lt. 20	5																	340	44.3	76
R-09-005	11-Aug-09	175+42	A	Lt. 20	15																	730	59.1	65
R-09-006	12-Aug-09	174+96	A	Rt. 44	1																	100	97.0	46
R-09-006	12-Aug-09	174+96	A	Rt. 44	5																	130	71.5	57
R-09-006	12-Aug-09	174+96	A	Rt. 44	10																	580	87.8	49
R-09-007	31-Aug-09	177+35	A	Lt. 12	5																		13.7	109
R-09-008	23-Aug-09	179+54	A	Lt. 2	33.5																	3,530	13.1	128
R-09-008	23-Aug-09	179+54	A	Lt. 2	43.5			100	98	93	78	61	48	40	33	27	23						17.1	119
R-09-008	23-Aug-09	179+54	A	Lt. 2	78.5																	5,670	32.6	91
R-09-008	23-Aug-09	179+54	A	Lt. 2	98.5																	8,980	21.6	108
R-09-011	23-Jun-09	187+43	A	Lt. 1	19																		7.6	125
R-09-011	23-Jun-09	187+43	A	Lt. 1	54.2																	6,130	23.0	103
R-09-011	23-Jun-09	187+43	A	Lt. 1	58.8																	7,530	18.0	119
R-09-011	23-Jun-09	187+43	A	Lt. 1	69																	8,260	18.6	110

TABLE 2-1
SUMMARY OF LABORATORY TEST RESULTS

Boring or Sample No.	Date Sampled	Station	Line	Distance from Line (feet)	Depth (feet)	Sieve Analysis Results (Percent Passing)												R-value	Atterberg Limits			Unconfined Compressive Strength (psf)	In-Place Conditions	
						%<1.5-in	%<1-in	%<3/4-in	%<1/2-in	%<3/8-in	%<#4	%<#8	%<#16	%<#30	%<#50	%<#100	%<#200		Liquid Limit	Plastic Limit	Plasticity Index		Water Content (%)	Dry Unit Weight (pcf)
R-09-011	23-Jun-09	187+43	A	Lt. 1	78																	5,160	20.8	104
R-09-011	23-Jun-09	187+43	A	Lt. 1	83																		17.5	112
R-09-012	10-Jun-09	190+06	A	Rt. 28	10																	1,760	27.1	97
R-09-012	10-Jun-09	190+06	A	Rt. 28	15																	4,450	27.5	97
R-09-012	10-Jun-09	190+06	A	Rt. 28	20														87	26	61	2,850	35.1	87
R-09-012	10-Jun-09	190+06	A	Rt. 28	40																	2,560	29.2	94
R-09-012	10-Jun-09	190+06	A	Rt. 28	45														81	26	55	2,060	45.3	77
R-09-012	10-Jun-09	190+06	A	Rt. 28	46.2																	1,910	16.7	117
R-09-012	10-Jun-09	190+06	A	Rt. 28	50																	2,740	32.0	90
R-09-013	11-Jun-09	191+80	A	Rt. 14	11																	1,670	27.6	94
R-09-013	11-Jun-09	191+80	A	Rt. 14	14														67	22	45	4,540	28.2	95
R-09-013	11-Jun-09	191+80	A	Rt. 14	19																	3,460	25.9	97
R-09-013	11-Jun-09	191+80	A	Rt. 14	25																	820	25.1	100
R-09-013	11-Jun-09	191+80	A	Rt. 14	26							100	100	100	98	66	41						22.9	103
R-09-013	11-Jun-09	191+80	A	Rt. 14	34																	2,430	24.6	101
R-09-013	11-Jun-09	191+80	A	Rt. 14	39																	3,450	22.1	104
R-09-013	11-Jun-09	191+80	A	Rt. 14	44																	2,750	31.1	91
R-09-013	11-Jun-09	191+80	A	Rt. 14	50.2																	2,820	23.1	103
R-09-014	14-Jun-09	193+17	A	Lt. 2	11.2														73	20	54	2,550	31.3	91
R-09-014	14-Jun-09	193+17	A	Lt. 2	15							100	100	100	100	80	44					1,500	22.5	104
R-09-014	14-Jun-09	193+17	A	Lt. 2	20																		21.4	104
R-09-014	14-Jun-09	193+17	A	Lt. 2	30																	3,070	27.2	97
R-09-014	14-Jun-09	193+17	A	Lt. 2	35																	3,300	23.5	103
R-09-014	14-Jun-09	193+17	A	Lt. 2	40																	3,790	21.8	106
R-09-014	14-Jun-09	193+17	A	Lt. 2	46																	1,340	23.7	102
R-09-014	14-Jun-09	193+17	A	Lt. 2	50																	2,360	28.3	94
R-09-014	14-Jun-09	193+17	A	Lt. 2	65														55	22	33		34.6	89
R-09-014	14-Jun-09	193+17	A	Lt. 2	75																	3,750	28.6	94
R-09-014	14-Jun-09	193+17	A	Lt. 2	86																		13.8	115
R-09-014	14-Jun-09	193+17	A	Lt. 2	90																		46.3	70
R-09-015	16-Jun-09	194+32	A	Rt. 21	10																		7.1	128
R-09-015	16-Jun-09	194+32	A	Rt. 21	15																		11.6	123
R-09-015	16-Jun-09	194+32	A	Rt. 21	25																	1,780	22.1	100
R-09-015	16-Jun-09	194+32	A	Rt. 21	36.2																		19.1	109
R-09-015	16-Jun-09	194+32	A	Rt. 21	45																		18.5	106
R-09-015	16-Jun-09	194+32	A	Rt. 21	65																	3,230	21.0	105
R-09-015	16-Jun-09	194+32	A	Rt. 21	75														78	27	51	2,910	45.5	75
R-09-015	16-Jun-09	194+32	A	Rt. 21	85																	1,490	41.5	78

INDEX OF PLANS

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON AND ADJACENT TO

STATE HIGHWAY

IN SONOMA COUNTY
IN AND NEAR PETALUMA FROM 0.1 MILE SOUTH OF PETALUMA BOULEVARD SOUTH OVERCROSSING TO 0.2 MILE NORTH OF CAULFIELD LANE OVERCROSSING

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

ROUTE 101 MARIN SONOMA NARROWS
(CONTRACT B4) 65% SUBMITTAL
MARCH 22, 2010

LOCATION MAP

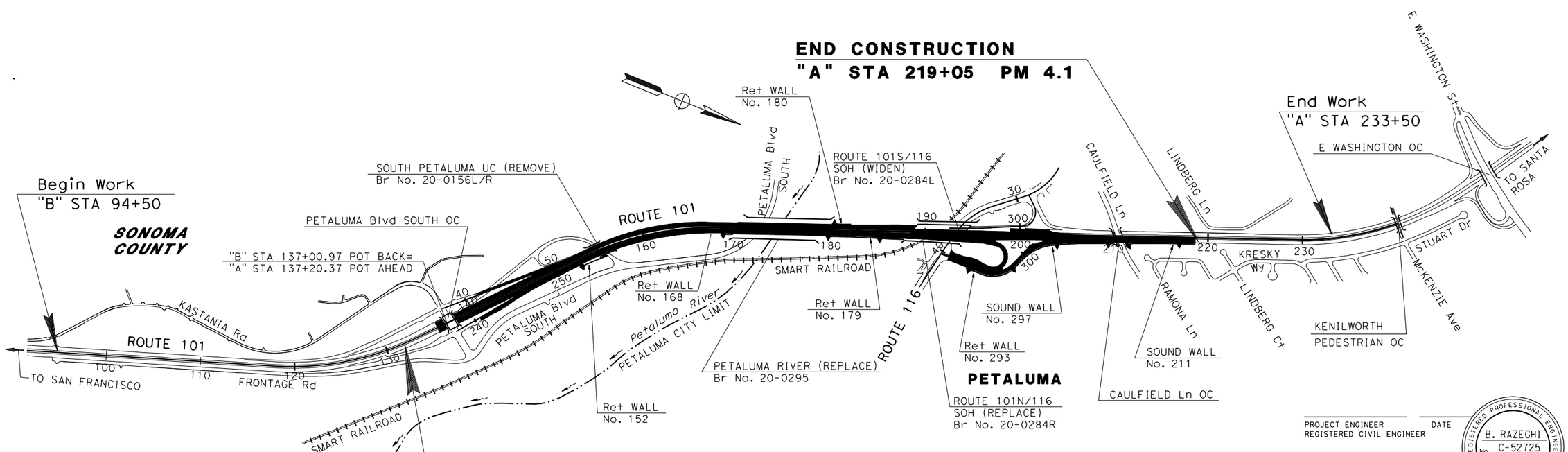

FIGURE 1-1

PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI No. C-52725 Exp. 12-31-10 CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

URS CORPORATION
100 W. SAN FERNANDO St
SUITE 200
SAN JOSE, CA 95113

SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401

CONTRACT No. **04-2640C4**

THE CONTRACTOR SHALL POSSESS THE CLASS (OR CLASSES) OF LICENSE AS SPECIFIED IN THE "NOTICE TO CONTRACTORS."

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER | CALTRANS DESIGN OVERSIGHT APPROVAL | REGISTRATION No. | LICENSE Exp DATE | DATE SIGNED

DATE PLOTTED => 3/22/2010
TIME PLOTTED => 9:40:24 AM
LAST REVISION 00-00-00

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI No. C-52725 Exp. 12-31-10 CIVIL STATE OF CALIFORNIA

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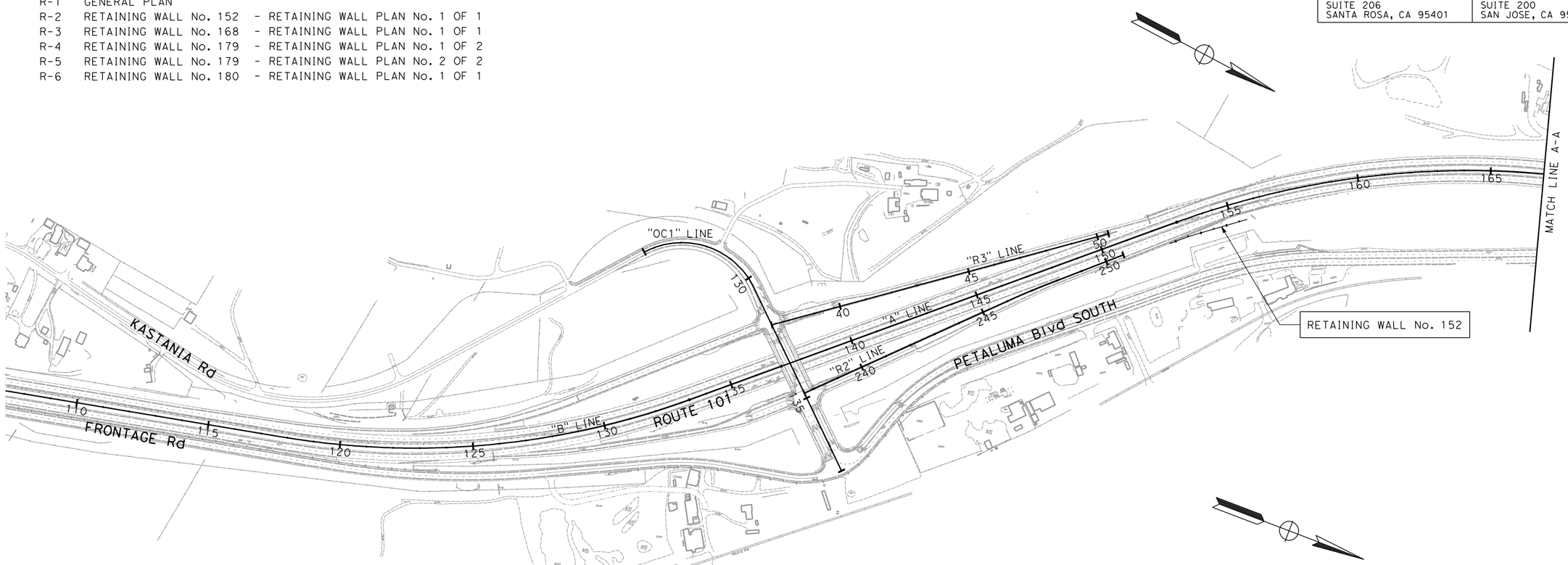
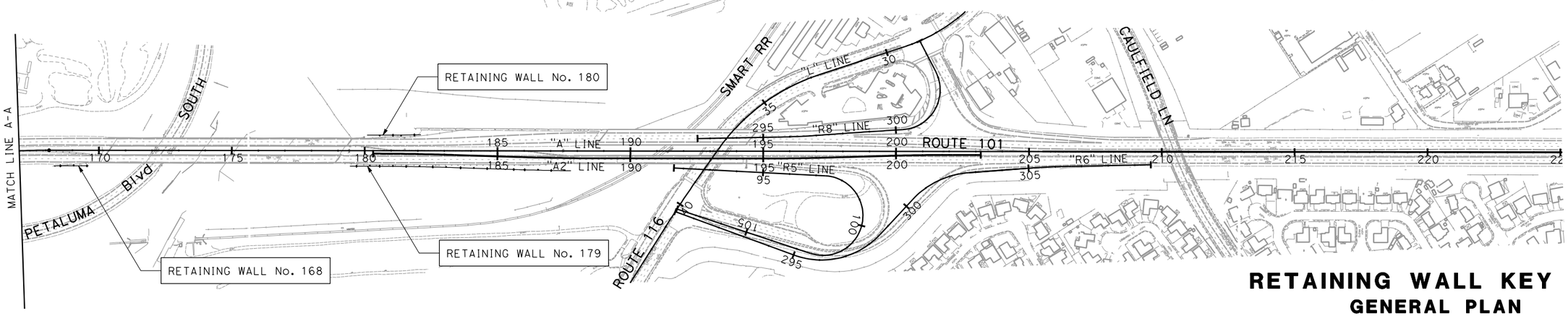
SAN JOSE, CA 95113

INDEX TO PLANS

SHEET No.	TITLE
R-1	GENERAL PLAN
R-2	RETAINING WALL No. 152 - RETAINING WALL PLAN No. 1 OF 1
R-3	RETAINING WALL No. 168 - RETAINING WALL PLAN No. 1 OF 1
R-4	RETAINING WALL No. 179 - RETAINING WALL PLAN No. 1 OF 2
R-5	RETAINING WALL No. 179 - RETAINING WALL PLAN No. 2 OF 2
R-6	RETAINING WALL No. 180 - RETAINING WALL PLAN No. 1 OF 1





RETAINING WALL KEY MAP

GENERAL PLAN

FIGURE 1-2

SCALE: 1"=200'

R-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

CALCULATED-DESIGNED BY: ELIE ABI-JAOUDE

CHECKED BY: BEN RAZEGHI

REVISED BY | DATE REVISED

LAST REVISION 00-00-00

DATE PLOTTED => 3/22/2010
TIME PLOTTED => 9:53:22 AM

BORDER LAST REVISED 4/11/2008

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

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CU 00000

EA 2640C1

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI No. C-52725 Exp. 12-31-10 CIVIL STATE OF CALIFORNIA

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INDEX TO PLANS

SHEET No.	TITLE
SW-1	GENERAL PLAN
SW-2	SOUND WALL No. 297 - SOUND WALL PLAN SHEET 1 OF 3
SW-3	SOUND WALL No. 297 - SOUND WALL PLAN SHEET 2 OF 3
SW-4	SOUND WALL No. 297 - SOUND WALL PLAN SHEET 3 OF 3
SW-5	SOUND WALL No. 211 - SOUND WALL PLAN SHEET 1 OF 2
SW-6	SOUND WALL No. 211 - SOUND WALL PLAN SHEET 2 OF 2
SW-7	SOUND WALL DETAILS - SOUND WALL ON BARRIER AESTHETIC DETAILS SHEET 1 OF 2
SW-8	SOUND WALL DETAILS - SOUND WALL ON BARRIER AESTHETIC DETAILS SHEET 2 OF 2
SW-9	SOUND WALL PILE SPACING ARRANGEMENT SHEET 1 OF 1

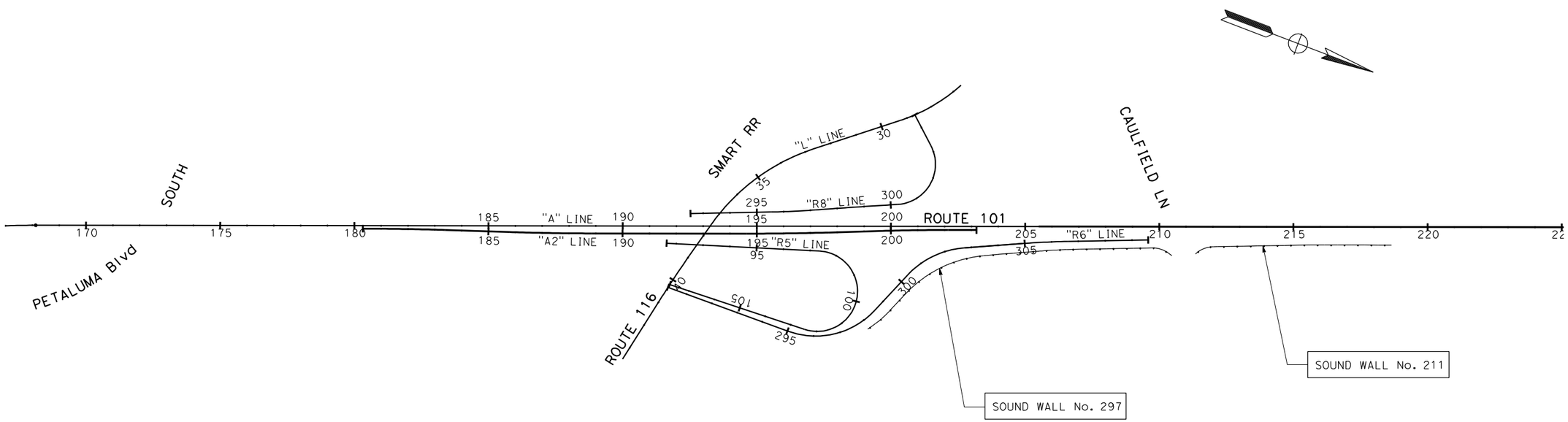

FIGURE 1-3

SOUND WALL KEY MAP
GENERAL PLAN
SCALE: 1"=200'

SW-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN
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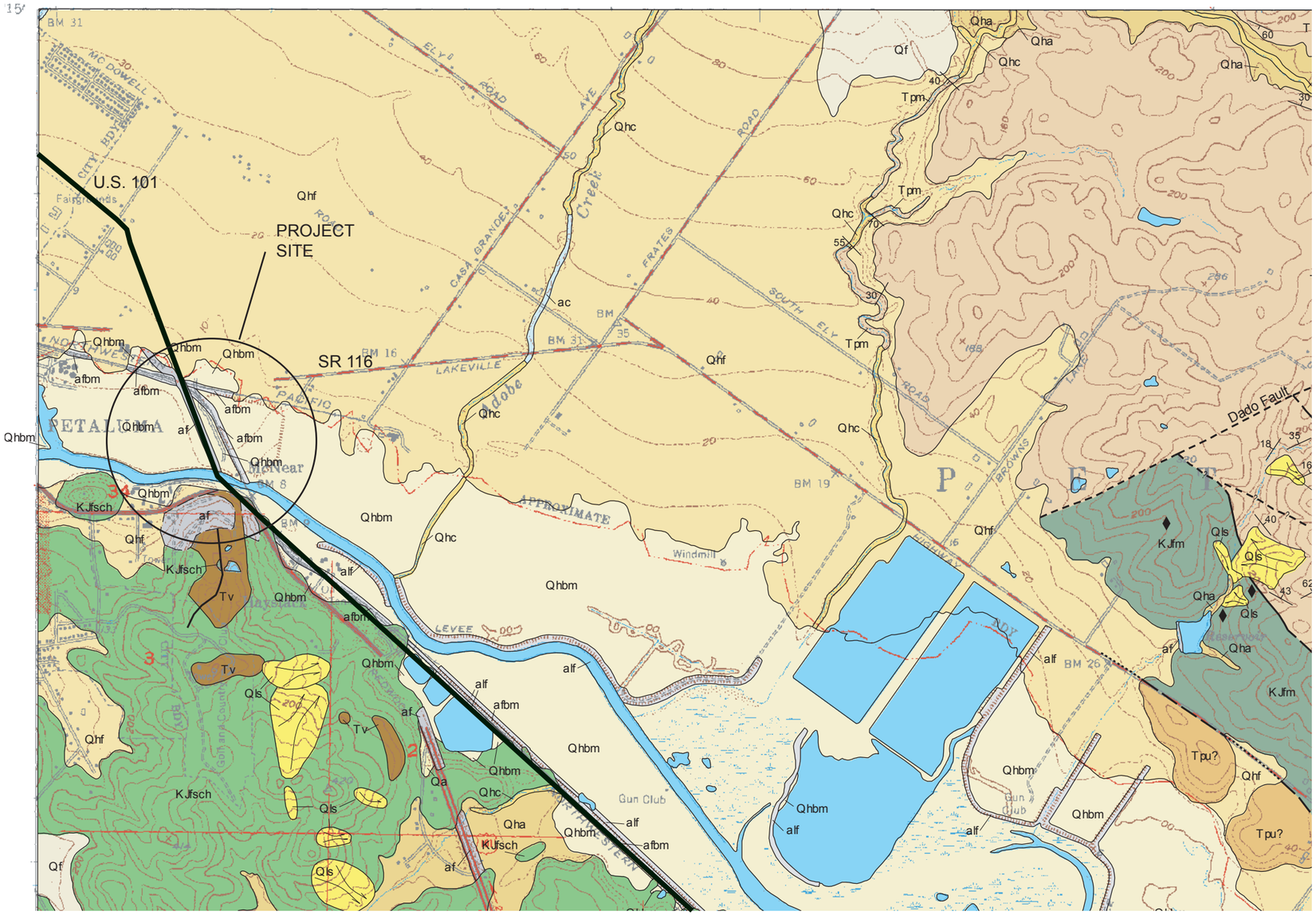
CHECKED BY: BEN RAZEGHI
REVISED BY
DATE REVISED

LAST REVISION 00-00-00
DATE PLOTTED => 3/22/2010
TIME PLOTTED => 9:54:03 AM



LEGEND

af	Artificial Fill
afbm	Artificial Fill placed over Bay Mud
alf	Artificial Levee Fill
Qhc	Late Holocene to moderate alluvial
Qhbm	Holocene Bay Mud moderate alluvial
Qhf	Holocene alluvial fan desposite
Qhf	Holocene alluvial fan desposite
Qls	Landslides
Tv	Tertiary Volcanic Rock
KJfsch	Franciscan Complex Rock

Source:
Wagner, D. L., Rice, S.R., Bezore S., Randolph-Loar, C.E., Allen J., and Witter R.C., 2002, Geologic map of the Petaluma River 7 1/2' quadrangle, Marin and Sonoma counties, California, a digital database: California Geological Survey.

0 0.1 0.2 0.3 0.4 0.5 mile

URS	Highway 101 Widening Petaluma, California Project Number: 28645045	Regional Geologic Map Sonoma County, California	Figure 1-4 August 19, 2009

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI No. C-52725 Exp. 12-31-10 CIVIL STATE OF CALIFORNIA

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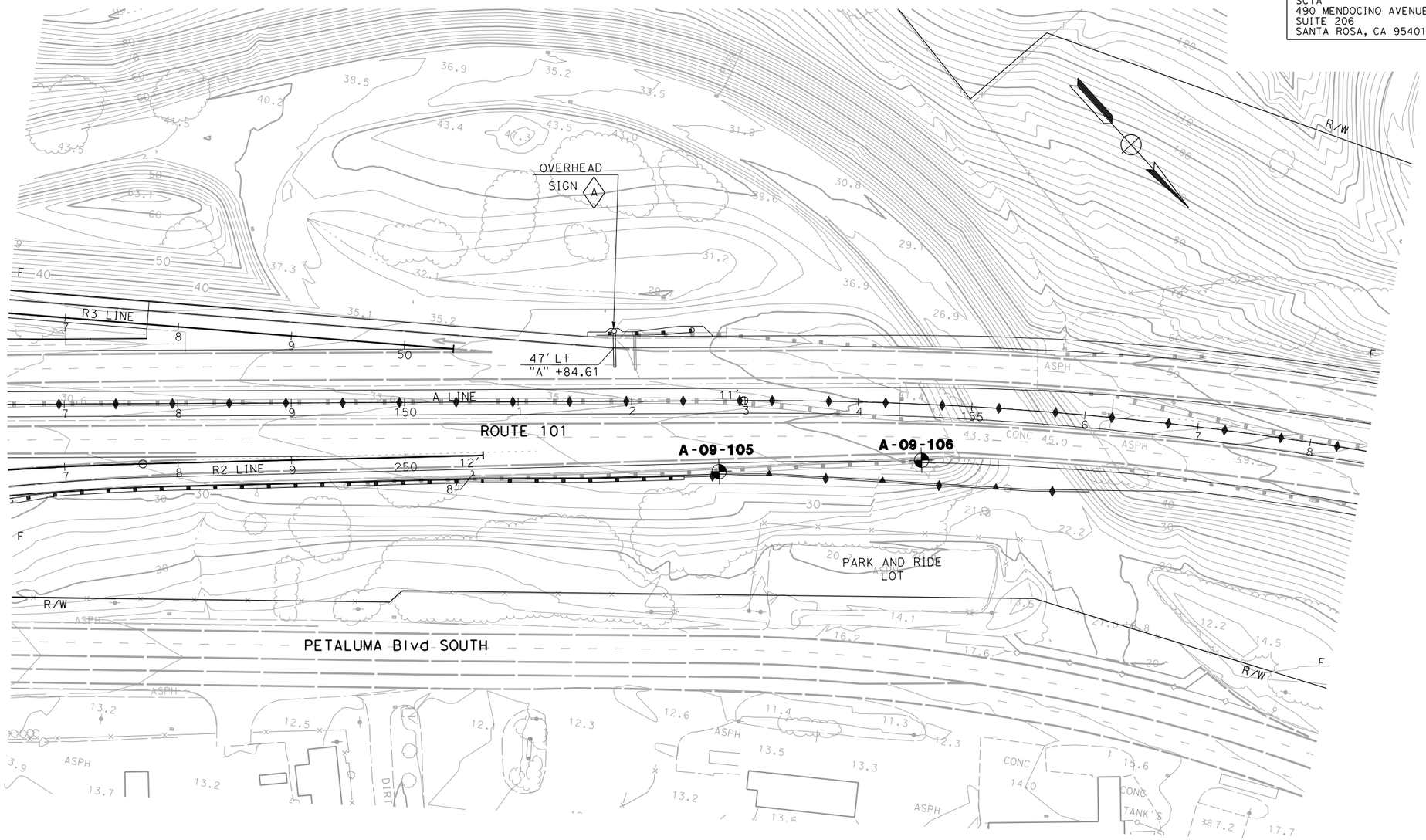
SAN JOSE, CA 95113

NOTE:

FOR ACCURATE RIGHT OF WAY AND ACCESS DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

LEGEND:

- 2009 BORING LOCATION
- EXISTING BORING LOCATION (1956)
- EXISTING CPT LOCATION (2002)
- EXISTING BORING LOCATION (2002)
- CPT LOCATION (2009)



FOR NOTES, ABBREVIATIONS AND LEGEND SEE SHEET L-1.

FIGURE 2-1

SITE AND BORING LOCATION PLAN

SCALE: 1" = 50'

B-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

CALCULATED-DESIGNED BY: ELIE ABI-JAOUDE

CHECKED BY: BEN RAZEGHI

REVISED BY / DATE REVISED

LAST REVISION 00-00-00

DATE PLOTTED => 3/31/2010
TIME PLOTTED => 10:02:13 AM

BORDER LAST REVISED 4/11/2008

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

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CU 00000

EA 2640C1

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI No. C-52725 Exp. 12-31-10 CIVIL STATE OF CALIFORNIA

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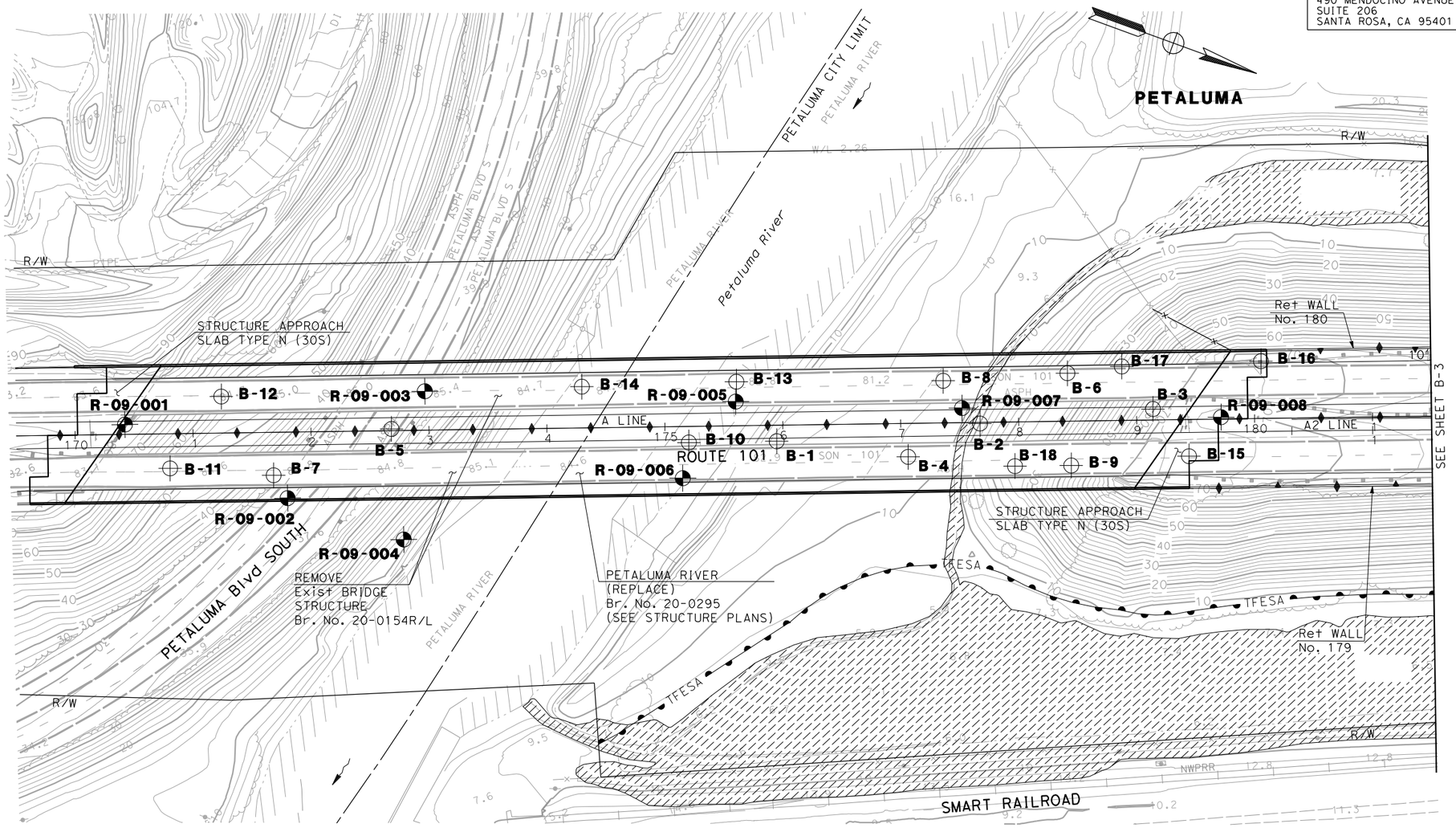
NOTE:

FOR ACCURATE RIGHT OF WAY AND ACCESS DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

LEGEND:

- 2009 BORING LOCATION
- EXISTING BORING LOCATION (1956)
- EXISTING CPT LOCATION (2002)
- EXISTING BORING LOCATION (2002)
- CPT LOCATION (2009)



FOR NOTES, ABBREVIATIONS AND LEGEND SEE SHEET L-1.

FIGURE 2-2

SITE AND BORING LOCATION PLAN

SCALE: 1" = 50'

B-2

REVISED BY	DATE REVISED

CALCULATED-DESIGNED BY: ELIE ABI-JAOUDE
CHECKED BY: BEN RAZEGHI

CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

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NOTE:

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LEGEND:

- 2009 BORING LOCATION
- EXISTING BORING LOCATION (1956)
- EXISTING CPT LOCATION (2002)
- EXISTING BORING LOCATION (2002)
- CPT LOCATION (2009)

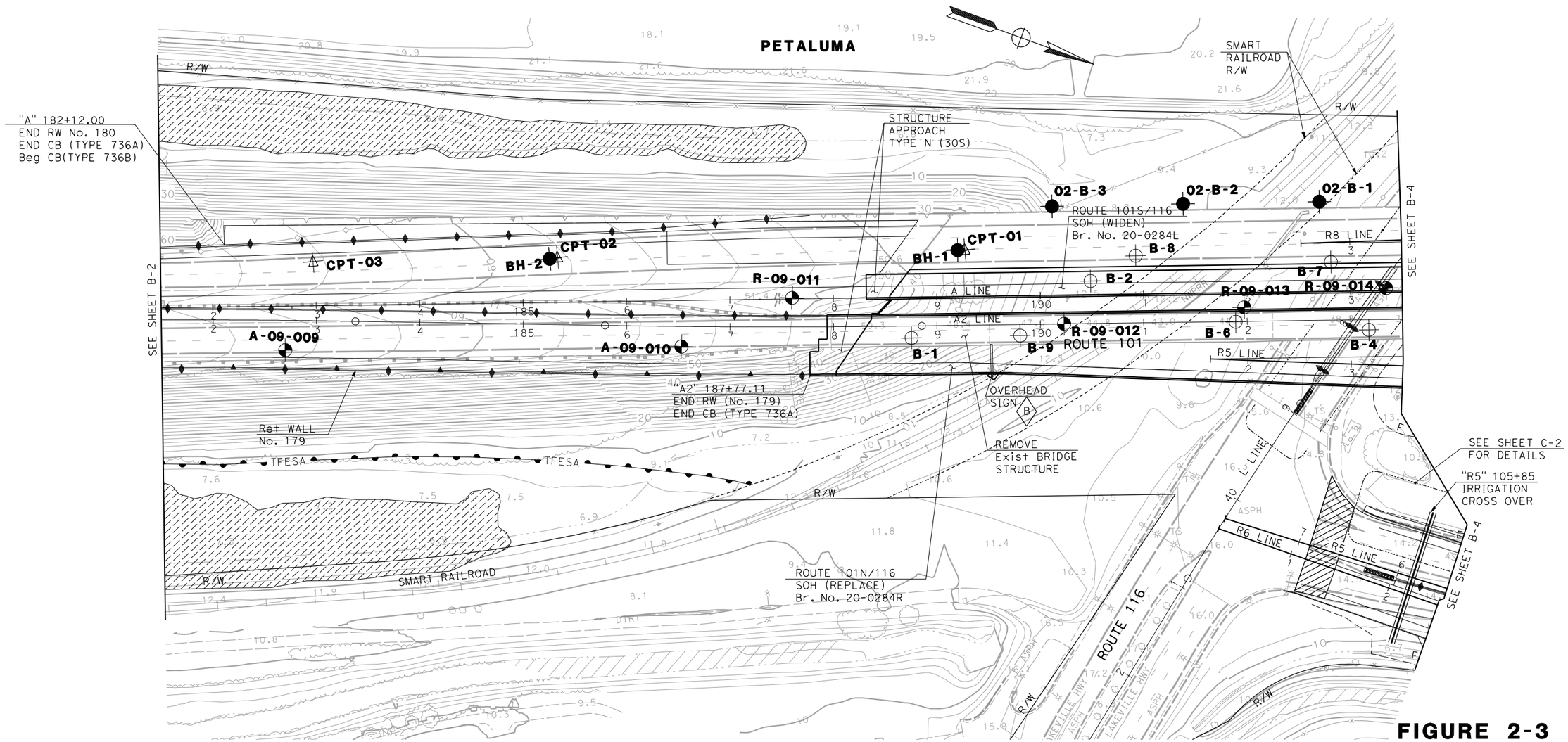

FIGURE 2-3

SITE AND BORING LOCATION PLAN

SCALE: 1" = 50'

B-3

FOR NOTES, ABBREVIATIONS AND LEGEND SEE SHEET L-1.

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

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CU 00000

EA 2640C1

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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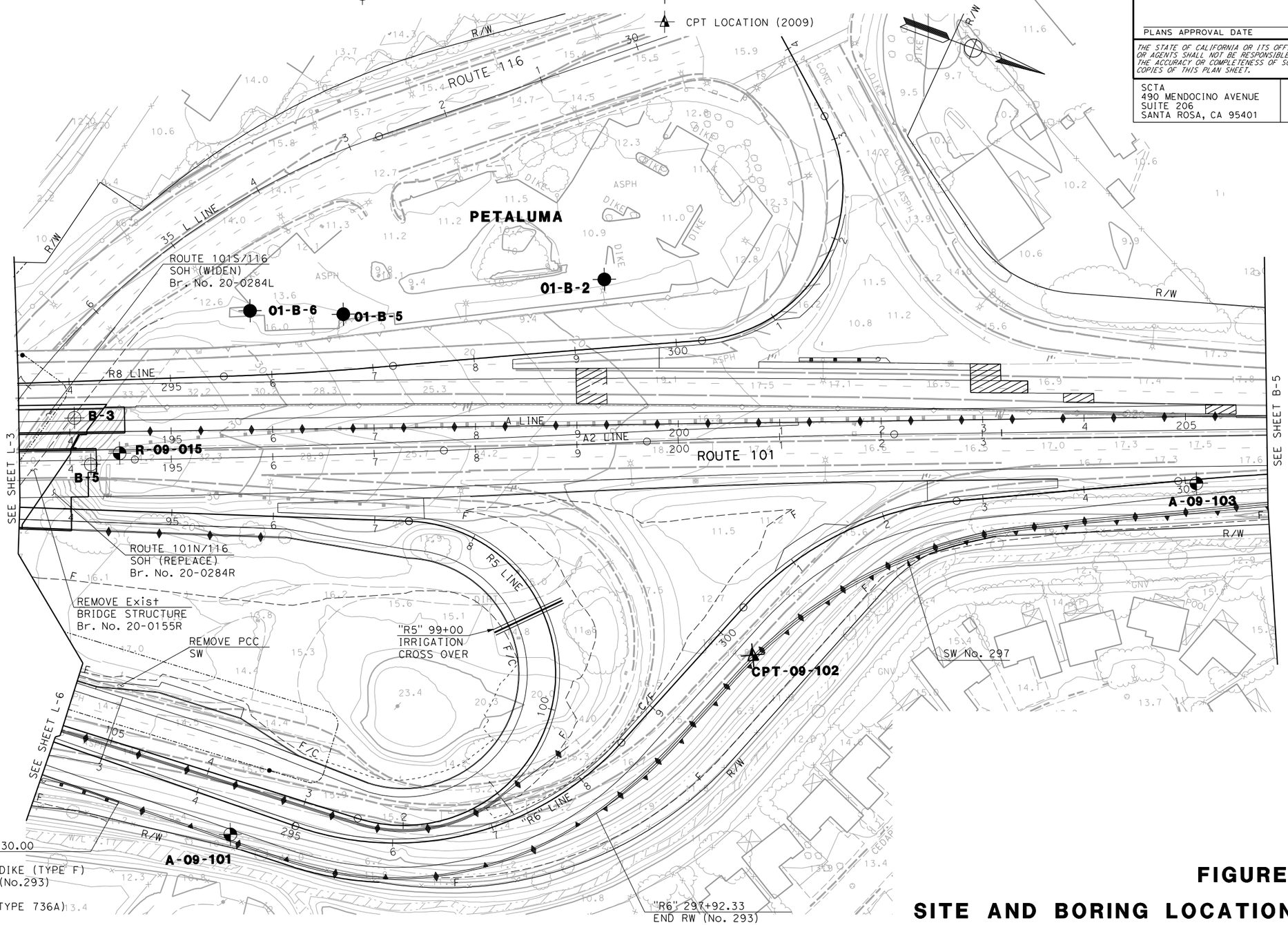
SUITE 200
SAN JOSE, CA 95113

NOTE:

FOR ACCURATE RIGHT OF WAY AND ACCESS DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

LEGEND:

- 2009 BORING LOCATION
- EXISTING BORING LOCATION (1956)
- EXISTING CPT LOCATION (2002)
- EXISTING BORING LOCATION (2002)
- CPT LOCATION (2009)



FOR NOTES, ABBREVIATIONS AND LEGEND SEE SHEET L-1.

FIGURE 2-4

SITE AND BORING LOCATION PLAN

SCALE: 1" = 50'

B-4

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

CALCULATED-DESIGNED BY: ELIE ABI-JAOUDE

CHECKED BY: BEN RAZEGHI

REVISED BY / DATE REVISED

LAST REVISION 00-00-00

DATE PLOTTED => 3/31/2010
TIME PLOTTED => 10:03:06 AM

BORDER LAST REVISED 4/11/2008

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME => andrew_cheung
DGN FILE => ...\qc-geotech\gdr\B-4.dgn

CU 00000

EA 2640C1

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI No. C-52725 Exp. 12-31-10 CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401

URS CORPORATION
100 W. SAN FERNANDO St
SUITE 200
SAN JOSE, CA 95113

NOTE:

FOR ACCURATE RIGHT OF WAY AND ACCESS DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

LEGEND:

- 2009 BORING LOCATION
- EXISTING BORING LOCATION (1956)
- EXISTING CPT LOCATION (2002)
- EXISTING BORING LOCATION (2002)
- CPT LOCATION (2009)

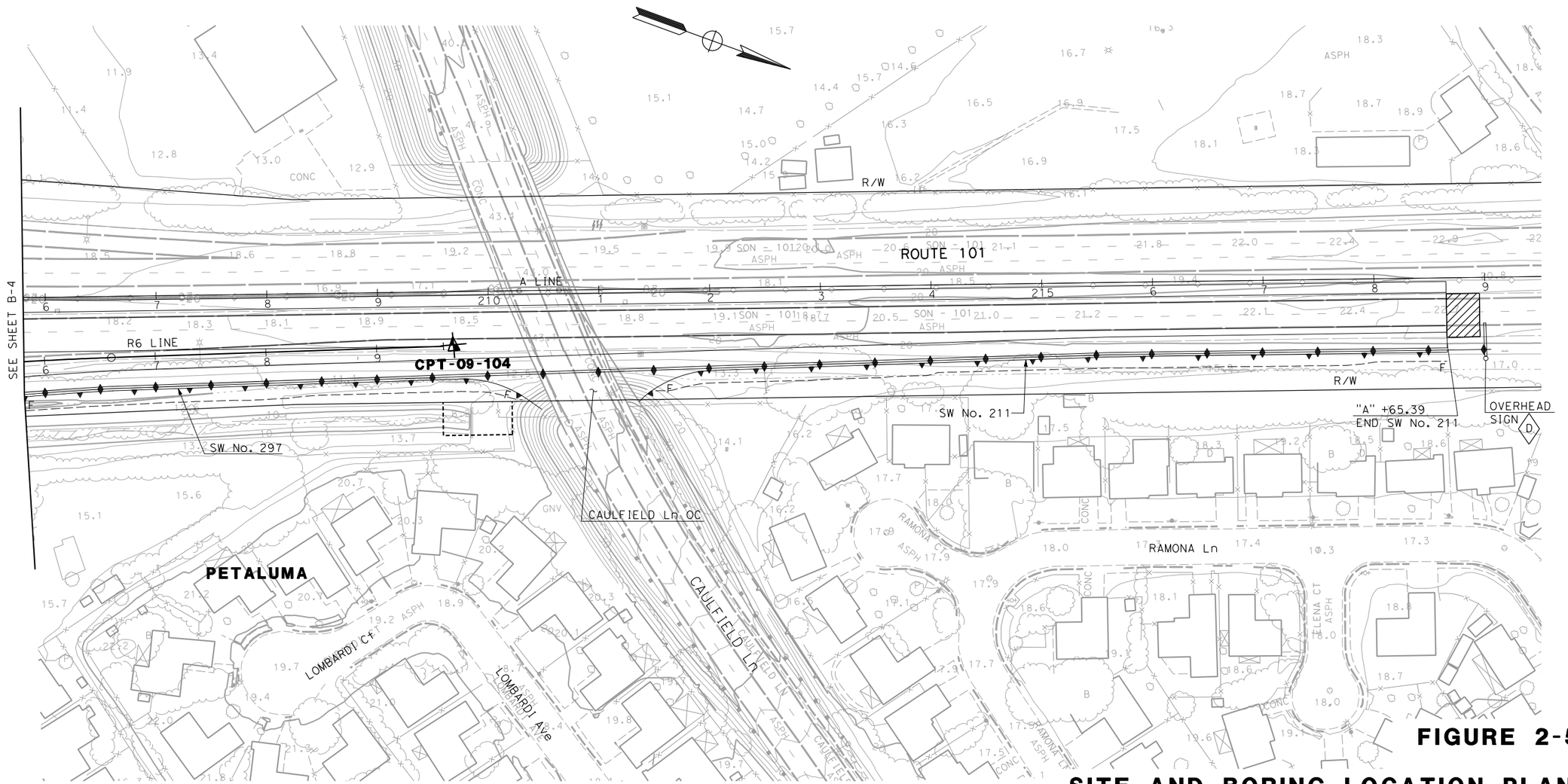


FIGURE 2-5

SITE AND BORING LOCATION PLAN

SCALE: 1" = 50'

FOR NOTES, ABBREVIATIONS AND LEGEND SEE SHEET L-1.

B-5

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

CALCULATED-DESIGNED BY: ELIE ABI-JAOUDE

CHECKED BY: BEN RAZEGHI

REVISED BY / DATE REVISED

LAST REVISION 00-00-00

DATE PLOTTED => 3/31/2010
TIME PLOTTED => 10:03:27 AM

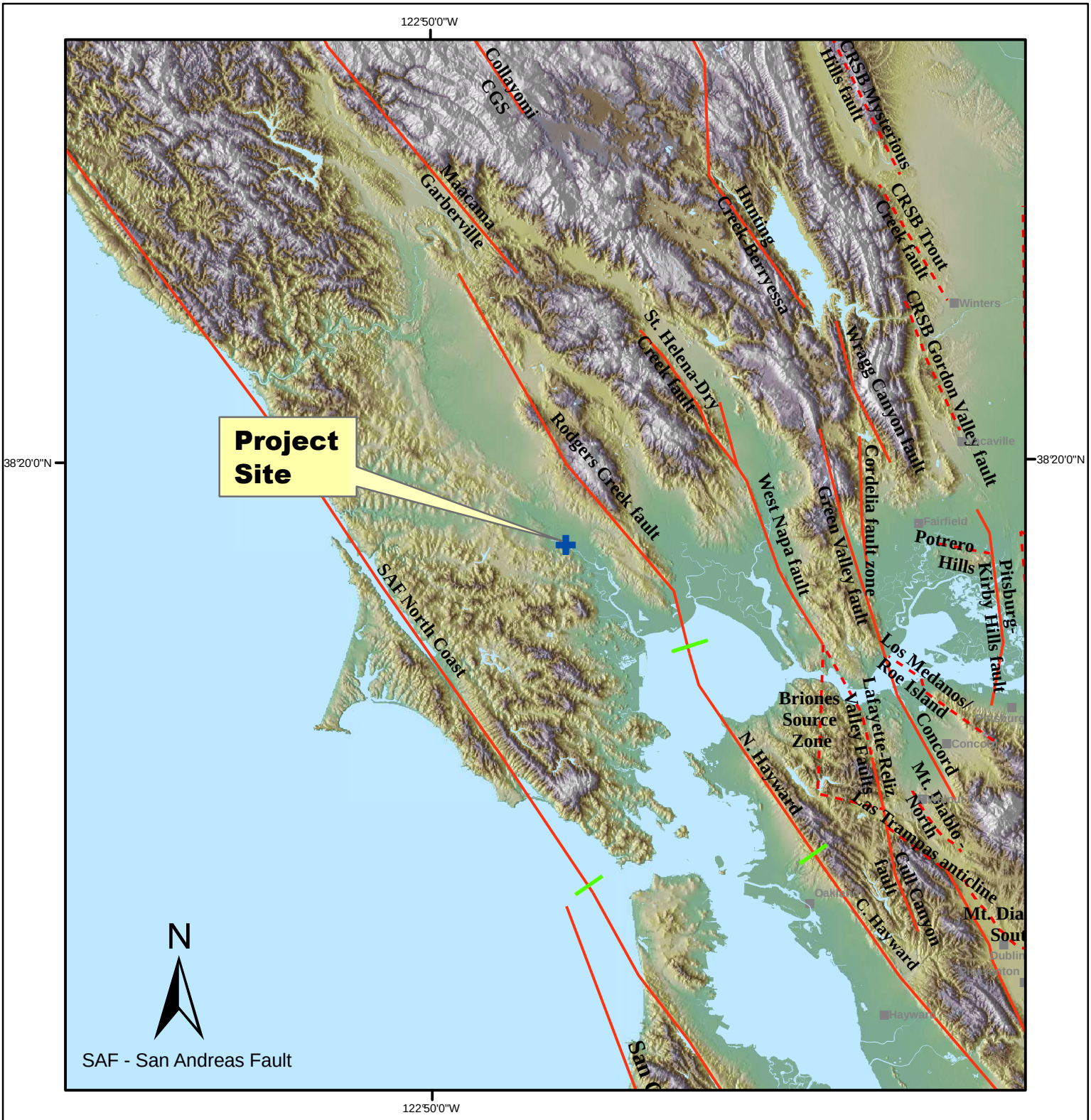
BORDER LAST REVISED 4/11/2008

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME => andrew_cheung
DGN FILE => ...\qc-geotech\gdr\B-5.dgn

CU 00000

EA 2640C1



7 3.5 0 7 Miles

0 4.5 9 18 27 36 Kilometers

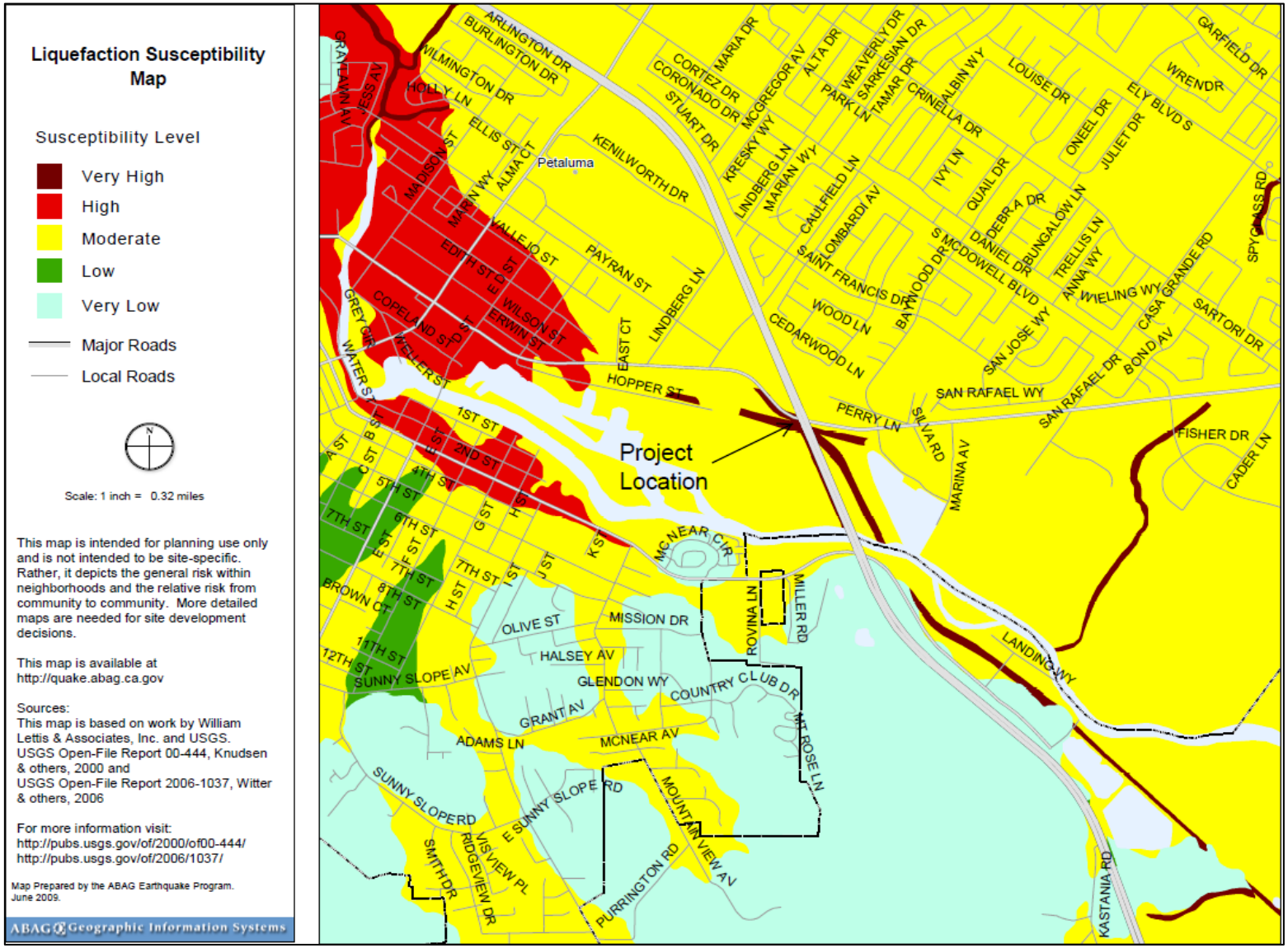
Faults with surface rupture

Blind faults and zones

Segment boundary

Fault Source: URS Seismic Source Model

URS	Project No. 28645045 Marin Sonoma Narrows Project, Petaluma Bridge, Phase B4	ACTIVE FAULTS IN THE SAN FRANCISCO BAY REGION	Figure 3-1



URS
55 South Market Street,
Suite 1500
San Jose, CA 95113
PHONE: (408) 297-9585
FAX: (408) 297-6962

Marin Sonoma Narrows-B4
U.S.101/SR 116 SOH
Petaluma, CA

Project No: 28645045

Liquefaction Susceptibility Map

FIGURE 3-2

August, 2009

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

REGISTERED CIVIL ENGINEER

May 1, 2006
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Jeffrey B. Woody No. C41260 Exp. 3-31-07 CIVIL STATE OF CALIFORNIA

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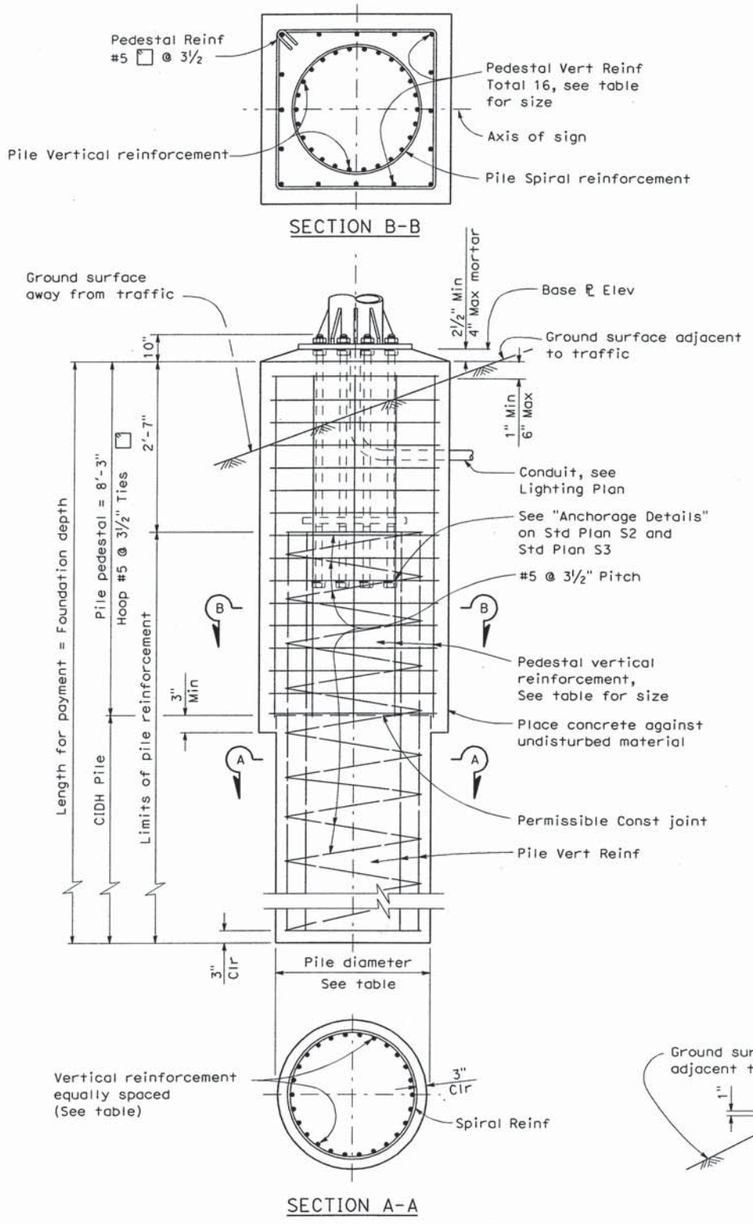
To get to the Caltrans web site, go to: http://www.dot.ca.gov



Post Type No.	Anchor Bolts			Square Pile Pedestal						CIDH Pile					Foundation Depth **
	Bolt Circle	Bolt Total and Dia	Total Length	Pedestal Square one side	Vertical Reinforcing			Hoop		Pile Dia	Vertical Reinforcing		Spiral		
					Total	Bar Size	# of bars each face	Bar Size	Spacing		Total	Bar Size	Bar Size	Pitch	
II	2'-0"	12-2"	4'-2"	5'-3"	16	#10	5	#5	3½"	4'-6"	26	#10	#5	3½"	14'-9"
III	2'-0"	12-2"													16'-0"
IV	2'-0"	12-2"													18'-0"
V	2'-10"	14-2"													19'-0"
VI		16-2½"	5'-0"	5'-9"		#11				5'-0"	28	#11			22'-0"
VII															23'-0"
VIII															25'-0"
IX															25'-0"

** Use Foundation Depth shown in table unless otherwise shown on the Project Plans.

NOTES:

1. For anchor bolt layout, see Standard Plan S3.
2. For "Base ℄ elevation" see Project Plans.
3. Prior to erection of the post, backfill which is equivalent to the surrounding material shall be in place.
4. Pedestal shall be formed 6" minimum below ground surface Remainder to be placed against undisturbed material.
5. Slope protection required when indicated on the Project Plans.
6. Foundation design is based on 2001 AASHTO article 13.6 Broms' approximate procedure assuming a cohesionless material. The angle of internal friction used is 30 degree and unit weight of soil used is 120 lb/ft^3.

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

OVERHEAD SIGNS-TRUSS SINGLE POST TYPE SQUARE PEDESTAL PILE FOUNDATION

NO SCALE

S7

1-4-06

2006 STANDARD PLAN S7

FIGURE 4-1

APPENDIX A FIELD EXPLORATION, BORING RECORDS AND LOG OF TEST BORING SHEETS FOR RETAINING WALLS

FIELD EXPLORATION PROGRAM

The geotechnical field investigation consisted of three periods of field explorations. The first period included seven borings extending to depths of 85 to 119½ feet below the existing ground surface (bgs) and 2 cone penetration tests (CPT) extending to depths of 50 and 51½ feet. The explorations were performed on June 10 to 29, 2009, by WDC Exploration & Wells, Richmond, California. Then, during August 11 to September 2, 2009, the second period of field explorations consisted of ten borings extending to depths of 18½ to 112 feet below the existing ground surface. PC Exploration Inc., Lincoln, California, was the drilling subcontractor. The third period was on October 28 and 29, 2010; two borings extending to 30 and 40 feet were performed by Exploration Geoservices, Inc.

The boring locations were carefully selected to obtain supplemental subsurface information to provide geotechnical design recommendations for the proposed structures while avoiding underground utilities and subsurface obstructions. Layout of the explorations was performed by representatives of URS, and exploration locations were checked for conflict with underground utilities by contacting Underground Service Alert (USA) Network. USA, in turn, alerted the various municipalities and utility companies that a subsurface investigation was to be conducted near their utilities.

After underground utility clearance, URS obtained permits from the County of Sonoma, Permit and Resource Management Department, Well and Permit Section, and coordinated with appropriate personnel to accommodate the required inspection during and following exploration at each location.

Rotary Wash Borings (R-09-001 through R-09-008, R-09-011 through R-09-015)

Rotary wash borings were drilled to provide the necessary information to evaluate the subsurface stratigraphy and to allow acquisition of high-quality soil samples for laboratory testing. The borings were drilled and sampled at the location indicated on the Site and Boring Location Plan, Figures 2-1 through 2-4. The borings were advanced to depths ranging from 19 to 119½ feet below existing ground surface using a truck-mounted drill rig, a crawler drill rig (limited-low overhead access), and a barge drill rig. All field explorations were advanced under the supervision of a URS engineer who maintained a record of all field activities, classified the soils encountered using the Unified Soil Classification System (USCS), and prepared a log of the boring.

The drilling operation proceeded carefully, with particular attention to potential interference with utilities or other buried structures. During drilling, both disturbed and undisturbed samples were obtained for identification and laboratory testing. Soil samples were generally obtained at 5-foot intervals and at changes in strata. Samples were obtained using an unlined split spoon sampler (SPT), having an outside diameter of 2 inches, and lined Modified California (MC) sampler, having an outside diameter of 2½ inches. A 140-pound hammer falling through a distance of 30 inches was used to drive the samplers. The blow count recorded on the boring logs adjacent to the sample depth is the number of blows required to drive the sampler for the final 1 foot of a maximum 18 inch drive. The Franciscan Complex bedrock in boring R-09-012 was drilled using HQ wireline coring methods below a depth of 60

feet, which provides a 2.4-inch diameter core sample. Due to the very poor rock recovery obtained in this boring and the poor quality of the shale and serpentinite rock samples that were recovered, rotary wash drilling with SPT and MC drive samples was considered to provide more meaningful information for the foundation design and was used on the remaining borings that penetrated the Franciscan Complex rocks.

One of the objectives of the field investigation was to obtain high-quality undisturbed samples for laboratory testing. An effort was made to minimize sample disturbance during sample handling and transportation. After careful withdrawal from the ground, the sample was placed upright and the ends of the sample were cleaned of disturbed soil. If possible, pocket penetrometer tests were performed on the bottom end of cohesive soil samples. Both ends of the samples were covered with plastic caps, and carefully transported to URS' laboratory in San Jose. Rock core samples obtained from boring R-09-012 was placed in wooden core boxes, photographed and transported to URS' laboratory in San Jose.

Hollow Stem Auger Boring (A-09-009, A-09-010, A-09-101, A-09-103, A-09-105 and A-09-106)

The hollow stem auger boring was drilled to provide the necessary information to evaluate the subsurface stratigraphy and to allow acquisition of soil samples for laboratory testing. The borings were drilled and sampled at the locations indicated on the Site and Boring Location Plans, Figures 2-1 through 2-5. The boring was advanced to depths of 30 to 52 feet below existing ground surface using a crawler drill rig (limited-low overhead access) and a truck-mounted drill rig under the supervision of a URS engineer who maintained a record of all field activities, classified the soils encountered using the Unified Soil Classification System (USCS), and prepared a log of the boring.

The drilling operation proceeded carefully, with particular attention to potential interference with utilities or other buried structures. During drilling, samples were obtained for identification and laboratory testing. Soil samples were generally obtained at 5-foot intervals and at changes in strata. Samples were obtained using a lined Modified California (MC) sampler, having an outside diameter of 2½ inches. A 140-pound hammer falling through a distance of 30 inches was used to drive the samplers. The blow count recorded on the boring logs adjacent to the sample depth is the number of blows required to drive the sampler for the final 1 foot of a maximum 18 inch drive.

One of the objectives of the field investigation was to obtain high-quality undisturbed samples for laboratory testing. An effort was made to minimize sample disturbance during sample handling and transportation. After careful withdrawal from the ground, the sample was placed upright and the ends of the sample were cleaned of disturbed soil. Both ends of the samples were covered with plastic caps, and carefully transported to URS' laboratory in San Jose.

Cone Penetration Tests (CPT-09-102 and CPT-09-104)

We also performed two Cone Penetration Tests (CPT) at locations shown on the Site and Boring Location Plan, Figures 2-4 and 2-5. The CPTs were advanced to depths of 100 feet below existing ground surface under the supervision of a URS representative.

The CPT consists of pushing a cone-tipped probe into the soil while simultaneously recording the cone tip resistance and side friction resistance to penetration. The CPT was conducted in

general accordance with ASTM specifications (ASTM D3441-79) using an electric cone penetrometer. The CPT equipment consists of a cone assembly mounted at the end of a series of hollow rods. A set of hydraulic rams is used to push the cone and rods into the soil while a continuous record of tip and friction resistance versus depth is obtained in both analog and digital form at the ground surface. A specially designed all-wheel drive truck is used to transport and house the test equipment and to provide a 178 kN reaction to the thrust of the hydraulic rams.

The cone penetrometer assembly consists of a conical tip and a cylindrical friction sleeve. The conical tip has a 60-degree apex angle and a projected cross-sectional area of 15 cm^2. The cylindrical friction sleeve has a surface area of 225 cm^2. Both the conical tip and the cylindrical friction sleeve have outer diameters of 4.37 centimeters. The interior of the cone penetrometer is instrumented with strain gauges that allow simultaneous measurement of cone tip and friction sleeve resistance during penetration. Continuous electric signals from the strain gauges are transmitted by a cable in the sounding rods to analog and digital data recorders in the CPT truck.

Data obtained during a CPT consists of continuous stratigraphic information with close vertical resolution. Stratigraphic interpretation is based on relationships between cone tip resistance and friction resistance. The calculated friction ratio (CPT friction sleeve resistance divided by cone tip resistance) is used as an indicator of soil type. Granular soils typically have low friction ratios and high cone resistance, while cohesive or organic soils have high friction ratios and low cone resistance. These stratigraphic material categories form the basis for all subsequent calculations that utilize the CPT data. Soil interpretation presented on the CPT logs from this investigation was based on recent correlations developed by Robertson, 1986, presented on Figure A-1.

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	8-26-09	8-26-09	2277451.0 ft / 5953791.2 ft	A-09-009
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
PC Exploration, Inc			43' Rt Sta 182+69 A	64 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			Gefco D-444	8-inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96")			Auto Hammer 140lb/30in	81%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement			Dry to 51.5'	51.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	8 inches Asphalt Concrete.												
	1	CLAYEY GRAVEL (GC); medium dense; brown; gray gravel; [FILL].												
62.00	2			1	6 8 8	16	50		25	95				
	3													
60.00	4													
	5			2	25 50/6"	50/ 6"	35							
58.00	6	At EL. 58.0 ft, becomes very dense; coarse GRAVEL.												Sampler advanced 12 in.
	7	GRAVELLY lean CLAY (CL); reddish brown; moist; [FILL].												
56.00	8													
	9	CLAYEY GRAVEL (GC); dense; brown; gray gravel; [FILL].												
54.00	10			3	14 25 29	54	40							
	11													
52.00	12													
	13													
50.00	14													
	15			4	14 30 24	54	60							
48.00	16													
	17													
46.00	18													
	19													
44.00	20			5	13 24 26	50	65		5	125				PA
	21													
42.00	22													
	23													
40.00	24													
	25													

(continued)

URS

San Jose Office

100 W. San Fernando St, Suite 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				A-09-009
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN B4, Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	S. Manoharan	9-3-09	1 of 2	

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25	CLAYEY GRAVEL (GC) *(continued)*.		6	14 28 27	55	65		10	131				
38.00	26	[FILL].												
	27													
36.00	28													
	29													
34.00	30	At EL. 34.0 ft, becomes very dense.		7	12 20 50/5"	70/ 11"	40							
	31													Sampler advanced 17 in.
32.00	32													
	33													
30.00	34													
	35	At EL. 29.0 ft, becomes dense.		8	23 24 21	45	35							
28.00	36													
	37													
26.00	38													
	39													
24.00	40			9	6 20 28	48	20							
	41													
22.00	42													
	43													
20.00	44													
	45			10	17 24 31	55	40							
18.00	46													
	47													
16.00	48													
	49													
14.00	50			11	14 26 28	54	65							
	51	At EL. 13.5 ft, becomes mottled with red.												
12.00	52	Bottom of Borehole at 51.5 ft.												
	53													
10.00	54													
	55													

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

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100 W. San Fernando St, Suite 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				**A-09-009**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101 MSN B4, Petaluma**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**	DATE **9-3-09**	SHEET **2 of 2**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	8-27-09	8-27-09	2277809.7 ft / 5953656.9 ft	A-09-010
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
PC Exploration, Inc			45' Rt Sta 186+52 A	54 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			Gefco D-444	8-inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96"), Shelby (2.87")			Auto Hammer 140lb/30in	81%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement			Dry to 52.1'	52.1 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	10 inches Asphalt Concrete.												
	1	CLAYEY GRAVEL (GC/CL); brown; moist; gray gravel; [FILL].												
52.00	2			1	7 10 16	26	35							
	3													
50.00	4													
	5			2	9 10 18	28	40							
48.00	6													
	7	Lean CLAY (CL); reddish brown; moist; [FILL].												
46.00	8													
	9	CLAYEY GRAVEL (GC/CL); brown; moist; [FILL].												
44.00	10			3	18 17 14	31	60							
	11													
42.00	12													
	13													
40.00	14													
	15			4	10 14 15	29	60							
38.00	16													
	17													
36.00	18													
	19													
34.00	20			5	12 14 14	28	65							
	21													
32.00	22													
	23													
30.00	24													
	25													

(continued)

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San Jose Office

100 W. San Fernando St, Suite 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				A-09-010
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101 MSN B4, Petaluma				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	S. Manoharan	9-3-09	1 of 2	

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25	CLAYEY GRAVEL (GC/CL) *(continued)*.												
28.00	26	[FILL].		6	12 11 19	30	60							
	27													
26.00	28													
	29													
24.00	30			7	10 11 23	34	65		19	105				
	31													
22.00	32													
	33	CLAYEY GRAVEL (GC); dense; brown; moist; gray gravel; [FILL].												
20.00	34													
	35			8	25 23 30	53	40							
18.00	36													
	37													
16.00	38													
	39													
14.00	40			9	14 22 18	40	70							
	41													
12.00	42													
	43													
10.00	44	SANDY lean CLAY with GRAVEL (CL); very stiff; gray mottled with brown; [FILL].												
	45			10	12 12 16	28	70							
8.00	46													
	47													
6.00	48	SANDY lean CLAY (CL); stiff; grayish brown; moist; [FILL].												
	49													
4.00	50			11			48							
	51													
2.00	52	Bottom of Borehole at 52.1 ft.												
	53													
0.00	54													
	55													

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

URS

San Jose Office

100 W. San Fernando St, Suite 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				**A-09-010**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101 MSN B4, Petaluma**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**	DATE **9-3-09**	SHEET **2 of 2**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	6-8-09	6-8-09	2278777.0 ft / 5953668.1 ft	A-09-101
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
WDC Exploration & Wells			398' Rt Sta 195+53 A	7 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			CME 75 Crawler	8-inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96"), SPT (1.44")			Auto Hammer 140lb/30in	69%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement			10 ft	N/A	51.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	Fat CLAY (CH); stiff; dark brown; moist.												
	1			1	3 3 3	6	50		34	86	UC =0.63			
5.00	2													
	3													
3.00	4			2	0 0 1	1	60							Weight of rods for first 12 inches; no liners in sampler
	5	At EL. 2.5 ft, becomes brown; trace fine GRAVEL.		3	1 5 6	11	65		32	88	UC =0.66			
1.00	6													
	7													
-1.00	8													
	9	Poorly graded SAND with SILT (SP-SM); medium dense; grayish brown; wet.		4	5 11 8	19	80							
-3.00	10	Fat CLAY (CH); stiff; light brown; moist.												
	11													
-5.00	12													
	13													
-7.00	14													
	15	CLAYEY SAND (SC); loose; dark grayish brown; wet.		5	2 3 7	10	80		20	104				+#4=5% -#200=17% PA
-9.00	16													
	17													
-11.00	18													
	19													
-13.00	20	At EL. -13.0 ft, becomes very loose.		6	1 2 1	3	40							
	21													
-15.00	22	At EL. -15.0 ft, contains thin Lean Clay (CL) seams; medium stiff; gray.												
	23													
-17.00	24	SILTY, CLAYEY SAND (SC-SM); dense; gray; moist.												
	25													

(continued)

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

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REPORT TITLE				HOLE ID
BORING RECORD				A-09-101
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
Retaining Wall 293				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	L.Phillips	6-11-09	1 of 2	

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25	SILTY, CLAYEY SAND (SC-SM) *(continued)*.		7	24 19 20	39	65		19	105				
-19.00	26													
	27													
-21.00	28													
	29													
-23.00	30			8	4 6 9	15	60							
	31	Lean CLAY (CL); very stiff; bluish gray; moist.												
-25.00	32													
	33													
-27.00	34													
	35			9	4 6 7	13	100		21	106	UC =1.49			
-29.00	36													
	37													
-31.00	38													
	39													
-33.00	40			10	8 14 14	28	65		24	102	UC =1.63			
	41													
-35.00	42	GRAVELLY lean CLAY (CL); medium stiff; gray; moist to wet.												Hard drilling from 42 to 45 feet
	43													
-37.00	44													
	45	Lean CLAY (CL); very stiff; dark bluish gray mottled with brown; moist.		11	3 7 10	17	100							
-39.00	46													
	47													
-41.00	48													
	49													
-43.00	50	At EL. -43.0 ft, becomes medium stiff; brown.		12	0 7 13	20	100		21	105	UC =0.94			
	51	At EL. -43.5 ft, becomes stiff; dark bluish gray.												
-45.00	52	Bottom of Borehole at 51.5 ft.												
	53													
-47.00	54													
	55													

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

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REPORT TITLE				HOLE ID
BORING RECORD				**A-09-101**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Retaining Wall 293**				
BRIDGE NUMBER	PREPARED BY **L.Phillips**	DATE **6-11-09**	SHEET **2 of 2**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	6-9-09	6-9-09	2279553.6 ft / 5953017.2 ft	A-09-103
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
WDC Exploration & Wells			66' Rt Sta 205+10 A	16 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			CME 75 Crawler	8-inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96"), SPT (1.44")			Auto Hammer 140lb/30in	69%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement			26 ft	N/A	51.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	SILTY SAND with GRAVEL (SM); very dense; light reddish brown; moist; [FILL].												
	1			1	18 50/3"	50/ 3"	30							
14.00	2													Sampler advanced 9 in.
	3	Lean CLAY (CL); very stiff; dark grayish brown; moist.												
12.00	4													
	5			2	4 5 7	12	65		21	102	UC =1.29			
10.00	6													
	7													
8.00	8													
	9	Fat CLAY (CH); stiff; light brown; moist.												
6.00	10			3	3 5 7	12	70							
	11													
4.00	12													
	13													
2.00	14													
	15			4	2 5 9	14	65		28	96	UC =0.85			LL=57 PI=38 PI
0.00	16	At EL. 0.0 ft, with trace GRAVEL.												
	17													
-2.00	18													
	19													
-4.00	20	At EL. -4.0 ft, becomes very stiff; mottled with black.		5	5 6 8	14	65		29	94	UC =1.11			
	21													
-6.00	22													
	23													
-8.00	24													
	25													

(continued)

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

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REPORT TITLE				HOLE ID
BORING RECORD				A-09-103
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
Sound Wall				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	L.Phillips	6-11-09	1 of 2	

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25	Fat CLAY (CH) *(continued)*.		6	3 13 17	30	90							
-10.00	26	SILTY SAND (SM); medium dense; brown; moist.												
	27													
-12.00	28													
	29	SILTY, CLAYEY SAND (SC-SM); medium dense; bluish gray; moist to wet.												
-14.00	30			7	4 7 8	15	80							
	31	Lean CLAY (CL); very stiff; bluish gray; moist.												
-16.00	32													
	33													
-18.00	34	Poorly graded SAND with SILT (SP-SM); medium dense; bluish gray; moist to wet; trace fine GRAVEL.												
	35			8	0 4 8	12	80		16	113				
-20.00	36													
	37													
-22.00	38													
	39													
-24.00	40	At EL. -24.0 ft, becomes dense.		9	9 13 18	31	100							
	41													
-26.00	42													
	43													
-28.00	44													
	45			10	5 8 11	19	65							
-30.00	46	Lean CLAY (CL); very stiff; grayish brown; moist.												
	47													
-32.00	48													
	49													
-34.00	50	At EL. -34.0 ft, becomes stiff; gray mottled with light reddish brown.		11	4 6 9	15	50		50	72	UC =0.76			
	51													
-36.00	52	Bottom of Borehole at 51.5 ft.												
	53													
-38.00	54													
	55													

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

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REPORT TITLE				HOLE ID
BORING RECORD				**A-09-103**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Sound Wall**				
BRIDGE NUMBER	PREPARED BY **L.Phillips**	DATE **6-11-09**	SHEET **2 of 2**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	10-28-09	10-28-09	2274867.2 ft / 5955173.0 ft	A-09-105
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Exploration Geoservices, Inc.			62' Rt Sta 152+76 A	36 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			EGI	8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96")			Auto Hammer 140lb/30in	
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement			Dry to 40' / N/A	40.0 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	7 inches Asphalt Concrete over 12 inches Aggregate Base.												
	1													
34.00	2	Sub base, dark brown.												
	3	SANDY lean CLAY (CL); stiff; gray; moist.												
32.00	4			1	2 7 10	17	65							
	5													
30.00	6													
	7													
28.00	8													
	9			2	4 6 9	15	65		17	110	UC =0.96			
26.00	10													
	11													
24.00	12													
	13													
22.00	14			3	4 5 6	11	50		23	98	UC =0.75			
	15	Lean CLAY (CL); very stiff; dark gray; moist.												
20.00	16													
	17													
18.00	18													
	19			4	4 6 11	17	60		18	116	UC =1.9			
16.00	20	SANDY lean CLAY (CL); stiff; dark gray; moist.												
	21													
14.00	22													
	23													
12.00	24			5	6 13 8	21	70		15	118	UC =0.97			
	25													

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				A-09-105
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
Std. Retaining Wall				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	S. Manoharan		11-30-09	1 of 2

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25	At EL. 11.0 ft, grades to with gravel. SANDY lean CLAY (CL) *(continued)*.												
10.00	26													
	27													
8.00	28													
	29	SANDY lean CLAY (CL); stiff; grayish brown; moist.		6	8 10 20	30	70							
6.00	30													
	31	METAMORPHIC ROCK (SERPENTINITE), light green, intensely weathered.												
4.00	32													
	33													
2.00	34			7	5 10 12	22	65							
	35													
0.00	36													
	37													
-2.00	38													
	39	At EL. -3.0 ft, becomes less talc more serpentinite, dark blue.		8	10 23 27	50	65							Refusal at 40 feet
-4.00	40	Bottom of Borehole at 40.0 ft.												
	41													
-6.00	42													
	43													
-8.00	44													
	45													
-10.00	46													
	47													
-12.00	48													
	49													
-14.00	50													
	51													
-16.00	52													
	53													
-18.00	54													
	55													

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REPORT TITLE				HOLE ID
BORING RECORD				**A-09-105**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Std. Retaining Wall**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**	DATE **11-30-09**	SHEET **2 of 2**	

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	10-29-09	10-29-09	2274980.2 ft / 5955034.5 ft	A-09-106
DRILLING CONTRACTOR: Exploration Geoservices, Inc.			BOREHOLE LOCATION (Offset, Station, Line): 49' Rt Sta 154+58 A	SURFACE ELEVATION: 40 ft
DRILLING METHOD: Hollow-Stem Auger			DRILL RIG: EGI	BOREHOLE DIAMETER: 8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID): Modified CA (1.96"), SPT (1.44")			SPT HAMMER TYPE: Auto Hammer 140lb/30in	HAMMER EFFICIENCY, ERi
BOREHOLE BACKFILL AND COMPLETION: Cement			GROUNDWATER READINGS: DURING DRILLING Dry to 30' / AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 30.0 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	5 inches Asphalt Concrete over 12 inches Aggregate Base.												
	1			1	4 6 7	13	65		15	116	UC =0.94			
38.00	2	SANDY lean CLAY (CL); gray; moist; trace GRAVEL [FILL].												
	3													
36.00	4			2	4 4 5	9	65							
	5	At EL. 35.0 ft, becomes grayish brown.												
34.00	6													
	7													
32.00	8													
	9			3	3 4 4	8	65		18	106	UC =0.58			
30.00	10	At EL. 30.0 ft, becomes gray; with gravel.												
	11													
28.00	12													
	13													
26.00	14	Lean CLAY with SAND (CL); grayish brown; moist [FILL].		4	3 4 8	12	65		20	109	UC =0.76			
	15													
24.00	16													
	17													
22.00	18	Fat CLAY with SAND (CH); very stiff; dark gray; moist.												
	19			5	7 9 14	23	50		28	94	UC =1.0			
20.00	20													
	21													
18.00	22													
	23	METAMORPHIC ROCK (SERPENTINITE), dark bluish gray.												
16.00	24			6	19 34 57	91	60							
	25													

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				A-09-106
DIST. 04	COUNTY Sonoma	ROUTE 101	POSTMILE 0.9/2.9	EA 04-28645045
PROJECT OR BRIDGE NAME: Std. Retaining Wall				
BRIDGE NUMBER	PREPARED BY S. Manoharan	DATE 11-30-09	SHEET 1 of 2	

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25		METAMORPHIC ROCK (Serpentinite) *(continued)*.												
14.00	26														
	27														
12.00	28														
	29			X	7	17 26 47	73	60							
10.00	30		Bottom of Borehole at 30.0 ft.												
	31														
8.00	32														
	33														
6.00	34														
	35														
4.00	36														
	37														
2.00	38														
	39														
0.00	40														
	41														
-2.00	42														
	43														
-4.00	44														
	45														
-6.00	46														
	47														
-8.00	48														
	49														
-10.00	50														
	51														
-12.00	52														
	53														
-14.00	54														
	55														

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REPORT TITLE				HOLE ID
BORING RECORD				**A-09-106**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Std. Retaining Wall**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**	DATE **11-30-09**	SHEET **2 of 2**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	8-17-09	8-17-09	2276285.6 ft / 5954179.4 ft	R-09-001
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
PC Exploration, Inc			8' Lt Sta 170+42 A	84 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Rotary Wash with HQ Core Barrel			Gefco D-444	3-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96"), SPT (1.44")			Auto Hammer 140lb/30in	81%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement			Dry to 5' / N/A	21.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	METAMORPHIC ROCK, Graywacke (sandstone), brownish gray, intensely weathered, very weak, intensely fractured, with Lean Clay (CL) infilling along fractures.												
	1			1	17 22 40	62	70							8-inch hollow stem auger to 5 feet
81.50	2	[Franciscan Complex].												
	3													
79.50	4													
	5			2	12 23 33	56	75							Switch to mud rotary
77.50	6	At EL. 77.5 ft, becomes intensely to moderately weathered.												
	7	At EL. 76.5 ft, becomes black to dark gray, intensely weathered, weak to medium strong, little to no clay infilling along joints.												
75.50	8													
	9													
73.50	10	At EL. 73.5 ft, becomes light greenish gray, intensely weathered, very weak, trace of serpentinite, foliated fabric, breaks down to Clayey Sand (SC).		3	17 23 53	76	35							
	11													
71.50	12													
	13													
69.50	14	At EL. 69.5 ft, becomes Greenstone ?(meta-volcanic), dark gray, moderately weathered, medium strong, intensely fractured, (meta-volcanic).												
	15			4	28 50/2"	50/ 2"	100							
67.50	16	[Franciscan Complex].												Sampler advanced 8 in.
	17													
65.50	18													
	19													
63.50	20			5	92/5"	REF	20							
	21													Sampler advanced 5 in.
61.50	22	Bottom of Borehole at 21.5 ft.												
	23													
59.50	24													
	25													

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REPORT TITLE				HOLE ID
BORING RECORD				R-09-001
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
Petalum River Bridge				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	8-20-09	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	8-18-09	8-18-09	2276436.4 ft / 5954190.8 ft	R-09-002
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
PC Exploration, Inc			56' Rt Sta 171+79 A	34 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Rotary Wash with HQ Core Barrel			Gefco D-444	3-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96"), SPT (1.44")			Auto Hammer 140lb/30in	81%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement			Dry to 5'	N/A	26.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	7 inches Asphalt Concrete over 8 inches Aggregate Base.												
	1													8 inch hollow stem auger to 5 feet
32.00	2	SANDY lean CLAY (CL); stiff; brown; moist; little GRAVEL; [FILL].		1	7 6 8	14	65		19	116				
	3	Aggregate Base? 3/4" max gravel size; moist; [FILL].												
30.00	4													
	5	Lean CLAY (CL); very stiff; black; moist; [COLLUVIUM].		2	6 8 11	19	65		20	110	UC =1.43			Switch to mud rotary
28.00	6													
	7	GRAVELLY lean CLAY with SAND (CL); [COLLUVIUM].												
26.00	8													
	9													
24.00	10	SANDY lean CLAY (CL); stiff; brown; moist.		3	14 12 30	42	55							
	11	METAMORPHIC ROCK, Graywacke (Sandstone), yellowish gray to olive black, intensely weathered, very weak, with trace of shale and serpentinite, foliated fabric.												
22.00	12													
	13	[FRANCISCAN COMPLEX].												
20.00	14	At EL. 20.0 ft, becomes dark gray, moderately weathered.												
	15			4	13 25 78/2"	103/ 8"	70							
18.00	16													Sampler advanced 14 in.
	17													
16.00	18													
	19													
14.00	20	At EL. 14.0 ft, becomes dark gray to grayish green, intensely weathered, very weak, increasing shale/serpentinite with a trace of graywacke; breaks down to clayey sand (SC); banded.		5	14 81/4.5"	81/ 4.5"	45							
	21													Sampler advanced 10.5 in.
12.00	22													
	23													
10.00	24													
	25			6	17 25 42	67	85							
8.00	26													
	27	Bottom of Borehole at 26.5 ft.												

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

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REPORT TITLE				HOLE ID
BORING RECORD				R-09-002
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
Petalum River Bridge				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	8-20-09	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
S.Manoharan	8-19-09	8-19-09	2276515.0 ft / 5954065.9 ft	R-09-003
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
PC Exploration, Inc			33' Lt Sta 172+97 A	39 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Rotary Wash with HQ Core Barrel			Gefco D-444	3-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96"), SPT (1.44")			Auto Hammer 140lb/30in	81%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement			Dry to 5' / N/A	61.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method / Casing Depth	Remarks
	0	7 inches Asphalt Concrete over 8 inches Aggregate Base.											
	1												8 inch hollow stem auger to 5 feet
37.00	2	CLAYEY GRAVEL with SAND (GC); very dense; brown; moist; [FILL].		1	14 34 28	62	40						
	3												
35.00	4	SANDY lean CLAY with GRAVEL (CL); medium stiff; brown mottled with yellowish brown; moist; [FILL].											
	5			2	5 6 7	13	80						Began rotary wash
33.00	6												
	7	At EL. 32.5 ft, becomes light greenish gray; with black fat CLAY lenses.											
31.00	8												
	9												
29.00	10	Lean CLAY (CL); stiff; dark gray; moist; trace SAND; residual soil.		3	5 7 18	25	100		24	100	UC =0.40		
	11												
27.00	12	METAMORPHIC ROCK, Graywacke (Sandstone), intensely weathered, very weak, intensely fractured, brown; trace of shale; foliated fabric; breaks down to clayey sand (SC).											
	13												
25.00	14	[FRANCISCAN COMPLEX].											
	15			4	16 33 49	82	70						
23.00	16												
	17												
21.00	18	At EL. 21.5 ft, becomes dark greenish gray to dark gray, moderately weathered, some calcite viens; approximately 50% shale and 50% graywacke.											
	19												
19.00	20			5	18 42 55	97	50						
	21												
17.00	22												
	23												
15.00	24												
	25												

(continued)

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

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REPORT TITLE				HOLE ID
BORING RECORD				R-09-003
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
Petalum River Bridge				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	8-20-09	1 of 3	

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25	At EL. 14.0 ft, becomes dark gray, intensely weathered, very weak, mostly shale with approximately 20% graywacke; highly sheared/foliated fabric.		6	16 30 42	72	60							
13.00	26	METAMORPHIC ROCK *(continued)*.												
	27													
11.00	28	[FRANCISCAN COMPLEX].												
	29													
9.00	30	At EL. 9.0 ft, becomes black, mostly shale; breaks down to lean clay (CL) with sand/gravel.		7	6 15 27	42	0							
	31													
7.00	32													
	33													
5.00	34													
	35			8	19 23 41	64	35							
3.00	36													
	37													
1.00	38													
	39													
-1.00	40			9	14 18 33	51	40							
	41													
-3.00	42													
	43													
-5.00	44													
	45	At EL. -6.0 ft, becomes moderately weathered, very weak to weak.		10	30 51 68	119	50		5	148				
-7.00	46													
	47													
-9.00	48													
	49													
-11.00	50			11	36 57 64	121	35							
	51													
-13.00	52													
	53													
-15.00	54													
	55													

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-003**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Petalum River Bridge**				
BRIDGE NUMBER	PREPARED BY **M.Thummaluru**	DATE **8-20-09**	SHEET **2 of 3**	

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55														
-17.00	56				12	33 79 50/3"	129/ 9"	40							Sampler advanced 15 in.
	57														
-19.00	58														
	59														
-21.00	60				13	41 50 67	117	60							
	61														
-23.00	62		Bottom of Borehole at 61.5 ft.												
	63														
-25.00	64														
	65														
-27.00	66														
	67														
-29.00	68														
	69														
-31.00	70														
	71														
-33.00	72														
	73														
-35.00	74														
	75														
-37.00	76														
	77														
-39.00	78														
	79														
-41.00	80														
	81														
-43.00	82														
	83														
-45.00	84														
	85														

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-003**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Petalum River Bridge**				
BRIDGE NUMBER	PREPARED BY **M.Thummaluru**	DATE **8-20-09**	SHEET **3 of 3**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	9-2-09	9-2-09	2276541.2 ft / 5954190.0 ft	R-09-004
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
PC Exploration, Inc			92' Rt Sta 172+77 A	11 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Rotary Wash with HQ Core Barrel			Diedrich D-25	3-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96"), SPT (1.44")			Auto Hammer 140lb/30in	
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement			Dry to 1' / N/A	18.7 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	Lean CLAY (CL); grayish brown.												8 inch hollow stem auger to 1 feet
	1													Switch to mud rotary
9.00	2	METAMORPHIC ROCK, Graywacke with a trace of serpentinite, breaks down to clayey sand, intensely weathered, intensely fractured, bluish gray mottled with brown. [FRANCISCAN COMPLEX].		1	14 16 22	38	10							
	3													
7.00	4			2	15 27 25	52	35							
	5													
5.00	6													
	7													
3.00	8			3	15 20 56	76	0							
	9													
1.00	10													
	11	At EL. 0.0 ft, becomes slightly weathered, very weak.												
-1.00	12													
	13			4	49 96 50/1.5"	146/ 7.5"	40							
-3.00	14													Sampler advanced 13.5 in.
	15													
-5.00	16													
	17													
-7.00	18			5	86 50/2"	50/ 2"	15							
	19	Bottom of Borehole at 18.7 ft.												Sampler advanced 8 in.
-9.00	20													
	21													
-11.00	22													
	23													
-13.00	24													
	25													

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REPORT TITLE				HOLE ID
BORING RECORD				R-09-004
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
Petalum River Bridge				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	S. Manoharan		9-8-09	1 of 1

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	8-11-09	8-11-09	2276765.7 ft / 5953984.0 ft	R-09-005
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
PC Exploration, Inc			20' Lt Sta 175+60 A	1 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Rotary Wash with HQ Core Barrel			Diedrich D-25	3-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96"), SPT (1.44")			Auto Hammer 140lb/30in	
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement			N/A	N/A	38.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	Fat CLAY (CH); very soft; dark gray; trace GRAVEL; trace SAND; [BAY MUD].												
	1		X	1	1 1 1	2	95		37	83	UC =0.02			Mud rotary
-1.00	2													
	3	CLAYEY SAND (SC); very loose; dark gray; [BAY MUD].												
-3.00	4													
	5	Fat CLAY (CH); very soft; dark gray to black; with traces of peat; [BAY MUD].	X	2	1 1 2	3	95		44	76	UC =0.09			
-5.00	6													
	7													
-7.00	8													
	9													
-9.00	10		X	3	1 1 1	2	100							
	11													
-11.00	12													
	13													
-13.00	14													
	15		X	4	1 2 2	4	70		59	65	PP = 0.25 UC =0.18			
-15.00	16													
	17													
-17.00	18	CLAYEY SAND (SC); dark gray; [ALLUVIUM].												Hard drilling
	19													
-19.00	20		X	5	9 30 41	71	0							No recovery with rock core @ 20 ft. followed up with SPT
	21	METAMORPHIC ROCK, Grawacke/Shale, dark gray to light gray, intensely weathered, very weak, graywacke occurs as strong gravel in a clayey shale matrix.												After core 4 feet of cavein hole
-21.00	22													
	23	[FRANCISCAN COMPLEX].												Easy drilling
-23.00	24													
	25													

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REPORT TITLE				HOLE ID
BORING RECORD				R-09-005
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
Petalum River Bridge				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	8-14-09	1 of 2	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25		METAMORPHIC ROCK *(continued)*.												
-25.00	26		At EL. -25.0 ft, becomes very weak, mostly shale with approximately 20% graywake and trace of serpentinite; highly sheared/foliated fabric; FRANCISCAN COMPLEX.												
	27				6	8 10 17	27	45							
-27.00	28														
	29		[FRANCISCAN COMPLEX].												
-29.00	30														
	31														
-31.00	32														
	33		At EL. -32.0 ft, becomes slightly weathered, trace of talc.		7	20 76/4"	76/ 4"	45							Sampler advanced 10 in.
-33.00	34														
	35														
-35.00	36														
	37				8	25 50/1"	50/ 1"	35							
-37.00	38														Sampler advanced 7 in.
	39		Bottom of Borehole at 38.5 ft.												
-39.00	40														
	41														
-41.00	42														
	43														
-43.00	44														
	45														
-45.00	46														
	47														
-47.00	48														
	49														
-49.00	50														
	51														
-51.00	52														
	53														
-53.00	54														
	55														

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-005**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Petalum River Bridge**				
BRIDGE NUMBER	PREPARED BY **M.Thummaluru**	DATE **8-14-09**	SHEET **2 of 2**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	8-12-09	8-12-09	2276745.7 ft / 5954060.3 ft	R-09-006
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
PC Exploration, Inc			44' Rt Sta 175+14 A	2 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Rotary Wash with HQ Core Barrel			Diedrich D-25	3-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96"), SPT (1.44")			Auto Hammer 140lb/30in	
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement			N/A	N/A	31.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	Fat CLAY (CH); very soft; dark gray; with peat; [BAY MUD].												
	1			1	0 0 0	0	95		97	46	UC =0.03			Mud rotary
-0.50	2													
	3													
-2.50	4													
	5			2	0 0 0	0	95		71	57	UC =0.03			
-4.50	6													
	7													
-6.50	8													
	9	At EL. -7.5 ft, becomes gray.												
-8.50	10			3	1 1 1	2	70		88	49	PP = <0.25 UC =0.15			
	11													
-10.50	12													
	13	SANDY lean CLAY (CL); gray; [ALLUVIUM].												
-12.50	14													
	15			4	5 10 10	20	45							
-14.50	16	CLAYEY SAND (SC); medium dense; gray; with fine to 1/2" gravel; well-rounded; [ALLUVIUM].												
	17													
-16.50	18													
	19	Lean CLAY (CL); stiff; gray; trace fine GRAVEL; trace SAND; [ALLUVIUM].												
-18.50	20			5	5 5 79/5.5"	84/ 11.5"	50							
	21													Sampler advanced 17.5 in.
-20.50	22	METAMORPHIC ROCK, Shale/Serpentinite, intensely weathered, very weak, intensely fractured, black with light green streaks; highly sheared fabric.												
	23													
-22.50	24	[FRANCISCAN COMPLEX].												
	25													

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REPORT TITLE				HOLE ID
BORING RECORD				R-09-006
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
Petalum River Bridge				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	8-14-09	1 of 2	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25		METAMORPHIC ROCK *(continued)*.		6	29 78/4"	78/ 4"	33							
-24.50	26														Sampler advanced 10 in.
	27														
-26.50	28		At EL. -26.5 ft, becomes slightly weathered.												
	29														
-28.50	30				7	42 50/1.5"	50/ 1.5"	30							
	31														Sampler advanced 7.5 in.
-30.50	32		Bottom of Borehole at 31.5 ft.												
	33														
-32.50	34														
	35														
-34.50	36														
	37														
-36.50	38														
	39														
-38.50	40														
	41														
-40.50	42														
	43														
-42.50	44														
	45														
-44.50	46														
	47														
-46.50	48														
	49														
-48.50	50														
	51														
-50.50	52														
	53														
-52.50	54														
	55														

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-006**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Petalum River Bridge**				
BRIDGE NUMBER	PREPARED BY **M.Thummaluru**	DATE **8-14-09**	SHEET **2 of 2**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	8-31-09	9-3-09	2276947.8 ft / 5953923.5 ft	R-09-007
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
PC Exploration, Inc			12' Lt Sta 177+52 A	11 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Rotary Wash with HQ Core Barrel			Diedrich D-25	3-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96"), SPT (1.44"), Shelby (2.87")			Auto Hammer 140lb/30in	81%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement			Dry to 5'	N/A	80.0 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	GRAVELLY lean CLAY (CL); stiff; gray mottled with brown; moist [FILL].												
	1			1	10 17 16	33	20							
9.00	2													
	3													
7.00	4													
	5			2	5 3 5	8	40		14	109				
5.00	6	Brown; moist to wet.												
	7	CLAYEY GRAVEL (GC); dense; black; moist.												
3.00	8													
	9			3	14 11 18	29	10							
1.00	10													
	11													
-1.00	12													
	13													
-3.00	14			4	7 10 17	27	5							
	15													
-5.00	16	[FILL ?].												
	17													
-7.00	18	Lean CLAY (CL); medium stiff; gray; Alluvium.												
	19			5			25							
-9.00	20	SILTY, CLAYEY SAND (SC-SM); dense; olive.												
	21													
-11.00	22													
	23													
-13.00	24	SILTY SAND (SM/SC); dense; gray; moist.		6	13 14 15	29	40							
	25													

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REPORT TITLE				HOLE ID
BORING RECORD				R-09-007
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
Petalum River Bridge				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	S. Manoharan	9-8-09	1 of 3	

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ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25	SILTY SAND (SM/SC) *(continued)*.												
-15.00	26													
	27													
-17.00	28	Poorly graded SAND with SILT (SP-SM); dark gray.												
	29	METAMORPHIC ROCK, graywacke and shale with trace of green serpentinite and white talc, black to dusky brown, intensely weathered, intensely fractured, clay infilling along fractures, [FRANCISCAN COMPLEX].		7	21 50/5"	50/ 5"	20							Sampler advanced 11 in.
-19.00	30													
	31	METAMORPHIC ROCK, shale, serpentinite and talc, pale green to brownish gray, decomposed, highly sheared, lean to fat clay.												
-21.00	32													
	33	[FRANCISCAN COMPLEX].												
-23.00	34			8	17 11 14	25	30							
	35													
-25.00	36													
	37													
-27.00	38													
	39			9	9 10 9	19	40							
-29.00	40													
	41													
-31.00	42													
	43													
-33.00	44			10	8 13 16	29	0							
	45													
-35.00	46													
	47	At EL. -36.0 ft, becomes intensely weathered, shale breaks down to fat clay.												
-37.00	48													
	49			11	10 11 16	27	75							
-39.00	50													
	51													
-41.00	52													
	53													
-43.00	54			12	21 30 32	62	70							
	55													

(continued)

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100 W. San Fernando St, Suite 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				**R-09-007**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Petalum River Bridge**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**	DATE **9-8-09**	SHEET **2 of 3**	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55		METAMORPHIC ROCK *(continued)*.												
-45.00	56														
	57														
-47.00	58		At EL. -47.0 ft, becomes graywacke fragments less weathered, shale and serpentinite highly weathered, soft clay.												
	59			X	13	12 13 14	27	35							
-49.00	60														
	61														
-51.00	62														
	63														
-53.00	64			X	14	13 17 16	33	70		19	114				
	65														
-55.00	66														
	67														
-57.00	68														
	69			X	15	31 55 54	109	50							
-59.00	70														
	71														
-61.00	72														
	73														
-63.00	74			X	16	22 35 44	79	65							
	75														
-65.00	76														
	77														
-67.00	78														
	79			X	17	18 34 48	82	70							
-69.00	80		Bottom of Borehole at 80.0 ft.												
	81														
-71.00	82														
	83														
-73.00	84														
	85														

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-007**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Petalum River Bridge**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**	DATE **9-8-09**	SHEET **3 of 3**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	8-23-09	8-25-09	2277156.9 ft / 5953855.6 ft	R-09-008
DRILLING CONTRACTOR: PC Exploration, Inc			BOREHOLE LOCATION (Offset, Station, Line): 2' Lt Sta 179+72 A	SURFACE ELEVATION: 72 ft
DRILLING METHOD: Rotary Wash with HQ Core Barrel			DRILL RIG: Gefco D-444	BOREHOLE DIAMETER: 3-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID): Modified CA (1.96"), SPT (1.44")			SPT HAMMER TYPE: Auto Hammer 140lb/30in	HAMMER EFFICIENCY, ERi: 81%
BOREHOLE BACKFILL AND COMPLETION: Cement			GROUNDWATER READINGS: DURING DRILLING: Dry to 5' AFTER DRILLING (DATE): N/A	TOTAL DEPTH OF BORING: 112.0 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	CLAYEY GRAVEL (GC); dense; moist; brown clay and gray gravel, [FILL].												
	1			1	9 21 23	44	65							8-inch hollow stem auger to 5 feet
70.00	2													
	3													
68.00	4													
	5			2	23 27 18	45	50							Switch to mud rotary; Start HQ coring
66.00	6													
	7	SANDY lean CLAY with GRAVEL (CL); brown; [FILL].												
64.00	8													
	9	CLAYEY GRAVEL (GC); dense; brown; [FILL].		3	9 15 13	28	0							Big rock in shoe
62.00	10	CLAYEY SAND with GRAVEL (SC); medium dense; brown; moist; [FILL].		4	8 8 11	19	35							
60.00	12													
	13													
58.00	14			5	10 8 10	18	40							Used 400 gallons of water
	15													
56.00	16													
	17													
54.00	18													
	19			6	12 13 13	26	35							
52.00	20													
	21													
50.00	22													
	23													
48.00	24			7	14 12 14	26	40							
	25													

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				R-09-008
DIST. 04	COUNTY Sonoma	ROUTE 101	POSTMILE 0.9/2.9	EA 04-28645045
PROJECT OR BRIDGE NAME: Petalum River Bridge				
BRIDGE NUMBER	PREPARED BY S. Manoharan	DATE 9-2-09	SHEET 1 of 4	

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25	CLAYEY SAND with GRAVEL (SC) *(continued)*.												
46.00	26													
	27													
44.00	28													
	29		X	8	10 18 22	40	60							
42.00	30													
	31													
40.00	32													
	33													
38.00	34	At EL. 38.0 ft, becomes dark gray.	X	9	7 10 15	25	40		13	128	UC =0.88			
	35													
36.00	36													
	37													
34.00	38													
	39	At EL. 33.5 ft, becomes brown.	X	10	11 15 17	32	65							
32.00	40													
	41													
30.00	42													
	43													
28.00	44		X	11	11 12 10	22	65		17	119				End of drilling Day - 1 PA +#4=22% -#200=23%
	45													
26.00	46													
	47													
24.00	48													
	49	At EL. 23.0 ft, becomes mottled with gray.	X	12	14 10 10	20	35							
22.00	50													
	51													
20.00	52													
	53													
18.00	54	At EL. 18.0 ft, becomes reddish brown mottled with gray and brown.	X	13	11 10 19	29	50							
	55													

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-008**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Petalum River Bridge**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**	DATE **9-2-09**	SHEET **2 of 4**	

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55														
16.00	56														
	57														
14.00	58		SANDY lean CLAY with GRAVEL (CL); stiff; reddish brown; moist; [FILL].												
	59				14	15 14 16	30	35							
12.00	60														
	61														
10.00	62														
	63														
8.00	64				15	16 20 20	40	50							
	65														
6.00	66														
	67														
4.00	68														
	69				16	12 14 22	36	65							
2.00	70														
	71														
0.00	72														
	73														
-2.00	74				17	23 17 15	32	35							
	75														
-4.00	76		Fat CLAY (CH); stiff; olive gray; moist; [ALLUVIUM].												
	77														
-6.00	78														
	79				18	7 9 11	20	60		33	91	UC =1.42			End of drilling Day - 2
-8.00	80														
	81														
-10.00	82														
	83														
-12.00	84														
	85														

(continued)

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-008**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Petalum River Bridge**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**	DATE **9-2-09**	SHEET **3 of 4**	

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	85	Fat CLAY (CH) *(continued)*.												
-14.00	86													
	87													
-16.00	88													
	89	At EL. -17.0 ft, with sand.	X	19	12 20 30	50	70							
-18.00	90	SILTY, CLAYEY SAND (SC-SM); dense; grayish brown; medium to fine SAND; [ALLUVIUM].												
	91													
-20.00	92													
	93													
-22.00	94													
	95													
-24.00	96													
	97	Lean CLAY (CL); very stiff; dark bluish gray; moist.												
-26.00	98													
	99		X	20	12 13 13	26	65		22	108	UC =2.25			
-28.00	100													
	101													
-30.00	102	SILTY, CLAYEY SAND (SC-SM); gray.												
	103													
-32.00	104													
	105													
-34.00	106													
	107													
-36.00	108													
	109	Lean CLAY (CL); stiff; olive gray; moist; [ALLUVIUM].	X	21	7 10 13	23	100							
-38.00	110													
	111													
-40.00	112	Bottom of Borehole at 112.0 ft.												
	113													
-42.00	114													
	115													

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-008**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Petalum River Bridge**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**	DATE **9-2-09**	SHEET **4 of 4**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	6-23-09	6-25-09	2277894.2 ft / 5953576.1 ft	R-09-011
DRILLING CONTRACTOR: WDC Exploration & Wells			BOREHOLE LOCATION (Offset, Station, Line): 1' Lt Sta 187+60 A	SURFACE ELEVATION: 51 ft
DRILLING METHOD: Rotary Wash			DRILL RIG: CME 85	BOREHOLE DIAMETER: 4-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID): Modified CA (1.96"), SPT (1.44")			SPT HAMMER TYPE: Auto Hammer 140lb/30in	HAMMER EFFICIENCY, ERi: 84%
BOREHOLE BACKFILL AND COMPLETION: Cement			GROUNDWATER READINGS: DURING DRILLING: Dry to 19' AFTER DRILLING (DATE): N/A	TOTAL DEPTH OF BORING: 119.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	SILTY GRAVEL (GM); some asphalt concrete chunks. [FILL].												
	1	Poorly graded GRAVEL (GP); gravel size upto 3 inches. [FILL].												8 inch hollow stem auger to 19 feet
49.00	2													
	3													
47.00	4													
	5	Lean CLAY (CL); grayish brown; [FILL].												
45.00	6	CLAYEY GRAVEL (GC); medium dense; gray; moist.												
	7		X	1	6 15 15	30	50							
43.00	8													
	9		X	2	9 16 11	27	70							
41.00	10													
	11													
39.00	12													
	13													
37.00	14		X	3	20 14 12	26	35							
	15													
35.00	16	CLAYEY GRAVEL (GC/CL); medium dense; bluish gray; moist; with bluish gray Serpentinite gravel. [FILL].												
	17													
33.00	18													
	19		X	4	10 7 8	15	35		8	125				Began rotary wash
31.00	20													
	21													
29.00	22													
	23													
27.00	24		X	5		21	35							
	25													

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				R-09-011
DIST. 04	COUNTY Sonoma	ROUTE 101	POSTMILE 0.9/2.9	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101/ SR 116 SOH				
BRIDGE NUMBER	PREPARED BY S. Manoharan	DATE 6-29-09	SHEET 1 of 5	

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25	CLAYEY GRAVEL (GC/CL) *(continued)*.			4 8 13									
25.00	26													
	27	SANDY lean CLAY (CL); medium stiff; brown; moist; with bluish sand and trace gravel. [FILL].												
23.00	28			6	3 11 9	20	20							
	29													
21.00	30													
	31													
19.00	32													
	33			7	8 35 16	51	35							
17.00	34	At EL. 17.5 ft, observed 6-inch gravel lense. CLAYEY SAND (SC); medium dense; grayish brown; moist; [FILL].												
	35													
15.00	36													
	37													
13.00	38	SANDY lean CLAY with GRAVEL (CL); grayish brown; moist; [FILL].		8	6 8 10	18	60							
	39													
11.00	40													
	41													
9.00	42													
	43			9	5 9 10	19	30							
7.00	44													
	45	CLAYEY SAND with GRAVEL (SC); medium dense; brown; moist; [FILL].												
5.00	46													
	47													
3.00	48			10	8 8 10	18	10							
	49													
1.00	50													Stop drilling 06/23/09 Resume drilling 06/24/09
	51													
-1.00	52													
	53			11	5 8 12	20	100							
-3.00	54	Lean CLAY (CL); very stiff; grayish brown; moist.							23	103	UC =1.53			
	55													

(continued)

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-011**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**	DATE **6-29-09**	SHEET **2 of 5**	

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55	Lean CLAY (CL) *(continued)*.												
-5.00	56													
	57													
-7.00	58			12	9 15 19	34	80							
	59	SANDY lean CLAY (CL); very stiff; gray; moist. Lean CLAY (CL); very stiff; grayish brown; moist.							18	119	UC =1.88			
-9.00	60													
	61													
-11.00	62													
	63			13	17 38 50/3"	88/ 9"	70							
-13.00	64	SILTY SAND (SM); very dense; grayish brown; moist.												Sampler advanced 15 in.
	65													
-15.00	66													
	67	Poorly graded SAND (SP); medium dense; grayish brown; moist; trace of fine gravel.												
-17.00	68			14	14 19 24	43	60							
	69	Lean CLAY (CL); hard; grayish brown; moist. At EL. -18.0 ft, becomes bluish gray.							19	110	UC =2.07			
-19.00	70													
	71													
-21.00	72													
	73													
-23.00	74	Poorly graded SAND with SILT (SP-SM); very dense; grayish brown; wet.		15	23 33 41	74	100							
	75	SILTY, CLAYEY SAND (SC-SM); very dense; dark bluish gray; wet; weathered Serpentinite sand.												
-25.00	76													
	77	Lean CLAY (CL); very stiff; dark bluish gray; moist.												
-27.00	78			16	8 11 10	21	70		21	104	UC =1.29			C
	79													
-29.00	80													
	81													
-31.00	82													
	83			17	4 9 12	21	80		18	112				
-33.00	84													
	85	Poorly graded SAND with SILT (SP-SM); dense; dark												

(continued)

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-011**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**	DATE **6-29-09**	SHEET **3 of 5**	

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	85	bluish gray; moist.												
-35.00	86													
	87													
-37.00	88			18	10 15 24	39	60							
	89													
-39.00	90													Stop drilling 06/24/09 Resume drilling 06/25/09
	91													
-41.00	92	Lean CLAY (CL); bluish gray; moist.												
	93													
-43.00	94	SANDY lean CLAY (CL); brown; moist.												
	95													
-45.00	96													
	97	CLAYEY GRAVEL (GC); very dense; brown; moist.												
-47.00	98			19	45 50/3"	50/ 3"	50							
	99	METAMORPHIC ROCK (SERPENTINITE), dark greenish gray, intensely weathered.												Sampler advanced 9 in.
-49.00	100													
	101													
-51.00	102													
	103													
-53.00	104													
	105													Easy drilling
-55.00	106													
	107													
-57.00	108			20	31 50/4"	50/ 4"	60							
	109													Sampler advanced 10 in.
-59.00	110													
	111													
-61.00	112													
	113													Hard drilling
-63.00	114													
	115													

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-011**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**	DATE **6-29-09**	SHEET **4 of 5**	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	115		METAMORPHIC ROCK (Serpentinite) *(continued)*.												
-65.00	116														
	117														
-67.00	118				21	50 50/1"	50/ 1"	50							
	119														Sampler advanced 7 in.
-69.00	120		Bottom of Borehole at 119.5 ft.												
	121														
-71.00	122														
	123														
-73.00	124														
	125														
-75.00	126														
	127														
-77.00	128														
	129														
-79.00	130														
	131														
-81.00	132														
	133														
-83.00	134														
	135														
-85.00	136														
	137														
-87.00	138														
	139														
-89.00	140														
	141														
-91.00	142														
	143														
-93.00	144														
	145														

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-011**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**		DATE **6-29-09**	SHEET **5 of 5**

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo/S.Mano	6-10-09	6-11-09	2278149.9 ft / 5953509.7 ft	R-09-012
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
WDC Exploration & Wells			28' Rt Sta 190+23 A	11 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Rotary Wash			CME 75 Crawler	4-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96"), SPT (1.44"), Rock Core			Auto Hammer 140lb/30in	69%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement			Dry to 21.5' / N/A	85.0 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	SANDY lean CLAY (CL/SC); brown; moist.												
	1			1	17 18 50/5"	68/ 11"	70							8 inch hollow stem auger to 21.5 feet
9.00	2	SILTY GRAVEL with SAND (GM); very dense; brown; moist; gray gravel.												
	3	SANDY lean CLAY with GRAVEL (CL); stiff; grayish brown; moist.												Sampler advanced 17 in.
7.00	4													
	5			2	7 10 4	14	70							Drilling Fluid was at 5.5 feet on 6/11/09
5.00	6	Fat CLAY with SAND (CH); medium stiff; dark gray; moist.												Stabilization fabric at 6 feet
	7													
3.00	8													
	9													
1.00	10	At EL. 1.0 ft, becomes gray.		3	2 4 7	11	100		27	97	UC =0.44			
	11													
-1.00	12													
	13													
-3.00	14													
	15	At EL. -4.0 ft, becomes very stiff; grayish brown; with some black speckling.		4	2 6 7	13	100		27	97	UC =1.11			C
-5.00	16													
	17													
-7.00	18													
	19													
-9.00	20	At EL. -9.0 ft, becomes stiff; gray mottled with brown.		5	4 6 7	13	100		35	87	UC =0.71			LL=87
	21													PI=61
-11.00	22													Began rotary wash
	23													
-13.00	24													
	25													

(continued)

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San Jose Office

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REPORT TITLE				HOLE ID
BORING RECORD				R-09-012
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101/ SR 116 SOH				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	L.Phillips	6-17-09	1 of 3	

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25	At EL. -14.0 ft, becomes medium stiff; bluish gray. Fat CLAY with SAND (CH) *(continued)*.		6	2 3 3	6	80							
-15.00	26													
	27													
-17.00	28	At EL. -17.0 ft, becomes brown.												
	29	Poorly graded SAND with SILT (SP-SM); medium dense; brown; moist.												
-19.00	30			7	6 8 8	16	70							
	31	At EL. -20.0 ft, becomes gray.												
-21.00	32													
	33													
-23.00	34													
	35			8	4 9 7	16	80							
-25.00	36	Fat CLAY (CH); stiff; bluish gray; moist; with some black speckling.												
	37													
-27.00	38													
	39													
-29.00	40			9	5 6 9	15	80		29	94	UC =0.64			
	41													
-31.00	42													
	43													
-33.00	44													
	45			10	3 8 19	27	100		45	77	UC =0.52			LL=81 PI=55 PI
-35.00	46	SANDY lean CLAY (CL); stiff; very dark greenish gray; moist.							17	117	UC =0.48			
	47													
-37.00	48													
	49													
-39.00	50	Fat CLAY with SAND (CH); stiff; very dark greenish gray; moist; some GRAVEL.		11	10 9 11	20	70		32	90	UC =0.69			
	51													
-41.00	52													
	53													
-43.00	54													
	55													

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-012**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **L.Phillips**	DATE **6-17-09**	SHEET **2 of 3**	

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Remarks
	55	METAMORPHIC ROCK.	12	31 50/5"	50/ 5"	50		
-45.00	56							Sampler advanced 11 in.
	57							
-47.00	58							
	59							
-49.00	60	METAMORPHIC ROCK (SERPENTINITE), dark greenish gray, intensely weathered, extremely weak, intensely fractured, trace of white talc?, material breaks down easily to Lean Clay (CL) with sand and rock fragments.	13	33 50/5"	50/ 5"			
	61							Sampler advanced 11 in.
-51.00	62		14			69	0	
	63							
-53.00	64							
	65		15			46	0	
-55.00	66							
	67							
-57.00	68							
	69							
-59.00	70	[FRANCISCAN COMPLEX] [FRANCISCAN COMPLEX].	16			8	0	
	71							Core barrel blocked at 74 feet
-61.00	72							
	73							
-63.00	74	At EL. -63.0 ft, becomes moderately weathered, weak, with black shale lenses and talc, highly sheared fabric.	17			60	0	
	75		18			4	0	
-65.00	76							
	77	(SERPENTINITE), Shale, decomposed, very weak, soft, clayey.						
-67.00	78							
	79							
-69.00	80	At EL. -69.0 ft, becomes Serpentinite, intensely to moderately weathered, very weak, mostly black shale with 20% serpentinite, highly sheared.	19			100	0	
	81							
-71.00	82		20			33	0	
	83							
-73.00	84							
	85	Bottom of Borehole at 85.0 ft.						

Sample Location | Material Graphics | Moisture Content (%) | Dry Unit Weight (pcf) | Shear Strength (tsf) | Drilling Method | Casing Depth

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-012**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **L.Phillips**	DATE **6-17-09**	SHEET **3 of 3**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
S.Mano/C.Rambo	6-11-09	6-12-09	2278308.1 ft / 5953435.2 ft	R-09-013
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
WDC Exploration & Wells			14' Rt Sta 191+97 A	10 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Rotary Wash			CME 85	4-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96"), SPT (1.44")			Auto Hammer 140lb/30in	85%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement			Dry to 19' / N/A	86.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	CLAYEY SAND with GRAVEL (SC); light brown; moist.												
	1			1	6 7 7	14	35							8 inch hollow stem auger to 21.5 feet
8.00	2	CLAYEY GRAVEL with SAND (GC); grayish brown; moist.												
	3													
6.00	4			2	3 11 3	14	35							
	5	Lean to fat CLAY with SAND (CL/CH/CH); stiff; dark gray; moist.												
4.00	6													Drilling fluid measured at 5.5 feet on 6/11/09 Stabilization fabric at 6 feet
	7													
2.00	8													
	9	Fat CLAY (CH); medium stiff; gray; moist.		3	1 2 3	5	100							
0.00	10													
	11			4	1 2 4	6	100		28	94	UC =0.42			
-2.00	12	At EL. -2.0 ft, with Clayey Sand lenses with some black speckling.												
	13													
-4.00	14	At EL. -4.0 ft, becomes very stiff; mottled with brown.		5	2 4 9	13	80		28	95	UC =1.14			LL=67 PI=45 PI
	15													
-6.00	16													
	17													
-8.00	18													
	19	At EL. -9.0 ft, becomes stiff.		6	2 7 9	16	90		26	97	UC =0.87			
-10.00	20													
	21	SILTY SAND (SM); medium dense; gray; moist.												
-12.00	22													Began rotary wash
	23	SANDY lean CLAY (CL); soft; grayish brown; moist.												
-14.00	24													
	25													

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				R-09-013
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101/ SR 116 SOH				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	L.Phillips	6-17-09	1 of 4	

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25	SANDY lean CLAY (CL) *(continued)*.		7	2 3 5	8	100		25	100	UC =0.21			
-16.00	26	SILTY SAND (SM); loose; greenish gray; moist.							23	103				+#4=0 -#200=41% PA
	27													
-18.00	28													
	29	Lean CLAY with SAND (CL); medium stiff; bluish gray; moist to wet.		8	1 2 3	5	100							
-20.00	30													
	31													
-22.00	32													
	33													
-24.00	34	At EL. -24.0 ft, becomes stiff; moist.		9	3 4 7	11	60		25	101	UC =0.61			
	35													
-26.00	36													
	37													
-28.00	38													
	39	SANDY lean CLAY (CL); stiff; very dark greenish gray; moist.		10	3 7 7	14	80		22	104	UC =0.86			
-30.00	40													
	41													
-32.00	42													
	43													
-34.00	44	Fat CLAY (CH); stiff; dark bluish gray; moist.		11	4 5 6	11	90		31	91	UC =0.69			
	45													
-36.00	46													
	47													
-38.00	48	SANDY lean CLAY (CL); stiff; very dark greenish gray; moist.												
	49			12	3 9 9	18	90							
-40.00	50	Lean CLAY (CL); stiff; very dark greenish gray; moist.							23	103	UC =0.71			
	51													
-42.00	52													
	53	SANDY lean CLAY with GRAVEL (CL); greenish gray; moist; weathered rock.												
-44.00	54			13		35	25							
	55													

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-013**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **L.Phillips**	DATE **6-17-09**	SHEET **2 of 4**	

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55	SANDY lean CLAY with GRAVEL (CL) *(continued)*.			12 20 15									
-46.00	56													
	57													
-48.00	58													
	59	METAMORPHIC ROCK (SERPENTINITE), dark greenish gray, intensely weathered, Lean Clay (CL).		14	3 4 6	10	100							
-50.00	60													
	61													
-52.00	62													
	63													
-54.00	64			15	16 10 41	51	80							
	65													
-56.00	66	At EL. -55.5 ft, with trace of white talc.												
	67													
-58.00	68													
	69			16	26 50/1"	50/ 1"	60							
-60.00	70													Sampler advanced 7 in.
	71													Stop drilling 06/11/09 Resume drilling 06/12/09
-62.00	72													
	73													
-64.00	74													
	75			17	50 50/1"	50/ 1"	40							
-66.00	76													Sampler advanced 7 in.
	77													
-68.00	78													
	79													
-70.00	80													
	81													
-72.00	82													
	83													
-74.00	84													
	85													

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-013**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **L.Phillips**	DATE **6-17-09**	SHEET **3 of 4**	

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	85		METAMORPHIC ROCK (Serpentinite) *(continued)*.		18	42 77 87/4"	164/ 10"								
-76.00	86														Sampler advanced 16 in.
	87		Bottom of Borehole at 86.5 ft.												
-78.00	88														
	89														
-80.00	90														
	91														
-82.00	92														
	93														
-84.00	94														
	95														
-86.00	96														
	97														
-88.00	98														
	99														
-90.00	100														
	101														
-92.00	102														
	103														
-94.00	104														
	105														
-96.00	106														
	107														
-98.00	108														
	109														
-100.00	110														
	111														
-102.00	112														
	113														
-104.00	114														
	115														

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-013**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **L.Phillips**	DATE **6-17-09**	SHEET **4 of 4**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	6-14-09	6-15-09	2278430.6 ft / 5953370.8 ft	R-09-014
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
WDC Exploration & Wells			2' Lt Sta 193+34 A	14 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Rotary Wash			CME 85	4-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96"), SPT (1.44")			Auto Hammer 140lb/30in	85%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement			18 ft	N/A	96.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	8 inches Asphalt Concrete over 6 inches Aggregate Base.												
	1	SILTY SAND with GRAVEL (SM); very dense; brown; moist.												8 inch hollow stem auger to 20 feet
12.00	2			1	16 33 27	60	70							
	3													
10.00	4													
	5			2	4 15 7	22	50							
8.00	6	At EL. 8.0 ft, observed 6 inch lense of SILTY GRAVEL (GM); gray; moist.												Bridging material?
	7	At EL. 7.5 ft, becomes medium dense; dark brown; wet.												
6.00	8													
	9													
4.00	10			3	1 2 3	5	65							LL=73 PI=54
	11	Fat CLAY (CH); stiff; light brown with black speckling; moist; with black speckling.							31	91	UC =0.64			PI
2.00	12													
	13													
0.00	14	SILTY SAND (SM); medium dense; light brown; moist.												
	15			4	2 7 11	18	70		22	104	UC =0.38			+#4=0 -#200=44% PA
-2.00	16													
	17													
-4.00	18													
	19													
-6.00	20			5	9 16 20	36	100		21	104				Began rotary wash
	21													
-8.00	22													
	23													
-10.00	24													
	25													

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REPORT TITLE				HOLE ID
BORING RECORD				R-09-014
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101/ SR 116 SOH				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	S. Manoharan	6-19-09	1 of 4	

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25	At EL. -11.0 ft, becomes dense; light gray; less silt. SILTY SAND (SM) *(continued)*.		6	13 24 35	59	90							
-12.00	26													
	27													
-14.00	28	Lean CLAY (CL); stiff; gray; moist.												
	29													
-16.00	30			7	3 4 6	10	100		27	97	UC =0.77			C
	31													
-18.00	32													
	33													
-20.00	34													
	35	At EL. -21.0 ft, becomes dark gray.		8	3 6 8	14	100		23	103	UC =0.83			
-22.00	36													
	37													
-24.00	38													
	39													
-26.00	40			9	4 8 12	20	90		22	106	UC =0.95			
	41													
-28.00	42	Poorly graded SAND with SILT (SP-SM); dark gray; moist.												
	43													
-30.00	44	SANDY lean CLAY (CL/SC); gray; moist.												
	45			10	5 8 7	15	100							
-32.00	46	Lean CLAY with SAND (CL); medium stiff; gray; moist.							24	102	UC =0.34			
	47													
-34.00	48													
	49													
-36.00	50	At EL. -36.0 ft, becomes stiff.		11	2 3 5	8	100		28	94	UC =0.59			
	51													
-38.00	52													
	53													
-40.00	54													
	55													

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-014**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**	DATE **6-19-09**	SHEET **2 of 4**	

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55		Fat CLAY (CH); stiff; gray; moist.		12	6 8 11	19	30							
-42.00	56														
	57														Stop drilling 6/14/09 Resume drilling 06/15/09
-44.00	58														
	59														
-46.00	60														
	61														
-48.00	62														
	63														
-50.00	64														
	65				13	3 6 8	14	100		35	89				LL=55 PI=33 C, PI
-52.00	66														
	67														
-54.00	68														
	69														
-56.00	70														
	71														
-58.00	72														
	73														
-60.00	74														
	75				14	6 11 13	24	60		29	94	UC =0.94			
-62.00	76														
	77														
-64.00	78														
	79														
-66.00	80														
	81														
-68.00	82														
	83														
-70.00	84														
	85														

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-014**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**		DATE **6-19-09**	SHEET **3 of 4**

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	85	SILTY SAND (SM); medium dense; gray; moist.		15	14 50/5"	50/ 5"	40							
-72.00	86	SILTY GRAVEL with SAND (GM); very dense; dark gray; moist.							14	115				Sampler advanced 11 in.
	87	SANDY lean CLAY (CL); gray; moist.												
-74.00	88													
	89													
-76.00	90	At EL. -75.5 ft, observed 6 inch gravel lense. At EL. -76.0 ft, becomes stiff; brown.		16	14 33 29	62	70		46	70				
	91													Hard drilling
-78.00	92	METAMORPHIC ROCK (SERPENTINITE), light brown to grayish blue, intensely fractured.												
	93													
-80.00	94													
	95			17	42 67 92/3"	159/ 9"	80							
-82.00	96													Sampler advanced 15 in.
	97	Bottom of Borehole at 96.5 ft.												
-84.00	98													
	99													
-86.00	100													
	101													
-88.00	102													
	103													
-90.00	104													
	105													
-92.00	106													
	107													
-94.00	108													
	109													
-96.00	110													
	111													
-98.00	112													
	113													
-100.00	114													
	115													

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-014**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**	DATE **6-19-09**	SHEET **4 of 4**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	6-16-09	6-17-09	2278545.9 ft / 5953352.3 ft	R-09-015
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
WDC Exploration & Wells			22' Rt Sta 194+49 A	34 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Rotary Wash			CME 85	4-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96"), SPT (1.44")			Auto Hammer 140lb/30in	85%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement			Dry to 22' / N/A	108.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SILTY GRAVEL (GM); dense; brown; moist; [FILL].												
	1				1	9 19 24	43	65							8 inch hollow stem auger to 22 feet
32.00	2														
	3														
30.00	4														
	5		SILTY SAND with GRAVEL (SM/ML); medium dense; brown; moist; [FILL].		2	4 7 10	17	65							
28.00	6														
	7														
26.00	8														
	9														
24.00	10				3	4 6 11	17	80		7	128				
	11														
22.00	12														
	13														
20.00	14														
	15		SANDY lean CLAY (CL); stiff; brown; moist; some GRAVEL; [FILL].		4	2 5 7	12	60		12	123				
18.00	16														
	17														
16.00	18														
	19														
14.00	20		At EL. 14.0 ft, becomes medium stiff; moist to wet.		5	1 4 7	11	50							
	21														
12.00	22														Began rotary wash
	23		Lean CLAY (CL); medium stiff; dark gray; moist.												
10.00	24														
	25														

(continued)

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

URS

San Jose Office

100 W. San Fernando St, Suite 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				R-09-015
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101/ SR 116 SOH				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	L.Phillips	6-23-09	1 of 4	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25		Lean CLAY (CL) *(continued)*.		6	2 3 6	9	50		22	100	UC =0.45		C	
8.00	26														
	27														
6.00	28														
	29														
4.00	30														
	31		At EL. 3.0 ft, becomes stiff; brown.												
2.00	32														
	33														
0.00	34														
	35		Poorly graded SAND with SILT (SP-SM); medium dense; grayish brown; moist.		7	9 11 10	21	70							
-2.00	36		Lean CLAY (CL); stiff; light brown; moist.							19	109				
	37														
-4.00	38														
	39														
-6.00	40														
	41														
-8.00	42														
	43		Poorly graded SAND with SILT (SP-SM); dense; gray; moist.												
-10.00	44														
	45				8	14 24 16	40	80		18	106				
-12.00	46														
	47														
-14.00	48														
	49														
-16.00	50														
	51														
-18.00	52		SILTY, CLAYEY SAND (SC-SM); medium dense; gray; moist.												
	53														
-20.00	54														
	55														

(continued)

URS

San Jose Office

100 W. San Fernando St, Suite 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				**R-09-015**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **L.Phillips**	DATE **6-23-09**	SHEET **2 of 4**	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55		SILTY, CLAYEY SAND (SC-SM) *(continued)*.		9	9		100							
-22.00	56		Lean CLAY (CL); stiff; gray; moist.			9 11	20								
	57														Stop drilling 6/16/09 Resume drilling 6/17/09
-24.00	58														
	59														
-26.00	60														
	61														
-28.00	62														
	63														
-30.00	64														
	65				10	4		60		21	105	UC =0.81			
-32.00	66					13 22	35								
	67		SILTY, CLAYEY SAND (SC-SM); dense; gray; moist.												
-34.00	68														
	69														
-36.00	70														
	71														
-38.00	72		Fat CLAY (CH); stiff; gray mottled with brown; moist; trace coarse SAND.												
	73														
-40.00	74														
	75				11	4		65		46	75	UC =0.73			LL=78
-42.00	76					6 9	15								PI=51 PI
	77														
-44.00	78														
	79														
-46.00	80														
	81														
-48.00	82														
	83														
-50.00	84														
	85														

(continued)

URS

San Jose Office

100 W. San Fernando St, Suite 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				**R-09-015**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **L.Phillips**	DATE **6-23-09**	SHEET **3 of 4**	

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	85	At EL. -51.0 ft, becomes medium stiff. Fat CLAY (CH) *(continued)*.		12	6 9 12	21	70		41	78	UC =0.37			
-52.00	86	SANDY lean CLAY (CL); very stiff; gray; moist.												
	87													
-54.00	88													
	89													
-56.00	90													
	91													
-58.00	92													
	93													
-60.00	94													
	95	SILTY, CLAYEY SAND (SC-SM); very dense; gray; moist.		13	26 50/4"	50/ 4"	0							
-62.00	96													Sampler advanced 10 in.
	97													
-64.00	98													
	99													
-66.00	100			14	19 28 26	54	70							
	101													
-68.00	102													
	103													
-70.00	104													Refusal with drag bit at 107 ft; 5 psi pressure on tip
	105													
-72.00	106													
	107	SANDY lean CLAY (CL); very stiff; gray mottled with brown; moist; trace GRAVEL.		15	9 9 15	24	80							
-74.00	108													
	109	Bottom of Borehole at 108.5 ft.												
-76.00	110													
	111													
-78.00	112													
	113													
-80.00	114													
	115													

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

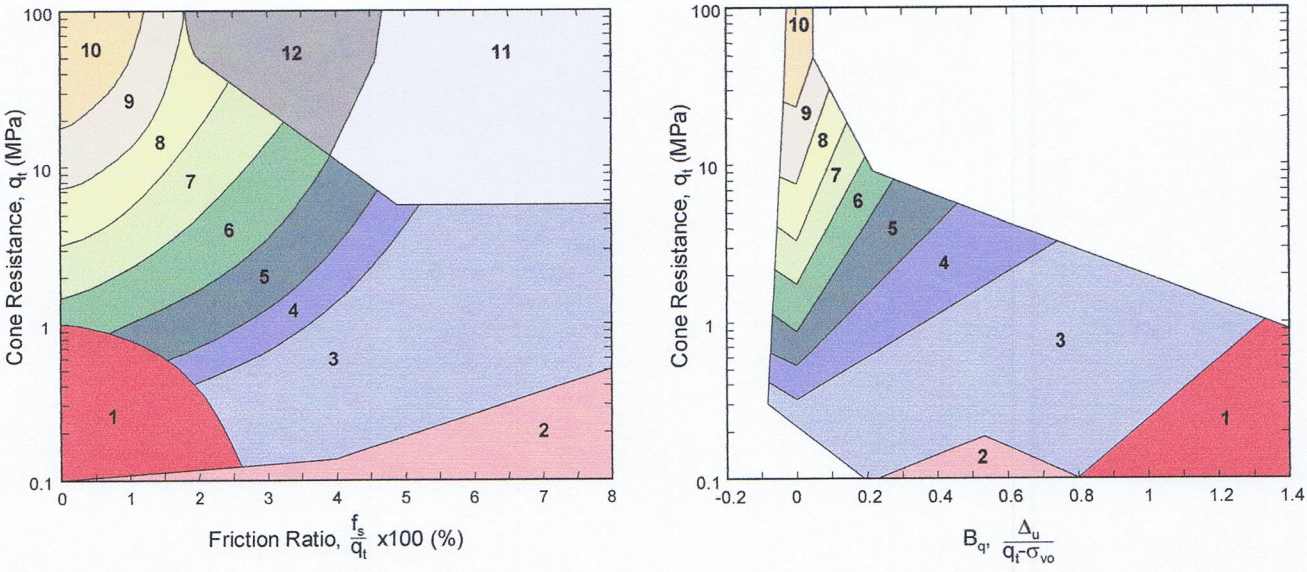
URS

San Jose Office

100 W. San Fernando St, Suite 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				**R-09-015**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **L.Phillips**	DATE **6-23-09**	SHEET **4 of 4**	

CPT Soil Behavior Type Legend
(Robertson et al. 1986)

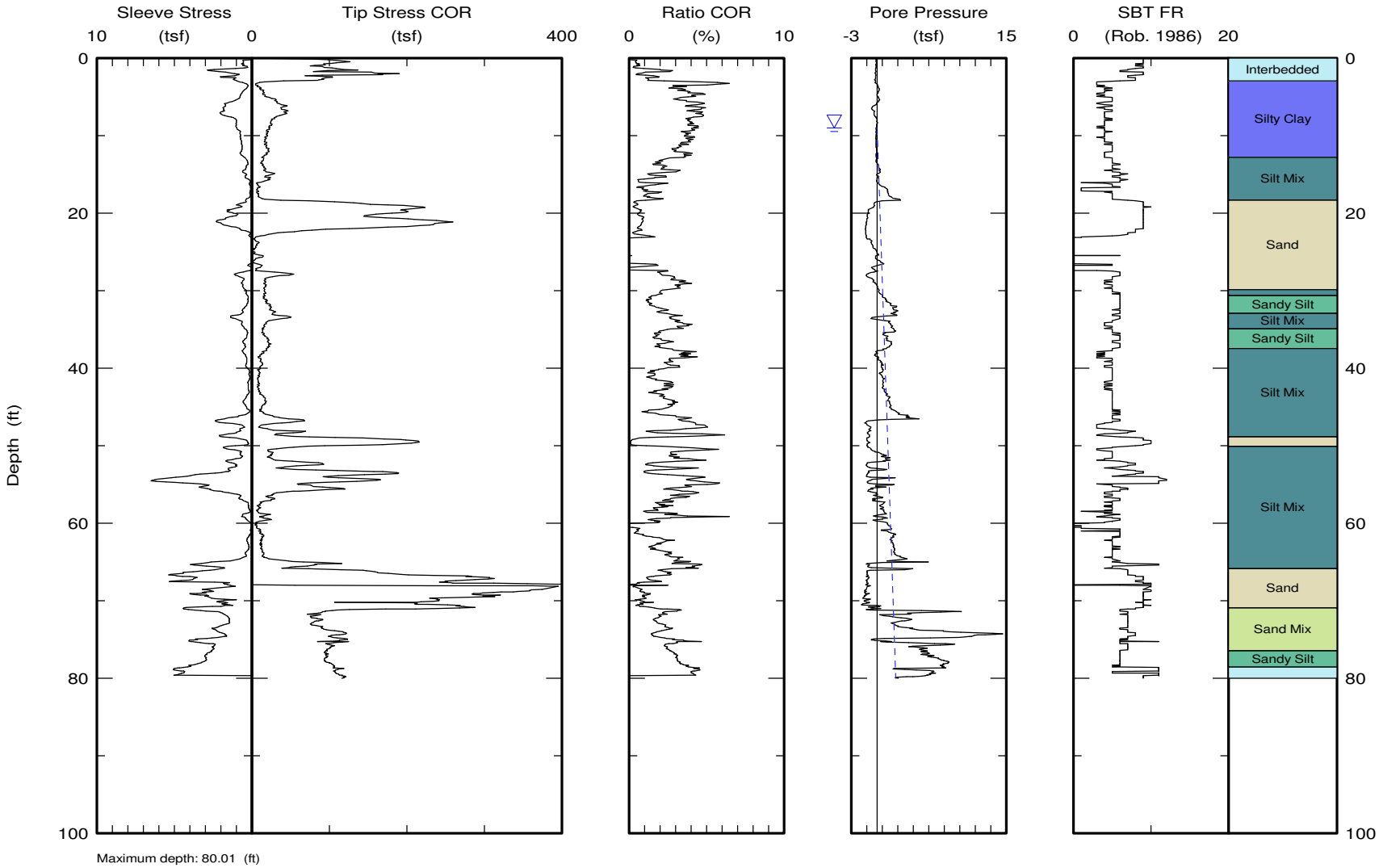


Zone	Soil Behavior Type
1	Sensitive, Fine Grained
2	Organic Material
3	Clay
4	Silty Clay to Clay
5	Clayey Silt to Silty Clay
6	Sandy Silt to Clayey Silt
7	Silty Sand to Sandy Silt
8	Sand to Silty Sand
9	Sand
10	Gravelly Sand to Sand
11	Very Stiff Fine Grained*
12	Sand to Clayey Sand*

*Overconsolidated or Cemented

Figure A-1

Lankelma, Inc. Richmond, CA 94801 713-231-7661 umeshbachu@lankelma.com www.lankelma.com	Northing: Easting: Elevation:	Date: 22/Jun/2009 Test ID: CPT-09-102 Project: PRB
	Customer: URS Job Site: Petaluma River Bridge	

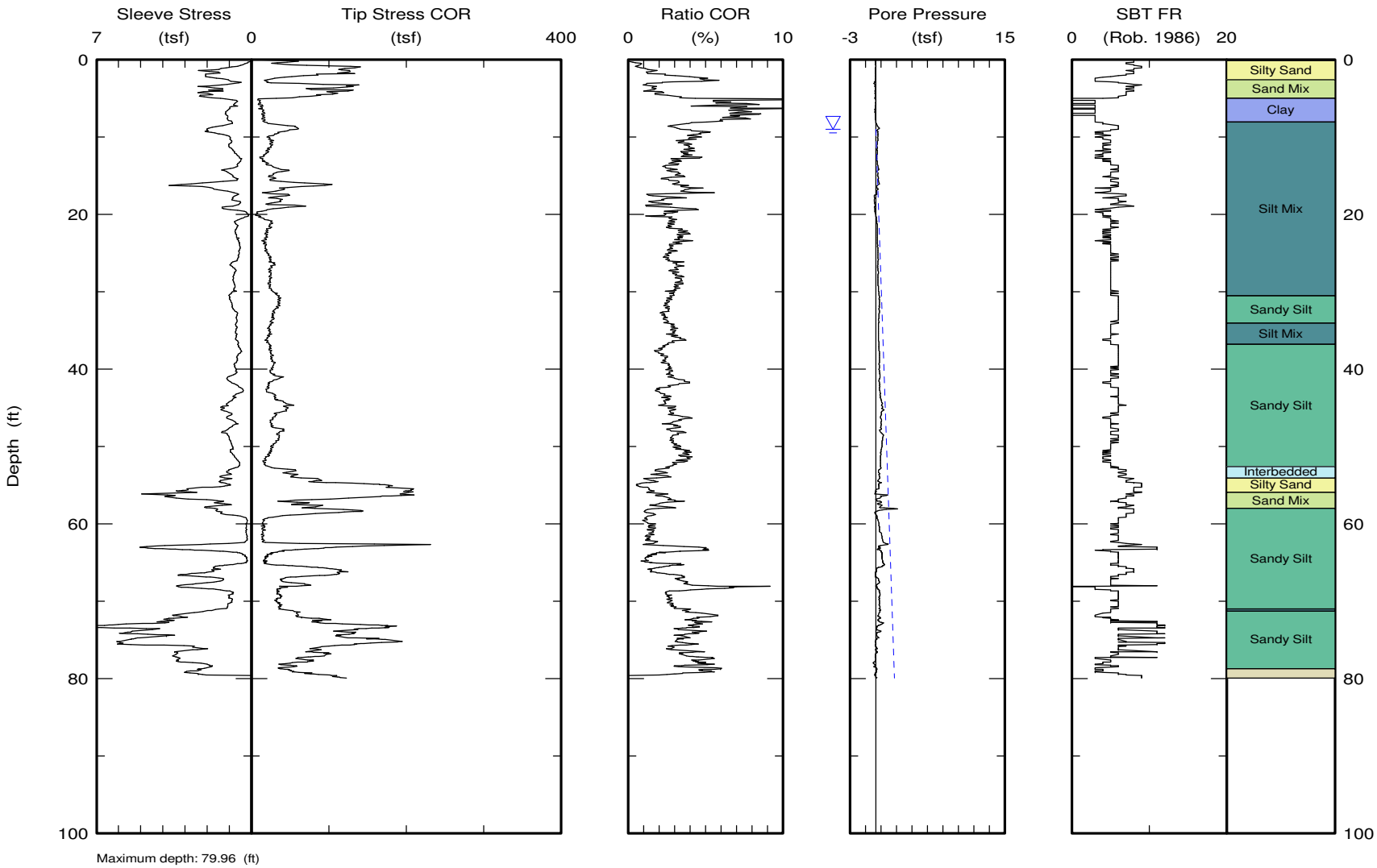


Maximum depth: 80.01 (ft)

Estimated Phreatic Surface

Test ID: CPT-09-102
File: Z22U0903C.ecp

Lankelma, Inc. Richmond, CA 94801 713-231-7661 umeshbachu@lankelma.com www.lankelma.com	Northing: Easting: Elevation:	Date: 22/Jun/2009 Test ID: CPT-09-104 Project: PRB
	Customer: URS Job Site: Petaluma River Bridge	



Estimated Phreatic Surface

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SON	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL — DATE: NA

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Stephen Huang — No. GE 2150 — Exp. 03/31/12 — GEOTECHNICAL — STATE OF CALIFORNIA

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SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401

URS Corporation
100 WEST SAN FERNANDO St
SUITE #200
SAN JOSE, CA 95113

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

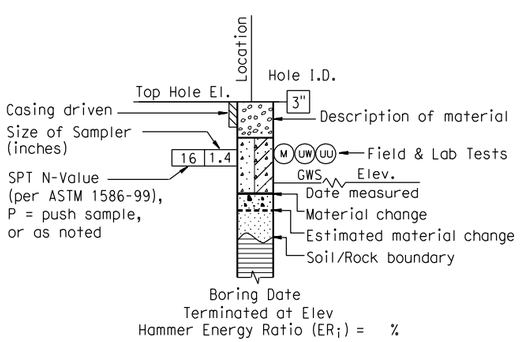
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
⬚	O	Other

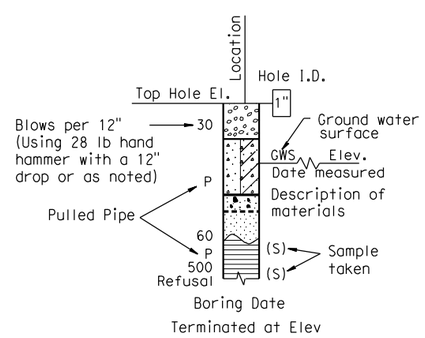
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

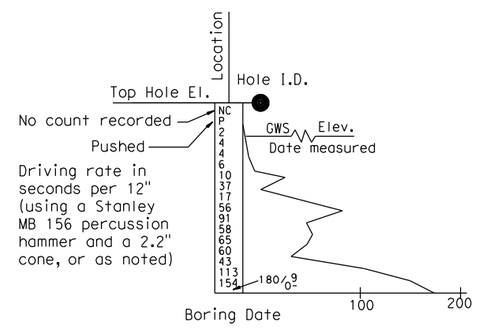
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.



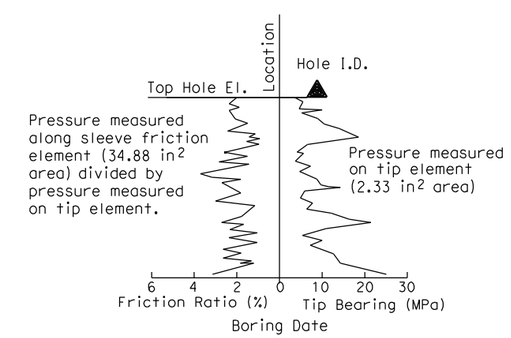
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

DESIGN OVERSIGHT	DRAWN BY: A. CHEUNG	C. RAMBO FIELD INVESTIGATION BY: DATE:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	S. HUANG PROJECT ENGINEER	BRIDGE NO.
SIGN OFF DATE	CHECKED BY: MANOHARAN				POST MILES

SOIL LEGEND

LOG OF TEST BORINGS 1 OF 7

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS: 0 1 2 3

CU 04
EA 2640C1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES — SHEET — OF

FILE => ...\LOTB\RW 152\152-z-ltb01.dgn

USERNAME => andrew_cheung — DATE PLOTTED => 11/23/2010 — TIME PLOTTED => 2:12:53 PM

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic/Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SON	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL — DATE NA

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Stephen Huang — No. GE 2150 — Exp. 03/31/12 — GEOTECHNICAL — STATE OF CALIFORNIA

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SUITE 206
SANTA ROSA, CA 95401

URS Corporation
100 WEST SAN FERNANDO St
SUITE #200
SAN JOSE, CA 95113

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY A. CHEUNG

CHECKED BY MANOHARAN

C. RAMBO
FIELD INVESTIGATION BY:
DATE:

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. HUANG
PROJECT ENGINEER

BRIDGE NO. XX-XXXX
POST MILES XX.XX

SOIL LEGEND
LOG OF TEST BORINGS 2 OF 7

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 2640C1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET OF

FILE => ...\lotb\rw 152\152-z-ltb02.dgn

USERNAME => andrew_cheung PLOTTED => 11/23/2010 TIME PLOTTED => 2:13:03 PM

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SON	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL — NA DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Stephen Huang — No. GE 2150 — Exp. 03/31/12 — GEOTECHNICAL — STATE OF CALIFORNIA

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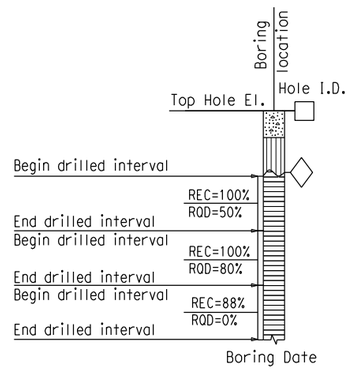
SUITE 206
SANTA ROSA, CA 95401

URS Corporation
100 WEST SAN FERNANDO St
SUITE #200
SAN JOSE, CA 95113

PERCENT CORE RECOVERY (REC) & ROCK QUALITY DESIGNATION (RQD)

$$REC = \frac{\sum \text{Length of the recovered core pieces (inches)}}{\text{Total length of core run (inches)}} \times 100\%$$

$$RQD = \frac{\sum \text{Length of intact core pieces} \geq 4''}{\text{Total length of core run (inches)}} \times 100\%$$



RELATIVE STRENGTH OF INTACT ROCK

Term	Uniaxial Compressive Strength (PSI)
Extremely Strong	> 30,000
Very Strong	14,500 - 30,000
Strong	7,000 - 14,500
Medium Strong	3,500 - 7,000
Weak	700 - 3,500
Very Weak	150 - 700
Extremely Weak	< 150

BEDDING SPACING

Description	Thickness / Spacing
Massive	Greater than 10 ft
Very thickly bedded	3 to 10 ft
Thickly bedded	1 to 3 ft
Moderately bedded	3-5/8" to 1 ft
Thinly bedded	1-1/4" to 3-5/8"
Very thinly bedded	3/8" to 1-1/4"
Laminated	Less than 3/8"

LEGEND OF ROCK MATERIALS

- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

ROCK HARDNESS

Description	Criteria
Extremely Hard	Specimen cannot be scratched with a pocket knife or sharp pick; can only be chipped with repeated heavy hammer blows.
Very Hard	Specimen cannot be scratched with a pocket knife or sharp pick. Breaks with repeated heavy hammer blows.
Hard	Specimen can be scratched with a pocket knife or sharp pick with difficulty (heavy pressure). Heavy hammer blows required to break specimen.
Moderately Hard	Specimen can be scratched with pocket knife or sharp pick with light or moderate pressure. Core breaks with moderate hammer pressure.
Moderately Soft	Specimen can be grooved 1/6" deep with a pocket knife or sharp pick with moderate or heavy pressure. Breaks with light hammer blow or heavy manual pressure.
Soft	Specimen can be grooved or gouged easily by a pocket knife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
Very Soft	Specimen can be readily indented, grooved or gouged with fingernail, or carved with a pocket knife. Breaks with light manual pressure.

FRACTURE DENSITY

Description	Observed Fracture Density
Unfractured	No fractures.
Very slightly fractured	Lengths greater than 3 feet.
Slightly fractured	Lengths from 1 to 3 feet with few lengths less than 1 foot or greater than 3 feet.
Moderately fractured	Lengths mostly in 4" to 1 foot range with most lengths about 8"
Intensely fractured	Lengths average from 1 to 4" with scattered fragmented intervals with lengths less than 4"
Very intensely fractured	Mostly chips and fragments with a few scattered short core lengths.

Combination descriptors (such as "Very intensely to intensely fractured") are used where equal distribution of both fracture density characteristics is present over a significant interval or exposure, or where characteristics are "in between" the descriptor definitions. Only two adjacent descriptors may be combined.

WEATHERING DESCRIPTORS FOR INTACT ROCK

Description	Diagnostic features					General Characteristics
	Chemical Weathering-Discoloration and/or oxidation		Mechanical Weathering-Grain boundary conditions (disaggregation) primarily for granitics and some coarse-grained sediments	Texture and Solutioning		
	Body of Rock	Fracture Surfaces		Texture	Solutioning	
Fresh	No discoloration, not oxidized.	No discoloration or oxidation.	No separation, intact (tight).	No change.	No solutioning.	Hammer rings when crystalline rocks are struck.
Slightly Weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull.	Minor to complete discoloration or oxidation of most surfaces.	No visible separation, intact (tight).	Preserved.	Minor leaching of some soluble minerals may be noted.	Hammer rings when crystalline rocks are struck. Body of rock not weakened.
Moderately Weathered	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are "rusty," feldspar crystals are "cloudy."	All fracture surfaces are discolored or oxidized.	Partial separation of boundaries visible.	Generally preserved.	Soluble minerals may be mostly leached.	Hammer does not ring when rock is struck. Body of rock is slightly weakened.
Intensely Weathered	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in-situ disaggregation, see grain boundary conditions.	All fracture surfaces are discolored or oxidized, surfaces friable.	Partial separation, rock is friable; in semiarid conditions granitics are disaggregated.	Texture altered by chemical disintegration (hydration, argillation).	Leaching of soluble minerals may be complete.	Dull sound when struck with hammer, usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures, or veinlets. Rock is significantly weakened.
Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay.		Complete separation of grain boundaries (disaggregated).	Resembles a soil, partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete.		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes."

Combination descriptors (such as "slightly weathered to fresh") are permissible where equal distribution of both weathering characteristics is present over significant intervals or where characteristics present are "in between" the diagnostic feature. However, combination descriptors should not be used where significant, identifiable zones can be delineated. Only two adjacent descriptors may be combined. "Very intensely weathered" is the combination descriptor for "intensely weathered to decomposed."

ROCK LEGEND

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY A. CHEUNG

CHECKED BY

GEOTECHNICAL SERVICES

FIELD INVESTIGATION BY:

DATE:

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. HUANG
PROJECT ENGINEER

BRIDGE NO. 20-0295

POST MILES 3.23

PETALUMA RIVER (REPLACE)

LOG OF TEST BORINGS 3 OF 7

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET OF

FILE => ...\lotb\rw 152\152-z-ltb03.dgn

USERNAME => andrew_cheung PLOTTED => 11/23/2010 TIME PLOTTED => 2:13:13 PM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SON	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL — DATE: NA

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Stephen Huang — No. GE 2150 — Exp. 03/31/12 — GEOTECHNICAL — STATE OF CALIFORNIA

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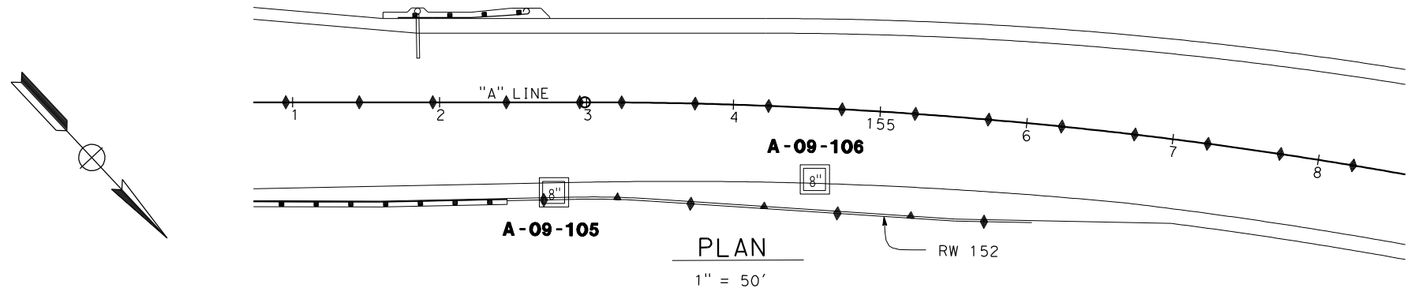
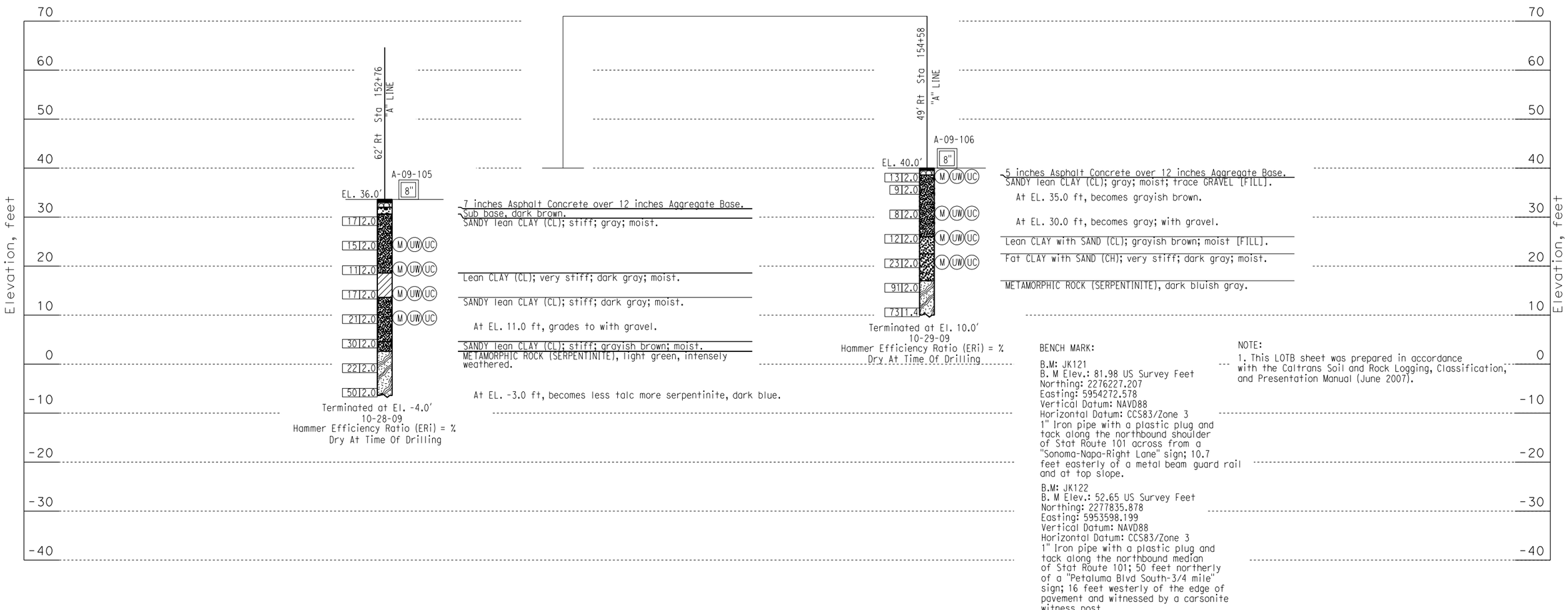
SUITE #200
SAN JOSE, CA 95113



PLAN
1" = 50'



BENCH MARK:

B.M: JK121
B. M Elev.: 81.98 US Survey Feet
Northing: 2276227.207
Easting: 5954272.578
Vertical Datum: NAVD88
Horizontal Datum: CCS83/Zone 3
1" Iron pipe with a plastic plug and tack along the northbound shoulder of Stat Route 101 across from a "Sonoma-Napa-Right Lane" sign; 10.7 feet easterly of a metal beam guard rail and at top slope.

B.M: JK122
B. M Elev.: 52.65 US Survey Feet
Northing: 2277835.878
Easting: 5953598.199
Vertical Datum: NAVD88
Horizontal Datum: CCS83/Zone 3
1" Iron pipe with a plastic plug and tack along the northbound median of Stat Route 101; 50 feet northerly of a "Petaluma Blvd South-3/4 mile" sign; 16 feet westerly of the edge of pavement and witnessed by a carsonite witness post.

NOTE:
1. This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (June 2007).

PROFILE
Ver. 1" = 10'
Hor. 1" = 50'

DESIGN OVERSIGHT
SIGN OFF DATE

DRAWN BY: A. CHEUNG
CHECKED BY: S. MANOHARAN

FIELD INVESTIGATION BY: C. RAMBO
DATE: XXXX

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. HUANG
PROJECT ENGINEER

BRIDGE NO. XX-XXXX
POST MILES XX.XX

RETAINING WALL No. 152
LOG OF TEST BORINGS 4 OF 7

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 2640C1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES — SHEET — OF

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SON	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL NA DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. GE 2150 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

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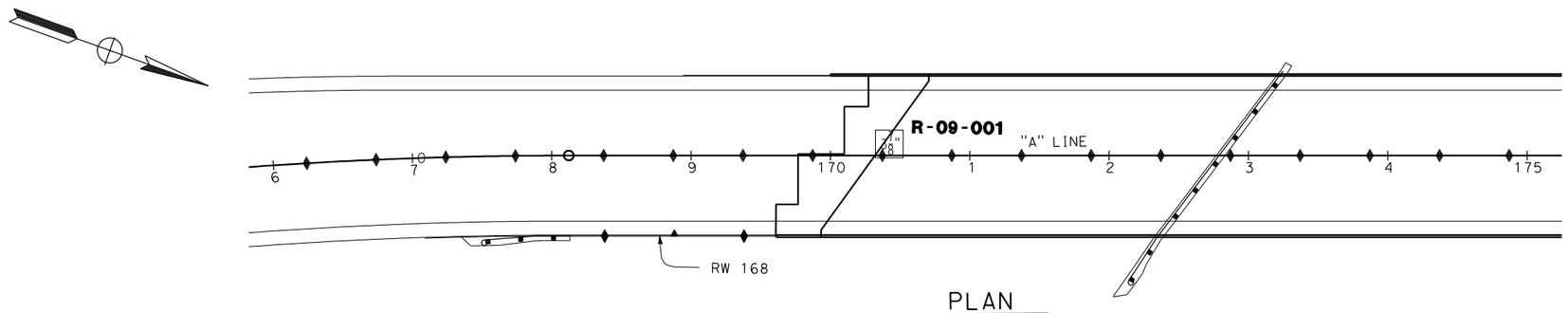
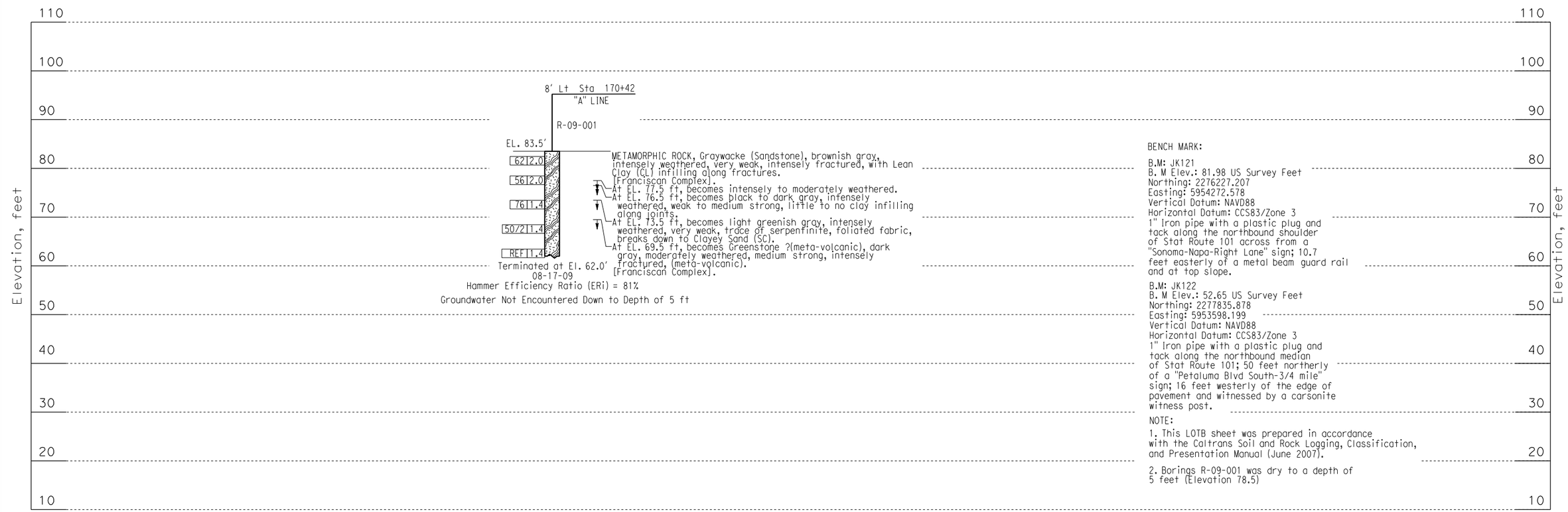
SUITE #200
SAN JOSE, CA 95113



PLAN

1" = 50'



BENCH MARK:

B.M: JK121
B. M Elev.: 81.98 US Survey Feet
Northing: 2276227.207
Easting: 5954272.578
Vertical Datum: NAVD88
Horizontal Datum: CCS83/Zone 3
1" Iron pipe with a plastic plug and tack along the northbound shoulder of Stat Route 101 across from a "Sonoma-Napa-Right Lane" sign; 10.7 feet easterly of a metal beam guard rail and at top slope.

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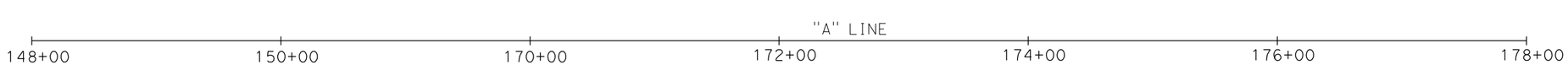
B. M Elev.: 52.65 US Survey Feet
Northing: 2277835.878
Easting: 5953598.199
Vertical Datum: NAVD88
Horizontal Datum: CCS83/Zone 3
1" Iron pipe with a plastic plug and tack along the northbound median of Stat Route 101; 50 feet northerly of a "Petaluma Blvd South-3/4 mile" sign; 16 feet westerly of the edge of pavement and witnessed by a carsonite witness post.

NOTE:

1. This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (June 2007).

2. Borings R-09-001 was dry to a depth of 5 feet (Elevation 78.5)



PROFILE
Ver. 1" = 10'
Hor. 1" = 50'

DESIGN OVERSIGHT	DRAWN BY A. CHEUNG	C. RAMBO FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	S. HUANG PROJECT ENGINEER	BRIDGE NO. XX-XXXX
SIGN OFF DATE	CHECKED BY S. MANOHARAN	DATE: XXXX			POST MILES XX.XX

RETAINING WALL No. 168

LOG OF TEST BORINGS 5 OF 7

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 2640C1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET OF

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04	SON	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL — DATE: NA

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Stephen Huang — No. GE 2150 — Exp. 03/31/12 — GEOTECHNICAL — STATE OF CALIFORNIA

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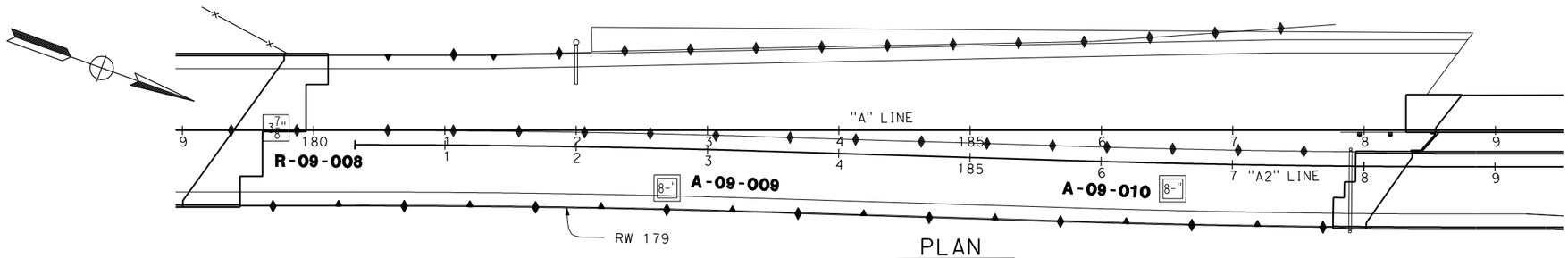
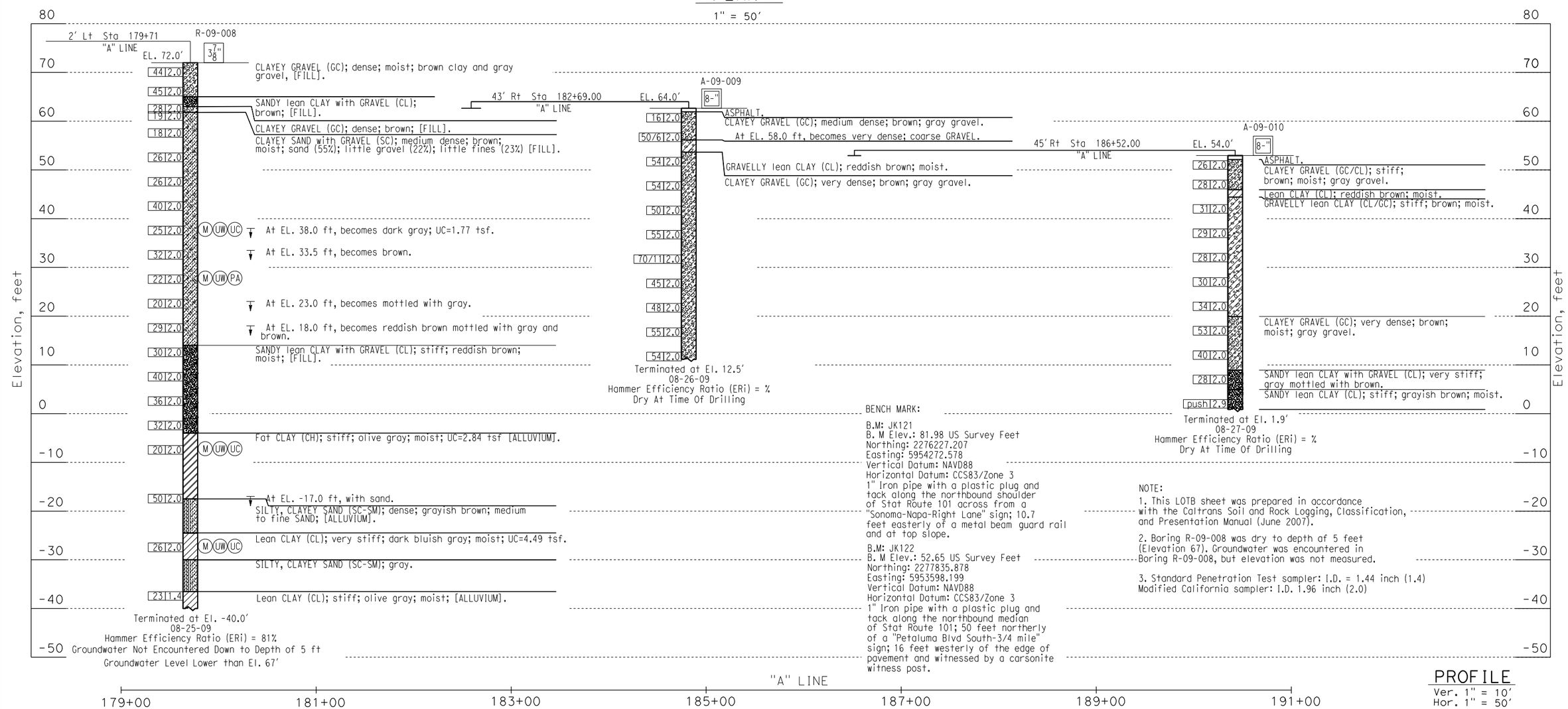
SAN JOSE, CA 95113



PLAN

1" = 50'



BENCH MARK:

B.M: JK121
B. M Elev.: 81.98 US Survey Feet
Northing: 2276227.207
Easting: 5954272.578
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NOTE:

1. This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (June 2007).

2. Boring R-09-008 was dry to depth af 5 feet (Elevation 67). Groundwater was encountered in Boring R-09-008, but elevation was not measured.

3. Standard Penetration Test sampler: I.D. = 1.44 inch (1.4)
Modified California sampler: I.D. 1.96 inch (2.0)

PROFILE

Ver. 1" = 10'
Hor. 1" = 50'

DESIGN OVERSIGHT	DRAWN BY: A. CHEUNG	C. RAMBO	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	S. HUANG	BRIDGE NO. XX-XXXX
SIGN OFF DATE	CHECKED BY: S. MANOHARAN	FIELD INVESTIGATION BY: DATE: XXXX		PROJECT ENGINEER	POST MILES XX.XX

RETAINING WALL No. 179

LOG OF TEST BORINGS 6 OF 7

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 2640C1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES — SHEET — OF

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04	SON	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL — DATE: NA

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Stephen Huang — No. GE 2150 — Exp. 03/31/12 — GEOTECHNICAL — STATE OF CALIFORNIA

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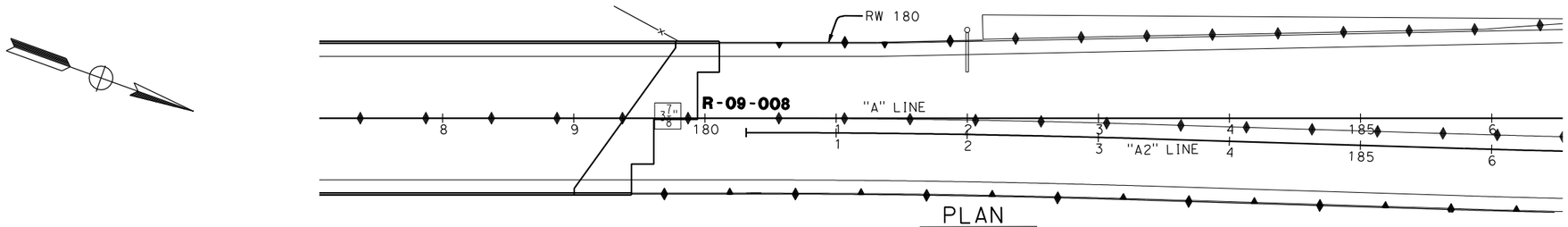
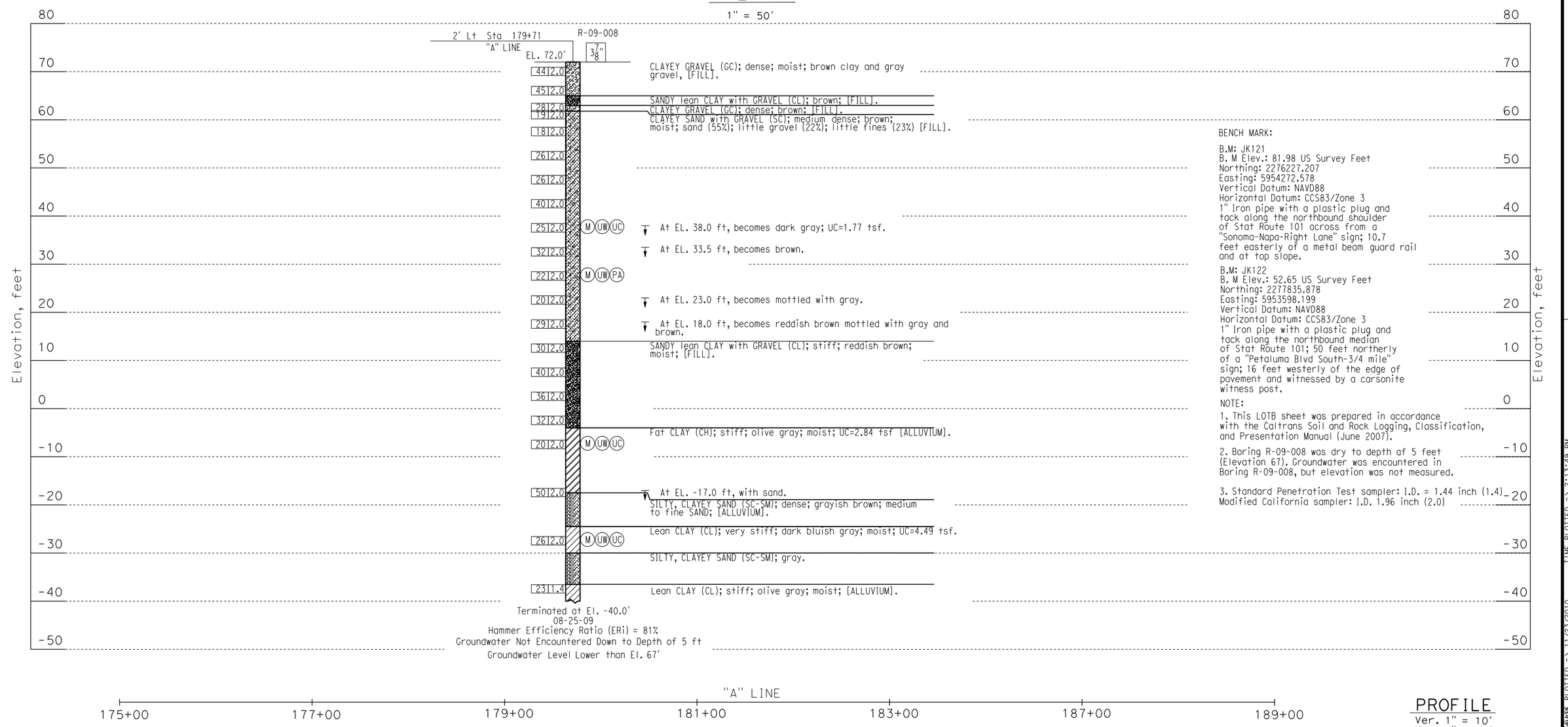


PLAN
1" = 50'



BENCH MARK:

B.M: JK121
B. M Elev.: 81.98 US Survey Feet
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NOTE:

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2. Boring R-09-008 was dry to depth of 5 feet (Elevation 67). Groundwater was encountered in Boring R-09-008, but elevation was not measured.

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Modified California sampler: I.D. 1.96 inch (2.0)

PROFILE
Ver. 1" = 10'
Hor. 1" = 50'

DESIGN OVERSIGHT	DRAWN BY: A. CHEUNG	C. RAMBO	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	S. HUANG	BRIDGE NO. XX-XXXX
SIGN OFF DATE	CHECKED BY: S. MANOHARAN	FIELD INVESTIGATION BY: DATE: XXXX		PROJECT ENGINEER	POST MILES XX.XX

RETAINING WALL No. 180

LOG OF TEST BORINGS 7 OF 7

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 2640C1

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REVISION DATES — SHEET — OF

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REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SON	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL — DATE: NA

PLANS APPROVAL DATE

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CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

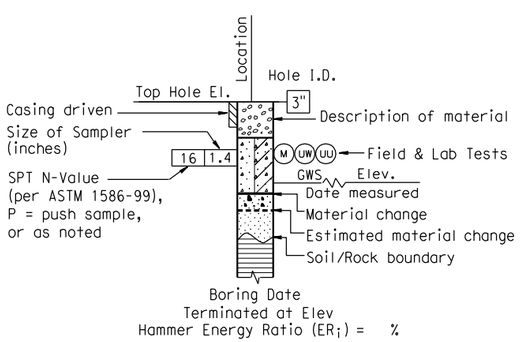
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
⬚	O	Other

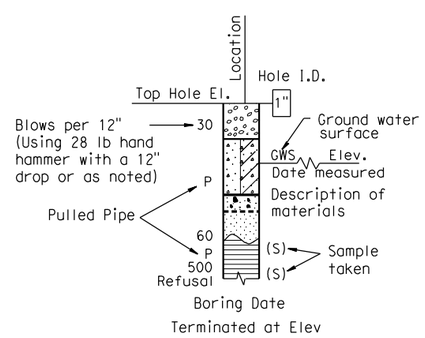
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

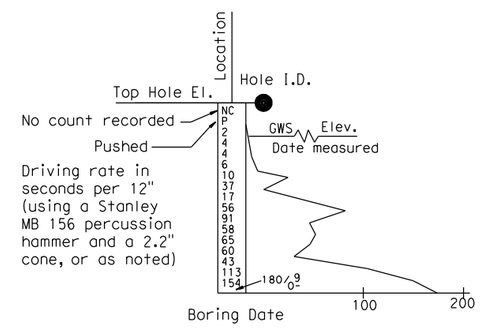
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.



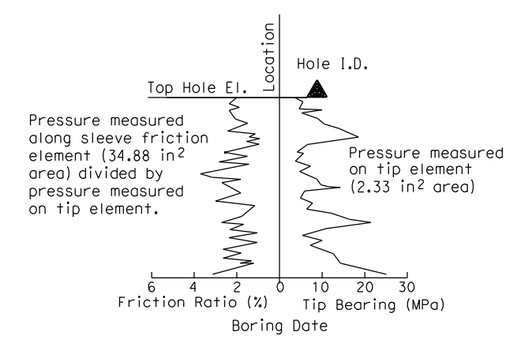
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

DESIGN OVERSIGHT	DRAWN BY: A. CHEUNG	C. RAMBO FIELD INVESTIGATION BY: DATE:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	S. HUANG PROJECT ENGINEER	BRIDGE NO.
SIGN OFF DATE	CHECKED BY: MANOHARAN				POST MILES

SOUNDWALL 297

LOG OF TEST BORINGS 1 OF 3

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS: 0 1 2 3

CU 04
EA 2640C1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES — SHEET — OF

FILE => ...\soundwall-297-ltb01.dgn

USERNAME => andrew_cheung PLOTTED => 3/30/2010 TIME PLOTTED => 5:02:16 PM

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic/Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SON	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL — DATE NA

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Stephen Huang — No. GE 2150 — Exp. 03/31/12 — GEOTECHNICAL — STATE OF CALIFORNIA

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SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401

URS Corporation
100 WEST SAN FERNANDO St
SUITE #200
SAN JOSE, CA 95113

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY A. CHEUNG

CHECKED BY MANOHARAN

C. RAMBO
FIELD INVESTIGATION BY:
DATE:

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. HUANG
PROJECT ENGINEER

BRIDGE NO.

POST MILES

SOUNDWALL 297
LOG OF TEST BORINGS 2 OF 3

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 2640C1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET OF

FILE => ...\soundwall-297-ltb02.dgn

USERNAME => andrew_cheung PLOTTED => 3/30/2010 TIME PLOTTED => 5:02:31 PM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SON	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL — DATE: NA

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Stephen Huang — No. GE 2150 — Exp. 03/31/12 — GEOTECHNICAL — STATE OF CALIFORNIA

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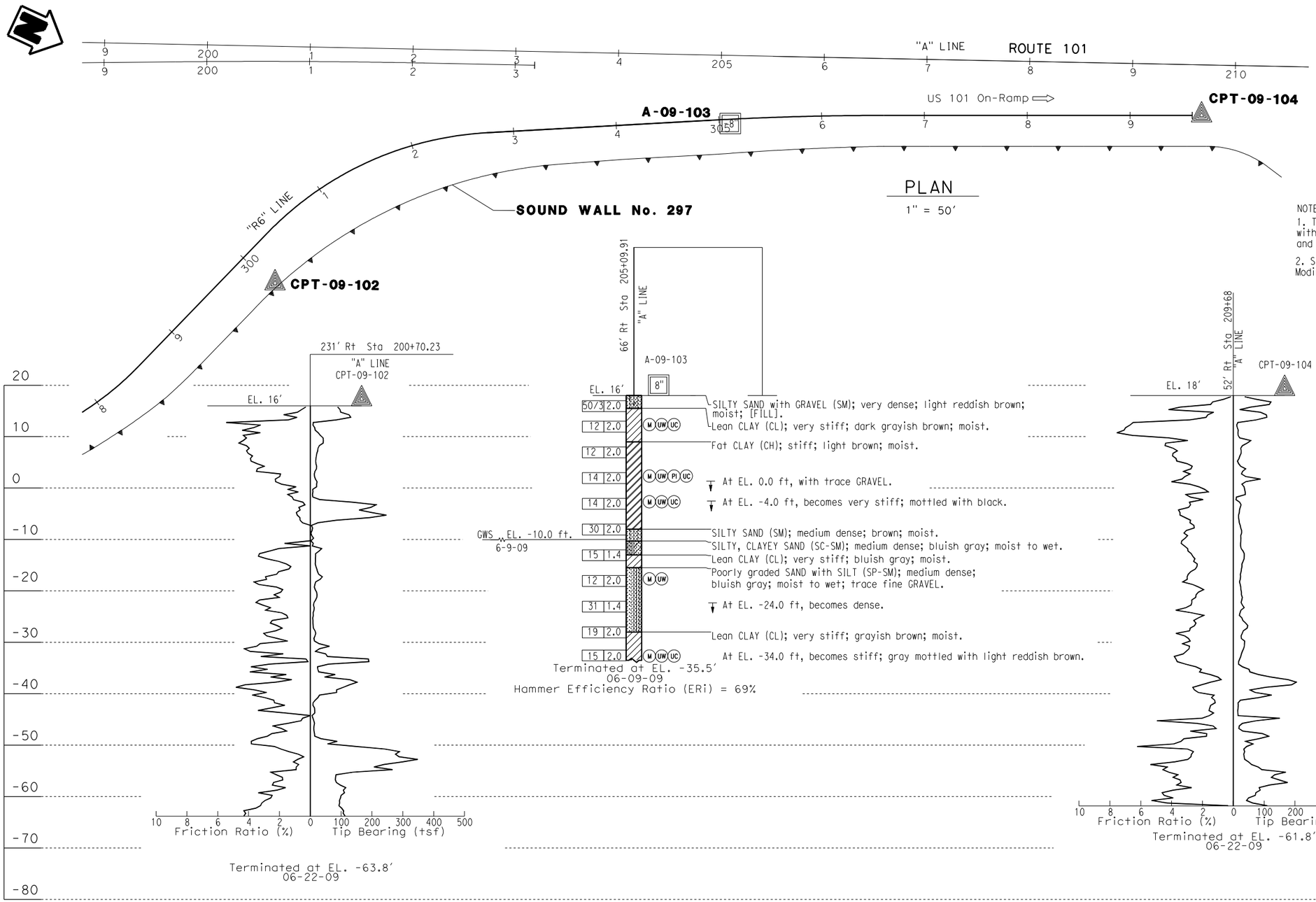
100 WEST SAN FERNANDO St
SUITE #200
SAN JOSE, CA 95113



NOTE:

1. This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (June 2007).

2. Standard Penetration Test sampler: I.D. = 1.44 inch (1.4)
Modified California sampler: I.D. = 1.96 inch (2.0)

BENCH MARK:

B.M: JK121
B. M Elev.: 81.98 US Survey Feet
Northing: 2276227.207
Easting: 5954272.578
Vertical Datum: NAVD88
Horizontal Datum: CCS83/Zone 3
1" Iron pipe with a plastic plug and tack along the northbound shoulder of Stat Route 101 across from a "Sonoma-Napa-Right Lane" sign; 10.7 feet easterly of a metal beam guard rail and at top slope.

B.M: JK122
B. M Elev.: 52.65 US Survey Feet
Northing: 2277835.878
Easting: 5953598.199
Vertical Datum: NAVD88
Horizontal Datum: CCS83/Zone 3
1" Iron pipe with a plastic plug and tack along the northbound median of Stat Route 101; 50 feet northerly of a "Petaluma Blvd South-3/4 mile" sign; 16 feet westerly of the edge of pavement and witnessed by a carsonite witness post.

PROFILE
Ver. 1" = 10'
Hor. 1" = 50'

DESIGN OVERSIGHT	DRAWN BY: A. CHEUNG	C. RAMBO — FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	S. HUANG — PROJECT ENGINEER	BRIDGE NO.
SIGN OFF DATE	CHECKED BY: MANOHARAN	DATE:			POST MILES

SOUND WALL No. 297

LOG OF TEST BORINGS 3 OF 3

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 2640C1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

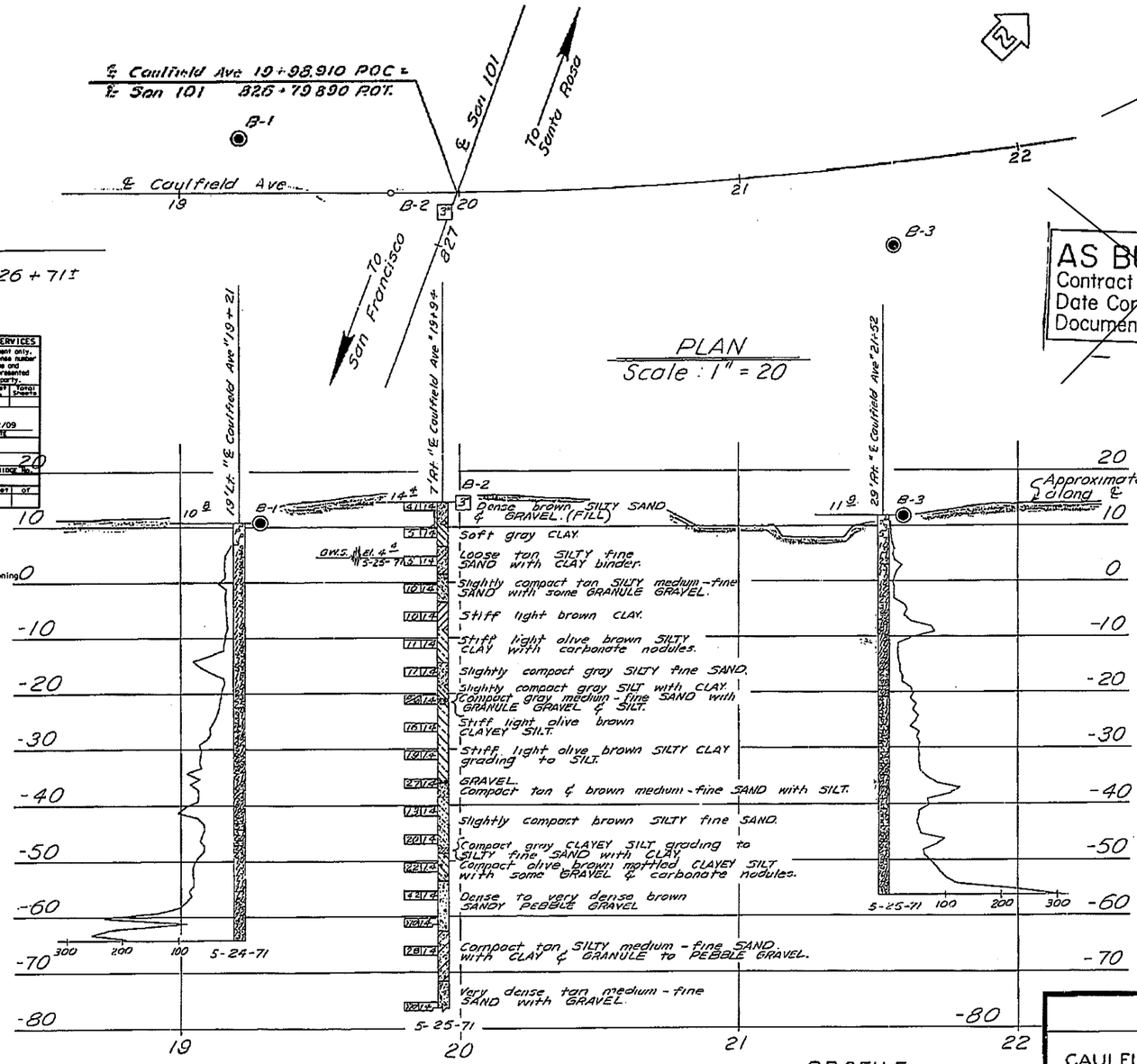
REVISION DATES — SHEET — OF

FILE => ...\soundwall-297-ltb03.dgn

USERNAME => andrew_cheung — DATE PLOTTED => 3/30/2010 — TIME PLOTTED => 5:02:47 PM

DIST.	COUNTY	ROUTE	PROJECT	PROJECT No.	TOTAL SHEETS
04	Son	101	4.8	35	35

John A. Freund
October 2, 1972



AS BUILT PLANS
Contract No. 04-358714
Date Completed 10-72
Document No. 04-000 6464

AS BUILT
CORRECTIONS
CONTRACT NO.
DATE

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

"As-Built" Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	PROJECT No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED GEOTECHNICAL ENGINEER — DATE 12/2/09

DATE PLOTTED => 3/24/2010

SOUND WALL No. 211

LOG OF TEST BORINGS (1 OF 1)

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

DIst 04
EA: 2640C1

BRIDGE No.
Sheet of

Revisions made to this Log of Test Borings from the original 1971 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from ℄ Line
B2	210+40.00	0 Ctr

Notes:
1. See the General plans and/or Foundation plan for stationing

REGISTERED PROFESSIONAL ENGINEER
Stephen Huang
No. GE 2150
Exp. 03/31/12
GEOTECHNICAL
STATE OF CALIFORNIA

LEGEND OF BORING OPERATIONS

Penetrometer
2½" Core Penetrometer
Sampler Borings (any)
Rotary Borings (any)
Auger Borings (any)
Jet Borings
Core Borings
Test Pit

LEGEND OF EARTH MATERIALS

Gravel
Sand
Silt
Clay
Silty Clay or Clayey Silt
Organic Matter
Fill Material
Igneous Rock
Sedimentary Rock
Metamorphic Rock
Sandy Clay or Clayey Sand
Silty Sand or Silty Sand

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRAIN SIZE LIMITS

Durgin prepared the base for estimates of grain size distribution curves as after-thought. If equal to passed is approximately equal to the clay fraction, the term "silty" is used. If equal to passed is approximately equal to the silt fraction, the term "clayey" is used. The terms "silty sand" or "clayey sand" are used to describe sand, silt and gravel, refer to unified soil classification chart for limits.

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

FIELD STUDY — W.F. Christian 5-71
DRAWN — S. Tomasevich 7-71
CHECKED — R.E. Ryan 7-71
Approved for Transmittal by R.E. Ryan
Geotechnical Engineer

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

35

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

CAULFIELD LANE OVERCROSSING

LOG OF TEST BORINGS

BRIDGE NO.	POST MILE	DRAWING NO.	SHEET	OF
20-245	4.0		10	10

REVISION DATES

WO 358711
CU 04219

Disregard prints bearing earlier revision dates

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	1.3/2.6		

Ali Kaddoura 12-09-09
REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Ali K. Kaddoura No. 55710 Exp. 12-31-10 CIVIL STATE OF CALIFORNIA

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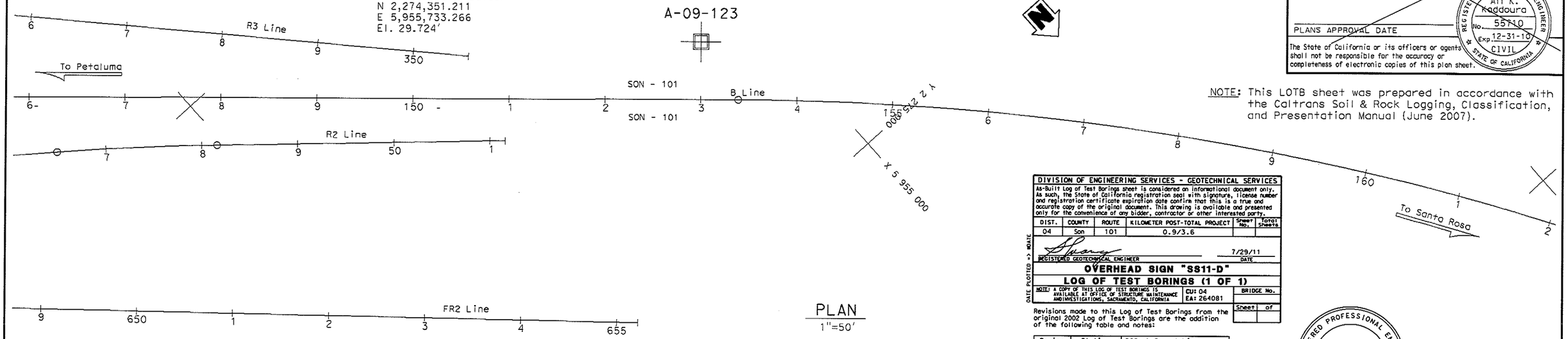
BENCH MARK

PM 2.80
VG 9,167
Found Surveyers' marker pin
in flight cross
HV626 in NB shoulder
N 2,274,351.211
E 5,955,733.266
El. 29.724'



PLAN
1"=50'

NOTE: This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2007).

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	Sheet No.	Total Sheets
04	Son	101	0.9/3.6		

REGISTERED GEOTECHNICAL ENGINEER 7/29/11 DATE

OVERHEAD SIGN "SS11-D"

LOG OF TEST BORINGS (1 OF 1)

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: 04
EA: 264081

BRIDGE No.
Sheet of

DATE PLOTTED => MDATE

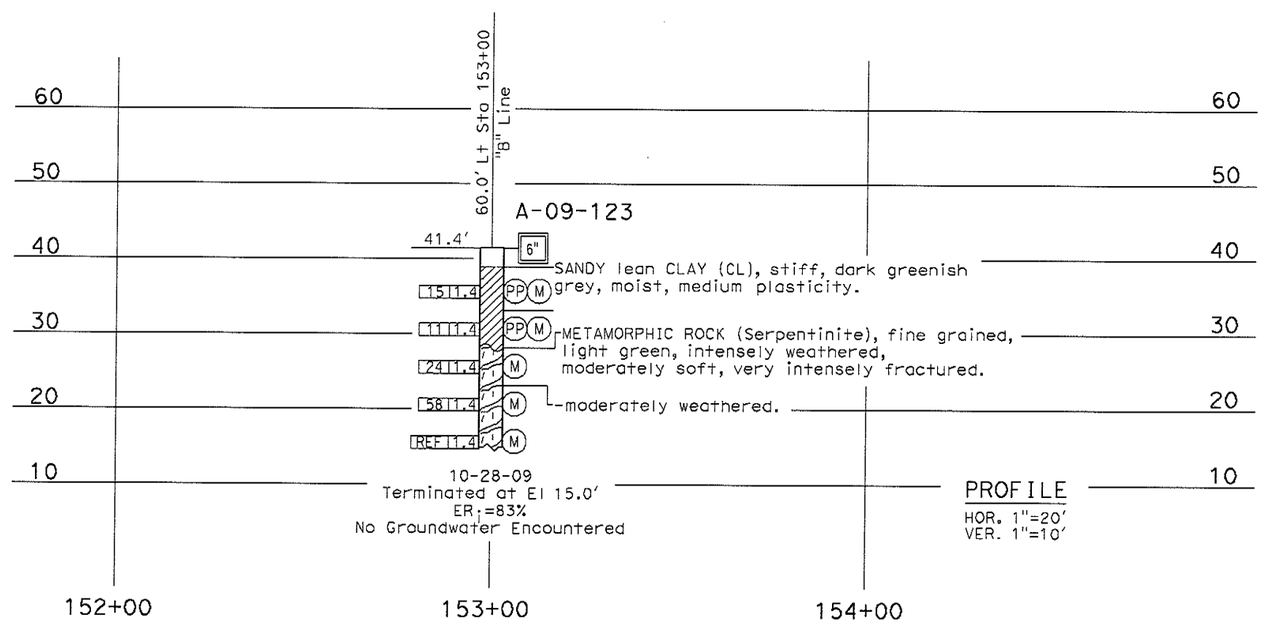
Revisions made to this Log of Test Borings from the original 2002 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from A Line
A-09-123	153+00.00	60.0' Lt

Notes:

1. See the General plan and Foundation plan for stationing.

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. GE 2150 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA



ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES OFFICE OF GEOTECHNICAL DESIGN BRANCH	BRIDGE NO. / POST MILES	OVERHEAD SIGN "F" LOG OF TEST BORINGS 10 of 13
FUNCTIONAL SUPERVISOR NAME: H. Nikoui	DRAWN BY: M. Reynolds 12-09 CHECKED BY: R. Nashed	FIELD INVESTIGATION BY: M. Zabolzadeh			

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 264081

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 12-21-09 03-16-10 SHEET OF

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USERNAME => andrew_chang TIME PLOTTED => 8:56:45 AM DATE PLOTTED => 3/23/2010

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SON	101	0.9/3.6		

GEOTECHNICAL PROFESSIONAL 7/29/11 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. GE 2150 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

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SUITE #200
SAN JOSE, CA 95113

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

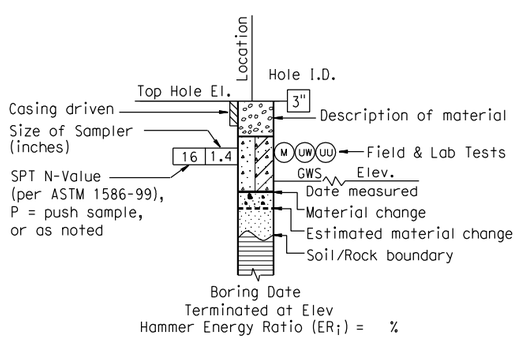
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
⬚	O	Other

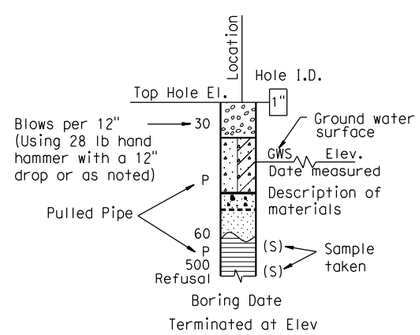
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

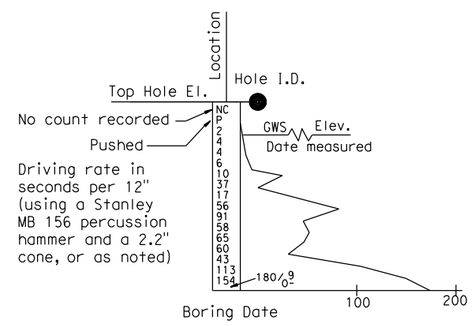
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.



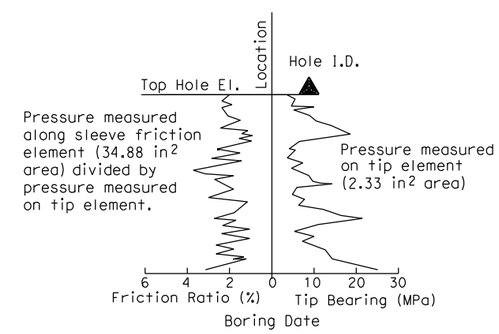
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

DESIGN OVERSIGHT	DRAWN BY A. CHEUNG	C. RAMBO FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	S. HUANG PROJECT ENGINEER	BRIDGE NO. / POST MILES
SIGN OFF DATE	CHECKED BY MANOHARAN	DATE:			OVERHEAD SIGN "SS14-E" / LOG OF TEST BORINGS 1 OF 3

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 2640C1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

FILE => ...\OverheadSign-SS14-E-ltb01.dgn

USERNAME => madhu_thurlo@dot.ca.gov PLOTTED => 7/29/2011 TIME PLOTTED => 9:10:39 AM

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SON	101	0.9/3.6		

GEOTECHNICAL PROFESSIONAL — DATE 7/29/11

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Stephen Huang — No. GE 2150 — Exp. 03/31/12 — GEOTECHNICAL — STATE OF CALIFORNIA

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URS Corporation
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SUITE #200
SAN JOSE, CA 95113

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names	Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND	CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND		
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND	CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND	ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GM	SILTY GRAVEL SILTY GRAVEL with SAND	OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND	OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL		
SP	Poorly graded SAND Poorly graded SAND with GRAVEL	CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL		
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL		
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
SM	SILTY SAND SILTY SAND with GRAVEL		
SC	CLAYEY SAND CLAYEY SAND with GRAVEL	OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
PT	PEAT	OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND
	COBBLES COBBLES and BOULDERS BOULDERS		

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY A. CHEUNG

CHECKED BY MANOHARAN

C. RAMBO
FIELD INVESTIGATION BY:
DATE:

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. HUANG
PROJECT ENGINEER

BRIDGE NO. XX-XXXX
POST MILES XX.XX

OVERHEAD SIGN "SS14-E"
LOG OF TEST BORINGS 2 OF 3

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 2640C1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES — SHEET — OF

FILE => ...\OverheadSign-SS14-E-ltb02.dgn

USERNAME => madhu_thurai — LAST PLOTTED => 7/29/2011 — TIME PLOTTED => 9:11:38 AM

BENCH MARK:
B.M: JK 121 Elev 81.98′
1" Iron pipe with a plastic plug and tack along the northbound shoulder of State Route 101 across from a "Sonoma-Napa-Right Lane" sign; 10.7 feet easterly of a metal beam guard rail and at top of slope.
NAVD 1988
B.M: JK122 Elev 52.65′
1" Iron pipe with a plastic plug and tack along the northbound median of State Route 101; 50′ northerly of a "Petaluma Blvd South-3/4 mile" sign; 16 feet westerly of the edge of pavement and witnessed by a carsonite witness post.
NAVD 1988

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SON	101	0.9/3.6		

GEOTECHNICAL PROFESSIONAL 7/29/11 DATE

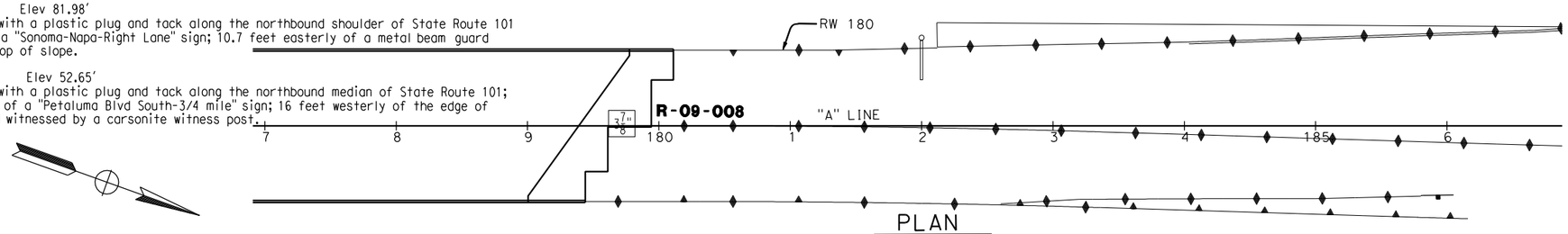
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. GE 2150 EXP. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

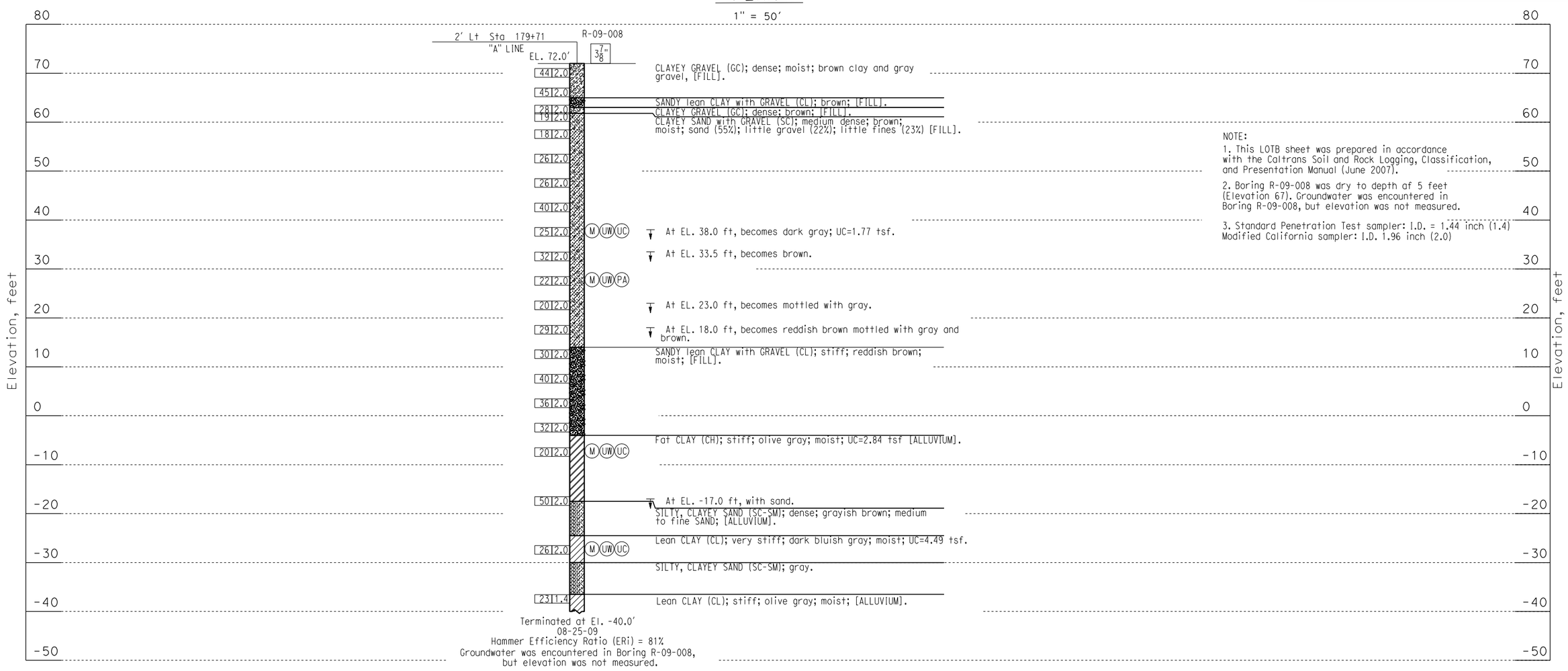
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401

URS Corporation
100 WEST SAN FERNANDO St
SUITE #200
SAN JOSE, CA 95113



PLAN
1" = 50′



NOTE:
1. This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (June 2007).
2. Boring R-09-008 was dry to depth af 5 feet (Elevation 67). Groundwater was encountered in Boring R-09-008, but elevation was not measured.
3. Standard Penetration Test sampler: I.D. = 1.44 inch (1.4)
Modified California sampler: I.D. 1.96 inch (2.0)

PROFILE
Ver. 1" = 10′
Hor. 1" = 50′

DESIGN OVERSIGHT	DRAWN BY: A. CHEUNG	C. RAMBO	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	S. HUANG	BRIDGE NO. N/A
SIGN OFF DATE	CHECKED BY: S. MANOHARAN	FIELD INVESTIGATION BY: DATE: 8/25/2009		PROJECT ENGINEER	POST MILES N/A

OVERHEAD SIGN "SS14-E"
LOG OF TEST BORINGS 3 OF 3

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 264081

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

FILE => ...\OverheadSign-SS14-E-1tb03.dgn

USERNAME => modhu_thuong@urs PLOTTED => 7/29/2011 TIME PLOTTED => 9:13:17 AM

LABORATORY TESTING PROGRAM

A laboratory testing program was carried out to determine the index and engineering properties of the major subsurface strata encountered at the site. The laboratory testing program included conventional tests to confirm the existing information on the engineering characteristics of the major strata and to refine some of the engineering parameters. These tests were performed at the URS' laboratory.

This appendix briefly describes the testing program and procedures for the different types of tests, and then presents detailed test results.

Index Tests

Index tests were performed on both cohesive and cohesionless soil samples to aid in soil classification and in correlation with other engineering parameters. Index tests included Atterberg Limits, gradation analyses, moisture content and dry density determinations. Atterberg Limits tests were performed in accordance with ASTM D 4318. Particle analyses were performed in accordance with ASTM D 422. The moisture content tests were performed in accordance with ASTM D 2216. Dry density was determined in accordance with ASTM D 2937. The locations of these tests are indicated on the Logs of Test Borings adjacent to the appropriate sample depths. The results are summarized in Table 2-1.

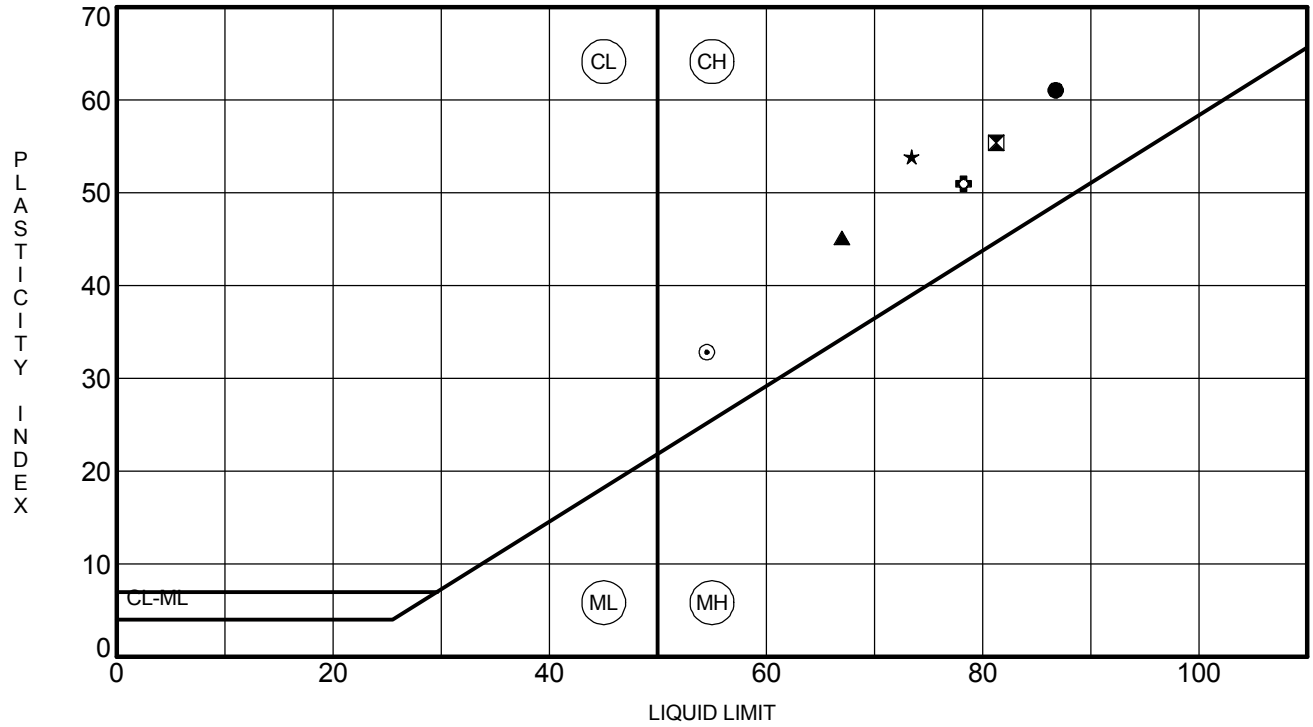
A plasticity chart graphically presenting the results of the Atterberg Limits tests is included on Figure B-1. Grain size distribution curves are presented graphically on Figure B-2.

Unconfined Compression Tests

Unconfined compression tests were performed on select cohesive soil samples to assist in determining shear strength parameters. These tests were performed in accordance with ASTM D 2166. The locations of these tests are indicated on the Logs of Test Borings adjacent to the appropriate sample depths. The results are summarized in Table 2-1.

Consolidation Tests

Five consolidation tests were performed on selected samples of undisturbed clayey soil to evaluate the compressibility characteristics and past geologic history. The consolidation test was performed in accordance with ASTM D 4186. Consolidation test results are graphically presented on Figure B-3 through B-7.



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**R-09-012**	**20.0**	**87**	**26**	**61**		**Fat CLAY with SAND**
⊠	**R-09-012**	**45.0**	**81**	**26**	**55**		**Fat CLAY**
▲	**R-09-013**	**14.0**	**67**	**22**	**45**		**Fat CLAY**
★	**R-09-014**	**11.2**	**73**	**20**	**53**		**Fat CLAY**
⊙	**R-09-014**	**65.0**	**55**	**22**	**33**		**Fat CLAY**
✿	**R-09-015**	**75.0**	**78**	**27**	**51**		**Fat CLAY**

URS

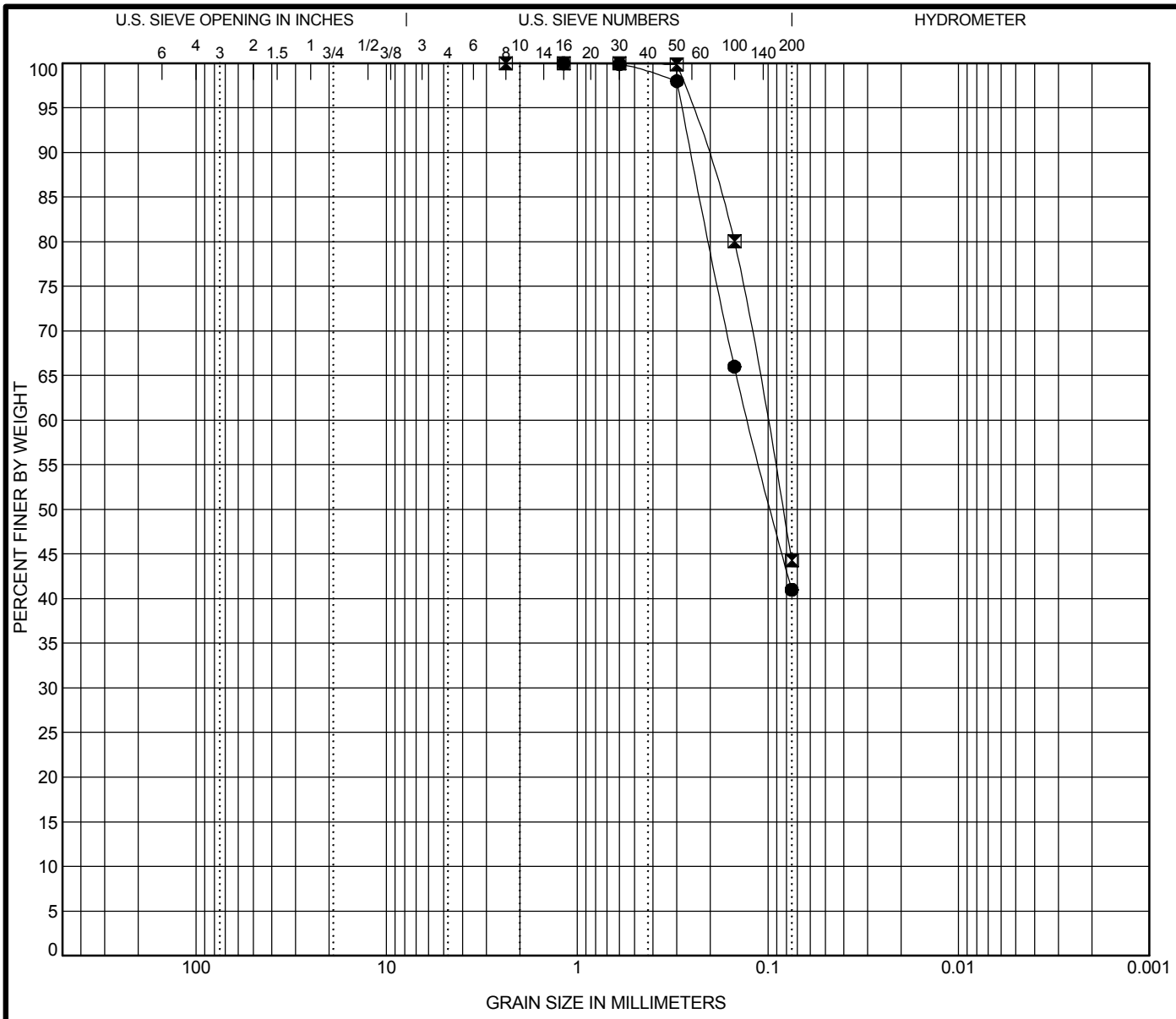
55 S. Market St, Ste 1500
San Jose, CA 95113

ATTERBERG LIMITS' RESULTS

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-1

URS ATTERBERG LIMITS 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 9/29/09



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**R-09-013**	**26.0**	**SILTY SAND**					
⊠	**R-09-014**	**15.0**	**Silty SAND (SM)**					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**R-09-013**	**26.0**	**1.18**	**0.127**			**0.0**	**59.0**	**41.0**	
⊠	**R-09-014**	**15.0**	**2.36**	**0.102**			**0.0**	**55.7**	**44.3**	

URS

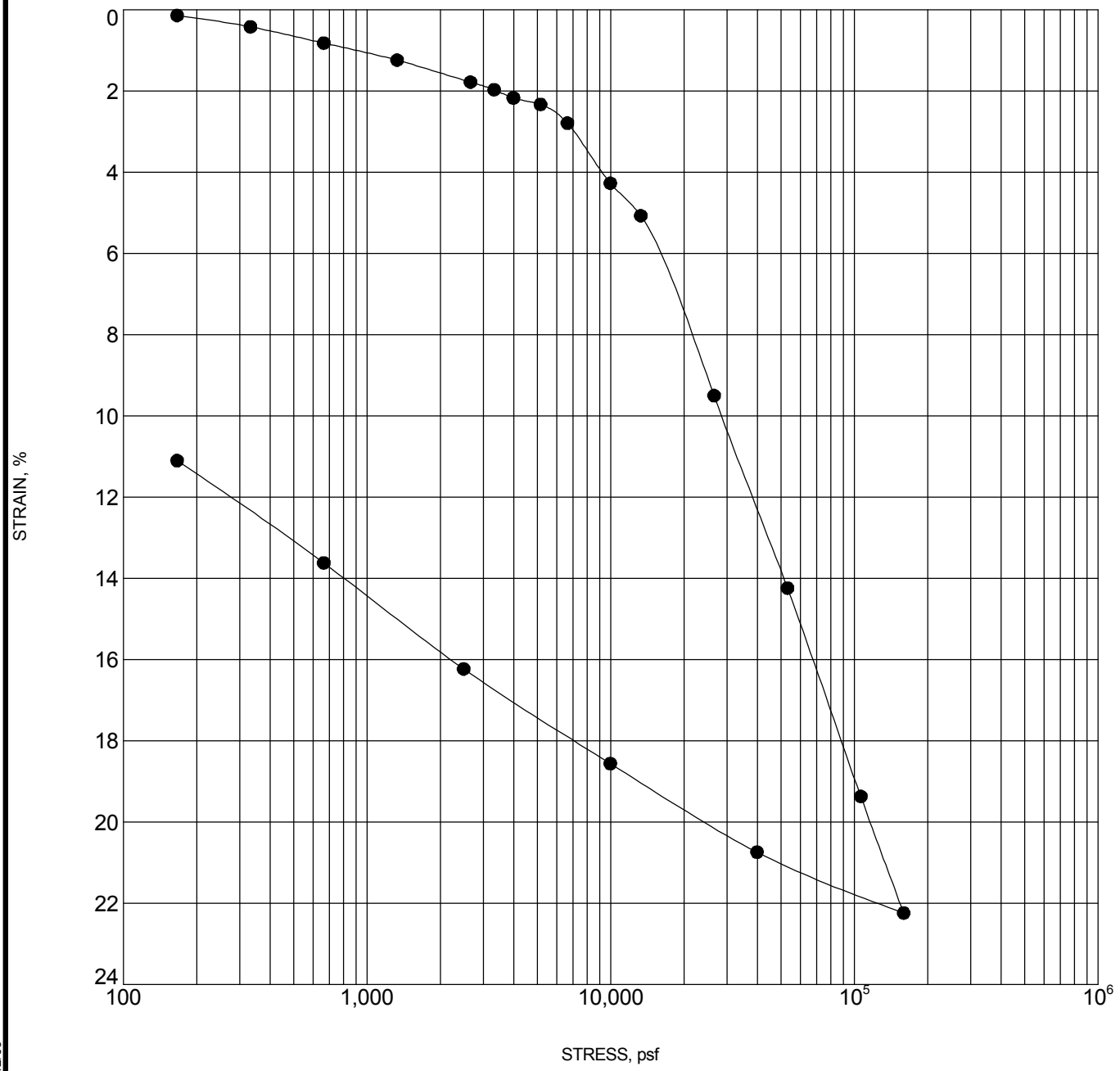
55 S. Market St, Ste 1500
San Jose, CA 95113

GRAIN SIZE DISTRIBUTION

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-2

URS GRAIN SIZE 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 12/2/09



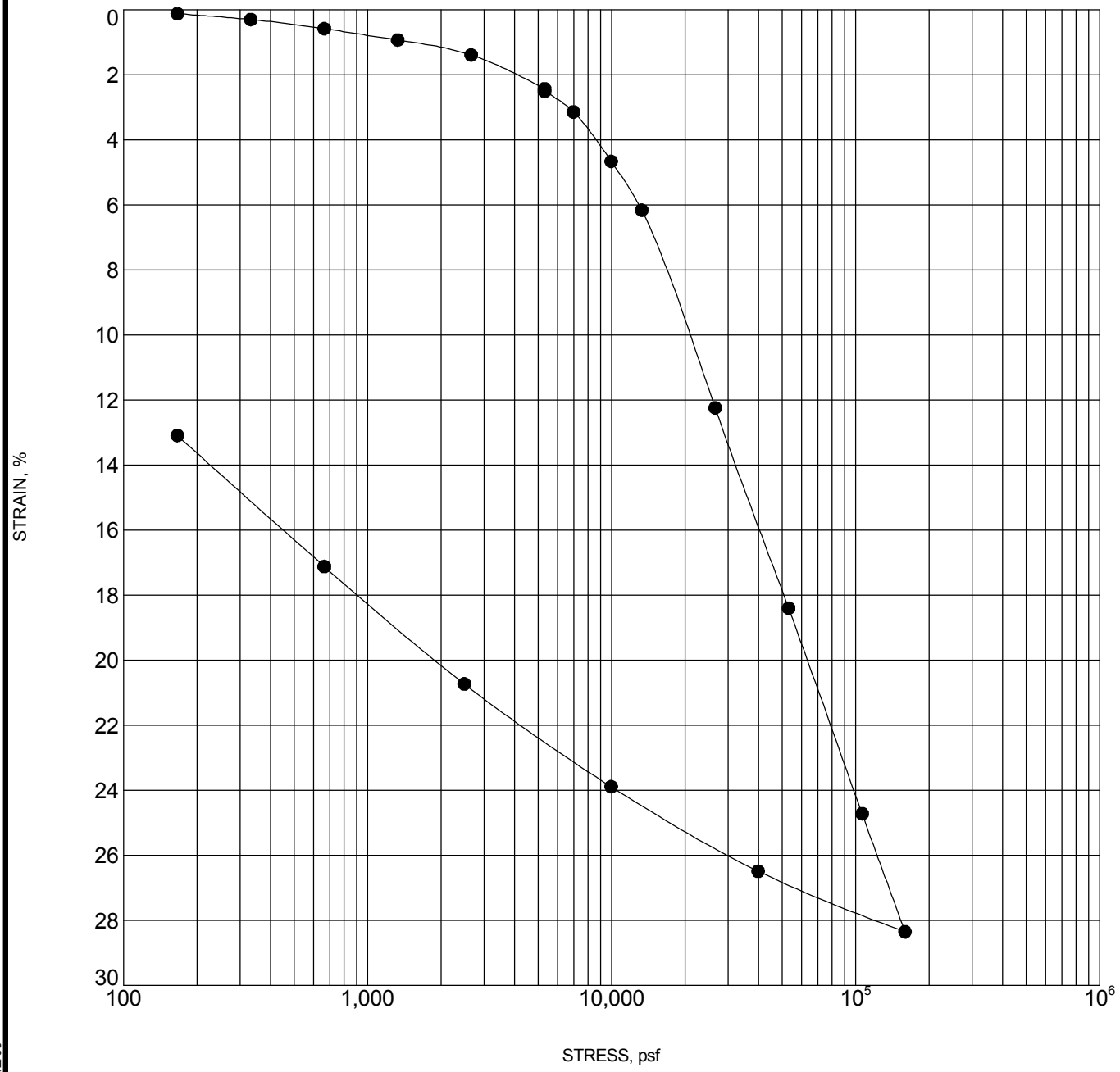
Specimen Identification			Classification	γ_d	MC%
●	**R-09-011**	**78.0**	**Lean CLAY**	**108**	**25**

CONSOLIDATION TEST

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-3

US EM CONSOL STRAIN 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 12/2/09



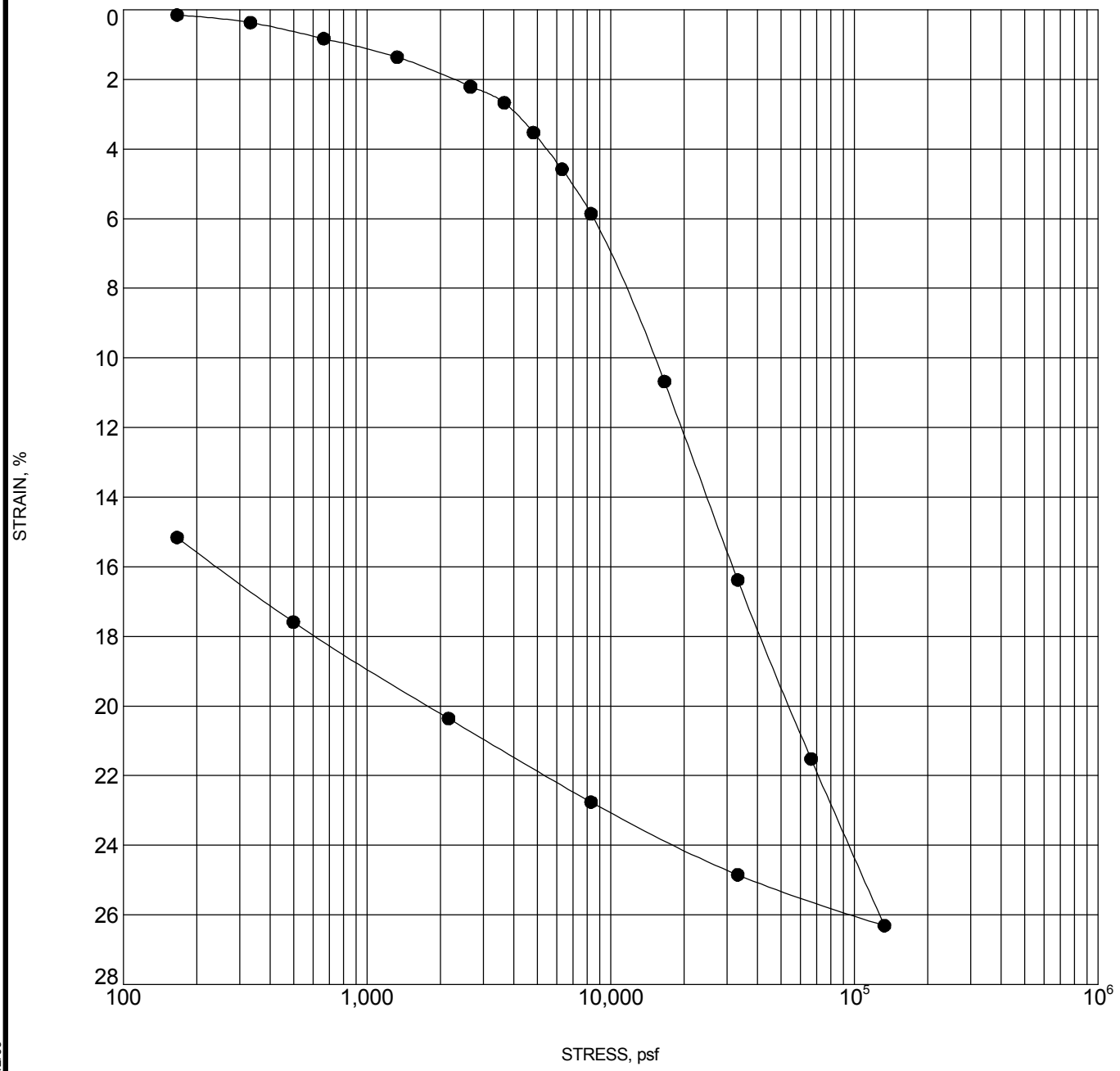
Specimen Identification			Classification	γ_d	MC%
●	**R-09-012**	**15.0**	**Fat CLAY**	**99**	**31**

CONSOLIDATION TEST

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-4

US EM CONSOL STRAIN 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 12/2/09



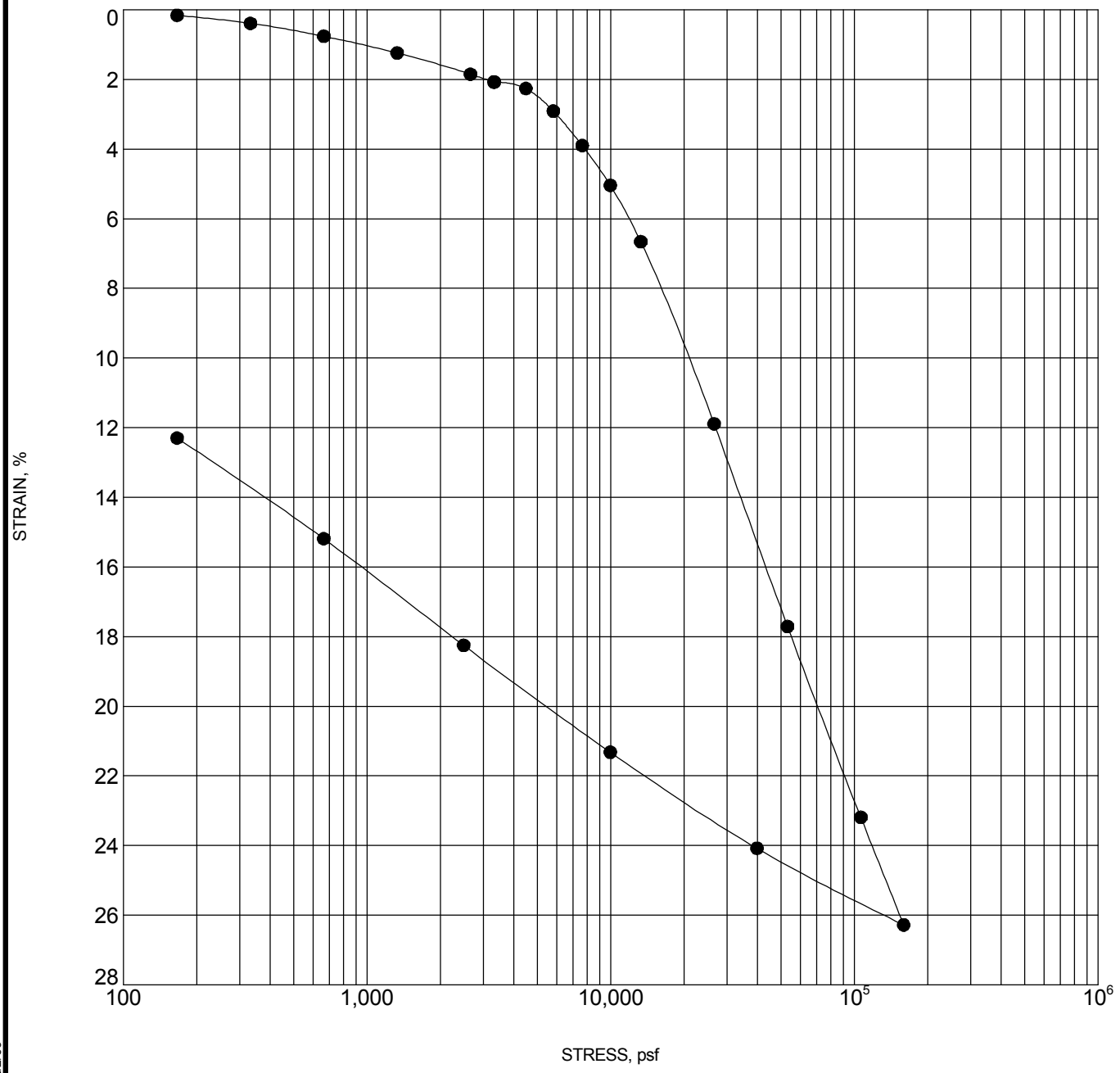
Specimen Identification			Classification	γ_d	MC%
●	**R-09-014**	**30.0**	**Lean CLAY**	**101**	**27**

CONSOLIDATION TEST

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-5

US EM CONSOL STRAIN 28645040 MSNB4PETRIVER.GPJ SNJ_CT.GLB 12/2/09



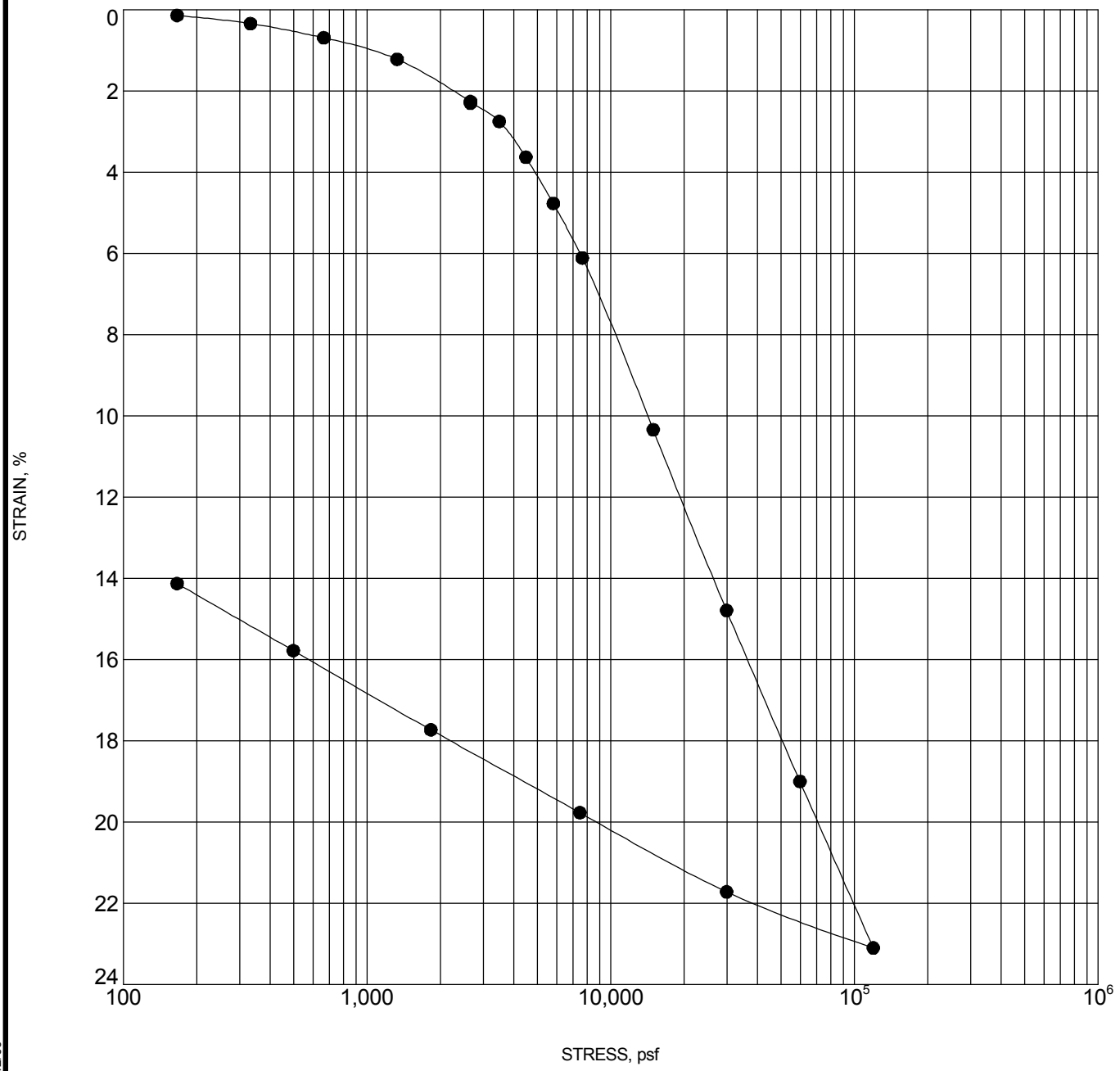
Specimen Identification			Classification	γ_d	MC%
●	**R-09-014**	**65.0**	**Fat CLAY**	**100**	**29**

CONSOLIDATION TEST

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-6

US EM CONSOL STRAIN 28645040 MSNB4PETRIVER.GPJ SNJ CT.GLB 12/2/09



Specimen Identification			Classification	γ_d	MC%
●	**R-09-015**	**25.0**	**Lean CLAY**	**101**	**25**

CONSOLIDATION TEST

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-7

US EM CONSOL STRAIN 28645040 MSNB4PETRIVER.GPJ SNJ_CT.GLB 12/2/09

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	120	148

Caltrans Metric

GEOTECHNICAL PROFESSIONAL

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/05 — STATE OF CALIFORNIA

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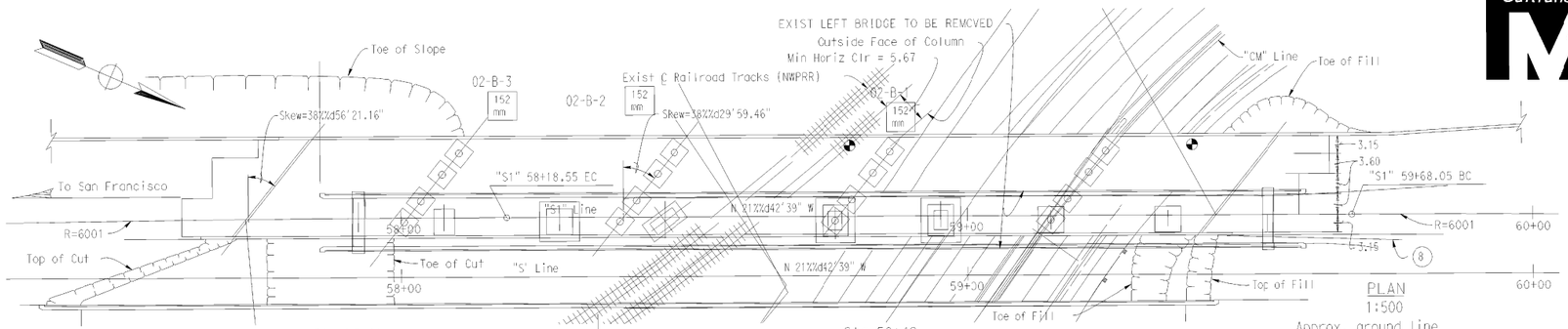
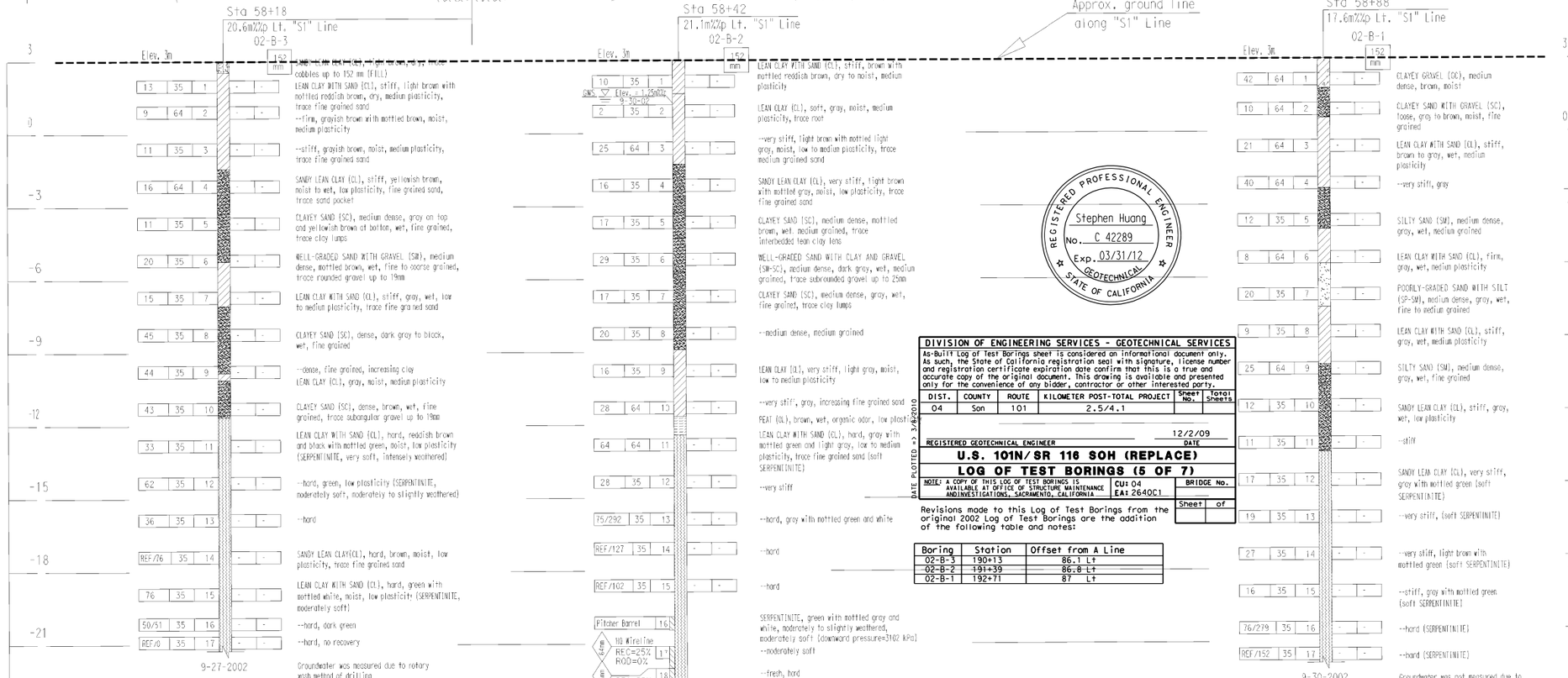
PARIKH CONSULTANTS, INC.
356 SOUTH MILPITAS BLVD.
MILPITAS CA 95035

Caltrans now has a web site! To get to the web site, go to: http://www.dot.pa.gov





BENCHMARK:
Elevations based on surveyed topography.

REGISTERED PROFESSIONAL ENGINEER — Stephen Huang — No. C 42289 — Exp. 03/31/12 — GEOTECHNICAL — STATE OF CALIFORNIA

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	Sheet No.	Total Sheets
04	Son	101	2.5/4.1		

REGISTERED GEOTECHNICAL ENGINEER — 12/2/09 DATE

DATE PLOTTED => 3/8/2010

U.S. 101N/SR 116 SOH (REPLACE)

LOG OF TEST BORINGS (5 OF 7)

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA.

CU: 04
EA: 2640C1

BRIDGE No. ____ Sheet ____ of ____

Revisions made to this Log of Test Borings from the original 2002 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from A Line
02-B-3	190+13	86.1 Lt
02-B-2	191+39	86.8 Lt
02-B-1	192+71	87 Lt

PROFILE
Vert. = 1:100
Hor. = 1:200

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

Notes:

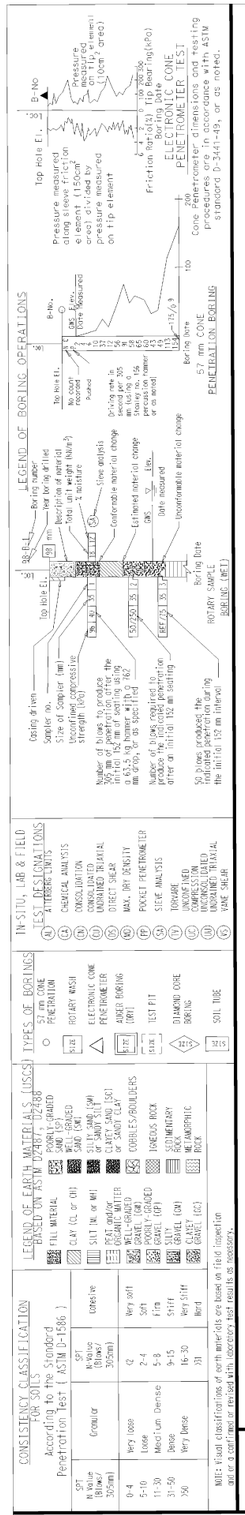
1. See the General plan and/or Foundation plan for stationing.
2. Structure Design produced the data presented in the table below. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.

NOTE

1. Standard Penetration Test sampler: I.D. = 35mm; O.D. = 50mm
   Modified California Sampler: I.D. = 64mm; O.D. = 76mm
   Hammer Assembly: A 63.5 kg hammer with a 762 mm drop (rope and pulley)
2. A temporary piezometer was install at Boring B-2. Groundwater was measured at 1.8 meters below existing ground on 9/30/2002.

"S1" LINE 58+00

59+00



DESIGN OVERSIGHT	DRAWN BY	F. WANG	F. WANG/E. BHANGOO	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	CHRISTOPHER KOEPKE	BRIDGE NO. 20-0284L	101/116 SOH REPLACE
SIGN OFF DATE	CHECKED BY	Y. DAVID WANG	FIELD INVESTIGATION BY: DATE: 9/26-9/30		PROJECT ENGINEER	KILOMETER POST 5.6/6.3	LOG OF TEST BORINGS

GEOTECHNICAL LOG OF TEST BORINGS SHEET (METRIC) (REV 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04276
EA 276001

FILE => gslotb01.dgn

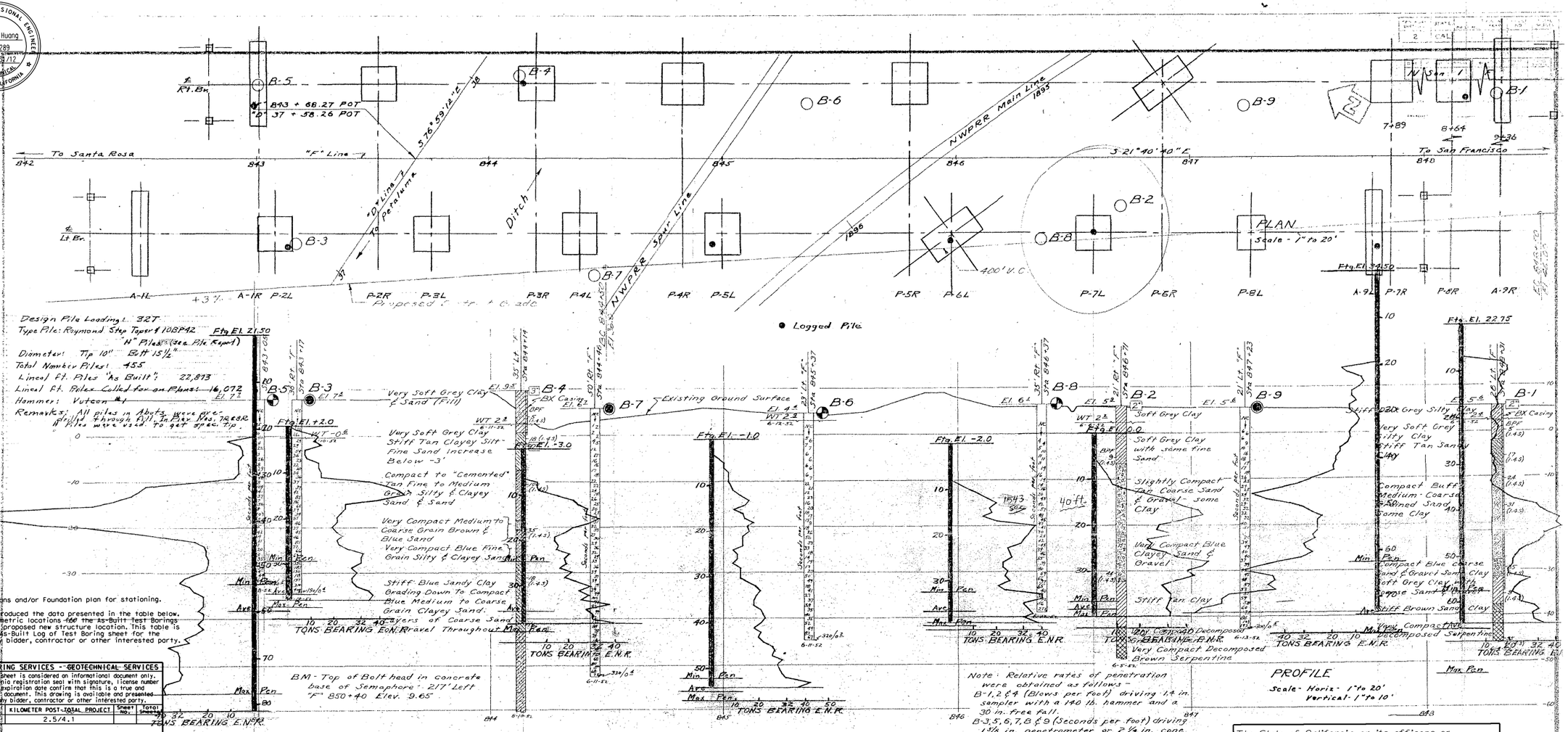
DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): ~~12/11/02~~ 3/01/03

SHEET 26 OF 27

USERNAME => trilm DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:49

REGISTERED PROFESSIONAL ENGINEER
Stephen Huang
No. C 42289
Exp. 03/31/12
GEOTECHNICAL
STATE OF CALIFORNIA



Design Pile Loading: 32T
Type Pile: Raymond Step Taper # 10BP42 "H" Piles (See Pile Report)
Diameter: Tip 10" Butt 15 1/2"
Total Number Piles: 455
Lineal Ft. Piles "As Built": 22,813
Lineal Ft. Piles Called for on Plans: 16,072
Hammer: Vulcan #1
Remarks: All piles in Abut. were driven through fill in Pier. Pile 76R8R 8" Piles were used to get spec. tip.

Notes:

1. See the General plans and/or Foundation plan for stationing.
2. Structure Design produced the data presented in the table below. The data are the metric locations of the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

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DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	Sheet No.	Total Sheets
04	Son	101	2.5/4.1		

REGISTERED GEOTECHNICAL ENGINEER — DATE 12/2/09

U.S. 101N/SR 116 SOH (REPLACE)

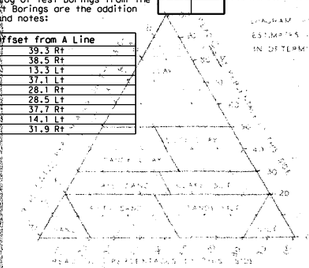
LOG OF TEST BORINGS (6 OF 7)

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA — CU: 04 EA: 2640C1 — BRIDGE No. — Sheet ___ of ___

DATE PLOTTED => 3/8/2010

Revisions made to this Log of Test Borings from the original 1952 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from A Line
B-1	188+75	39.3 Rt
B-9	189+80	38.5 Rt
B-2	190+49	13.3 Lt
B-8	190+93	37.1 Lt
B-6	191+19	28.1 Rt
B-7	192+81	28.5 Lt
B-4	193+17	37.7 Rt
B-3	194+05	14.1 Lt
B-5	194+20	31.9 Rt



LEGEND OF BORING OPERATIONS

PLAN OF AN BORING — CASING
" SAMPLER BORING — JET BOR
ROTARY WASH BORING — SAMPLE
" DRIVEN SAMPLER DRIVEN — 1 3/8" A-S
NORE BORING — 2 1/4" CON
2 1/2" PENETROMETER DRIVEN
1 3/8" SAMPLER BORING
2 1/4" CONE BORING
2 1/2" CONE BORING

THE APPROPRI SYMBOLS OF SIGN METHOD OF DRIL SHOWN AT THE HAND CORNER OF THE PROPOSED BORING. WHERE TOOL CHANGES WERE MADE DURING THE BORING OPERATION SYMBOLS ARE SHOWN AT THE POINT OF CHANGE.

Revisions made to this Log of Test Borings from the original 1952 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from "S" Line
B-1	57+76	7.9 m Left
B-2	58+25	6.4 m Right
B-3	59+33	10.9 m Right
B-4	59+93	10.7 m Left
B-5	59+38	9.4 m Left
B-6	58+65	7.0 m Left
B-7	58+93	15.2 m Right
B-8	58+35	18.7 m Right
B-9	58+09	6.4 m Left

Notes:

1. See the General Plan and/or Foundation Plan for Metric Stationing.
2. Structure Design produced the data presented in the table above. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.

ROCK - R

FILL MATERIAL

CLAYEY SILT - C SI

SANDY CLAY - SC

DIVISION OF ENGINEERING SERVICES - OFFICE OF GEOTECHNICAL SERVICES

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. It does not attest to the accuracy or validity of the information contained in the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	KILOMETER POST - TOTAL PROJECT	Sheet No.	Total sheets
04	Son	101	5.6/6.3	121	148

CERTIFIED ENGINEERING GEOLOGIST

101 / 116 SOH (REPLACE)

LOG OF TEST BORINGS

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA — CU: 04 EA: 276001 — BRIDGE No. 20-0155L — Sheet 27 of 27

REGISTERED GEOLOGIST
Christopher W. Kopke
No. 2305
Exp. 10-31-09
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Caltrans now has a web site! To get to the web site, go to: http://www.dot.ca.gov

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

NOTES

THE CONTRACTOR'S ATTENTION IS DIRECTED TO SECTION 2, ARTICLE (E) OF THE STANDARD SPECIFICATIONS AND TO THE SPECIAL PROVISIONS ACCOMPANYING THIS SET OF PLANS.

CLASSIFICATION OF EARTH MATERIAL AS SHOWN ON THIS SHEET IS BASED UPON FIELD INSPECTION AND IS NOT TO BE CONSTRUED TO IMPLY MECHANICAL ANALYSIS.

Alinement & Profile data was obtained from Division of Bridge Design #P 207(1) & FO 2622-2 and is FOR PRELIMINARY PURPOSES

ROUTE 101 SEPARATION AND OVERHEAD

LOG OF TEST BORINGS

SCALE as noted — DATE 6-30

BRIDGE NO. 20-155 — DRAWING NO. FO 2622-2

To accompany plans dated 3-15-04

aslotb02.tif

DIST.	COUNTY	ROUTE	KILOMETER POSTS TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Son	101	5.6/6.3	148	148

Caltrans Metric

08-05-02
REGISTERED ENGNEER - CIVIL

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER S.T. Kakihara No. 42351 Exp. 3-31-04 CIVIL STATE OF CALIFORNIA

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Caltrans now has a web site! To get to the web site, go to: http://www.dot.ca.gov

All Dimensions are in Meters unless otherwise shown

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. C 42289 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	Sheet No.	Total Sheets
04	Son	101	2.5/4.1		

REGISTERED GEOTECHNICAL ENGINEER — DATE 12/2/09

U.S. 101N/SR 116 SOH (REPLACE)

LOG OF TEST BORINGS (7 OF 7)

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: 04
EA: 2640C1

BRIDGE No.
Sheet of

DATE PLOTTED => 3/8/2010

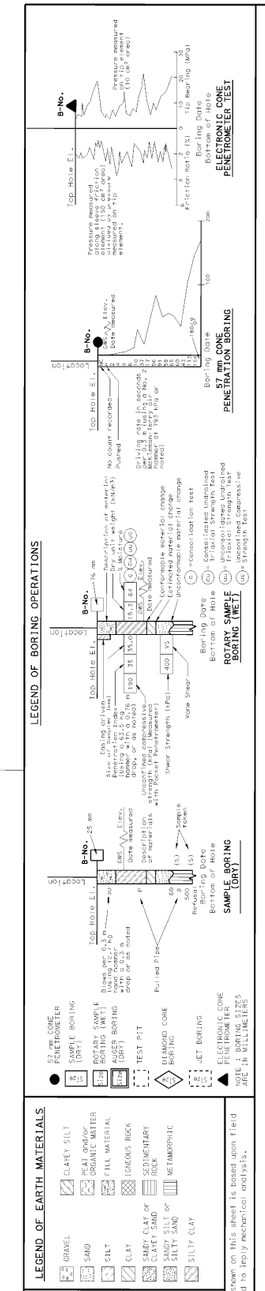
Revisions made to this Log of Test Borings from the original 2002 Log of Test Borings are the addition of the following table and notes:

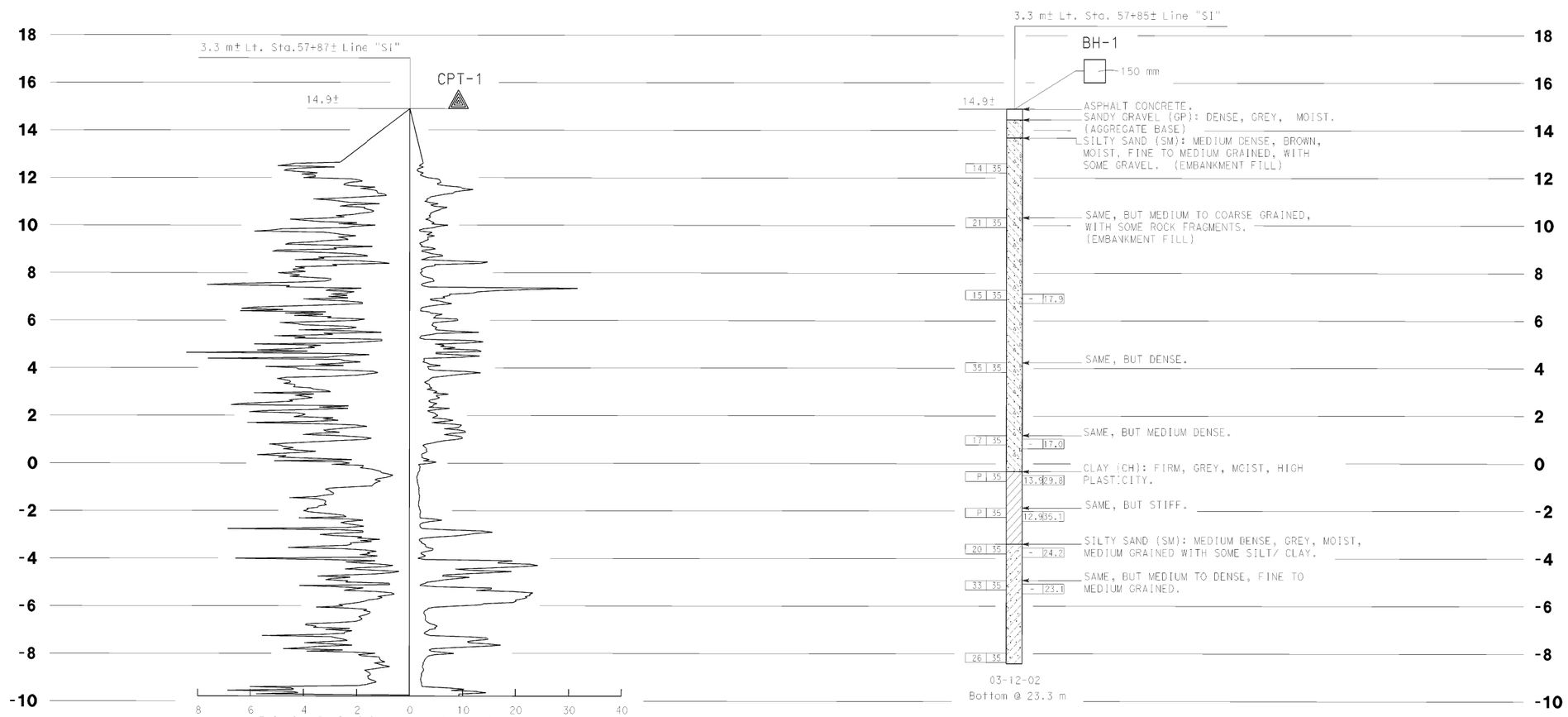
Boring	Station	Offset from A Line
CPT-1	189+28	72.8 Lt
BH-1	189+21	72.6 Lt

Notes:

1. See the General plan and Foundation plan for stationing.
2. Structure Design produced the data presented in the table below. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.

(For boring location see PLAN, LOTB sheet 1 of 2)





PROFILE
HORIZ. NO SCALE
VERT. 1 : 100

DATE PLOTTED => 19-MAR-2004
TIME PLOTTED => 10:29

DIVISION OF ENGINEERING SERVICES		FIELD INVESTIGATION BY:	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	GEOTECHNICAL SERVICES OFFICE OF GEOTECHNICAL DESIGN - WEST	BRIDGE NO.	MECHANICALLY STABILIZED EMBANKMENT
DRAWN BY	M. REYNOLDS 06/02	T. NGUYEN			KILOMETER POST	LOG OF TEST BORINGS
CHECKED BY	S. KAKIHARA			CU 04276 EA 276001		

(Rev 01/02)

ORIGINAL SCALE IN MILLMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

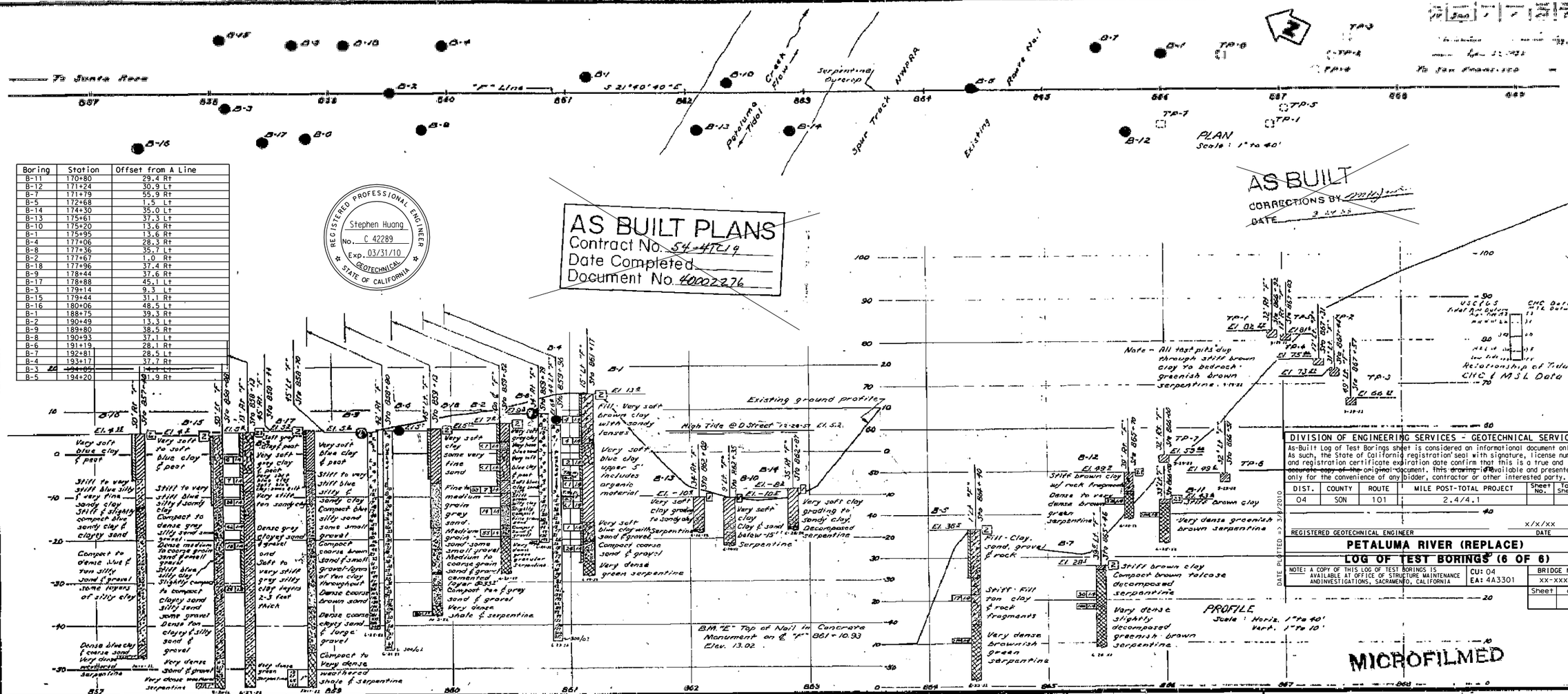
DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 2 OF 2

USERNAME => trmariak
DGN FILE => 427600g004.dgn

F-0185 (1) Unit 2



Boring	Station	Offset from A Line
B-11	170+80	29.4 Rt
B-12	171+24	30.9 Lt
B-7	171+79	55.9 Rt
B-5	172+68	1.5 Lt
B-14	174+30	35.0 Lt
B-13	175+61	37.3 Lt
B-10	175+20	13.6 Rt
B-1	175+95	13.6 Rt
B-4	177+06	28.3 Rt
B-8	177+36	35.7 Lt
B-2	177+67	1.0 Rt
B-18	177+96	37.4 Rt
B-9	178+44	37.6 Rt
B-17	178+88	45.1 Lt
B-3	179+14	9.3 Lt
B-15	179+44	31.1 Rt
B-16	180+06	48.5 Lt
B-1	188+75	39.3 Rt
B-2	190+49	13.3 Lt
B-9	189+80	38.5 Rt
B-8	190+93	37.1 Lt
B-6	191+19	28.1 Rt
B-7	192+81	28.5 Lt
B-4	193+17	37.7 Rt
B-3	~~194+05~~	14.1 Lt
B-5	194+20	31.9 Rt

REGISTERED PROFESSIONAL ENGINEER
Stephen Huang
No. C 42289
Exp. 03/31/10
GEOTECHNICAL
STATE OF CALIFORNIA

AS BUILT PLANS
Contract No. 54-4TC19
Date Completed
Document No. 40002276

AS BUILT
CORRECTIONS BY
DATE

BRIDGE DEPARTMENT

FIELD STUDY	H. Hill Fuller
DRAWN	H. H. Fuller 8-8-58
CHECKED	W. H. Ehlers 8-8-58
Approved	Bridge Engineer

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

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DIST.	COUNTY	ROUTE	MILE POST-TOTAL PROJECT	Sheet No.	Total Sheets
04	SON	101	2.4/4.1		

REGISTERED GEOTECHNICAL ENGINEER — DATE x/x/xx

PETALUMA RIVER (REPLACE)

LOG OF TEST BORINGS (6 OF 6)

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: 04
EA: 4A3301

BRIDGE No. XX-XXXX
Sheet of

DATE PLOTTED => 3/8/2010

MICROFILMED

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

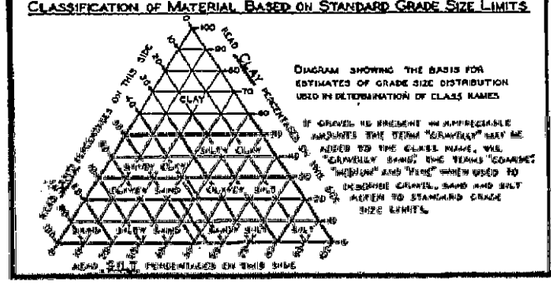


DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES

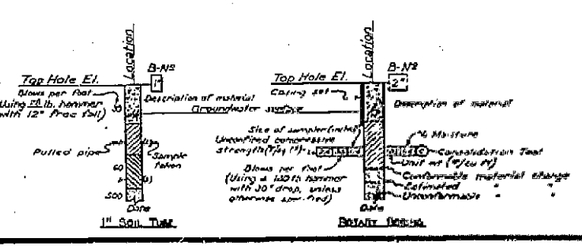
IF GRAVEL IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE CLASS NAME. USE "GRAVELLY SAND" THE TERMS "COARSE", "MEDIUM" AND "FINE" WHEN USED TO DESCRIBE GRAVEL, SAND AND SILT REFER TO STANDARD GRADE SIZE LIMITS.

LEGEND OF EARTH MATERIALS

- GRAVEL
- SAND
- SILT
- CLAY
- SANDY CLAY OR CLAYEY SAND
- SANDY SILT OR SILTY SAND
- SILTY CLAY OR CLAYEY SILT
- PEAT AND/OR ORGANIC CLAY
- FILLED MATERIAL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS

- PLAN OF ANY BORING
- PENETROMETER
- 2.4" CONE PENETROMETER
- SAMPLER BORING (DRY)
- ROTARY BORING (WET)
- AUGER BORING (DRY)
- JET BORING
- CORE BORING
- TEST PIT



NOTES

THE CONTRACTOR'S ATTENTION IS DIRECTED TO SECTION 2, ARTICLE (c) OF THE STANDARD SPECIFICATIONS AND TO THE SPECIAL PROVISIONS ACCOMPANYING THIS SET OF PLANS. CLASSIFICATION OF EARTH MATERIAL AS SHOWN ON THIS SHEET IS BASED UPON FIELD INSPECTION AND IS NOT TO BE CONSTRUED TO IMPLY MECHANICAL ANALYSIS.

PENETROMETER BORINGS HAVING A RATE OF PENETRATION MEASURED IN SECONDS PER FOOT ARE DRIVEN WITH A Nº 2 McKIERNAN-TERRY AIR HAMMER AT 115 PSI.

BRIDGE ACROSS PETALUMA CREEK

LOG OF TEST BORINGS

SCALE: As Noted | BRIDGE 20-154 | FILE | DRAWING 5-7618-24

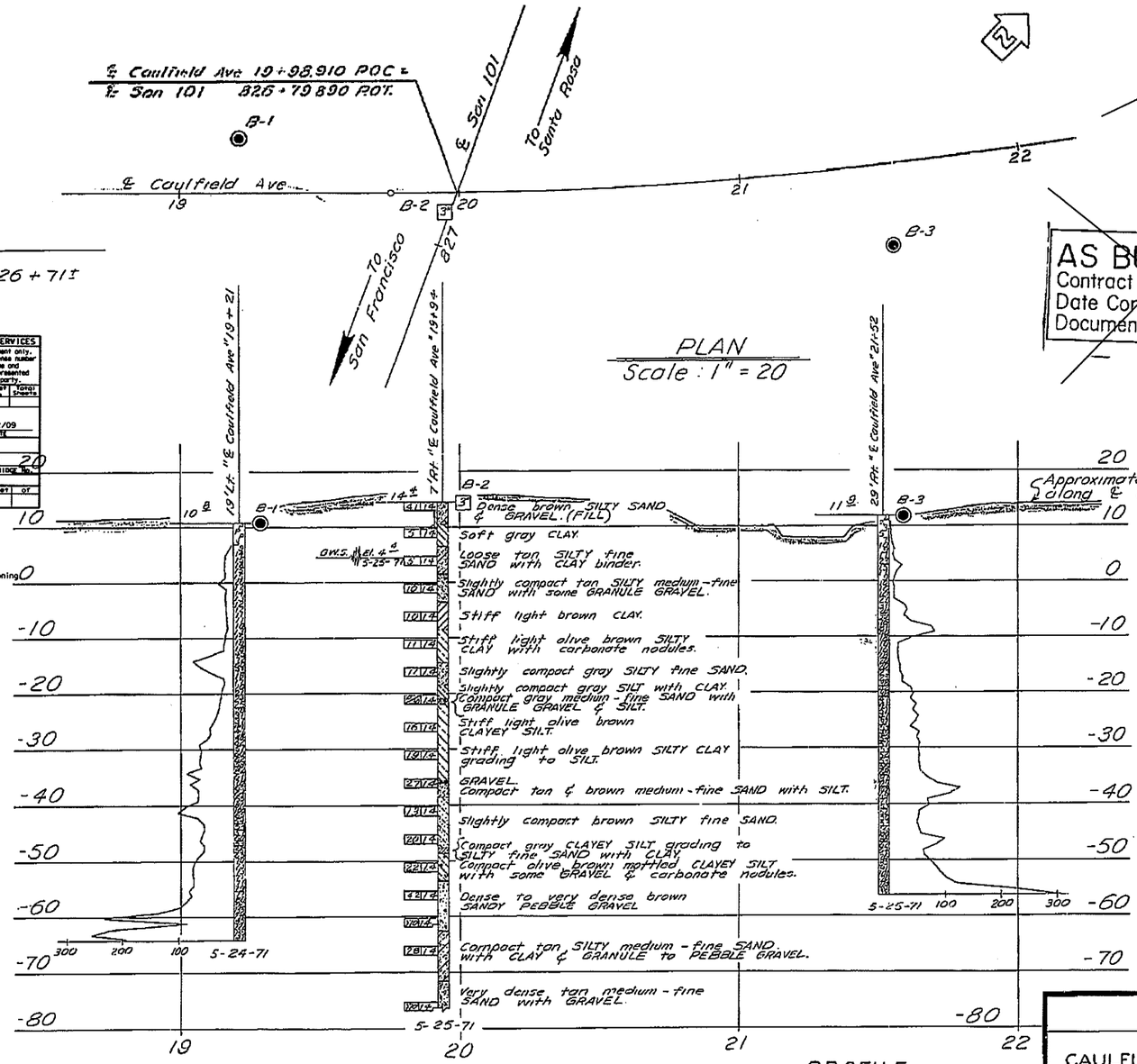
I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT PREPARED UNDER MY DIRECTION AND CONTROL OF THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE _____ SIGNATURE _____ TITLE _____

PDF - www.tiff2pdf.com

DIST.	COUNTY	ROUTE	PROJECT	PROJECT No.	TOTAL SHEETS
04	Son	101	4.8	35	35

John A. Freund
October 2, 1972



AS BUILT PLANS
Contract No. 04-358714
Date Completed 10-72
Document No. 04-000 6464

AS BUILT
CORRECTIONS
CONTRACT NO.
DATE

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

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DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	PROJECT No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED GEOTECHNICAL ENGINEER — DATE 12/2/09

DATE PLOTTED => 3/24/2010

SOUND WALL No. 211

LOG OF TEST BORINGS (1 OF 1)

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

DIst 04
EA: 2640C1

BRIDGE No.
Sheet of

Revisions made to this Log of Test Borings from the original 1971 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from ℄ Line
B2	210+40.00	0 Ctr

Notes:
1. See the General plans and/or Foundation plan for stationing

REGISTERED PROFESSIONAL ENGINEER
Stephen Huang
No. GE 2150
Exp. 03/31/12
GEOTECHNICAL
STATE OF CALIFORNIA

LEGEND OF BORING OPERATIONS

Penetrometer
2½" Core Penetrometer
Sampler Borings (any)
Rotary Borings (any)
Auger Borings (any)
Jet Borings
Core Borings
Test Pit

LEGEND OF EARTH MATERIALS

Gravel
Sand
Silt
Clay
Silty Clay or Clayey Silt
Organic Matter
Fill Material
Igneous Rock
Sedimentary Rock
Metamorphic Rock
Sandy Clay or Clayey Sand
Silty Sand or Silty Sand

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRAIN SIZE LIMITS

Durgin prepared the base for estimates of grain size distribution curves as after-thought. If equal to passed is approximately equal to the clay fraction, the term "silty" is used. If equal to passed is approximately equal to the silt fraction, the term "clayey" is used. The terms "silty sand" or "clayey sand" are used to describe sand, silt and gravel, refer to unified soil classification chart for limits.

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

FIELD STUDY — W.F. Christian 5-71
DRAWN — S. Tomasevich 7-71
CHECKED — R.E. Ryan 7-71
Approved for Transmittal by R.E. Ryan
Geotechnical Engineer

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

35

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

CAULFIELD LANE OVERCROSSING

LOG OF TEST BORINGS

BRIDGE NO.	POST MILE	DRAWING NO.	SHEET	OF
20-245	4.0		10	10

REVISION DATES

WO 358711
CU 04219

Disregard prints bearing earlier revision dates

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	1.3/2.6		

Ali Kaddoura 12-09-09
REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

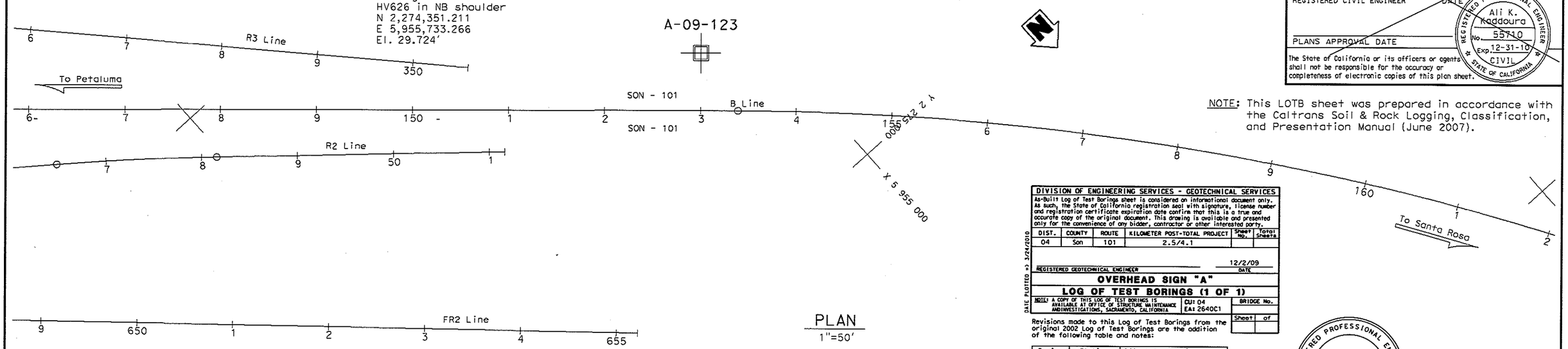
REGISTERED PROFESSIONAL ENGINEER Ali K. Kaddoura No. 55710 Exp. 12-31-10 CIVIL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

NOTE: This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2007).

BENCH MARK

PM 2.80
VG 9,167
Found Surveyers' marker pin
in flight cross
HV626 in NB shoulder
N 2,274,351.211
E 5,955,733.266
El. 29.724'



PLAN
1"=50'

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES					
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DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	Sheet No.	Total Sheets
04	Son	101	2.5/4.1		
REGISTERED GEOTECHNICAL ENGINEER			12/2/09 DATE		
OVERHEAD SIGN "A"					
LOG OF TEST BORINGS (1 OF 1)					
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA			CU: 04 EA: 264001	BRIDGE No.	
				Sheet	of

DATE PLOTTED => 3/24/2010

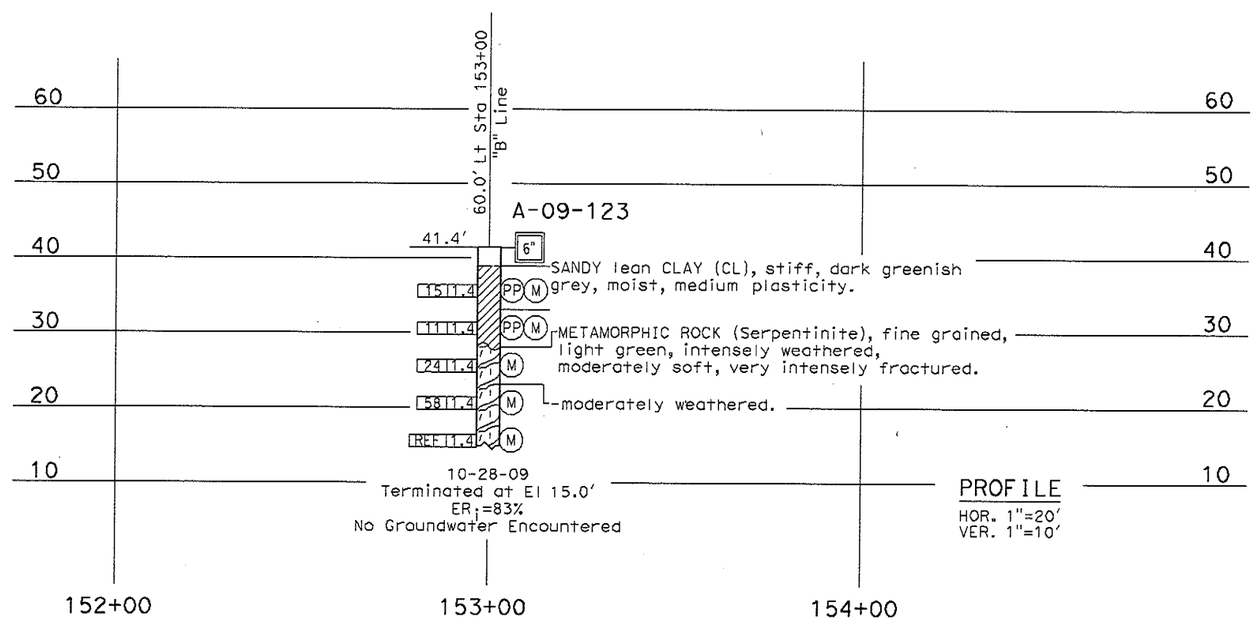
Revisions made to this Log of Test Borings from the original 2002 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from A Line
A-09-123	153+00.00	60.0' LT

Notes:

1. See the General plan and Foundation plan for stationing.

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. GE 2150 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA



10-28-09
Terminated at El 15.0'
ER;=83%
No Groundwater Encountered

PROFILE
HOR. 1"=20'
VER. 1"=10'

ENGINEERING SERVICES	GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES OFFICE OF GEOTECHNICAL DESIGN BRANCH	BRIDGE NO. / POST MILES	OVERHEAD SIGN "F" LOG OF TEST BORINGS 10 of 13
FUNCTIONAL SUPERVISOR	DRAWN BY: M. Reynolds 12-09	FIELD INVESTIGATION BY: M. Zabolizadeh				
NAME: H. Nikoui	CHECKED BY: R. Nashed					
OGS CIVIL LOG OF TEST BORINGS SHEET	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3		CU 04 EA 264081	DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES 12-21-09 03-16-10	SHEET OF

FILE => ...\Sign Structure\426408p010.dgn

USERNAME => andrew.chaung PLOTTED => 3/23/2010 TIME PLOTTED => 8:56:45 AM

Retaining Wall Analysis

Liquefaction Analysis

Overhead Sign Structure Support

URS

Job 101 MSN SEGMENT B4 - RW 152 | Project No. | Sheet ___ of ___

Description RETAINING WALL # 152 | Computed by MT | Date 03/22/10

Checked by SHUANG | Date 3/26/10

Reference

RW 152 - TYPE 1 WALL (WALL PLANS REFER TO SHEETS R-2, 65% SUBMITTAL, MARCH 2010)

RW 152 EXTENDS FROM STATION "A" 152+45.93 TO 156+03.49

TOTAL LENGTH: ~358 feet

DESIGN HEIGHT: 10 TO 24 feet

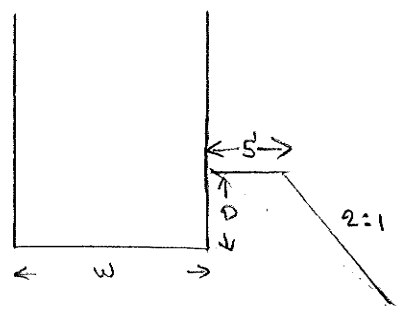
Bottom of Footing Elevation: 34.80 ft TO 44.40 ft

NEARBY BORINGS:
A-09-105
A-09-106

AS SHOWN ON ATTACHED CROSS SECTIONS FOOTING WILL BE PLACED IN CONTROLLED ENGINEERING FILL. ($\gamma_T = 130$ PCF $\phi = 33°$)

$H = 24$ feet $W = 13' 3''$

- TOE PRESSURE $= 4.9$ KSF



BEARING CAPACITY (pg. 3 of 6)

$D = 3$ ft

$\frac{D}{W} = \frac{3}{13.25} = 0.226 \cong 0.23$

$\frac{b}{W} = \frac{5}{13.25} = 0.377 \cong 0.38$ $\beta = 26.6°$

EXPLORATORY DATA:
A-09-105
A-09-106

$\phi = 30°$ $N_{\gamma q} = 15$

$\phi = 40°$ $N_{\gamma q} = 50$

FOR $\phi = 34°$ $N_{\gamma q} \cong \frac{(\tan 34° - \tan 30°)}{(\tan 40° - \tan 30°)}(50-15) + 15 = \frac{(0.674 - 0.577)}{(0.839 - 0.577)}(35) + 15$

$= \frac{0.097}{0.262}(35) + 15 = 12.9 + 15 = 27.9 \cong 28$ ✓

$q_{ult} = cN_{cq} + \gamma_T \frac{W}{2} N_{\gamma q}$ $c = 0$ $q_{ult} = \gamma_T \frac{W}{2} N_{\gamma q}$

$q_{ult} = (130)\left(\frac{13.25}{2}\right)(28) = 24{,}115$ psf

ASSUMING CLAY FILL
$N_{cq} = 5.0$

$q_{all} = \frac{24{,}115}{3} = 8{,}038$ psf $>$ 4,900 psf

MIN REQ $c = \frac{(4{,}900)(3)}{5.0}$
$= 2{,}940$ psf

URS

Job 101 MSN SEGMENT RG-RW 152 | Project No. 28645045 | Sheet ___ of ___

Description RETAINING WALL #152 | Computed by MT | Date 03/22/10

Checked by ___ | Date ___

Reference

SETTLEMENT :-

ELEV	γ PCF	ω%	$\frac{C_c}{1+e_0}$	$\frac{C_\gamma}{1+e_0}$	E
20					
CH	120	28	0.17	0.05	$E = KS_u = (200)(2{,}000) = 400\,KSF$
17					

$\frac{C_c}{1+e_0}, \frac{C_\gamma}{1+e_0}$ based on similar materials from R-09-014 @ 30' consolidation results.

ROCK (UN COMPRESSIBLE) $\sigma'_{VO} = (125)(20) \doteq 2{,}500$ PSF $\frac{S_u}{\sigma_{VO}} = \frac{2{,}000}{2{,}500} = 0.8$

$\frac{S_u}{p'} = m \cdot OCR^{\alpha}$ $\alpha = 0.8$ $m = 0.23$ $\left(\frac{S_u}{\sigma_{VC\,N.C}} = 0.23\right)$

$0.8 = 0.23\,(OCR)^{0.8}$ $OCR \cong 4.5$ $\sigma_p = (4.5)(2{,}500) = 11{,}250$ PSF

$C_\alpha = 0.003$ (FROM NAVFAC DM 7.1-237)

TOTAL SETTLEMENT < 0.5 inch . See DEFORM RUNS . (pg 3 OF 7)

SLOPE STABILITY FS = 1.54 (static)

FS = 1.14 (seismic)

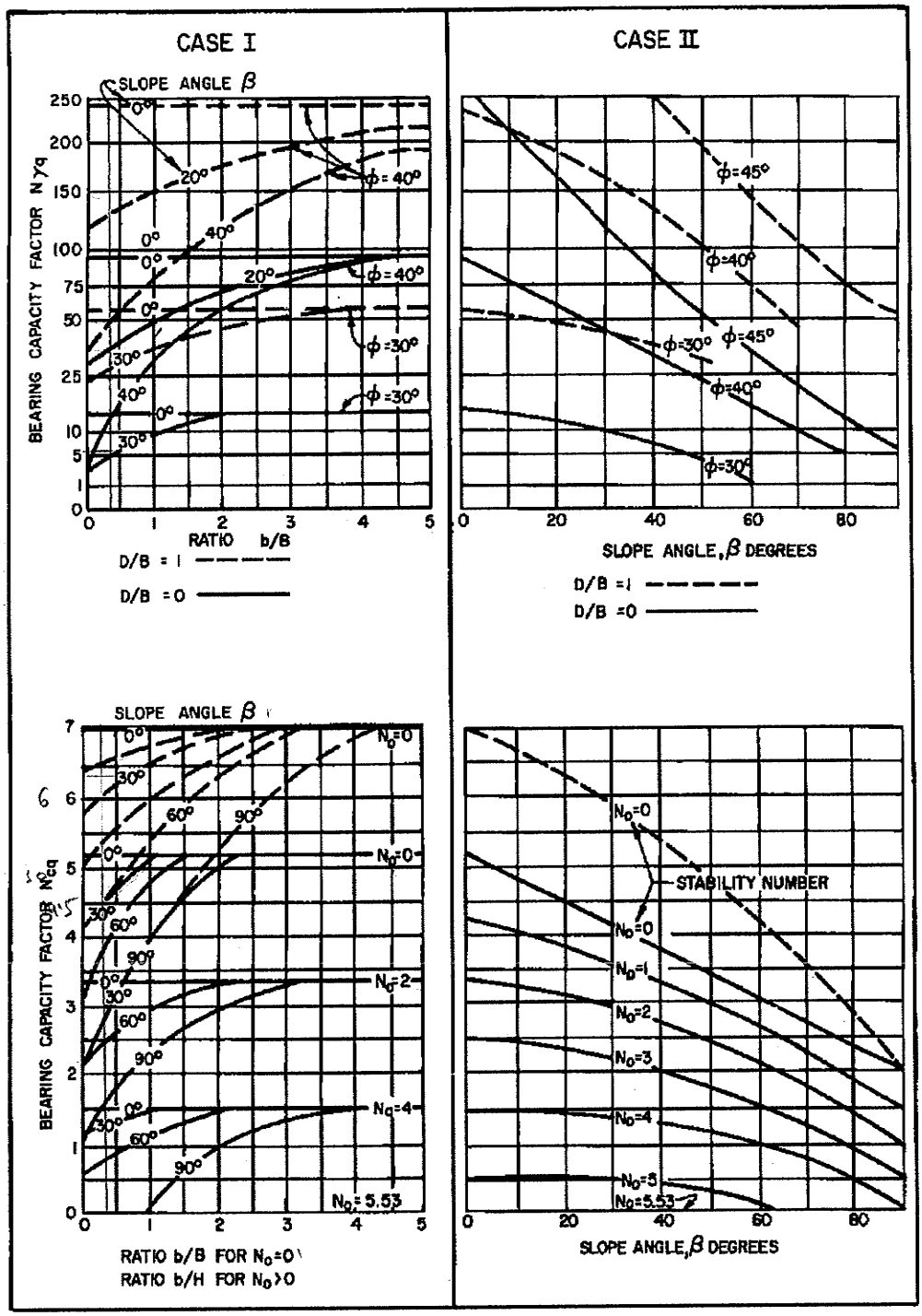


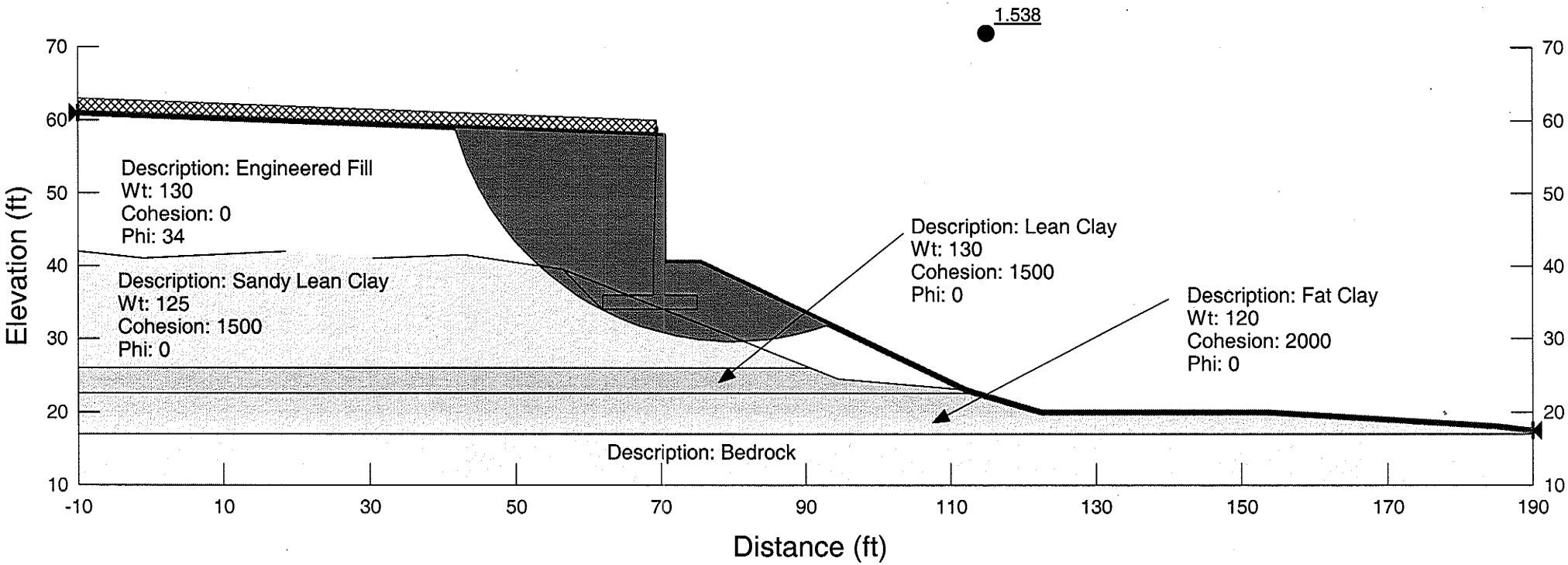
FIGURE 4b
Bearing Capacity Factors for Shallow Footing Placed on or Near a Slope

SETTLEMENT POINT : 70.0, .0

SOIL LAYER	INITIAL STRESS (PSF)	VERTICAL STRESS INCREASE (PSF)	HORIZ. X STRESS INCREASE (PSF)	HORIZ. Y STRESS INCREASE (PSF)	SKEMPTON BJERRUM FACTOR	CONSOL. COMP. (IN.)	SECOND. COMP. 20. YR (IN.)	ELASTIC COMP. (IN.)	TOTAL COMP. (IN.)
1	1628.3	846.9	-523.3	5.3	.589	.193	.141	.134	.467
						.193	.141	.134	.467

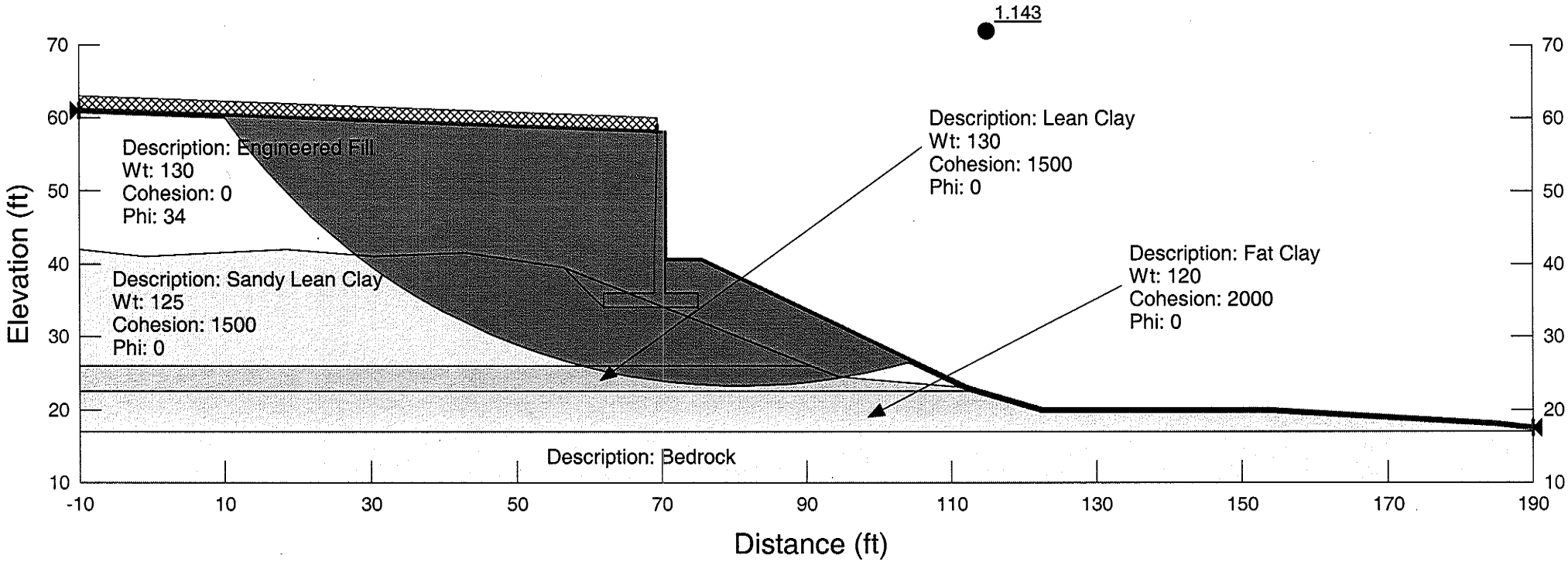
SETTLEMENT POINT : 70.0,-100.0

SOIL LAYER	INITIAL STRESS (PSF)	VERTICAL STRESS INCREASE (PSF)	HORIZ. X STRESS INCREASE (PSF)	HORIZ. Y STRESS INCREASE (PSF)	SKEMPTON BJERRUM FACTOR	CONSOL. COMP. (IN.)	SECOND. COMP. 20. YR (IN.)	ELASTIC COMP. (IN.)	TOTAL COMP. (IN.)
1	904.3	425.4	-251.9	59.5	.628	.189	.141	.064	.394
						.189	.141	.064	.394



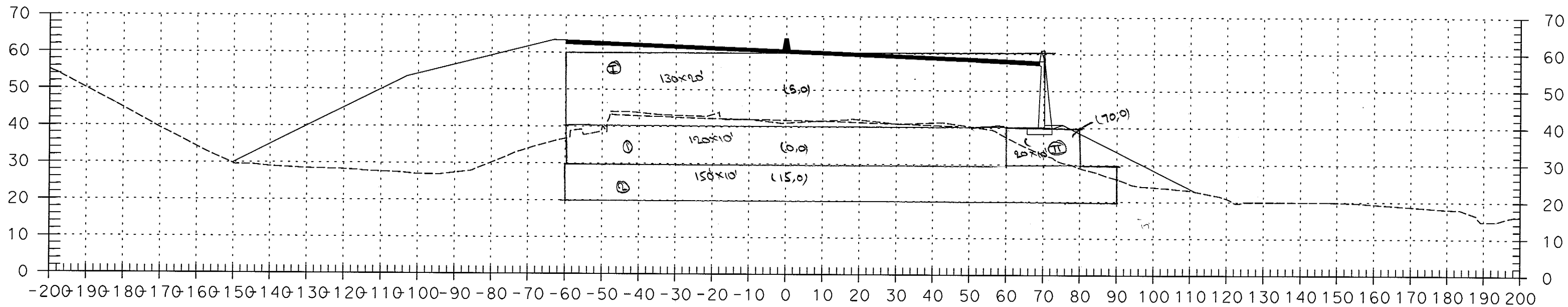
RW 152

STATIC

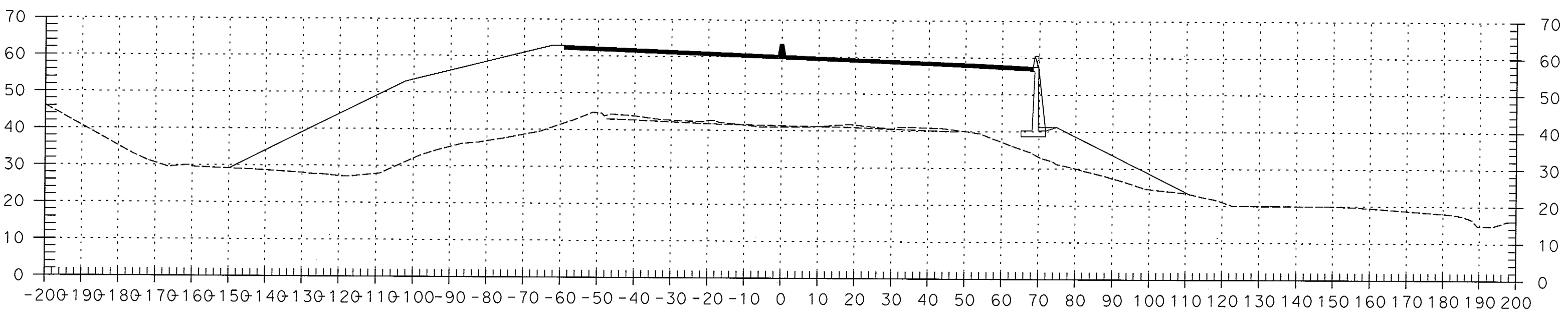


RW 152

SEISMIC $K_h = \frac{1}{3}(0.6) = 0.2\ g$



154+40.00



154+20.00

URS

Job 101 MSN SEGMENT B4 - RW 168 | Project No. | Sheet ___ of ___

Description RETAINING WALL #168 | Computed by MT | Date 03/22/10

Checked by S. HUANG | Date 3/29/10

Reference

RW 168 TYPE I WALL (WALL PLAN REFER TO SHEET R-3, 65% SUBMITTAL, MARCH 2010)

RW 168 EXTENDS FROM STATION "A" 168+13.00 to 169+61.00

TOTAL LENGTH = 148 feet

DESIGN HEIGHT = 10 TO 12 FEET.

BOTTOM OF FOOTING ELEVATION: 75.0 feet to 76.2 feet.

NEARBY BORING: R-09-001. (see pg 2 of 2)

BOTTOM OF FOOTING WILL BE ON TOP OF ROCK (N > 50) - INCOMPRESSIBLE.

NO BEARING CAPACITY OR SETTLEMENT ISSUES ARE ANTICIPATED FOR THIS RETAINING WALL.

CONSTRUCTION CONSIDERATION

- ROCK EXCAVATION FOR FOUNDATION

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	8-17-09	8-17-09	2276285.6 ft / 5954179.4 ft	R-09-001
DRILLING CONTRACTOR: PC Exploration, Inc			BOREHOLE LOCATION (Offset, Station, Line): 8' Lt Sta 170+25 A	SURFACE ELEVATION: 84 ft
DRILLING METHOD: Rotary Wash with HQ Core Barrel			DRILL RIG: Gefco D-444	BOREHOLE DIAMETER: 3-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID): Modified CA (1.96"), SPT (1.44")			SPT HAMMER TYPE: Auto Hammer 140lb/30in	HAMMER EFFICIENCY, ERi: 81%
BOREHOLE BACKFILL AND COMPLETION: Cement			GROUNDWATER READINGS: DURING DRILLING Dry to 5' AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 21.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	SEDIMENTARY ROCK, Graywacke (sandstone), brownish gray, intensely weathered, very weak, intensely fractured, with Lean Clay (CL) infilling along fractures.												
	1			1	17 22 40	62	70							8-inch hollow stem auger to 5 feet
81.50	2	[Franciscan Complex].												
	3													
79.50	4													
	5			2	12 23 33	56	75							Switch to mud rotary; Start HQ coring
77.50	6	At EL. 77.5 ft, becomes intensely to moderately weathered.												
	7	At EL. 76.5 ft, becomes black to dark gray, intensely weathered, weak to medium strong, little to no clay infilling along joints.												
75.50	8													
	9													
73.50	10	At EL. 73.5 ft, becomes light greenish gray, intensely weathered, very weak, trace of serpentinite, foliated fabric, breaks down to Clayey Sand (SC).		3	17 23 53	76	35							
	11													
71.50	12													
	13													
69.50	14	At EL. 69.5 ft, becomes Greenstone ?(meta-volcanic), dark gray, moderately weathered, medium strong, intensely fractured, (meta-volcanic).												
	15			4	28 50/2"	50/ 2"	100							
67.50	16	[Franciscan Complex].												Sampler advanced 8 in.
	17													
65.50	18													
	19													
63.50	20			5	92/5"	REF	20							Sampler advanced 5 in.
	21													
61.50	22	Bottom of Borehole at 21.5 ft.												
	23													
59.50	24													
	25													

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 2/9/10

URS

San Jose Office

55 S. Market St, Ste 1500
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				R-09-001
DIST. 04	COUNTY Sonoma	ROUTE 101	POSTMILE 0.9/2.9	EA 04-28645045
PROJECT OR BRIDGE NAME: Petalum River Bridge				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 8-20-09	SHEET 1 of 1	

URS

Job 101 MSN SEGMENT B4 | Project No. 28645045 | Sheet ___ of ___

Description RETAINING WALL 179 | Computed by MT | Date 03/22/10

Checked by MLL | Date 03/29/10

Reference

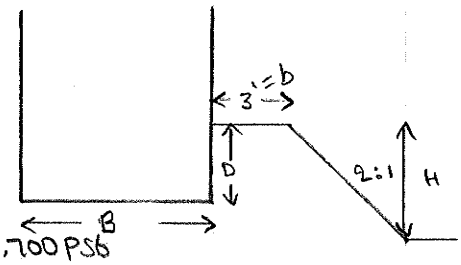
RW 179 TYPE I WALL (WALL PLANS REFER TO SHEETS R-4 TO R-6; 65% SUBMITTAL, MARCH 2010)

RW 179 EXTENDS FROM STATION "A" 179+44.00 to 187+76.60

TOTAL LENGTH ≅ 833 feet

DESIGN HEIGHT : 14 to 28 feet.

BOTTOM OF FOOTING ELEVATION: 26 feet to 62.2 feet.



MAX DESIGN HEIGHT = 28' B = 15' 3" TOE pressure: 5,700 psf

BEARING CAPACITY:- (FROM DM 7.2-135 & 136, CASE I) COHESION LESS MATERIAL

D = 3 ft H = 28' B = 15.25' ; B < H $d_o > B$

EXPLORATORY DATA :
A-09-009
A-09-010
R-09-008
R-09-011

$\frac{b}{B} = \frac{3}{15.25} = 0.196 \sim 0.2$ $\beta = 26.6°$ $\frac{D}{B} = \frac{3}{15.25} = 0.196 \sim 0.2$

$\phi = 30°$ $N_{\gamma q} = 10$

$\phi = 40°$ $N_{\gamma q} = 40$

FOR $\phi = 34'$ $N_{\gamma q} = \frac{(\tan 34° - \tan 30°)}{(\tan 40° - \tan 30°)}(40-10) + 10 = \frac{(0.674 - 0.577)}{(0.839 - 0.577)}(30) + 10$

(INTERPOLATION BASED ON (1) IMPORTED BACKFILL AND (2) LOGS OF NEARBY BORINGS R-09-008, A-09-009, & A-09-010)

$= \frac{0.097}{0.262}(30) + 10 = 11.1 + 10 = 21.1 \sim 21.$

$q_{ult} = (130)\frac{(15.25)}{2}(21) = 20{,}816$ psf

$q_{all} = \frac{20{,}816}{3} = 6{,}940$ psf > 5,700 psf.

ASSUME SOILS ARE COHESIVE AS ENCOUNTERED IN BORING R-09-011

N_{cq} = SAY 5.5 (varies from 4.7 to 6.2) c = 3,100 psf (blow counts for CL from 27'-34' and 54'-58.5' similar)

$q_{ult} = cN_{cq} = (5.5)(3{,}100) = 17{,}050$ psf B < H, $N_\gamma = 0$.

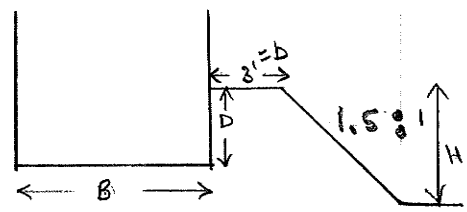
$q_{all} = \frac{17{,}050}{3} = 5{,}690$ psf ≅ 5,700 psf OK

SLOPE STABILITY FS = 1.7 (static) > 1.3 (CALTRANS MIN, BDS 5.2.2.3 overall stability)

FS = 1.3 (seismic) > 1.1 (CALTRANS MIN, Guidelines for structures Foundation Report, 3.10 slope stability Analysis)

SEE ATTACHED FIGURES 1 AND 2 FOR GRAPHICAL PRESENTATION OF SLOPE RESULTS.

RW 179 TYPE I WALL



DESIGN HEIGHT = 24 feet

$w = 13'3''$ TOE PRESSURE = 4,900 psf

BEARING CAPACITY: (FROM DM 7.2-135 & 136, CASE I)

$D = 3$ ft $H = 24'$ $B = 13'3''$ $B < H$ $d_0 > B$

$\frac{b}{B} = \frac{3}{13.25} = 0.226 \cong 0.23$ $\frac{D}{B} = \frac{3}{13.25} = 0.226 \cong 0.23$ $\beta = 1.5:1 = 33.7°$

$\phi = 30°$ $N_{\gamma q} = 7$

$\phi = 40°$ $N_{\gamma q} = 35$

FOR $\phi = 34°$ $N_{\gamma q} = \frac{(\tan 34° - \tan 30°)}{(\tan 40° - \tan 30°)}(35-7) + 7 = \frac{(0.674 - 0.577)}{(0.839 - 0.577)}(28) + 7$

(INTERPOLATION BASED ON (1) IMPORTED BACKFILL AND (2) LOGS OF NEARBY BORINGS R-09-008, R-09-009, & A-09-010)

$= \frac{(0.097)}{(0.262)}(28) + 7 = 17.4 \cong 17.5$

$q_{ult} = CN_{cq} + \gamma_1 \frac{B}{2} N_{\gamma q}$ $C = 0$

$= (130)\left(\frac{13.25}{2}\right)(17.5) = 15{,}072$ psf

$q_{all} = \frac{15{,}072}{3} = 5{,}023$ psf $\cong 5{,}000$ psf $> 4{,}900$ psf

ASSUME SOILS ARE COHESIVE AS ENCOUNTERED IN BORING R-09-011

N_{cq} = SAY 4.9 (VARIES FROM 5.8 TO 4.0) $C = 3{,}100$ psf (BLOW COUNTS 651 CL FROM 27'-34' AND 54'-58.5' ARE SIMILAR)

$q_{ult} = CN_{cq} = (4.9)(3{,}100) = 15{,}190$ psf

$q_{all} = \frac{15{,}190}{3} = 5{,}063$ psf $= 5{,}000$ psf $> 4{,}900$ psf

SLOPE STABILITY FS = 1.3 (static) ~ 1.3 (CALTRANS MIN, BDS 5.2.2.3 overall stability)

FS = 1.1 (seismic) ~ 1.1 (CALTRANS MIN, Guidelines for Structures Foundation Reports, 3.10 Slope Stability Analysis).

SEE ATTACHED FIGURES 3 AND 4 FOR GRAPHICAL PRESENTATION OF SLOPE RESULTS.

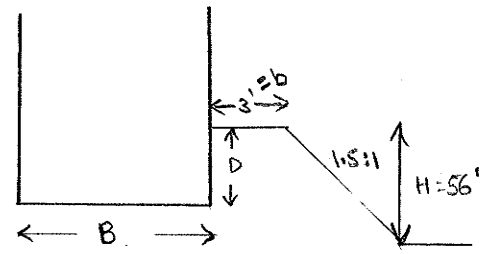
RW 180 TYPE I WALL

RW 180 EXTENDS FROM STATION "A" 180+11.00 to 182+12.02

TOTAL LENGTH = 201 feet

DESIGN HEIGHT = 12 to 14 feet

Bottom of Footing Elevation: 62.3 to 57.5 feet



BEARING CAPACITY: (FROM DM 7.2-135 & 136, case I)

$D = 3$ ft $\quad H = 14' \quad B = 8' \quad$ Toe pressure = 3,300 psf

$\frac{b}{B} = \frac{3}{8} = 0.375 \quad \beta = 33.7^\circ \quad \frac{D}{B} = \frac{3}{8} = 0.375 \quad B = 8', H = 56'$; $B < H$, $d_o > B$

$\phi = 30^\circ \quad N_{\gamma q} = 15$

$\phi = 40^\circ \quad N_{\gamma q} = 30$

FOR $\phi = 34^\circ$ $\quad N_{\gamma q} = \frac{(\tan 34^\circ - \tan 30^\circ)}{(\tan 40^\circ - \tan 30^\circ)}(30-15) + 15 = \frac{(0.674 - 0.577)}{(0.839 - 0.577)}(15) + 15$

(INTERPOLATION BASED ON IMPORTED BACKFILL AND LOG OF NEAR BY BORING R-09-008)

$= \frac{0.097}{0.262}(15) + 15 = 5.5 + 15 = 20.5 \cong 20$ (ASSUMES LINEAR RELATIONSHIP OF TAN ϕ)

$q_{ult} = c N_{cq} + \gamma_T \frac{B}{2} N_{\gamma q} \quad c = 0 \quad q_{ult} = \gamma_T \frac{B}{2} N_{\gamma q}$

$q_{ult} = (130)\left(\frac{8}{2}\right)(20) = 10{,}400$ psf

$q_{all} = \frac{10{,}400}{3} \cong 3{,}450$ psf $> 3{,}300$ psf

TOTAL CONSOLIDATION SETTLEMENT $< \frac{1}{2}$ INCH (BASED ON CALCULATIONS FOR PETALUMA RIVER NORTH ABUTMENT APPROACH EMBANKMENT SETTLEMENT)

SLOPE STABILITY $\quad FS = 1.5$ (static) $\quad > 1.3$ (CALTRANS MIN, BDS 5.2.2.3 over all stability) (Guideline 63)

$FS = 1.1$ (seismic) $\quad > 1.1$ (Stand alone Foundation Report, 3.10 Slope Stability Analysis)

SEE ATTACHED FIGURES 5 AND 6 FOR GRAPHICAL PRESENTATION OF SLOPE RESULTS

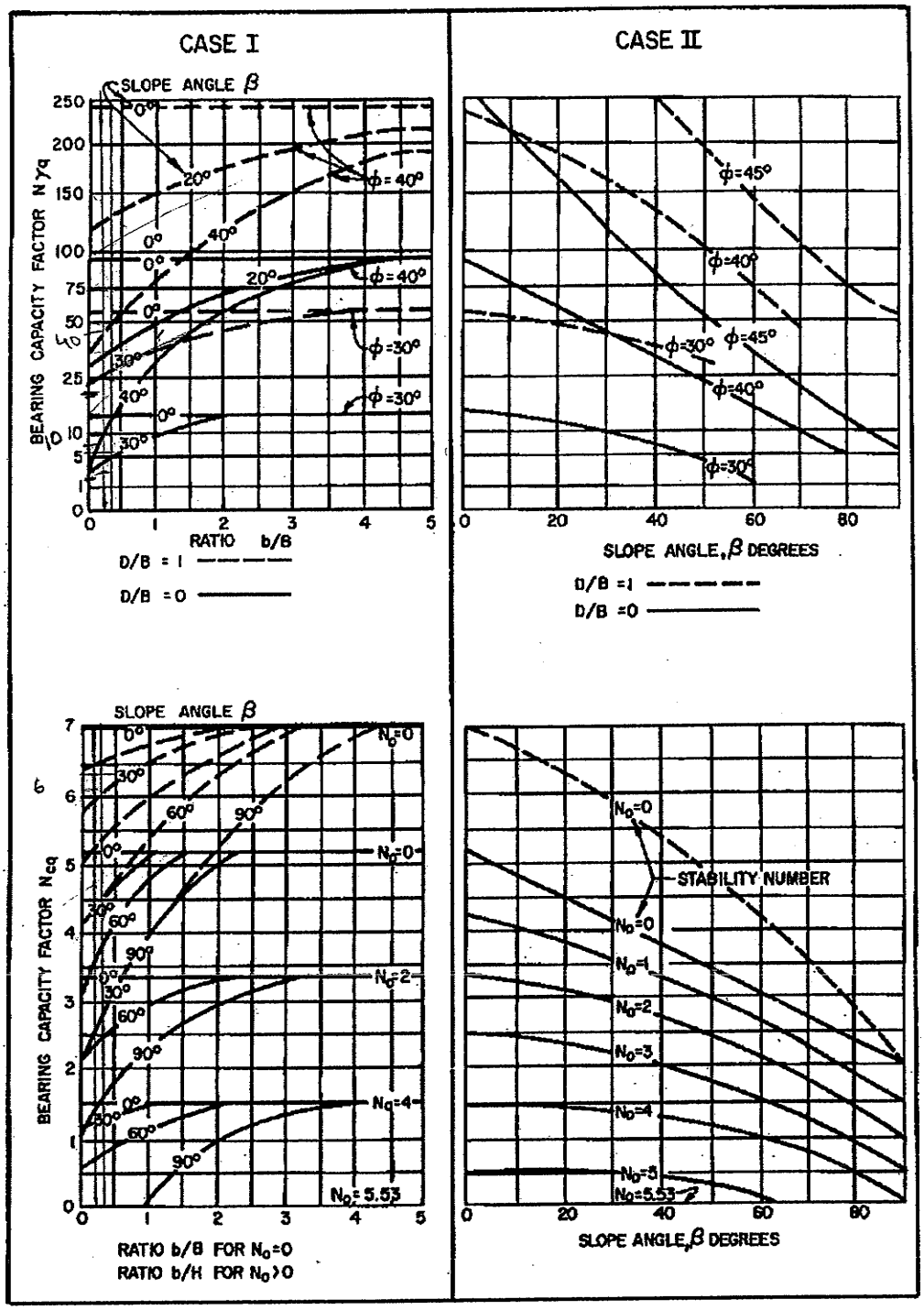


FIGURE 4b
Bearing Capacity Factors for Shallow Footing Placed on or Near a Slope

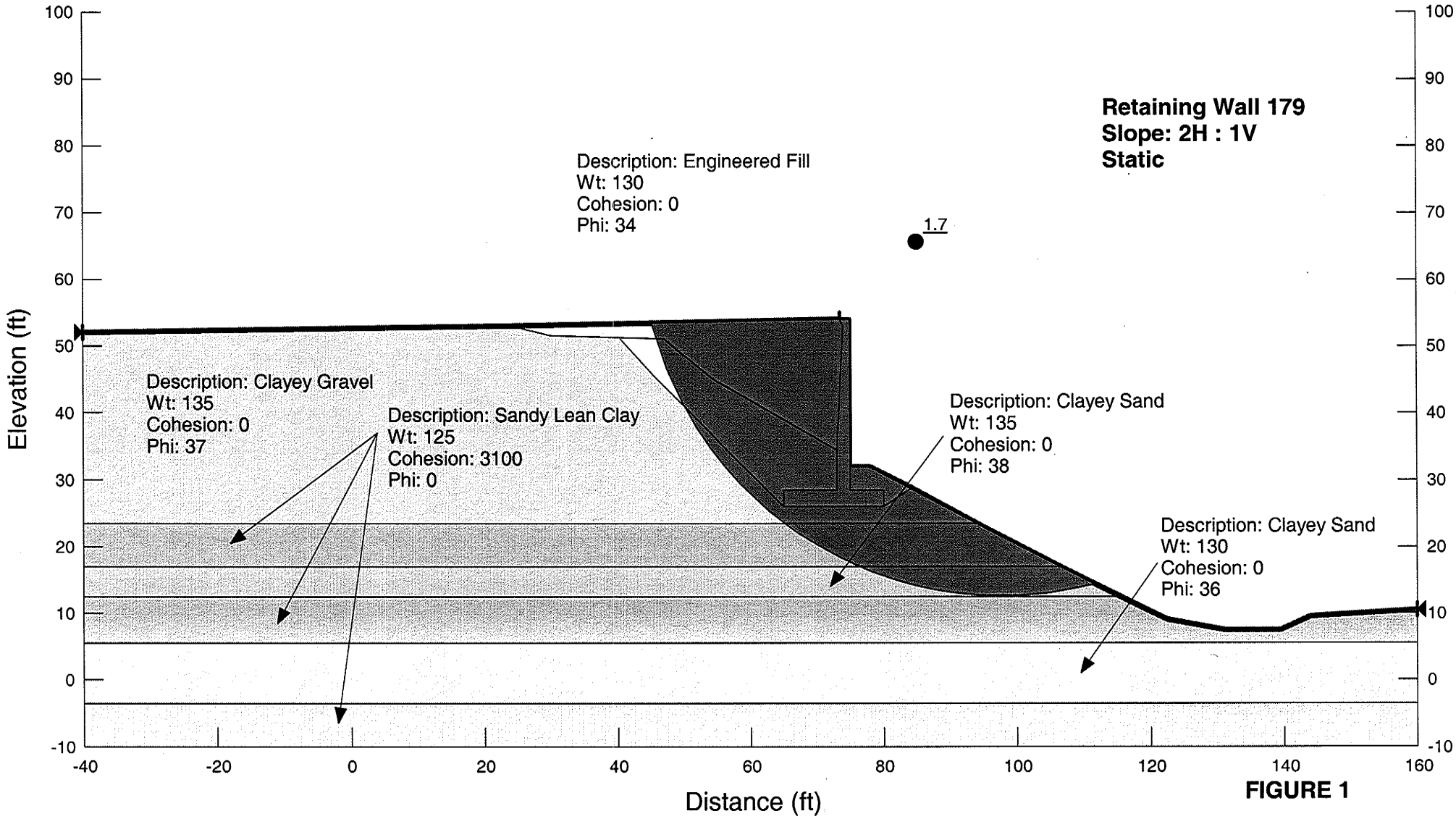


FIGURE 1

RW 179

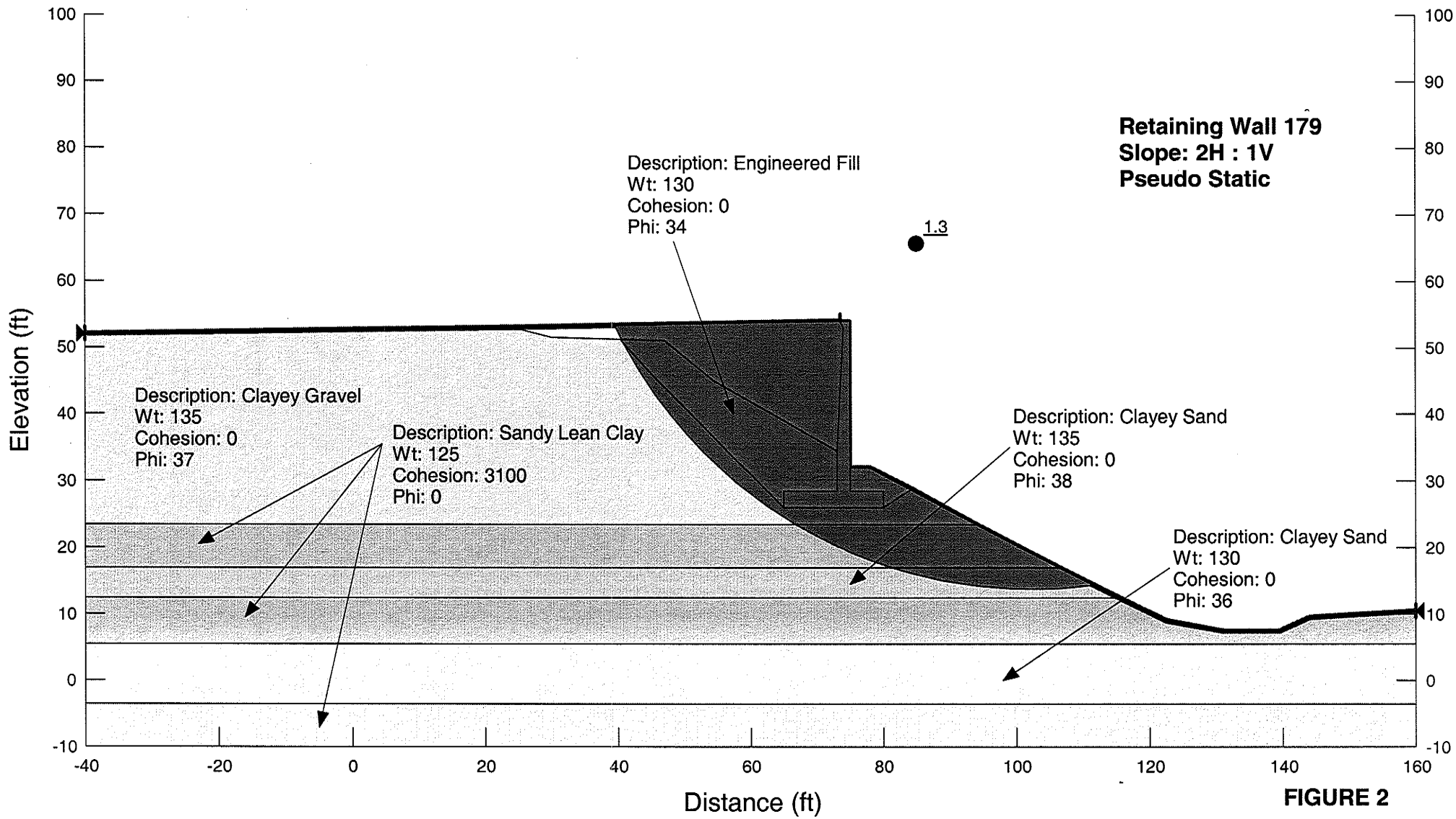


FIGURE 2

RW 179

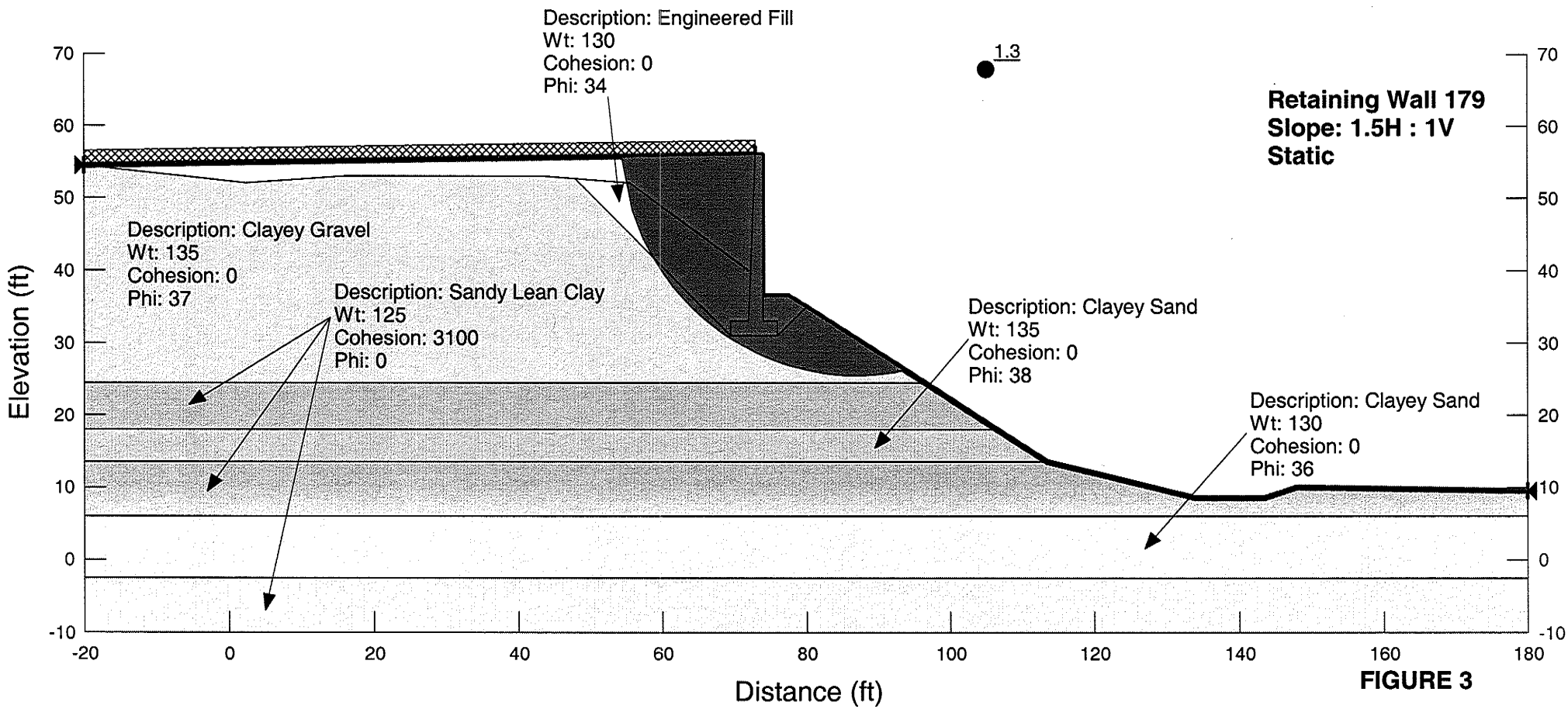


FIGURE 3

RW 179

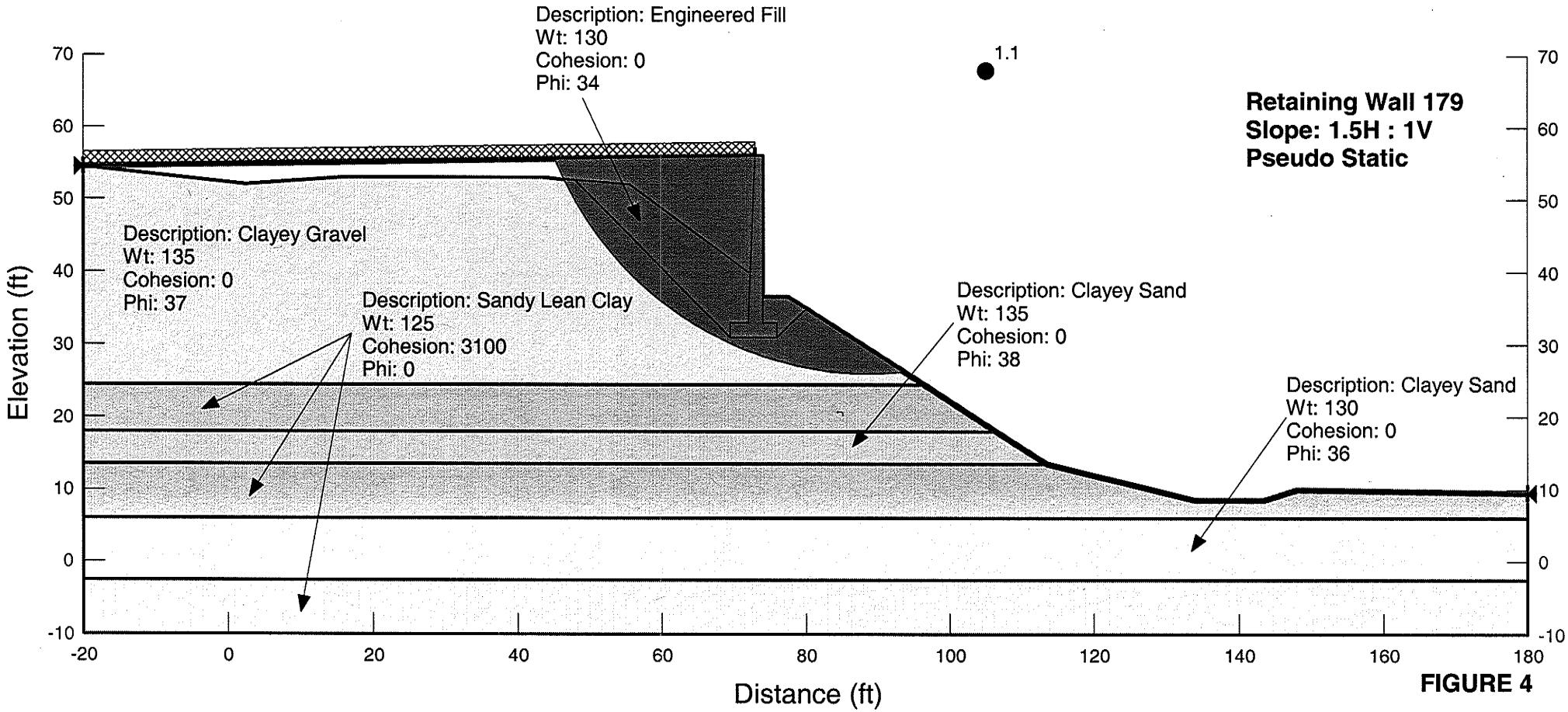


FIGURE 4

RW 179

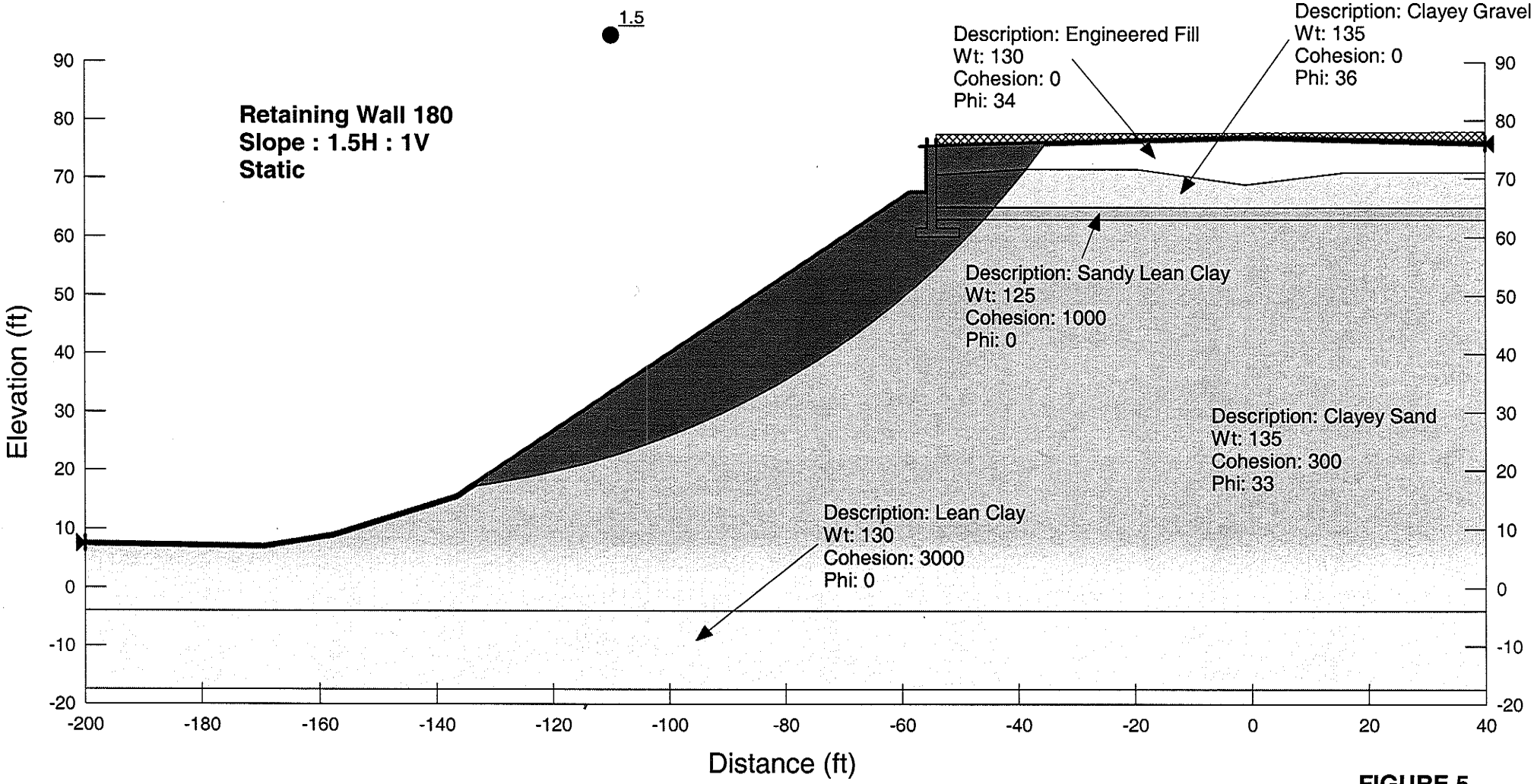


FIGURE 5

RW 179

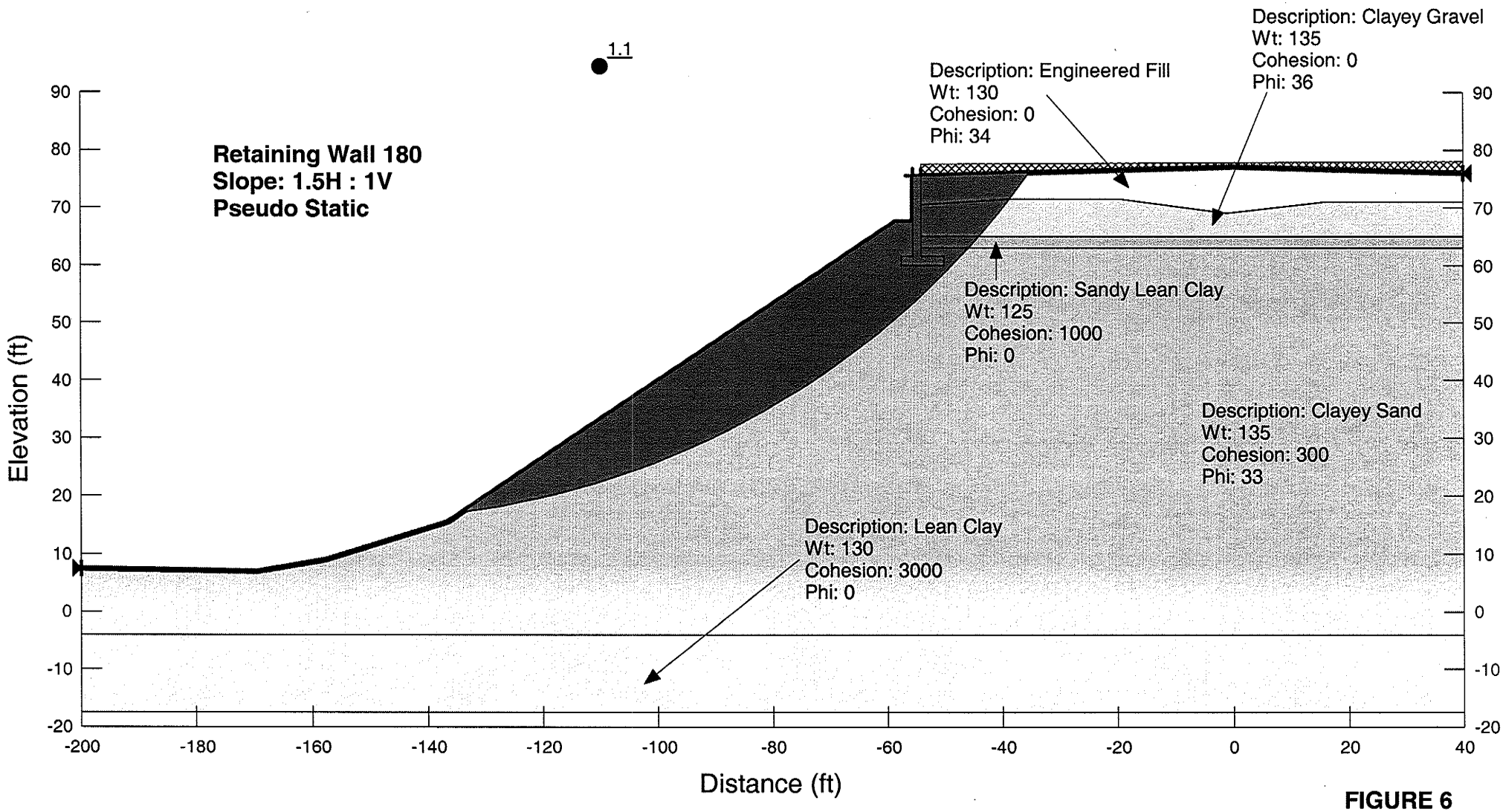


FIGURE 6

RW179

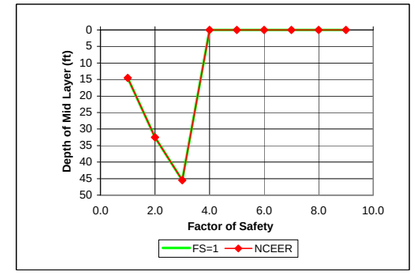
LIQUEFACTION ANALYSIS

Project	101 MSN Petaluma
Project No.	28645045
Boring No.	R-09-012

PGA =	0.6	
M_w =	7.0	
GWT during EQ	6.0	ft
Sampler:	Symbol	Corr. Factor
SPT	S	1
Mod.Cal	M	0.8
California	C	0.7
Mag. Weighting Factor($CSR_M/CSR_{M=7.5}$)		0.82

Note: Cells in Red must be input

Hammer type :	Type		C_E	Code	C_E
	Donut		0.75	1	3
	Safety		1	2	
	Auto		1.16	3	
Borehole Diameter:	(inch)	(mm)	C_B		C_B
	2.5-4.5	65-115	1	1	1
	6	150	1.05	2	
	8	200	1.15	3	
Rod Length:	(feet)	(m)	C_R		
	Default			999	
Sampling Method:	Type		Cs		
	Stand		1		
	No liners		1.2		



Note: F.S. greater than 2 is set to be equal to 2

Layer Number	Soil Type	γ_m	At Bottom of Layer Depth		At Center of Layer Depth		EQ σ_o	EQ u	EQ σ'_o	r_d	EQ CSR	N raw	Sampler	N SPT	Fines Content	$N_{60\text{-}cs}$	C_N	C_E	C_B	C_R	C_S	$(N_1)_{60\text{-}cs}$	$CRR^*_{7.5,1tsf}$	Magnitude Scaling Factor NCEER K_m			Overburden Correction K_σ	Above GWT?	F.S.	Liquefy ?	F.S=1.0
	(USCS)	pcf	ft	m	ft	m	psf	psf	psf						%	FC< 5%	EQ					during EQ	Critical	Lower	Upper	Middle			NCEER	NCEER	
1	CL/CH	120	29.0	8.84	14.5	4.42	1,740	530	1,210	0.970	0.544			0		0.0	1.32	1.16	1.00	0.85	1.00	0		1.19	1.26	1.22	1.000	N	2.00	N	1
2	SP-SM	125	36.0	10.97	32.5	9.91	3,918	1,654	2,264	0.907	0.612	16	S	16	12	18.1	0.97	1.16	1.00	0.95	1.20	23	0.254	1.19	1.26	1.22	0.989	N	0.50	Liquef	1
3	CL/CH	120	55.0	16.76	45.5	13.87	5,495	2,465	3,030	0.799	0.565			0		0.0	0.84	1.16	1.00	1.00	1.00	0		1.19	1.26	1.22	0.944	N	2.00	N	1

Layer Number	Depth to Bot. Layer	Thickness	σ_o	u	σ'_o	r_d	$(N_1)_{60\text{-}cs}$	Liquefy ?	τ_{cyc}	$CSR_{M=7.5}$	CSR_M	Volumetric Strain**			Settl.
	ft	ft	psf	psf	psf			NCEER	psf	τ_{cyc}/σ'_o	τ_{cyc}/σ'_o		%		in
1	29.0	29.0	1,740	530	1,210	0.970	0.0	N	658.0	0.544	0.44				0.00
2	36.0	7.0	3,918	1,654	2,264	0.907	23.1	Liquef	1385.4	0.612	0.50		1.1		0.92
3	55.0	19.0	5,495	2,465	3,030	0.799	0.0	N	1711.5	0.565	0.46				0.00
4															
5															
6															
7															
8															
9															

Total Settlement (inch) = 0.9

* Note: The equation used to obtain $CRR_{7.5}$ is not valid for corrected $(N_1)_{60}$ higher than 30. According to NCEER 1997, the soil layer with corrected $(N_1)_{60}$ higher than 30 blows per foot is unlikely to be susceptible to liquefaction.

** Note: These values were obtained from a chart for estimation of volumetric strain in saturated sands based on a cyclic stress ratio and standard penetration resistance (Tokimatsu and Seed, 1987).
See figure 9.53 from "Geotechnical Earthquake Engineering" by S. Kramer.

LIQUEFACTION ANALYSIS

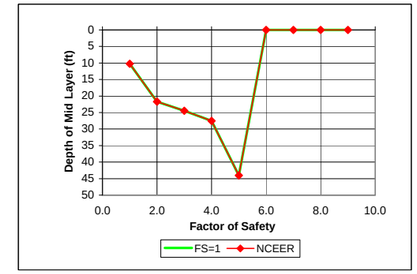
Project	101 MSN Petaluma
Project No.	28645045
Boring No.	R-09-013

PGA =	0.6	
M_w =	7.0	
GWT during EQ	5.0	ft
Sampler:	Symbol	Corr. Factor
SPT	S	1
Mod.Cal	M	0.8
California	C	0.7
Mag. Weighting Factor($CSR_M/CSR_{M=7.5}$)		0.82

Note: Cells in Red must be input

Hammer type :	Type		C_E	Code	C_E
	Donut		0.75	1	3
	Safety		1	2	
	Auto		1.41	3	
Borehole Diameter:	(inch)	(mm)	C_B		C_B
	2.5-4.5	65-115	1	1	1
	6	150	1.05	2	
	8	200	1.15	3	
Rod Length:	(feet)	(m)	C_R		
	Default			999	
Sampling Method:	Type		Cs		
	Stand		1		
	No liners		1.2		

Hammer Eff. (85/60) = 1.41



Note: F.S. greater than 2 is set to be equal to 2

Layer Number	Soil Type	γ_m	At Bottom of Layer Depth		At Center of Layer Depth			EQ u	EQ σ'_o	r_d	EQ CSR	N raw	Sampler	N SPT	Fines Content	$N_{60\text{-}cs}$	C_N	C_E	C_B	C_R	C_S	$(N_1)_{60\text{-}cs}$	$CRR^*_{7.5,1tsf}$	Magnitude Scaling Factor NCEER K_m			Overburden Correction K_σ	Above GWT?	F.S.	Liquefy ?	F.S=1.0
	(USCS)	pcf	ft	m	ft	m	σ_o psf	psf	psf						%	FC< 5%	EQ					during EQ	Critical	Lower	Upper	Middle			NCEER	NCEER	
1	CL	120	20.5	6.25	10.25	3.12	1,230	328	902	0.979	0.520			0		0.0	1.53	1.41	1.00	0.75	1.00	0		1.19	1.26	1.22	1.000	N	2.00	N	1
2	SM	125	23.0	7.01	21.8	6.63	2,616	1,045	1,571	0.952	0.618	18	M	14.4	41	22.3	1.16	1.41	1.00	0.95	1.00	35	0.459	1.19	1.26	1.22	1.000	N	2.00	N	1
3	CL	125	26.0	7.92	24.5	7.47	2,960	1,217	1,743	0.944	0.625			0		0.0	1.10	1.41	1.00	0.95	1.00	0		1.19	1.26	1.22	1.000	N	2.00	N	1
4	SM	125	29.0	8.84	27.5	8.38	3,335	1,404	1,931	0.932	0.628	10	M	8	41	14.6	1.05	1.41	1.00	0.95	1.00	20	0.222	1.19	1.26	1.22	1.000	N	0.43	Liquef	1
5	CL	120	59.0	17.98	44.0	13.41	5,323	2,434	2,889	0.814	0.585					0.0	0.86	1.41	1.00	1.00	1.00	0		1.19	1.26	1.22	0.952	N	2.00	N	1

Layer Number	Depth to Bot. Layer	Thickness	σ_o	u	σ'_o	r_d	$(N_1)_{60\text{-}cs}$	Liquefy ?	τ_{cyc}	$CSR_{M=7.5}$	CSR_M	Volumetric Strain**			Settl.
	ft	ft	psf	psf	psf			NCEER	psf	τ_{cyc}/σ'_o	τ_{cyc}/σ'_o		%		in
1	20.5	20.5	1,230	328	902	0.979	0.0	N	469.4	0.520	0.42				0.00
2	23.0	2.5	2,616	1,045	1,571	0.952	34.6	N	971.5	0.618	0.51				0.00
3	26.0	3.0	2,960	1,217	1,743	0.944	0.0	N	1089.3	0.625	0.51				0.00
4	29.0	3.0	3,335	1,404	1,931	0.932	20.5	Liquef	1212.4	0.628	0.51		1.4		0.50
5	59.0	30.0	5,323	2,434	2,889	0.814	0.0	N	1688.8	0.585	0.48				0.00
6															
7															
8															
9															

Total Settlement (inch) =	0.50

* Note: The equation used to obtain $CRR_{7.5}$ is not valid for corrected $(N_1)_{60}$ higher than 30. According to NCEER 1997, the soil layer with corrected $(N_1)_{60}$ higher than 30 blows per foot is unlikely to be susceptible to liquefaction.

** Note: These values were obtained from a chart for estimation of volumetric strain in saturated sands based on a cyclic stress ratio and standard penetration resistance (Tokimatsu and Seed, 1987).
See figure 9.53 from "Geotechnical Earthquake Engineering" by S. Kramer.

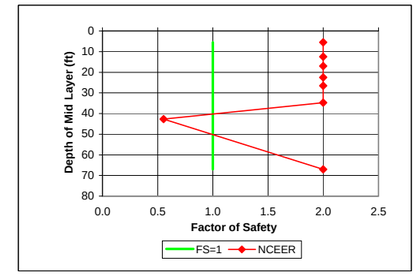
LIQUEFACTION ANALYSIS

Project	101 MSN Petaluma
Project No.	28645045
Boring No.	R-09-014

PGA =	0.6	
M_w =	7.0	
GWT during EQ	9.0	ft
Sampler:	Symbol	Corr. Factor
SPT	S	1
Mod.Cal	M	0.8
California	C	0.7
Mag. Weighting Factor($CSR_M/CSR_{M=7.5}$)		0.82

Note: Cells in Red must be input

Hammer type :	Type		C_E	Code	C_E
	Donut		0.75	1	3
	Safety		1	2	
	Auto		1.41	3	
Borehole Diameter:	(inch)	(mm)	C_B		C_B
	2.5-4.5	65-115	1	1	1
	6	150	1.05	2	
	8	200	1.15	3	
Rod Length:	(feet)	(m)	C_R		
	Default			999	
Sampling Method:	Type		Cs		
	Stand		1		
	No liners		1.2		



Note: F.S. greater than 2 is set to be equal to 2

Layer Number	Soil Type	γ_m	At Bottom of Layer Depth		At Center of Layer Depth		σ_o	EQ u	EQ σ'_o	r_d	EQ CSR	N raw	Sampler	N SPT	Fines Content	N_{60-cs}	C_N	C_E	C_B	C_R	C_S	$(N_1)_{60-cs}$	CRR*$_{7.5,1tsf}$	Magnitude Scaling Factor NCEER K_m			Overburden Correction K_σ	Above GWT?	F.S.	Liquefy ?	F.S=1.0
	(USCS)	pcf	ft	m	ft	m	psf	psf	psf						%	FC< 5%	EQ					during EQ	Critical	Lower	Upper	Middle			NCEER	NCEER	
1	SM	125	11.0	3.35	5.5	1.68	688	0	688	0.989	0.386	41	M	32.8	25	40.9	1.75	1.41	1.00	0.75	1.00	76	0.459	1.19	1.26	1.22	1.000	Y	2.00	N	1
2	CL	120	14.0	4.27	12.5	3.81	1,555	218	1,337	0.974	0.442					0.0	1.26	1.41	1.00	0.75	1.00	0		1.19	1.26	1.22	1.000	N	2.00	N	1
3	SM	125	20.0	6.10	17.0	5.18	2,110	499	1,611	0.964	0.493	18	M	14.4	44	22.3	1.15	1.41	1.00	0.85	1.00	31	0.459	1.19	1.26	1.22	1.000	N	2.00	N	1
4	SM	125	25.0	7.62	22.5	6.86	2,798	842	1,955	0.950	0.530	36	M	28.8	44	39.6	1.04	1.41	1.00	0.95	1.00	55	0.459	1.19	1.26	1.22	1.000	N	2.00	N	1
5	SM	130	28.0	8.53	26.5	8.08	3,305	1,092	2,213	0.936	0.545	59	M	47.2	44	61.6	0.98	1.41	1.00	0.95	1.00	81	0.459	1.19	1.26	1.22	0.992	N	2.00	N	1
6	CL	125	41.5	12.65	34.8	10.59	4,344	1,607	2,737	0.892	0.552			0		0.0	0.88	1.41	1.00	1.00	1.00	0		1.19	1.26	1.22	0.961	N	2.00	N	1
7	SP-SM	130	44.0	13.41	42.8	13.03	5,350	2,106	3,244	0.826	0.531	24	M	19.2	10	20.5	0.81	1.41	1.00	1.00	1.00	23	0.258	1.19	1.26	1.22	0.932	N	0.55	Liquef	1
8	CL	120	90.0	27.43	67.0	20.42	8,273	3,619	4,653	0.609	0.422			0		0.0	0.67	1.41	1.00	1.00	1.00	0		1.19	1.26	1.22	0.862	N	2.00	N	1

Layer Number	Depth to Bot. Layer	Thickness	σ_o	u	σ'_o	r_d	$(N_1)_{60-cs}$	Liquefy ?	τ_{cyc}	$CSR_{M=7.5}$	CSR_M	Volumetric Strain**			Settl.
	ft	ft	psf	psf	psf			NCEER	psf	τ_{cyc}/σ'_o	τ_{cyc}/σ'_o		%		in
1	11.0	11.0	688	0	688	0.989	75.8	N	265.2	0.386	0.32				0.00
2	14.0	3.0	1,555	218	1,337	0.974	0.0	N	590.6	0.442	0.36				0.00
3	20.0	6.0	2,110	499	1,611	0.964	30.6	N	793.4	0.493	0.40				0.00
4	25.0	5.0	2,798	842	1,955	0.950	55.1	N	1036.4	0.530	0.43				0.00
5	28.0	3.0	3,305	1,092	2,213	0.936	80.7	N	1206.8	0.545	0.45				0.00
6	41.5	13.5	4,344	1,607	2,737	0.892	0.0	N	1511.7	0.552	0.45				0.00
7	44.0	2.5	5,350	2,106	3,244	0.826	23.3	Liquef	1722.8	0.531	0.43		1.2		0.36
8	90.0	46.0	8,273	3,619	4,653	0.609	0.0	N	1965.5	0.422	0.35				0.00

Total Settlement (inch) = 0.4

* Note: The equation used to obtain $CRR_{7.5}$ is not valid for corrected $(N_1)_{60}$ higher than 30. According to NCEER 1997, the soil layer with corrected $(N_1)_{60}$ higher than 30 blows per foot is unlikely to be susceptible to liquefaction.

** Note: These values were obtained from a chart for estimation of volumetric strain in saturated sands based on a cyclic stress ratio and standard penetration resistance (Tokimatsu and Seed, 1987).
See figure 9.53 from "Geotechnical Earthquake Engineering" by S. Kramer.

LIQUEFACTION ANALYSIS

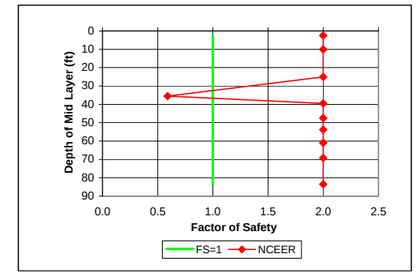
Project	101 MSN Petaluma
Project No.	28645045
Boring No.	R-09-015

PGA =	0.6	
M_w =	7.0	
GWT during EQ	29.0	ft
Sampler:	Symbol	Corr. Factor
SPT	S	1
Mod.Cal	M	0.8
California	C	0.7
Mag. Weighting Factor($CSR_M/CSR_{M=7.5}$)		0.82

Note: Cells in Red must be input

Hammer type :	Type		C_E	Code	C_E
	Donut		0.75	1	3
	Safety		1	2	
	Auto		1.41	3	
Borehole Diameter:	(inch)	(mm)	C_B		C_B
	2.5-4.5	65-115	1	1	1
	6	150	1.05	2	
	8	200	1.15	3	
Rod Length:	(feet)	(m)	C_R		
	Default			999	
Sampling Method:	Type		Cs		
	Stand		1		
	No liners		1.2		

Hammer Efficiency
85%
(85/60 = 1.41)



Note: F.S. greater than 2 is set to be equal to 2

Layer Number	Soil Type	γ_m	At Bottom of Layer Depth		At Center of Layer Depth		EQ σ_o	EQ u	EQ σ'_o	r_d	EQ CSR	N raw	Sampler	N SPT	Fines Content	$N_{60\text{-}cs}$	C_N	C_E	C_B	C_R	C_S	$(N_1)_{60\text{-}cs}$	$CRR^*_{7.5,1tsf}$	Magnitude Scaling Factor NCEER K_m Lower	Upper	Middle	Overburden Correction K_σ	Above GWT?	F.S. NCEER	Liquefy ? NCEER	F.S=1.0
	(USCS)	pcf	ft	m	ft	m	psf	psf	psf						%	FC< 5%	EQ					during EQ	Critical								
1	GM	135	5.0	1.52	2.5	0.76	338	0	338	0.996	0.388	43	M	34.4	45	46.3	2.00	1.41	1.00	0.75	1.00	98	0.459	1.19	1.26	1.22	1.000	Y	2.00	N	1
2	SM	135	15.0	4.57	10.0	3.05	1,350	0	1,350	0.979	0.382	17	M	13.6	25	19.5	1.25	1.41	1.00	0.75	1.00	26	0.295	1.19	1.26	1.22	1.000	Y	2.00	N	1
3	CL	120	35.0	10.67	25.0	7.62	3,225	0	3,225	0.942	0.367					0.0	0.81	1.41	1.00	0.95	1.00	0		1.19	1.26	1.22	0.933	Y	2.00	N	1
4	SP-SM	130	36.0	10.97	35.5	10.82	4,490	406	4,084	0.887	0.380	22	M	17.6	10	18.8	0.72	1.41	1.00	1.00	1.00	19	0.206	1.19	1.26	1.22	0.889	N	0.59	Liquef	1
5	CL	130	43.0	13.11	39.5	12.04	5,010	655	4,355	0.855	0.384					0.0	0.70	1.41	1.00	1.00	1.00	0		1.19	1.26	1.22	0.876	N	2.00	N	1
6	SP-SM	125	52.0	15.85	47.5	14.48	6,028	1,154	4,873	0.778	0.375	40	M	32	10	33.6	0.66	1.41	1.00	1.00	1.00	31	0.459	1.19	1.26	1.22	0.852	N	2.00	N	1
7	SC-SM	125	55.5	16.92	53.8	16.38	6,809	1,544	5,264	0.715	0.361	30	M	24	40	33.8	0.63	1.41	1.00	1.00	1.00	30	0.459	1.19	1.26	1.22	0.835	N	2.00	N	1
8	CL	125	66.5	20.27	61.0	18.59	7,715	1,997	5,718	0.651	0.343			0		0.0	0.61	1.41	1.00	1.00	1.00	0		1.19	1.26	1.22	0.817	N	2.00	N	1
9	SC-SM	125	72.0	21.95	69.3	21.11	8,746	2,512	6,235	0.596	0.326	35	M	28	40	38.6	0.58	1.41	1.00	1.00	1.00	32	0.459	1.19	1.26	1.22	0.797	N	2.00	N	1
10	CL	110	95.0	28.96	83.5	25.45	10,355	3,401	6,954	0.537	0.312					0.0	0.55	1.41	1.00	1.00	1.00	0		1.19	1.26	1.22	0.772	N	2.00	N	1

Layer Number	Depth to Bot. Layer	Thickness	σ_o	u	σ'_o	r_d	$(N_1)_{60\text{-}cs}$	Liquefy ?	τ_{cyc}	$CSR_{M=7.5}$	CSR_M	Volumetric Strain**			Settl.
	ft	ft	psf	psf	psf			NCEER	psf	τ_{cyc}/σ'_o	τ_{cyc}/σ'_o		%		in
1	5.0	5.0	338	0	338	0.996	97.9	N	131.1	0.388	0.32				0.00
2	15.0	10.0	1,350	0	1,350	0.979	25.8	N	515.5	0.382	0.31				0.00
3	35.0	20.0	3,225	0	3,225	0.942	0.0	N	1184.6	0.367	0.30				0.00
4	36.0	1.0	4,490	406	4,084	0.887	19.1	Liquef	1553.4	0.380	0.31		1.2		0.14
5	43.0	7.0	5,010	655	4,355	0.855	0.0	N	1671.4	0.384	0.31				0.00
6	52.0	9.0	6,028	1,154	4,873	0.778	31.2	N	1829.5	0.375	0.31				0.00
7	55.5	3.5	6,809	1,544	5,264	0.715	30.2	N	1899.4	0.361	0.29				0.00
8	66.5	11.0	7,715	1,997	5,718	0.651	0.0	N	1959.5	0.343	0.28				0.00
9	72.0	5.5	8,746	2,512	6,235	0.596	31.7	N	2033.0	0.326	0.27				0.00
10	95.0	23.0	10,355	3,401	6,954	0.537	0.0	N	2167.9	0.312	0.25				0.00

Total Settlement (inch) = 0.14

* Note: The equation used to obtain $CRR_{7.5}$ is not valid for corrected $(N_1)_{60}$ higher than 30. According to NCEER 1997, the soil layer with corrected $(N_1)_{60}$ higher than 30 blows per foot is unlikely to be susceptible to liquefaction.

** Note: These values were obtained from a chart for estimation of volumetric strain in saturated sands based on a cyclic stress ratio and standard penetration resistance (Tokimatsu and Seed, 1987).
See figure 9.53 from "Geotechnical Earthquake Engineering" by S. Kramer.

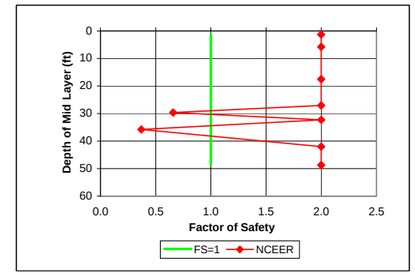
LIQUEFACTION ANALYSIS

Project	101 MSN Petaluma
Project No.	28645045
Boring No.	A-09-103

PGA =	0.6	
M_w =	7.0	
GWT during EQ	14.0	ft
Sampler:	Symbol	Corr. Factor
SPT	S	1
Mod.Cal	M	0.8
California	C	0.7
Mag. Weighting Factor($CSR_M/CSR_{M=7.5}$)		0.82

Note: Cells in Red must be input

Hammer type :	Type		C_E	Code	C_E
	Donut		0.75	1	3
	Safety		1	2	
	Auto		1.16	3	
Borehole Diameter:	(inch)	(mm)	C_B		C_B
	2.5-4.5	65-115	1	1	3
	6	150	1.05	2	
	8	200	1.15	3	
Rod Length:	(feet)	(m)	C_R		
	Default			999	
Sampling Method:	Type		Cs		
	Stand		1		
	No liners		1.2		



Note: F.S. greater than 2 is set to be equal to 2

Layer Number	Soil Type	γ_m	At Bottom of Layer Depth		At Center of Layer Depth		EQ σ_o	EQ u	EQ σ'_o	r_d	EQ CSR	N raw	Sampler	N SPT	Fines Content	$N_{60\text{-}cs}$	C_N	C_E	C_B	C_R	C_S	$(N_1)_{60\text{-}cs}$	$CRR^*_{7.5,1tsf}$	Magnitude Scaling Factor NCEER K_m Lower	Upper	Middle	Overburden Correction K_σ	Above GWT?	F.S.	Liquefy ?	F.S=1.0
	(USCS)	pcf	ft	m	ft	m	psf	psf	psf						%	FC< 5%	EQ					during EQ	Critical						NCEER	NCEER	
1	SM	120	2.5	0.76	1.25	0.38	150	0	150	0.999	0.390	100	M	80	25	93.5	2.00	1.16	1.15	0.75	1.00	187	0.459	1.19	1.26	1.22	1.000	Y	2.00	N	1
2	CL	120	9.0	2.74	5.8	1.75	690	0	690	0.989	0.386			0		0.0	1.75	1.16	1.15	0.75	1.00	0		1.19	1.26	1.22	1.000	Y	2.00	N	1
3	CH	120	26.0	7.92	17.5	5.33	2,100	218	1,882	0.963	0.419			0		0.0	1.06	1.16	1.15	0.85	1.00	0		1.19	1.26	1.22	1.000	N	2.00	N	1
4	SM	125	28.2	8.60	27.1	8.26	3,258	817	2,440	0.934	0.486	34	M	27.2	17	31.8	0.93	1.16	1.15	0.95	1.00	38	0.459	1.19	1.26	1.22	0.978	N	2.00	N	1
5	SC-SM	125	31.0	9.45	29.6	9.02	3,570	973	2,597	0.923	0.495	14	S	14	17	17.9	0.90	1.16	1.15	0.95	1.20	25	0.275	1.19	1.26	1.22	0.969	N	0.66	Liquef	1
6	CL	120	33.5	10.21	32.3	9.83	3,895	1,139	2,756	0.908	0.501			0		0.0	0.88	1.16	1.15	0.95	1.00	0		1.19	1.26	1.22	0.960	N	2.00	N	1
7	SP-SM	130	38.0	11.58	35.8	10.90	4,338	1,357	2,980	0.885	0.502	12	M	9.6	17	13.2	0.84	1.16	1.15	1.00	1.00	15	0.160	1.19	1.26	1.22	0.947	N	0.37	Liquef	1
8	SP-SM	130	46.0	14.02	42.0	12.80	5,150	1,747	3,403	0.833	0.492	31	S	31	12	33.5	0.79	1.16	1.15	1.00	1.20	42	0.459	1.19	1.26	1.22	0.924	N	2.00	N	1
9	CL	110	51.5	15.70	48.8	14.86	5,973	2,168	3,804	0.765	0.469			0		0.0	0.75	1.16	1.15	1.00	1.00	0		1.19	1.26	1.22	0.903	N	2.00	N	1

Layer Number	Depth to Bot. Layer	Thickness	σ_o	u	σ'_o	r_d	$(N_1)_{60\text{-}cs}$	Liquefy ?	τ_{cyc}	$CSR_{M=7.5}$	CSR_M	Volumetric Strain**			Settl.
	ft	ft	psf	psf	psf			NCEER	psf	τ_{cyc}/σ'_o	τ_{cyc}/σ'_o		%		in
1	2.5	2.5	150	0	150	0.999	187.1	N	58.4	0.390	0.32				0.00
2	9.0	6.5	690	0	690	0.989	0.0	N	266.0	0.386	0.31				0.00
3	26.0	17.0	2,100	218	1,882	0.963	0.0	N	788.7	0.419	0.34				0.00
4	28.2	2.2	3,258	817	2,440	0.934	37.6	N	1186.4	0.486	0.40				0.00
5	31.0	2.8	3,570	973	2,597	0.923	24.5	Liquef	1284.5	0.495	0.40		1.1		0.37
6	33.5	2.5	3,895	1,139	2,756	0.908	0.0	N	1379.7	0.501	0.41				0.00
7	38.0	4.5	4,338	1,357	2,980	0.885	14.8	Liquef	1497.6	0.502	0.41		1.90		1.03
8	46.0	8.0	5,150	1,747	3,403	0.833	42.3	N	1672.7	0.492	0.40				0.00
9	51.5	5.5	5,973	2,168	3,804	0.765	0.0	N	1783.0	0.469	0.38				0.00

Total Settlement (inch) = 1.40

* Note: The equation used to obtain $CRR_{7.5}$ is not valid for corrected $(N_1)_{60}$ higher than 30. According to NCEER 1997, the soil layer with corrected $(N_1)_{60}$ higher than 30 blows per foot is unlikely to be susceptible to liquefaction.

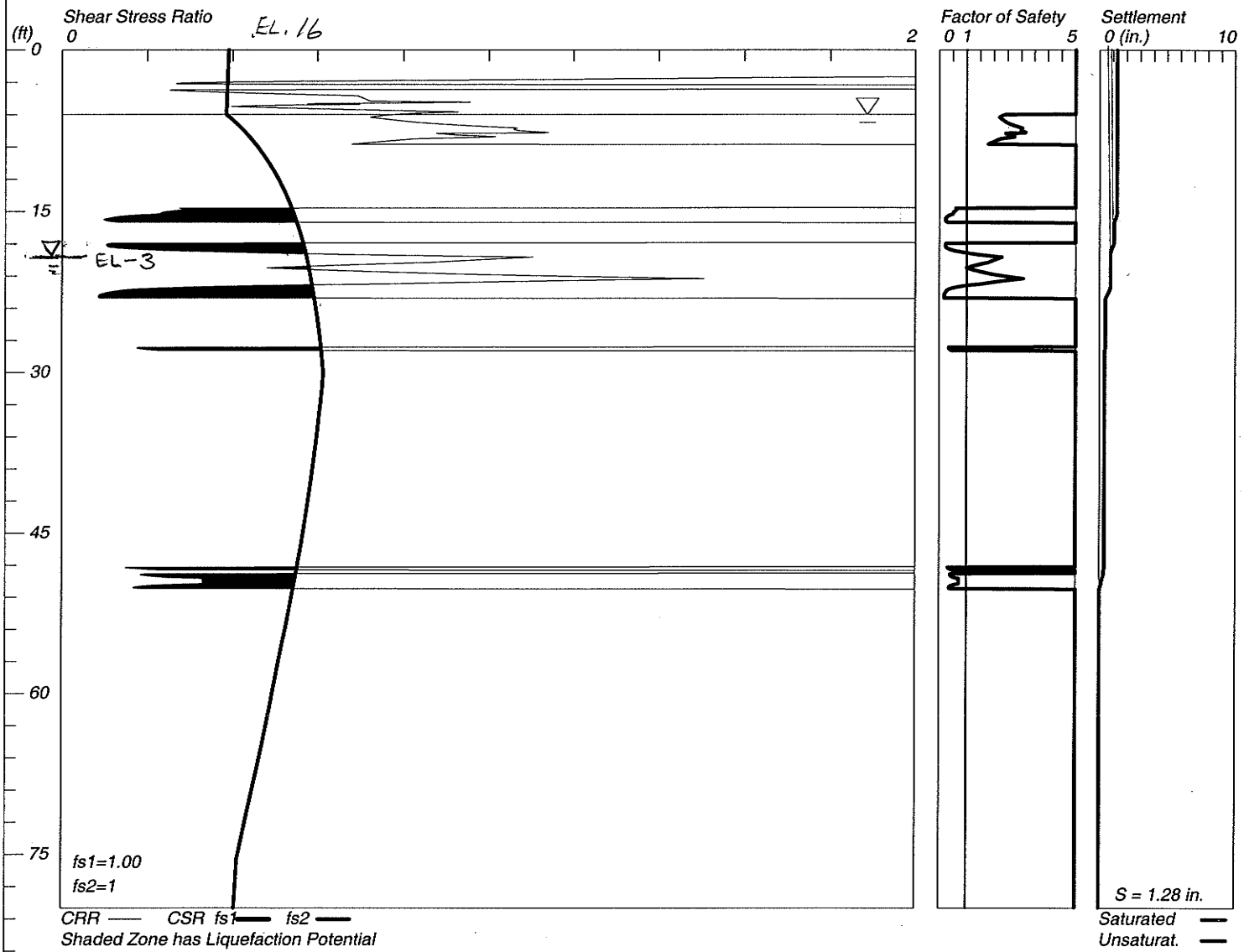
** Note: These values were obtained from a chart for estimation of volumetric strain in saturated sands based on a cyclic stress ratio and standard penetration resistance (Tokimatsu and Seed, 1987).
See figure 9.53 from "Geotechnical Earthquake Engineering" by S. Kramer.

LIQUEFACTION ANALYSIS

101 MSN Petaluma

Hole No.=CPT-09-102 Water Depth=6 ft

Magnitude=7
Acceleration=0.6g



LiquefyPro CivilTech Software USA www.civiltech.com

URS

28645045

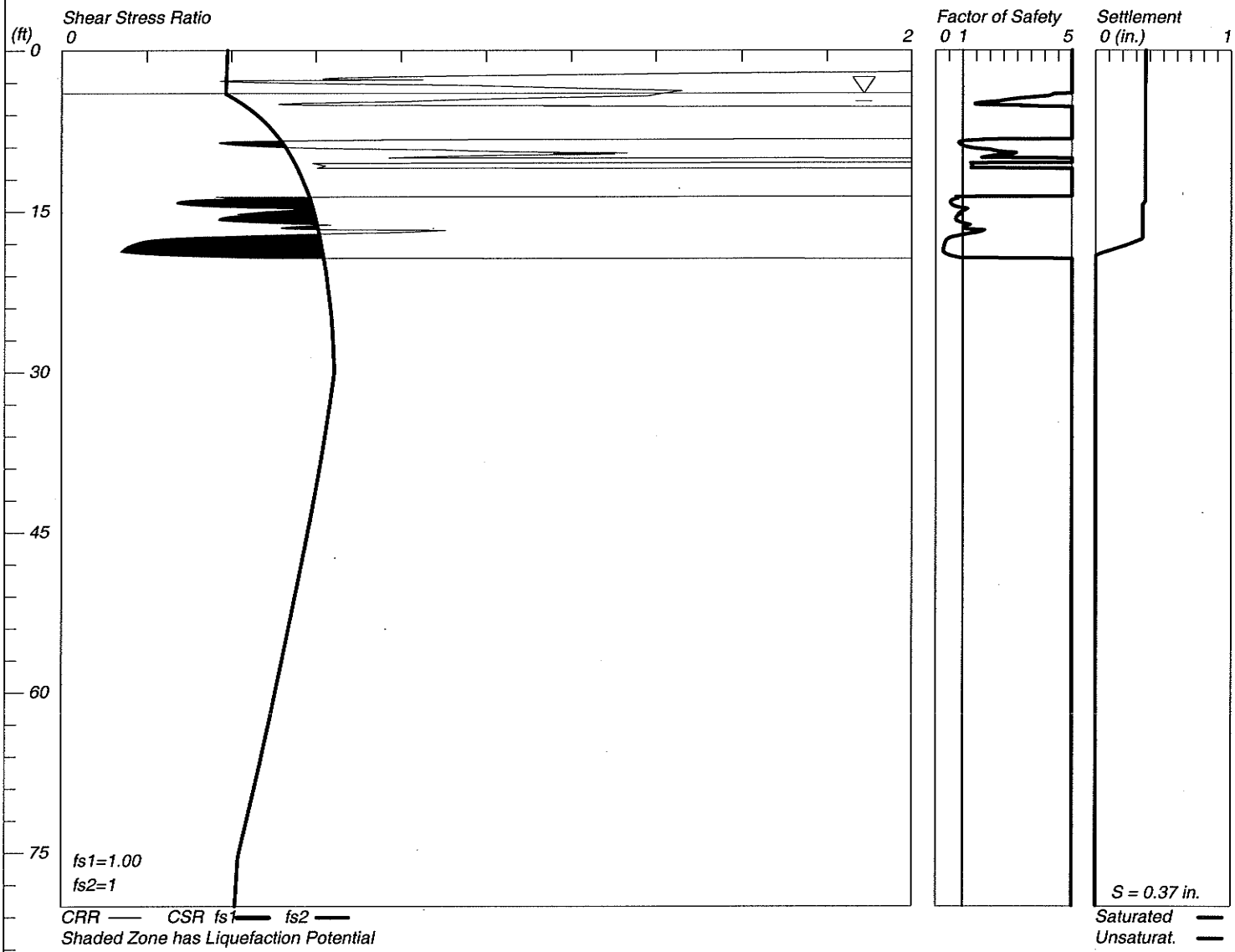
Plate D-1

LIQUEFACTION ANALYSIS

101 MSN Petaluma

Hole No.=CPT-09-104 Water Depth=4 ft

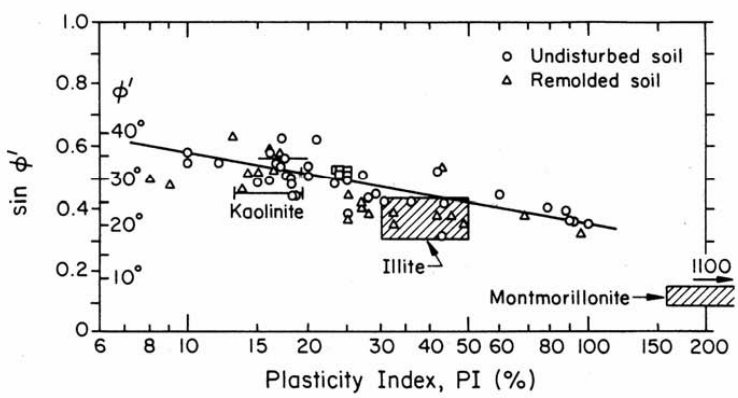
Magnitude=7
Acceleration=0.6g



LiquefyPro CivilTech Software USA www.civiltech.com

Overhead Sign A at "A" Line Station 151+84

1. Estimate ϕ' for CIDH Piles in cohesive clays
    a. Include borings A-09-123 from B2, EA 264081.
    b. Lean Clays of PI = 15 to 50
    c. PI = 15 => ϕ' = 33°
    d. PI = 50 => ϕ' = 26°
    e. Use ϕ' = 30°



Source: Mitchell (1993), Kulhawy and Mayne (1990).

Figure 3.4: Correlation Between Drained Angle of Friction of Fine-Grained Soils and Plasticity Index.

Reference: FHWA Geotechnical Engineering Circular No. 7, Soil Nail Walls, Report No. FHWA 0-IF-03-017.

2. Estimate ϕ' for CIDH Piles in granular – sands
    a. N average = 24
    b. Overburden, σ' = 13 x 120 + 2 x 135 = 1830 psf (1.8 ksf)
    c. Dr = 80%
    d. ϕ' = 38°

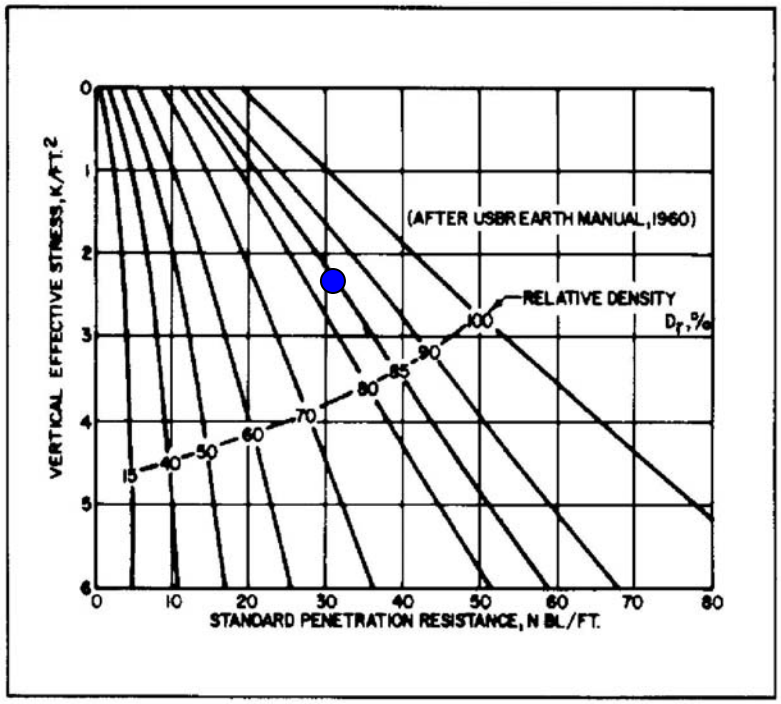


FIGURE 3
Correlations Between Relative Density and Standard Penetration Resistance in Accordance with Gibbs and Holtz

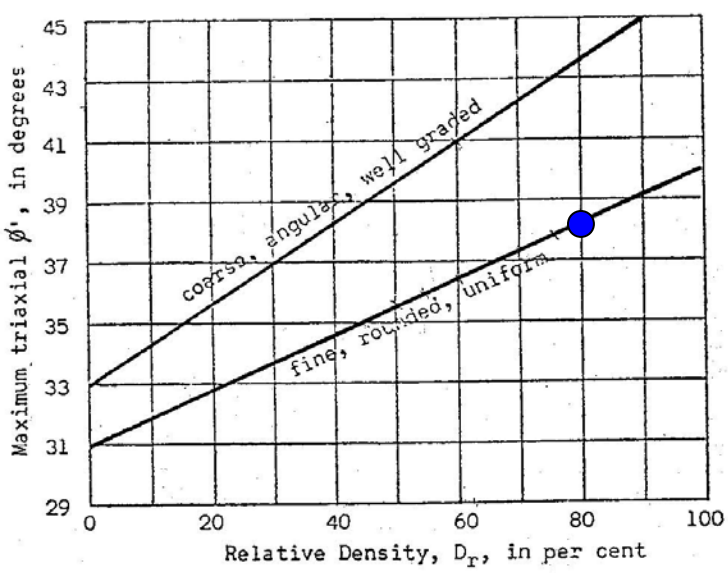


Fig. 45. Approximate Correlation Between the Effective Friction Angle and Relative Density for Quartz Sands (After Schmertmann, 1975).

3. Summary
    a. For clays, $\phi' \approx 30°$
    b. For sands, $\phi' \approx 38°$
    c. Recommend $\phi' = 30°$

US 101 MSN B4

3/30/2010

CIDH Pile Design Spreadsheet

Sign "D"

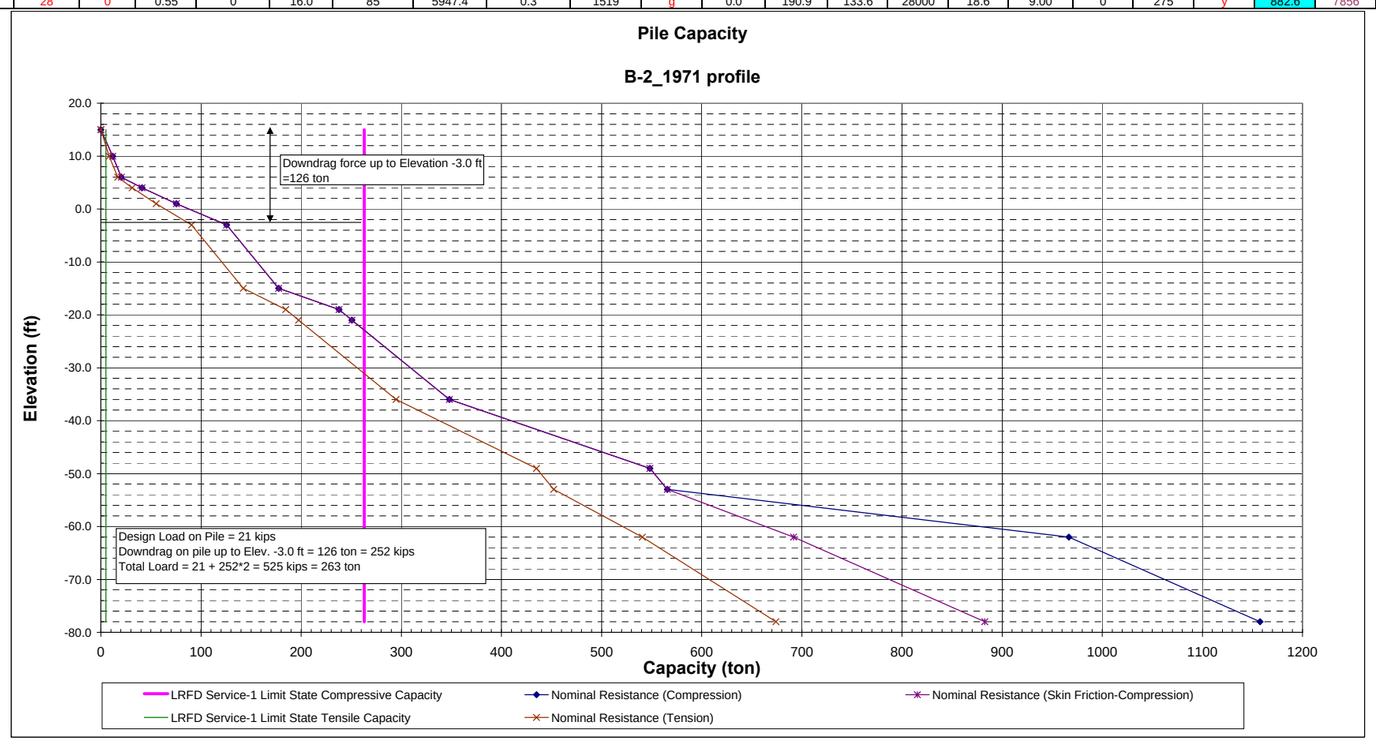
B-2_1971

Caltrans Design Method For CIDH Pile

Project Name:	US 101 MSN B4 Petaluma
Project Number:	28645045
Bridge Name:	Overhead Sign D
Boring Surface El. (m)	4.6
Boring Surface El. (ft)	15.0
Design GWS El. (ft)	4.0
Unit Weight of Water (pcf)	62.4
Depth with no strength	
Convert. Factor	3.281
Bottom of Pile Cap El. (m)	4.6
Bottom of Pile Cap El. (ft)	15.0
Bottom of Fill El. (ft)	15
Scour El. (ft)	NA

LRFD service-1 limit state compressive capacity	263	ton	(including downdrag force)				
LRFD service-1 limit state compressive capacity	2341	kN		Pile Type	CIDH		
Pile Diameter	60	inch		Pile Shape	Circular		
Pile Diameter	1524	mm		Pile Surface Area	4.79	sq. m/m	Pile Tip Area 1.82 sq. m
Pile Diameter	5.00	ft		Pile Surface Area	15.71	sq. ft/ft	Pile Tip Area 19.63 sq. ft.

Layer No.	Layer Elevation Top (m)	Top (feet)	Bot. (m)	Bot. (feet)	Lateral Resists?	N_{SPT} blows/ft	Cohesion c (psf)	Adhesion Factor α	Ult. Load Transfer f_{si} (psf)	Layer Thickness (feet)	Depth to Layer Center (feet)	Effective Vert. Stress (Cen. Lay.) (psf)	β	f_{max} (psf)	Soil Type G= gran. C=cohes.	delta Lat. Res. Cohesive (ton)	Friction (comp) (ton)	Friction (tensile) (ton)	q_T (granular) (psf)	z/B (-)	Nc (cohesive) (-)	q_T (cohesive) (psf)	Bearing Capacity (B.C.) (ton)	Include B.C.?	Compression Cumulative Axial Res. (skin) (ton)	(skin) (kN)	(Tot) (ton)	(Tot) (kN)	LRFD service-1 Limit State Compressive Capacity (ton)	(kN)	Tension Cumulative Axial Res. (Skin) (ton)	(kN)	LRFD service-1 Limit State Compressive Capacity (ton)	(kN)
			4.57	15.0																					0	0	0.0	0	263	2341	0	0	5	45
1	4.57	15.0	3.05	10.0	Y	41	0	0.55	0	5.0	2.5	250.0	1.2	300	g	0.0	11.8	8.2	41000	1.0	7.20	0	403	n	11.8	105	11.8	105	263	2341	8.2	73	5	45
2	3.05	10.0	1.83	6.0	y	5	500	0.55	275	4.0	7	865.0	1.1	989	c	8.6	0.0	0.0	5000	1.8	8.16	4080	40	n	20.4	182	20.4	182	263	2341	16.9	150	5	45
3	1.83	6.0	1.22	4.0	y	5	0	0.55	0	2.0	10	1230.0	1.1	1320	g	0.0	20.7	14.5	5000	2.2	8.64	0	49	n	41.2	366	41.2	366	263	2341	31.4	279	5	45
4	1.22	4.0	0.3	1.0	Y	5	0	0.55	0	3.0	12.5	1417.6	1.0	1450	g	0.0	34.2	23.9	5000	2.8	9.00	0	49	n	75.3	670	75.3	670	263	2341	55.3	492	5	45
5	0.3	1.0	-0.91	-3.0	Y	10	0	0.55	0	4.0	16	1668.0	1.0	1601	g	0.0	50.3	35.2	10000	3.6	9.00	0	98	n	125.6	1118	125.6	1118	263	2341	90.5	805	5	45
6	-0.91	-3.0	-4.57	-15.0	Y	10	1000	0.55	550	12.0	24	2138.8	0.8	1794	c	51.8	0.0	0.0	10000	6.0	9.00	9000	88	n	177.5	1579	177.5	1579	263	2341	142.4	1266	5	45
7	-4.57	-15.0	-5.79	-19.0	Y	11	0	0.55	0	4.0	32	2609.6	0.7	1922	g	0.0	60.4	42.3	11000	6.8	9.00	0	108	n	237.8	2117	237.8	2117	263	2341	184.6	1642	5	45
8	-5.79	-19.0	-6.4	-21.0	Y	11	1500	0.55	825	2.0	35	2792.4	0.7	1958	c	13.0	0.0	0.0	11000	7.2	9.00	13500	133	n	250.8	2232	250.8	2232	263	2341	197.6	1758	5	45
9	-6.4	-21.0	-10.97	-36.0	Y	17	1500	0.55	825	15.0	43.5	3253.2	0.6	1983	c	97.2	0.0	0.0	17000	10.2	9.00	13500	133	n	348.0	3097	348.0	3097	263	2341	294.8	2622	5	45
10	-10.97	-36.0	-14.93	-49.0	Y	20	0	0.55	0	13.0	57.5	4119.6	0.5	1962	g	0.0	200.3	140.2	20000	12.8	9.00	0	196	n	548.3	4880	548.3	4880	263	2341	435.0	3870	5	45
11	-14.93	-49.0	-16.15	-53.0	Y	22	1000	0.55	550	4.0	66	4718.0	0.4	1903	c	17.3	0.0	0.0	22000	13.6	9.00	9000	88	n	565.6	5034	565.6	5034	263	2341	452.3	4024	5	45
12	-16.15	-53.0	-18.9	-62.0	Y	28	0	0.55	0	9.0	72.5	5093.6	0.4	1785	g	0.0	126.2	88.3	28000	15.4	9.00	0	275	y	691.8	6157	966.7	8604	263	2341	540.6	4809	5	45
13	-18.9	-62.0	-23.77	-78.0	Y	28	0	0.55	0	16.0	85	5947.4	0.3	1519	g	0.0	190.9	133.6	28000	18.6	9.00	0	275	y	882.6	7856	1157.5	10302	263	2341	674.2	5998	5	45
14	-23.77	-78.0																																	
Bottom																																			



24" CIDH Pile with 70 tons Allowable Bearing Capacity

PLANS OF RETAINING WALLS, SOUND WALLS AND OVERHEAD SIGN STRUCTURES

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

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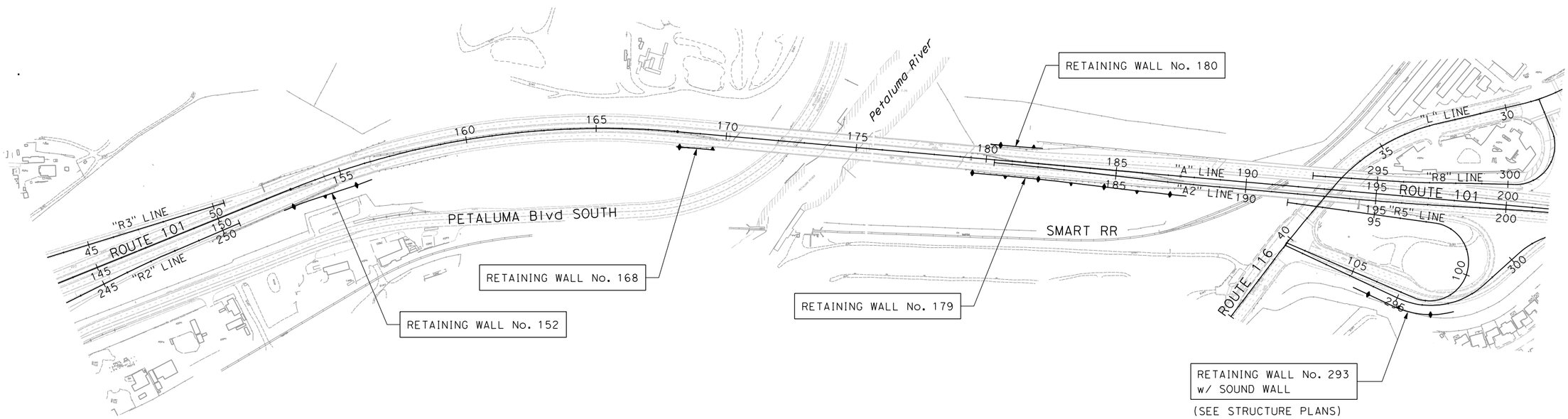
INDEX TO PLANS

SHEET No.	TITLE
R-1	RETAINING WALL KEY MAP - GENERAL PLAN
R-2	RETAINING WALL No. 152 - RETAINING WALL PLAN No. 1 OF 1
R-3	RETAINING WALL No. 168 - RETAINING WALL PLAN No. 1 OF 1
R-4	RETAINING WALL No. 179 - RETAINING WALL PLAN No. 1 OF 2
R-5	RETAINING WALL No. 179 - RETAINING WALL PLAN No. 2 OF 2
R-6	RETAINING WALL No. 180 - RETAINING WALL PLAN No. 1 OF 1
R-7	RETAINING WALL DETAILS
R-8	RETAINING WALL QUANTITIES



RETAINING WALL KEY MAP
GENERAL PLAN
SCALE: 1"=200'

R-1

TT	10/31/10	TYSON TANO	ELIE ABI-JAOUDE
REVISED BY	DATE REVISED	CALCULATED-DESIGNED BY	CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

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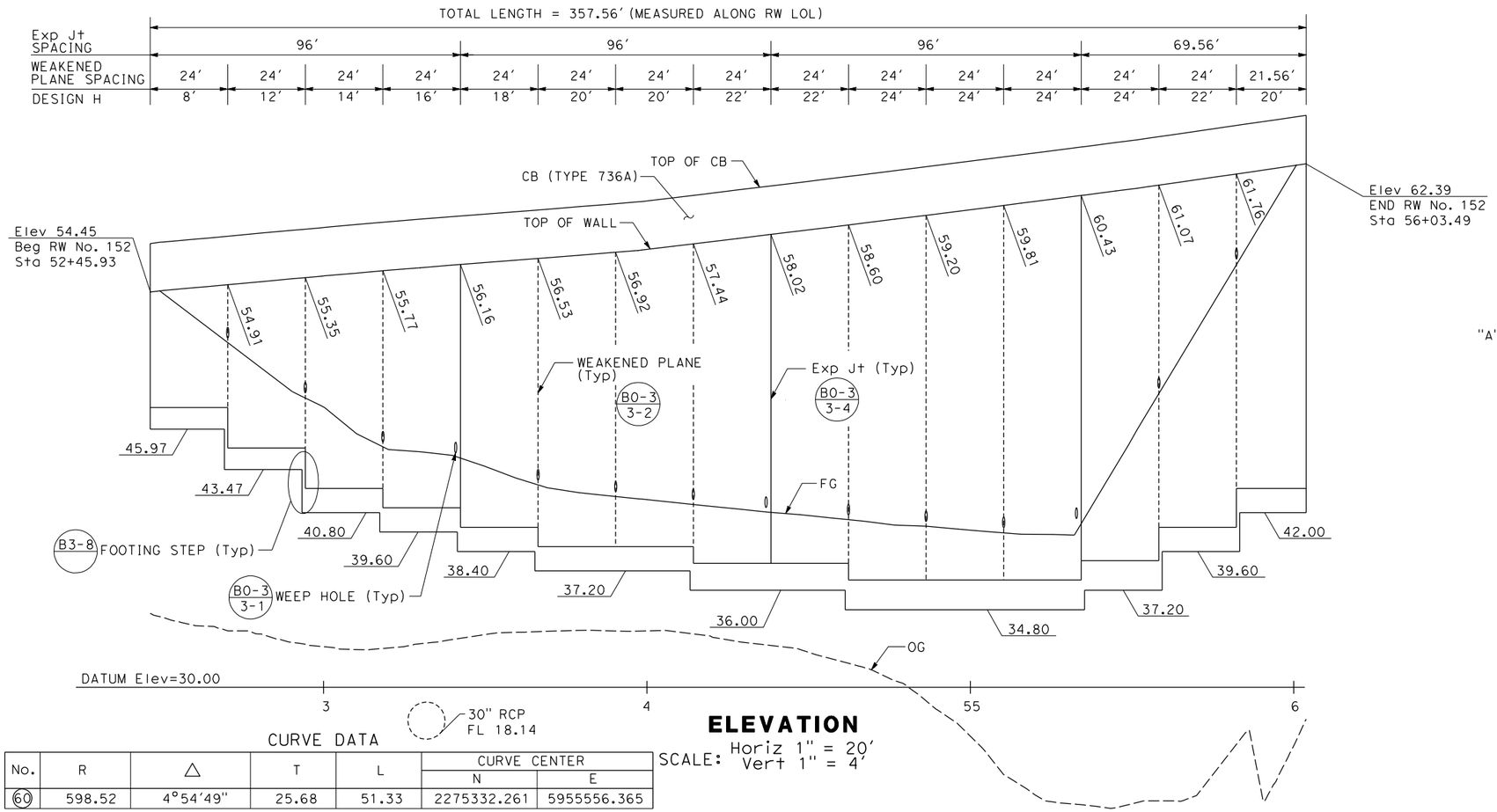

30" RCP
FL 18.14

ELEVATION

SCALE: Horiz 1" = 20'
Vert 1" = 4'

CURVE DATA

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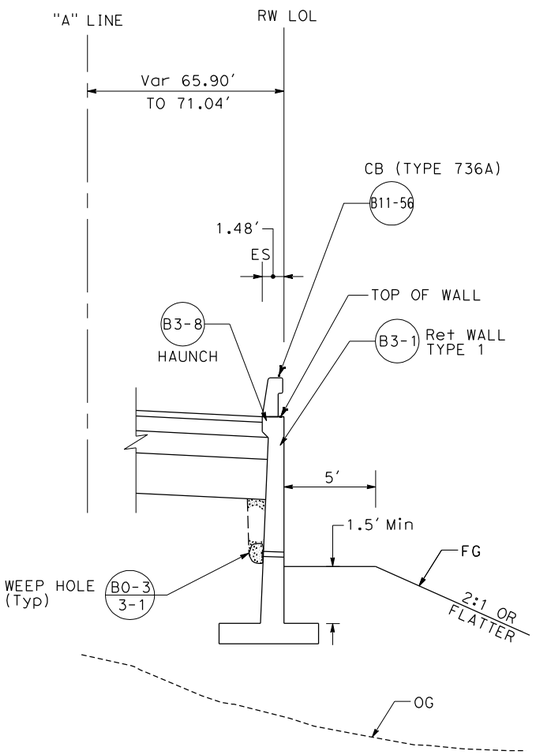
60	598.52	4°54'49"	25.68	51.33	2275332.261	5955556.365



FOR DETAILS NOT SHOWN SEE STANDARD PLANS

TYPICAL SECTION

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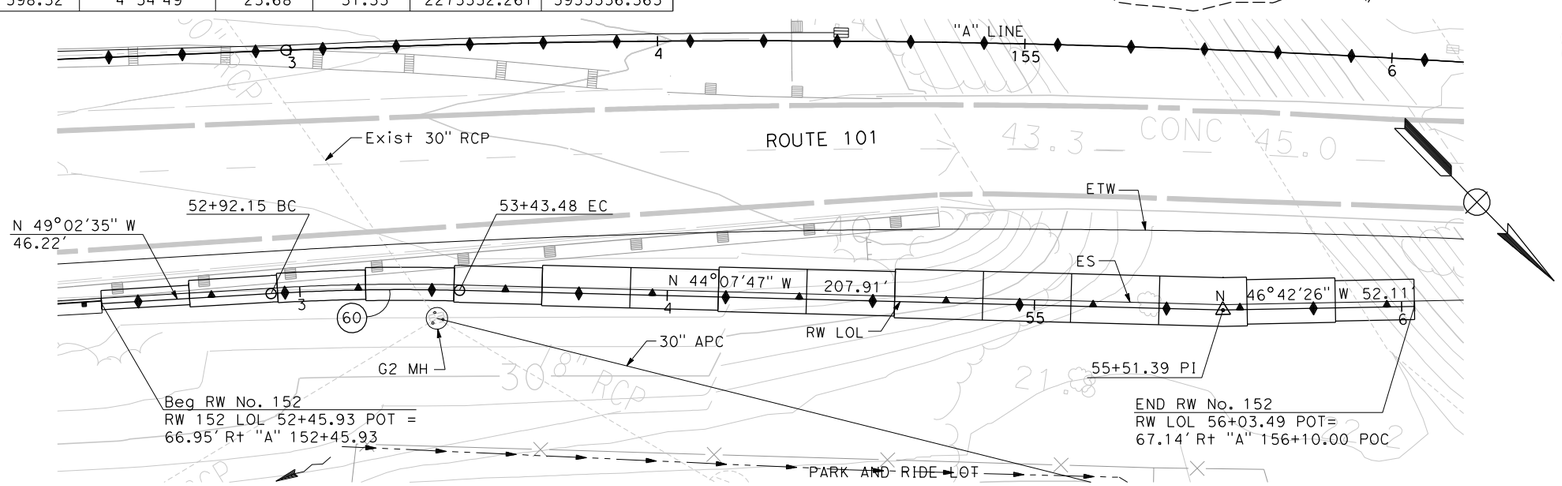

PLAN

SCALE: 1" = 20'

THIS PLAN ACCURATE FOR RETAINING WALL WORK ONLY

RETAINING WALL PLAN

RETAINING WALL No. 152

SCALE AS SHOWN

R-2

CALCULATED-DESIGNED BY	TYSON TANO	REVISED BY	TT
CHECKED BY	ELIE ABI-JAOUDE	DATE REVISED	10/31/10
CONSULTANT FUNCTIONAL SUPERVISOR	RAMSEY HISSEN		

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04	Son	101	2.5/4.1		

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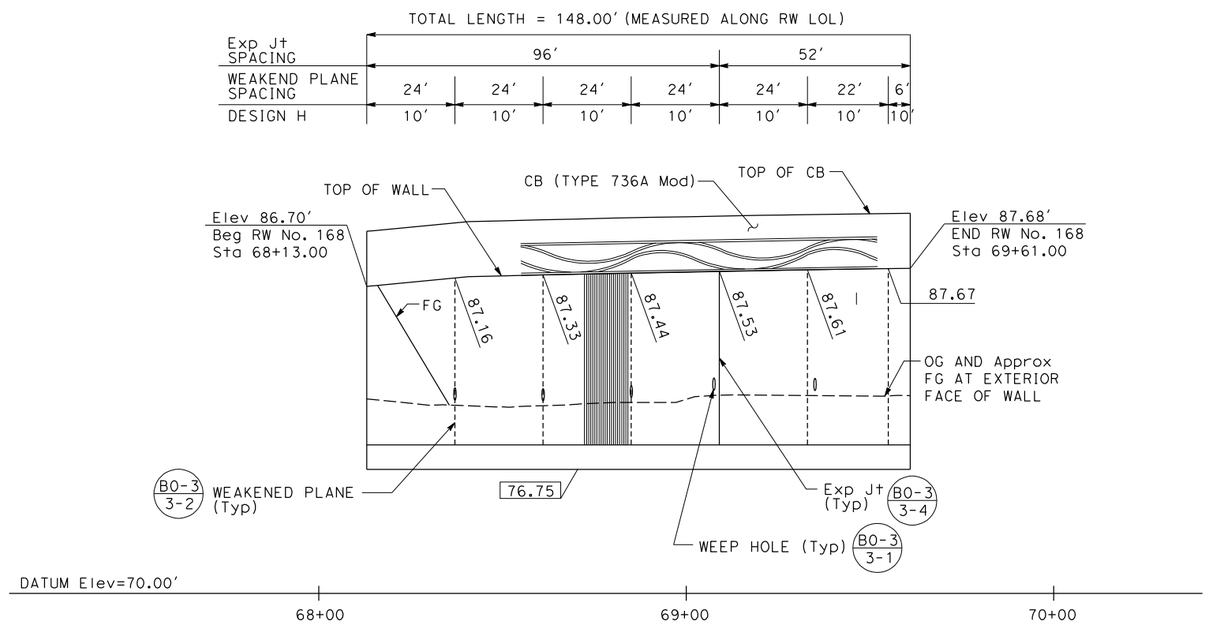
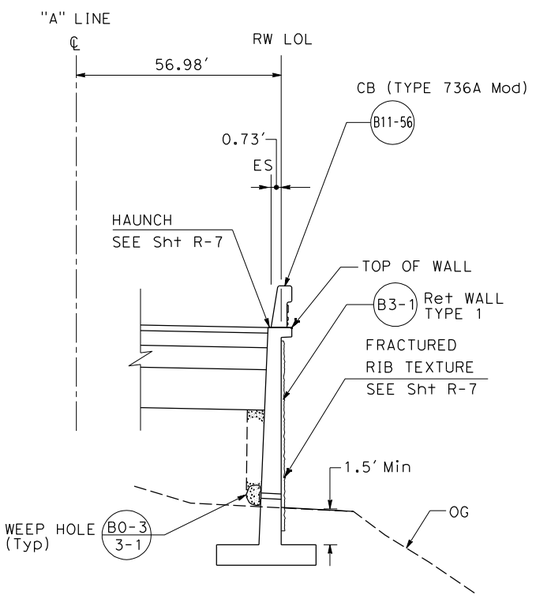


ELEVATION

SCALE: Horiz 1"=20'
Vert 1"=4'



FOR DETAILS NOT SHOWN SEE STANDARD PLANS

TYPICAL SECTION

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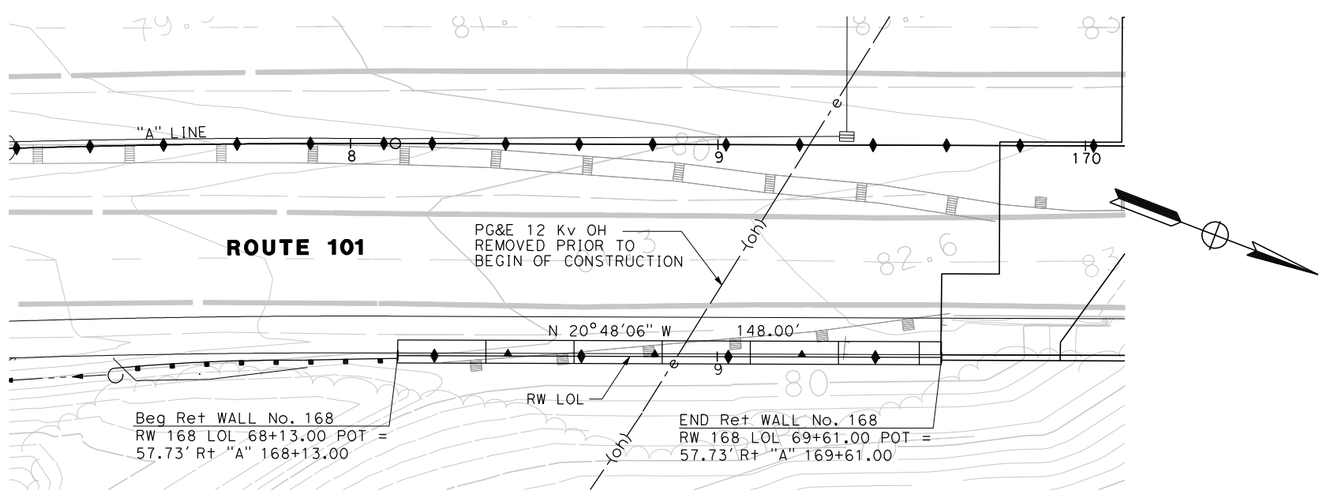

PLAN

SCALE: 1"=20'

THIS PLAN ACCURATE FOR RETAINING WALL WORK ONLY

RETAINING WALL PLAN

RETAINING WALL No. 168

SCALE AS SHOWN

R-3

REVISED BY	TT
DATE REVISED	10/31/10
TYSON TANO	
ELIE ABI-JAOUDE	
CALCULATED-DESIGNED BY	
CHECKED BY	
CONSULTANT FUNCTIONAL SUPERVISOR	
RAMSEY HISSEN	

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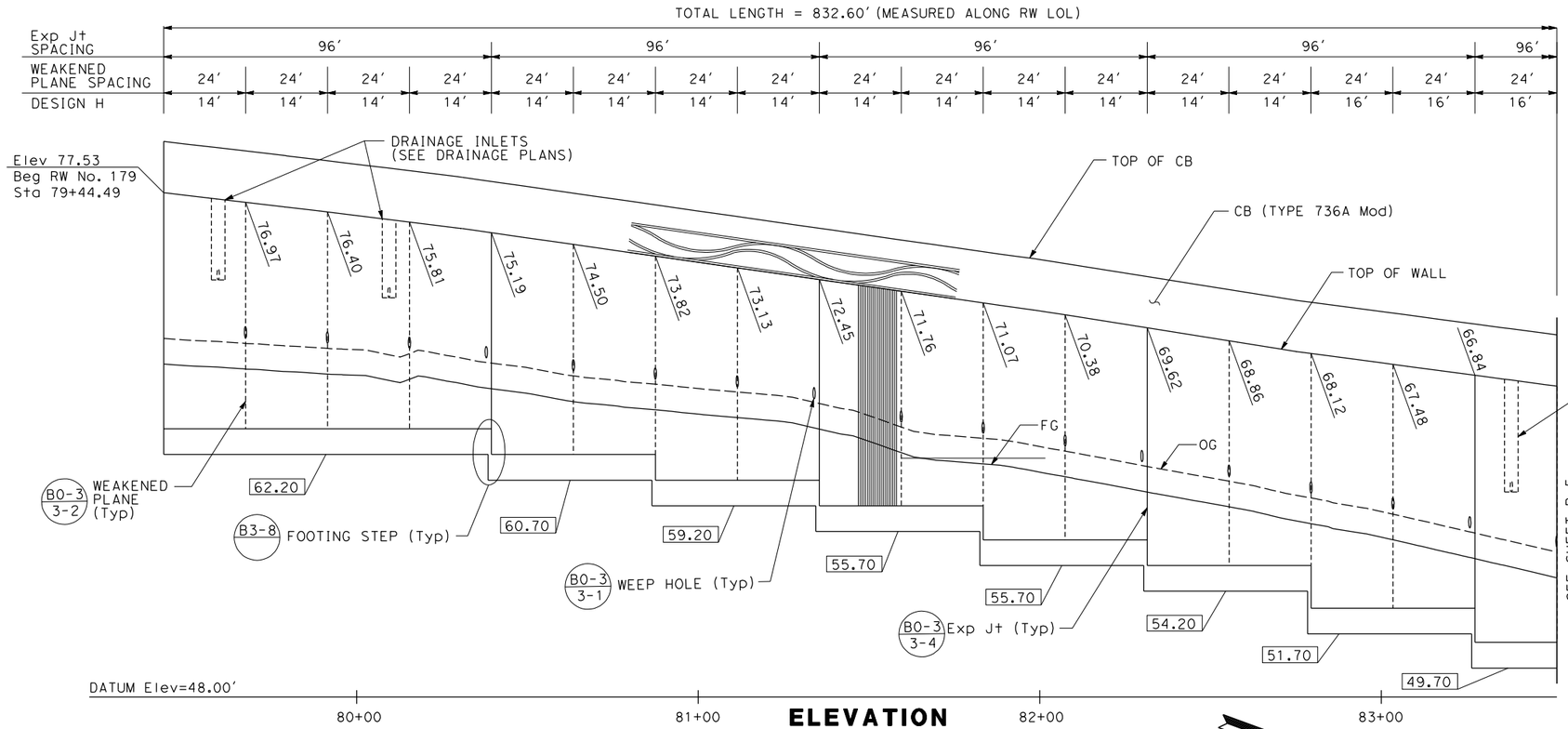

ELEVATION

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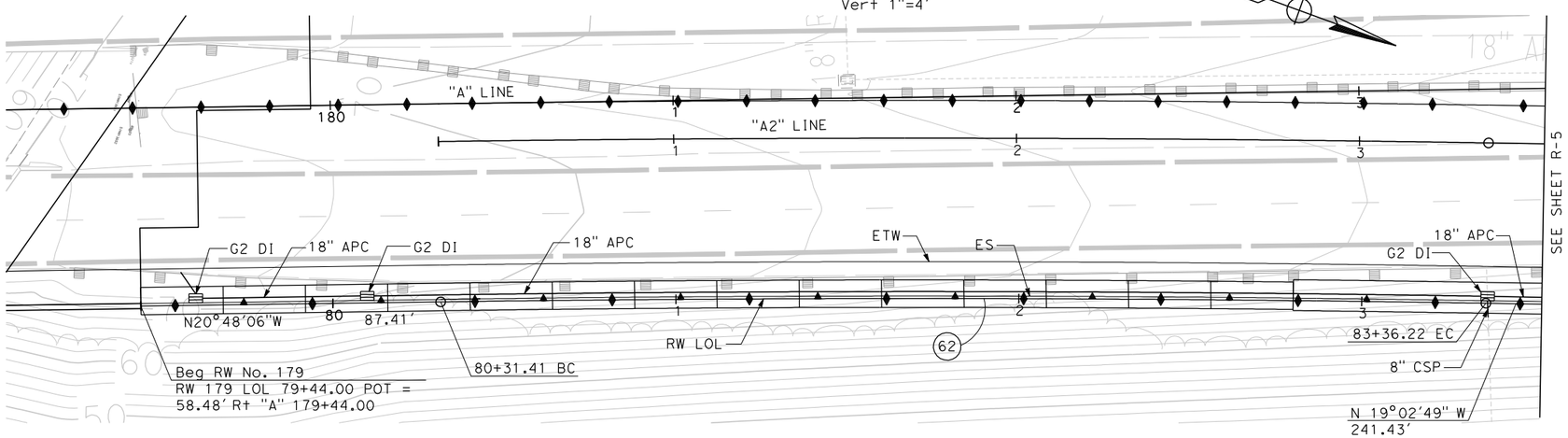
Vert 1"=4'



PLAN

SCALE: 1"=20'

CURVE DATA

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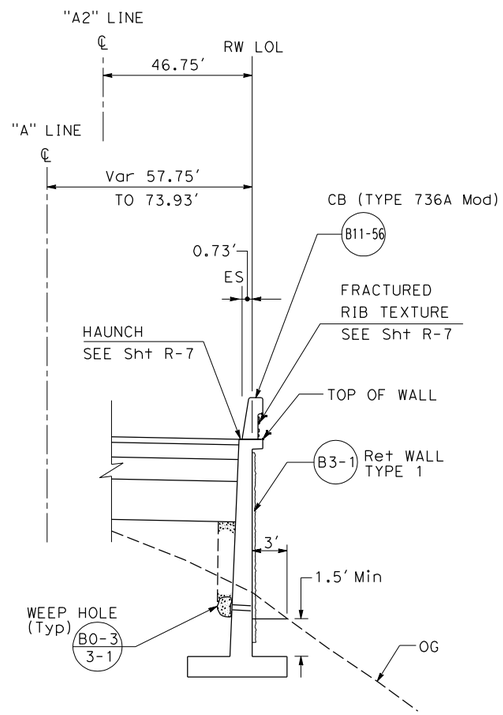

FOR DETAILS NOT SHOWN SEE STANDARD PLANS

TYPICAL SECTION

NO SCALE

RETAINING WALL PLAN

RETAINING WALL No. 179

SHEET 1 OF 2

SCALE AS SHOWN

R-4

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REVISED BY	DATE REVISED
TT	10/31/10

CALCULATED-DESIGNED BY: TYSON TANO
CHECKED BY: ELIE ABI-JAOUDE
CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

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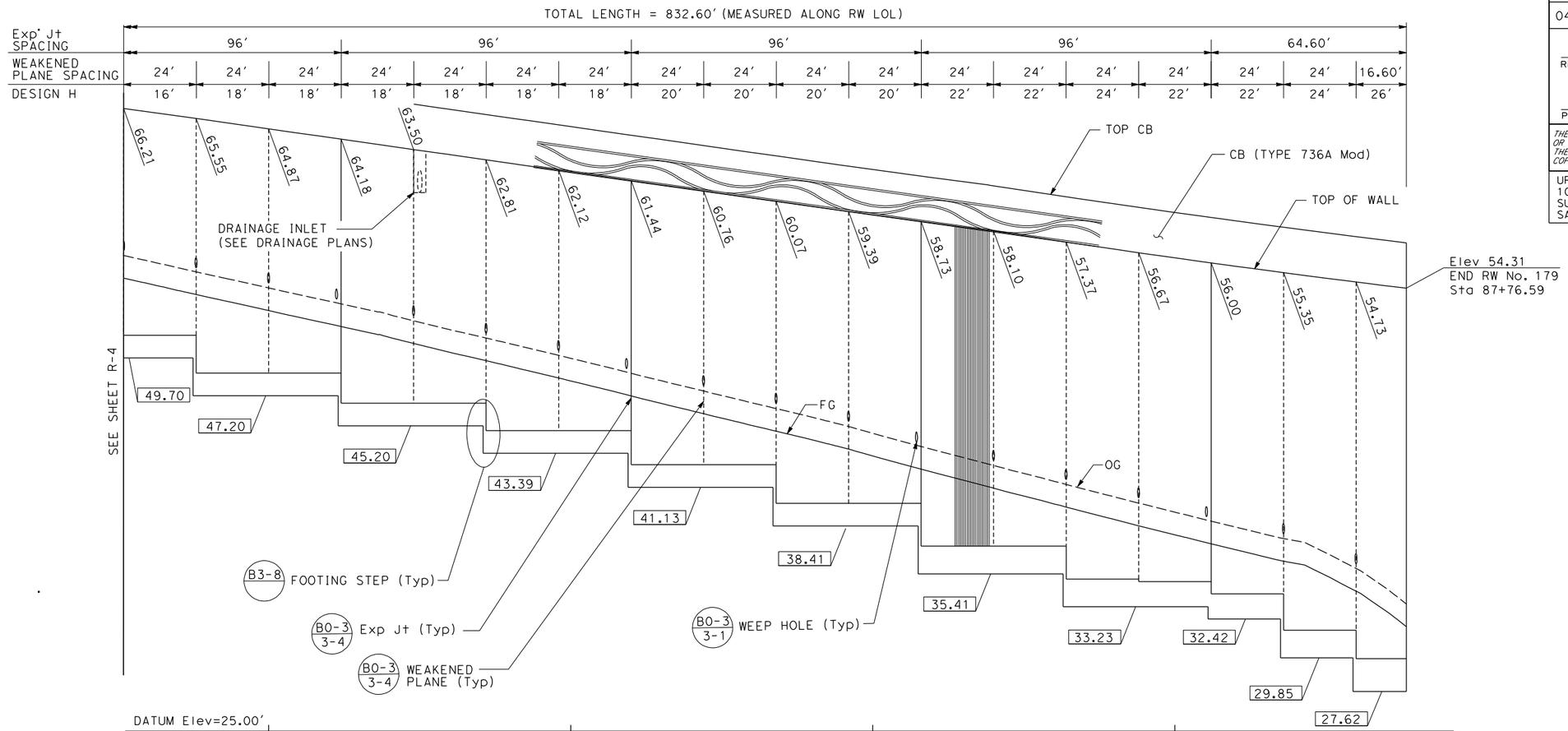
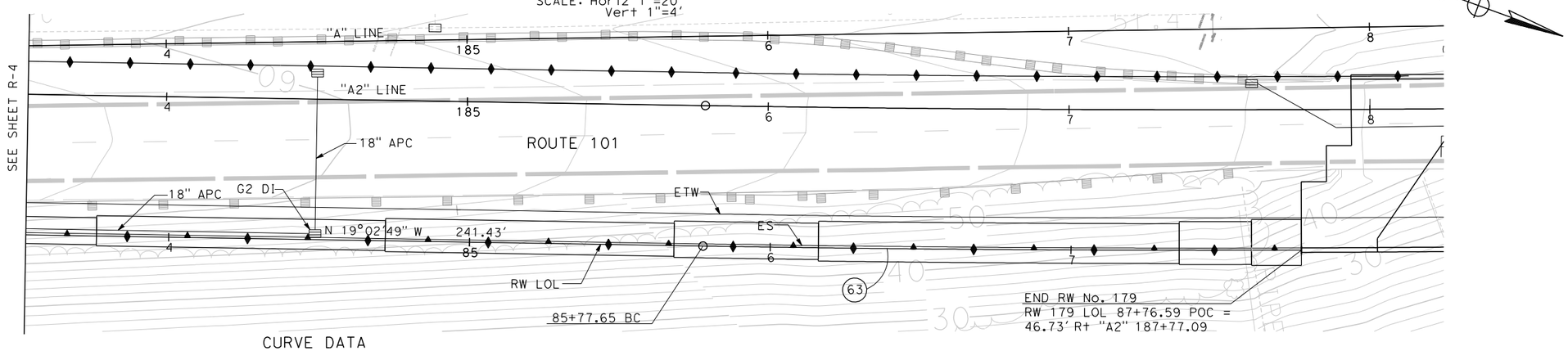


ELEVATION
SCALE: Horiz 1"=20'
Vert 1"=4'



CURVE DATA

No.	R	△	T	L	CURVE CENTER N	CURVE CENTER E
63	10046.73	01°08'04"	99.47	198.94	2274469.928	5944210.475

PLAN
SCALE: 1"=20'

RETAINING WALL PLAN
RETAINING WALL No. 179
SHEET 2 OF 2
SCALE AS SHOWN

R-5

THIS PLAN ACCURATE FOR RETAINING WALL WORK ONLY

TT	10/31/10
REVISED BY	DATE REVISED
TYSON TANO	ELIE ABI-JAOUDE
CALCULATED-DESIGNED BY	CHECKED BY
CONSULTANT FUNCTIONAL SUPERVISOR	RAMSEY HISSEN

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RAMSEY J. HISSEN No. C-39608 Exp. 12-31-11 CIVIL STATE OF CALIFORNIA

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SCTA
490 MENDOCINO AVENUE
SUITE 206
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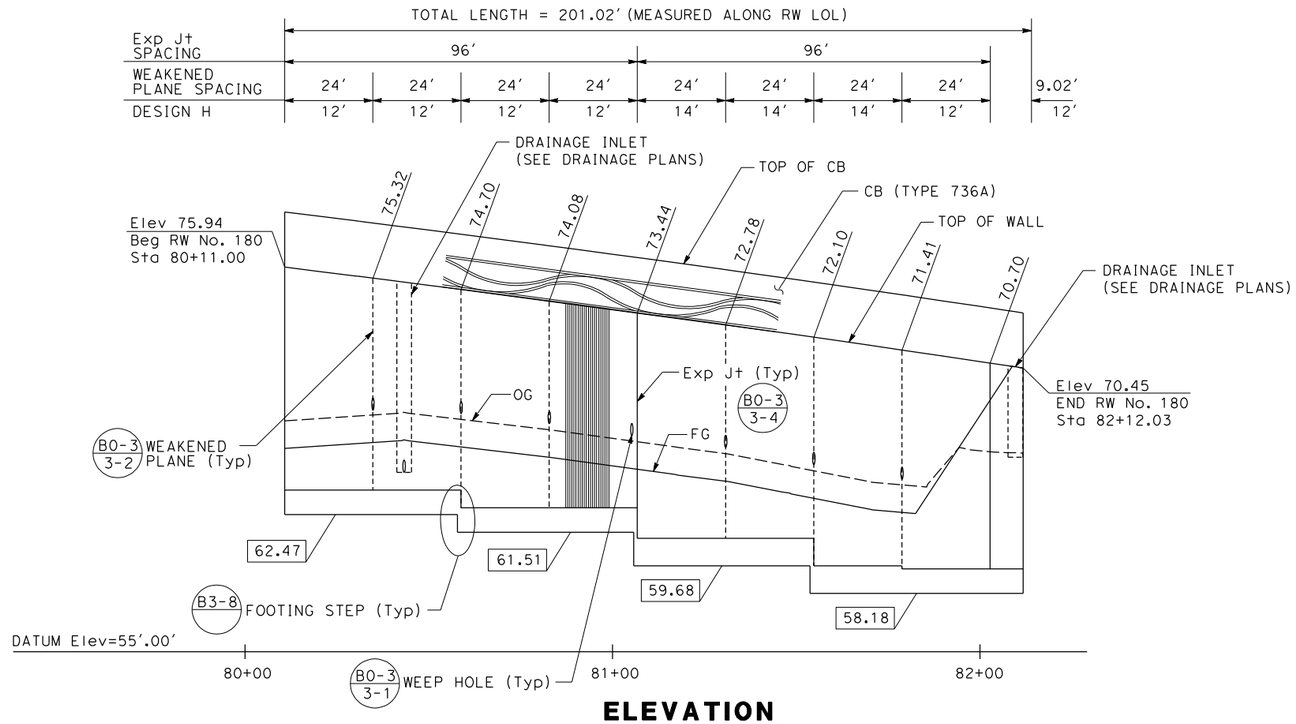
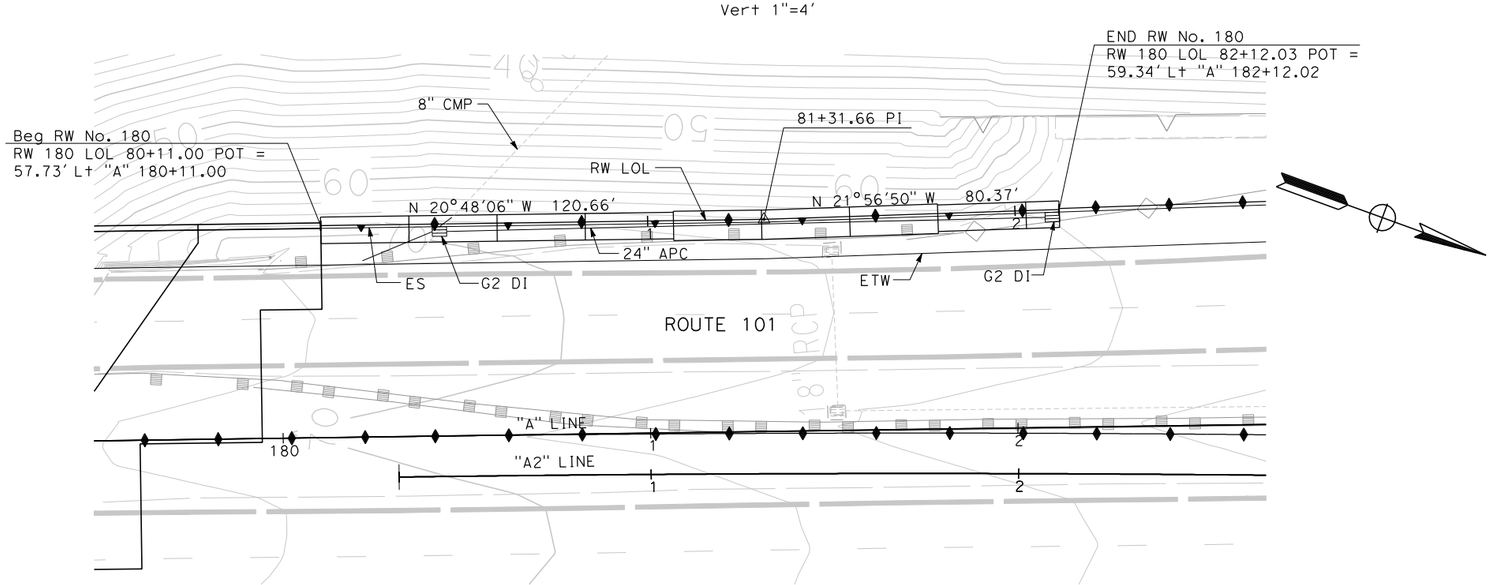


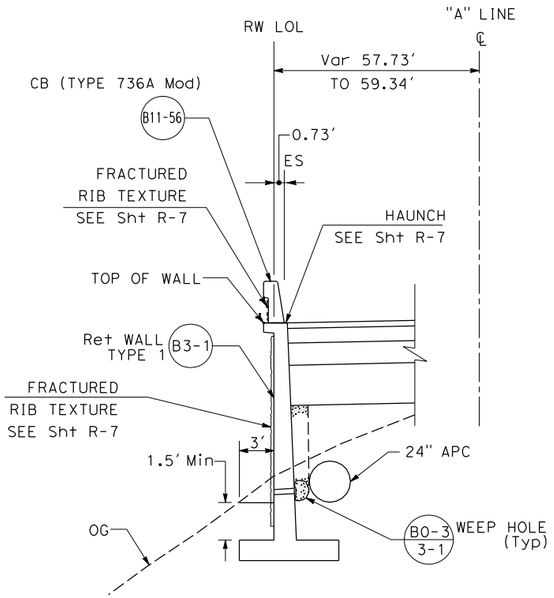
ELEVATION

SCALE: Horiz 1"=20'
Vert 1"=4'



PLAN

SCALE: 1"=20'



FOR DETAILS NOT SHOWN SEE STANDARD PLANS

TYPICAL SECTION

NO SCALE

RETAINING WALL PLAN

RETAINING WALL No. 180

SCALE AS SHOWN

R-6

THIS PLAN ACCURATE FOR RETAINING WALL WORK ONLY

REVISED BY	DATE REVISED
TT	10/31/10

CALCULATED-DESIGNED BY: TYSON TANO
CHECKED BY: ELIE ABI-JAOUDE
CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

LAST REVISION 11-22-10
DATE PLOTTED => 11/23/2010
TIME PLOTTED => 11:55:02 AM

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RAMSEY J. HISSEN No. C-39608 Exp. 12-31-11 CIVIL STATE OF CALIFORNIA

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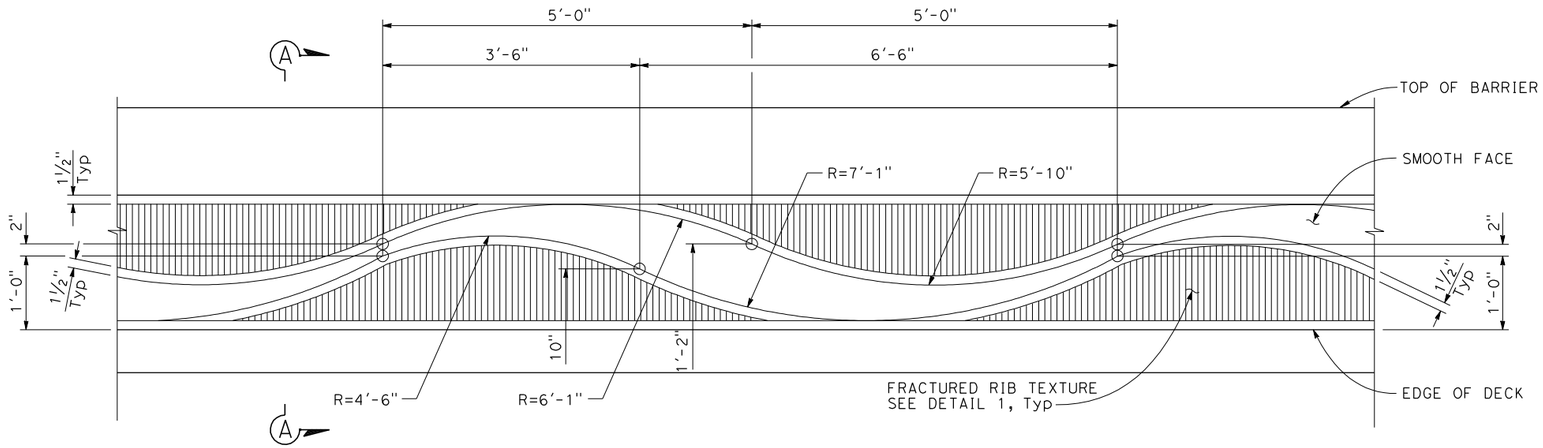
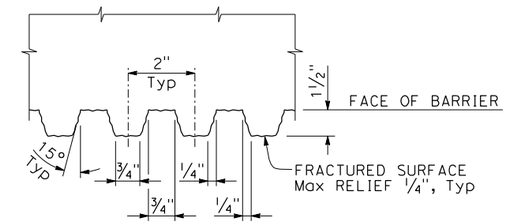


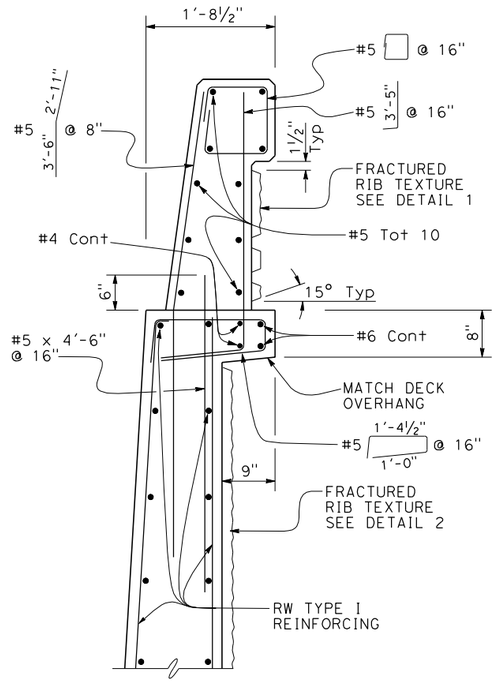
BARRIER ELEVATION DETAIL



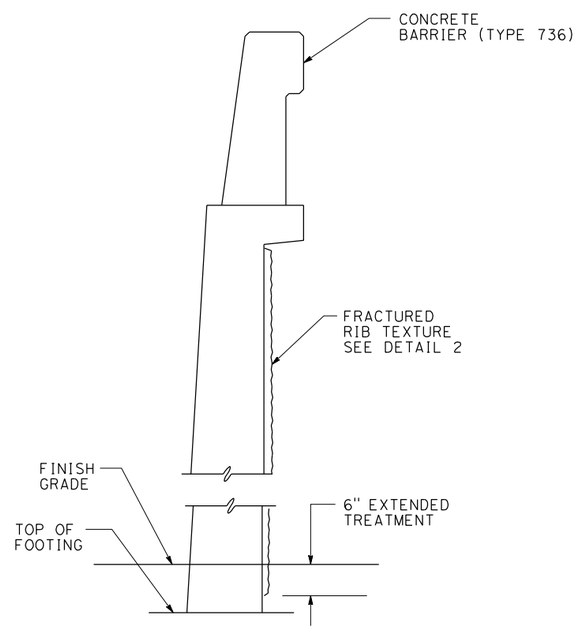
NOTES:

1. VERTICAL JOINTS IN FORM LINERS WILL BE AT CENTER OF TROUGH BETWEEN RIBS. Min SPACING OF FORM LINER VERTICAL JOINTS WILL BE 4'-0".
2. NO HORIZONTAL JOINTS WILL BE PERMITTED IN FORM LINERS.

1	FRACTURED RIB TEXTURE
-	



SECTION A-A



RETAINING WALL DETAILS

NO SCALE

R-7

REVISED BY	DATE REVISED
TT	10/31/10

CALCULATED-DESIGNED BY: TYSON TANO
CHECKED BY: ELIE ABI-JAOUDE
CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

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Caltrans

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RAMSEY J. HISSEN No. C-39608 Exp. 12-31-11 CIVIL STATE OF CALIFORNIA

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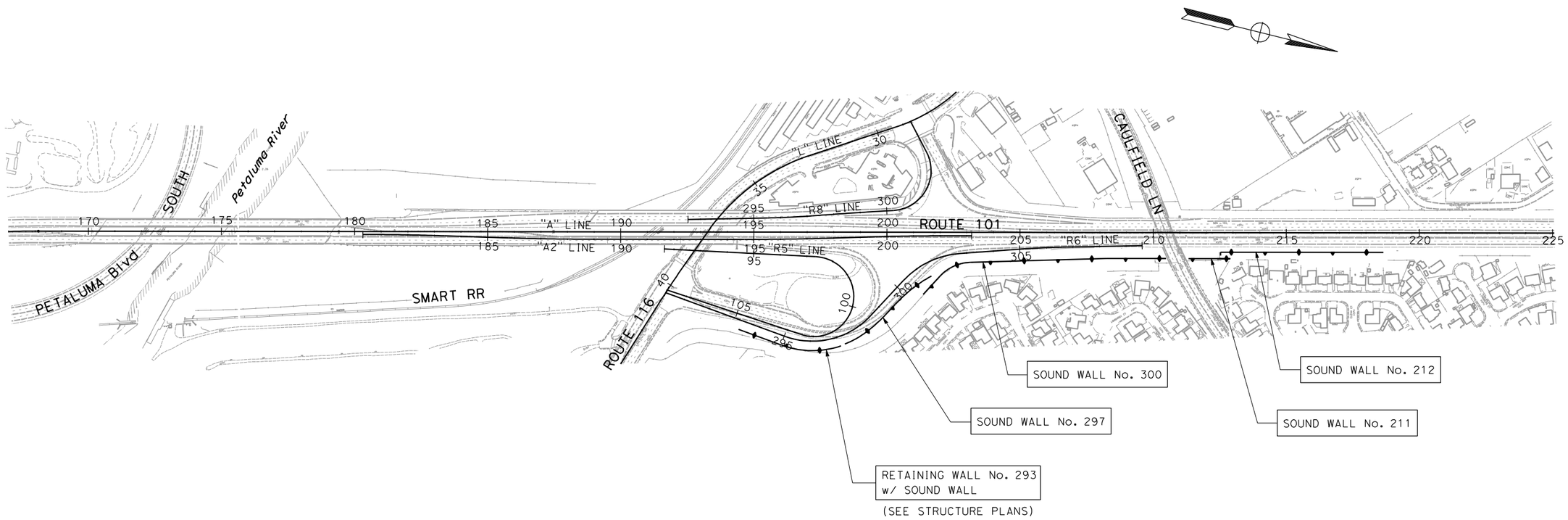
INDEX TO PLANS

SHEET No.	TITLE
SW-1	SOUND WALL KEY MAP - GENERAL PLAN
SW-2	SOUND WALL No. 297 - SOUND WALL PLAN SHEET 1 OF 1
SW-3	SOUND WALL No. 300 - SOUND WALL PLAN SHEET 1 OF 3
SW-4	SOUND WALL No. 300 - SOUND WALL PLAN SHEET 2 OF 3
SW-5	SOUND WALL No. 300 - SOUND WALL PLAN SHEET 3 OF 3
SW-6	SOUND WALL No. 211 - SOUND WALL PLAN SHEET 1 OF 1
SW-7	SOUND WALL No. 212 - SOUND WALL PLAN SHEET 1 OF 2
SW-8	SOUND WALL No. 212 - SOUND WALL PLAN SHEET 2 OF 2
SW-9	SOUND WALL DETAILS - SOUND WALL AESTHETICS SHEET 1 OF 2
SW-10	SOUND WALL DETAILS - SOUND WALL AESTHETICS SHEET 2 OF 2
SW-11	SOUND WALL PILE SPACING ARRANGEMENT SHEET 1 OF 1
SW-12	SOUND WALL QUANTITIES



SOUND WALL KEY MAP
GENERAL PLAN
SCALE: 1" = 200'

SW-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
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CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN
CALCULATED-DESIGNED BY: TYSON TANO
CHECKED BY: ELIE ABI-JAOUDE
REVISED BY: TT
DATE REVISED: 10/31/10

LAST REVISION 11-22-10
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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

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REGISTERED PROFESSIONAL ENGINEER RAMSEY J. HISSEN No. C-39608 Exp. 12-31-11 CIVIL STATE OF CALIFORNIA

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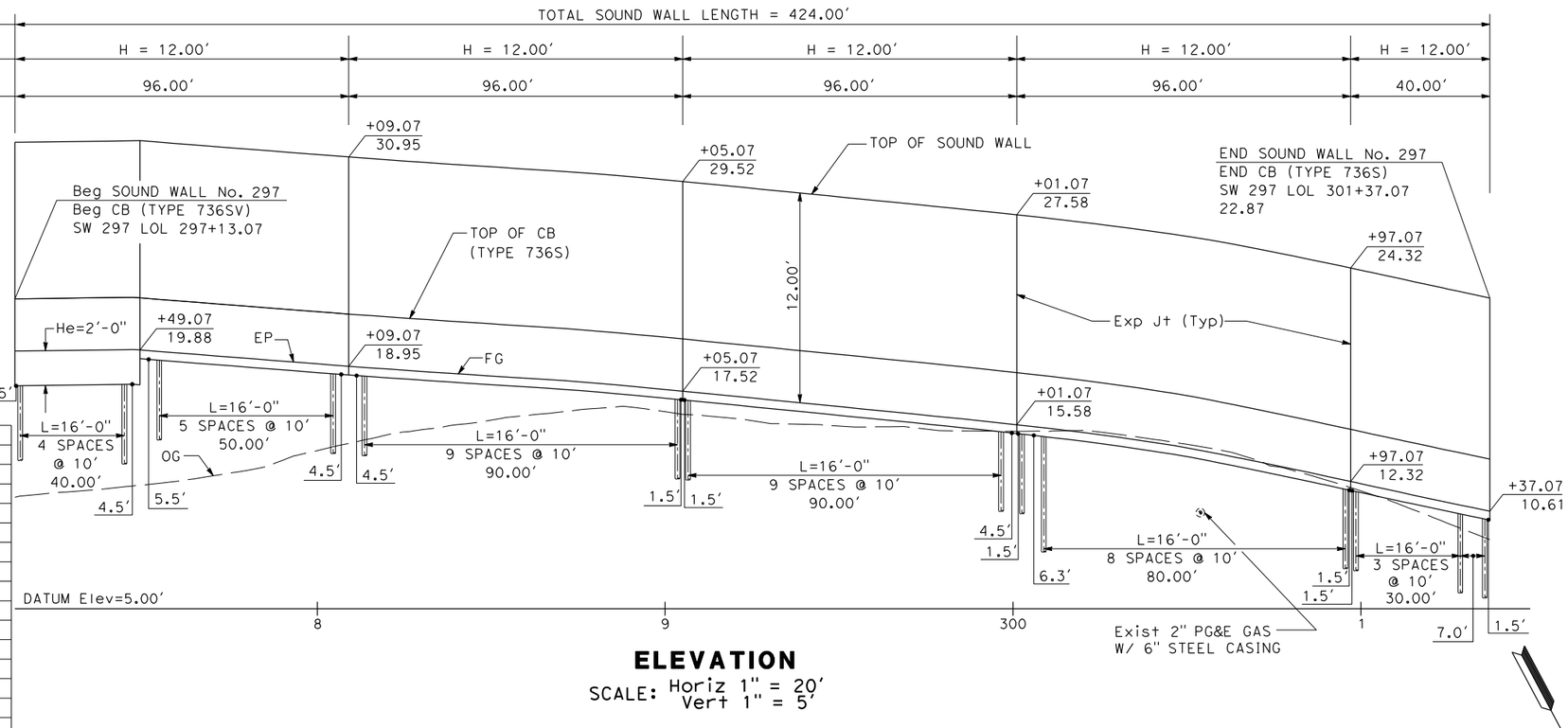
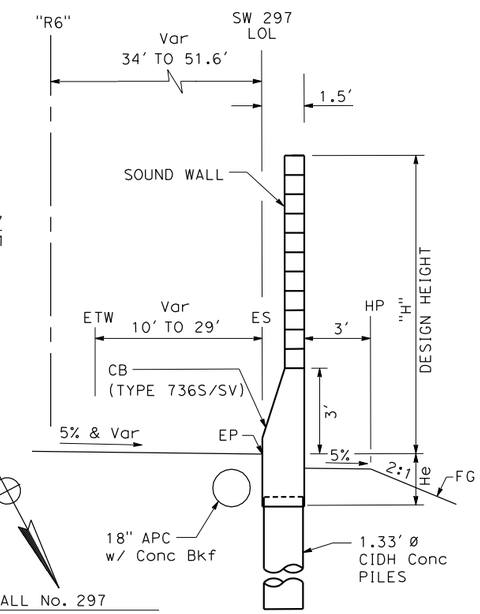


ELEVATION

SCALE: Horiz 1" = 20'
Vert 1" = 5'

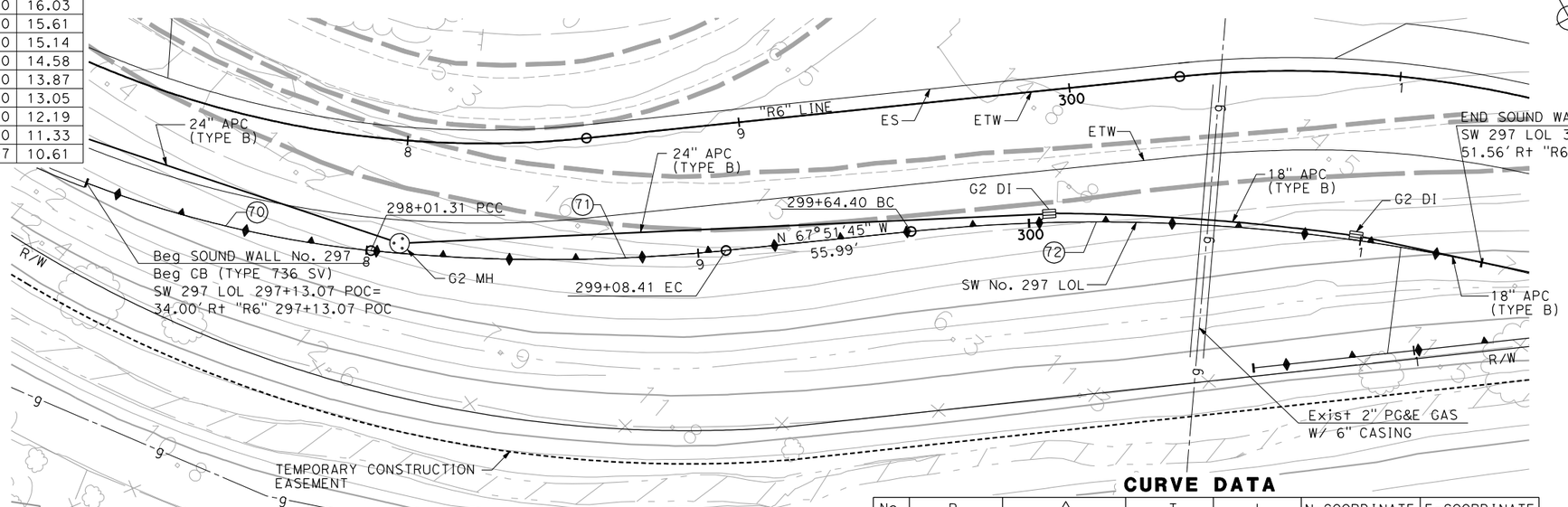
FG ELEVATIONS

Sta	Elev
297+13.07	19.82
297+20.00	19.84
297+40.00	19.89
297+60.00	19.71
297+80.00	19.40
298+00.00	19.08
298+20.00	18.79
298+40.00	18.52
298+60.00	18.26
298+80.00	17.97
299+00.00	17.61
299+20.00	17.22
299+40.00	16.82
299+60.00	16.43
299+80.00	16.03
300+00.00	15.61
300+20.00	15.14
300+40.00	14.58
300+60.00	13.87
300+80.00	13.05
301+00.00	12.19
301+20.00	11.33
301+37.07	10.61



SOUND WALL TYPICAL SECTION

NO SCALE



PLAN

SCALE: 1" = 20'

CURVE DATA

No.	R	Δ	T	L	N-COORDINATE	E-COORDINATE
70	334.00'	15°08'16"	44.38'	88.24'	2278830.335	5953338.485
71	524.77'	11°41'37"	53.74'	107.10'	2278671.866	5953232.275
72	550.00'	17°59'29"	87.07'	172.71'	2279688.503	5953585.425

NOTES:

1. SOUNDWALL HEIGHT ON Conc BARRIER IS MEASURED PERPENDICULAR TO ES.
2. SPACING IS MEASURED ALONG SW LOL.
3. FOR UTILITY SPANNING DETAILS NOT SHOWN, SEE Std PLAN B15-15

THIS PLAN ACCURATE FOR SOUND WALL WORK ONLY

SOUND WALL PLAN
SOUND WALL No. 297
SHEET 1 OF 1
SCALE: 1" = 20'

SW-2

REVISED BY	DATE REVISED
TT	10/31/10

CALCULATED-DESIGNED BY: TYSON TANO
CHECKED BY: ELIE ABI-JAOUDE
CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN
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04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

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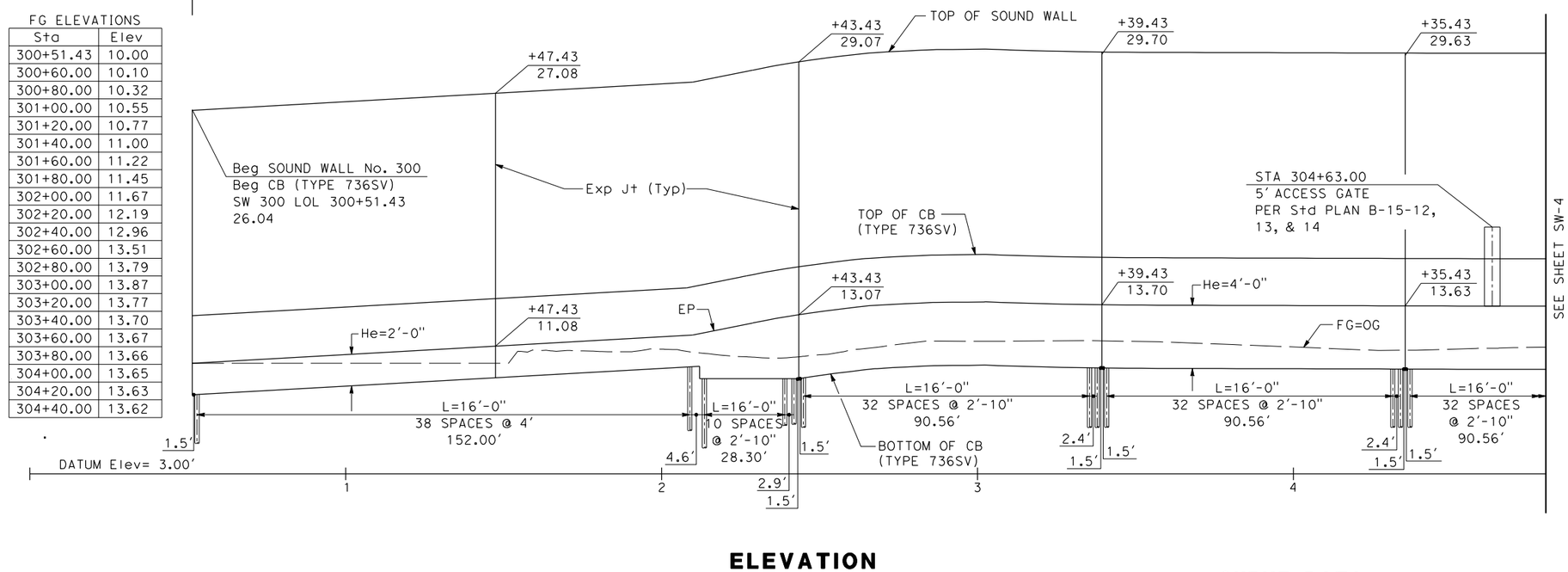
FOR ACCURATE RIGHT OF WAY DATA, CONTACT
RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

LENGTH	TOTAL SOUND WALL LENGTH = 957.33′				
DESIGN HEIGHT	H = 16.00′	H = 16.00′	H = 16.00′	H = 16.00′	H = 16.00′
Exp Jt SPACING	96.00′	96.00′	96.00′	96.00′	96.00′

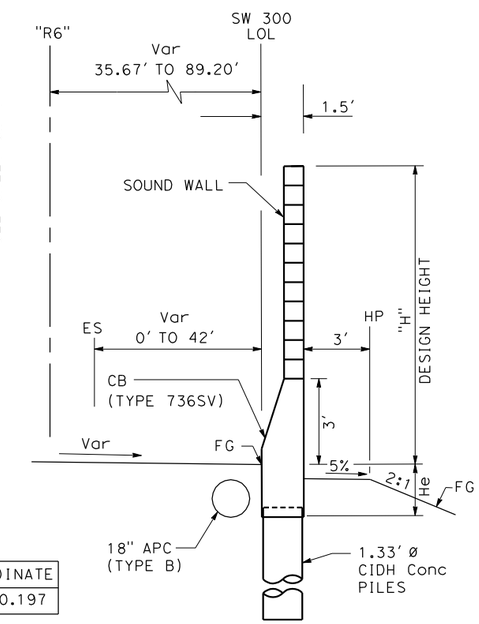
FG ELEVATIONS

Sta	Elev
300+51.43	10.00
300+60.00	10.10
300+80.00	10.32
301+00.00	10.55
301+20.00	10.77
301+40.00	11.00
301+60.00	11.22
301+80.00	11.45
302+00.00	11.67
302+20.00	12.19
302+40.00	12.96
302+60.00	13.51
302+80.00	13.79
303+00.00	13.87
303+20.00	13.77
303+40.00	13.70
303+60.00	13.67
303+80.00	13.66
304+00.00	13.65
304+20.00	13.63
304+40.00	13.62



ELEVATION

SCALE: Horiz 1" = 20′
Vert 1" = 5′

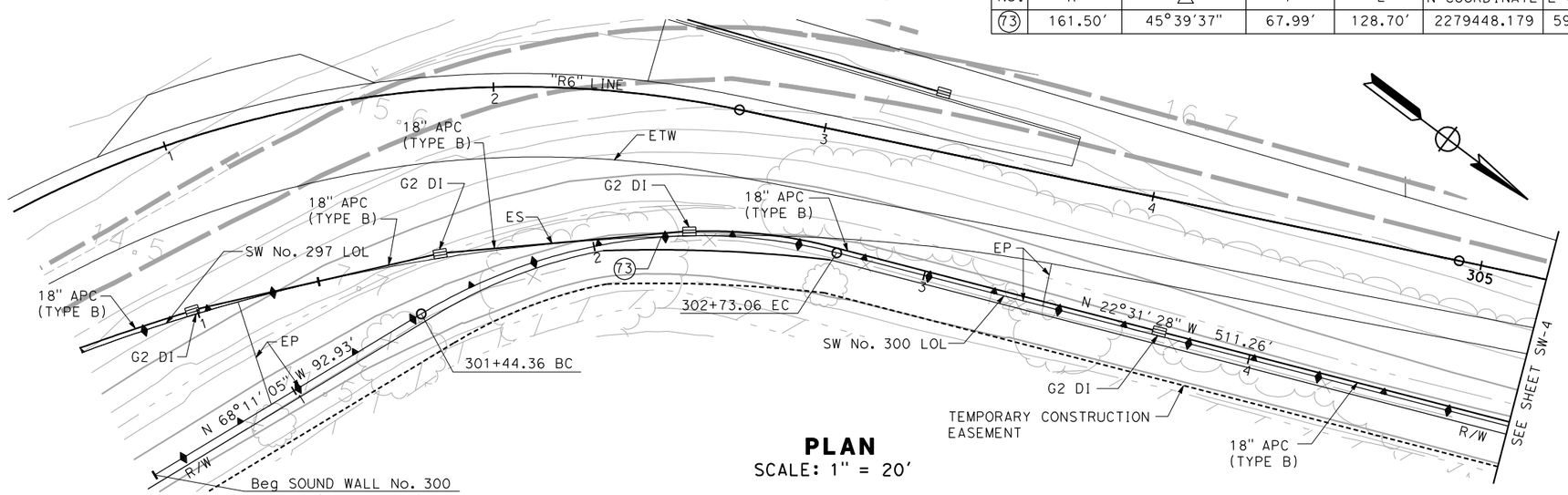


SOUND WALL TYPICAL SECTION

(STA 197+92.33 TO 198+58.49)
NO SCALE

CURVE DATA

No.	R	△	T	L	N-COORDINATE	E-COORDINATE
73	161.50′	45°39′37"	67.99′	128.70′	2279448.179	5953280.197



PLAN

SCALE: 1" = 20′

FOR NOTES, SEE SHEET SW-2

THIS PLAN ACCURATE FOR SOUND WALL WORK ONLY

SOUND WALL PLAN
SOUND WALL No. 300
SHEET 1 OF 3
SCALE: 1" = 20′

SW-3

REVISED BY	DATE REVISED
TT	10/31/10

CALCULATED-DESIGNED BY: TYSON TANO
CHECKED BY: ELIE ABI-JAOUDE
CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

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04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

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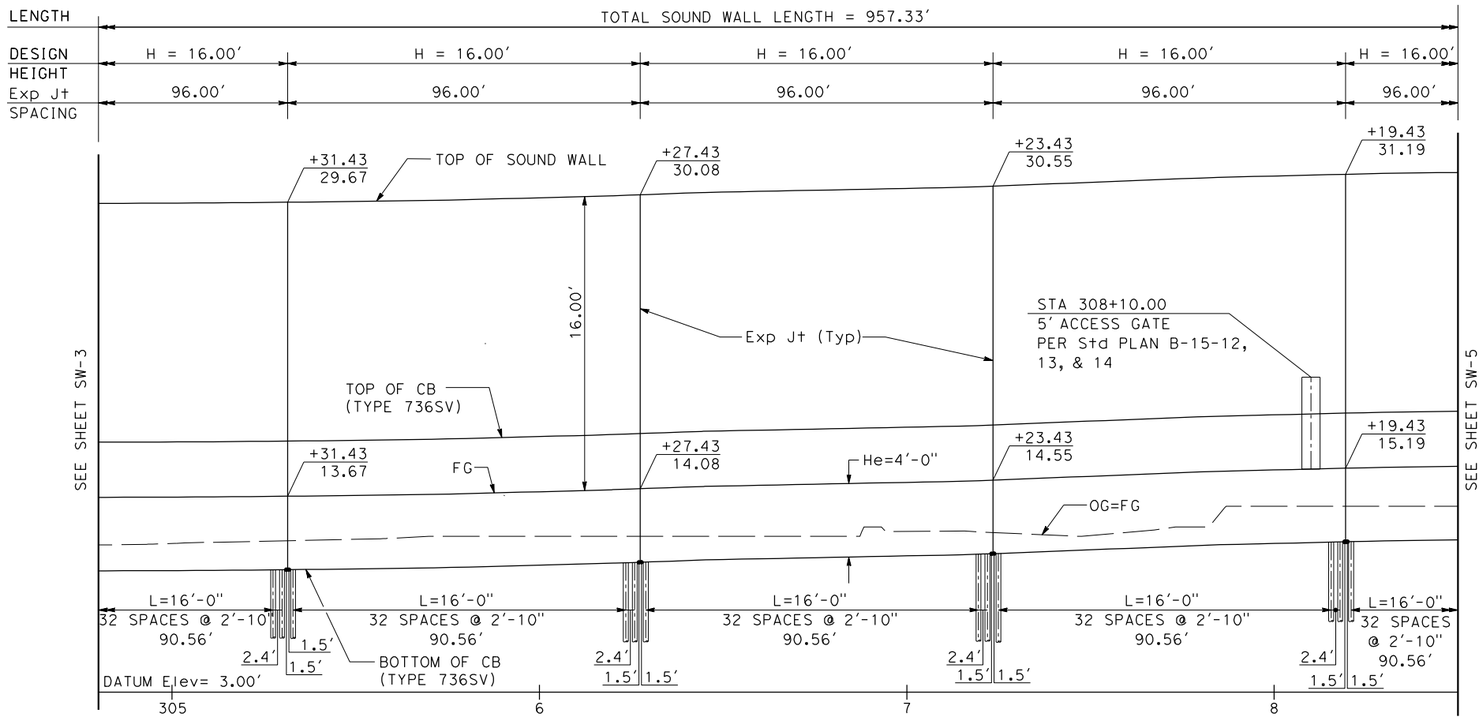

ELEVATION
SCALE: Horiz 1" = 20'
Vert 1" = 5'

FG ELEVATIONS

Sta	Elev
304+60.00	13.61
304+80.00	13.61
305+00.00	13.62
305+20.00	13.65
305+40.00	13.69
305+60.00	13.74
305+80.00	13.81
306+00.00	13.92
306+20.00	14.03
306+40.00	14.17
306+60.00	14.27
306+80.00	14.35
307+00.00	14.42
307+20.00	14.52
307+40.00	14.68
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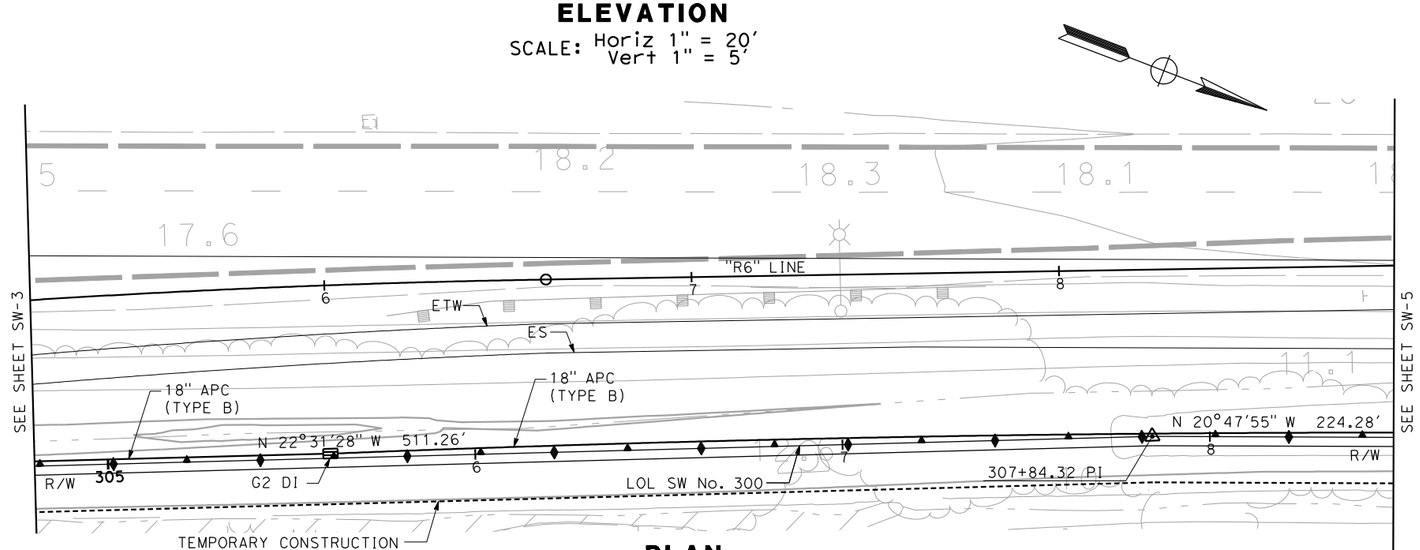
307+80.00	14.99
308+00.00	15.10
308+20.00	15.20
308+40.00	15.27



PLAN
SCALE: 1" = 20'

FOR NOTES, SEE SHEET SW-2

THIS PLAN ACCURATE FOR SOUND WALL WORK ONLY

SOUND WALL PLAN
SOUND WALL No. 300
SHEET 2 OF 3
SCALE: 1" = 20'

SW-4

REVISED BY	DATE REVISED
TT	10/31/10

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CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

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04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

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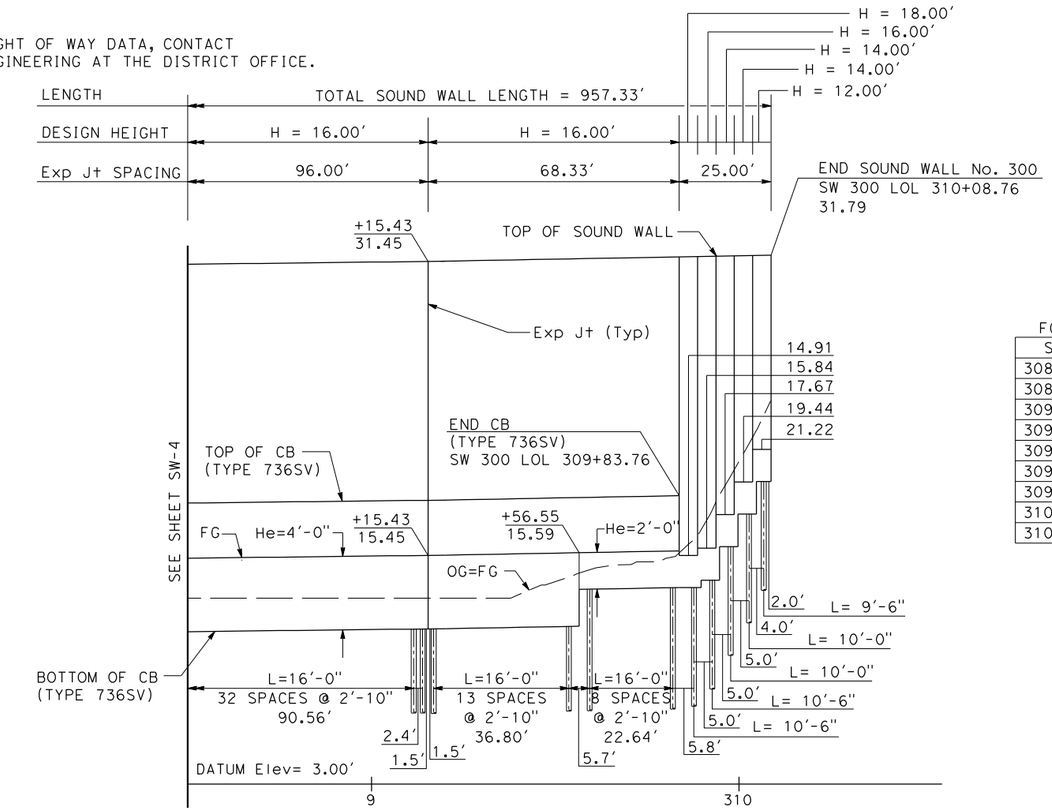
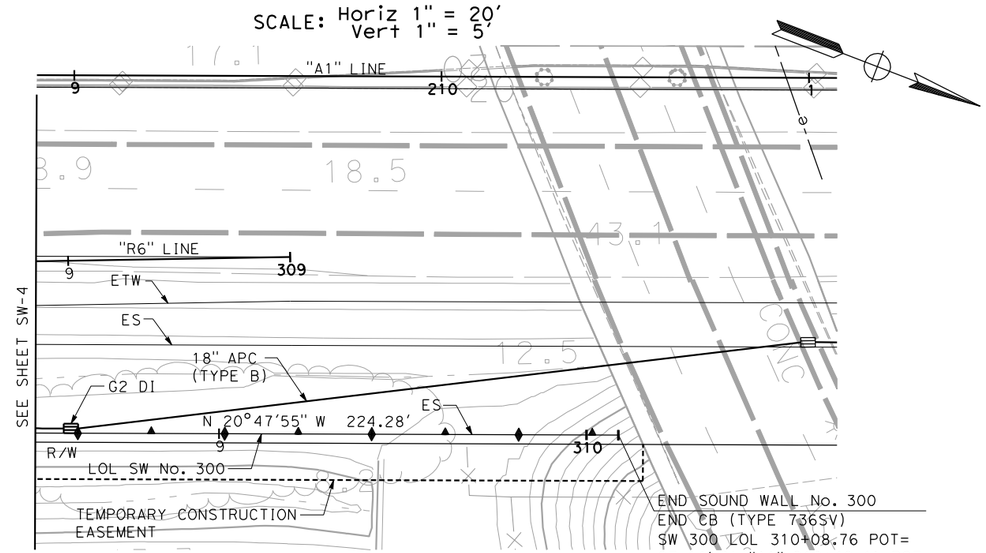


ELEVATION
SCALE: Horiz 1" = 20'
Vert 1" = 5'

FG ELEVATIONS

Sta	Elev
308+60.00	15.32
308+80.00	15.36
309+00.00	15.41
309+20.00	15.46
309+40.00	15.53
309+60.00	15.60
309+80.00	15.68
310+00.00	20.68
310+08.65	23.85



PLAN
SCALE: 1" = 20'

FOR NOTES, SEE SHEET SW-2

THIS PLAN ACCURATE FOR SOUND WALL WORK ONLY

SOUND WALL PLAN
SOUND WALL No. 300
SHEET 3 OF 3
SCALE: 1" = 20'

SW-5

REVISED BY	DATE REVISED
TT	10/31/10

CALCULATED-DESIGNED BY: TYSON TANO
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CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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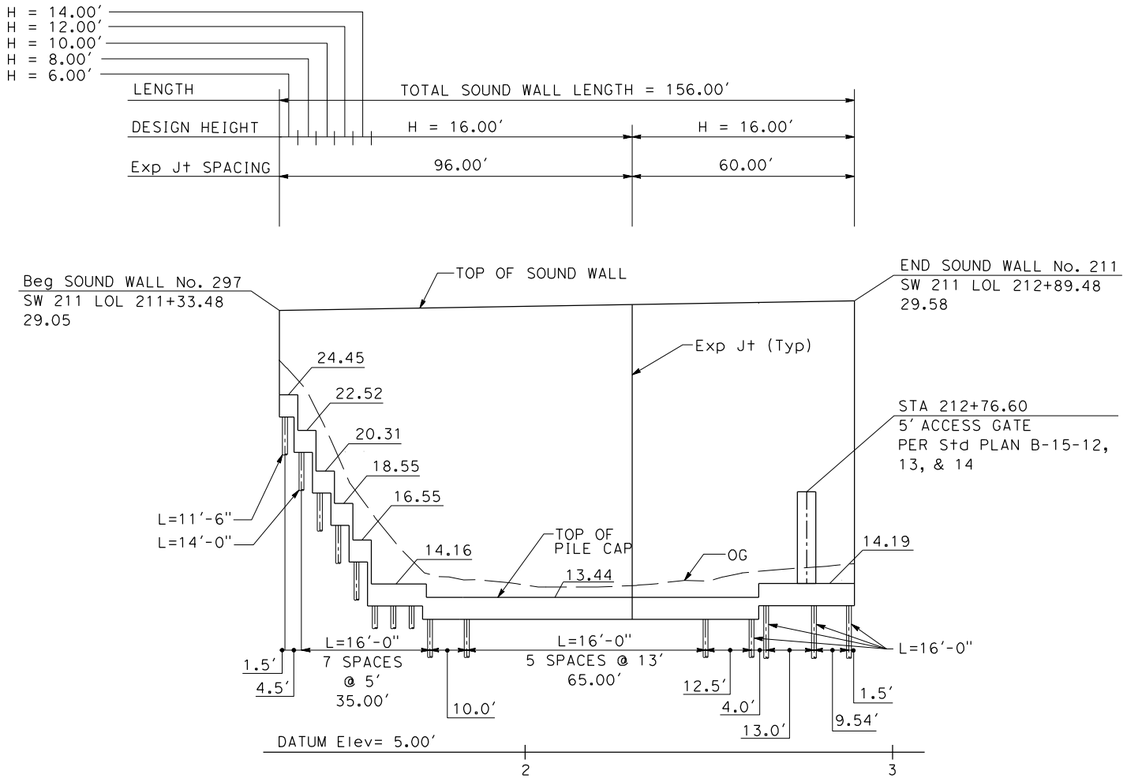
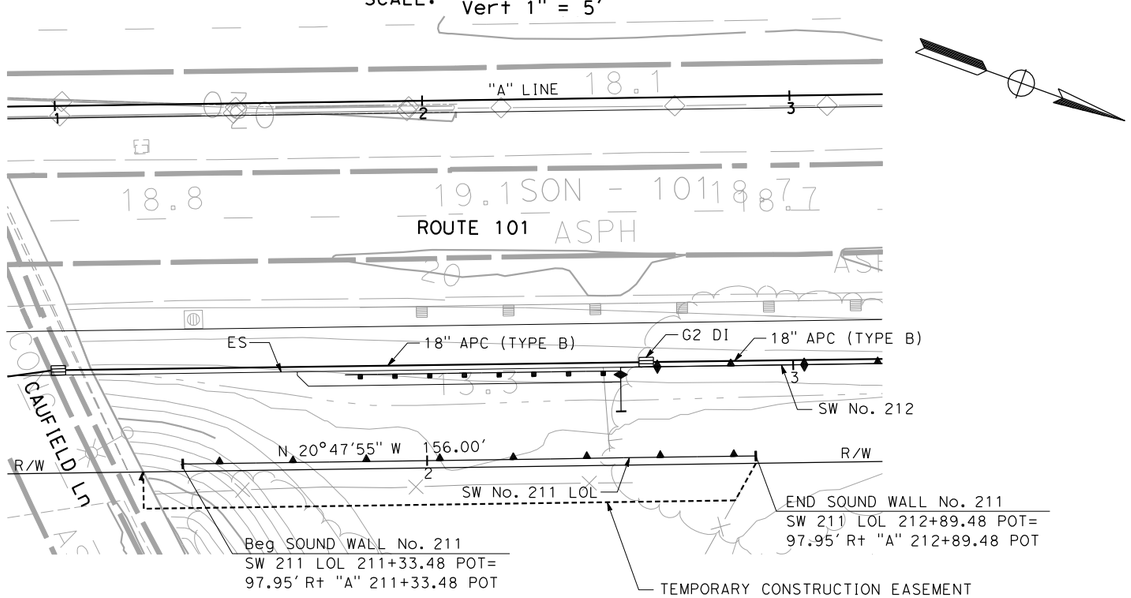


ELEVATION

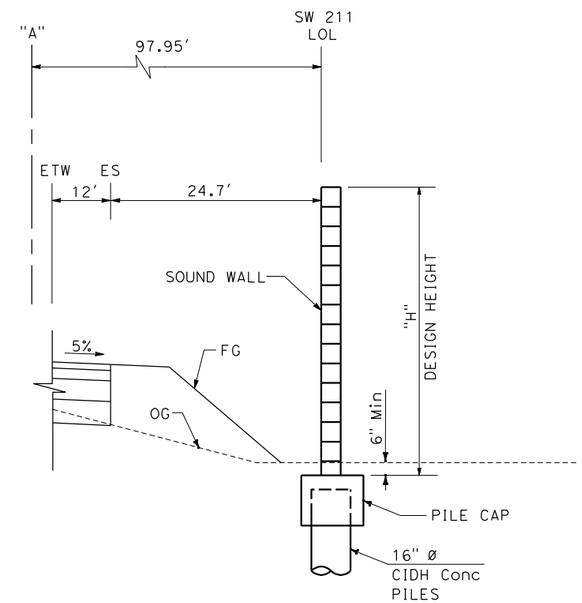
SCALE: Horiz 1" = 20′
Vert 1" = 5′



PLAN

SCALE: 1" = 20′

THIS PLAN ACCURATE FOR SOUND WALL WORK ONLY



SOUND WALL TYPICAL SECTION

NO SCALE

SOUND WALL PLAN

SOUND WALL No. 211
SHEET 1 OF 1

SCALE: 1" = 20′

SW-6

FOR NOTES, SEE SHEET SW-2

REVISED BY	DATE REVISED
TT	10/31/10

CALCULATED-DESIGNED BY: TYSON TANO
CHECKED BY: ELIE ABI-JAOUDE
CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
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REGISTERED CIVIL ENGINEER DATE

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490 MENDOCINO AVENUE
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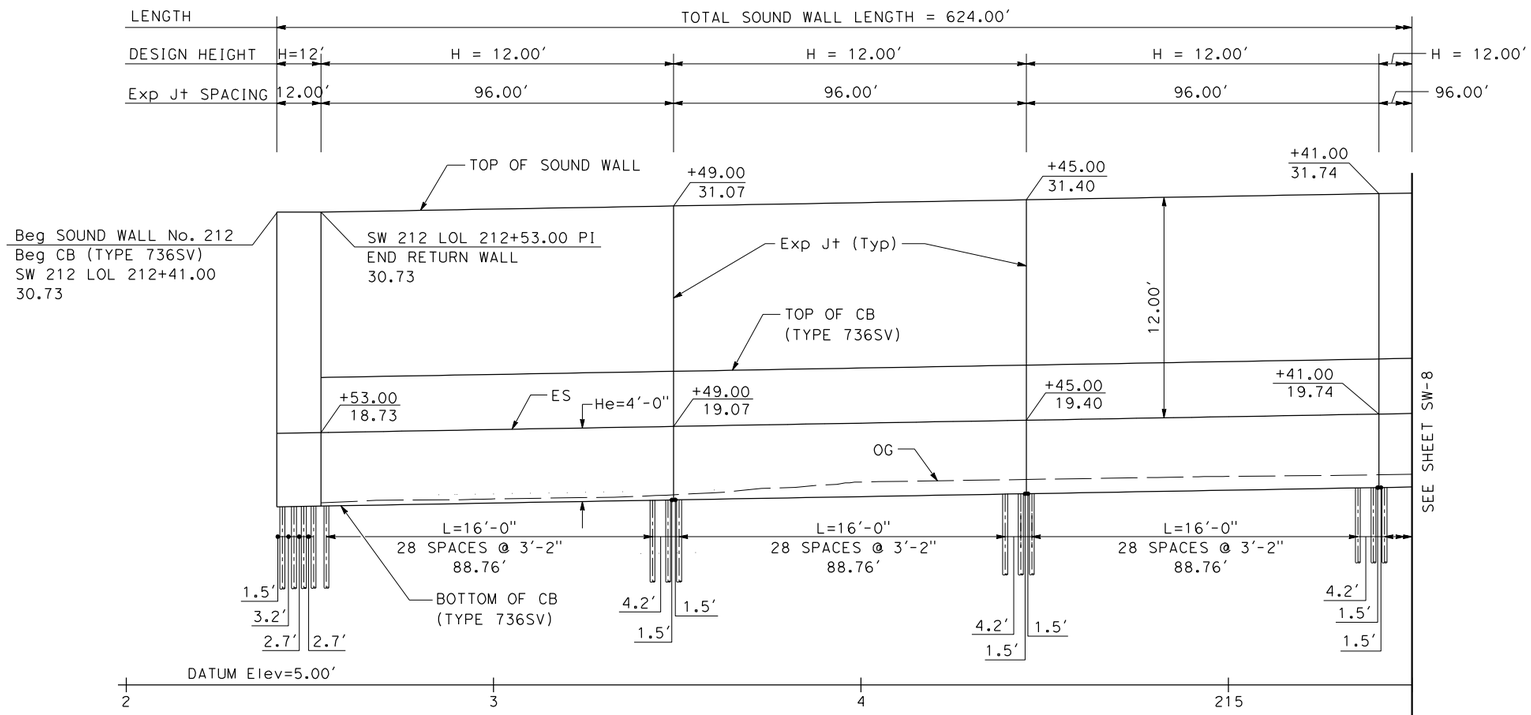
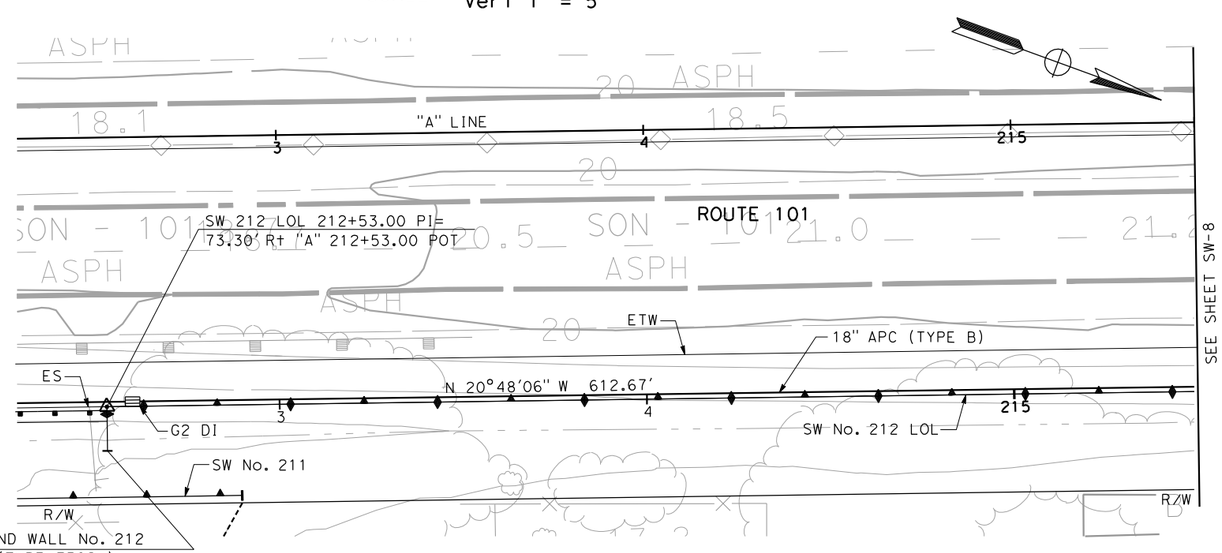
SANTA ROSA, CA 95401

FOR ACCURATE RIGHT OF WAY DATA, CONTACT
RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.



ELEVATION

SCALE: Horiz 1" = 20'
Vert 1" = 5'



PLAN

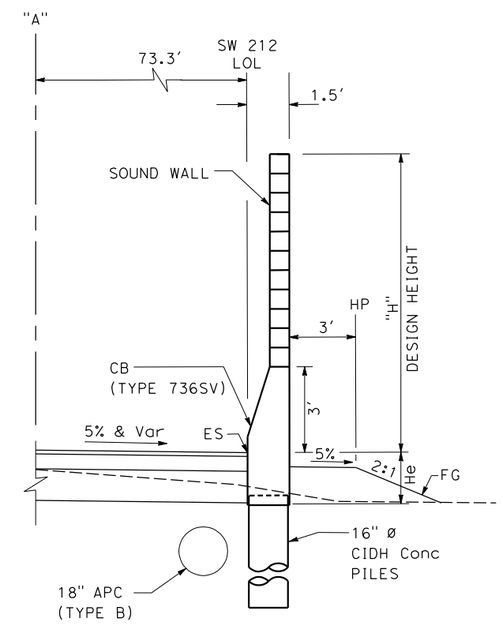
SCALE: 1" = 20'

FOR NOTES, SEE SHEET SW-2

THIS PLAN ACCURATE FOR SOUND WALL WORK ONLY

EP ELEVATIONS

Sta	Elev
212+53.00	18.73
212+60.00	18.75
212+80.00	18.82
213+00.00	18.89
213+20.00	18.96
213+40.00	19.03
213+60.00	19.10
213+80.00	19.17
214+00.00	19.24
214+20.00	19.31
214+40.00	19.38
214+60.00	19.45
214+80.00	19.52
215+00.00	19.59
215+20.00	19.66
215+40.00	19.73



SOUND WALL TYPICAL SECTION

NO SCALE

SOUND WALL PLAN

SOUND WALL No. 212

SHEET 1 OF 2

SCALE: 1"=20'

SW-7

REVISED BY	DATE REVISED
TT	10/31/10

CALCULATED-DESIGNED BY: TYSON TANO
CHECKED BY: ELIE ABI-JAOUDE
CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

LAST REVISION 11-22-10
DATE PLOTTED => 11/23/2010
TIME PLOTTED => 12:05:33 PM

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RAMSEY J. HISSEN No. C-39608 Exp. 12-31-11 CIVIL STATE OF CALIFORNIA

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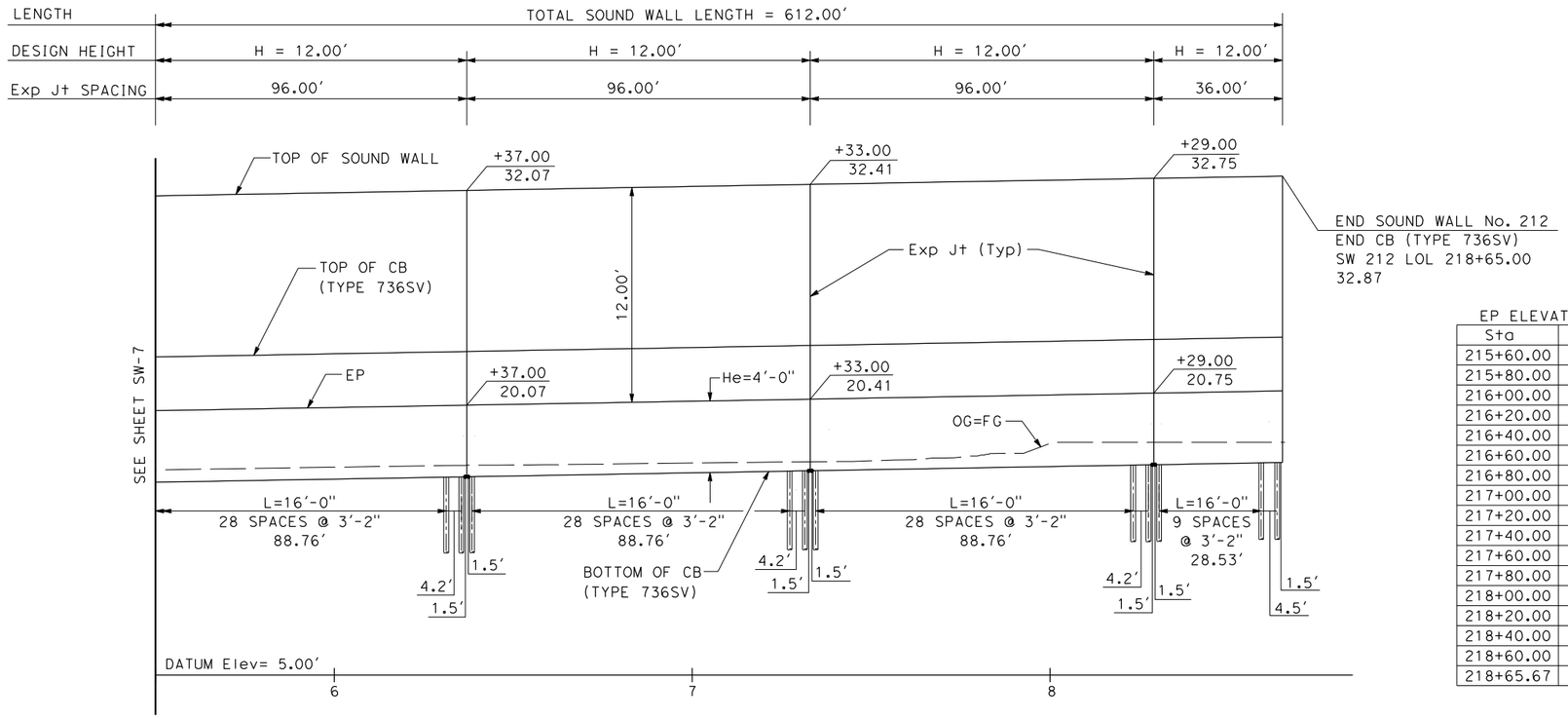
SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401

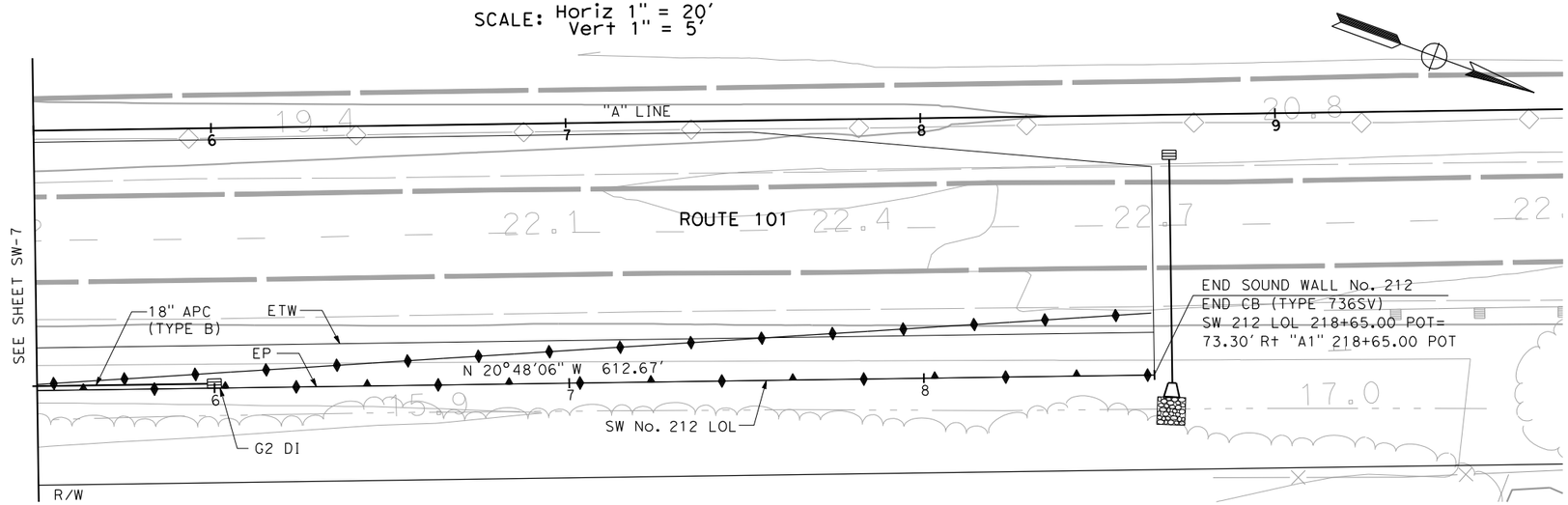
FOR ACCURATE RIGHT OF WAY DATA, CONTACT
RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.



ELEVATION
SCALE: Horiz 1" = 20'
Vert 1" = 5'

EP ELEVATIONS

Sta	Elev
215+60.00	19.80
215+80.00	19.87
216+00.00	19.95
216+20.00	20.02
216+40.00	20.09
216+60.00	20.16
216+80.00	20.23
217+00.00	20.30
217+20.00	20.37
217+40.00	20.44
217+60.00	20.51
217+80.00	20.58
218+00.00	20.65
218+20.00	20.72
218+40.00	20.79
218+60.00	20.86
218+65.67	10.61



PLAN
SCALE: 1" = 20'

FOR NOTES, SEE SHEET SW-2

THIS PLAN ACCURATE FOR SOUND WALL WORK ONLY

SOUND WALL PLAN
SOUND WALL No. 212
SHEET 2 OF 2
SCALE: 1"=20'

SW-8

REVISED BY	DATE REVISED
TT	10/31/10

CALCULATED-DESIGNED BY: TYSON TANO
CHECKED BY: ELIE ABI-JAOUDE
CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

LAST REVISION 11-22-10
DATE PLOTTED => 11/23/2010
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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RAMSEY J. HISSEN No. C-39608 Exp. 12-31-11 CIVIL STATE OF CALIFORNIA

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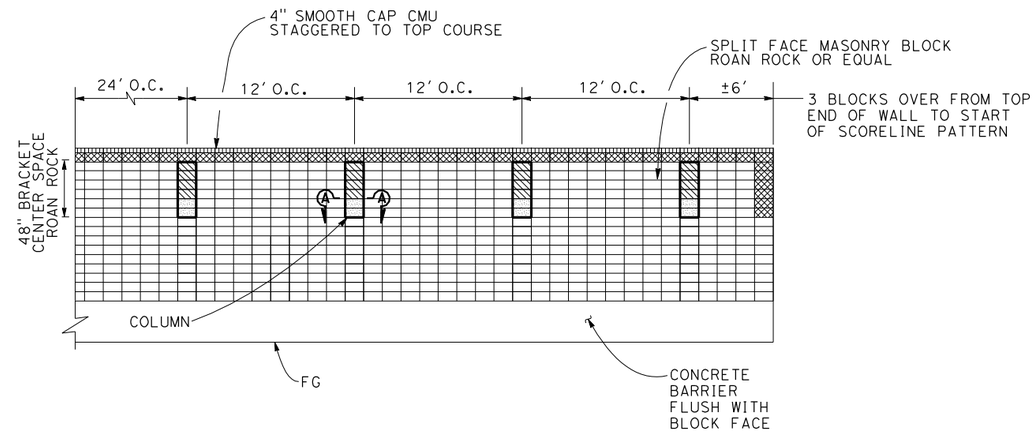
SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401

NOTES

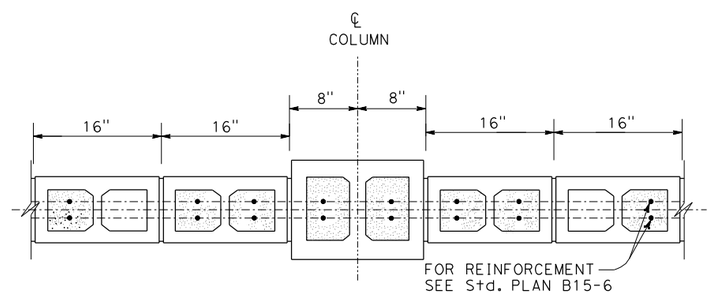
1. FOR DETAILS NOT SHOWN ON SECTION A-A, SEE STANDARD PLANS B15-6, B15-7, AND B15-8
2. INTERNAL CELLS OF THE CMU BLOCKS SHALL BE ON THE CENTER LINE OF THE WALL, NOT THE CENTER OF THE BLOCKS IF POSSIBLE
3. ADDITIONAL BOND BEAM #5 IN 4" x 2" DEEP OPENING. LENGTH = 7'-6" CENTERED ABOUT ℄ OF COLUMN
3. COLUMNS ARE 24' ON CENTER EXCEPT AT END OF WALL WHERE THEY SHALL BE 12' ON CENTER AS SHOWN ON "SOUND WALL PATTERN" DETAIL ON THIS SHEET.



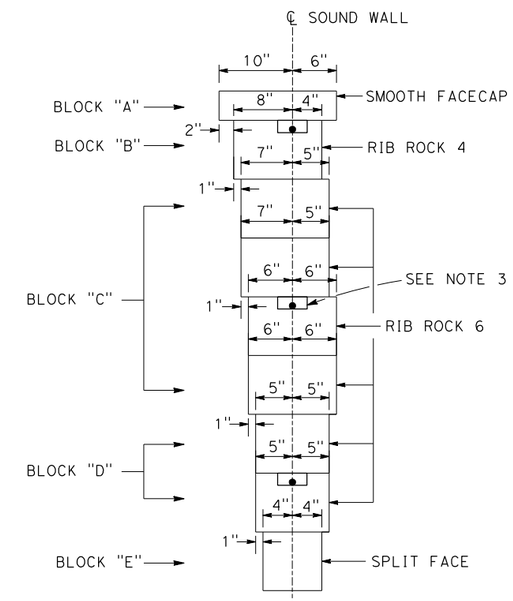
SOUND WALL PATTERN

LEGEND:

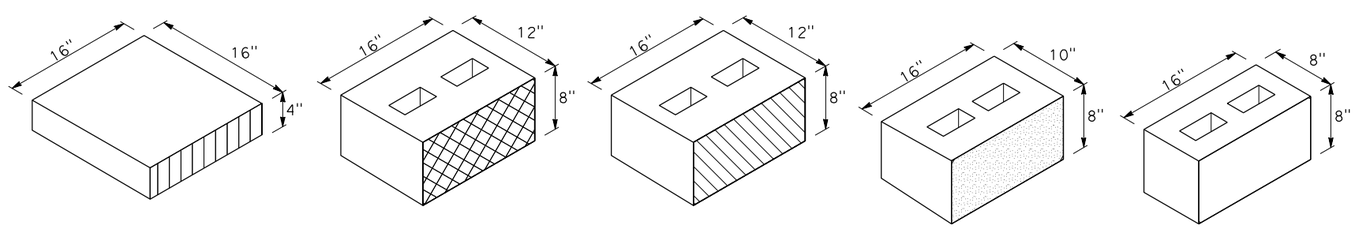
- BLOCK "A"
- BLOCK "B"
- BLOCK "C"
- BLOCK "D"
- BLOCK "E"



SECTION A-A



TYPICAL SOUNDWALL SECTIONS AT COLUMNS



COLOR: GRAY PRECISION CALSTONE 100 (SMOOTH FACECAP) ON BOTH SIDES

BLOCK "A"

COLOR: SLATE CALSTONE 142 (RIB ROCK 4) ON BOTH SIDES

BLOCK "B"

* CELLS WIDTH TO MATCH 8" BLOCK

COLOR: SLATE CALSTONE 142 (RIB ROCK 6) ON BOTH SIDES

BLOCK "C"

* CELLS WIDTH TO MATCH 8" BLOCK

COLOR: SLATE CALSTONE 142 (RIB ROCK 6) ON BOTH SIDES

BLOCK "D"

* CELLS WIDTH TO MATCH 8" BLOCK

COLOR: GOLD CALSTONE 149 (SPLIT FACE) ON BOTH SIDES

BLOCK "E"

SOUND WALL DETAILS
SOUND WALL AESTHETICS
SHEET 1 OF 2

NO SCALE

SW-9

REVISED BY	TT
DATE REVISED	10/31/10
CALCULATED-DESIGNED BY	TYSON TANO
CHECKED BY	ELIE ABI-JAOUDE
CONSULTANT FUNCTIONAL SUPERVISOR	RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RAMSEY J. HISSEN No. C-39608 Exp. 12-31-11 CIVIL STATE OF CALIFORNIA

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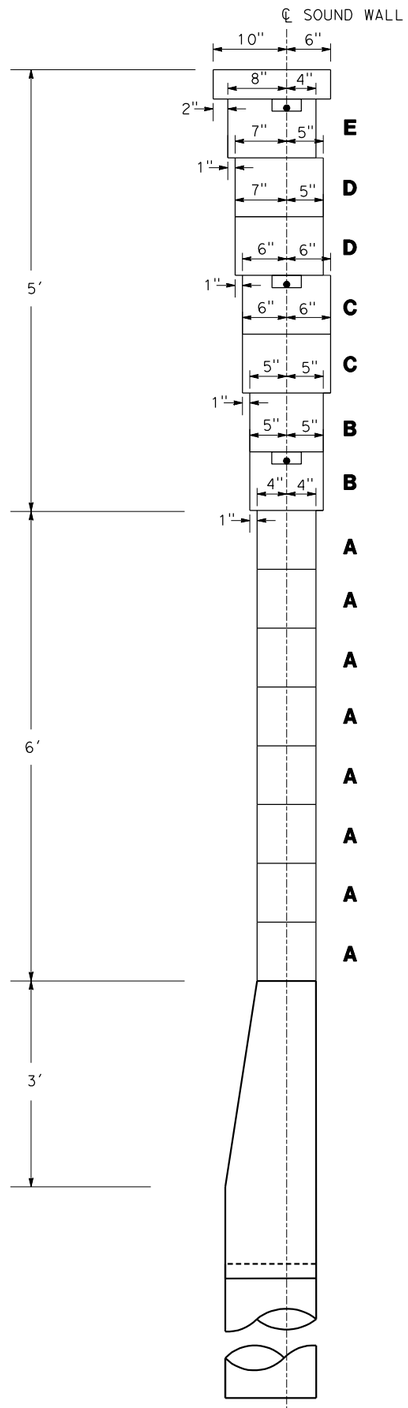
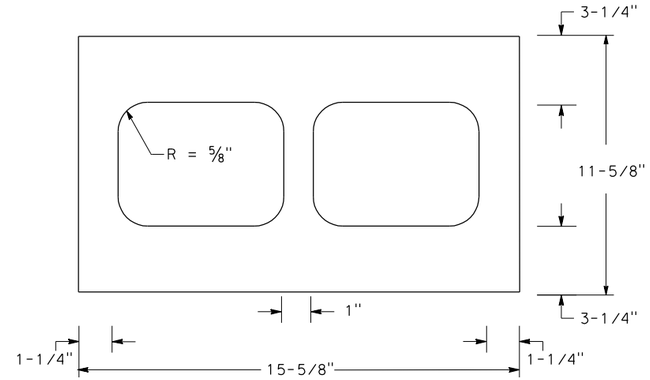
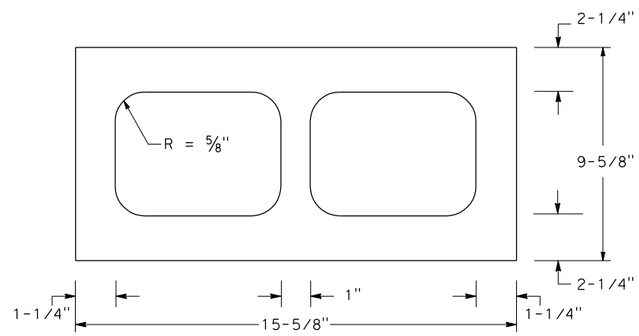
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401



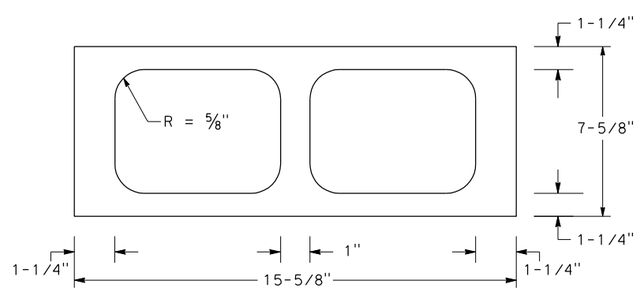
TYPICAL SOUNDWALL SECTION AT COLUMNS



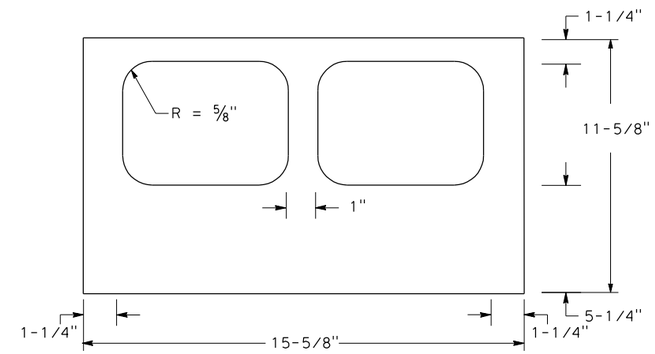
C (2" OFFSET)
12-INCH UNIT CONFIGURATIONS



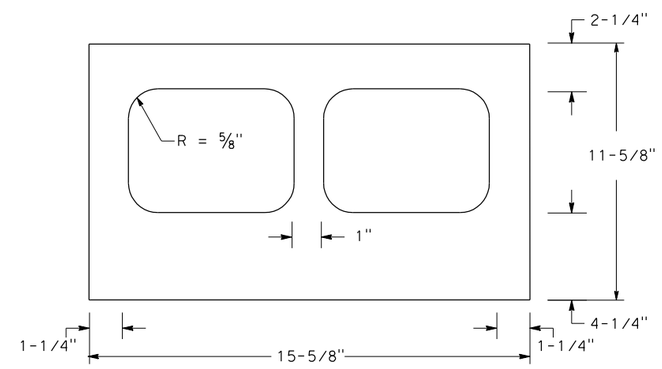
B (1" OFFSET)
10-INCH UNIT CONFIGURATIONS



A
8-INCH UNIT CONFIGURATIONS



E (4" OFFSET)
12-INCH UNIT CONFIGURATIONS



D (3" OFFSET)
12-INCH UNIT CONFIGURATIONS

SOUND WALL DETAILS
SOUND WALL AESTHETICS
SHEET 2 OF 2

NO SCALE

SW-10

TT	10/31/10	TYSON TANO	ELIE ABI-JAOUDE
REVISED BY	DATE REVISED	CALCULATED-DESIGNED BY	CHECKED BY
CONSULTANT FUNCTIONAL SUPERVISOR	RAMSEY HISSEN		

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 11-22-10 DATE PLOTTED => 11/23/2010 TIME PLOTTED => 12:05:47 PM

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RAMSEY J. HISSEN No. C-39608 Exp. 12-31-11 CIVIL STATE OF CALIFORNIA

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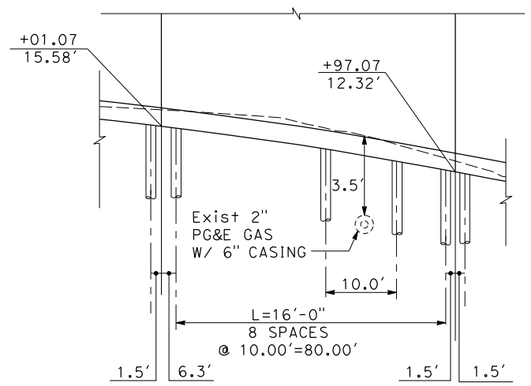
NOTE:

1. APPROXIMATE ELEVATION, STATIONING AND DIAMETER SHOWN. CONTRACTOR SHALL VERIFY FIELD CONTROL DIMENSIONS PRIOR TO INSTALLING CIDH PILES.



SOUND WALL No. 297
PILE SPACING ARRANGEMENT

PILE SPACING ARRANGEMENT
SHEET 1 OF 1
SCALE: 1"=10'

SW-11

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION	CONSULTANT FUNCTIONAL SUPERVISOR	CALCULATED-DESIGNED BY	TYSON TANO
Caltrans	RAMSEY HISSEN	CHECKED BY	ELIE ABI-JAOUDE
		REVISED BY	TT
		DATE REVISED	10/31/10

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RAMSEY J. HISSEN No. C-39608 Exp. 12-31-11 CIVIL STATE OF CALIFORNIA

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SANTA ROSA, CA 95401

SOUNDWALLS

DESCRIPTION	UNIT	SOUNDWALL NUMBER				TOTAL
		211	212	297	300	
16 in CAST-IN-DRILLED-HOLE CONCRETE PILING (SOUND WALL)*	LF	282	5139	2274	8600	16295
MINOR CONCRETE (SOUND WALL)*	CY	10.4			1.7	12
SOUND WALL (BARRIER) (MASONRY BLOCK)*	SQFT		7344	5088	14917	27349
SOUND WALL (MASONRY BLOCK)*	SQFT	2346			400	2746
CONCRETE BARRIER (TYPE 736SV)*	LF		612	40	933	1585
CONCRETE BARRIER (TYPE 736S)*	LF			384		384
ACCESS GATE (N)	EA	1			2	3
BAR REINFORCING STEEL (SOUNDWALL)*	LB	5416	17562	12535	32405	67918

* SEE STRUCTURE PLANS FOR ADDITIONAL SOUND WALL QUANTITIES

SOUND WALL QUANTITIES

SW-12

LAST REVISION 11-22-10 | DATE PLOTTED => 11/23/2010 TIME PLOTTED => 12:05:54 PM

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
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CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN
CALCULATED-DESIGNED BY: TYSON TANO
CHECKED BY: ELIE ABI-JAOUDE
REVISED BY: TT
DATE REVISED: 10/31/10

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	0.9/3.6	.	.

REGISTERED CIVIL ENGINEER 7/29/11 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RUTA JARIWALA No. C-73840 Exp. 06-30-11 CIVIL STATE OF CALIFORNIA

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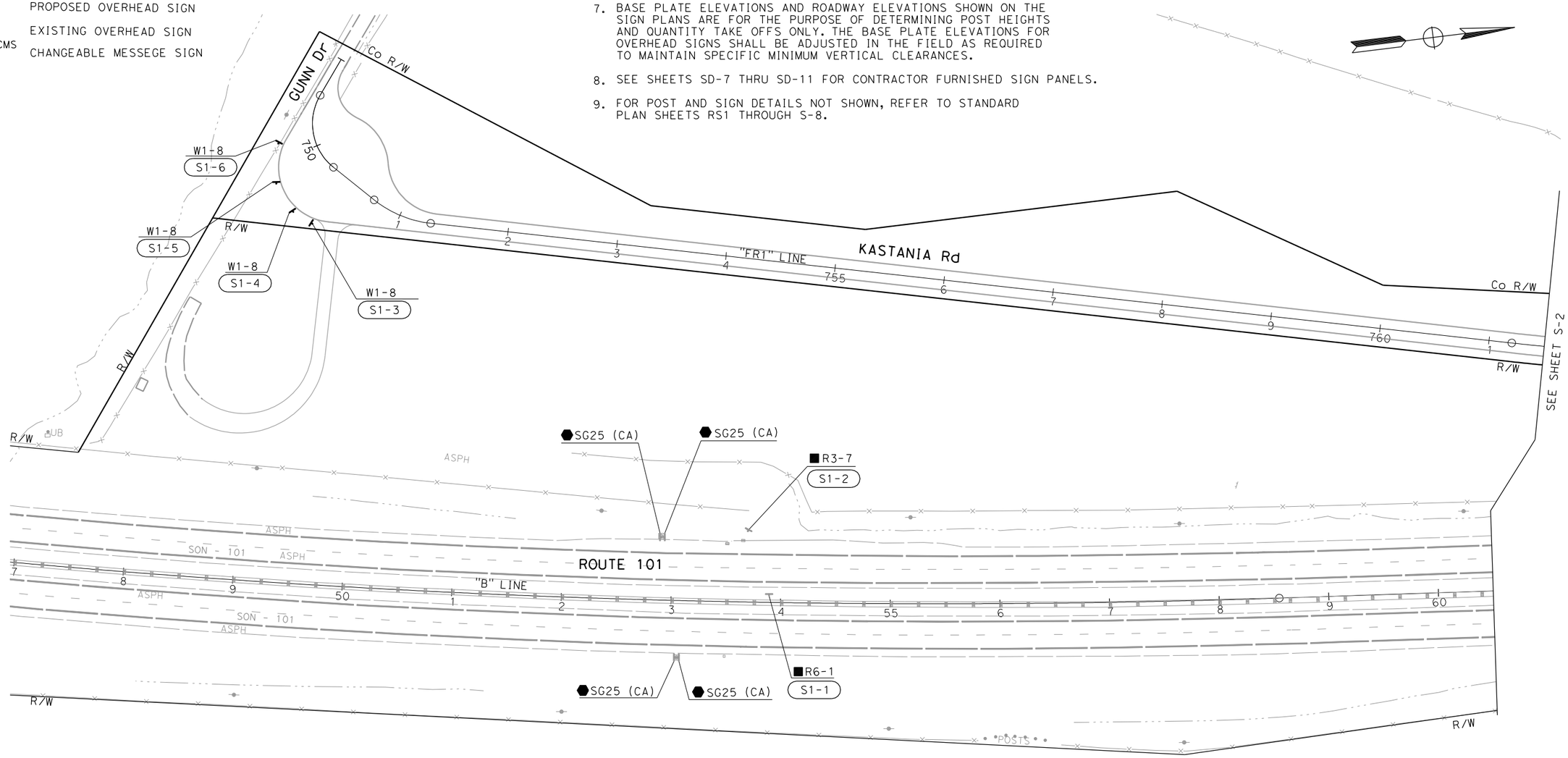
SANTA ROSA, CA 95401

LEGEND:

- NEW TWO POST ROADWAY SIGN
- EXISTING TWO POST ROADWAY SIGN
- NEW ONE POST ROADWAY SIGN
- EXISTING ONE POST ROADWAY SIGN
- SSX-X — OVERHEAD SIGN LETTER
- SX-X — ROADSIDE SIGN NUMBER
- EXISTING SIGN TO REMAIN
- RELOCATE ROADSIDE SIGN
- REMOVE ROADSIDE SIGN
- PROPOSED OVERHEAD SIGN
- EXISTING OVERHEAD SIGN
- CMS — CHANGEABLE MESSEGE SIGN

NOTES:

1. FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.
2. EXACT LOCATION OF ROADSIDE SIGNS SHALL BE DETERMINED BY THE ENGINEER.
3. ALL ROADSIDE SIGNS TO BE MOUNTED ON S4S WOOD POSTS, UNLESS OTHERWISE INDICATED.
4. POST SIZE AND LENGTH GIVEN ARE APPROXIMATE. EXACT SIZE AND LENGTH TO BE DETERMINED BY THE ENGINEER.
5. SEE SHEETS SD-1 THRU SD-6 FOR ROADSIDE AND OVERHEAD SIGN DETAILS.
6. THE MINIMUM VERTICAL CLEARANCES SHOWN ON THE PLANS SHALL BE PROVIDED BETWEEN THE FINISHED SURFACE OF THE ROADWAY AND THE BOTTOM OF ALL OVERHEAD SIGNS.
7. BASE PLATE ELEVATIONS AND ROADWAY ELEVATIONS SHOWN ON THE SIGN PLANS ARE FOR THE PURPOSE OF DETERMINING POST HEIGHTS AND QUANTITY TAKE OFFS ONLY. THE BASE PLATE ELEVATIONS FOR OVERHEAD SIGNS SHALL BE ADJUSTED IN THE FIELD AS REQUIRED TO MAINTAIN SPECIFIC MINIMUM VERTICAL CLEARANCES.
8. SEE SHEETS SD-7 THRU SD-11 FOR CONTRACTOR FURNISHED SIGN PANELS.
9. FOR POST AND SIGN DETAILS NOT SHOWN, REFER TO STANDARD PLAN SHEETS RS1 THROUGH S-8.



SIGN PLAN

NO SCALE

S-1

THIS PLAN ACCURATE FOR SIGN WORK ONLY.

REVISED BY	NA
DATE REVISED	7/29/11
NAYAN AMIN	
RUTA JARIWALA	
CALCULATED-DESIGNED BY	
CHECKED BY	
CONSULTANT FUNCTIONAL SUPERVISOR	
RAMSEY HISSEN	

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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LAST REVISION 07-27-11
DATE PLOTTED => 7/30/2011
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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	0.9/3.6	.	.

REGISTERED CIVIL ENGINEER 7/29/11 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RUTA JARIWALA No. C-73840 Exp. 06-30-11 CIVIL STATE OF CALIFORNIA

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NOTE:
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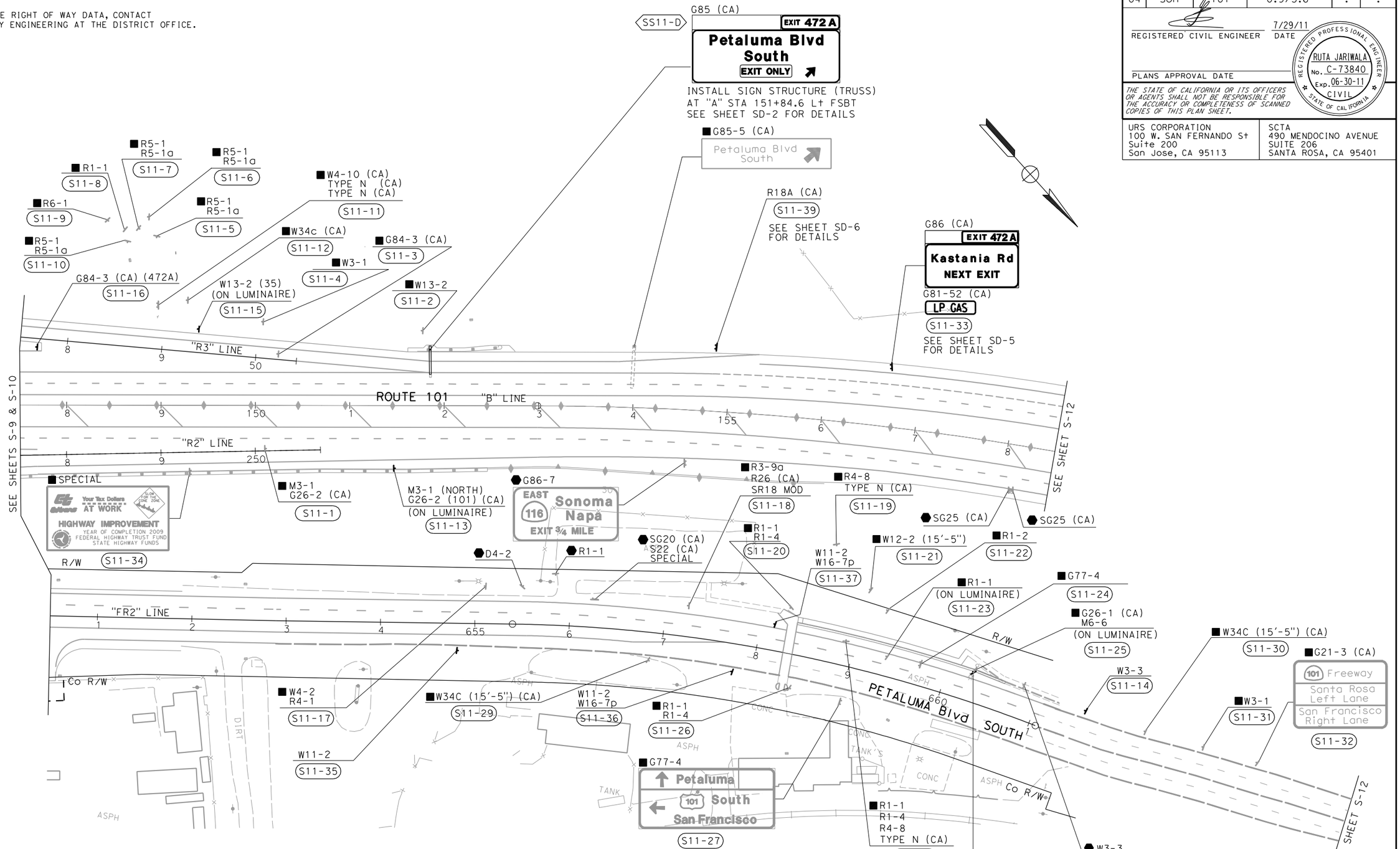

FOR NOTES AND LEGEND,
SEE SHEET S-1

SIGN PLAN
NO SCALE

THIS PLAN ACCURATE FOR SIGN WORK ONLY.

S-11

NA	7/29/11
REVISED BY	DATE REVISED
NAYAN AMIN	RUTA JARIWALA
CALCULATED-DESIGNED BY	CHECKED BY
CONSULTANT FUNCTIONAL SUPERVISOR	RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
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LAST REVISION 07-27-11
DATE PLOTTED => 7/30/2011
TIME PLOTTED => 8:13:50 AM

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	0.9/3.6	.	.

REGISTERED CIVIL ENGINEER 7/29/11 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RUTA JARIWALA No. C-73840 Exp. 06-30-11 CIVIL STATE OF CALIFORNIA

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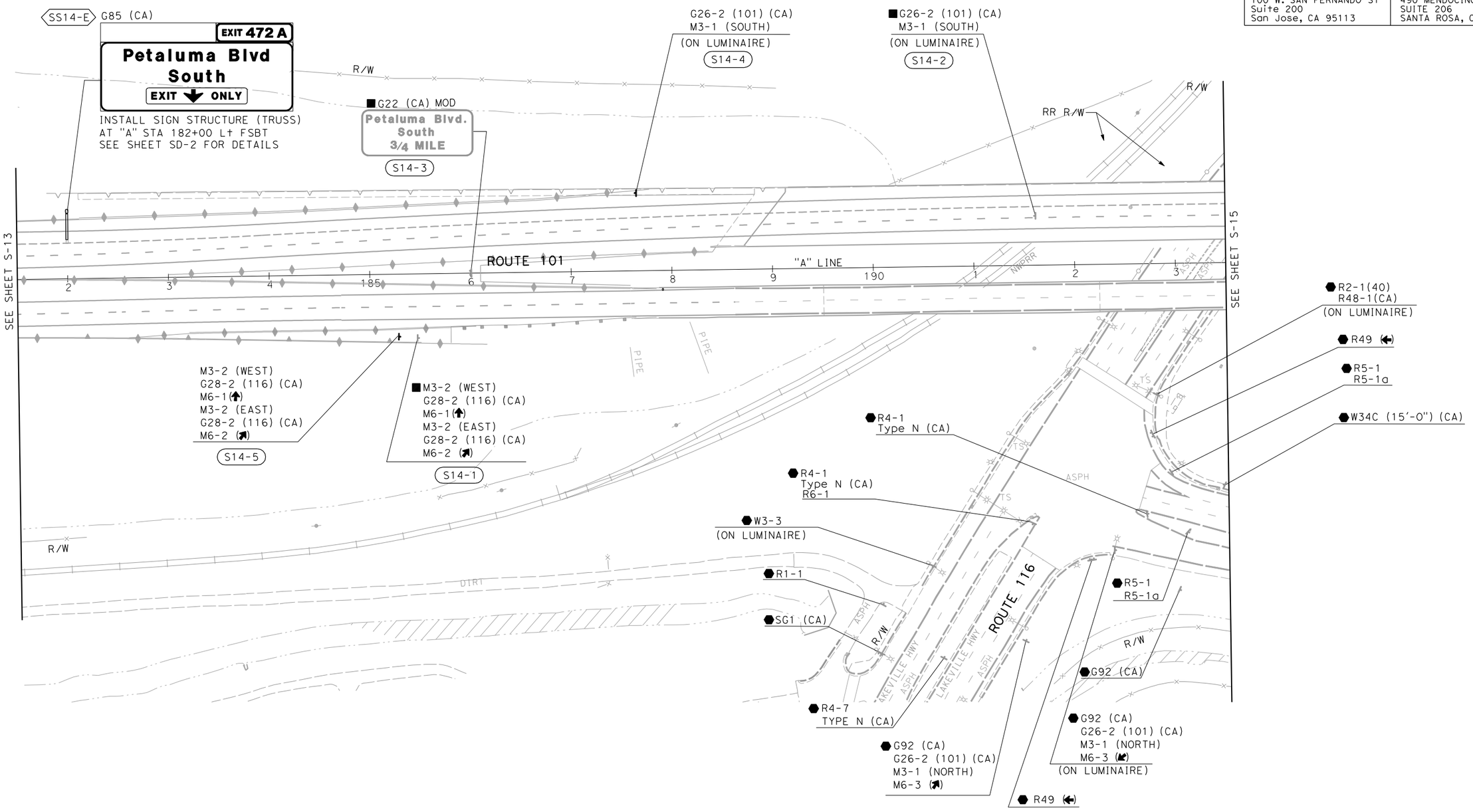

FOR NOTES AND LEGEND, SEE SHEET S-1

THIS PLAN ACCURATE FOR SIGN WORK ONLY.

SIGN PLAN
NO SCALE

S-14

REVISED BY	DATE REVISED
NA	7/29/11

NAYAN AMIN — RUTA JARIWALA
CALCULATED-DESIGNED BY — CHECKED BY
CONSULTANT FUNCTIONAL SUPERVISOR — RAMSEY HISSEN
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

LAST REVISION 07-27-11
DATE PLOTTED => 7/30/2011
TIME PLOTTED => 8:14:09 AM

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	0.9/3.6	.	.

REGISTERED CIVIL ENGINEER 7/29/11 DATE

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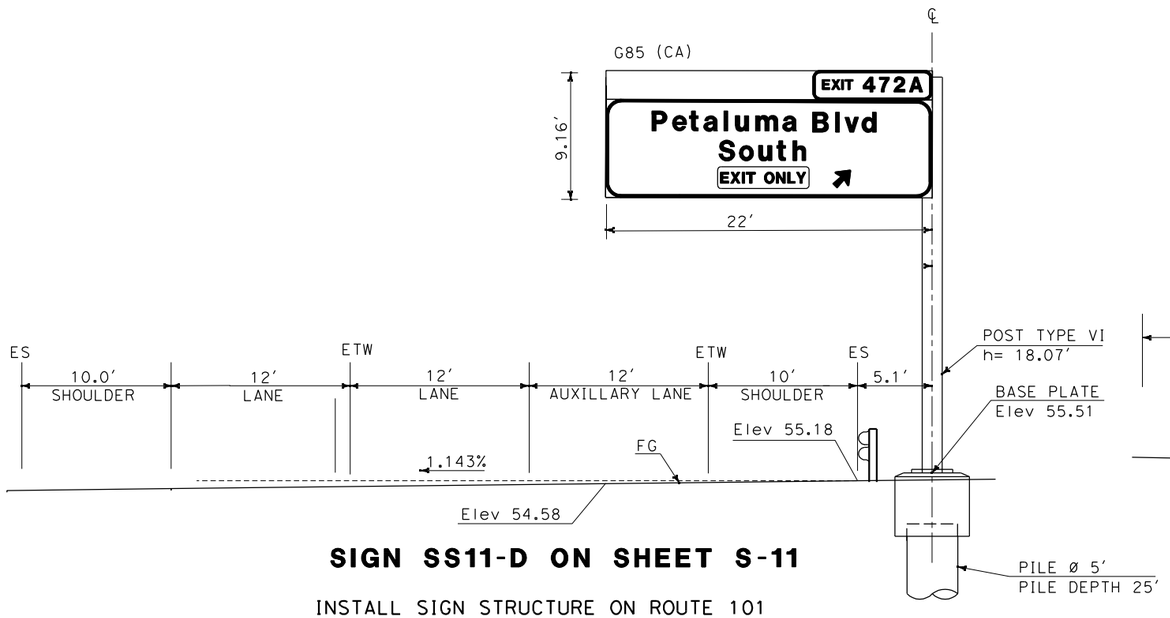
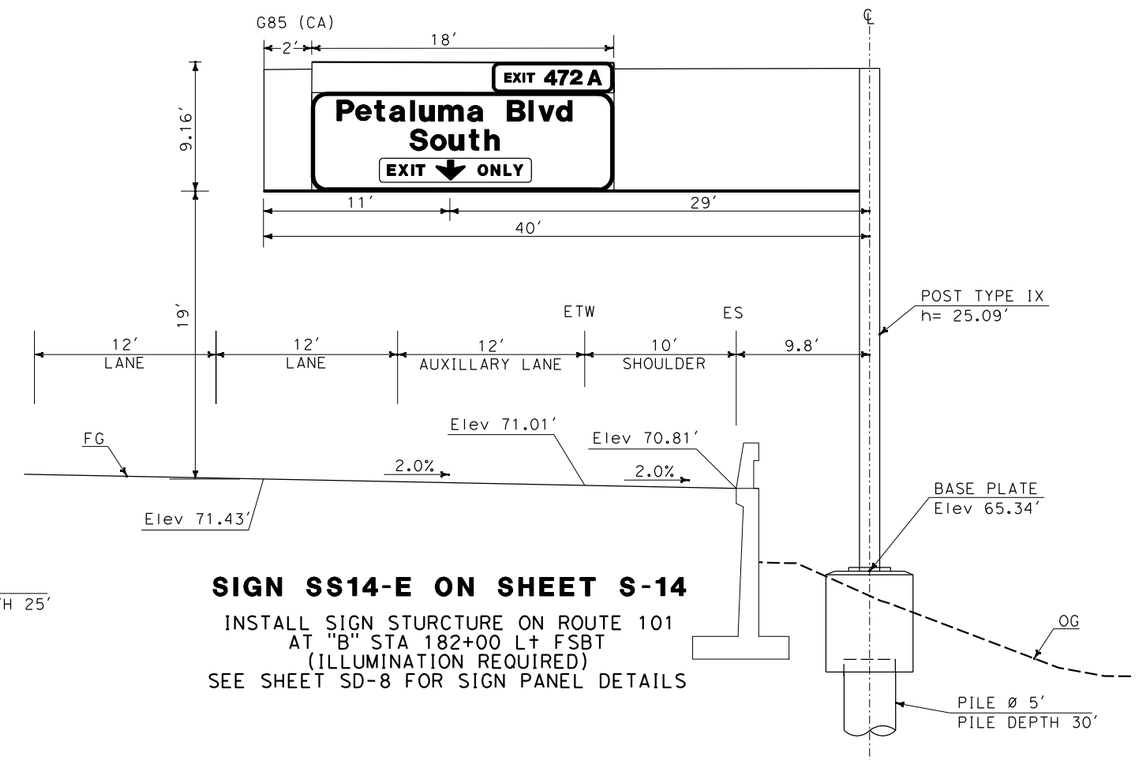
SANTA ROSA, CA 95401



SIGN SS11-D ON SHEET S-11

INSTALL SIGN STRUCTURE ON ROUTE 101
AT "B" STA 151+84.6 Lt FSBT
(ILLUMINATION REQUIRED)
SEE SHEET SD-8 FOR SIGN PANEL DETAILS



SIGN SS14-E ON SHEET S-14

INSTALL SIGN STURCTURE ON ROUTE 101
AT "B" STA 182+00 Lt FSBT
(ILLUMINATION REQUIRED)
SEE SHEET SD-8 FOR SIGN PANEL DETAILS

SIGN DETAILS

NO SCALE

SD-2

CALCULATED-DESIGNED BY	NAYAN AMIN	REVISED BY	NA
CHECKED BY	RUTA JARIWALA	DATE REVISED	7/29/11

CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 07-27-11 | DATE PLOTTED => 7/30/2011 TIME PLOTTED => 8:14:48 AM

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

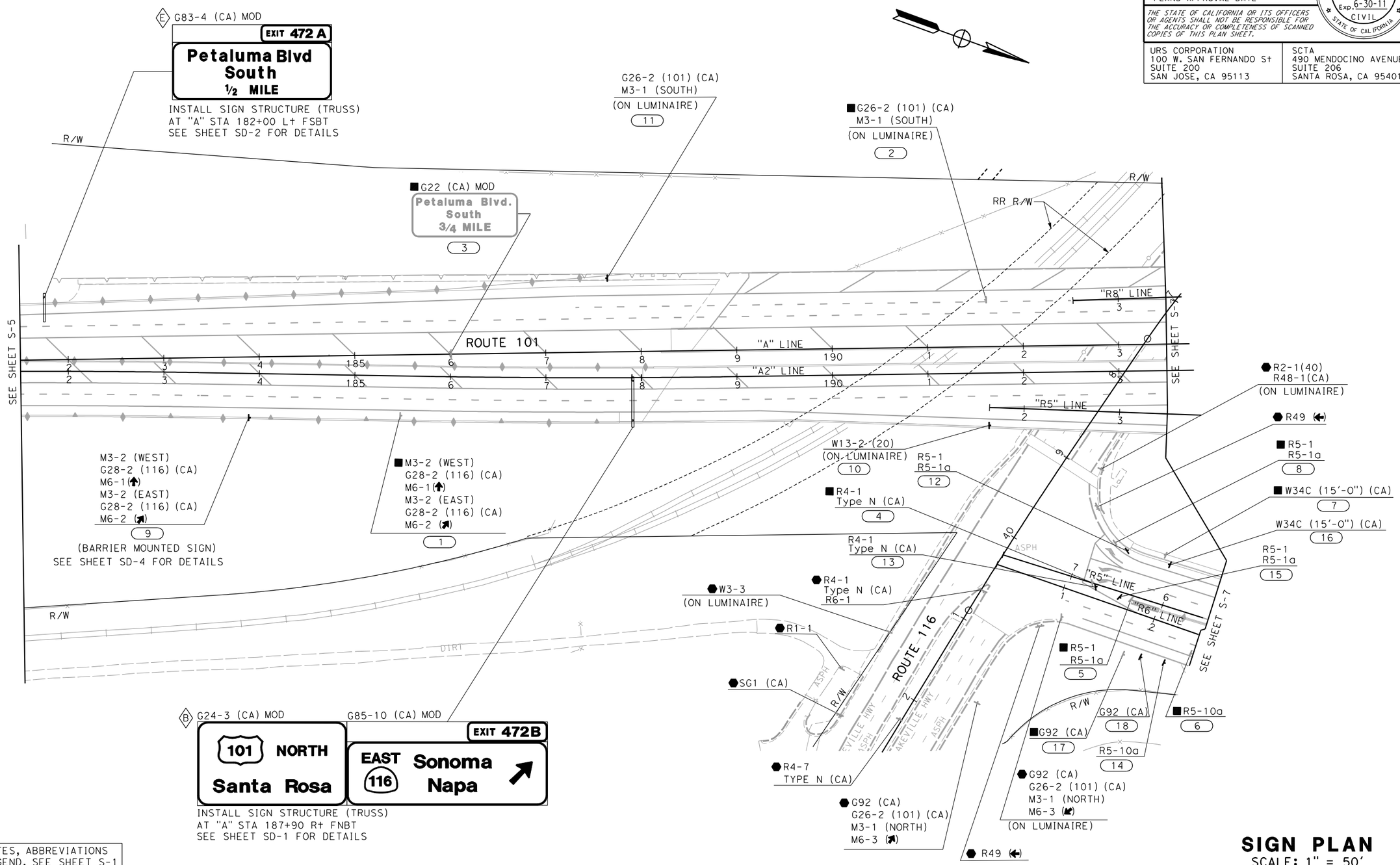
REGISTERED PROFESSIONAL ENGINEER RUTA JARIWALA No. C-73840 Exp. 6-30-11 CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

URS CORPORATION
100 W. SAN FERNANDO St
SUITE 200
SAN JOSE, CA 95113

SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401

FOR ACCURATE RIGHT OF WAY DATA, CONTACT
RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.



FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET S-1

THIS PLAN ACCURATE FOR SIGN WORK ONLY

SIGN PLAN

SCALE: 1" = 50'

S-6

REVISED BY	DATE REVISED
NAYAN AMIN	RUTA JARIWALA
CALCULATED-DESIGNED BY	CHECKED BY
RAMSEY HISSEN	

CONSULTANT FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 11-22-10

DATE PLOTTED => 11/22/2010
TIME PLOTTED => 3:11:01 PM

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RUTA JARIWALA No. C-73840 Exp. 6-30-11 CIVIL STATE OF CALIFORNIA

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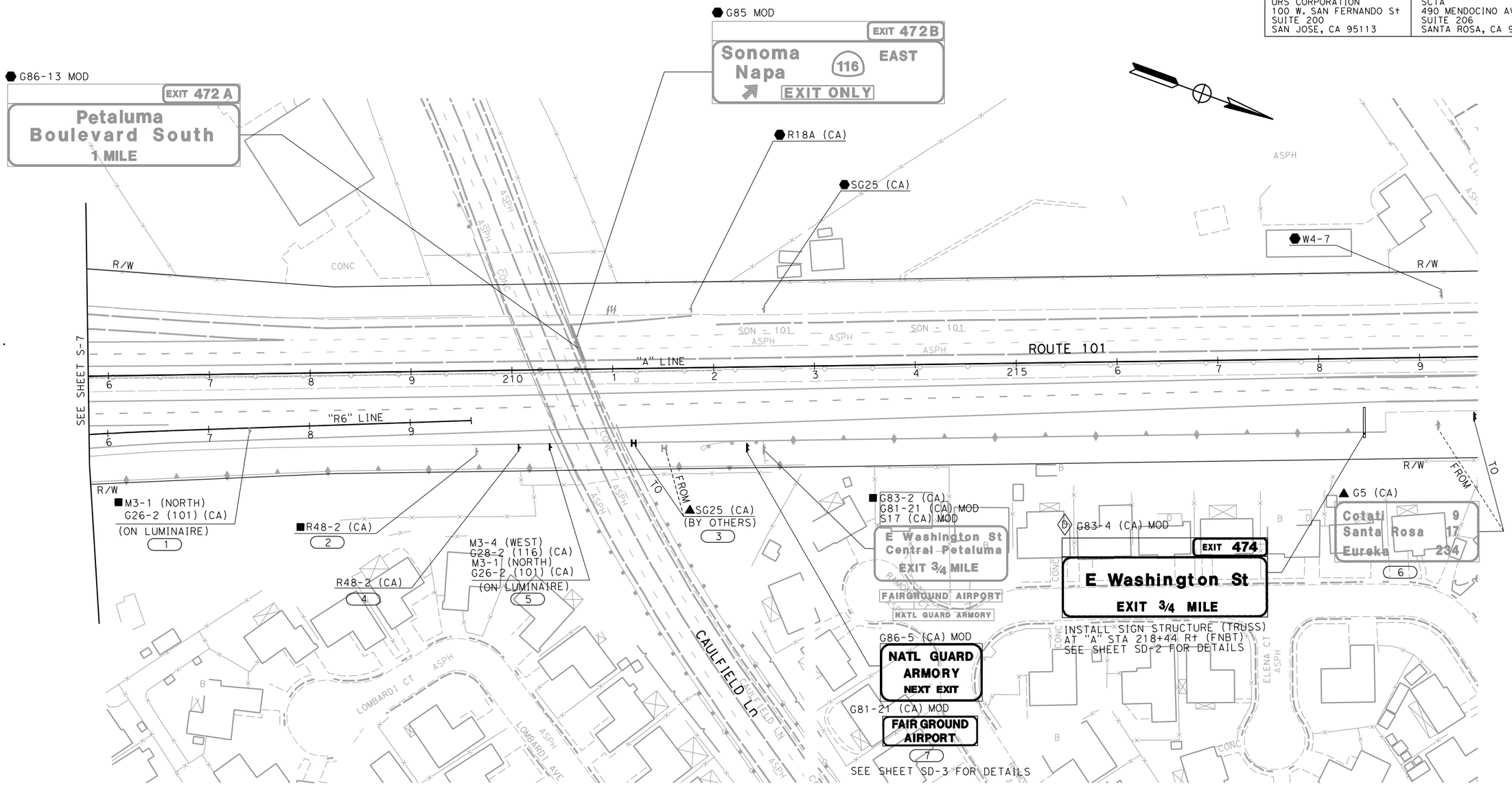
SAN JOSE, CA 95113

SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401

FOR ACCURATE RIGHT OF WAY DATA, CONTACT
RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.



FOR NOTES, ABBREVIATIONS
AND LEGEND, SEE SHEET S-1

THIS PLAN ACCURATE FOR SIGN WORK ONLY

SIGN PLAN
SCALE: 1" = 50'

S-8

REVISED BY	DATE REVISED

CALCULATED-DESIGNED BY	NAYAN AMIN
CHECKED BY	RUTA JARIWALA

CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 11-22-10 | DATE PLOTTED => 11/22/2010 | TIME PLOTTED => 3:11:10 PM

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RUTA JARIWALA No. C-73840 Exp. 6-30-11 CIVIL STATE OF CALIFORNIA

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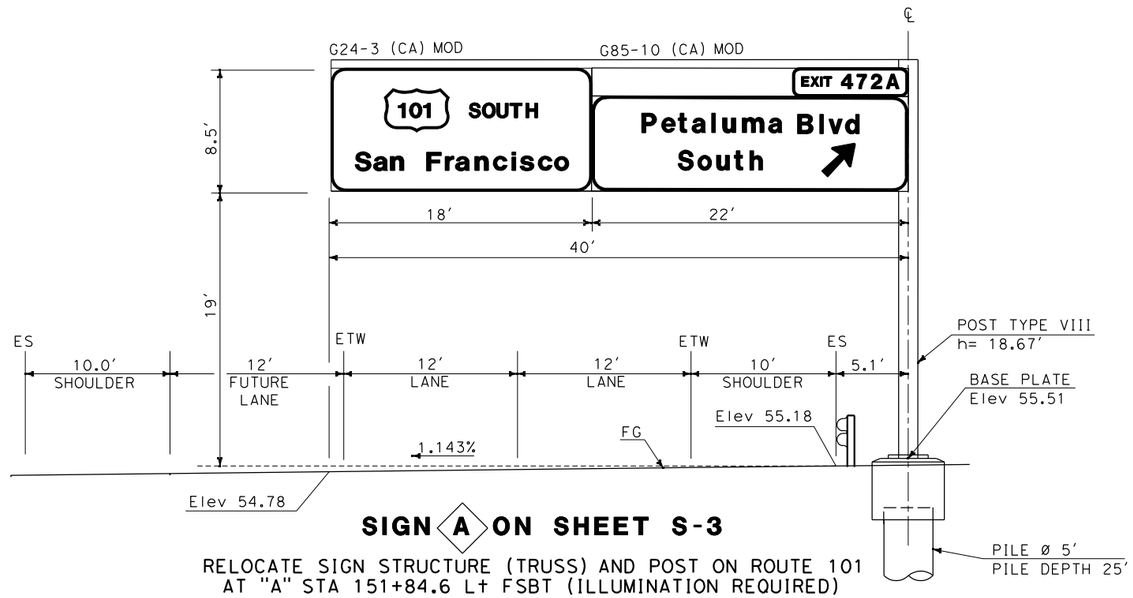
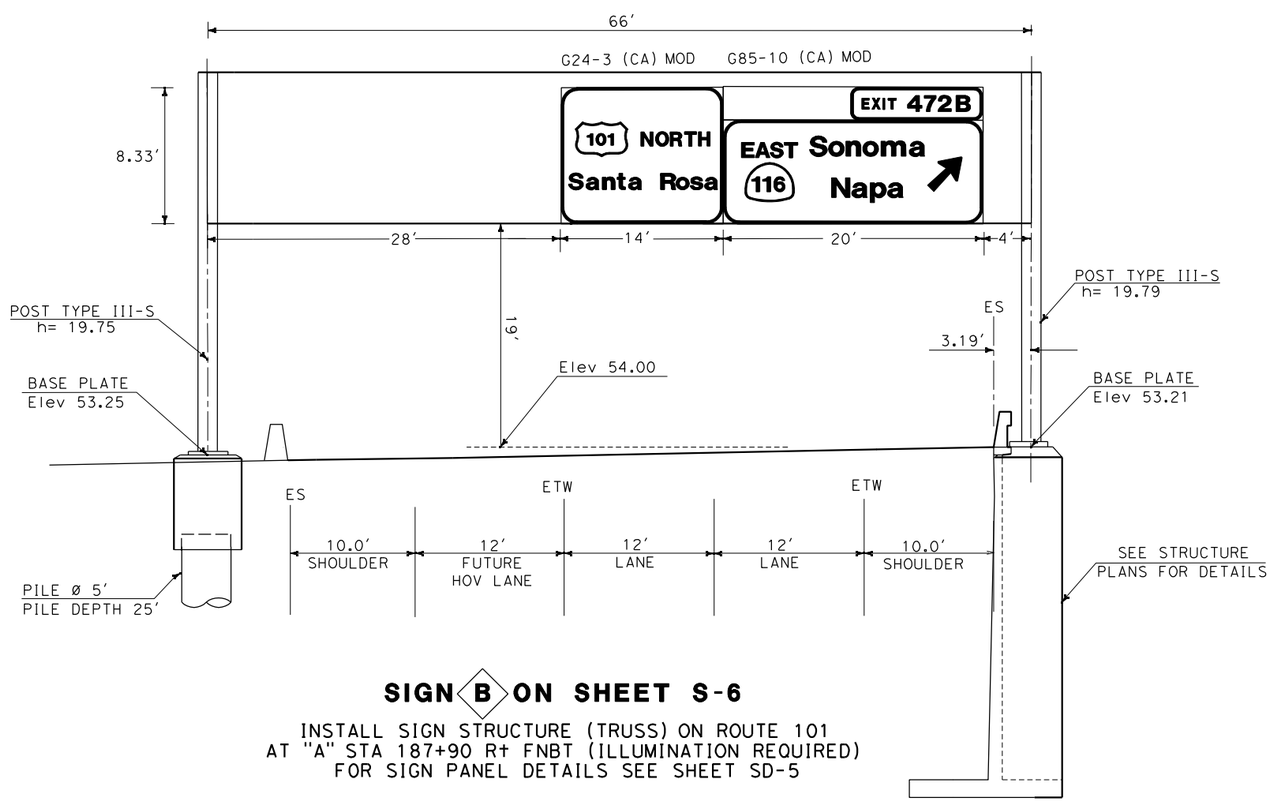
SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401



SIGN A ON SHEET S-3

RELOCATE SIGN STRUCTURE (TRUSS) AND POST ON ROUTE 101
AT "A" STA 151+84.6 L+ FSBT (ILLUMINATION REQUIRED)



SIGN B ON SHEET S-6

INSTALL SIGN STRUCTURE (TRUSS) ON ROUTE 101
AT "A" STA 187+90 R+ FNBT (ILLUMINATION REQUIRED)
FOR SIGN PANEL DETAILS SEE SHEET SD-5

SIGN DETAILS

NO SCALE

SD-1

REVISED BY	DATE REVISED

CALCULATED-DESIGNED BY	NAYAN AMIN
CHECKED BY	RUTA JARIWALA

CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 11-22-10 | DATE PLOTTED => 11/22/2010 | TIME PLOTTED => 3:11:15 PM

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RUTA JARIWALA No. C-73840 Exp. 6-30-11 CIVIL STATE OF CALIFORNIA

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URS CORPORATION
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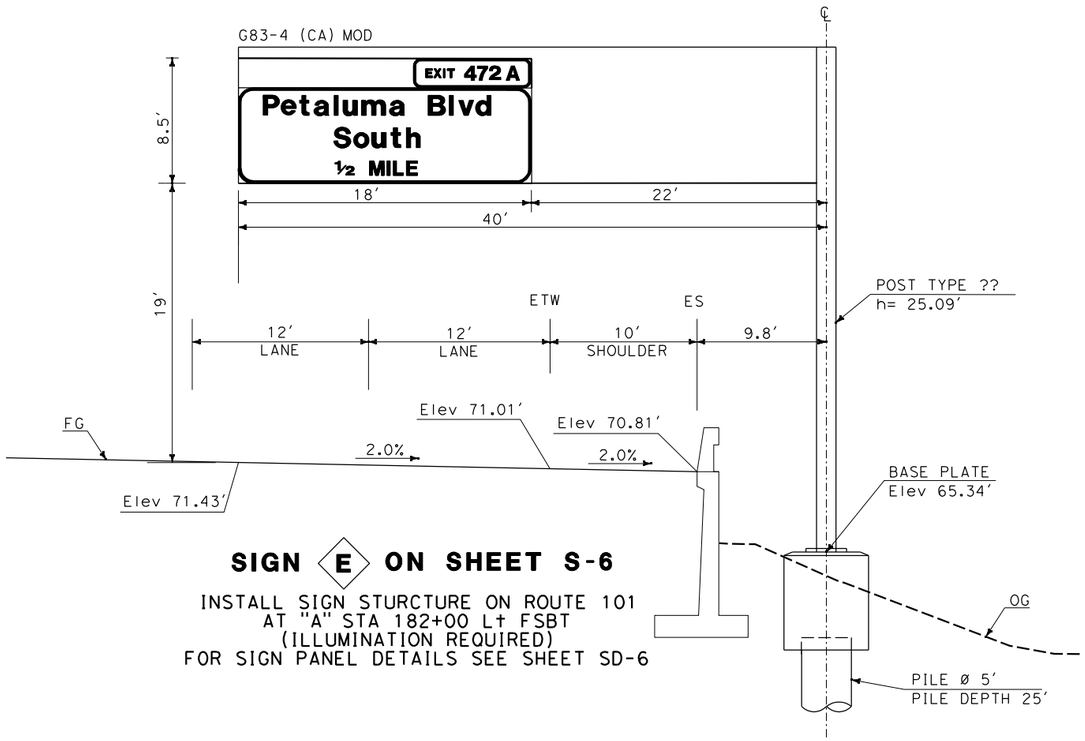
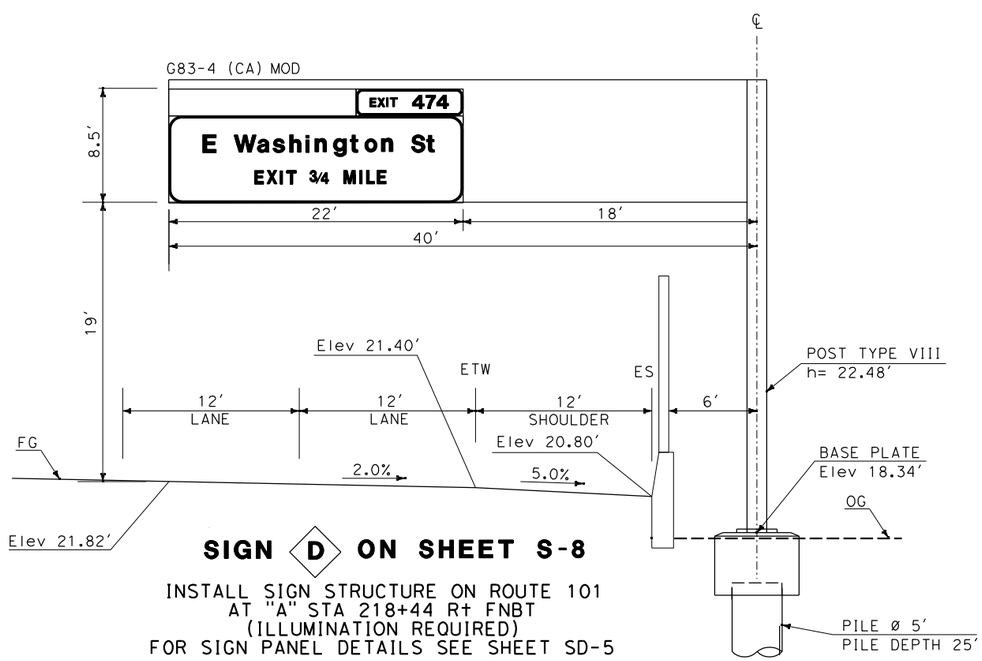
SUITE 200
SAN JOSE, CA 95113

SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401



SIGN E ON SHEET S-6

INSTALL SIGN STURCTURE ON ROUTE 101
AT "A" STA 182+00 Lt FSBT
(ILLUMINATION REQUIRED)
FOR SIGN PANEL DETAILS SEE SHEET SD-6



SIGN D ON SHEET S-8

INSTALL SIGN STRUCTURE ON ROUTE 101
AT "A" STA 218+44 Rt FNBT
(ILLUMINATION REQUIRED)
FOR SIGN PANEL DETAILS SEE SHEET SD-5

SIGN DETAILS

NO SCALE

SD-2

REVISED BY	DATE REVISED
NAYAN AMIN	RUTA JARIWALA

CALCULATED-DESIGNED BY / CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 11-22-10 | DATE PLOTTED => 11/22/2010 | TIME PLOTTED => 3:11:17 PM

Review Discipline:	Caltrans Office of Geotechnical Comments for FINAL PS&E – MSN C3(EA 2640K1)	**By:**	Caltrans
Comments Due By:	Mohammad Zabolzadeh	**Date:**	Feb 17, 2012
Date Reviewed By:	2-17-12	**Next JRT Meeting Date:**	

TECHNICAL COMMENT REVIEW AND RESPONSE

Title: CT EA# 04-2640K4
101 MSN – (Contract C3). PM 3.4/4.1

Caltrans Comments

CODE: A - Will Comply; B - Caltrans to Evaluate; C - Will Not Incorporate; D – Agency (SCTA/URS) to Evaluate; E - No Action Required

AGCY	INIT	Item No.	Drawing or Page No.	Review Comments	Designer Responses	Initial Disp.	JRT Disp.	Final Disp.
Geotechnical Comments								
CT	MZ	1	SD-Sheets	The overhead sign numbers do not match with the Geotechnical Design Report dated September 30, 2011. The pile depths also do not match with GDR.	Will update Geotechnical Design Report to be consistent with project plans on sign numbers. Foundation type and pile depth will be coordinated so that both GDR and plans are consistent. For Sign SS2-A will be supported on the new wing wall of the Northbound Overhead structure. For Sign SS4-C, the depth of CIDH pile should be 40 feet as discussed in the GDR.	A	A	A
CT	MZ	2	SSP	Based on the submitted GDR (Page 4-2), five settlement-monitoring plates are proposed: two at Station "A" 194+50 and three at Stations "RW 293 LOL" 194+30, 195+50, and 196+50. These monitoring plates should be included in either, plan sheets, or SSP.	Will include in SSP locations and durations of the settlement monitoring plates.	A	A	A
CT	MZ	3	Page 431	Under pile installation section - There is no soft bay mud overlying dense soils. Remove this and add "blocks of hard to very hard rock in a soft clayey matrix.	Will modify SSP as indicated.	A	A	A

State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

Flex your power!
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To: MR. TUNG LY
District Branch Chief
Design South – Santa Clara B

Date: February 17, 2012

Attention: S. Yoo

File: 4-SON-101-PM 3.4/4.1
04- 2640K1
Route 101 Widening

From: MOHAMMAD ZABOLZADEH
Associate Materials and Research Engineer
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

H. Nikoui
HOOSHMAND NIKOUI
Chief, Branch A
Office of Geotechnical Design - West
Geotechnical Services
Division of Engineering Services

Subject : PS & E Review

We have reviewed the submitted 100% Plans, and Special Provisions for the above referenced project. We have the following comments:

PLANS

SD- Sheets

The overhead sign numbers do not match with the Geotechnical Design Report dated September 30, 2011. The pile depths also do not match with GDR.

SSP

Based on the submitted GDR (Page 4-2), five settlement-monitoring plates are proposed: two at Station "A" 194+50 and three at Stations "RW 293 LOL" 194+30, 195+50, and 196+50. These monitoring plates should be included in either, plan sheets, or SSP.

Page 431

Under pile installation section – There is no soft bay mud overlying dense soils. Remove this and add "blocks of hard to very hard rock in a soft clayey matrix.

If you have any questions or need additional information, please call me at 286-4831, or Hooshmand Nikoui, Branch Chief at 286-4811.

c: TPokrywka, HNikoui, Daily File, Project File

MZabolzadeh/mm/2640C1 100% Review GDR, Plans, SSP

Agency: Caltrans	**Responded by:**	URS
MSN Contract B2/B4 – EA 26408 (Now EA 2640U)	**Date Responded:**	09/23/2011
100% PS&E Comment Responses	**Next JRT Meeting Date:**	

TECHNICAL COMMENT REVIEW AND RESPONSE

CODE: A - Will Comply; B - Caltrans to Evaluate; C - Will Not Incorporate; D – Agency (SCTA/URS) to Evaluate; E - No Action Required

INIT	Item No.	Drawing or Page No.	Review Comments	Designer Responses	Rev. By	Initial Disp.	Final Disp.
Geotechnical Services / 08.10.2011							
Mohammad Zabolzadeh	13	SD 2	SD 2 Sheet - Proposed Signs SS11-D and SS14-E at Stations 151+84.6 and 182+00, respectively, appear to be the same as Signs A and E of B-4 project. There are two proposed signs B and D in B-4 project that are not included in the combined project. Check discrepancy.	Yes, Signs A and E of the original B-4 contract correspond to Signs SS11-D and SS14-E, respectively. The other signs B and D of the original B-4 contract will be included in a future contract. Have revised report to clarify the designation change in Signs SS11-D and SS14-E.	A		

State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

Flex your power!
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To: MR. PAUL MAI
District Office Chief
Design South Santa Clara - B

Date: August 10, 2011

Attention: T. Ly

File: 04-SON-101-PM 0.9/3.6
04-264081
Route 101 Widening and I/C
Combined B2 & B4 Contracts

From: M. ZABOLZADEH/A. KADDOURA
Associate Materials & Research Engineers
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

H. Nikoui
HOOSHMAND NIKOUI
Chief, Branch A
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

Subject : 100% PS&E Review

We have reviewed the submitted 100% PS& E package for the above referenced project and have the following comments:

Plans

Foundation Plan No.1 Sheet – Spread footing size is missing from the Spread Footing Data Table.

Pier 2 Footing Details Sheet – Foundation report page 7-3 recommends total of 4 tiedown anchors. Plan sheet shows total of 6. Check discrepancy.

Pier 3 Footing Details Sheet - Foundation report page 7-3 recommends total of 8 tiedown anchors. Plan sheet shows total of 18. Check discrepancy

LOTB Legend Sheets – The three LOTB legend sheets should be placed (renumbered) at the end of the LOTB sheets not in front.

SD 2 Sheet – Proposed Signs SS11-D and SS14-E at Stations 151+84.6 and 182+00, respectively, appear to be the same as Signs A and E of B-4 project. There are two proposed signs B and D in B-4 project that are not included in the combined project. Check discrepancy.

Special Provisions

Section 10_1-Piling, page 551of the Special Provisions should read: "Difficult pile installation is anticipated due to presence of overlying gravel, serpentinite, caving soils, high groundwater, traffic control, hard rock (< 10%), and cobbles and large boulders. The geology at this location has a chaotic structure which results in discontinuous, cobble to boulder sized blocks of formational rock within a soft, intensely weathered to a very stiff, slightly weathered clayey sand/sandy clay/argillite matrix." This comment was our previous comment dated June 8, 2010 that has not been addressed.

Should you have any questions, please call Mohammad Zabolzadeh/Ali Kaddoura at 510-286-4831/4676 or Hooshmand Nikoui at 510-286-4811, at the Office of Geotechnical Design-West, Branch A.

c: TPokrywka, WNyaz, HNikoui, AKaddoura, MZabolzadeh, Daily File, Route File, Translab File

Zabolzadeh-Kaddoura/mm/264081 100% PS&E

Agency: Caltrans				**Responded by:**	URS		
MSN Contract B4 – EA 2640C1				**Date Responded:**			
95% PS&E Comment Responses				**Next JRT Meeting Date:**			
TECHNICAL COMMENT REVIEW AND RESPONSE							
CODE: A - Will Comply; B - Caltrans to Evaluate; C - Will Not Incorporate; D – Agency (SCTA/URS) to Evaluate; E - No Action Required							
INIT	**Item No.**	**Drawing or Page No.**	**Review Comments**	**Designer Responses**	**Rev. By**	**Initial Disp.**	**Final Disp.**
Note to Reviewers: MSN Contract B4 (EA 2640C1) is being split into two segments. The southern segment including the Petaluma River Bridge replacement will be combined with MSN Contract B2 (EA 264081) to cover PM 0.9/3.6 . The remaining work within PM 3.6/4.1 will be packaged in a future contract. Responses to comments related only to the future contract will be implemented in the future.							
Geotechnical Design Comments / 12.28.10							
Mohammad Zabolzadeh	35		**GDR** All our previous comments dated April 21, 2010, have been incorporated into the GDR.	Noted.	TT	E	E
MZ	36	Page 4-2	Embankment fills up to 38 ft high are planned for this project. The existing utilities (if any) within the limits of this fill may be affected significantly. This should be discussed in the report.	Will add discussion of existing utilities. The closest existing utilities are about 50 feet from the toe of the planned embankment. Therefore, it is our opinion that the new embankment fill should post no adverse effect on the utilities.	SH	A	
MZ	37	Page 7-4	The design values shown on Tables 7-5 (Spread Footing Data table) and 7-8 (Pile Data Table) are different than the ones shown on the plans. Check discrepancy.	Presumably this comment refers to the Petaluma River Bridge Foundation Report (FR). The pile data table presented on the structural plan has been modified and is consistent to Tables 7-5 and 7-8 of the FR.	SH	A	

State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

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To: MR. TUNG LY
District Branch Chief
Design South – Santa Clara B

Date: December 28, 2010

Attention: Quoc Tran

File: 4-SON-01-PM 2.9/3.4
04- 2640C1
Route 101 Widening

From: MOHAMMAD ZABOLZADEH
Associate Materials and Research Engineer
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

For HOOSHMAND NIKOUI
Chief, Branch A
Office of Geotechnical Design - West
Geotechnical Services
Division of Engineering Services

Subject : PS & E Review

We have reviewed the submitted 95% Geotechnical Design Report (GDR), Plans, and Special Provisions for the above referenced project. We have the following comments:

GDR

- All our previous comments dated April 21, 2010, have been incorporated into the GDR.

- Page 4-2 -

  Embankment fills up to 38 ft high are planned for this project. The existing utilities (if any) within the limits of this fill may be affected significantly. This should be discussed in the report.

- Page 7-4 -

  The design values shown on Tables 7-5 (Spread Footing Data table) and 7-8 (Pile Data Table) are different than the ones shown on the plans. Check discrepancy.

PLANS

Petaluma Bridge Foundation Plan No.1 -

The design values shown on Spread Footing Data Table and Pile Data Table are different than the ones shown on page 7-4 of GDR. Check discrepancy.

SD-2 Sheet

The pile depth of 25 ft is indicated for the proposed Sign D. Based on the submitted GDR dated November 22, 2010, the pile depth should be 40 ft because of potential liquefaction. Check discrepancy.

SSP

Based on the submitted GDR (page 4-2), five settlement-monitoring plates are proposed: two at Station "A" 194+50 and three at Stations "RW 293 LOL" 194+30, 195+50, and 196+50. These monitoring plates should be included in either plans, or SSP.

Page 428 –

Difficult pile installation should read "Difficult pile installation is anticipated due to presence of caving soils, serpentine materials, high groundwater, cobbles and boulders, blocks of hard to very hard rock in a soft clayey matrix, sound control and traffic control". This paragraph may also be modified to accommodate Structures requirements, if necessary.

If you have any questions or need additional information, please call me at 286-4831, or Hooshmand Nikoui, Branch Chief at 286-4811.

c: TPokrywka, HNikoui, Daily File, Project File

MZabolzadeh/mm/2640C1 95% Review GDR, Plans, SSP

State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

Flex your power!
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To: MR. PAUL MAI
District Office Chief
Design, Santa Clara - B

Date: April 21, 2010

Attention: W. Nyaz
T. Ly

File: 4-SON-01-PM 2.9/3.4
04- 2640C1
Route 101 Widening

MZ

H. Nikoui

From: MOHAMMAD ZABOLZADEH
Associate Materials and Research Engineer
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

HOOSHMAND NIKOUI
Chief, Branch A
Office of Geotechnical Design - West
Geotechnical Services
Division of Engineering Services

Subject : PS & E Review

We have reviewed the submitted 65% Geotechnical Design Report (GDR), plans, and Special Provisions for the above referenced project. We have the following comments:

GDR

- Page 3-3 refers to Appendix D for copies of the liquefaction calculations for borings R-09-012 through R-09-015. Appendix D does not have these calculations.

- Page 4-2 – Table 4-1 refers to consolidation settlements up to 4.5 inches. Should these settlements be monitored? If so, specify the locations. The consolidation period is estimated to be about 9 months for Route 101/116 SOH, north abutment fill. Provide surcharge program to reduce the time in case settlement time needs to be reduced.

- Page 4-7 – Table 4-7 shows pile depth of 25 ft for the proposed Sign A. Table 4-8 shows pile depth of 23 ft for the same sign. Check discrepancy.

- All boring logs should comply with Caltrans revised updated manual dated June 2007. For example, rock hardness (soft, etc.) is not included in boring R-09-001.

PLANS

Sheet SQ-2

- Overhead sign quantities shows a proposed sign E with pile depth of 25 ft. This sign is not included in the GDR.
- The pile depth for the proposed Sign A is missing.
- The pile depth of 25 ft is indicated for the proposed Sign B. Sign B does not have pile foundation.

R-1 Through R-6

- The beginning and end of the proposed retaining walls should match with layout sheets L-1 through L-8.
- Log of Test Boring (LOTB) Sheets are missing.

SSP

Page 365 Piling – Difficult pile installation should read "Difficult pile installation is anticipated due to presence of caving soils, serpentine materials, high groundwater, cobbles and boulders, the requirements of pile embedment depth into rock, sound control and traffic control". This paragraph may also be modified to accommodate Structures requirements, if necessary.

If you have any questions or need additional information, please call me at 286-4831, or Hooshmand Nikoui, Branch Chief at 286-4811.

c: TPokrywka, HNikoui, Daily File, Project File

MZabolzadeh/mm/2640C1 Review GDR, Plans, SSP

State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

M e m o r a n d u m

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To: MR. HOOSHMAD NIKOUI
Chief, Branch A
Office of Geotechnical Design – West

Date: May 25, 2010

Attention: M. Zabolzadeh

File: 04-SON-101, PM 2.5/4.1
04 – 2640C1
MARIN/ SONOMA NARROWS
(Segment B4)

From: RIFAAT NASHED
Engineering Geologist
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

GRANT WILCOX
Chief, Branch B
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

Subject : Geotechnical Design Report Review and Comments

This memo is in regards to the submitted 65% Geotechnical Design Report – Geology and Subsurface Condition Sections- prepared by URS Consultant for the MARIN/ SONOMA NARROWS Segment B4 Project, dated March 2010. We have the following comments:

1.2.4 Regional Geology

1- The second paragraph " The north abutment of the Petaluma…….the south abutment of the Petaluma River Bridge" should be put in a separate section titled **"Site Geology".**

2.1 FIELD EXPLORATION

1- The statement " URS drilled six hollow stem auger borings (A-09-009, A-09-010, and A-09-101 to A-09-106)" should be re-wrote to reflect the correct number (6 boreholes).

2.2.2 Groundwater

1- This statement should be added and taken into consideration " Groundwater was encountered at depths of 10 feet and 26 feet bgs (Elevation –3 and –10) in Borings A-09-101 and A-09-103, respectively.

2- Groundwater elevation should be denoted in the Boring Report (gInt report) of borehole No. R-09-014.
3- The groundwater elevation range should be mentioned with specifying locations

If you have any questions or need additional information, please call me at (510) 622-1773 or Grant Wilcox at (510) 286-4835.

c: Project File, Daily File, TPokrywka, GWilcox

RNashed/mm

Agency: Caltrans	**Responded by:**	URS
MSN Contract B4 – EA 2640C1	**Date Responded:**	
65% PS&E Comment Responses	**Next JRT Meeting Date:**	

TECHNICAL COMMENT REVIEW AND RESPONSE

CODE: A - Will Comply; B - Caltrans to Evaluate; C - Will Not Incorporate; D – Agency (SCTA/URS) to Evaluate; E - No Action Required

INIT	Item No.	Drawing or Page No.	Review Comments	Designer Responses	Rev. By	Initial Disp.	JRT Disp.	Final Disp.
Geotechnical Design Comments / 04.23.10								
Mohammad Zabolzadeh	1	Page 3-3	**GDR** Page 3-3 refers to Appendix D for copies of the liquefaction calculations for borings R-09-012 through R-09-015. Appendix D does not have these calculations.	Appendix D presents liquefaction calculations for borings and CPTs that exhibit post-liquefaction settlement more than 1 inch. Calculations for borings R-09-12 to R-09-15 indicate liquefaction induced settlement to be less than 1 inch, and were not presented. Will include in next submittal.	SH	A		A
MZ	2	Page 4-2 - Table 4-1	Page 4-2 - Table 4-1 refers to consolidation settlements up to 4.5 inches. Should these settlements be monitored? If so, specify the locations. The consolidation period is estimated to be about 9 months for Route 1011116 SOH, north abutment fill Provide surcharge program to reduce the time in case settlement time needs to be reduced.	Concur that settlement should be monitored during the specified settlement period. Will include approximate locations of settlement devices and add estimates of time rate of settlement for 2 surcharge heights, e.g. 5 feet and 10 feet in next submittal.	SH	A		A
MZ	3	Page 4-7 - Table 4-7	Page 4-7 - Table 4-7 shows pile depth of 25 ft for the proposed Sign A. Table 4-8 shows piIe depth of 23 ft for the same sign. Check discrepancy.	Pile depth for Sign A should be 25 feet. Will revise.	SH	A		A
MZ	4		All boring logs should comply with Caltrans revised updated manual dated June 2007. For example, rock hardness (soft, etc.) is not included in boring R-09-001.	Will comply.	SH	A		A
Geotechnical Design Report Comments / 06.02.2010								
Rifaat Nashed	5	1.2.4 Regional Geology	The second paragraph " The north abutment of the Petaluma……the south abutment of the Petaluma River Bridge" should be put in a separate section titled "Site Geology".	Will comply.	SH	A		A
RN	6	2.1 Field Exploration	The statement " URS drilled six hollow stem auger borings (A-09-009, A-09-010, and A-09-	Will comply.	SH	A		A

Agency: Caltrans	**Responded by:**	URS
MSN Contract B4 – EA 2640C1	**Date Responded:**	
65% PS&E Comment Responses	**Next JRT Meeting Date:**	

TECHNICAL COMMENT REVIEW AND RESPONSE

CODE: A - Will Comply; B - Caltrans to Evaluate; C - Will Not Incorporate; D – Agency (SCTA/URS) to Evaluate; E - No Action Required

INIT	Item No.	Drawing or Page No.	Review Comments	Designer Responses	Rev. By	Initial Disp.	JRT Disp.	Final Disp.
			101 to A-09-106)" should be re-wrote to reflect the correct number (6 boreholes).					
RN	7	2.2.2 Groundwater	This statement should be added and taken into consideration " Groundwater was encountered at depths of 10 feet and 26 feet bgs (Elevation –3 and –10) in Borings A-09-101 and A-09-103, respectively.	Will comply.	SH	A		A
RN	8	2.2.2 Groundwater	Groundwater elevation should be denoted in the Boring Report (gInt report) of borehole No. R-09-014.	Will comply.	SH	A		A
RN	9	2.2.2 Groundwater	The groundwater elevation range should be mentioned with specifying locations	Will comply.	SH	A		A

04-SON-101, PM2.5/4.1
EA#04-2640C4
MAY 20, 2011

FOUNDATION REPORT

U.S. 101N/SR116 SOH (REPLACE) (BRIDGE NO. 20-0284R) PETALUMA, CALIFORNIA

Prepared for
Sonoma County Transportation Authority
490 Mendocino Avenue, Suite 240
Santa Rosa, CA 95401

URS

100 West San Fernando Street, Suite 200
San Jose, California 95113

Project No: 28645045

May 20, 2011 File No.04-SON-101-PM 3.57
Project 28645045 EA 2640C4 CU 04

Mr. Guy Preston
Project Manager
Sonoma County Transportation Authority (SCTA)
490 Mendocino Avenue, Suite 240
Santa Rosa, CA 95401

Subject: **Foundation Report**
U.S. 101N/SR116 SOH (Replace), Bridge No. 20-0284R
U.S. 101 Marin Sonoma Narrows-Contract 4 (MSN B4)
Petaluma, California

Dear Mr. Preston:

URS has completed the accompanying Foundation Report for the U.S. 101N/SR116 SOH (replace) in the City of Petaluma, California. The report was prepared in accordance with Caltrans Guidelines for Foundation Investigation Reports, Version 2.0, updated December 2009.

The Foundation Report presents our engineering opinions and recommendations regarding the geotechnical factors influencing the design and construction of the proposed bridge (replace). The opinions and recommendations have been based upon the results of our field investigation, laboratory testing, engineering judgment and local experience. Mr. Mark Schmoll, C.E.G, prepared the site geology and geologic hazards portion of this report.

If any questions should arise, or if we can be of further service, please contact the undersigned at (408) 297-9585.

Sincerely,

Jose I. Landazuri, G.E. 501
Geotechnical Task Leader

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1.1 GENERAL

The Marin Sonoma Narrows (MSN) HOV Widening project proposes to add high occupancy vehicle (HOV) facilities to U.S. 101 from the junction of SR 37 in the City of Novato to just north of the Corona Road Overcrossing in the City of Petaluma, a distance of approximately 16 miles. The project has been divided into three main segments. Segments A and C consist of the existing freeway in the cities of Novato and Petaluma, respectively. Segment B is the existing expressway between the two cities. The focus of this report is Segment B4, which is a part of Segment B.

The planned improvements in Segment B4 include the following structures:

- U.S. 101/SR116 SOH Left (Widen) – recently constructed (completed in 2007) five span structure will be widened by 24 feet along the eastern edge of the deck
- U.S. 101/SR116 SOH Right (Replace) – existing four span structure (constructed in 1955) will be replaced
- Petaluma River Bridge (Replace) – existing nine span twin-structure (constructed in 1955) will be replaced
- Retaining Wall along NB 101 – the new retaining wall along the eastern edge of NB 101 (RW 152)
- Retaining Wall along NB 101 – the new retaining wall along the eastern edge of NB 101 will connect to the new Petaluma River Bridge (RW168)
- Retaining Wall along SB 101 – the new retaining wall along the western edge of SB 101 will span from the new Petaluma River Bridge to the end of existing retaining wall (RW180)
- Retaining Wall along NB 101 – the new retaining wall along the eastern edge of NB 101 will connect the new Petaluma River Bridge with the new U.S. 101/SR 116 SOH Right structure (RW 179)
- Retaining wall along northbound on-ramp to U.S. 101 from SR 116 (RW 293)
- Sound Wall along NB on-ramp – the new sound wall along northbound on-ramp to U.S. 101N from SR116 (SW297)
- Sound Wall along NB 101 – the new sound wall along the eastern edge of NB 101 (SW 211).

The subject of this foundation report (FR) is the replacement of the U.S. 101N/SR116 SOH (Bridge No. 20-0284R), located in Petaluma, California. Figure 1-1 shows the location of the project site relative to the U.S. 101 MSN-B4 Project alignment. Please note that figure numbers used in the report correspond to the specific sections.

1.2 SCOPE OF INVESTIGATION

The geotechnical services performed for the U.S. 101N/SR116 SOH (Replace) were as follows:

- Reviewed existing plans
- Site geologic reconnaissance
- Geotechnical field investigation including five rotary wash borings R-09-011 through R-09-015
- Laboratory testing to estimate pertinent engineering properties

- Design recommendations and opinions were developed for the following topics:
  - Precast prestressed (PCPS) concrete pile design
  - Resistance to lateral loads
  - Approach fill settlement, if any
  - Abutment grading and approach fill construction
  - Earthquake information consistent with Caltrans Response Spectra Design Techniques
  - Assessment of the potential for earthquake induced liquefaction, settlement, and lateral spreading
  - Corrosion testing and analysis
  - Consideration of construction issues, including:
    - Earthwork for abutments and new bridge approaches
    - Construction dewatering

A review related to environmental and hazardous waste issues and the results of evaluations are presented in a separate report, titled "Site Investigation Report," dated February 10, 2011.

1.3 CALTRANS REVIEW COMMENTS

We reviewed the comments prepared by Caltrans for the 101/116 SOH Replace dated May 27, 2010 and December 2, 2010. The review comments and our responses are presented in Appendix K.

The proposed improvements of Segment B4 of the U.S. 101 Marin Sonoma Narrows (MSN) HOV widening project, in the City of Petaluma, will include adding high occupancy vehicle (HOV) lanes to U.S. 101. As part of the proposed highway widening, the U.S. 101N/SR116 SOH Replacement Bridge will be constructed east of the existing bridge and will carry four lanes of northbound traffic. The width of the new structure will range from 59 to 80.7 feet and the length will be 562 feet. It will be a four-span structure consisting of a cast-in-place reinforced concrete deck on reinforced concrete pier walls to match the new widened bridge (20-0284L). PCPS concrete piles (14-inch x 14-inch, Class 200) are currently proposed to support new bridge foundation elements. Fill height of generally less than 5 feet thick is planned for the southern bridge approach. An approximately 20-foot high abutment fill is planned for the northern bridge approach. Two 20-foot high retaining walls are planned at each abutment spanning across the median between the U.S.101N/SR116 SOH Replacement Bridge and the U.S. 101S/SR 116 Widening. The Abutment 1 median retaining wall is planned to be a Caltrans standard Type I wall. The Abutment 5 median retaining wall will be a non-standard wall supported on prescast, prestressed (PCPS) concrete piles. Typical sections of the planned improvements are presented in Figures 2-1 and 2-2. Figure 2-3 shows the foundation plan.

The bridge begins at 'A2' Line, Station 188+33.25, and ends at 'A2' Line, Station 193+94.75, with the bridge deck positioned at Elevation 52.06 feet and at Elevation 37.53 feet, respectively. Pile caps are planned as follows:

Location		**Bottom of Pile Cap Elevation (ft)**
Abutment 1	Footing 1A Footing 1B Footing 1C	30.5 26.5 22.5
Abutment 1 Median RW	Footing 1D	32.5
Bent 2	Footing 2A Footing 2B Footing 2C	1.0 1.0 -0.5
Bent 3	Footing 3A Footing 3B Footing 3C	2.0 2.7 4.2
Bent 4	Footing 4A Footing 4B Footing 4C Footing 4D	4.2 4.9 5.6 6.4
Abutment 5	Footing 5A	17.2
Abutment 5 RW	Footing 5B Footing 5C	21.9 26.1
Abutment 5 Median RW	Footing 5D	17.9

As noted on Figure 2-3, Bench Mark JK121 and JK122 are located nearby. The horizontal survey control is based on the California Coordinate System, Zone 3, U.S. survey feet, North American Datum of 1983 (NAD83), Epoch 2007.00. Vertical control is the National Geodetic Vertical Datum of 1988 (NGVD88).

3.1 GEOLOGIC SETTING

3.1.1 Regional Geology

The project is located along the western margins of the Petaluma Valley within the central portion of the Coast Ranges geomorphic province of California. Northwest-southeast-trending valleys and ridges characterize the regional morphology of the Coast Ranges province. These topographic features are controlled by folds and faults that resulted from the collision of the Farallon and North American plates and subsequent predominantly strike-slip faulting along the San Andreas fault system between the Pacific and North American plates. Regional geologic mapping shows the project alignment to be underlain by manmade fill, Holocene Bay Mud deposits, Holocene alluvial fan deposits, Tertiary age volcanic rocks, and Jurassic-Cretaceous age Franciscan Complex rocks (Wagner et al, 2000; Armstrong, 1980). The regional geologic map (Figure 3-1) shows the approximate areal extent of these various geologic units.

3.1.2 Regional Tectonic Setting and Seismicity

The project alignment lies between known active and potentially active geologic faults. In general, earthquakes occur as a result of movement along active faults. For the purpose of activity classification, faults are generally grouped into the following categories by the California Division of Mines and Geology (renamed the California Geological Survey, CGS) (Jennings, 1994):

- Holocene: displacement has occurred within the last 10,000 to 11,000 years.
- Late Quaternary: displacement has occurred within the last 700,000 years, but evidence of Holocene activity is lacking.
- Quaternary: evidence of displacement within the last 1.6 million years, but evidence of Holocene activity is lacking.
- Pre-quaternary: no recognized evidence of displacement in the last 1.6 million years.

Generally, faults with Holocene movement are considered to be “active” while faults with late Quaternary to Quaternary movement are considered to be “potentially active”.

The closest active faults to the project alignment are the Rodgers Creek-Healdsburg fault, San Andreas (north) fault, the northern end of the Hayward fault and the Maacama-Garberville fault (referred to as the Maacama-Brush fault on the Caltrans Seismic map by Mualchin, 1996). The nearest potentially active fault is the Late Quaternary Tolay fault located 2.3 miles (3.7 km) northeast of the site. The California Geological Survey (2000) has produced maps showing Alquist-Priolo Earthquake Fault Zones along faults with known Holocene activity that pose a potential surface faulting hazard. With the exception of the Tolay fault, all of these faults are included as Alquist-Priolo (A-P) zoned faults. The Rodgers Creek-Healdsburg fault is located about 4.6 miles (7.4 km) northeast of the site and the San Andreas (north) fault is located about 15.8 miles (25.4 km) southwest of the project alignment. More distant active faults include the north end of Hayward fault located about 18 miles (30 km) southeast of the site, and the Maacama-Garberville fault located about 21.5 miles (34.6 km) northeast of the site. Figure 3-2 shows active faults within the site region relative to the project. The project alignment does not cross any mapped A-P zoned faults.

The site is within an area of high seismic activity. The major active faults extending through the region have the potential of generating damaging earthquakes. There is a potential that the site will be subject to moderate to strong seismic ground shaking one or more times during the life of the project. The nearest significant earthquake epicenter to the site was the 1969 Santa Rosa earthquake series on the Rodgers Creek-Healdsburg fault. Other large magnitude historic earthquakes have occurred on the San Andreas fault and the Hayward fault.

3.1.3 Local Geology

The southern abutment (Abutment 1) of the planned U.S. 101/SR 116 (Replace) structure is composed of man-made fill constructed on the underlying Bay Mud and alluvial fan deposits. Man-made fill also underlies the Northwestern Pacific railroad tracks and SR 116, including the on-ramps and off-ramps to U.S. 101. Holocene Bay Mud deposits underlie the south margins of the Petaluma River below about Elevation 10 feet and extend to just north of SR 116. Holocene alluvial fan deposits underlie portions of the Bay Mud deposits and occur at the ground surface in the area generally north of SR 116. The "bedrock" that underlies the alluvial fan deposits and portions of the Bay Mud is the Jurassic-Cretaceous age Franciscan Complex. This unit is mapped by Wagner, et al. (2000) as schist and phyllite; however, based on a review of the 2009 URS borings, the existing Caltrans Log of Test Borings (LOTBs) and site geologic mapping, this unit appears to be composed mainly of mélange consisting of tectonic mixtures of sheared shale, greenstone, greywacke and serpentinite with scattered blocks of blueschist. A geologic map of the site by Wentworth (1997) shows this area as mélange. The only surface outcrops of the Franciscan Complex rocks occur near the south abutment of the Petaluma River Bridge. The northern abutment (Abutment 5) is underlain by Holocene Bay Mud deposits.

Borings R-09-011 through R-09-015 completed for U.S. 101N/SR116 SOH (Replace) in 2009 and the available LOTBs were reviewed to characterize the subsurface conditions along the project alignment. The soil profile for the U.S. 101N/SR116 bridge consists of fill soils, Bay Mud, alluvial fan deposits (alluvium) and Franciscan Complex bedrock. With the exception of the bridge approach embankment fills, the fill soil ranges from 0 to about 6 feet in thickness and consists of sandy clay with gravel. Bay Mud was encountered in all of the borings completed in 1952, but was absent in two of the three borings completed in 2002 and all borings completed in 2009. It appears the Bay Mud was excavated and mostly removed during preparation for construction of the fill embankments for the existing bridge. The northern limits of Bay Mud, as mapped by Wagner et al. (2000) and Armstrong (1980), only extend to about SR 116. Alluvial fan deposits underlie the Bay Mud and locally occur at the ground surface. These deposits range from medium stiff to hard lean clay to sandy lean clay and fat clay and loose to dense silty to clayey sand, poorly graded sand and well-graded sand with gravel. The alluvial fan deposits are about 35 to 90 feet thick and extend down to about Elevation –45 to -80 feet. The Franciscan Complex bedrock underlies the alluvial fan deposits. The depth to Franciscan Complex bedrock ranged from Elevation -45 feet to -80 feet. The Franciscan Complex was completely to highly weathered in the upper 10 to 25 feet, becoming moderately to slightly weathered below this depth. The depth to moderately to slightly weathered bedrock ranged from about Elevation –50 feet to –80 feet.

3.2 SITE AND SUBSURFACE CONDITIONS

3.2.1 Site Topography

The existing SR 116 Bridge consists of separate northbound and southbound structures. The south abutments of both bridges share the same man-made approach fill that the north side of the Petaluma Bridge lands on, with the surface at about Elevation 50 feet. The north approach embankment is also a man-made fill extending to about Elevation 30 feet at road grade. These bridges cross over two sets of Northwestern Pacific railroad tracks at about Elevation 10 feet and the Lakeville Highway (SR 116) at about Elevation 14 feet.

Development along the project alignment is mixed, including an abandoned quarry west of U.S. 101 and south of Petaluma Boulevard, a park and marina (Hollen Berger Park) located east of U.S. 101 between the Petaluma River and SR 116, and scattered commercial and industrial development both east and west of U.S. 101 and north of SR 116. Open space and farmland occupy the area west of U.S. 101 between the Petaluma River and SR 116.

3.2.2 Field Exploration

The following subsurface explorations were previously performed for the existing bridge and near structure.

- Borings B-1 through B-9 completed for the U.S. 101/116 northbound and southbound bridges (Bridge No. 20-284L and 20-155R), dated 1952, completed by Caltrans; and
- Borings 02-B-1 through 02-B-3 completed for the U.S. 101/116 northbound and southbound bridges (Bridge No. 20-284L and 20-155R), dated 2002, completed by Parikh Consultants, Inc. for Caltrans.
- Boring BH-1 and cone penetration test CPT-1 completed for the Mechanically Stabilized Embankment at the south embankment of U.S. 101/116 southbound bridge, dated 2002, completed by Caltrans.

The above explorations included both penetration borings without sampling and rotary wash borings with split spoon drive samples. Boring 02-B-2 also included Pitcher barrel sampling and wireline coring in the Franciscan Complex bedrock. Boring locations for U.S. 101/SR116 bridges are shown on Figure 3-3 and 3-4. Copies of the LOTBs are included in Appendix A.

To supplement available data, URS performed five rotary wash Borings, R-09-011 through R-09-015, to terminal depths ranging from 85 to 119½ feet. HQ wireline diamond coring of the Franciscan Complex bedrock was used in Boring R-9-012 below a depth of 60 feet. However, due to the limited rock recovery with this drilling method and the sheared and highly weathered nature of the shale and serpentinite rock, rotary wash drilling with SPT and MC drive samples was used on the remaining borings that penetrated the Franciscan Complex rocks, to obtain meaningful information for the foundation design.

The field explorations were performed on June 10 to 25, 2009. The locations of the borings are shown on the Site and Boring Location Plan, Figure 3-3 and 3-4, as well as on the LOTBs, Appendix A. The LOTBs present descriptions of the soils encountered along with the results of laboratory tests.

A representative of URS supervised the drilling operations and soil and rock sampling. Visual classifications of the materials encountered were made from cuttings and samples. The soil samples collected from the boring were labeled and sealed immediately to preserve their natural moisture content. The recovered rock core samples were placed in wooded core boxes. At completion of the exploration, samples were delivered to the laboratory for further examination and testing. The borings were backfilled with mixture of cement and bentonite in accordance with the requirements of the Sonoma County Health Department. A detailed discussion of the field exploration program is presented in Appendix B.

The Unified Soil Classification System and the guidelines summarizing soil consistency and relative density are presented on the LOTB legend, Appendix A – LOTB 1 of 7 and 2 of 7. Descriptions of the soils encountered in the borings are presented on LOTB 3 of 7 and 4 of 7. The logging method used in preparing the LOTB is consistent with Caltrans Soil and Rock Logging, Classification and Presentation Manual, dated June 2007. These logs also illustrate the notation used for the size of samplers and the methods of advancing them.

3.2.3 Laboratory Testing

The water content, dry density, Plasticity Index (PI), grain size distribution (PA), consolidation, and Unconfined Compressive Strength (UC) were determined for selected samples to estimate the strength and compressibility of the underlying soils. The locations of these tests, together with the resistance to penetration of the samplers, are shown at the corresponding locations on the LOTBs. The laboratory test results are provided in tabular form and/or graphically in Appendix B.

3.2.4 Soil Conditions

3.2.4.1 Fill

Borings R-09-011 and R-09-015 were located at the top of the existing embankment near the south and north bridge abutments, respectively. Fill soil was encountered to depths of 54 feet (Elevation -3.0) and 23 feet (Elevation +11.0) in Borings R-09-011 and R-09-015, respectively. The fill consists primarily of granular soils (silty sand, silty sand with gravel, clayey sand with gravel, clayey sand, silty gravel, poorly graded gravel and clayey gravel) with cohesive interbeds (lean clay, sandy lean clay, and gravelly lean clay). The granular soils are medium dense to dense in relative density, whereas the cohesive layers are judged to be medium stiff to stiff in consistency. The fill from about Elevation +5 to -3 feet appears to have been placed after removal of the “soft, gray silty clay” revealed in nearby Boring B-1 (1952).

Borings R-09-012 and -013 were drilled on the south and north sides of the railroad tracks, respectively, between the bridge approach fill embankments. These two borings encountered 2½ feet and 5 feet of sandy to clayey gravel, respectively overlying the alluvium. Boring R-09-014 was drilled in the Route 116 pavement median. An 8-inch asphalt concrete pavement was encountered overlying 6 inches of aggregate base underlain by silty sand with gravel fill extending to a depth of 11 feet. The bottom of the fill layer (Elevation +3 feet) appears to be consistent with the fill thickness revealed in nearby Boring B-4 (1952).

3.2.4.2 Native

Occurring below the fill in borings R-09-011 through R-09-015 are native alluvial fan deposits (alluvium) consisting of complexly interbedded layers of cohesive and granular soils. The cohesive deposits (lean clay, fat clay and sandy lean clay) are generally medium stiff to very stiff; at a few locations (Borings R-09-012 at 45 feet and R-09-015 at 76 and 85 feet) the dry density is relatively low (75 to 78 pcf) and the moisture content is high (41 to 46 percent). Fat clay was encountered in all borings except in R-09-011. Fat clay layers 22 and 33 feet thick were encountered below Elevation +5 feet and -41 feet in Borings R-09-012 and R-09-014, respectively. The granular interbeds include medium dense to very dense silty sand, silty sand with gravel, clayey sand, poorly graded sand, clayey sand with gravel, clayey gravel, silty gravel with sand and silty gravel. However, the silty sand layer is loose in Boring R-09-013, at a depth of 26 feet. Boring R-09-015 terminated in sandy lean clay alluvium at a depth of 108.5 feet. The granular layer between Elevation -10 to -25 feet is consistent with the "fine to medium silty and clayey sand" recorded in Borings B-1, B-2 and B-4 (1952).

Four of the five borings terminated in bedrock, as summarized in the following table.

Boring	Depth to Top of Bedrock (feet)	Elevation of Top of Bedrock (feet)	Length of Sampled Bedrock (feet)
R-09-011	98.5	-47.5	21.0
R-09-012	55.0	-44.0	30.0
R-09-013	59.0	-49.0	27.5
R-09-014	91.5	-77.5	5.0

The condition revealed in Boring B-4 (1952), which terminated at approximately Elevation -60 feet without reaching bedrock, is consistent with the bedrock interpolation between R-09-13 and R-09-14. Franciscan Complex bedrock was encountered and was completely to highly weathered in the upper 10 to 25 feet, becoming moderately to slightly weathered below this depth. The Franciscan Complex consists of mélange, a tectonic mixture of highly sheared metamorphic rock consisting of black shale and serpentinite with greenstone, greywacke, talc and scattered blocks of blueschist. Where encountered, the depth to moderately to slightly weathered bedrock ranged from about Elevation -50 feet to -80 feet. A generalized soil profile is presented in Figure 3-5, based on the conditions encountered in Borings R-09-011 through R-09-015.

3.2.5 Groundwater

All of the previous borings were completed using rotary wash drilling or wireline coring methods. Groundwater levels were measured in a few of the borings from Elevation +1.7 to +5.2 feet. These water levels were measured in June 1952 and September 2002. (1952 Elevations have been converted as follows:

Elevation 0 NGVD29 = Elevation + 2.28 NAVD88).

All of the 2009 borings were started with hollow-stem auger and then completed using either the rotary wash drilling or wireline coring methods. Borings R-09-011, R-09-012, R-09-013 and R-09-015 were dry to depths of 19 feet (Elevation +32), 21 feet (Elevation -10), 19 feet

(Elevation -9) and 22 feet (Elevation +12), respectively. Groundwater was encountered in Boring R-09-014 at a depth of 18 feet (Elevation -4).

Considering the previous measurements, we believe a design groundwater level at Elevation 5 feet would be reasonable for the site.

3.3 GEOLOGIC HAZARDS

3.3.1 Surface Fault Displacement and Ground Shaking

The project alignment does not cross any Alquist-Priolo Earthquake Fault Zones (Hart, 1975). Therefore, surface rupture due to faulting along the alignment is not expected to occur. However, the short distance to nearby active faults including the Rodgers Creek-Healdsburg fault, San Andreas (north) fault, and the northern end of the Hayward fault does create a high risk for ground shaking from fault movement. The intensity of the ground shaking is dependent upon the size of the earthquake, the distance of the epicenter from the site, the direction that the earthquake propagates along the fault, and the site geologic conditions.

3.3.2 Landslide and Slope Failure

With the exception of the man-made bridge approach embankment fills, the project alignment is on relatively flat ground and is not subject to landsliding. Regional geologic maps by Wagner et al (2000) and Wentworth (1997), as well as the landslide hazard area maps in the Sonoma County Hazard Mitigation Plan (2006), do not show any mapped landslides on the hills at or near the project. Furthermore, no evidence of landslide scarps or slumping of the man-made fill embankments was observed during site reconnaissance.

3.3.3 Scour

No creeks or active channels cross the alignment at the proposed U.S. 101/116 SOH (Replace). Therefore, scour is not a potential hazard at the site

3.3.4 Flooding

The Petaluma River channel is within a floodplain. Federal Emergency Management Agency (FEMA) defines the area as Zone AE. Zone AE is defined as an area with a 1% annual chance of flooding. With the exception of the active channel of the Petaluma River and the low lying area south of SR 116 below about Elevation +9 feet, the project alignment is located outside of Zone AE.

3.3.5 Subsidence and Seismic Compaction

Subsidence typically occurs as a result of subsurface fluid extraction (e.g. groundwater or petroleum) or compression of soft, geologically young sediments. Groundwater extraction for high volume municipal and agricultural use has the potential to cause future ground subsidence in the region. However, we are unaware of subsidence in the area. No active petroleum wells are present within many miles of the site (California Division of Oil, Gas, and Geothermal Resources, 2001).

Elastic and consolidation settlement can occur when soil is loaded by a structure or by the placement of fill on top of the soil. Typically consolidation settlement occurs gradually when

soil pore pressures, increased by vertical loading, dissipate over time. Bay Mud is very susceptible to consolidation settlement.

Compaction settlement, or seismic densification, occurs when loose granular soils above the water table densify as a result of earthquake shaking. The soil densification can result in differential settlement because of variations in soil composition, thickness, and initial density. As previously mentioned, localized layers of medium dense granular soils were encountered in a few of the borings. At the location of Boring R-09-012, the soils above the groundwater table were found to consist of primarily sandy lean to fat clay. Therefore, post-earthquake settlement due to seismic compaction settlement is not expected. We estimated the potential post-earthquake settlement at Borings R-09-011 and R-09-013 through R-09-015 using the computer program LIQUEFY PRO. In our analyses we used a peak ground acceleration (PGA) of 0.6g and a design earthquake moment magnitude (**M**) of 7.0. The design PGA and earthquake moment magnitude are discussed in Section 5.2. Based on the results of these analyses, the magnitude of seismic compaction settlement at Borings R-09-013 through R-09-015 probably will range from negligible to ¼ inch. Seismic compaction on the order of ½ inch is estimated for the soils encountered in Boring R-09-011. Copies of these calculations are included in Appendix C.

3.3.6 Liquefaction Potential

Liquefaction is a phenomenon whereby sediments temporarily lose shear strength and collapse. This condition is caused by cyclic loading during earthquake shaking that generates high pore water pressures within the sediments. The soil type most susceptible to liquefaction is loose, cohesionless, granular soil below the water table and within about 50 feet of the ground surface. Liquefaction can result in loss of foundation support and settlement of overlying structures, ground subsidence and translation due to lateral spreading, lurch cracking, and differential settlement of affected deposits. Lateral spreading occurs when a layer liquefies at depth and causes horizontal movement or displacement of the overburden mass toward a free face such as a stream bank or excavation, or toward an open body of water.

In a regional study of the nine-county San Francisco Bay region for the U.S. Geological Survey, Witter et al. (2006) mapped the liquefaction susceptibility of the site soils along the project alignment. The alluvial fan and Bay Mud deposits found from the south bank of the Petaluma River and extending north past SR 116 have been mapped as having a “moderate” liquefaction susceptibility (see Figure 3-6). The thin fill embankments that underlie the railroad tracks are shown as having a "very high" liquefaction susceptibility. The Sonoma County Hazard Mitigation Plan (2006) maps these deposits as having a “high” liquefaction hazard. The Franciscan Complex bedrock mapped south of the river is not subject to liquefaction.

Potentially liquefiable sand layers were encountered in few of the borings completed for this study. Post-liquefaction settlement of the medium dense sand layers encountered in Borings R-09-012 through R-09-015 were analyzed for a peak ground acceleration (PGA) of 0.6g and design earthquake moment magnitude, **M** 7.0. The measured driving resistance (blow counts) recorded in the field were adjusted to account for hammer type, sampler size, overburden pressure, rod length, and fines content. The magnitude of settlement at these boring locations is estimated to range from 0.1 inch to 0.9 inch. Copies of these calculations are included in Appendix C.

3.3.7 Naturally Occurring Asbestos

Asbestos is a term used for several types of naturally-occurring fibrous minerals generally found in ultramafic rocks. The most common type of asbestos is chrysotile. Serpentinite often contains chrysotile asbestos. Serpentinite is a common rock type occurring in the Fransican Complex and was found in several of the borings completed by Caltrans in 1952 and in the 2009 URS borings. Serpentinite is typically grayish-green to bluish-black in color and may have a shiny appearance. The amount of asbestos that is typically present in these rocks ranges from less than 1% up to about 25%, and sometimes more. Asbestos is released from Serpentinite rock when it is broken or crushed. This can happen when land is graded for building purposes or at quarrying operations. It is also released naturally through weathering and erosion. Once released from the rock, asbestos can become airborne and may stay in the air for long periods of time. The potential for asbestos to be encountered during construction is low since driven piles will be used for support of the new bridges and excavations into the Franciscan complex rocks will not be made.

3.4 GEOLOGICAL PROFILES AND ENGINEERING PARAMETERS

Figure 3-5 presents a generalized soil profile for the project site; it illustrates the layering of the various soil strata encountered in the explorations and the approximate depth to Franciscan complex bedrock. A table summarizing geotechnical parameters for each of the 5 soil layers also is presented. The soil parameters tabulated on Figure 3-5 were selected based on laboratory test results as well as engineering judgment and local experience.

The undrained shear strength, relative density, dry unit weight and moisture content are the primary geotechnical parameters used in our foundation design and analysis. Atterberg limits tests and particle analyses were performed for classification of soils. In general, unconfined compression tests were performed on cohesive soil samples to estimate the undrained shear strength. Some disturbance occurs while sampling cohesive soils; therefore unconfined compressive strengths can be somewhat lower than the insitu field conditions. Consequently, engineering judgment and local experience were applied in our interpretation of the laboratory test results. The relative density of cohesionless soils was estimated from vertical effective stress and Standard Penetration Resistance, N blows per 1 foot based on correlations developed by Gibbs and Holtz (DM7.1 – 87, 1986). Where non-standard sampler sizes were used, such as the modified California sampler (2½ inch outside diameter), a correction factor was applied to the recorded blows per foot to approximate the equivalent Standard Penetration Resistance.

4.1 CORROSION EVALUATION

An assessment of the potential for corrosion of various buried foundation and pipe structures was performed by V&A Consulting Engineers (V&A). The results of their investigation are presented in Appendix D, and summarized below.

4.2 SUMMARY

V&A was retained by URS Corporation to perform a corrosion survey along U.S. 101, in and near Petaluma, California from 0.4 mile south of Petaluma Boulevard South over crossing to 0.2 mile north of Caulfield Lane overcrossing. The objective was to measure various soil parameters and evaluate the results with respect to possible levels of corrosion at the proposed bridge site. Corrosivity was evaluated for materials within a depth range of 0 to 100 feet below grade.

The California Department of Transportation, Division of Engineering Services, Materials Engineering and Testing Services, Corrosion Technology Branch has published "Corrosion Guidelines" (Guidelines) to define what constitutes corrosive soil. The Guidelines consider soil to be corrosive to structural elements (steel reinforced concrete) if one or more of the following conditions exist for water or soil samples:

1. The chloride concentration is 500 ppm (mg/kg) or greater,
2. The sulfate concentration is 2,000 mg/kg or greater, or
3. The pH is 5.5 or less.

Also, a minimum resistivity value of less than 1,000 ohm-cm indicates the presence of high quantities of soluble salts and a higher propensity for corrosion. A wide variety of soluble salts are typically found in soils. Two soils having the same resistivity may have significantly different corrosion characteristics, depending on the specific ions available. The major constituents that accelerate corrosion are chlorides, sulfates and the acidity (pH) of the soil. Chloride ions tend to break down otherwise protective surface deposits, and can result in corrosion of reinforcing steel in concrete structures. Sulfates in soil can be highly aggressive to Portland cement concrete by combining chemically with certain constituents of the concrete, principally tricalcium aluminate. The reaction is accompanied by expansion and eventual disruption of the concrete matrix. High concentrations of bicarbonates tend to decrease soil resistivities. Although bicarbonates are not aggressive to concrete, lower resistivity environments can promote corrosion activity.

Acidity, as indicated by the pH value, is another measure of corrosivity. The lower the pH (the more acidic the environment), the higher will be the corrosivity with respect to buried metallic and concrete structures. As pH increases above 7 (the neutral value), conditions become increasingly more alkaline and passive to buried structures.

Evaluation of the in-situ soil environment was made in terms of potential damage to structures due to corrosion. Soil resistivity measurements were conducted in the field during the initial stages of the work. In addition, soil samples collected by URS during the geotechnical investigation were forwarded to Cooper Testing Laboratory in Palo Alto, California, for chemical analysis. The soil samples were analyzed for minimum resistivity, pH, water soluble chloride ion concentration, and water soluble sulfate ion concentration in accordance with the Guidelines.

Soil samples were selected from the Borings R-09-010, R-09-012, and R-09-015 in the general vicinity of Northbound 101 / SR 116. The results are summarized in the following table.

Table 4-1: Soil Corrosion Test Results Summary

Sample ID	Minimum Resistivity (ohm-cm)	pH	Chloride Content (mg/kg)	Sulfate Content (mg/kg)
R-09-010	1,762	7.6	12	<5
R-09-012	268	8.0	2,225	187
R-09-015	388	6.8	38	2,325

4.3 CONCLUSIONS

Minimum soil resistivity less than 1,000 ohm-cm measured in samples from Borings R-09-012 and R-09-015 suggests that soils are corrosive, whereas the pH, measured for all 3 samples, ranges from a minimum of 6.8 to a maximum value of 8.0; this suggests a relatively neutral to alkaline environment. The project site is not located within 1,000 feet of salt or brackish water, indicating the proposed structure will not be exposed to marine atmosphere. However, the soluble chloride concentrations exceed 500 mg/kg and the soluble sulfate concentrations exceed 2,000 mg/kg, indicating that the soils are corrosive. Therefore, according to the Guidelines, the soils at the project site are considered corrosive.

5.1 SEISMIC DESIGN METHODOLOGY AND RESOURCES

The seismic design methodology adopted for this project is based on the following current Caltrans standards:

1. Development of the 2007 Caltrans Deterministic PGA Map and Caltrans ARS Online, July 2009
2. Seismic Design Criteria (SDC), v 1.5, August 2009
3. Guidelines for Foundation Investigations and Reports, v 2.0, dated March 2006

5.2 PEAK BEDROCK ACCELERATION

The closest active faults to the project alignment are the Rodgers Creek-Healdsburg fault, San Andreas (north) fault, the northern end of the Hayward fault and the Maacama-Garberville fault (referred to as the Maacama-Brush fault on the Caltrans Seismic map by Mualchin, 1996). The nearest potentially active fault is the Late Quaternary Tolay fault located 2.3 miles (3.7 km) northeast of the site. The California Geological Survey (2000) has produced maps showing Alquist-Priolo Earthquake Fault Zones along faults with known Holocene activity that pose a potential surface faulting hazard. With the exception of the Tolay fault, all of these faults are included as Alquist-Priolo (A-P) zoned faults. The Rodgers Creek-Healdsburg fault is located about 4.6 miles (7.4 km) northeast of the site with a corresponding PGA [V_s=2,500 feet per second (fps)] contour of 0.6g based on the 2007 Caltrans Deterministic PGA map. San Andreas (north) fault is located about 15.8 miles (25.4 km) southwest of the project alignment. More distant active faults include the north end of Hayward fault located about 18.6 miles (30.0 km) southeast of the site, and the Maacama-Garberville fault located about 21.5 miles (34.6 km) northeast of the site. Figure 3-2 shows active faults within the site region relative to the project. The project alignment does not cross any mapped A-P zoned faults.

Table 5-1: Seismic Source Parameters

Fault	Type	M_{Max}	Distance (miles)	Near Field Effects?
Rodgers Creek-Healdsburg	strike-slip	7.1	4.6	Yes
San Andreas (north)	strike-slip	7.9	15.8	No
Hayward	strike-slip	7.3	18.6	No

Note: The distances are based on Caltrans ARS Online (2009)

5.3 FAULT TYPE, NEAR-FIELD, AND SPECTRAL ACCELERATION INCREASES

The technical report that accompanies the 2007 Caltrans Deterministic PGA Map (Merriam and Shantz, 2007) indicates that the controlling active fault (Rodgers Creek-Healdsburg) has strike-slip displacement. Therefore, in accordance with Caltrans design procedures referenced above, no increase in design spectral accelerations is required for fault type. However, since the project

site is located less than 9.3 miles (15.0 km) from the nearest active fault, the design spectral accelerations should be modified to account for near-field effects as follows:

Table 5-2: Spectral Acceleration Increase for Near-Field Effects

Period (sec)	Increase in Spectral Acceleration (%)
< 0.5	0
0.5 – 1.0	0 – 20 (determined by linear interpolation)
≥1	20

At the time of this study, no bridge structures with a fundamental period of vibration greater than 1.5 seconds were anticipated; therefore no adjustments are required for long period effects.

5.4 SOIL PROFILE TYPE

The logs of 2009 Borings R-09-011 through R-09-015 reveal that the soils at the site consist of fine and coarse-grained alluvium that becomes denser and stiffer with depth, terminating mostly in bedrock; the weighted average of the recorded standard penetration test (SPT) blow counts in soil in these five borings was used to determine the average SPT resistance value (N) of 29, 15, 15, 26 and 24, respectively. In addition, the undrained shear strength of clay deposits in these borings ranges from about 650 to 3,700 pounds per square foot (psf). These two parameters are indicative of soil profile Type D based on the guidelines given in SDC Figure B.12. Furthermore, the shear wave velocity (V_s) is estimated to be about 1,000 fps or 305 meters per second (mps), which falls within the soil profile Type D V_s range of 600 to 1,200 fps. Therefore, Soil Profile Type D should be used for design.

5.5 DESIGN ACCELERATION RESPONSE SPECTRA

The design response spectrum for the site is estimated with spectral acceleration values generated using Caltrans ARS Online (2009). This method was developed by Caltrans Geo Research Group in partnership with United States Geological Survey (USGS), Pacific Earthquake Engineering Research (PEER) and California Department of Conservation. This web-based tool calculates both deterministic and probabilistic acceleration response spectra for any location in California based on criteria provided in Appendix B of Caltrans SDC.

The deterministic spectrum is determined as the average of median response spectra calculated using the Campbell-Bozorgnia (2008) and Chiou-Youngs (2008) ground motion prediction equations developed under the "Next Generation Attenuation" project coordinated through the PEER-Lifelines program. These equations are applied to all faults considered to be active in the last 750,000 years (late-Quaternary age) that are capable of producing a moment magnitude earthquake of 6.0 or greater. The probabilistic spectrum is obtained from the USGS (2008) National Hazard Map for 5% probability of exceedance in 50 years. Caltrans design spectrum is based on the larger of the deterministic and probabilistic spectral values. Both the deterministic and probabilistic spectra account for soil effects through incorporation of the parameter Vs30, the average shear wave velocity in the upper 30 meters (100 feet) of the soil profile.

The input values selected for use in Caltrans ARS Online included:

- Vs30 of 1,000 fps (305 mps)
- Maximum Moment (M_{Max}) Magnitude 7.1 (Rodgers Creek-Healdsburg fault)

- No ARS increase for fault-type or long period structure
- ARS increase for near-field effects

The calculated spectra for both deterministic and probabilistic methods are presented graphically in Figure 5-1. Since the maximum spectral acceleration curve is the USGS 5% in 50 years hazard, this curve is presented in Figure 5-2 as a design curve. Spectral values (from Figure 5-2) are provided below in Table 5-3.

Table 5-3: Spectral Acceleration Values
(V_s= 305 mps, Lat. = 38.23298053, Long. = -122.61780739)

Period (seconds)	Sa (g)	Sa* (g)
0.010	0.611	0.611
0.020	0.711	0.711
0.030	0.777	0.777
0.050	0.870	0.870
0.075	0.951	0.951
0.100	1.013	1.013
0.120	1.066	1.066
0.150	1.136	1.136
0.170	1.177	1.177
0.200	1.232	1.232
0.240	1.263	1.263
0.300	1.303	1.303
0.400	1.273	1.273
0.500	1.249	1.249
0.750	1.077	1.184
1.000	0.883	1.060
1.500	0.636	0.764
2.000	0.504	0.605
3.000	0.328	0.394
4.000	0.236	0.283
5.000	0.190	0.228

*Modified with near-fault factors outlined in Section 5.3.

Three sets of previous as-built plans from Caltrans were reviewed including:

1. Bridge No. 20-0155L (Contract Number unknown) date unknown; apparently constructed in about 1952 at location of proposed widening. Only LOTB sheet was provided.
2. Bridge No. 20-0155R/L (Contract No: 04-147204) dated October 24, 1996 was Earthquake Retrofit Project No. 693. The pile caps of Piers 4, 5 and 7 of both bridges were increased in width and length and supported on Class 70 Modified (70-ton service load) concrete piles.
3. Bridge No. 20-0284L (Contract Number unknown) dated March 3, 2003. Original 1952 bridge was replaced with a new bridge, U.S. 101/116 SOH Left (Replace).

The 1952 LOTB indicates the original bridge is supported on a total of 455 Raymond step-taper piles (32-ton design capacity) at the abutments and bents. The pile diameter increases from 10 inches at the tip to a maximum of 15½ inches at the butt. At Bents 7R and 8R, steel H piles (10 BP 42) were driven to reach specified tip. Average pile tips range from about Elevation -38 to -57 feet.

The 1996 earthquake retrofit project at this bridge (20-0155R/L) is supported on driven concrete piles at Piers 4, 5 and 7. Available data for modified bents are summarized in the following table. Copies of pertinent as-built plans are included in Appendix E.

Table 6.1: Pile Data Table for 1996 Earthquake Retrofit at U.S.101/116 SOH

Location		Pile Type	Specified Pile Tip Elevation (feet)
Bridge No.	Abutment/Pier No.		
20-0155 R/L	Piers 4, 5 and 7	Class 70C Modified Concrete Pile	-42.0

The 2003 replacement bridge (20-0284L) is supported on driven precast prestressed concrete (PCPS) piles at 2 abutments, 4 bents and 2 retaining walls. Except for Abutment 1, which is supported on Class 900C (100-ton) piles, the remainder of the bridge is supported on Class 625C (70-ton) piles. Retaining walls at abutments were supported on Class 400C (45-ton) piles. Design pile data for the abutments and bents are summarized in the following Table 6-2. Copies of pertinent as-built plans are included in Appendix E.

Table 6-2: Pile Data Table for U.S. 101/SR116 SOH Left

Location		Pile Type	Specified Pile Tip Elevation (feet)
Bridge No.	Abutment/Pier No.		
20-0284L	Abutment. 1	PCPS	-41.0
20-0284L	Bent 2	PCPS	-40.0
20-0284L	Bent 3	PCPS	-44.9
20-0284L	Bent 4	PCPS	-55.8
20-0284L	Bent 5	PCPS	-47.9
20-0284L	Abutment 6	PCPS	-52.5
20-0284L	Abutment. 1 Retaining Wall	PCPS	-39.4
20-0284L	Abutment. 6 Retaining Wall	PCPS	-39.4

It should be noted that as-built pile tip elevations were not available.

7.1 DISCUSSION

The proposed bridge is underlain predominantly by medium to very stiff lean and fat clay, loose to very dense sand and slightly to highly weathered bedrock (Franciscan Complex). The principal geotechnical issues at the site are:

- Selection of the type and depth of foundation that will be compatible with the underlying soils, and
- Construction issues associated with the proximity of proposed new piles to existing piles.

In addition, soils at the project site are considered corrosive. We understand that the project Structural Engineer has elected to use driven PCPS concrete piles with minimum dimension of 14 inches (Class 200, T=14 inch, Alternative "X") to support the proposed structure.

The following sections present the geotechnical design parameters for PCPS piles that are consistent with the Load and Resistant Factor Design (LRFD) design procedure adopted by Caltrans.

7.2 PILE DESIGN CAPACITY AND TIP ELEVATION

7.2.1 Axial Pile Capacity

Based on of the subsurface conditions encountered in the current borings and 1952 and 2003 as-built borings, it is recommended that the proposed structure be supported on driven PCPS concrete piles with a minimum dimension of 14 inches. Current Caltrans practice is to design abutments in accordance with Working Stress Design (WSD) methodology and bents/piers in accordance with LRFD. Table 7-1 on the following page presents a summary of the foundation design data for the proposed U.S. 101N/SR116 SOH (Replace).

Table 7-1: Foundation Design Data for U.S. 101N/SR116 SOH (Replace)

Location		Design Method	Pile Type	Finished Grade Elevation (ft)	Cut-off Elevation (ft)	Pile Cap Size (ft)		Permissible Settlement under Service Load (in)	No. of Piles per Support
Abutment 1	Footing 1A	WSD	Class 200	40	30.75	21*	10.5*	1	9
	Footing 1B			39	26.75	24	10.5*	1	9
	Footing 1C			varies: 30-38	22.75	49.1*	10.5*	1	27
Bent 2	Footing 2A	LRFD	Class 200	10	1.25	13	13	1	12
	Footing 2B			10	1.25	13	13	1	12
	Footing 2C			10	-0.25	13	13	1	12
Bent 3	Footing 3A	LRFD	Class 200	12	2.25	13	13	1	12
	Footing 3B			12	2.95	13	13	1	12
	Footing 3C			12	4.45	13	13	1	12
Bent 4	Footing 4A	LRFD	Class 200	13	4.45	13	13	1	12
	Footing 4B			13	5.15	13	13	1	12
	Footing 4C			13	5.85	13	13	1	12
	Footing 4D			13	6.65	13	13	1	12
Abutment 5	Footing 5	WSD	Class 200	varies:22-30	17.45	86.7*	10.5*	1	28
Abutment 5	Footing 5RW-1	WSD	Class 140	varies:30-37	22.15	24.0	9.0	1	5
	Footing 5RW-2			varies:37-40	26.35	15.21	7.25	1	4

*Pile Cap is not rectangular. Size shown is approximate based on actual dimensions.

Loads from LRFD service-1 Limit State are used as design loads for WSD of abutments. Table 7-2 presents the design loads.

Table 7-2: Foundation Design Loads for U.S. 101N/SR116 SOH (Replace)

Location	Service Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Limit State (Controlling Group, kips)			
	Total Load		Per-manent Loads	Compression		Tension		Compression		Tension	
	Per Support	Max per Pile	Per Support	Per Support	Max per Pile	Per Support	Max per Pile	Per Support	Max per Pile	Per Support	Max per Pile
Abutment 1	3942	191	3255	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bent 2	2534	N/A	2000	3287	253	0	0	3225	248	0	0
Bent 3	2183	N/A	1655	2999	250	0	0	2362	197	0	0
Bent 4	2029	N/A	1509	2786	232	0	0	2307	192	0	0
Abutment 5	3979	168	3289	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

The specified tip elevations presented in the following pile data table (Table 7-3) are based on friction resistance developed in subgrade soils and end-bearing resistance developed in the bedrock stratum that underlie the site.

Table 7-3: Pile Data Table for U.S. 101N/SR116 SOH (Replace)

Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevation (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance (kips)
		Compression	Tension			
Abutment 1	Class 200 Alt "X"	390	0	-47 (a) +2.5 (b)	-47	390
Bent 2	Class 200 Alt "X"	370	0	-47 (a) -16 (b)	-47	370
Bent 3	Class 200 Alt "X"	360	0	-56 (a) -17 (b)	-56	360
Bent 4	Class 200 Alt "X"	340	0	-68 (a) -11 (b)	-68	340
Abutment 5	Class 200 Alt "X"	340	0	-64(a) -5 (b)	-64	340
Abutment 5 RW	Class 140 Alt "X"	280	0	-62 (a) +2(b)	-62	280
Abutment 5 Median RW	Class 140 Alt "X"	280	0	-61 (a) -5 (b)	-61	280

Design tip elevation is controlled by the following demands: (a) compression, (b) lateral

The results of our axial pile capacity analysis, which forms the basis for the design and specified tip elevations provided above, are presented in Appendix F.

No group reduction factor needs to be applied to single pile compression load capacities presented above, provided a center-to-center spacing of at least three pile diameters is used.

7.2.2 Lateral Load Capacity

Driven pile foundations are capable of resisting lateral loads, by bending of the pile and by pile-soil interaction. The magnitude of the lateral load resistance that can develop depends upon several factors such as the pile size, the physical properties of the surrounding soils, the structural design of the pile, and the direction of loading. We used LPILE 4.0 (Reese et al., October 2000) to assist in estimating the lateral load resistance of 14-inch PCPS concrete piles. Output files for analysis of piles at the abutments and bents are presented in Appendix G. Charts showing estimated load versus deflection for free and fixed head conditions at top of pile are included as Figures G-1 through G-10 in Appendix G.

California Amendment to ASHTO LRFD Bridge Design Specifications, Section 10.7.2.4, recommends that a P-multiplier (P_m) be applied to the lateral capacity of individual piles to account for pile group efficiency. Table 7-4 presents Caltrans recommended P_m for the corresponding rows of piles within a group.

Table 7-4: Pile P-Multiplier, P_m for Multiple Row Shading

Pile Center-to-Center Spacing (in the direction of loading)	Group Efficiency Factor (P-Multiplier, P_m)		
	Row 1	Row 2	Row 3 and higher
2 x Pile Width/Diameter (B)	0.60	0.35	0.25
3 B	0.75	0.55	0.4
5 B	1.0	0.85	0.7
7 B	1.0	1.0	0.9

Note: Row 1 refers to the leading row of piles in the direction of loading.

If additional lateral capacity is needed beyond the lateral load capacity of the piles, passive resistance against the abutment walls or pile cap can be utilized. For abutments, Caltrans limits the soil resistance at the back of the wall to a 5.5 feet wall height and a maximum uniform soil pressure of 5,000 psf. For wall heights less than 5.5 feet, the average unit pressure should be reduced linearly in proportion to the height. The uniform soil pressure of 5,000 psf is an ultimate value, and should be used with appropriate load resistance factor for the service limit-state consistent with the LRFD approach. For bents, passive resistance against the embedded pile cap can be utilized. The mobilization of passive resistance depends on the amount of pile cap deflection/rotation. The ultimate passive resistance of the soil should be estimated using an equivalent fluid pressure as shown on Figure G-11 (Appendix G). Figure G-11 also presents plots of the percent of maximum equivalent fluid pressure versus pile cap movement.

7.2.3 Lateral Pile Load-Deflection (P-Y)

Lateral load-deflection (p-y) curves were generated to evaluate the behavior of piles supporting bents of the bridge structure. LPILE plus 5.0 (Ensoft, Inc. 2008) was used to model the lateral pile behavior and to estimate the lateral load-deflection curve for 14-inch prestressed precast concrete piles. Results of LPILE analysis are presented in Appendix H.

7.2.4 Axial Pile Load-Deflection

Axial pile load-deflection curves are used by the Structural Engineer to develop vertical foundation stress-strain coefficients for use in the super structure analyses. The computer program TZPILE 2.0 (Ensoft, Inc. 2005) was used to model the axial pile load behavior. Axial load-deflection curves were developed for 14-inch prestressed precast concrete piles. The results of the TZPILE analysis are presented in Appendix I.

7.3 PILE INSTALLATION

All piles should be installed under the direct observation of the Geotechnical Engineer and in accordance with Section 49 of the Caltrans Standard Specifications, "Piling." Specific additions and modifications to these requirements are discussed below.

The Contractor should submit evidence of compatibility of the proposed pile hammer with the pile type and soil conditions at the site. The Contractor's hammer submittal should include, as a minimum, a dynamic analysis of the pile driving system that is based on wave equation analysis using computer programs such as WEAP. Pile Driving Acceptance Criteria described in Caltrans Standard Specifications Section 49-1.08 should be followed, as well as Special Provisions 49-228, Redriving. Driven piles reaching refusal within 10 feet of the specified tip elevation and meeting the acceptance criteria may be cut-off above the tip elevation required by the compression loads. This assumes that the design lateral load and tension load tip elevations have been reached (see Pile Data Table). Preliminarily, we recommend that the refusal criteria be two times the minimum required blowcount as determined by the nominal resistance formula outlined in Section 49-1.08 of the Standard Specifications. However, refusal criteria should be defined later based on the pile driving system proposed by the Contractor and evaluated by WEAP analysis.

We anticipate that piles may encounter "hard driving" conditions within granular deposits found at Abutment 1, Bent 4 and Abutment 5. The approximate elevations of the granular deposits and location are presented in Table 7-5.

Table 7-5: Location and Approximate Elevation of "Hard Driving" Layers at U.S. 101N/SR116 SOH (Replace)

Location	Approximate Elevation of "Hard Driving" Layers (feet)
Abutment 1	-12½ to -17½, -22½ to -26
Bent 4	-10.0 to -14.0
Abutment 5	-9.0 to -18.0

Where required, and as approved by the Geotechnical Engineer, predrilling should be used to assist in the installation of piles to the required tip elevations. Predrilled holes should be no larger than the least dimension of the new pile, in conformance with the provisions of Section 49-1.05 of the Standard Specifications, Driving Equipment. The use of water in the predrilling

process or jetting should not be allowed, unless approved in advance by the Geotechnical Engineer.

7.4 APPROACH EMBANKMENT SETTLEMENT

It is planned to raise the existing south approach embankment by about 5 feet at the south abutment (Abutment 1). The footprint of the north approach embankment will be enlarged to the southeast, requiring additional fill depths ranging from 5 feet to as much as 21 feet at Abutment 5. Settlement of the approach embankments due to placement of additional fill has been estimated for those changes in the roadway design profile and embankment widening. Based on the analysis, it is estimated that long-term consolidation settlement on the order of ½ inch and from ½ inch to 4½ inches could occur at Abutment 1 and Abutment 5, respectively. The settlement at the top edge of the existing embankment is estimated to be less than ½ inch. Since the nearest existing abutment pile is about 5 feet away from the embankment edge, the settlement around the pile is estimated to be less than ½ inch; therefore settlement-induced downdrag force on existing abutment piles is unlikely.

For the north approach embankment, we estimate that approximately 90% of this settlement should occur within 270 days of fill placement, assuming the final embankment width is constructed at one time. The time to reach 90% consolidation, T_{90}, could be reduced by adding surcharge fill for the width of the widened embankment. For example, it is estimated that 5 feet of surcharge fill would be expected to reduce T_{90} to about 150 days, and that 10 feet of surcharge fill would further reduce it to about 100 days. Appendix J presents the results of the settlement analysis.

7.5 SLOPE STABILITY

Consistent with Caltrans standards, the proposed slope inclination of new embankments at the north abutment is generally 2 to 1 (horizontal to vertical). The embankment soils and underlying native soils are capable of supporting these typical slopes, provided that the embankments are constructed in accordance with the recommendations of this report and Caltrans Standard Specifications.

7.6 APPROACH FILL EARTHWORK

All earthwork should be completed in accordance with the applicable sections of the Caltrans Standard Specifications and Project Standard Specific Provisions. The requirements of structural backfill and pervious backfill are set forth under Section 19-3.06 and 19-3.065, respectively, in the Standard Specifications (Caltrans 2006).

7.7 ABUTMENT/BENT PILE CAP EXCAVATION

Once footing/pile cap areas have been excavated to the required finish subgrade elevations, all loosened soil should be removed prior to concrete placement. Based on available groundwater information, we recommend the type of excavation should be classified as a “Structure Excavation (Bridge)” at both abutments and at Bents 2, 3 and 4 as “Structure Excavation Type D” in accordance with Section 11 of Bridge Design Aids, March 2005. However, based on a review of the contract documents for the bridge replacement in 2007, the excavation at Bent 4 was classified as “Structural Excavation Type DR”. However, no contamination was detected at

the same location and the details are provided in a separate report, titled “Site Investigation Report,” dated February 10, 2011.

8.1 TEMPORARY CONSTRUCTION EXCAVATIONS

We anticipate that excavations into the existing embankment fill for construction of the abutments could result in temporary near vertical unsupported soil faces as high as about 15 feet. Safety standards set by OSHA limit the height of unshored vertical excavations to 5 feet if construction personnel will be working in the excavations. The set of guidelines published by OSHA (Department of Labor, Occupational Safety and Health Administration, 1989), classifies soils in detail as Type A, B or C. In general, Type A soils are stronger and more cohesive, Type B soils are intermediate, and Type C soils are weaker or more granular. Based on the soil type, depth, duration the excavation is open, and sequence of soils exposed in the excavation, OSHA recommends maximum allowable slopes. For example, for excavations 20 feet or less in depth through homogeneous soils, they state that maximum allowable slopes (horizontal to vertical) should be ¾:1, 1:1, and 1½:1 for Type A, B, and C soils, respectively. Based on the strengths of the soils encountered at the site, the existing fills and the native sand strata are considered to be OSHA Type C, whereas the native medium stiff to stiff clay soils are considered to be Type B.

The guidelines provided by OSHA are for trench excavations; they state that there is uncertainty as to when and to what degree an employer must slope, shore, or otherwise protect employees in a "non-trench" excavation. In consideration of these factors, we recommend that temporary cut slopes in the existing embankment fills not exceed 1½:1 during construction.

For locations where excavation with sloping sides is not viable because of space limitations, or in areas where temporary slopes steeper than 1½:1 are planned, shoring will be required. The Contractor should retain an experienced Registered Civil Engineer to design the shoring system.

8.2 CONSTRUCTION DEWATERING

The bottoms of pile caps at Bents 2, 3 and 4 are planned at Elevation -0.5, 2.0 and 4.2 feet, respectively, whereas Abutments 1 and 5 are planned at Elevation 22.5 and 17.2 feet, respectively. Free groundwater was encountered in Boring R-09-014 at a depth of about 18 feet (Elevation -4.0 feet). Groundwater levels also were measured somewhat shallower in borings from the previous studies (June 1952 and September 2002) at Elevations +1.7 to +5.2 feet. Based on these exploratory findings, it should be anticipated that groundwater could be encountered during pile cap excavation at the bents.

8.3 EFFECTS OF CONSTRUCTION WORK ON ADJACENT STRUCTURES

Efforts should be made to minimize effects of construction work on adjacent structures. If new foundation excavations and overexcavations are located in close proximity to existing bridge foundations, shoring could be required to minimize exposure of existing pile foundations.

The recommendations presented in this Foundation Report are based on information obtained from new explorations made at widely separated locations, site reconnaissance, review of available historic data, and upon local experience and engineering judgment. As-built drawings pertinent to the geotechnical investigation are included, for convenience of reference.

The recommendations presented in this report are based on the assumption that the soil and geologic conditions do not deviate substantially from those encountered in the previous and new explorations. If any variations are encountered during construction, URS should be contacted so that supplementary recommendations can be made.

If the planned construction is changed from that presently conceived, URS should be retained to review the changes and make modifications to the original recommendations represented in this report in order to meet the project needs.

The Geotechnical Engineer should review the final specifications and drawings to verify that these documents are consistent with the intent of the geotechnical recommendations. Geotechnical issues may arise which are not apparent at this time. URS should be retained during construction to review the soil conditions encountered and the construction procedures. All earthwork and testing should be completed under the direct observation of a representative of our firm.

Specific review and investigation for environmental issues and subsurface environmental contamination were beyond the scope of the geotechnical services.

The elevations shown on the new LOTBs are based on interpolation from spot and contour elevations shown on available topographic maps.

The opinions and recommendations presented in this Foundation Report were developed with the standard of care commonly used as state of the practice in the profession. No other warranties are included, either express or implied, as to the professional advice provided in this report.

ABAG, 2007, Floodplain Maps, abag.ca.gov/bayarea/eqmaps/eqfloods/floods

Armstrong, C.F. and Huffman, M.E., 1980, Geology for planning in Sonoma County, California Division of Mines and Geology Special Report 120, Plate 2b and 3B, scale 1:62,500.

California Division of Mines and Geology, 1982, Alquist-Priolo Special Studies Zone revised official map of the Petaluma River quadrangle, scale 1: 24,000, January 1.

California Division of Oil, Gas, and Geothermal Resources, 2001, Oil, Gas, & Geothermal Fields in California, scale 1: 1,500,000: ftp://ftp.consrv.ca.gov/pub/oil/maps/Map_S-1, accessed 7-17-09

California Geological Survey [Tianqing Cao and others], 2003, The revised 2002 California probabilistic seismic hazard maps, June 2003: CGS online publication at www.consrv.ca.gov/cgs/rghm/psha/fault_parameters/pdf/2002_CA_Hazard_Maps.pdf

California Department of Transportation: Caltrans ARS Online, 2009: Web-based tool calculates both deterministic and probabilistic acceleration response spectra: http://dap3.dot.ca.gov/shake_stable/

Campbell-Bozorgnia (2008) and Chiou-Youngs (2008) ground motion prediction equations: "Next Generation Attenuation" project: PEER-Lifelines program: http://peer.berkeley.edu/products/nga_project.html

City of Petaluma, 2008, Final General Plan 2025, May, http://cityofpetaluma.net/genplan/finalgp2025.html, accessed 7-15-09

Hart, E.W., 1975 (revised 1997), Fault-rupture hazard zones in California: California Division of Mines and Geology Special Publication 42.

Jennings, C.W., 1994, Fault activity map of California and adjacent areas with locations and ages of recent volcanic eruptions: California Division of Mines and Geology Geologic Data Map No. 6, scale 1: 750,000.

Merriam, M. and Shantz, T., 2007, Caltrans Deterministic PGA Map, California Department of Transportation.

http://dap3.dot.ca.gov/shake_stable/references/Deterministic_PGA_Map_8-12-09.pdf

Sonoma County Hazard Mitigation Plan, 2006 Landslide hazard areas, September 19, http://www.sonoma-county.org/PRMD/docs/hmp/fig_2-04.pdf, accessed 7-17-09.

Wagner, D.L., Rice, S.R., Bezore, S., Randolph-Loar, C.E., Allen, J., and Witter, R.C., 2002, Geologic map of the Petaluma River 7 ½' quadrangle, Marin and Sonoma counties, California, a digital database: California Geological Survey.

Wentworth, C.M., 1997, Geologic materials of the San Francisco Bay Region, U. S. Geological Survey OFR 97-744, compiled from the work of Brabb (1989) , Ellen and Wentworth (1995) and Helley and Lajoie (1979) a digital database

Witter, R.C., Knudsen, K.L., Sowers, J.M., Wentworth, C.M., Koehler, R.D., and Randolph, C.E., 2006, Maps of Quaternary deposits and liquefaction susceptibility in the central San Francisco Bay region, California, in cooperation with the California Geological Survey: A digital database, U.S. Geological Survey, Open-File Report 2006-1037.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON

STATE HIGHWAY

IN SONOMA COUNTY IN AND NEAR PETALUMA FROM 0.4 MILES SOUTH OF SOUTH PETALUMA UNDERCROSSING TO 0.2 MILE NORTH OF CAULFIELD LANE OVERCROSSING

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

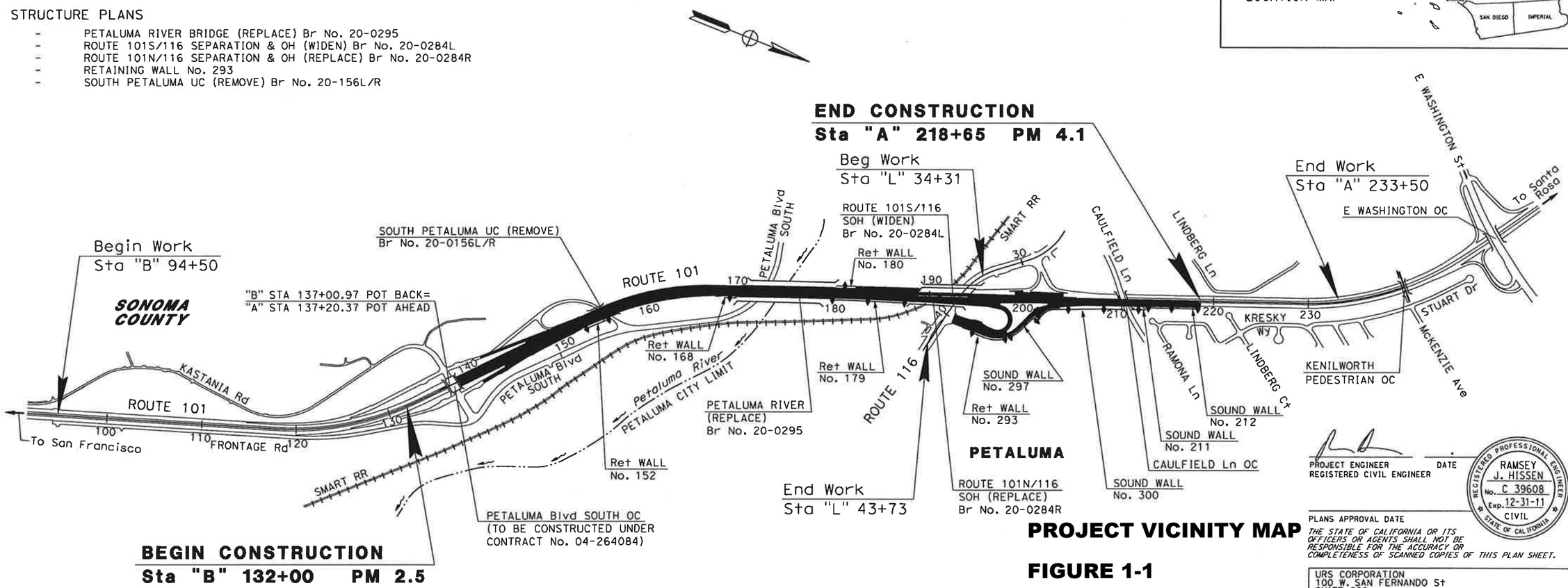
INDEX OF PLANS

SHEET No.
- TITLE
- TYPICAL CROSS SECTIONS
- KEY MAP AND LINE INDEX
- LAYOUTS
- PROFILES AND SUPERELEVATION DIAGRAMS
- CONSTRUCTION DETAILS
- TEMPORARY WATER POLLUTION CONTROL PLANS AND QUANTITIES
- EROSION CONTROL PLANS, DETAILS AND QUANTITIES
- CONTOUR GRADING AND PAVEMENT ELEVATIONS
- DRAINAGE PLANS, PROFILES, DETAILS AND QUANTITIES
- SANITARY SEWER PLANS, PROFILES, DETAILS AND QUANTITIES
- UTILITY PLANS
- CONSTRUCTION AREA SIGNS
- STAGE CONSTRUCTION PLANS
- TRAFFIC HANDLING PLANS AND QUANTITIES
- DETOUR LAYOUTS
- PAVEMENT DELINEATION PLANS AND QUANTITIES
- SIGN PLANS, DETAILS AND QUANTITIES
- SUMMARY OF QUANTITIES
- RETAINING WALL PLANS, DETAILS, QUANTITIES AND LOG OF TEST BORINGS
- SOUND WALL PLANS, DETAILS AND QUANTITES
- PLANT REMOVAL PLANS
- ELECTRICAL PLANS

STRUCTURE PLANS

- PETALUMA RIVER BRIDGE (REPLACE) Br No. 20-0295
- ROUTE 101S/116 SEPARATION & OH (WIDEN) Br No. 20-0284L
- ROUTE 101N/116 SEPARATION & OH (REPLACE) Br No. 20-0284R
- RETAINING WALL No. 293
- SOUTH PETALUMA UC (REMOVE) Br No. 20-156L/R

LOCATION MAP



PROJECT VICINITY MAP

FIGURE 1-1

101 MSN CONTRACT B4
95% PS&E SUBMITTAL
NOVEMBER 30, 2010

NO SCALE

THE CONTRACTOR SHALL POSSESS THE CLASS (OR CLASSES) OF LICENSE AS SPECIFIED IN THE "NOTICE TO BIDDERS."

PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER RAMSEY J. HISSEN No. C 39608 Exp. 12-31-11 CIVIL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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SUITE 200
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SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401

CONTRACT No.	04-2640C4
PROJECT ID	0400000736

LAST REVISION 11-22-10 | DATE PLOTTED => 11/29/2010 | TIME PLOTTED => 10:06:52 AM

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER	CALTRANS DESIGN OVERSIGHT APPROVAL	REGISTRATION No.	LICENSE Exp DATE	DATE	DATE SIGNED
RAMSEY J. HISSEN	TUNG LY				

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Jan M. Hueser No. C050215 Exp. 6/30/11 CIVIL STATE OF CALIFORNIA

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SANTA ROSA, CA 95401

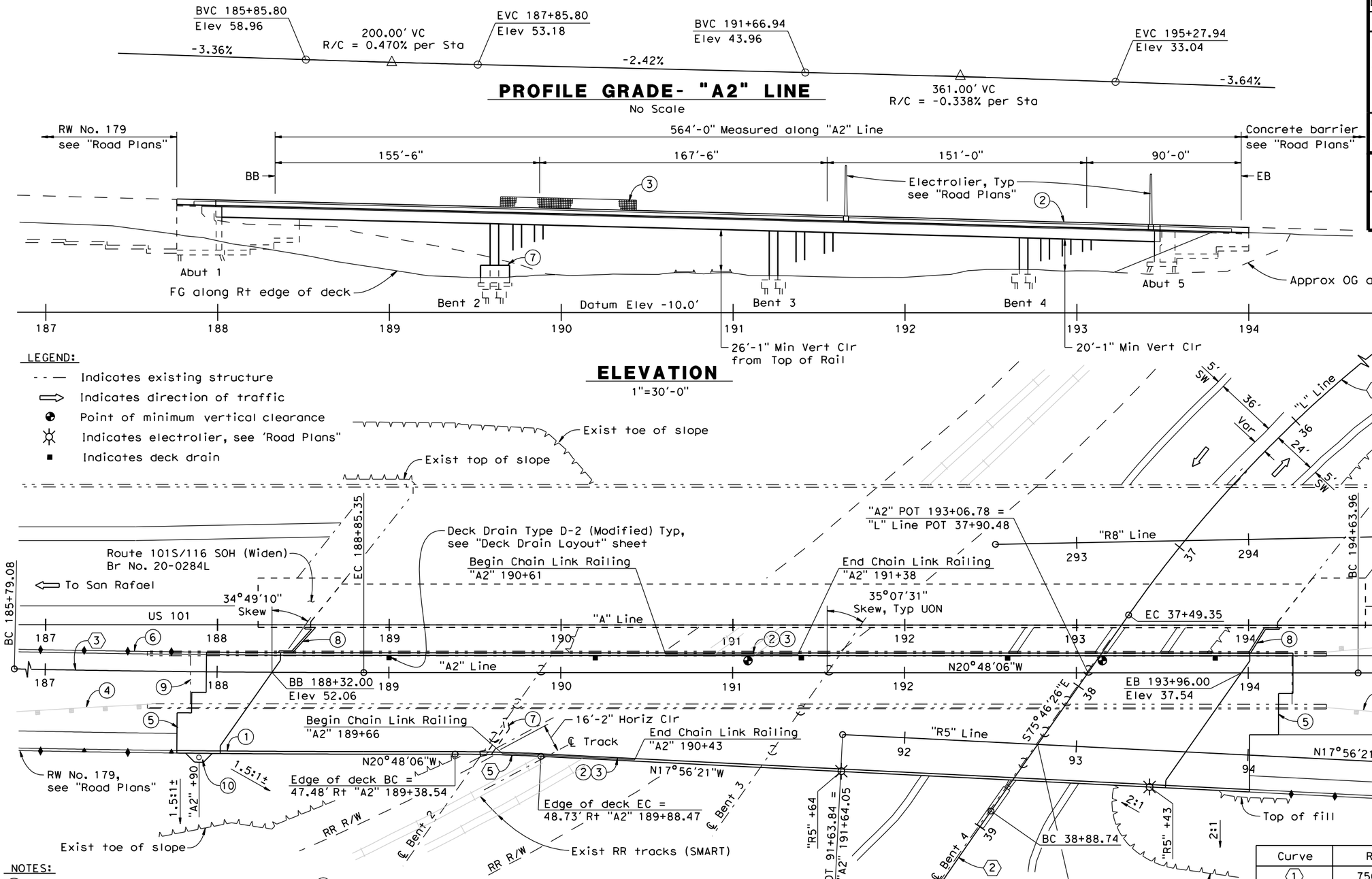

FIGURE 2-1

NOTES:

1. Paint Bridge Number 20-0284R, Bridge Name and Year Completed
2. Concrete Barrier (Type 736 Modified) with Architectural Treatment
3. Chain Link Railing (Type 7 Modified)
4. Remove existing MBGR, see "Road Plans"
5. Structure Approach Type N(30S)
6. Barrier Railing, see "Road Plans"
7. Concrete Crash Wall
8. Median Retaining Wall
9. Remove Existing Br No. 20-0155R
10. Overhead Sign Pilaster

Note: For "General Notes", "Standard Plans", "Index to Plans" and "Quantities" see "Index to Plans" sheet. For "Quantities" see "General Plans No. 2" sheet.

CURVE DATA

Curve	R	Δ	T	L
1	750'	36°40'42"	248.61'	480.12'
2	4000'	02°52'51"	100.58'	201.12'
3	10000'	01°45'17"	153.15'	306.24'
4	10000'	01°44'48"	152.43'	304.84'
5	1000'	02°51'45"	24.99'	49.96'

DESIGN OVERSIGHT	DESIGN	BY S. Landis/J. Hueser	CHECKED A. Dubovik	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE
SIGN OFF DATE	DETAILS	BY L. Davis	CHECKED A. Dubovik	LAYOUT BY S. Landis	CHECKED J. Hueser
	QUANTITIES	BY M. Jackson	CHECKED S. Landis	SPECIFICATIONS BY D. Harnagel	PLANS AND SPECS COMPARED S. Landis

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Walt LaFranchi
PROJECT ENGINEER

BRIDGE NO. 20-0284R
POST MILES 3.57

ROUTE 101N/116 SOH (REPLACE)
GENERAL PLAN No. 1

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV.7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 04000007361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 4-18-10 9-24-10 11-28-10

SHEET 1 OF 48

FILE => 20-0284R-a-gp01.dgn

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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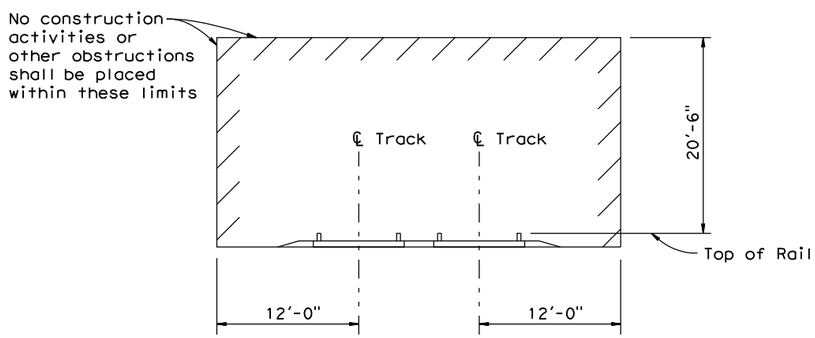
SANTA ROSA, CA 95401

CONSTRUCTION NOTES:

1. Any shoring system that impacts the Railroad's operation and/or supports the Railroad's embankment shall be designed and constructed per Railroad Guidelines for temporary shoring.
2. All demolition within the Railroad's right-of-way and/or demolition that may impact the Railroad's tracks or operations shall comply with the Railroad's Demolition requirements.
3. Erection over the Railroad's track shall be planned such that it enables the track(s) to remain open to traffic per Railroad requirements.
4. The elevation of the existing top-of-rail profile shall be verified before beginning construction. All discrepancies shall be brought to the attention of the Railroad prior to construction.
5. The proposed grade separation project shall not change the quantity and/or characteristics of the flow in the Railroad ditches and/or drainage structures.
6. The contractor must submit a proposed method of erosion and sediment control and have the method approved by the Railroad prior to beginning any grading on the project site.
7. For Railroad coordination please refer to the Railroad's Coordination requirements as part of the Specifications or Special Provisions of the project.
8. Temporary Construction Clearances, including falsework clearances, shall comply with the figure shown.
9. All permanent clearances shall be verified before project closeout.



MINIMUM CONSTRUCTION CLEARANCE ENVELOPE

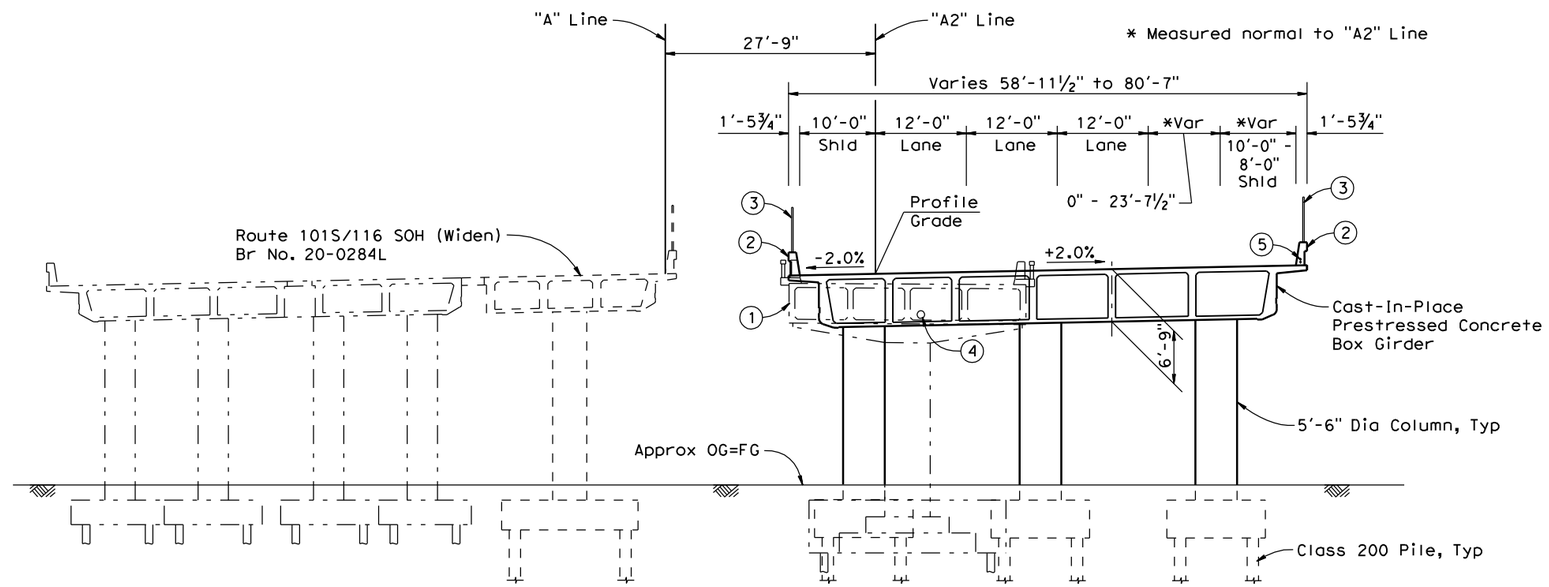
No Scale

LEGEND:

- - — Indicates existing structure

NOTES:

1. Remove Existing Br No. 20-0155R
2. Concrete Barrier (Type 736 Modified) with Architectural Treatment
3. Chain Link Railing (Type 7 Modified) over RR R/W
4. 12" Dia welded steel pipe, see "Road Plans"
5. 2-2" Conduits



TYPICAL SECTION

1"=10'-0"

FIGURE 2-2

DESIGN OVERSIGHT	DESIGN	BY S. Landis/J. Hueser	CHECKED A. Dubovik	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE	
	DETAILS	BY L. Davis	CHECKED A. Dubovik	LAYOUT	BY S. Landis	CHECKED J. Hueser
SIGN OFF DATE	QUANTITIES	BY M. Jackson	CHECKED S. Landis	SPECIFICATIONS	BY D. Harnagel	PLANS AND SPECS COMPARED S. Landis

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Walt LaFranchi
PROJECT ENGINEER

BRIDGE NO. 20-0284R
POST MILES 3.57

ROUTE 101N/116 SOH (REPLACE)
GENERAL PLAN No. 2

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV.7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 04000007361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING 5-28-09 FOR REVISION DATES

REVISION DATES 4-18-10 9-24-10 11-28-10

SHEET 2 OF 48

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Jon M. Hueser No. C050215 Exp. 6/30/11 CIVIL STATE OF CALIFORNIA

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FIGURE 2-3

PILE DATA TABLE

Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevation (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance (kips)
		Compression	Tension			
Abut 1	Class 200 Alt "X"	390	0	-47 (a) +2.5 (c)	-47	390
Bent 2	Class 200 Alt "X"	370	0	-47 (a) -16 (c)	-47	370
Bent 3	Class 200 Alt "X"	360	0	-56 (a) -17 (c)	-56	360
Bent 4	Class 200 Alt "X"	340	0	-68 (a) -11 (c)	-68	340
Abut 5	Class 200 Alt "X"	340	0	-64 (a) -5 (c)	-64	340
Abut 5 RW	Class 140 Alt "X"	280	0	-62 (a) +2 (c)	-62	280
Abut 5 Median RW	Class 140 Alt "X"	280	0	-61 (a) -5 (c)	-61	280

Notes: Design tip elevation are controlled by: (a) Compression, (b) Tension, (c) Lateral Loads.

UTILITIES

UTILITY	OWNER	DISPOSITION
1 Existing Sewer 36" Force Main	City of Petaluma	Relocate
2 Existing Sewer 33" Gravity Main	City of Petaluma	Protect in place
3 Existing 12" PVC Water	City of Petaluma	Protect in place
4 Existing Underground Fiber Optic	Qwest / Comcast	Protect in place
5 Existing Underground Telephone/ Fiber Optics Bank (12 - 4" conduits)	AT&T	To be relocated prior to construction (by others)
6 Existing Underground Electric	PG&E	Abandoned

BENCH MARK

BENCH MARK	N	E	ELEV	DESCRIPTION
JK121	2276227.207	5954272.578	81.98	1" Iron pipe with a plastic plug and tack along the northbound shoulder of State Route 101 across from a "Sonoma-Napa-Right Lane" sign; 10.7 feet easterly of a metal beam guard rail and at top of slope.
JK122	2277835.878	5953598.199	52.65	1" Iron pipe with a plastic plug and tack along the northbound median of State Route 101; 50 feet northerly of a "Petaluma Blvd South-3/4 mile" sign; 16 feet westerly of the edge of pavement and witnessed by a carsonite witness post.

SURVEY CONTROL: Horizontal control for this survey is based on the California Coordinate System, Zone 3, US Survey feet, North American Datum of 1983 (NAD83), Epoch 2007.00. Vertical control is the National Geodetic Vertical Datum (NAVD88).

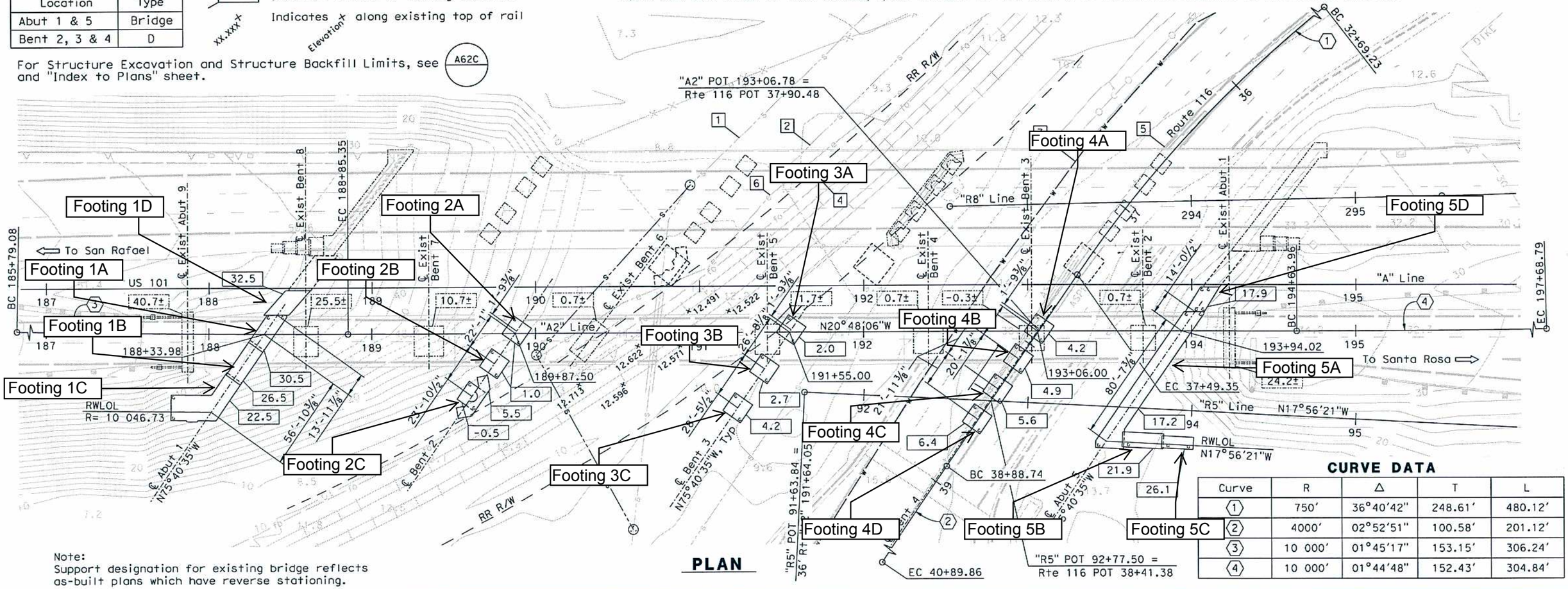
STRUCTURE EXCAVATION

Location	Type
Abut 1 & 5	Bridge
Bent 2, 3 & 4	D

LEGEND:

- Indicates piles (not all piles shown)
- Indicates bottom of footing elevation
- Indicates XX.XXX Elevation along existing top of rail

For Structure Excavation and Structure Backfill Limits, see A62C and "Index to Plans" sheet.



Note:
Support designation for existing bridge reflects as-built plans which have reverse stationing.

PLAN

CURVE DATA

Curve	R	Δ	T	L
1	750'	36°40'42"	248.61'	480.12'
2	4000'	02°52'51"	100.58'	201.12'
3	10 000'	01°45'17"	153.15'	306.24'
4	10 000'	01°44'48"	152.43'	304.84'

11-28-10 GEOTECHNICAL PROFESSIONAL APPROVAL DATE

DESIGN OVERSIGHT	SCALE: 1"=30'-0"	VERT.DATUM NAVD 88	HORZ.DATUM NAD 83 (1991.35)	DESIGN BY S. Landis/J. Hueser	CHECKED A. Dubovik
	PHOTOGRAMMETRY AS OF:	ALIGNMENT TIES		DETAILS BY L. Davis	CHECKED A. Dubovik
	SURVEYED BY Caltrans	DRAFTED BY Caltrans		QUANTITIES BY M. Jackson	CHECKED S. Landis
SIGN OFF DATE	FIELD CHECKED BY Caltrans	CHECKED BY Caltrans			

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Walt LaFranchi
PROJECT ENGINEER

BRIDGE NO. 20-0284R
POST MILE 3.57

ROUTE 101N/116 SOH (REPLACE)
FOUNDATION PLAN

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV.7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 04000007361

CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 4-16-10 9-24-10 11-28-10

SHEET OF 48

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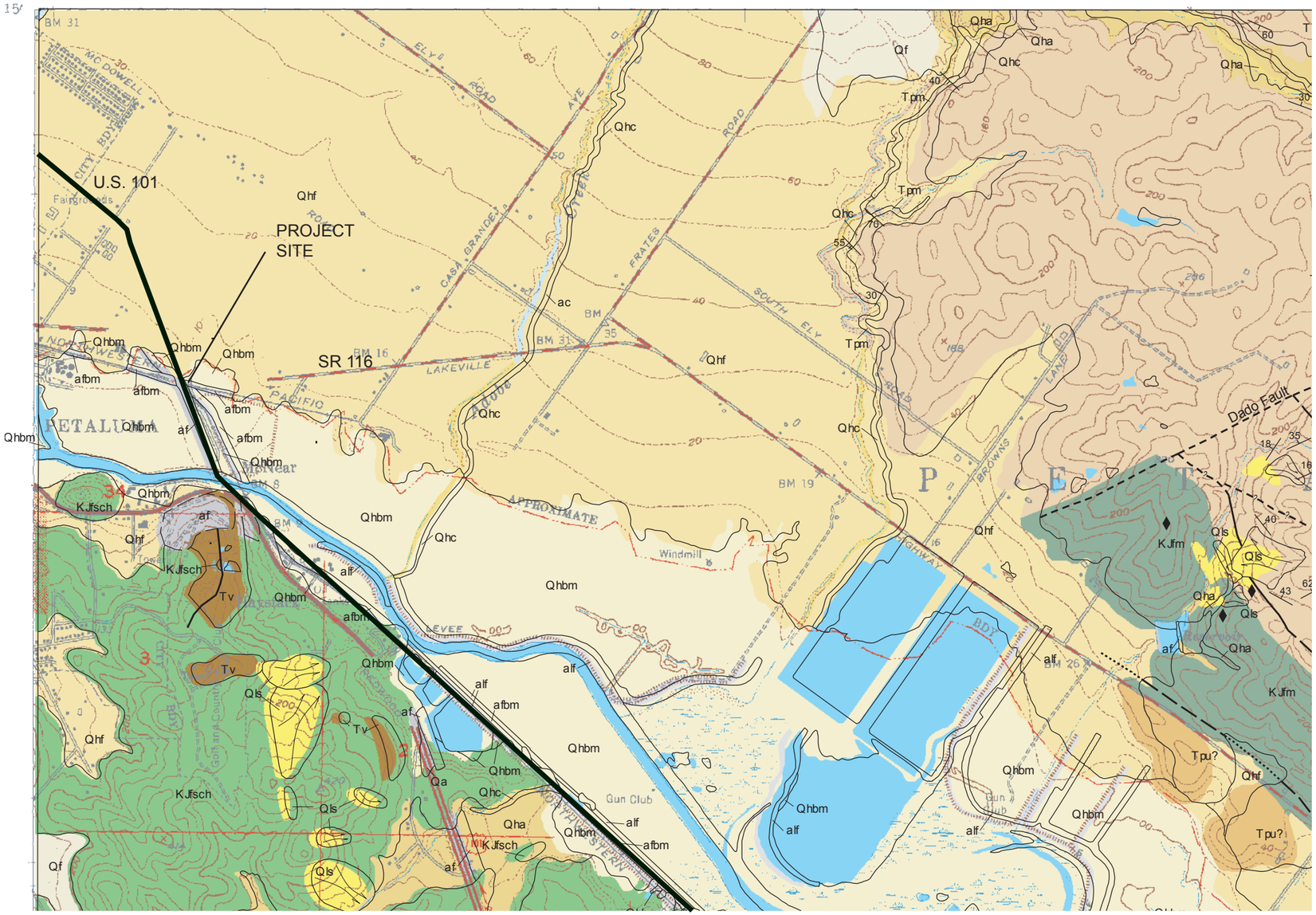
USERNAME => raymond_l DATE PLOTTED => 5/16/2011 TIME PLOTTED => 8:26:03 AM



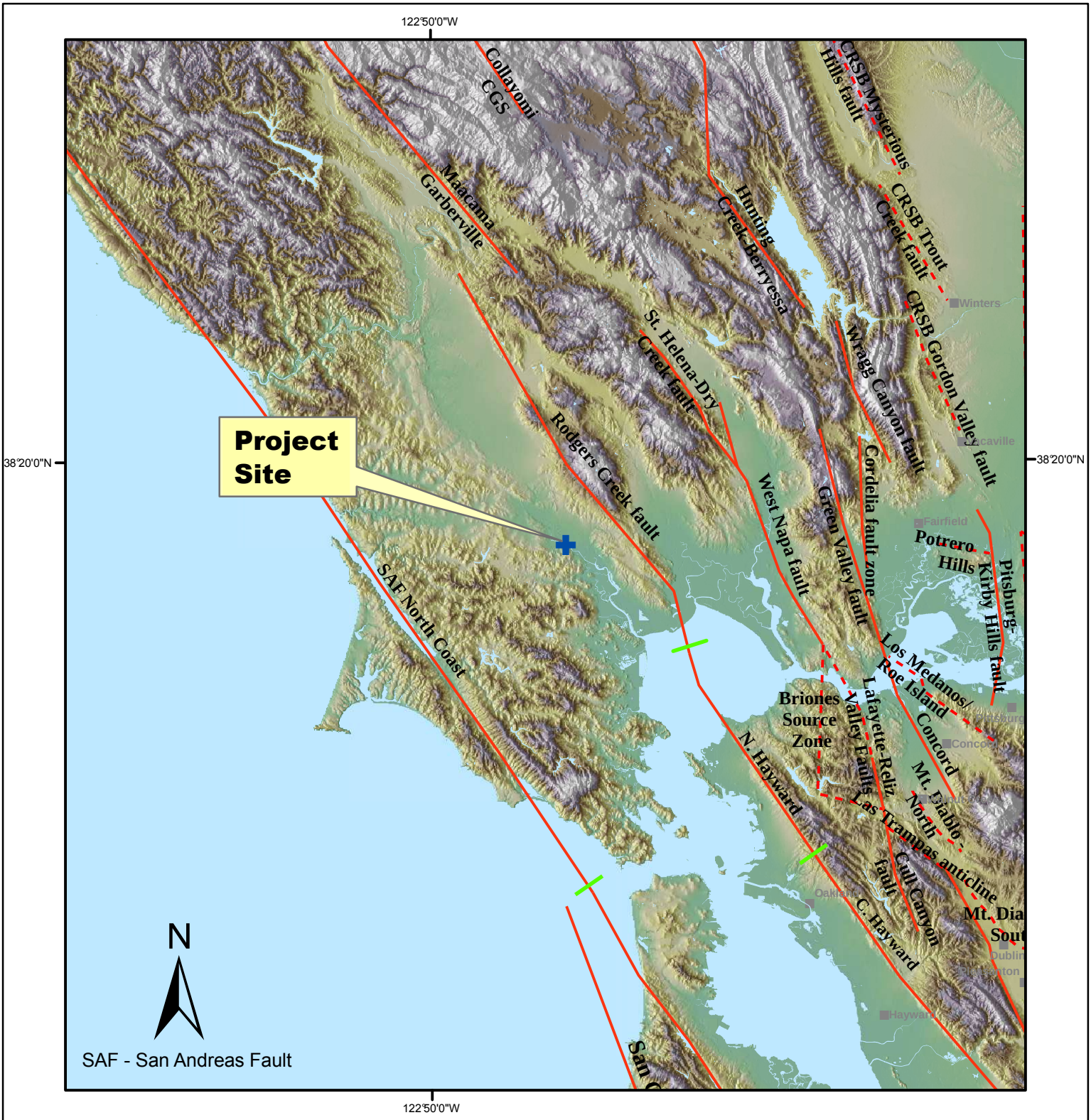
LEGEND

af	Artificial Fill
afbm	Artificial Fill placed over Bay Mud
alf	Artificial Levee Fill
Qhc	Late Holocene to modern stream channel deposits
Qhbm	Holocene Bay Mud deposits
Qhf	Holocene alluvial fan desposits
Qls	Landslides
Tv	Tertiary Volcanic Rock
KJfsch	Franciscan Complex Rock

Source:
Wagner, D. L., Rice, S.R., Bezore S., Randolph-Loar, C.E., Allen J., and Witter R.C., 2002, Geologic map of the Petaluma River 7 1/2' quadrangle, Marin and Sonoma counties, California, a digital database: California Geological Survey.

0 0.1 0.2 0.3 0.4 0.5 mile

URS	Marin Sonoma Narrows Project, Segment B4 Project Number: 28645045	Regional Geologic Map Sonoma County, California	Figure 3-1 August 19, 2009



7 3.5 0 7 Miles

0 4.5 9 18 27 36 Kilometers

Faults with surface rupture

Blind faults and zones

Segment boundary

Fault Source: URS Seismic Source Model

URS	Project No. 28645045 Marin Sonoma Narrows Project, 101/116 Bridge, Segment B4	ACTIVE FAULTS IN THE SAN FRANCISCO BAY REGION	Figure 3-2

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI No. C-52725 Exp. 12-31-10 CIVIL STATE OF CALIFORNIA

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URS CORPORATION
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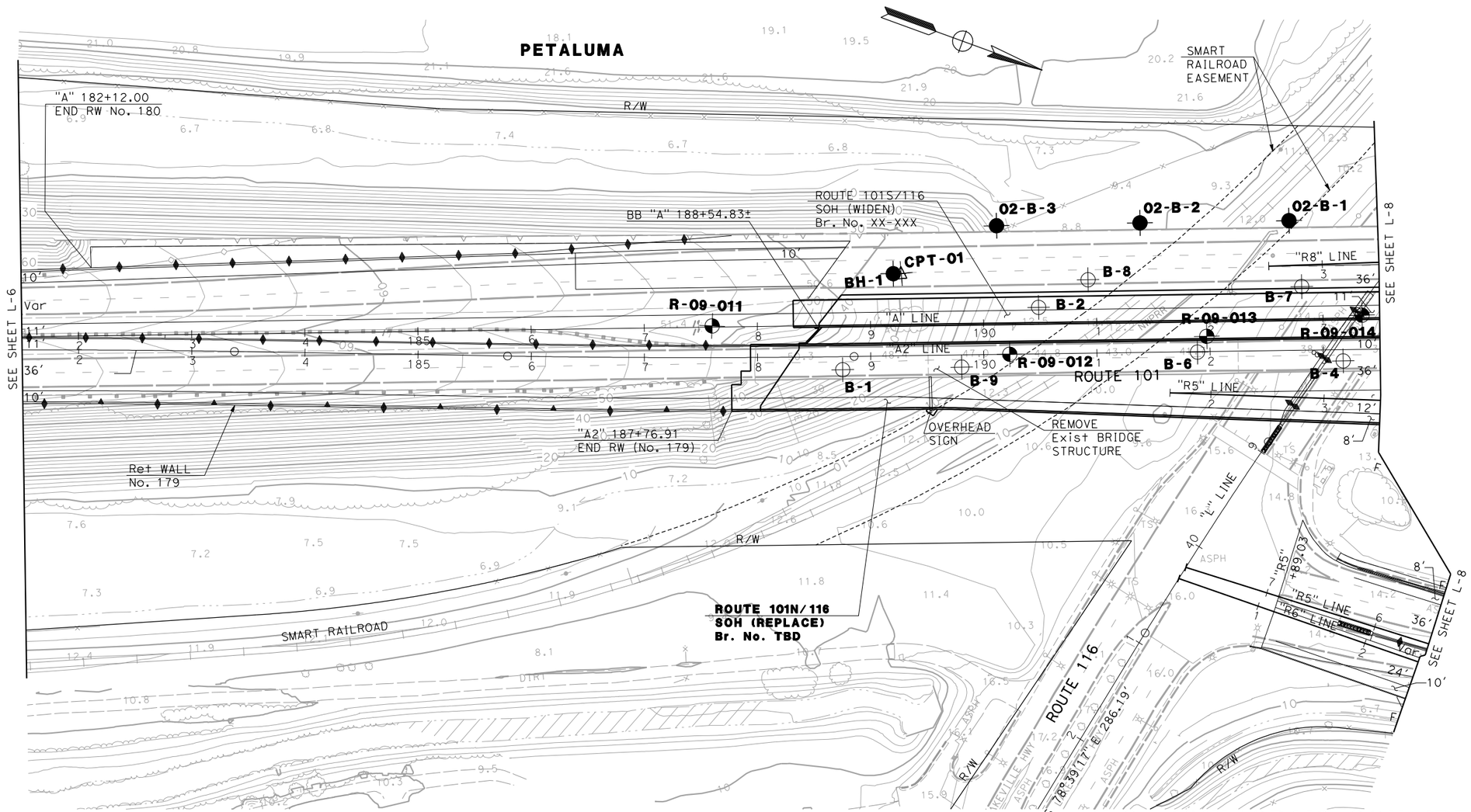
SUITE 200
SAN JOSE, CA 95113



U.S. 101N/SR116 SOH (REPLACE)
SITE AND BORING LOCATION PLAN
FIGURE 3-3

SCALE: 1" = 50'

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

CALCULATED-DESIGNED BY: ELIE ABI-JAOUDE

CHECKED BY: BEN RAZEGHI

REVISED BY

DATE REVISED

LAST REVISION 00-00-00

DATE PLOTTED => 4/9/2010
TIME PLOTTED => 3:25:03 PM

BORDER LAST REVISED 4/11/2008

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

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DGN FILE => ...\Fig3-3_bor_location_L-07.dgn

CU 00000

EA 2640C1

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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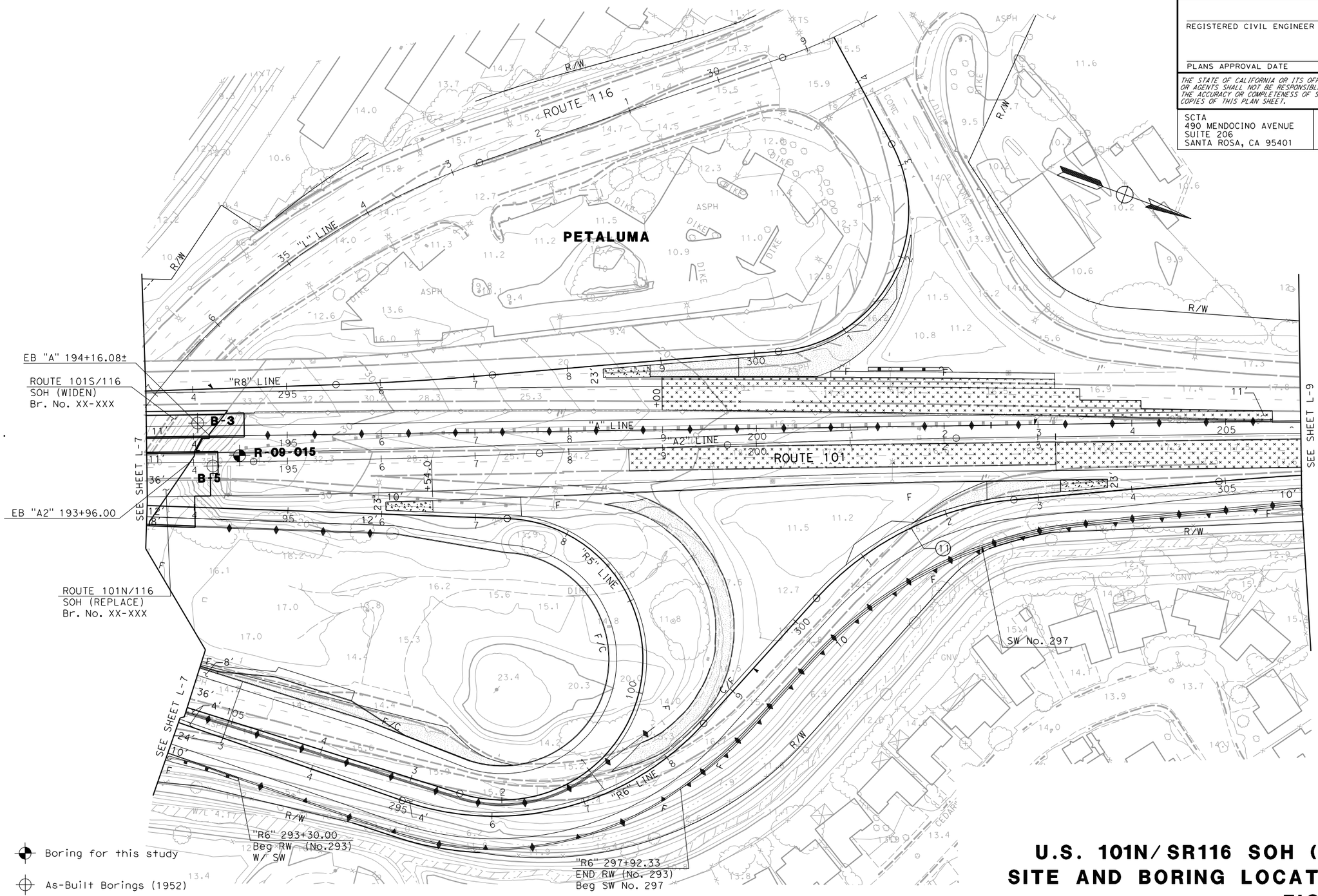
100 W. SAN FERNANDO St
SUITE 200
SAN JOSE, CA 95113



Boring for this study

As-Built Borings (1952)

As-Built Borings (2001/2002)

U.S. 101N/SR116 SOH (REPLACE)
SITE AND BORING LOCATION PLAN
FIGURE 3-4

SCALE: 1" = 50'

REVISED BY	DATE REVISED
ELIE ABI-JAOUDE	BEN RAZEGHI
CALCULATED-DESIGNED BY	CHECKED BY
CONSULTANT FUNCTIONAL SUPERVISOR	RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 00-00-00

DATE PLOTTED => 4/9/2010
TIME PLOTTED => 3:26:29 PM

BORDER LAST REVISED 4/11/2008

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

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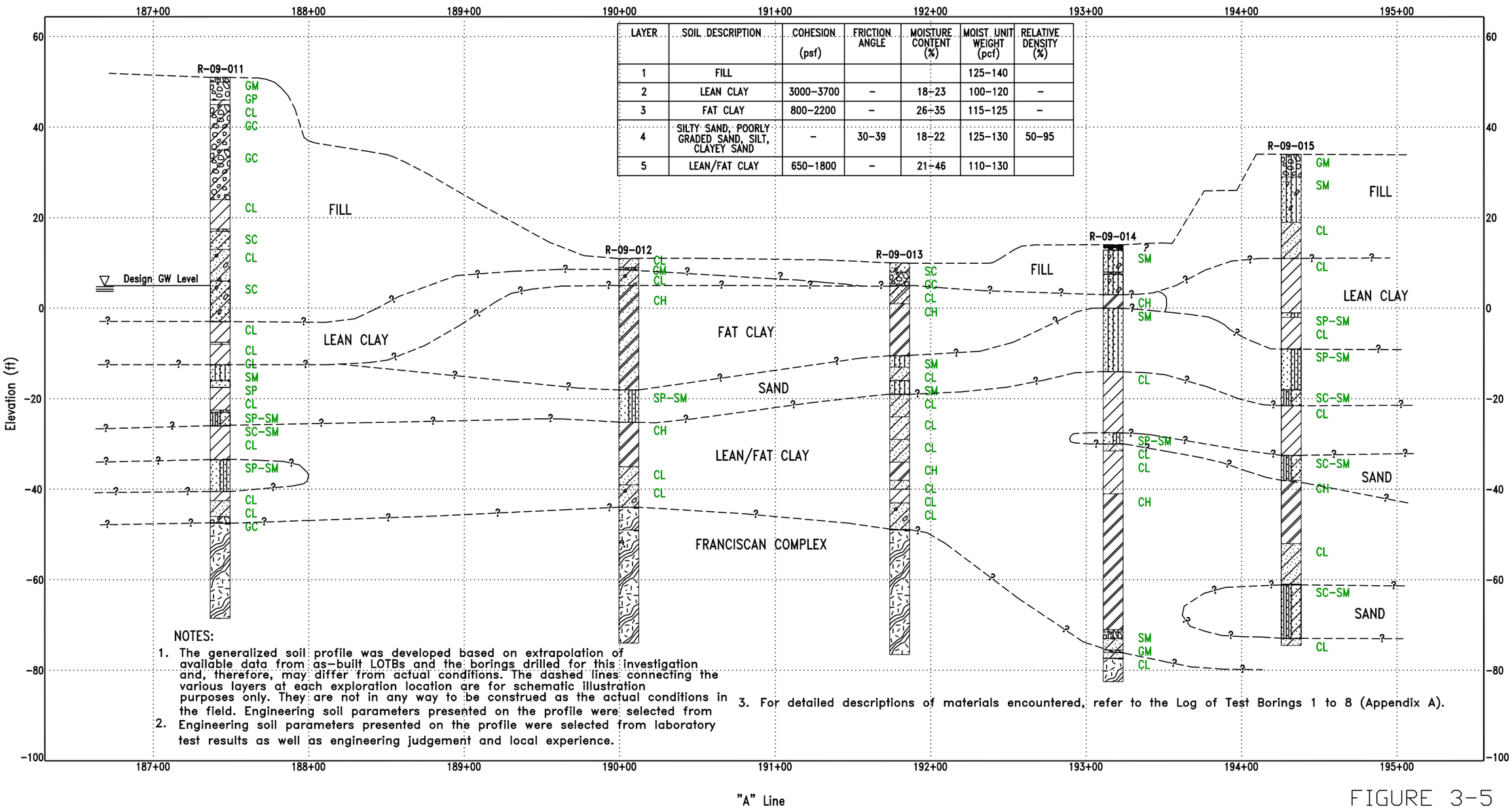
DGN FILE => ...\Fig3-4_bor_location_L-08.dgn

CU 00000

EA 2640C1

LAYER	SOIL DESCRIPTION	COHESION (psf)	FRICTION ANGLE	MOISTURE CONTENT (%)	MOIST. UNIT WEIGHT (pcf)	RELATIVE DENSITY (%)
1	FILL				125–140	
2	LEAN CLAY	3000–3700	–	18–23	100–120	–
3	FAT CLAY	800–2200	–	26–35	115–125	–
4	SILTY SAND, POORLY GRADED SAND, SILT, CLAYEY SAND	–	30–39	18–22	125–130	50–95
5	LEAN/FAT CLAY	650–1800	–	21–46	110–130	



NOTES:

1. The generalized soil profile was developed based on extrapolation of available data from as-built LOTBs and the borings drilled for this investigation and, therefore, may differ from actual conditions. The dashed lines connecting the various layers at each exploration location are for schematic illustration purposes only. They are not in any way to be construed as the actual conditions in the field. Engineering soil parameters presented on the profile were selected from
2. Engineering soil parameters presented on the profile were selected from laboratory test results as well as engineering judgement and local experience.
3. For detailed descriptions of materials encountered, refer to the Log of Test Borings 1 to 8 (Appendix A).

FIGURE 3-5

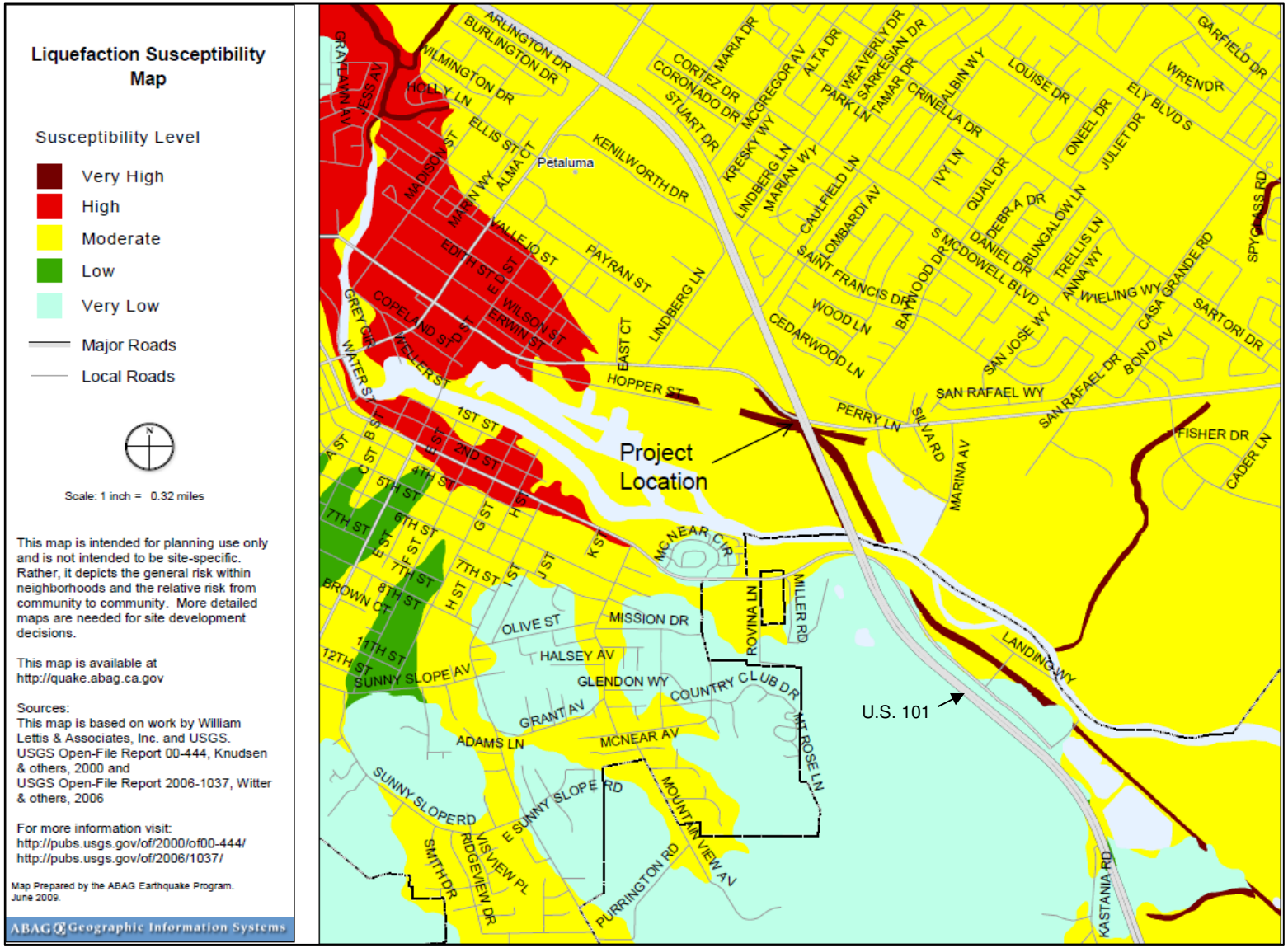
URS CORPORATION – SAN JOSE
100 W. SAN FERNANDO ST, SUITE 200
SAN JOSE, CA 95113

LITHOLOGY GRAPHICS

USCS Silty Gravel (poorly graded) | USCS Poorly Graded Gravel | USCS Lean Clay | USCS Clayey Gravel | USCS Clayey Sand
USCS Sandy Lean Clay with gravel | USCS Clayey Sand with gravel | USCS Sandy Lean Clay | USCS Silty Sand | USCS Poorly Graded Sand
USCS Poorly Graded Sand with silt | USCS Silty, Clayey Sand | USCS Silty Gravel with sand | USCS Fat Clay with sand | USCS Fat Clay

GENERALIZED SOIL PROFILE
U.S. 101S/SR 116 SOH (REPLACE)
101 MSN-B4
PETALUMA, CALIFORNIA

SIMPLE FENCE B-SIZE - URS MODIFIED 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 9/24/09



URS
100 W. San Fernando Street, Suite 200
San Jose, CA 95113
PHONE: (408) 297-9585
FAX: (408) 297-6962

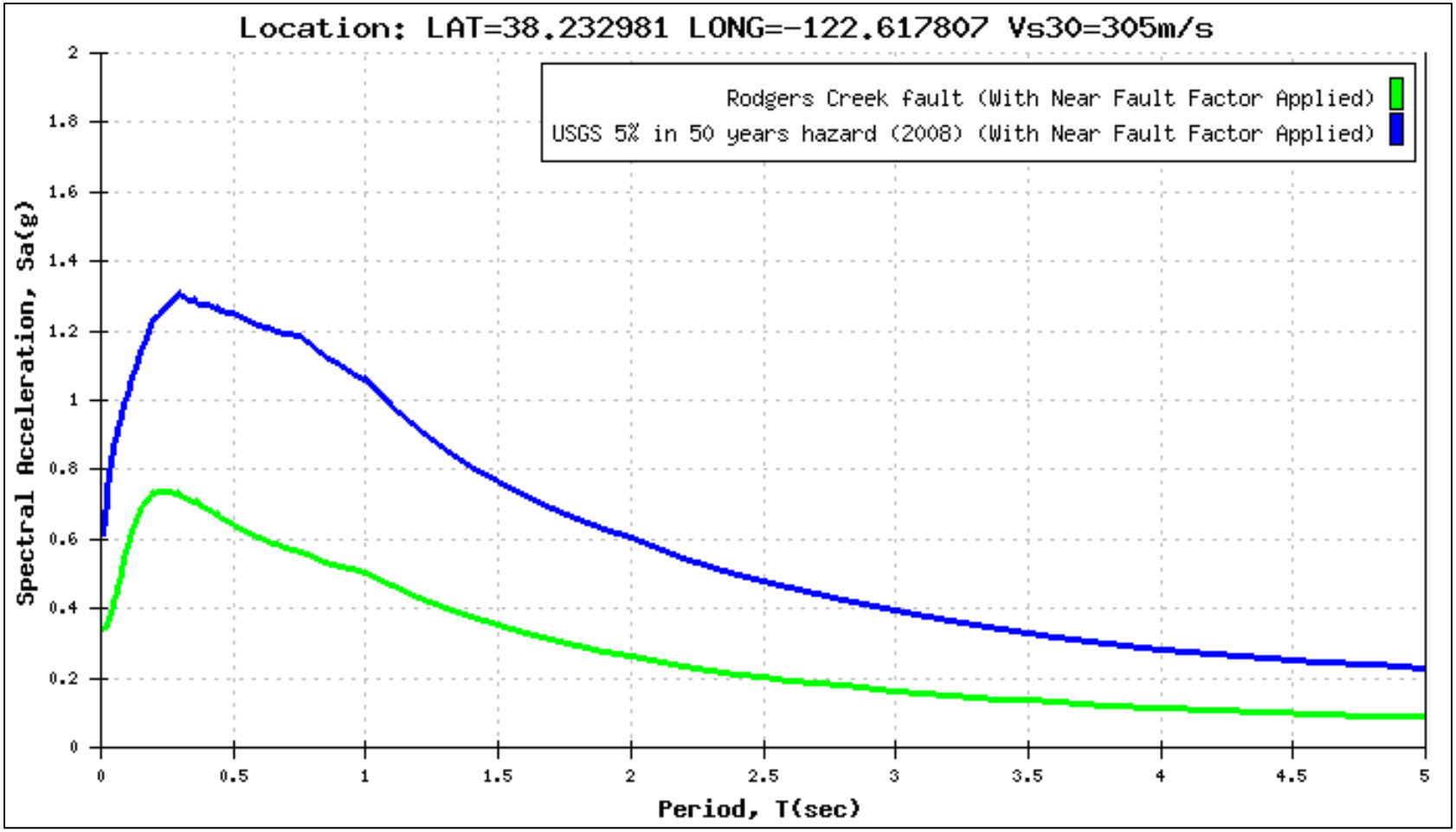
Marin Sonoma Narrows-B4
U.S.101/SR 116 SOH
Petaluma, CA

Project No: 28645045

Liquefaction Susceptibility Map

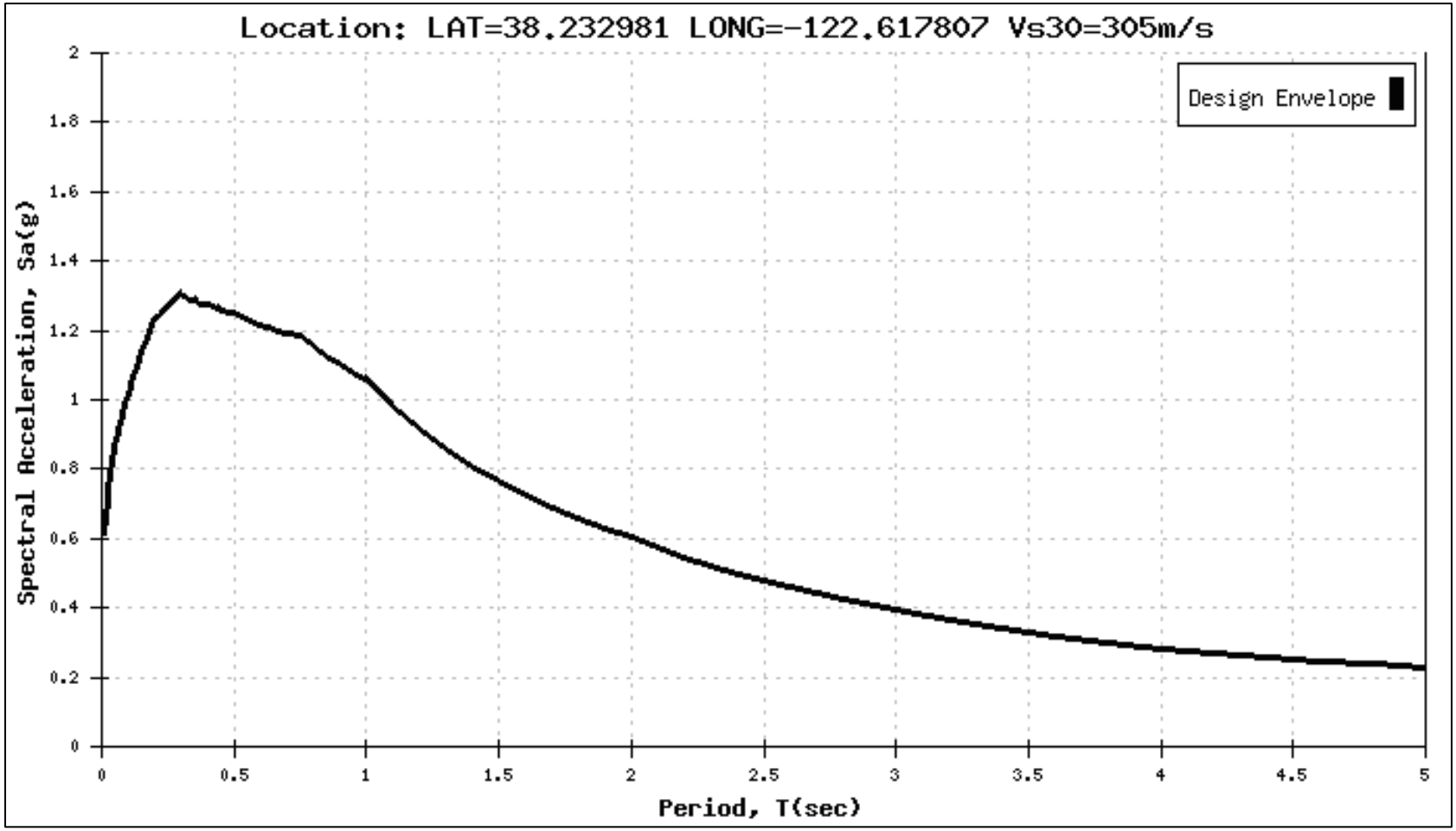
FIGURE 3-6

August, 2009



Reference: Caltrans ARS Online (2009)

URS 100 W. San Fernando Street, Suite 200 San Jose, CA 95113 PHONE: (408) 297-9585 FAX: (408) 297-6962	PROJECT No 28645045	CALCULATED BY Madhu Thummaluru	**Marin Sonoma Narrows-B4** **U.S.101/SR 116 SOH** **Petaluma, CA** **Calculated Spectra**	**FIGURE** **5-1**
	Date August, 2009			



Reference: Caltrans ARS Online (2009)

URS 100 W. San Fernando Street, Suite 200 San Jose, CA 95113 PHONE: (408) 297-9585 FAX: (408) 297-6962	PROJECT No 28645045	CALCULATED BY Madhu Thummaluru	**Marin Sonoma Narrows-B4** **U.S.101/SR 116 SOH** **Petaluma, CA**	**FIGURE** **5-2**
	Date August, 2009		**Calculated Spectra Design Curve**	

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. C 42289 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

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SAN JOSE, CA 95113

SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

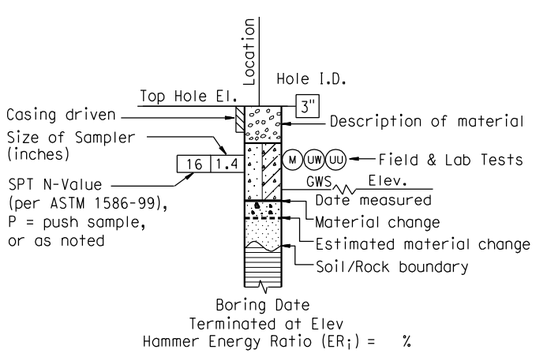
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
⬚	O	Other

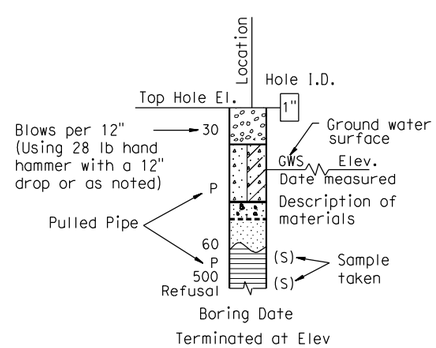
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

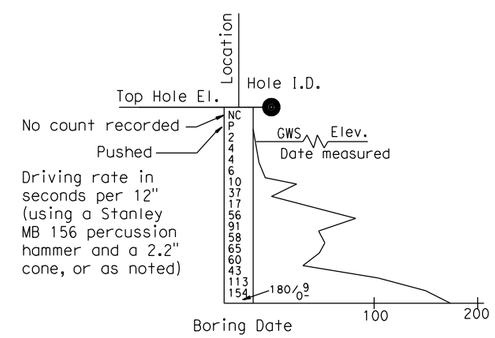
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.



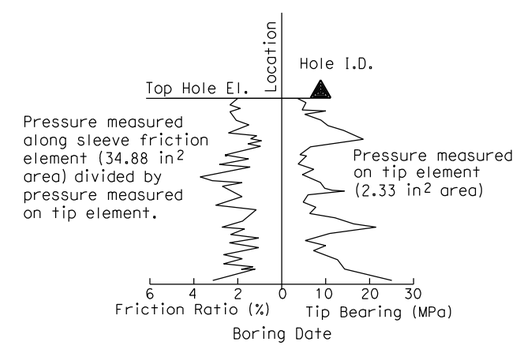
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

SOIL LEGEND

DESIGN OVERSIGHT	DRAWN BY	A. CHEUNG	C. RAMBO	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	S. HUANG PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	MANOHARAN	FIELD INVESTIGATION BY: DATE:		

BRIDGE NO. 20-0284R
POST MILES 3.57

ROUTE 101N/116 SOH (REPLACE)
LOG OF TEST BORINGS 1 OF 8

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 040000077361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 4-15-10 9-21-10 11-28-10 SHEET OF

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USERNAME => modhu_thu0 DATE PLOTTED => 5/17/2011 TIME PLOTTED => 10:06:22 AM

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names	Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND	CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND		
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND	CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND	ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GM	SILTY GRAVEL SILTY GRAVEL with SAND	OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND	OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL		
SP	Poorly graded SAND Poorly graded SAND with GRAVEL	CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL		
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL		
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
SM	SILTY SAND SILTY SAND with GRAVEL		
SC	CLAYEY SAND CLAYEY SAND with GRAVEL	OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
PT	PEAT	OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND
	COBBLES COBBLES and BOULDERS BOULDERS		

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. C 42289 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

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SAN JOSE, CA 95113

SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

SOIL LEGEND

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY A. CHEUNG

CHECKED BY MANOHARAN

C. RAMBO
FIELD INVESTIGATION BY:
DATE:

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. HUANG
PROJECT ENGINEER

BRIDGE NO. 20-0284R
POST MILES 3.57

ROUTE 101N/116 SOH (REPLACE)
LOG OF TEST BORINGS 2 OF 8

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 040000077361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 4-15-10 9-27-10 11-28-10

SHEET OF

FILE => ...\20-0284R-z-1tb02.dgn

USERNAME => mcdhu_thu DATE PLOTTED => 5/17/2011 TIME PLOTTED => 10:08:03 AM

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. C 42289 EXP. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

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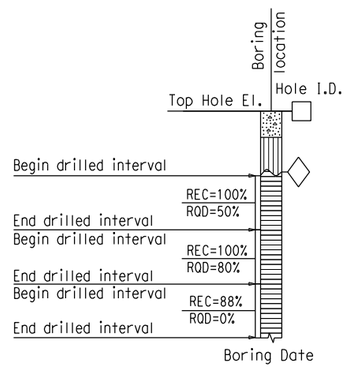
URS CORPORATION
100 WEST SAN FERNANDO STREET, SUITE 200
SAN JOSE, CA 95113

SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401

PERCENT CORE RECOVERY (REC) & ROCK QUALITY DESIGNATION (RQD)

$$REC = \frac{\sum \text{Length of the recovered core pieces (inches)}}{\text{Total length of core run (inches)}} \times 100\%$$

$$RQD = \frac{\sum \text{Length of intact core pieces} \geq 4''}{\text{Total length of core run (inches)}} \times 100\%$$



RELATIVE STRENGTH OF INTACT ROCK

Term	Uniaxial Compressive Strength (PSI)
Extremely Strong	> 30,000
Very Strong	14,500 - 30,000
Strong	7,000 - 14,500
Medium Strong	3,500 - 7,000
Weak	700 - 3,500
Very Weak	150 - 700
Extremely Weak	< 150

BEDDING SPACING

Description	Thickness / Spacing
Massive	Greater than 10 ft
Very thickly bedded	3 to 10 ft
Thickly bedded	1 to 3 ft
Moderately bedded	3-5/8" to 1 ft
Thinly bedded	1-1/4" to 3-5/8"
Very thinly bedded	3/8" to 1-1/4"
Laminated	Less than 3/8"

LEGEND OF ROCK MATERIALS

- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

ROCK HARDNESS

Description	Criteria
Extremely Hard	Specimen cannot be scratched with a pocket knife or sharp pick; can only be chipped with repeated heavy hammer blows.
Very Hard	Specimen cannot be scratched with a pocket knife or sharp pick. Breaks with repeated heavy hammer blows.
Hard	Specimen can be scratched with a pocket knife or sharp pick with difficulty (heavy pressure). Heavy hammer blows required to break specimen.
Moderately Hard	Specimen can be scratched with pocket knife or sharp pick with light or moderate pressure. Core breaks with moderate hammer pressure.
Moderately Soft	Specimen can be grooved 1/6" deep with a pocket knife or sharp pick with moderate or heavy pressure. Breaks with light hammer blow or heavy manual pressure.
Soft	Specimen can be grooved or gouged easily by a pocket knife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
Very Soft	Specimen can be readily indented, grooved or gouged with fingernail, or carved with a pocket knife. Breaks with light manual pressure.

FRACTURE DENSITY

Description	Observed Fracture Density
Unfractured	No fractures.
Very slightly fractured	Lengths greater than 3 feet.
Slightly fractured	Lengths from 1 to 3 feet with few lengths less than 1 foot or greater than 3 feet.
Moderately fractured	Lengths mostly in 4" to 1 foot range with most lengths about 8"
Intensely fractured	Lengths average from 1 to 4" with scattered fragmented intervals with lengths less than 4"
Very intensely fractured	Mostly chips and fragments with a few scattered short core lengths.

Combination descriptors (such as "Very intensely to intensely fractured") are used where equal distribution of both fracture density characteristics is present over a significant interval or exposure, or where characteristics are "in between" the descriptor definitions. Only two adjacent descriptors may be combined.

WEATHERING DESCRIPTORS FOR INTACT ROCK

Description	Diagnostic features					General Characteristics
	Chemical Weathering-Discoloration and/or oxidation		Mechanical Weathering-Grain boundary conditions (disaggregation) primarily for granitics and some coarse-grained sediments	Texture and Solutioning		
	Body of Rock	Fracture Surfaces		Texture	Solutioning	
Fresh	No discoloration, not oxidized.	No discoloration or oxidation.	No separation, intact (tight).	No change.	No solutioning.	Hammer rings when crystalline rocks are struck.
Slightly Weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull.	Minor to complete discoloration or oxidation of most surfaces.	No visible separation, intact (tight).	Preserved.	Minor leaching of some soluble minerals may be noted.	Hammer rings when crystalline rocks are struck. Body of rock not weakened.
Moderately Weathered	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are "rusty," feldspar crystals are "cloudy."	All fracture surfaces are discolored or oxidized.	Partial separation of boundaries visible.	Generally preserved.	Soluble minerals may be mostly leached.	Hammer does not ring when rock is struck. Body of rock is slightly weakened.
Intensely Weathered	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in-situ disaggregation, see grain boundary conditions.	All fracture surfaces are discolored or oxidized, surfaces friable.	Partial separation, rock is friable; in semiarid conditions granitics are disaggregated.	Texture altered by chemical disintegration (hydration, argillation).	Leaching of soluble minerals may be complete.	Dull sound when struck with hammer, usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures, or veinlets. Rock is significantly weakened.
Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay.		Complete separation of grain boundaries (disaggregated).	Resembles a soil, partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete.		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes."

Combination descriptors (such as "slightly weathered to fresh") are permissible where equal distribution of both weathering characteristics is present over significant intervals or where characteristics present are "in between" the diagnostic feature. However, combination descriptors should not be used where significant, identifiable zones can be delineated. Only two adjacent descriptors may be combined. "Very intensely weathered" is the combination descriptor for "intensely weathered to decomposed."

ROCK LEGEND

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY A. CHEUNG

CHECKED BY MANOHARAN

C. RAMBO
FIELD INVESTIGATION BY:
DATE:

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. HUANG
PROJECT ENGINEER

BRIDGE NO. 20-0284R
POST MILES 3.57

ROUTE 101N/116 SOH (REPLACE)

LOG OF TEST BORINGS 3 OF 8

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 040000077361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 4-15-10 9-24-10 11-28-10

SHEET OF

FILE => ...\20-0284R-z-ltb03.dgn

USERNAME => mdahu_thu DATE PLOTTED => 5/17/2011 TIME PLOTTED => 10:09:09 AM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. C 42289 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

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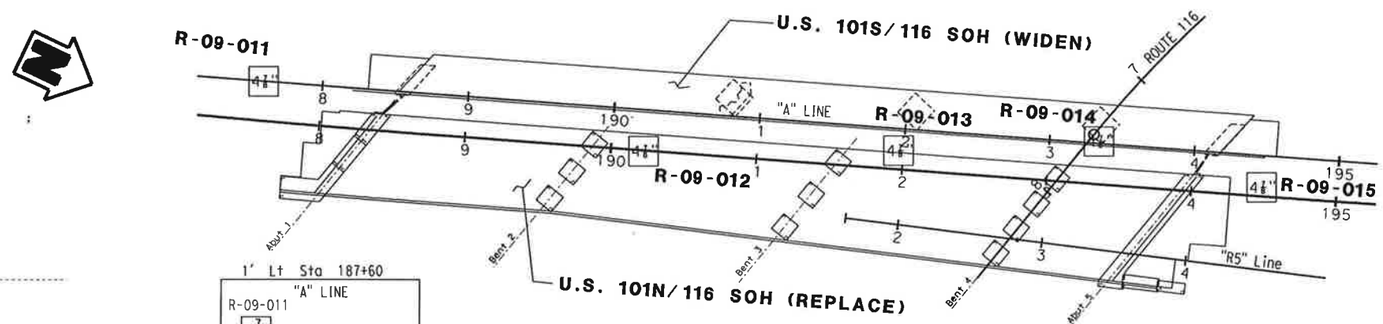
URS CORPORATION
100 WEST SAN FERNANDO STREET, SUITE 200
SAN JOSE, CA 95113

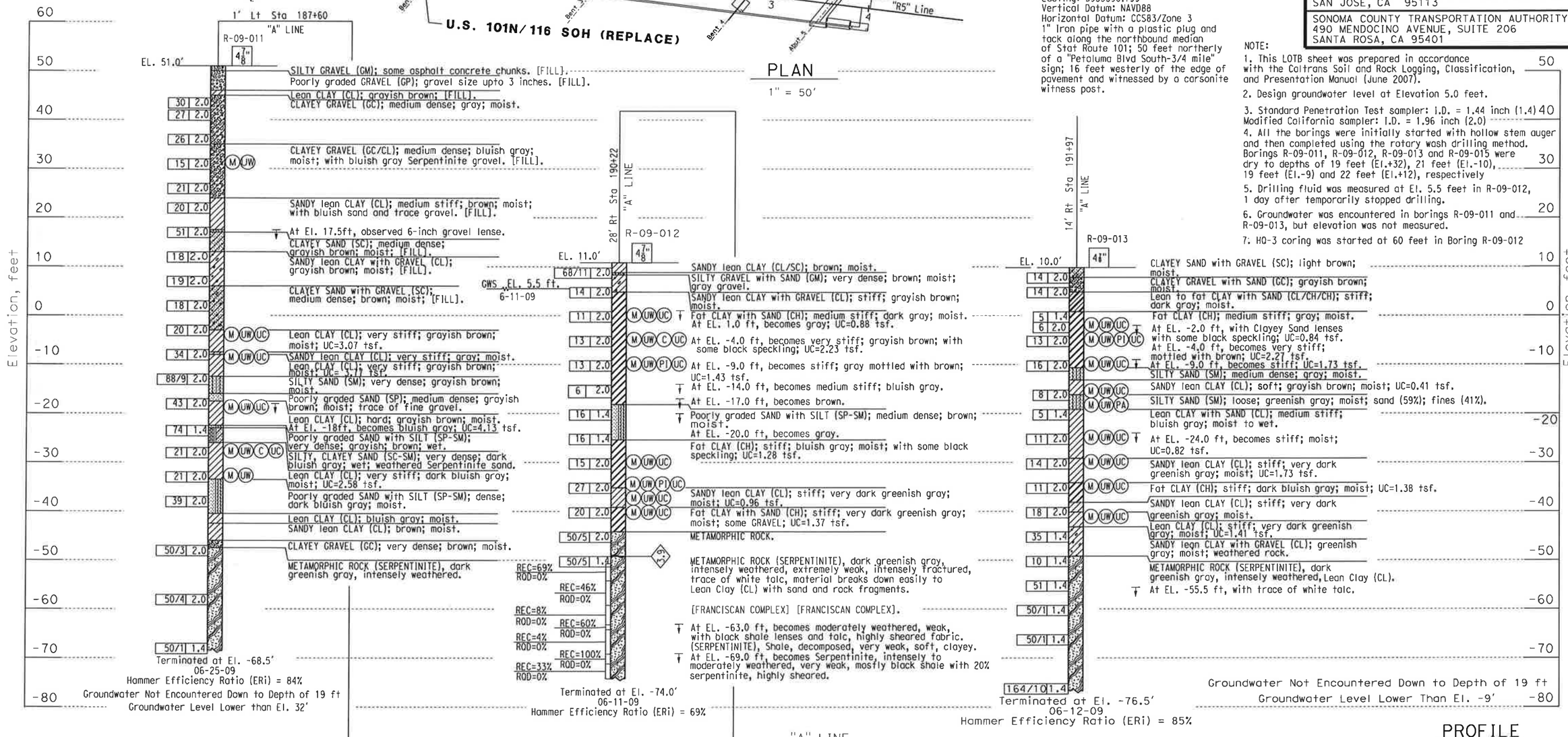
SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401

BENCH MARK:
B.M: JK121
B. M Elev.: 81.98 US Survey Feet
Northing: 2276227.207
Easting: 5954272.578
Vertical Datum: NAVD88
Horizontal Datum: CCS83/Zone 3
1" Iron pipe with a plastic plug and tack along the northbound shoulder of Stat Route 101 across from a "Sonoma-Napa-Right Lane" sign; 10.7 feet easterly of a metal beam guard rail and at top slope.
B.M: JK122
B. M Elev.: 52.65 US Survey Feet
Northing: 2277835.878
Easting: 5953598.199
Vertical Datum: NAVD88
Horizontal Datum: CCS83/Zone 3
1" Iron pipe with a plastic plug and tack along the northbound median of Stat Route 101; 50 feet northerly of a "Petaluma Blvd South-3/4 mile" sign; 16 feet westerly of the edge of pavement and witnessed by a carsonite witness post.

NOTE:
1. This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (June 2007).
2. Design groundwater level at Elevation 5.0 feet.
3. Standard Penetration Test sampler: I.D. = 1.44 inch (1.4) Modified California sampler: I.D. = 1.96 inch (2.0)
4. All the borings were initially started with hollow stem auger and then completed using the rotary wash drilling method. Borings R-09-011, R-09-012, R-09-013 and R-09-015 were dry to depths of 19 feet (El.+32), 21 feet (El.-10), 19 feet (El.-9) and 22 feet (El.+12), respectively
5. Drilling fluid was measured at El. 5.5 feet in R-09-012, 1 day after temporarily stopped drilling.
6. Groundwater was encountered in borings R-09-011 and R-09-013, but elevation was not measured.
7. HQ-3 coring was started at 60 feet in Boring R-09-012



PLAN
1" = 50'



PROFILE
Ver. 1" = 10'
Hor. 1" = 25'

DESIGN OVERSIGHT	DRAWN BY	A. CHEUNG	C. RAMBO
SIGN OFF DATE	CHECKED BY	MANOHARAN	FIELD INVESTIGATION BY: DATE:

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. HUANG
PROJECT ENGINEER

BRIDGE NO. 20-0284R
POST MILES 3.57

ROUTE 101N/116 SOH (REPLACE)
LOG OF TEST BORINGS 4 OF 8

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 040000077361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES 4-16-10 3-22-10 11-29-10

SHEET OF

FILE => ...\20-0284R-z-ltb04.dgn

USERNAME => mcdhu_thu0ABE1 PLOTTED => 5/17/2011 TIME PLOTTED => 10:10:04 AM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. C 42289 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

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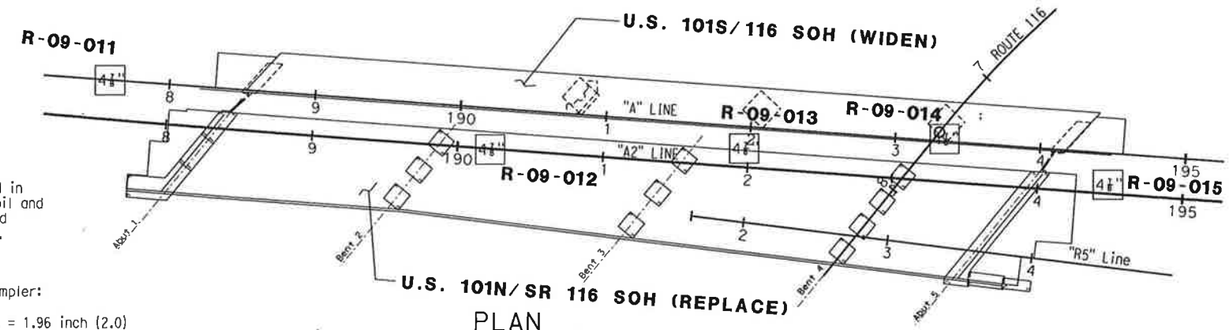
URS CORPORATION
100 WEST SAN FERNANDO STREET, SUITE 200
SAN JOSE, CA 95113

SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401

NOTE:

1. This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (June 2007).
2. Design groundwater level at Elevation 5.0 feet.
3. Standard Penetration Test sampler:
I.D. = 1.44 inch (1.4)
Modified California sampler: I.D. = 1.96 inch (2.0)
4. All the borings were initially started with hollow stem auger and then completed using the rotary wash drilling method. Borings R-09-011, R-09-012, R-09-013 and R-09-015 were dry to depths of 19 feet (El.+32), 21 feet (El.-10), 19 feet (El.-9) and 22 feet (El.+12), respectively.
5. Groundwater was encountered in boring R-09-015, but elevation was not measured.

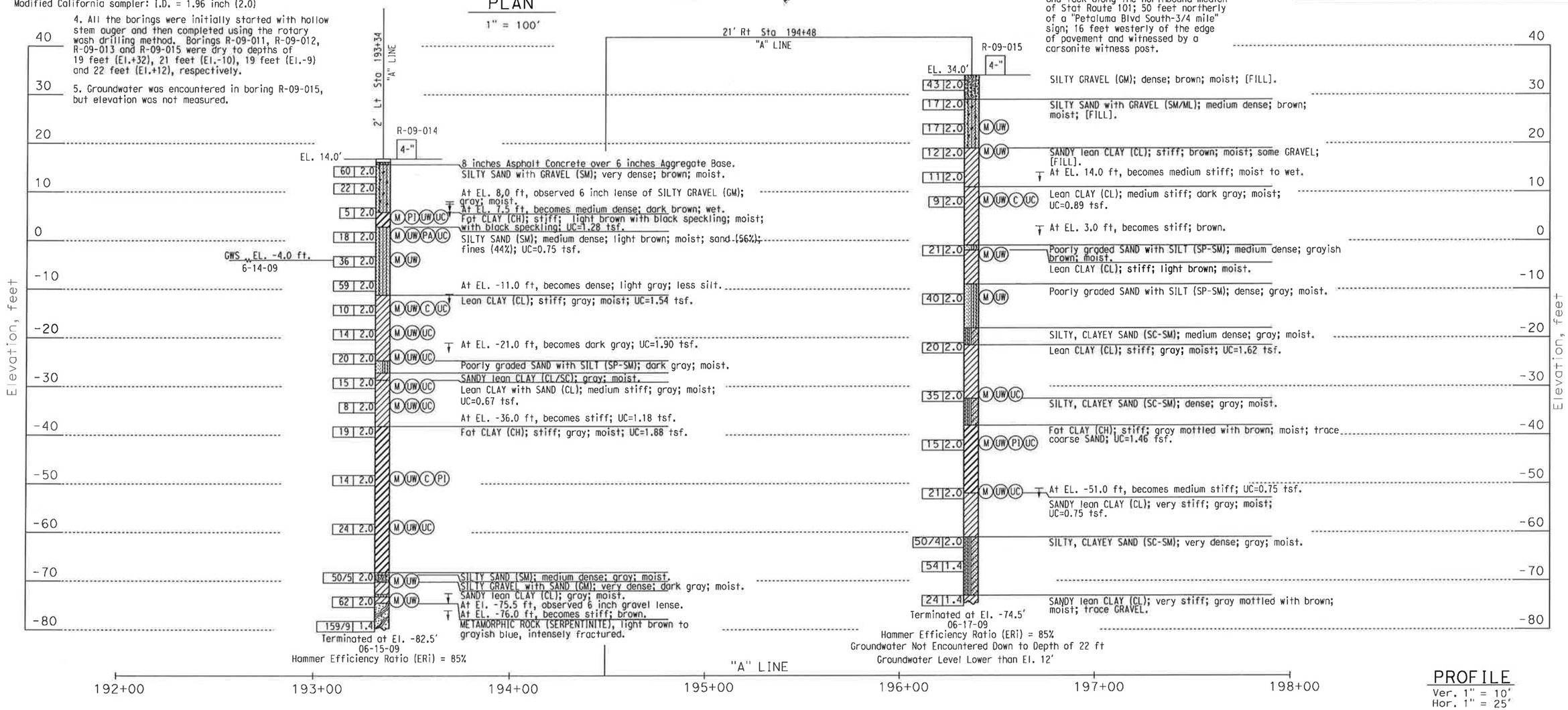


PLAN
1" = 100'

BENCH MARK:

B.M: JK121
B. M Elev.: 81.98 US Survey Feet
Northing: 2276227.207
Easting: 5954272.578
Vertical Datum: NAVD88
Horizontal Datum: CCS83/Zone 3
1" Iron pipe with a plastic plug and tack along the northbound shoulder of Stat Route 101 across from a "Sonoma-Napa-Right Lane" sign; 10.7 feet easterly of a metal beam guard rail and at top slope.

B.M: JK122
B. M Elev.: 52.65 US Survey Feet
Northing: 2277835.878
Easting: 5953598.199
Vertical Datum: NAVD88
Horizontal Datum: CCS83/Zone 3
1" Iron pipe with a plastic plug and tack along the northbound median of Stat Route 101; 50 feet northerly of a "Petaluma Blvd South-3/4 mile" sign; 16 feet westerly of the edge of pavement and witnessed by a carsonite witness post.



PROFILE
Ver. 1" = 10'
Hor. 1" = 25'

DESIGN OVERSIGHT	DRAWN BY	A. CHEUNG	C. RAMBO	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	S. HUANG PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	MANOHARAN	FIELD INVESTIGATION BY: DATE:		

BRIDGE NO. 20-0284R
POST MILES 3.57

ROUTE 101N/116 SOH (REPLACE)
LOG OF TEST BORINGS 5 OF 8

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 040000077361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 4-15-10 9-23-10 11-28-10 SHEET OF

FILE => ...\20-0284R-z-ltb05.dgn

USERNAME => mapthu_thu; DATE&TIME PLOTTED => 5/17/2011 TIME PLOTTED => 10:12:51 AM

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	120	148

GEOTECHNICAL PROFESSIONAL

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/05 — STATE OF CALIFORNIA

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PARIKH CONSULTANTS, INC.
356 SOUTH MILPITAS BLVD.
MILPITAS CA 95035

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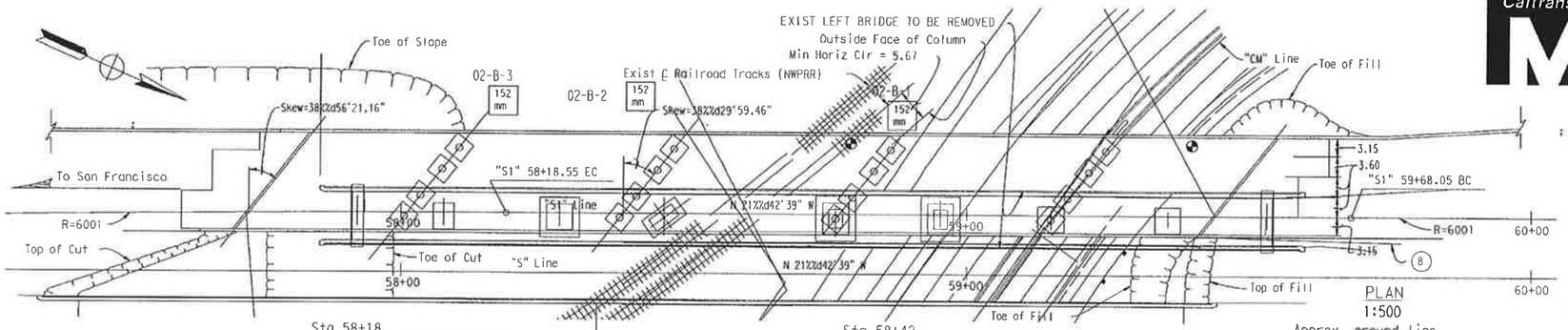
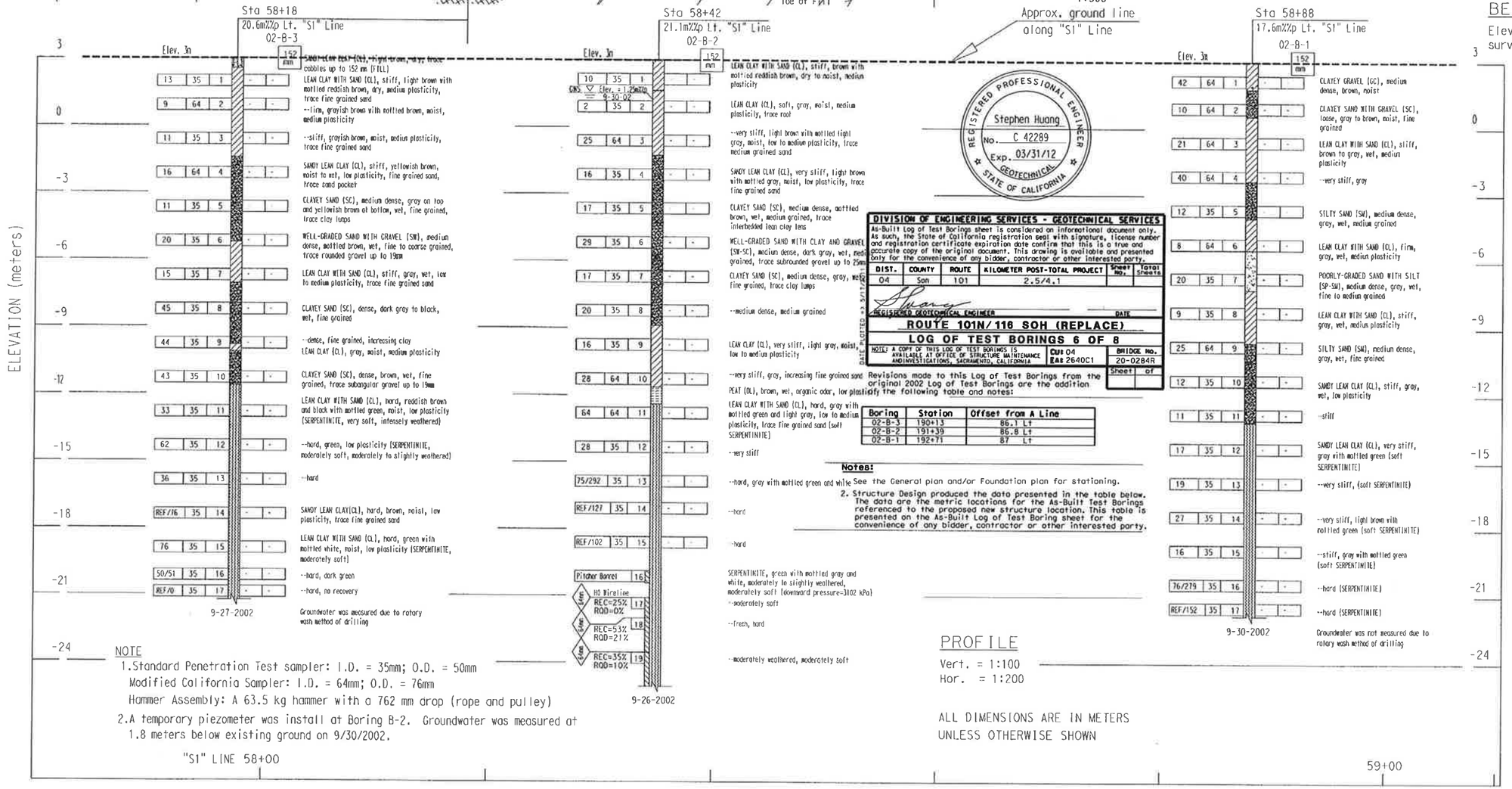


PLAN
1:500

BENCHMARK:
Elevations based on surveyed topography.



REGISTERED PROFESSIONAL ENGINEER — Stephen Huang — No. C 42289 — Exp. 03/31/12 — GEOTECHNICAL — STATE OF CALIFORNIA

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

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DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED GEOTECHNICAL ENGINEER — DATE

ROUTE 101N/116 SOH (REPLACE)

LOG OF TEST BORINGS 6 OF 8

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU# 04 EA# 2640C1 — BRIDGE No. 20-0284R — Sheet of

Revisions made to this Log of Test Borings from the original 2002 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from A Line
02-B-3	190+13	86.1 Lt
02-B-2	191+39	86.8 Lt
02-B-1	192+71	87 Lt

Notes:

1. See the General plan and/or Foundation plan for stationing.
2. Structure Design produced the data presented in the table below. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.

NOTE

1. Standard Penetration Test sampler: I.D. = 35mm; O.D. = 50mm
   Modified California Sampler: I.D. = 64mm; O.D. = 76mm
   Hammer Assembly: A 63.5 kg hammer with a 762 mm drop (rope and pulley)
2. A temporary piezometer was install at Boring B-2. Groundwater was measured at 1.8 meters below existing ground on 9/30/2002.

"S1" LINE 58+00

PROFILE
Vert. = 1:100
Hor. = 1:200

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

DESIGN OVERSIGHT	DRAWN BY	F. WANG	F. WANG/E. BHANGOO
SIGN OFF DATE	CHECKED BY	Y. DAVID WANG	FIELD INVESTIGATION BY: DATE: 9/26-9/30

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

CHRISTOPHER KOEPKE
PROJECT ENGINEER

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

CU 04276
EA 276001

101/116 SOH REPLACE
LOG OF TEST BORINGS

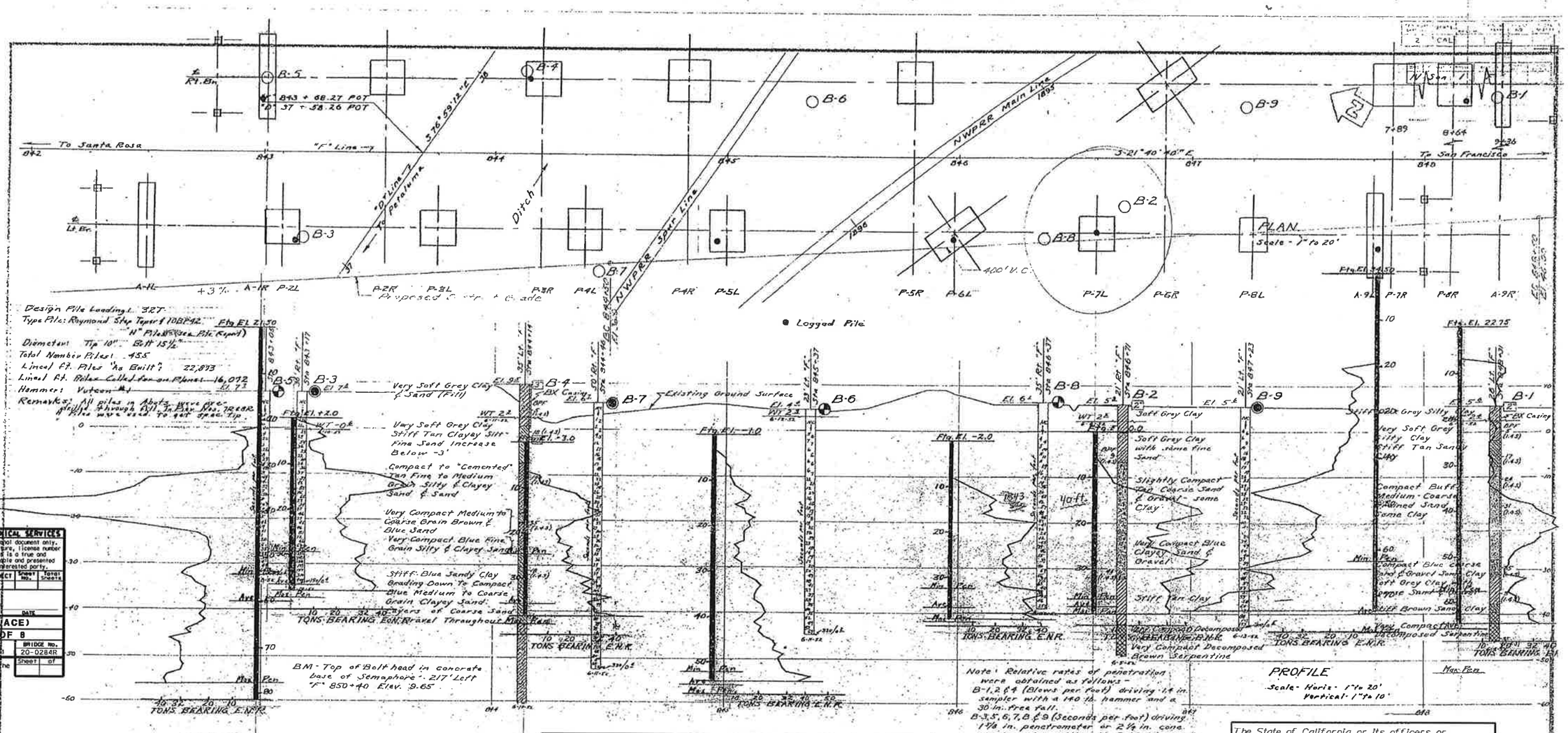
DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES (PRELIMINARY STAGE ONLY): ~~12/11/02~~ 3/01/03

SHEET 26 OF 27

GEOTECHNICAL LOG OF TEST BORINGS SHEET (METRIC) (REV 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

FILE => oslorb01.dgn



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REGISTERED PROFESSIONAL ENGINEER
Stephen Huang
No. C 42289
Exp. 03/31/12
GEOTECHNICAL
STATE OF CALIFORNIA

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

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DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	Sheet No.	Total Sheets
04	Son	101	2.5/4.1		

REGISTERED GEOTECHNICAL ENGINEER — DATE

ROUTE 101N/116 SOH (REPLACE)

LOG OF TEST BORINGS 7 OF 8

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: 04 EA: 264003

BRIDGE No. 20-0284R Sheet of

DATE PLOTTED AS 3/17/2011

Revisions made to this Log of Test Borings from the original 1952 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from A Line
B-1	188+75	39.1 Rt
B-2	189+80	38.5 Rt
B-3	190+49	13.3 Lt
B-4	190+93	37.1 Lt
B-5	191+19	28.1 Rt
B-6	192+81	28.5 Lt
B-7	193+17	31.7 Rt
B-8	194+05	14.1 Lt
B-9	194+20	31.9 Rt

Notes:

1. See the General plans and/or Foundation plan for stationing.
2. Structure Design produced the data presented in the table below. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

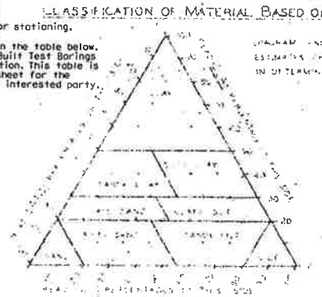

DIAGRAM AND TABLE SHOWS THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES

GRAPHING USCS CLASSIFICATION

CLASS NAME	PERCENTAGE OF SIZES PRESENT			
SAND	[illegible]	[illegible]	[illegible]	0-20
SILTY SAND	[illegible]	[illegible]	[illegible]	0-20
SANDY [illegible]	[illegible]	[illegible]	[illegible]	0-20
[illegible]	[illegible]	[illegible]	[illegible]	0-20
[illegible] SAND	[illegible]	[illegible]	[illegible]	20-40
[illegible]	[illegible]	[illegible]	[illegible]	20-40
SANDY [illegible]	[illegible]	[illegible]	[illegible]	20-40
[illegible]	[illegible]	[illegible]	[illegible]	40-60
[illegible]	[illegible]	[illegible]	[illegible]	40-60

[illegible]

LEGEND OF BORING OPERATIONS

- PLAN OF AN BORING
- 2" SAMPLED BORING
- ROTARY WASH BORING
- 1 7/8" CONED SAMPLER DRIVEN
- HAND BORING
- 2 1/4" PENETROMETER DRIVEN
- 1 1/4" SAMPLE BORING
- 2 1/2" AUGER BORING
- 6" 20" AUGER BORING
- CASING
- JET BOR
- SAMPLE
- 1 3/8" A-F
- 2 1/4" CON

THE APPROPRIATE SYMBOLS OF SIGNIFICANT METHOD OF DRILL SHOWN AT THE HAND CORNER OF THE PERTINENT BORING WHERE TOOL CHANGES WERE MADE DURING THE BORING OPERATION. SYMBOLS ARE SHOWN AT THE POINT OF CHANGES.

ROCK - R

FILL MATERIAL

CLAYEY SILT - C SI

SANDY CLAY - SC

Revisions made to this Log of Test Borings from the original 1952 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from "S" Line
B-1	57+76	7.9 m Left
B-2	58+25	6.4 m Right
B-3	59+33	10.9 m Right
B-4	59+03	10.7 m Left
B-5	59+38	9.4 m Left
B-6	58+65	7.0 m Left
B-7	50+93	15.2 m Right
B-8	58+35	10.7 m Right
B-9	58+09	6.4 m Left

Notes:

1. See the General Plan and/or Foundation Plan for Metric Stationing.
2. Structure Design produced the data presented in the table above. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.

DIVISION OF ENGINEERING SERVICES - OFFICE OF GEOTECHNICAL SERVICES

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. It does not attest to the accuracy or validity of the information contained in the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	KILOMETER POST - TOTAL PROJECT	Sheet No.	Total Sheets
04	Son	101	5.6/6.3	121	148

CERTIFIED ENGINEERING GEOLOGIST

101 / 116 SOH (REPLACE)

LOG OF TEST BORINGS

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: 04 EA: 276001

BRIDGE No. 20-0284L Sheet 27 of 27

REGISTERED GEOLOGIST
Christopher W. Koepke
No. 2207
Exp. 10-31-04
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

NOTES

THE CONTRACTOR'S ATTENTION IS DIRECTED TO SECTION 2, ARTICLE (L) OF THE STANDARD SPECIFICATIONS AND TO THE SPECIAL PROVISIONS ACCOMPANYING THIS SET OF PLANS.

CLASSIFICATION OF EARTH MATERIAL AS SHOWN ON THIS SHEET IS BASED UPON FIELD INSPECTION AND IS NOT TO BE CONSTRUED TO IMPLY MECHANICAL ANALYSIS

Alinement & Profile data was obtained from District 4 "Proj. Alinement" File #P 284(1) & PR 2822-2 [illegible]

FOR PRELIMINARY REPORT

To accompany plans dated 3-15-04

ROUTE 1/104 SEPARATION AND OVERHEAD

LOG OF TEST BORINGS

SCALE as noted — DATE [illegible]

BRIDGE No. 20-155 — DRAWING No. PR [illegible]

aslotb02.ti

DIST.	COUNTY	ROUTE	KILOMETER POSTS TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	San	101	5.6/6.3	148	148

08-05-02
REGISTERED ENGINEER CIVIL

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER S.T. Kakihara No. 42351 Exp. 3-31-04 CIVIL STATE OF CALIFORNIA

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Caltrans Metric

All Dimensions are in Meters unless otherwise shown

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. C 42289 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

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DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	Sheet No.	Total Sheets
04	San	101	2.5/4.1		

REGISTERED GEOTECHNICAL ENGINEER — DATE

ROUTE 101N/116 SOH (REPLACE)

LOG OF TEST BORINGS 8 OF 8

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: 04 EA: 2640C1

BRIDGE No. 20-0284R

Sheet ___ of ___

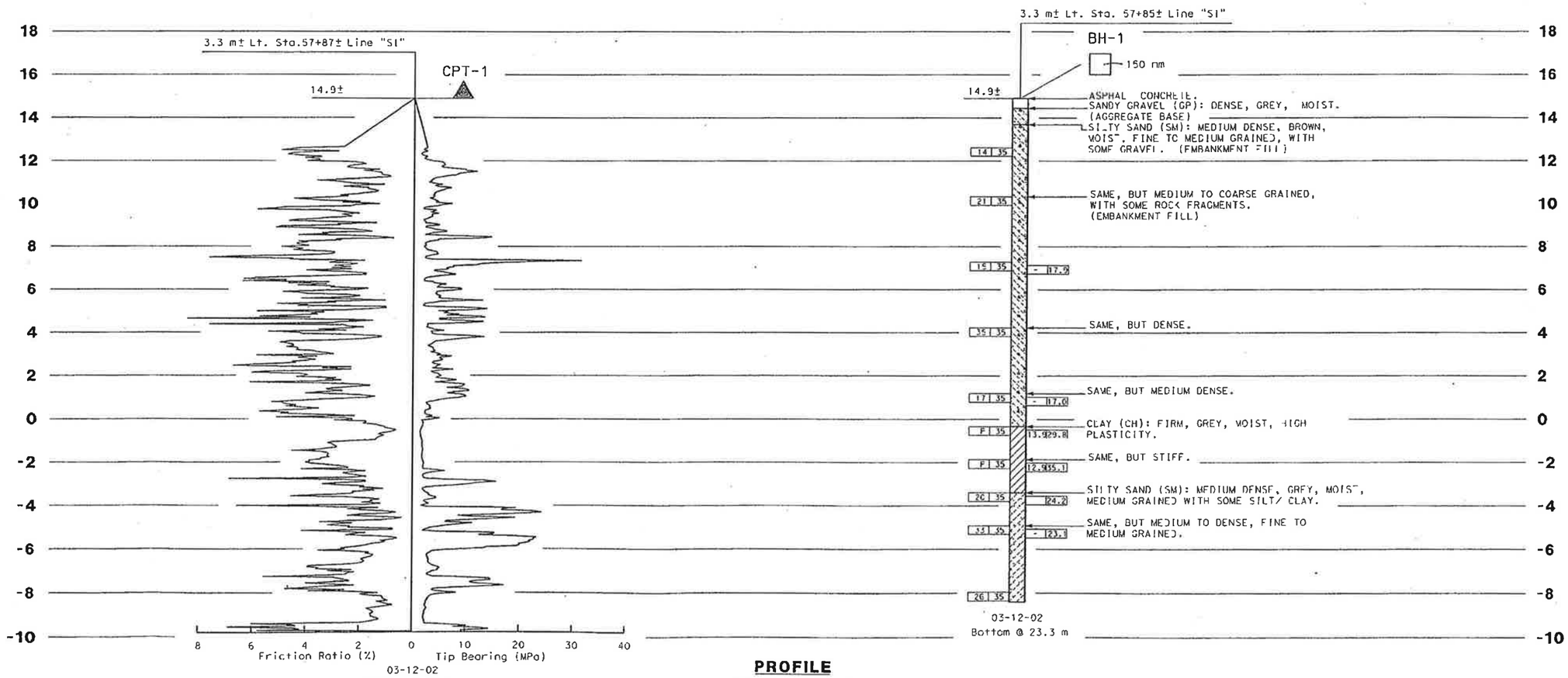
DATE PLOTTED => 5/17/2011

Revisions made to this Log of Test Borings from the original 2002 Log of Test Borings are the addition of the following table and notes:

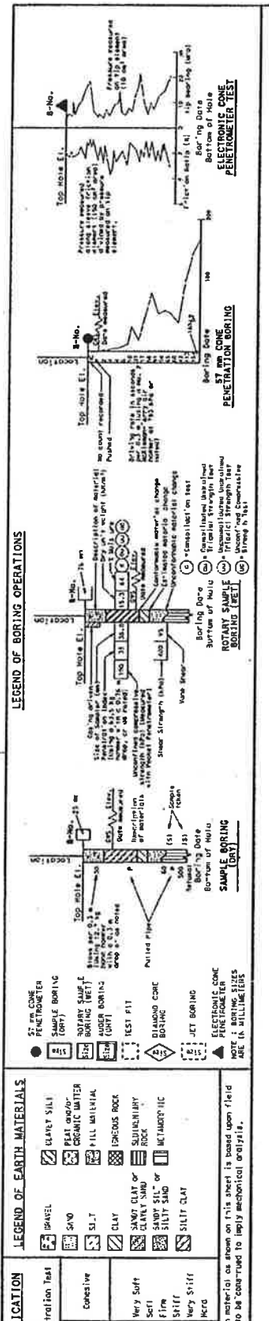
Boring	Station	Offset from A Line
CPT-1	189+28	72.8 Lt
BH-1	189+21	72.6 Lt

Notes:

1. See the General plan and Foundation plan for stationing.
2. Structure Design produced the data presented in the table below. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.



PROFILE
HORIZ. NO SCALE
VERT. 1 : 100



DIVISION OF ENGINEERING SERVICES		FIELD INVESTIGATION BY:	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	GEOTECHNICAL SERVICES OFFICE OF GEOTECHNICAL DESIGN - WEST	BRIDGE NO. / KILOMETER POST	MECHANICALLY STABILIZED EMBANKMENT
DRAWN BY	M. REYNOLDS 06/02	T. NGUYEN		CU 04276 EA 276001		LOG OF TEST BORINGS
CHECKED BY	S. KAKIHARA				DISREGARD PRINTS BEARING EARLIER REVISION DATES	SHEET 2 OF 2

(Rev 01/02)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

REVISION DATES (PRELIMINARY STAGE ONLY)

DATE PLOTTED => 19-MAR-2004
TIME PLOTTED => 10:29

USERNAME => trmariak

FIELD EXPLORATION PROGRAM

The geotechnical field investigation consisted of five borings extending to depths of 85 to 119½ feet below the existing ground surface. The explorations were performed on June 10 to 29, 2009, by WDC Exploration & Wells, Richmond, California.

The borings locations were carefully selected to obtain supplemental subsurface information to provide geotechnical design recommendations for the proposed structure while avoiding underground utilities and subsurface obstructions. Layout of the explorations was performed by representatives of URS, and exploration locations were checked for conflict with underground utilities by contacting Underground Service Alert (USA) Network. USA, in turn, alerted the various municipalities and utility companies that a subsurface investigation was to be conducted near their utilities.

After underground utility clearance, URS obtained permits from the County of Sonoma, Permit and Resource Management Department, Well and Permit Section, and coordinated with appropriate personnel to accommodate the required inspection during and following exploration at each location.

Rotary Wash Boring (R-09-011 through R-09-015)

The rotary wash borings were drilled to provide the necessary information to evaluate the subsurface stratigraphy and to allow acquisition of high-quality soil samples for laboratory testing. The borings were drilled and sampled at the location indicated on the Site and Boring Location Plan, Figure 3-2. The borings were advanced to depths of 85 to 119½ feet below existing ground surface using a truck-mounted drill rig and crawler drill rig (limited-low access) under the supervision of a URS engineer who maintained a record of all field activities, classified the soils encountered using the Unified Soil Classification System (USCS), and prepared a log of the boring.

The drilling operation proceeded carefully, with particular attention to potential interference with utilities or other buried structures. During drilling, both disturbed and undisturbed samples were obtained for identification and laboratory testing. Soil samples were generally obtained at 5-foot intervals and at changes in strata. Samples were obtained using an unlined split spoon sampler (SPT), having an outside diameter of 2 inches, and lined Modified California (MC) sampler, having an outside diameter of 2½ inches. A 140-pound hammer falling through a distance of 30 inches was used to drive the samplers. The blow count recorded on the boring logs adjacent to the sample depth is the number of blows required to drive the sampler for the final 1 foot of a maximum 18 inch drive. The Franciscan Complex bedrock in boring R-09-012 was drilled using HQ wireline coring methods below a depth of 60 feet, which provides an 2.4-inch diameter core sample. Due to the very poor rock recovery obtained in this boring and the poor quality of the shale and serpentinite rock samples that were recovered, and in order to provide more meaningful information for the foundation design, rotary wash drilling with SPT and MC drive samples were used on the remaining borings that penetrated the Franciscan Complex rocks.

One of the objectives of the field investigation was to obtain high-quality undisturbed samples for laboratory testing. Effort was made to minimize sample disturbance during sample handling and transportation. After careful withdrawal from the ground, the sample was placed upright and the ends of the sample were cleaned of disturbed soil. If possible, pocket penetrometer tests

were performed on the bottom end of cohesive soil samples. Both ends of the samples were covered with plastic caps, and carefully transported to URS' laboratory in San Jose. Rock core samples obtained from boring R-09-012 was placed in wooded core boxes, photographed and transported to URS' laboratory in San Jose.

LABORATORY TESTING PROGRAM

A laboratory testing program was carried out to determine the index and engineering properties of the major subsurface strata encountered at the site. The laboratory testing program included conventional tests to confirm the existing information on the engineering characteristics of the major strata and to refine some of the engineering parameters. These tests were performed at the URS' laboratory.

This appendix briefly describes the testing program and procedures for the different types of tests, and then presents detailed test results.

Index Tests

Index tests were performed on both cohesive and cohesionless soil samples to aid in soil classification and in correlation with other engineering parameters. Index tests included Atterberg Limits, gradation analyses, moisture content and dry density determinations. Atterberg Limits tests were performed in accordance with ASTM D 4318. Particle analyses were performed in accordance with ASTM D 422. The moisture content tests were performed in accordance with ASTM D 2216. Dry density was determined in accordance with ASTM D 2937. The locations of these tests are indicated on the Logs of Test Borings adjacent to the appropriate sample depths. The results are summarized in Table B-1.

A plasticity chart graphically presenting the results of the Atterberg Limits tests is included on Figure B-1. Grain size distribution curves are presented graphically on Figure B-2

Unconfined Compression Tests

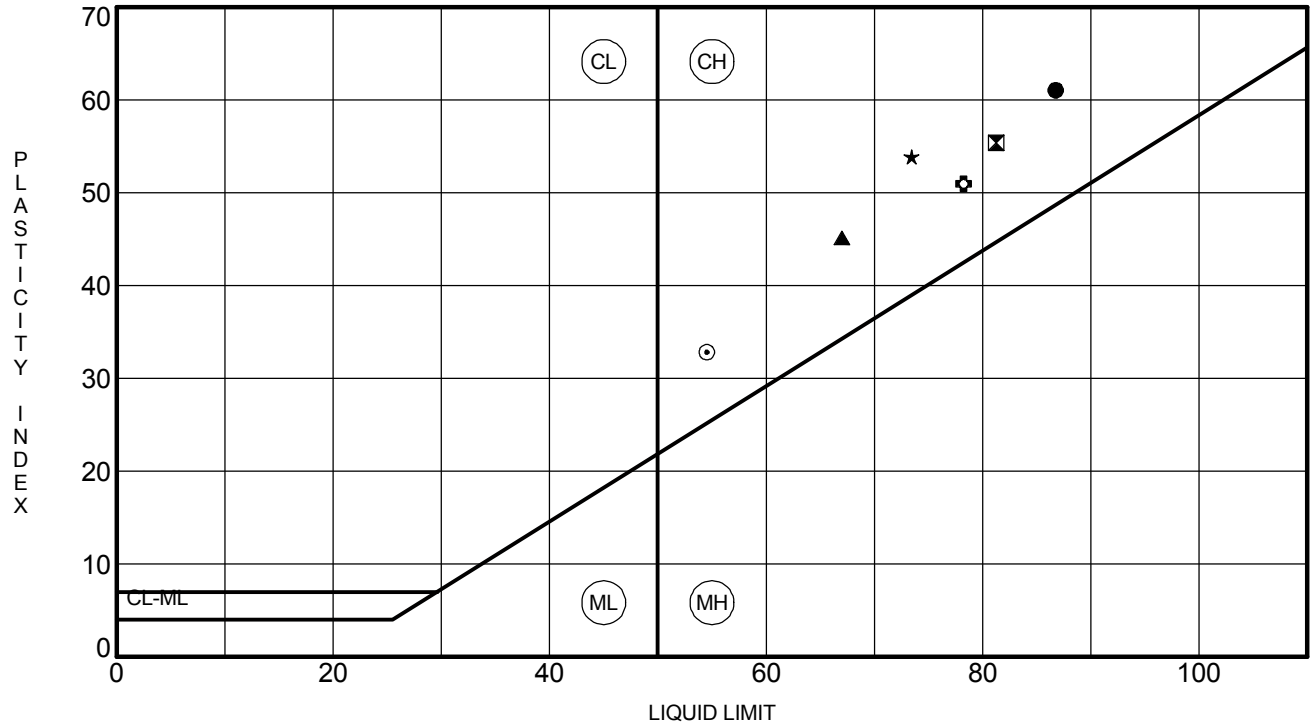
Unconfined compression tests were performed on select cohesive soil samples to assist in determining shear strength parameters. These tests were performed in accordance with ASTM D 2166. The locations of these tests are indicated on the Logs of Test Borings adjacent to the appropriate sample depths. The results are summarized in Table B-1.

Consolidation Tests

Five consolidation tests were performed on selected samples of undisturbed clayey soil to evaluate the compressibility characteristics and past geologic history. The consolidation test was performed in accordance with ASTM D 4186. Consolidation test results are graphically presented on Figure B-3 through B-7.

TABLE B-1
SUMMARY OF LABORATORY TEST RESULTS

Boring or Sample No.	Date Sampled	Station	Line	Distance from Line (feet)	Depth (feet)	Unconfined Compressive Strength (psf)	In-Place Conditions		Sieve Analysis Results (Percent Passing)							R-value	Atterberg Limits		
							Water Content (%)	Dry Unit Weight (pcf)	%<#4	%<#8	%<#16	%<#30	%<#50	%<#100	%<#200		Liquid Limit	Plastic Limit	Plasticity Index
R-09-011	23-Jun-09	187+43	A	Lt. 1	19		7.6	125											
R-09-011	23-Jun-09	187+43	A	Lt. 1	54.2	6,130	23.0	103											
R-09-011	23-Jun-09	187+43	A	Lt. 1	58.8	7,530	18.0	119											
R-09-011	23-Jun-09	187+43	A	Lt. 1	69	8,260	18.6	110											
R-09-011	23-Jun-09	187+43	A	Lt. 1	78	5,160	20.8	104											
R-09-011	23-Jun-09	187+43	A	Lt. 1	83		17.5	112											
R-09-012	10-Jun-09	190+06	A	Rt. 28	10	1,760	27.1	97											
R-09-012	10-Jun-09	190+06	A	Rt. 28	15	4,450	27.5	97											
R-09-012	10-Jun-09	190+06	A	Rt. 28	20	2,850	35.1	87									87	26	61
R-09-012	10-Jun-09	190+06	A	Rt. 28	40	2,560	29.2	94											
R-09-012	10-Jun-09	190+06	A	Rt. 28	45	2,060	45.3	77									81	26	55
R-09-012	10-Jun-09	190+06	A	Rt. 28	46.2	1,910	16.7	117											
R-09-012	10-Jun-09	190+06	A	Rt. 28	50	2,740	32.0	90											
R-09-013	11-Jun-09	191+80	A	Rt. 14	11	1,670	27.6	94											
R-09-013	11-Jun-09	191+80	A	Rt. 14	14	4,540	28.2	95									67	22	45
R-09-013	11-Jun-09	191+80	A	Rt. 14	19	3,460	25.9	97											
R-09-013	11-Jun-09	191+80	A	Rt. 14	25	820	25.1	100											
R-09-013	11-Jun-09	191+80	A	Rt. 14	26		22.9	103		100	100	100	98	66	41				
R-09-013	11-Jun-09	191+80	A	Rt. 14	34	2,430	24.6	101											
R-09-013	11-Jun-09	191+80	A	Rt. 14	39	3,450	22.1	104											
R-09-013	11-Jun-09	191+80	A	Rt. 14	44	2,750	31.1	91											
R-09-013	11-Jun-09	191+80	A	Rt. 14	50.2	2,820	23.1	103											
R-09-014	14-Jun-09	193+17	A	Lt. 2	11.2	2,550	31.3	91									73	20	54
R-09-014	14-Jun-09	193+17	A	Lt. 2	15	1,500	22.5	104		100	100	100	100	80	44				
R-09-014	14-Jun-09	193+17	A	Lt. 2	20		21.4	104											
R-09-014	14-Jun-09	193+17	A	Lt. 2	30	3,070	27.2	97											
R-09-014	14-Jun-09	193+17	A	Lt. 2	35	3,300	23.5	103											
R-09-014	14-Jun-09	193+17	A	Lt. 2	40	3,790	21.8	106											
R-09-014	14-Jun-09	193+17	A	Lt. 2	46	1,340	23.7	102											
R-09-014	14-Jun-09	193+17	A	Lt. 2	50	2,360	28.3	94											
R-09-014	14-Jun-09	193+17	A	Lt. 2	65		34.6	89									55	22	33
R-09-014	14-Jun-09	193+17	A	Lt. 2	75	3,750	28.6	94											
R-09-014	14-Jun-09	193+17	A	Lt. 2	86		13.8	115											
R-09-014	14-Jun-09	193+17	A	Lt. 2	90		46.3	70											
R-09-015	16-Jun-09	194+32	A	Rt. 21	10		7.1	128											
R-09-015	16-Jun-09	194+32	A	Rt. 21	15		11.6	123											
R-09-015	16-Jun-09	194+32	A	Rt. 21	25	1,780	22.1	100											
R-09-015	16-Jun-09	194+32	A	Rt. 21	36.2		19.1	109											
R-09-015	16-Jun-09	194+32	A	Rt. 21	45		18.5	106											
R-09-015	16-Jun-09	194+32	A	Rt. 21	65	3,230	21.0	105											
R-09-015	16-Jun-09	194+32	A	Rt. 21	75	2,910	45.5	75									78	27	51
R-09-015	16-Jun-09	194+32	A	Rt. 21	85	1,490	41.5	78											



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**R-09-012**	**20.0**	**87**	**26**	**61**		**Fat CLAY with SAND**
⊠	**R-09-012**	**45.0**	**81**	**26**	**55**		**Fat CLAY**
▲	**R-09-013**	**14.0**	**67**	**22**	**45**		**Fat CLAY**
★	**R-09-014**	**11.2**	**73**	**20**	**53**		**Fat CLAY**
⊙	**R-09-014**	**65.0**	**55**	**22**	**33**		**Fat CLAY**
✿	**R-09-015**	**75.0**	**78**	**27**	**51**		**Fat CLAY**

URS

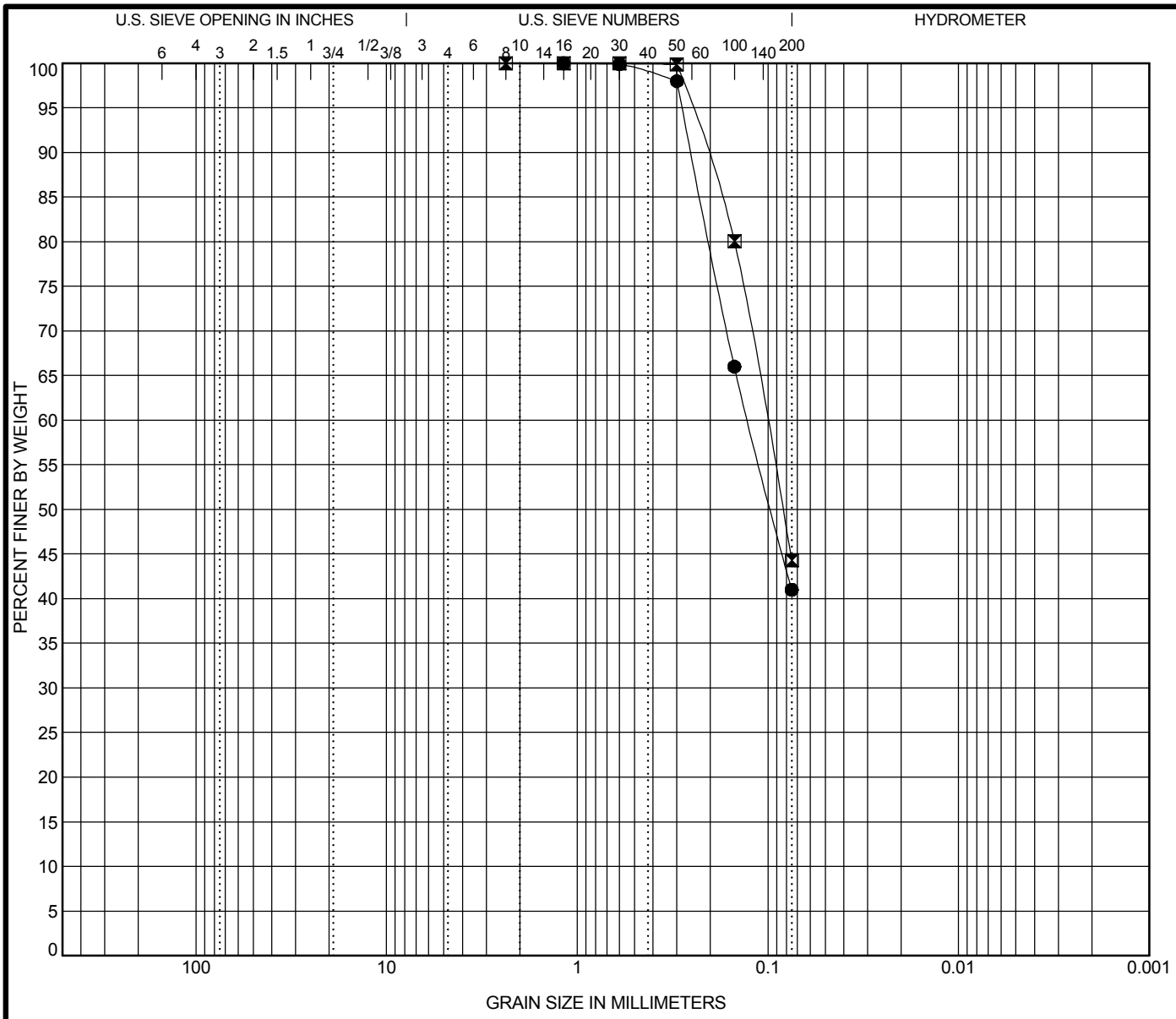
55 S. Market St, Ste 1500
San Jose, CA 95113

ATTERBERG LIMITS' RESULTS

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-1

URS ATTERBERG LIMITS 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 9/29/09



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**R-09-013**	**26.0**	**SILTY SAND**					
⧗	**R-09-014**	**15.0**	**Silty SAND (SM)**					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**R-09-013**	**26.0**	**1.18**	**0.127**			**0.0**	**59.0**	**41.0**	
⧗	**R-09-014**	**15.0**	**2.36**	**0.102**			**0.0**	**55.7**	**44.3**	

URS

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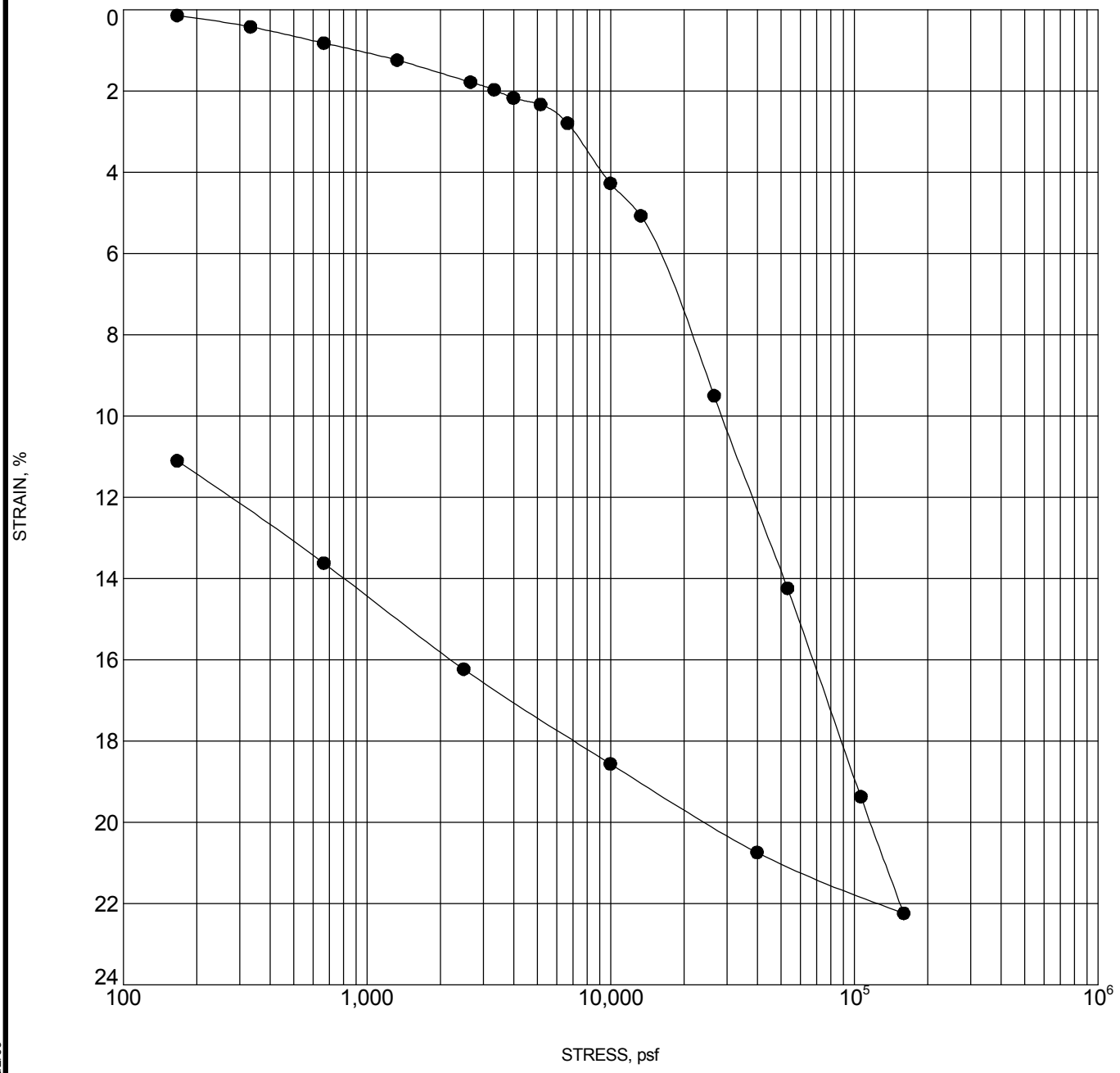
GRAIN SIZE DISTRIBUTION

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-2

URS GRAIN SIZE 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 12/2/09



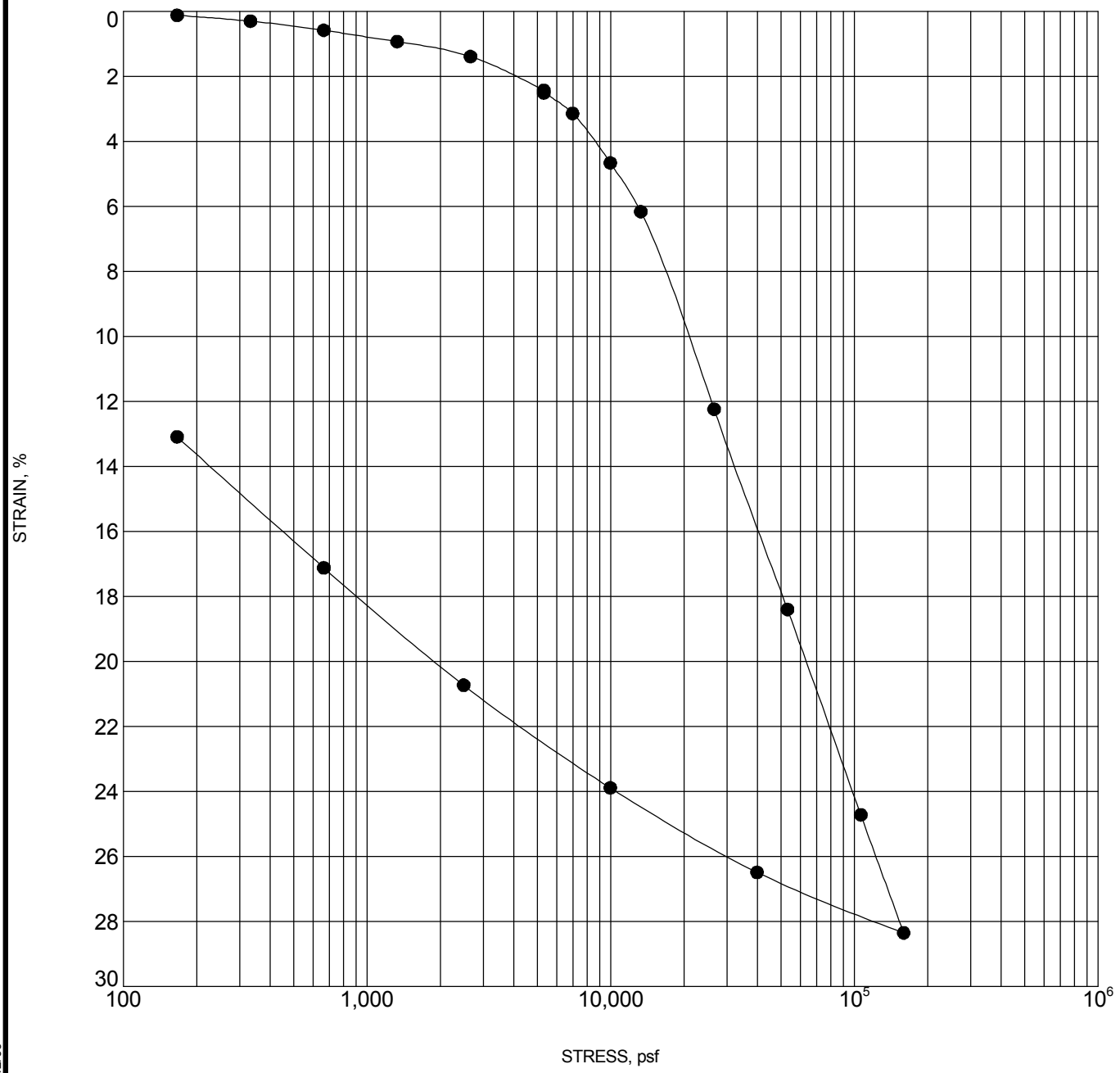
Specimen Identification			Classification	γ_d	MC%
●	**R-09-011**	**78.0**	**Lean CLAY**	**108**	**25**

CONSOLIDATION TEST

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-3

US EM CONSOL STRAIN 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 12/2/09



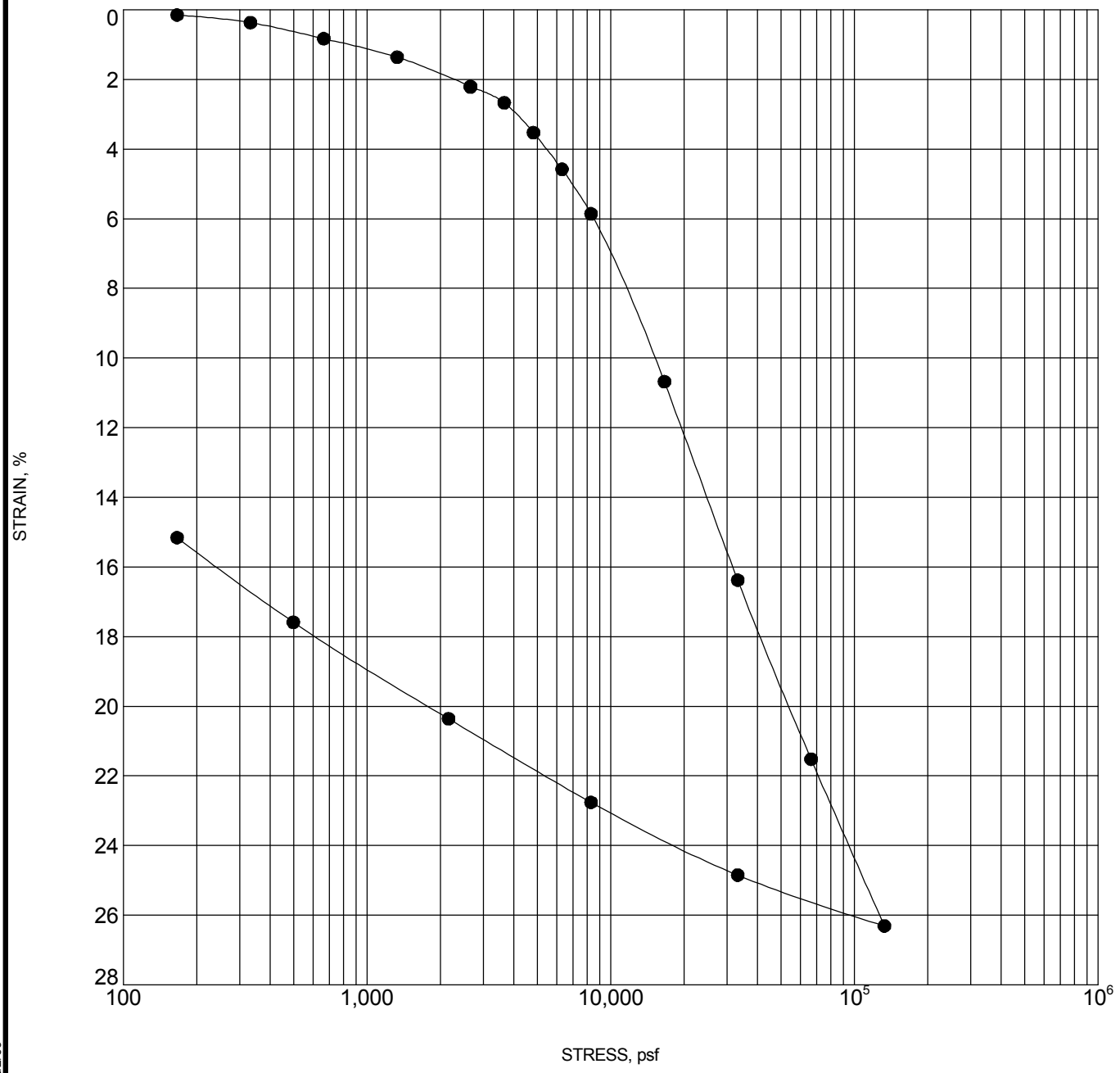
Specimen Identification			Classification	γ_d	MC%
●	**R-09-012**	**15.0**	**Fat CLAY**	**99**	**31**

CONSOLIDATION TEST

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-4

US EM CONSOL STRAIN 28645040 MSNB4PETRIVER.GPJ SNJ CT.GLB 12/2/09



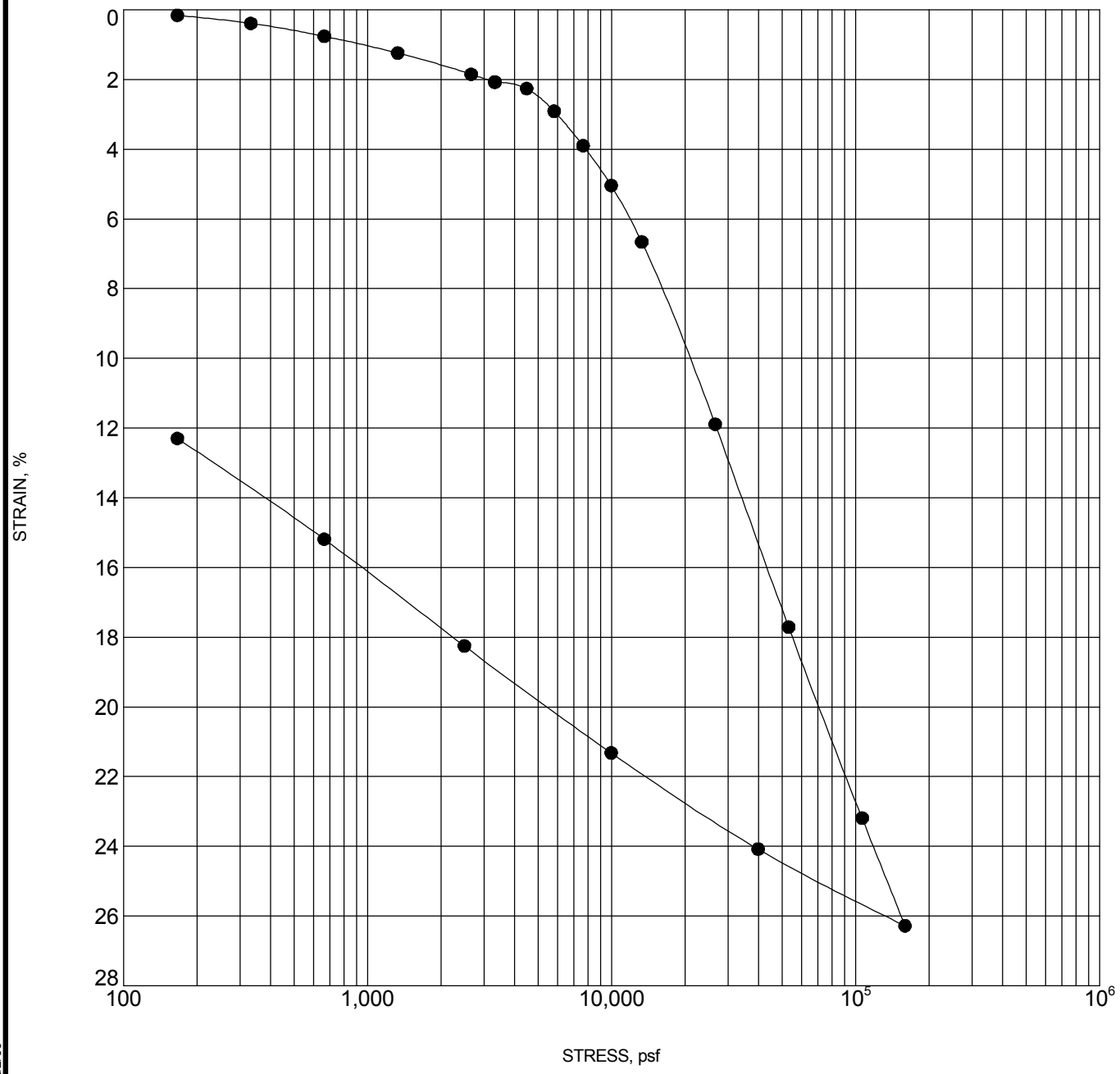
Specimen Identification			Classification	γ_d	MC%
●	**R-09-014**	**30.0**	**Lean CLAY**	**101**	**27**

CONSOLIDATION TEST

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-5

US EM CONSOL STRAIN 28645040 MSNB4PETRIVER.GPJ SNJ_CT.GLB 12/2/09



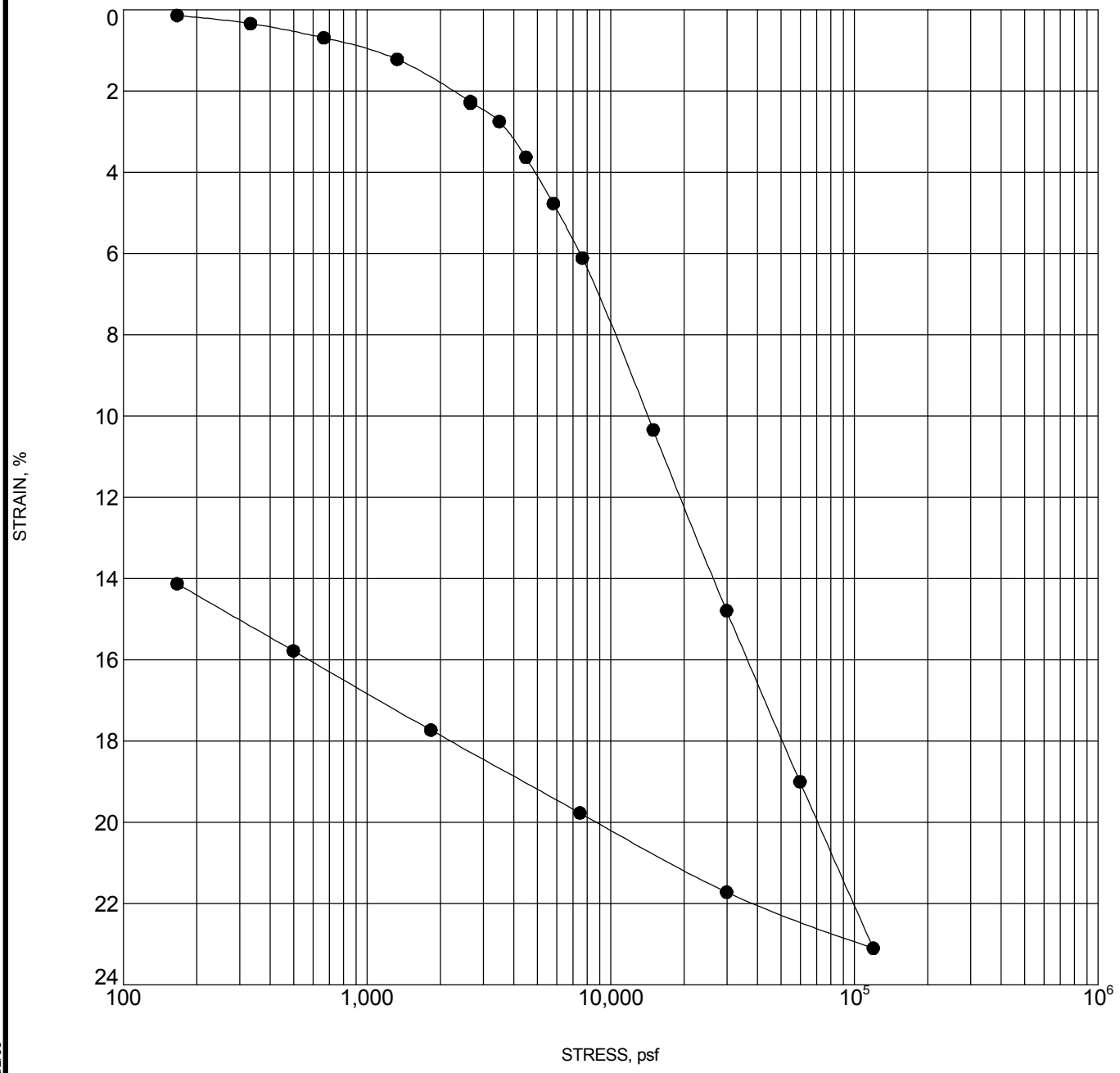
Specimen Identification			Classification	γ_d	MC%
●	**R-09-014**	**65.0**	**Fat CLAY**	**100**	**29**

CONSOLIDATION TEST

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-6

US EM CONSOL STRAIN 28645040 MSNB4PETRIVER.GPJ SNJ CT.GLB 12/2/09



Specimen Identification			Classification	γ_d	MC%
●	**R-09-015**	**25.0**	**Lean CLAY**	**101**	**25**

CONSOLIDATION TEST

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-7

US EM CONSOL STRAIN 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 12/2/09

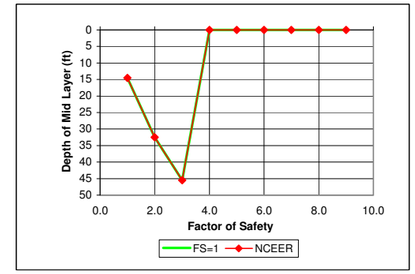
LIQUEFACTION ANALYSIS

Project	101 MSN Petaluma
Project No.	28645045
Boring No.	R-09-012

PGA =	0.6	
M_w =	7.0	
GWT during EQ	6.0	ft
Sampler:	Symbol	Corr. Factor
SPT	S	1
Mod.Cal	M	0.8
California	C	0.7
Mag. Weighting Factor($CSR_M/CSR_{M=7.5}$)		0.82

Note: Cells in Red must be input

Hammer type :	Type		C_E	Code	C_E
	Donut		0.75	1	3
	Safety		1	2	
	Auto		1.16	3	
Borehole Diameter:	(inch)	(mm)	C_B		C_B
	2.5-4.5	65-115	1	1	1
	6	150	1.05	2	
	8	200	1.15	3	
Rod Length:	(feet)	(m)	C_R		
	Default			999	
Sampling Method:	Type		Cs		
	Stand		1		
	No liners		1.2		



Note: F.S. greater than 2 is set to be equal to 2

Layer Number	Soil Type	γ_m	At Bottom of Layer: Depth		At Center of Layer: Depth		σ_o	EQ: u	EQ: σ'_o	r_d	EQ CSR	N raw	Sampler	N SPT	Fines Content	$N_{60\text{-}cs}$	C_N	C_E	C_B	C_R	C_S	$(N_1)_{60\text{-}cs}$	$CRR^*_{7.5,1tsf}$	Magnitude Scaling Factor NCEER K_m: Lower	Upper	Middle	Overburden Correction K_σ	Above GWT?	F.S.	Liquefy ?	F.S=1.0
	(USCS)	pcf	ft	m	ft	m	psf	psf	psf						%	FC< 5%	EQ					during EQ	Critical						NCEER	NCEER	
1	CL/CH	120	29.0	8.84	14.5	4.42	1,740	530	1,210	0.970	0.544			0		0.0	1.32	1.16	1.00	0.85	1.00	0		1.19	1.26	1.22	1.000	N	2.00	N	1
2	SP-SM	125	36.0	10.97	32.5	9.91	3,918	1,654	2,264	0.907	0.612	16	S	16	12	18.1	0.97	1.16	1.00	0.95	1.20	23	0.254	1.19	1.26	1.22	0.989	N	0.50	Liquef	1
3	CL/CH	120	55.0	16.76	45.5	13.87	5,495	2,465	3,030	0.799	0.565			0		0.0	0.84	1.16	1.00	1.00	1.00	0		1.19	1.26	1.22	0.944	N	2.00	N	1

Layer Number	Depth to Bot. Layer	Thickness	σ_o	u	σ'_o	r_d	$(N_1)_{60\text{-}cs}$	Liquefy ?	τ_{cyc}	$CSR_{M=7.5}$	CSR_M	Volumetric Strain**			Settl.
	ft	ft	psf	psf	psf			NCEER	psf	τ_{cyc}/σ'_o	τ_{cyc}/σ'_o		%		in
1	29.0	29.0	1,740	530	1,210	0.970	0.0	N	658.0	0.544	0.44				0.00
2	36.0	7.0	3,918	1,654	2,264	0.907	23.1	Liquef	1385.4	0.612	0.50		1.1		0.92
3	55.0	19.0	5,495	2,465	3,030	0.799	0.0	N	1711.5	0.565	0.46				0.00
4															
5															
6															
7															
8															
9															

Total Settlement (inch) = 0.9

* Note: The equation used to obtain $CRR_{7.5}$ is not valid for corrected $(N_1)_{60}$ higher than 30. According to NCEER 1997, the soil layer with corrected $(N_1)_{60}$ higher than 30 blows per foot is unlikely to be susceptible to liquefaction.

** Note: These values were obtained from a chart for estimation of volumetric strain in saturated sands based on a cyclic stress ratio and standard penetration resistance (Tokimatsu and Seed, 1987).
See figure 9.53 from "Geotechnical Earthquake Engineering" by S. Kramer.

LIQUEFACTION ANALYSIS

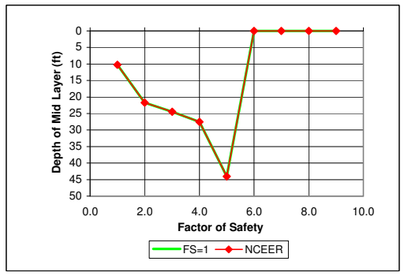
Project	101 MSN Petaluma
Project No.	28645045
Boring No.	R-09-013

PGA =	0.6	
M_w =	7.0	
GWT during EQ	5.0	ft
Sampler:	Symbol	Corr. Factor
SPT	S	1
Mod.Cal	M	0.8
California	C	0.7
Mag. Weighting Factor($CSR_M/CSR_{M=7.5}$)		0.82

Note: Cells in Red must be input

Hammer type :	Type		C_E	Code	C_E
	Donut		0.75	1	3
	Safety		1	2	
	Auto		1.41	3	
Borehole Diameter:	(inch)	(mm)	C_B		C_B
	2.5-4.5	65-115	1	1	1
	6	150	1.05	2	
	8	200	1.15	3	
Rod Length:	(feet)	(m)	C_R		
	Default			999	
Sampling Method:	Type		Cs		
	Stand		1		
	No liners		1.2		

Hammer Eff. (85/60) = 1.41



Note: F.S. greater than 2 is set to be equal to 2

Layer Number	Soil Type	γ_m	At Bottom of Layer Depth		At Center of Layer Depth		σ_o	EQ u	EQ σ'_o	r_d	EQ CSR	N raw	Sampler	N SPT	Fines Content	$N_{60\text{-}cs}$	C_N	C_E	C_B	C_R	C_S	$(N_1)_{60\text{-}cs}$	$CRR^*_{7.5,1tsf}$	Magnitude Scaling Factor NCEER K_m Lower	Upper	Middle	Overburden Correction K_σ	Above GWT?	F.S.	Liquefy ?	F.S=1.0
	(USCS)	pcf	ft	m	ft	m	psf	psf	psf						%	FC< 5%	EQ					during EQ	Critical						NCEER	NCEER	
1	CL	120	20.5	6.25	10.25	3.12	1,230	328	902	0.979	0.520			0		0.0	1.53	1.41	1.00	0.75	1.00	0		1.19	1.26	1.22	1.000	N	2.00	N	1
2	SM	125	23.0	7.01	21.8	6.63	2,616	1,045	1,571	0.952	0.618	18	M	14.4	41	22.3	1.16	1.41	1.00	0.95	1.00	35	0.459	1.19	1.26	1.22	1.000	N	2.00	N	1
3	CL	125	26.0	7.92	24.5	7.47	2,960	1,217	1,743	0.944	0.625			0		0.0	1.10	1.41	1.00	0.95	1.00	0		1.19	1.26	1.22	1.000	N	2.00	N	1
4	SM	125	29.0	8.84	27.5	8.38	3,335	1,404	1,931	0.932	0.628	10	M	8	41	14.6	1.05	1.41	1.00	0.95	1.00	20	0.222	1.19	1.26	1.22	1.000	N	0.43	Liquef	1
5	CL	120	59.0	17.98	44.0	13.41	5,323	2,434	2,889	0.814	0.585					0.0	0.86	1.41	1.00	1.00	1.00	0		1.19	1.26	1.22	0.952	N	2.00	N	1

Layer Number	Depth to Bot. Layer	Thickness	σ_o	u	σ'_o	r_d	$(N_1)_{60\text{-}cs}$	Liquefy ?	τ_{cyc}	$CSR_{M=7.5}$	CSR_M	Volumetric Strain**		Settl.
	ft	ft	psf	psf	psf			NCEER	psf	τ_{cyc}/σ'_o	τ_{cyc}/σ'_o		%	in
1	20.5	20.5	1,230	328	902	0.979	0.0	N	469.4	0.520	0.42			0.00
2	23.0	2.5	2,616	1,045	1,571	0.952	34.6	N	971.5	0.618	0.51			0.00
3	26.0	3.0	2,960	1,217	1,743	0.944	0.0	N	1089.3	0.625	0.51			0.00
4	29.0	3.0	3,335	1,404	1,931	0.932	20.5	Liquef	1212.4	0.628	0.51		1.4	0.50
5	59.0	30.0	5,323	2,434	2,889	0.814	0.0	N	1688.8	0.585	0.48			0.00
6														
7														
8														
9														

Total Settlement (inch) = 0.50

* Note: The equation used to obtain $CRR_{7.5}$ is not valid for corrected $(N_1)_{60}$ higher than 30. According to NCEER 1997, the soil layer with corrected $(N_1)_{60}$ higher than 30 blows per foot is unlikely to be susceptible to liquefaction.

** Note: These values were obtained from a chart for estimation of volumetric strain in saturated sands based on a cyclic stress ratio and standard penetration resistance (Tokimatsu and Seed, 1987).
See figure 9.53 from "Geotechnical Earthquake Engineering" by S. Kramer.

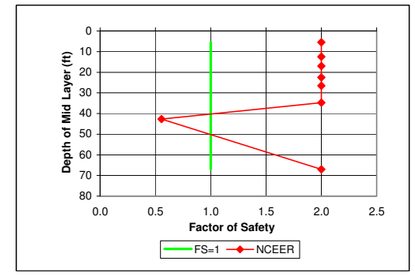
LIQUEFACTION ANALYSIS

Project	101 MSN Petaluma
Project No.	28645045
Boring No.	R-09-014

PGA =	0.6	
M_w =	7.0	
GWT during EQ	9.0	ft
Sampler:	Symbol	Corr. Factor
SPT	S	1
Mod.Cal	M	0.8
California	C	0.7
Mag. Weighting Factor($CSR_M/CSR_{M=7.5}$)		0.82

Note: Cells in Red must be input

Hammer type :	Type		C_E	Code	C_E
	Donut		0.75	1	3
	Safety		1	2	
	Auto		1.41	3	
Borehole Diameter:	(inch)	(mm)	C_B		C_B
	2.5-4.5	65-115	1	1	1
	6	150	1.05	2	
	8	200	1.15	3	
Rod Length:	(feet)	(m)	C_R		
	Default			999	
Sampling Method:	Type		Cs		
	Stand		1		
	No liners		1.2		



Note: F.S. greater than 2 is set to be equal to 2

Layer Number	Soil Type	γ_m	At Bottom of Layer Depth		At Center of Layer Depth		EQ σ_o	EQ u	EQ σ'_o	r_d	EQ CSR	N raw	Sampler	N SPT	Fines Content	$N_{60\text{-}cs}$	C_N	C_E	C_B	C_R	C_S	$(N_1)_{60\text{-}cs}$	$CRR^*_{7.5,1tsf}$	Magnitude Scaling Factor NCEER K_m Lower	Upper	Middle	Overburden Correction K_σ	Above GWT?	F.S.	Liquefy ?	F.S=1.0
	(USCS)	pcf	ft	m	ft	m	psf	psf	psf						%	FC< 5%	EQ					during EQ	Critical						NCEER	NCEER	
1	SM	125	11.0	3.35	5.5	1.68	688	0	688	0.989	0.386	41	M	32.8	25	40.9	1.75	1.41	1.00	0.75	1.00	76	0.459	1.19	1.26	1.22	1.000	Y	2.00	N	1
2	CL	120	14.0	4.27	12.5	3.81	1,555	218	1,337	0.974	0.442					0.0	1.26	1.41	1.00	0.75	1.00	0		1.19	1.26	1.22	1.000	N	2.00	N	1
3	SM	125	20.0	6.10	17.0	5.18	2,110	499	1,611	0.964	0.493	18	M	14.4	44	22.3	1.15	1.41	1.00	0.85	1.00	31	0.459	1.19	1.26	1.22	1.000	N	2.00	N	1
4	SM	125	25.0	7.62	22.5	6.86	2,798	842	1,955	0.950	0.530	36	M	28.8	44	39.6	1.04	1.41	1.00	0.95	1.00	55	0.459	1.19	1.26	1.22	1.000	N	2.00	N	1
5	SM	130	28.0	8.53	26.5	8.08	3,305	1,092	2,213	0.936	0.545	59	M	47.2	44	61.6	0.98	1.41	1.00	0.95	1.00	81	0.459	1.19	1.26	1.22	0.992	N	2.00	N	1
6	CL	125	41.5	12.65	34.8	10.59	4,344	1,607	2,737	0.892	0.552			0		0.0	0.88	1.41	1.00	1.00	1.00	0		1.19	1.26	1.22	0.961	N	2.00	N	1
7	SP-SM	130	44.0	13.41	42.8	13.03	5,350	2,106	3,244	0.826	0.531	24	M	19.2	10	20.5	0.81	1.41	1.00	1.00	1.00	23	0.258	1.19	1.26	1.22	0.932	N	0.55	Liquef	1
8	CL	120	90.0	27.43	67.0	20.42	8,273	3,619	4,653	0.609	0.422			0		0.0	0.67	1.41	1.00	1.00	1.00	0		1.19	1.26	1.22	0.862	N	2.00	N	1

Layer Number	Depth to Bot. Layer	Thickness	σ_o	u	σ'_o	r_d	$(N_1)_{60\text{-}cs}$	Liquefy ?	τ_{cyc}	$CSR_{M=7.5}$	CSR_M	Volumetric Strain**			Settl.
	ft	ft	psf	psf	psf			NCEER	psf	τ_{cyc}/σ'_o	τ_{cyc}/σ'_o		%		in
1	11.0	11.0	688	0	688	0.989	75.8	N	265.2	0.386	0.32				0.00
2	14.0	3.0	1,555	218	1,337	0.974	0.0	N	590.6	0.442	0.36				0.00
3	20.0	6.0	2,110	499	1,611	0.964	30.6	N	793.4	0.493	0.40				0.00
4	25.0	5.0	2,798	842	1,955	0.950	55.1	N	1036.4	0.530	0.43				0.00
5	28.0	3.0	3,305	1,092	2,213	0.936	80.7	N	1206.8	0.545	0.45				0.00
6	41.5	13.5	4,344	1,607	2,737	0.892	0.0	N	1511.7	0.552	0.45				0.00
7	44.0	2.5	5,350	2,106	3,244	0.826	23.3	Liquef	1722.8	0.531	0.43		1.2		0.36
8	90.0	46.0	8,273	3,619	4,653	0.609	0.0	N	1965.5	0.422	0.35				0.00

Total Settlement (inch) = 0.4

* Note: The equation used to obtain $CRR_{7.5}$ is not valid for corrected $(N_1)_{60}$ higher than 30. According to NCEER 1997, the soil layer with corrected $(N_1)_{60}$ higher than 30 blows per foot is unlikely to be susceptible to liquefaction.

** Note: These values were obtained from a chart for estimation of volumetric strain in saturated sands based on a cyclic stress ratio and standard penetration resistance (Tokimatsu and Seed, 1987).
See figure 9.53 from "Geotechnical Earthquake Engineering" by S. Kramer.

LIQUEFACTION ANALYSIS

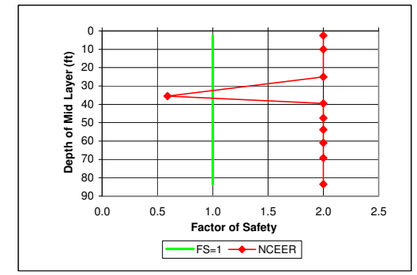
Project	101 MSN Petaluma
Project No.	28645045
Boring No.	R-09-015

PGA =	0.6	
M_w =	7.0	
GWT during EQ	29.0	ft
Sampler:	Symbol	Corr. Factor
SPT	S	1
Mod.Cal	M	0.8
California	C	0.7
Mag. Weighting Factor($CSR_M/CSR_{M=7.5}$)		0.82

Note: Cells in Red must be input

Hammer type :	Type		C_E	Code	C_E
	Donut		0.75	1	3
	Safety		1	2	
	Auto		1.41	3	
Borehole Diameter:	(inch)	(mm)	C_B		C_B
	2.5-4.5	65-115	1	1	1
	6	150	1.05	2	
	8	200	1.15	3	
Rod Length:	(feet)	(m)	C_R		
	Default			999	
Sampling Method:	Type		Cs		
	Stand		1		
	No liners		1.2		

Hammer Efficiency
85%
(85/60 = 1.41)



Note: F.S. greater than 2 is set to be equal to 2

Layer Number	Soil Type	γ_m	At Bottom of Layer Depth		At Center of Layer Depth		σ_o	EQ u	EQ σ'_o	r_d	EQ CSR	N raw	Sampler	N SPT	Fines Content	N_{60-cs}	C_N	C_E	C_B	C_R	C_S	$(N_1)_{60-cs}$	CRR*$_{7.5,1tsf}$	Magnitude Scaling Factor NCEER K_m Lower	Upper	Middle	Overburden Correction K_σ	Above GWT?	F.S.	Liquefy ?	F.S=1.0
	(USCS)	pcf	ft	m	ft	m	psf	psf	psf						%	FC< 5%	EQ					during EQ	Critical						NCEER	NCEER	
1	GM	135	5.0	1.52	2.5	0.76	338	0	338	0.996	0.388	43	M	34.4	45	46.3	2.00	1.41	1.00	0.75	1.00	98	0.459	1.19	1.26	1.22	1.000	Y	2.00	N	1
2	SM	135	15.0	4.57	10.0	3.05	1,350	0	1,350	0.979	0.382	17	M	13.6	25	19.5	1.25	1.41	1.00	0.75	1.00	26	0.295	1.19	1.26	1.22	1.000	Y	2.00	N	1
3	CL	120	35.0	10.67	25.0	7.62	3,225	0	3,225	0.942	0.367					0.0	0.81	1.41	1.00	0.95	1.00	0		1.19	1.26	1.22	0.933	Y	2.00	N	1
4	SP-SM	130	36.0	10.97	35.5	10.82	4,490	406	4,084	0.887	0.380	22	M	17.6	10	18.8	0.72	1.41	1.00	1.00	1.00	19	0.206	1.19	1.26	1.22	0.889	N	0.59	Liquef	1
5	CL	130	43.0	13.11	39.5	12.04	5,010	655	4,355	0.855	0.384					0.0	0.70	1.41	1.00	1.00	1.00	0		1.19	1.26	1.22	0.876	N	2.00	N	1
6	SP-SM	125	52.0	15.85	47.5	14.48	6,028	1,154	4,873	0.778	0.375	40	M	32	10	33.6	0.66	1.41	1.00	1.00	1.00	31	0.459	1.19	1.26	1.22	0.852	N	2.00	N	1
7	SC-SM	125	55.5	16.92	53.8	16.38	6,809	1,544	5,264	0.715	0.361	30	M	24	40	33.8	0.63	1.41	1.00	1.00	1.00	30	0.459	1.19	1.26	1.22	0.835	N	2.00	N	1
8	CL	125	66.5	20.27	61.0	18.59	7,715	1,997	5,718	0.651	0.343			0		0.0	0.61	1.41	1.00	1.00	1.00	0		1.19	1.26	1.22	0.817	N	2.00	N	1
9	SC-SM	125	72.0	21.95	69.3	21.11	8,746	2,512	6,235	0.596	0.326	35	M	28	40	38.6	0.58	1.41	1.00	1.00	1.00	32	0.459	1.19	1.26	1.22	0.797	N	2.00	N	1
10	CL	110	95.0	28.96	83.5	25.45	10,355	3,401	6,954	0.537	0.312					0.0	0.55	1.41	1.00	1.00	1.00	0		1.19	1.26	1.22	0.772	N	2.00	N	1

Layer Number	Depth to Bot. Layer	Thickness	σ_o	u	σ'_o	r_d	$(N_1)_{60-cs}$	Liquefy ?	τ_{cyc}	$CSR_{M=7.5}$	CSR_M	Volumetric Strain**			Settl.
	ft	ft	psf	psf	psf			NCEER	psf	τ_{cyc}/σ'_o	τ_{cyc}/σ'_o		%		in
1	5.0	5.0	338	0	338	0.996	97.9	N	131.1	0.388	0.32				0.00
2	15.0	10.0	1,350	0	1,350	0.979	25.8	N	515.5	0.382	0.31				0.00
3	35.0	20.0	3,225	0	3,225	0.942	0.0	N	1184.6	0.367	0.30				0.00
4	36.0	1.0	4,490	406	4,084	0.887	19.1	Liquef	1553.4	0.380	0.31		1.2		0.14
5	43.0	7.0	5,010	655	4,355	0.855	0.0	N	1671.4	0.384	0.31				0.00
6	52.0	9.0	6,028	1,154	4,873	0.778	31.2	N	1829.5	0.375	0.31				0.00
7	55.5	3.5	6,809	1,544	5,264	0.715	30.2	N	1899.4	0.361	0.29				0.00
8	66.5	11.0	7,715	1,997	5,718	0.651	0.0	N	1959.5	0.343	0.28				0.00
9	72.0	5.5	8,746	2,512	6,235	0.596	31.7	N	2033.0	0.326	0.27				0.00
10	95.0	23.0	10,355	3,401	6,954	0.537	0.0	N	2167.9	0.312	0.25				0.00

Total Settlement (inch) = 0.14

* Note: The equation used to obtain $CRR_{7.5}$ is not valid for corrected $(N_1)_{60}$ higher than 30. According to NCEER 1997, the soil layer with corrected $(N_1)_{60}$ higher than 30 blows per foot is unlikely to be susceptible to liquefaction.

** Note: These values were obtained from a chart for estimation of volumetric strain in saturated sands based on a cyclic stress ratio and standard penetration resistance (Tokimatsu and Seed, 1987).
See figure 9.53 from "Geotechnical Earthquake Engineering" by S. Kramer.

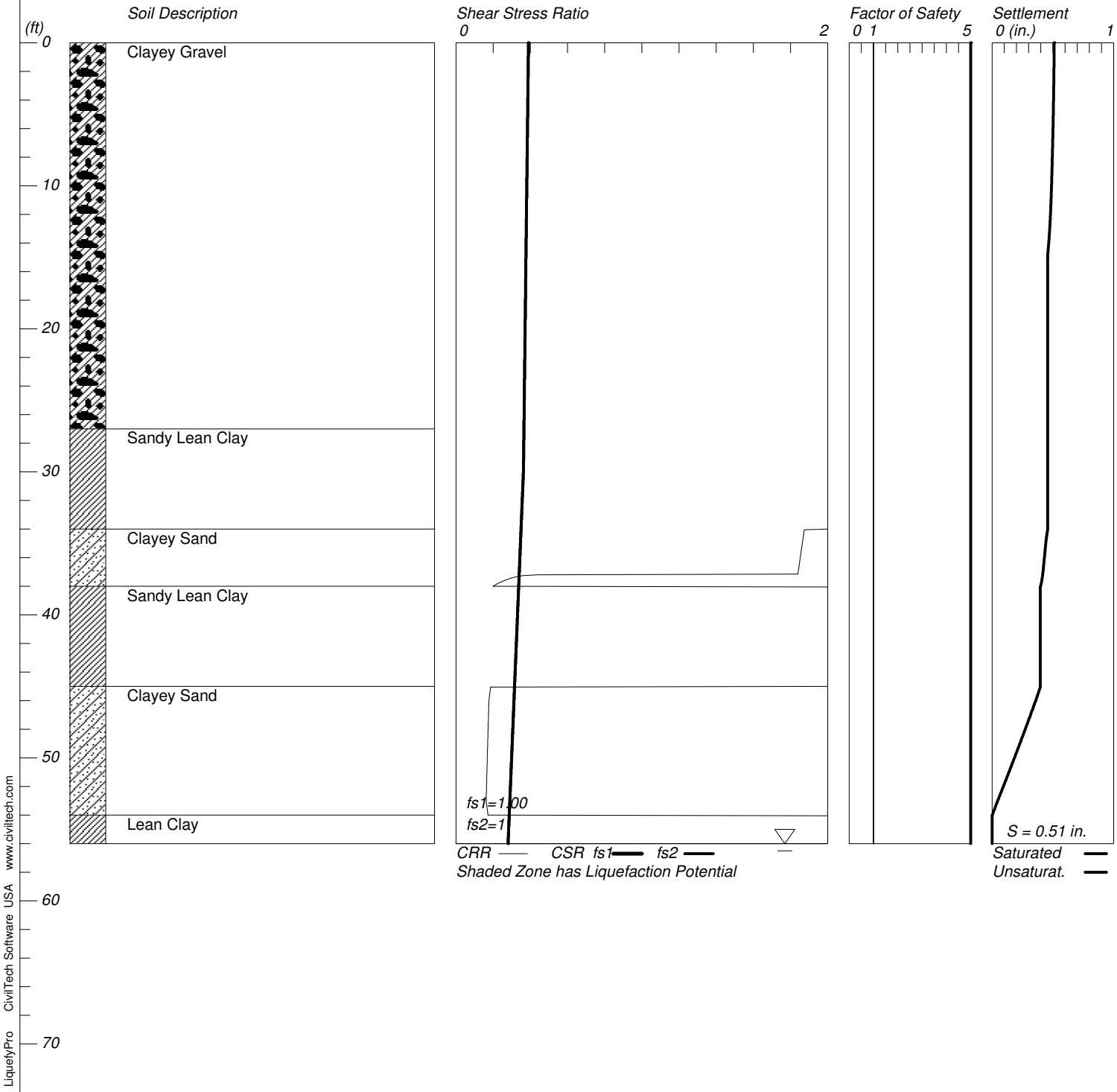
Results of Seismic Compaction Analysis

LIQUEFACTION ANALYSIS

101 MSN-B4 Petaluma

Hole No.=R-09-011 Water Depth=56 ft Surface Elev.=51

Magnitude=7
Acceleration=0.6g



URS

US101/116

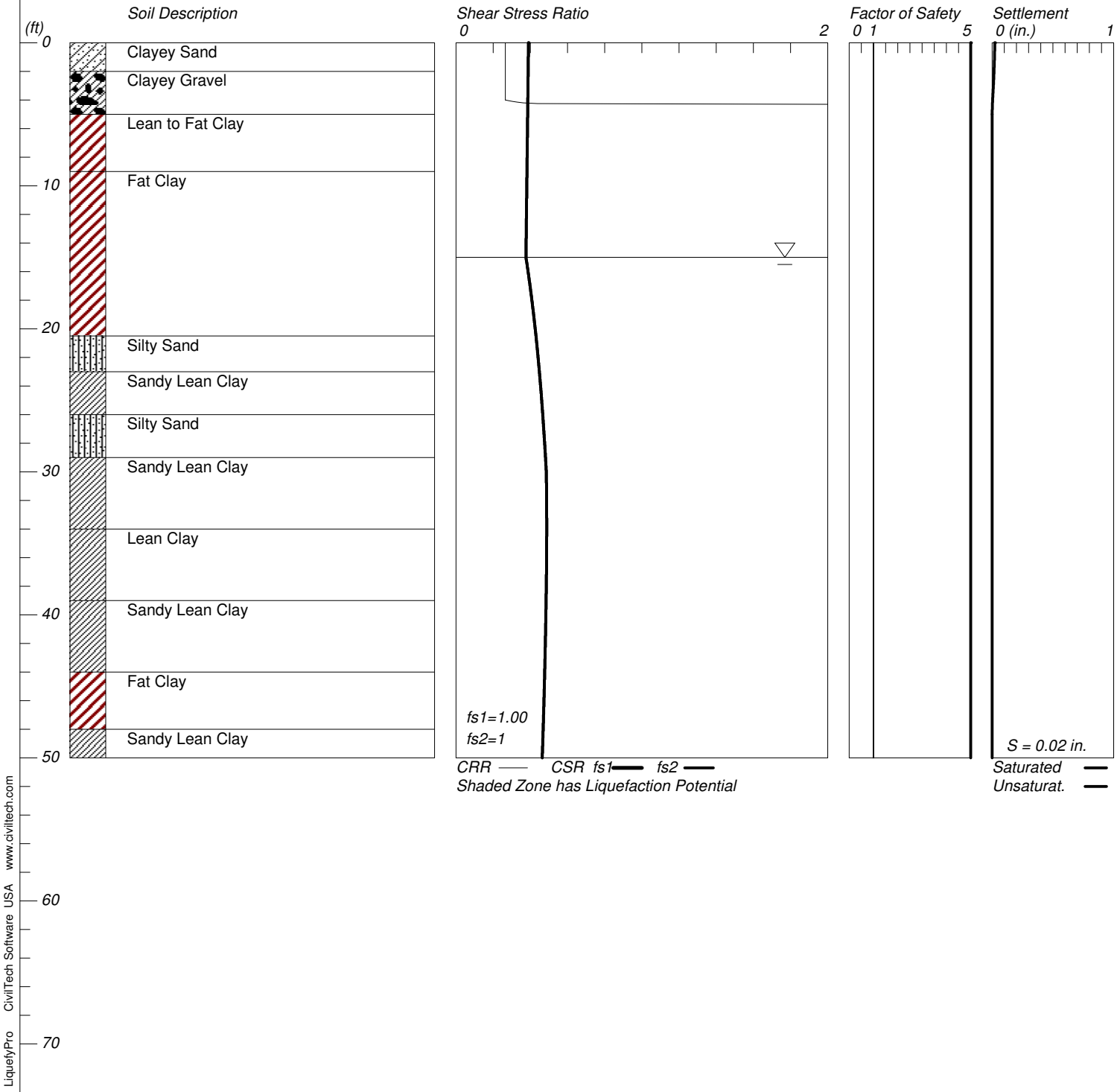
FigureC-1

LIQUEFACTION ANALYSIS

101 MSN-B4 Petaluma

Hole No.=R-09-013 Water Depth=15 ft Surface Elev.=10

Magnitude=7
Acceleration=0.6g



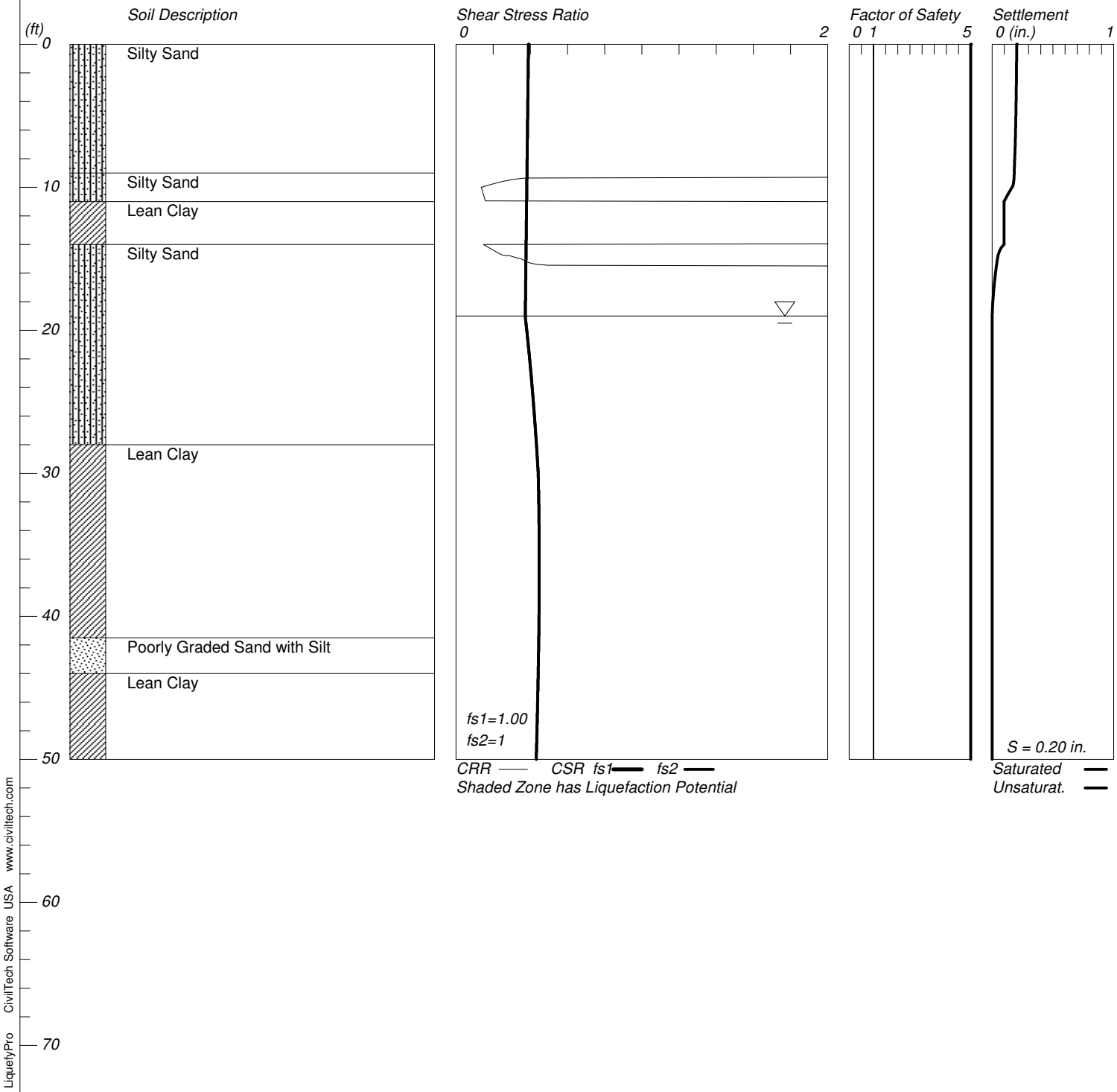
LiquefyPro CivilTech Software USA www.civiltech.com

LIQUEFACTION ANALYSIS

101 MSN-B4 Petaluma

Hole No.=R-09-014 Water Depth=19 ft Surface Elev.=14

Magnitude=7
Acceleration=0.6g



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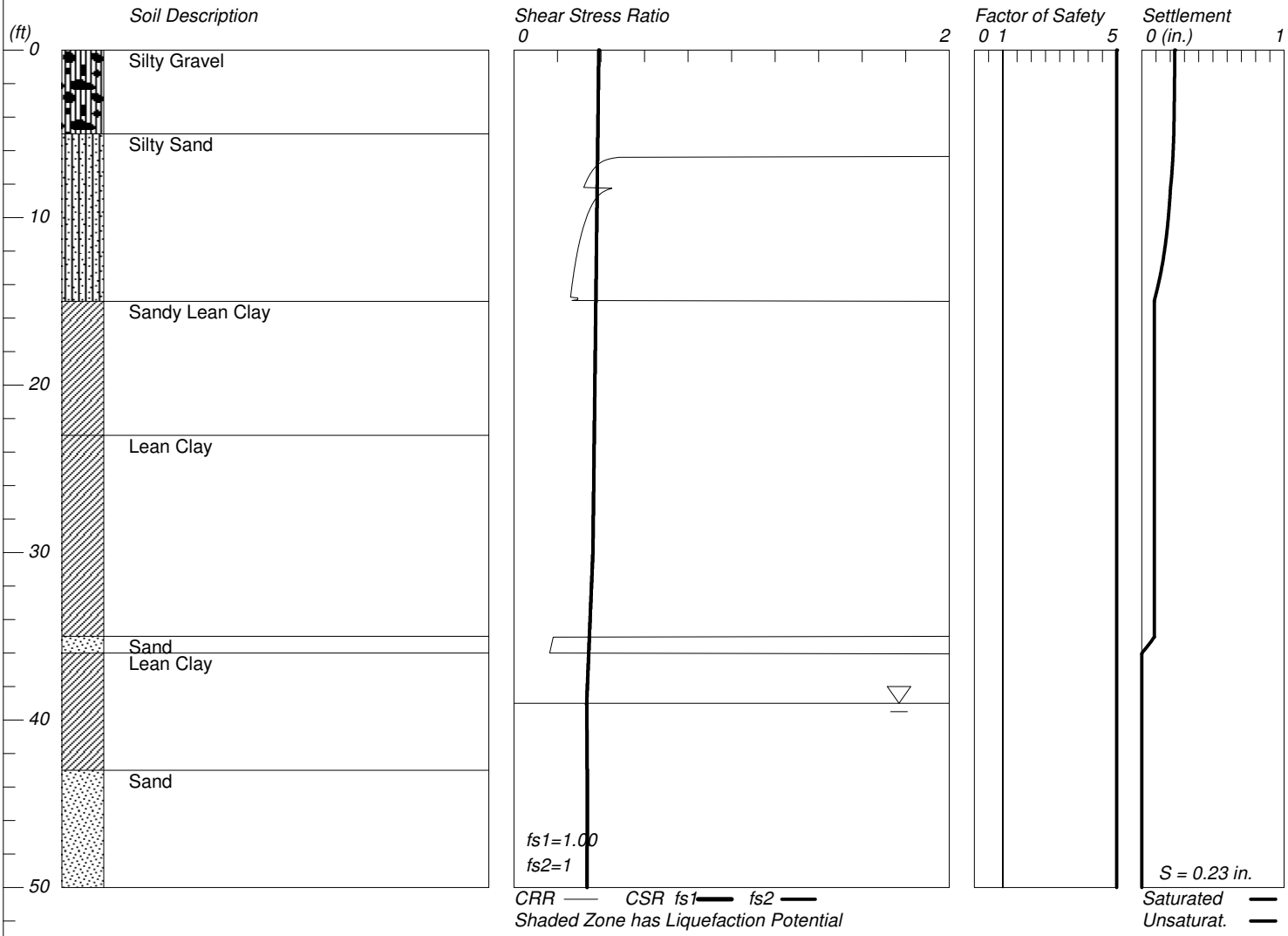
LIQUEFACTION ANALYSIS

101 MSN-B4 Petaluma

Hole No.=R-09-015 Water Depth=39 ft Surface Elev.=34

Magnitude=7
Acceleration=0.6g



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US 101 MARIN SONOMA NARROW HOV WIDENING PROJECT

IN AND NEAR PETALUMA
FROM 0.4 MILE SOUTH OF PETALUMA BOULEVARD SOUTH OVERCROSSING TO 0.2 MILE NORTH OF CAULFIELD LANE OVERCROSSING

Proposed

NORTHBOUND US 101 / SR 116 SEPARATION FOUNDATION INVESTIGATION REPORT

Prepared for:

URS Corporation
55 South Market Street, Suite 1500
San Jose, CA 95113

Prepared by:

V&A
155 Grand Avenue, Suite 700
Oakland, CA 94612

January 2010

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INTRODUCTION

V&A was retained by URS Corporation to perform a corrosion survey on US 101, in and near Petaluma, CA, from 0.4 miles south of Petaluma Boulevard South overcrossing to 0.2 miles north of Caulfield Lane overcrossing. The objective of this investigation was to measure various soil parameters and evaluate the results with respect to possible levels of corrosion at the site. The soil was tested at depths ranging from 0 to 30.5 meters below existing grade. This report provides recommendations for corrosion control of structural foundation materials under consideration for the proposed Northbound US 101 / SR 116 Separation (Figure 1) on US 101 in Petaluma, CA. The materials being considered as part of this investigation include buried reinforced concrete, prestressed concrete piles and steel piles.

The investigation was conducted in accordance with California Department of Transportation's Division of Engineering Services, Materials Engineering and Testing Services Corrosion Technology Branch "Corrosion Guidelines" (Guidelines) dated September 2003. These Guidelines consider representative soil or water samples to be corrosive to structural elements if one or more of the following conditions exist:

1) **The chloride concentration is 500 ppm or greater**
2) **The sulfate concentration is 2,000 ppm or greater**
3) **The pH is 5.5 or less.**

Evaluation of the soil environment was made in terms of potential corrosion damage to concrete and metal structures. Soil resistivity measurements were conducted in the field during the initial stages of the work. In addition, soil samples taken during the geotechnical investigation were provided to V&A for laboratory testing. The soil sample was analyzed for minimum (saturated) resistivity, as well as for pH, chloride and sulfate ion concentrations. All of these affect the corrosion rate of buried structures.

The minimum (saturated) resistivity of soil sample selected from the Borings No. R-09-010, R-09-012 and R-09-015 at the general vicinity of Northbound 101 / SR 116 measured 1,762, 268 and 388 ohm-cm, respectively. The soil pH measured 7.6, 8.0 and 6.8, while the water-soluble chloride concentrations measured 12, 2,225, and 38 mg/kg. The water-soluble sulfate concentrations measured less than 5, 187, and 2,325 mg/kg. The chloride and sulfate ion concentrations indicate the sampled soils are *corrosive*, as defined by the Guidelines.

CONCLUSIONS

- The soil boring chemical analysis gave pH values greater than 5.5, <u>soluble chloride concentrations greater than 500 mg/kg and soluble sulfate concentrations greater than 2,000 mg/kg</u>. According to the Guidelines, the soil tested at Boring Locations R-09-012 and R-09-015 are considered *corrosive,* while the soil tested at Boring Location R-09-010 is considered *non-corrosive*, as defined by the Guidelines.
- This structure is not within 300 meters (1,000 feet) of salt or brackish water.

RECOMMENDATIONS

The test data and a review of the project requirements were used to make recommendations for each structural foundation material alternative listed below.

Buried Reinforced Concrete Structures and Cast-in-Place Piles (Non-Corrosive Soil)

Buried concrete structures should be constructed of durable concrete as described in ACI Standards 201.2R and 222R. These recommendations include, but are not limited to, the following for installations in *non-corrosive* soil:

- The water/cement ratio should not exceed 0.50.
- A minimum concrete cover of 2 inches should be applied over all steel reinforcement.
- Sand and water used in concrete mixtures should contain a maximum of 100 ppm of water-soluble chloride ions and water-soluble sulfate ions. They should also have a pH in the range of 6.5 to 8.0. Potable water should be used in concrete mixtures.
- Type I-P (MS) modified or Type II modified cement should be used.

Buried Reinforced Concrete Structures (Corrosive Soil)

Buried concrete structures should be constructed per the minimum concrete cover requirements established by CALTRANS. See Bridge Design Specifications (BDS) Section 8.22 and Table 8.22.1 for complete information regarding the minimum concrete cover for footing, columns, cast-in-place piles and precast piles.

- The water/cement ratio should not exceed 0.40.[1]
- Use pre-fabricated epoxy coated reinforcing bars.[1]
- A minimum of 3 inches of concrete cover is required for the footing, columns and cast-in-place piles. For precast piles and pile extensions, use a minimum of 2 inches of concrete cover.[1]
- For the precast piles and pile extensions mineral admixtures conforming to ASTM Designation C1240 and /or ASTM Designation C618 Type F and/or N, may be required.[1]
- Concrete in a corrosive environment shall contain not less than 675 pounds of cementitious material per cubic yard. Reduction in the cementitious material content specified or ordered, in conformance with the provisions in Section 90-4.05, "Optional Use of Chemical Admixtures," of the Standard Specifications, is not permitted for concrete in a corrosive environment.[2]
- For concrete in a corrosive environment, the amount of Portland cement shall be 75 percent by weight, and the amount of supplementary cementitious material shall be 25 percent by weight, of the total amount of cementitious material to be used in the concrete mix.[2]
- Type II modified or Type V cement shall be used when the sulfate concentrations exceed 2, 000 ppm.[3]

[1]CALTRANS – Bridge Design Specs, Table 8.22.1
[2]CALTRANS – Structure Reference Specification S8-C04 (90CORR)
[3]CALTRANS – Bridge Design Specs, Table 8.22.2

Prestressed Concrete Piles

Prestressed concrete piles should be constructed of durable concrete as described in ACI Standards 201.2R and 222R. These recommendations include, but are not limited to, the following:

- The water/cement ratio should not exceed 0.40.
- A minimum concrete cover of 2 inches should be applied over all steel reinforcement.
- Sand and water used in concrete mixtures should contain a maximum of 100 ppm of water-soluble chloride ions and water-soluble sulfate ions. They should also have a pH in the range of 6.5 to 8.0. Potable water should be used in concrete mixtures.
- Type I-P (MS) modified or Type II modified cement should be used.

Steel Piles

According to the CALTRANS Guidelines the soil tested at this site is considered *non-corrosive to corrosive*, therefore corrosion mitigation is required.

- Steel vertical support elements should be protected over their exposed height and a nominal distance below finished grade with an appropriate coating system[4].
- Steel facing elements and fasteners should be protected with an appropriate coating system[4].
- Extra metal thickness shall be added to all surfaces of the pile exposed to the corrosive soil[5].
- Corrosion rate of 0.100 mm/year shall be used per the Guidelines[5].

[4]CALTRANS – Bridge Design Specs – Retaining Walls - 5.7.10 – Corrosion Protection

[5]CALTRANS – Corrosion Guidelines – September 2003 – Volume 1.0 – 10.1

TEST METHODS

When predicting potential corrosion problems associated with a particular type of structure prior to installation, it is necessary to investigate the soil conditions the structure will encounter. Since corrosion is an electrochemical process accompanied by current flow, the electrochemical characteristics of a soil are of primary importance. Test methods utilized during this investigation reflect the most practical methods of evaluating corrosivity.

Resistivity is a measure of the ability of a soil to conduct an electric current. The higher the resistivity the more difficult it is for the soil to conduct current. Resistivity is primarily dependent on the soluble chemical and moisture content of the soil. Soils with high dissolved ion contents generally have low resistivity. As moisture is added to a soil, its resistivity will decrease as more ions are taken into solution. The soil resistivity decreases until the maximum solubility of the dissolved ions is reached. Increasing the moisture content beyond this point increases the soil resistivity by diluting the solution. Since corrosion rate depends on current flow through the soil, corrosivity normally increases as soil resistivity decreases.

Soils can contain a wide variety of soluble salts. Therefore, soils with similar resistivities can have significantly different corrosion characteristics, depending on the ions present. In most soils, the principal agents of corrosion are the chloride and sulfate ions, as well as pH. Chloride ions break down the protective surface films on metals and can corrode reinforcing steel in concrete structures. Sulfates attack the Portland cement in concrete. This is an expansive reaction that disrupts the concrete matrix and softens the surface. A high bicarbonate ion concentration lowers soil resistivity and facilitates other forms of corrosion; however, bicarbonate is not corrosive to metals. Soil pH is another measure of corrosivity. Acid (low pH) soils are corrosive to buried metallic and concrete structures. Neutral (pH 7) and alkaline (pH greater than 7) soils are passive to metal surfaces; therefore, corrosion rates become negligible.

Field Soil Resistivity

Field (in-situ) soil resistivity was determined at four locations along the US 101 project at the SR 116 Separation location. Figure 2 shows the soil resistivity test locations.

Figure 1. Project Site Map* for Northbound US 101 / SR 116 Separation Foundation Investigation, Petaluma, CA

*Map courtesy of www.google.com

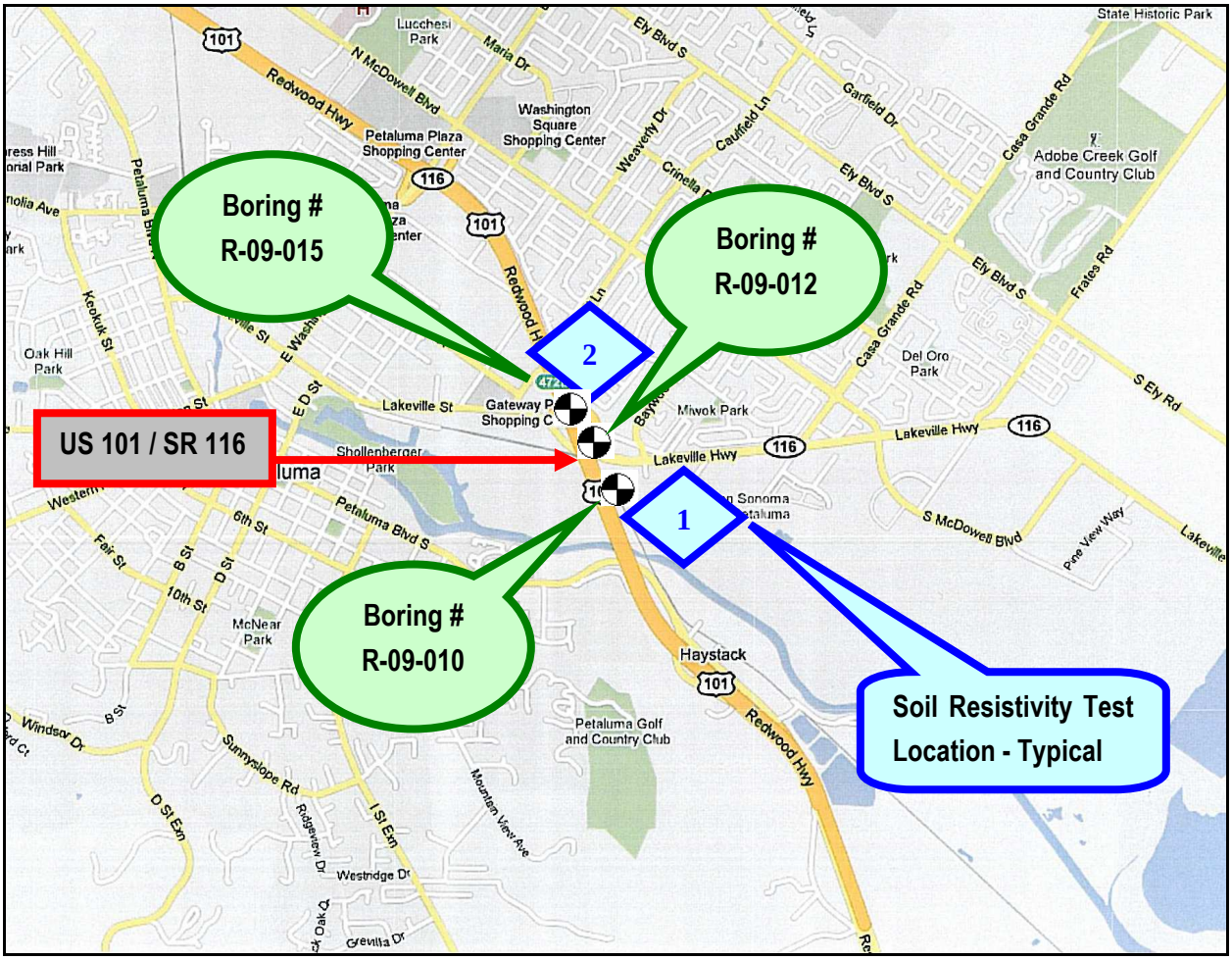


Figure 2. In-Situ Soil Resistivity Test and Boring Locations*

*Locations are approximate. Map courtesy of www.google.com

In-situ soil resistivity measurements were conducted by the Wenner Electrode Method, using an AEMC Soil Resistance Meter, Model 4500. The Wenner Electrode Method uses four equally spaced metal pins, driven into the ground in a straight line, as electrodes (see Figure 3).

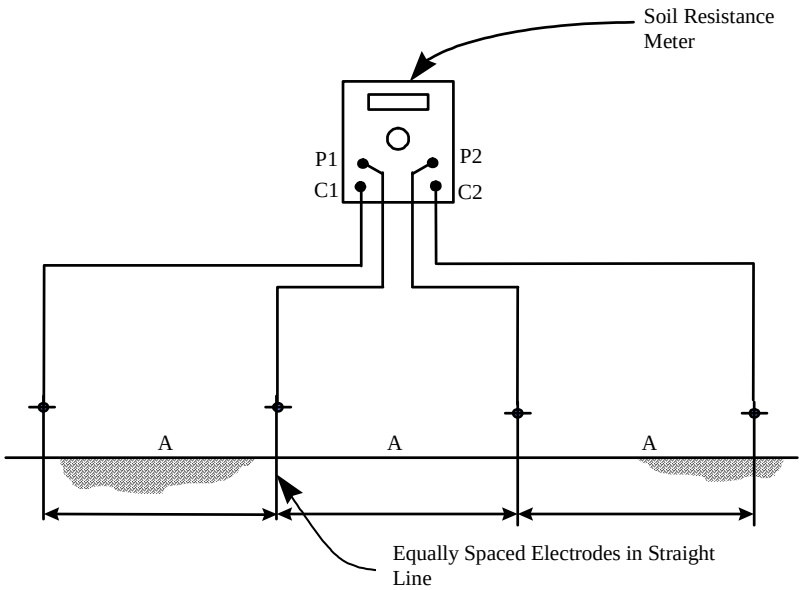


Figure 3. Wenner Four Electrode Method for Soil Resistivity Measurement

An alternating current from the soil resistance meter causes a current to flow through the soil between the outside electrodes, C1 and C2. Due to the resistance of the soil, the current creates a voltage gradient which is proportional to the average resistance of the soil mass to a depth equal to the distance between electrodes. The voltage drop is measured across electrodes P1 and P2. Resistivity of the soil is then computed from the instrument reading according to the following formula:

$$\rho = 2\pi AR$$

where: ρ = soil resistivity in ohm-cm
A = the distance between probes in cm
R = soil resistance in ohms (instrument reading)
π = 3.1416

Soil resistance is measured with electrodes spaced 0.8, 1.5, 2.3, 3, 4.6, 7.6, 15.2, 23.0 and 30.5 meters (2.5, 5, 7.5, 10, 15, 25, 50, 75 and 100 feet) apart. The resistivity values obtained represent the average resistivity of the soil to a depth equal to the electrode spacing. An additional method of calculating the soil resistivity using the data from the Wenner Method is the Barnes-Layer resistivity calculation. The Barnes Layer calculation is used to determine the resistivity of the soil for each soil layer. While the Wenner Method at 3 meters will consider all 3 meters of soil below the surface, the Barnes-Layer method will only

consider the resistivity of the layer of soil between 2.3 m and 3 m below the surface. This method assumes the soil layers are a uniform thickness and parallel to the surface, which may not always be true.

The Barnes-Layer method uses the following parameters to calculate layer resistivities:

$$\rho_{b-a} = KR_{b-a}$$

and

$$\frac{1}{R_{b-a}} = \frac{1}{R_a} - \frac{1}{R_b}$$

where:

ρ_{b-a}	=	Soil resistivity of layer depth b-a (ohm-cm)
a	=	Soil depth to top of layer (cm)
b	=	Soil depth to bottom of layer (cm)
R_a	=	Soil resistance read at depth a (ohms)
R_b	=	Soil resistance read at depth b (ohms)
R_{b-a}	=	Resistance of soil layer from a to b (ohms)
K	=	Layer constant (cm)
	=	$2\pi(b-a)$

Laboratory Soil Analysis

To supplement the field resistivity test data, three soil samples were obtained from Soil Borings R-09-010, R-09-012 and R-09-015 for laboratory soil resistivity analysis. A soil box was used in accordance with California Test Method 643. This apparatus is shown in Figure 4.

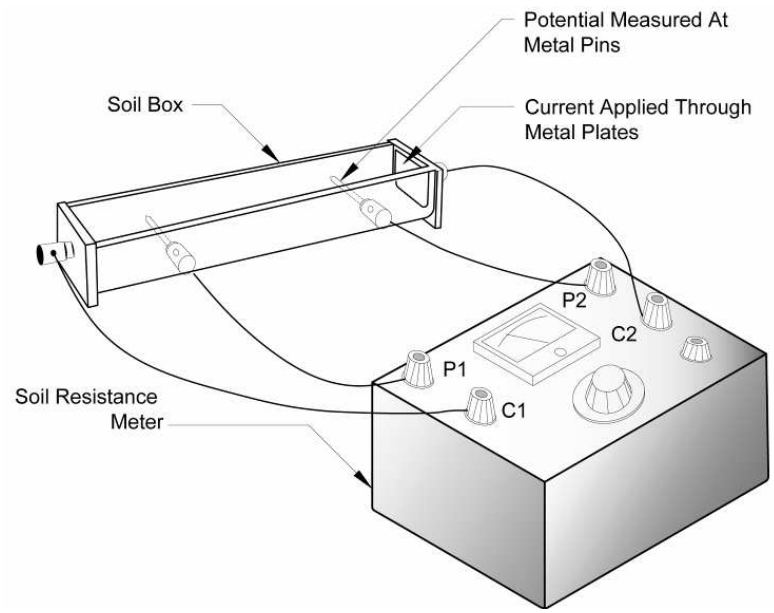


Figure 4. Soil Resistivity Measurement Using the Soil Box Method

This apparatus consists of a small plastic box with metal end plates for passing current through a tightly packed soil sample. Current is passed through the sample, causing a voltage drop across the sample. The soil resistivity is measured with a soil resistance meter, similar to the AEMC Model 4500.

Soil resistivity is first measured in the "as-received" state. Distilled water is then added to the soil sample in 10-mL increments. The resistivity is measured after each addition. As the soil sample becomes more saturated, the soil resistivity decreases until the minimum soil resistivity is reached.

Soil boring samples from this study were forwarded to Cooper Testing Labs, Inc., in Palo Alto, CA, for minimum resistivity measurement, pH analysis and analysis of water soluble chloride and sulfate ion concentrations. The analytical procedures followed California Test Methods 417, 422 and 643.

TEST RESULTS

Table 1 and Table 2 list the field soil resistivity measurements and the calculated Barnes-Layer resistivities. Table 3 lists the minimum resistivities and chemical analyses for the soil boring samples.

Table 1. Field Soil Resistivity Data, Site 1

Test Location No.	Site	Survey Station	Depth (meters)	Resistivity (ohm-cm)	Layer (meters)	Layer Resistivity (ohm-cm)
1	US 101 / SR 116 Separation, North Bound, South Side of SR 116	189+00	0.8	4,079	0 - 0.8	
			1.5	1,580	0.8 - 1.5	980
			2.3	539	1.5 - 2.3	232
			3.1	347	2.3 – 3.1	168
			4.6	396	3.1 - 4.6	556
			7.6	12,831	4.6 – 7.6	279
			15.2	14,660	7.6 – 15.2	17,097
			23.0	23,972	15.2 – 23.0	88,652
			30.5	34,261	23.0 – 30.5	119,130

Table 2. Field Soil Resistivity Data, Site 2

Test Location No.	Site	Survey Station	Depth (meters)	Resistivity (ohm-cm)	Layer (meters)	Layer Resistivity (ohm-cm)
2	US 101 / SR 116 Separation, North Bound, North Side of SR 116	193+00	0.8	2,672	0 - 0.8	
			1.5	1,915	0.8 - 1.5	1,493
			2.3	1,132	1.5 - 2.3	623
			3.1	988	2.3 - 3	716
			4.6	939	3 - 4.6	855
			7.6	527	4.6 – 7.6	317
			15.2	182	7.6 – 15.2	110
			23.0	675	15.2 – 23.0	153
			30.5	326	23.0 – 30.5	128

Table 3. Laboratory Soil Resistivity and Chemical Data

Item No.	Boring No.	Station	Depth (meters)	Minimum Soil Resistivity (ohm-cm)	Chemical Data		
					pH	Sulfate (mg/kg)	Chloride (mg/kg)
1	R-09-010	186+35	3.1	1,762	7.6	<5	12
2	R-09-012	190+06	16.8	268	8.0	187	2,225
3	R-09-015	194+32	25.9	388	6.8	2,325	38

Appendix 1
Soil and Water Sample Minimum Resistivity and Chemical Analysis

Corrosivity Test Summary

CTL # 632-008 Date: 1/13/2010 Tested By: PJ Checked: PJ
Client: V & A Project: URS Caltrans 101 Marin/Sonoma Proj. No: 09-0597
Remarks:

Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate		pH	ORP	Moisture	Soil Visual Description
Boring	Sample, No.	Depth, ft.	As Rec.	Minimum	Saturated	mg/kg Dry Wt.	mg/kg Dry Wt.	% Dry Wt.		(Redox) mv	As Received %	
			ASTM G57	Cal 643	ASTM G57	Cal 422-mod.	Cal 417-mod.	Cal 417-mod.	Cal 643	SM 2580B	ASTM D2216	
A-09-106	-	28.5	-	2542	-	<2	<5	<0.0005	8.1	-	8.5	Greenish Gray Silty SAND w/ Gravel (slightly plastic)
R-09-003	-	55	-	1556	-	4	154	0.0154	7.6	-	3.7	Bluish Gray Silty SAND w/ Gravel (slightly plastic)
R-09-007	-	68.5	-	520	-	199	356	0.0356	8.4	-	15.5	Greenish Gray Clayey SAND
R-09-008	-	88.5	-	173	-	2,259	495	0.0495	9.0	-	21.6	Bluish Gray CLAY w/ Sand
R-09-010	-	10	-	1762	-	12	<5	<0.0005	7.6	-	11.3	Brown Clayey SAND w/ Gravel
R-09-011	-	98	-	116	-	4,813	825	0.0825	8.3	-	23.0	Greenish Brown Clayey SAND
R-09-012	-	55	-	268	-	2,225	187	0.0187	8.0	-	13.7	Greenish Gray Silty SAND (slightly plastic)
R-09-015	-	85	-	388	-	38	2,325	0.2325	6.8	-	26.9	Greenish Brown Clayey SAND
R-09-101	-	8.5	-	1523	-	183	91	0.0091	7.4	-	4.1	Brown Silty SAND (slightly plastic)
R-09-103	-	10	-	1093	-	30	<5	<0.0005	8.2	-	6.0	Light Olive Brown Sandy CLAY
Petaluma Crk	-	Water Sample	-	49	-	2456 mg/L	251 mg/L	-	6.9	-	N/A	Water

Earthquake Retrofit Project Plans for U.S. 101/116 SOH

Bridge No. 20-0155 R/L

DIST	COUNTY	ROUTE	POST MILE TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Son	101	3.2/5.8	1	49

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

ACNH-P101(774)E

PROJECT PLANS FOR CONSTRUCTION ON

STATE HIGHWAY

IN SONOMA COUNTY
IN AND NEAR PETALUMA
AT VARIOUS LOCATIONS FROM PETALUMA RIVER BRIDGE TO NORTH PETALUMA OVERHEAD

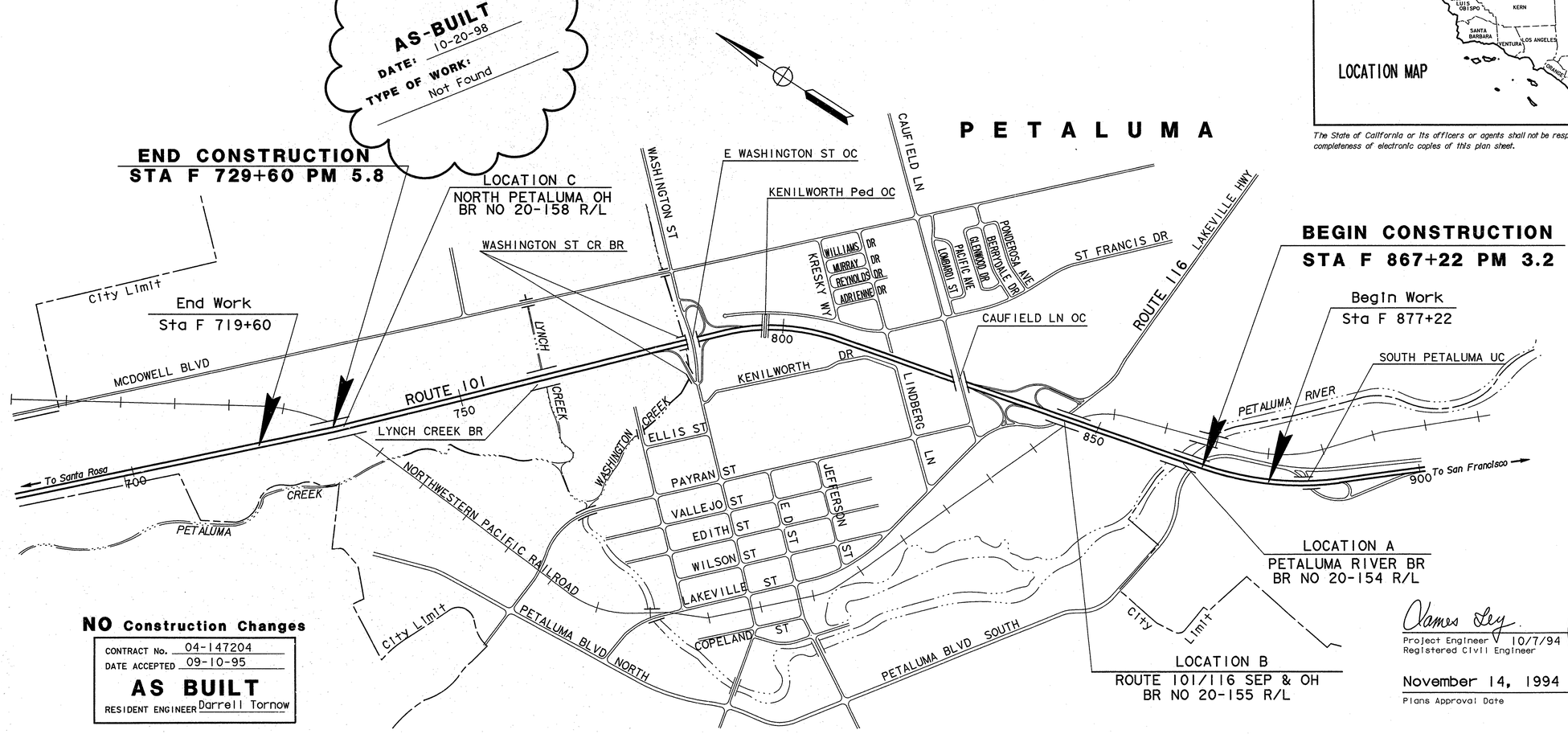
To be supplemented by Standard Plans dated July, 1992

INDEX OF SHEETS

Sheet No.	1	Title and Location Map
'' ''	2-3	Standard Plans List
'' ''	4-6	Layouts
'' ''	7-9	Construction Details
'' ''	10	Sanitary Sewer Plan, Profile and Details
'' ''	11	Traffic Handling Plans
'' ''	12	Construction Area Signs
'' ''	13	Summary of Quantities
'' ''	14	New Standard Plan
STRUCTURE PLANS		
'' ''	15-29	Petaluma River Bridge (Br. No. 20-0154R/L)
'' ''	30-40	101/116 Separation Overhead (Br. No. 20-0155R/L)
'' ''	41-49	North Petaluma River Overhead (Br. No. 20-0158R/L)

AS-BUILT
DATE: 10-20-98
TYPE OF WORK: Not Found

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.



NO Construction Changes

CONTRACT No. 04-147204
DATE ACCEPTED 09-10-95
AS BUILT
RESIDENT ENGINEER Darrell Tornow

The Contractor shall possess the Class (or classes) of license as specified in the ''Notice to Contractors''.

0 800 1600 2400
SCALE IN FEET

James Ley
Project Engineer 10/7/94
Registered Civil Engineer

November 14, 1994
Plans Approval Date

REGISTERED PROFESSIONAL ENGINEER
J.W. Ley
No. 49340
Exp. 9-30-96
CIVIL
STATE OF CALIFORNIA

PROJECT ENGINEER J.W. LEY
PROJECT MANAGER G.H. CHERRIER

Contract No. 04-147204

LAST REVISION 10-20-94
TIME PLOTTED => $$$$$$$$SYTIME$$$$$$$$
FILE: /home/14nvouna/147201/4147204a.asb
DATE: Tue Oct 20 1998 TIME : 15:11
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FORM DC-OE-93-PF (REV. 3/88)
FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3
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DGN FILE => $$$$$$$$$$DGNSPEC$$$$$$$$$$
CU 04279
EA 147201

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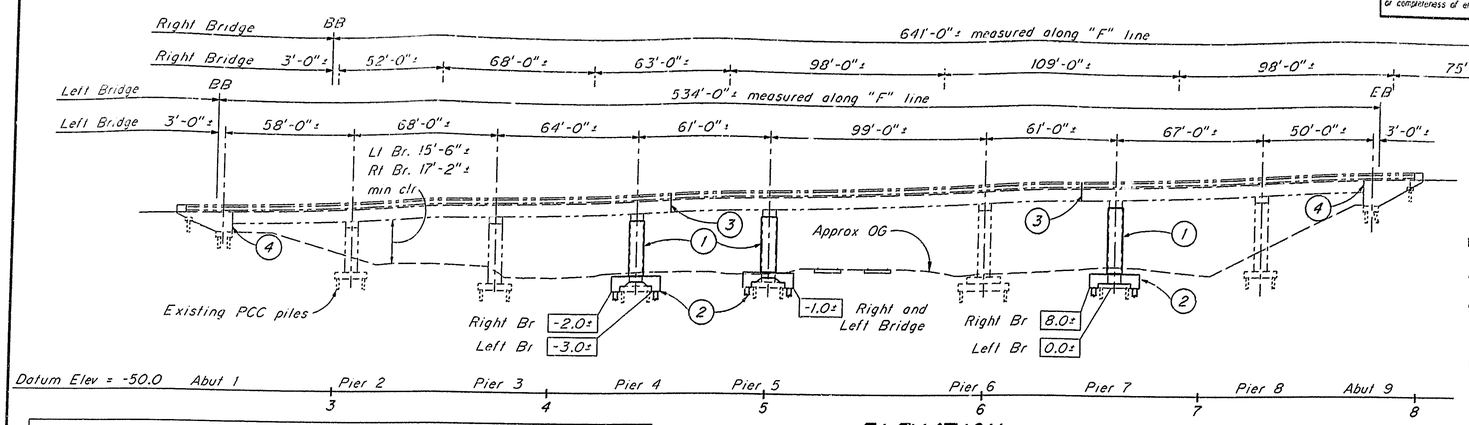
DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	San	101	3.2/5.8	30	49

John Scales
REGISTERED CIVIL ENGINEER
11-14-94
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER J. Scales No. 42895 Exp. 3-31-96 CIVIL STATE OF CALIFORNIA

Parsons Brinckerhoff Quade & Douglas, Inc.
2485 Natoma Park Drive, Suite 400
Sacramento, CA 95833



ELEVATION

1" = 30'

Left bridge shown

NO AS BUILT CHANGES

AS BUILT

CORRECTIONS BY J. Kress

CONTRACT NO. 04-147204

DATE 04-96 10-24-96

INDEX TO PLANS

SHEET NO.	TITLE
1	GENERAL PLAN
2	BRIDGE SECTIONS
3	ABUTMENT DETAILS
4	PIER 4R AND 7R FOOTINGS
5	PIER 4L, 5L AND 5R FOOTINGS
6	PIER 7L FOOTING
7	COLUMN RETROFIT DETAILS
8	HINGE RETROFIT DETAIL NO. 1
9	HINGE RETROFIT DETAIL NO. 2
10	LIMITS OF EXCAVATION AND BACKFILL
11	AS-BUILT LOG OF TEST BORING

PILE DATA - CLASS 70C MODIFIED CONCRETE PILES

Location	Design Loading (Service Load)	Specified Tip Elevation	Probable Tip Elevation	Ultimate Uplift Capacity
Piers 4R, 4L, 5R, 5L, 7L and 7R	70 Tons	-42	-47	70 Tons

STANDARD PLANS DATED JULY, 1992

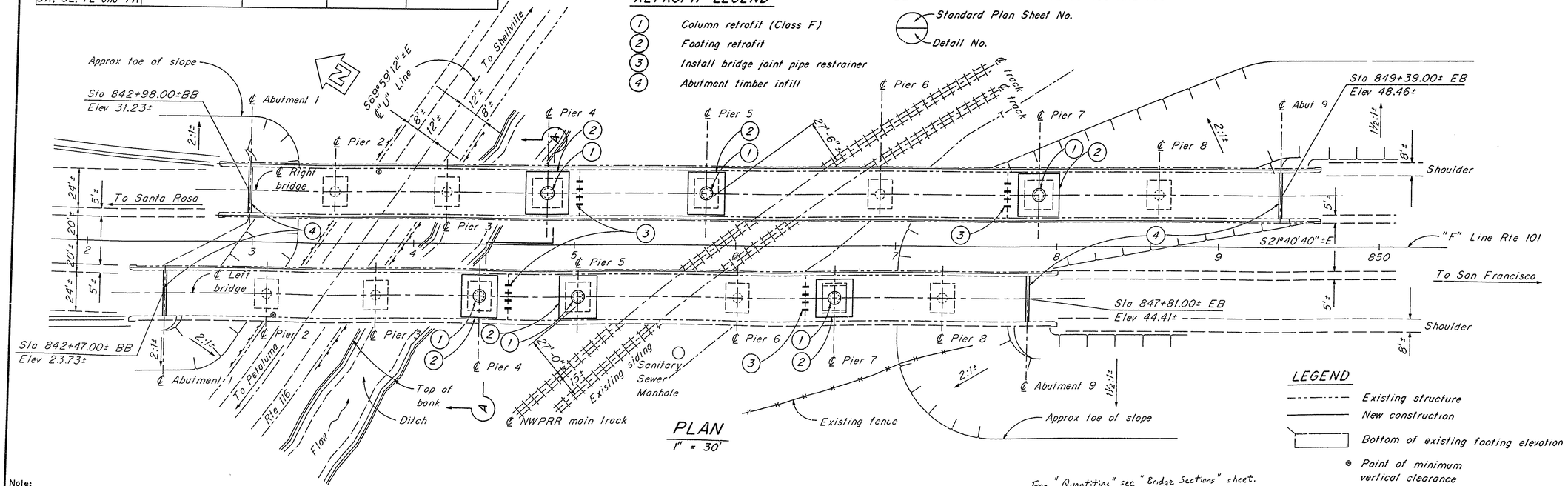
A10A	ABBREVIATIONS
A10B	SYMBOLS
B0-1	BRIDGE DETAILS
B2-8	PILE DETAILS - CLASS 45C AND 70C

Standard Plan Sheet No.

Detail No.

RETROFIT LEGEND

1. Column retrofit (Class F)
2. Footing retrofit
3. Install bridge joint pipe restrainer
4. Abutment timber infill



PLAN

1" = 30'

LEGEND

- Existing structure
- New construction
- Bottom of existing footing elevation
- ⊗ Point of minimum vertical clearance

For "Quantities" see "Bridge Sections" sheet.
For "General Notes" and "Section A-A", see "Bridge Sections" sheet

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

Earthquake Retrofit Project No. 693

Moe Amini, DESIGN OVERSIGHT	DESIGN	BY C. Subrizi	CHECKED H. Chui	LOAD FACTOR DESIGN
	DETAILS	BY A. Korbmacher	CHECKED C. Subrizi	LAYOUT BY A. Korbmacher CHECKED C. Subrizi
SIGNOFF DATE	QUANTITIES	BY C. Subrizi	CHECKED A. Read	SPECIFICATIONS BY R. Smith PLANS AND SPECS COMPARED C. Subrizi

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. Kazmi, PROJECT ENGINEER

BRIDGE NO. 20-0155R/L
POST MILE 3.75

101/116 SEPARATION OVERHEAD
GENERAL PLAN

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 147201
CONTRACT NO. 59N764

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 12-12-92, 3-19-93, 4-19-93, 6-28-93, 10-01-93, 11-22-93, 12-23-93

SHEET 1 OF 11

LTM SAC31::4287:(P722)SS001.FGB>1 27DEC93-13.54.20

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	San	101	3.2/5.8	31	49

REGISTERED CIVIL ENGINEER

11-14-94

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER J. Scales No. 42895 Exp. 3-31-96 CIVIL STATE OF CALIFORNIA

Parsons Brinckerhoff Quade & Douglas, Inc
2485 Natomas Park Drive, Suite 400
Sacramento, CA 95833

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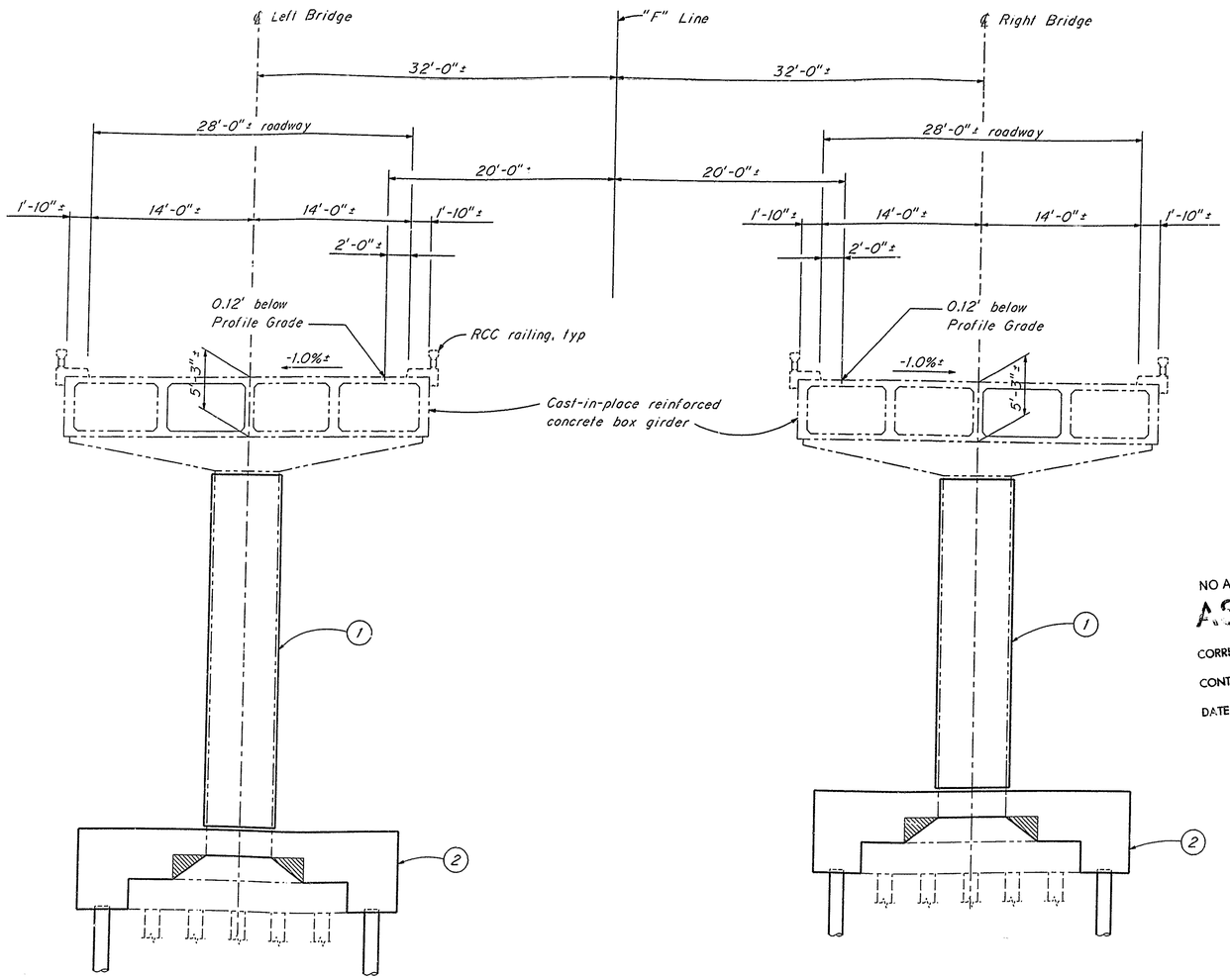

SECTION A-A

3/16" = 1'-0"

NO AS BUILT CHANGES

AS BUILT

CORRECTIONS BY J. Kress

CONTRACT NO. 04-147204

DATE 04-96 10-24-96

GENERAL NOTES

LOAD FACTOR DESIGN

DESIGN: BRIDGE DESIGN SPECIFICATIONS (1983 AASHTO with interims and revisions by CALTRANS)

SEISMIC LOADING: Peak rock acceleration = 0.5g
Depth of alluvium = 10 - 80 ft

REINFORCED CONCRETE: EXISTING (ASSUMED FOR RETROFIT EVALUATION)
f_y = 44,000 psi
f'_c = 5,000 psi

NEW CONSTRUCTION
f_y = 60,000 psi
f'_c = 5,000 psi

STRUCTURAL STEEL: ASTM A36
f_y = 36,000 psi

XX PIPE: ASTM A53 TYPE F
fy = 35,000 psi

RETROFIT LEGEND

1. Column retrofit (Class F)
2. Footing retrofit

QUANTITIES

ACCESS OPENING, SOFFIT	16	EA
BRIDGE REMOVAL (PORTION), LOCATION B	LUMP	SUM
STRUCTURE EXCAVATION (BRIDGE)	720	CY
STRUCTURE EXCAVATION (TYPE H)	280	CY
STRUCTURE BACKFILL (BRIDGE)	290	CY
FURNISH PILING (CLASS 70C MODIFIED)	5,060	LF
DRIVE PILE (CLASS 70C MODIFIED)	120	EA
STRUCTURAL CONCRETE, BRIDGE FOOTING	780	CY
DIAPHRAGM BOLSTER	16	EA
DRILL AND BOND DOWEL	900	LF
CORE CONCRETE (9")	40	LF
BAR REINFORCING STEEL (BRIDGE)	162,000	LB
ASPHALT MEMBRANE WATERPROOFING	210	SQFT
COLUMN CASING	55,200	LB
TREATED LUMBER AND TIMBER	6	MFBM
MISCELLANEOUS METAL (RESTRAINER)	9,200	LB

LEGEND

Concrete removal

NOTE:
The contractor shall verify all controlling field dimensions before ordering or fabricating any material.

Earthquake Retrofit Project No. 693

Moe Amini
DESIGN OVERSIGHT
SIGN OFF DATE

	BY	CHECKED
DESIGN	C. Subrizi	H. Chui
DETAILS	A. Korbmacher	C. Subrizi
QUANTITIES	C. Subrizi	A. Reed

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. Kozmi
PROJECT ENGINEER

BRIDGE NO. 20-0155R/L
POST MILE 3.75

101/116 SEPARATION OVERHEAD BRIDGE SECTIONS

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 147201

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 3-19-93, 4-19-93, 8-23-93, 10-20-93, 11-22-93, 12-23-93

SHEET 2 OF 11

TKB SAC31::4287:[P722]SS009.FGB;1 22DEC93-08.09.10

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Son	101	3.2/5.8	32	49

John Scales
REGISTERED CIVIL ENGINEER

11-14-94
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
J. Scales
No. 42895
Exp. 3-31-96
CIVIL
STATE OF CALIFORNIA

Parsons Brinckerhoff Quade & Douglas, Inc
2485 Natomas Park Drive, Suite 400
Sacramento, CA 95833

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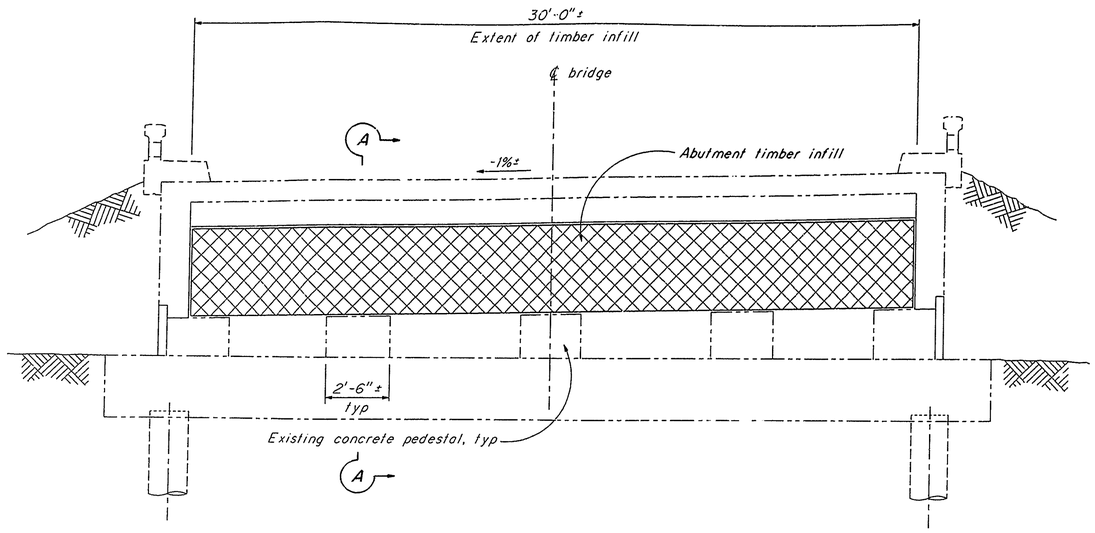
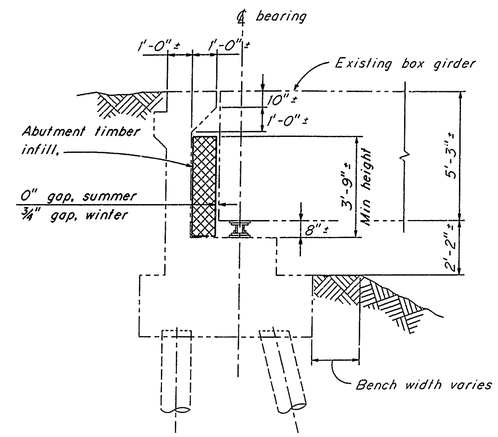


ELEVATION
3/8" = 1'-0"

Abutment 9R shown; Abutment 1R, 1L, & 9L similar.



SECTION A-A
3/8" = 1'-0"

NO AS BUILT CHANGES
AS BUILT
CORRECTIONS BY J. Kress
CONTRACT NO. 04-147204
DATE 04-96 J.M.V. 10-24-96

LEGEND

Abutment timber infill

NOTE:
The contractor shall verify all controlling field dimensions before ordering or fabricating any material.

Earthquake Retrofit Project No. 693

Moe Amini
DESIGN OVERSIGHT
SIGN OFF DATE

DESIGN	BY C. Subrizi	CHECKED H. Chui	
DETAILS	BY F. Carzon	CHECKED C. Subrizi	
QUANTITIES	BY C. Subrizi	CHECKED H. Chui	

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

S. Kazmi
PROJECT ENGINEER

BRIDGE NO. 20-0155R/L
POST MILE 3.75

101/116 SEPARATION OVERHEAD
ABUTMENT DETAILS

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 147201

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 3-19-93, 4-19-93, 6-23-93, 10-01-93, 11-22-93, 12-23-93

SHEET 3 OF 11

TKB SAC31::4287:[P722]SS002.FGB;1 22DEC93-08.10.10

< 24

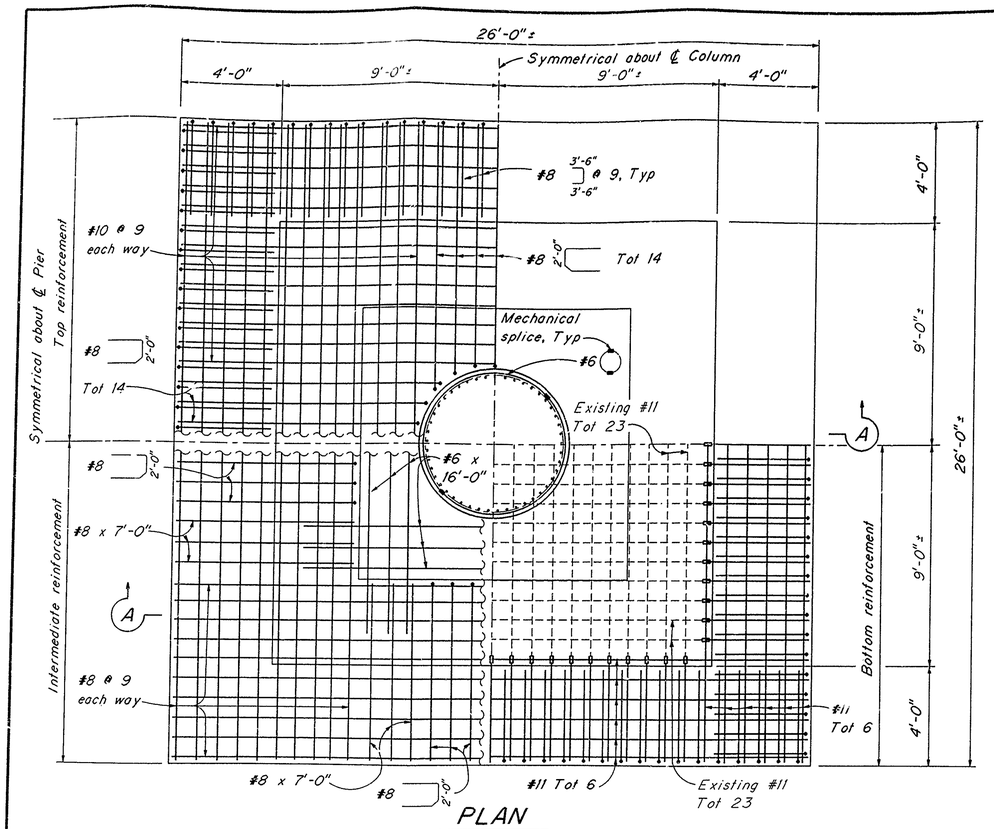
DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Son	101	3.2/5.8	33	49

John Scales
REGISTERED CIVIL ENGINEER

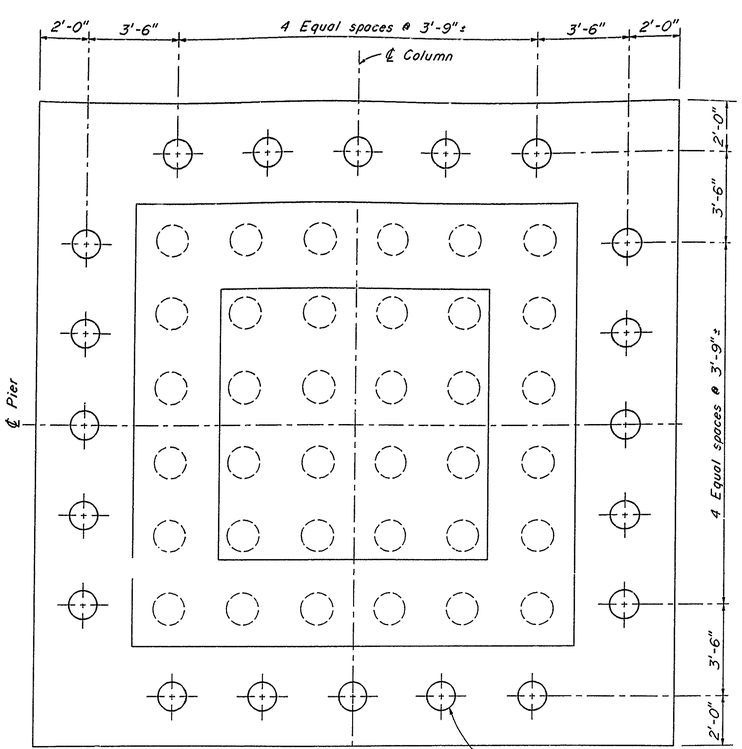
11-14-94
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — J. Scales No. 42895 Exp. 3-31-96 CIVIL — STATE OF CALIFORNIA

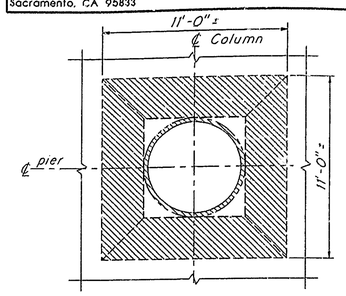
Parsons Brinckerhoff Quade & Douglas, Inc
2485 Natomas Park Drive, Suite 400
Sacramento, CA 95833



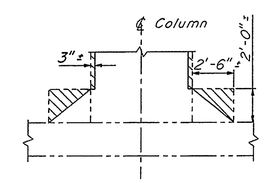
PLAN
3/8" = 1'-0"



PILE LAYOUT
3/8" = 1'-0"

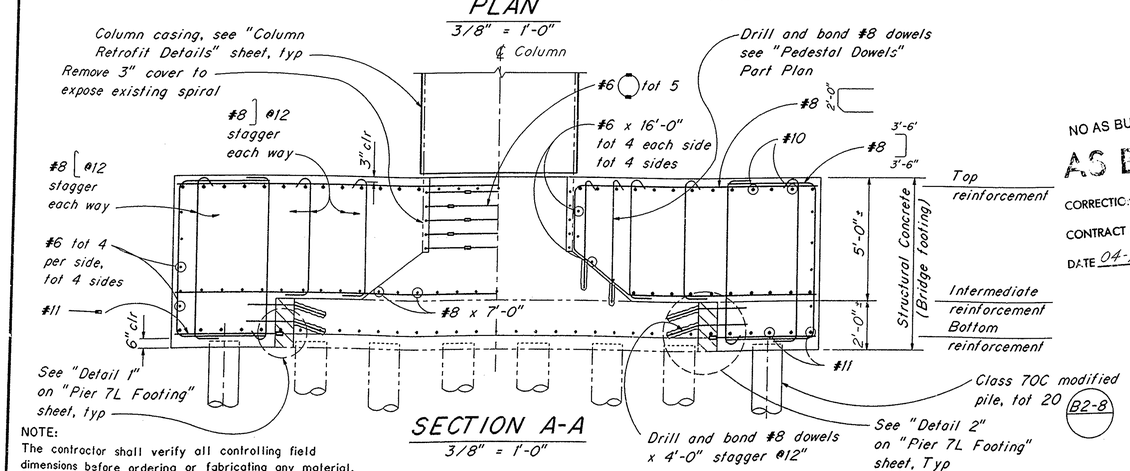


PLAN



ELEVATION

PEDESTAL CONCRETE REMOVAL
No Scale

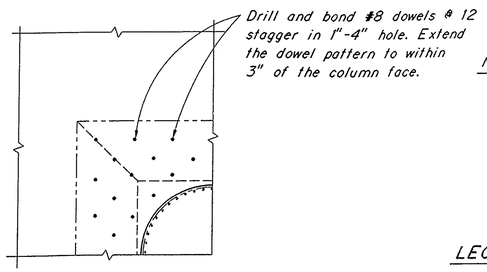


NOTE:
The contractor shall verify all controlling field dimensions before ordering or fabricating any material.

SECTION A-A
3/8" = 1'-0"

NO AS BUILT CHANGES

AS BUILT
CORRECTIONS BY J. Kress
CONTRACT NO. 04-147204
DATE 04-96 10.24.96



PEDESTAL DOWELS
PART PLAN
No Scale

NOTES:

1. For "Class 70C Modified Pile" detail see "Column Retrofit Details" sheet.

LEGEND

Concrete removal

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

Earthquake Retrofit Project No. 693

Moe Amini — DESIGN OVERSIGHT	DESIGN	BY C. Subrizi	CHECKED H. Chui
SIGN OF DATE	DETAILS	BY A. Korbmacher	CHECKED S. Kazmi
	QUANTITIES	BY C. Subrizi	CHECKED A. Read

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. Kazmi — PROJECT ENGINEER

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 147201

BRIDGE NO. 20-0155R/L
POST MILE 3.75

101/116 SEPARATION OVERHEAD
PIER 4R AND 7R FOOTING

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 3-19-93, 4-19-93, 6-23-93, 10-07-93, 11-22-93, 12-23-93

SHEET 4 OF 11

LIM SAC31::4287:[P722]SS005A.FGB;1 27DEC93-14.02.00

< 24

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	San	101	3.2/5.8	34	49

REGISTERED CIVIL ENGINEER

11-14-94

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER J. Scales No. 42895 Exp. 3-31-96 CIVIL STATE OF CALIFORNIA

Parsons Brinckerhoff Quade & Douglas, Inc
2485 Natomas Park Drive, Suite 150
Sacramento, CA 95833

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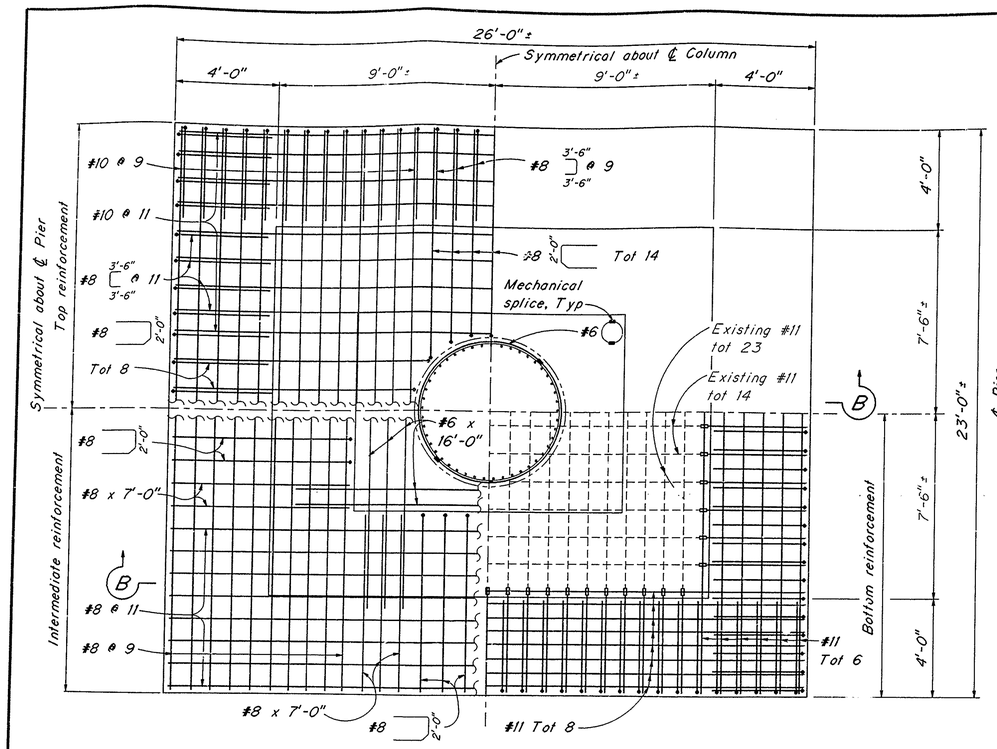
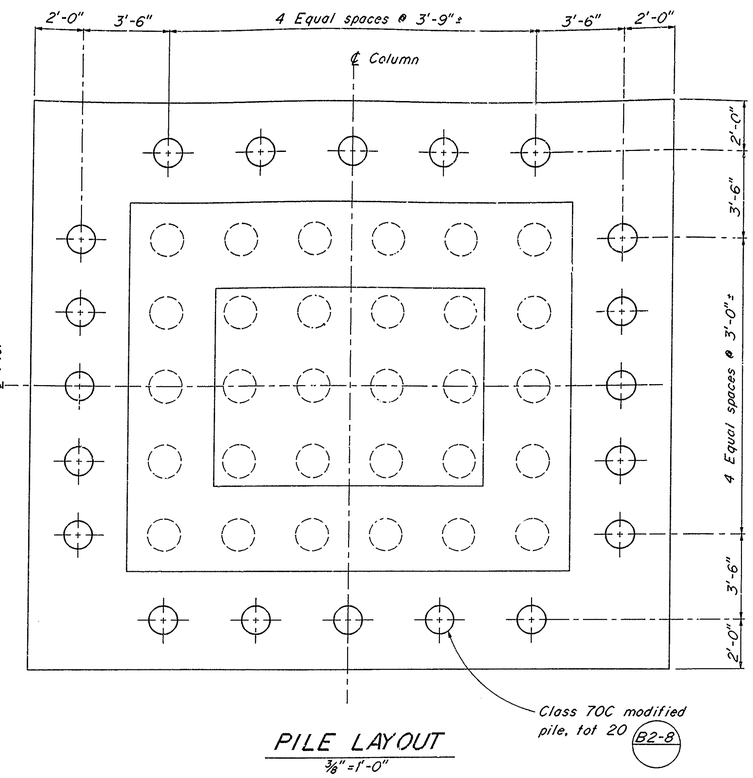


PLAN
3/8" = 1'-0"



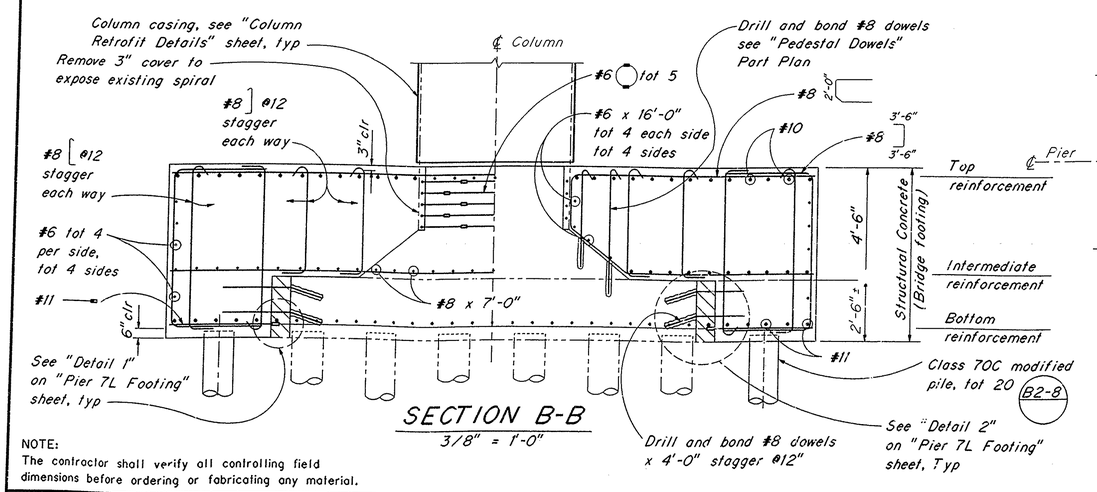
PILE LAYOUT
3/8" = 1'-0"

LEGEND

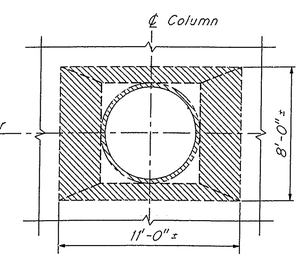
Concrete removal

NOTES:

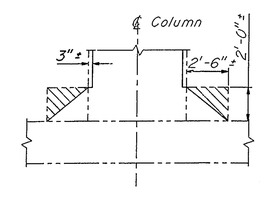
1. For "Class 70C Modified Pile" detail see "Column Retrofit Details" sheet.



SECTION B-B
3/8" = 1'-0"

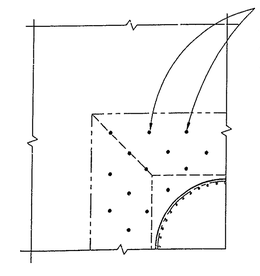


PLAN



ELEVATION

PEDESTAL CONCRETE REMOVAL
1/4" = 1'-0"



Drill and bond #8 dowels @ 12 stagger in 1"-4" hole. Extend the dowel pattern to within 3" of the column face.

PEDESTAL DOWELS PART PLAN
No Scale

NO AS BUILT CHANGES

AS BUILT

CORRECTIONS BY J. Kress

CONTRACT NO. 04-147201 Amt

DATE 04-96 10-24-96

NOTE:
The contractor shall verify all controlling field dimensions before ordering or fabricating any material.

Earthquake Retrofit Project No. 693

Moe Amini — DESIGN OVERSIGHT — SIGN OFF DATE	DESIGN	BY C. Subrizi	CHECKED H. Chui
	DETAILS	BY R. Hernandez	CHECKED S. Kazmi
	QUANTITIES	BY C. Subrizi	CHECKED A. Read

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. Kazmi — PROJECT ENGINEER

BRIDGE NO. 20-0155R/L

POST MILE 3.75

101/116 SEPARATION OVERHEAD

PIER 4L, 5L AND 5R FOOTING

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 147201

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 3-19-93, 4-14-93, 6-23-93, 10-01-93, 11-22-93, 12-23-93

SHEET 5 OF 11

LIM SAC31::4287:[P722]SS004A.FGB/1 27DEC93-14.08.30

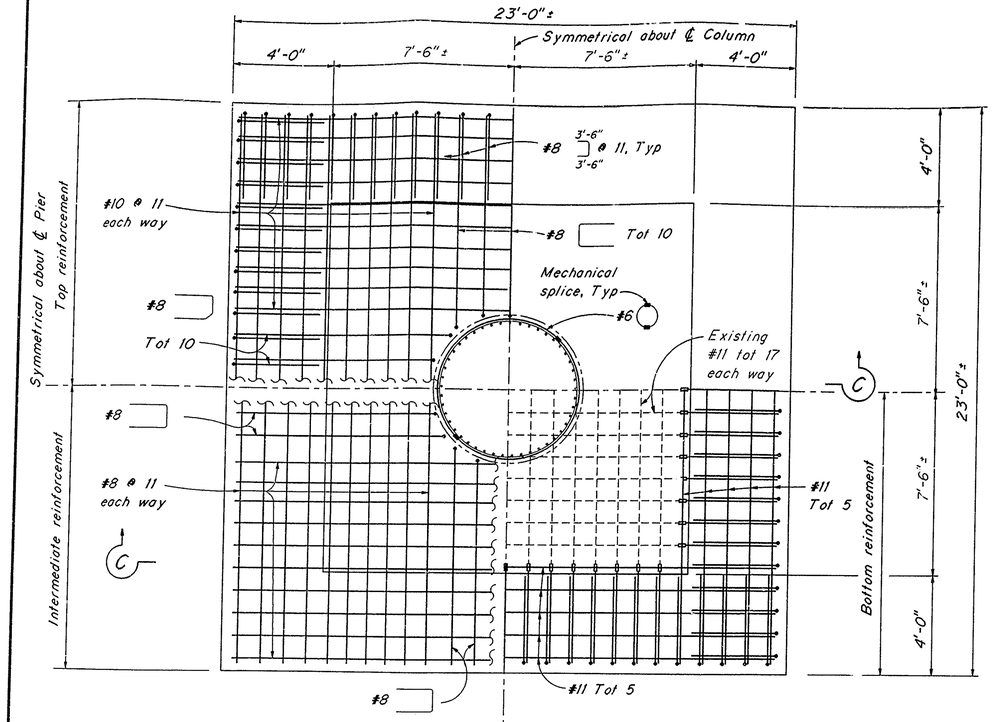
DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Son	101	3.2/5.8	35	49

John Scales
REGISTERED CIVIL ENGINEER

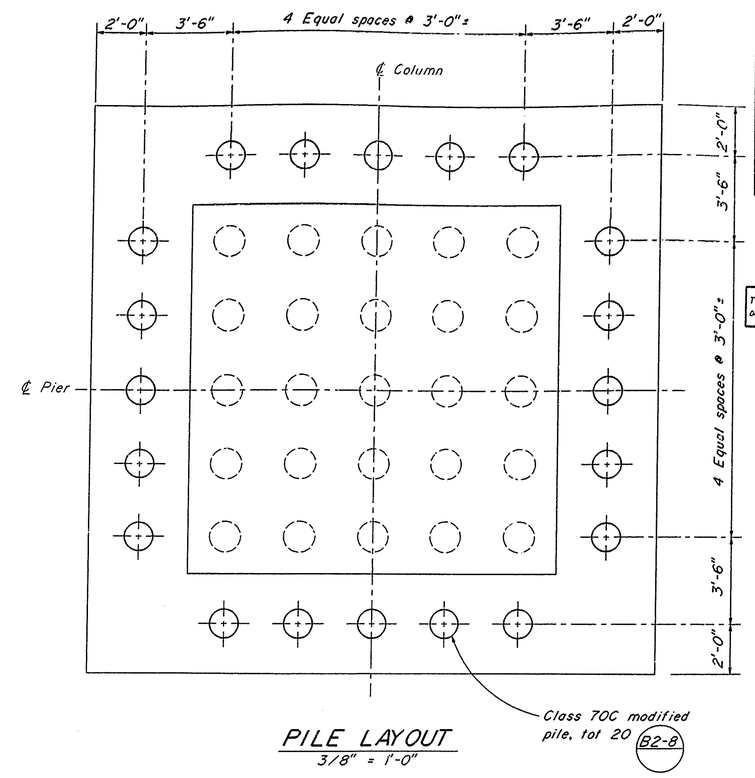
11-14-94
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — J. Scales No. 42895 Exp. 3-31-96 CIVIL — STATE OF CALIFORNIA

Parsons Brinckerhoff Quade & Douglas, Inc
2485 Natomas Park Drive, Suite 400
Sacramento, CA 95833



PLAN
3/8" = 1'-0"



PILE LAYOUT
3/8" = 1'-0"

LEGEND

Concrete removal

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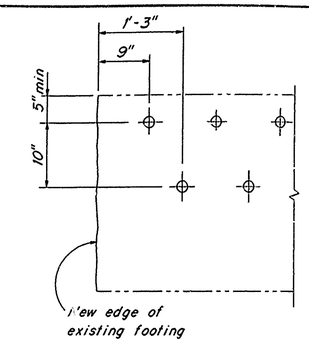
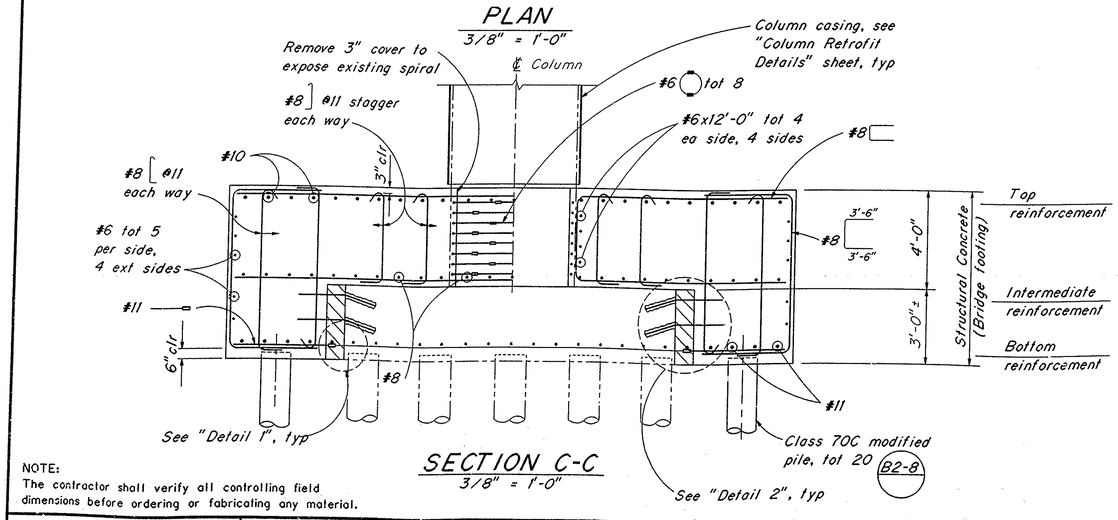
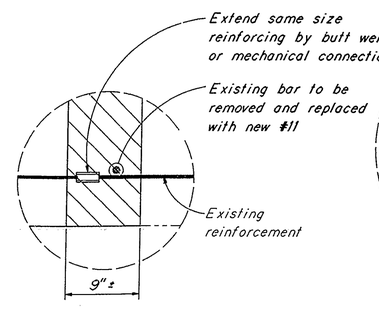


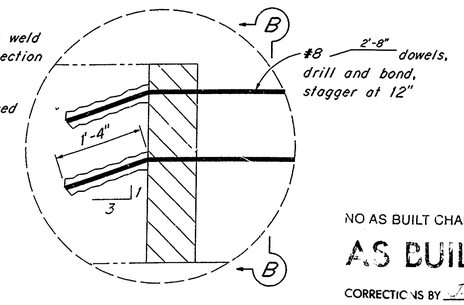
VIEW B-B
No Scale



SECTION C-C
3/8" = 1'-0"



DETAIL 1
No Scale



DETAIL 2
No Scale

NOTES:

1. For "Class 70C Modified Pile" detail see "Column Retrofit Details" sheet.

NO AS BUILT CHANGES

AS BUILT
CORRECTIONS BY
CONTRACT NO.
DATE 04-96

NOTE:
The contractor shall verify all controlling field dimensions before ordering or fabricating any material.

Earthquake Retrofit Project No. 693

Moe Amini — DESIGN OVERSIGHT / SIGN OFF DATE	DESIGN BY C. Subrizi	CHECKED H. Chui	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
	DETAILS BY R. Hernandez	CHECKED S. Kazmi	S. Kazmi — PROJECT ENGINEER
	QUANTITIES BY C. Subrizi	CHECKED A. Read	

BRIDGE NO. 20-0155R/L
POST MILE 3.75

101/116 SEPARATION OVERHEAD
PIER 7L FOOTING

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 147201

DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES (PRELIMINARY STAGE ONLY) 3-19-93 4-16-93 6-23-93 10-01-93 11-22-93 12-23-93

SHEET 6 OF 11

LTM SAC31:4287:EP722)SS110.FGB71 27DEC93-14.13.50

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	San	101	3.215.8	36	49

REGISTERED CIVIL ENGINEER
11-14-94
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER J. Scales No. 42895 Exp. 3-31-96 CIVIL STATE OF CALIFORNIA

Parsons Brinckerhoff Quade & Douglas, Inc
2485 Natomas Park Drive, Suite 400
Sacramento, CA 95833

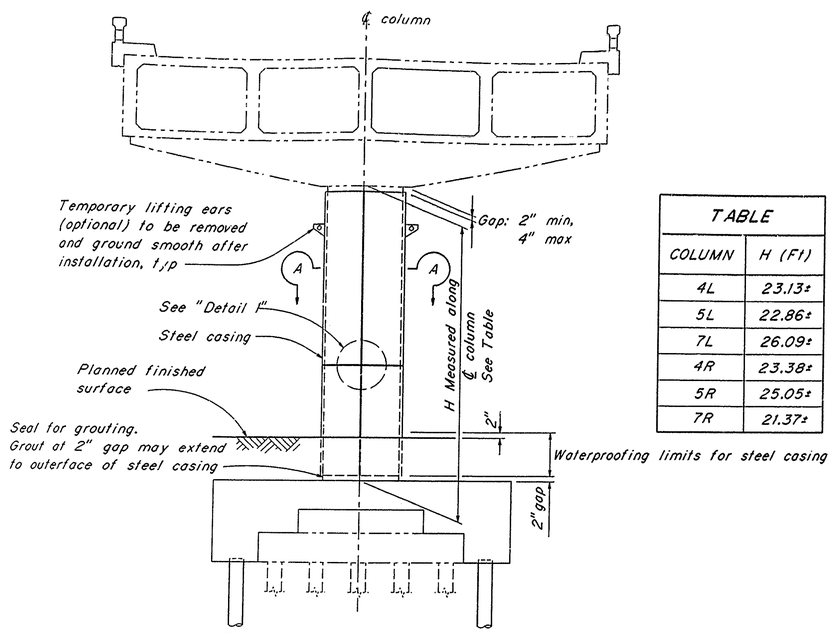
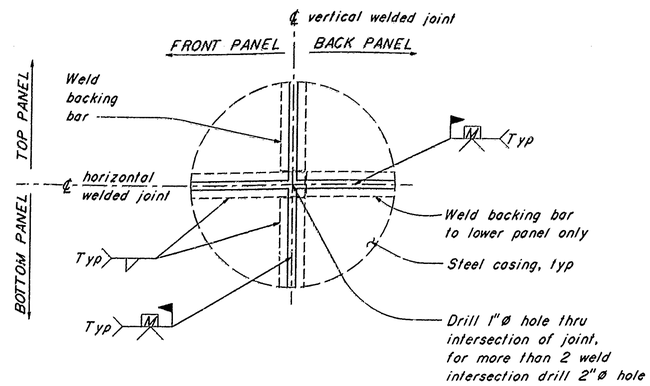


TABLE	
COLUMN	H (Ft)
4L	23.13±
5L	22.86±
7L	26.09±
4R	23.38±
5R	25.05±
7R	21.37±

CLASS F COLUMN RETROFIT
No Scale

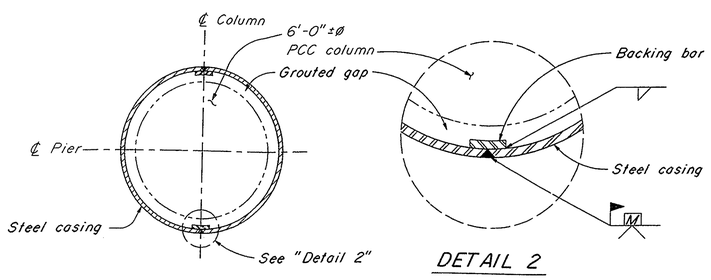


(TWO WELDED INTERSECTION JOINT)

DETAIL 1
No Scale

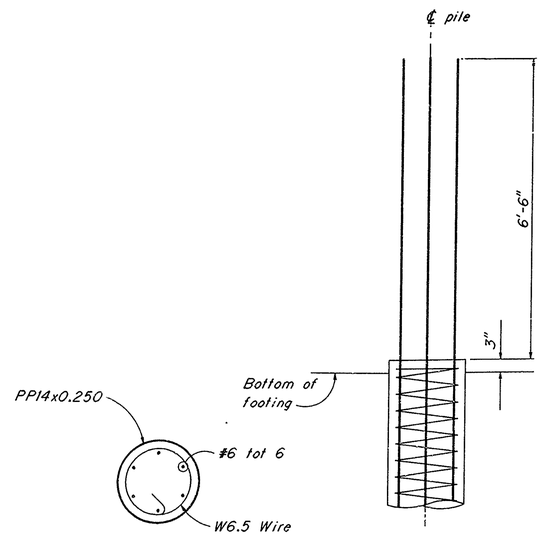
NOTES

1. Appropriate injection nozzles to be provided on casing, but removed and ground flush following completion of grouting operation.
2. All voids between steel casing and PCC column to be grouted from bottom to top.
3. Location and number of vertical and horizontal welds to be determined by the Contractor, and subject to the approval of the Engineer. The location of casing welds are for illustration. No skip welds allowed.
4. Casings and backing bars shall be ½" thick.
5. Minimum inside diameter of steel casing shall be 1½" greater than nominal column diameter.



SECTION A-A
No Scale

DETAIL 2



PLAN

ELEVATION

CLASS 70C MODIFIED PILE
No Scale
NOTE: This special detail supersedes "Section V-V" and "Section U-U" on Sheet No. B 2-8, page 131, of the Standard Plans dated July, 1992.

NO AS BUILT CHANGES
AS BUILT
CORRECTIONS BY J. Kress
CONTRACT NO. 04-147204
DATE 04-96 10-24-96

NOTE:
The contractor shall verify all controlling field dimensions before ordering or fabricating any material.

Earthquake Retrofit Project No. 693

Moe Amini, DESIGN OVERSIGHT	DESIGN	BY C. Subrizi	CHECKED H. Chui
	DETAILS	BY F. Corzon	CHECKED C. Subrizi
	QUANTITIES	BY C. Subrizi	CHECKED H. Chui

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. Kazmi, PROJECT ENGINEER

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 147201

BRIDGE NO. 20-0155R/L
POST MILE 3.75

101/116 SEPARATION OVERHEAD
COLUMN RETROFIT DETAILS

DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES (PRELIMINARY STAGE ONLY) 3-19-93 4-16-93 6-23-93 10-01-93 11-22-93 12-23-93

SHEET 7 OF 11

LIM SAC31::4287:(P722)SS006.FGB;1 27DEC93-14.18.00

< 24

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Son	101	3.2/5.8	37	49

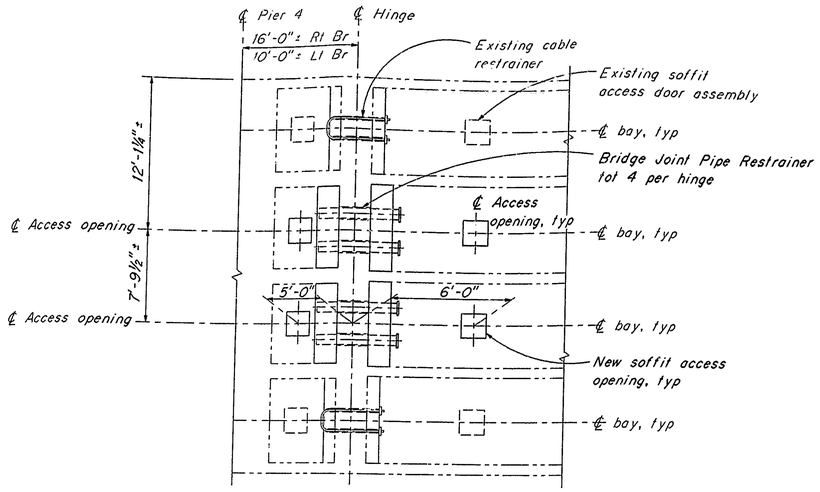
REGISTERED CIVIL ENGINEER

11-14-94

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — J. Scales No. 42895 Exp. 3-31-96 CIVIL — STATE OF CALIFORNIA

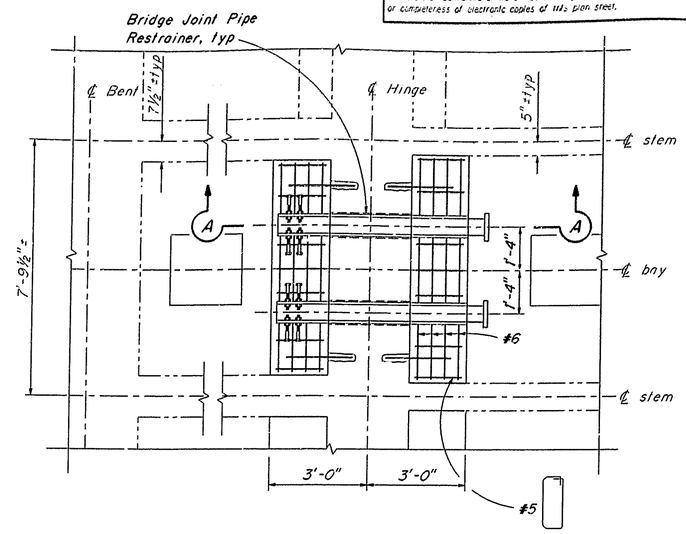
Parsons Brinckerhoff Quade & Douglas, Inc
2485 Natomas Park Drive, Suite 400
Sacramento, CA 95833



Hinge in Span 4L shown, Spans 4R, 6L and 6R similar

PART PLAN - SUPERSTRUCTURE HINGE

No Scale

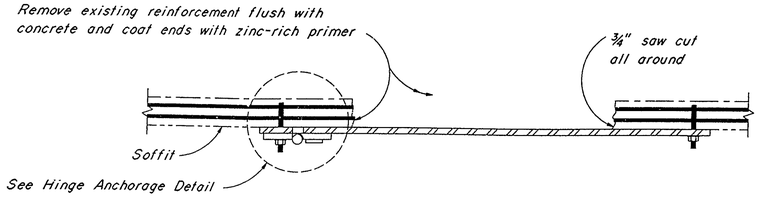


CONCRETE BOLSTER PLAN

1/2" = 1'-0"

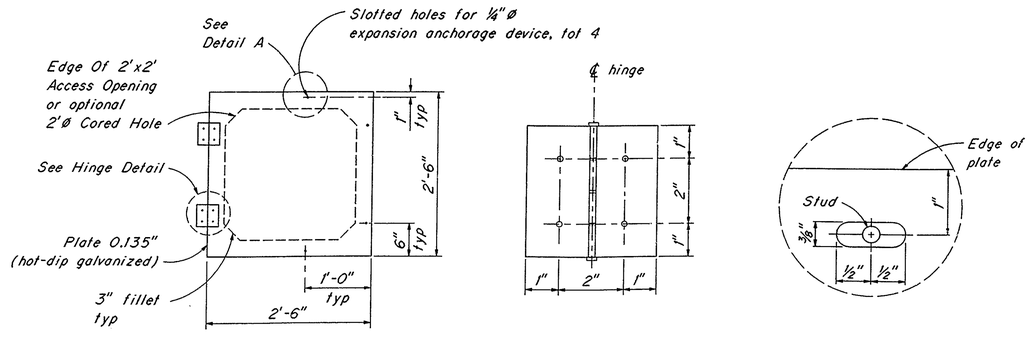
NOTES

1. See "Hinge Retrofit Details No. 2" sheet for Section A-A.
2. Non-removable pin in hinge.
3. Hinge assembly to be galvanized, brass or stainless steel.
4. Use thread locking system for all hinge nuts.
5. Hinge assembly to be minimum ⅛" thick.
6. Soffit acces door opening direction to be determined by the Engineer.



SOFFIT OPENING DETAIL

No Scale



PLAN

1"=1'-0"

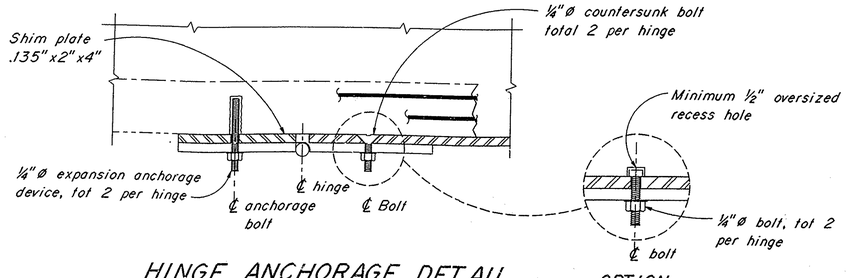
HINGE DETAIL

1" = 6"

DETAIL A

No Scale

SOFFIT ACCESS DOOR ASSEMBLY



HINGE ANCHORAGE DETAIL

No Scale

OPTION

NO AS BUILT CHANGES

AS BUILT

CORRECTIONS BY J Kr

CONTRACT NO. 04-1H124

DATE 04-96

NOTE:
The contractor shall verify all controlling field dimensions before ordering or fabricating any material.

Earthquake Retrofit Project No. 693

Moe Amini — DESIGN OVERSIGHT — SIGN OFF DATE	DESIGN	BY C. Subrizi	CHECKED H. Chui
	DETAILS	BY F. Carzon	CHECKED C. Subrizi
	QUANTITIES	BY C. Subrizi	CHECKED H. Chui

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. Kazmi — PROJECT ENGINEER

BRIDGE NO. 20-0155R/L

POST MILE 3.75

101/116 SEPARATION OVERHEAD

HINGE RETROFIT DETAILS NO. 1

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 147201

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 3-19-93 4-19-93 6-23-93 10-01-93 11-22-93 12-23-93

SHEET 8 OF 11

TKB SAC31::4287;(P722)SS007.FGB;1 22DEC93-08.20.50

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Son	101	3.2/5.8	38	49

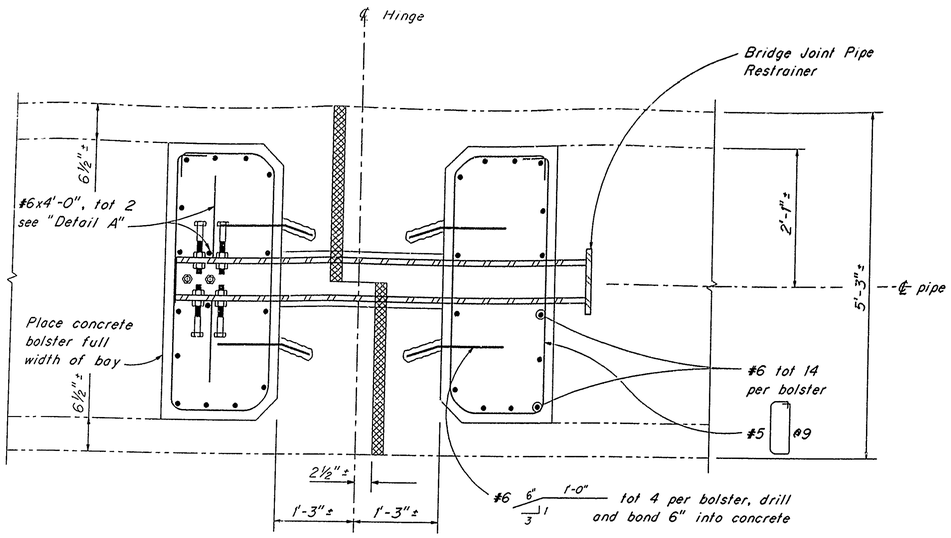
John Scales
REGISTERED CIVIL ENGINEER

11-14-94
PLANS APPROVAL DATE

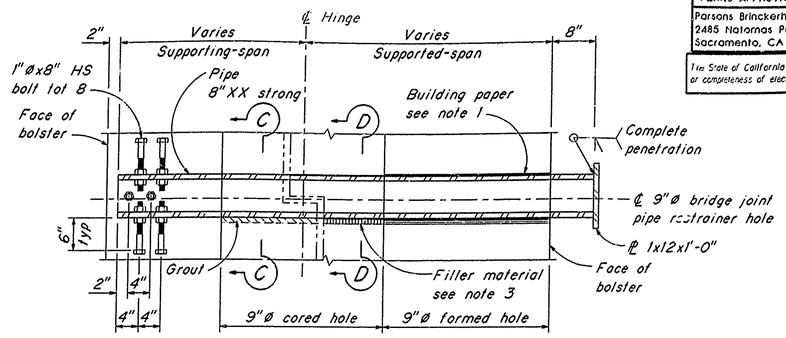
REGISTERED PROFESSIONAL ENGINEER J. Scales No. 42895 Exp. 3-31-96 CIVIL STATE OF CALIFORNIA

Parsons Brinckerhoff Quade & Douglas, Inc
2485 Natomas Park Drive, Suite 400
Sacramento, CA 95833

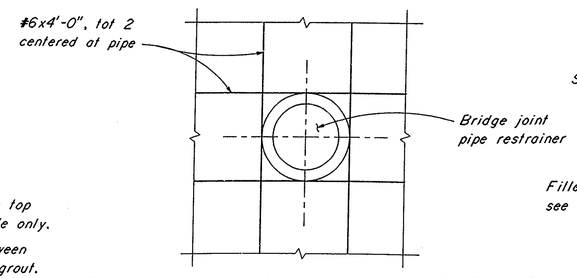
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.



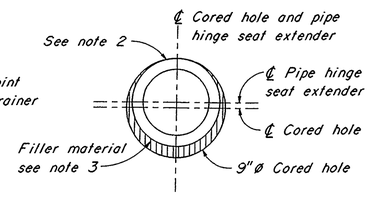
SECTION A-A
1" = 1'-0"



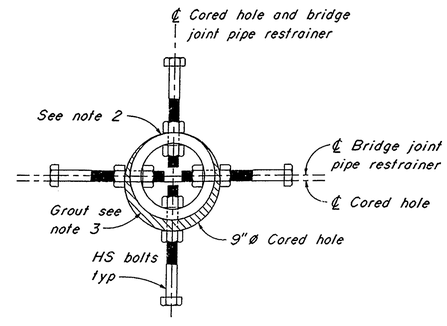
BRIDGE JOINT PIPE RESTRAINER
1" = 1'-0"



DETAIL A
2" = 1'-0"



SECTION D-D
2" = 1'-0"



SECTION C-C
2" = 1'-0"

NOTES:

1. At formed hole, provide 15# building paper at the supported-span side only. Tightly wrap pipe with two (2) layers of building paper.
2. Bridge joint pipe restrainer should be placed against the top of hole and embedded in concrete at supporting-span side only.
3. Where hole is cored in the supporting-span, fill void between bridge joint pipe restrainer and cored hole surface with grout. Where hole is cored, in the supported-span fill void between bridge joint pipe restrainer and the hole surface with filler material.
4. Location of cored holes shown on the plans are approximate. Prior to coring holes in concrete, the contractor shall locate all major existing reinforcing steel and adjust the location of the holes to clear all major reinforcement. Final hole locations are subject to the approval of the engineer.

NO AS BUILT CHANGES
AS BUILT
CORRECTIONS BY J. Arce
CONTRACT NO. 04-14-20
DATE 04-96

NOTE:
The contractor shall verify all controlling field dimensions before ordering or fabricating any material.

Earthquake Retrofit Project No. 693

Moe Amini
DESIGN OVERSIGHT
SIGN OFF DATE

	BY	CHECKED
DESIGN	C. Subrizi	H. Chui
DETAILS	F. Carzon	C. Subrizi
QUANTITIES	C. Subrizi	H. Chui

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. Kazmi
PROJECT ENGINEER

BRIDGE NO. 20-0155R/L
POST MILE 3.75

101/116 SEPARATION OVERHEAD
HINGE RETROFIT DETAILS NO. 2

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 147201

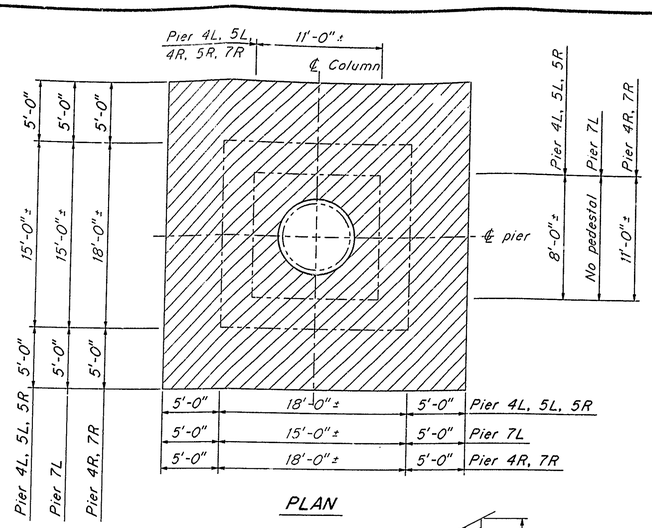
DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 3-19-93, 4-14-93, 6-22-93, 10-01-93, 11-22-93, 12-23-93

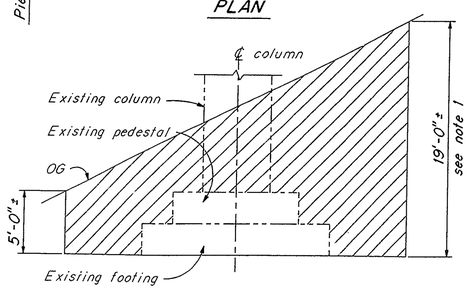
SHEET 9 OF 11

TKB SAC31::4287:[P722]SS008.FGB;1 22DEC93-08.47.00

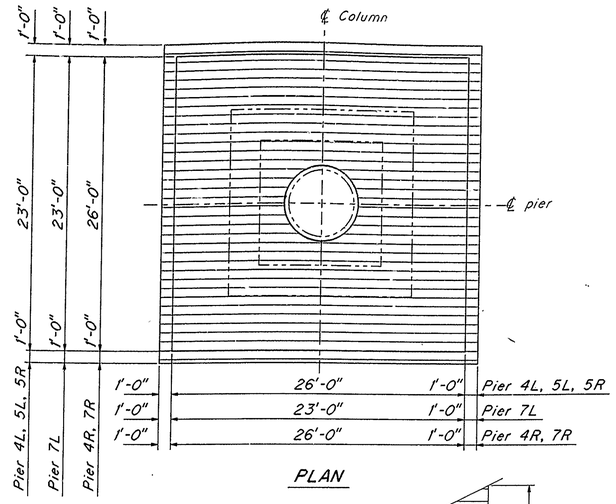
< 24



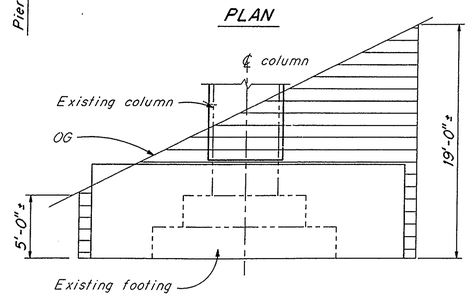
PLAN



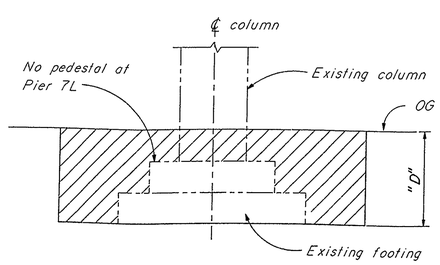
ELEVATION AT PIER 7R



PLAN



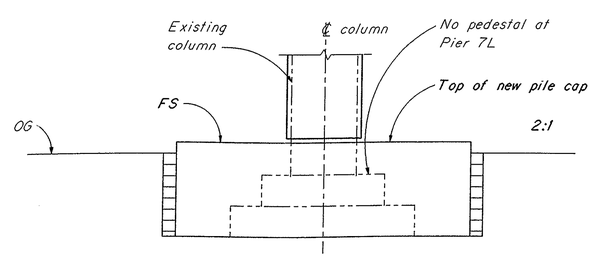
ELEVATION AT PIER 7R



ELEVATION (ALL EXCEPT 7R)

EXCAVATION

Pier	"D"
4L	8'-0"±
5L	6'-0"±
7L	6'-0"±
4R	7'-0"±
5R	6'-0"±



ELEVATION (ALL EXCEPT 7R)

BACKFILL

FOOTING RETROFITS

No Scale

NOTE:
The contractor shall verify all controlling field dimensions before ordering or fabricating any material.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Son	101	3.2/5.8	39	49

REGISTERED CIVIL ENGINEER

11-14-94
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER J. Scales No. 42895 Exp. 3-31-96 CIVIL STATE OF CALIFORNIA

Parsons Brinckerhoff Quade & Douglas, Inc
2485 Natomas Park Drive, Suite 400
Sacramento, CA 95833

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NO AS BUILT CHANGES
AS BUILT
CORRECTIONS BY J. Kress
CONTRACT NO. 04-147204
DATE 04-96 10-24-96

LEGEND

Structure excavation

Structure backfill

Earthquake Retrofit Project No. 693

Moe Amini
DESIGN OVERSIGHT
SIGN OFF DATE

	BY	CHECKED
DESIGN	C. Subrizi	H. Chui
DETAILS	F. Carzon	C. Subrizi
QUANTITIES	C. Subrizi	A. Read

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. Kazmi
PROJECT ENGINEER

BRIDGE NO. 20-0155R/L
POST MILE 3.75

101/116 SEPARATION OVERHEAD
LIMITS OF EXCAVATION AND BACKFILL

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 147201

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 3-19-93 4-19-93 6-23-93 10-27-93 11-22-93 12-23-93

SHEET 10 OF 11

LIM SAC51::4287:(P7221SS003.FGB)! 27DEC93-13.09.10

NOTE:
THE AS-BUILT LOG OF TEST BORING SHEETS WERE USED TO PREPARE THE GEOTECHNICAL REPORT.

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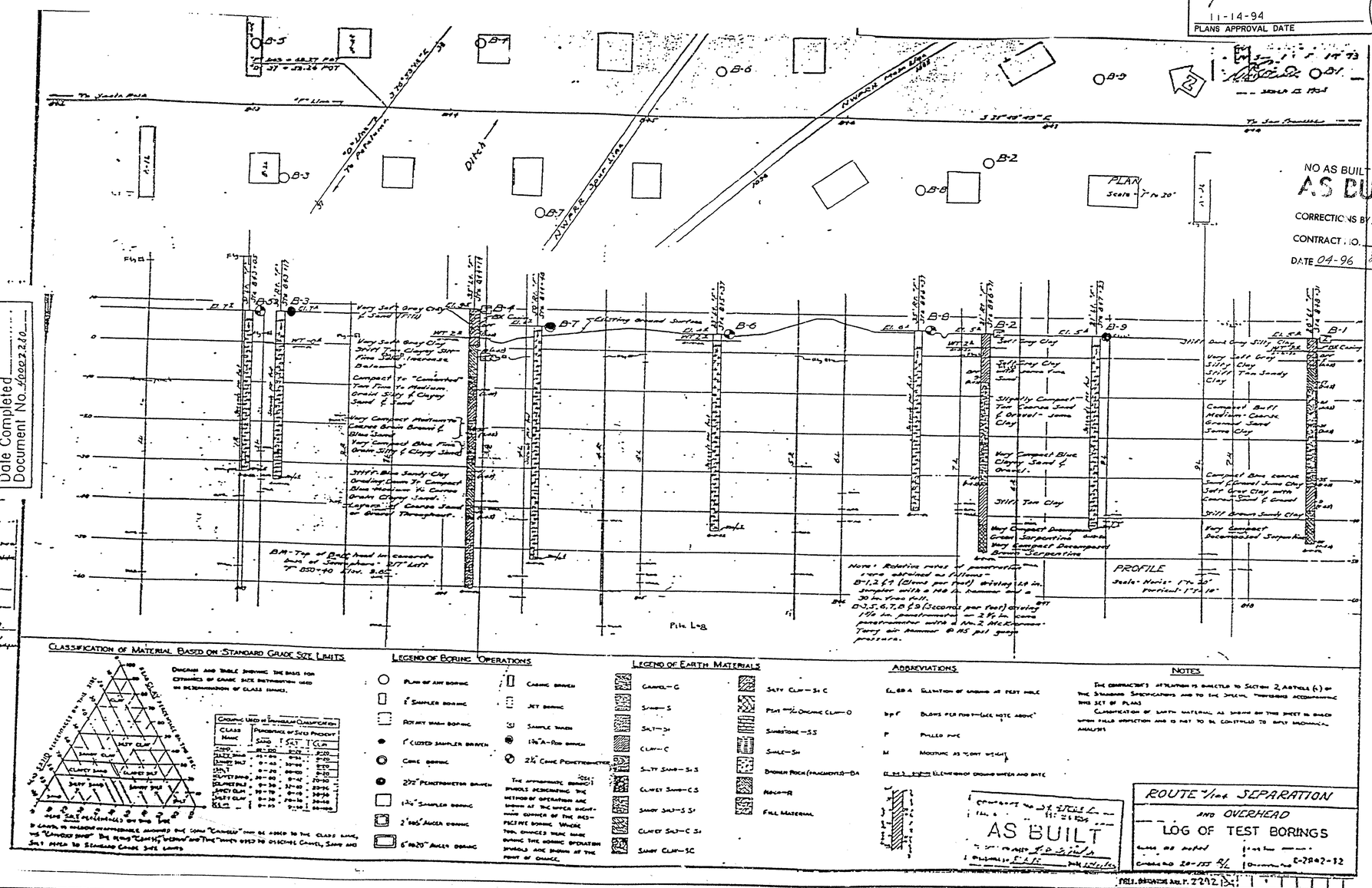
DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Son	101	3.2/5.8	40	49

John Scales
REGISTERED CIVIL ENGINEER
11-14-94
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
J. Scales
No. 42895
Exp. 3-31-96
CIVIL
STATE OF CALIFORNIA

NO AS BUILT CHANGES
AS BUILT
CORRECTIONS BY J. Kress
CONTRACT NO. 04-147204
DATE 04-96 10-24-96

AS BUILT PLANS
Contract No. 04-147204
Date Completed
Document No. 400022210



ROUTE 101 SEPARATION AND OVERHEAD
LOG OF TEST BORINGS

Moe Amini
DESIGN OVERSIGHT
SIGN AND DATE 3/94

NOTE:
ADDITIONAL AS-BUILT FOUNDATION DATA MAY BE AVAILABLE AT THE DIVISION OF NEW TECHNOLOGY, MATERIALS AND RESEARCH 5900 FOLSOM BOULEVARD, SACRAMENTO, CALIFORNIA 95819

DESIGN	BY	CHECKED
DETAILS	BY	CHECKED
QUANTITIES	BY	CHECKED

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

S. Kazmi
PROJECT ENGINEER

BRIDGE NO. 20-0155R/L
POST MILE 3.57

101/116 SEPARATION OVERHEAD
AS-BUILT LOG OF TEST BORINGS

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 04
EA 147201

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 3-18-93, 4-14-93, 6-23-93, 10-07-93, 11-22-93, 12-23-93

SHEET 11 OF 11

< 24

Pre As-Built Plans for RTE U.S. 101/116 SOH Left (Replace)

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	1	148

ACNH-Q101(058)E

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON
STATE HIGHWAY

IN SONOMA COUNTY
IN PETALUMA FROM PETALUMA RIVER BRIDGE
TO 0.2 KM NORTH OF ROUTE 101/116
SEPARATION AND OVERHEAD

To be supplemented by Standard Plans dated July, 1999

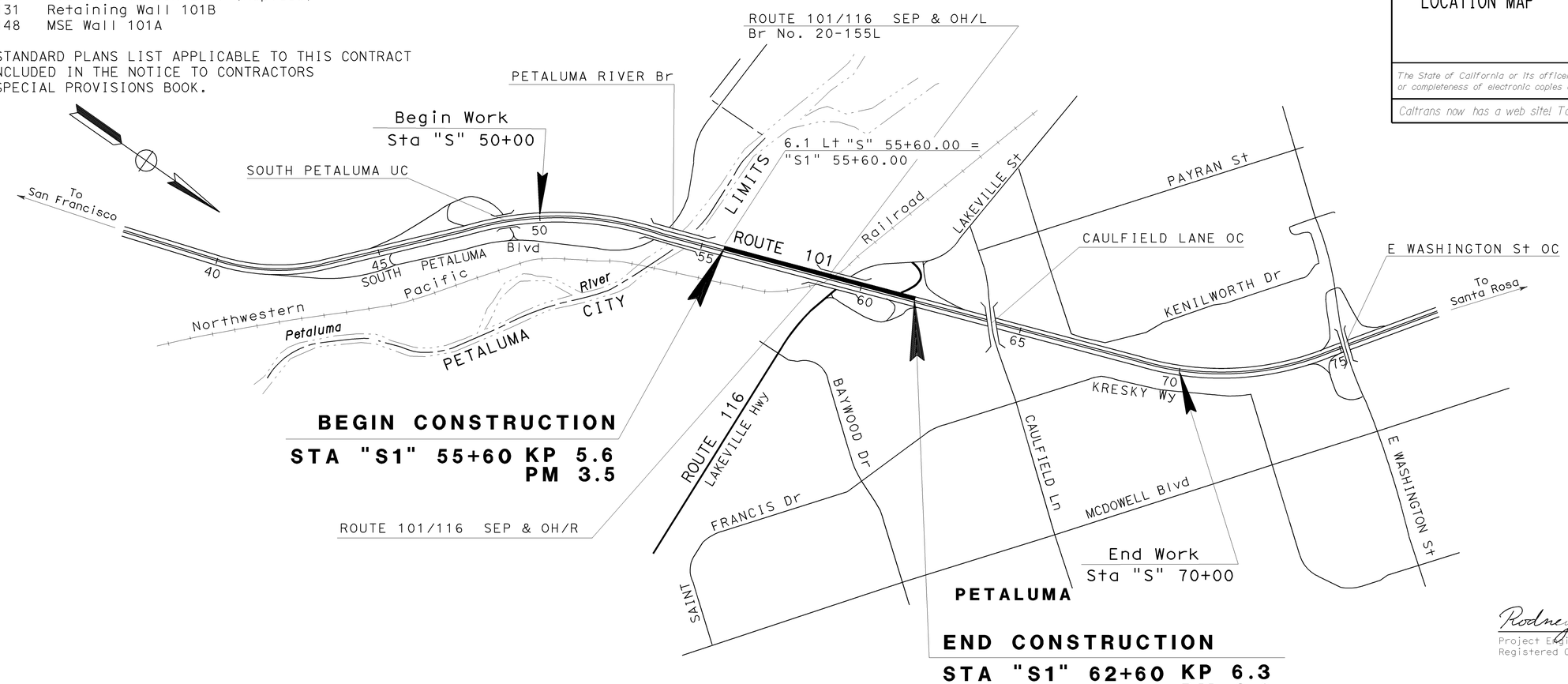
INDEX OF SHEETS

Sheet No.	Description
1	Title and Location Map
2-3	Typical Cross Sections
4-5	Layouts
6-7	Profiles
8-9	Superelevation Diagrams
10	Construction Details
11-18	Water Pollution Control Details
19-23	Erosion Control Plans and Deatils
24-25	Drainage Plan, Utility Plan and Contour Grading Plan
26-30	Drainage Profiles, Details, and Quantities
31-45	Stage Construction Plans and Quantities
46-47	Traffic Handling Plans
48	Construction Area Signs
49-51	Pavement Delineation Plans, Details and Quantities
52-53	Summary of Quantities
54-59	Sign Plans, Details and Quantities
60-64	Highway Planting
65-80	Electrical Plans
81-94	Revised Standard Plans

STRUCTURE PLANS

95-121	Rte 101/116 SOH Left (Replace)
122-131	Retaining Wall 101B
132-148	MSE Wall 101A

THE STANDARD PLANS LIST APPLICABLE TO THIS CONTRACT IS INCLUDED IN THE NOTICE TO CONTRACTORS AND SPECIAL PROVISIONS BOOK.



NO SCALE

LOCATION MAP

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Caltrans now has a web site! To get to the web site, go to: http://www.dot.ca.gov

Caltrans Metric

4-01-03
Rodney J. Noda
Project Engineer Date
Registered Civil Engineer

REGISTERED PROFESSIONAL ENGINEER
R.J. Noda
No. 39809
Exp. 12-31-05
CIVIL
STATE OF CALIFORNIA

March 15, 2004
Plans Approval Date

PROJECT ENGINEER	DATE	PROJECT MANAGER	DATE
R.J. NODA	4/03	L. ACORDA	4/03

The Contractor shall possess the Class (or Classes) of license as specified in the ''Notice to Contractors''.

Contract No. **04-276004**

LAST REVISION 03-19-03 DATE PLOTTED => 23-MAR-2004 TIME PLOTTED => 12:54

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	95	148

Caltrans Metric

REGISTERED CIVIL ENGINEER 3-26-03 DATE

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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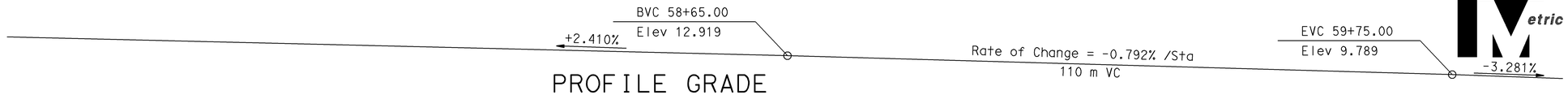
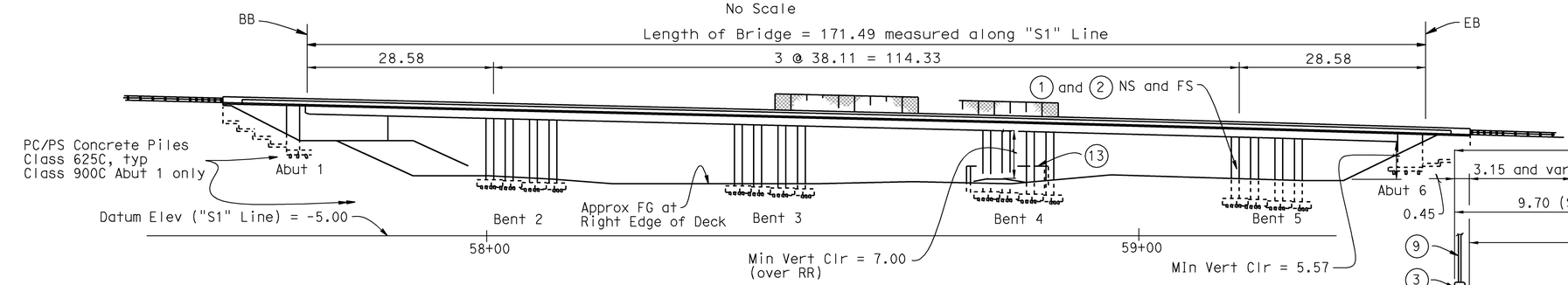


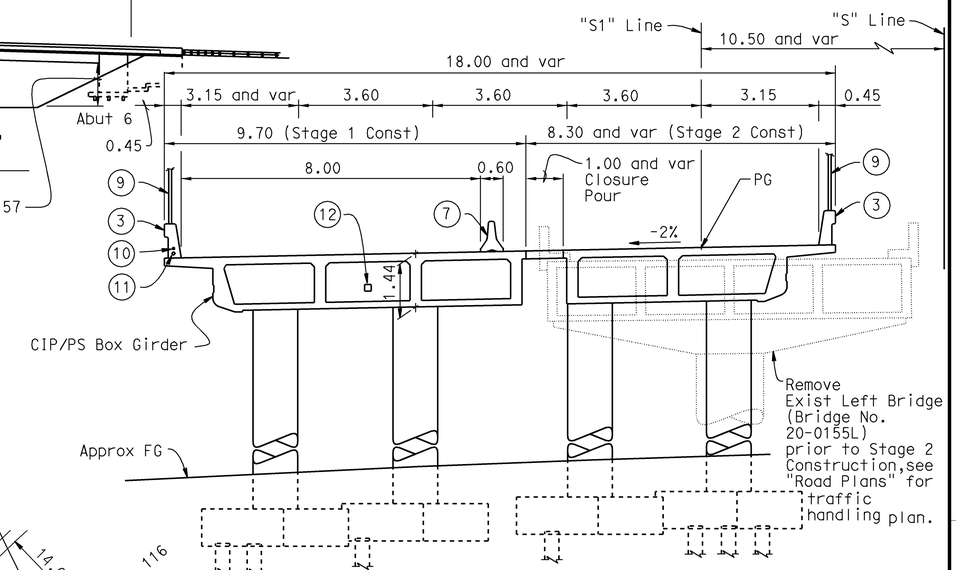
PROFILE GRADE

No Scale



ELEVATION

1:400

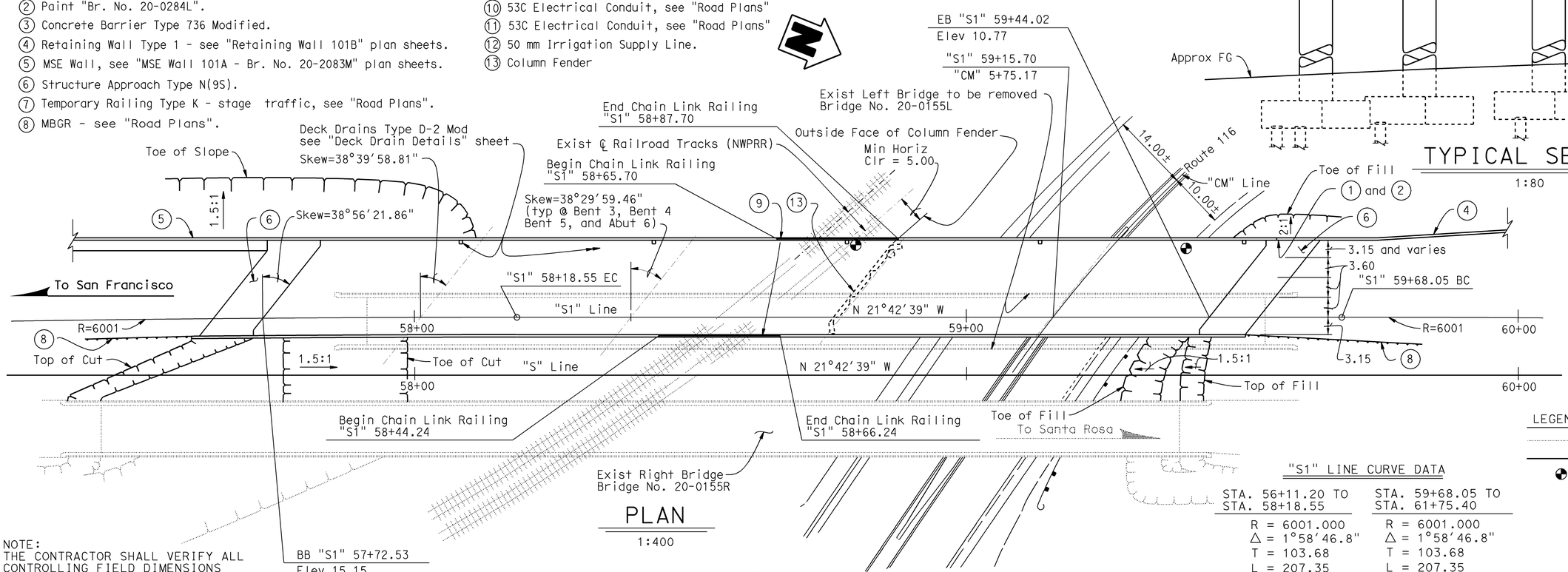


TYPICAL SECTION

1:80

NOTES:

1. Paint Br. Name: "101/116 SOH LEFT".
2. Paint "Br. No. 20-0284L".
3. Concrete Barrier Type 736 Modified.
4. Retaining Wall Type 1 - see "Retaining Wall 101B" plan sheets.
5. MSE Wall, see "MSE Wall 101A - Br. No. 20-2083M" plan sheets.
6. Structure Approach Type N(9S).
7. Temporary Railing Type K - stage traffic, see "Road Plans".
8. MBGR - see "Road Plans".
9. Chain Link Railing Type 7 Modified.
10. 53C Electrical Conduit, see "Road Plans"
11. 53C Electrical Conduit, see "Road Plans"
12. 50 mm Irrigation Supply Line.
13. Column Fender



PLAN

1:400

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

For General Notes, Index to Plans, Standard Plans, Pile Data Table and Quantities, see "Index To Plans" sheet.

LEGEND:

- Indicates existing structure.
- Indicates new structure.
- Indicates points of minimum vertical clearance.

"S1" LINE CURVE DATA

STA. 56+11.20 TO STA. 58+18.55	STA. 59+68.05 TO STA. 61+75.40
R = 6001.000	R = 6001.000
Δ = 1°58'46.8"	Δ = 1°58'46.8"
T = 103.68	T = 103.68
L = 207.35	L = 207.35

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

GUDMUND SETBERG DESIGN ENGINEER	DESIGN	BY A. Gilani	CHECKED D. Abellon	LOAD FACTOR DESIGN	LIVE LOADING: HS20-44 AND ALTERNATIVE AND PERMIT DESIGN LOAD		
	DETAILS	BY E. Montevirgen	CHECKED D. Abellon	LAYOUT	BY A. Gilani	CHECKED D. Abellon	
	QUANTITIES	BY S. Davis	CHECKED N. Nguyen	SPECIFICATIONS	BY K. Meier	PLANS AND SPECS COMPARED K. Meier	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)

GENERAL PLAN

STRUCTURES DESIGN GENERAL PLAN SHEET (METRIC) (REV.12-1-01)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 4-18-02 1-14-03 2-3-03 2-26-03 3-03-03 3-03-26

SHEET 1 OF 27

USERNAME => trbing DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:28

FILE => aagp.dgn

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	96	148

Caltrans Metric

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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GENERAL NOTES
LOAD FACTOR DESIGN

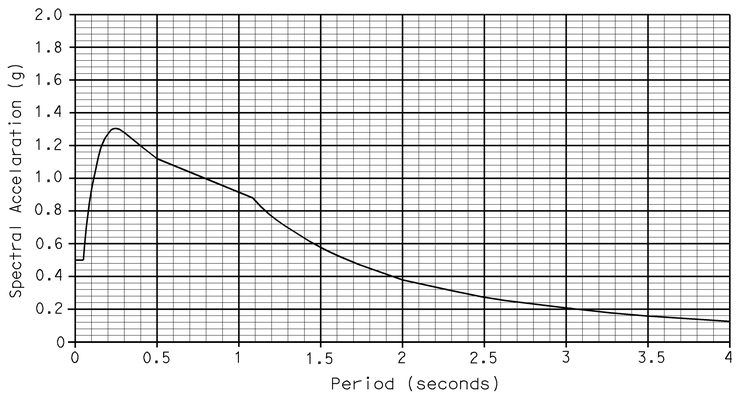
DESIGN: BRIDGE DESIGN SPECIFICATIONS (1996 AASHTO with Interims through 1998 and Revisions by CALTRANS)

DEAD LOAD: Includes 1675 Pa for future wearing surfaces.

LIVE LOADING: HS20-44 and alternative and permit design load.

SEISMIC DESIGN: Caltrans Seismic Design Criteria (SDC), Version 1.1 July 1999.

SEISMIC LOADING: Site Specific Acceleration Response Spectra Curve.

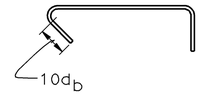


REINFORCED CONCRETE: f_y = 420 MPa

f'_c = see Concrete Strength and Type Limits on "Deck Contours" sheet.

Transverse Deck Slabs (Working Stress Design)
f_s = 140 MPa
f_c = 9 MPa
n = 8

PRESTRESSED CONCRETE: see "Prestressing Notes" on "Deck Contours" sheet.



Typical all 135° hooks

PILE DATA TABLE

Location	Pile Type	Design Loading (kN)	Nominal Resistance Compression (kN)	Nominal Resistance Tension (kN)	Design Pile Tip Elevations (m)	Specified Pile Tip Elevations (m)
Abut 1	Class 900C Alt."X"	900	1800	0	-12.5(1)	-12.5
Bent 2	Class 625C Alt."X"	625	1250	390	-12.2(1)	-12.2
Bent 3	Class 625C Alt."X"	625	1250	390	-13.7(1)	-13.7
Bent 4	Class 625C Alt."X"	625	1250	390	-17.0(1)	-17.0
Bent 5	Class 625C Alt."X"	625	1250	390	-14.6(1)	-14.6
Abut 6	Class 625C Alt."X"	625	1250	0	-16.0(1)	-16.0
Abut 1 Retaining Wall	Class 400C Alt."X"	400	800	0	-12.0(1)	-12.0
Abut 6 Retaining Wall	Class 400C Alt."X"	400	800	0	-12.0(1)	-12.0

Notes:
(1) Design tip elevations are controlled by compression.

101/116 SOH — BR NO 20-0284L

QUANTITIES

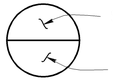
BRIDGE REMOVAL	LUMP SUM	
STRUCTURE EXCAVATION (BRIDGE)	530	m^3
STRUCTURE EXCAVATION (TYPE D)	300	m^3
STRUCTURE EXCAVATION (TYPE DR)	208	m^3
STRUCTURE BACKFILL (BRIDGE)	860	m^3
NPS 2 SUPPLY LINE (BRIDGE)	190	m
FURNISH PILING (CLASS 900C) (ALTERNATIVE X)	554	m
DRIVE PILE (CLASS 900C)(ALTERNATIVE X)	27	EA
FURNISH PILING (CLASS 625C) (ALTERNATIVE X)	2 838	m
DRIVE PILE (CLASS 625C)(ALTERNATIVE X)	173	EA
FURNISH PILING (CLASS 400C) (ALTERNATIVE X)	583	m
DRIVE PILE (CLASS 400C)(ALTERNATIVE X)	28	EA
PRESTRESSING CAST-IN-PLACE CONCRETE	LUMP SUM	
STRUCTURAL CONCRETE, BRIDGE FOOTING	262	m^3
STRUCTURAL CONCRETE, BRIDGE	2 242	m^3
STRUCTURAL CONCRETE, APPROACH SLAB (TYPE N)	98	m^3
JOINT SEAL ASSEMBLY (MR 90 MM)	47	m
BAR REINFORCING STEEL (BRIDGE)	450 050	kg
ROCK SLOPE PROTECTION (BACKING NO. 2, METHOD B)	2.7	m^3
MISCELLANEOUS METAL (BRIDGE)	1 320	kg
CHAIN LINK RAILING (TYPE 7 MODIFIED)	44	m
CONCRETE BARRIER (TYPE 736 MODIFIED)	364	m

INDEX TO PLANS

SHEET NO.	TITLE
1.	GENERAL PLAN
2.	INDEX TO PLANS
3.	DECK CONTOURS
4.	FOUNDATION PLAN NO. 1
5.	FOUNDATION PLAN NO. 2
6.	ABUTMENT 1 LAYOUT
7.	ABUTMENT 6 LAYOUT
8.	ABUTMENT DETAILS NO. 1
9.	ABUTMENT DETAILS NO. 2
10.	ABUTMENT DETAILS NO. 3
11.	ABUTMENT 1 AND 6 RETAINING WALL DETAILS
12.	BENT DETAILS NO. 1
13.	BENT DETAILS NO. 2
14.	BENT DETAILS NO. 3
15.	TYPICAL SECTION
16.	GIRDER LAYOUT
17.	ADDITIONAL GIRDER REINFORCEMENT
18.	DECK DRAIN LAYOUT
19.	MISCELLANEOUS DETAILS
20.	CHAIN LINK RAILING TYPE 7 MODIFIED
21.	ARCHITECTURAL DETAILS
22.	JOINT SEAL ASSEMBLY (MAXIMUM MOVEMENT RATING = 90 mm)
23.	DECK DRAIN TYPE D-2 MODIFIED
24.	STRUCTURE APPROACH DRAINAGE DETAILS
25.	STRUCTURE APPROACH TYPE N(9S)
26.	LOG OF TEST BORINGS SHEET 1 OF 2
27.	LOG OF TEST BORINGS SHEET 2 OF 2

STANDARD PLANS DATED JULY 1999 (AND ERRATUM NO. 99-1)

A10A	ABBREVIATIONS
A10B	SYMBOLS
A62C	LIMITS OF PAYMENTS FOR EXCAVATION AND BACKFILL BRIDGE
B0-1	BRIDGE DETAILS
RSP B0-3	BRIDGE DETAILS
B0-5	BRIDGE DETAILS
B0-13	BRIDGE DETAILS
B2-6	PILE DETAILS CLASS 400C AND CLASS 625C
B2-8	PILE DETAILS CLASS 900 AND 900C
RSP B3-1	RETAINING WALL TYPE 1 , H=1200 THROUGH 9100 mm
RSP B3-8	RETAINING WALL DETAILS NO. 1
B7-1	BOX GIRDER DETAILS
B7-10	UTILITY OPENING BOX GIRDER
B8-5	CAST-IN-PLACE PRESTRESSED GIRDER DETAILS
RSP B11-56	CONCRETE BARRIER TYPE 736
B14-3	COMMUNICATION AND SPRINKLER CONTROL CONDUITS
B14-4	WATER SUPPLY LINE (BRIDGE) (PIPE SIZES LESS THAN NPS 4)
B14-5	WATER SUPPLY LINE (DETAILS) (PIPE SIZES LESS THAN NPS 4)



ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

	BY	CHECKED
DESIGN	A. Gilani	D. Abellon
DETAILS	E. Montevirgen/DE	D. Abellon
QUANTITIES	S. Davis	N. Nguyen

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
INDEX TO PLANS

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 8-08-02 8-29-02 12-18-02 3-1-03 3-03-03

SHEET 2 OF 27

FILE => aaitp.dgn

USERNAME => trbing DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:28

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	97	148

Caltrans Metric

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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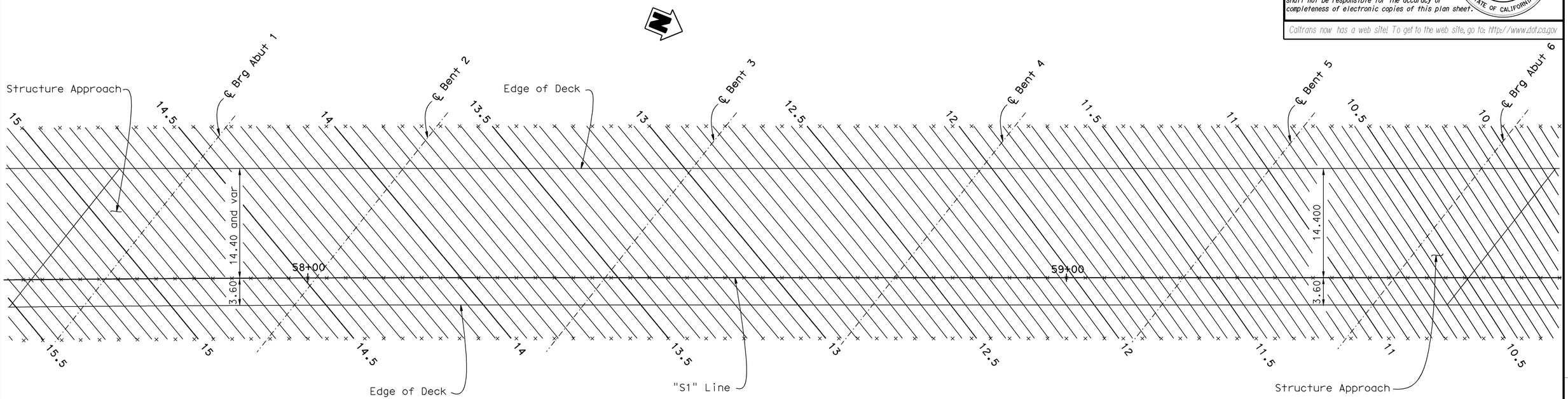
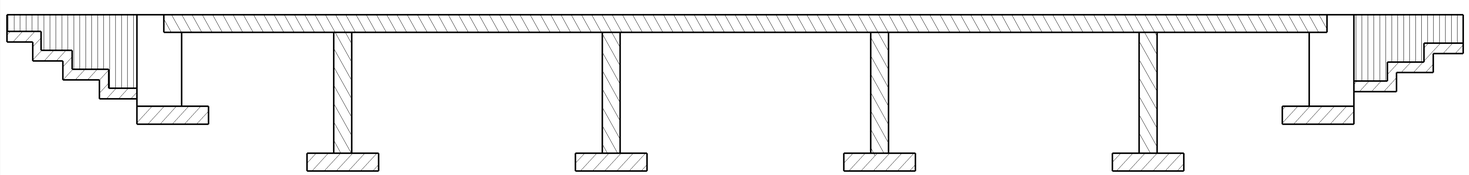


PLAN

1:250

NOTES:

1. X = Indicates 2.5 m station intervals.
2. Contours do not include camber.



CONCRETE STRENGTH AND TYPE LIMITS

- STRUCTURE CONCRETE BRIDGE (28 MPa @ 28 days)
- STRUCTURE CONCRETE BRIDGE (35 MPa @ 28 days)
- STRUCTURE CONCRETE BRIDGE FOOTING (28 MPa @ 28 days)
- STRUCTURE CONCRETE, BRIDGE

PRESTRESSING NOTES

STAGE 1

1860 MPa Low Relaxation Strand:

P_{jack} = 27000 kN

Anchor Set = 10 mm

Total Number of Girders = 4

Distribution of prestress force (Pjack) between girders shall not exceed the ratio of 3:2. Maximum final force variation between girders shall not exceed 3200 kN.

Concrete: f'_c = 35 MPa @ 28 days

f'_{ci} = 25 MPa @ time of stressing

Contractor shall submit elongation calculations based on initial stress at

⊠ = 0.729 times jacking stress.

One end stressing only.

STAGE 2

1860 MPa Low Relaxation Strand:

P_{jack} = 21000 kN

Anchor Set = 10 mm

Total Number of Girders = 3

Distribution of prestress force (Pjack) between girders shall not exceed the ratio of 3:2. Maximum final force variation between girders shall not exceed 3200 kN.

Concrete: f'_c = 35 MPa @ 28 days

f'_{ci} = 25 MPa @ time of stressing

Contractor shall submit elongation calculations based on initial stress at

⊠ = 0.723 times jacking stress.

One end stressing only.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

	BY	CHECKED
DESIGN	A. Gilani	D. Abellon
DETAILS	E. Montevirgen	D. Abellon
QUANTITIES	S. Davis	N. Nguyen

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)

DECK CONTOURS

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 6-28-02 10-23-02 2-28-03 3-04-03 3-03-03

SHEET 3 OF 27

FILE => abdc.dgn

USERNAME => trbing DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:28

NO	R	Δ	T	L
1	6001.000	1°58′46.8"	103.683	207.345

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	98	148

REGISTERED CIVIL ENGINEER 3-26-03 DATE

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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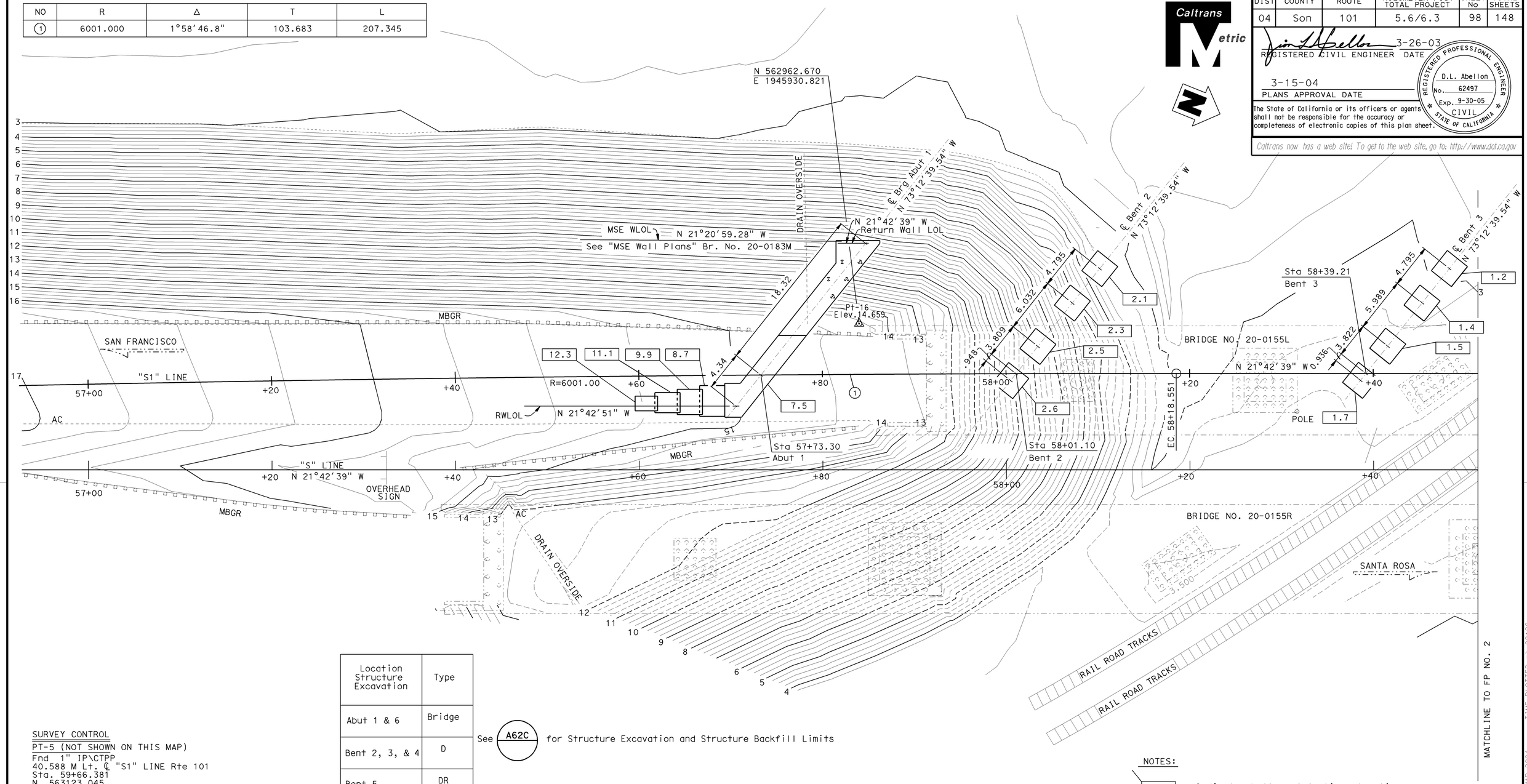

Location Structure Excavation	Type
Abut 1 & 6	Bridge
Bent 2, 3, & 4	D
Bent 5	DR

See A62C for Structure Excavation and Structure Backfill Limits

SURVEY CONTROL

PT-5 (NOT SHOWN ON THIS MAP)
Fnd 1" IP\CTPP
40.588 M Lt. ℄ "S1" LINE Rte 101
Sta. 59+66.381
N 563123.045
E 1945840.431
Elev. = 3.861

PT-16
Fnd PN\CTBRSHN
15.936 M Lt. ℄ "S1" LINE Rte 101
Sta. 57+83.945
N 562962.670
E 1945930.821
Elev. = 14.659

NOTES:

= Indicates bottom of footing elevation.

See "Road Plans" for Utility Layout.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

PRELIMINARY INVESTIGATION SECTION

SCALE 1:200	VERT. DATUM NAVD 88	PHOTOGRAMMETRY AS OF:	
	HORZ. DATUM NAD 83 (1991.35)	SURVEYED BY C. SCHENDEL 1/02	DRAFTED BY F. BANDA 4/02
ALIGNMENT TIES DIST. TRAVERSE SHEET		FIELD CHECKED BY	CHECKED BY J. RING 4/02

STRUCTURES FOUNDATION PLAN SHEET (METRIC) (REV.12-1-01)

	BY	CHECKED
DESIGN	A. Gilani	D. Abellon
DETAILS	E. Montevirgen	D. Abellon
QUANTITIES	S. Davis	N. Nguyen

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN

CU 04
EA 276001

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
FOUNDATION PLAN NO.1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 04/25/02 10/18/02 12/11/02 2/03/03 2/26/03 3/04/03 3/05/03 3/26/03

SHEET 4 OF 27

USERNAME => trbling DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:28

FILE => acfp01.dgn

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	99	148

REGISTERED CIVIL ENGINEER 3-26-03 DATE

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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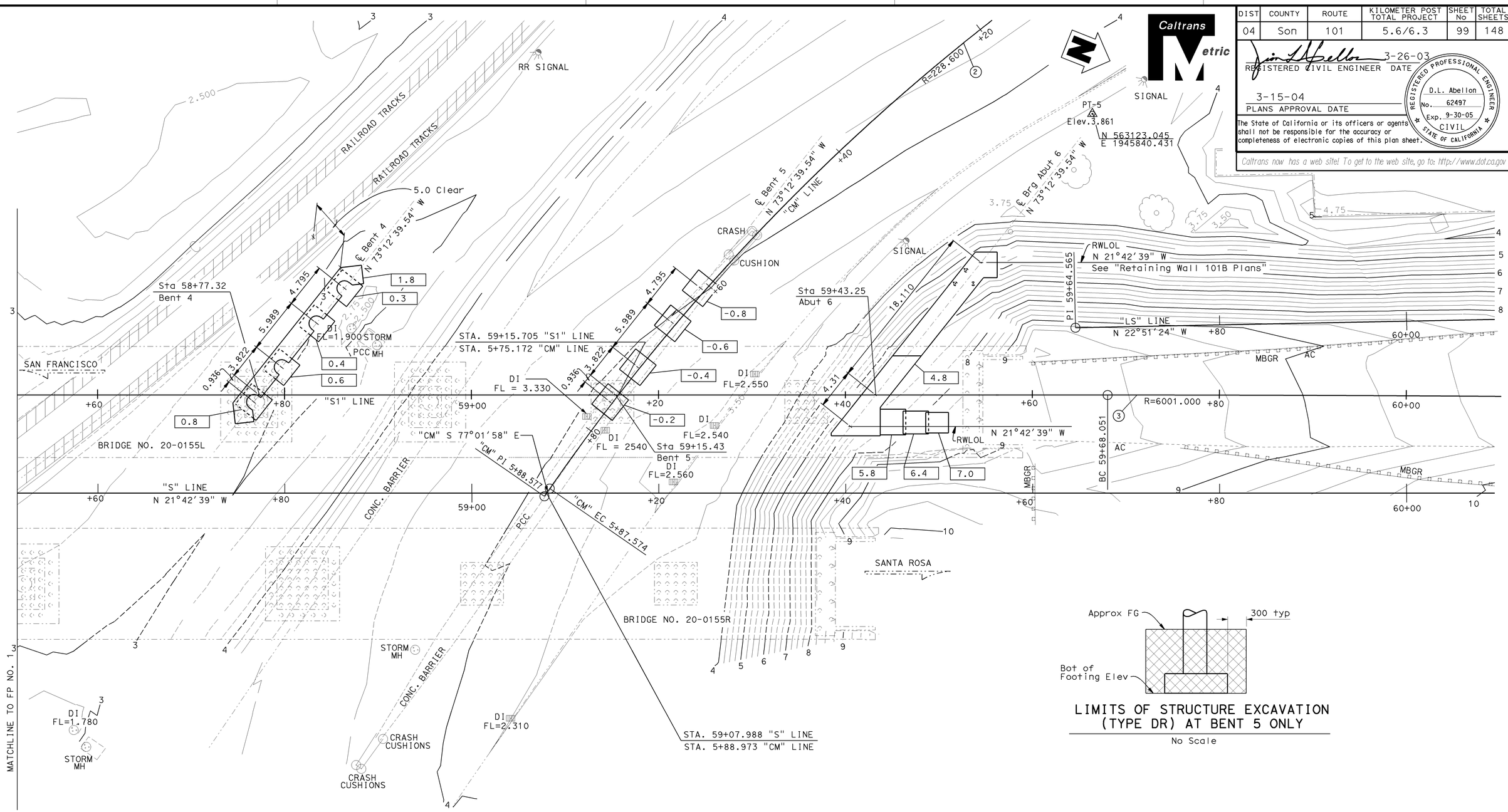

LIMITS OF STRUCTURE EXCAVATION (TYPE DR) AT BENT 5 ONLY

No Scale

NO	R	Δ	T	L
2	228.600	37°28'11.7"	77.532	149.498
3	6001.000	1°58'46.8"	103.683	207.345

NOTES:

= Indicates bottom of footing elevation.

See "Road Plans" for Utility Layout.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

PRELIMINARY INVESTIGATION SECTION

SCALE	VERT. DATUM NAVD 88	PHOTOGRAMMETRY AS OF:			
1:200	HORZ. DATUM NAD 83 (1991.35)	SURVEYED	BY C. SCHENDEL 1/02	DRAFTED	BY F. BANDA 4/02
ALIGNMENT TIES DIST TRAVERSE SHEET		FIELD CHECKED	BY	CHECKED	BY J. RING 4/02

STRUCTURES FOUNDATION PLAN SHEET (METRIC) (REV.12-1-01)

	BY	CHECKED
DESIGN	A. Gilani	D. Abellon
DETAILS	E. Montevirgen	D. Abellon
QUANTITIES	S. Davis	N. Nguyen

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN

CU 04276
EA 276001

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
FOUNDATION PLAN NO.2

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 04/05/02 10/15/02 12/12/02 2/18/03 2/28/03 3/03/03

SHEET 5 OF 27

FILE => acfp02.dgn

USERNAME => rrbing DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:28

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	100	148

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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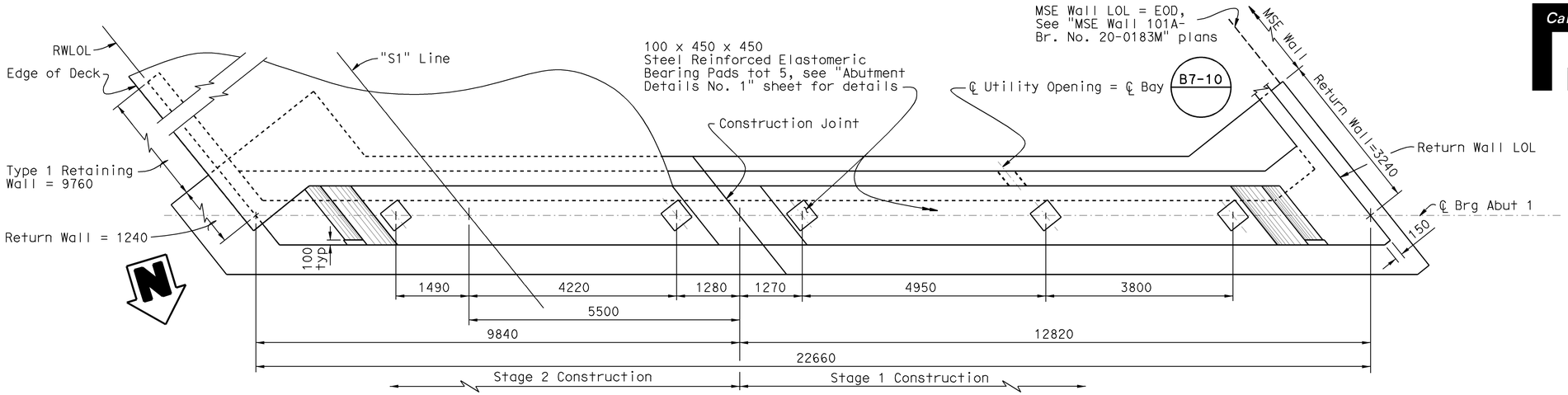
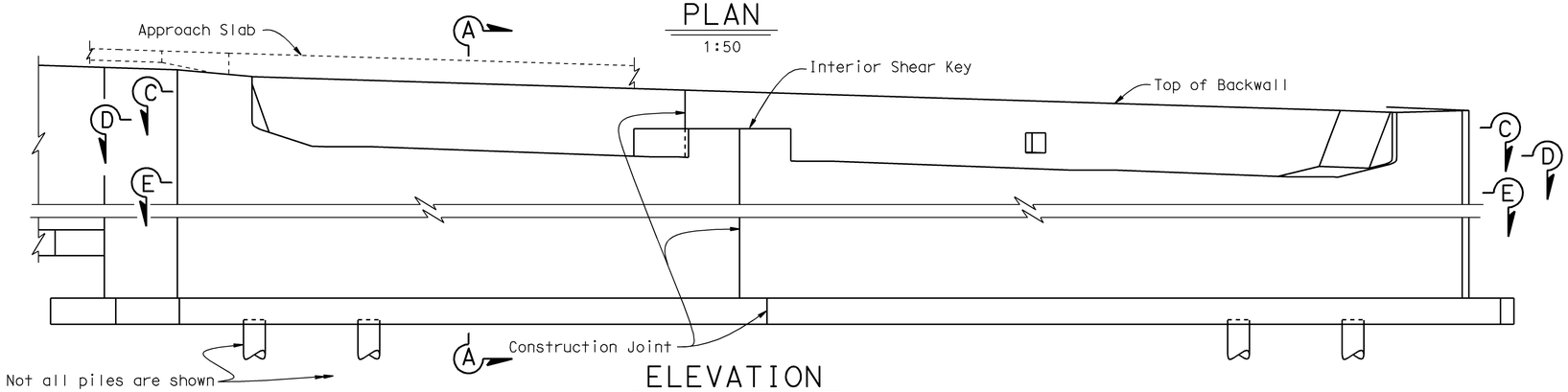
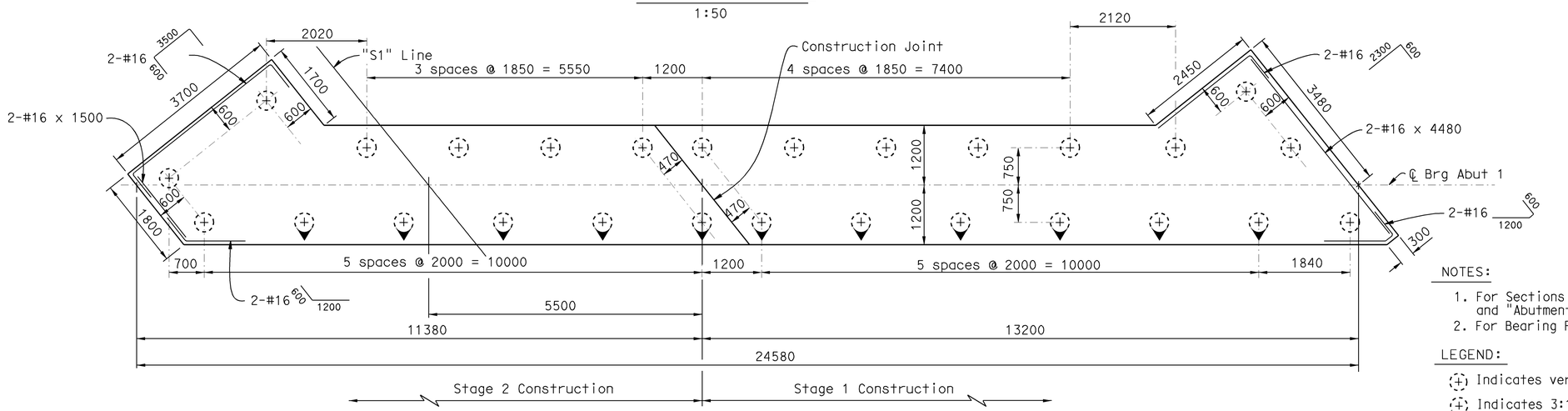


PLAN
1:50



ELEVATION
1:50



FOOTING PLAN
1:50

NOTES:

1. For Sections A-A, C-C, D-D and E-E, see "Abutment Details No. 1" and "Abutment Details No. 2" sheet.
2. For Bearing Pad Details, see "Abutment Details No. 1" sheet.

LEGEND:

Indicates vertical piles.

Indicates 3:1 battered piles.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

DESIGN	BY A. Gilani/T. Shi	CHECKED D. Abellon	
DETAILS	BY E. Montevirgen	CHECKED D. Abellon	
QUANTITIES	BY S. Davis/M. Keo	CHECKED N. Nguyen/M. Abdi	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
ABUTMENT 1 LAYOUT

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 7-15-02 7-31-02 10-25-02 12-13-02 2-18-03 2-25-03 3-03-03 3-03-03

SHEET 6 OF 27

FILE => adabut01io.dgn

USERNAME => trbing DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:29

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	101	148

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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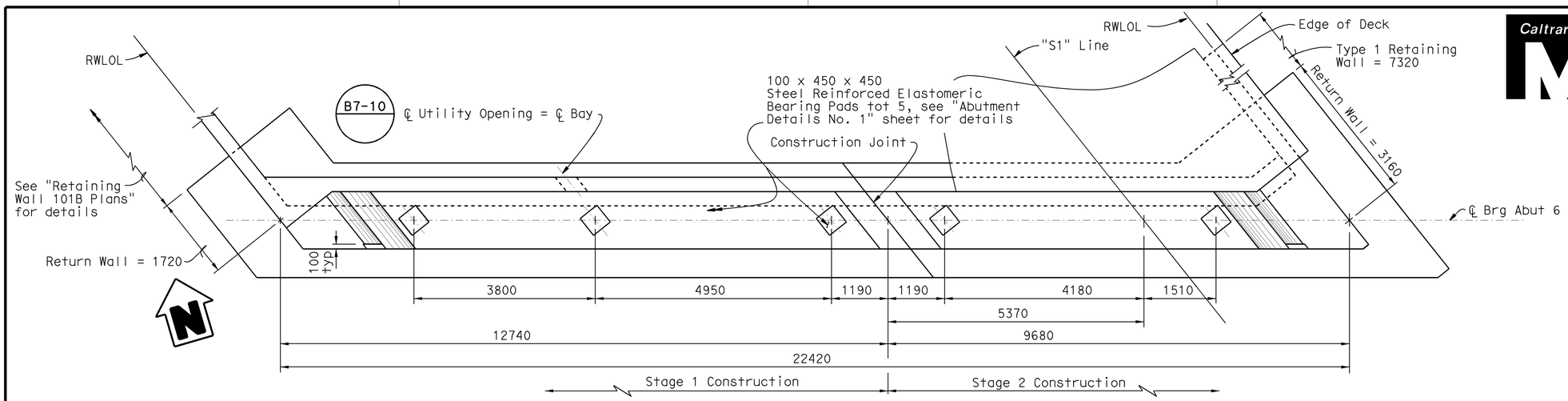
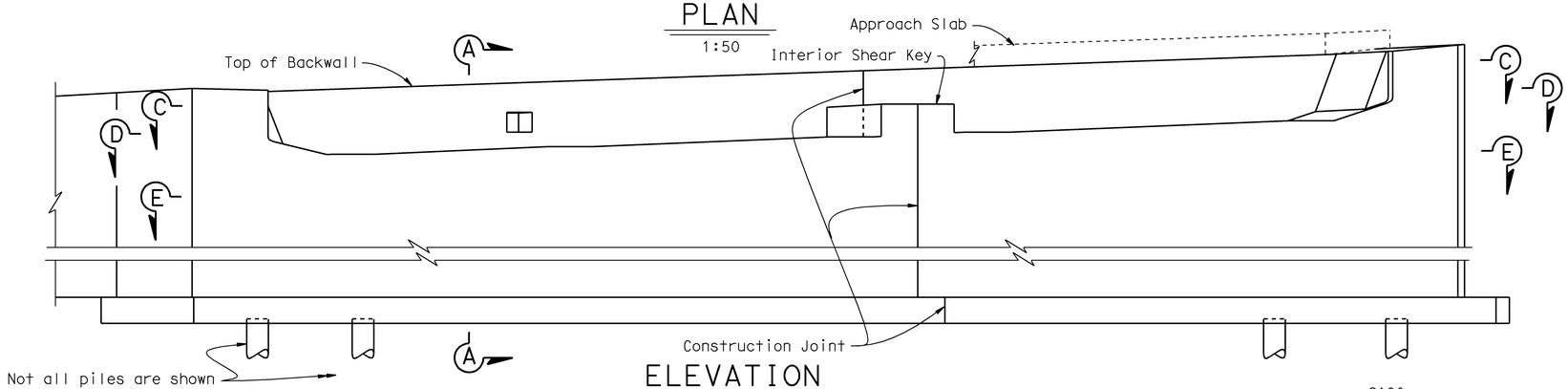
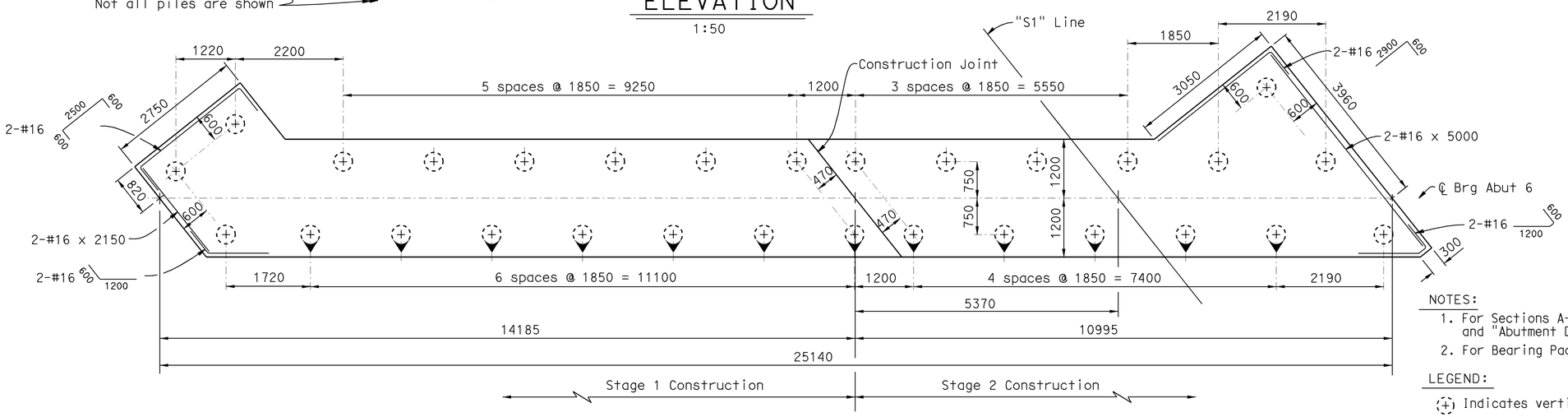


PLAN
1:50



ELEVATION
1:50



FOOTING PLAN
1:50

NOTES:

1. For Sections A-A, C-C, D-D and E-E, see "Abutment Details No. 1" and "Abutment Details No. 2" sheet.
2. For Bearing Pad Details, see "Abutment Details No. 1" sheet.

LEGEND:

Indicates vertical piles.

Indicates 3:1 battered piles.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

DESIGN	BY A. Gilani/T. Shi	CHECKED D. Abellon	
DETAILS	BY E. Montevirgen	CHECKED D. Abellon	
QUANTITIES	BY S. Davis/M. Keo	CHECKED N. Nguyen/M. Abdi	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
ABUTMENT 6 LAYOUT

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 7-15-02 7-15-02 10-15-02 1-15-03 2-15-03 3-15-03 3-03-03

SHEET 7 OF 27

FILE => adabut06lo.dgn

USERNAME => trmartok DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:08

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	102	148

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REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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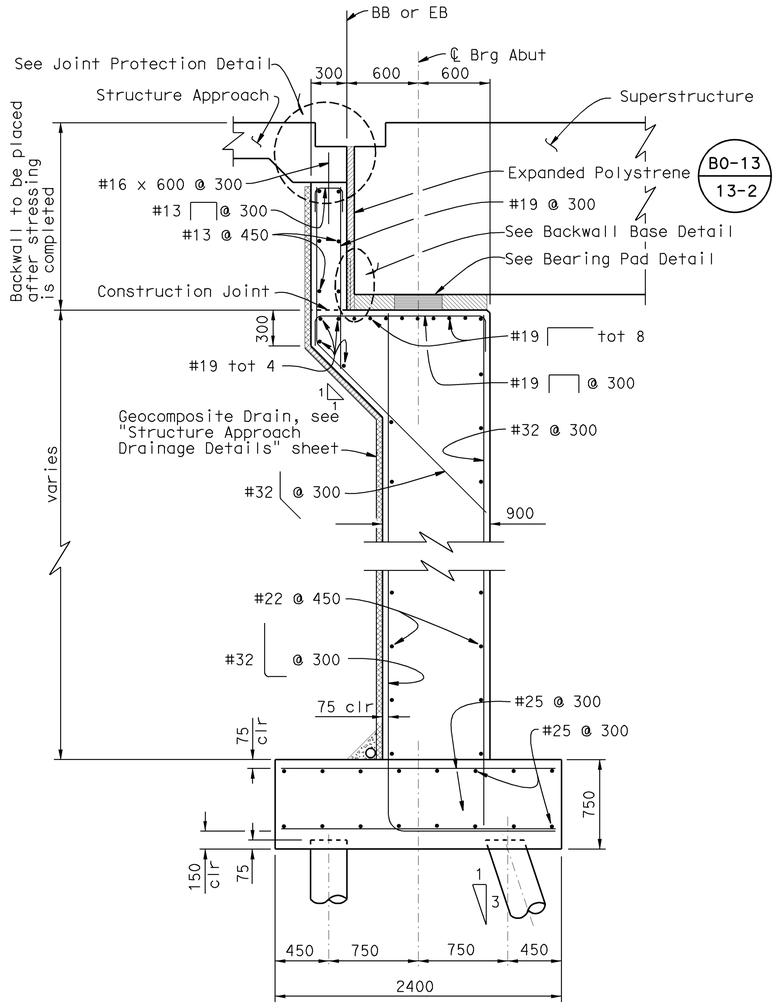
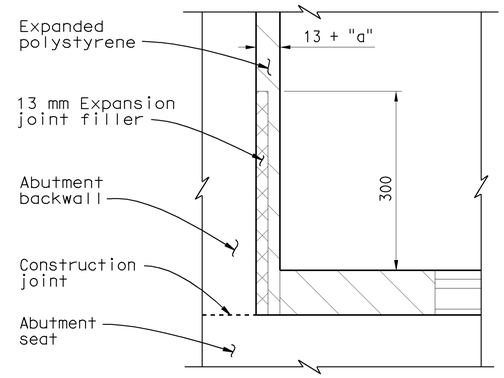


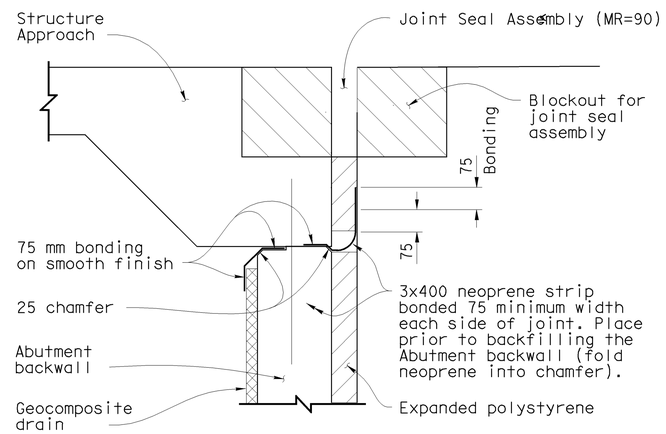
SECTION A-A

1:25



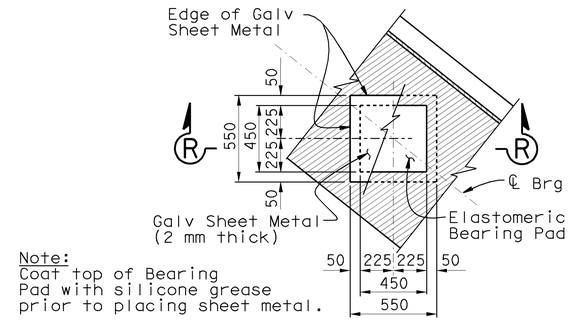
BACKWALL BASE DETAIL

No Scale



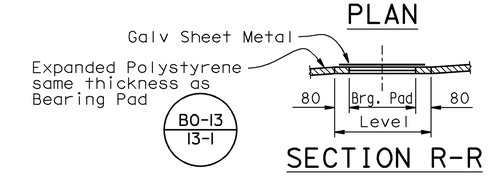
JOINT PROTECTION DETAIL

No Scale



Note:
Coat top of Bearing Pad with silicone grease prior to placing sheet metal.

PLAN



SECTION R-R

BEARING PAD DETAIL

No Scale
Details typical at all bearing pads

NOTES:

1. For location of Section A-A, see "Abutment 1 Layout" and "Abutment 6 Layout" sheets.
1. For Dimension "a", see "Joint Seal Assembly (Maximum Movement Rating = 90 mm)" sheet.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

DESIGN	BY A. Gilani/T. Shi	CHECKED D. Abellon	
DETAILS	BY E. Montevirgen	CHECKED D. Abellon	
QUANTITIES	BY S. Davis/M. Keo	CHECKED N. Nguyen/M. Abdi	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)

ABUTMENT DETAILS NO. 1

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 7-18-02 10-21-02 11-19-02 12-16-02 2-18-03 3-26-03 3-01-03

SHEET 8 OF 27

FILE => geabutdet01.dgn

USERNAME => trmartok DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:09

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	103	148

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REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

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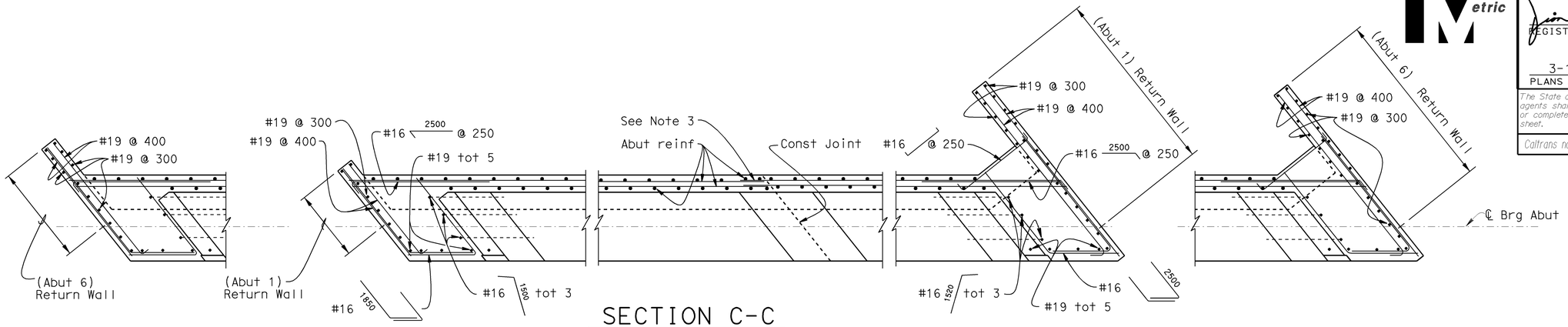
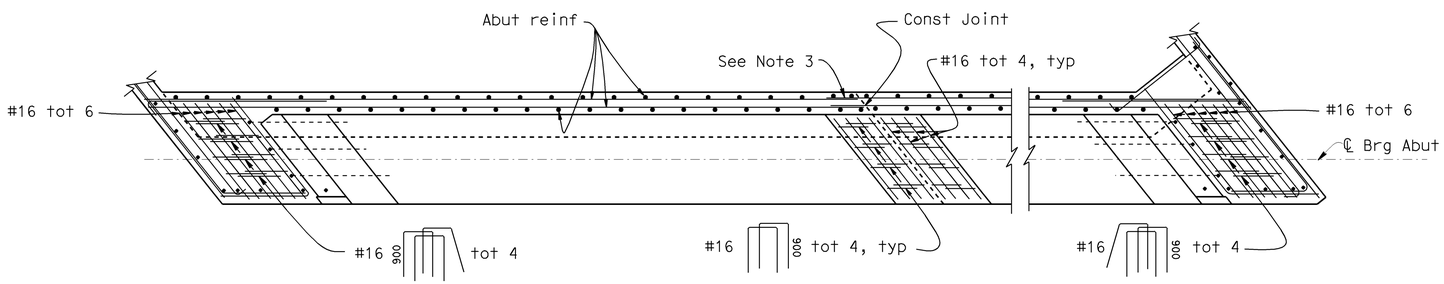
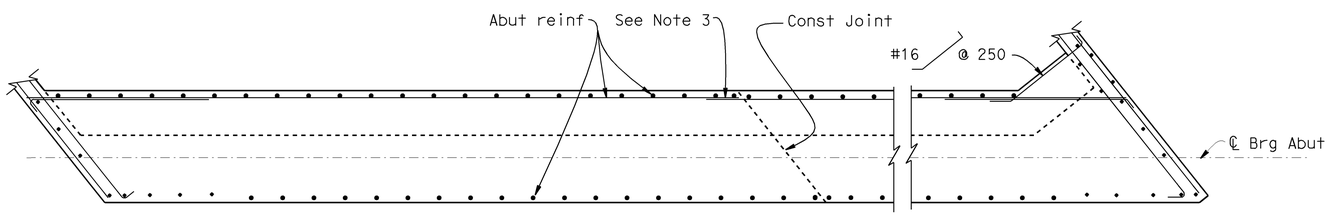


SECTION C-C
1:40



SECTION D-D
1:40



SECTION E-E
1:40

NOTES:

1. For location of Sections C-C, D-D and E-E, see "Abutment 1 Layout" and "Abutment 6 Layout" sheets.
2. See "Abutment Details No. 3" sheet for Shear Key Details.
3. Lap splice continuous bar reinforcing steel through construction joint.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

DESIGN	BY A. Gilani/T.Shi	CHECKED D. Abellon	
DETAILS	BY E. Montevirgen	CHECKED D. Abellon	
QUANTITIES	BY M. Keo/S. Davis	CHECKED M. Abdi/N. Nguyen	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
ABUTMENT DETAILS NO. 2

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 7-15-02 10-11-02 11-14-02 12-1-02 2-18-03 3-01-03

SHEET 9 OF 27

FILE => aeabutdet02.dgn

USERNAME => trmortok DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:09

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	104	148

Caltrans Metric

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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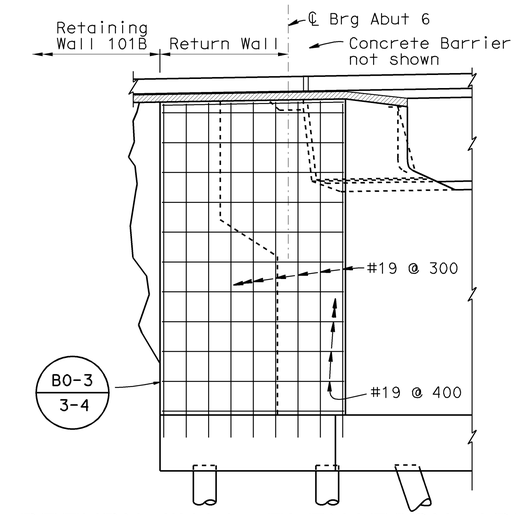
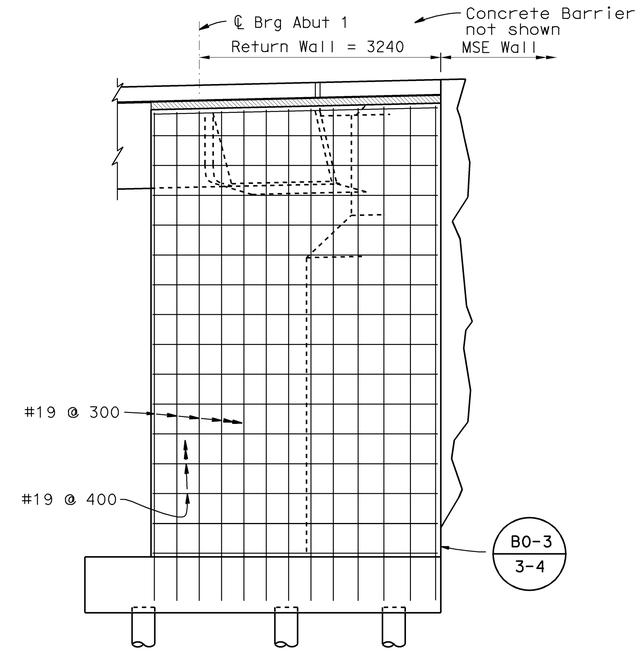


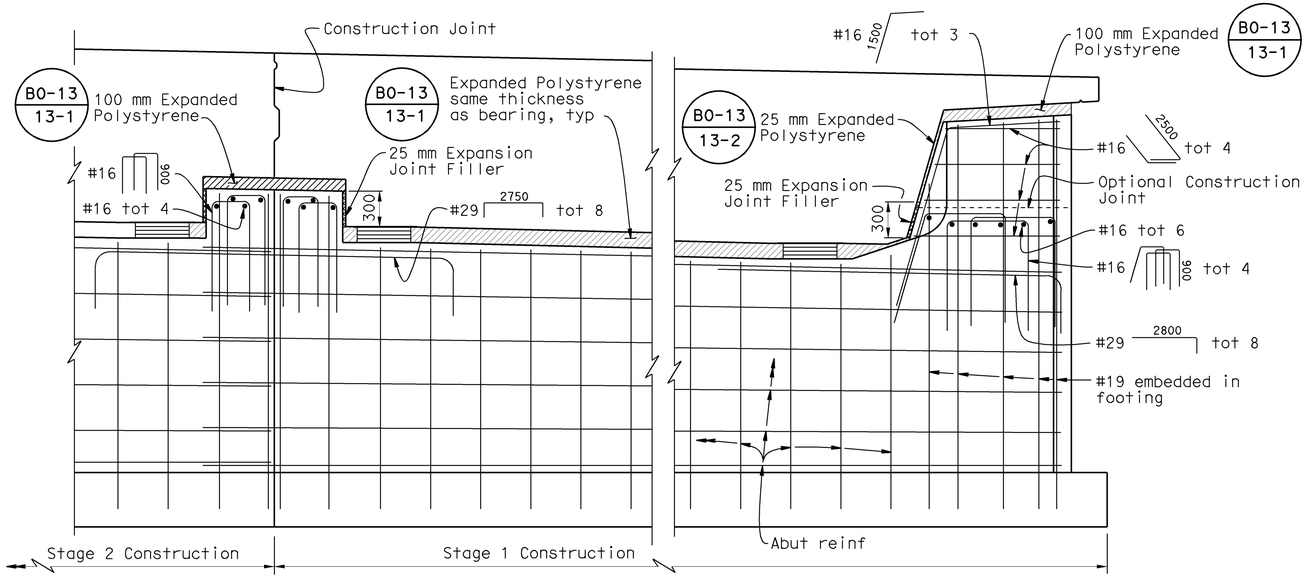
RETURN WALL ELEVATION-ABUT 6

1:40



RETURN WALL ELEVATION-ABUT 1

1:40



PART ELEVATION-SHEAR KEY DETAILS

1:25

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

DESIGN	BY A. Gilani	CHECKED D. Abellon	
DETAILS	BY E. Montevirgen	CHECKED D. Abellon	
QUANTITIES	BY M. Keo	CHECKED M. Abdi	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)

ABUTMENT DETAILS NO. 3

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 7-17-02 10-28-02 11-15-02 12-16-02 2-24-03 3-01-03

SHEET 10 OF 27

FILE => aeabutdet03.dgn

USERNAME => trmartok DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:09

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	105	148

Caltrans Metric

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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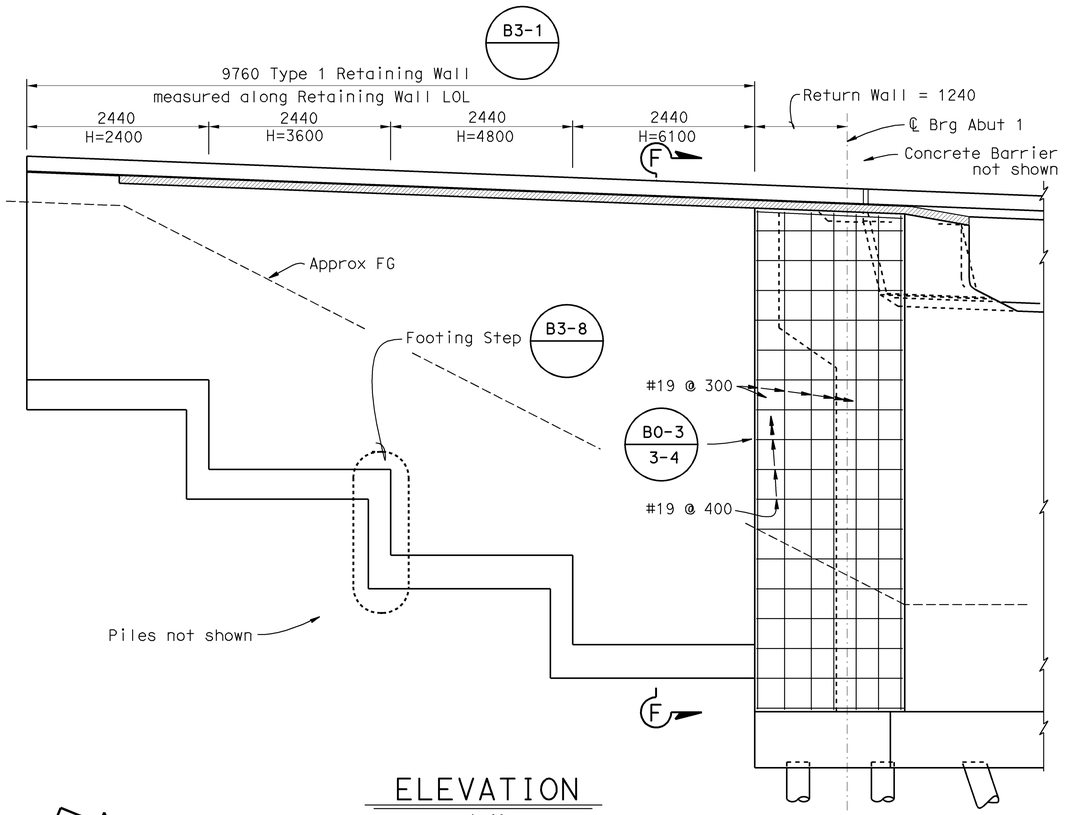
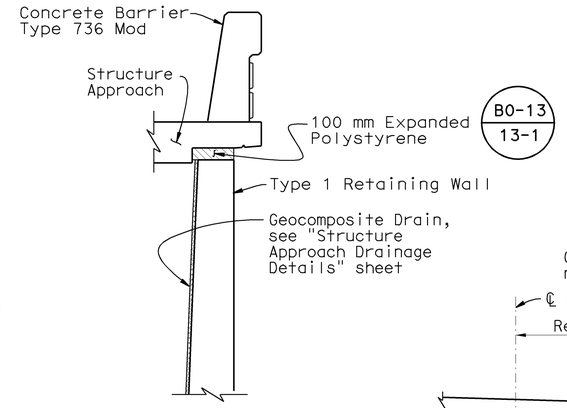
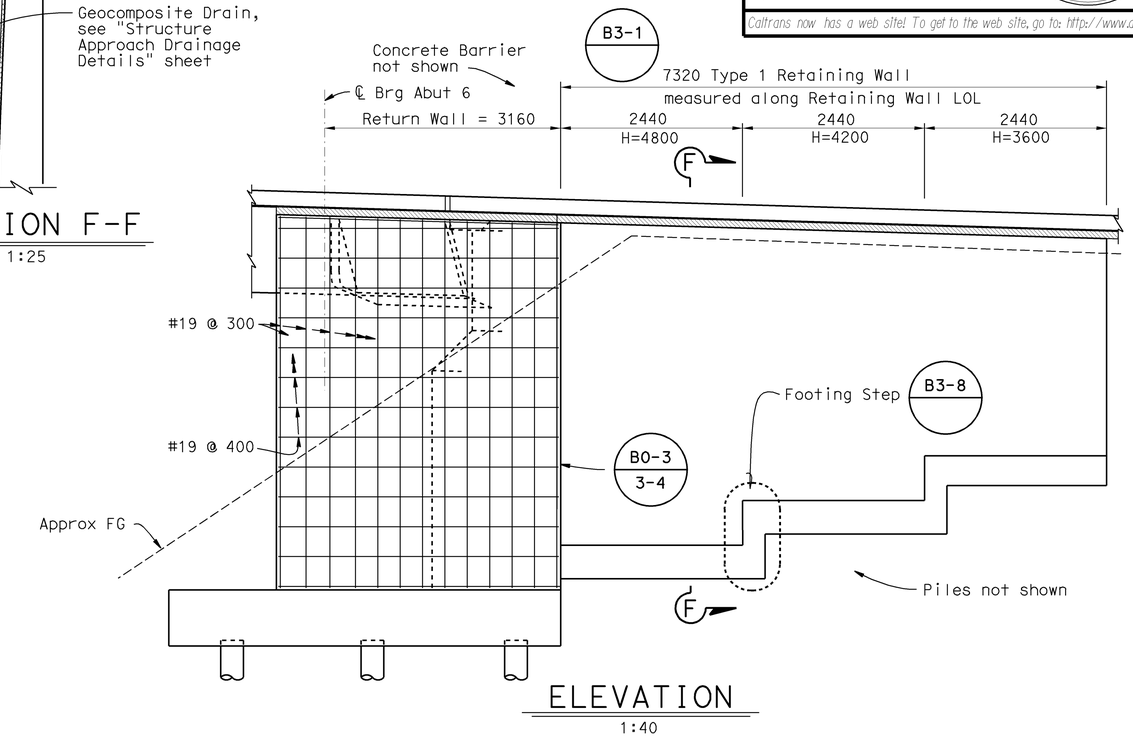


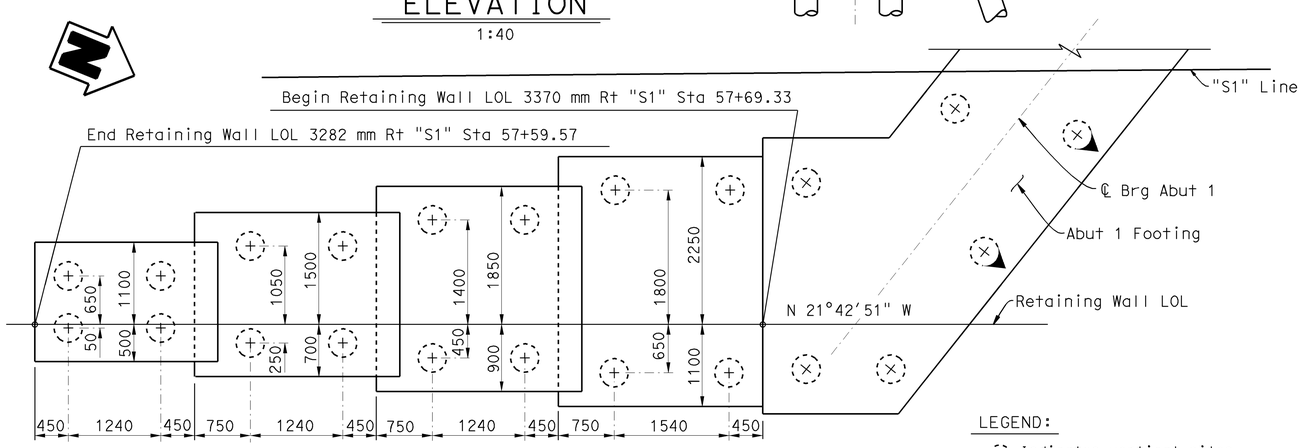
ELEVATION
1:40



SECTION F-F
1:25

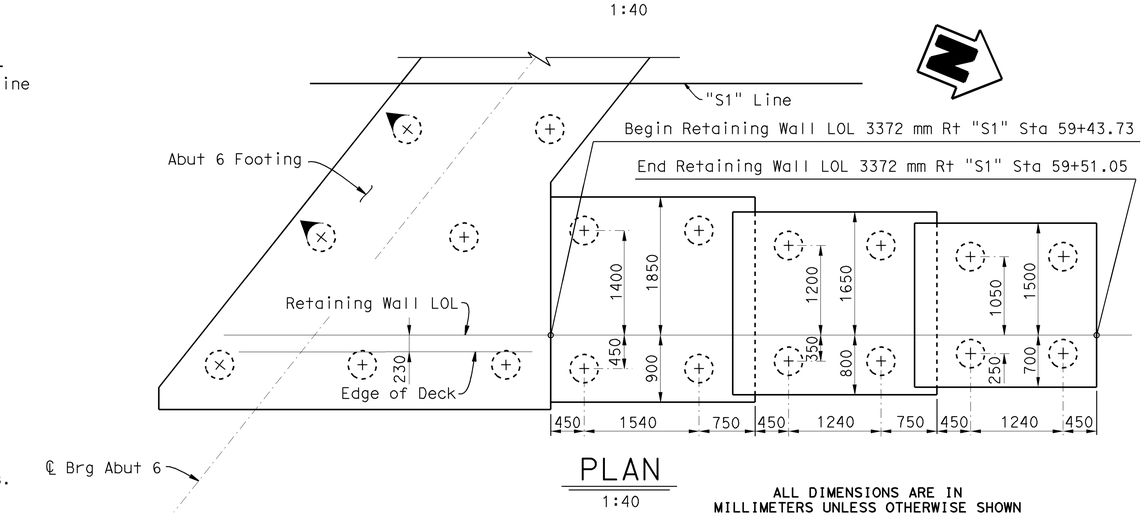


ELEVATION
1:40



PLAN
1:40

LEGEND:
Indicates vertical piles.
Indicates 3:1 battered piles.



PLAN
1:40

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

DESIGN	BY T. Shi	CHECKED D. Abellon	
DETAILS	BY E. Montevirgen	CHECKED D. Abellon	
QUANTITIES	BY M. Keo/S. Davis	CHECKED M. Abdi/N. Nguyen	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
ABUTMENT 1 AND 6 RETAINING WALL DETAILS

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 1-29-03 2-28-03 3-01-03

SHEET 11 OF 27

FILE => afabut0106rwd.dgn

USERNAME => trrene DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:31

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DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	106	148

Caltrans Metric

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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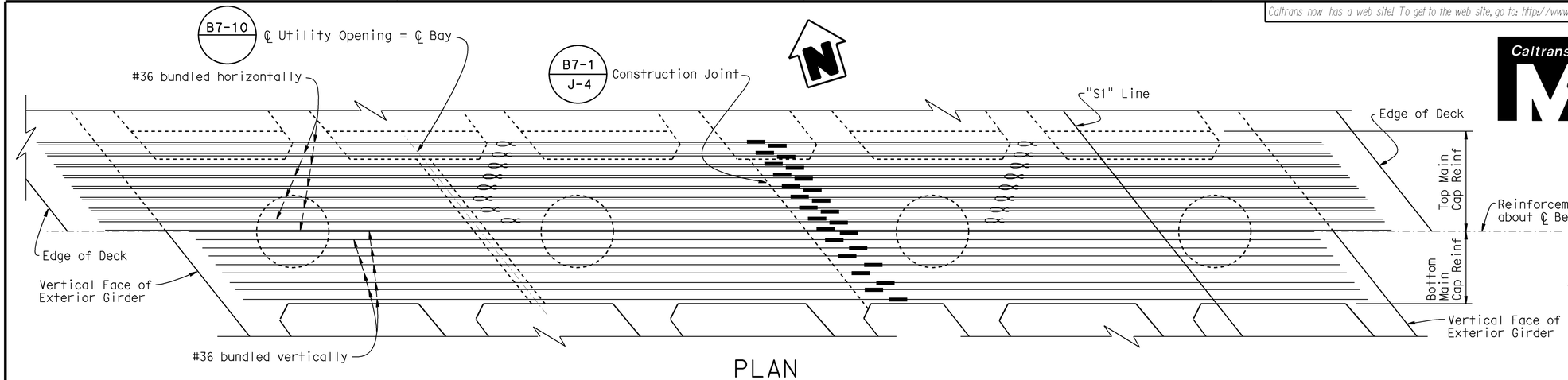


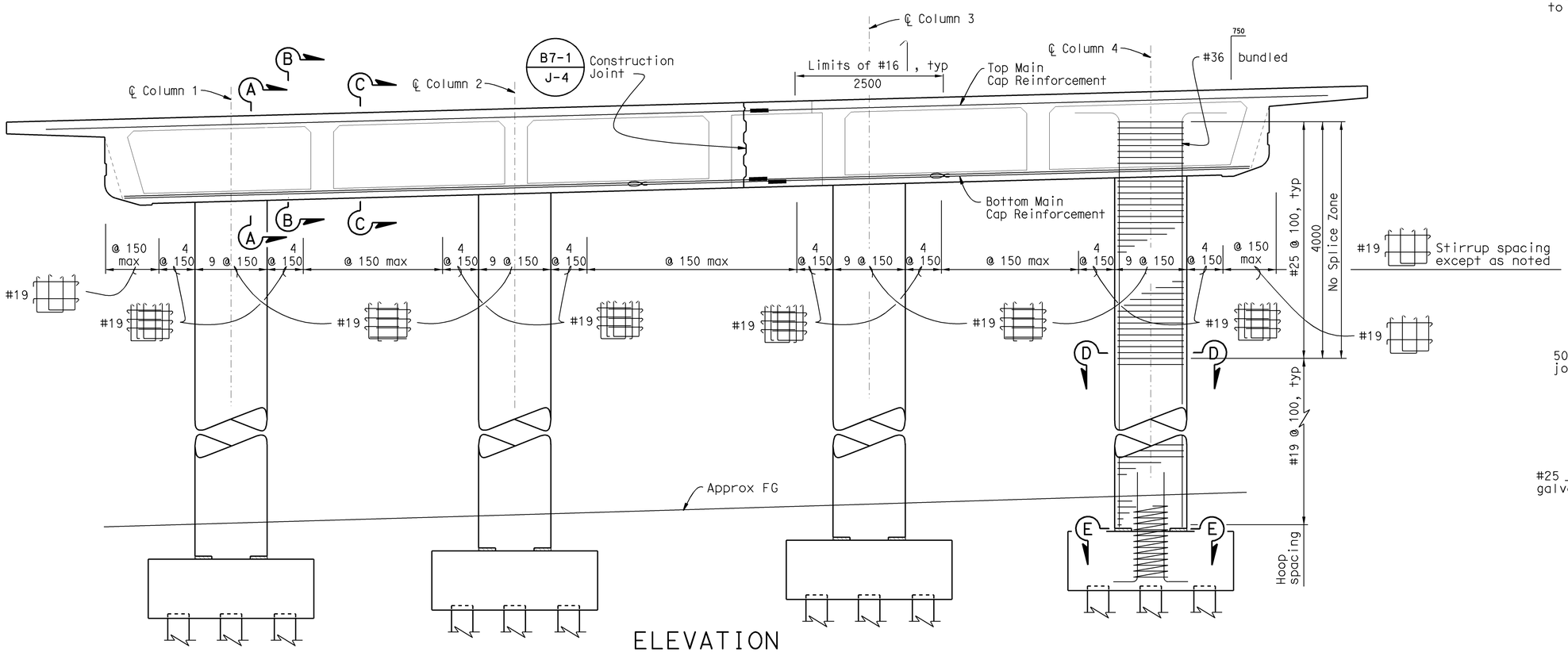
PLAN

1:40

Bent 3 shown, Bents 2, 4 and 5 similar except as noted

NOTES:

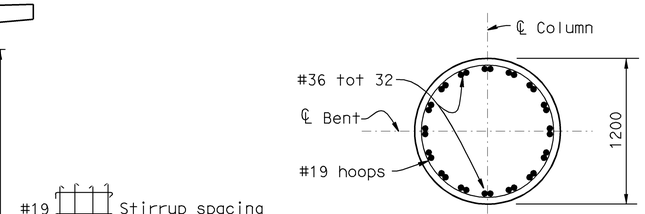
1. For Sections A-A, B-B and C-C, see "Bent Details No. 2" sheet.
2. = bundled bars.
3. All splices shall be ultimate butt splices and shall be staggered.
4. For additional stem reinforcement, see "Additional Girder Reinforcement" sheet.
5. Main column reinforcement and hoops may be adjusted to clear longitudinal P/S ducts and deck drain pipes subject to approval by the Engineer.



ELEVATION

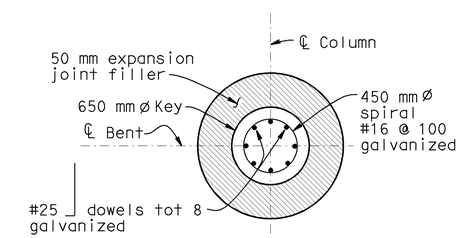
1:40

Bent 3 shown, Bents 2, 4 and 5 similar except as noted



SECTION D-D

1:25



SECTION E-E

1:25

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

DESIGN	BY A. Gilani	CHECKED D. Abellon	
DETAILS	BY E. Montevirgen	CHECKED D. Abellon	
QUANTITIES	BY S. Davis/M. Keo	CHECKED N. Nguyen/M. Abdi	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
BENT DETAILS NO. 1

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 1-18-02 1-15-02 2-14-03 3-03-03 3-03-03

SHEET 12 OF 27

FILE => agbd01.dgn

USERNAME => ttrene DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:31

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	107	148

Caltrans Metric

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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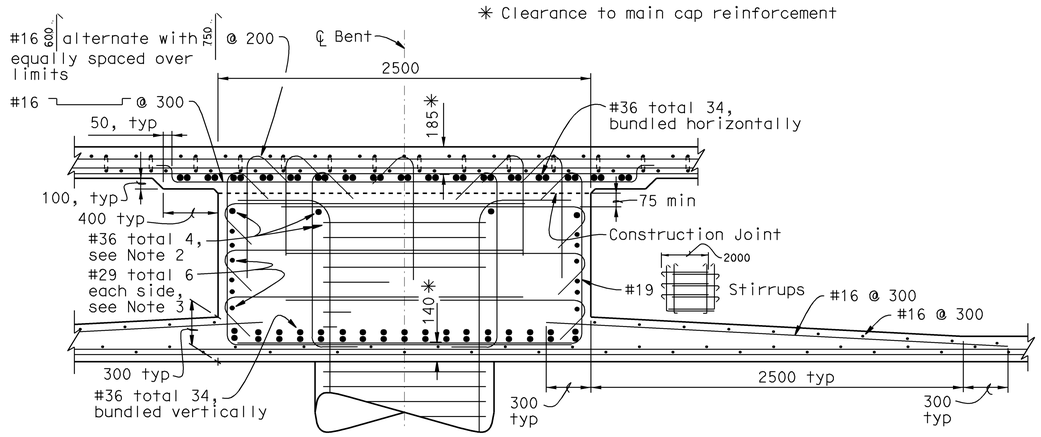
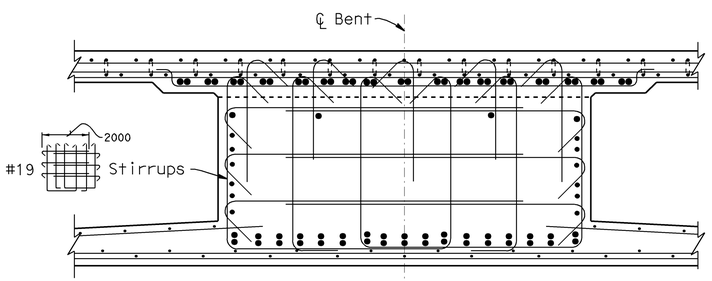
NOTES:

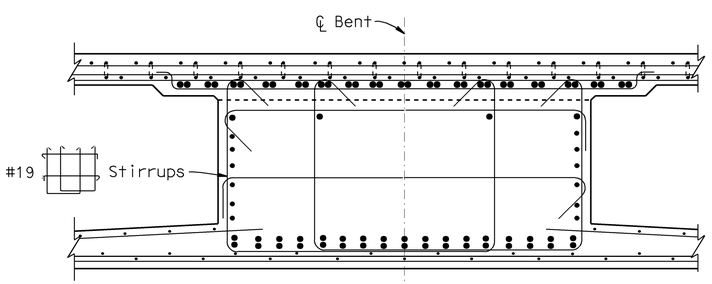
1. For location of Sections A-A, B-B, and C-C, see "Bent details No. 1" sheet.
2. Reinforcement may be bent or lowered to clear Prestressing Ducts. Subject to approval by the Engineer.
3. Side Reinforcement shall be continuous. All splices shall be ultimate butt splices.
4. No lap splices allowed in Main Cap reinforcement. All splices shall be ultimate butt splices.



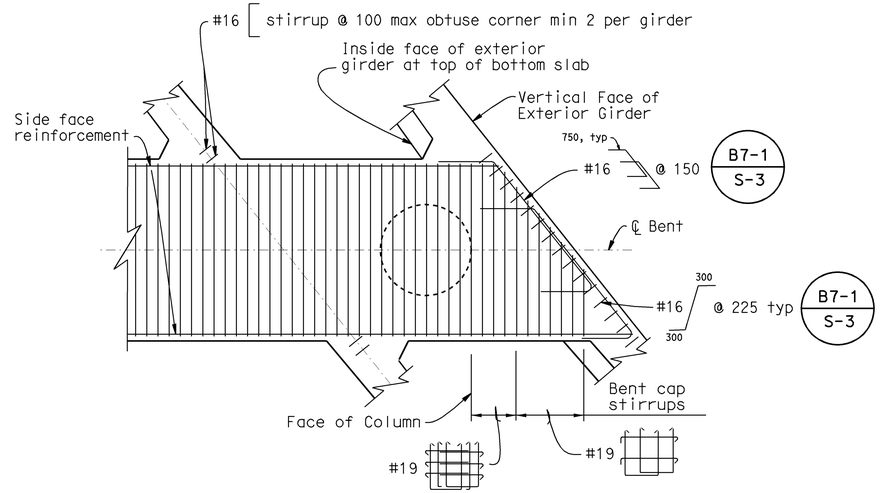
SECTION A-A
1:20



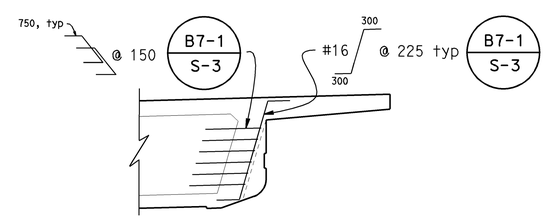
SECTION B-B
1:20
See Section A-A for Notes and Dimensions



SECTION C-C
1:20
See Section A-A for Notes and Dimensions

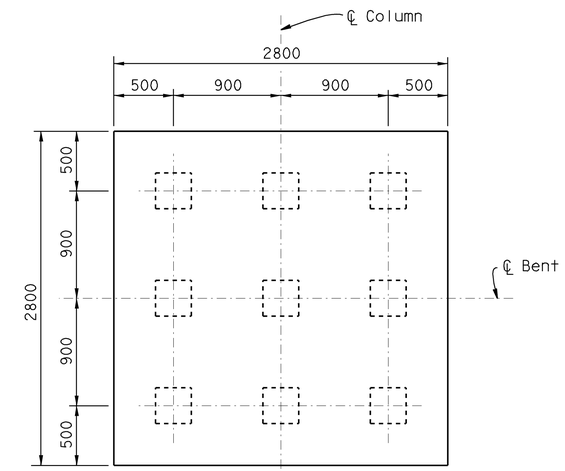


PLAN

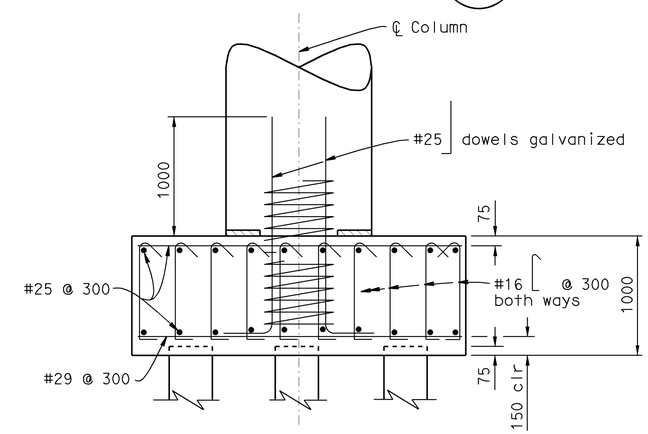


ELEVATION

BENT CAP CORNER REINFORCEMENT DETAILS
1:40



FOOTING PLAN B2-6
1:25



FOOTING ELEVATION
1:25

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

	BY	CHECKED
DESIGN	A. Gilani	D. Abellon
DETAILS	E. Montevirgen	D. Abellon
QUANTITIES	S. Davis/M. Keo	N. Nguyen/M. Abdi

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
BENT DETAILS NO. 2

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 1-18-02 1-18-02 1-14-03 2-24-03 3-11-03 3-03-03

SHEET 13 OF 27

FILE => agbd02.dgn

USERNAME => ttrene DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:31

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	108	148

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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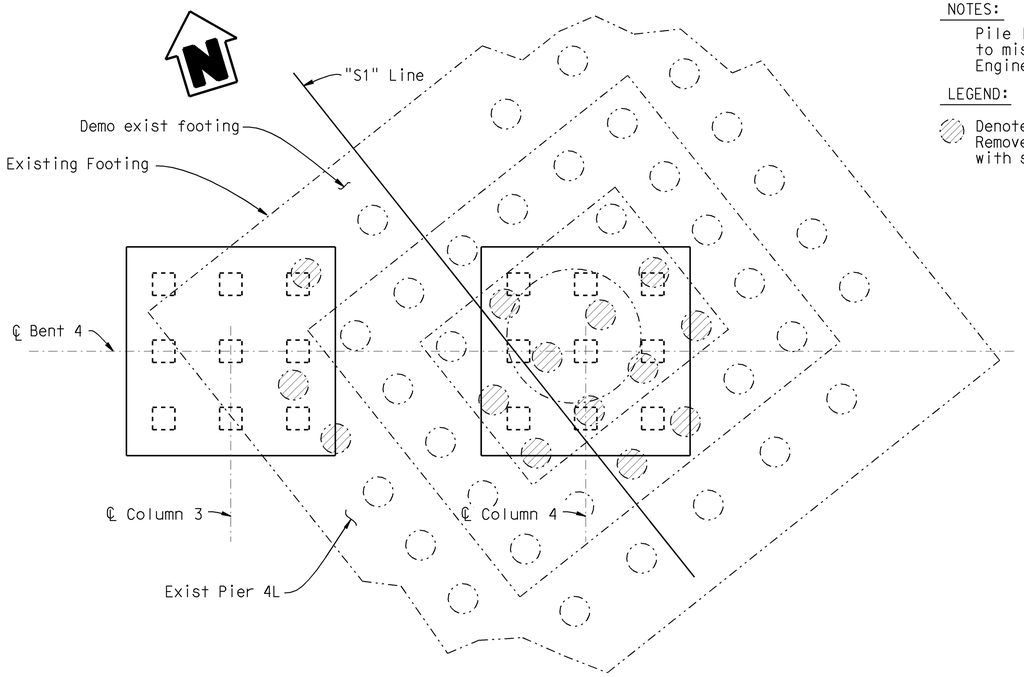
NOTES:

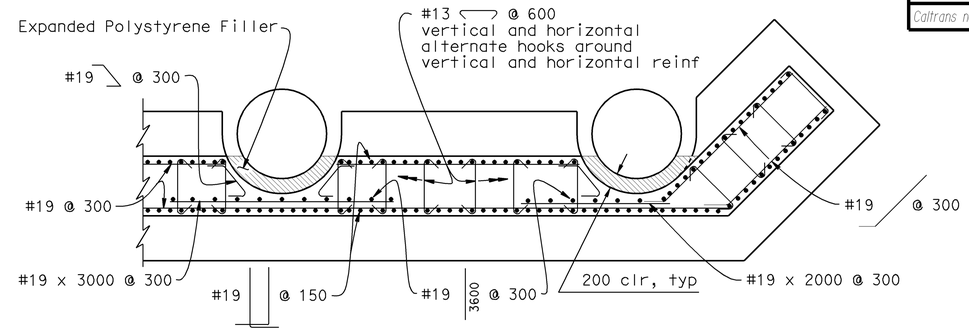
Pile layout shall be adjusted as directed by the Engineer to miss existing piles.
Engineer shall approve pile layout prior to driving.

LEGEND:

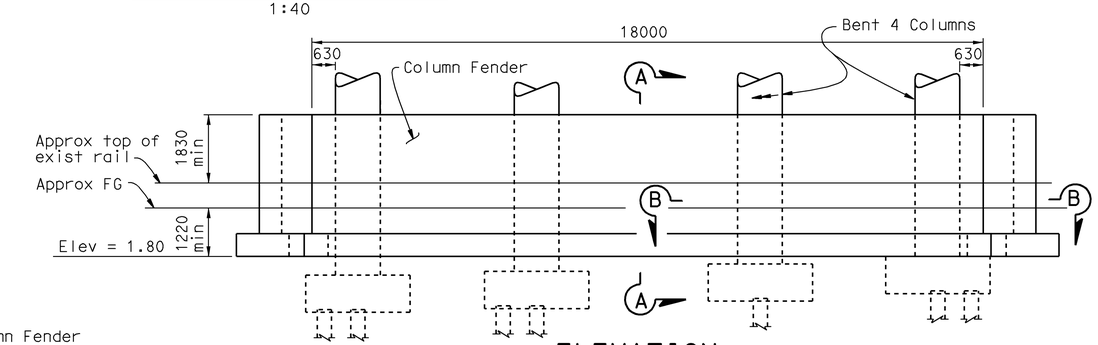
Denotes existing piles to be exposed 1500 mm max below bottom of new footing elevation. Remove existing piles a minimum of 300 mm below bottom of new footing elevation and backfill with structure backfill.



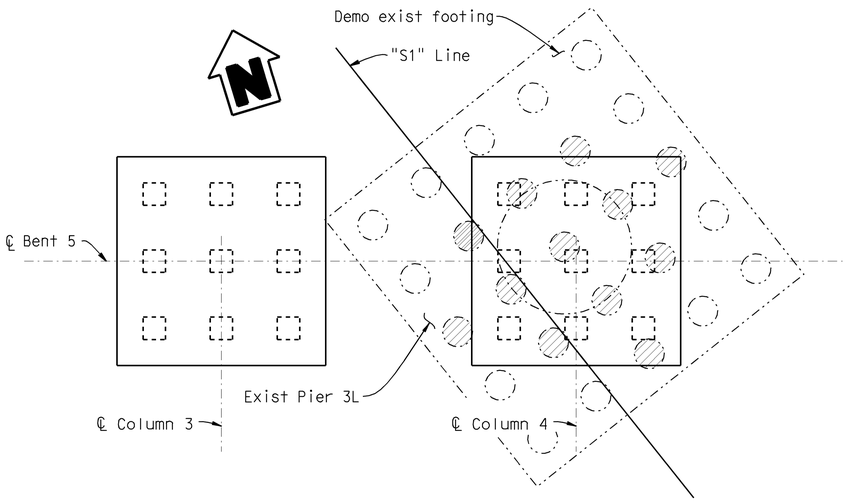
FOOTING PLAN AT BENT 4
1:40



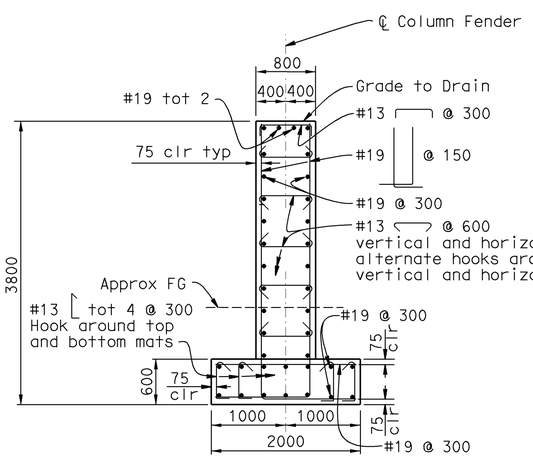
PART SECTION B-B
1:40



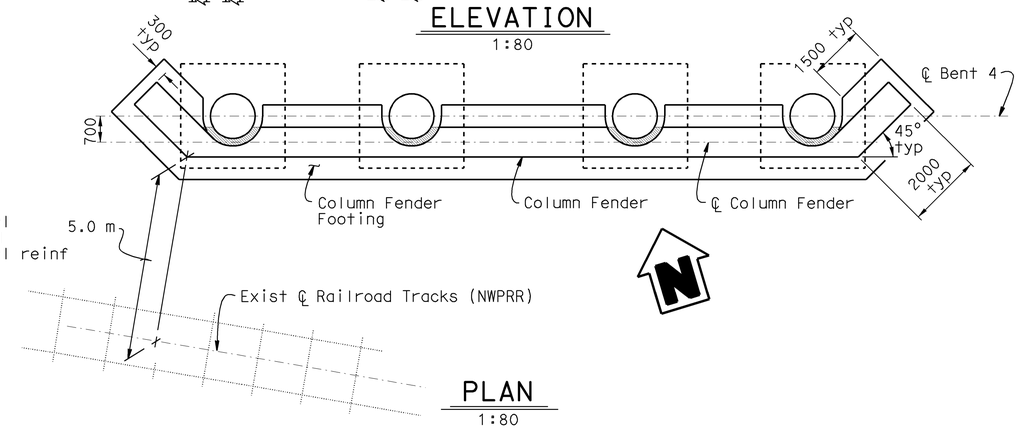
ELEVATION
1:80



FOOTING PLAN AT BENT 5
1:40



SECTION A-A
1:40



PLAN
1:80

COLUMN FENDER DETAILS

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

	BY	CHECKED
DESIGN	A. Gilani	D. Abellon
DETAILS	E. Montevirgen	D. Abellon
QUANTITIES	S. Davis/M. Keo	N. Nguyen/M. Abdi

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
BENT DETAILS NO. 3

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 1-14-03 2-28-03 3-04-03 3-14-03 3-19-03

SHEET 14 OF 27

FILE => agbd03.dgn

USERNAME => trrene DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:32

MSN B4 - U.S. 101/ SR116 SOH

10/6/2010

Pile Design Spreadsheet

Abut - 1 (R-09-011)

NAVFAC Design Method For a Single Pile

Project Name:	101 MSN Petaluma
Project Number:	28645045
Bridge Name:	US 101/SR 116 SOH
Boring Surface El. (m)	9.5
Boring Surface El. (ft)	31.0
Design GWS El. (ft)	5.0
Unit Weight of Water (pcf)	62.4
Depth with no strength	
Convert. Factor	3.281
Bottom of Pile Cap El. (m)	6.86
Bottom of Pile Cap El. (ft)	22.50

Nominal axial compress. Capacity (ult.)	195	ton
Nominal axial compress. Capacity (ult.)	1736	kN
Pile Width	14	inch
Pile Width	356	mm
Pile Width	1.17	ft
Crit depth ratio	20	-
Crit depth	23.3	ft
Crit. Depth. Elev	7.7	ft
Crit. Depth. Elev	2.3	m
Crit. Eff. Vert. Str.	2913	psf

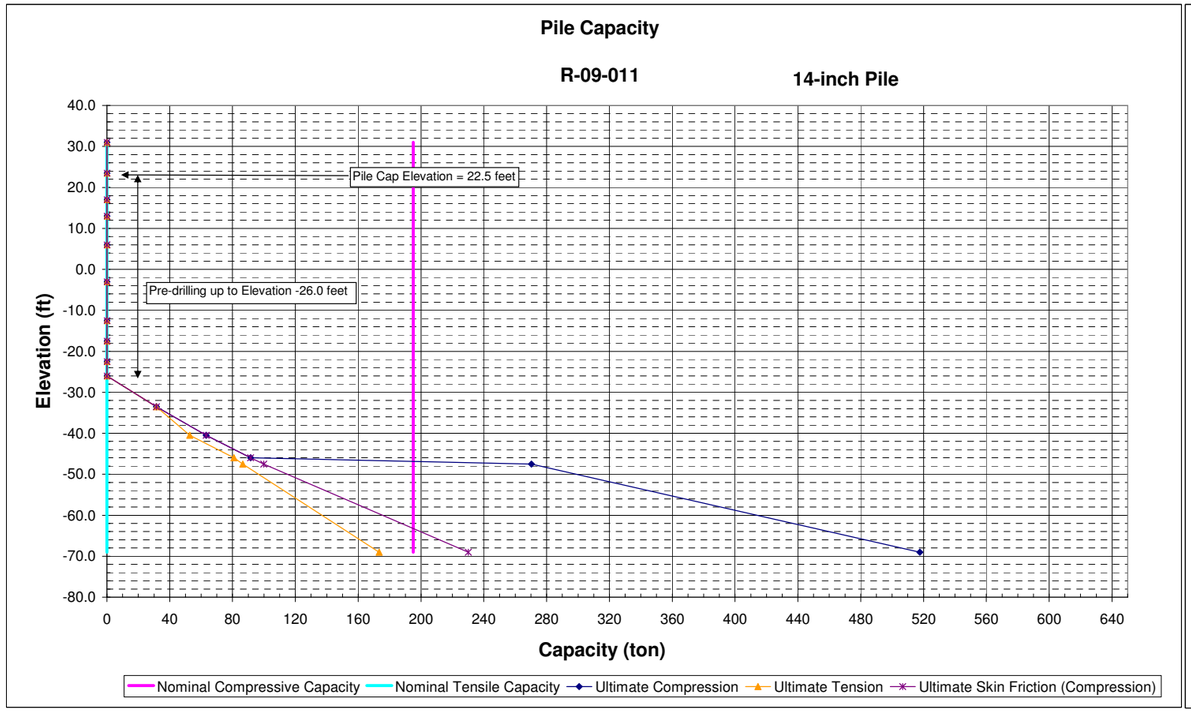
Skin Resistance (Friction) of Pile in Granular Material:

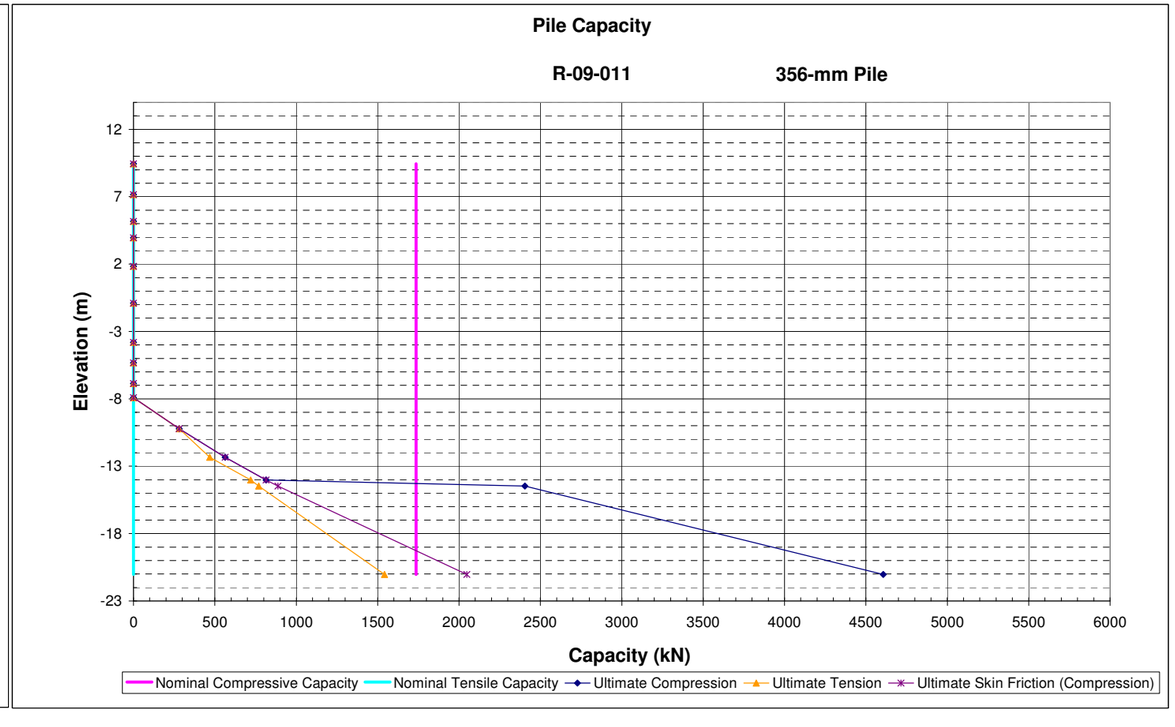
Type (Steel=S,Concrete=C,Timber=T)	C	
Earth Press. Coefficient * (Comp.)	1.5	
Earth Press. Coefficient * (Tens)	1.0	
Minimum Adhesion	500	psf

Pile Shape	Square	(Square, Circular or Octogonal)		
Pile Surface Area	1.42	sq. m/m	Pile Tip Area	0.13 sq. m
Pile Surface Area	4.67	sq. ft/ft	Pile Tip Area	1.36 sq. ft.

* Note: Appropriate tension/compresion ratios for skin friction for granular soils applied is 0.65 and 1.0 for cohesive soil.

Layer No.	Layer Elevation Top (m)	Top (feet)	Bot. (m)	Bot. (feet)	Lateral Resists?	Cohesion c (kPa)	Cohesion c (psf)	Adhesion Ratio c_a/c	Adhesion c_a (psf)	Friction Angle ϕ (deg)	Friction Angle δ (deg)	Layer Thickness (feet)	Internal Depth to Layer Top (feet)	Effective Vert. Stress (Bot. Lay.) (psf)	Design Effective Vert. Stress (Bot. Lay.) (psf)	delta Lat. Res. Cohesive (ton)	delta Lat. Res. Friction (comp) (ton)	delta Lat. Res. Friction (tensile) (ton)	Nq (granular) (-)	z/B (-)	Nc (cohesive) (-)	Soil Type G= gran. C=cohes.	Bearing Capacity (B.C.) (ton)	Include B.C.?	Elevation to midlayer (ft)	Compression Cumulative Axial Res. (skin) (ton)	Compression Cumulative Axial Res. (skin) (kN)	Compression Cumulative Axial Res. (Tot) (ton)	Compression Cumulative Axial Res. (Tot) (kN)	Compression Nominal Axial Capacity (ton)	Compression Nominal Axial Capacity (kN)	Tension Cumulative Axial Res. (Skin) (ton)	Tension Cumulative Axial Res. (Skin) (kN)	Tension Nominal Axial Capacity (ton)	Tension Nominal Axial Capacity (kN)
			9.45	31.0										0	0					0.0	6.25	g	0	n	31.0	0	0	0.0	0	195	1736	0	0	0	0
1	9.45	31.0	7.16	23.5	n	0	0	0.00	0	32	24	7.5	0.0	1793	1793	0.0	0.0	0.0	29	3.2	8.89	g	35	n	27.3	0.0	0	0.0	0	195	1736	0.0	0	0	0
2	7.16	23.5	5.18	17.0	n	38	800	1.00	0	0	0	6.5	7.5	2313	2313	0.0	0.0	0.0	0	9.2	9.00	c	5	n	20.3	0.0	0	0.0	0	195	1736	0.0	0	0	0
3	5.18	17.0	3.96	13.0	n	0	0	0.00	0	30	22.5	4.0	14.0	2313	2313	0.0	0.0	0.0	21	13.7	9.00	g	33	n	15.0	0.0	0	0.0	0	195	1736	0.0	0	0	0
4	3.96	13.0	1.83	6.0	n	38	800	1.00	0	0	0	7.0	18.0	3153	2913	0.0	0.0	0.0	0	18.4	9.00	c	5	n	9.5	0.0	0	0.0	0	195	1736	0.0	0	0	0
5	1.83	6.0	-0.91	-3.0	n	0	0	0.00	0	30	22.5	9.0	25.0	3823	2913	0.0	0.0	0.0	21	25.3	9.00	g	42	n	1.5	0.0	0	0.0	0	195	1736	0.0	0	0	0
6	-0.91	-3.0	-3.81	-12.5	n	96	2000	0.90	0	0	0	9.5	34.0	4432	2913	0.0	0.0	0.0	0	33.2	9.00	c	12	n	-7.8	0.0	0	0.0	0	195	1736	0.0	0	0	0
7	-3.81	-12.5	-5.33	-17.5	n	0	0	0.00	0	32	24	5.0	43.5	4770	2913	0.0	0.0	0.0	29	39.4	9.00	g	57	n	-15.0	0.0	0	0.0	0	195	1736	0.0	0	0	0
8	-5.33	-17.5	-6.86	-22.5	n	96	2000	0.90	0	0	0	5.0	48.5	5108	2913	0.0	0.0	0.0	0	43.7	9.00	c	12	n	-20.0	0.0	0	0.0	0	195	1736	0.0	0	0	0
9	-6.86	-22.5	-7.92	-26.0	n	0	0	0.00	0	32	24	3.5	53.5	5378	2913	0.0	0.0	0.0	29	47.4	9.00	g	57	n	-24.3	0.0	0	0.0	0	195	1736	0.0	0	0	0
10	-7.92	-26.0	-10.21	-33.5	Y	96	2000	0.90	1800	0	0	7.5	57.0	5816	2913	31.5	0.0	0.0	0	52.1	9.00	c	12	n	-29.8	31.5	280	31.5	280	195	1736	31.5	280	0	0
11	-10.21	-33.5	-12.34	-40.5	Y	0	0	0.00	0	32	24	7.0	64.5	6287	2913	0.0	31.8	21.2	29	58.3	9.00	g	57	n	-37.0	63.3	563	63.3	563	195	1736	52.7	469	0	0
12	-12.34	-40.5	-14.02	-46.0	Y	192	4000	0.55	2200	0	0	5.5	71.5	6665	2913	28.2	0.0	0.0	0	63.6	9.00	c	25	n	-43.3	91.5	814	91.5	814	195	1736	80.9	720	0	0
13	-14.02	-46.0	-14.48	-47.5	Y	0	0	0.00	0	38	28.5	1.5	77.0	6738	2913	0.0	8.3	5.5	86	66.6	9.00	g	170	y	-46.8	99.8	888	270.3	2405	195	1736	86.4	769	0	0
14	-14.48	-47.5	-21.03	-69.0	Y	0	0	0.00	0	41	30.75	21.5	78.5	8657	2913	0.0	130.4	86.9	145	76.5	9.00	g	287	y	-58.3	230.2	2049	517.6	4607	195	1736	173.4	1542	0	0
Bottom	-21.03	-69.0																																	





14-inch PCPS Pile with 100 tons Allowable Bearing Capacity

MSN B4 - US 101/SR116 SOH

10/6/2010

Pile Design Spreadsheet

Bent 2_R-09-012

NAVFAC Design Method For a Single Pile

Project Name:	101 MSN Petaluma
Project Number:	28645045
Bridge Name:	U.S. 101/SR116 SOH
Boring Surface El. (m)	3.4
Boring Surface El. (ft)	11.0
Design GWS El. (ft)	5.0
Unit Weight of Water (pcf)	62.4
Depth with no strength	
Convert. Factor	3.281
Bottom of Pile Cap El. (m)	-0.15
Bottom of Pile Cap El. (ft)	-0.50

Nominal axial compress. Capacity (ult.)	185	ton
Nominal axial compress. Capacity (ult.)	1647	kN
Pile Width	14	inch
Pile Width	356	mm
Pile Width	1.17	ft
Crit depth ratio	20	-
Crit depth	23.3	ft
Crit. Depth. Elev	-12.3	ft
Crit. Depth. Elev	-3.8	m
Crit. Eff. Vert. Str.	1699	psf

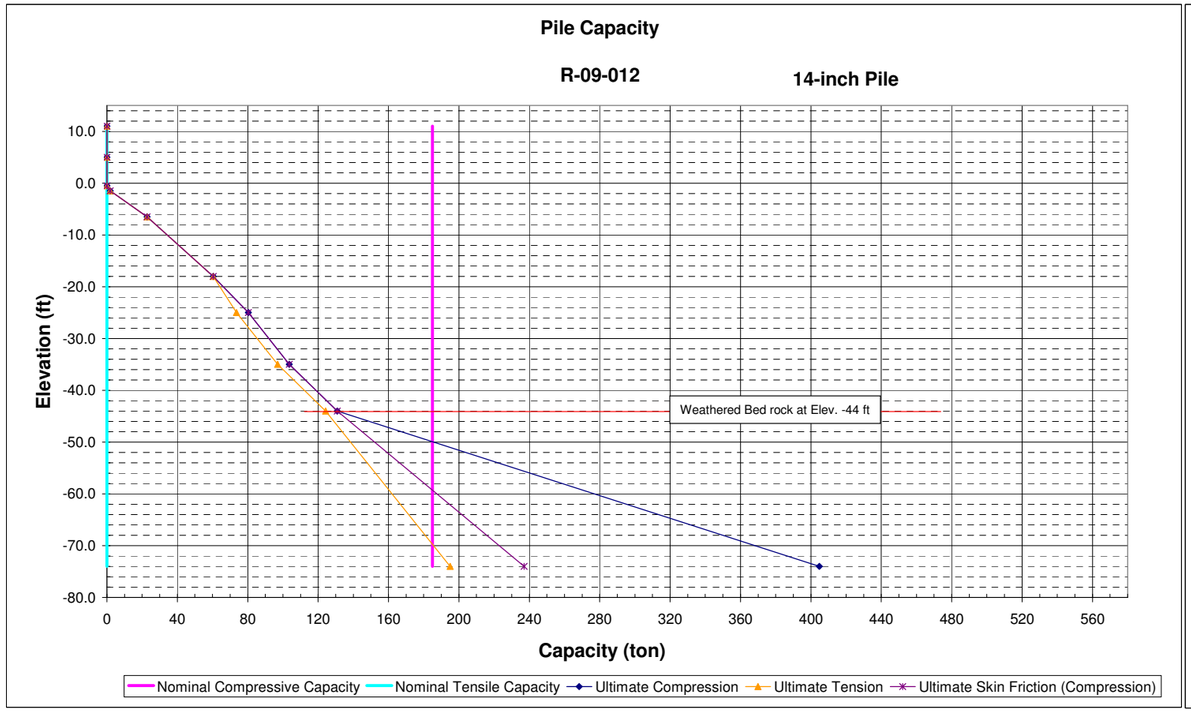
Skin Resistance (Friction) of Pile in Granular Material:

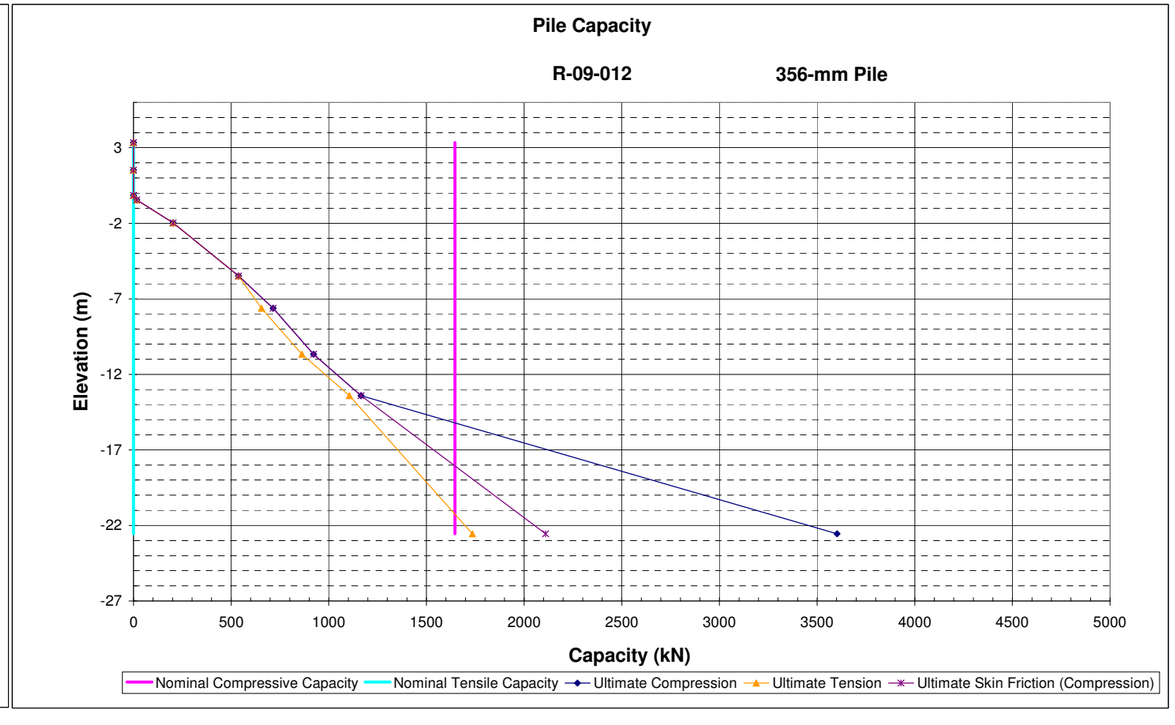
Type (Steel=S,Concrete=C,Timber=T)	C	
Earth Press. Coefficient * (Comp.)	1.5	
Earth Press. Coefficient * (Tens)	1.0	
Minimum Adhesion	500	psf

Pile Shape	Square	(Square, Circular or Octogonal)			
Pile Surface Area	1.42	sq. m/m	Pile Tip Area	0.13	sq. m
Pile Surface Area	4.67	sq. ft/ft	Pile Tip Area	1.36	sq. ft.

* Note: Appropriate tension/compresion ratios for skin friction for granular soils applied is 0.65 and 1.0 for cohesive soil.

Layer No.	Layer Elevation Top (m)	Layer Elevation Top (feet)	Layer Elevation Bot. (m)	Layer Elevation Bot. (feet)	Lateral Resists?	Cohesion c (kPa)	Cohesion c (psf)	Adhesion Ratio c_a/c	Adhesion c_a (psf)	Friction Angle ϕ (deg)	Friction Angle δ (deg)	Layer Thickness (feet)	Internal Depth to Layer Top (feet)	Effective Vert. Stress (Bot. Lay.) (psf)	Design Effective Vert. Stress (Bot. Lay.) (psf)	delta Lat. Res. Cohesive (ton)	delta Lat. Res. Friction (comp) (ton)	delta Lat. Res. Friction (tensile) (ton)	Nq (granular) (-)	z/B (-)	Nc (cohesive) (-)	Soil Type G= gran. C=cohes.	Bearing Capacity (B.C.) (ton)	Include B.C.?	Elevation to midlayer (ft)	Compression Cumulative Axial Res. (skin) (ton)	Compression Cumulative Axial Res. (skin) (kN)	Compression Cumulative Axial Res. (Tot) (ton)	Compression Cumulative Axial Res. (Tot) (kN)	Compression Nominal Axial Capacity (ton)	Compression Nominal Axial Capacity (kN)	Tension Cumulative Axial Res. (Skin) (ton)	Tension Cumulative Axial Res. (Skin) (kN)	Tension Nominal Axial Capacity (ton)	Tension Nominal Axial Capacity (kN)
			3.35	11.0										0	0					0.0	6.25	c	0	N	11.0	0	0	0.0	0	185	1647	0	0	0	0
1	3.35	11.0	1.52	5.0	n	48	1000	1.00	0	0	0	6.0	0.0	1008	1008	0.0	0.0	0.0	0	2.6	8.63	c	6	N	8.0	0.0	0	0.0	0	185	1647	0.0	0	0	0
2	1.52	5.0	-0.15	-0.5	n	38	800	1.00	0	0	0	5.5	6.0	1066	1066	0.0	0.0	0.0	0	7.5	9.00	c	5	N	2.3	0.0	0	0.0	0	185	1647	0.0	0	0	0
3	-0.15	-0.5	-0.46	-1.5	Y	38	800	1.00	800	0	0	1.0	11.5	1066	1066	1.9	0.0	0.0	0	10.3	9.00	c	5	N	-1.0	1.9	17	1.9	17	185	1647	1.9	17	0	0
4	-0.46	-1.5	-1.98	-6.5	Y	96	2000	0.90	1800	0	0	5.0	12.5	1354	1354	21.0	0.0	0.0	0	12.9	9.00	c	12	N	-4.0	22.9	204	22.9	204	185	1647	22.9	203	0	0
5	-1.98	-6.5	-5.49	-18.0	Y	67	1400	1.00	1400	0	0	11.5	17.5	2045	1699	37.6	0.0	0.0	0	19.9	9.00	c	9	N	-12.3	60.4	538	60.4	538	185	1647	60.4	538	0	0
6	-5.49	-18.0	-7.62	-25.0	Y	0	0	0.00	0	34	25.5	7.0	29.0	2518	1699	0.0	19.9	13.2	42	27.9	9.00	g	49	n	-21.5	80.3	715	80.3	715	185	1647	73.7	655	0	0
7	-7.62	-25.0	-10.67	-35.0	y	48	1000	1.00	1000	0	0	10.0	36.0	3094	1699	23.3	0.0	0.0	0	35.1	9.00	c	6	n	-30.0	103.6	922	103.6	922	185	1647	97.0	863	0	0
8	-10.67	-35.0	-13.41	-44.0	y	62	1300	1.00	1300	0	0	9.0	46.0	3612	1699	27.3	0.0	0.0	0	43.3	9.00	c	8	n	-39.5	130.9	1165	130.9	1165	185	1647	124.3	1106	0	0
9	-13.41	-44.0	-22.55	-74.0	y	0	0	0.00	0	41	30.75	30.0	55.0	6090	1699	0.0	106.1	70.8	145	60.0	9.00	g	168	y	-59.0	237.1	2110	404.7	3602	185	1647	195.1	1735	0	0
Bottom	-22.55	-74.0																																	





14-inch PCPS Pile with 100 tons Allowable Bearing Capacity

MSN B4 - US101/SR116 SOH

10/6/2010

Pile Design Spreadsheet

Bent 3_R-09-013

NAVFAC Design Method For a Single Pile

Project Name:	101 MSN Petaluma
Project Number:	28645045
Bridge Name:	US 101/SR116 SOH
Boring Surface El. (m)	3.1
Boring Surface El. (ft)	10.0
Design GWS El. (ft)	5.0
Unit Weight of Water (pcf)	62.4
Depth with no strength	
Convert. Factor	3.281
Bottom of Pile Cap El. (m)	0.61
Bottom of Pile Cap El. (ft)	2.00

Nominal axial compress. Capacity (ult.)	180	ton
Nominal axial compress. Capacity (ult.)	1602	kN
Pile Width	14	inch
Pile Width	356	mm
Pile Width	1.17	ft
Crit depth ratio	20	-
Crit depth	23.3	ft
Crit. Depth. Elev	-13.3	ft
Crit. Depth. Elev	-4.1	m
Crit. Eff. Vert. Str.	1704	psf

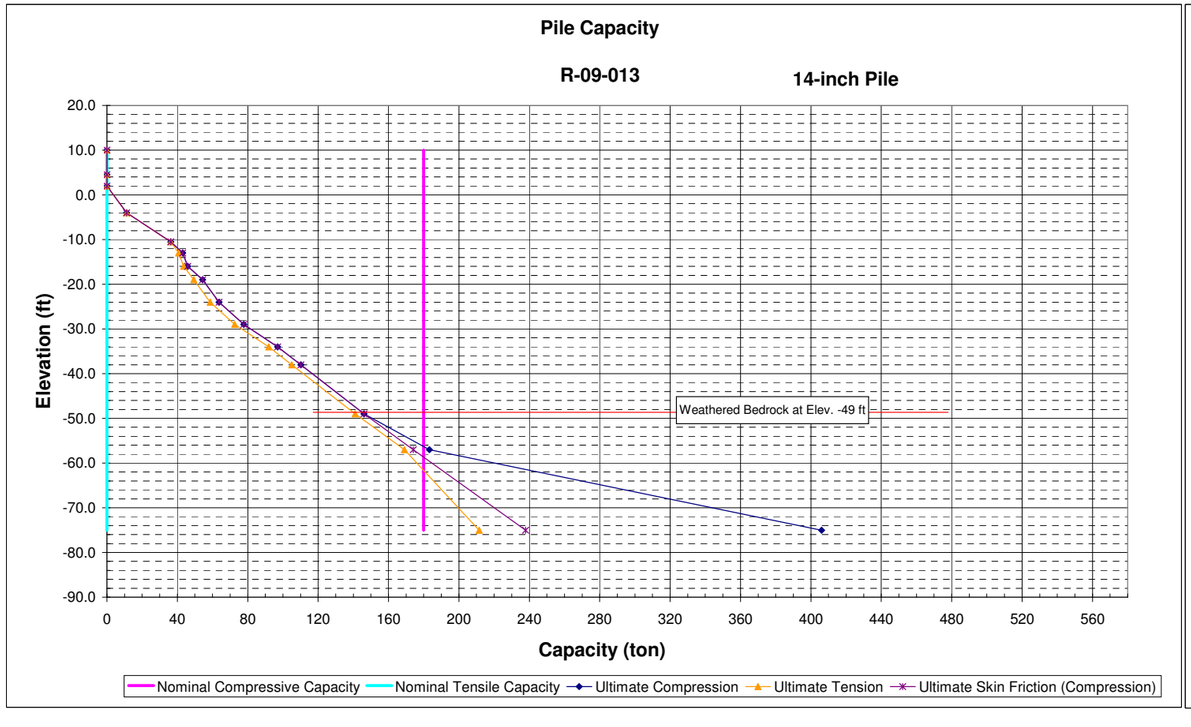
Skin Resistance (Friction) of Pile in Granular Material:

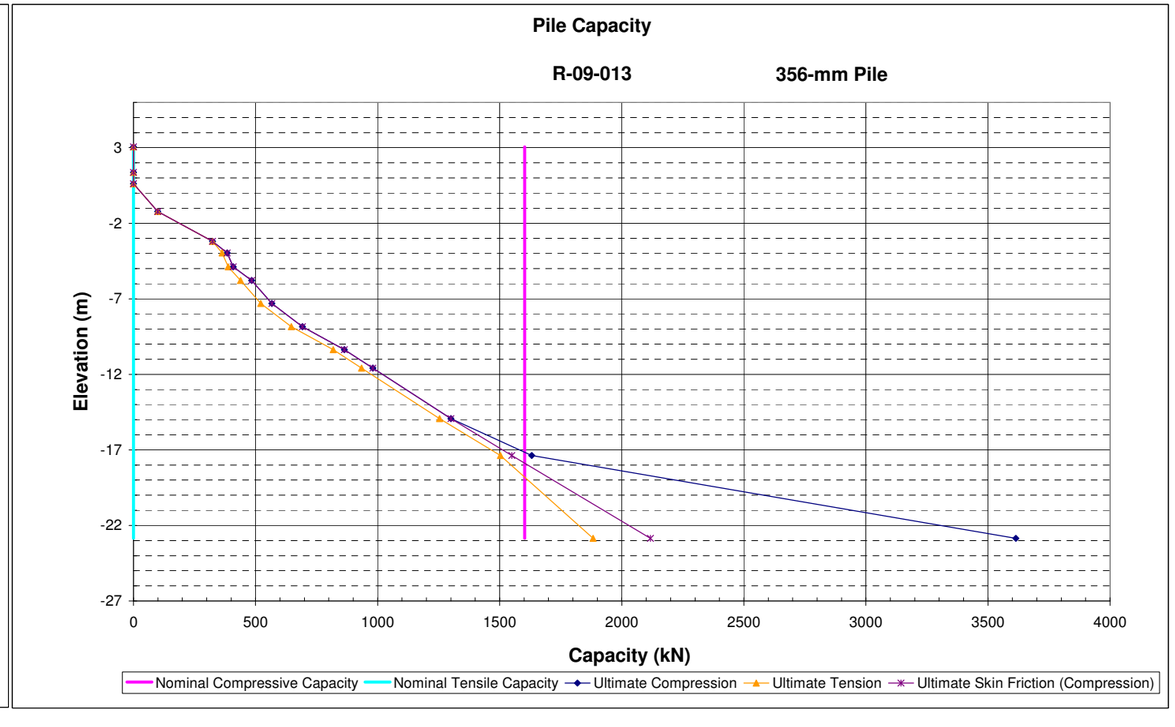
Type (Steel=S,Concrete=C,Timber=T)	C	
Earth Press. Coefficient * (Comp.)	1.5	
Earth Press. Coefficient * (Tens)	1.0	
Minimum Adhesion	500	psf

Pile Shape	Square	(Square, Circular or Octogonal)		
Pile Surface Area	1.42	sq. m/m	Pile Tip Area	0.13 sq. m
Pile Surface Area	4.67	sq. ft/ft	Pile Tip Area	1.36 sq. ft.

* Note: Appropriate tension/compresion ratios for skin friction for granular soils applied is 0.65 and 1.0 for cohesive soil.

Layer No.	Layer Elevation Top (m)	Layer Elevation Top (feet)	Layer Elevation Bot. (m)	Layer Elevation Bot. (feet)	Lateral Resists?	Cohesion c (kPa)	Cohesion c (psf)	Adhesion Ratio c_a/c	Adhesion c_a (psf)	Friction Angle ϕ (deg)	Friction Angle δ (deg)	Layer Thickness (feet)	Internal Depth to Layer Top (feet)	Effective Vert. Stress (Bot. Lay.) (psf)	Design Effective Vert. Stress (Bot. Lay.) (psf)	delta Lat. Res. Cohesive (ton)	delta Lat. Res. Friction (comp) (ton)	delta Lat. Res. Friction (tensile) (ton)	Nq (granular) (-)	z/B (-)	Nc (cohesive) (-)	Soil Type G= gran. C=cohes.	Bearing Capacity (B.C.) (ton)	Include B.C.?	Elevation to midlayer (ft)	Compression Cumulative Axial Res. (skin) (ton)	Compression Cumulative Axial Res. (skin) (kN)	Compression Cumulative Axial Res. (Tot) (ton)	Compression Cumulative Axial Res. (Tot) (kN)	Compression Nominal Axial Capacity (ton)	Compression Nominal Axial Capacity (kN)	Tension Cumulative Axial Res. (Skin) (ton)	Tension Cumulative Axial Res. (Skin) (kN)	Tension Nominal Axial Capacity (ton)	Tension Nominal Axial Capacity (kN)
			3.05	10.0										0	0					0.0	6.25	g	0	n	10.0	0	0	0.0	0	180	1602	0	0	0	0
1	3.05	10.0	1.37	4.5	n	0	0	0.00	0	32	24	5.5	0.0	828	828	0.0	0.0	0.0	29	2.4	8.54	g	16	n	7.3	0.0	0	0.0	0	180	1602	0.0	0	0	0
2	1.37	4.5	0.61	2.0	n	38	800	1.00	0	0	0	2.5	5.5	1173	1173	0.0	0.0	0.0	0	5.8	9.00	c	5	n	3.3	0.0	0	0.0	0	180	1602	0.0	0	0	0
3	0.61	2.0	-1.22	-4.0	Y	38	800	1.00	800	0	0	6.0	8.0	1173	1173	11.2	0.0	0.0	0	9.4	9.00	c	5	n	-1.0	11.2	100	11.2	100	180	1602	11.2	100	0	0
4	-1.22	-4.0	-3.2	-10.5	Y	81	1700	0.98	1658	0	0	6.5	14.0	1519	1519	25.1	0.0	0.0	0	14.8	9.00	c	10	n	-7.3	36.3	323	36.3	323	180	1602	36.3	323	0	0
5	-3.2	-10.5	-3.96	-13.0	Y	0	0	0.00	0	34	25.5	2.5	20.5	1704	1704	0.0	6.7	4.5	42	18.6	9.00	g	49	n	-11.8	43.1	383	43.1	383	180	1602	40.8	363	0	0
6	-3.96	-13.0	-4.88	-16.0	Y	19	400	1.00	400	0	0	3.0	23.0	1892	1704	2.8	0.0	0.0	0	21.0	9.00	c	2	n	-14.5	45.9	408	45.9	408	180	1602	43.6	388	0	0
7	-4.88	-16.0	-5.79	-19.0	Y	0	0	0.00	0	34	25.5	3.0	26.0	2080	1704	0.0	8.5	5.7	42	23.6	9.00	g	49	n	-17.5	54.4	484	54.4	484	180	1602	49.3	439	0	0
8	-5.79	-19.0	-7.31	-24.0	Y	38	800	1.00	800	0	0	5.0	29.0	2393	1704	9.3	0.0	0.0	0	27.0	9.00	c	5	n	-21.5	63.7	567	63.7	567	180	1602	58.6	522	0	0
9	-7.31	-24.0	-8.84	-29.0	Y	57	1200	1.00	1200	0	0	5.0	34.0	2706	1704	14.0	0.0	0.0	0	31.3	9.00	c	7	n	-26.5	77.7	692	77.7	692	180	1602	72.6	646	0	0
10	-8.84	-29.0	-10.36	-34.0	Y	81	1700	0.98	1658	0	0	5.0	39.0	3019	1704	19.3	0.0	0.0	0	35.6	9.00	c	10	n	-31.5	97.1	864	97.1	864	180	1602	92.0	818	0	0
11	-10.36	-34.0	-11.58	-38.0	Y	67	1400	1.00	1400	0	0	4.0	44.0	3245	1704	13.1	0.0	0.0	0	39.4	9.00	c	9	n	-36.0	110.1	980	110.1	980	180	1602	105.1	935	0	0
12	-11.58	-38.0	-14.93	-49.0	Y	67	1400	1.00	1400	0	0	11.0	48.0	3879	1704	35.9	0.0	0.0	0	45.9	9.00	c	9	n	-43.5	146.1	1300	146.1	1300	180	1602	141.0	1254	0	0
13	-14.93	-49.0	-17.37	-57.0	Y	72	1500	1.00	1500	0	0	8.0	59.0	4460	1704	28.0	0.0	0.0	0	54.0	9.00	c	9	y	-53.0	174.1	1549	183.3	1631	180	1602	169.0	1503	0	0
14	-17.37	-57.0	-22.86	-75.0	Y	0	0	0.00	0	41	30.75	18.0	67.0	5767	1704	0.0	63.9	42.6	145	65.1	9.00	g	168	y	-66.0	238.0	2118	406.1	3615	180	1602	211.6	1882	0	0
Bottom	-22.86	-75.0																																	





14-inch PCPS Pile with 100 tons Allowable Bearing Capacity

MSN B4 - U.S.101/SR116 SOH

10/6/2010

Pile Design Spreadsheet

Bent 4_R-09-014

NAVFAC Design Method For a Single Pile

Project Name:	101 MSN Petaluma
Project Number:	28645045
Bridge Name:	U.S.101/SR116 SOH
Boring Surface El. (m)	4.3
Boring Surface El. (ft)	14.0
Design GWS El. (ft)	5.0
Unit Weight of Water (pcf)	62.4
Depth with no strength	
Convert. Factor	3.281
Bottom of Pile Cap El. (m)	1.22
Bottom of Pile Cap El. (ft)	4.00

Nominal axial compress. Capacity (ult.)	170	ton
Nominal axial compress. Capacity (ult.)	1513	kN
Pile Width	14	inch
Pile Width	356	mm
Pile Width	1.17	ft
Crit depth ratio	20	-
Crit depth	23.3	ft
Crit. Depth. Elev	-9.3	ft
Crit. Depth. Elev	-2.8	m
Crit. Eff. Vert. Str.	2041	psf

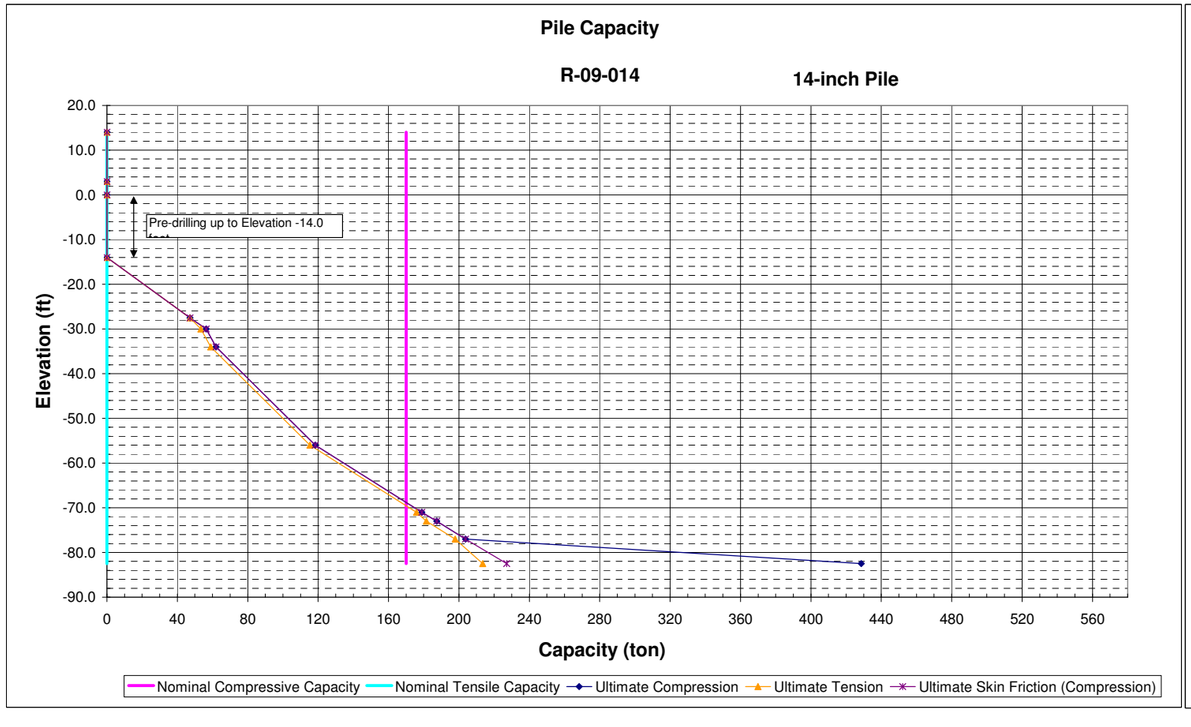
Skin Resistance (Friction) of Pile in Granular Material:

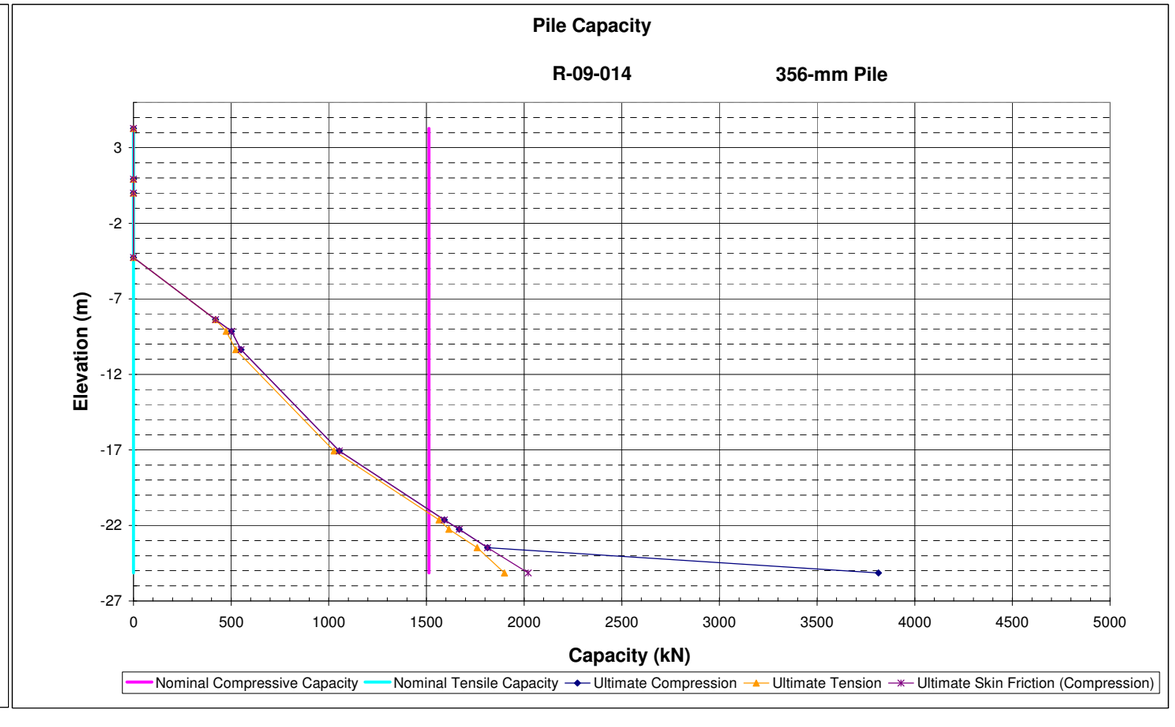
Type (Steel=S,Concrete=C,Timber=T)	C	
Earth Press. Coefficient * (Comp.)	1.5	
Earth Press. Coefficient * (Tens)	1.0	
Minimum Adhesion	500	psf

Pile Shape	Square	(Square, Circular or Octogonal)		
Pile Surface Area	1.42	sq. m/m	Pile Tip Area	0.13 sq. m
Pile Surface Area	4.67	sq. ft/ft	Pile Tip Area	1.36 sq. ft.

* Note: Appropriate tension/compresion ratios for skin friction for granular soils applied is 0.65 and 1.0 for cohesive soil.

Layer No.	Layer Elevation Top (m)	Top (feet)	Bot. (m)	Bot. (feet)	Lateral Resists?	Cohesion c (kPa)	Cohesion c (psf)	Adhesion Ratio c_a/c	Adhesion c_a (psf)	Friction Angle ϕ (deg)	Friction Angle δ (deg)	Layer Thickness (feet)	Internal Depth to Layer Top (feet)	Effective Vert. Stress (Bot. Lay.) (psf)	Design Effective Vert. Stress (Bot. Lay.) (psf)	delta Lat. Res. Cohesive (ton)	delta Lat. Res. Friction (comp) (ton)	delta Lat. Res. Friction (tensile) (ton)	Nq (granular) (-)	z/B (-)	Nc (cohesive) (-)	Soil Type C=cohes. G= gran.	Bearing Capacity (B.C.) (ton)	Include B.C.?	Elevation to midlayer (ft)	Compression Cumulative Axial Res. (skin) (ton)	Compression Cumulative Axial Res. (skin) (kN)	Compression Cumulative Axial Res. (Tot) (ton)	Compression Cumulative Axial Res. (Tot) (kN)	Compression Nominal Axial Capacity (ton)	Compression Nominal Axial Capacity (kN)	Tension Cumulative Axial Res. (Skin) (ton)	Tension Cumulative Axial Res. (Skin) (kN)	Tension Nominal Axial Capacity (ton)	Tension Nominal Axial Capacity (kN)
			4.27	14.0										0	0					0.0	6.25	g	0	n	14.0	0	0	0.0	0	170	1513	0	0	0	0
1	4.27	14.0	0.91	3.0	n	0	0	0.00	0	32	24	11.0	0.0	1478	1478	0.0	0.0	0.0	29	4.7	9.00	g	29	n	8.5	0.0	0	0.0	0	170	1513	0.0	0	0	0
2	0.91	3.0	0	0.0	n	60	1250	1.00	0	0	0	3.0	11.0	2354	2041	0.0	0.0	0.0	0	10.7	9.00	c	8	n	1.5	0.0	0	0.0	0	170	1513	0.0	0	0	0
3	0	0.0	-4.27	-14.0	n	0	0	0.00	0	36	27	14.0	14.0	2354	2041	0.0	0.0	0.0	62	18.0	9.00	g	86	n	-7.0	0.0	0	0.0	0	170	1513	0.0	0	0	0
4	-4.27	-14.0	-8.38	-27.5	Y	72	1500	1.00	1500	0	0	13.5	28.0	3168	2041	47.3	0.0	0.0	0	29.8	9.00	c	9	n	-20.8	47.3	421	47.3	421	170	1513	47.3	420	0	0
5	-8.38	-27.5	-9.14	-30.0	Y	0	0	0.00	0	36	27	2.5	41.5	3369	2041	0.0	9.1	6.1	62	36.6	9.00	g	86	n	-28.8	56.4	502	56.4	502	170	1513	53.3	474	0	0
6	-9.14	-30.0	-10.36	-34.0	Y	29	600	1.00	600	0	0	4.0	44.0	3619	2041	5.6	0.0	0.0	0	39.4	9.00	c	4	n	-32.0	62.0	551	62.0	551	170	1513	58.9	524	0	0
7	-10.36	-34.0	-17.07	-56.0	Y	53	1100	1.00	1100	0	0	22.0	48.0	4886	2041	56.5	0.0	0.0	0	50.6	9.00	c	7	n	-45.0	118.4	1054	118.4	1054	170	1513	115.4	1026	0	0
8	-17.07	-56.0	-21.64	-71.0	Y	86	1800	0.96	1728	0	0	15.0	70.0	5750	2041	60.5	0.0	0.0	0	66.4	9.00	c	11	n	-63.5	178.9	1592	178.9	1592	170	1513	175.9	1564	0	0
9	-21.64	-71.0	-22.25	-73.0	Y	0	0	0.00	0	41	30.75	2.0	85.0	5885	2041	0.0	8.5	5.7	145	73.7	9.00	g	201	n	-72.0	187.4	1668	187.4	1668	170	1513	181.5	1615	0	0
10	-22.25	-73.0	-23.47	-77.0	Y	120	2500	0.70	1750	0	0	4.0	87.0	6076	2041	16.3	0.0	0.0	0	76.3	9.00	c	15	n	-75.0	203.7	1813	203.7	1813	170	1513	197.9	1760	0	0
11	-23.47	-77.0	-25.14	-82.5	Y	0	0	0.00	0	41	30.75	5.5	91.0	6364	2041	0.0	23.4	15.6	145	80.4	9.00	g	201	y	-79.8	227.1	2021	428.6	3814	170	1513	213.5	1899	0	0
Bottom	-25.14	-82.5																																	





14-inch PCPS Pile with 100 tons Allowable Bearing Capacity

MSN B4 - U.S.101/SR116 SOH

10/6/2010

Pile Design Spreadsheet

Abut 5_R-09-015

NAVFAC Design Method For a Single Pile

Project Name: 101 MSN Petaluma
Project Number: 28645045
Bridge Name: U.S>101/SR116 SOH
Boring Surface El. (m) 6.7
Boring Surface El. (ft) 22.0 (Varies 22-30)
Design GWS El. (ft) 5.0
Unit Weight of Water (pcf) 62.4
Depth with no strength
Convert. Factor 3.281

Bottom of Pile Cap El. (m) 5.18
Bottom of Pile Cap El. (ft) 17.00

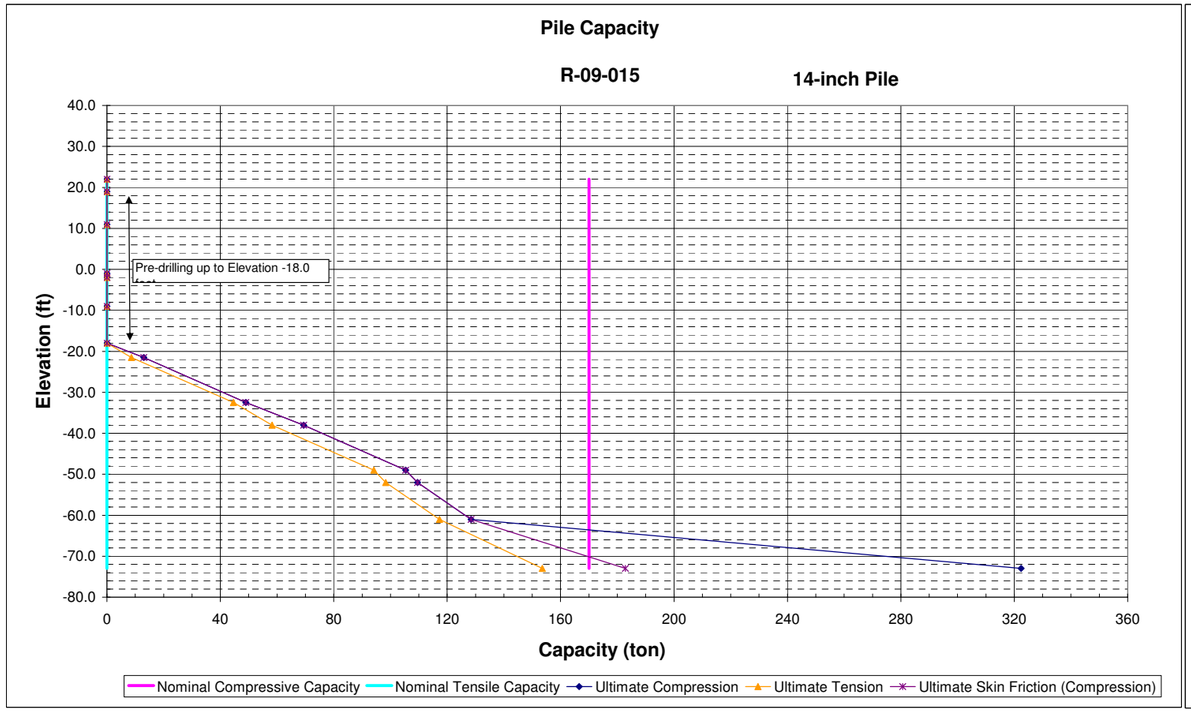
Nominal axial compress. Capacity (ult.)	170	ton
Nominal axial compress. Capacity (ult.)	1513	kN
Pile Width	14	inch
Pile Width	356	mm
Pile Width	1.17	ft
Crit depth ratio	20	-
Crit depth	23.3	ft
Crit. Depth. Elev	-1.3	ft
Crit. Depth. Elev	-0.4	m
Crit. Eff. Vert. Str.	2386	psf

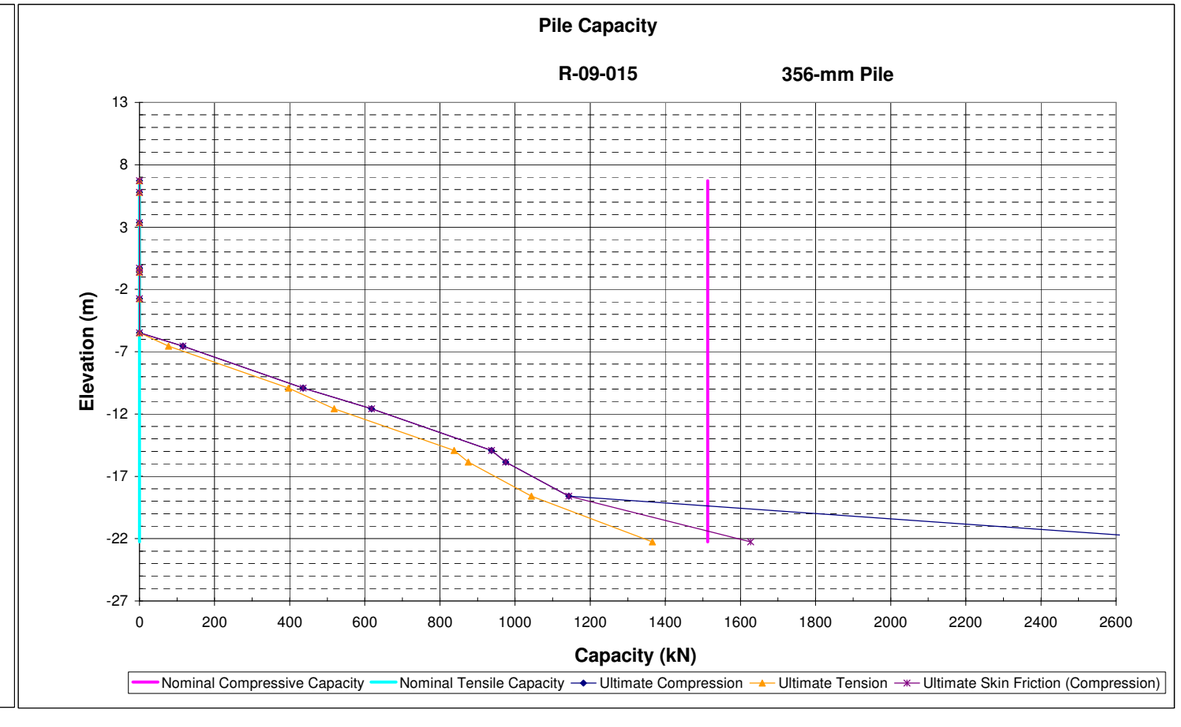
Skin Resistance (Friction) of Pile in Granular Material:
Type (Steel=S,Concrete=C,Timber=T) C
Earth Press. Coefficient * (Comp.) 1.5
Earth Press. Coefficient * (Tens) 1.0
Minimum Adhesion 500 psf

Pile Shape Square (Square, Circular or Octogonal)
Pile Surface Area 1.42 sq. m/m Pile Tip Area 0.13 sq. m
Pile Surface Area 4.67 sq. ft/ft Pile Tip Area 1.36 sq. ft.

* Note: Appropriate tension/compresion ratios for skin friction for granular soils applied is 0.65 and 1.0 for cohesive soil.

Layer No.	Layer Elevation Top (m)	Top (feet)	Bot. (m)	Bot. (feet)	Lateral Resists?	Cohesion c (kPa)	Cohesion c (psf)	Adhesion Ratio c_a/c	Adhesion c_a (psf)	Friction Angle ϕ (deg)	Friction Angle δ (deg)	Layer Thickness (feet)	Internal Depth to Layer Top (feet)	Effective Vert. Stress (Bot. Lay.) (psf)	Design Effective Vert. Stress (Bot. Lay.) (psf)	delta Lat. Res. Cohesive (ton)	delta Lat. Res. Friction (comp) (ton)	delta Lat. Res. Friction (tensile) (ton)	Nq (granular) (-)	z/B (-)	Nc (cohesive) (-)	Soil Type G= gran. C=cohes.	Bearing Capacity (B.C.) (ton)	Include B.C.?	Elevation to midlayer (ft)	Compression Cumulative Axial Res. (skin) (ton)	Compression Cumulative Axial Res. (skin) (kN)	Compression Cumulative Axial Res. (Tot) (ton)	Compression Cumulative Axial Res. (Tot) (kN)	Compression Nominal Axial Capacity (ton)	Compression Nominal Axial Capacity (kN)	Tension Cumulative Axial Res. (Skin) (ton)	Tension Cumulative Axial Res. (Skin) (kN)	Tension Nominal Axial Capacity (ton)	Tension Nominal Axial Capacity (kN)
			6.71	22.0										0	0					0.0	6.25	g	0	n	22.0	0	0	0.0	0	170	1513	0	0	0	0
1	6.71	22.0	5.79	19.0	n	0	0	0.00	0	32	24	3.0	0.0	1320	1320	0.0	0.0	0.0	29	1.3	7.92	g	26	n	20.5	0.0	0	0.0	0	170	1513	0.0	0	0	0
2	5.79	19.0	3.35	11.0	n	48	1000	1.00	0	0	0	8.0	3.0	2386	2386	0.0	0.0	0.0	0	6.0	9.00	c	6	n	15.0	0.0	0	0.0	0	170	1513	0.0	0	0	0
3	3.35	11.0	-0.3	-1.0	n	43	900	1.00	0	0	0	12.0	11.0	2386	2386	0.0	0.0	0.0	0	14.6	9.00	c	6	n	5.0	0.0	0	0.0	0	170	1513	0.0	0	0	0
4	-0.3	-1.0	-0.61	-2.0	n	0	0	0.00	0	32	24	1.0	23.0	2453	2386	0.0	0.0	0.0	29	20.1	9.00	g	47	n	-1.5	0.0	0	0.0	0	170	1513	0.0	0	0	0
5	-0.61	-2.0	-2.74	-9.0	n	43	900	1.00	0	0	0	7.0	24.0	2926	2386	0.0	0.0	0.0	0	23.6	9.00	c	6	n	-5.5	0.0	0	0.0	0	170	1513	0.0	0	0	0
6	-2.74	-9.0	-5.49	-18.0	n	0	0	0.00	0	32	24	9.0	31.0	3490	2386	0.0	0.0	0.0	29	30.4	9.00	g	47	n	-13.5	0.0	0	0.0	0	170	1513	0.0	0	0	0
7	-5.49	-18.0	-6.55	-21.5	Y	0	0	0.00	0	32	24	3.5	40.0	3678	2386	0.0	13.0	8.7	29	35.8	9.00	g	47	n	-19.8	13.0	116	13.0	116	170	1513	8.7	77	0	0
8	-6.55	-21.5	-9.91	-32.5	Y	67	1400	1.00	1400	0	0	11.0	43.5	4366	2386	35.9	0.0	0.0	0	42.0	9.00	c	9	n	-27.0	48.9	436	48.9	436	170	1513	44.6	397	0	0
9	-9.91	-32.5	-11.58	-38.0	Y	0	0	0.00	0	32	24	5.5	54.5	4742	2386	0.0	20.4	13.6	29	49.1	9.00	g	47	n	-35.3	69.4	618	69.4	618	170	1513	58.2	518	0	0
10	-11.58	-38.0	-14.93	-49.0	Y	67	1400	1.00	1400	0	0	11.0	60.0	5265	2386	35.9	0.0	0.0	0	56.1	9.00	c	9	n	-43.5	105.3	937	105.3	937	170	1513	94.2	838	0	0
11	-14.93	-49.0	-15.85	-52.0	Y	29	600	1.00	600	0	0	3.0	71.0	5408	2386	4.2	0.0	0.0	0	62.1	9.00	c	4	n	-50.5	109.5	975	109.5	975	170	1513	98.4	875	0	0
12	-15.85	-52.0	-18.59	-61.0	Y	43	900	1.00	900	0	0	9.0	74.0	5837	2386	18.9	0.0	0.0	0	67.3	9.00	c	6	n	-56.5	128.4	1143	128.4	1143	170	1513	117.3	1043	0	0
13	-18.59	-61.0	-22.25	-73.0	Y	0	0	0.00	0	38	28.5	12.0	83.0	6588	2386	0.0	54.4	36.3	86	76.3	9.00	g	140	y	-67.0	182.8	1627	322.4	2870	170	1513	153.5	1366	0	0
Bottom	-22.25	-73.0																																	





14-inch PCPS Pile with 100 tons Allowable Bearing Capacity

MSN B4 - U.S.101/SR116 SOH

4/9/2010

Pile Design Spreadsheet

Abut 5-RW1_R-09-015

NAVFAC Design Method For a Single Pile

Project Name:	101 MSN Petaluma	
Project Number:	28645045	
Bridge Name:	U.S>101/SR116 SOH	
Boring Surface El. (m)	9.1	
Boring Surface El. (ft)	30.0	(Varies 30-37)
Design GWS El. (ft)	5.0	
Unit Weight of Water (pcf)	62.4	
Depth with no strength		
Convert. Factor	3.281	
Bottom of Pile Cap El. (m)	6.71	
Bottom of Pile Cap El. (ft)	22.00	

Nominal axial compress. Capacity (ult.)	140	ton
Nominal axial compress. Capacity (ult.)	1246	kN
Pile Width	14	inch
Pile Width	356	mm
Pile Width	1.17	ft
Crit depth ratio	20	-
Crit depth	23.3	ft
Crit. Depth. Elev	6.7	ft
Crit. Depth. Elev	2.0	m
Crit. Eff. Vert. Str.	2635	psf

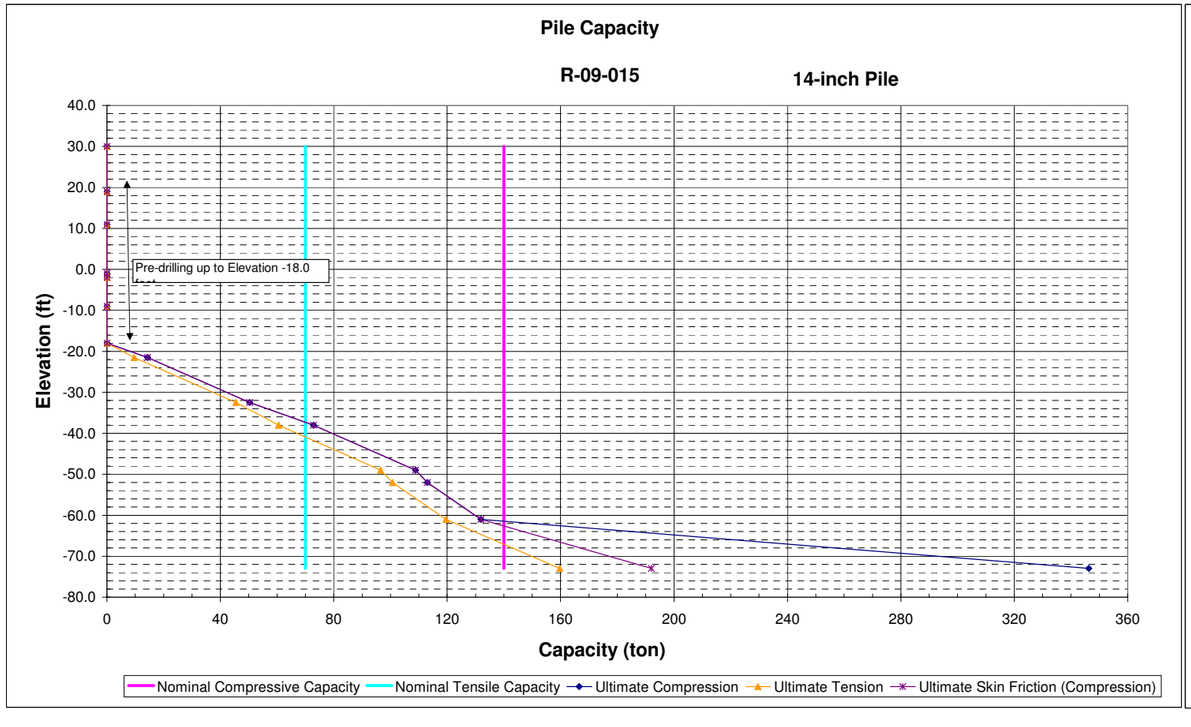
Skin Resistance (Friction) of Pile in Granular Material:

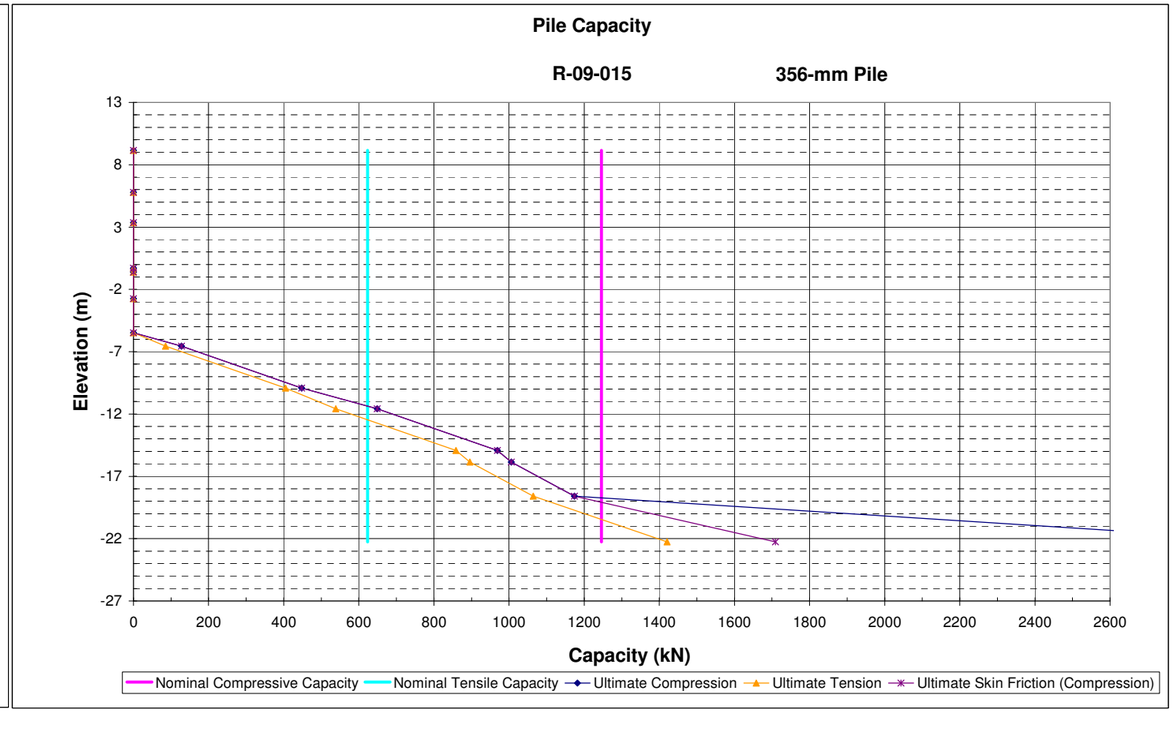
Type (Steel=S,Concrete=C,Timber=T)	C	
Earth Press. Coefficient * (Comp.)	1.5	
Earth Press. Coefficient * (Tens)	1.0	
Minimum Adhesion	500	psf

Pile Shape	Square	(Square, Circular or Octogonal)		
Pile Surface Area	1.42	sq. m/m	Pile Tip Area	0.13 sq. m
Pile Surface Area	4.67	sq. ft/ft	Pile Tip Area	1.36 sq. ft.

* Note: Appropriate tension/compresion ratios for skin friction for granular soils applied is 0.65 and 1.0 for cohesive soil.

Layer No.	Layer Elevation Top (m)	Layer Elevation Top (feet)	Layer Elevation Bot. (m)	Layer Elevation Bot. (feet)	Lateral Resists?	Cohesion c (kPa)	Cohesion c (psf)	Adhesion Ratio c_a/c	Adhesion c_a (psf)	Friction Angle ϕ (deg)	Friction Angle δ (deg)	Layer Thickness (feet)	Internal Depth to Layer Top (feet)	Effective Vert. Stress (Bot. Lay.) (psf)	Design Effective Vert. Stress (Bot. Lay.) (psf)	delta Lat. Res. Cohesive (ton)	delta Lat. Res. Friction (comp) (ton)	delta Lat. Res. Friction (tensile) (ton)	Nq (granular) (-)	z/B (-)	Nc (cohesive) (-)	Soil Type G= gran. C=cohes.	Bearing Capacity (B.C.) (ton)	Include B.C.?	Elevation to midlayer (ft)	Compression Cumulative Axial Res. (skin) (ton)	Compression Cumulative Axial Res. (skin) (kN)	Compression Cumulative Axial Res. (Tot) (ton)	Compression Cumulative Axial Res. (Tot) (kN)	Compression Nominal Axial Capacity (ton)	Compression Nominal Axial Capacity (kN)	Tension Cumulative Axial Res. (Skin) (ton)	Tension Cumulative Axial Res. (Skin) (kN)	Tension Nominal Axial Capacity (ton)	Tension Nominal Axial Capacity (kN)
			9.14	30.0										0	0					0.0	6.25	g	0	n	30.0	0	0	0.0	0	140	1246	0	0	70	623
1	9.14	30.0	5.79	19.0	n	0	0	0.00	0	32	24	11.0	0.0	2280	2280	0.0	0.0	0.0	29	4.7	9.00	g	45	n	24.5	0.0	0	0.0	0	140	1246	0.0	0	70	623
2	5.79	19.0	3.35	11.0	n	48	1000	1.00	0	0	0	8.0	11.0	3346	2635	0.0	0.0	0.0	0	12.9	9.00	c	6	n	15.0	0.0	0	0.0	0	140	1246	0.0	0	70	623
3	3.35	11.0	-0.3	-1.0	n	43	900	1.00	0	0	0	12.0	19.0	3346	2635	0.0	0.0	0.0	0	21.4	9.00	c	6	n	5.0	0.0	0	0.0	0	140	1246	0.0	0	70	623
4	-0.3	-1.0	-0.61	-2.0	n	0	0	0.00	0	32	24	1.0	31.0	3413	2635	0.0	0.0	0.0	29	27.0	9.00	g	52	n	-1.5	0.0	0	0.0	0	140	1246	0.0	0	70	623
5	-0.61	-2.0	-2.74	-9.0	n	43	900	1.00	0	0	0	7.0	32.0	3886	2635	0.0	0.0	0.0	0	30.4	9.00	c	6	n	-5.5	0.0	0	0.0	0	140	1246	0.0	0	70	623
6	-2.74	-9.0	-5.49	-18.0	n	0	0	0.00	0	32	24	9.0	39.0	4450	2635	0.0	0.0	0.0	29	37.3	9.00	g	52	n	-13.5	0.0	0	0.0	0	140	1246	0.0	0	70	623
7	-5.49	-18.0	-6.55	-21.5	Y	0	0	0.00	0	32	24	3.5	48.0	4638	2635	0.0	14.4	9.6	29	42.6	9.00	g	52	n	-19.8	14.4	128	14.4	128	140	1246	9.6	85	70	623
8	-6.55	-21.5	-9.91	-32.5	Y	67	1400	1.00	1400	0	0	11.0	51.5	5326	2635	35.9	0.0	0.0	0	48.9	9.00	c	9	n	-27.0	50.3	448	50.3	448	140	1246	45.5	405	70	623
9	-9.91	-32.5	-11.58	-38.0	Y	0	0	0.00	0	32	24	5.5	62.5	5702	2635	0.0	22.6	15.1	29	55.9	9.00	g	52	n	-35.3	72.9	649	72.9	649	140	1246	60.6	539	70	623
10	-11.58	-38.0	-14.93	-49.0	Y	67	1400	1.00	1400	0	0	11.0	68.0	6225	2635	35.9	0.0	0.0	0	63.0	9.00	c	9	n	-43.5	108.8	969	108.8	969	140	1246	96.5	859	70	623
11	-14.93	-49.0	-15.85	-52.0	Y	29	600	1.00	600	0	0	3.0	79.0	6368	2635	4.2	0.0	0.0	0	69.0	9.00	c	4	n	-50.5	113.0	1006	113.0	1006	140	1246	100.7	896	70	623
12	-15.85	-52.0	-18.59	-61.0	Y	43	900	1.00	900	0	0	9.0	82.0	6797	2635	18.9	0.0	0.0	0	74.1	9.00	c	6	n	-56.5	131.9	1174	131.9	1174	140	1246	119.6	1064	70	623
13	-18.59	-61.0	-22.25	-73.0	Y	0	0	0.00	0	38	28.5	12.0	91.0	7548	2635	0.0	60.1	40.1	86	83.1	9.00	g	154	y	-67.0	192.0	1709	346.3	3082	140	1246	159.7	1420	70	623
Bottom	-22.25	-73.0																																	





14-inch PCPS Pile with 70 tons Allowable Bearing Capacity

MSN B4 - U.S.101/SR116 SOH

4/9/2010

Pile Design Spreadsheet

Abut 5-RW2_R-09-015

NAVFAC Design Method For a Single Pile

Project Name:	101 MSN Petaluma	
Project Number:	28645045	
Bridge Name:	U.S>101/SR116 SOH	
Boring Surface El. (m)	11.3	
Boring Surface El. (ft)	37.0	(Varies 37-40)
Design GWS El. (ft)	5.0	
Unit Weight of Water (pcf)	62.4	
Depth with no strength		
Convert. Factor	3.281	
Bottom of Pile Cap El. (m)	7.92	
Bottom of Pile Cap El. (ft)	26.00	

Nominal axial compress. Capacity (ult.)	140	ton
Nominal axial compress. Capacity (ult.)	1246	kN
Pile Width	14	inch
Pile Width	356	mm
Pile Width	1.17	ft
Crit depth ratio	20	-
Crit depth	23.3	ft
Crit. Depth. Elev	13.7	ft
Crit. Depth. Elev	4.2	m
Crit. Eff. Vert. Str.	2760	psf

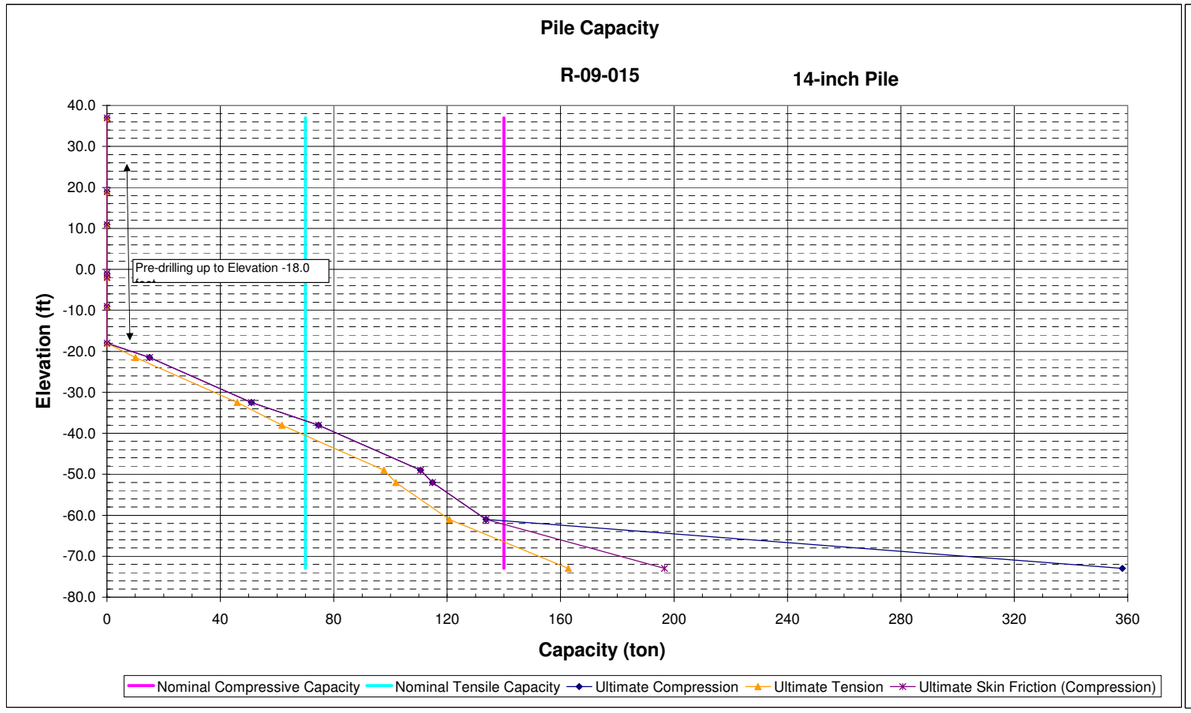
Skin Resistance (Friction) of Pile in Granular Material:

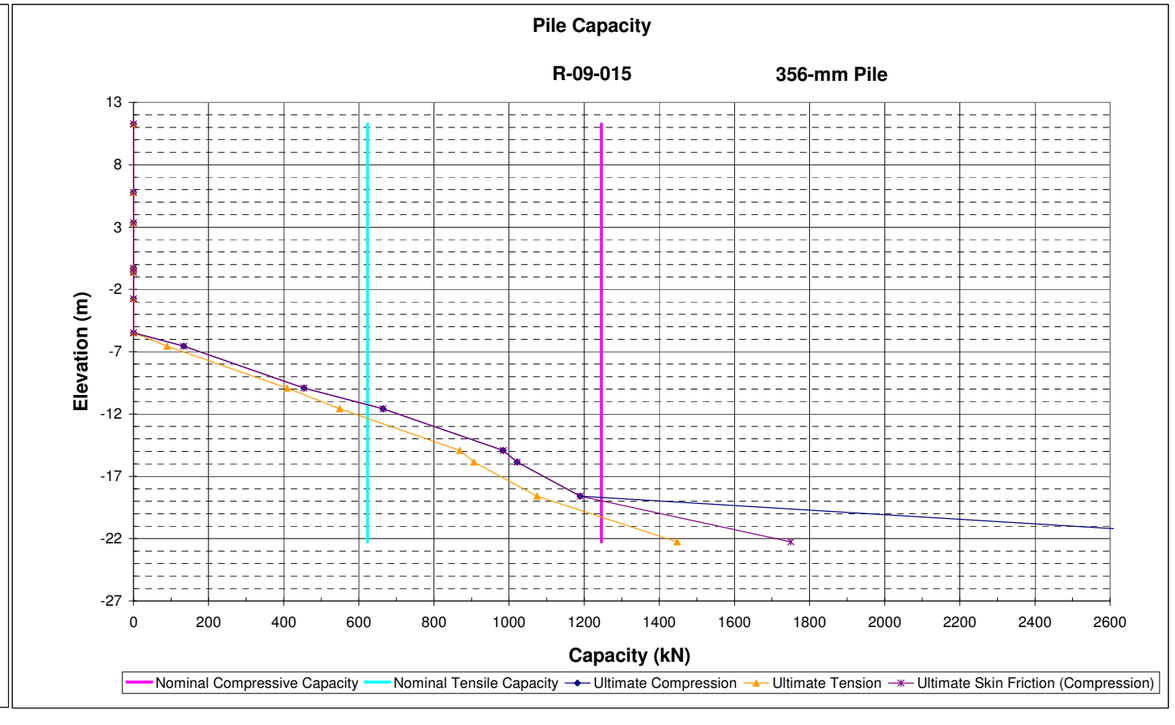
Type (Steel=S,Concrete=C,Timber=T)	C	
Earth Press. Coefficient * (Comp.)	1.5	
Earth Press. Coefficient * (Tens)	1.0	
Minimum Adhesion	500	psf

Pile Shape	Square	(Square, Circular or Octogonal)		
Pile Surface Area	1.42	sq. m/m	Pile Tip Area	0.13 sq. m
Pile Surface Area	4.67	sq. ft/ft	Pile Tip Area	1.36 sq. ft.

* Note: Appropriate tension/compresion ratios for skin friction for granular soils applied is 0.65 and 1.0 for cohesive soil.

Layer No.	Layer Elevation Top (m)	Layer Elevation Top (feet)	Layer Elevation Bot. (m)	Layer Elevation Bot. (feet)	Lateral Resists?	Cohesion c (kPa)	Cohesion c (psf)	Adhesion Ratio c_a/c	Adhesion c_a (psf)	Friction Angle ϕ (deg)	Friction Angle δ (deg)	Layer Thickness (feet)	Internal Depth to Layer Top (feet)	Effective Vert. Stress (Bot. Lay.) (psf)	Design Effective Vert. Stress (Bot. Lay.) (psf)	delta Lat. Res. Cohesive (ton)	delta Lat. Res. Friction (comp) (ton)	delta Lat. Res. Friction (tensile) (ton)	Nq (granular) (-)	z/B (-)	Nc (cohesive) (-)	Soil Type G= gran. C=cohes.	Bearing Capacity (B.C.) (ton)	Include B.C.?	Elevation to midlayer (ft)	Compression Cumulative Axial Res. (skin) (ton)	Compression Cumulative Axial Res. (skin) (kN)	Compression Cumulative Axial Res. (Tot) (ton)	Compression Cumulative Axial Res. (Tot) (kN)	Compression Nominal Axial Capacity (ton)	Compression Nominal Axial Capacity (kN)	Tension Cumulative Axial Res. (Skin) (ton)	Tension Cumulative Axial Res. (Skin) (kN)	Tension Nominal Axial Capacity (ton)	Tension Nominal Axial Capacity (kN)
			11.28	37.0										0	0					0.0	6.25	g	0	n	37.0	0	0	0.0	0	140	1246	0	0	70	623
1	11.28	37.0	5.79	19.0	n	0	0	0.00	0	32	24	18.0	0.0	3120	2760	0.0	0.0	0.0	29	7.7	9.00	g	54	n	28.0	0.0	0	0.0	0	140	1246	0.0	0	70	623
2	5.79	19.0	3.35	11.0	n	48	1000	1.00	0	0	0	8.0	18.0	4186	2760	0.0	0.0	0.0	0	18.9	9.00	c	6	n	15.0	0.0	0	0.0	0	140	1246	0.0	0	70	623
3	3.35	11.0	-0.3	-1.0	n	43	900	1.00	0	0	0	12.0	26.0	4186	2760	0.0	0.0	0.0	0	27.4	9.00	c	6	n	5.0	0.0	0	0.0	0	140	1246	0.0	0	70	623
4	-0.3	-1.0	-0.61	-2.0	n	0	0	0.00	0	32	24	1.0	38.0	4253	2760	0.0	0.0	0.0	29	33.0	9.00	g	54	n	-1.5	0.0	0	0.0	0	140	1246	0.0	0	70	623
5	-0.61	-2.0	-2.74	-9.0	n	43	900	1.00	0	0	0	7.0	39.0	4726	2760	0.0	0.0	0.0	0	36.4	9.00	c	6	n	-5.5	0.0	0	0.0	0	140	1246	0.0	0	70	623
6	-2.74	-9.0	-5.49	-18.0	n	0	0	0.00	0	32	24	9.0	46.0	5290	2760	0.0	0.0	0.0	29	43.3	9.00	g	54	n	-13.5	0.0	0	0.0	0	140	1246	0.0	0	70	623
7	-5.49	-18.0	-6.55	-21.5	Y	0	0	0.00	0	32	24	3.5	55.0	5478	2760	0.0	15.1	10.0	29	48.6	9.00	g	54	n	-19.8	15.1	134	15.1	134	140	1246	10.0	89	70	623
8	-6.55	-21.5	-9.91	-32.5	Y	67	1400	1.00	1400	0	0	11.0	58.5	6166	2760	35.9	0.0	0.0	0	54.9	9.00	c	9	n	-27.0	51.0	454	51.0	454	140	1246	46.0	409	70	623
9	-9.91	-32.5	-11.58	-38.0	Y	0	0	0.00	0	32	24	5.5	69.5	6542	2760	0.0	23.7	15.8	29	61.9	9.00	g	54	n	-35.3	74.6	664	74.6	664	140	1246	61.7	549	70	623
10	-11.58	-38.0	-14.93	-49.0	Y	67	1400	1.00	1400	0	0	11.0	75.0	7065	2760	35.9	0.0	0.0	0	69.0	9.00	c	9	n	-43.5	110.6	984	110.6	984	140	1246	97.7	869	70	623
11	-14.93	-49.0	-15.85	-52.0	Y	29	600	1.00	600	0	0	3.0	86.0	7208	2760	4.2	0.0	0.0	0	75.0	9.00	c	4	n	-50.5	114.8	1021	114.8	1021	140	1246	101.9	906	70	623
12	-15.85	-52.0	-18.59	-61.0	Y	43	900	1.00	900	0	0	9.0	89.0	7637	2760	18.9	0.0	0.0	0	80.1	9.00	c	6	n	-56.5	133.7	1190	133.7	1190	140	1246	120.8	1074	70	623
13	-18.59	-61.0	-22.25	-73.0	Y	0	0	0.00	0	38	28.5	12.0	98.0	8388	2760	0.0	62.9	42.0	86	89.1	9.00	g	162	y	-67.0	196.6	1750	358.2	3188	140	1246	162.7	1448	70	623
Bottom	-22.25	-73.0																																	





14-inch PCPS Pile with 70 tons Allowable Bearing Capacity

MSN B4 - U.S.101/SR116 SOH

10/22/2010

Pile Design Spreadsheet

Abut 5 MeidanRW_R-09-015

NAVFAC Design Method For a Single Pile

Project Name:	101 MSN Petaluma
Project Number:	28645045
Bridge Name:	U.S.101/SR116 SOH (Replace)
Boring Surface El. (m)	5.5
Boring Surface El. (ft)	17.9
Design GWS El. (ft)	5.0
Unit Weight of Water (pcf)	62.4
Depth with no strength	
Convert. Factor	3.281
Bottom of Pile Cap El. (m)	5.46
Bottom of Pile Cap El. (ft)	17.90

Nominal axial compress. Capacity (ult.)	140	ton
Nominal axial compress. Capacity (ult.)	1246	kN
Pile Width	14	inch
Pile Width	356	mm
Pile Width	1.17	ft
Crit depth ratio	20	-
Crit depth	23.3	ft
Crit. Depth. Elev	-5.4	ft
Crit. Depth. Elev	-1.7	m
Crit. Eff. Vert. Str.	2195	psf

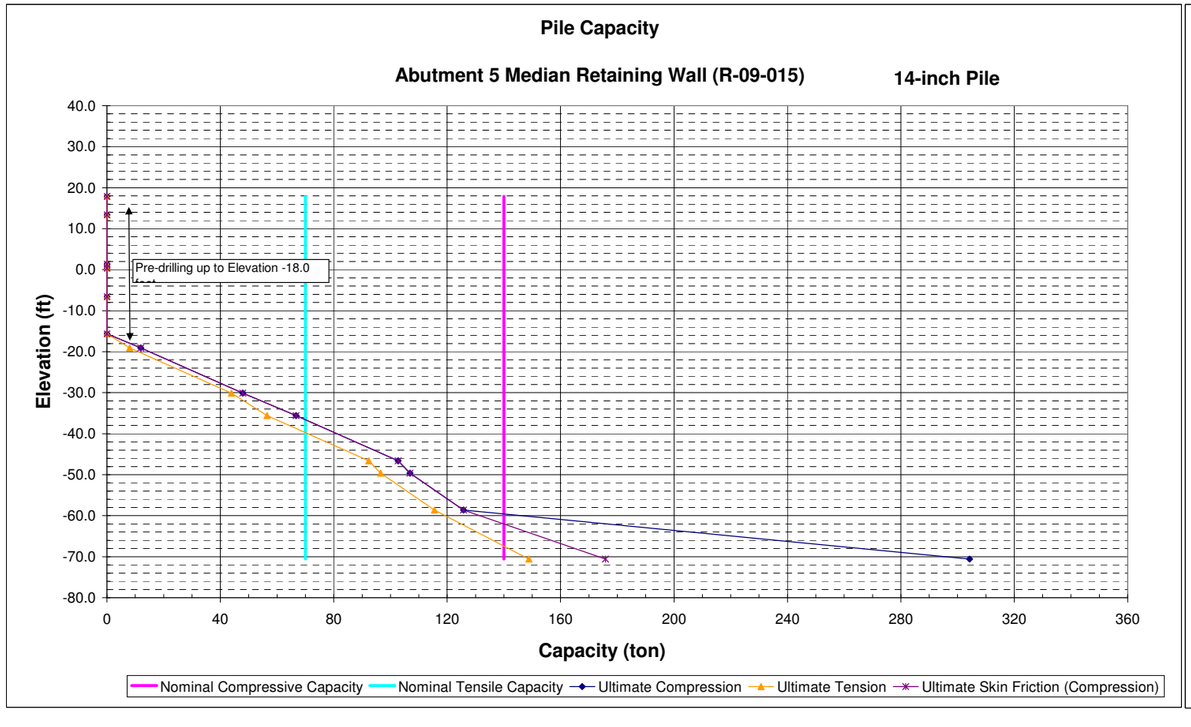
Skin Resistance (Friction) of Pile in Granular Material:

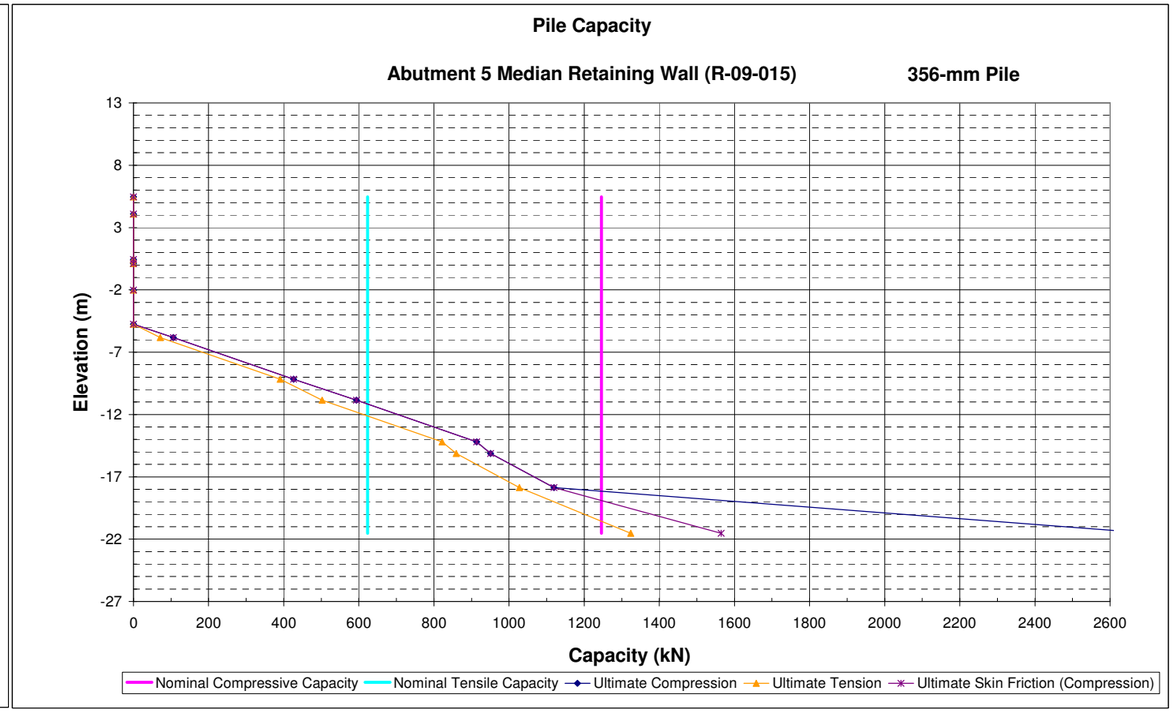
Type (Steel=S,Concrete=C,Timber=T)	C	
Earth Press. Coefficient * (Comp.)	1.5	
Earth Press. Coefficient * (Tens)	1.0	
Minimum Adhesion	500	psf

Pile Shape	Square	(Square, Circular or Octogonal)		
Pile Surface Area	1.42	sq. m/m	Pile Tip Area	0.13 sq. m
Pile Surface Area	4.67	sq. ft/ft	Pile Tip Area	1.36 sq. ft.

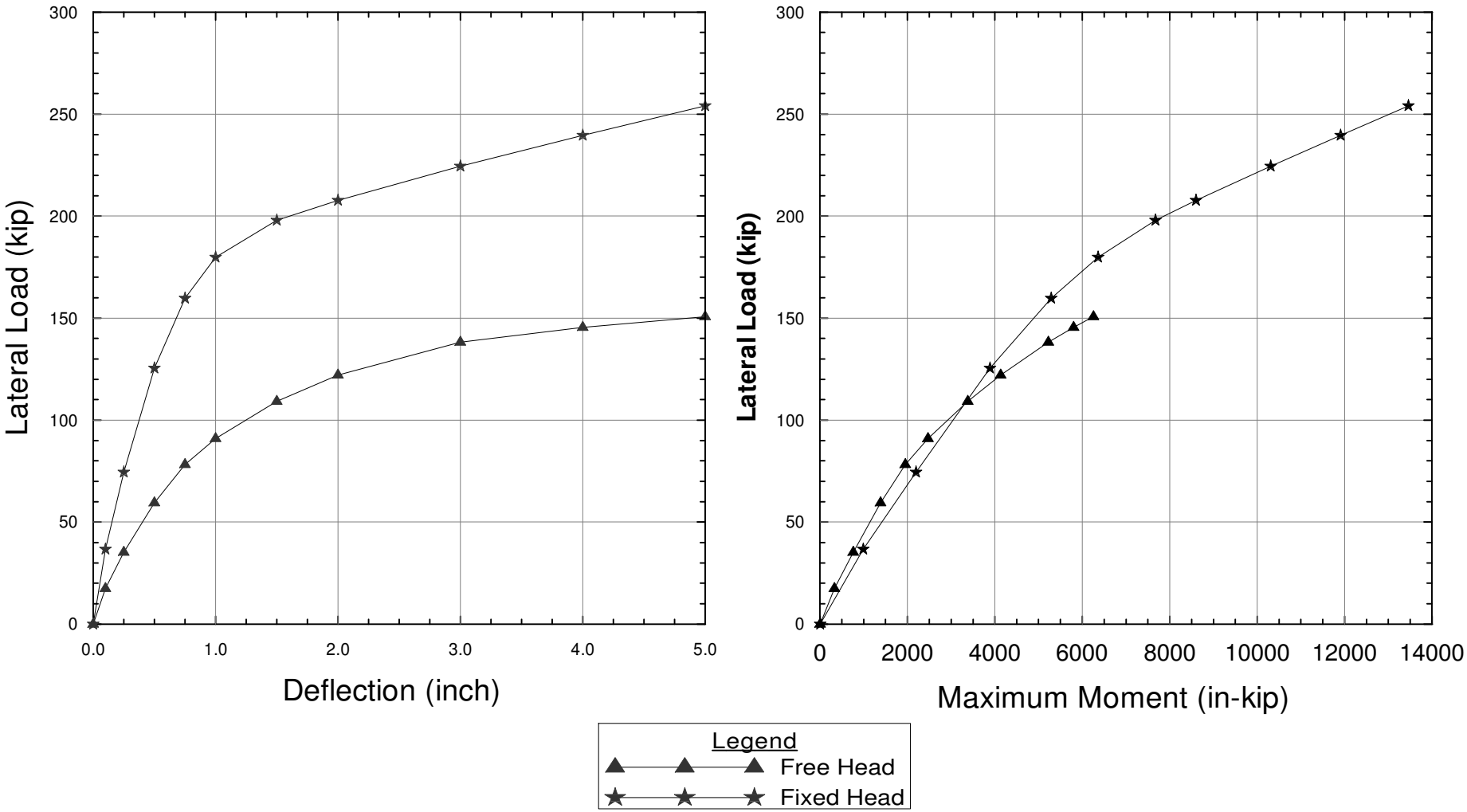
* Note: Appropriate tension/compresion ratios for skin friction for granular soils applied is 0.65 and 1.0 for cohesive soil.

Layer No.	Layer Elevation Top (m)	Top (feet)	Bot. (m)	Bot. (feet)	Lateral Resists?	Cohesion c (kPa)	Cohesion c (psf)	Adhesion Ratio c_a/c	Adhesion c_a (psf)	Friction Angle ϕ (deg)	Friction Angle δ (deg)	Layer Thickness (feet)	Internal Depth to Layer Top (feet)	Effective Vert. Stress (Bot. Lay.) (psf)	Design Effective Vert. Stress (Bot. Lay.) (psf)	delta Lat. Res. Cohesive (ton)	delta Lat. Res. Friction (comp) (ton)	delta Lat. Res. Friction (tensile) (ton)	Nq (granular) (-)	z/B (-)	Nc (cohesive) (-)	Soil Type C=cohes. G= gran.	Bearing Capacity (B.C.) (ton)	Include B.C.?	Elevation to midlayer (ft)	Compression Cumulative Axial Res. (skin) (ton)	Compression Cumulative Axial Res. (skin) (kN)	Compression Cumulative Axial Res. (Tot) (ton)	Compression Cumulative Axial Res. (Tot) (kN)	Compression Nominal Axial Capacity (ton)	Compression Nominal Axial Capacity (kN)	Tension Cumulative Axial Res. (Skin) (ton)	Tension Cumulative Axial Res. (Skin) (kN)	Tension Nominal Axial Capacity (ton)	Tension Nominal Axial Capacity (kN)
			5.46	17.9										0	0					0.0	6.25	g	0	n	17.9	0	0	0.0	0	140	1246	0	0	70	623
1	5.46	17.9	4.08	13.4	n	48	1000	1.00	0	0	0	4.5	0.0	1705	1705	0.0	0.0	0.0	0	1.9	8.37	g	0	n	15.7	0.0	0	0.0	0	140	1246	0.0	0	70	623
2	4.08	13.4	0.43	1.4	n	43	900	1.00	0	0	0	12.0	4.5	1789	1789	0.0	0.0	0.0	0	9.0	9.00	c	6	n	7.4	0.0	0	0.0	0	140	1246	0.0	0	70	623
3	0.43	1.4	0.12	0.4	n	0	0	0.00	0	32	24	1.0	16.5	1789	1789	0.0	0.0	0.0	29	14.6	9.00	c	0	n	0.9	0.0	0	0.0	0	140	1246	0.0	0	70	623
4	0.12	0.4	-2.01	-6.6	n	43	900	1.00	0	0	0	7.0	17.5	2262	2195	0.0	0.0	0.0	0	18.0	9.00	g	0	n	-3.1	0.0	0	0.0	0	140	1246	0.0	0	70	623
5	-2.01	-6.6	-4.75	-15.6	n	0	0	0.00	0	32	24	9.0	24.5	2828	2195	0.0	0.0	0.0	29	24.9	9.00	c	0	n	-11.1	0.0	0	0.0	0	140	1246	0.0	0	70	623
6	-4.75	-15.6	-5.82	-19.1	Y	0	0	0.00	0	32	24	3.5	33.5	3079	2195	0.0	12.0	8.0	29	30.2	9.00	g	43	n	-17.4	12.0	107	12.0	107	140	1246	8.0	71	70	623
7	-5.82	-19.1	-9.17	-30.1	Y	67	1400	1.00	1400	0	0	11.0	37.0	3767	2195	35.9	0.0	0.0	0	36.4	9.00	g	0	n	-24.6	47.9	426	47.9	426	140	1246	43.9	391	70	623
8	-9.17	-30.1	-10.85	-35.6	Y	0	0	0.00	0	32	24	5.5	48.0	4080	2195	0.0	18.8	12.5	29	43.5	9.00	c	0	n	-32.9	66.7	594	66.7	594	140	1246	56.5	502	70	623
9	-10.85	-35.6	-14.2	-46.6	Y	67	1400	1.00	1400	0	0	11.0	53.5	4611	2195	35.9	0.0	0.0	0	50.6	9.00	g	0	n	-41.1	102.6	914	102.6	914	140	1246	92.4	822	70	623
10	-14.2	-46.6	-15.12	-49.6	Y	29	600	1.00	600	0	0	3.0	64.5	4754	2195	4.2	0.0	0.0	0	56.6	9.00	c	4	n	-48.1	106.8	951	106.8	951	140	1246	96.6	859	70	623
11	-15.12	-49.6	-17.86	-58.6	Y	43	900	1.00	900	0	0	9.0	67.5	5183	2195	18.9	0.0	0.0	0	61.7	9.00	c	6	n	-54.1	125.7	1119	125.7	1119	140	1246	115.5	1027	70	623
12	-17.86	-58.6	-21.52	-70.6	Y	0	0	0.00	0	38	28.5	12.0	76.5	5926	2195	0.0	50.0	33.4	86	70.7	9.00	g	128	y	-64.6	175.8	1565	304.3	2708	140	1246	148.9	1324	70	623
Bottom	-21.52	-70.6																																	





14-inch Class 200 Pile



Project No. 28645045	MSN B4 Petaluma, California	**U.S. 101N/SR116 SOH (Replace) Pile Lateral Resistance - Class200 Pile Abut.1 _ Footing 1A**	Figure G-1
	URS		

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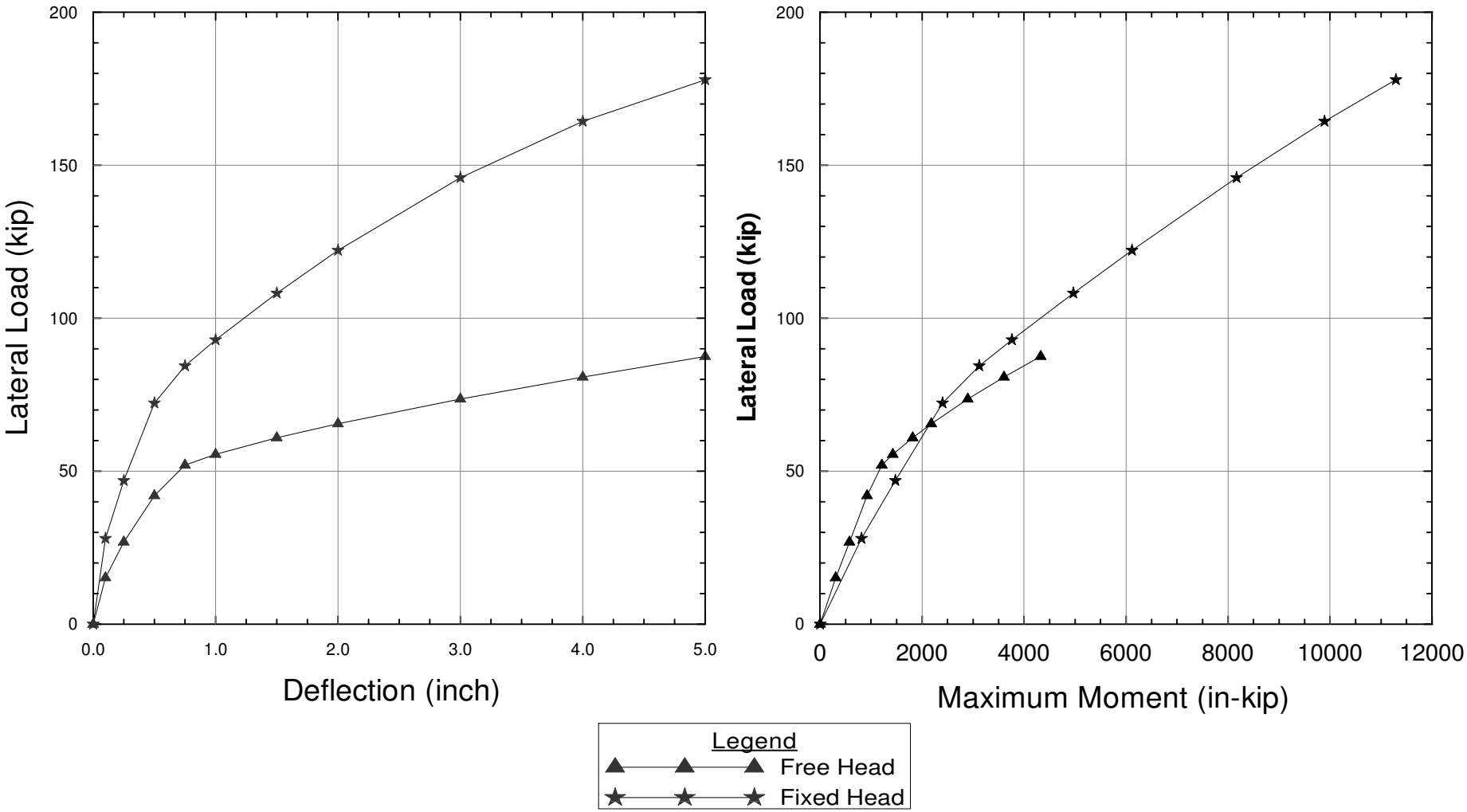

Project No. 28645045	MSN B4 Petaluma, California	**U.S. 101N/SR116 SOH (Replace)** **Pile Lateral Resistance - Class 200 Pile** **Abut. 1 _ Footing 1B**	Figure G-2
	URS		

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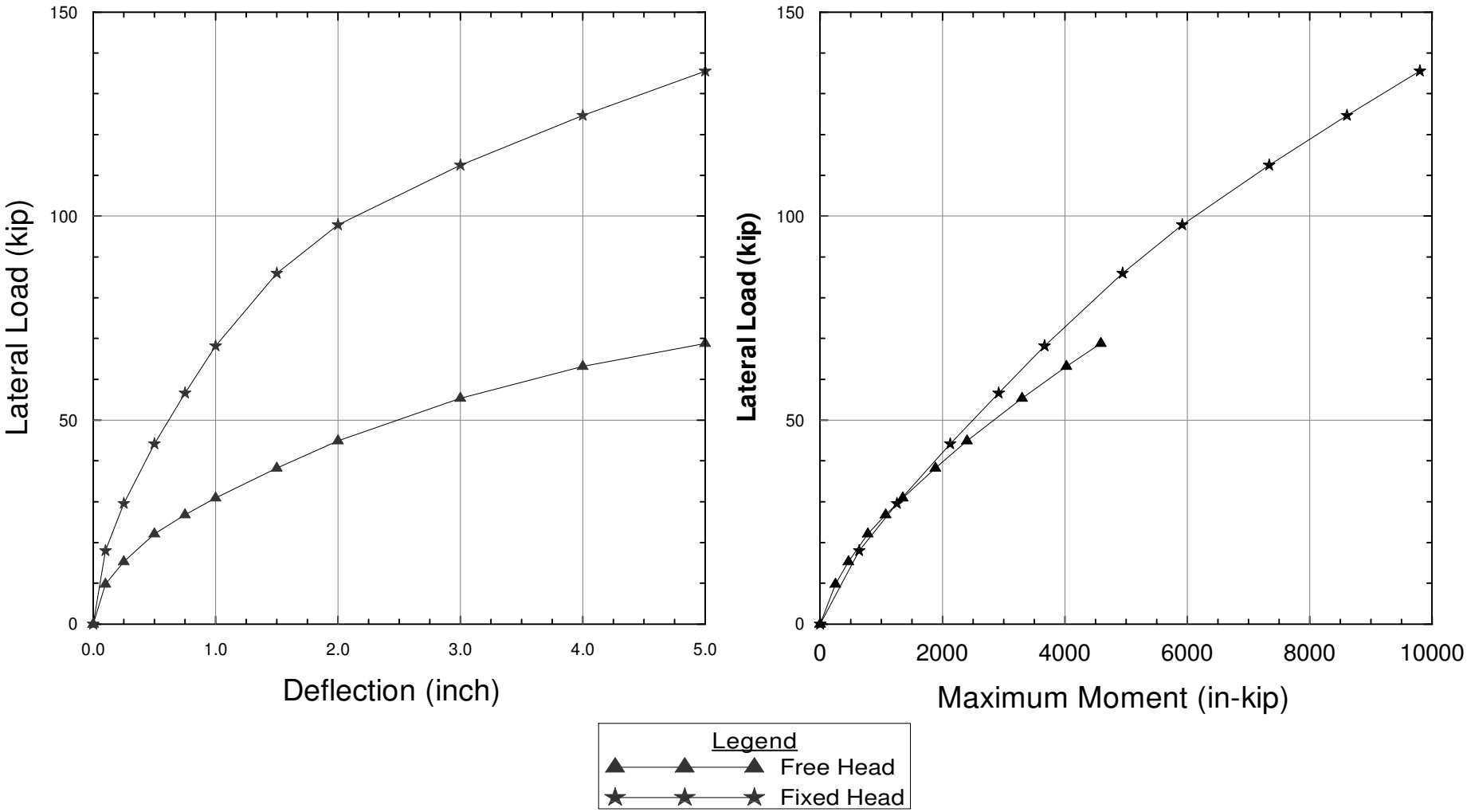

Project No. 28645045	MSN B4 Petaluma, California	U.S. 101N/SR116 SOH (Replace) Pile Lateral Resistance - Class 200 Pile Abut. 1 _ Footing 1C	Figure G-3
	URS		

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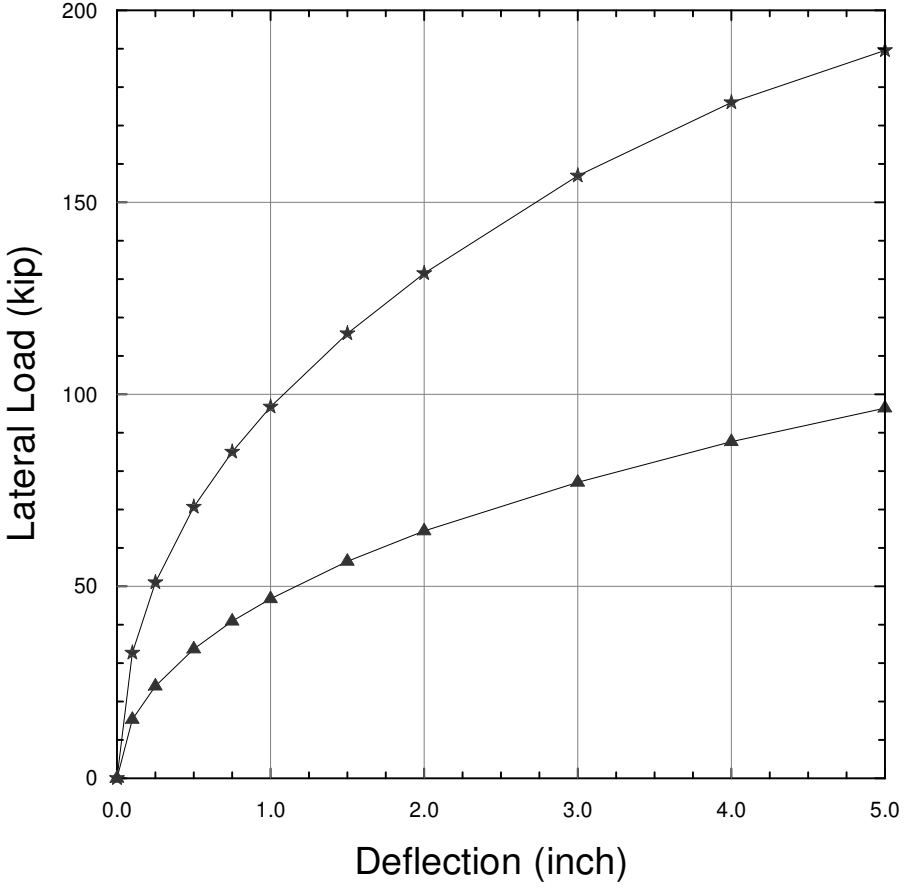

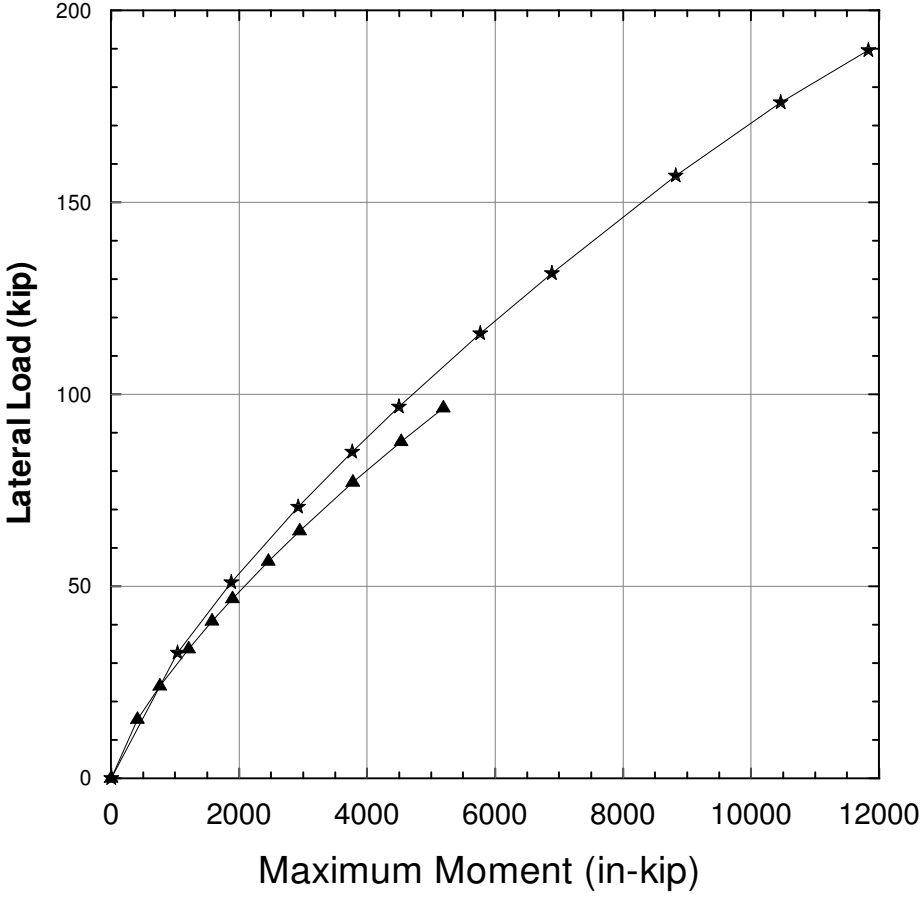

Legend
Free Head
Fixed Head

Project No. 28645045	MSN B4 Petaluma, California	U.S. 101N/SR116 SOH (Replace) Bent 2 Pile Lateral Resistance Class200 Pile	Figure G-4
	URS		

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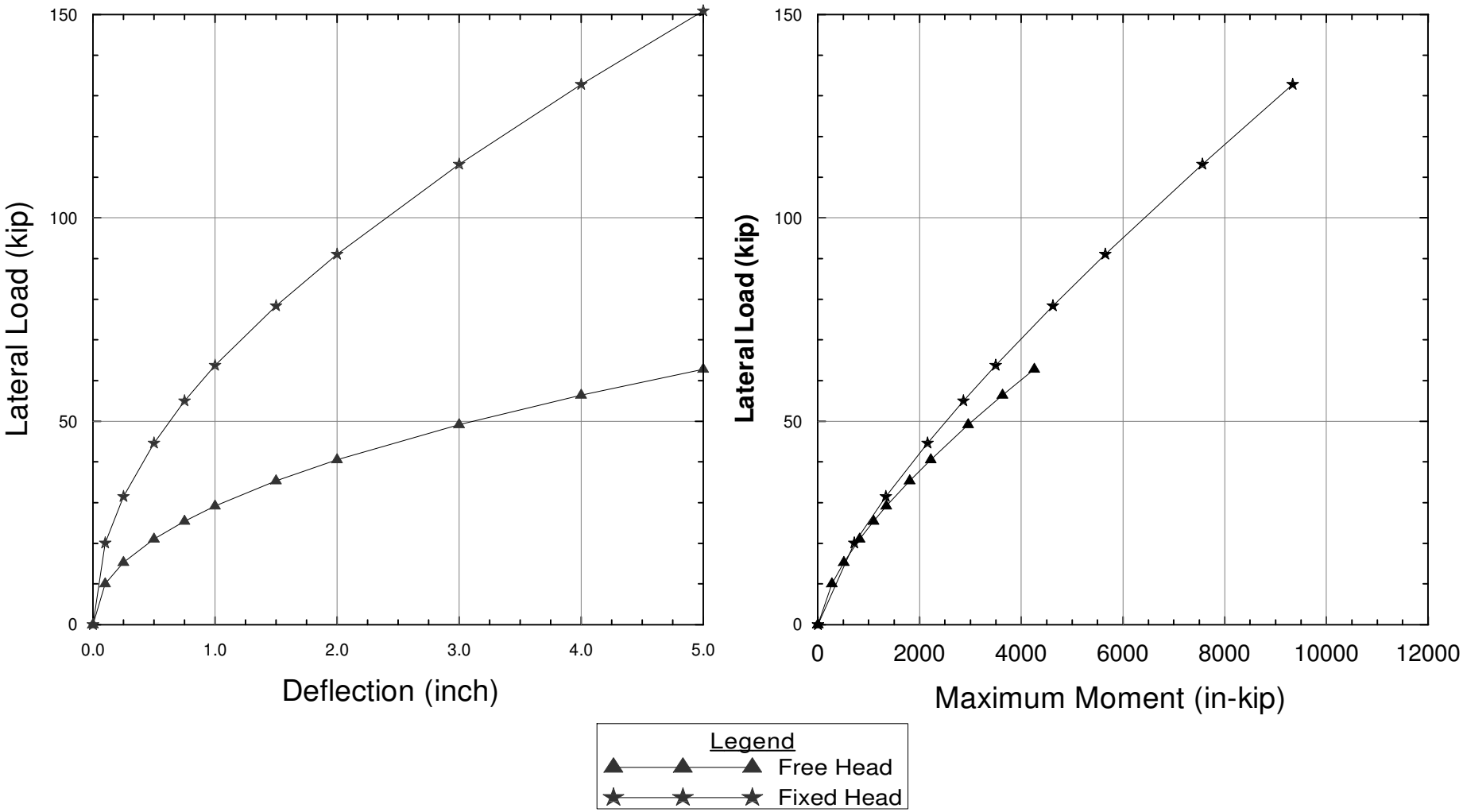

Project No. 28645045	MSN B4 Petaluma, California	U.S. 101N/SR116 SOH (Replace) Bent 3 Pile Lateral Resistance Class200 Pile	Figure G-5
	URS		

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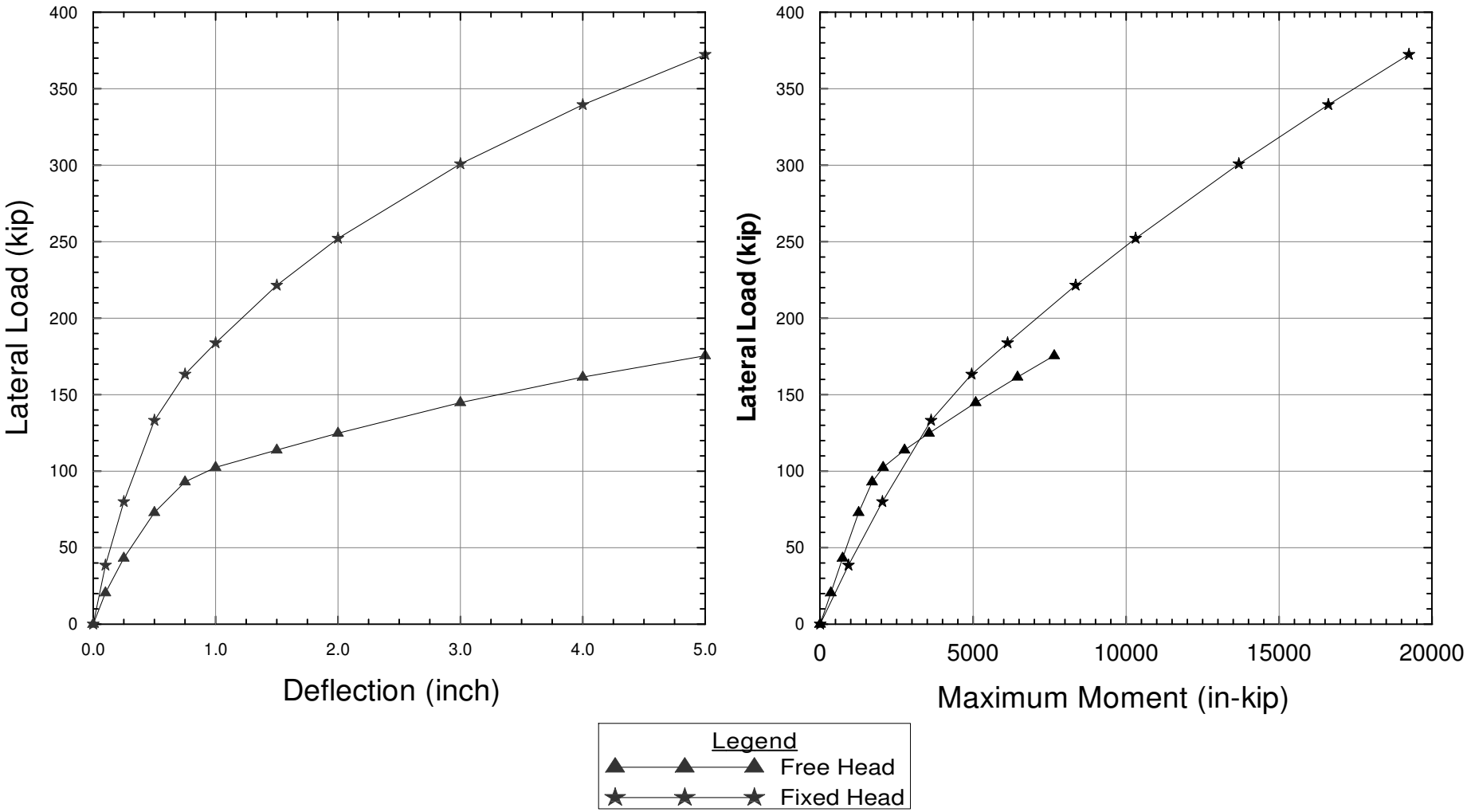

Project No. 28645045	MSN B4 Petaluma, California	U.S. 101N/SR116 SOH (Replace) Bent 4 Pile Lateral Resistance Class200 Pile	Figure G-6
	URS		

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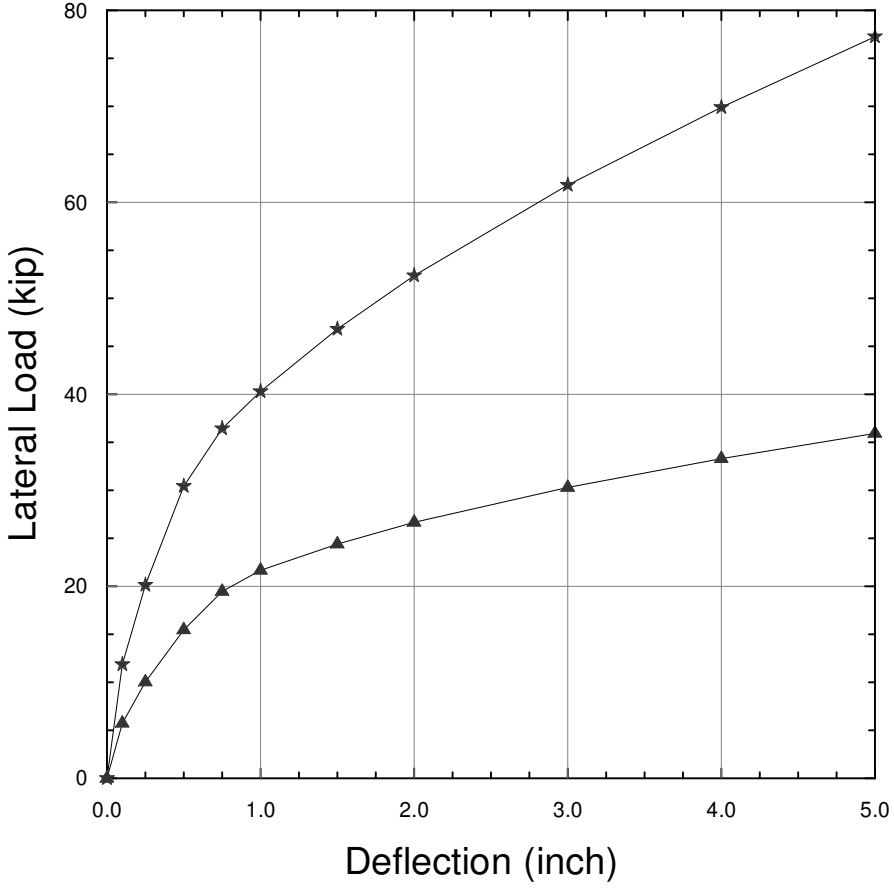

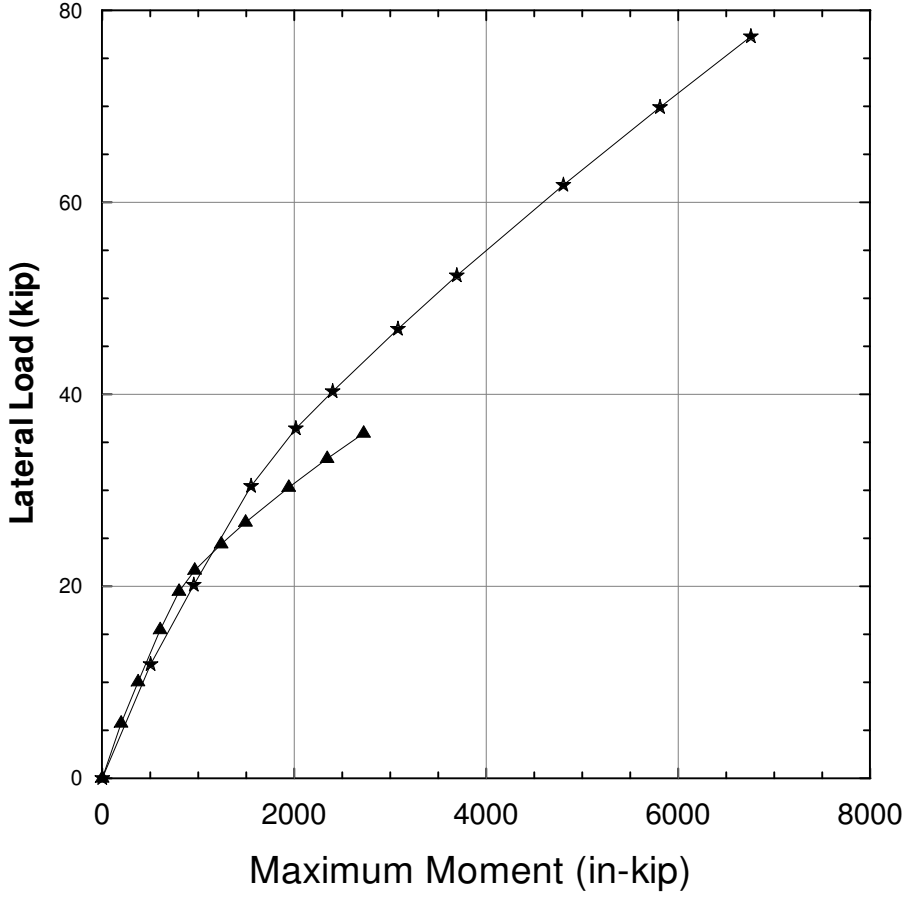

Legend
Free Head
Fixed Head

Project No. 28645045	MSN B4 Petaluma, California	U.S. 101N/SR116 SOH (Replace) Abutment 5 Pile Lateral Resistance Class200 Pile	Figure G-7
	URS		

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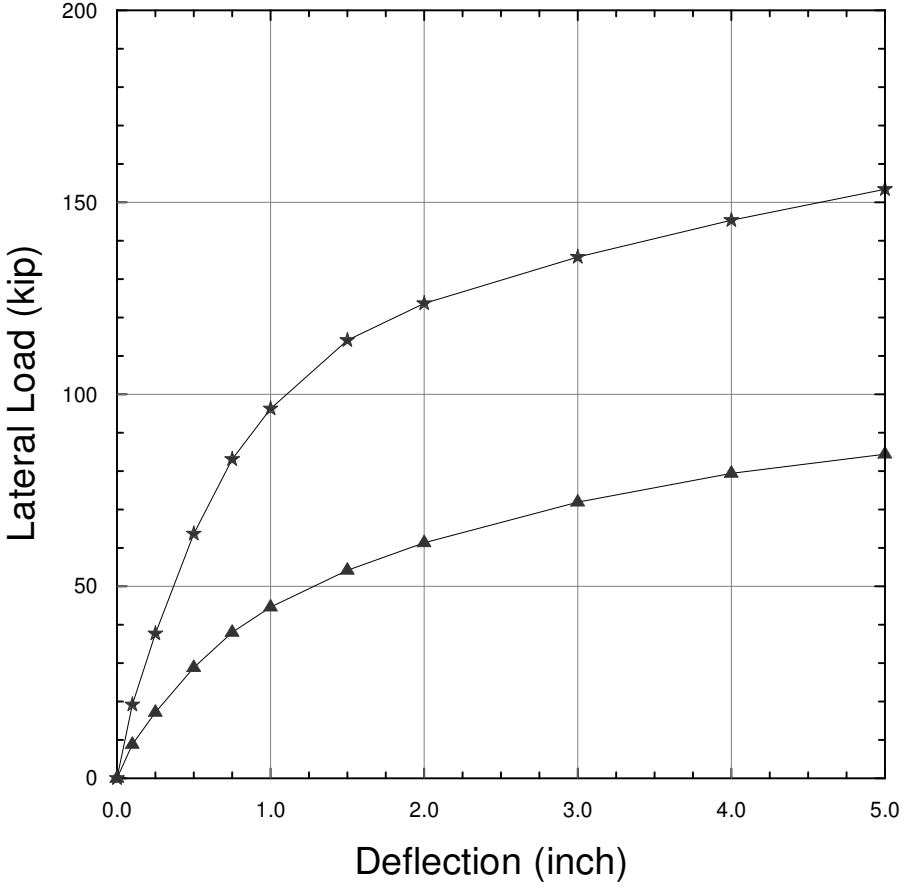

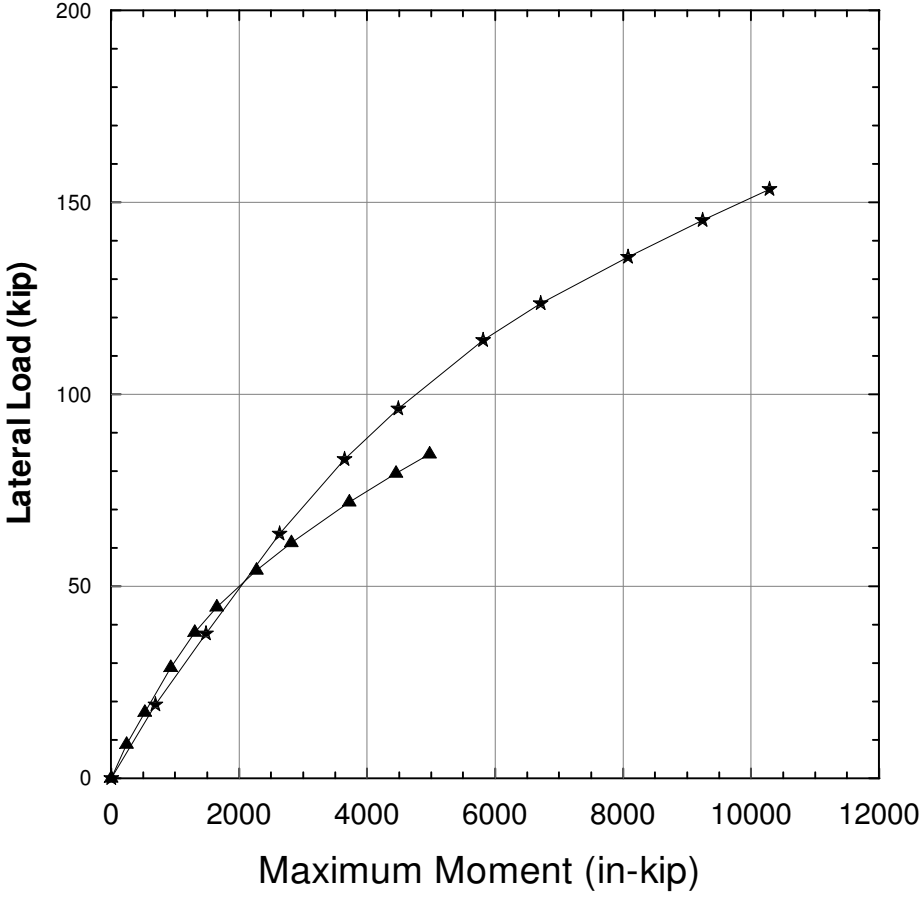

Project No. 28645045	MSN B4 Petaluma, California	U.S. 101N/SR116 SOH (Replace) Abutment 5 - RW1 Pile Lateral Resistance - Class140	Figure G-8
	URS		

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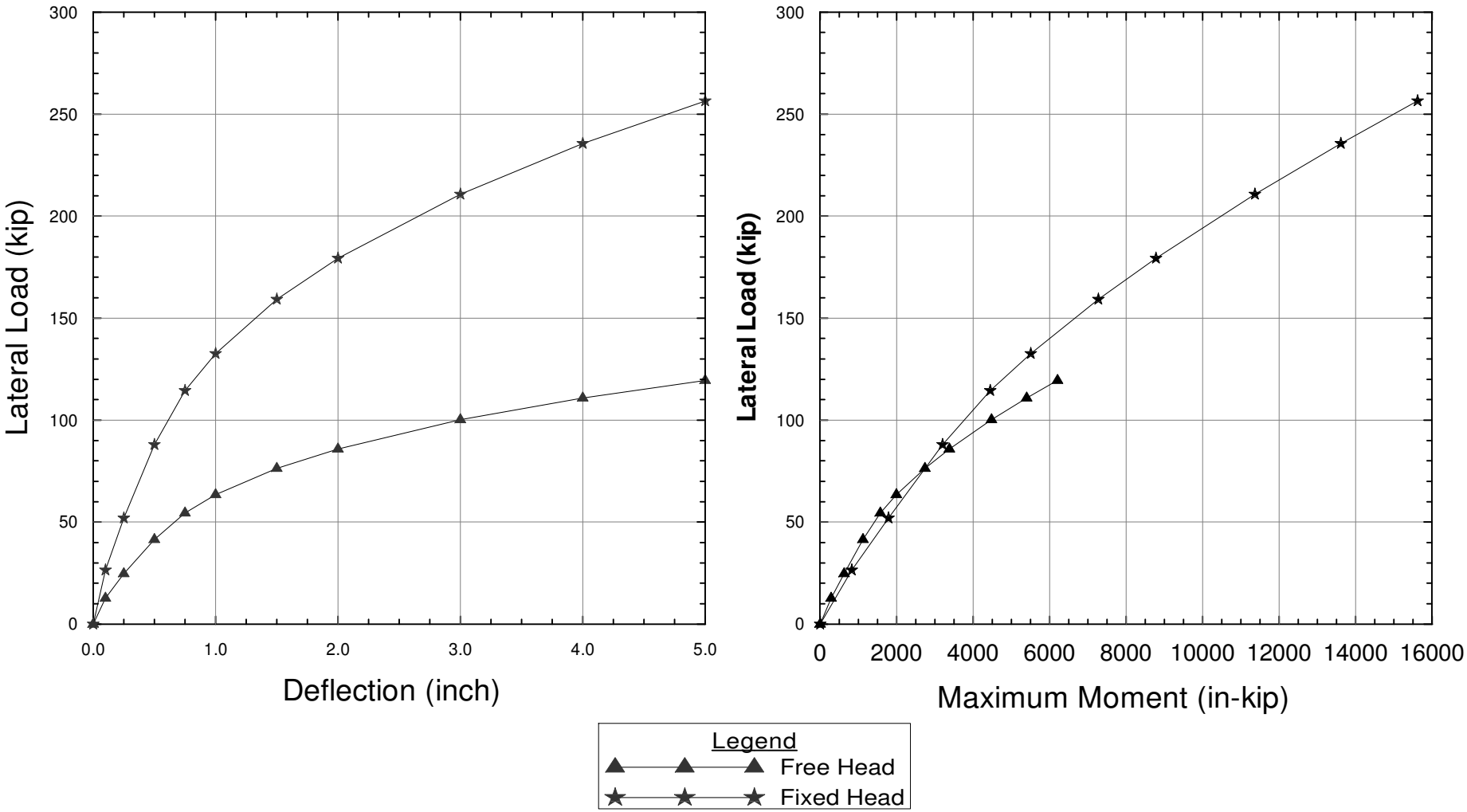

Project No. 28645045	MSN B4 Petaluma, California	U.S. 101N/SR116 SOH (Replace) Abutment 5 - RW2 Pile Lateral Resistance - Class140	Figure G-9
	URS		

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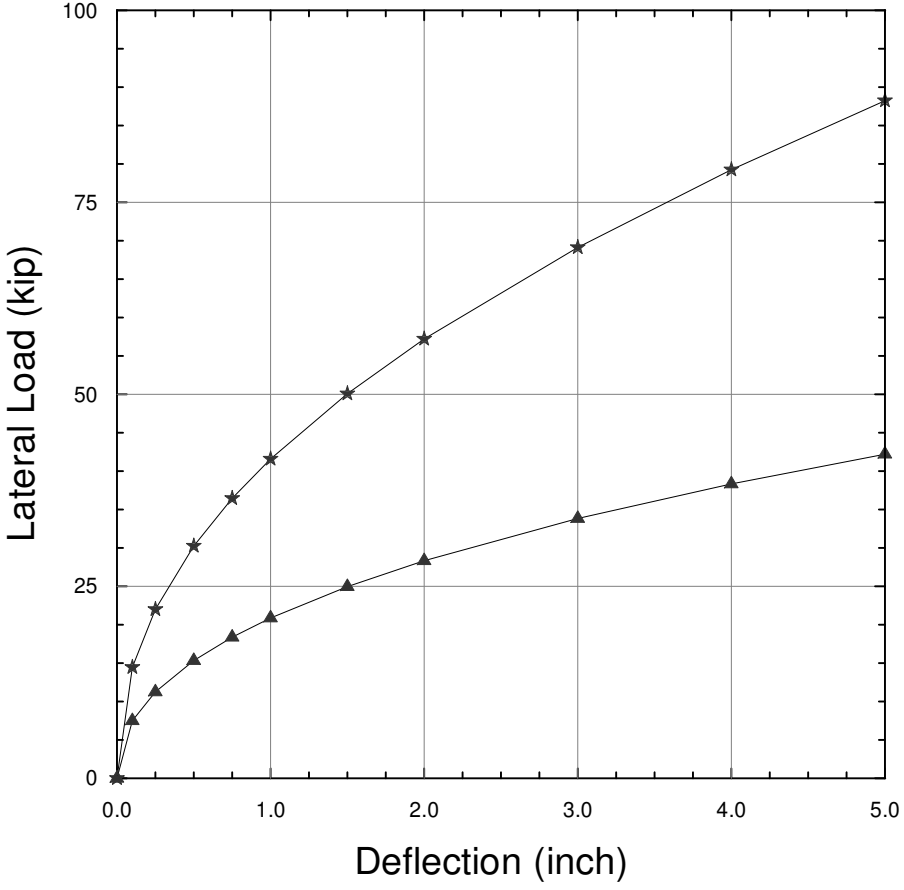
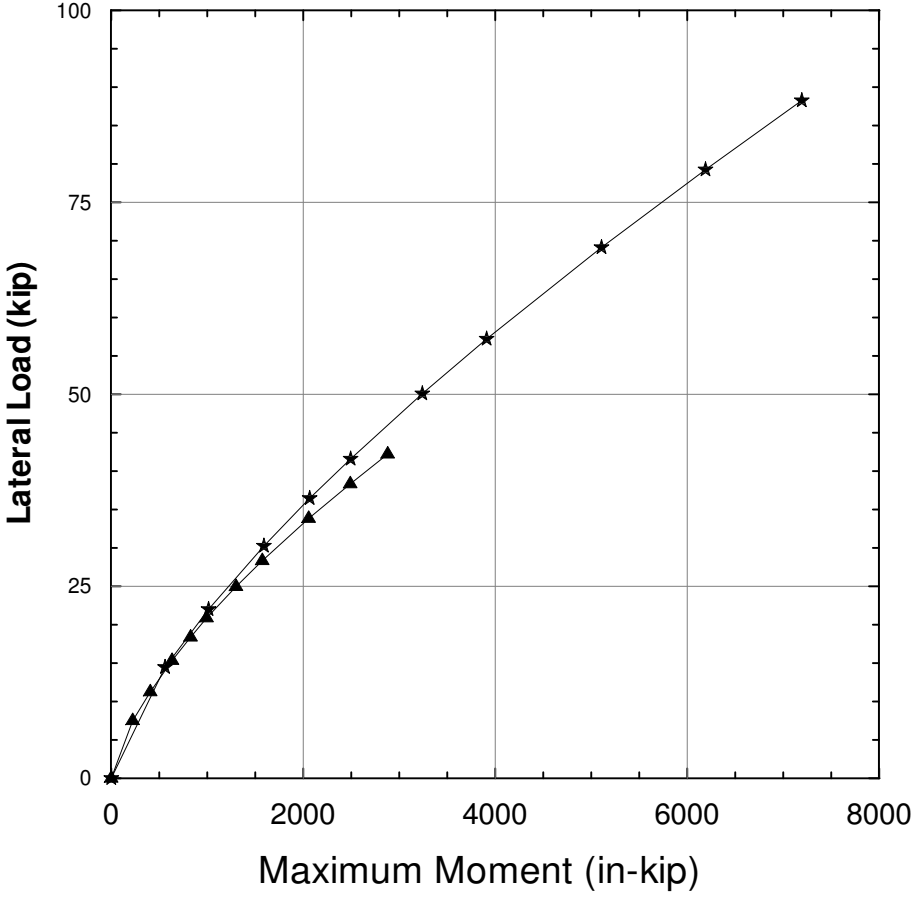


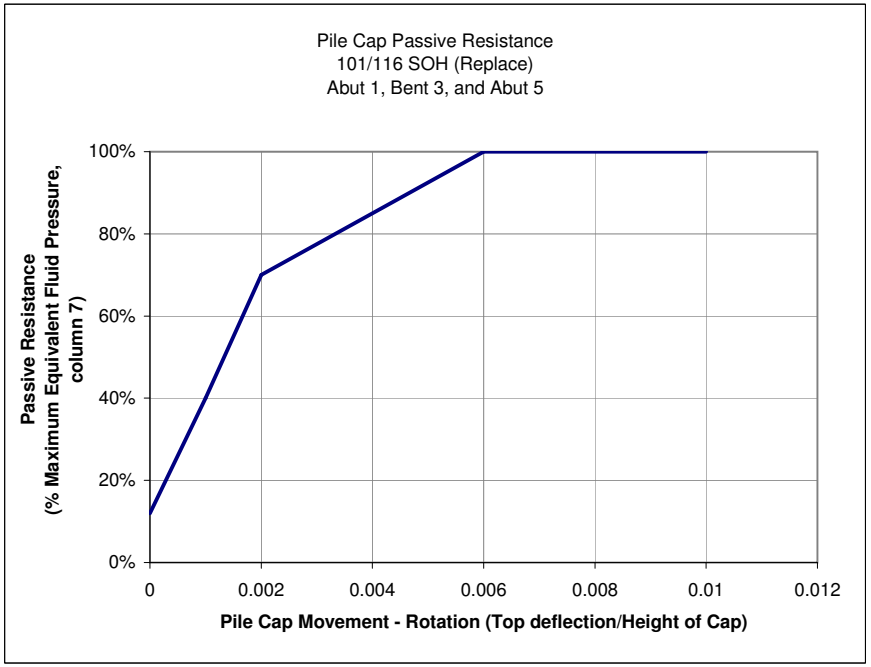


Project No. 28645045	MSN B4 Petaluma, California	U.S. 101S/SR116 SOH (Widen) Abutment 5 Median RW Class140 Pile - Pile Lateral Resistance	Figure G-10
	URS		

X:/101_MSN_SCTA/450_Geotech/Analysis/Pile/Lateral/101&116 SOH Widen/116Widen_abutment 6.grf

101/116 (Replace)

	1	2	3	4	5	6	7	8	9
	Ground Surf	Bottom Pile Cap	Soil Type			Passive Pressure Coefficient	Equivalent Fluid Pressure (triangular distribution)	At-rest Pressure Coefficent	At-rest Equivalent Fluid Pressure
Abut / Bent				Unit Wt	ϕ	Kp	Pp	Ko	Po = Ko γ
				pcf			psf/ft		psf/ft
Abut 1	29.5	23.5	Sand Fill	135	36	3.85	500	0.41	60
Bent 2	11	4.5	Clay	120	31	3.12	300	0.48	60
Bent 3	10	4.5	Sand/Gravel	125	32	3.25	400	0.47	60
Bent 4	14	0	Clay	115	30	3	300	0.5	60
Abut 5	22	15.5	Fill	125	34	3.54	400	0.44	60



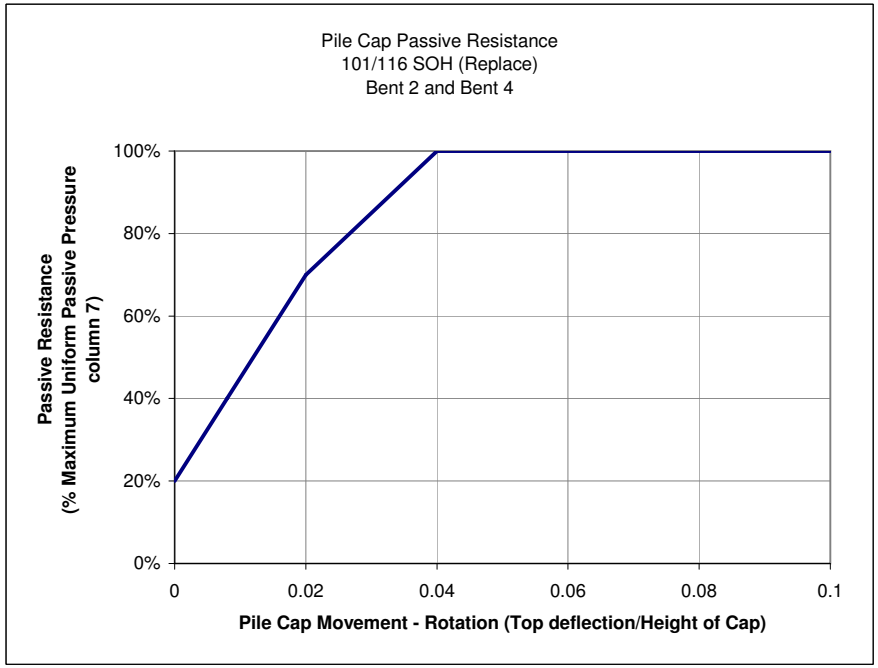


FIGURE G-11

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Replace\
Name of input data file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1A_free.lpd
Name of output file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1A_free.lpo
Name of plot output file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1A_free.lpp
Name of runtime file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1A_free.lpr

---

Time and Date of Analysis

Date: October 14, 2010 Time: 14:50:53

Problem Title

US 101/SR116 SOH (Replace) Abutment 1_R-09-011 -Free_Footing 1A

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis

- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 160
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 960.00 in

Depth of ground surface below top of pile = -114.00 in

Slope angle of ground surface = 21.80 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	14.00000000	3201.3000	196.0000	3600000.
2	960.0000	14.00000000	3201.3000	196.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 13 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = -114.000 in
Distance from top of pile to bottom of layer = 78.000 in
p-y subgrade modulus k for top of soil layer = 60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 60.000 lbs/in**3

Layer 2 is stiff clay without free water
Distance from top of pile to top of layer = 78.000 in
Distance from top of pile to bottom of layer = 162.000 in

```
Layer  3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      162.000 in
Distance from top of pile to bottom of layer =      210.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =      210.000 in
Distance from top of pile to bottom of layer =      294.000 in

Layer  5 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      294.000 in
Distance from top of pile to bottom of layer =      402.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  6 is stiff clay without free water
Distance from top of pile to top of layer    =      402.000 in
Distance from top of pile to bottom of layer =      516.000 in

Layer  7 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      516.000 in
Distance from top of pile to bottom of layer =      576.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer  8 is stiff clay without free water
Distance from top of pile to top of layer    =      576.000 in
Distance from top of pile to bottom of layer =      636.000 in

Layer  9 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      636.000 in
Distance from top of pile to bottom of layer =      678.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer 10 is stiff clay without free water
Distance from top of pile to top of layer    =      678.000 in
Distance from top of pile to bottom of layer =      768.000 in

Layer 11 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      768.000 in
Distance from top of pile to bottom of layer =      852.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer 12 is stiff clay without free water
Distance from top of pile to top of layer    =      852.000 in
Distance from top of pile to bottom of layer =      936.000 in

Layer 13 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      936.000 in
Distance from top of pile to bottom of layer =     1188.000 in
p-y subgrade modulus k for top of soil layer =      150.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      150.000 lbs/in**3
```

(Depth of lowest layer extends 228.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 26 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-114.00	0.07810
2	78.00	0.07810
3	78.00	0.06940
4	162.00	0.06940
5	162.00	0.07230
6	210.00	0.07230
7	210.00	0.06940
8	294.00	0.06940
9	294.00	0.03330
10	402.00	0.03330
11	402.00	0.03620
12	516.00	0.03620
13	516.00	0.03910
14	576.00	0.03910
15	576.00	0.03910
16	636.00	0.03910
17	636.00	0.04200
18	678.00	0.04200
19	678.00	0.03620
20	768.00	0.03620
21	768.00	0.04200
22	852.00	0.04200
23	852.00	0.03620
24	936.00	0.03620
25	936.00	0.04990
26	1188.00	0.04990

Shear Strength of Soils

Shear strength parameters with depth defined using 26 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-114.000	0.00000	36.00	------	------
2	78.000	0.00000	36.00	------	------
3	78.000	6.94000	0.00	0.00900	0.0
4	162.000	6.94000	0.00	0.00900	0.0
5	162.000	0.00000	32.00	------	------
6	210.000	0.00000	32.00	------	------
7	210.000	6.94000	0.00	0.00900	0.0

8	294.000	6.94000	0.00	0.00900	0.0
9	294.000	0.00000	32.00	------	------
10	402.000	0.00000	32.00	------	------
11	402.000	20.83000	0.00	0.00600	0.0
12	516.000	20.83000	0.00	0.00600	0.0
13	516.000	0.00000	36.00	------	------
14	576.000	0.00000	36.00	------	------
15	576.000	27.78000	0.00	0.00500	0.0
16	636.000	27.78000	0.00	0.00500	0.0
17	636.000	0.00000	36.00	------	------
18	678.000	0.00000	36.00	------	------
19	678.000	18.06000	0.00	0.00600	0.0
20	768.000	18.06000	0.00	0.00600	0.0
21	768.000	0.00000	36.00	------	------
22	852.000	0.00000	36.00	------	------
23	852.000	17.36000	0.00	0.00600	0.0
24	936.000	17.36000	0.00	0.00600	0.0
25	936.000	0.00000	41.00	------	------
26	1188.000	0.00000	41.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.100 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 191000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.250 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 191000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.500 in

```
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs

Load Case Number  4

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           0.750 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs

Load Case Number  5

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           1.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs

Load Case Number  6

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           1.500 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs

Load Case Number  7

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           2.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs

Load Case Number  8

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           3.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs

Load Case Number  9

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           4.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           5.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs
```

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment, y = pile-head displacment in
Type 2 = Shear and Slope, M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness, V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment, S = Pile-head Slope, radians
Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= 0.100000	M= 0.000	191000.	0.1000000	330532.	17383.0262
4	y= 0.250000	M= 0.000	191000.	0.2500000	763407.	35239.1794
4	y= 0.500000	M= 0.000	191000.	0.5000000	1385160.	59424.9792
4	y= 0.750000	M= 0.000	191000.	0.7500000	1952176.	78172.4024
4	y= 1.000000	M= 0.000	191000.	1.0000000	2466546.	90993.0318
4	y= 1.500	M= 0.000	191000.	1.5000	3381743.	109175.
4	y= 2.000	M= 0.000	191000.	2.0000	4131246.	122009.
4	y= 3.000	M= 0.000	191000.	3.0000	5224912.	138234.
4	y= 4.000	M= 0.000	191000.	4.0000	5803023.	145403.
4	y= 5.000	M= 0.000	191000.	5.0000	6257600.	150744.

Pile-head Deflection vs. Pile Length

Boundary Condition Type 4, Deflection and Moment

Deflection = 0.10000 in
Moment = 0. in-lbs
Axial Load = 191000. lbs

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
960.000	0.10000000	330532.43260	17383.02617
912.000	0.10000000	330389.36998	17378.98951
864.000	0.10000000	329343.38392	17384.46621
816.000	0.10000000	330267.56141	17389.95890
768.000	0.10000000	329640.52053	17379.48527
720.000	0.10000000	330315.35147	17379.04066
672.000	0.10000000	330221.58235	17390.29547
624.000	0.10000000	329945.43963	17380.03297
576.000	0.10000000	330493.90325	17385.31649
528.000	0.10000000	330487.40295	17385.22219

This analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Replace\
Name of input data file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1A_fixed.lpd
Name of output file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1A_fixed.lpo
Name of plot output file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1A_fixed.lpp
Name of runtime file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1A_fixed.lpr

---

Time and Date of Analysis

Date: October 14, 2010 Time: 14:49:28

Problem Title

US 101/SR116 SOH (Replace) Abutment 1_R-09-011 -Free_Footing 1A

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis

- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 160
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 960.00 in

Depth of ground surface below top of pile = -114.00 in

Slope angle of ground surface = 21.80 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	14.00000000	3201.3000	196.0000	3600000.
2	960.0000	14.00000000	3201.3000	196.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 13 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = -114.000 in
Distance from top of pile to bottom of layer = 78.000 in
p-y subgrade modulus k for top of soil layer = 60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 60.000 lbs/in**3

Layer 2 is stiff clay without free water
Distance from top of pile to top of layer = 78.000 in
Distance from top of pile to bottom of layer = 162.000 in

```
Layer  3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      162.000 in
Distance from top of pile to bottom of layer =      210.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =      210.000 in
Distance from top of pile to bottom of layer =      294.000 in

Layer  5 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      294.000 in
Distance from top of pile to bottom of layer =      402.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  6 is stiff clay without free water
Distance from top of pile to top of layer    =      402.000 in
Distance from top of pile to bottom of layer =      516.000 in

Layer  7 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      516.000 in
Distance from top of pile to bottom of layer =      576.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer  8 is stiff clay without free water
Distance from top of pile to top of layer    =      576.000 in
Distance from top of pile to bottom of layer =      636.000 in

Layer  9 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      636.000 in
Distance from top of pile to bottom of layer =      678.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer 10 is stiff clay without free water
Distance from top of pile to top of layer    =      678.000 in
Distance from top of pile to bottom of layer =      768.000 in

Layer 11 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      768.000 in
Distance from top of pile to bottom of layer =      852.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer 12 is stiff clay without free water
Distance from top of pile to top of layer    =      852.000 in
Distance from top of pile to bottom of layer =      936.000 in

Layer 13 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      936.000 in
Distance from top of pile to bottom of layer =     1188.000 in
p-y subgrade modulus k for top of soil layer =      150.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      150.000 lbs/in**3
```

(Depth of lowest layer extends 228.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 26 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-114.00	0.07810
2	78.00	0.07810
3	78.00	0.06940
4	162.00	0.06940
5	162.00	0.07230
6	210.00	0.07230
7	210.00	0.06940
8	294.00	0.06940
9	294.00	0.03330
10	402.00	0.03330
11	402.00	0.03620
12	516.00	0.03620
13	516.00	0.03910
14	576.00	0.03910
15	576.00	0.03910
16	636.00	0.03910
17	636.00	0.04200
18	678.00	0.04200
19	678.00	0.03620
20	768.00	0.03620
21	768.00	0.04200
22	852.00	0.04200
23	852.00	0.03620
24	936.00	0.03620
25	936.00	0.04990
26	1188.00	0.04990

Shear Strength of Soils

Shear strength parameters with depth defined using 26 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-114.000	0.00000	36.00	------	------
2	78.000	0.00000	36.00	------	------
3	78.000	6.94000	0.00	0.00900	0.0
4	162.000	6.94000	0.00	0.00900	0.0
5	162.000	0.00000	32.00	------	------
6	210.000	0.00000	32.00	------	------
7	210.000	6.94000	0.00	0.00900	0.0
8	294.000	6.94000	0.00	0.00900	0.0
9	294.000	0.00000	32.00	------	------
10	402.000	0.00000	32.00	------	------

11	402.000	20.83000	0.00	0.00600	0.0
12	516.000	20.83000	0.00	0.00600	0.0
13	516.000	0.00000	36.00	------	------
14	576.000	0.00000	36.00	------	------
15	576.000	27.78000	0.00	0.00500	0.0
16	636.000	27.78000	0.00	0.00500	0.0
17	636.000	0.00000	36.00	------	------
18	678.000	0.00000	36.00	------	------
19	678.000	18.06000	0.00	0.00600	0.0
20	768.000	18.06000	0.00	0.00600	0.0
21	768.000	0.00000	36.00	------	------
22	852.000	0.00000	36.00	------	------
23	852.000	17.36000	0.00	0.00600	0.0
24	936.000	17.36000	0.00	0.00600	0.0
25	936.000	0.00000	41.00	------	------
26	1188.000	0.00000	41.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.100 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 191000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.250 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 191000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.500 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 191000.000 lbs

Load Case Number 4

```
Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           0.750 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs

Load Case Number  5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           1.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs

Load Case Number  6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           1.500 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs

Load Case Number  7

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           2.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs

Load Case Number  8

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           3.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs

Load Case Number  9

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           4.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           5.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs

--------------------------------------------------------------------------------
                           Summary of Pile Response(s)
--------------------------------------------------------------------------------

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
```

Type 4 = Deflection and Moment, S = Pile-head Slope, radians
Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
5	y= 0.100000	S= 0.000	191000.	0.1000000	-989966.	36656.3260
5	y= 0.250000	S= 0.000	191000.	0.2500000	-2193205.	74378.8308
5	y= 0.500000	S= 0.000	191000.	0.5000000	-3885201.	125374.
5	y= 0.750000	S= 0.000	191000.	0.7500000	-5289392.	159759.
5	y= 1.000000	S= 0.000	191000.	1.0000000	-6361296.	179881.
5	y= 1.500	S= 0.000	191000.	1.5000	-7672850.	197997.
5	y= 2.000	S= 0.000	191000.	2.0000	-8600305.	207638.
5	y= 3.000	S= 0.000	191000.	3.0000	-1.0309E+07	224472.
5	y= 4.000	S= 0.000	191000.	4.0000	-1.1911E+07	239628.
5	y= 5.000	S= 0.000	191000.	5.0000	-1.3462E+07	253990.

Pile-head Deflection vs. Pile Length

Boundary Condition Type 5, Deflection and Slope

Deflection = 0.10000 in
Slope = 0.00000
Axial Load = 191000. lbs

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
960.000	0.10000000	-989966.03215	36656.32602
912.000	0.10000000	-990559.47285	36657.67652
864.000	0.10000000	-991367.21445	36672.46720
816.000	0.10000000	-991417.34312	36658.15998
768.000	0.10000000	-991893.87043	36656.75661
720.000	0.10000000	-992574.68680	36670.91112
672.000	0.10000000	-993149.43534	36671.29611
624.000	0.10000000	-993229.08395	36668.92264
576.000	0.10000000	-994076.44590	36678.66540
528.000	0.10000000	-994574.72965	36684.08845

This analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Replace\
Name of input data file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1B_fixed.lpd
Name of output file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1B_fixed.lpo
Name of plot output file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1B_fixed.lpp
Name of runtime file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1B_fixed.lpr

---

Time and Date of Analysis

Date: October 14, 2010 Time: 14:52:09

Problem Title

US 101/SR116 SOH (Replace) Abutment 1_R-09-011 -Free_Footing 1B

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis

- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 150
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 900.00 in

Depth of ground surface below top of pile = -102.00 in

Slope angle of ground surface = 21.80 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	14.00000000	3201.3000	196.0000	3600000.
2	900.0000	14.00000000	3201.3000	196.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 13 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = -102.000 in
Distance from top of pile to bottom of layer = 30.000 in
p-y subgrade modulus k for top of soil layer = 60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 60.000 lbs/in**3

Layer 2 is stiff clay without free water
Distance from top of pile to top of layer = 30.000 in
Distance from top of pile to bottom of layer = 114.000 in

```
Layer  3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      114.000 in
Distance from top of pile to bottom of layer =      162.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =      162.000 in
Distance from top of pile to bottom of layer =      246.000 in

Layer  5 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      246.000 in
Distance from top of pile to bottom of layer =      354.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  6 is stiff clay without free water
Distance from top of pile to top of layer    =      354.000 in
Distance from top of pile to bottom of layer =      468.000 in

Layer  7 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      468.000 in
Distance from top of pile to bottom of layer =      528.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer  8 is stiff clay without free water
Distance from top of pile to top of layer    =      528.000 in
Distance from top of pile to bottom of layer =      588.000 in

Layer  9 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      588.000 in
Distance from top of pile to bottom of layer =      630.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer 10 is stiff clay without free water
Distance from top of pile to top of layer    =      630.000 in
Distance from top of pile to bottom of layer =      720.000 in

Layer 11 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      720.000 in
Distance from top of pile to bottom of layer =      804.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer 12 is stiff clay without free water
Distance from top of pile to top of layer    =      804.000 in
Distance from top of pile to bottom of layer =      888.000 in

Layer 13 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      888.000 in
Distance from top of pile to bottom of layer =     1140.000 in
p-y subgrade modulus k for top of soil layer =      150.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      150.000 lbs/in**3
```

(Depth of lowest layer extends 240.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 26 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-102.00	0.07810
2	30.00	0.07810
3	30.00	0.06940
4	114.00	0.06940
5	114.00	0.07230
6	162.00	0.07230
7	162.00	0.06940
8	246.00	0.06940
9	246.00	0.03330
10	354.00	0.03330
11	354.00	0.03620
12	468.00	0.03620
13	468.00	0.03910
14	528.00	0.03910
15	528.00	0.03910
16	588.00	0.03910
17	588.00	0.04200
18	630.00	0.04200
19	630.00	0.03620
20	720.00	0.03620
21	720.00	0.04200
22	804.00	0.04200
23	804.00	0.03620
24	888.00	0.03620
25	888.00	0.04990
26	1140.00	0.04990

Shear Strength of Soils

Shear strength parameters with depth defined using 26 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-102.000	0.00000	36.00	------	------
2	30.000	0.00000	36.00	------	------
3	30.000	6.94000	0.00	0.00900	0.0
4	114.000	6.94000	0.00	0.00900	0.0
5	114.000	0.00000	32.00	------	------
6	162.000	0.00000	32.00	------	------
7	162.000	6.94000	0.00	0.00900	0.0
8	246.000	6.94000	0.00	0.00900	0.0
9	246.000	0.00000	32.00	------	------
10	354.000	0.00000	32.00	------	------
11	354.000	20.83000	0.00	0.00600	0.0

12	468.000	20.83000	0.00	0.00600	0.0
13	468.000	0.00000	36.00	------	------
14	528.000	0.00000	36.00	------	------
15	528.000	27.78000	0.00	0.00500	0.0
16	588.000	27.78000	0.00	0.00500	0.0
17	588.000	0.00000	36.00	------	------
18	630.000	0.00000	36.00	------	------
19	630.000	18.06000	0.00	0.00600	0.0
20	720.000	18.06000	0.00	0.00600	0.0
21	720.000	0.00000	36.00	------	------
22	804.000	0.00000	36.00	------	------
23	804.000	17.36000	0.00	0.00600	0.0
24	888.000	17.36000	0.00	0.00600	0.0
25	888.000	0.00000	41.00	------	------
26	1140.000	0.00000	41.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.100 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 191000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.250 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 191000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.500 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 191000.000 lbs

Load Case Number 4

```
Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           0.750 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs

Load Case Number  5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           1.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs

Load Case Number  6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           1.500 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs

Load Case Number  7

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           2.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs

Load Case Number  8

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           3.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs

Load Case Number  9

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           4.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           5.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs

--------------------------------------------------------------------------------
                           Summary of Pile Response(s)
--------------------------------------------------------------------------------

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
```

Type 4 = Deflection and Moment, S = Pile-head Slope, radians
Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
5	y= 0.100000	S= 0.000	191000.	0.1000000	-810022.	27937.0305
5	y= 0.250000	S= 0.000	191000.	0.2500000	-1474522.	46920.2036
5	y= 0.500000	S= 0.000	191000.	0.5000000	-2399563.	72195.1989
5	y= 0.750000	S= 0.000	191000.	0.7500000	-3122912.	84400.0446
5	y= 1.000000	S= 0.000	191000.	1.0000000	-3762681.	92839.7779
5	y= 1.500	S= 0.000	191000.	1.5000	-4968602.	108096.
5	y= 2.000	S= 0.000	191000.	2.0000	-6117618.	122174.
5	y= 3.000	S= 0.000	191000.	3.0000	-8168478.	145911.
5	y= 4.000	S= 0.000	191000.	4.0000	-9894682.	164298.
5	y= 5.000	S= 0.000	191000.	5.0000	-1.1292E+07	177886.

Pile-head Deflection vs. Pile Length

Boundary Condition Type 5, Deflection and Slope

Deflection = 0.10000 in
Slope = 0.00000
Axial Load = 191000. lbs

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
900.000	0.10000000	-810022.32375	27937.03052
855.000	0.10000000	-834822.04803	29091.04777
810.000	0.10000000	-826399.51469	28668.04897
765.000	0.10000000	-818918.59496	28256.18594
720.000	0.10000000	-837501.90858	29094.45144
675.000	0.10000000	-826495.72313	28584.98812
630.000	0.10000000	-838651.95647	29150.89301
585.000	0.10000000	-826918.06104	28581.29562
540.000	0.10000000	-835688.38590	28951.18386
495.000	0.10000000	-839555.77786	29127.24644

This analysis ended normally.

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LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Replace\
Name of input data file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1B_free.lpd
Name of output file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1B_free.lpo
Name of plot output file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1B_free.lpp
Name of runtime file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1B_free.lpr

---

Time and Date of Analysis

Date: October 14, 2010 Time: 14:53:20

Problem Title

US 101/SR116 SOH (Replace) Abutment 1_R-09-011 -Free_Footing 1B

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis

- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 150
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 900.00 in

Depth of ground surface below top of pile = -102.00 in

Slope angle of ground surface = 21.80 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	14.00000000	3201.3000	196.0000	3600000.
2	900.0000	14.00000000	3201.3000	196.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 13 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = -102.000 in
Distance from top of pile to bottom of layer = 30.000 in
p-y subgrade modulus k for top of soil layer = 60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 60.000 lbs/in**3

Layer 2 is stiff clay without free water
Distance from top of pile to top of layer = 30.000 in
Distance from top of pile to bottom of layer = 114.000 in

```
Layer  3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      114.000 in
Distance from top of pile to bottom of layer =      162.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =      162.000 in
Distance from top of pile to bottom of layer =      246.000 in

Layer  5 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      246.000 in
Distance from top of pile to bottom of layer =      354.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  6 is stiff clay without free water
Distance from top of pile to top of layer    =      354.000 in
Distance from top of pile to bottom of layer =      468.000 in

Layer  7 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      468.000 in
Distance from top of pile to bottom of layer =      528.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer  8 is stiff clay without free water
Distance from top of pile to top of layer    =      528.000 in
Distance from top of pile to bottom of layer =      588.000 in

Layer  9 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      588.000 in
Distance from top of pile to bottom of layer =      630.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer 10 is stiff clay without free water
Distance from top of pile to top of layer    =      630.000 in
Distance from top of pile to bottom of layer =      720.000 in

Layer 11 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      720.000 in
Distance from top of pile to bottom of layer =      804.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer 12 is stiff clay without free water
Distance from top of pile to top of layer    =      804.000 in
Distance from top of pile to bottom of layer =      888.000 in

Layer 13 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      888.000 in
Distance from top of pile to bottom of layer =     1140.000 in
p-y subgrade modulus k for top of soil layer =      150.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      150.000 lbs/in**3
```

(Depth of lowest layer extends 240.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 26 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-102.00	0.07810
2	30.00	0.07810
3	30.00	0.06940
4	114.00	0.06940
5	114.00	0.07230
6	162.00	0.07230
7	162.00	0.06940
8	246.00	0.06940
9	246.00	0.03330
10	354.00	0.03330
11	354.00	0.03620
12	468.00	0.03620
13	468.00	0.03910
14	528.00	0.03910
15	528.00	0.03910
16	588.00	0.03910
17	588.00	0.04200
18	630.00	0.04200
19	630.00	0.03620
20	720.00	0.03620
21	720.00	0.04200
22	804.00	0.04200
23	804.00	0.03620
24	888.00	0.03620
25	888.00	0.04990
26	1140.00	0.04990

Shear Strength of Soils

Shear strength parameters with depth defined using 26 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-102.000	0.00000	36.00	------	------
2	30.000	0.00000	36.00	------	------
3	30.000	6.94000	0.00	0.00900	0.0
4	114.000	6.94000	0.00	0.00900	0.0
5	114.000	0.00000	32.00	------	------
6	162.000	0.00000	32.00	------	------
7	162.000	6.94000	0.00	0.00900	0.0
8	246.000	6.94000	0.00	0.00900	0.0
9	246.000	0.00000	32.00	------	------
10	354.000	0.00000	32.00	------	------

11	354.000	20.83000	0.00	0.00600	0.0
12	468.000	20.83000	0.00	0.00600	0.0
13	468.000	0.00000	36.00	------	------
14	528.000	0.00000	36.00	------	------
15	528.000	27.78000	0.00	0.00500	0.0
16	588.000	27.78000	0.00	0.00500	0.0
17	588.000	0.00000	36.00	------	------
18	630.000	0.00000	36.00	------	------
19	630.000	18.06000	0.00	0.00600	0.0
20	720.000	18.06000	0.00	0.00600	0.0
21	720.000	0.00000	36.00	------	------
22	804.000	0.00000	36.00	------	------
23	804.000	17.36000	0.00	0.00600	0.0
24	888.000	17.36000	0.00	0.00600	0.0
25	888.000	0.00000	41.00	------	------
26	1140.000	0.00000	41.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.100 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 191000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.250 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 191000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.500 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 191000.000 lbs

```
Load Case Number  4

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           0.750 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs

Load Case Number  5

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           1.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs

Load Case Number  6

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           1.500 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs

Load Case Number  7

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           2.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs

Load Case Number  8

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           3.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs

Load Case Number  9

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           4.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           5.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs

--------------------------------------------------------------------------------
                          Summary of Pile Response(s)
--------------------------------------------------------------------------------

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
```

Type 3 = Shear and Rot. Stiffness, V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment, S = Pile-head Slope, radians
Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= 0.100000	M= 0.000	191000.	0.1000000	309217.	15090.4839
4	y= 0.250000	M= 0.000	191000.	0.2500000	576712.	26784.2691
4	y= 0.500000	M= 0.000	191000.	0.5000000	924676.	42020.5140
4	y= 0.750000	M= 0.000	191000.	0.7500000	1211131.	51938.8480
4	y= 1.000000	M= 0.000	191000.	1.0000000	1425566.	55476.6715
4	y= 1.500	M= 0.000	191000.	1.5000	1814785.	60893.5655
4	y= 2.000	M= 0.000	191000.	2.0000	2182335.	65517.1618
4	y= 3.000	M= 0.000	191000.	3.0000	2896808.	73571.8789
4	y= 4.000	M= 0.000	191000.	4.0000	3604755.	80763.1619
4	y= 5.000	M= 0.000	191000.	5.0000	4330458.	87474.7950

Pile-head Deflection vs. Pile Length

Boundary Condition Type 4, Deflection and Moment

Deflection = 0.10000 in
Moment = 0. in-lbs
Axial Load = 191000. lbs

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
900.000	0.10000000	309216.80548	15090.48392
855.000	0.10000000	318855.99599	15470.48936
810.000	0.10000000	315167.06009	15348.29655
765.000	0.10000000	312795.45717	15220.86739
720.000	0.10000000	317281.73808	15444.12391
675.000	0.10000000	315219.67712	15320.55271
630.000	0.10000000	319094.69953	15490.66364
585.000	0.10000000	314917.31866	15321.30003
540.000	0.10000000	317333.49443	15427.78215
495.000	0.10000000	318452.09995	15467.67901

This analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Replace\
Name of input data file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1C_fixed.lpd
Name of output file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1C_fixed.lpo
Name of plot output file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1C_fixed.lpp
Name of runtime file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1C_fixed.lpr

---

Time and Date of Analysis

Date: September 21, 2010 Time: 16:48:48

Problem Title

US 101/SR116 SOH (Replace) Abutment 1_R-09-011 -Free_Footing 1C

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis

- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 120
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 840.00 in

Depth of ground surface below top of pile = -90.00 in

Slope angle of ground surface = 21.80 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	14.00000000	3201.3000	196.0000	3600000.
2	840.0000	14.00000000	3201.3000	196.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 12 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = -90.000 in
Distance from top of pile to bottom of layer = 0.001 in
p-y subgrade modulus k for top of soil layer = 60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 60.000 lbs/in**3

Layer 2 is stiff clay without free water
Distance from top of pile to top of layer = 0.001 in
Distance from top of pile to bottom of layer = 66.000 in

```
Layer  3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =       66.000 in
Distance from top of pile to bottom of layer =      114.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =      114.000 in
Distance from top of pile to bottom of layer =      198.000 in

Layer  5 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      198.000 in
Distance from top of pile to bottom of layer =      306.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  6 is stiff clay without free water
Distance from top of pile to top of layer    =      306.000 in
Distance from top of pile to bottom of layer =      420.000 in

Layer  7 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      420.000 in
Distance from top of pile to bottom of layer =      480.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer  8 is stiff clay without free water
Distance from top of pile to top of layer    =      480.000 in
Distance from top of pile to bottom of layer =      540.000 in

Layer  9 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      540.000 in
Distance from top of pile to bottom of layer =      582.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer 10 is stiff clay without free water
Distance from top of pile to top of layer    =      582.000 in
Distance from top of pile to bottom of layer =      672.000 in

Layer 11 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      672.000 in
Distance from top of pile to bottom of layer =      756.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer 12 is stiff clay without free water
Distance from top of pile to top of layer    =      756.000 in
Distance from top of pile to bottom of layer =      840.000 in


(Depth of lowest layer extends    0.00 in below pile tip)

--------------------------------------------------------------------------------
                   Effective Unit Weight of Soil vs. Depth
--------------------------------------------------------------------------------
```

Effective unit weight of soil with depth defined using 24 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-90.00	0.07810
2	0.00	0.07810
3	0.00	0.06940
4	66.00	0.06940
5	66.00	0.07230
6	114.00	0.07230
7	114.00	0.06940
8	198.00	0.06940
9	198.00	0.03330
10	306.00	0.03330
11	306.00	0.03620
12	420.00	0.03620
13	420.00	0.03910
14	480.00	0.03910
15	480.00	0.03910
16	540.00	0.03910
17	540.00	0.04200
18	582.00	0.04200
19	582.00	0.03620
20	672.00	0.03620
21	672.00	0.04200
22	756.00	0.04200
23	756.00	0.03620
24	840.00	0.03620

Shear Strength of Soils

Shear strength parameters with depth defined using 24 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-90.000	0.00000	36.00	------	------
2	0.001	0.00000	36.00	------	------
3	0.001	6.94000	0.00	0.00900	0.0
4	66.000	6.94000	0.00	0.00900	0.0
5	66.000	0.00000	32.00	------	------
6	114.000	0.00000	32.00	------	------
7	114.000	6.94000	0.00	0.00900	0.0
8	198.000	6.94000	0.00	0.00900	0.0
9	198.000	0.00000	32.00	------	------
10	306.000	0.00000	32.00	------	------
11	306.000	20.83000	0.00	0.00600	0.0
12	420.000	20.83000	0.00	0.00600	0.0
13	420.000	0.00000	36.00	------	------
14	480.000	0.00000	36.00	------	------
15	480.000	27.78000	0.00	0.00500	0.0
16	540.000	27.78000	0.00	0.00500	0.0
17	540.000	0.00000	36.00	------	------
18	582.000	0.00000	36.00	------	------

19	582.000	18.06000	0.00	0.00600	0.0
20	672.000	18.06000	0.00	0.00600	0.0
21	672.000	0.00000	36.00	------	------
22	756.000	0.00000	36.00	------	------
23	756.000	17.36000	0.00	0.00600	0.0
24	840.000	17.36000	0.00	0.00600	0.0

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.100 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 191000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.250 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 191000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.500 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 191000.000 lbs

Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.750 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 191000.000 lbs

Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 1.000 in

```
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs

Load Case Number  6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           1.500 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs

Load Case Number  7

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           2.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs

Load Case Number  8

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           3.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs

Load Case Number  9

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           4.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           5.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      191000.000 lbs
--------------------------------------------------------------------------------
                          Summary of Pile Response(s)
--------------------------------------------------------------------------------

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad

Load  Pile-Head    Pile-Head       Axial    Pile-Head    Maximum     Maximum
Type  Condition    Condition       Load     Deflection    Moment      Shear
          1            2            lbs         in        in-lbs       lbs
---- ------------ ------------ ----------- ----------- ----------- -----------
  5  y=  0.100000 S=     0.000     191000.   0.1000000    -639686.  17964.2764
  5  y=  0.250000 S=     0.000     191000.   0.2500000   -1257521.  29515.7669
  5  y=  0.500000 S=     0.000     191000.   0.5000000   -2128674.  44124.2772
  5  y=  0.750000 S=     0.000     191000.   0.7500000   -2917020.  56591.9527
```

```
  5  y=  1.000000 S=     0.000     191000.   1.0000000   -3668569.  68164.1974
  5  y=     1.500 S=     0.000     191000.      1.5000   -4943689.  85976.3415
  5  y=     2.000 S=     0.000     191000.      2.0000   -5918722.  97832.5040
  5  y=     3.000 S=     0.000     191000.      3.0000   -7339471.     112470.
  5  y=     4.000 S=     0.000     191000.      4.0000   -8610012.     124664.
  5  y=     5.000 S=     0.000     191000.      5.0000   -9802374.     135578.
```

Pile-head Deflection vs. Pile Length

Boundary Condition Type 5, Deflection and Slope

```
Deflection =         0.10000  in
Slope      =         0.00000
Axial Load =         191000. lbs
```

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
840.000	0.10000000	-639686.07185	17964.27645
798.000	0.10000000	-637693.35450	17903.64739
756.000	0.10000000	-639712.21652	17956.92892
714.000	0.10000000	-641575.30146	18001.40222
672.000	0.10000000	-640309.98089	17952.59015
630.000	0.10000000	-642294.67210	17994.96950
588.000	0.10000000	-641794.34498	17986.43938
546.000	0.10000000	-641611.80844	17980.65324
504.000	0.10000000	-641703.94820	17975.18018
462.000	0.10000000	-644135.12440	18031.74182

This analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Replace\
Name of input data file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1C_free.lpd
Name of output file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1C_free.lpo
Name of plot output file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1C_free.lpp
Name of runtime file: 101 & 116 SOH Replace_R-09-011_Abut 1_Footing-1C_free.lpr

---

Time and Date of Analysis

Date: September 21, 2010 Time: 16:49:19

Problem Title

US 101/SR116 SOH (Replace) Abutment 1_R-09-011 -Free_Footing 1C

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis

- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 120
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 840.00 in

Depth of ground surface below top of pile = -90.00 in

Slope angle of ground surface = 21.80 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	14.00000000	3201.3000	196.0000	3600000.
2	840.0000	14.00000000	3201.3000	196.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 12 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = -90.000 in
Distance from top of pile to bottom of layer = 0.001 in
p-y subgrade modulus k for top of soil layer = 60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 60.000 lbs/in**3

Layer 2 is stiff clay without free water
Distance from top of pile to top of layer = 0.001 in
Distance from top of pile to bottom of layer = 66.000 in

```
Layer  3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =       66.000 in
Distance from top of pile to bottom of layer =      114.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =      114.000 in
Distance from top of pile to bottom of layer =      198.000 in

Layer  5 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      198.000 in
Distance from top of pile to bottom of layer =      306.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  6 is stiff clay without free water
Distance from top of pile to top of layer    =      306.000 in
Distance from top of pile to bottom of layer =      420.000 in

Layer  7 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      420.000 in
Distance from top of pile to bottom of layer =      480.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer  8 is stiff clay without free water
Distance from top of pile to top of layer    =      480.000 in
Distance from top of pile to bottom of layer =      540.000 in

Layer  9 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      540.000 in
Distance from top of pile to bottom of layer =      582.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer 10 is stiff clay without free water
Distance from top of pile to top of layer    =      582.000 in
Distance from top of pile to bottom of layer =      672.000 in

Layer 11 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      672.000 in
Distance from top of pile to bottom of layer =      756.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer 12 is stiff clay without free water
Distance from top of pile to top of layer    =      756.000 in
Distance from top of pile to bottom of layer =      840.000 in


(Depth of lowest layer extends    0.00 in below pile tip)


--------------------------------------------------------------------------------
                    Effective Unit Weight of Soil vs. Depth
--------------------------------------------------------------------------------
```

Effective unit weight of soil with depth defined using 24 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-90.00	0.07810
2	0.00	0.07810
3	0.00	0.06940
4	66.00	0.06940
5	66.00	0.07230
6	114.00	0.07230
7	114.00	0.06940
8	198.00	0.06940
9	198.00	0.03330
10	306.00	0.03330
11	306.00	0.03620
12	420.00	0.03620
13	420.00	0.03910
14	480.00	0.03910
15	480.00	0.03910
16	540.00	0.03910
17	540.00	0.04200
18	582.00	0.04200
19	582.00	0.03620
20	672.00	0.03620
21	672.00	0.04200
22	756.00	0.04200
23	756.00	0.03620
24	840.00	0.03620

Shear Strength of Soils

Shear strength parameters with depth defined using 24 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-90.000	0.00000	36.00	------	------
2	0.001	0.00000	36.00	------	------
3	0.001	6.94000	0.00	0.00900	0.0
4	66.000	6.94000	0.00	0.00900	0.0
5	66.000	0.00000	32.00	------	------
6	114.000	0.00000	32.00	------	------
7	114.000	6.94000	0.00	0.00900	0.0
8	198.000	6.94000	0.00	0.00900	0.0
9	198.000	0.00000	32.00	------	------
10	306.000	0.00000	32.00	------	------
11	306.000	20.83000	0.00	0.00600	0.0
12	420.000	20.83000	0.00	0.00600	0.0
13	420.000	0.00000	36.00	------	------
14	480.000	0.00000	36.00	------	------
15	480.000	27.78000	0.00	0.00500	0.0
16	540.000	27.78000	0.00	0.00500	0.0
17	540.000	0.00000	36.00	------	------
18	582.000	0.00000	36.00	------	------

19	582.000	18.06000	0.00	0.00600	0.0
20	672.000	18.06000	0.00	0.00600	0.0
21	672.000	0.00000	36.00	------	------
22	756.000	0.00000	36.00	------	------
23	756.000	17.36000	0.00	0.00600	0.0
24	840.000	17.36000	0.00	0.00600	0.0

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.100 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 191000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.250 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 191000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.500 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 191000.000 lbs

Load Case Number 4

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.750 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 191000.000 lbs

Load Case Number 5

Pile-head boundary conditions are Displacement and Moment (BC Type 4)

```
Deflection at pile head     =           1.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs

Load Case Number  6

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           1.500 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs

Load Case Number  7

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           2.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs

Load Case Number  8

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           3.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs

Load Case Number  9

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           4.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           5.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      191000.000 lbs
--------------------------------------------------------------------------------
                          Summary of Pile Response(s)
--------------------------------------------------------------------------------

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad

Load  Pile-Head    Pile-Head       Axial    Pile-Head    Maximum     Maximum
Type  Condition    Condition       Load     Deflection    Moment      Shear
          1            2            lbs         in        in-lbs       lbs
---- ------------ ------------ ----------- ----------- ----------- -----------
  4  y=  0.100000 M=     0.000     191000.   0.1000000     249127.   9785.1692
  4  y=  0.250000 M=     0.000     191000.   0.2500000     464006.  15310.4087
  4  y=  0.500000 M=     0.000     191000.   0.5000000     780240.  22137.9851
```

```
  4  y=  0.750000 M=     0.000     191000.   0.7500000    1073230.  26830.3080
  4  y=  1.000000 M=     0.000     191000.   1.0000000    1352198.  30908.0017
  4  y=     1.500 M=     0.000     191000.      1.5000    1886071.  38216.3038
  4  y=     2.000 M=     0.000     191000.      2.0000    2400751.  44872.6616
  4  y=     3.000 M=     0.000     191000.      3.0000    3301229.  55346.4717
  4  y=     4.000 M=     0.000     191000.      4.0000    4026681.  63144.7838
  4  y=     5.000 M=     0.000     191000.      5.0000    4590054.  68782.4136


-------------------------------------------------------------------------------
                     Pile-head Deflection vs. Pile Length
-------------------------------------------------------------------------------

Boundary Condition Type 4, Deflection and Moment

Deflection =         0.10000  in
Moment     =              0. in-lbs
Axial Load =         191000. lbs


   Pile       Pile Head       Maximum      Maximum
  Length      Deflection      Moment        Shear
    in           in           in-lbs         lbs
-----------  ------------  ------------  ------------
   840.000    0.10000000  249126.58089    9785.16916
   798.000    0.10000000  246669.86287    9708.48981
   756.000    0.10000000  249430.14949    9734.57307
   714.000    0.10000000  251589.58855    9748.93587
   672.000    0.10000000  247768.20312    9659.46470
   630.000    0.10000000  248869.32512    9654.87639
   588.000    0.10000000  249217.35051    9642.74491
   546.000    0.10000000  249126.32001    9617.54967
   504.000    0.10000000  248430.82580    9580.39044
   462.000    0.10000000  250277.47538    9593.04751


This analysis ended normally.
```

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LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Replace\
Name of input data file: 101 & 116 SOH Replace_R-09-012_Bent 2_fixed.lpd
Name of output file: 101 & 116 SOH Replace_R-09-012_Bent 2_fixed.lpo
Name of plot output file: 101 & 116 SOH Replace_R-09-012_Bent 2_fixed.lpp
Name of runtime file: 101 & 116 SOH Replace_R-09-012_Bent 2_fixed.lpr

---

Time and Date of Analysis

Date: September 22, 2010 Time: 17:39:48

Problem Title

US 101/SR116 SOH (Replace) Bent 2_R-09-012 - Free

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length

- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 95
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 570.00 in

Depth of ground surface below top of pile = -120.00 in

Slope angle of ground surface = 0.00 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	14.00000000	3201.3000	196.0000	3600000.
2	570.0000	14.00000000	3201.3000	196.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 8 layers

Layer 1 is stiff clay without free water
Distance from top of pile to top of layer = -120.000 in
Distance from top of pile to bottom of layer = 0.001 in

Layer 2 is stiff clay without free water
Distance from top of pile to top of layer = 0.001 in
Distance from top of pile to bottom of layer = 30.000 in

Layer 3 is stiff clay without free water
Distance from top of pile to top of layer = 30.000 in
Distance from top of pile to bottom of layer = 90.000 in

Layer 4 is stiff clay without free water
Distance from top of pile to top of layer = 90.000 in

Distance from top of pile to bottom of layer = 228.000 in

Layer 5 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 228.000 in
Distance from top of pile to bottom of layer = 312.000 in
p-y subgrade modulus k for top of soil layer = 60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 60.000 lbs/in**3

Layer 6 is stiff clay without free water
Distance from top of pile to top of layer = 312.000 in
Distance from top of pile to bottom of layer = 432.000 in

Layer 7 is stiff clay without free water
Distance from top of pile to top of layer = 432.000 in
Distance from top of pile to bottom of layer = 540.000 in

Layer 8 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 540.000 in
Distance from top of pile to bottom of layer = 900.000 in
p-y subgrade modulus k for top of soil layer = 150.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 150.000 lbs/in**3

(Depth of lowest layer extends 330.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 16 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-120.00	0.06940
2	0.00	0.06940
3	0.00	0.03330
4	30.00	0.03330
5	30.00	0.03330
6	90.00	0.03330
7	90.00	0.03040
8	228.00	0.03040
9	228.00	0.03620
10	312.00	0.03620
11	312.00	0.03040
12	432.00	0.03040
13	432.00	0.03330
14	540.00	0.03330
15	540.00	0.04490
16	900.00	0.04490

Shear Strength of Soils

Shear strength parameters with depth defined using 16 points

Point	Depth X	Cohesion c	Angle of Friction	E50 or	RQD

No.	in	lbs/in**2	Deg.	k_rm	%
1	-120.000	6.94000	0.00	0.00900	0.0
2	0.001	6.94000	0.00	0.00900	0.0
3	0.001	6.11000	0.00	0.01000	0.0
4	30.000	6.11000	0.00	0.01000	0.0
5	30.000	15.28000	0.00	0.00500	0.0
6	90.000	15.28000	0.00	0.00500	0.0
7	90.000	9.72000	0.00	0.00800	0.0
8	228.000	9.72000	0.00	0.00800	0.0
9	228.000	0.00000	35.00	------	------
10	312.000	0.00000	35.00	------	------
11	312.000	7.99000	0.00	0.00900	0.0
12	432.000	7.99000	0.00	0.00900	0.0
13	432.000	9.58000	0.00	0.00800	0.0
14	540.000	9.58000	0.00	0.00800	0.0
15	540.000	0.00000	41.00	------	------
16	900.000	0.00000	41.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.100 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 248000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.250 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 248000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.500 in
Slope at pile head = 0.000 in/in

```
Axial load at pile head     =      248000.000 lbs

Load Case Number  4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           0.750 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      248000.000 lbs

Load Case Number  5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           1.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      248000.000 lbs

Load Case Number  6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           1.500 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      248000.000 lbs

Load Case Number  7

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           2.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      248000.000 lbs

Load Case Number  8

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           3.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      248000.000 lbs

Load Case Number  9

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           4.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      248000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           5.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      248000.000 lbs
```

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment, y = pile-head displacment in
Type 2 = Shear and Slope, M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness, V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment, S = Pile-head Slope, radians
Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
5	y= 0.100000	S= 0.000	248000.	0.1000000	-1034227.	32657.6026
5	y= 0.250000	S= 0.000	248000.	0.2500000	-1878781.	50969.1019
5	y= 0.500000	S= 0.000	248000.	0.5000000	-2920764.	70583.8342
5	y= 0.750000	S= 0.000	248000.	0.7500000	-3764005.	84969.6416
5	y= 1.000000	S= 0.000	248000.	1.0000000	-4496659.	96694.3000
5	y= 1.500	S= 0.000	248000.	1.5000	-5770400.	115779.
5	y= 2.000	S= 0.000	248000.	2.0000	-6885967.	131431.
5	y= 3.000	S= 0.000	248000.	3.0000	-8823226.	156836.
5	y= 4.000	S= 0.000	248000.	4.0000	-1.0460E+07	175952.
5	y= 5.000	S= 0.000	248000.	5.0000	-1.1833E+07	189540.

Pile-head Deflection vs. Pile Length

Boundary Condition Type 5, Deflection and Slope

Deflection = 0.10000 in
Slope = 0.00000
Axial Load = 248000. lbs

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
570.000	0.10000000	-1034227.	32657.60256
541.500	0.10000000	-986491.51803	30828.07400
513.000	0.10000000	-995535.19212	31245.38681
484.500	0.10000000	-1003652.	31651.44752
456.000	0.10000000	-990145.98971	30938.10452
427.500	0.10000000	-1000924.	31434.66200
399.000	0.10000000	-991136.95885	30931.97316
370.500	0.10000000	-1002915.	31492.11166
342.000	0.10000000	-995208.17953	31143.68572
313.500	0.10000000	-994291.70598	31032.76557

This analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Replace\
Name of input data file: 101 & 116 SOH Replace_R-09-012_Bent 2_free.lpd
Name of output file: 101 & 116 SOH Replace_R-09-012_Bent 2_free.lpo
Name of plot output file: 101 & 116 SOH Replace_R-09-012_Bent 2_free.lpp
Name of runtime file: 101 & 116 SOH Replace_R-09-012_Bent 2_free.lpr

---

Time and Date of Analysis

Date: September 22, 2010 Time: 17:45:23

Problem Title

US 101/SR116 SOH (Replace) Bent 2_R-09-012 - Free

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length

- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 95
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 570.00 in

Depth of ground surface below top of pile = -120.00 in

Slope angle of ground surface = 0.00 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	14.00000000	3201.3000	196.0000	3600000.
2	570.0000	14.00000000	3201.3000	196.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 8 layers

Layer 1 is stiff clay without free water
Distance from top of pile to top of layer = -120.000 in
Distance from top of pile to bottom of layer = 0.000 in

Layer 2 is stiff clay without free water
Distance from top of pile to top of layer = 0.000 in
Distance from top of pile to bottom of layer = 30.000 in

Layer 3 is stiff clay without free water
Distance from top of pile to top of layer = 30.000 in
Distance from top of pile to bottom of layer = 90.000 in

Layer 4 is stiff clay without free water
Distance from top of pile to top of layer = 90.000 in

Distance from top of pile to bottom of layer = 228.000 in

Layer 5 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 228.000 in
Distance from top of pile to bottom of layer = 312.000 in
p-y subgrade modulus k for top of soil layer = 60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 60.000 lbs/in**3

Layer 6 is stiff clay without free water
Distance from top of pile to top of layer = 312.000 in
Distance from top of pile to bottom of layer = 432.000 in

Layer 7 is stiff clay without free water
Distance from top of pile to top of layer = 432.000 in
Distance from top of pile to bottom of layer = 540.000 in

Layer 8 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 540.000 in
Distance from top of pile to bottom of layer = 900.000 in
p-y subgrade modulus k for top of soil layer = 150.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 150.000 lbs/in**3

(Depth of lowest layer extends 330.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 16 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-120.00	0.06940
2	0.00	0.06940
3	0.00	0.03330
4	30.00	0.03330
5	30.00	0.03330
6	90.00	0.03330
7	90.00	0.03040
8	228.00	0.03040
9	228.00	0.03620
10	312.00	0.03620
11	312.00	0.03040
12	432.00	0.03040
13	432.00	0.03330
14	540.00	0.03330
15	540.00	0.04490
16	900.00	0.04490

Shear Strength of Soils

Shear strength parameters with depth defined using 16 points

Point	Depth X	Cohesion c	Angle of Friction	E50 or	RQD

No.	in	lbs/in**2	Deg.	k_rm	%
1	-120.000	6.94000	0.00	0.00900	0.0
2	0.000	6.94000	0.00	0.00900	0.0
3	0.000	6.11000	0.00	0.01000	0.0
4	30.000	6.11000	0.00	0.01000	0.0
5	30.000	15.28000	0.00	0.00500	0.0
6	90.000	15.28000	0.00	0.00500	0.0
7	90.000	9.72000	0.00	0.00800	0.0
8	228.000	9.72000	0.00	0.00800	0.0
9	228.000	0.00000	35.00	------	------
10	312.000	0.00000	35.00	------	------
11	312.000	7.99000	0.00	0.00900	0.0
12	432.000	7.99000	0.00	0.00900	0.0
13	432.000	9.58000	0.00	0.00800	0.0
14	540.000	9.58000	0.00	0.00800	0.0
15	540.000	0.00000	41.00	------	------
16	900.000	0.00000	41.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.100 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 248000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.250 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 248000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.500 in
Bending moment at pile head = 0.000 in-lbs

```
Axial load at pile head     =      248000.000 lbs

Load Case Number  4

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           0.750 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      248000.000 lbs

Load Case Number  5

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           1.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      248000.000 lbs

Load Case Number  6

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           1.500 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      248000.000 lbs

Load Case Number  7

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           2.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      248000.000 lbs

Load Case Number  8

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           3.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      248000.000 lbs

Load Case Number  9

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           4.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      248000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           5.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      248000.000 lbs
```

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment, y = pile-head displacment in
Type 2 = Shear and Slope, M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness, V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment, S = Pile-head Slope, radians
Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= 0.100000	M= 0.000	248000.	0.1000000	413694.	15312.6994
4	y= 0.250000	M= 0.000	248000.	0.2500000	762223.	23971.5776
4	y= 0.500000	M= 0.000	248000.	0.5000000	1211969.	33662.0076
4	y= 0.750000	M= 0.000	248000.	0.7500000	1576830.	40829.8825
4	y= 1.000000	M= 0.000	248000.	1.0000000	1897866.	46762.6591
4	y= 1.500	M= 0.000	248000.	1.5000	2457083.	56449.5698
4	y= 2.000	M= 0.000	248000.	2.0000	2945106.	64333.3409
4	y= 3.000	M= 0.000	248000.	3.0000	3776626.	77053.5676
4	y= 4.000	M= 0.000	248000.	4.0000	4531491.	87581.0255
4	y= 5.000	M= 0.000	248000.	5.0000	5192837.	96386.3069

Pile-head Deflection vs. Pile Length

Boundary Condition Type 4, Deflection and Moment

Deflection = 0.10000 in
Moment = 0. in-lbs
Axial Load = 248000. lbs

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
570.000	0.10000000	413693.83386	15312.69941
541.500	0.10000000	395373.54647	14661.16730
513.000	0.10000000	396378.77450	14847.10312
484.500	0.10000000	400627.44356	15054.36671
456.000	0.10000000	394615.50960	14663.12799
427.500	0.10000000	398893.32395	14907.65442
399.000	0.10000000	395290.87238	14636.83754
370.500	0.10000000	399920.64926	14924.29650
342.000	0.10000000	396876.42014	14739.65073
313.500	0.10000000	395932.87856	14655.60283

This analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Replace\
Name of input data file: 101 & 116 SOH Replace_R-09-013_Bent 3_fixed.lpd
Name of output file: 101 & 116 SOH Replace_R-09-013_Bent 3_fixed.lpo
Name of plot output file: 101 & 116 SOH Replace_R-09-013_Bent 3_fixed.lpp
Name of runtime file: 101 & 116 SOH Replace_R-09-013_Bent 3_fixed.lpr

---

Time and Date of Analysis

Date: September 22, 2010 Time: 10:24:01

Problem Title

US 101/SR116 SOH (Replace) Bent 3_R-09-013 - Free

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length

- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 118
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 708.00 in

Depth of ground surface below top of pile = -84.00 in

Slope angle of ground surface = 0.00 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	14.00000000	3201.3000	196.0000	3600000.
2	708.0000	14.00000000	3201.3000	196.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 12 layers

Layer 1 is stiff clay without free water
Distance from top of pile to top of layer = -84.000 in
Distance from top of pile to bottom of layer = 84.000 in

Layer 2 is stiff clay without free water
Distance from top of pile to top of layer = 84.000 in
Distance from top of pile to bottom of layer = 162.000 in

Layer 3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 162.000 in
Distance from top of pile to bottom of layer = 192.000 in
p-y subgrade modulus k for top of soil layer = 60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 60.000 lbs/in**3

```
Layer  4 is soft clay, p-y criteria by Matlock, 1970
Distance from top of pile to top of layer    =      192.000 in
Distance from top of pile to bottom of layer =      228.000 in

Layer  5 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      228.000 in
Distance from top of pile to bottom of layer =      264.000 in
p-y subgrade modulus k for top of soil layer =       20.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       20.000 lbs/in**3

Layer  6 is stiff clay without free water
Distance from top of pile to top of layer    =      264.000 in
Distance from top of pile to bottom of layer =      324.000 in

Layer  7 is stiff clay without free water
Distance from top of pile to top of layer    =      324.000 in
Distance from top of pile to bottom of layer =      384.000 in

Layer  8 is stiff clay without free water
Distance from top of pile to top of layer    =      384.000 in
Distance from top of pile to bottom of layer =      444.000 in

Layer  9 is stiff clay without free water
Distance from top of pile to top of layer    =      444.000 in
Distance from top of pile to bottom of layer =      492.000 in

Layer 10 is stiff clay without free water
Distance from top of pile to top of layer    =      492.000 in
Distance from top of pile to bottom of layer =      624.000 in

Layer 11 is stiff clay without free water
Distance from top of pile to top of layer    =      624.000 in
Distance from top of pile to bottom of layer =      720.000 in

Layer 12 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      720.000 in
Distance from top of pile to bottom of layer =      954.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3


(Depth of lowest layer extends  246.00 in below pile tip)


--------------------------------------------------------------------------------
                   Effective Unit Weight of Soil vs. Depth
--------------------------------------------------------------------------------

Effective unit weight of soil with depth defined using 24 points

Point        Depth X    Eff. Unit Weight
 No.           in          lbs/in**3
-----      ----------   ----------------
  1           -84.00        0.03330
  2            84.00        0.03330
  3            84.00        0.03330
  4           162.00        0.03330
```

5	162.00	0.03910
6	192.00	0.03910
7	192.00	0.03620
8	228.00	0.03620
9	228.00	0.03620
10	264.00	0.03620
11	264.00	0.03620
12	324.00	0.03620
13	324.00	0.03620
14	384.00	0.03620
15	384.00	0.03620
16	444.00	0.03620
17	444.00	0.03620
18	492.00	0.03620
19	492.00	0.03620
20	624.00	0.03620
21	624.00	0.04200
22	720.00	0.04200
23	720.00	0.04200
24	954.00	0.04200

Shear Strength of Soils

Shear strength parameters with depth defined using 24 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-84.000	5.83000	0.00	0.01000	0.0
2	84.000	5.83000	0.00	0.01000	0.0
3	84.000	13.89000	0.00	0.00700	0.0
4	162.000	13.89000	0.00	0.00700	0.0
5	162.000	0.00000	34.00	------	------
6	192.000	0.00000	34.00	------	------
7	192.000	2.78000	0.00	0.02000	0.0
8	228.000	2.78000	0.00	0.02000	0.0
9	228.000	0.00000	34.00	------	------
10	264.000	0.00000	34.00	------	------
11	264.000	5.56000	0.00	0.01000	0.0
12	324.000	5.56000	0.00	0.01000	0.0
13	324.000	8.33000	0.00	0.00800	0.0
14	384.000	8.33000	0.00	0.00800	0.0
15	384.000	11.81000	0.00	0.00700	0.0
16	444.000	11.81000	0.00	0.00700	0.0
17	444.000	9.72000	0.00	0.00800	0.0
18	492.000	9.72000	0.00	0.00800	0.0
19	492.000	9.72000	0.00	0.00800	0.0
20	624.000	9.72000	0.00	0.00800	0.0
21	624.000	10.42000	0.00	0.00700	0.0
22	720.000	10.42000	0.00	0.00700	0.0
23	720.000	0.00000	41.00	------	------
24	954.000	0.00000	41.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.100 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 197000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.250 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 197000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.500 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 197000.000 lbs

Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.750 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 197000.000 lbs

Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 1.000 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 197000.000 lbs

Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 1.500 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 197000.000 lbs

Load Case Number 7

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 2.000 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 197000.000 lbs

Load Case Number 8

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 3.000 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 197000.000 lbs

Load Case Number 9

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 4.000 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 197000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 5.000 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 197000.000 lbs

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment, y = pile-head displacment in
Type 2 = Shear and Slope, M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness, V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment, S = Pile-head Slope, radians
Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
5	y= 0.100000	S= 0.000	197000.	0.1000000	-715754.	20059.5164
5	y= 0.250000	S= 0.000	197000.	0.2500000	-1336530.	31483.5087
5	y= 0.500000	S= 0.000	197000.	0.5000000	-2155864.	44624.8768
5	y= 0.750000	S= 0.000	197000.	0.7500000	-2862601.	54965.7602
5	y= 1.000000	S= 0.000	197000.	1.0000000	-3499210.	63752.5618
5	y= 1.500	S= 0.000	197000.	1.5000	-4622059.	78376.3883
5	y= 2.000	S= 0.000	197000.	2.0000	-5650505.	91006.0294
5	y= 3.000	S= 0.000	197000.	3.0000	-7560501.	113179.
5	y= 4.000	S= 0.000	197000.	4.0000	-9337774.	132776.
5	y= 5.000	S= 0.000	197000.	5.0000	-1.1035E+07	150851.

Pile-head Deflection vs. Pile Length

Boundary Condition Type 5, Deflection and Slope

Deflection = 0.10000 in
Slope = 0.00000
Axial Load = 197000. lbs

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
708.000	0.10000000	-715753.66906	20059.51638
672.600	0.10000000	-712504.65658	19980.17200
637.200	0.10000000	-711197.81902	19942.61022
601.800	0.10000000	-710301.29554	19916.60496
566.400	0.10000000	-710847.32262	19926.20980
531.000	0.10000000	-712018.29237	19953.42197
495.600	0.10000000	-708114.75117	19850.27562
460.200	0.10000000	-711767.15867	19940.67644
424.800	0.10000000	-710645.29443	19908.46923
389.400	0.10000000	-711822.50420	19936.09205

This analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Replace\
Name of input data file: 101 & 116 SOH Replace_R-09-013_Bent 3_free.lpd
Name of output file: 101 & 116 SOH Replace_R-09-013_Bent 3_free.lpo
Name of plot output file: 101 & 116 SOH Replace_R-09-013_Bent 3_free.lpp
Name of runtime file: 101 & 116 SOH Replace_R-09-013_Bent 3_free.lpr

---

Time and Date of Analysis

Date: September 22, 2010 Time: 10:26:15

Problem Title

US 101/SR116 SOH (Replace) Bent 3_R-09-013 - Free

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length

- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 118
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 708.00 in

Depth of ground surface below top of pile = -84.00 in

Slope angle of ground surface = 0.00 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	14.00000000	3201.3000	196.0000	3600000.
2	708.0000	14.00000000	3201.3000	196.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 12 layers

Layer 1 is stiff clay without free water
Distance from top of pile to top of layer = -84.000 in
Distance from top of pile to bottom of layer = 84.000 in

Layer 2 is stiff clay without free water
Distance from top of pile to top of layer = 84.000 in
Distance from top of pile to bottom of layer = 162.000 in

Layer 3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 162.000 in
Distance from top of pile to bottom of layer = 192.000 in
p-y subgrade modulus k for top of soil layer = 60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 60.000 lbs/in**3

```
Layer  4 is soft clay, p-y criteria by Matlock, 1970
Distance from top of pile to top of layer    =      192.000 in
Distance from top of pile to bottom of layer =      228.000 in

Layer  5 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      228.000 in
Distance from top of pile to bottom of layer =      264.000 in
p-y subgrade modulus k for top of soil layer =       20.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       20.000 lbs/in**3

Layer  6 is stiff clay without free water
Distance from top of pile to top of layer    =      264.000 in
Distance from top of pile to bottom of layer =      324.000 in

Layer  7 is stiff clay without free water
Distance from top of pile to top of layer    =      324.000 in
Distance from top of pile to bottom of layer =      384.000 in

Layer  8 is stiff clay without free water
Distance from top of pile to top of layer    =      384.000 in
Distance from top of pile to bottom of layer =      444.000 in

Layer  9 is stiff clay without free water
Distance from top of pile to top of layer    =      444.000 in
Distance from top of pile to bottom of layer =      492.000 in

Layer 10 is stiff clay without free water
Distance from top of pile to top of layer    =      492.000 in
Distance from top of pile to bottom of layer =      624.000 in

Layer 11 is stiff clay without free water
Distance from top of pile to top of layer    =      624.000 in
Distance from top of pile to bottom of layer =      720.000 in

Layer 12 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      720.000 in
Distance from top of pile to bottom of layer =      954.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3


(Depth of lowest layer extends  246.00 in below pile tip)
--------------------------------------------------------------------------------
                   Effective Unit Weight of Soil vs. Depth
--------------------------------------------------------------------------------

Effective unit weight of soil with depth defined using 24 points

Point        Depth X    Eff. Unit Weight
 No.           in          lbs/in**3
-----      ----------   ----------------
  1           -84.00        0.03330
  2            84.00        0.03330
  3            84.00        0.03330
  4           162.00        0.03330
  5           162.00        0.03910
  6           192.00        0.03910
```

7	192.00	0.03620
8	228.00	0.03620
9	228.00	0.03620
10	264.00	0.03620
11	264.00	0.03620
12	324.00	0.03620
13	324.00	0.03620
14	384.00	0.03620
15	384.00	0.03620
16	444.00	0.03620
17	444.00	0.03620
18	492.00	0.03620
19	492.00	0.03620
20	624.00	0.03620
21	624.00	0.04200
22	720.00	0.04200
23	720.00	0.04200
24	954.00	0.04200

Shear Strength of Soils

Shear strength parameters with depth defined using 24 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-84.000	5.83000	0.00	0.01000	0.0
2	84.000	5.83000	0.00	0.01000	0.0
3	84.000	13.89000	0.00	0.00700	0.0
4	162.000	13.89000	0.00	0.00700	0.0
5	162.000	0.00000	34.00	------	------
6	192.000	0.00000	34.00	------	------
7	192.000	2.78000	0.00	0.02000	0.0
8	228.000	2.78000	0.00	0.02000	0.0
9	228.000	0.00000	34.00	------	------
10	264.000	0.00000	34.00	------	------
11	264.000	5.56000	0.00	0.01000	0.0
12	324.000	5.56000	0.00	0.01000	0.0
13	324.000	8.33000	0.00	0.00800	0.0
14	384.000	8.33000	0.00	0.00800	0.0
15	384.000	11.81000	0.00	0.00700	0.0
16	444.000	11.81000	0.00	0.00700	0.0
17	444.000	9.72000	0.00	0.00800	0.0
18	492.000	9.72000	0.00	0.00800	0.0
19	492.000	9.72000	0.00	0.00800	0.0
20	624.000	9.72000	0.00	0.00800	0.0
21	624.000	10.42000	0.00	0.00700	0.0
22	720.000	10.42000	0.00	0.00700	0.0
23	720.000	0.00000	41.00	------	------
24	954.000	0.00000	41.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.

(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.100 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 197000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.250 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 197000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.500 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 197000.000 lbs

Load Case Number 4

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.750 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 197000.000 lbs

Load Case Number 5

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 1.000 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 197000.000 lbs

Load Case Number 6

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 1.500 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 197000.000 lbs

Load Case Number 7

```
Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           2.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      197000.000 lbs

Load Case Number  8

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           3.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      197000.000 lbs

Load Case Number  9

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           4.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      197000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           5.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      197000.000 lbs
--------------------------------------------------------------------------------
                          Summary of Pile Response(s)
--------------------------------------------------------------------------------

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad
```

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= 0.100000	M= 0.000	197000.	0.1000000	275115.	10037.0235
4	y= 0.250000	M= 0.000	197000.	0.2500000	512419.	15304.4455
4	y= 0.500000	M= 0.000	197000.	0.5000000	822586.	21037.3832
4	y= 0.750000	M= 0.000	197000.	0.7500000	1093864.	25412.9613
4	y= 1.000000	M= 0.000	197000.	1.0000000	1348440.	29128.0896
4	y= 1.500	M= 0.000	197000.	1.5000	1805349.	35312.8755
4	y= 2.000	M= 0.000	197000.	2.0000	2218681.	40533.9228
4	y= 3.000	M= 0.000	197000.	3.0000	2959441.	49167.9109
4	y= 4.000	M= 0.000	197000.	4.0000	3629751.	56424.3993
4	y= 5.000	M= 0.000	197000.	5.0000	4257973.	62823.8991

Pile-head Deflection vs. Pile Length

Boundary Condition Type 4, Deflection and Moment

Deflection = 0.10000 in
Moment = 0. in-lbs
Axial Load = 197000. lbs

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
708.000	0.10000000	275114.51293	10037.02352
672.600	0.10000000	274424.71675	10032.04517
637.200	0.10000000	274506.74649	10026.48730
601.800	0.10000000	273883.81146	10024.92629
566.400	0.10000000	274416.20276	10025.44973
531.000	0.10000000	274713.35492	10030.23902
495.600	0.10000000	273713.68706	10015.36316
460.200	0.10000000	274522.75923	10028.57682
424.800	0.10000000	274363.55951	10024.56331
389.400	0.10000000	274389.28964	10025.30682

This analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Replace\
Name of input data file: 101 & 116 SOH Replace_R-09-014_Bent 4_fixed.lpd
Name of output file: 101 & 116 SOH Replace_R-09-014_Bent 4_fixed.lpo
Name of plot output file: 101 & 116 SOH Replace_R-09-014_Bent 4_fixed.lpp
Name of runtime file: 101 & 116 SOH Replace_R-09-014_Bent 4_fixed.lpr

---

Time and Date of Analysis

Date: September 22, 2010 Time: 10:34:46

Problem Title

US 101/SR116 SOH (Replace) Bent 4_R-09-014 - Free

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length

- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 150
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 882.00 in

Depth of ground surface below top of pile = -102.00 in

Slope angle of ground surface = 0.00 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	14.00000000	3201.3000	196.0000	3600000.
2	882.0000	14.00000000	3201.3000	196.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 13 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = -102.000 in
Distance from top of pile to bottom of layer = 0.001 in
p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 0.001 in
Distance from top of pile to bottom of layer = 6.000 in
p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 6.000 in

```
Distance from top of pile to bottom of layer =       30.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =       30.000 in
Distance from top of pile to bottom of layer =       66.000 in

Layer  5 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =       66.000 in
Distance from top of pile to bottom of layer =      234.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  6 is stiff clay without free water
Distance from top of pile to top of layer    =      234.000 in
Distance from top of pile to bottom of layer =      396.000 in

Layer  7 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      396.000 in
Distance from top of pile to bottom of layer =      426.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  8 is stiff clay without free water
Distance from top of pile to top of layer    =      426.000 in
Distance from top of pile to bottom of layer =      474.000 in

Layer  9 is stiff clay without free water
Distance from top of pile to top of layer    =      474.000 in
Distance from top of pile to bottom of layer =      738.000 in

Layer 10 is stiff clay without free water
Distance from top of pile to top of layer    =      738.000 in
Distance from top of pile to bottom of layer =      918.000 in

Layer 11 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      918.000 in
Distance from top of pile to bottom of layer =      942.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer 12 is stiff clay without free water
Distance from top of pile to top of layer    =      942.000 in
Distance from top of pile to bottom of layer =      996.000 in

Layer 13 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      996.000 in
Distance from top of pile to bottom of layer =     1056.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3


(Depth of lowest layer extends  174.00 in below pile tip)


--------------------------------------------------------------------------------
```

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 26 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-102.00	0.07230
2	0.00	0.07230
3	0.00	0.07230
4	6.00	0.07230
5	6.00	0.03620
6	30.00	0.03620
7	30.00	0.03040
8	66.00	0.03040
9	66.00	0.03620
10	234.00	0.03620
11	234.00	0.03620
12	396.00	0.03620
13	396.00	0.03910
14	426.00	0.03910
15	426.00	0.03620
16	474.00	0.03620
17	474.00	0.03330
18	738.00	0.03330
19	738.00	0.03330
20	918.00	0.03330
21	918.00	0.03910
22	942.00	0.03910
23	942.00	0.02180
24	996.00	0.02180
25	996.00	0.04200
26	1056.00	0.04200

Shear Strength of Soils

Shear strength parameters with depth defined using 26 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-102.000	0.00000	34.00	------	------
2	0.001	0.00000	34.00	------	------
3	0.001	0.00000	34.00	------	------
4	6.000	0.00000	34.00	------	------
5	6.000	0.00000	34.00	------	------
6	30.000	0.00000	34.00	------	------
7	30.000	8.68000	0.00	0.00800	0.0
8	66.000	8.68000	0.00	0.00800	0.0
9	66.000	0.00000	36.00	------	------
10	234.000	0.00000	36.00	------	------
11	234.000	11.46000	0.00	0.00700	0.0
12	396.000	11.46000	0.00	0.00700	0.0
13	396.000	0.00000	36.00	------	------

14	426.000	0.00000	36.00	------	------
15	426.000	4.17000	0.00	0.01300	0.0
16	474.000	4.17000	0.00	0.01300	0.0
17	474.000	7.64000	0.00	0.00900	0.0
18	738.000	7.64000	0.00	0.00900	0.0
19	738.000	12.50000	0.00	0.00700	0.0
20	918.000	12.50000	0.00	0.00700	0.0
21	918.000	0.00000	41.00	------	------
22	942.000	0.00000	41.00	------	------
23	942.000	17.36000	0.00	0.00500	0.0
24	996.000	17.36000	0.00	0.00500	0.0
25	996.000	0.00000	41.00	------	------
26	1056.000	0.00000	41.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.100 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 192000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.250 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 192000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.500 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 192000.000 lbs

Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)

```
Deflection at pile head     =           0.750 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      192000.000 lbs

Load Case Number  5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           1.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      192000.000 lbs

Load Case Number  6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           1.500 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      192000.000 lbs

Load Case Number  7

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           2.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      192000.000 lbs

Load Case Number  8

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           3.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      192000.000 lbs

Load Case Number  9

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           4.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      192000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           5.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      192000.000 lbs

--------------------------------------------------------------------------------
                           Summary of Pile Response(s)
--------------------------------------------------------------------------------

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad
```

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
5	y= 0.100000	S= 0.000	192000.	0.1000000	-932051.	38526.2759
5	y= 0.250000	S= 0.000	192000.	0.2500000	-2034307.	79917.4694
5	y= 0.500000	S= 0.000	192000.	0.5000000	-3622672.	133087.
5	y= 0.750000	S= 0.000	192000.	0.7500000	-4953991.	163258.
5	y= 1.000000	S= 0.000	192000.	1.0000000	-6123010.	183660.
5	y= 1.500	S= 0.000	192000.	1.5000	-8347861.	221351.
5	y= 2.000	S= 0.000	192000.	2.0000	-1.0308E+07	252107.
5	y= 3.000	S= 0.000	192000.	3.0000	-1.3686E+07	300703.
5	y= 4.000	S= 0.000	192000.	4.0000	-1.6617E+07	339548.
5	y= 5.000	S= 0.000	192000.	5.0000	-1.9244E+07	372281.

Pile-head Deflection vs. Pile Length

Boundary Condition Type 5, Deflection and Slope

Deflection = 0.10000 in
Slope = 0.00000
Axial Load = 192000. lbs

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
882.000	0.10000000	-932050.72444	38526.27595
837.900	0.10000000	-923484.72842	38042.97680
793.800	0.10000000	-918353.53990	37639.28866
749.700	0.10000000	-931536.06574	38131.06054
705.600	0.10000000	-924819.95692	37677.99621
661.500	0.10000000	-914733.72009	37115.67459
617.400	0.10000000	-925159.65881	37454.73067
573.300	0.10000000	-915972.08437	36895.34649
529.200	0.10000000	-919731.74191	36985.10860
485.100	0.10000000	-922829.73310	37002.89618

This analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Replace\
Name of input data file: 101 & 116 SOH Replace_R-09-014_Bent 4_free.lpd
Name of output file: 101 & 116 SOH Replace_R-09-014_Bent 4_free.lpo
Name of plot output file: 101 & 116 SOH Replace_R-09-014_Bent 4_free.lpp
Name of runtime file: 101 & 116 SOH Replace_R-09-014_Bent 4_free.lpr

---

Time and Date of Analysis

Date: September 22, 2010 Time: 10:40:32

Problem Title

US 101/SR116 SOH (Replace) Bent 4_R-09-014 - Free

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length

- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 150
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 882.00 in

Depth of ground surface below top of pile = -102.00 in

Slope angle of ground surface = 0.00 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	14.00000000	3201.3000	196.0000	3600000.
2	882.0000	14.00000000	3201.3000	196.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 13 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = -102.000 in
Distance from top of pile to bottom of layer = 0.001 in
p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 0.001 in
Distance from top of pile to bottom of layer = 6.000 in
p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 6.000 in

```
Distance from top of pile to bottom of layer =       30.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =       30.000 in
Distance from top of pile to bottom of layer =       66.000 in

Layer  5 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =       66.000 in
Distance from top of pile to bottom of layer =      234.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  6 is stiff clay without free water
Distance from top of pile to top of layer    =      234.000 in
Distance from top of pile to bottom of layer =      396.000 in

Layer  7 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      396.000 in
Distance from top of pile to bottom of layer =      426.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  8 is stiff clay without free water
Distance from top of pile to top of layer    =      426.000 in
Distance from top of pile to bottom of layer =      474.000 in

Layer  9 is stiff clay without free water
Distance from top of pile to top of layer    =      474.000 in
Distance from top of pile to bottom of layer =      738.000 in

Layer 10 is stiff clay without free water
Distance from top of pile to top of layer    =      738.000 in
Distance from top of pile to bottom of layer =      918.000 in

Layer 11 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      918.000 in
Distance from top of pile to bottom of layer =      942.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer 12 is stiff clay without free water
Distance from top of pile to top of layer    =      942.000 in
Distance from top of pile to bottom of layer =      996.000 in

Layer 13 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      996.000 in
Distance from top of pile to bottom of layer =     1056.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3


(Depth of lowest layer extends  174.00 in below pile tip)
```

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 26 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-102.00	0.07230
2	0.00	0.07230
3	0.00	0.07230
4	6.00	0.07230
5	6.00	0.03620
6	30.00	0.03620
7	30.00	0.03040
8	66.00	0.03040
9	66.00	0.03620
10	234.00	0.03620
11	234.00	0.03620
12	396.00	0.03620
13	396.00	0.03910
14	426.00	0.03910
15	426.00	0.03620
16	474.00	0.03620
17	474.00	0.03330
18	738.00	0.03330
19	738.00	0.03330
20	918.00	0.03330
21	918.00	0.03910
22	942.00	0.03910
23	942.00	0.02180
24	996.00	0.02180
25	996.00	0.04200
26	1056.00	0.04200

Shear Strength of Soils

Shear strength parameters with depth defined using 26 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-102.000	0.00000	34.00	------	------
2	0.001	0.00000	34.00	------	------
3	0.001	0.00000	34.00	------	------
4	6.000	0.00000	34.00	------	------
5	6.000	0.00000	34.00	------	------
6	30.000	0.00000	34.00	------	------
7	30.000	8.68000	0.00	0.00800	0.0
8	66.000	8.68000	0.00	0.00800	0.0
9	66.000	0.00000	36.00	------	------
10	234.000	0.00000	36.00	------	------
11	234.000	11.46000	0.00	0.00700	0.0
12	396.000	11.46000	0.00	0.00700	0.0

13	396.000	0.00000	36.00	------	------
14	426.000	0.00000	36.00	------	------
15	426.000	4.17000	0.00	0.01300	0.0
16	474.000	4.17000	0.00	0.01300	0.0
17	474.000	7.64000	0.00	0.00900	0.0
18	738.000	7.64000	0.00	0.00900	0.0
19	738.000	12.50000	0.00	0.00700	0.0
20	918.000	12.50000	0.00	0.00700	0.0
21	918.000	0.00000	41.00	------	------
22	942.000	0.00000	41.00	------	------
23	942.000	17.36000	0.00	0.00500	0.0
24	996.000	17.36000	0.00	0.00500	0.0
25	996.000	0.00000	41.00	------	------
26	1056.000	0.00000	41.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.100 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 192000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.250 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 192000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.500 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 192000.000 lbs

Load Case Number 4

```
Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           0.750 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      192000.000 lbs

Load Case Number  5

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           1.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      192000.000 lbs

Load Case Number  6

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           1.500 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      192000.000 lbs

Load Case Number  7

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           2.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      192000.000 lbs

Load Case Number  8

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           3.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      192000.000 lbs

Load Case Number  9

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           4.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      192000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           5.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      192000.000 lbs


--------------------------------------------------------------------------------
                          Summary of Pile Response(s)
--------------------------------------------------------------------------------

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
```

Type 4 = Deflection and Moment, S = Pile-head Slope, radians
Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= 0.100000	M= 0.000	192000.	0.1000000	356022.	20500.6384
4	y= 0.250000	M= 0.000	192000.	0.2500000	733204.	43097.9040
4	y= 0.500000	M= 0.000	192000.	0.5000000	1260188.	72892.8626
4	y= 0.750000	M= 0.000	192000.	0.7500000	1702431.	92863.0163
4	y= 1.000000	M= 0.000	192000.	1.0000000	2063465.	102528.
4	y= 1.500	M= 0.000	192000.	1.5000	2762618.	113800.
4	y= 2.000	M= 0.000	192000.	2.0000	3560772.	124657.
4	y= 3.000	M= 0.000	192000.	3.0000	5088782.	144769.
4	y= 4.000	M= 0.000	192000.	4.0000	6448100.	161396.
4	y= 5.000	M= 0.000	192000.	5.0000	7656861.	175441.

Pile-head Deflection vs. Pile Length

Boundary Condition Type 4, Deflection and Moment

Deflection = 0.10000 in
Moment = 0. in-lbs
Axial Load = 192000. lbs

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
882.000	0.10000000	356021.60411	20500.63838
837.900	0.10000000	352224.26327	20370.22147
793.800	0.10000000	354664.19245	20301.76129
749.700	0.10000000	354314.28117	20208.71736
705.600	0.10000000	355518.39230	20130.47862
661.500	0.10000000	351013.59151	19977.64689
617.400	0.10000000	354430.91898	19935.57706
573.300	0.10000000	353759.22674	19829.74304
529.200	0.10000000	352191.78962	19715.51244
485.100	0.10000000	352838.01802	19633.23436

This analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Replace\
Name of input data file: 101 & 116 SOH Replace_R-09-015_Abut 5_fixed.lpd
Name of output file: 101 & 116 SOH Replace_R-09-015_Abut 5_fixed.lpo
Name of plot output file: 101 & 116 SOH Replace_R-09-015_Abut 5_fixed.lpp
Name of runtime file: 101 & 116 SOH Replace_R-09-015_Abut 5_fixed.lpr

---

Time and Date of Analysis

Date: September 21, 2010 Time: 16:53:53

Problem Title

US 101/SR116 SOH (Replace) Abutment 5_R-09-105 - Free

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length

- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 162
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 972.00 in

Depth of ground surface below top of pile = -60.00 in

Slope angle of ground surface = 26.56 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	14.00000000	3201.3000	196.0000	3600000.
2	972.0000	14.00000000	3201.3000	196.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 14 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = -60.000 in
Distance from top of pile to bottom of layer = 0.001 in
p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 0.001 in
Distance from top of pile to bottom of layer = 48.000 in
p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 3 is stiff clay without free water
Distance from top of pile to top of layer = 48.000 in

```
Distance from top of pile to bottom of layer =       72.000 in

Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =       72.000 in
Distance from top of pile to bottom of layer =      144.000 in

Layer  5 is stiff clay without free water
Distance from top of pile to top of layer    =      144.000 in
Distance from top of pile to bottom of layer =      216.000 in

Layer  6 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      216.000 in
Distance from top of pile to bottom of layer =      228.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  7 is stiff clay without free water
Distance from top of pile to top of layer    =      228.000 in
Distance from top of pile to bottom of layer =      312.000 in

Layer  8 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      312.000 in
Distance from top of pile to bottom of layer =      462.000 in
p-y subgrade modulus k for top of soil layer =       90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       90.000 lbs/in**3

Layer  9 is stiff clay without free water
Distance from top of pile to top of layer    =      462.000 in
Distance from top of pile to bottom of layer =      594.000 in

Layer 10 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      594.000 in
Distance from top of pile to bottom of layer =      660.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer 11 is stiff clay without free water
Distance from top of pile to top of layer    =      660.000 in
Distance from top of pile to bottom of layer =      792.000 in

Layer 12 is stiff clay without free water
Distance from top of pile to top of layer    =      792.000 in
Distance from top of pile to bottom of layer =      828.000 in

Layer 13 is stiff clay without free water
Distance from top of pile to top of layer    =      828.000 in
Distance from top of pile to bottom of layer =      936.000 in

Layer 14 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      936.000 in
Distance from top of pile to bottom of layer =     1080.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3


(Depth of lowest layer extends  108.00 in below pile tip)
```

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 28 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-60.00	0.07230
2	0.00	0.07230
3	0.00	0.07230
4	48.00	0.07230
5	48.00	0.06940
6	72.00	0.06940
7	72.00	0.06940
8	144.00	0.06940
9	144.00	0.03330
10	216.00	0.03330
11	216.00	0.03620
12	228.00	0.03620
13	228.00	0.03910
14	312.00	0.03910
15	312.00	0.03620
16	462.00	0.03620
17	462.00	0.03620
18	594.00	0.03620
19	594.00	0.03910
20	660.00	0.03910
21	660.00	0.02750
22	792.00	0.02750
23	792.00	0.02750
24	828.00	0.02750
25	828.00	0.03620
26	936.00	0.03620
27	936.00	0.04200
28	1080.00	0.04200

Shear Strength of Soils

Shear strength parameters with depth defined using 28 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-60.000	0.00000	32.00	------	------
2	0.001	0.00000	32.00	------	------
3	0.001	0.00000	32.00	------	------
4	48.000	0.00000	32.00	------	------
5	48.000	6.94000	0.00	0.01000	0.0
6	72.000	6.94000	0.00	0.01000	0.0
7	72.000	6.25000	0.00	0.01000	0.0
8	144.000	6.25000	0.00	0.01000	0.0
9	144.000	6.25000	0.00	0.01000	0.0
10	216.000	6.25000	0.00	0.01000	0.0

11	216.000	0.00000	32.00	------	------
12	228.000	0.00000	32.00	------	------
13	228.000	6.25000	0.00	0.01000	0.0
14	312.000	6.25000	0.00	0.01000	0.0
15	312.000	0.00000	38.00	------	------
16	462.000	0.00000	38.00	------	------
17	462.000	11.11000	0.00	0.00700	0.0
18	594.000	11.11000	0.00	0.00700	0.0
19	594.000	0.00000	38.00	------	------
20	660.000	0.00000	38.00	------	------
21	660.000	10.07000	0.00	0.00700	0.0
22	792.000	10.07000	0.00	0.00700	0.0
23	792.000	4.86000	0.00	0.01500	0.0
24	828.000	4.86000	0.00	0.01500	0.0
25	828.000	6.25000	0.00	0.01000	0.0
26	936.000	6.25000	0.00	0.01000	0.0
27	936.000	0.00000	38.00	------	------
28	1080.000	0.00000	38.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.100 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 168000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.250 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 168000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.500 in
Slope at pile head = 0.000 in/in

```
Axial load at pile head     =      168000.000 lbs

Load Case Number  4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           0.750 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      168000.000 lbs

Load Case Number  5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           1.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      168000.000 lbs

Load Case Number  6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           1.500 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      168000.000 lbs

Load Case Number  7

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           2.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      168000.000 lbs

Load Case Number  8

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           3.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      168000.000 lbs

Load Case Number  9

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           4.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      168000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           5.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      168000.000 lbs

--------------------------------------------------------------------------------
                          Summary of Pile Response(s)
--------------------------------------------------------------------------------

Definition of Symbols for Pile-Head Loading Conditions:
```

```
Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad
```

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
5	y= 0.100000	S= 0.000	168000.	0.1000000	-504440.	11853.1103
5	y= 0.250000	S= 0.000	168000.	0.2500000	-955762.	20110.0238
5	y= 0.500000	S= 0.000	168000.	0.5000000	-1552943.	30427.1146
5	y= 0.750000	S= 0.000	168000.	0.7500000	-2017444.	36410.3844
5	y= 1.000000	S= 0.000	168000.	1.0000000	-2401158.	40309.6540
5	y= 1.500	S= 0.000	168000.	1.5000	-3079862.	46795.5229
5	y= 2.000	S= 0.000	168000.	2.0000	-3695148.	52341.5376
5	y= 3.000	S= 0.000	168000.	3.0000	-4803555.	61780.0987
5	y= 4.000	S= 0.000	168000.	4.0000	-5811433.	69904.3163
5	y= 5.000	S= 0.000	168000.	5.0000	-6757282.	77236.4301

Pile-head Deflection vs. Pile Length

Boundary Condition Type 5, Deflection and Slope

```
Deflection =         0.10000  in
Slope      =         0.00000
Axial Load =         168000. lbs
```

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
972.000	0.10000000	-504440.15959	11853.11027
923.400	0.10000000	-507309.28280	11935.75075
874.800	0.10000000	-507383.65699	11919.26979
826.200	0.10000000	-508720.97727	11967.25439
777.600	0.10000000	-507012.56128	11908.01629
729.000	0.10000000	-506683.08219	11910.33163
680.400	0.10000000	-509371.74821	11973.81551
631.800	0.10000000	-509344.50723	11975.41381
583.200	0.10000000	-508995.36991	11964.30867
534.600	0.10000000	-509256.97947	11962.02932

This analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Replace\
Name of input data file: 101 & 116 SOH Replace_R-09-015_Abut 5_free.lpd
Name of output file: 101 & 116 SOH Replace_R-09-015_Abut 5_free.lpo
Name of plot output file: 101 & 116 SOH Replace_R-09-015_Abut 5_free.lpp
Name of runtime file: 101 & 116 SOH Replace_R-09-015_Abut 5_free.lpr

---

Time and Date of Analysis

Date: September 21, 2010 Time: 16:53:26

Problem Title

US 101/SR116 SOH (Replace) Abutment 5_R-09-105 - Free

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length

- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 162
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 972.00 in

Depth of ground surface below top of pile = -60.00 in

Slope angle of ground surface = 26.56 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	14.00000000	3201.3000	196.0000	3600000.
2	972.0000	14.00000000	3201.3000	196.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 14 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = -60.000 in
Distance from top of pile to bottom of layer = 0.001 in
p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 0.001 in
Distance from top of pile to bottom of layer = 48.000 in
p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 3 is stiff clay without free water
Distance from top of pile to top of layer = 48.000 in

```
Distance from top of pile to bottom of layer =       72.000 in

Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =       72.000 in
Distance from top of pile to bottom of layer =      144.000 in

Layer  5 is stiff clay without free water
Distance from top of pile to top of layer    =      144.000 in
Distance from top of pile to bottom of layer =      216.000 in

Layer  6 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      216.000 in
Distance from top of pile to bottom of layer =      228.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  7 is stiff clay without free water
Distance from top of pile to top of layer    =      228.000 in
Distance from top of pile to bottom of layer =      312.000 in

Layer  8 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      312.000 in
Distance from top of pile to bottom of layer =      462.000 in
p-y subgrade modulus k for top of soil layer =       90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       90.000 lbs/in**3

Layer  9 is stiff clay without free water
Distance from top of pile to top of layer    =      462.000 in
Distance from top of pile to bottom of layer =      594.000 in

Layer 10 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      594.000 in
Distance from top of pile to bottom of layer =      660.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer 11 is stiff clay without free water
Distance from top of pile to top of layer    =      660.000 in
Distance from top of pile to bottom of layer =      792.000 in

Layer 12 is stiff clay without free water
Distance from top of pile to top of layer    =      792.000 in
Distance from top of pile to bottom of layer =      828.000 in

Layer 13 is stiff clay without free water
Distance from top of pile to top of layer    =      828.000 in
Distance from top of pile to bottom of layer =      936.000 in

Layer 14 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      936.000 in
Distance from top of pile to bottom of layer =     1080.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3


(Depth of lowest layer extends  108.00 in below pile tip)
```

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 28 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-60.00	0.07230
2	0.00	0.07230
3	0.00	0.07230
4	48.00	0.07230
5	48.00	0.06940
6	72.00	0.06940
7	72.00	0.06940
8	144.00	0.06940
9	144.00	0.03330
10	216.00	0.03330
11	216.00	0.03620
12	228.00	0.03620
13	228.00	0.03910
14	312.00	0.03910
15	312.00	0.03620
16	462.00	0.03620
17	462.00	0.03620
18	594.00	0.03620
19	594.00	0.03910
20	660.00	0.03910
21	660.00	0.02750
22	792.00	0.02750
23	792.00	0.02750
24	828.00	0.02750
25	828.00	0.03620
26	936.00	0.03620
27	936.00	0.04200
28	1080.00	0.04200

Shear Strength of Soils

Shear strength parameters with depth defined using 28 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-60.000	0.00000	32.00	------	------
2	0.001	0.00000	32.00	------	------
3	0.001	0.00000	32.00	------	------
4	48.000	0.00000	32.00	------	------
5	48.000	6.94000	0.00	0.01000	0.0
6	72.000	6.94000	0.00	0.01000	0.0
7	72.000	6.25000	0.00	0.01000	0.0
8	144.000	6.25000	0.00	0.01000	0.0
9	144.000	6.25000	0.00	0.01000	0.0

10	216.000	6.25000	0.00	0.01000	0.0
11	216.000	0.00000	32.00	------	------
12	228.000	0.00000	32.00	------	------
13	228.000	6.25000	0.00	0.01000	0.0
14	312.000	6.25000	0.00	0.01000	0.0
15	312.000	0.00000	38.00	------	------
16	462.000	0.00000	38.00	------	------
17	462.000	11.11000	0.00	0.00700	0.0
18	594.000	11.11000	0.00	0.00700	0.0
19	594.000	0.00000	38.00	------	------
20	660.000	0.00000	38.00	------	------
21	660.000	10.07000	0.00	0.00700	0.0
22	792.000	10.07000	0.00	0.00700	0.0
23	792.000	4.86000	0.00	0.01500	0.0
24	828.000	4.86000	0.00	0.01500	0.0
25	828.000	6.25000	0.00	0.01000	0.0
26	936.000	6.25000	0.00	0.01000	0.0
27	936.000	0.00000	38.00	------	------
28	1080.000	0.00000	38.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.100 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 168000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.250 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 168000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.500 in

```
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      168000.000 lbs

Load Case Number  4

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           0.750 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      168000.000 lbs

Load Case Number  5

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           1.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      168000.000 lbs

Load Case Number  6

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           1.500 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      168000.000 lbs

Load Case Number  7

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           2.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      168000.000 lbs

Load Case Number  8

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           3.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      168000.000 lbs

Load Case Number  9

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           4.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      168000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           5.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      168000.000 lbs

--------------------------------------------------------------------------------
                          Summary of Pile Response(s)
--------------------------------------------------------------------------------

Definition of Symbols for Pile-Head Loading Conditions:
```

```
Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad
```

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= 0.100000	M= 0.000	168000.	0.1000000	197729.	5715.3860
4	y= 0.250000	M= 0.000	168000.	0.2500000	374090.	10019.3972
4	y= 0.500000	M= 0.000	168000.	0.5000000	603807.	15444.7071
4	y= 0.750000	M= 0.000	168000.	0.7500000	800075.	19467.3268
4	y= 1.000000	M= 0.000	168000.	1.0000000	963046.	21662.0615
4	y= 1.500	M= 0.000	168000.	1.5000	1242217.	24379.0951
4	y= 2.000	M= 0.000	168000.	2.0000	1494695.	26631.4226
4	y= 3.000	M= 0.000	168000.	3.0000	1944046.	30300.5822
4	y= 4.000	M= 0.000	168000.	4.0000	2346334.	33293.8615
4	y= 5.000	M= 0.000	168000.	5.0000	2725102.	35920.2448

Pile-head Deflection vs. Pile Length

Boundary Condition Type 4, Deflection and Moment

```
Deflection =         0.10000  in
Moment     =              0. in-lbs
Axial Load =         168000. lbs
```

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
972.000	0.10000000	197729.06541	5715.38604
923.400	0.10000000	198061.20963	5711.11084
874.800	0.10000000	198722.72987	5718.82981
826.200	0.10000000	198420.58490	5716.04683
777.600	0.10000000	198321.38601	5715.48327
729.000	0.10000000	198050.62020	5706.15289
680.400	0.10000000	198784.81159	5710.47643
631.800	0.10000000	198489.16705	5706.63899
583.200	0.10000000	198347.05494	5702.22161
534.600	0.10000000	198580.39942	5701.65434

This analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Replace\
Name of input data file: 101 & 116 SOH Replace_R-09-015_Abut 5-RW1_fixed.lpd
Name of output file: 101 & 116 SOH Replace_R-09-015_Abut 5-RW1_fixed.lpo
Name of plot output file: 101 & 116 SOH Replace_R-09-015_Abut 5-RW1_fixed.lpp
Name of runtime file: 101 & 116 SOH Replace_R-09-015_Abut 5-RW1_fixed.lpr

---

Time and Date of Analysis

Date: August 27, 2010 Time: 15:27:52

Problem Title

US 101/SR116 SOH (Replace) Abutment 5-RW1_R-09-105 - Free

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length

- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 170
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 1020.00 in

Depth of ground surface below top of pile = -96.00 in

Slope angle of ground surface = 26.56 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	14.00000000	3201.3000	196.0000	3600000.
2	1020.0000	14.00000000	3201.3000	196.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 14 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = -96.000 in
Distance from top of pile to bottom of layer = 0.001 in
p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 0.001 in
Distance from top of pile to bottom of layer = 108.000 in
p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 3 is stiff clay without free water
Distance from top of pile to top of layer = 108.000 in

```
Distance from top of pile to bottom of layer =      132.000 in

Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =      132.000 in
Distance from top of pile to bottom of layer =      204.000 in

Layer  5 is stiff clay without free water
Distance from top of pile to top of layer    =      204.000 in
Distance from top of pile to bottom of layer =      276.000 in

Layer  6 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      276.000 in
Distance from top of pile to bottom of layer =      288.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  7 is stiff clay without free water
Distance from top of pile to top of layer    =      288.000 in
Distance from top of pile to bottom of layer =      372.000 in

Layer  8 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      372.000 in
Distance from top of pile to bottom of layer =      522.000 in
p-y subgrade modulus k for top of soil layer =       90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       90.000 lbs/in**3

Layer  9 is stiff clay without free water
Distance from top of pile to top of layer    =      522.000 in
Distance from top of pile to bottom of layer =      654.000 in

Layer 10 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      654.000 in
Distance from top of pile to bottom of layer =      720.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer 11 is stiff clay without free water
Distance from top of pile to top of layer    =      720.000 in
Distance from top of pile to bottom of layer =      852.000 in

Layer 12 is stiff clay without free water
Distance from top of pile to top of layer    =      852.000 in
Distance from top of pile to bottom of layer =      888.000 in

Layer 13 is stiff clay without free water
Distance from top of pile to top of layer    =      888.000 in
Distance from top of pile to bottom of layer =      996.000 in

Layer 14 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      996.000 in
Distance from top of pile to bottom of layer =     1140.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3


(Depth of lowest layer extends  120.00 in below pile tip)
```

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 28 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-96.00	0.07230
2	0.00	0.07230
3	0.00	0.07230
4	108.00	0.07230
5	108.00	0.06940
6	132.00	0.06940
7	132.00	0.06940
8	204.00	0.06940
9	204.00	0.03330
10	276.00	0.03330
11	276.00	0.03620
12	288.00	0.03620
13	288.00	0.03910
14	372.00	0.03910
15	372.00	0.03620
16	522.00	0.03620
17	522.00	0.03620
18	654.00	0.03620
19	654.00	0.03910
20	720.00	0.03910
21	720.00	0.02750
22	852.00	0.02750
23	852.00	0.02750
24	888.00	0.02750
25	888.00	0.03620
26	996.00	0.03620
27	996.00	0.04200
28	1140.00	0.04200

Shear Strength of Soils

Shear strength parameters with depth defined using 28 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-96.000	0.00000	32.00	------	------
2	0.001	0.00000	32.00	------	------
3	0.001	0.00000	32.00	------	------
4	108.000	0.00000	32.00	------	------
5	108.000	6.94000	0.00	0.01000	0.0
6	132.000	6.94000	0.00	0.01000	0.0
7	132.000	6.25000	0.00	0.01000	0.0
8	204.000	6.25000	0.00	0.01000	0.0
9	204.000	6.25000	0.00	0.01000	0.0
10	276.000	6.25000	0.00	0.01000	0.0

11	276.000	0.00000	32.00	------	------
12	288.000	0.00000	32.00	------	------
13	288.000	6.25000	0.00	0.01000	0.0
14	372.000	6.25000	0.00	0.01000	0.0
15	372.000	0.00000	38.00	------	------
16	522.000	0.00000	38.00	------	------
17	522.000	11.11000	0.00	0.00700	0.0
18	654.000	11.11000	0.00	0.00700	0.0
19	654.000	0.00000	38.00	------	------
20	720.000	0.00000	38.00	------	------
21	720.000	10.07000	0.00	0.00700	0.0
22	852.000	10.07000	0.00	0.00700	0.0
23	852.000	4.86000	0.00	0.01500	0.0
24	888.000	4.86000	0.00	0.01500	0.0
25	888.000	6.25000	0.00	0.01000	0.0
26	996.000	6.25000	0.00	0.01000	0.0
27	996.000	0.00000	38.00	------	------
28	1140.000	0.00000	38.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.100 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 140000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.250 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 140000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.500 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 140000.000 lbs

```
Load Case Number  4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           0.750 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      140000.000 lbs

Load Case Number  5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           1.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      140000.000 lbs

Load Case Number  6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           1.500 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      140000.000 lbs

Load Case Number  7

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           2.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      140000.000 lbs

Load Case Number  8

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           3.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      140000.000 lbs

Load Case Number  9

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           4.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      140000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           5.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      140000.000 lbs
--------------------------------------------------------------------------
                          Summary of Pile Response(s)
--------------------------------------------------------------------------

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
```

Type 3 = Shear and Rot. Stiffness, V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment, S = Pile-head Slope, radians
Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
5	y= 0.100000	S= 0.000	140000.	0.1000000	-693206.	19133.6655
5	y= 0.250000	S= 0.000	140000.	0.2500000	-1482480.	37662.7148
5	y= 0.500000	S= 0.000	140000.	0.5000000	-2635269.	63659.5466
5	y= 0.750000	S= 0.000	140000.	0.7500000	-3648657.	83040.9328
5	y= 1.000000	S= 0.000	140000.	1.0000000	-4487427.	96236.3622
5	y= 1.500	S= 0.000	140000.	1.5000	-5810366.	114046.
5	y= 2.000	S= 0.000	140000.	2.0000	-6711821.	123627.
5	y= 3.000	S= 0.000	140000.	3.0000	-8080372.	135754.
5	y= 4.000	S= 0.000	140000.	4.0000	-9244298.	145307.
5	y= 5.000	S= 0.000	140000.	5.0000	-1.0288E+07	153419.

Pile-head Deflection vs. Pile Length

Boundary Condition Type 5, Deflection and Slope

Deflection = 0.10000 in
Slope = 0.00000
Axial Load = 140000. lbs

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
1020.000	0.10000000	-693206.43010	19133.66553
969.000	0.10000000	-693326.91782	19130.83365
918.000	0.10000000	-692099.06452	19104.75082
867.000	0.10000000	-692657.18923	19110.15237
816.000	0.10000000	-693475.97755	19120.84166
765.000	0.10000000	-694186.02206	19130.72187
714.000	0.10000000	-694033.04427	19124.34816
663.000	0.10000000	-694226.17184	19124.13202
612.000	0.10000000	-694645.11724	19129.35312
561.000	0.10000000	-694547.70498	19124.93897

This analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Replace\
Name of input data file: 101 & 116 SOH Replace_R-09-015_Abut 5-RW1_free.lpd
Name of output file: 101 & 116 SOH Replace_R-09-015_Abut 5-RW1_free.lpo
Name of plot output file: 101 & 116 SOH Replace_R-09-015_Abut 5-RW1_free.lpp
Name of runtime file: 101 & 116 SOH Replace_R-09-015_Abut 5-RW1_free.lpr

---

Time and Date of Analysis

Date: August 27, 2010 Time: 15:28:25

Problem Title

US 101/SR116 SOH (Replace) Abutment 5-RW1_R-09-105 - Free

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length

- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 170
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 1020.00 in

Depth of ground surface below top of pile = -96.00 in

Slope angle of ground surface = 26.56 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	14.00000000	3201.3000	196.0000	3600000.
2	1020.0000	14.00000000	3201.3000	196.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 14 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = -96.000 in
Distance from top of pile to bottom of layer = 0.001 in
p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 0.001 in
Distance from top of pile to bottom of layer = 108.000 in
p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 3 is stiff clay without free water
Distance from top of pile to top of layer = 108.000 in

```
Distance from top of pile to bottom of layer =      132.000 in

Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =      132.000 in
Distance from top of pile to bottom of layer =      204.000 in

Layer  5 is stiff clay without free water
Distance from top of pile to top of layer    =      204.000 in
Distance from top of pile to bottom of layer =      276.000 in

Layer  6 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      276.000 in
Distance from top of pile to bottom of layer =      288.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  7 is stiff clay without free water
Distance from top of pile to top of layer    =      288.000 in
Distance from top of pile to bottom of layer =      372.000 in

Layer  8 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      372.000 in
Distance from top of pile to bottom of layer =      522.000 in
p-y subgrade modulus k for top of soil layer =       90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       90.000 lbs/in**3

Layer  9 is stiff clay without free water
Distance from top of pile to top of layer    =      522.000 in
Distance from top of pile to bottom of layer =      654.000 in

Layer 10 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      654.000 in
Distance from top of pile to bottom of layer =      720.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer 11 is stiff clay without free water
Distance from top of pile to top of layer    =      720.000 in
Distance from top of pile to bottom of layer =      852.000 in

Layer 12 is stiff clay without free water
Distance from top of pile to top of layer    =      852.000 in
Distance from top of pile to bottom of layer =      888.000 in

Layer 13 is stiff clay without free water
Distance from top of pile to top of layer    =      888.000 in
Distance from top of pile to bottom of layer =      996.000 in

Layer 14 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      996.000 in
Distance from top of pile to bottom of layer =     1140.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3


(Depth of lowest layer extends  120.00 in below pile tip)
```

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 28 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-96.00	0.07230
2	0.00	0.07230
3	0.00	0.07230
4	108.00	0.07230
5	108.00	0.06940
6	132.00	0.06940
7	132.00	0.06940
8	204.00	0.06940
9	204.00	0.03330
10	276.00	0.03330
11	276.00	0.03620
12	288.00	0.03620
13	288.00	0.03910
14	372.00	0.03910
15	372.00	0.03620
16	522.00	0.03620
17	522.00	0.03620
18	654.00	0.03620
19	654.00	0.03910
20	720.00	0.03910
21	720.00	0.02750
22	852.00	0.02750
23	852.00	0.02750
24	888.00	0.02750
25	888.00	0.03620
26	996.00	0.03620
27	996.00	0.04200
28	1140.00	0.04200

Shear Strength of Soils

Shear strength parameters with depth defined using 28 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-96.000	0.00000	32.00	------	------
2	0.001	0.00000	32.00	------	------
3	0.001	0.00000	32.00	------	------
4	108.000	0.00000	32.00	------	------
5	108.000	6.94000	0.00	0.01000	0.0
6	132.000	6.94000	0.00	0.01000	0.0
7	132.000	6.25000	0.00	0.01000	0.0
8	204.000	6.25000	0.00	0.01000	0.0
9	204.000	6.25000	0.00	0.01000	0.0

10	276.000	6.25000	0.00	0.01000	0.0
11	276.000	0.00000	32.00	------	------
12	288.000	0.00000	32.00	------	------
13	288.000	6.25000	0.00	0.01000	0.0
14	372.000	6.25000	0.00	0.01000	0.0
15	372.000	0.00000	38.00	------	------
16	522.000	0.00000	38.00	------	------
17	522.000	11.11000	0.00	0.00700	0.0
18	654.000	11.11000	0.00	0.00700	0.0
19	654.000	0.00000	38.00	------	------
20	720.000	0.00000	38.00	------	------
21	720.000	10.07000	0.00	0.00700	0.0
22	852.000	10.07000	0.00	0.00700	0.0
23	852.000	4.86000	0.00	0.01500	0.0
24	888.000	4.86000	0.00	0.01500	0.0
25	888.000	6.25000	0.00	0.01000	0.0
26	996.000	6.25000	0.00	0.01000	0.0
27	996.000	0.00000	38.00	------	------
28	1140.000	0.00000	38.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.100 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 140000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.250 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 140000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.500 in

```
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs

Load Case Number  4

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           0.750 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs

Load Case Number  5

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           1.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs

Load Case Number  6

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           1.500 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs

Load Case Number  7

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           2.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs

Load Case Number  8

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           3.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs

Load Case Number  9

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           4.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           5.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs
--------------------------------------------------------------------------------
                          Summary of Pile Response(s)
--------------------------------------------------------------------------------

Definition of Symbols for Pile-Head Loading Conditions:
```

```
Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad
```

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= 0.100000	M= 0.000	140000.	0.1000000	244129.	8811.5911
4	y= 0.250000	M= 0.000	140000.	0.2500000	524432.	17172.8219
4	y= 0.500000	M= 0.000	140000.	0.5000000	932671.	28786.4876
4	y= 0.750000	M= 0.000	140000.	0.7500000	1307779.	37934.1303
4	y= 1.000000	M= 0.000	140000.	1.0000000	1654303.	44531.9264
4	y= 1.500	M= 0.000	140000.	1.5000	2271085.	54141.0810
4	y= 2.000	M= 0.000	140000.	2.0000	2815609.	61312.2440
4	y= 3.000	M= 0.000	140000.	3.0000	3721441.	71849.1335
4	y= 4.000	M= 0.000	140000.	4.0000	4450676.	79394.5969
4	y= 5.000	M= 0.000	140000.	5.0000	4977605.	84347.4338

Pile-head Deflection vs. Pile Length

Boundary Condition Type 4, Deflection and Moment

```
Deflection =         0.10000  in
Moment     =              0. in-lbs
Axial Load =         140000. lbs
```

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
1020.000	0.10000000	244128.90299	8811.59112
969.000	0.10000000	243549.56590	8800.65297
918.000	0.10000000	244334.27885	8788.59628
867.000	0.10000000	243995.60969	8776.47935
816.000	0.10000000	244101.20479	8765.51904
765.000	0.10000000	244203.91005	8754.14305
714.000	0.10000000	244256.20614	8742.68841
663.000	0.10000000	244209.97136	8730.03115
612.000	0.10000000	244225.80288	8718.74881
561.000	0.10000000	244117.93786	8707.06073

This analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Replace\
Name of input data file: 101 & 116 SOH Replace_R-09-015_Abut 5-RW2_fixed.lpd
Name of output file: 101 & 116 SOH Replace_R-09-015_Abut 5-RW2_fixed.lpo
Name of plot output file: 101 & 116 SOH Replace_R-09-015_Abut 5-RW2_fixed.lpp
Name of runtime file: 101 & 116 SOH Replace_R-09-015_Abut 5-RW2_fixed.lpr

---

Time and Date of Analysis

Date: August 26, 2010 Time: 16:22:55

Problem Title

US 101/SR116 SOH (Replace) Abutment 5-RW2_R-09-105 - Free

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length

```
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments            =          170
- Maximum number of iterations allowed =          100
- Deflection tolerance for convergence =   1.0000E-05 in
- Maximum allowable deflection         =   1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and
  soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) =  1


--------------------------------------------------------------------------------
                   Pile Structural Properties and Geometry
--------------------------------------------------------------------------------

Pile Length                                =    1080.00 in

Depth of ground surface below top of pile =    -132.00 in

Slope angle of ground surface              =      26.56 deg.

Structural properties of pile defined using  2 points

Point    Depth         Pile      Moment of       Pile      Modulus of
           X         Diameter     Inertia       Area      Elasticity
           in           in         in**4        Sq.in      lbs/Sq.in
-----  ---------   -----------   ----------   ----------   -----------
  1       0.0000   14.00000000    3201.3000     196.0000      3600000.
  2    1080.0000   14.00000000    3201.3000     196.0000      3600000.

--------------------------------------------------------------------------------
                      Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 14 layers

Layer  1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =     -132.000 in
Distance from top of pile to bottom of layer =        0.001 in
p-y subgrade modulus k for top of soil layer =       90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       90.000 lbs/in**3

Layer  2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =        0.001 in
Distance from top of pile to bottom of layer =      156.000 in
p-y subgrade modulus k for top of soil layer =       90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       90.000 lbs/in**3

Layer  3 is stiff clay without free water
Distance from top of pile to top of layer    =      156.000 in
Distance from top of pile to bottom of layer =      180.000 in
```

```
Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =      180.000 in
Distance from top of pile to bottom of layer =      252.000 in

Layer  5 is stiff clay without free water
Distance from top of pile to top of layer    =      252.000 in
Distance from top of pile to bottom of layer =      324.000 in

Layer  6 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      324.000 in
Distance from top of pile to bottom of layer =      336.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  7 is stiff clay without free water
Distance from top of pile to top of layer    =      336.000 in
Distance from top of pile to bottom of layer =      420.000 in

Layer  8 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      420.000 in
Distance from top of pile to bottom of layer =      570.000 in
p-y subgrade modulus k for top of soil layer =       90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       90.000 lbs/in**3

Layer  9 is stiff clay without free water
Distance from top of pile to top of layer    =      570.000 in
Distance from top of pile to bottom of layer =      702.000 in

Layer 10 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      702.000 in
Distance from top of pile to bottom of layer =      768.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer 11 is stiff clay without free water
Distance from top of pile to top of layer    =      768.000 in
Distance from top of pile to bottom of layer =      900.000 in

Layer 12 is stiff clay without free water
Distance from top of pile to top of layer    =      900.000 in
Distance from top of pile to bottom of layer =      936.000 in

Layer 13 is stiff clay without free water
Distance from top of pile to top of layer    =      936.000 in
Distance from top of pile to bottom of layer =     1044.000 in

Layer 14 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =     1044.000 in
Distance from top of pile to bottom of layer =     1188.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3


(Depth of lowest layer extends  108.00 in below pile tip)
```

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 28 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-132.00	0.07230
2	0.00	0.07230
3	0.00	0.07230
4	156.00	0.07230
5	156.00	0.06940
6	180.00	0.06940
7	180.00	0.06940
8	252.00	0.06940
9	252.00	0.03330
10	324.00	0.03330
11	324.00	0.03620
12	336.00	0.03620
13	336.00	0.03910
14	420.00	0.03910
15	420.00	0.03620
16	570.00	0.03620
17	570.00	0.03620
18	702.00	0.03620
19	702.00	0.03910
20	768.00	0.03910
21	768.00	0.02750
22	900.00	0.02750
23	900.00	0.02750
24	936.00	0.02750
25	936.00	0.03620
26	1044.00	0.03620
27	1044.00	0.04200
28	1188.00	0.04200

Shear Strength of Soils

Shear strength parameters with depth defined using 28 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-132.000	0.00000	32.00	------	------
2	0.001	0.00000	32.00	------	------
3	0.001	0.00000	32.00	------	------
4	156.000	0.00000	32.00	------	------
5	156.000	6.94000	0.00	0.01000	0.0
6	180.000	6.94000	0.00	0.01000	0.0
7	180.000	6.25000	0.00	0.01000	0.0
8	252.000	6.25000	0.00	0.01000	0.0
9	252.000	6.25000	0.00	0.01000	0.0
10	324.000	6.25000	0.00	0.01000	0.0

11	324.000	0.00000	32.00	------	------
12	336.000	0.00000	32.00	------	------
13	336.000	6.25000	0.00	0.01000	0.0
14	420.000	6.25000	0.00	0.01000	0.0
15	420.000	0.00000	38.00	------	------
16	570.000	0.00000	38.00	------	------
17	570.000	11.11000	0.00	0.00700	0.0
18	702.000	11.11000	0.00	0.00700	0.0
19	702.000	0.00000	38.00	------	------
20	768.000	0.00000	38.00	------	------
21	768.000	10.07000	0.00	0.00700	0.0
22	900.000	10.07000	0.00	0.00700	0.0
23	900.000	4.86000	0.00	0.01500	0.0
24	936.000	4.86000	0.00	0.01500	0.0
25	936.000	6.25000	0.00	0.01000	0.0
26	1044.000	6.25000	0.00	0.01000	0.0
27	1044.000	0.00000	38.00	------	------
28	1188.000	0.00000	38.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.100 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 140000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.250 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 140000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.500 in
Slope at pile head = 0.000 in/in

```
Axial load at pile head     =      140000.000 lbs

Load Case Number  4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           0.750 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      140000.000 lbs

Load Case Number  5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           1.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      140000.000 lbs

Load Case Number  6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           1.500 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      140000.000 lbs

Load Case Number  7

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           2.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      140000.000 lbs

Load Case Number  8

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           3.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      140000.000 lbs

Load Case Number  9

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           4.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      140000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           5.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      140000.000 lbs
--------------------------------------------------------------------------------
                          Summary of Pile Response(s)
--------------------------------------------------------------------------------

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment,          y = pile-head displacment in
```

```
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad
```

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
5	y= 0.100000	S= 0.000	140000.	0.1000000	-833388.	26407.0032
5	y= 0.250000	S= 0.000	140000.	0.2500000	-1788297.	51884.0960
5	y= 0.500000	S= 0.000	140000.	0.5000000	-3201388.	87997.8553
5	y= 0.750000	S= 0.000	140000.	0.7500000	-4453757.	114453.
5	y= 1.000000	S= 0.000	140000.	1.0000000	-5506696.	132569.
5	y= 1.500	S= 0.000	140000.	1.5000	-7275117.	159137.
5	y= 2.000	S= 0.000	140000.	2.0000	-8782548.	179358.
5	y= 3.000	S= 0.000	140000.	3.0000	-1.1368E+07	210658.
5	y= 4.000	S= 0.000	140000.	4.0000	-1.3615E+07	235540.
5	y= 5.000	S= 0.000	140000.	5.0000	-1.5622E+07	256519.

Pile-head Deflection vs. Pile Length

Boundary Condition Type 5, Deflection and Slope

```
Deflection =         0.10000  in
Slope      =         0.00000
Axial Load =         140000. lbs
```

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
1080.000	0.10000000	-833387.79345	26407.00316
1026.000	0.10000000	-833994.82758	26414.40405
972.000	0.10000000	-834227.45931	26408.46066
918.000	0.10000000	-834696.49016	26415.33034
864.000	0.10000000	-835069.99785	26415.58033
810.000	0.10000000	-835458.18216	26417.89849
756.000	0.10000000	-835817.74233	26416.71364
702.000	0.10000000	-836129.64270	26421.16519
648.000	0.10000000	-836496.92610	26424.61840
594.000	0.10000000	-836737.69910	26423.83045

This analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Replace\
Name of input data file: 101 & 116 SOH Replace_R-09-015_Abut 5-RW2_free.lpd
Name of output file: 101 & 116 SOH Replace_R-09-015_Abut 5-RW2_free.lpo
Name of plot output file: 101 & 116 SOH Replace_R-09-015_Abut 5-RW2_free.lpp
Name of runtime file: 101 & 116 SOH Replace_R-09-015_Abut 5-RW2_free.lpr

---

Time and Date of Analysis

Date: August 26, 2010 Time: 16:24:20

Problem Title

US 101/SR116 SOH (Replace) Abutment 5-RW2_R-09-105 - Free

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length

- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 170
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 1080.00 in

Depth of ground surface below top of pile = -132.00 in

Slope angle of ground surface = 26.56 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	14.00000000	3201.3000	196.0000	3600000.
2	1080.0000	14.00000000	3201.3000	196.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 14 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = -132.000 in
Distance from top of pile to bottom of layer = 0.001 in
p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 0.001 in
Distance from top of pile to bottom of layer = 156.000 in
p-y subgrade modulus k for top of soil layer = 90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 90.000 lbs/in**3

Layer 3 is stiff clay without free water
Distance from top of pile to top of layer = 156.000 in

```
Distance from top of pile to bottom of layer =      180.000 in

Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =      180.000 in
Distance from top of pile to bottom of layer =      252.000 in

Layer  5 is stiff clay without free water
Distance from top of pile to top of layer    =      252.000 in
Distance from top of pile to bottom of layer =      324.000 in

Layer  6 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      324.000 in
Distance from top of pile to bottom of layer =      336.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  7 is stiff clay without free water
Distance from top of pile to top of layer    =      336.000 in
Distance from top of pile to bottom of layer =      420.000 in

Layer  8 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      420.000 in
Distance from top of pile to bottom of layer =      570.000 in
p-y subgrade modulus k for top of soil layer =       90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       90.000 lbs/in**3

Layer  9 is stiff clay without free water
Distance from top of pile to top of layer    =      570.000 in
Distance from top of pile to bottom of layer =      702.000 in

Layer 10 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      702.000 in
Distance from top of pile to bottom of layer =      768.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer 11 is stiff clay without free water
Distance from top of pile to top of layer    =      768.000 in
Distance from top of pile to bottom of layer =      900.000 in

Layer 12 is stiff clay without free water
Distance from top of pile to top of layer    =      900.000 in
Distance from top of pile to bottom of layer =      936.000 in

Layer 13 is stiff clay without free water
Distance from top of pile to top of layer    =      936.000 in
Distance from top of pile to bottom of layer =     1044.000 in

Layer 14 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =     1044.000 in
Distance from top of pile to bottom of layer =     1188.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3


(Depth of lowest layer extends  108.00 in below pile tip)
```

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 28 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-132.00	0.07230
2	0.00	0.07230
3	0.00	0.07230
4	156.00	0.07230
5	156.00	0.06940
6	180.00	0.06940
7	180.00	0.06940
8	252.00	0.06940
9	252.00	0.03330
10	324.00	0.03330
11	324.00	0.03620
12	336.00	0.03620
13	336.00	0.03910
14	420.00	0.03910
15	420.00	0.03620
16	570.00	0.03620
17	570.00	0.03620
18	702.00	0.03620
19	702.00	0.03910
20	768.00	0.03910
21	768.00	0.02750
22	900.00	0.02750
23	900.00	0.02750
24	936.00	0.02750
25	936.00	0.03620
26	1044.00	0.03620
27	1044.00	0.04200
28	1188.00	0.04200

Shear Strength of Soils

Shear strength parameters with depth defined using 28 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-132.000	0.00000	32.00	------	------
2	0.001	0.00000	32.00	------	------
3	0.001	0.00000	32.00	------	------
4	156.000	0.00000	32.00	------	------
5	156.000	6.94000	0.00	0.01000	0.0
6	180.000	6.94000	0.00	0.01000	0.0
7	180.000	6.25000	0.00	0.01000	0.0
8	252.000	6.25000	0.00	0.01000	0.0
9	252.000	6.25000	0.00	0.01000	0.0

10	324.000	6.25000	0.00	0.01000	0.0
11	324.000	0.00000	32.00	------	------
12	336.000	0.00000	32.00	------	------
13	336.000	6.25000	0.00	0.01000	0.0
14	420.000	6.25000	0.00	0.01000	0.0
15	420.000	0.00000	38.00	------	------
16	570.000	0.00000	38.00	------	------
17	570.000	11.11000	0.00	0.00700	0.0
18	702.000	11.11000	0.00	0.00700	0.0
19	702.000	0.00000	38.00	------	------
20	768.000	0.00000	38.00	------	------
21	768.000	10.07000	0.00	0.00700	0.0
22	900.000	10.07000	0.00	0.00700	0.0
23	900.000	4.86000	0.00	0.01500	0.0
24	936.000	4.86000	0.00	0.01500	0.0
25	936.000	6.25000	0.00	0.01000	0.0
26	1044.000	6.25000	0.00	0.01000	0.0
27	1044.000	0.00000	38.00	------	------
28	1188.000	0.00000	38.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.100 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 140000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.250 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 140000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.500 in

```
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs

Load Case Number  4

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           0.750 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs

Load Case Number  5

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           1.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs

Load Case Number  6

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           1.500 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs

Load Case Number  7

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           2.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs

Load Case Number  8

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           3.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs

Load Case Number  9

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           4.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           5.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs

--------------------------------------------------------------------------------
                          Summary of Pile Response(s)
--------------------------------------------------------------------------------

Definition of Symbols for Pile-Head Loading Conditions:
```

```
Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad
```

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= 0.100000	M= 0.000	140000.	0.1000000	290542.	12712.7294
4	y= 0.250000	M= 0.000	140000.	0.2500000	628818.	24723.1593
4	y= 0.500000	M= 0.000	140000.	0.5000000	1121899.	41480.5792
4	y= 0.750000	M= 0.000	140000.	0.7500000	1577577.	54450.8986
4	y= 1.000000	M= 0.000	140000.	1.0000000	1994178.	63438.0976
4	y= 1.500	M= 0.000	140000.	1.5000	2740214.	76357.9424
4	y= 2.000	M= 0.000	140000.	2.0000	3381486.	85911.0639
4	y= 3.000	M= 0.000	140000.	3.0000	4484839.	100179.
4	y= 4.000	M= 0.000	140000.	4.0000	5399737.	110861.
4	y= 5.000	M= 0.000	140000.	5.0000	6210526.	119464.

Pile-head Deflection vs. Pile Length

Boundary Condition Type 4, Deflection and Moment

```
Deflection =         0.10000  in
Moment     =              0. in-lbs
Axial Load =         140000. lbs
```

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
1080.000	0.10000000	290541.76833	12712.72935
1026.000	0.10000000	291568.27537	12693.17513
972.000	0.10000000	291237.17703	12671.68886
918.000	0.10000000	291512.00897	12652.51319
864.000	0.10000000	291248.10125	12631.41479
810.000	0.10000000	291669.46757	12612.05151
756.000	0.10000000	291325.10731	12588.91380
702.000	0.10000000	291219.60888	12571.10820
648.000	0.10000000	291299.79730	12550.56181
594.000	0.10000000	291453.17597	12529.81855

This analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Widen\
Name of input data file: 101 & 116 SOH Widen_R-09-015_Abut 6 RW_fixed.lpd
Name of output file: 101 & 116 SOH Widen_R-09-015_Abut 6 RW_fixed.lpo
Name of plot output file: 101 & 116 SOH Widen_R-09-015_Abut 6 RW_fixed.lpp
Name of runtime file: 101 & 116 SOH Widen_R-09-015_Abut 6 RW_fixed.lpr

---

Time and Date of Analysis

Date: August 27, 2010 Time: 11:28:43

Problem Title

US 101/SR116 SOH (Widen) Abut6 RW_R-09-015 - Free

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length

- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 930.00 in

Depth of ground surface below top of pile = -48.00 in

Slope angle of ground surface = 26.56 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	14.00000000	3201.3000	196.0000	3600000.
2	930.0000	14.00000000	3201.3000	196.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 12 layers

Layer 1 is stiff clay without free water
Distance from top of pile to top of layer = -48.000 in
Distance from top of pile to bottom of layer = 66.000 in

Layer 2 is stiff clay without free water
Distance from top of pile to top of layer = 66.000 in
Distance from top of pile to bottom of layer = 138.000 in

Layer 3 is stiff clay without free water
Distance from top of pile to top of layer = 138.000 in
Distance from top of pile to bottom of layer = 210.000 in

Layer 4 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 210.000 in

```
Distance from top of pile to bottom of layer =      222.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  5 is stiff clay without free water
Distance from top of pile to top of layer    =      222.000 in
Distance from top of pile to bottom of layer =      306.000 in

Layer  6 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      306.000 in
Distance from top of pile to bottom of layer =      456.000 in
p-y subgrade modulus k for top of soil layer =       90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       90.000 lbs/in**3

Layer  7 is stiff clay without free water
Distance from top of pile to top of layer    =      456.000 in
Distance from top of pile to bottom of layer =      588.000 in

Layer  8 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      588.000 in
Distance from top of pile to bottom of layer =      654.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer  9 is stiff clay without free water
Distance from top of pile to top of layer    =      654.000 in
Distance from top of pile to bottom of layer =      786.000 in

Layer 10 is stiff clay without free water
Distance from top of pile to top of layer    =      786.000 in
Distance from top of pile to bottom of layer =      822.000 in

Layer 11 is stiff clay without free water
Distance from top of pile to top of layer    =      822.000 in
Distance from top of pile to bottom of layer =      930.000 in

Layer 12 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      930.000 in
Distance from top of pile to bottom of layer =     1074.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3


(Depth of lowest layer extends  144.00 in below pile tip)

--------------------------------------------------------------------------------
                   Effective Unit Weight of Soil vs. Depth
--------------------------------------------------------------------------------

Effective unit weight of soil with depth defined using 24 points

Point        Depth X    Eff. Unit Weight
 No.           in          lbs/in**3
-----      ----------   ----------------
  1           -48.00        0.06940
  2            66.00        0.06940
  3            66.00        0.06940
```

4	138.00	0.06940
5	138.00	0.03330
6	210.00	0.03330
7	210.00	0.03620
8	222.00	0.03620
9	222.00	0.03910
10	306.00	0.03910
11	306.00	0.03620
12	456.00	0.03620
13	456.00	0.03620
14	588.00	0.03620
15	588.00	0.03910
16	654.00	0.03910
17	654.00	0.02750
18	786.00	0.02750
19	786.00	0.02750
20	822.00	0.02750
21	822.00	0.03620
22	930.00	0.03620
23	930.00	0.04200
24	1074.00	0.04200

Shear Strength of Soils

Shear strength parameters with depth defined using 24 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-48.000	6.94000	0.00	0.01000	0.0
2	66.000	6.94000	0.00	0.01000	0.0
3	66.000	6.25000	0.00	0.01000	0.0
4	138.000	6.25000	0.00	0.01000	0.0
5	138.000	6.25000	0.00	0.01000	0.0
6	210.000	6.25000	0.00	0.01000	0.0
7	210.000	0.00000	32.00	------	------
8	222.000	0.00000	32.00	------	------
9	222.000	6.25000	0.00	0.01000	0.0
10	306.000	6.25000	0.00	0.01000	0.0
11	306.000	0.00000	38.00	------	------
12	456.000	0.00000	38.00	------	------
13	456.000	11.11000	0.00	0.00700	0.0
14	588.000	11.11000	0.00	0.00700	0.0
15	588.000	0.00000	38.00	------	------
16	654.000	0.00000	38.00	------	------
17	654.000	10.07000	0.00	0.00700	0.0
18	786.000	10.07000	0.00	0.00700	0.0
19	786.000	4.86000	0.00	0.01500	0.0
20	822.000	4.86000	0.00	0.01500	0.0
21	822.000	6.25000	0.00	0.01000	0.0
22	930.000	6.25000	0.00	0.01000	0.0
23	930.000	0.00000	38.00	------	------
24	1074.000	0.00000	38.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.100 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 140000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.250 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 140000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.500 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 140000.000 lbs

Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.750 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 140000.000 lbs

Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 1.000 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 140000.000 lbs

Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 1.500 in

```
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      140000.000 lbs

Load Case Number  7

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           2.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      140000.000 lbs

Load Case Number  8

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           3.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      140000.000 lbs

Load Case Number  9

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           4.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      140000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head     =           5.000 in
Slope at pile head          =           0.000 in/in
Axial load at pile head     =      140000.000 lbs
--------------------------------------------------------------------------------
                          Summary of Pile Response(s)
--------------------------------------------------------------------------------

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad
```

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
5	y= 0.100000	S= 0.000	140000.	0.1000000	-562424.	14440.2956
5	y= 0.250000	S= 0.000	140000.	0.2500000	-1014994.	21968.8737
5	y= 0.500000	S= 0.000	140000.	0.5000000	-1590110.	30214.7490
5	y= 0.750000	S= 0.000	140000.	0.7500000	-2068548.	36418.2786
5	y= 1.000000	S= 0.000	140000.	1.0000000	-2493497.	41580.8196
5	y= 1.500	S= 0.000	140000.	1.5000	-3239611.	50061.2449
5	y= 2.000	S= 0.000	140000.	2.0000	-3909182.	57184.2267
5	y= 3.000	S= 0.000	140000.	3.0000	-5108183.	69128.6111
5	y= 4.000	S= 0.000	140000.	4.0000	-6190839.	79247.3833
5	y= 5.000	S= 0.000	140000.	5.0000	-7195849.	88220.4158

Pile-head Deflection vs. Pile Length

Boundary Condition Type 5, Deflection and Slope

Deflection = 0.10000 in
Slope = 0.00000
Axial Load = 140000. lbs

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
930.000	0.10000000	-562424.35045	14440.29563
883.500	0.10000000	-560497.96350	14382.73690
837.000	0.10000000	-558484.68747	14320.34958
790.500	0.10000000	-561839.84546	14402.87469
744.000	0.10000000	-559560.84131	14334.04479
697.500	0.10000000	-561928.68718	14391.42227
651.000	0.10000000	-563576.33919	14428.19129
604.500	0.10000000	-560625.63664	14343.69838
558.000	0.10000000	-561426.31127	14359.16370
511.500	0.10000000	-561476.26718	14355.67885

This analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\101&116 SOH Widen\
Name of input data file: 101 & 116 SOH Widen_R-09-015_Abut 6 RW_free.lpd
Name of output file: 101 & 116 SOH Widen_R-09-015_Abut 6 RW_free.lpo
Name of plot output file: 101 & 116 SOH Widen_R-09-015_Abut 6 RW_free.lpp
Name of runtime file: 101 & 116 SOH Widen_R-09-015_Abut 6 RW_free.lpr

---

Time and Date of Analysis

Date: August 27, 2010 Time: 11:29:23

Problem Title

US 101/SR116 SOH (Widen) Abut6 RW_R-09-015 - Free

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length

- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 930.00 in

Depth of ground surface below top of pile = -48.00 in

Slope angle of ground surface = 26.56 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	14.00000000	3201.3000	196.0000	3600000.
2	930.0000	14.00000000	3201.3000	196.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 12 layers

Layer 1 is stiff clay without free water
Distance from top of pile to top of layer = -48.000 in
Distance from top of pile to bottom of layer = 66.000 in

Layer 2 is stiff clay without free water
Distance from top of pile to top of layer = 66.000 in
Distance from top of pile to bottom of layer = 138.000 in

Layer 3 is stiff clay without free water
Distance from top of pile to top of layer = 138.000 in
Distance from top of pile to bottom of layer = 210.000 in

Layer 4 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 210.000 in

```
Distance from top of pile to bottom of layer =      222.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  5 is stiff clay without free water
Distance from top of pile to top of layer    =      222.000 in
Distance from top of pile to bottom of layer =      306.000 in

Layer  6 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      306.000 in
Distance from top of pile to bottom of layer =      456.000 in
p-y subgrade modulus k for top of soil layer =       90.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       90.000 lbs/in**3

Layer  7 is stiff clay without free water
Distance from top of pile to top of layer    =      456.000 in
Distance from top of pile to bottom of layer =      588.000 in

Layer  8 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      588.000 in
Distance from top of pile to bottom of layer =      654.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3

Layer  9 is stiff clay without free water
Distance from top of pile to top of layer    =      654.000 in
Distance from top of pile to bottom of layer =      786.000 in

Layer 10 is stiff clay without free water
Distance from top of pile to top of layer    =      786.000 in
Distance from top of pile to bottom of layer =      822.000 in

Layer 11 is stiff clay without free water
Distance from top of pile to top of layer    =      822.000 in
Distance from top of pile to bottom of layer =      930.000 in

Layer 12 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      930.000 in
Distance from top of pile to bottom of layer =     1074.000 in
p-y subgrade modulus k for top of soil layer =      125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      125.000 lbs/in**3


(Depth of lowest layer extends  144.00 in below pile tip)


--------------------------------------------------------------------------------
                    Effective Unit Weight of Soil vs. Depth
--------------------------------------------------------------------------------

Effective unit weight of soil with depth defined using 24 points

Point        Depth X    Eff. Unit Weight
 No.           in          lbs/in**3
-----      ----------   ----------------
  1           -48.00        0.06940
  2            66.00        0.06940
```

3	66.00	0.06940
4	138.00	0.06940
5	138.00	0.03330
6	210.00	0.03330
7	210.00	0.03620
8	222.00	0.03620
9	222.00	0.03910
10	306.00	0.03910
11	306.00	0.03620
12	456.00	0.03620
13	456.00	0.03620
14	588.00	0.03620
15	588.00	0.03910
16	654.00	0.03910
17	654.00	0.02750
18	786.00	0.02750
19	786.00	0.02750
20	822.00	0.02750
21	822.00	0.03620
22	930.00	0.03620
23	930.00	0.04200
24	1074.00	0.04200

Shear Strength of Soils

Shear strength parameters with depth defined using 24 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-48.000	6.94000	0.00	0.01000	0.0
2	66.000	6.94000	0.00	0.01000	0.0
3	66.000	6.25000	0.00	0.01000	0.0
4	138.000	6.25000	0.00	0.01000	0.0
5	138.000	6.25000	0.00	0.01000	0.0
6	210.000	6.25000	0.00	0.01000	0.0
7	210.000	0.00000	32.00	------	------
8	222.000	0.00000	32.00	------	------
9	222.000	6.25000	0.00	0.01000	0.0
10	306.000	6.25000	0.00	0.01000	0.0
11	306.000	0.00000	38.00	------	------
12	456.000	0.00000	38.00	------	------
13	456.000	11.11000	0.00	0.00700	0.0
14	588.000	11.11000	0.00	0.00700	0.0
15	588.000	0.00000	38.00	------	------
16	654.000	0.00000	38.00	------	------
17	654.000	10.07000	0.00	0.00700	0.0
18	786.000	10.07000	0.00	0.00700	0.0
19	786.000	4.86000	0.00	0.01500	0.0
20	822.000	4.86000	0.00	0.01500	0.0
21	822.000	6.25000	0.00	0.01000	0.0
22	930.000	6.25000	0.00	0.01000	0.0
23	930.000	0.00000	38.00	------	------
24	1074.000	0.00000	38.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.100 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 140000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.250 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 140000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.500 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 140000.000 lbs

Load Case Number 4

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.750 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 140000.000 lbs

Load Case Number 5

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 1.000 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 140000.000 lbs

Load Case Number 6

Pile-head boundary conditions are Displacement and Moment (BC Type 4)

```
Deflection at pile head     =           1.500 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs

Load Case Number  7

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           2.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs

Load Case Number  8

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           3.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs

Load Case Number  9

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           4.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs

Load Case Number 10

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head     =           5.000 in
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =      140000.000 lbs
-------------------------------------------------------------------------------
                          Summary of Pile Response(s)
-------------------------------------------------------------------------------

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad
```

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= 0.100000	M= 0.000	140000.	0.1000000	225959.	7463.9880
4	y= 0.250000	M= 0.000	140000.	0.2500000	407133.	11259.4393
4	y= 0.500000	M= 0.000	140000.	0.5000000	634831.	15324.3832
4	y= 0.750000	M= 0.000	140000.	0.7500000	827377.	18351.8814
4	y= 1.000000	M= 0.000	140000.	1.0000000	995676.	20845.9511
4	y= 1.500	M= 0.000	140000.	1.5000	1301935.	24940.3844
4	y= 2.000	M= 0.000	140000.	2.0000	1573231.	28307.9435
4	y= 3.000	M= 0.000	140000.	3.0000	2057528.	33827.3060
4	y= 4.000	M= 0.000	140000.	4.0000	2490451.	38318.4462
4	y= 5.000	M= 0.000	140000.	5.0000	2881412.	42174.4843

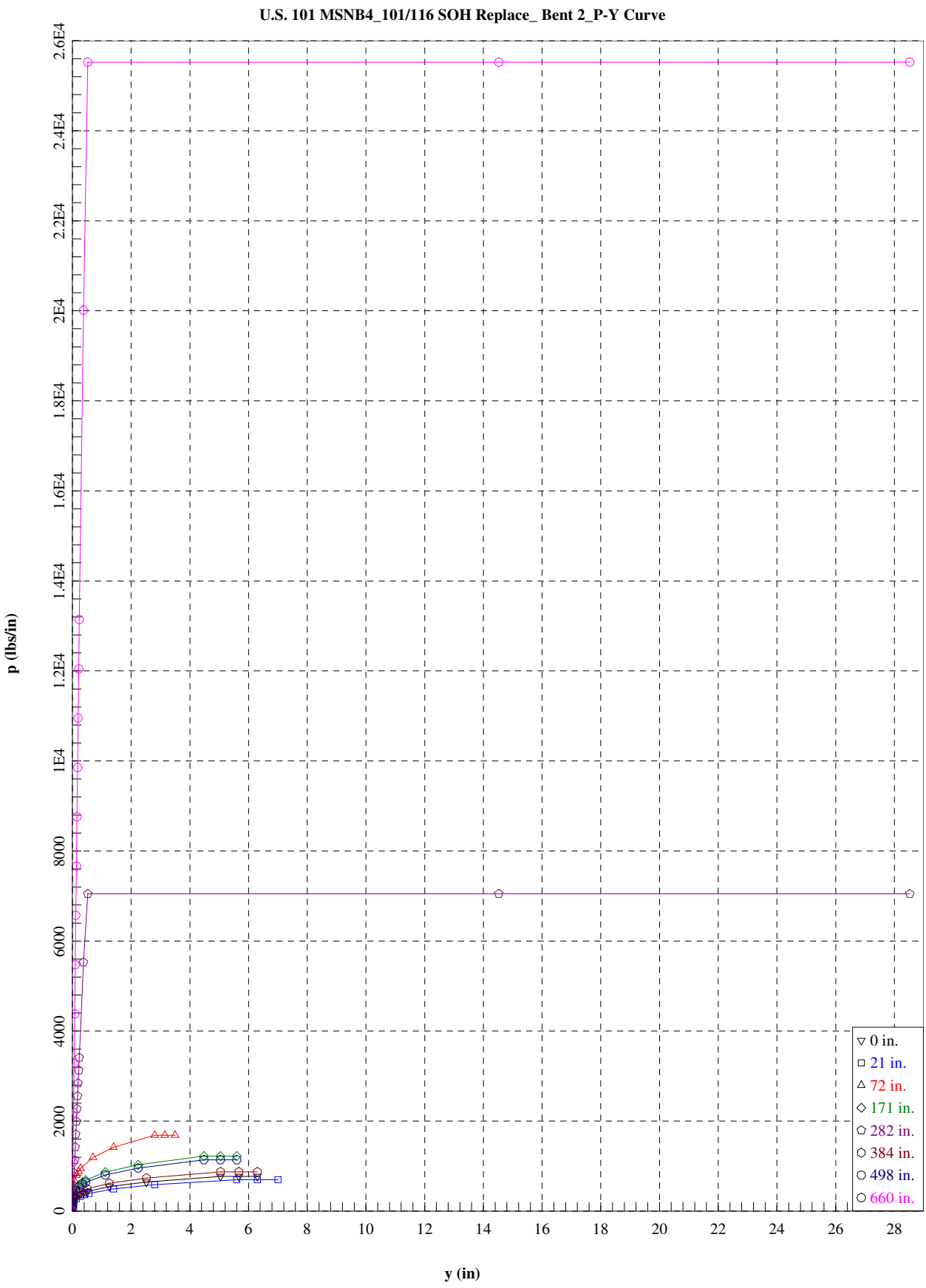
Pile-head Deflection vs. Pile Length

Boundary Condition Type 4, Deflection and Moment

Deflection = 0.10000 in
Moment = 0. in-lbs
Axial Load = 140000. lbs

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
930.000	0.10000000	225958.73012	7463.98798
883.500	0.10000000	223992.23210	7441.82577
837.000	0.10000000	223589.56027	7421.82552
790.500	0.10000000	225010.89608	7452.53248
744.000	0.10000000	223908.07118	7429.53771
697.500	0.10000000	224695.42388	7445.73411
651.000	0.10000000	225671.20325	7456.54023
604.500	0.10000000	223609.47853	7430.29277
558.000	0.10000000	223989.53796	7435.09720
511.500	0.10000000	224027.54808	7434.18775

This analysis ended normally.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p (lbs/in)
y (in)
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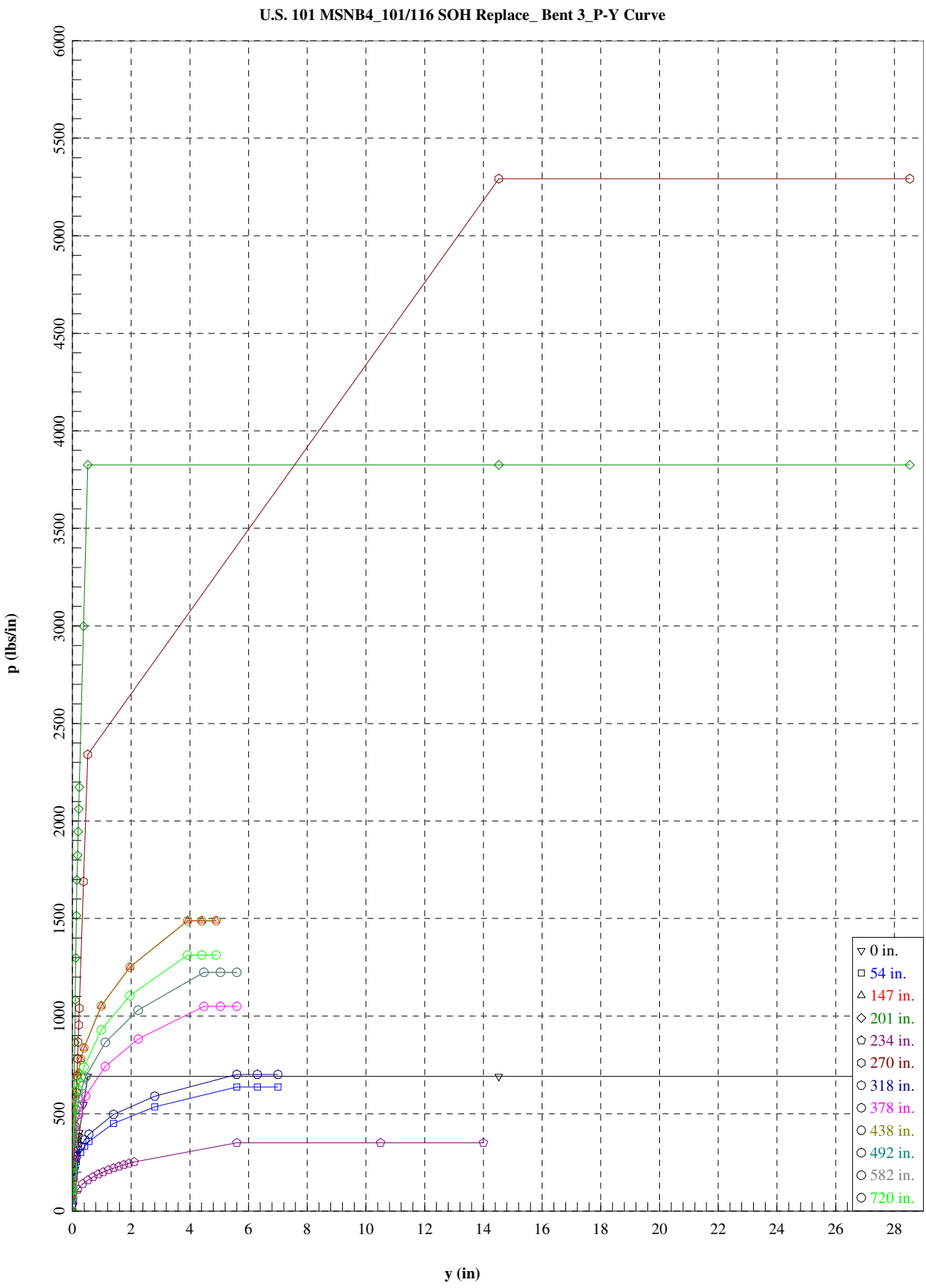
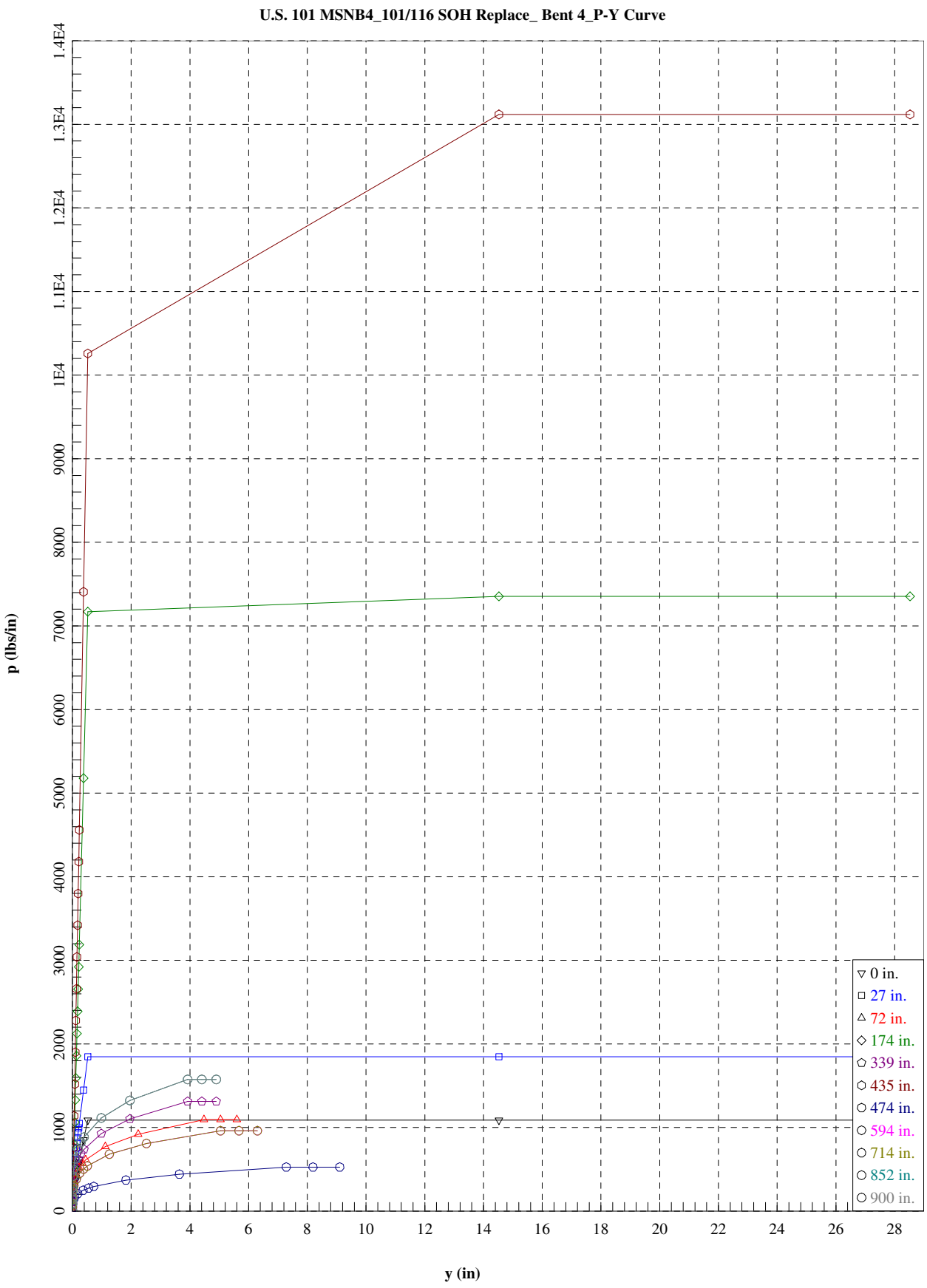
2000
4000
6000
8000
1E4
1.2E4
1.4E4
1.6E4
1.8E4
2E4
2.2E4
2.4E4
2.6E4
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
0 in.
21 in.
72 in.
171 in.
282 in.
384 in.
498 in.
660 in.


U.S. 101 MSNB4_101/116 SOH Replace_ Bent 3_P-Y Curve
p (lbs/in)
y (in)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
0 in.
54 in.
147 in.
201 in.
234 in.
270 in.
318 in.
378 in.
438 in.
492 in.
582 in.
720 in.


U.S. 101 MSNB4_101/116 SOH Replace_ Bent 4_P-Y Curve
p (lbs/in)
y (in)
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1000
2000
3000
4000
5000
6000
7000
8000
9000
1E4
1.1E4
1.2E4
1.3E4
1.4E4
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
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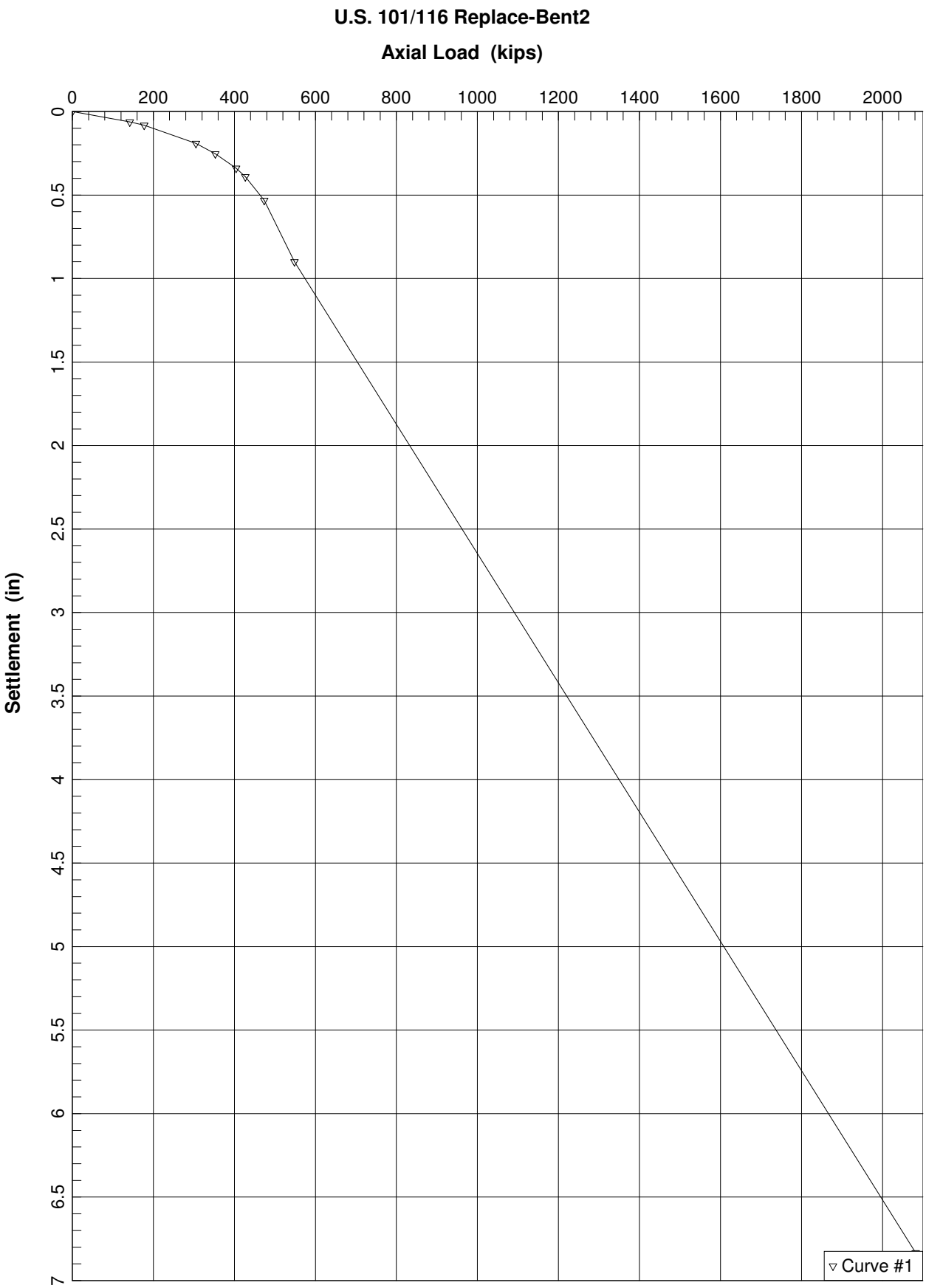
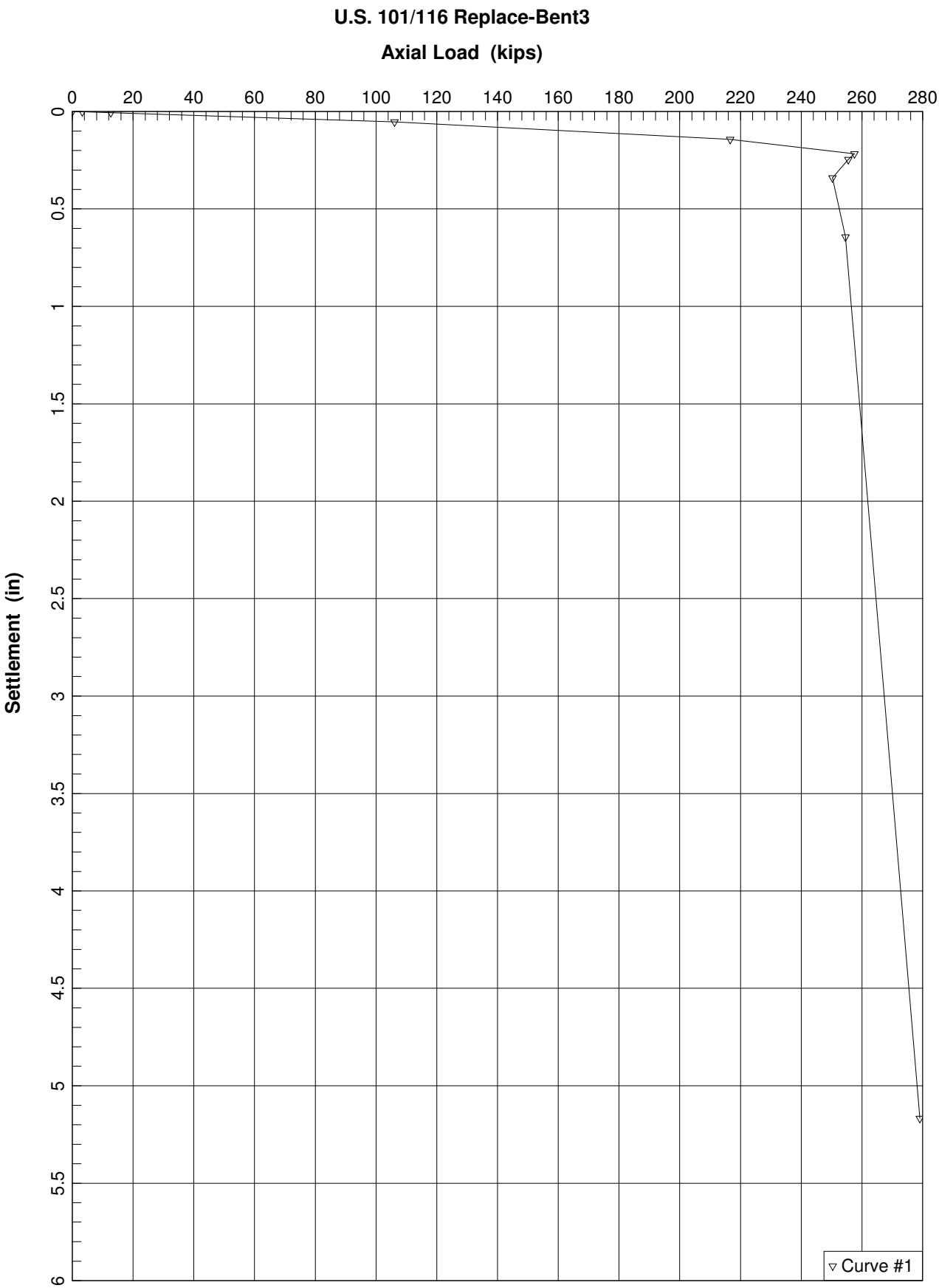
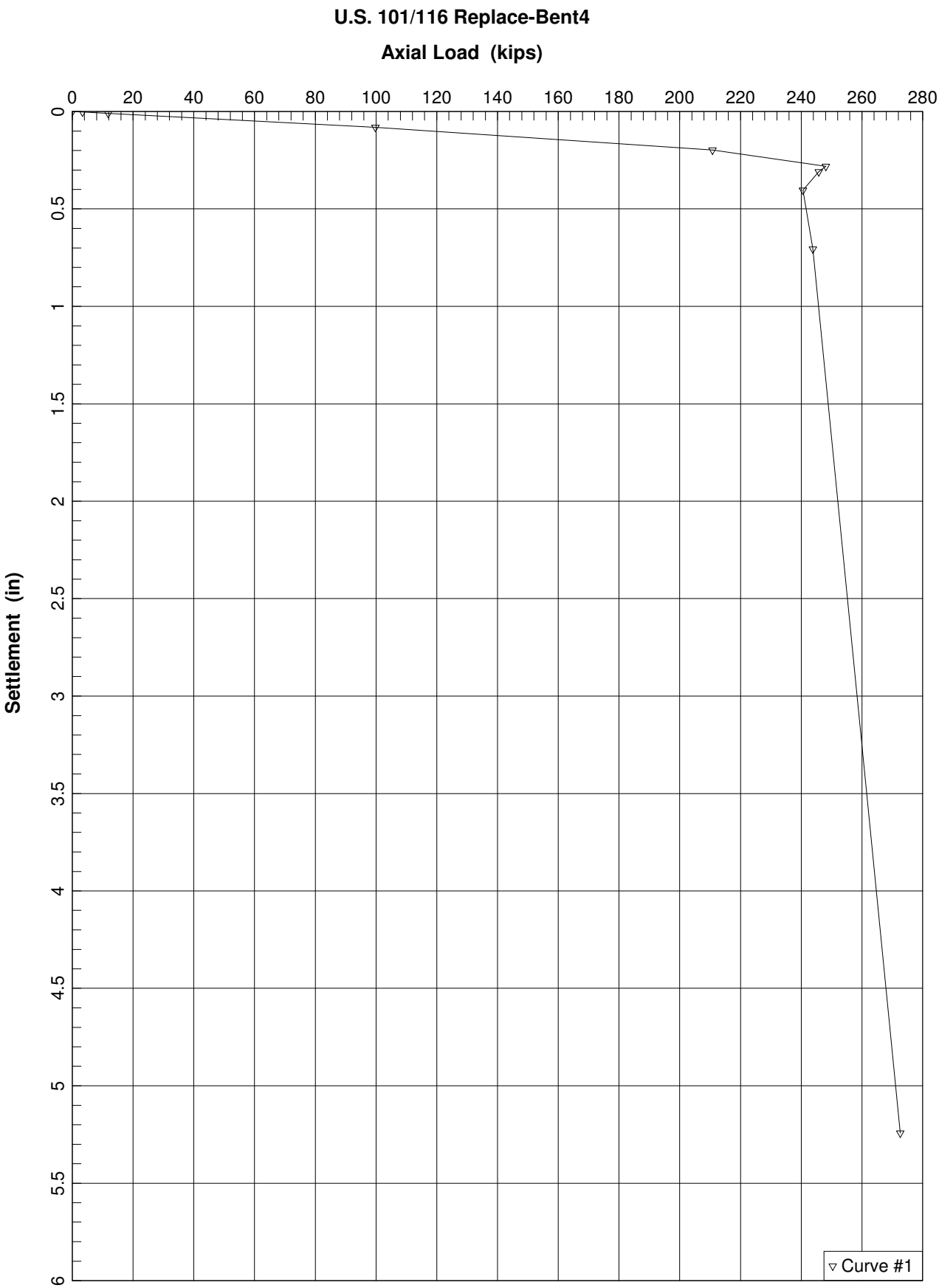
435 in.
474 in.
594 in.
714 in.
852 in.
900 in.


U.S. 101/116 Replace-Bent2
Axial Load (kips)
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Settlement (in)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
Curve #1


U.S. 101/116 Replace-Bent3
Axial Load (kips)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
Settlement (in)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
Curve #1


U.S. 101/116 Replace-Bent4
Axial Load (kips)
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20
40
60
80
100
120
140
160
180
200
220
240
260
280
Settlement (in)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
Curve #1

```
=====================================================
CONSOL - 1d Consolidation Analysis Program
         Version 3.0
         Virginia Tech, Department of Civil Engineering
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\Roadway\Sta194_116NAbutment\Consol3\101 @ sta 194-20_OC_change_32lay_
11-19.dat

       Title     : US101 MSN B4_101/116_NC

       ****  C O N T R O L   D A T A  ****

       Number of compressible units  ..............................
5
       Number of soil layers  .....................................
32
       Number of different soils  .................................
4
       Elevation of the ground surface  ...........................
16.00
       Elevation of the top of the compressible soil mass .........
16.00
       Ground water elevation  ....................................
5.00
       Unit weight of water  ......................................
62.40
       Moist unit wt. of soil btwn grn. surf. & comp. soil mass ...
125.00
       Satur. unit wt. of soil btwn grn. surf. & comp. soil mass ..
130.00


       ****  U N I T  B O U N D A R Y  D A T A  ****

        Unit         Top         Bottom       Drainage
       Number      Boundary     Boundary     Condition

          1           1           13              2
          2          13           14              2
          3          14           21              2
          4          21           22              2
          5          22           33              2


       ****  S O I L  P R O P E R T Y  D A T A  ****

       Soil      Unit       Void
```

Type	Weight	Ratio	Cc	Ccs	Cv	Cvs
1	125.00	0.67	0.24	0.03	40.00	130.00
2	125.00	0.59	0.00	0.00	100.00	200.00
3	125.00	0.67	0.28	0.04	40.00	130.00
4	125.00	0.69	0.31	0.05	16.00	43.00

**** S U B L A Y E R D A T A ****

Layer	Center Elev	Bottom Elev	Thick	Overbn Pressure	Precons Pressure	Soil Type
1	15.50	15.00	1.00	62.50	5000.00	1
2	14.50	14.00	1.00	187.50	5000.00	1
3	13.00	12.00	2.00	375.00	5000.00	1
4	10.50	9.00	3.00	687.50	5000.00	1
5	7.50	6.00	3.00	1062.50	5000.00	1
6	4.50	3.00	3.00	1406.30	5000.00	1
7	1.50	0.00	3.00	1594.10	5000.00	1
8	-1.50	-3.00	3.00	1781.90	5000.00	1
9	-4.50	-6.00	3.00	1969.70	5000.00	1
10	-6.50	-7.00	1.00	2094.90	5000.00	1
11	-7.50	-8.00	1.00	2157.50	5000.00	1
12	-8.50	-9.00	1.00	2220.10	5000.00	1
13	-15.25	-21.50	12.50	2642.65	8000.00	2
14	-22.00	-22.50	1.00	3065.20	9300.00	3
15	-23.00	-23.50	1.00	3127.80	9300.00	3
16	-24.00	-24.50	1.00	3190.40	9300.00	3
17	-26.00	-27.50	3.00	3315.60	9300.00	3
18	-29.00	-30.50	3.00	3503.40	9300.00	3
19	-31.00	-31.50	1.00	3628.60	9300.00	3
20	-32.00	-32.50	1.00	3691.20	9300.00	3
21	-35.25	-38.00	5.50	3894.65	10000.00	2
22	-38.50	-39.00	1.00	4098.10	11000.00	4
23	-39.50	-40.00	1.00	4160.70	11000.00	4
24	-40.50	-41.00	1.00	4223.30	11000.00	4
25	-42.50	-44.00	3.00	4348.50	11000.00	4
26	-45.50	-47.00	3.00	4536.30	11000.00	4
27	-48.50	-50.00	3.00	4724.10	11000.00	4
28	-51.50	-53.00	3.00	4911.90	11000.00	4
29	-54.50	-56.00	3.00	5099.70	11000.00	4
30	-57.50	-59.00	3.00	5287.50	11000.00	4
31	-59.50	-60.00	1.00	5412.70	11000.00	4
32	-60.50	-61.00	1.00	5475.30	11000.00	4

**** Number of Loadcases to be Analysed: 1

**** L O A D C A S E : 1 ****
**** S p e c i f i e d C h a n g e i n S t r e s s ****

Time intervals: 0.08 0.25 0.50 0.75 1.00 2.00
4.00 8.00 15.00 20.00 30.00

Layer	Overbn Pressure	Stress Change	Precons Pressure	Final Pressure

1	62.50	2638.00	5000.00	2700.50
2	187.50	2612.00	5000.00	2799.50
3	375.00	2525.00	5000.00	2900.00
4	687.50	2448.00	5000.00	3135.50
5	1062.50	2350.00	5000.00	3412.50
6	1406.30	2250.00	5000.00	3656.30
7	1594.10	2250.00	5000.00	3844.10
8	1781.90	2050.00	5000.00	3831.90
9	1969.70	2050.00	5000.00	4019.70
10	2094.90	2000.00	5000.00	4094.90
11	2157.50	2000.00	5000.00	4157.50
12	2220.10	1950.00	5000.00	4170.10
13	2642.65	1790.00	8000.00	4432.65
14	3065.20	1650.00	9300.00	4715.20
15	3127.80	1600.00	9300.00	4727.80
16	3190.40	1600.00	9300.00	4790.40
17	3315.60	1550.00	9300.00	4865.60
18	3503.40	1500.00	9300.00	5003.40
19	3628.60	1450.00	9300.00	5078.60
20	3691.20	1450.00	9300.00	5141.20
21	3894.65	1364.00	10000.00	5258.65
22	4098.10	1330.00	11000.00	5428.10
23	4160.70	1310.00	11000.00	5470.70
24	4223.30	1250.00	11000.00	5473.30
25	4348.50	1250.00	11000.00	5598.50
26	4536.30	1020.00	11000.00	5556.30
27	4724.10	1142.00	11000.00	5866.10
28	4911.90	1110.00	11000.00	6021.90
29	5099.70	1080.00	11000.00	6179.70
30	5287.50	1030.00	11000.00	6317.50
31	5412.70	970.00	11000.00	6382.70
32	5475.30	950.00	11000.00	6425.30

Layer	Thick.	Void Ratio	Initial Pressure	Precons. Pressure	Final Pressure	Ult. Settl.
1	1.00	0.67	62.50	5000.00	2700.50	0.032
2	1.00	0.67	187.50	5000.00	2799.50	0.023
3	2.00	0.67	375.00	5000.00	2900.00	0.035
4	3.00	0.67	687.50	5000.00	3135.50	0.039
5	3.00	0.67	1062.50	5000.00	3412.50	0.030
6	3.00	0.67	1406.30	5000.00	3656.30	0.025
7	3.00	0.67	1594.10	5000.00	3844.10	0.023
8	3.00	0.67	1781.90	5000.00	3831.90	0.020
9	3.00	0.67	1969.70	5000.00	4019.70	0.018
10	1.00	0.67	2094.90	5000.00	4094.90	0.006
11	1.00	0.67	2157.50	5000.00	4157.50	0.006

12	1.00	0.67	2220.10	5000.00	4170.10	0.005
13	12.50	0.59	2642.65	8000.00	4432.65	0.000
14	1.00	0.67	3065.20	9300.00	4715.20	0.005
15	1.00	0.67	3127.80	9300.00	4727.80	0.005
16	1.00	0.67	3190.40	9300.00	4790.40	0.005
17	3.00	0.67	3315.60	9300.00	4865.60	0.013
18	3.00	0.67	3503.40	9300.00	5003.40	0.012
19	1.00	0.67	3628.60	9300.00	5078.60	0.004
20	1.00	0.67	3691.20	9300.00	5141.20	0.004
21	5.50	0.59	3894.65	10000.00	5258.65	0.000
22	1.00	0.69	4098.10	11000.00	5428.10	0.004
23	1.00	0.69	4160.70	11000.00	5470.70	0.004
24	1.00	0.69	4223.30	11000.00	5473.30	0.004
25	3.00	0.69	4348.50	11000.00	5598.50	0.010
26	3.00	0.69	4536.30	11000.00	5556.30	0.008
27	3.00	0.69	4724.10	11000.00	5866.10	0.009
28	3.00	0.69	4911.90	11000.00	6021.90	0.008
29	3.00	0.69	5099.70	11000.00	6179.70	0.008
30	3.00	0.69	5287.50	11000.00	6317.50	0.007
31	1.00	0.69	5412.70	11000.00	6382.70	0.002
32	1.00	0.69	5475.30	11000.00	6425.30	0.002

Ultimate settlement without correction for buoyancy : 0.375

**** Time since load was applied: 0.08 ****

Elevation	Effective Stress	Pore Pressure
15.32	2672.69	27.81
14.35	2657.63	133.87
12.87	2427.04	486.56
10.40	1930.77	1203.33
7.42	1547.86	1864.14
4.43	1556.08	2125.22
1.43	1679.64	2114.46
-1.57	1976.27	1905.63

-4.56	2590.08	1410.87
-6.56	3190.46	910.69
-7.55	3575.94	569.06
-8.55	3982.51	194.16
-15.30	4441.91	0.00
-22.04	4598.04	109.84
-23.04	4418.39	321.91
-24.04	4274.64	509.51
-26.03	4167.82	704.03
-29.02	4373.18	623.97
-31.02	4753.00	331.85
-32.02	5020.12	114.47
-35.26	5280.65	0.00
-38.51	5241.65	184.06
-39.51	4931.15	529.55
-40.51	4675.82	812.48
-42.51	4517.38	1023.62
-45.51	4535.54	1108.76
-48.51	4721.45	1106.15
-51.51	4927.69	1094.71
-54.50	5141.58	1033.12
-57.50	5514.15	793.35
-59.50	5922.21	462.99
-60.50	6263.23	162.07

**** Time since load was applied: 0.25 ****

Elevation	Effective Stress	Pore Pressure
15.24	2691.92	8.58
14.27	2749.12	42.38
12.80	2749.49	164.11
10.33	2649.22	484.88
7.36	2476.57	935.43
4.38	2379.12	1302.18
1.39	2349.32	1444.78
-1.60	2571.83	1310.07
-4.59	3083.80	917.15
-6.58	3543.60	557.55
-7.58	3801.79	343.21
-8.57	4060.48	116.19
-15.32	4441.91	0.00
-22.07	4690.85	17.03
-23.06	4690.28	50.02
-24.06	4704.68	79.48
-26.05	4760.21	111.64
-29.04	4897.29	99.86
-31.03	5031.89	52.97
-32.03	5116.33	18.26
-35.27	5280.65	0.00
-38.52	5327.45	98.26
-39.52	5169.98	290.72
-40.52	5018.18	470.13
-42.51	4805.39	735.62
-45.51	4660.94	983.36
-48.51	4769.31	1058.29
-51.51	4992.81	1029.58
-54.51	5286.68	888.02
-57.51	5736.27	571.22

-59.50	6112.78	272.42
-60.50	6332.79	92.51

**** Time since load was applied: 0.50 ****

Elevation	Effective Stress	Pore Pressure
15.20	2697.03	3.47
14.23	2774.30	17.20
12.76	2846.42	67.18
10.29	2930.69	203.41
7.32	3003.77	408.23
4.35	3084.77	596.53
1.37	3101.61	692.49
-1.62	3231.75	650.15
-4.60	3535.71	465.24
-6.59	3815.19	285.96
-7.59	3968.55	176.45
-8.58	4116.87	59.81
-15.33	4441.91	0.00
-22.08	4706.85	1.04
-23.07	4737.25	3.05
-24.07	4779.30	4.85
-26.06	4865.04	6.81
-29.05	4991.06	6.09
-31.04	5081.62	3.23
-32.03	5133.47	1.11
-35.28	5280.65	0.00
-38.53	5361.13	64.58
-39.53	5267.78	192.92
-40.52	5170.49	317.81
-42.52	5003.68	537.32
-45.52	4856.23	788.07
-48.51	4925.00	902.60
-51.51	5143.14	879.26
-54.51	5453.65	721.05
-57.51	5871.67	435.83
-59.50	6186.59	198.61
-60.50	6358.35	66.95

**** Time since load was applied: 0.75 ****

Elevation	Effective Stress	Pore Pressure
15.18	2698.91	1.59
14.21	2783.61	7.89
12.74	2882.73	30.87
10.27	3040.32	93.78
7.31	3222.71	189.29
4.33	3402.62	278.68
1.35	3468.10	326.00
-1.63	3573.78	308.12
-4.61	3779.40	221.55
-6.60	3964.61	136.54
-7.59	4060.69	84.31
-8.59	4148.09	28.59
-15.34	4441.91	0.00

-22.08	4707.82	0.06
-23.08	4740.12	0.19
-24.07	4783.86	0.30
-26.07	4871.44	0.42
-29.05	4996.78	0.37
-31.04	5084.65	0.20
-32.04	5134.52	0.07
-35.29	5280.65	0.00
-38.54	5376.00	49.71
-39.53	5311.88	148.82
-40.53	5242.11	246.19
-42.53	5117.54	423.46
-45.52	5008.26	636.04
-48.52	5084.21	743.39
-51.51	5293.63	728.77
-54.51	5581.37	593.33
-57.51	5952.79	354.71
-59.50	6224.74	160.46
-60.50	6371.28	54.02

**** Time since load was applied: 1.00 ****

Elevation	Effective Stress	Pore Pressure
15.17	2699.76	0.74
14.20	2787.81	3.69
12.73	2899.16	14.44
10.26	3090.22	43.88
7.30	3323.35	88.65
4.32	3550.63	130.67
1.35	3641.05	153.05
-1.63	3737.08	144.82
-4.62	3896.73	104.22
-6.60	4036.89	64.26
-7.60	4105.32	39.68
-8.59	4163.22	13.46
-15.34	4441.91	0.00
-22.09	4707.88	0.00
-23.08	4740.29	0.01
-24.08	4784.13	0.02
-26.07	4871.83	0.03
-29.06	4997.13	0.02
-31.05	5084.84	0.01
-32.05	5134.58	0.00
-35.29	5280.65	0.00
-38.54	5385.93	39.79
-39.54	5341.52	119.18
-40.54	5290.90	197.40
-42.53	5199.78	341.22
-45.52	5127.98	516.32
-48.52	5219.65	607.96
-51.52	5423.68	598.72
-54.51	5686.71	487.99
-57.51	6015.97	291.53
-59.50	6253.43	131.77
-60.50	6380.94	44.36

**** Time since load was applied: 2.00 ****

Elevation	Effective Stress	Pore Pressure
15.15	2700.47	0.03
14.18	2791.34	0.16
12.71	2912.96	0.64
10.25	3132.16	1.94
7.28	3408.09	3.91
4.31	3675.53	5.77
1.33	3787.34	6.76
-1.65	3875.50	6.40
-4.63	3996.34	4.61
-6.62	4098.31	2.84
-7.61	4143.25	1.75
-8.61	4176.08	0.59
-15.35	4441.91	0.00
-22.10	4707.88	0.00
-23.10	4740.30	0.00
-24.09	4784.15	0.00
-26.08	4871.85	0.00
-29.07	4997.15	0.00
-31.06	5084.85	0.00
-32.06	5134.59	0.00
-35.31	5280.65	0.00
-38.56	5408.30	17.42
-39.55	5408.51	52.19
-40.55	5401.79	86.51
-42.54	5391.01	149.99
-45.53	5416.19	228.11
-48.53	5557.33	270.26
-51.52	5754.71	267.68
-54.51	5955.59	219.11
-57.51	6176.29	131.21
-59.50	6325.83	59.37
-60.50	6405.31	19.99

**** Time since load was applied: 4.00 ****

Elevation	Effective Stress	Pore Pressure
15.14	2700.50	0.00
14.17	2791.50	0.00
12.70	2913.60	0.00
10.24	3134.10	0.00
7.27	3412.00	0.00
4.30	3681.30	0.01
1.32	3794.09	0.01
-1.66	3881.89	0.01
-4.64	4000.95	0.00
-6.62	4101.15	0.00
-7.62	4145.00	0.00
-8.61	4176.67	0.00
-15.36	4441.91	0.00
-22.11	4707.88	0.00
-23.10	4740.30	0.00
-24.10	4784.15	0.00
-26.09	4871.85	0.00
-29.08	4997.15	0.00

-31.07	5084.85	0.00
-32.07	5134.59	0.00
-35.31	5280.65	0.00
-38.56	5422.31	3.40
-39.56	5450.50	10.20
-40.56	5471.40	16.90
-42.55	5511.69	29.31
-45.54	5599.70	44.60
-48.53	5774.74	52.86
-51.52	5970.01	52.39
-54.52	6131.79	42.90
-57.51	6281.80	25.70
-59.50	6373.57	11.63
-60.50	6421.38	3.92

**** Time since load was applied: 8.00 ****

Elevation	Effective Stress	Pore Pressure
15.14	2700.50	0.00
14.17	2791.50	0.00
12.70	2913.60	0.00
10.24	3134.10	0.00
7.27	3412.00	0.00
4.30	3681.30	0.00
1.32	3794.10	0.00
-1.66	3881.90	0.00
-4.64	4000.95	0.00
-6.63	4101.15	0.00
-7.62	4145.00	0.00
-8.62	4176.67	0.00
-15.36	4441.91	0.00
-22.11	4707.88	0.00
-23.11	4740.30	0.00
-24.10	4784.15	0.00
-26.09	4871.85	0.00
-29.08	4997.15	0.00
-31.07	5084.85	0.00
-32.07	5134.59	0.00
-35.32	5280.65	0.00
-38.56	5425.60	0.12
-39.56	5460.35	0.36
-40.56	5487.71	0.59
-42.55	5539.98	1.02
-45.54	5642.75	1.55
-48.53	5825.76	1.84
-51.52	6020.57	1.83
-54.52	6173.20	1.50
-57.51	6306.60	0.90
-59.50	6384.79	0.41
-60.50	6425.16	0.14

**** Time since load was applied: 15.00 ****

Elevation	Effective Stress	Pore Pressure
15.14	2700.50	0.00

14.17	2791.50	0.00
12.70	2913.60	0.00
10.24	3134.10	0.00
7.27	3412.00	0.00
4.30	3681.30	0.00
1.32	3794.10	0.00
-1.66	3881.90	0.00
-4.64	4000.95	0.00
-6.63	4101.15	0.00
-7.62	4145.00	0.00
-8.62	4176.67	0.00
-15.36	4441.91	0.00
-22.11	4707.88	0.00
-23.11	4740.30	0.00
-24.10	4784.15	0.00
-26.09	4871.85	0.00
-29.08	4997.15	0.00
-31.07	5084.85	0.00
-32.07	5134.59	0.00
-35.32	5280.65	0.00
-38.56	5425.72	0.00
-39.56	5460.70	0.00
-40.56	5488.30	0.00
-42.55	5541.00	0.00
-45.54	5644.30	0.00
-48.53	5827.60	0.00
-51.52	6022.40	0.00
-54.52	6174.70	0.00
-57.51	6307.50	0.00
-59.50	6385.20	0.00
-60.50	6425.30	0.00

**** Time since load was applied: 20.00 ****

Elevation	Effective Stress	Pore Pressure
15.14	2700.50	0.00
14.17	2791.50	0.00
12.70	2913.60	0.00
10.24	3134.10	0.00
7.27	3412.00	0.00
4.30	3681.30	0.00
1.32	3794.10	0.00
-1.66	3881.90	0.00
-4.64	4000.95	0.00
-6.63	4101.15	0.00
-7.62	4145.00	0.00
-8.62	4176.67	0.00
-15.36	4441.91	0.00
-22.11	4707.88	0.00
-23.11	4740.30	0.00
-24.10	4784.15	0.00
-26.09	4871.85	0.00
-29.08	4997.15	0.00
-31.07	5084.85	0.00
-32.07	5134.59	0.00
-35.32	5280.65	0.00
-38.56	5425.72	0.00
-39.56	5460.70	0.00

-40.56	5488.30	0.00
-42.55	5541.00	0.00
-45.54	5644.30	0.00
-48.53	5827.60	0.00
-51.52	6022.40	0.00
-54.52	6174.70	0.00
-57.51	6307.50	0.00
-59.50	6385.20	0.00
-60.50	6425.30	0.00

**** Time since load was applied: 30.00 ****

Elevation	Effective Stress	Pore Pressure
15.14	2700.50	0.00
14.17	2791.50	0.00
12.70	2913.60	0.00
10.24	3134.10	0.00
7.27	3412.00	0.00
4.30	3681.30	0.00
1.32	3794.10	0.00
-1.66	3881.90	0.00
-4.64	4000.95	0.00
-6.63	4101.15	0.00
-7.62	4145.00	0.00
-8.62	4176.67	0.00
-15.36	4441.91	0.00
-22.11	4707.88	0.00
-23.11	4740.30	0.00
-24.10	4784.15	0.00
-26.09	4871.85	0.00
-29.08	4997.15	0.00
-31.07	5084.85	0.00
-32.07	5134.59	0.00
-35.32	5280.65	0.00
-38.56	5425.72	0.00
-39.56	5460.70	0.00
-40.56	5488.30	0.00
-42.55	5541.00	0.00
-45.54	5644.30	0.00
-48.53	5827.60	0.00
-51.52	6022.40	0.00
-54.52	6174.70	0.00
-57.51	6307.50	0.00
-59.50	6385.20	0.00
-60.50	6425.30	0.00

For this load case		Accumulated		Surface
Time	Settlement	Time	Settlement	elevation
0.08	0.197	0.08	0.197	15.80
0.25	0.273	0.25	0.273	15.73
0.50	0.317	0.50	0.317	15.68
0.75	0.337	0.75	0.337	15.66
1.00	0.348	1.00	0.348	15.65
2.00	0.365	2.00	0.365	15.63
4.00	0.373	4.00	0.373	15.63
8.00	0.375	8.00	0.375	15.62

15.00	0.375	|	15.00	0.375	|	15.62
20.00	0.375	|	20.00	0.375	|	15.62
30.00	0.375	|	30.00	0.375	|	15.62

**** C o m p l e t e T i m e S e t t l e m e n t R e c o r d ****

Time	Settlement
0.08	0.197
0.25	0.273
0.50	0.317
0.75	0.337
1.00	0.348
2.00	0.365
4.00	0.373
8.00	0.375
15.00	0.375
20.00	0.375
30.00	0.375

OSFP Review Comment & Response Form

General Project Information	Review Phase		Reviewer Information
Dist: 04 EA: 2640C1 Project Name: MSN B4 OSFP Liaison: Tracy Bertram Phone: 916-227-8379 e-mail: tracy.bertram@dot.ca.gov	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection	☐ 65% PS&E Unchecked Details ☒ PS&E (Review No. 1) ☐ Construction Support ☐ Other: FR	Reviewer Name: M.Zabolzadeh/R.Nashed Functional Unit: GDW-GS Phone Number: ((510)2864831 e-mail: Mohammadzabolzadeh@dot.ca.gov Date of Review: 12/2/2010
	Structure Information (Use when necessary to document comments by individual structure) Structure Name: 101N/116 SOH (Replace) Br No: 20-0284R		

Consultant Information (to be filled in by Consultant)

Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
1	FR	N/A	FR prepared by URS Corporation dated 9/10/2010.	No comment.	
2	FR	General	All our comments dated May 27, 2010 have been addressed except for comment #13, which is repeated here.	No comment.	
3	FR	Page 7-4	The input and output of Lpile computer program corresponding to the design pile tip elevations (shown on Table 7-3) due to the lateral loads should be included in Appendix G.	Will include LPILE output files in Appendix G.	
4	FR	Appendix E	All the attached plan sheets are for the left side widening. Please attach the plans corresponding to right widening.	No widening was done for the right side bridge since its construction in 1952. The original as-built plans were not available during a search of BIRIS. However, the 1996 Earthquake Retrofit project as-built plans are available and will be included in Appendix E as reference.	
5	FR	Appendix F	The pile design spreadsheet shows the boring (R-09-011) surface elevation to be 31' for Abutment 1. The boring R-09-	Ground surface elevation at boring location R-09-011 is 51 feet as shown in Appendix A. The proposed slope inclination of new embankment at the Abutment	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

			011 surface elevation shown in appendix A is 51'. Check discrepancy.	1 is 1.5 to 1 (horizontal to vertical). As shown in Table 7-1, the finished grade elevation at Footing 1C varies from 30 to 38 Elevation 31 was conservatively selected for the pile design.	
6	FR	N/A	C3- Not approved. Resubmitted to GS is required.	Will comply and resubmit.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

OSFP Review Comment & Response Form

General Project Information	Review Phase		Reviewer Information
Dist: 04 EA: 2640C1 **Project Name: Petaluma River Bridge** **OSFP Liaison: Tracy Bertram** **Phone: 916-227-8379** **e-mail: TracyBertram/HQ/Caltrans/CAGov**	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection	☐ 65% PS&E Unchecked Details ☐ PS&E (Review No. _) ☐ Construction Support ☐ Other:FR	**Reviewer Name:M.Zabolzadeh/R.Nashed** **Functional Unit:GDW-GS** **Phone Number: ((510)2864831** **e-mail: Mohammadzabolzadeh@dot.ca.gov** **Date of Review: 5/27/2010**
	Structure Information (Use when necessary to document comments by individual structure) **Structure Name: U.S. 101/SR116 SOH (Replace** **Br No: 20-0284R**		

Consultant Information (to be filled in by Consultant)

Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date
_____	_____	_____	_____	_____

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
1	FR	N/A	FR prepared by URS Corporation dated 4/19/2010.		
2	FR	Section 3.1.1	The second paragraph " The north abutment of the Petaluma……the south abutment of the Petaluma River Bridge" should be moved under **"Local Geology"** section.	Will modify	
3	FR	Section 3.1.1	The statement "the southern abutment (abutment 1)" should replace "The north abutment of the Petaluma River Bridge" statement. This to be more specific to the job under study.	Will revise.	
4	FR	Section 3.1.1	Add the following statement: "The northern abutment (abutment 5) is underlain by Holocene Bay Mud deposits".	Will add statement.	
5	FR	Section 3.1.3	The borings list should be omitted from	Will modify.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

			this sector, since it is repeated properly under "Field Exploration" section.		
6	FR	Section 3.2.4	As–built Boreholes (drilled in 1952) No. B1, B4, B5, B6 and B9 should be taken into consideration and used in the description of subsurface conditions.	As-built boring information has been incorporated in the evaluation of the subsurface conditions. Will add reference to 1952 boring data in updated report.	
7	FR	Section 7.4	The 90% settlement time is estimated to about 270 days. Surcharge program should be provided in the report to reduce the time if needed during construction.	Will elaborate.	
8	FR	Section 7.4	The 90% settlement is estimated to be between 0.5" and 4.5" for approach embankment at Abutments 1 and 5. Do the piles in the close vicinity (in line of stress path) of the approach embankment subject to downdrag force? If so, this should be applied to the pile design at these locations.	The settlement due to new approach fill in the vicinity of existing piles is estimated to be less than 0.5 inch. Therefore, piles supporting existing abutments are not anticipated to experience downdrag forces.	
9	FR	Figure 2-2	Figure 2-2 shows the use of SDC version 1.4. This is an old version. Use the new version 1.5.	Will update.	
10	FR	Figure 2-3	Pile data table should be filled out.	Will revise.	
11	FR	Table 7-3	The specified tip elevation is shown to be –47. Based on Appendix F the design tip elevation is shown to be –49. Check discrepancy.	It is estimated that the top of weathered bedrock for Bent 2 to be about Elevation -44 feet. Assuming approximately 3 feet pile penetration would be required to achieve resistance criteria; thus the tip elevation is specified to be Elevation -47.	
12	FR	Table 7-3	Include the design tip elevation in Table 7-3 based on the lateral load demand.	Will revise.	
13	FR	Appendix E	All the attached plan sheets are for the left portion of the widening. Please remove.	Will update with structure specific plan sheets.	
14	FR	N/A	C3- Not approved. Resubmitted to GS is required.		
15					
16					

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

04-SON-101, PM2.5/4.1
EA#04-2640C1
MAY 20, 2011

FOUNDATION REPORT

U.S. 101S/SR116 SOH (WIDEN) (BRIDGE NO. 20-0284L) PETALUMA, CALIFORNIA

Prepared for
Sonoma County Transportation Authority
490 Mendocino Avenue, Suite 240
Santa Rosa, CA 95401

URS

100 West San Fernando Street, Suite 200
San Jose, California 95113

Project No: 28645045

May 20, 2011 File No.04-SON-101-PM 3.65
Project 28645045 EA 2640C1 CU 04

Mr. Guy Preston
Project Manager
Sonoma County Transportation Authority (SCTA)
490 Mendocino Avenue, Suite 240
Santa Rosa, CA 95401

Subject: **Foundation Report**
U.S. 101S/SR116 SOH (Widen), Bridge No. 20-0284L
U.S. 101 Marin Sonoma Narrows-Contract 4 (MSN B4)
Petaluma, California

Dear Mr. Preston:

URS has completed the accompanying Foundation Report for the U.S. 101S/SR116 SOH (widen) in the City of Petaluma, California. The report was prepared in accordance with Caltrans Guidelines for Foundation Investigation Reports, Version 2.0, updated December 2009.

The Foundation Report presents our engineering opinions and recommendations regarding the geotechnical factors influencing the design and construction of the proposed bridge widening. The opinions and recommendations have been based upon the results of our field investigation, laboratory testing, engineering judgment and local experience. Mr. Mark Schmoll, C.E.G, prepared the site geology and geologic hazards portion of this report.

If any questions should arise, or if we can be of further service, please contact the undersigned at (408) 297-9585.

Sincerely,

Jose Landazuri, G.E. 501
Geotechnical Task Leader

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1.1 GENERAL

The Marin Sonoma Narrows (MSN) HOV Widening project proposes to add high occupancy vehicle (HOV) facilities to U.S. 101 from the junction of SR 37 in the City of Novato to just north of the Corona Road Overcrossing in the City of Petaluma, a distance of approximately 16 miles. The project has been divided into three main segments. Segments A and C consist of the existing freeway in the cities of Novato and Petaluma, respectively. Segment B is the existing expressway between the two cities. The focus of this report is Segment B4, which is a part of Segment B.

The planned improvements in Segment B4 include the following structures:

- U.S. 101/SR116 SOH Left (Widen) – recently constructed (completed in 2007) five span structure will be widened by 24 feet along the eastern edge of the deck
- U.S. 101/SR116 SOH Right (Replace) – existing four span structure (constructed in 1955) will be replaced
- Petaluma River Bridge (Replace) – existing nine span twin-structure (constructed in 1955) will be replaced
- Retaining Wall along NB 101 – the new retaining wall along the eastern edge of NB 101 (RW 152)
- Retaining Wall along NB 101 – the new retaining wall along the eastern edge of NB 101 will connect to the new Petaluma River Bridge (RW168)
- Retaining Wall along SB 101 – the new retaining wall along the western edge of SB 101 will span from the new Petaluma River Bridge to the end of existing retaining wall (RW180)
- Retaining Wall along NB 101 – the new retaining wall along the eastern edge of NB 101 will connect the new Petaluma River Bridge with the new U.S. 101/SR 116 SOH Right structure (RW 179)
- Retaining wall along northbound on-ramp to U.S. 101 from SR 116 (RW 293)
- Sound Wall along NB on-ramp – the new sound wall along northbound on-ramp to U.S. 101N from SR116 (SW297)
- Sound Wall along NB 101 – the new sound wall along the eastern edge of NB 101 (SW 211).

The subject of this foundation report (FR) is the widening of the U.S. 101S/SR116 SOH (Bridge No. 20-0284L), located in Petaluma, California. Figure 1-1 shows the location of the project site relative to the U.S. 101 MSN-B4 Project alignment. Please note that figure numbers used in the report correspond to the specific sections.

1.2 SCOPE OF INVESTIGATION

The geotechnical services performed for the U.S. 101S/SR116 SOH (widen) were as follows:

- Reviewed existing plans

- Site geologic reconnaissance
- Geotechnical field investigation including five rotary wash borings R-09-011 through R-09-015
- Laboratory testing to estimate pertinent engineering properties
- Design recommendations and opinions were developed for the following topics:
  - Precast prestressed (PCPS) concrete pile design recommendations
  - Resistance to lateral loads
  - Approach fill settlement, if any
  - Abutment grading and approach fill construction
  - Earthquake information consistent with Caltrans Response Spectra Design Techniques
  - Assessment of the potential for earthquake induced liquefaction, settlement, and lateral spreading
  - Corrosion testing and analysis
  - Consideration of construction issues, including:
    - Earthwork for abutments and new bridge approaches
    - Construction dewatering

A review related to environmental and hazardous waste issues and the results of evaluations are presented in a separate report, titled "Site Investigation Report," dated February 10, 2011.

1.3 CALTRANS REVIEW COMMENTS

We reviewed the comments prepared by Caltrans for the 101/116 SOH Widen, dated May 28, 2010. The review comments and our responses are presented in Appendix J.

The proposed improvements of Segment B4 of the U.S. 101 Marin Sonoma Narrows (MSN) HOV widening project, in the City of Petaluma, will include adding high occupancy vehicle (HOV) lanes to U.S. 101. As part of the proposed highway widening, the recently constructed the U.S. 101S/SR116 SOH will be widened by 24 feet along the eastern edge of the deck. The bridge carries southbound U.S.101 traffic over the existing SMART railroad tracks as well as SR 116, at approximately a 39 degree skew. The bridge will have an overall length of approximately 562 feet with a width of 83 feet. The existing structure is a five-span structure consisting of a cast-in-place prestressed concrete box girder supported on two-column bents and seat type abutments. PCPS concrete piles (14-inch x 14-inch, Class 200) are currently proposed to support the bridge widening foundation elements. Typical sections of the planned improvements are presented in Figures 2-1 and 2-2. Figure 2-3 shows the foundation plan.

The bridge begins at 'A' Line, Station 188+54.7, and ends at 'A' Line, Station 194+16.8, with the bridge deck positioned at Elevation 49.6 feet and at Elevation 35.3 feet, respectively. Pile caps are planned as follows:

Location	Bottom of Pile Cap Elevation (ft)
Abutment 1	24.6
Bent 2	13.5
Bent 3	1.4
Bent 4	1.4
Bent 5	4.3
Abutment 6	15.5

As noted on Figure 2-3, Bench Mark JK121 and JK122 are located nearby. The horizontal survey control is based on the California Coordinate System, Zone 3, U.S. survey feet, North American Datum of 1983 (NAD83), Epoch 2007.00. Vertical control is the National Geodetic Vertical Datum of 1988 (NGVD88).

3.1 GEOLOGIC SETTING

3.1.1 Regional Geology

The project is located along the western margins of the Petaluma Valley within the central portion of the Coast Ranges geomorphic province of California. Northwest-southeast-trending valleys and ridges characterize the regional morphology of the Coast Ranges province. These topographic features are controlled by folds and faults that resulted from the collision of the Farallon and North American plates and subsequent predominantly strike-slip faulting along the San Andreas fault system between the Pacific and North American plates. Regional geologic mapping shows the project alignment to be underlain by manmade fill, Holocene Bay Mud deposits, Holocene alluvial fan deposits, Tertiary age volcanic rocks, and Jurassic-Cretaceous age Franciscan Complex rocks (Wagner et al, 2000; Armstrong, 1980). The regional geologic map (Figure 3-1) shows the approximate areal extent of these various geologic units.

3.1.2 Regional Tectonic Setting and Seismicity

The project alignment lies between known active and potentially active geologic faults. In general, earthquakes occur as a result of movement along active faults. For the purpose of activity classification, faults are generally grouped into the following categories by the California Division of Mines and Geology (renamed the California Geological Survey, CGS) (Jennings, 1994):

- Holocene: displacement has occurred within the last 10,000 to 11,000 years.
- Late Quaternary: displacement has occurred within the last 700,000 years, but evidence of Holocene activity is lacking.
- Quaternary: evidence of displacement within the last 1.6 million years, but evidence of Holocene activity is lacking.
- Pre-quaternary: no recognized evidence of displacement in the last 1.6 million years.

Generally, faults with Holocene movement are considered to be “active” while faults with late Quaternary to Quaternary movement are considered to be “potentially active”.

The closest active faults to the project alignment are the Rodgers Creek-Healdsburg fault, San Andreas (north) fault, the northern end of the Hayward fault and the Maacama-Garberville fault (referred to as the Maacama-Brush fault on the Caltrans Seismic map by Mualchin, 1996). The nearest potentially active fault is the Late Quaternary Tolay fault located 2.3 miles (3.7 km) northeast of the site. The California Geological Survey (2000) has produced maps showing Alquist-Priolo Earthquake Fault Zones along faults with known Holocene activity that pose a potential surface faulting hazard. With the exception of the Tolay fault, all of these faults are included as Alquist-Priolo (A-P) zoned faults. The Rodgers Creek-Healdsburg fault is located about 4.6 miles (7.4 km) northeast of the site and the San Andreas (north) fault is located about 15.8 miles (25.4 km) southwest of the project alignment. More distant active faults include the north end of Hayward fault located about 18 miles (30 km) southeast of the site, and the Maacama-Garberville fault located about 21.5 miles (34.6 km) northeast of the site. Figure 3-2 shows active faults within the site region relative to the project. The project alignment does not cross any mapped A-P zoned faults.

The site is within an area of high seismic activity. The major active faults extending through the region have the potential of generating damaging earthquakes. There is a potential that the site will be subject to moderate to strong seismic ground shaking one or more times during the life of the project. The nearest significant earthquake epicenter to the site was the 1969 Santa Rosa earthquake series on the Rodgers Creek-Healdsburg fault. Other large magnitude historic earthquakes have occurred on the San Andreas fault and the Hayward fault.

3.1.3 Local Geology

The southern abutment (Abutment 1) of the planned U.S. 101/SR 116 (Widen) structure is composed of man-made fill constructed on the underlying Bay Mud and alluvial fan deposits. Man-made fill also underlies the Northwestern Pacific railroad tracks and SR 116, including the on-ramps and off-ramps to U.S. 101. Holocene Bay Mud deposits underlie the south margins of the Petaluma River below about Elevation 10 feet and extend to just north of SR 116. Holocene alluvial fan deposits underlie portions of the Bay Mud deposits and occur at the ground surface in the area generally north of SR 116. The "bedrock" that underlies the alluvial fan deposits and portions of the Bay Mud is the Jurassic-Cretaceous age Franciscan Complex. This unit is mapped by Wagner, et al. (2000) as schist and phyllite; however, based on a review of the 2009 URS borings, the existing Caltrans Log of Test Borings (LOTBs) and site geologic mapping, this unit appears to be composed mainly of mélange consisting of tectonic mixtures of sheared shale, greenstone, greywacke and serpentinite with scattered blocks of blueschist. A geologic map of the site by Wentworth (1997) shows this area as mélange. The only surface outcrops of the Franciscan Complex rocks occur near the south abutment of the Petaluma River Bridge. The northern abutment (Abutment 6) is underlain by Holocene Bay Mud deposits.

Borings R-09-011 through R-09-015 completed for U.S. 101S/SR116 SOH in 2009 and the available LOTBs were reviewed to characterize the subsurface conditions along the project alignment. The soil profile for the U.S. 101S/SR116 bridge consists of fill soils, Bay Mud, alluvial fan deposits (alluvium) and Franciscan Complex bedrock. With the exception of the bridge approach embankment fills, the fill soil ranges from 0 to about 6 feet in thickness and consists of sandy clay with gravel. Bay Mud was encountered in all of the borings completed in 1952, but was absent in two of the three borings completed in 2002 and all borings completed in 2009. It appears the Bay Mud was excavated and mostly removed during preparation for construction of the fill embankments for the existing bridge. The northern limits of Bay Mud, as mapped by Wagner, et al. (2000) and Armstrong (1980), only extend to about SR 116. Alluvial fan deposits underlie the Bay Mud and locally occur at the ground surface. These deposits range from medium stiff to hard lean clay to sandy lean clay and fat clay and loose to dense silty to clayey sand, poorly graded sand and well-graded sand with gravel. The alluvial fan deposits are about 35 to 90 feet thick and extend down to about Elevation –45 to -80 feet. The Franciscan Complex bedrock underlies the alluvial fan deposits. The depth to Franciscan Complex bedrock ranged from Elevation -45 feet to - 100 feet. The Franciscan Complex was completely to highly weathered in the upper 10 to 25 feet, becoming moderately to slightly weathered below this depth. The depth to moderately to slightly weathered bedrock ranged from about Elevation –50 feet to – 100 feet.

3.2 SITE AND SUBSURFACE CONDITIONS

3.2.1 Site Topography

The existing SR 116 Bridge consists of separate northbound and southbound structures. The south abutments of both bridges share the same man-made approach fill that the north side of the Petaluma Bridge lands on, with the surface at about Elevation 50 feet. The north approach embankment is also a man-made fill extending to about Elevation 30 feet at road grade. These bridges cross over two sets of Northwestern Pacific railroad tracks at about Elevation 10 feet and the Lakeville Highway (SR 116) at about Elevation 14 feet.

Development along the project alignment is mixed, including an abandoned quarry west of U.S. 101 and south of Petaluma Boulevard, a park and marina (Hollen Berger Park) located east of U.S. 101 between the Petaluma River and SR 116, and scattered commercial and industrial development both east and west of U.S. 101 and north of SR 116. Open space and farmland occupy the area west of U.S. 101 between the Petaluma River and SR 116.

3.2.2 Field Exploration

The following subsurface explorations were previously performed for the existing bridge and near structure.

- Borings B-1 through B-9 completed for the U.S. 101/116 northbound and southbound bridges (Bridge No. 20-284L and 20-155R), dated 1952, completed by Caltrans;
- Borings 02-B-1 through 02-B-3 completed for the U.S. 101/116 northbound and southbound bridges (Bridge No. 20-284L and 20-155R), dated 2002, completed by Parikh Consultants, Inc. for Caltrans;
- Boring B-2, B-5 and B-6 completed for the retaining wall located along the west side of southbound U.S. 101 completed by Caltrans in 2001; and
- Boring BH-1 and cone penetration test CPT-1 completed for the Mechanically Stabilized Embankment at the south embankment of U.S. 101/116 southbound bridge, dated 2002, completed by Caltrans.

The above explorations included both penetration borings without sampling and rotary wash borings with split spoon drive samples. Boring 02-B-2 also included Pitcher barrel sampling and wireline coring in the Franciscan Complex bedrock. Boring locations for U.S. 101/SR116 bridges are shown on Figure 3-3 and 3-4. Copies of the LOTBs are included in Appendix A.

To supplement available data, URS performed five rotary wash Borings, R-09-011 through R-09-015, to terminal depths ranging from 85 to 119½ feet. HQ wireline diamond coring of the Franciscan Complex bedrock was used in Boring R-9-012 below a depth of 60 feet. However, due to the limited rock recovery with this drilling method and the sheared and highly weathered nature of the shale and serpentinite rock rotary wash drilling with SPT and MC drive samples was used on the remaining borings that penetrated the Franciscan Complex rocks, to obtain meaningful information for the foundation design.

The field explorations were performed on June 10 to 25, 2009. The locations of the borings are shown on the Site and Boring Location Plan, Figure 3-3 and 3-4, as well as on the LOTBs, Appendix A. The LOTBs present descriptions of the soils encountered, along with the results of laboratory tests.

A representative of URS supervised the drilling operations and soil and rock sampling. Visual classifications of the materials encountered were made from cuttings and samples. The soil samples collected from the boring were labeled and sealed immediately to preserve their natural moisture content. The recovered rock core samples were placed in wooded core boxes. At completion of the exploration, samples were delivered to the laboratory for further examination and testing. The borings were backfilled with mixture of cement and bentonite in accordance with the requirements of the Sonoma County Health Department. A detailed discussion of the field exploration program is presented in Appendix B.

The Unified Soil Classification System and the guidelines summarizing soil consistency and relative density are presented on the LOTB legend, Appendix A – LOTB 1 of 7 and 2 of 7. Descriptions of the soils encountered in the borings are presented on LOTB 3 of 7 and 4 of 7. The logging method used in preparing the LOTB is consistent with Caltrans Soil and Rock Logging, Classification and Presentation Manual, dated June 2007. These logs also illustrate the notation used for the size of samplers and the methods of advancing them.

3.2.3 Laboratory Testing

The water content, dry density, Plasticity Index (PI), grain size distribution (PA), consolidation, and Unconfined Compressive Strength (UC) were determined for selected samples to estimate the strength and compressibility of the underlying soils. The locations of these tests, together with the resistance to penetration of the samplers, are shown at the corresponding locations on the LOTBs. The laboratory test results are provided in tabular form and/or graphically in Appendix B.

3.2.4 Soil Conditions

3.2.4.1 Fill

Borings R-09-011 and R-09-015 were located at the top of the existing embankment near the south and north bridge abutments, respectively. Fill soil was encountered to depths of 54 feet (Elevation -3.0) and 23 feet (Elevation +11.0) in Borings R-09-011 and R-09-015, respectively. The fill consists primarily of granular soils (silty sand, silty sand with gravel, clayey sand with gravel, clayey sand, silty gravel, poorly graded gravel and clayey gravel) with cohesive interbeds (lean clay, sandy lean clay, and gravelly lean clay). The granular soils are medium dense to dense in relative density, whereas the cohesive layers are judged to be medium stiff to stiff in consistency. The fill from about Elevation +5 to -3 feet appears to be placed after removal of the "soft, gray silty clay" revealed in nearby Boring B-1 (1952).

Borings R-09-012 and R-09-013 were drilled on the south and north sides of the railroad tracks, respectively, between the bridge approach fill embankments. These two borings encountered 2½ feet and 5 feet of sandy to clayey gravel, respectively overlying the alluvium. Boring R-09-014 was drilled in the Route 116 pavement median. An 8-inch asphalt concrete pavement was encountered overlying 6 inches of aggregate base underlain by silty sand with gravel fill extending to a depth of 11 feet. The bottom of the fill layer (Elevation +3 feet) appears to be consistent with the fill thickness revealed in nearby Boring B-4 (1952).

3.2.4.2 Native

Occurring below the fill in Borings R-09-011 through R-09-015 are native alluvial fan deposits (alluvium) consisting of complexly interbedded layers of cohesive and granular soils. The cohesive deposits (lean clay, fat clay and sandy lean clay) are generally medium stiff to very stiff; at a few locations (Borings R-09-012 at 45 feet and R-09-015 at 76 and 85 feet) the dry density is relatively low (75 to 78 pcf) and the moisture content is high (41 to 46 percent). Fat clay was encountered in all borings except in R-09-011. Fat clay layers 22 and 33 feet thick were encountered below Elevation +5 feet and -41 feet in Borings R-09-012 and R-09-014, respectively. The granular interbeds include medium dense to very dense silty sand, silty sand with gravel, clayey sand, poorly graded sand, clayey sand with gravel, clayey gravel, silty gravel with sand and silty gravel. However, the silty sand layer is loose in Boring R-09-013, at a depth of 26 feet. Boring R-09-015 terminated in sandy lean clay alluvium at a depth of 108.5 feet. The granular layer between Elevation -10 to -25 feet is consistent with the "fine to medium silty and clayey sand" recorded in Borings B-1, B-2 and B-4 (1952).

Four of the five borings terminated in bedrock, as summarized in the following table.

Boring	Depth to Top of Bedrock (feet)	Elevation of Top of Bedrock (feet)	Length of Sampled Bedrock (feet)
R-09-011	98.5	-47.5	21.0
R-09-012	55.0	-44.0	30.0
R-09-013	59.0	-49.0	27.5
R-09-014	91.5	-77.5	5.0

The condition revealed in Boring B-4 (1952), which terminated at approximately Elevation -60 feet without reaching bedrock, is consistent with the bedrock interpolation between R-09-13 and R-09-14. Franciscan Complex bedrock was encountered and was completely to highly weathered in the upper 10 to 25 feet, becoming moderately to slightly weathered below this depth. The Franciscan Complex consists of mélange, a tectonic mixture of highly sheared metamorphic rock consisting of black shale and serpentinite with greenstone, greywacke, talc and scattered blocks of blueschist. Where encountered, the depth to moderately to slightly weathered bedrock ranged from about Elevation -50 feet to -80 feet. A generalized soil profile is presented in Figure 3-5, based on the conditions encountered in Borings R-09-011 through R-09-015.

3.2.5 Groundwater

All of the previous borings were completed using rotary wash drilling or wireline coring methods. Groundwater levels were measured in a few of the borings from Elevation +1.7 to +5.2 feet. These water levels were measured in June 1952 and September 2002. (1952 Elevations have been converted as follows: Elevation 0 NGVD29 = Elevation + 2.28 NAVD88.)

All of the 2009 borings were started with hollow-stem auger and then completed using either the rotary wash drilling or wireline coring methods. Borings R-09-011, R-09-012, R-09-013 and R-09-015 were dry to depths of 19 feet (Elevation +32), 21 feet (Elevation -10), 19 feet (Elevation -9) and 22 feet (Elevation +12), respectively. Groundwater was encountered in Boring R-09-014 at a depth of 18 feet (Elevation -4).

Considering the previous measurements, we believe a design groundwater level at Elevation 5 feet would be reasonable for the site.

3.3 GEOLOGIC HAZARDS

3.3.1 Surface Fault Displacement and Ground Shaking

The project alignment does not cross any Alquist-Priolo Earthquake Fault Zones (Hart, 1975). Therefore, surface rupture due to faulting along the alignment is not expected to occur. However, the short distance to nearby active faults including the Rodgers Creek-Healdsburg fault, San Andreas (north) fault, and the northern end of the Hayward fault does create a high risk for ground shaking from fault movement. The intensity of the ground shaking is dependent upon the size of the earthquake, the distance of the epicenter from the site, the direction that the earthquake propagates along the fault, and the site geologic conditions.

3.3.2 Landslide and Slope Failure

With the exception of the man-made bridge approach embankments fills, the project alignment is on relatively flat ground and is not subject to landsliding. Regional geologic maps by Wagner et al (2000) and Wentworth (1997), as well as the landslide hazard area maps in the Sonoma County Hazard Mitigation Plan (2006), do not show any mapped landslides on the hills at or near the project. Furthermore, no evidence of landslide scarps or slumping of the man-made fill embankments was observed during site reconnaissance.

3.3.3 Scour

No creeks or active channels cross the alignment at the proposed U.S. 101/116 SOH (Widen). Therefore, scour is not a potential hazard at the site

3.3.4 Flooding

The Petaluma River channel is within a floodplain. Federal Emergency Management Agency (FEMA) defines the area as Zone AE. Zone AE is defined as an area with a 1% annual chance of flooding. With the exception of the active channel of the Petaluma River and the low lying area south of SR 116 below about Elevation +9 feet, the project alignment is located outside of Zone AE.

3.3.5 Subsidence and Seismic Compaction

Subsidence typically occurs as a result of subsurface fluid extraction (e.g. groundwater or petroleum) or compression of soft, geologically young sediments. Groundwater extraction for high volume municipal and agricultural use has the potential to cause future ground subsidence in the region. However, we are unaware of subsidence in the area. No active petroleum wells are present within many miles of the site (California Division of Oil, Gas, and Geothermal Resources, 2001).

Elastic and consolidation settlement can occur when soil is loaded by a structure or by the placement of fill on top of soil. Typically consolidation settlement occurs gradually when soil pore pressures, increased by vertical loading, dissipate over time. Bay Mud is very susceptible to consolidation settlement.

Compaction settlement, or seismic densification, occurs when loose granular soils above the water table densify as a result of earthquake shaking. The soil densification can result in differential settlement because of variations in soil composition, thickness, and initial density. As previously mentioned, localized layers of medium dense granular soils were encountered in a few of the borings. At the location of Boring R-09-012, the soils above the groundwater table were found to consist primarily sandy lean to fat clay. Therefore, post-earthquake settlement due to seismic compaction is not expected. We estimated the potential post-earthquake settlement at Borings R-09-011 and R-09-013 through R-09-015 using the computer program LIQUEFY PRO. In our analyses we used a peak ground acceleration (PGA) of 0.6g and a design earthquake moment magnitude (**M**) of 7.0. The design PGA and earthquake moment magnitude are discussed in Section 5.2. Based on the results of these analyses, the magnitude of seismic compaction settlement at Borings R-09-013 through R-09-015 probably will range from negligible to ¼ inch. Seismic compaction settlement on the order of about ½ inch is estimated for the soils encountered in Boring R-09-011. Copies of these calculations are included in Appendix C.

3.3.6 Liquefaction Potential

Liquefaction is a phenomenon whereby sediments temporarily lose shear strength and collapse. This condition is caused by cyclic loading during earthquake shaking that generates high pore water pressures within the sediments. The soil type most susceptible to liquefaction is loose, cohesionless, granular soil below the water table and within about 50 feet of the ground surface. Liquefaction can result in loss of foundation support and settlement of overlying structures, ground subsidence and translation due to lateral spreading, lurch cracking, and differential settlement of affected deposits. Lateral spreading occurs when a layer liquefies at depth and causes horizontal movement or displacement of the overburden mass toward a free face such as a stream bank or excavation, or toward an open body of water.

In a regional study of the nine-county San Francisco Bay region for the U.S. Geological Survey, Witter et al. (2006) mapped the liquefaction susceptibility of the site soils along the project alignment. The alluvial fan and Bay Mud deposits found from the south bank of the Petaluma River and extending north past SR 116 have been mapped as having a “moderate” liquefaction susceptibility (see Figure 3-6). The thin fill embankments that underlie the railroad tracks are mapped as having a "very high" liquefaction susceptibility. The Sonoma County Hazard Mitigation Plan (2006) maps these deposits as having a “high” liquefaction hazard. The Franciscan Complex bedrock mapped south of the river is not subject to liquefaction.

Potentially liquefiable sand layers were encountered in few of the borings completed for this study. Post-liquefaction settlement of the medium dense sand layers encountered in Borings R-09-012 through R-09-015 was analyzed for a peak ground acceleration (PGA) of 0.6g and design earthquake moment magnitude, **M** 7.0. The measured driving resistance (blow counts) recorded in the field were adjusted to account for hammer type, sampler size, overburden pressure, rod length, and fines content. The magnitude of settlement at these boring locations is estimated to range from 0.1 inch to 0.9 inch. Copies of these calculations are included in Appendix C.

3.3.7 Naturally Occurring Asbestos

Asbestos is a term used for several types of naturally-occurring fibrous minerals generally found in ultramafic rocks. The most common type of asbestos is chrysotile. Serpentinite often contains

chrysotile asbestos. Serpentinite is a common rock type occurring in the Fransican Complex and was found in several of the borings completed by Caltrans in 1952 and in the 2009 URS borings. Serpentinite is typically grayish-green to bluish-black in color and may have a shiny appearance. The amount of asbestos that is typically present in these rocks ranges from less than 1% up to about 25%, and sometimes more. Asbestos is released from serpentinite rock when it is broken or crushed. This can happen when land is graded for building purposes, or at quarrying operations. It is also released naturally through weathering and erosion. Once released from the rock, asbestos can become airborne and may stay in the air for long periods of time. The potential for asbestos to be encountered during construction is low since driven piles will be used for support of the new bridges and excavations into the Franciscan complex rocks will not be made.

3.4 GEOLOGICAL PROFILES AND ENGINEERING PARAMETERS

Figure 3-5 presents a generalized soil profile for the project site; it illustrates the layering of the various soil strata encountered in the explorations and the approximate depth to Franciscan Complex bedrock. A table summarizing geotechnical parameters for each of the 5 soil layers also is presented. The soil parameters tabulated on Figure 3-5 were selected based on laboratory test results as well as engineering judgment and local experience.

The undrained shear strength, relative density, dry unit weight and moisture content are the primary geotechnical parameters used in our foundation design and analysis. Atterberg limits tests and particle analyses were performed for classification of soils. In general, unconfined compression tests were performed on cohesive soil samples to estimate the undrained shear strength. Some disturbance occurs while sampling cohesive soils; therefore unconfined compressive strengths can be somewhat lower than the insitu field conditions. Consequently, engineering judgment and local experience were applied in our interpretation of the laboratory test results. The relative density of cohesionless soils was estimated from vertical effective stress and Standard Penetration Resistance, N blows per 1 foot based on correlations developed by Gibbs and Holtz (DM7.1 – 87, 1986). Where non-standard sampler sizes were used, such as the modified California sampler (2½ inch outside diameter), a correction factor was applied to the recorded blows per foot to approximate the equivalent Standard Penetration Resistance.

4.1 CORROSION EVALUATION

An assessment of the potential for corrosion of various buried foundation and pipe structures was performed by V&A Consulting Engineers (V&A). The results of their investigation are presented in Appendix D, and summarized below.

4.2 SUMMARY

V&A was retained by URS Corporation to perform a corrosion survey along U.S. 101, in and near Petaluma, California from 0.4 mile south of Petaluma Boulevard South over crossing to 0.2 mile north of Caulfield Lane overcrossing. The objective was to measure various soil parameters and evaluate the results with respect to possible levels of corrosion at the proposed bridge site. Corrosivity was evaluated for materials within a depth range of 0 to 100 feet below grade.

The California Department of Transportation, Division of Engineering Services, Materials Engineering and Testing Services, Corrosion Technology Branch has published "Corrosion Guidelines" (Guidelines) to define what constitutes corrosive soil. The Guidelines consider soil to be corrosive to structural elements (steel reinforced concrete) if one or more of the following conditions exist for water or soil samples:

1) The chloride concentration is 500 ppm (mg/kg) or greater,
2) The sulfate concentration is 2,000 mg/kg or greater, or
3) The pH is 5.5 or less.

Also, a minimum resistivity value of less than 1,000 ohm-cm indicates the presence of high quantities of soluble salts and a higher propensity for corrosion. A wide variety of soluble salts are typically found in soils. Two soils having the same resistivity may have significantly different corrosion characteristics, depending on the specific ions available. The major constituents that accelerate corrosion are chlorides, sulfates and the acidity (pH) of the soil. Chloride ions tend to break down otherwise protective surface deposits, and can result in corrosion of reinforcing steel in concrete structures. Sulfates in soil can be highly aggressive to Portland cement concrete by combining chemically with certain constituents of the concrete, principally tricalcium aluminate. The reaction is accompanied by expansion and eventual disruption of the concrete matrix. High concentrations of bicarbonates tend to decrease soil resistivities. Although bicarbonates are not aggressive to concrete, lower resistivity environments can promote corrosion activity.

Acidity, as indicated by the pH value, is another measure of corrosivity. The lower the pH (the more acidic the environment), the higher will be the corrosivity with respect to buried metallic and concrete structures. As pH increases above 7 (the neutral value), conditions become increasingly more alkaline and passive to buried structures.

Evaluation of the in-situ soil environment was made in terms of potential damage to structures due to corrosion. Soil resistivity measurements were conducted in the field during the initial stages of the work. In addition, soil samples collected by URS during the geotechnical investigation were forwarded to Cooper Testing Laboratory in Palo Alto, California for chemical analysis. The soil samples were analyzed for minimum resistivity, pH, water soluble chloride ion concentration, and water soluble sulfate ion concentration in accordance with the Guidelines.

Soil samples were selected from the Borings R-09-011 and R-09-015 in the general vicinity of Southbound 101 / SR 116. The results are summarized in the following table.

Table 4-1: Soil Corrosion Test Results Summary

Sample ID	Minimum Resistivity (ohm-cm)	pH	Chloride Content (mg/kg)*	Sulfate Content (mg/kg)*
R-09-011	116	8.3	4,813	825
R-09-015	388	6.8	38	2,325

4.3 CONCLUSIONS

Minimum soil resistivity less than 1,000 ohm-cm measured in samples from Borings R-09-012 and R-09-015 suggests that soils are corrosive, whereas the pH, measured for all 3 samples, ranges from a minimum of 6.8 to a maximum value of 8.0; this suggests a relatively neutral to alkaline environment. The project site is not located within 1,000 feet of salt or brackish water, indicating the proposed structure will not be exposed to marine atmosphere. However, the soluble chloride concentrations exceed 500 mg/kg and the soluble sulfate concentrations exceed 2,000 mg/kg, indicating that the soils are corrosive. Therefore, according to the Guidelines, the soils at the project site are considered corrosive.

5.1 SEISMIC DESIGN METHODOLOGY AND RESOURCES

The seismic design methodology adopted for this project is based on the following current Caltrans standards:

1. Development of the 2007 Caltrans Deterministic PGA Map and Caltrans ARS Online, July 2009
2. Seismic Design Criteria (SDC), v 1.5, August 2009
3. Guidelines for Foundation Investigations and Reports, v 2.0, dated March 2006

5.2 PEAK BEDROCK ACCELERATION

The closest active faults to the project alignment are the Rodgers Creek-Healdsburg fault, San Andreas (north) fault, the northern end of the Hayward fault and the Maacama-Garberville fault (referred to as the Maacama-Brush fault on the Caltrans Seismic map by Mualchin, 1996). The nearest potentially active fault is the Late Quaternary Tolay fault located 2.3 miles (3.7 km) northeast of the site. The California Geological Survey (2000) has produced maps showing Alquist-Priolo Earthquake Fault Zones along faults with known Holocene activity that pose a potential surface faulting hazard. With the exception of the Tolay fault, all of these faults are included as Alquist-Priolo (A-P) zoned faults. The Rodgers Creek-Healdsburg fault is located about 4.6 miles (7.4 km) northeast of the site with a corresponding PGA [V_s =2,500 feet per second (fps)] contour of 0.6g based on the 2007 Caltrans Deterministic PGA map. San Andreas (north) fault is located about 15.8 miles (25.4 km) southwest of the project alignment. More distant active faults include the north end of Hayward fault located about 18.6 miles (30.0 km) southeast of the site, and the Maacama-Garberville fault located about 21.5 miles (34.6 km) northeast of the site. Figure 3-2 shows active faults within the site region relative to the project. The project alignment does not cross any mapped A-P zoned faults.

Table 5-1: Seismic Source Parameters

Fault	Type	M_{Max}	Distance (miles)	Near Field Effects ?
Rodgers Creek-Healdsburg	strike-slip	7.1	4.6	Yes
San Andreas (north)	strike-slip	7.9	15.8	No
Hayward	strike-slip	7.3	18.6	No

Note: The distances are based on Caltrans ARS Online (2009)

5.3 FAULT TYPE, NEAR-FIELD, AND SPECTRAL ACCELERATION INCREASES

The technical report that accompanies the 2007 Caltrans Deterministic PGA Map (Merriam and Shantz, 2007) indicates that the controlling active fault (Rodgers Creek-Healdsburg) has strike-slip displacement. Therefore, in accordance with Caltrans design procedures referenced above, no increase in design spectral accelerations is required for fault type. However, since the project

site is located less than 9.3 miles (15.0 km) from the nearest active fault, the design spectral accelerations should be modified to account for near-field effects as follows:

Table 5-2: Spectral Acceleration Increase for Near-Field Effects

Period (sec)	Increase in Spectral Acceleration (%)
< 0.5	0
0.5 – 1.0	0 – 20 (determined by linear interpolation)
≥1	20

At the time of this study, no bridge structures with a fundamental period of vibration greater than 1.5 seconds were anticipated; therefore no adjustments are required for long period effects.

5.4 SOIL PROFILE TYPE

The logs of 2009 Borings R-09-011 through R-09-015 reveal that the soils at the site consist of fine and coarse-grained alluvium soils that becomes denser and stiffer with depth, terminating mostly in bedrock; the weighted average of the recorded standard penetration test (SPT) blow counts in soil in these five borings was used to determine the average SPT resistance value (N) of 29, 15, 15, 26 and 24, respectively. In addition, the undrained shear strength of clay deposits in these borings ranges from about 650 to 3,700 pounds per square foot (psf). These two parameters are indicative of soil profile Type D based on the guidelines given in SDC Figure B.12. Furthermore, the shear wave velocity (V_s) is estimated to be about 1,000 feet per second (fps) or 305 meters per second (mps), which falls within the soil profile Type D V_s range of 600 to 1,200 fps. Therefore, Soil Profile Type D should be used for design.

5.5 DESIGN ACCELERATION RESPONSE SPECTRA

The design response spectrum for the site is estimated with spectral acceleration values generated using Caltrans ARS Online (2009). This method was developed by Caltrans Geo Research Group in partnership with United States Geological Survey (USGS), Pacific Earthquake Engineering Research (PEER) and California Department of Conservation. This web-based tool calculates both deterministic and probabilistic acceleration response spectra for any location in California based on criteria provided in Appendix B of Caltrans SDC.

The deterministic spectrum is determined as the average of median response spectra calculated using the Campbell-Bozorgnia (2008) and Chiou-Youngs (2008) ground motion prediction equations developed under the "Next Generation Attenuation" project coordinated through the PEER-Lifelines program. These equations are applied to all faults considered to be active in the last 750,000 years (late-Quaternary age) that are capable of producing a moment magnitude earthquake of 6.0 or greater. The probabilistic spectrum is obtained from the USGS (2008) National Hazard Map for 5% probability of exceedance in 50 years. Caltrans design spectrum is based on the larger of the deterministic and probabilistic spectral values. Both the deterministic and probabilistic spectra account for soil effects through incorporation of the parameter Vs30, the average shear wave velocity in the upper 30 meters (100 feet) of the soil profile.

The input values selected for use in Caltrans ARS Online included:

- Vs30 of 1,000 fps (305 mps)
- Maximum Moment (M_{Max}) Magnitude 7.1 (Rodgers Creek-Healdsburg fault)
- No ARS increase for fault-type or long period structure

- ARS increase for near-field effects

The calculated spectra for both deterministic and probabilistic methods are presented graphically in Figure 5-1. Since the maximum spectral acceleration curve is the USGS 5% in 50 years hazard, this curve is presented in Figure 5-2 as a design curve. Spectral values (from Figure 5-2) are provided below in Table 5-3.

Table 5-3: Spectral Acceleration Values
(V_s= 305 mps, Lat. = 38.23298053, Long. = -122.61780739)

Period (seconds)	Sa (g)	Sa* (g)
0.010	0.611	0.611
0.020	0.711	0.711
0.030	0.777	0.777
0.050	0.870	0.870
0.075	0.951	0.951
0.100	1.013	1.013
0.120	1.066	1.066
0.150	1.136	1.136
0.170	1.177	1.177
0.200	1.232	1.232
0.240	1.263	1.263
0.300	1.303	1.303
0.400	1.273	1.273
0.500	1.249	1.249
0.750	1.077	1.184
1.000	0.883	1.060
1.500	0.636	0.764
2.000	0.504	0.605
3.000	0.328	0.394
4.000	0.236	0.283
5.000	0.190	0.228

*Modified with near-fault factors outlined in Section 5.3.

Three sets of previous as-built plans from Caltrans were reviewed including:

1. Bridge No. 20-0155L (Contract Number unknown) date unknown; apparently constructed in about 1952 at location of proposed widening. Only LOTB sheet was provided.
2. Bridge No. 20-0155R/L (Contract No: 04-147204) dated October 24, 1996 was Earthquake Retrofit Project No. 693. Pile caps of Piers 4, 5 and 7 of both bridges were increased in width and length and supported on Class 70 Modified (70-ton service load) concrete piles.
3. Bridge No. 20-0284L (Contract Number unknown) dated March 3, 2003. Original 1952 bridge was replaced with a new bridge, U.S. 101/116 SOH Left (Replace).

The 1952 LOTB indicates the original bridge is supported on a total of 455 Raymond step-taper piles (32-ton design capacity) at the abutments and bents. The pile diameter increases from 10 inches at the tip to a maximum of 15½ inches at the butt. At Bents 7R and 8R, steel H piles (10 BP 42) were driven to reach specified tip. Average pile tips range from about Elevation -38 to -57 feet.

The 1996 earthquake retrofit project at this bridge (20-0155R/L) is supported on driven concrete piles at Piers 4, 5 and 7. Available data for modified bents are summarized in the following table.

Table 6.1: Pile Data Table for 1996 Earthquake Retrofit at U.S.101/116 SOH

Location		Pile Type	Specified Pile Tip Elevation (feet)
Bridge No.	Abutment/Pier No.		
20-0155 R/L	Piers 4, 5 and 7	Class 70C Modified Concrete Pile	-42.0

The 2003 replacement bridge (20-0284L) is supported on driven precast prestressed concrete (PCPS) piles at 2 abutments, 4 bents and 2 retaining walls. Except for Abutment 1, which is supported on Class 900C (100-ton) piles, the remainder of the bridge is supported on Class 625C (70-ton) piles. Retaining walls at abutments were supported on Class 400C (45-ton) piles. Design pile data for the abutments and bents are summarized in the following Table 6-2. Copies of pertinent as-built plans are included in Appendix E.

Table 6-2: Pile Data Table for U.S. 101/SR116 SOH Left

Location		Pile Type	Specified Pile Tip Elevation (feet)
Bridge No.	Abutment/Pier No.		
20-0284L	Abutment 1	PCPS	-41.0
20-0284L	Bent 2	PCPS	-40.0
20-0284L	Bent 3	PCPS	-44.9
20-0284L	Bent 4	PCPS	-55.8
20-0284L	Bent 5	PCPS	-47.9
20-0284L	Abut 6	PCPS	-52.5
20-0284L	Abutment 1 Retaining Wall	PCPS	-39.4
20-0284L	Abutment 6 Retaining Wall	PCPS	-39.4

It should be noted that as-built pile tip elevations were not available.

7.1 DISCUSSION

The proposed bridge is underlain predominantly by medium to very stiff lean and fat clay, loose to very dense sand and slightly to highly weathered bedrock (Franciscan Complex). The principal geotechnical issues at the site are:

- Selection of the type and depth of foundation that will be compatible with the underlying soils, and
- Construction issues associated with the proximity of proposed new piles to existing piles.

In addition, as discussed in Section 4.3, soils at the project site are considered corrosive. We understand that the project Structural Engineer has elected to use driven PCPS concrete piles with minimum dimension of 14 inches (Class 200, T=14 inch, Alternative "X") to support the proposed structure. Abutment 1 median RW is planned to be a Caltrans standard Type I wall. Because of excessive settlement and bearing capacity issues with spread footing foundations the Abutment 6 median RW is considered to be a non-standard plan wall, and will be supported on PCPS concrete piles with minimum dimension of 14 inches (Class 140, T=14 inch, Alt. "X").

The following sections present the geotechnical design parameters for PCPS piles that are consistent with the Load and Resistant Factor Design (LRFD) design procedure adopted by Caltrans.

7.2 PILE DESIGN CAPACITY AND TIP ELEVATION

7.2.1 Axial Pile Capacity

Based on the subsurface conditions encountered in the current borings and 1952 and 2003 as-built borings, it is recommended that the proposed structure be supported on driven PCPS concrete piles with a minimum dimension of 14 inches. Current Caltrans practice is to design abutments in accordance with Working Stress Design (WSD) methodology and bents/piers in accordance with LRFD. Table 7-1 in the following page presents a summary of the foundation design data for the proposed U.S. 101S/SR116 SOH (Widen).

Table 7-1: Foundation Design Data for U.S. 101S/SR116 SOH (Widen)

Location	Design Method	Pile Type	Finished Grade Elevation (ft)	Cut-off Elevation (ft)	Pile Cap Size (ft)		Permissible Settlement under Service Load (in)	No. of Piles per Support
					B	L		
Abutment 1	WSD	Class 200	39.5	24.85	26.75*	11*	1	9
Bent 2	LRFD	Class 200	22.5	13.75	22	22	1	25
Bent 3	LRFD	Class 200	12.4	1.65	17	17	1	20
Bent 4	LRFD	Class 200	12.4	1.65	17	17	1	20
Bent 5	LRFD	Class 200	12.3	4.55	17	17	1	25
Abutment 6	WSD	Class 200	20.0	15.75	26.75*	9*	1	9

*Pile Cap is not rectangular. Size shown is approximate based on actual dimensions.

Loads from LRFD service-1 Limit State are used as design loads for WSD of abutments. Table 7-2 presents the design loads.

Table 7-2: Foundation Design Loads for U.S. 101S/SR116 SOH (Widen)

Location	Service Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Limit State (Controlling Group, kips)			
	Total Load		Permanent Load	Compression		Tension		Compression		Tension	
	Per Support	Max per Pile	Per Support	Per Support	Max per Pile	Per Support	Max per Pile	Per Support	Max per Pile	Per Support	Max per Pile
Abutment 1	1367	160	1177	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bent 2	2149	N/A	1722	2173	204	N/A	-3	1719	247	N/A	-109
Bent 3	1922	N/A	1665	2782	191	N/A	0	1646	298	N/A	-133
Bent 4	1805	N/A	1546	2635	186	N/A	0	1524	296	N/A	-143
Bent 5	1702	N/A	1447	2113	224	N/A	-55	1445	305	N/A	-190
Abutment 6	1048	177	858	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

The specified tip elevations presented in the following pile data table (Table 7-3) are based on friction resistance developed in subgrade soils and end-bearing resistance developed in the bedrock that underlie the site.

Table 7-3: Pile Data Table for U.S. 101S/SR116 SOH (Widen)

Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevation (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance (kips)
		Compression	Tension			
Abutment 1	Class 200 Alt "X"	320	0	-47 (a), +2.5 (c)	-47	320
Bent 2	Class 200 Alt "X"	300	110	-40 (a), -8 (b) -16 (c)	-40	300
Bent 3	Class 200 Alt "X"	300	140	-46 (a), -20 (b) -16 (c)	-46	300
Bent 4	Class 200 Alt "X"	300	150	-50 (a), -28 (b) -17 (c)	-50	300
Bent 5	Class 200 Alt "X"	320	190	-66 (a), -48 (b) -11 (c)	-66	320
Abutment 6	Class 200 Alt "X"	360	0	-65 (a), -5 (c)	-65	360

Design tip elevation is controlled by the following demands:
(a) Compression, (b) Tension, and (c) lateral

The results of our axial pile capacity analysis, which forms the basis for the design and specified tip elevations provided above, are presented in Appendix F.

No group reduction factor needs to be applied to single pile compression load capacities presented above, provided a center-to-center spacing of at least three pile diameters is used.

7.2.2 Lateral Load Capacity

Driven pile foundations are capable of resisting lateral loads, by bending of the pile and by pile-soil interaction. The magnitude of the lateral load resistance that can develop depends upon several factors such as the pile size, the physical properties of the surrounding soils, the structural design of the pile, and the direction of loading. We used LPILE 4.0 (Reese et al., October 2000) to assist in estimating the lateral load resistance of 14-inch PCPS concrete piles. Output files for analysis of piles at the abutments and bents are presented in Appendix G. Charts showing estimated load versus deflection for free and fixed head conditions at top of pile are included as Figures G-1 through G-6 in Appendix G.

California Amendment to ASHTO LRFD Bridge Design Specifications, Section 10.7.2.4, recommends that a P-multiplier (P_m) be applied to the lateral capacity of individual piles to account for pile group efficiency. Table 7-4 presents Caltrans recommended P_m for the corresponding rows of piles within a group.

Table 7-4: Pile P-Multiplier, P_m for Multiple Row Shading

Pile Center-to-Center Spacing (in the direction of loading)	Group Efficiency Factor (P-Multiplier, P_m)		
	Row 1	Row 2	Row 3 and higher
2 x Pile Width/Diameter (B)	0.60	0.35	0.25
3 B	0.75	0.55	0.4
5 B	1.0	0.85	0.7
7 B	1.0	1.0	0.9

Note: Row 1 refers to the leading row of piles in the direction of loading.

If additional lateral capacity is needed beyond the lateral load capacity of the piles, passive resistance against the abutment walls or pile cap can be utilized. For abutments, Caltrans limits the soil resistance at the back of the wall to a 5.5 feet wall height and a maximum uniform soil pressure of 5,000 psf. For wall heights less than 5.5 feet, the average unit pressure should be reduced linearly in proportion to the height. The uniform soil pressure of 5,000 psf is an ultimate value, and should be used with appropriate load resistance factor for the service limit-state consistent with the LRFD approach. For bents, passive resistance against the embedded pile cap can be utilized. The mobilization of passive resistance depends on the amount of pile cap deflection/rotation. The ultimate passive resistance of the soil should be estimated using an equivalent fluid pressure as shown on Figure G-7 (Appendix G). Figure G-7 also presents plots of the percent of maximum equivalent fluid pressure versus pile cap movement.

7.2.3 Lateral Pile Load-Deflection (P-Y)

Lateral load-deflection (p-y) curves were generated to evaluate the behavior of piles supporting bents of the bridge structure. LPILE plus 5.0 (Ensoft, Inc. 2008) was used to model the lateral pile behavior and to estimate the lateral load-deflection curve for 14-inch prestressed precast concrete piles. Results of LPILE analysis are presented in Appendix H.

7.2.4 Axial Pile Load-Deflection

Axial pile load-deflection curves are used by the Structural Engineer to develop vertical foundation stress-strain coefficients for use in the super structure analyses. The computer program TZPILE 2.0 (Ensoft, Inc. 2005) was used to model the axial pile load behavior. Axial load-deflection curves were developed for 14-inch prestressed precast concrete piles. The results of the TZPILE analysis are presented in Appendix I.

7.3 PILE INSTALLATION

All piles should be installed under the direct observation of the Geotechnical Engineer and in accordance with Section 49 of the Caltrans Standard Specifications, “Piling.” Specific additions and modifications to these requirements are discussed below.

The Contractor should submit evidence of compatibility of the proposed pile hammer with the pile type and soil conditions at the site. The Contractor’s hammer submittal should include, as a minimum, a dynamic analysis of the pile driving system that is based on wave equation analysis using computer programs such as WEAP. Pile Driving Acceptance Criteria, described in Caltrans Standard Specifications Section 49-1.08, should be followed, as well as Special Provisions 49-228, Redriving. Driven piles reaching refusal within 10 feet of the specified tip elevation and meeting the acceptance criteria may be cut-off above the tip elevation required by

the compression loads. This assumes that the design lateral load and tension load tip elevations have been reached (see Pile Data Table). Preliminarily, we recommend that the refusal criteria be two times the minimum required blow count as determined by the nominal resistance formula outlined in Section 49-1.08 of the Standard Specifications. However, refusal criteria should be defined later based on the pile driving system proposed by the Contractor and evaluated by WEAP analysis.

We anticipate that piles may encounter "hard driving" conditions within granular deposits found at Abutment 1, Bent 5 and Abutment 6. The approximate elevations of the granular deposits and locations are presented in Table 7-5.

Table 7-5: Location and Approximate Elevation of "Hard Driving" Layers at U.S. 101N/SR116 SOH (Replace)

Location	Approximate Elevation of "Hard Driving" Layers (feet)
Abutment 1	-12½ to -17½, -22½ to -26
Bent 5	-10.0 to -14.0
Abutment 6	-9.0 to -18.0

Where required, and as approved by the Geotechnical Engineer, predrilling should be used to assist in the installation of piles to the required tip elevations. Predrilled holes should be no larger than the least dimension of the new pile, in conformance with the provisions of Section 49-1.05 of the Standard Specifications, Driving Equipment. The use of water in the predrilling process or jetting should not be allowed, unless approved in advance by the Geotechnical Engineer.

7.4 APPROACH EMBANKMENT SETTLEMENT

It is planned to raise the existing median by about 5 feet at both north and south approach embankments. The settlement of the approach embankments due to placement of additional fill has been estimated for these changes in the roadway design profile. Based on the analysis, it is estimated that long-term consolidation settlement less than ½ inch could occur at both abutments.

7.5 SLOPE STABILITY

Consistent with Caltrans standards, the proposed slope inclination of new embankments at the north abutment is generally 2 to 1 (horizontal to vertical). The embankment soils and underlying native are capable of supporting these typical slopes, provided that the embankments are constructed in accordance with the recommendations of this report and Caltrans Standard Specifications.

7.6 APPROACH FILL EARTHWORK

All earthwork should be completed in accordance with the applicable sections of the Caltrans Standard Specifications and Project Standard Specific Provisions. The requirements of structural backfill and pervious backfill are set forth under Section 19-3.06 and 19-3.065, respectively, in the Standard Specifications (Caltrans 2006).

7.7 ABUTMENT/BENT PILE CAP EXCAVATION

Once footing/pile cap areas have been excavated to the required finish subgrade elevations, all loosened soil should be removed prior to concrete placement. Based on available groundwater information, the type of excavation should be classified as a "Structure Excavation (Bridge)" at both abutments and at Bents 2, 3, 4 and 5 as "Structure Excavation Type D" in accordance with Section 11 of Bridge Design Aids, March 2005. However, based on a review of the contract documents for the bridge replacement in 2007, the excavation at Bent 5 was classified as "Structural Excavation Type DR". However, no contamination was detected at the same location and the details are provided in a separate report, titled "Site Investigation Report," dated February 10, 2011.

8.1 TEMPORARY CONSTRUCTION EXCAVATIONS

We anticipate that excavations into the existing embankment fills for construction of the abutments could result in temporary near vertical unsupported soil faces as high as about 15 feet. Safety standards set by OSHA limit the height of unshored vertical excavations to 5 feet if construction personnel will be working in the excavations. The set of guidelines published by OSHA (Department of Labor, Occupational Safety and Health Administration, 1989), classifies soils in detail as Type A, B or C. In general, Type A soils are stronger and more cohesive, Type B soils are intermediate, and Type C soils are weaker or more granular. Based on the soil type, depth, duration the excavation is open, and sequence of soils exposed in the excavation, OSHA recommends maximum allowable slopes. For example, for excavations 20 feet or less in depth through homogeneous soils, they state that maximum allowable slopes (horizontal to vertical) should be ¾:1, 1:1, and 1½:1 for Type A, B, and C soils, respectively. Based on the strengths of the soils encountered at the project site, the existing fills and the native sand strata are considered to be OSHA Type C, whereas the native medium stiff to stiff clay soils are considered to be Type B.

The guidelines provided by OSHA are for trench excavations; they state that there is uncertainty as to when and to what degree an employer must slope, shore, or otherwise protect employees in a "non-trench" excavation. In consideration of these factors, we recommend that temporary cut slopes in the existing embankment fills not exceed 1½:1 during construction.

For locations where excavation with sloping sides is not viable because of space limitations, or in areas where temporary slopes steeper than 1½:1 are planned, shoring will be required. The Contractor should retain an experienced Registered Civil Engineer to design the shoring system.

8.2 CONSTRUCTION DEWATERING

The bottoms of pile caps at Bents 2, 3, 4 and 5 are planned at Elevation 13.5, 1.4, 1.4 and 4.3 feet, respectively, whereas Abutments 1 and 6 are planned at Elevation 24.6 and 15.5 feet, respectively. Free groundwater was encountered in Boring R-09-014 at a depth of about 18 feet (Elevation -4.0 feet). Groundwater levels also were measured somewhat shallower in borings from the previous studies (June 1952 and September 2002) at Elevations +1.7 to +5.2 feet. Based on these exploratory findings, it should be anticipated that groundwater could be encountered during pile cap excavation at the bents.

8.3 EFFECTS OF CONSTRUCTION WORK ON ADJACENT STRUCTURES

Efforts should be made to minimize effects of construction work on adjacent structures. If new foundation excavations and overexcavations are located in close proximity to existing bridge foundations, shoring could be required to minimize exposure of existing pile foundations.

The recommendations presented in this Foundation Report are based on information obtained from new explorations made at widely separated locations, site reconnaissance, review of available historic data, and upon local experience and engineering judgment. As-built drawings pertinent to the geotechnical investigation are included, for convenience of reference.

The recommendations presented in this report are based on the assumption that the soil and geologic conditions do not deviate substantially from those encountered in the previous and new explorations. If any variations are encountered during construction, URS should be contacted so that supplementary recommendations can be made.

If the planned construction is changed from that presently conceived, URS should be retained to review the changes and make modifications to the original recommendations represented in this report in order to meet the project needs.

The Geotechnical Engineer should review the final specifications and drawings to verify that these documents are consistent with the intent of the geotechnical recommendations. Geotechnical issues may arise which are not apparent at this time. URS should be retained during construction to review the soil conditions encountered and the construction procedures. All earthwork and testing should be completed under the direct observation of a representative of our firm.

Specific review and investigation for environmental issues and subsurface environmental contamination were beyond the scope of the geotechnical services.

The elevations shown on the new LOTBs are based on interpolation from spot and contour elevations shown on available topographic maps.

The opinions and recommendations presented in this Foundation Report were developed with the standard of care commonly used as state of the practice in the profession. No other warranties are included, either express or implied, as to the professional advice provided in this report.

ABAG, 2007, Floodplain Maps, abag.ca.gov/bayarea/eqmaps/eqfloods/floods

Armstrong, C.F. and Huffman, M.E., 1980, Geology for planning in Sonoma County, California Division of Mines and Geology Special Report 120, Plate 2b and 3B, scale 1:62,500.

California Division of Mines and Geology, 1982, Alquist-Priolo Special Studies Zone revised official map of the Petaluma River quadrangle, scale 1: 24,000, January 1.

California Division of Oil, Gas, and Geothermal Resources, 2001, Oil, Gas, & Geothermal Fields in California, scale 1: 1,500,000: ftp://ftp.consrv.ca.gov/pub/oil/maps/Map_S-1, accessed 7-17-09

California Geological Survey [Tianqing Cao and others], 2003, The revised 2002 California probabilistic seismic hazard maps, June 2003: CGS online publication at www.consrv.ca.gov/cgs/rghm/psha/fault_parameters/pdf/2002_CA_Hazard_Maps.pdf

California Department of Transportation: Caltrans ARS Online, 2009: Web-based tool calculates both deterministic and probabilistic acceleration response spectra: http://dap3.dot.ca.gov/shake_stable/

Campbell-Bozorgnia (2008) and Chiou-Youngs (2008) ground motion prediction equations: "Next Generation Attenuation" project: PEER-Lifelines program: http://peer.berkeley.edu/products/nga_project.html

City of Petaluma, 2008, Final General Plan 2025, May, http://cityofpetaluma.net/genplan/finalgp2025.html, accessed 7-15-09

Hart, E.W., 1975 (revised 1997), Fault-rupture hazard zones in California: California Division of Mines and Geology Special Publication 42.

Jennings, C.W., 1994, Fault activity map of California and adjacent areas with locations and ages of recent volcanic eruptions: California Division of Mines and Geology Geologic Data Map No. 6, scale 1: 750,000.

Merriam, M. and Shantz, T., 2007, Caltrans Deterministic PGA Map, California Department of Transportation.

http://dap3.dot.ca.gov/shake_stable/references/Deterministic_PGA_Map_8-12-09.pdf

Sonoma County Hazard Mitigation Plan, 2006 Landslide hazard areas, September 19, http://www.sonoma-county.org/PRMD/docs/hmp/fig_2-04.pdf, accessed 7-17-09.

Wagner, D.L., Rice, S.R., Bezore, S., Randolph-Loar, C.E., Allen, J., and Witter, R.C., 2002, Geologic map of the Petaluma River 7 ½' quadrangle, Marin and Sonoma counties, California, a digital database: California Geological Survey.

Wentworth, C.M., 1997, Geologic materials of the San Francisco Bay Region, U. S. Geological Survey OFR 97-744, compiled from the work of Brabb (1989) , Ellen and Wentworth (1995) and Helley and Lajoie (1979) a digital database

Witter, R.C., Knudsen, K.L., Sowers, J.M., Wentworth, C.M., Koehler, R.D., and Randolph, C.E., 2006, Maps of Quaternary deposits and liquefaction susceptibility in the central San Francisco Bay region, California, in cooperation with the California Geological Survey: A digital database, U.S. Geological Survey, Open-File Report 2006-1037.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON

STATE HIGHWAY

IN SONOMA COUNTY IN AND NEAR PETALUMA FROM 0.4 MILES SOUTH OF SOUTH PETALUMA UNDERCROSSING TO 0.2 MILE NORTH OF CAULFIELD LANE OVERCROSSING

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

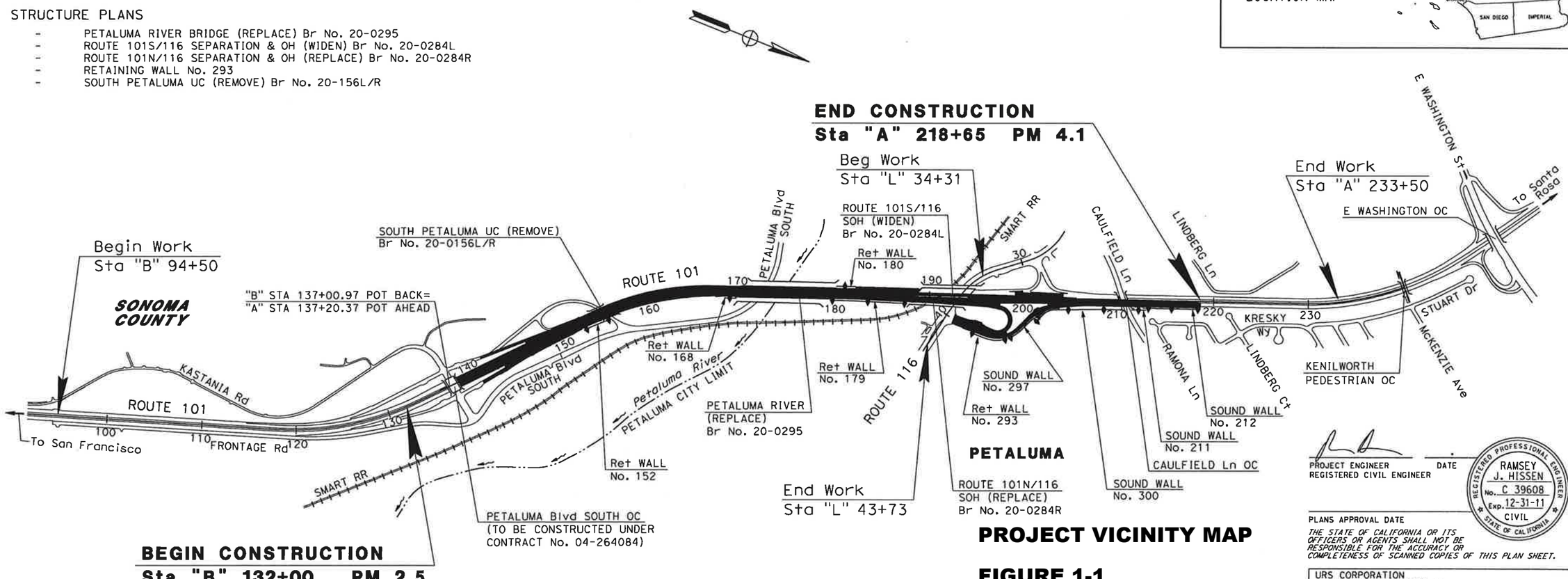
INDEX OF PLANS

SHEET No.
- TITLE
- TYPICAL CROSS SECTIONS
- KEY MAP AND LINE INDEX
- LAYOUTS
- PROFILES AND SUPERELEVATION DIAGRAMS
- CONSTRUCTION DETAILS
- TEMPORARY WATER POLLUTION CONTROL PLANS AND QUANTITIES
- EROSION CONTROL PLANS, DETAILS AND QUANTITIES
- CONTOUR GRADING AND PAVEMENT ELEVATIONS
- DRAINAGE PLANS, PROFILES, DETAILS AND QUANTITIES
- SANITARY SEWER PLANS, PROFILES, DETAILS AND QUANTITIES
- UTILITY PLANS
- CONSTRUCTION AREA SIGNS
- STAGE CONSTRUCTION PLANS
- TRAFFIC HANDLING PLANS AND QUANTITIES
- DETOUR LAYOUTS
- PAVEMENT DELINEATION PLANS AND QUANTITIES
- SIGN PLANS, DETAILS AND QUANTITIES
- SUMMARY OF QUANTITIES
- RETAINING WALL PLANS, DETAILS, QUANTITIES AND LOG OF TEST BORINGS
- SOUND WALL PLANS, DETAILS AND QUANTITES
- PLANT REMOVAL PLANS
- ELECTRICAL PLANS

STRUCTURE PLANS

- PETALUMA RIVER BRIDGE (REPLACE) Br No. 20-0295
- ROUTE 101S/116 SEPARATION & OH (WIDEN) Br No. 20-0284L
- ROUTE 101N/116 SEPARATION & OH (REPLACE) Br No. 20-0284R
- RETAINING WALL No. 293
- SOUTH PETALUMA UC (REMOVE) Br No. 20-156L/R

LOCATION MAP



PROJECT VICINITY MAP

FIGURE 1-1

101 MSN CONTRACT B4
95% PS&E SUBMITTAL
NOVEMBER 30, 2010

NO SCALE

THE CONTRACTOR SHALL POSSESS THE CLASS (OR CLASSES) OF LICENSE AS SPECIFIED IN THE "NOTICE TO BIDDERS."

PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER RAMSEY J. HISSEN No. C 39608 Exp. 12-31-11 CIVIL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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URS CORPORATION
100 W. SAN FERNANDO St
SUITE 200
SAN JOSE, CA 95113

SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401

CONTRACT No.	04-2640C4
PROJECT ID	0400000736

LAST REVISION 11-22-10 | DATE PLOTTED => 11/29/2010 TIME PLOTTED => 10:06:52 AM

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER	CALTRANS DESIGN OVERSIGHT APPROVAL	REGISTRATION No.	LICENSE Exp DATE	DATE	DATE SIGNED
RAMSEY J. HISSEN	TUNG LY				

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Jan M. Hueser No. C050215 Exp. 6/30/11 CIVIL — STATE OF CALIFORNIA

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1380 LEAD HILL BLVD, SUITE 100
ROSEVILLE, CA 95661-2997

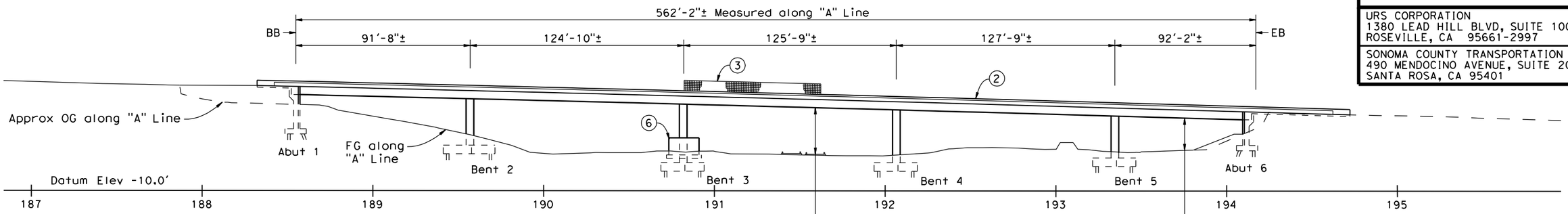
SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401

NOTES:

1. Paint Bridge Number 20-0284L, Paint Bridge Name and Year Completed
2. Concrete Barrier (Type 736 Modified) with Architectural Treatment
3. Chain Link Railing (Type 7 Modified)
4. Temporary Railing (Type K), see "Road Plans"
5. Structure Approach Type N(30S)
6. Concrete Crash Wall
7. Remove existing barrier, see "Road Plans"
8. Remove existing barrier, chain link railing and overhang
9. Concrete Barrier

LEGEND:

- - — Indicates existing structure
Indicates bridge removal (portion)
Indicates direction of traffic
Point of Exist minimum vertical clearance



ELEVATION
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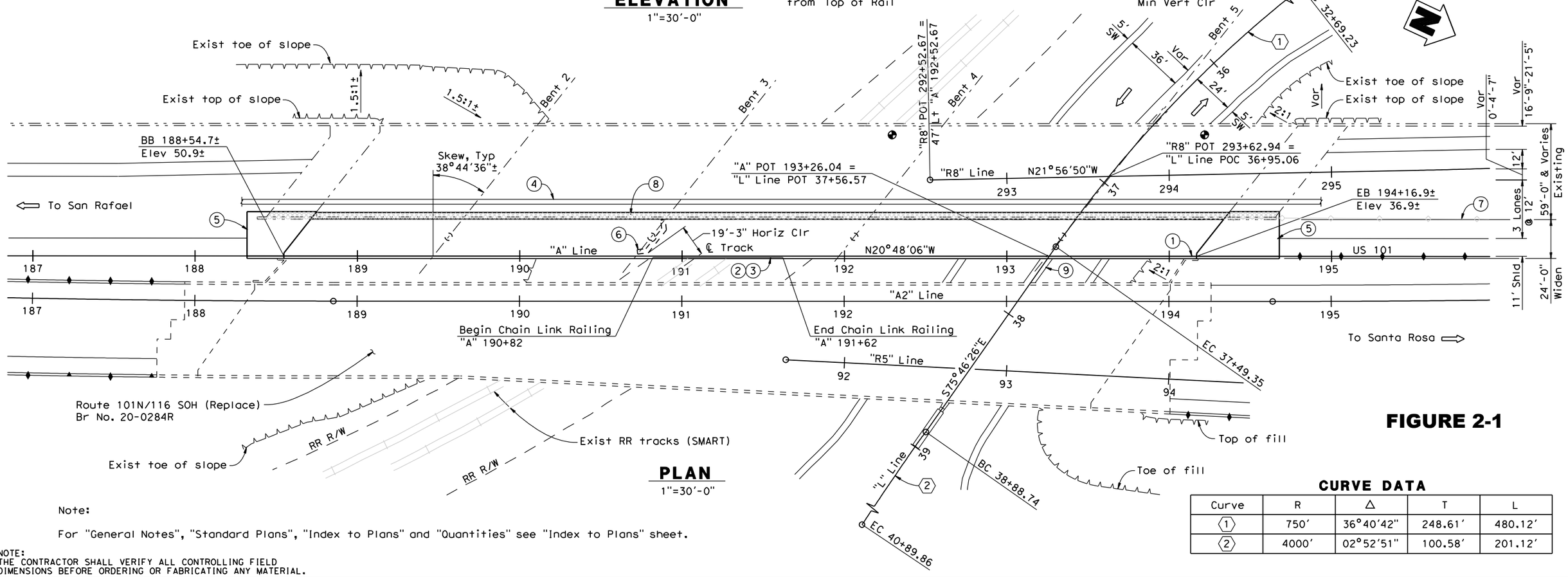

PLAN
1"=30'-0"

FIGURE 2-1

CURVE DATA

Curve	R	Δ	T	L
1	750'	36°40'42"	248.61'	480.12'
2	4000'	02°52'51"	100.58'	201.12'

Note:

For "General Notes", "Standard Plans", "Index to Plans" and "Quantities" see "Index to Plans" sheet.

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

DESIGN OVERSIGHT	DESIGN	BY H. Choi/J. Hueser	CHECKED S. Landis/G. Rowe	LOAD & RESISTANCE FACTOR DESIGN — LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE
	DETAILS	BY L. Davis	CHECKED S. Landis/G. Rowe	LAYOUT BY H. Choi — CHECKED J. Hueser
SIGN OFF DATE	QUANTITIES	BY M. Jackson	CHECKED S. Landis	SPECIFICATIONS BY D. Harnagel — PLANS AND SPECS COMPARED H. Choi

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Walt LaFranchi
PROJECT ENGINEER

BRIDGE NO. 20-0284L
POST MILES 3.65

ROUTE 101S/116 SOH (WIDEN)
GENERAL PLAN No. 1

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV.7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 04000007361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 4-15-10 9-21-10 11-28-10 — SHEET 1 OF 35

FILE => 20-0284L-a-gp01.dgn

USERNAME => Lynette_D@ATE PLOTTED => 5/3/2011 TIME PLOTTED => 9:35:07 AM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Jan M. Hueser No. C050215 Exp. 6/30/11 CIVIL STATE OF CALIFORNIA

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1380 LEAD HILL BLVD, SUITE 100
ROSEVILLE, CA 95661-2997

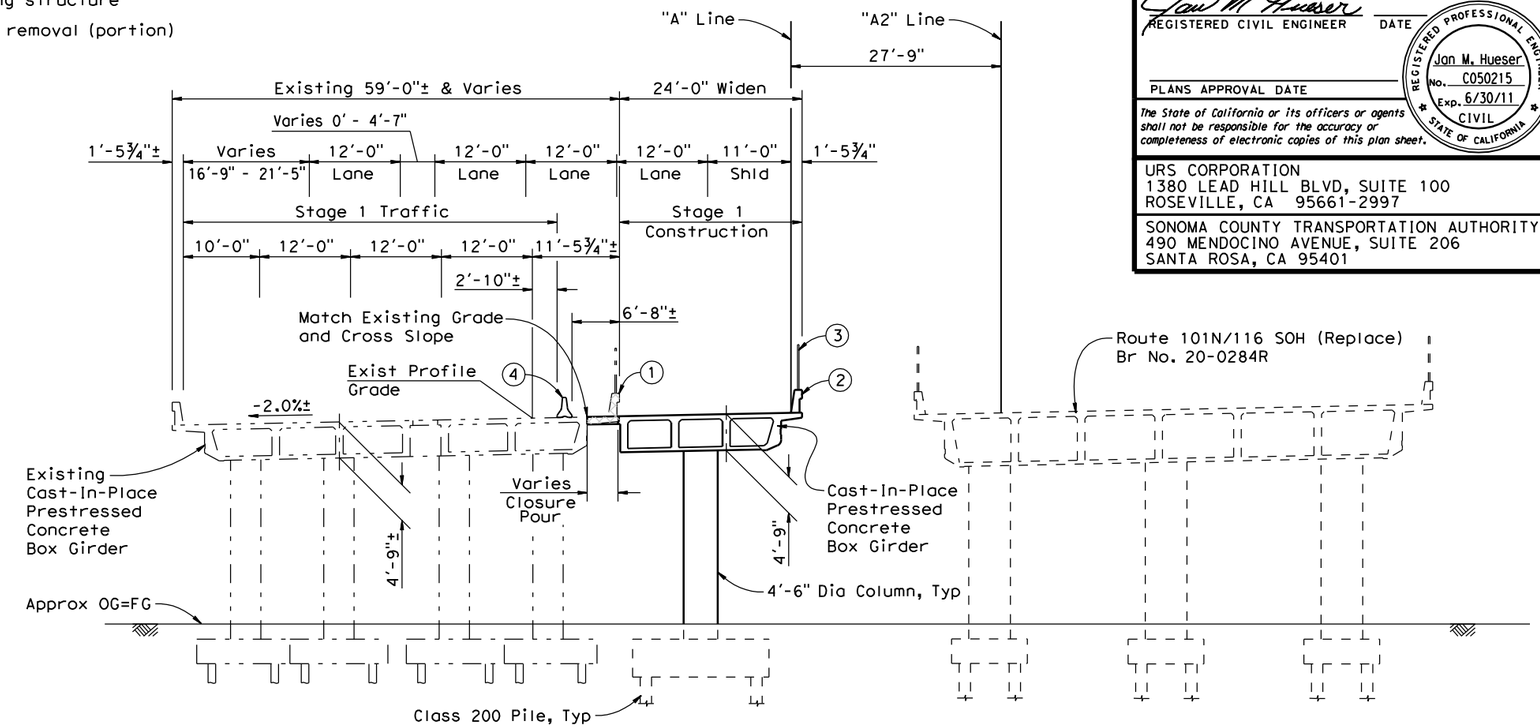
SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401

NOTES:

1. Remove existing barrier, chain link railing and overhang
2. Concrete Barrier (Type 736 Modified) with Architectural Treatment
3. Chain Link Railing (Type 7 Modified)
4. Temporary Railing (Type K), see "Road Plans"

LEGEND:

- - — Indicates existing structure
Indicates bridge removal (portion)

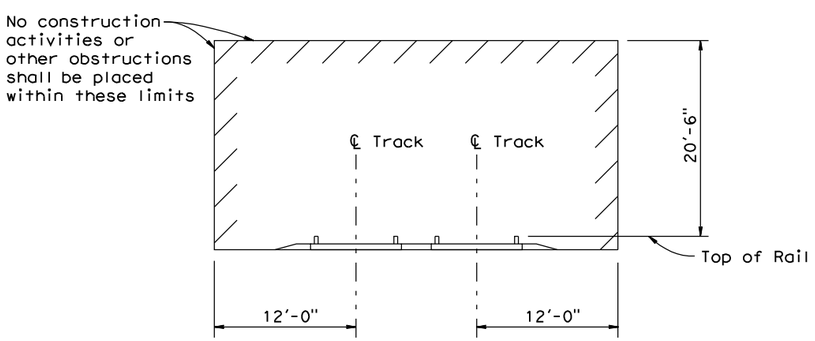


TYPICAL SECTION

1"=10'-0"

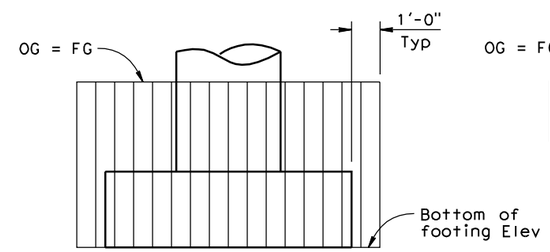
CONSTRUCTION NOTES:

1. Any shoring system that impacts the Railroad's operation and/or supports the Railroad's embankment shall be designed and constructed per Railroad Guidelines for temporary shoring.
2. All demolition within the Railroad's right-of-way and/or demolition that may impact the Railroad's tracks or operations shall comply with the Railroad's Demolition requirements.
3. Erection over the Railroad's track shall be planned such that it enables the track(s) to remain open to traffic per Railroad requirements.
4. The elevation of the existing top-of-rail profile shall be verified before beginning construction. All discrepancies shall be brought to the attention of the Railroad prior to construction.
5. The proposed grade separation project shall not change the quantity and/or characteristics of the flow in the Railroad ditches and/or drainage structures.
6. The contractor must submit a proposed method of erosion and sediment control and have the method approved by the Railroad prior to beginning any grading on the project site.
7. For Railroad coordination please refer to the Railroad's Coordination requirements as part of the Specifications or Special Provisions of the project.
8. Temporary Construction Clearances, including falsework clearances, shall comply with the figure shown.
9. All permanent clearances shall be verified before project closeout.

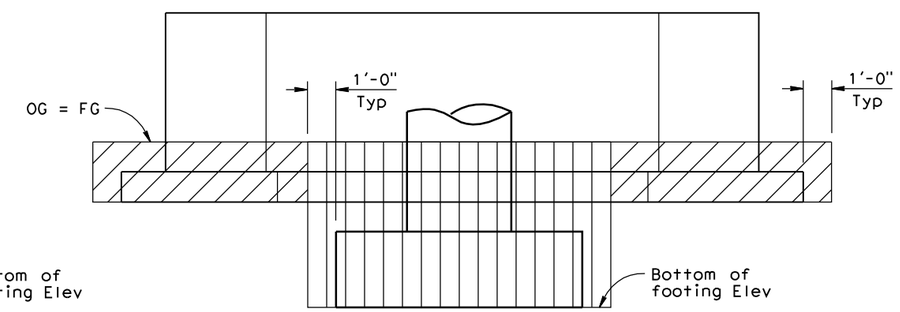


MINIMUM CONSTRUCTION CLEARANCE ENVELOPE

No Scale



TYPICAL COLUMN



COLUMN AT CRASH WALL

Indicates Limits of Structure Excavation (Type D)

Indicates Limits of Structure Excavation (Type D) (Crash Wall)

LIMITS OF STRUCTURE EXCAVATION

No Scale

FIGURE 2-2

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

DESIGN OVERSIGHT	DESIGN	BY H. Choi/J. Hueser	CHECKED S. Landis/G. Rowe	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE	
	DETAILS	BY L. Davis	CHECKED S. Landis/G. Rowe	LAYOUT	BY H. Choi	CHECKED J. Hueser
SIGN OFF DATE	QUANTITIES	BY M. Jackson	CHECKED S. Landis	SPECIFICATIONS	BY D. Harnagel	PLANS AND SPECS COMPARED H. Choi

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Walt LaFranchi
PROJECT ENGINEER

BRIDGE NO. 20-0284L
POST MILES 3.65

ROUTE 101S/116 SOH (WIDEN)
GENERAL PLAN No. 2

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV.7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 04000007361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES 5-28-09 10-15-10

REVISION DATES 6-18-10 9-24-10 11-26-10

SHEET 2 OF 35

FILE => 20-0284L-a-gp02.dgn

USERNAME => Lynette_D DATE PLOTTED => 5/3/2011 TIME PLOTTED => 9:35:09 AM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Jan M. Hueser No. C050215 Exp. 6/30/11 CIVIL STATE OF CALIFORNIA

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1380 LEAD HILL BLVD, SUITE 100
ROSEVILLE, CA 95661-2997

SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401

FIGURE 2-3

PILE DATA TABLE

Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevation (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance (kips)
		Compression	Tension			
Abut 1	Class 200 Alt "X"	320	0	-47 (a) +2.5 (c)	-47	320
Bent 2	Class 200 Alt "X"	300	110	-40 (a) -8 (b) -16 (c)	-40	300
Bent 3	Class 200 Alt "X"	300	140	-46 (a) -20 (b) -16 (c)	-46	300
Bent 4	Class 200 Alt "X"	300	150	-50 (a) -28 (b) -17 (c)	-50	300
Bent 5	Class 200 Alt "X"	320	190	-66 (a) -48 (b) -11 (c)	-66	320
Abut 6	Class 200 Alt "X"	360	0	-65 (a) -5 (c)	-65	360

Notes: Design tip elevation are controlled by: (a) Compression, (b) Tension, (c) Lateral Loads.

UTILITIES

UTILITY	OWNER	DISPOSITION
1 Existing Sewer 36" Force Main	City of Petaluma	Relocate
2 Existing Sewer 33" Gravity Main	City of Petaluma	Protect in place
3 Existing 12" PVC Water	City of Petaluma	Protect in place
4 Existing Underground Fiber Optic	Qwest / Comcast	Protect in place
5 Existing Underground Telephone/ Fiber Optics [illegible] 4" [illegible])	AT&T	To be relocated prior to construction (by others)
6 Existing Un[illegible]	G&E	Abandoned

BENCH MARK

BENCH MARK	N	E	ELEV	DESCRIPTION
JK121	2276227.207	5954272.578	81.98	1" Iron pipe with a plastic plug and tack along the northbound shoulder of State Route 101 across from a "Sonoma-Napa-Right Lane" sign; 10.7 feet easterly of a metal beam guard rail and at top of slope.
JK122	2277835.878	5953598.199	52.65	1" Iron pipe with a plastic plug and tack along the northbound median of State Route 101; 50 feet northerly of a "Petaluma Blvd South-3/4 mile" sign; 16 feet westerly of the edge of pavement and witnessed by a carsonite witness post.

SURVEY CONTROL: Horizontal control for this survey is based on the California Coordinate System, Zone 3, US Survey feet, North American Datum of 1983 (NAD83), Epoch 2007.00. Vertical control is the National Geodetic Vertical Datum (NAVD88).

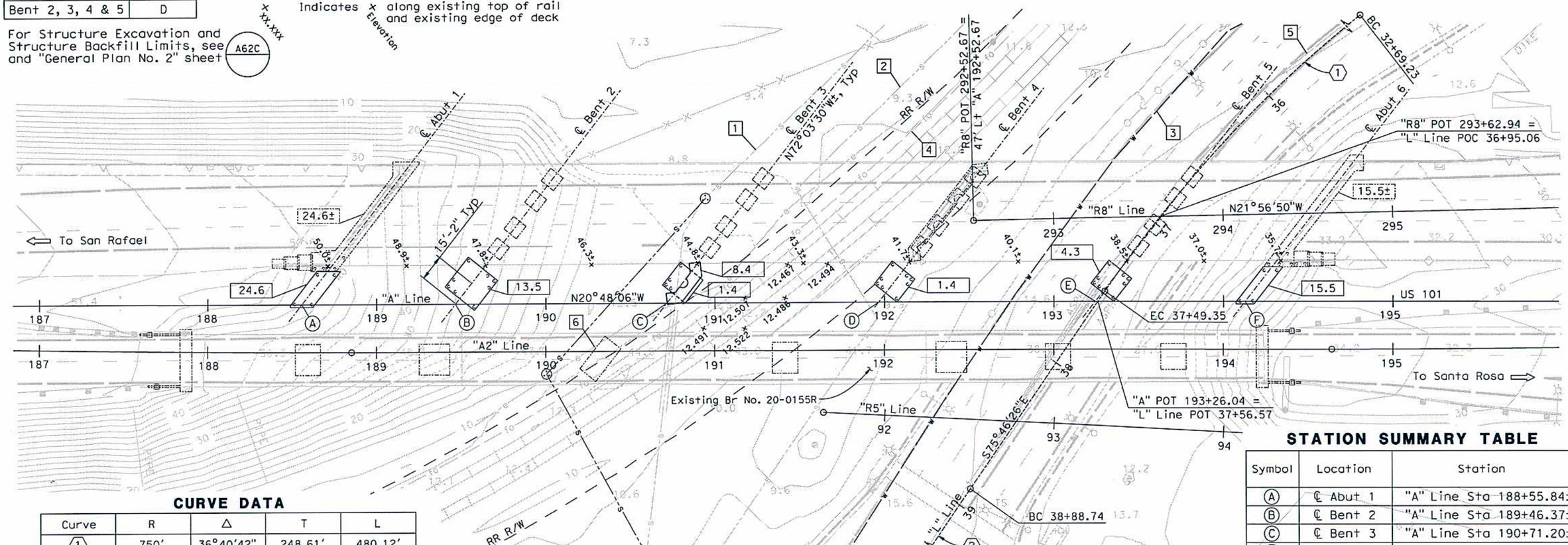
STRUCTURE EXCAVATION

Location	Type
Abut 1 & 6	Bridge
Bent 2, 3, 4 & 5	D

For Structure Excavation and Structure Backfill Limits, see A62C and "General Plan No. 2" sheet

LEGEND:

- Indicates piles (not all piles shown)
- Indicates bottom of footing elevation
- Indicates bottom of existing footing elevation
- Indicates x along existing top of rail and existing edge of deck (x xx.xxx Elevation)



CURVE DATA

Curve	R	Δ	T	L
1	750'	36°40'42"	248.61'	480.12'
2	4000'	02°52'51"	100.58'	201.12'

STATION SUMMARY TABLE

Symbol	Location	Station
A	℄ Abut 1	"A" Line Sta 188+55.84±
B	℄ Bent 2	"A" Line Sta 189+46.37±
C	℄ Bent 3	"A" Line Sta 190+71.20±
D	℄ Bent 4	"A" Line Sta 191+96.95±
E	℄ Bent 5	"A" Line Sta 193+24.70±
F	℄ Abut 6	"A" Line Sta 194+12.92±

PLAN

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

GEOTECHNICAL PROFESSIONAL APPROVAL DATE 11-28-10

DESIGN OVERSIGHT

SIGN OFF DATE

SCALE: 1"=30'-0" | VERT.DATUM NAVD 88 | HORZ.DATUM NAD 83 (1991.35)
PHOTOGRAMMETRY AS OF: | ALIGNMENT TIES
SURVEYED BY Caltrans | DRAFTED BY Caltrans
FIELD CHECKED BY Caltrans | CHECKED BY Caltrans

DESIGN BY H. Choi/J. Hueser CHECKED S. Landis/G. Rowe
DETAILS BY L. Davis CHECKED S. Landis/G. Rowe
QUANTITIES BY M. Jackson CHECKED S. Landis

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Walt LaFranchi
PROJECT ENGINEER

BRIDGE NO. 20-0284L
POST MILE 3.65

ROUTE 101S/116 SOH (WIDEN)
FOUNDATION PLAN

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV.7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 04000007361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 4-15-10 9-23-10 11-28-10

SHEET 4 OF 35

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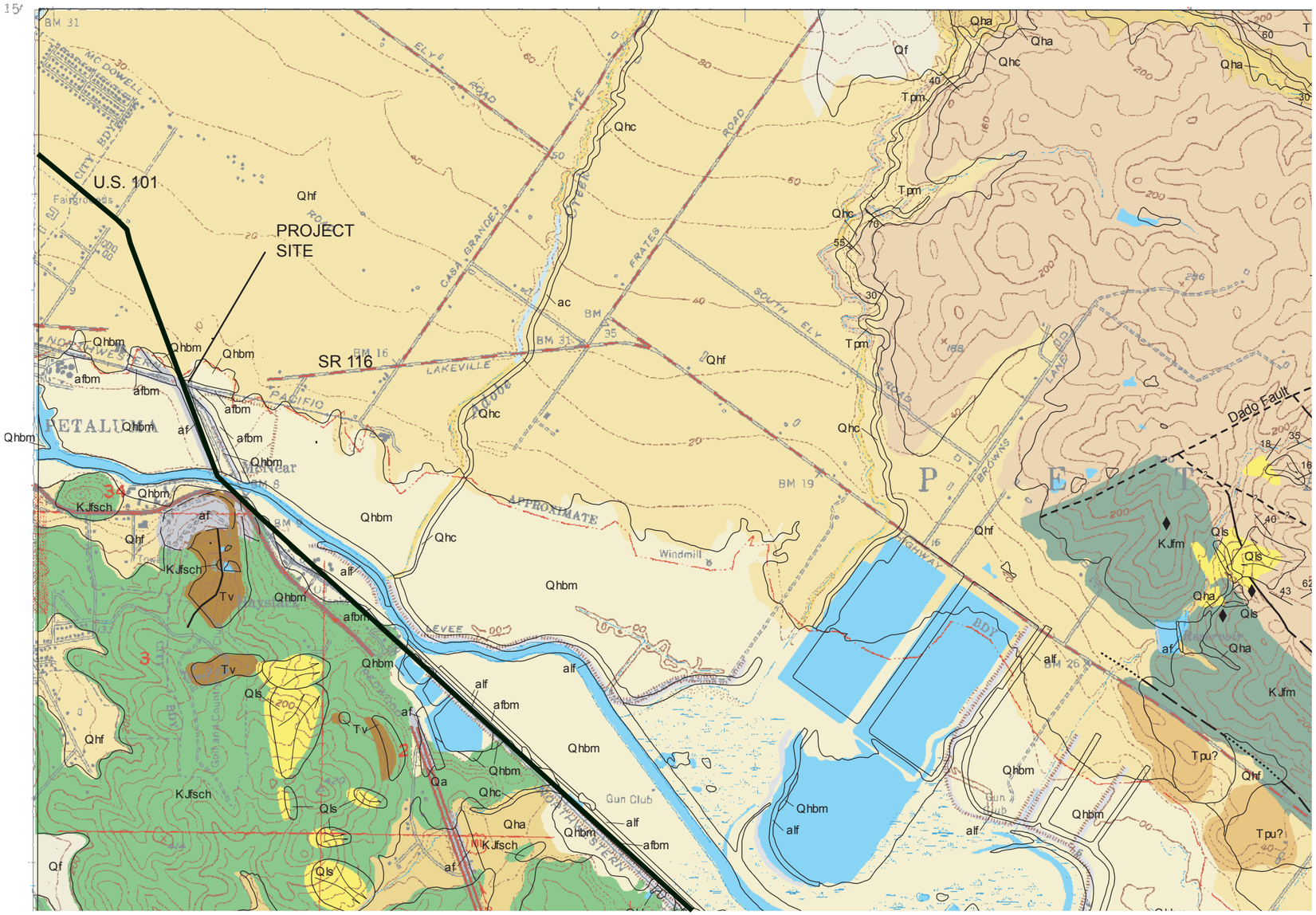


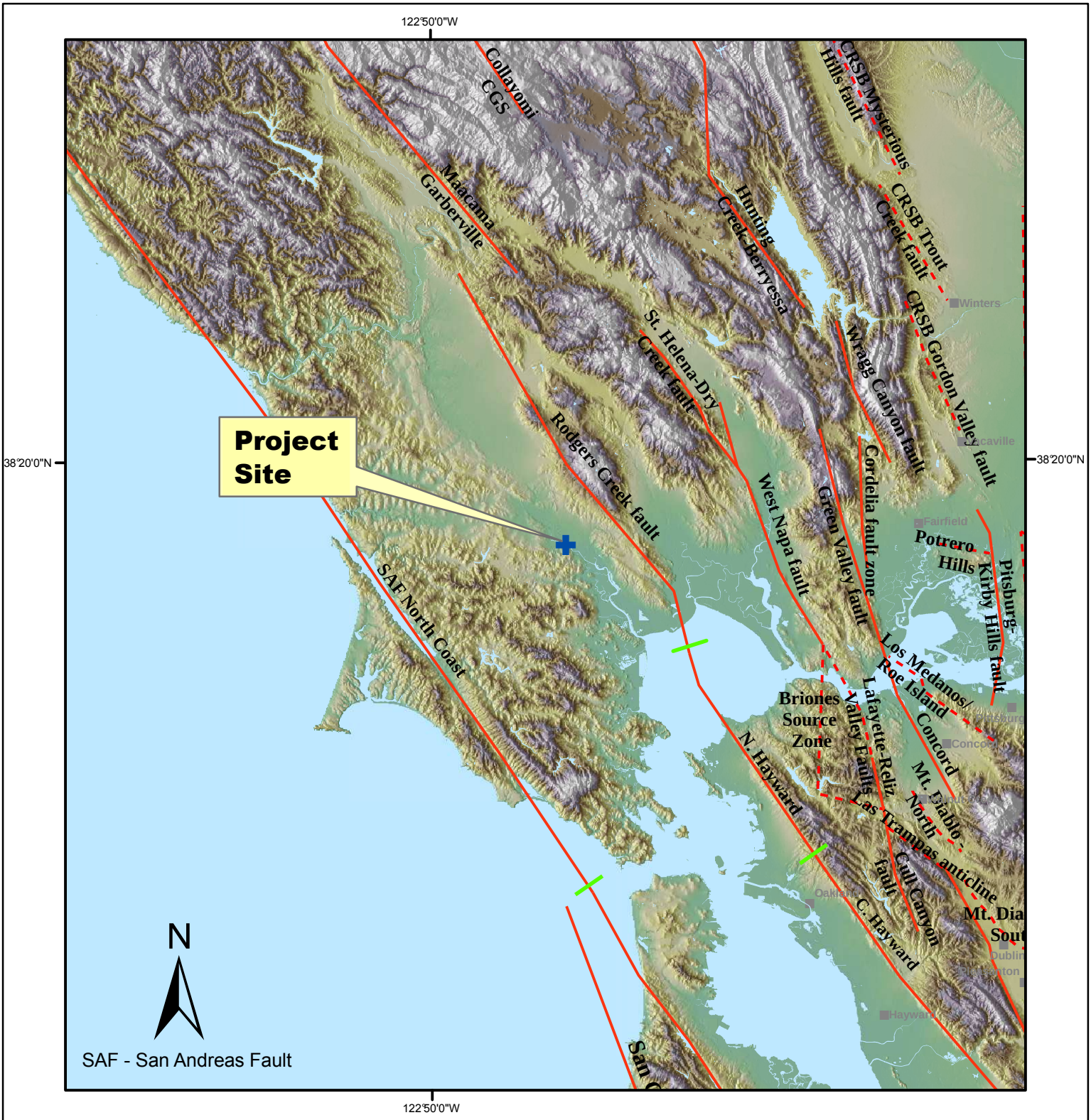
LEGEND

af	Artificial Fill
afbm	Artificial Fill placed over Bay Mud
alf	Artificial Levee Fill
Qhc	Late Holocene to modern stream channel deposits
Qhbm	Holocene Bay Mud deposits
Qhf	Holocene alluvial fan desposits
Qls	Landslides
Tv	Tertiary Volcanic Rock
KJfsch	Franciscan Complex Rock

Source:
Wagner, D. L., Rice, S.R., Bezore S., Randolph-Loar, C.E., Allen J., and Witter R.C., 2002, Geologic map of the Petaluma River 7 1/2' quadrangle, Marin and Sonoma counties, California, a digital database: California Geological Survey.

0 0.1 0.2 0.3 0.4 0.5 mile

URS	Marin Sonoma Narrows Project, Segment B4 Project Number: 28645045	Regional Geologic Map Sonoma County, California	Figure 3-1 August 19, 2009



7 3.5 0 7 Miles

0 4.5 9 18 27 36 Kilometers

Faults with surface rupture

Blind faults and zones

Segment boundary

Fault Source: URS Seismic Source Model

URS	Project No. 28645045 Marin Sonoma Narrows Project, 101/116 Bridge Phase B4	ACTIVE FAULTS IN THE SAN FRANCISCO BAY REGION	Figure 3-2

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

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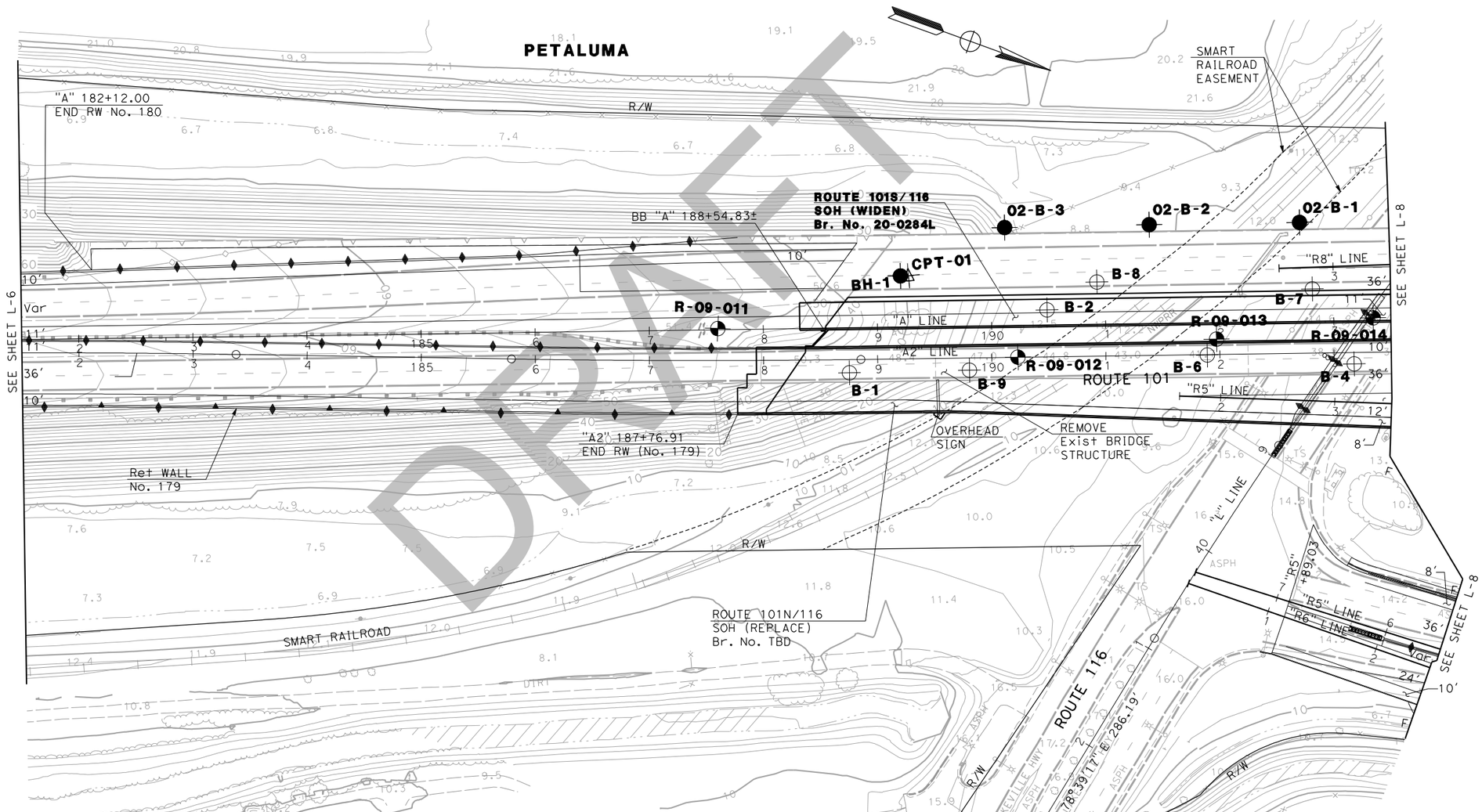
SAN JOSE, CA 95113



Boring for this study
As-Built Borings (2001/2002)
As-Built Borings (1952)
As-Built CPT (2002)

U.S. 101S/SR116 SOH (WIDEN)
SITE AND BORING LOCATION PLAN
FIGURE 3-3

SCALE: 1" = 50'

REVISED BY	DATE REVISED

CALCULATED-DESIGNED BY	CHECKED BY
ELIE ABI-JAOUDE	BEN RAZEGHI

CONSULTANT FUNCTIONAL SUPERVISOR
RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 00-00-00 DATE PLOTTED => 4/12/2010 TIME PLOTTED => 7:20:51 PM

BORDER LAST REVISED 4/11/2008

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

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DGN FILE => ...\Fig3-3_bor_location_L-07.dgn

CU 00000

EA 2640C1

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

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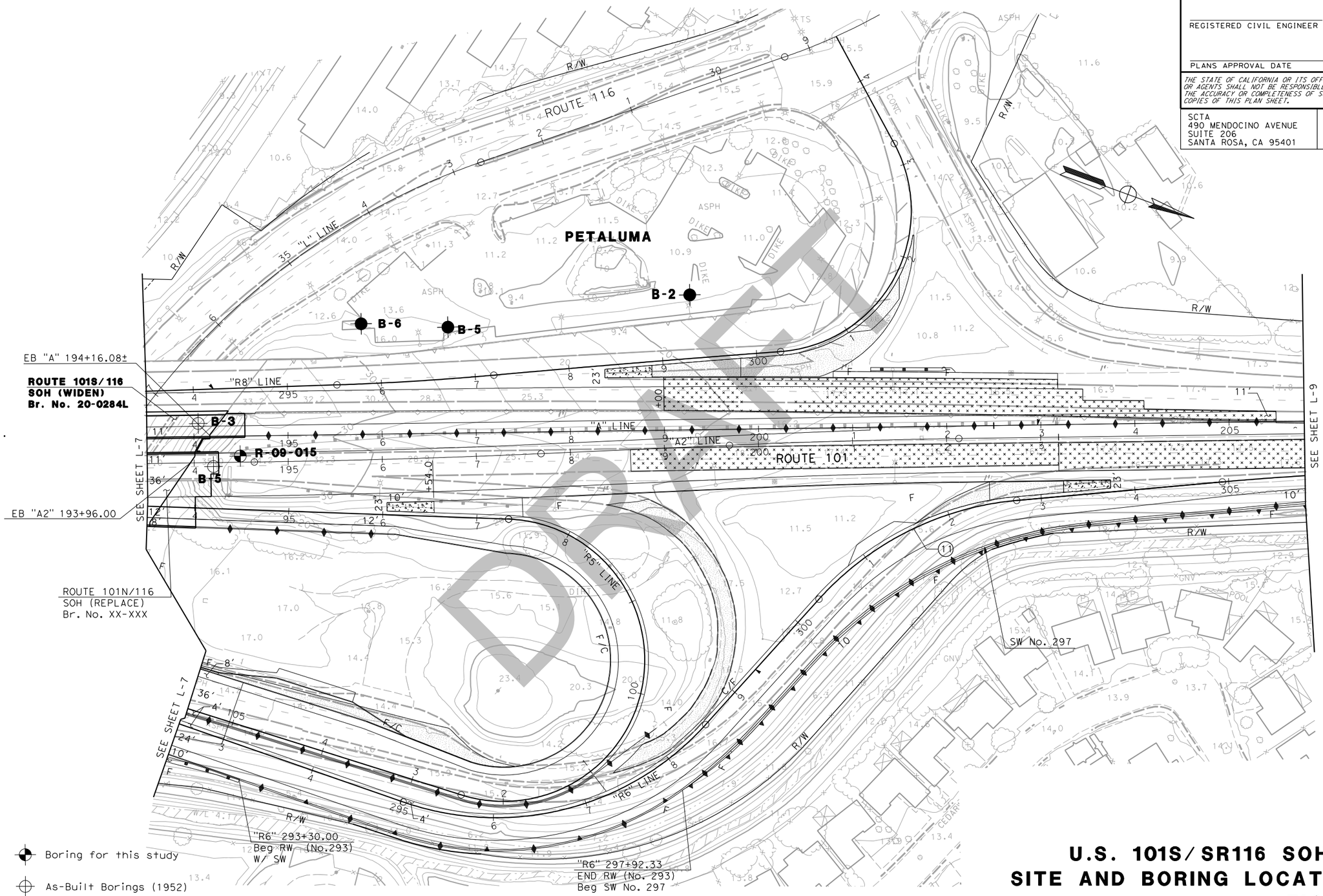
SAN JOSE, CA 95113



Boring for this study

As-Built Borings (1952)

As-Built Borings (2001/2002)

U.S. 101S/SR116 SOH (WIDEN)
SITE AND BORING LOCATION PLAN
FIGURE 3-4

SCALE: 1" = 50'

REVISED BY	DATE REVISED

CALCULATED-DESIGNED BY	ELIE ABI-JAOUDE
CHECKED BY	BEN RAZEGHI
CONSULTANT FUNCTIONAL SUPERVISOR	RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 00-00-00

DATE PLOTTED => 4/12/2010
TIME PLOTTED => 7:19:27 PM

BORDER LAST REVISED 4/11/2008

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

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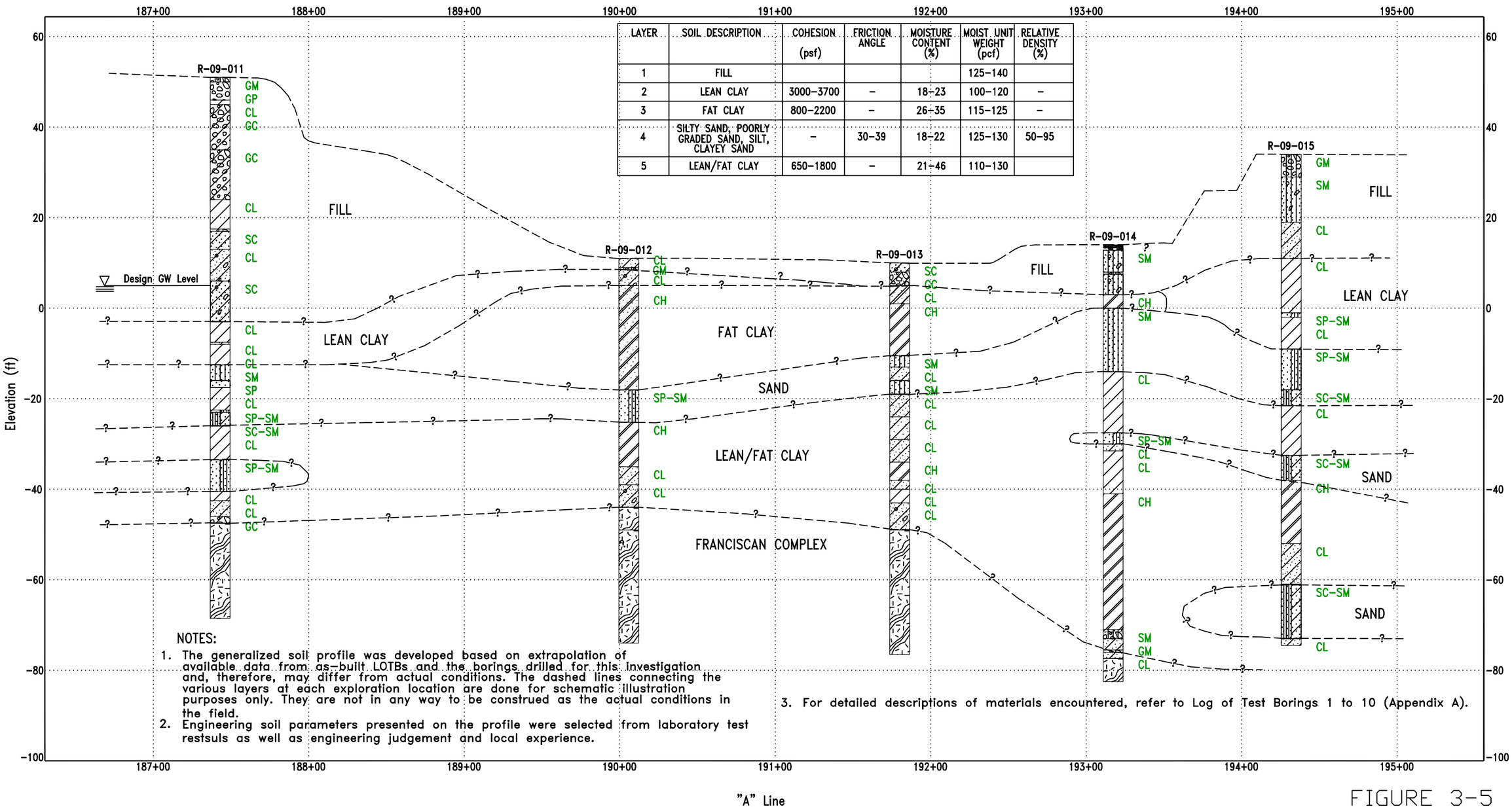
CU 00000

EA 2640C1

LAYER	SOIL DESCRIPTION	COHESION (psf)	FRICTION ANGLE	MOISTURE CONTENT (%)	MOIST. UNIT WEIGHT (pcf)	RELATIVE DENSITY (%)
1	FILL				125–140	
2	LEAN CLAY	3000–3700	–	18–23	100–120	–
3	FAT CLAY	800–2200	–	26–35	115–125	–
4	SILTY SAND, POORLY GRADED SAND, SILT, CLAYEY SAND	–	30–39	18–22	125–130	50–95
5	LEAN/FAT CLAY	650–1800	–	21–46	110–130	



NOTES:

1. The generalized soil profile was developed based on extrapolation of available data from as-built LOTBs and the borings drilled for this investigation and, therefore, may differ from actual conditions. The dashed lines connecting the various layers at each exploration location are done for schematic illustration purposes only. They are not in any way to be construed as the actual conditions in the field.
2. Engineering soil parameters presented on the profile were selected from laboratory test restsuls as well as engineering judgement and local experience.
3. For detailed descriptions of materials encountered, refer to Log of Test Borings 1 to 10 (Appendix A).

FIGURE 3-5

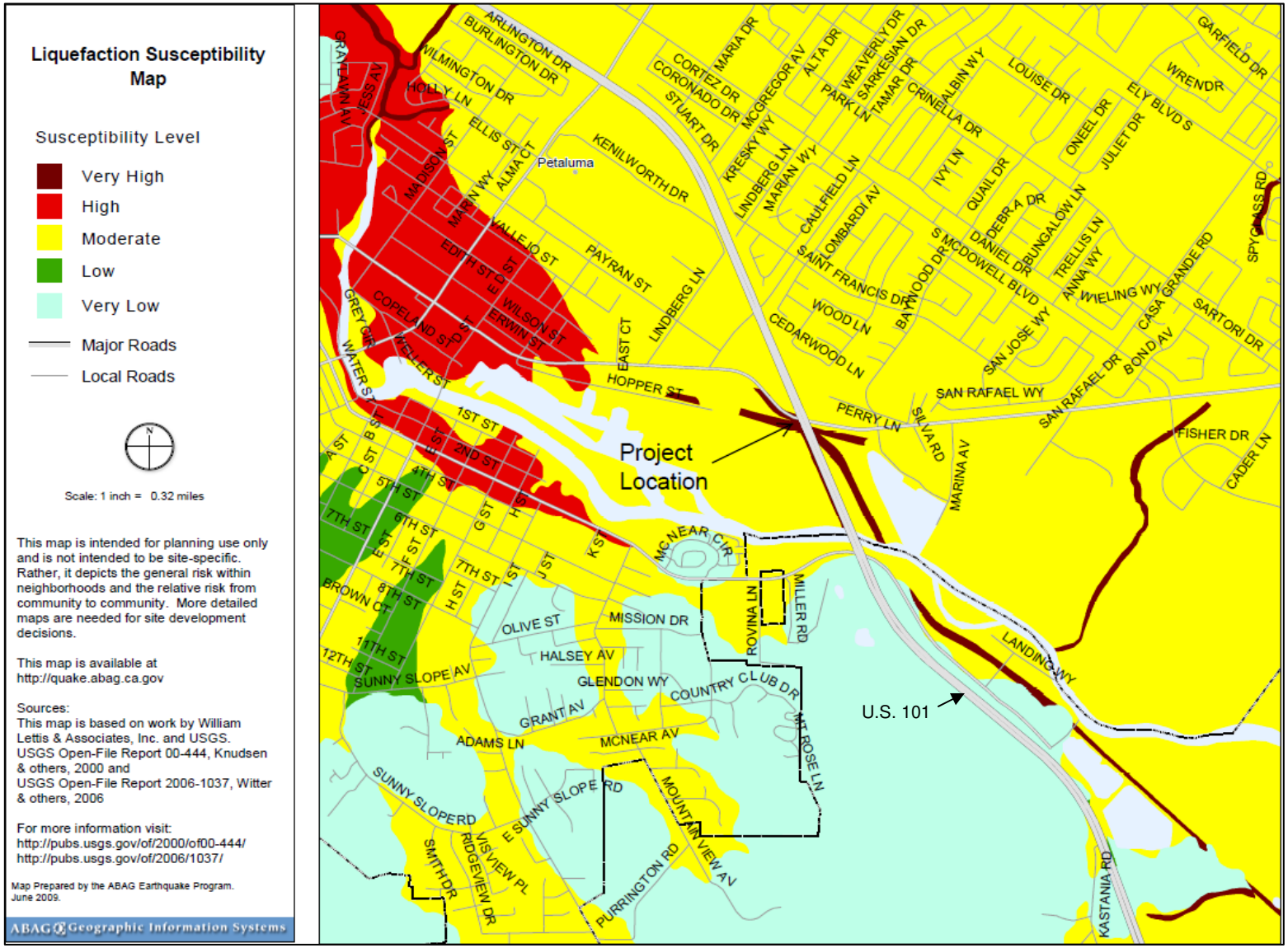
URS CORPORATION – SAN JOSE
100 W. SAN FERNANDO ST, SUITE 200
SAN JOSE, CA 95113

LITHOLOGY GRAPHICS

USCS Silty Gravel (poorly graded) | USCS Poorly Graded Gravel | USCS Lean Clay | USCS Clayey Gravel | USCS Clayey Sand
USCS Sandy Lean Clay with gravel | USCS Clayey Sand with gravel | USCS Sandy Lean Clay | USCS Silty Sand | USCS Poorly Graded Sand
USCS Poorly Graded Sand with silt | USCS Silty, Clayey Sand | USCS Silty Gravel with sand | USCS Fat Clay with sand | USCS Fat Clay

GENERALIZED SOIL PROFILE
U.S. 101S/SR 116 SOH (WIDEN)
101 MSN-B4
PETALUMA, CALIFORNIA

SIMPLE FENCE B-SIZE - URS MODIFIED 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 9/24/09



URS
100 W. San Fernando Street, Suite 200
San Jose, CA 95113
PHONE: (408) 297-9585
FAX: (408) 297-6962

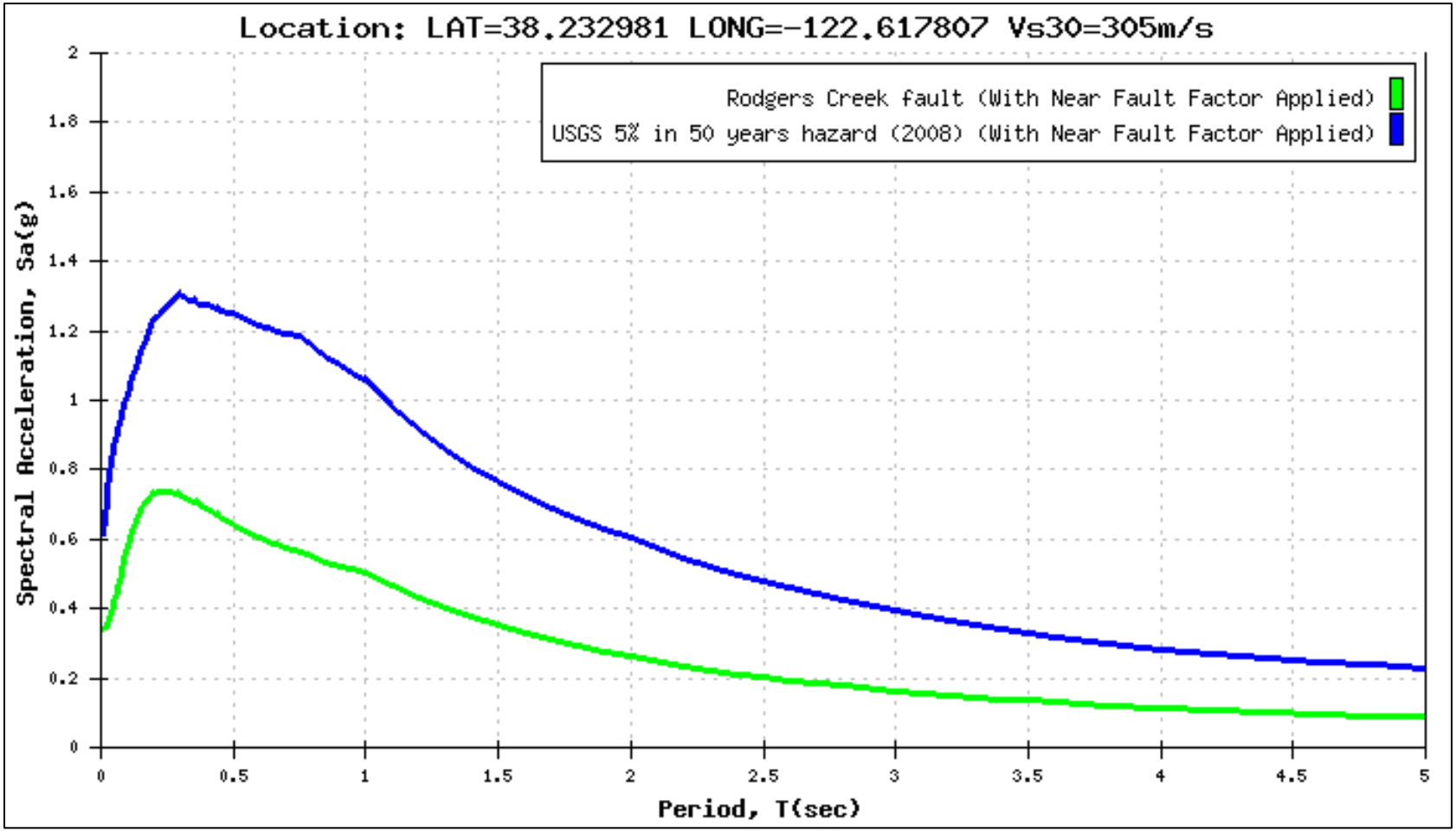
Marin Sonoma Narrows-B4
U.S.101/SR 116 SOH
Petaluma, CA

Project No: 28645045

Liquefaction Susceptibility Map

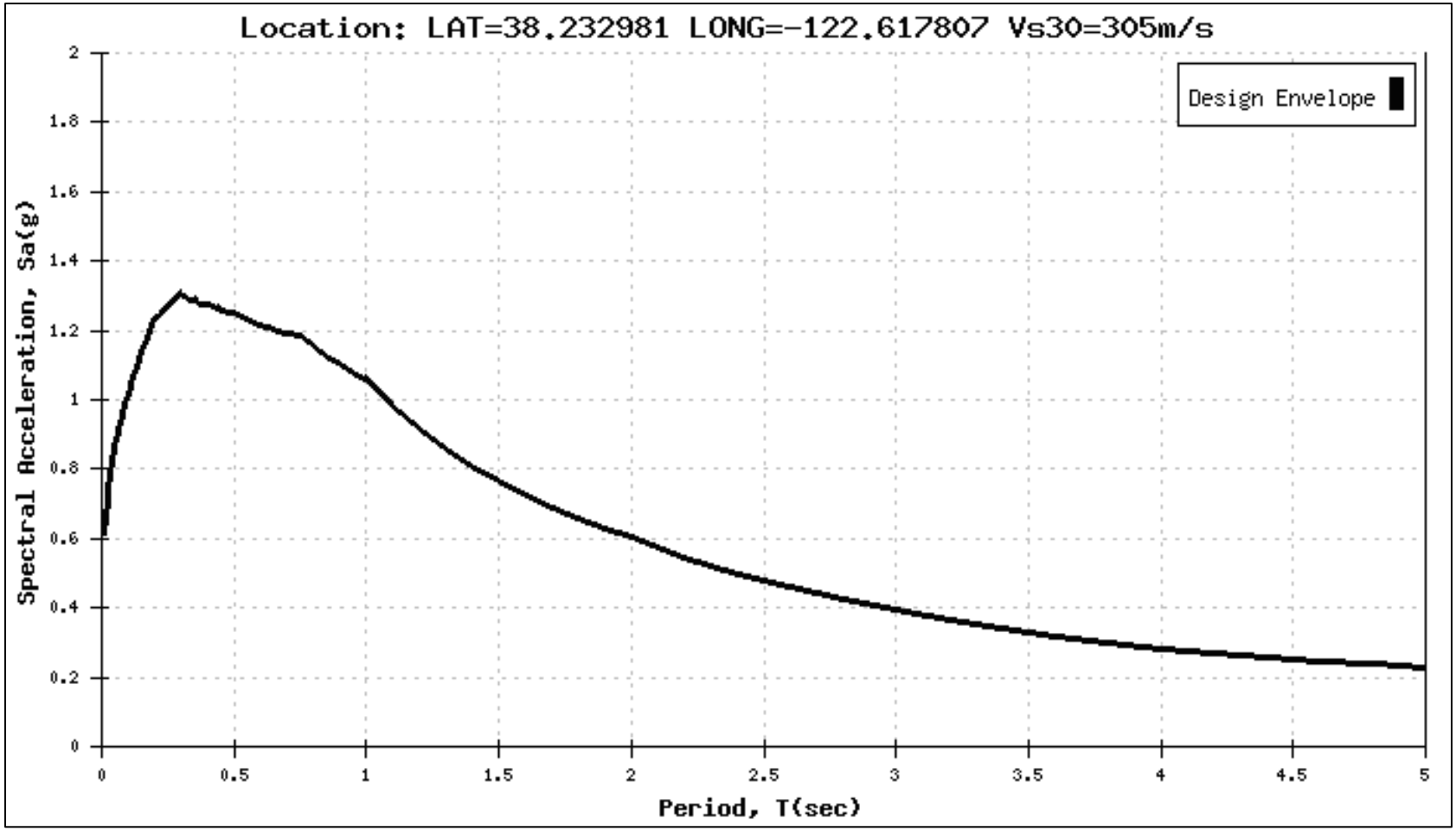
FIGURE 3-6

August, 2009



Reference: Caltrans ARS Online (2009)

URS 100 W. San Fernando Street, Suite 200 San Jose, CA 95113 PHONE: (408) 297-9585 FAX: (408) 297-6962	PROJECT No 28645045	CALCULATED BY Madhu Thummaluru	**Marin Sonoma Narrows-B4** **U.S.101/SR 116 SOH** **Petaluma, CA** **Calculated Spectra**	**FIGURE** **5-1**
	Date August, 2009			



Reference: Caltrans ARS Online (2009)

URS 100 W. San Fernando Street, Suite 200 San Jose, CA 95113 PHONE: (408) 297-9585 FAX: (408) 297-6962	PROJECT No 28645045	CALCULATED BY Madhu Thummaluru	**Marin Sonoma Narrows-B4** **U.S.101/SR 116 SOH** **Petaluma, CA**	**FIGURE** **5-2**
	Date August, 2009		**Calculated Spectra Design Curve**	

DRAFT

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	2.5/4.1		

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SAN JOSE, CA 95113

SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

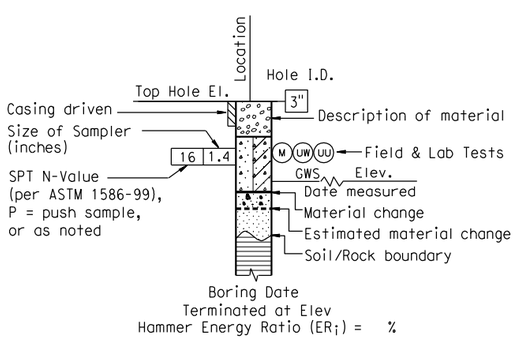
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
⬚	O	Other

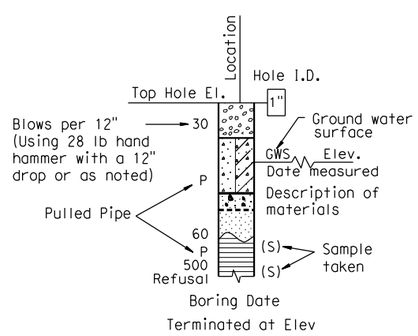
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

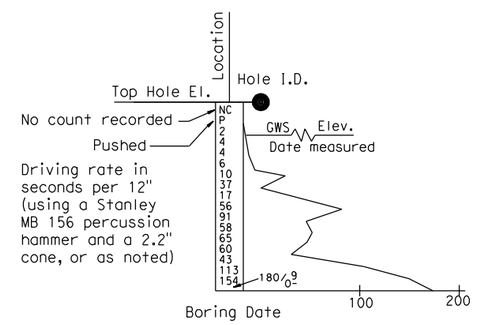
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.



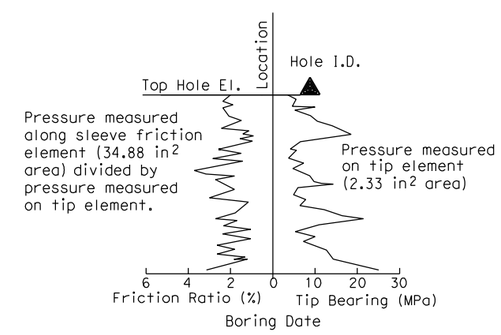
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

SOIL LEGEND

DESIGN OVERSIGHT	DRAWN BY	A. CHEUNG	C. RAMBO	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	S. HUANG
SIGN OFF DATE	CHECKED BY	MANOHARAN	FIELD INVESTIGATION BY: DATE:		PROJECT ENGINEER

BRIDGE NO. 20-0284L
POST MILES 3.65

ROUTE 101S/116 SOH (WIDEN)
LOG OF TEST BORINGS 1 OF 10

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 040000077361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 4-15-10 9-24-10 11-28-10 SHEET OF

FILE => ...\116 Widen\20-0284L-z-1tb01.dgn

USERNAME => madhu_thuba DATE PLOTTED => 5/17/2011 TIME PLOTTED => 9:09:14 AM

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	2.5/4.1		

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SANTA ROSA, CA 95401

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names	Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND	CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND		
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND	CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND	ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GM	SILTY GRAVEL SILTY GRAVEL with SAND	OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND	OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL		
SP	Poorly graded SAND Poorly graded SAND with GRAVEL	CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL		
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL		
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
SM	SILTY SAND SILTY SAND with GRAVEL		
SC	CLAYEY SAND CLAYEY SAND with GRAVEL	OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
PT	PEAT	OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND
	COBBLES COBBLES and BOULDERS BOULDERS		

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

SOIL LEGEND

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY A. CHEUNG

CHECKED BY MANOHARAN

C. RAMBO
FIELD INVESTIGATION BY:
DATE:

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. HUANG
PROJECT ENGINEER

BRIDGE NO. 20-0284L
POST MILES 3.65

ROUTE 101S/116 SOH (WIDEN)
LOG OF TEST BORINGS 2 OF 10

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 040000077361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 4-15-10 9-24-10 11-28-10

SHEET OF

FILE => ...\116 Widen\20-0284L-z-1tb02.dgn

USERNAME => madhu_thu DATE PLOTTED => 5/17/2011 TIME PLOTTED => 9:10:17 AM

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. C 42289 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

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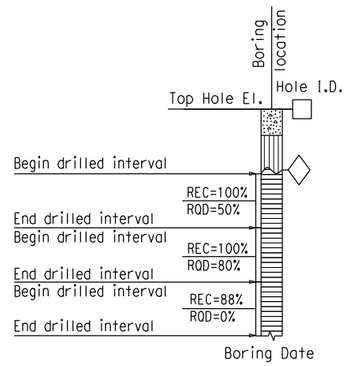
URS CORPORATION
100 WEST SAN FERNANDO STREET, SUITE 200
SAN JOSE, CA 95113

SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401

PERCENT CORE RECOVERY (REC) & ROCK QUALITY DESIGNATION (RQD)

$$REC = \frac{\sum \text{Length of the recovered core pieces (inches)}}{\text{Total length of core run (inches)}} \times 100\%$$

$$RQD = \frac{\sum \text{Length of intact core pieces} \geq 4''}{\text{Total length of core run (inches)}} \times 100\%$$



RELATIVE STRENGTH OF INTACT ROCK

Term	Uniaxial Compressive Strength (PSI)
Extremely Strong	> 30,000
Very Strong	14,500 - 30,000
Strong	7,000 - 14,500
Medium Strong	3,500 - 7,000
Weak	700 - 3,500
Very Weak	150 - 700
Extremely Weak	< 150

BEDDING SPACING

Description	Thickness / Spacing
Massive	Greater than 10 ft
Very thickly bedded	3 to 10 ft
Thickly bedded	1 to 3 ft
Moderately bedded	3-5/8" to 1 ft
Thinly bedded	1-1/4" to 3-5/8"
Very thinly bedded	3/8" to 1-1/4"
Laminated	Less than 3/8"

LEGEND OF ROCK MATERIALS

- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

ROCK HARDNESS

Description	Criteria
Extremely Hard	Specimen cannot be scratched with a pocket knife or sharp pick; can only be chipped with repeated heavy hammer blows.
Very Hard	Specimen cannot be scratched with a pocket knife or sharp pick. Breaks with repeated heavy hammer blows.
Hard	Specimen can be scratched with a pocket knife or sharp pick with difficulty (heavy pressure). Heavy hammer blows required to break specimen.
Moderately Hard	Specimen can be scratched with pocket knife or sharp pick with light or moderate pressure. Core breaks with moderate hammer pressure.
Moderately Soft	Specimen can be grooved 1/6" deep with a pocket knife or sharp pick with moderate or heavy pressure. Breaks with light hammer blow or heavy manual pressure.
Soft	Specimen can be grooved or gouged easily by a pocket knife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
Very Soft	Specimen can be readily indented, grooved or gouged with fingernail, or carved with a pocket knife. Breaks with light manual pressure.

FRACTURE DENSITY

Description	Observed Fracture Density
Unfractured	No fractures.
Very slightly fractured	Lengths greater than 3 feet.
Slightly fractured	Lengths from 1 to 3 feet with few lengths less than 1 foot or greater than 3 feet.
Moderately fractured	Lengths mostly in 4" to 1 foot range with most lengths about 8"
Intensely fractured	Lengths average from 1 to 4" with scattered fragmented intervals with lengths less than 4"
Very intensely fractured	Mostly chips and fragments with a few scattered short core lengths.

Combination descriptors (such as "Very intensely to intensely fractured") are used where equal distribution of both fracture density characteristics is present over a significant interval or exposure, or where characteristics are "in between" the descriptor definitions. Only two adjacent descriptors may be combined.

WEATHERING DESCRIPTORS FOR INTACT ROCK

Description	Diagnostic features					General Characteristics
	Chemical Weathering-Discoloration and/or oxidation		Mechanical Weathering-Grain boundary conditions (disaggregation) primarily for granitics and some coarse-grained sediments	Texture and Solutioning		
	Body of Rock	Fracture Surfaces		Texture	Solutioning	
Fresh	No discoloration, not oxidized.	No discoloration or oxidation.	No separation, intact (tight).	No change.	No solutioning.	Hammer rings when crystalline rocks are struck.
Slightly Weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull.	Minor to complete discoloration or oxidation of most surfaces.	No visible separation, intact (tight).	Preserved.	Minor leaching of some soluble minerals may be noted.	Hammer rings when crystalline rocks are struck. Body of rock not weakened.
Moderately Weathered	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are "rusty," feldspar crystals are "cloudy."	All fracture surfaces are discolored or oxidized.	Partial separation of boundaries visible.	Generally preserved.	Soluble minerals may be mostly leached.	Hammer does not ring when rock is struck. Body of rock is slightly weakened.
Intensely Weathered	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in-situ disaggregation, see grain boundary conditions.	All fracture surfaces are discolored or oxidized, surfaces friable.	Partial separation, rock is friable; in semiarid conditions granitics are disaggregated.	Texture altered by chemical disintegration (hydration, argillation).	Leaching of soluble minerals may be complete.	Dull sound when struck with hammer, usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures, or veinlets. Rock is significantly weakened.
Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay.		Complete separation of grain boundaries (disaggregated).	Resembles a soil, partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete.		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes."

Combination descriptors (such as "slightly weathered to fresh") are permissible where equal distribution of both weathering characteristics is present over significant intervals or where characteristics present are "in between" the diagnostic feature. However, combination descriptors should not be used where significant, identifiable zones can be delineated. Only two adjacent descriptors may be combined. "Very intensely weathered" is the combination descriptor for "intensely weathered to decomposed."

ROCK LEGEND

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY A. CHEUNG

CHECKED BY MANOHARAN

C. RAMBO
FIELD INVESTIGATION BY:
DATE:

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. HUANG
PROJECT ENGINEER

BRIDGE NO. 20-0284L
POST MILES 3.65

ROUTE 101S/116 SOH (WIDEN)
LOG OF TEST BORINGS 3 OF 10

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 040000077361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 4-18-10 9-23-10 11-28-10

SHEET OF

FILE => ...\116 Widen\20-0284L-z-1tb03.dgn

USERNAME => madhu_thuba DATE PLOTTED => 5/17/2011 TIME PLOTTED => 9:11:23 AM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. C 42289 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

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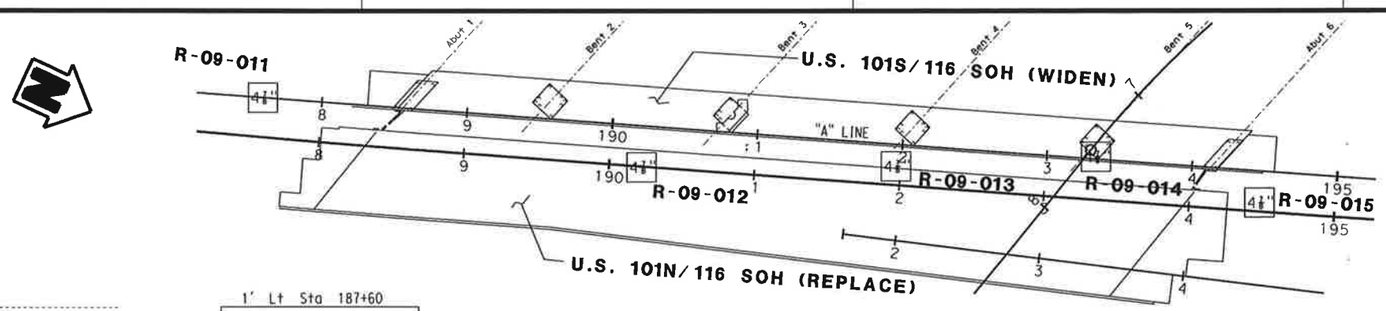
URS CORPORATION
100 WEST SAN FERNANDO STREET, SUITE 200
SAN JOSE, CA 95113

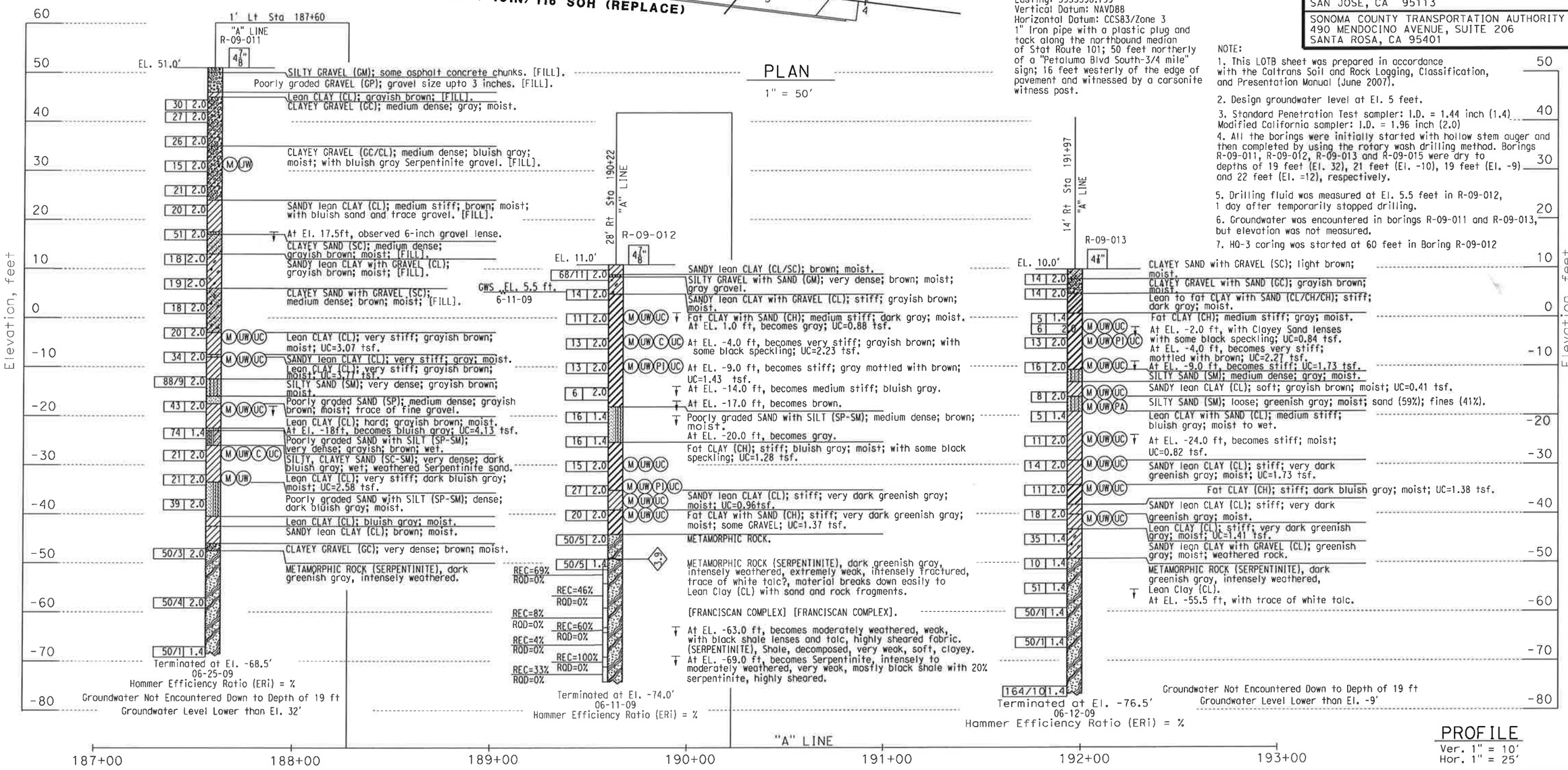
SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401



BENCH MARK:
B.M: JK121
B. M Elev.: 81.98 US Survey Feet
Northing: 2276227.207
Easting: 5954272.578
Vertical Datum: NAVD88
Horizontal Datum: CCS83/Zone 3
1" Iron pipe with a plastic plug and tack along the northbound shoulder of Stat Route 101 across from a "Sonoma-Napa-Right Lane" sign; 10.7 feet easterly of a metal beam guard rail and at top slope.
B.M: JK122
B. M Elev.: 52.65 US Survey Feet
Northing: 2277835.878
Easting: 5953598.199
Vertical Datum: NAVD88
Horizontal Datum: CCS83/Zone 3
1" Iron pipe with a plastic plug and tack along the northbound median of Stat Route 101; 50 feet northerly of a "Petaluma Blvd South-3/4 mile" sign; 16 feet westerly of the edge of pavement and witnessed by a carsonite witness post.

NOTE:
1. This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (June 2007).
2. Design groundwater level at El. 5 feet.
3. Standard Penetration Test sampler: I.D. = 1.44 inch (1.4) Modified California sampler: I.D. = 1.96 inch (2.0)
4. All the borings were initially started with hollow stem auger and then completed by using the rotary wash drilling method. Borings R-09-011, R-09-012, R-09-013 and R-09-015 were dry to depths of 19 feet (El. 32), 21 feet (El. -10), 19 feet (El. -9) and 22 feet (El. =12), respectively.
5. Drilling fluid was measured at El. 5.5 feet in R-09-012, 1 day after temporarily stopped drilling.
6. Groundwater was encountered in borings R-09-011 and R-09-013, but elevation was not measured.
7. HQ-3 coring was started at 60 feet in Boring R-09-012

PLAN
1" = 50'



PROFILE
Ver. 1" = 10'
Hor. 1" = 25'

DESIGN OVERSIGHT	DRAWN BY	A. CHEUNG	C. RAMBO
SIGN OFF DATE	CHECKED BY	MANOHARAN	FIELD INVESTIGATION BY: DATE:

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. HUANG
PROJECT ENGINEER

BRIDGE NO. 20-0284L
POST MILES 3.65

ROUTE 101S/116 SOH (WIDEN)
LOG OF TEST BORINGS 4 OF 10

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 040000077361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 5-18-10 3-21-10 11-23-10

SHEET OF

FILE => ...\116 Widen\20-0284L-z-ltb04.dgn

USERNAME => mohhu_thubrisu PLOTTED => 5/17/2011 TIME PLOTTED => 9:54:14 AM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	Son	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

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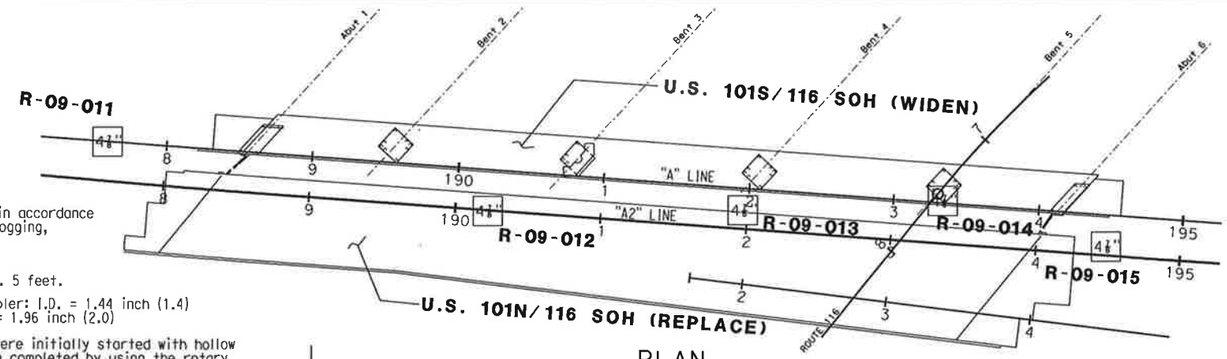
REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. C 42289 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

URS CORPORATION
100 WEST SAN FERNANDO STREET, SUITE 200
SAN JOSE, CA 95113

SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401

NOTE:

1. This LOTB sheet was prepared in accordance with the caltrans soil and Rock logging, Classification, and Presentation Manual (June 2007).
2. Design groundwater level at El. 5 feet.
3. Standard Penetration Test Sampler: I.D. = 1.44 inch (1.4)
Modified California Sampler: I.D. = 1.96 inch (2.0)
4. All the borings were initially started with hollow stem auger and then completed by using the rotary wash drilling method. Borings R-09-011, R-09-012, R-09-013 and R-09-015 were dry to depths of 19 feet (El. 32), 21 feet (El. -10), 19 feet (El. -9) and 22 feet (El. =12), respectively.
5. Groundwater was encountered in boring R-09-015, but elevation was not measured.

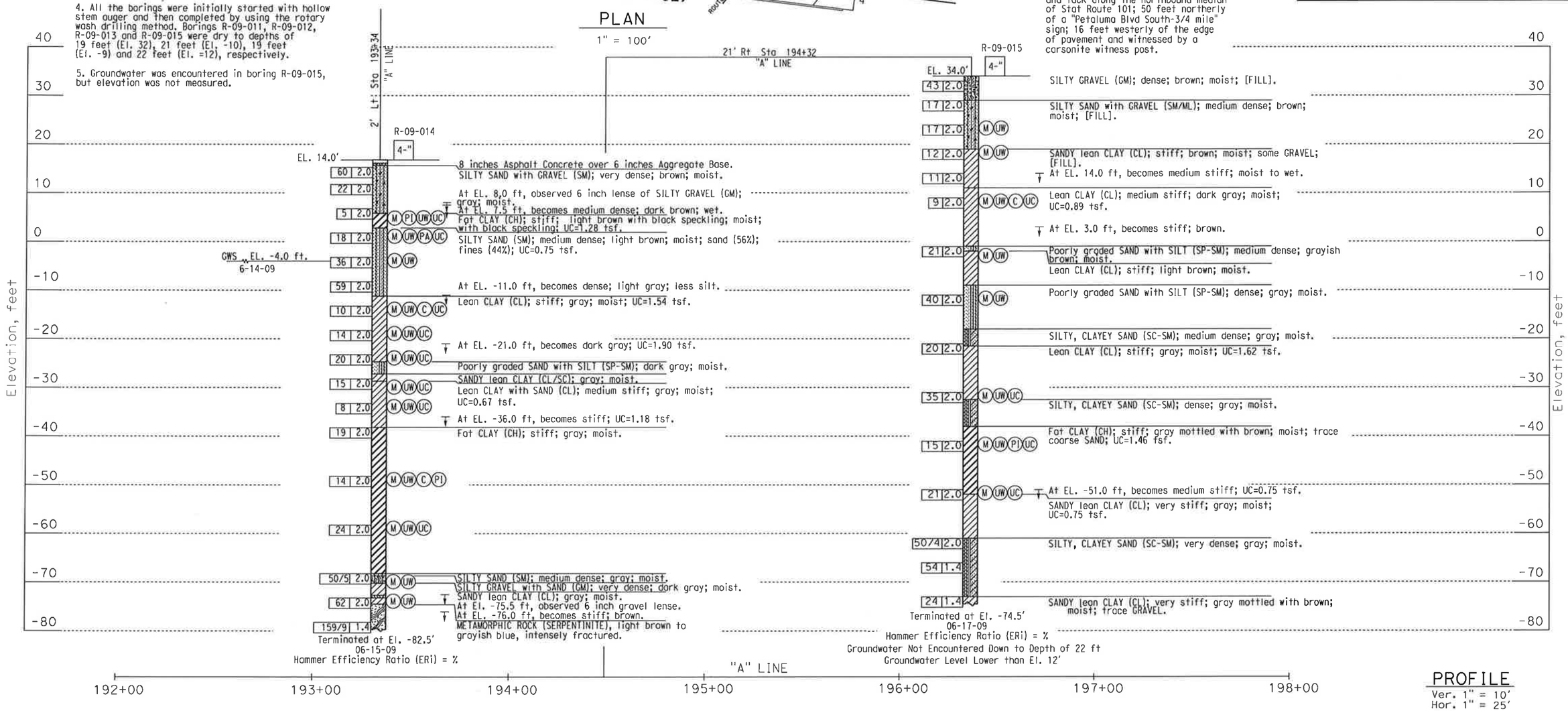


PLAN
1" = 100'

BENCH MARK:

B.M: JK121
B. M Elev.: 81.98 US Survey Feet
Northing: 2276227.207
Easting: 5954272.578
Vertical Datum: NAVD88
Horizontal Datum: CCS83/Zone 3
1" Iron pipe with a plastic plug and tack along the northbound shoulder of Stat Route 101 across from a "Sonoma-Napa-Right Lane" sign; 10.7 feet easterly of a metal beam guard rail and at top slope.

B.M: JK122
B. M Elev.: 52.65 US Survey Feet
Northing: 2277835.878
Easting: 5953598.199
Vertical Datum: NAVD88
Horizontal Datum: CCS83/Zone 3
1" Iron pipe with a plastic plug and tack along the northbound median of Stat Route 101; 50 feet northerly of a "Petaluma Blvd South-3/4 mile" sign; 16 feet westerly of the edge of pavement and witnessed by a carsonite witness post.



PROFILE
Ver. 1" = 10'
Hor. 1" = 25'

DESIGN OVERSIGHT	DRAWN BY	A. CHEUNG	C. RAMBO	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	S. HUANG
SIGN OFF DATE	CHECKED BY	MANOHARAN	FIELD INVESTIGATION BY: DATE:		PROJECT ENGINEER

BRIDGE NO. 20-0284L
POST MILES 3.65

ROUTE 101S/116 SOH (WIDEN)
LOG OF TEST BORINGS 5 OF 10

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 040000077361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 4-18-10 9-24-10 11-28-10 SHEET OF

FILE => ...\116 Widen\20-0284L-z-1tb05.dgn

USERNAME => mathu_thu DATE PLOTTED => 5/17/2011 TIME PLOTTED => 9:55:09 AM

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	120	148

GEOTECHNICAL PROFESSIONAL

3-15-04
PLANS APPROVAL DATE

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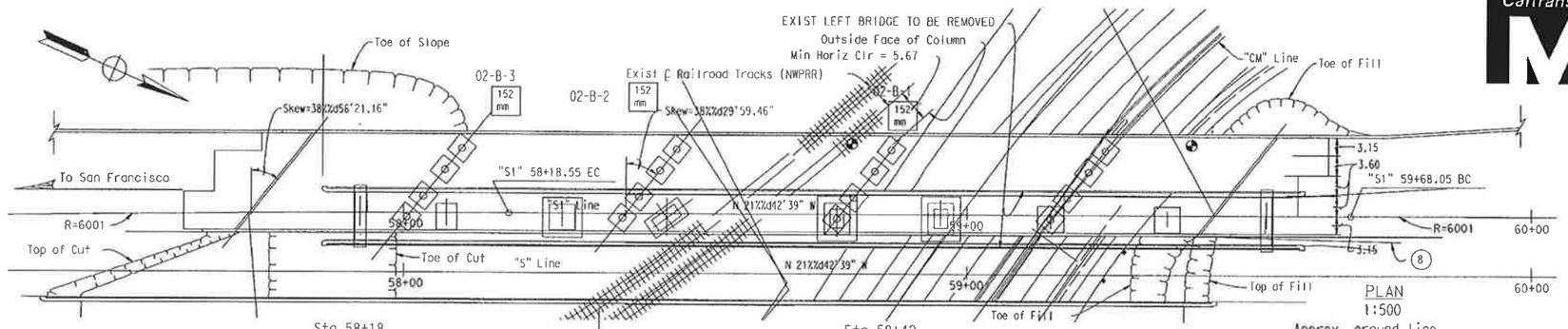
REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. G.E. 666 Exp. 12/31/05 STATE OF CALIFORNIA

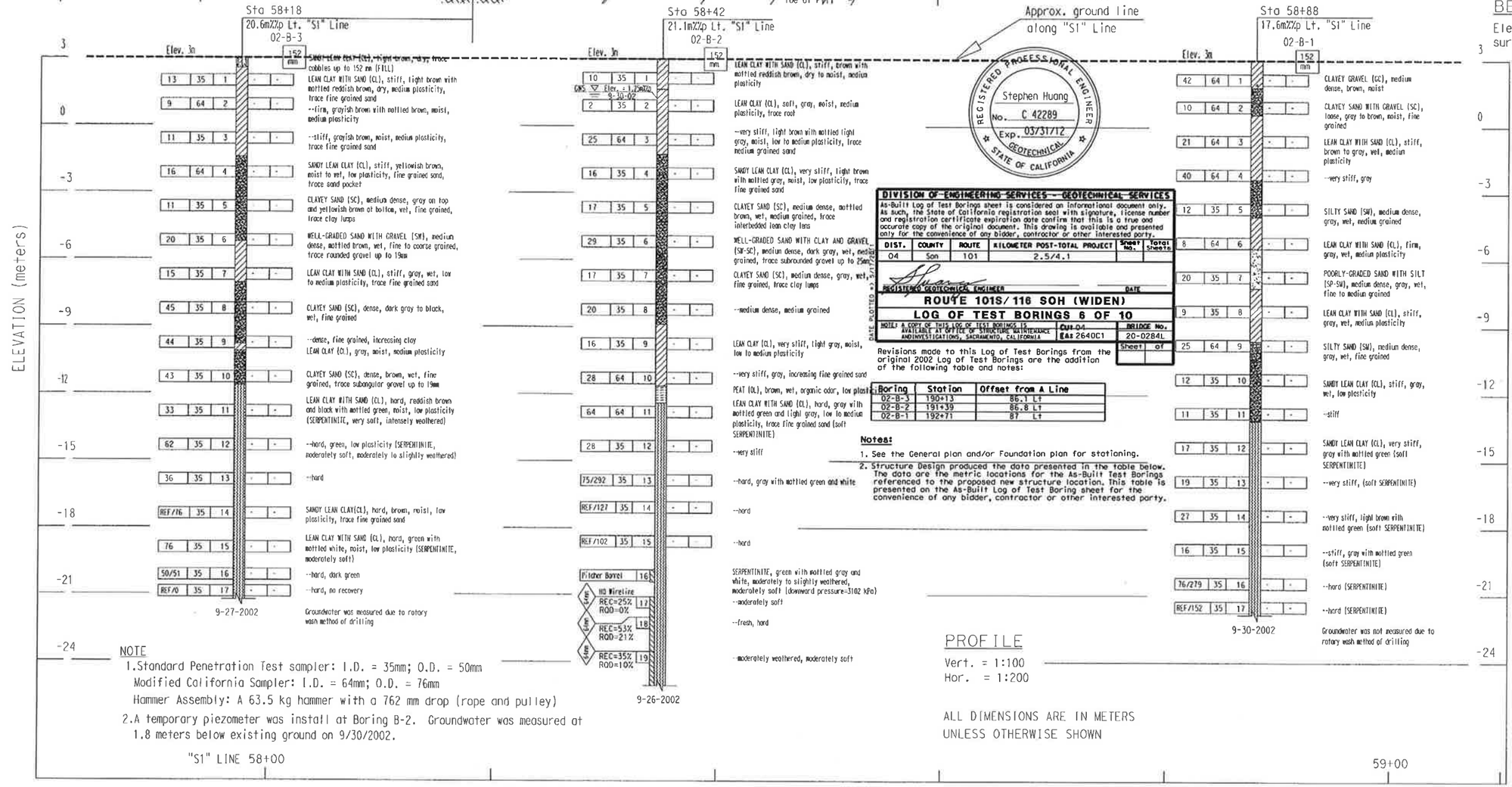
PARIKH CONSULTANTS, INC.
356 SOUTH MILPITAS BLVD.
MILPITAS CA 95035

Caltrans now has a web site! To get to the web site, go to: http://www.dot.ca.gov

Caltrans Metric



BENCHMARK:
Elevations based on surveyed topography.



REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. C 42289 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

DIVISION OF ENGINEERING SERVICES—GEOTECHNICAL SERVICES

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	Sheet No.	Total Sheets
04	Son	101	2.5/4.1		

REGISTERED GEOTECHNICAL ENGINEER — DATE

DATE PLOTTED >> 5/7/03

ROUTE 101S/116 SOH (WIDEN)

LOG OF TEST BORINGS 6 OF 10

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: 04 EA: 2640C1 — BRIDGE No. 20-0284L — Sheet of

Revisions made to this Log of Test Borings from the original 2002 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from ℄ Line
02-B-3	190+13	86.1 Lt
02-B-2	191+39	86.8 Lt
02-B-1	192+71	87 Lt

Notes:

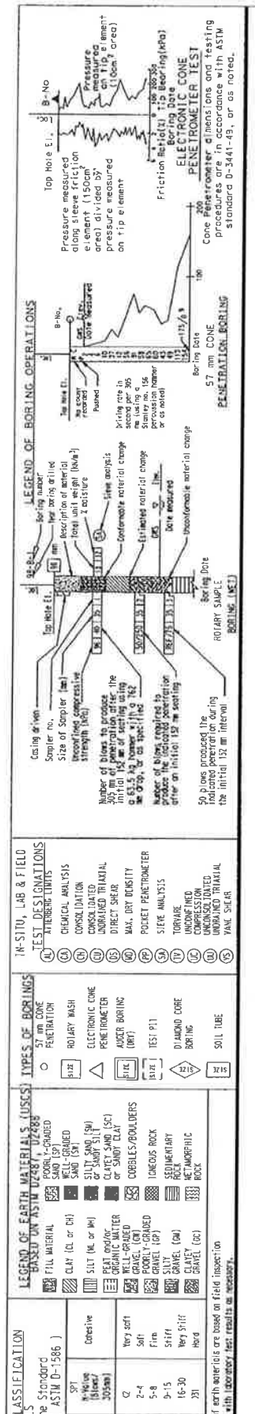
1. See the General plan and/or Foundation plan for stationing.
2. Structure Design produced the data presented in the table below. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.

NOTE

1. Standard Penetration Test sampler: I.D. = 35mm; O.D. = 50mm
   Modified California Sampler: I.D. = 64mm; O.D. = 76mm
   Hammer Assembly: A 63.5 kg hammer with a 762 mm drop (rope and pulley)
2. A temporary piezometer was install at Boring B-2. Groundwater was measured at 1.8 meters below existing ground on 9/30/2002.

PROFILE
Vert. = 1:100
Hor. = 1:200

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN



DESIGN OVERSIGHT	DRAWN BY	F. WANG	F. WANG/E. BHANGOO
SIGN OFF DATE	CHECKED BY	Y. DAVID WANG	FIELD INVESTIGATION BY: DATE: 9/26-9/30

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

CHRISTOPHER KOEPKE
PROJECT ENGINEER

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

101/116 SOH REPLACE
LOG OF TEST BORINGS

GEOTECHNICAL LOG OF TEST BORINGS SHEET (METRIC) (REV 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

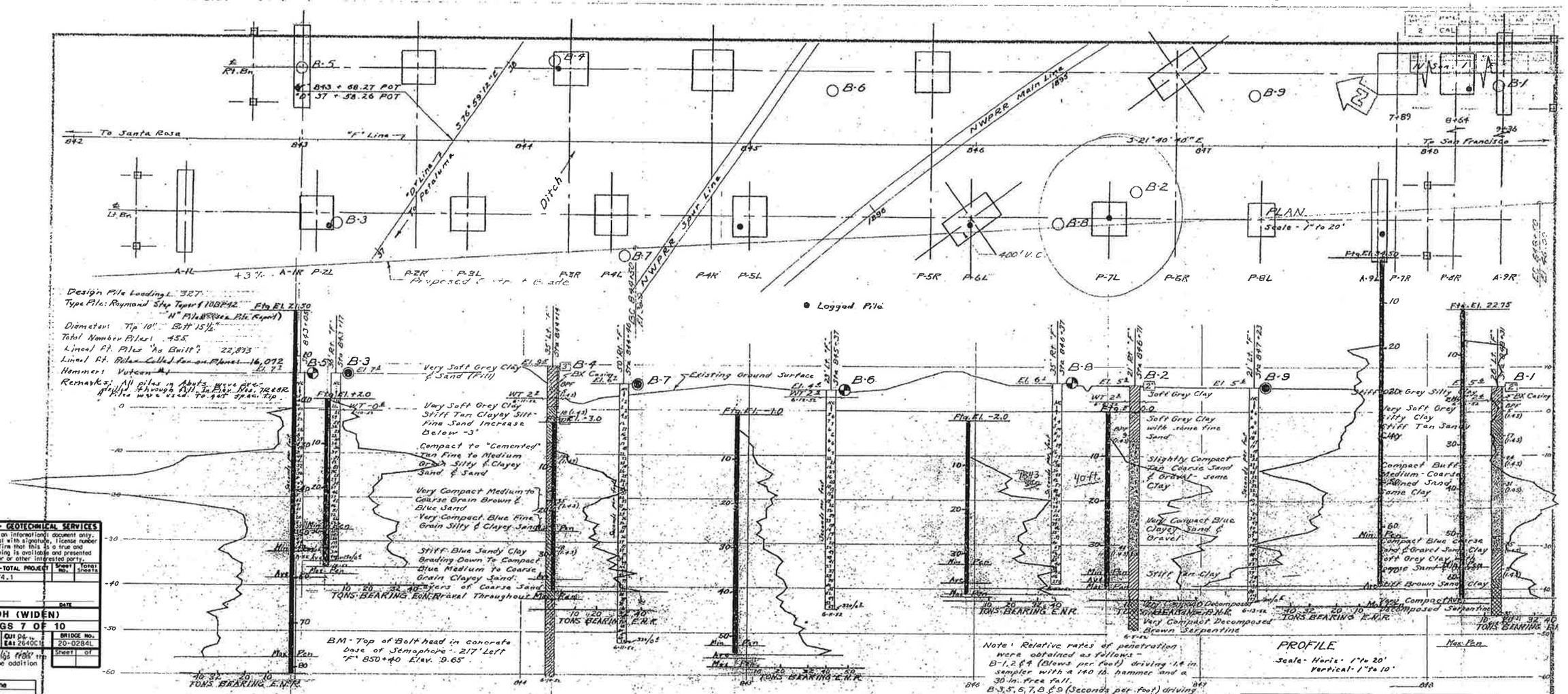
CU 04276
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 12/17/02 3/01/03

SHEET 26 OF 27

FILE => aslotb01.dgn



REGISTERED PROFESSIONAL ENGINEER
Stephen Huang
No. C 42289
Exp. 03/31/12
GEOTECHNICAL
STATE OF CALIFORNIA

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

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DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	Sheet No.	Total Sheets
04	Son	101	2.5/4.1		

DISTRICT GEOTECHNICAL ENGINEER — DATE

ROUTE 101S/116 SOH (WIDEN)

LOG OF TEST BORINGS 7 OF 10

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: 04 EA: 2640C1

BRIDGE No. 20-0284L

Sheet of

Revisions made to this Log of Test Borings from the original 1952 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset
B-1	188+75	39.3 Rt
B-2	189+80	38.5 Rt
B-3	190+49	15.3 Lt
B-8	190+93	37.1 Lt
B-6	191+19	28.1 Rt
B-7	192+81	28.5 Lt
B-4	193+17	37.7 Rt
B-3	194+05	14.1 Lt
B-5	194+20	31.9 Rt

Notes:

1. See the General plans and/or Foundation plan for stationing.
2. Structure Design produced the data presented in the table below. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

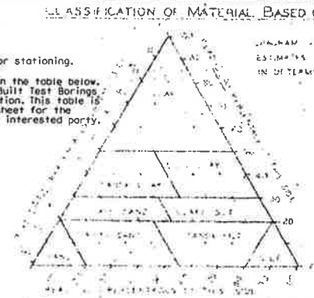

DIAGRAM AND TABLE SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION IN DETERMINATION OF CLASS NAMES

CLASS NAME	%	ESTIMATE OF SIZES PRESENT			
SAND					
SILTY SAND					
SANDY SILT					
[illegible]					
CLAYEY SAND					
SANDY CLAY					
[illegible]					
CLAY					

LEGEND OF BORING OPERATIONS

- Plant for Boring
- 3" Sampler Boring
- Rotary Wash Boring
- 4" Cored Sampler Driven
- Hand Boring
- 2 1/2" Penetrometer Driven
- 1 1/8" Sampler Boring
- 2 1/4" Cone Boring
- 6" Auger Boring
- 6" to 20" Auger Boring
- Casing
- Jet Bor
- Sample
- 1 3/8" A-F
- 2 1/4" Con

THE APPROPRIATE SYMBOLS DESIGNATING METHOD OF OPERATION SHOWN AT THE HAND CORNER OF THE MOST RECENT BORING. WHERE SUCH CHANGES WERE MADE DURING THE BORING OPERATION SYMBOLS ARE SHOWN AT THE POINT OF CHANGE.

Revisions made to this Log of Test Borings from the original 1952 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from "S" Line
B-1	57+76	7.9 m Left
B-2	58+25	6.4 m Right
B-3	59+33	10.9 m Right
B-4	59+03	10.7 m Left
B-5	59+38	9.4 m Left
B-6	58+65	7.0 m Left
B-7	59+93	15.2 m Right
B-8	58+35	10.7 m Right
B-9	58+09	6.4 m Left

Notes:

1. See the General Plan and/or Foundation Plan for Metric Stationing.
2. Structure Design produced the data presented in the table above. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.

ROCK - R

FILL MATERIAL

CLAYEY SILT - C SI

SANDY CLAY - SC

DIVISION OF ENGINEERING SERVICES - OFFICE OF GEOTECHNICAL SERVICES

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DIST.	COUNTY	ROUTE	KILOMETER POST - TOTAL PROJECT	Sheet No.	Total Sheets
04	Son	101	5.6/6.3	121	148

CERTIFIED ENGINEERING GEOLOGIST

101 / 116 SOH (REPLACE)

LOG OF TEST BORINGS

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CU: 04 EA: 276001

BRIDGE No. 20-0265L

Sheet 27 of 27

REGISTERED GEOLOGIST
Christopher W. Koepke
No. 2207
Exp. 10-31-04
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

NOTES

THE CONTRACTOR'S ATTENTION IS DIRECTED TO SECTION 2, ARTICLE (L) OF THE STANDARD SPECIFICATIONS AND TO THE SPECIAL PROVISIONS ACCOMPANYING THIS SET OF PLANS.

CLASSIFICATION OF EARTH MATERIAL AS SHOWN ON THIS SHEET IS BASED UPON FIELD INSPECTION AND IS NOT TO BE CONSTRUED TO IMPLY MECHANICAL ANALYSIS.

Alinement & Profile data was obtained from District 1: "Proposed Alinement" #A 284[illegible] & PP 2002-2 [illegible]

FOR PRELIMINARY REPORT

To accompany plans dated 3-15-04

ROUTE 1/04 SEPARATION AND OVERHEAD

LOG OF TEST BORINGS

SCALE as noted — DATE [illegible]

BRIDGE No. 20-155 — DRAWING No. PR [illegible]

aslotb02.ti

DIST.	COUNTY	ROUTE	KILOMETER POSTS TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Son	101	5.6/6.3	148	148

08-05-02
REGISTERED ENGINEER CIVIL

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER S.T. Kakihara No. 42351 Exp. 3-31-04 CIVIL STATE OF CALIFORNIA

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Caltrans Metric

All Dimensions are in Meters unless otherwise shown

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. C 42289 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

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DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED GEOTECHNICAL ENGINEER — DATE

DATE PLOTTED => 5/17/2011

ROUTE 101S/116 SOH (WIDEN)

LOG OF TEST BORINGS 8 OF 10

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: 04 EA: 2640C1

BRIDGE No. 20-0284L

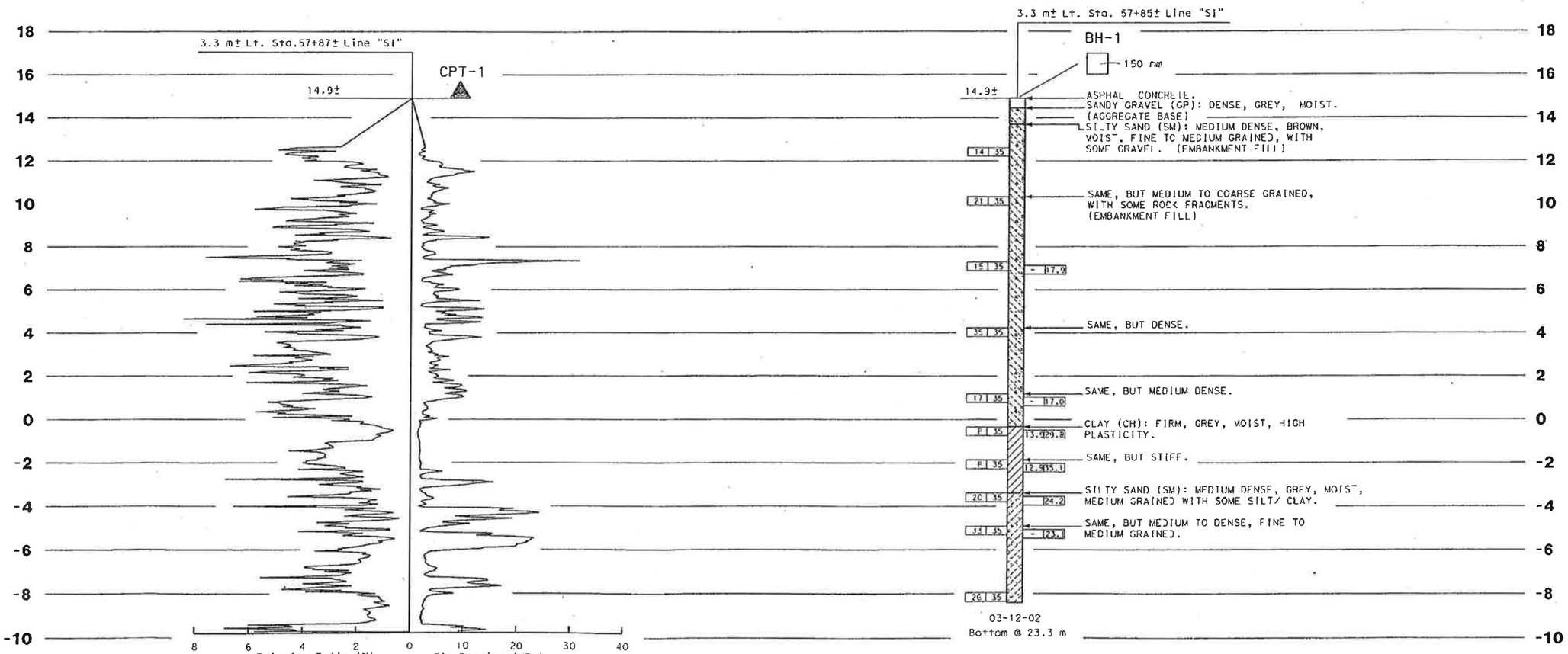
Sheet of

Revisions made to this Log of Test Borings from the original 2002 Log of Test Borings are the addition of the following table and notes:

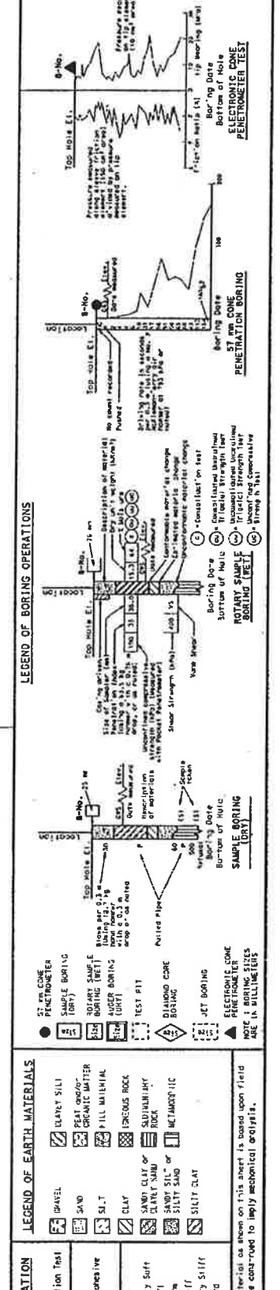
Boring	Station	Offset from A Line
CPT-1	189+28	72.6 Lt
BH-1	189+21	72.6 Lt

Notes:

1. See the General plan and Foundation plan for stationing.
2. Structure Design produced the data presented in the table below. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.



PROFILE
HORIZ. NO SCALE
VERT. 1 : 100



DIVISION OF ENGINEERING SERVICES		FIELD INVESTIGATION BY:	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	GEOTECHNICAL SERVICES OFFICE OF GEOTECHNICAL DESIGN - WEST	BRIDGE NO. / KILOMETER POST	MECHANICALLY STABILIZED EMBANKMENT LOG OF TEST BORINGS	DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 10:29
DRAWN BY	M. REYNOLDS 06/02	T. NGUYEN		CU 04276 EA 276001	DISREGARD PRINTS BEARING EARLIER REVISION DATES	SHEET 2 OF 2	
CHECKED BY	S. KAKIHARA						

(Rev 01/02) ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

USERNAME => trmariak

DIST.	COUNTY	ROUTE	KILOMETER POSTS TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Son	101	5.6/6.3	130	148

05-20-02
M. Momenzadeh
REGISTERED ENGINEER - CIVIL
03-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER M. Momenzadeh No. 57482 Exp. 12-31-05 CIVIL STATE OF CALIFORNIA

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All Dimensions are in Meters unless otherwise shown

For boring location see PLAN, Log of Test Borings 2 Sheet

12-05-01
Bottom @ 33.8 m
Groundwater Not Measured

PROFILE
HORIZ. NO SCALE
VERT. 1 : 100

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

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DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	Sheet No.	Total Sheets
04	Son	101	2.5/4.1		

REGISTERED GEOTECHNICAL ENGINEER — DATE 12/2/09

ROUTE 101N/116 SOH (WIDEN)

LOG OF TEST BORINGS (9 OF 10)

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: 04 EA: 2640C1 — BRIDGE No. 20-0284L — Sheet of

DATE PLOTTED: 5/17/2011

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. GE 2150 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

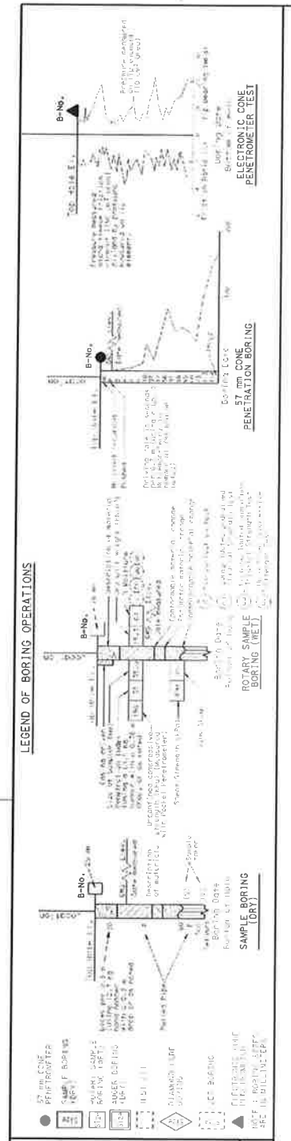
Revisions made to this Log of Test Borings from the original 2001 Log of Test Borings are the addition of the following table and notes:

Notes:

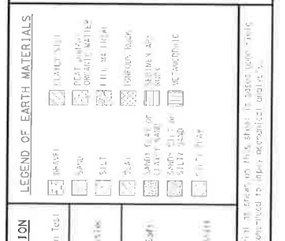
1. See the General plan and Foundation plan for stationing.
2. Structure Design produced the data presented in the table below. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.

Boring	Station	Offset from A Line
B-6	195+79	117.0 Lt

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS



CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

SPT Blows (Blows/Foot)	Granular	SPT Blows (Blows/Foot)	Cohesive
0-4	Very Loose	0-2	Very Soft
5-10	Loose	3-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
51-	Very Dense	16-30	Very Stiff
		31-	Hard

NOTE: Classification of earth material is based on this strip in accordance with Caltrans practice and is not to be construed to imply mechanical analysis.

DIVISION OF ENGINEERING SERVICES		FIELD INVESTIGATION BY:	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	GEOTECHNICAL SERVICES OFFICE OF GEOTECHNICAL DESIGN - WEST	BRIDGE NO. 20-0284L	RETAINING WALL 101B
DRAWN BY	M. Reynolds 04/02				KILOMETER POST 5.6/6.3	LOG OF TEST BORINGS 1 OF 2
CHECKED BY	M. Momenzadeh	M. Momenzadeh		CU 04 EA 276001	DISREGARD PRINTS BEARING EARLIER REVISION DATES 3-26-03	SHEET 9 OF 10

(Rev 01/02)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

REVISION DATES (PRELIMINARY STAGE ONLY)

DGN FILE PLOTTED ON 10-MAR-2004

DIST.	COUNTY	ROUTE	KILOMETER POSTS TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Son	101	5.6/6.3	131	148

Caltrans Metric

05-20-02
M. Momenzadeh
REGISTERED ENGINEER - CIVIL
03-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER M. Momenzadeh No. 57482 Exp. 12-31-05 CIVIL STATE OF CALIFORNIA

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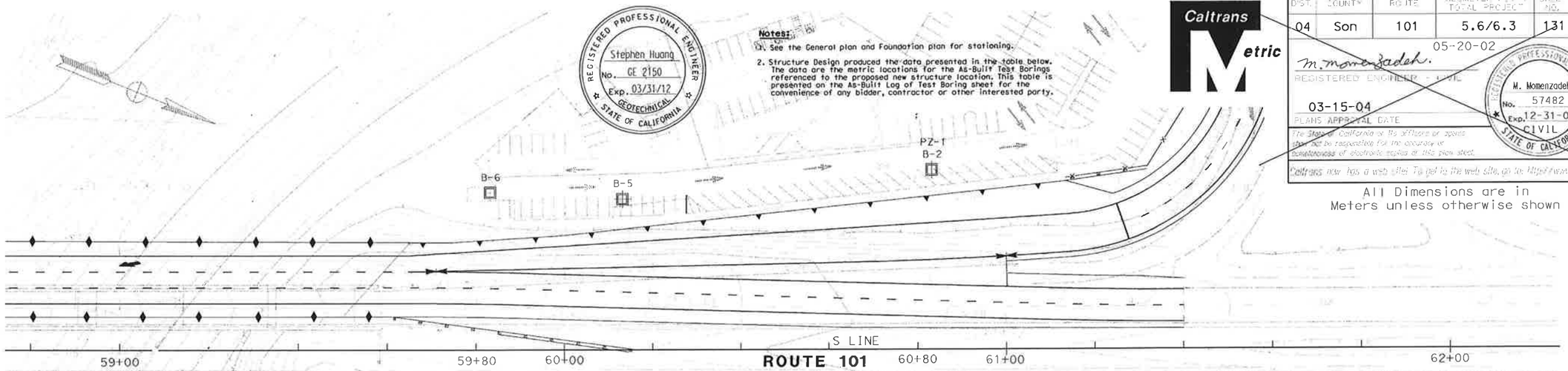
All Dimensions are in Meters unless otherwise shown

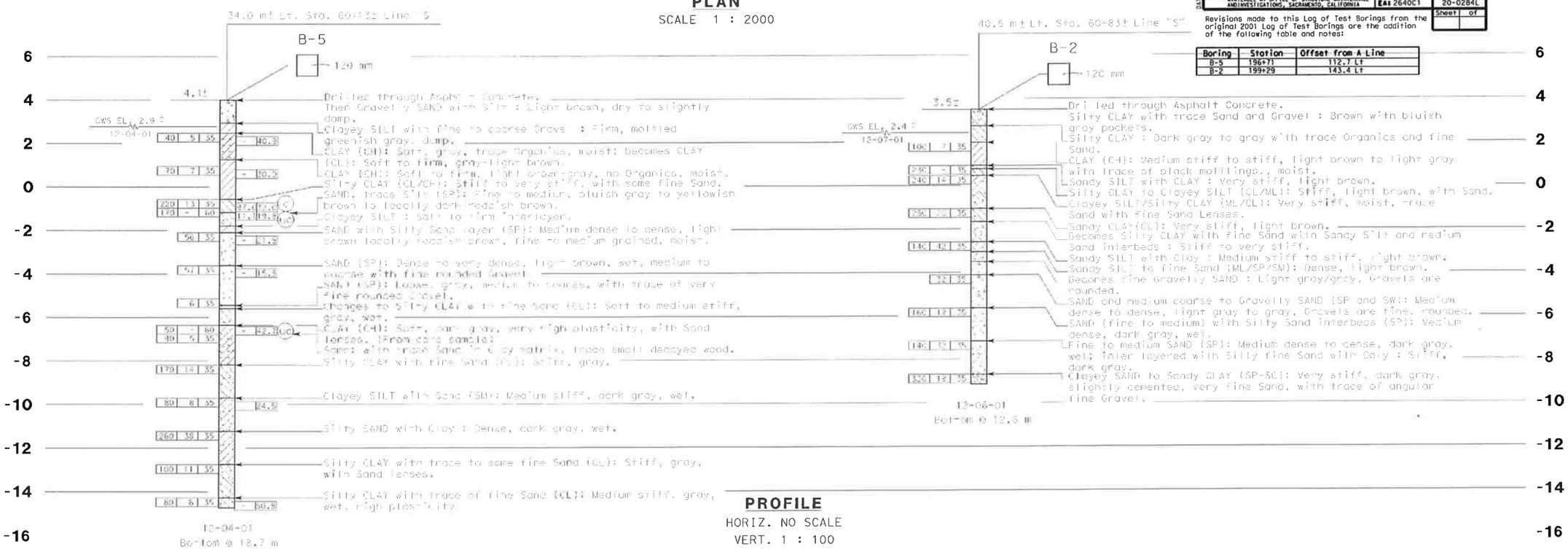
REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. GE 2150 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

Notes:

1. See the General plan and Foundation plan for stationing.
2. Structure Design produced the data presented in the table below. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.



PLAN
SCALE 1 : 2000



PROFILE
HORIZ. NO SCALE
VERT. 1 : 100

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

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DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	Sheet No.	Total Sheets
04	Son	101	2.5/4.1		

REGISTERED GEOTECHNICAL ENGINEER — DATE 12/2/09

ROUTE 101N/116 SOH (WIDEN)

LOG OF TEST BORINGS (10 OF 10)

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: 04 EA: 2640C1

BRIDGE No. 20-0284L

Sheet ___ of ___

DATE PLOTTED => 9/17/2011

Revisions made to this Log of Test Borings from the original 2001 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from A Line
B-5	196+71	112.7 Lt
B-2	199+29	143.4 Lt

LEGEND OF BORING OPERATIONS

ELECTRONIC CONE PENETROMETER TEST

57 mm CONE PENETRATION BORING

ROTARY SAMPLE BORING (TYPE I)

SAMPLE BORING (TYPE II)

LEGEND OF EARTH MATERIALS

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

DIVISION OF ENGINEERING SERVICES		FIELD INVESTIGATION BY:	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	GEOTECHNICAL SERVICES OFFICE OF GEOTECHNICAL DESIGN - WEST	BRIDGE NO. 20-0284L KILOMETER POST 5.6/6.3	RETAINING WALL 101B
DRAWN BY	M. Reynolds 04/02	M. Momenzadeh		CU 04 EA 276001		LOG OF TEST BORINGS 2 OF 2
CHECKED BY	M. Momenzadeh					

(Rev 01/02)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 3-26-03

REVISION DATES (PRELIMINARY STAGE ONLY) — SHEET 10 OF 10

DRAFT

FIELD EXPLORATION PROGRAM

The geotechnical field investigation consisted of five borings extending to depths of 85 to 119½ feet below the existing ground surface. The explorations were performed on June 10 to 29, 2009, by WDC Exploration & Wells, Richmond, California.

The borings locations were carefully selected to obtain supplemental subsurface information to provide geotechnical design recommendations for the proposed structure while avoiding underground utilities and subsurface obstructions. Layout of the explorations was performed by representatives of URS, and exploration locations were checked for conflict with underground utilities by contacting Underground Service Alert (USA) Network. USA, in turn, alerted the various municipalities and utility companies that a subsurface investigation was to be conducted near their utilities.

After underground utility clearance, URS obtained permits from the County of Sonoma, Permit and Resource Management Department, Well and Permit Section, and coordinated with appropriate personnel to accommodate the required inspection during and following exploration at each location.

Rotary Wash Boring (R-09-011 through R-09-015)

The rotary wash borings were drilled to provide the necessary information to evaluate the subsurface stratigraphy and to allow acquisition of high-quality soil samples for laboratory testing. The borings were drilled and sampled at the location indicated on the Site and Boring Location Plan, Figure 3-2. The borings were advanced to depths of 85 to 119½ feet below existing ground surface using a truck-mounted drill rig and crawler drill rig (limited-low access) under the supervision of a URS engineer who maintained a record of all field activities, classified the soils encountered using the Unified Soil Classification System (USCS), and prepared a log of the boring.

The drilling operation proceeded carefully, with particular attention to potential interference with utilities or other buried structures. During drilling, both disturbed and undisturbed samples were obtained for identification and laboratory testing. Soil samples were generally obtained at 5-foot intervals and at changes in strata. Samples were obtained using an unlined split spoon sampler (SPT), having an outside diameter of 2 inches, and lined Modified California (MC) sampler, having an outside diameter of 2½ inches. A 140-pound hammer falling through a distance of 30 inches was used to drive the samplers. The blow count recorded on the boring logs adjacent to the sample depth is the number of blows required to drive the sampler for the final 1 foot of a maximum 18 inch drive. The Franciscan Complex bedrock in boring R-09-012 was drilled using HQ wireline coring methods below a depth of 60 feet, which provides an 2.4-inch diameter core sample. Due to the very poor rock recovery obtained in this boring and the poor quality of the shale and serpentinite rock samples that were recovered, and in order to provide more meaningful information for the foundation design, rotary wash drilling with SPT and MC drive samples were used on the remaining borings that penetrated the Franciscan Complex rocks.

One of the objectives of the field investigation was to obtain high-quality undisturbed samples for laboratory testing. Effort was made to minimize sample disturbance during sample handling and transportation. After careful withdrawal from the ground, the sample was placed upright and the ends of the sample were cleaned of disturbed soil. If possible, pocket penetrometer tests

DRAFT

were performed on the bottom end of cohesive soil samples. Both ends of the samples were covered with plastic caps, and carefully transported to URS' laboratory in San Jose. Rock core samples obtained from boring R-09-012 was placed in wooded core boxes, photographed and transported to URS' laboratory in San Jose.

LABORATORY TESTING PROGRAM

A laboratory testing program was carried out to determine the index and engineering properties of the major subsurface strata encountered at the site. The laboratory testing program included conventional tests to confirm the existing information on the engineering characteristics of the major strata and to refine some of the engineering parameters. These tests were performed at the URS' laboratory.

This appendix briefly describes the testing program and procedures for the different types of tests, and then presents detailed test results.

Index Tests

Index tests were performed on both cohesive and cohesionless soil samples to aid in soil classification and in correlation with other engineering parameters. Index tests included Atterberg Limits, gradation analyses, moisture content and dry density determinations. Atterberg Limits tests were performed in accordance with ASTM D 4318. Particle analyses were performed in accordance with ASTM D 422. The moisture content tests were performed in accordance with ASTM D 2216. Dry density was determined in accordance with ASTM D 2937. The locations of these tests are indicated on the Logs of Test Borings adjacent to the appropriate sample depths. The results are summarized in Table B-1.

A plasticity chart graphically presenting the results of the Atterberg Limits tests is included on Figure B-1. Grain size distribution curves are presented graphically on Figure B-2

Unconfined Compression Tests

Unconfined compression tests were performed on select cohesive soil samples to assist in determining shear strength parameters. These tests were performed in accordance with ASTM D 2166. The locations of these tests are indicated on the Logs of Test Borings adjacent to the appropriate sample depths. The results are summarized in Table B-1.

Consolidation Tests

Five consolidation tests were performed on selected samples of undisturbed clayey soil to evaluate the compressibility characteristics and past geologic history. The consolidation test was performed in accordance with ASTM D 4186. Consolidation test results are graphically presented on Figure B-3 through B-7.

DRAFT

TABLE B-1
SUMMARY OF LABORATORY TEST RESULTS

Boring or Sample No.	Date Sampled	Station	Line	Distance from Line (feet)	Depth (feet)	Unconfined Compressive Strength (psf)	In-Place Conditions		Sieve Analysis Results (Percent Passing)							R-value	Atterberg Limits		
							Water Content (%)	Dry Unit Weight (pcf)	%<#4	%<#8	%<#16	%<#30	%<#50	%<#100	%<#200		Liquid Limit	Plastic Limit	Plasticity Index
R-09-011	23-Jun-09	187+43	A	Lt. 1	19		7.6	125											
R-09-011	23-Jun-09	187+43	A	Lt. 1	54.2	6,130	23.0	103											
R-09-011	23-Jun-09	187+43	A	Lt. 1	58.8	7,530	18.0	119											
R-09-011	23-Jun-09	187+43	A	Lt. 1	69	8,260	18.6	110											
R-09-011	23-Jun-09	187+43	A	Lt. 1	78	5,160	20.8	104											
R-09-011	23-Jun-09	187+43	A	Lt. 1	83		17.5	112											
R-09-012	10-Jun-09	190+06	A	Rt. 28	10	1,760	27.1	97											
R-09-012	10-Jun-09	190+06	A	Rt. 28	15	4,450	27.5	97											
R-09-012	10-Jun-09	190+06	A	Rt. 28	20	2,850	35.1	87									87	26	61
R-09-012	10-Jun-09	190+06	A	Rt. 28	40	2,560	29.2	94											
R-09-012	10-Jun-09	190+06	A	Rt. 28	45	2,060	45.3	77									81	26	55
R-09-012	10-Jun-09	190+06	A	Rt. 28	46.2	1,910	16.7	117											
R-09-012	10-Jun-09	190+06	A	Rt. 28	50	2,740	32.0	90											
R-09-013	11-Jun-09	191+80	A	Rt. 14	11	1,670	27.6	94											
R-09-013	11-Jun-09	191+80	A	Rt. 14	14	4,540	28.2	95									67	22	45
R-09-013	11-Jun-09	191+80	A	Rt. 14	19	3,460	25.9	97											
R-09-013	11-Jun-09	191+80	A	Rt. 14	25	820	25.1	100											
R-09-013	11-Jun-09	191+80	A	Rt. 14	26		22.9	103		100	100	100	98	66	41				
R-09-013	11-Jun-09	191+80	A	Rt. 14	34	2,430	24.6	101											
R-09-013	11-Jun-09	191+80	A	Rt. 14	39	3,450	22.1	104											
R-09-013	11-Jun-09	191+80	A	Rt. 14	44	2,750	31.1	91											
R-09-013	11-Jun-09	191+80	A	Rt. 14	50.2	2,820	23.1	103											
R-09-014	14-Jun-09	193+17	A	Lt. 2	11.2	2,550	31.3	91									73	20	54
R-09-014	14-Jun-09	193+17	A	Lt. 2	15	1,500	22.5	104		100	100	100	100	80	44				
R-09-014	14-Jun-09	193+17	A	Lt. 2	20		21.4	104											
R-09-014	14-Jun-09	193+17	A	Lt. 2	30	3,070	27.2	97											
R-09-014	14-Jun-09	193+17	A	Lt. 2	35	3,300	23.5	103											
R-09-014	14-Jun-09	193+17	A	Lt. 2	40	3,790	21.8	106											
R-09-014	14-Jun-09	193+17	A	Lt. 2	46	1,340	23.7	102											
R-09-014	14-Jun-09	193+17	A	Lt. 2	50	2,360	28.3	94											
R-09-014	14-Jun-09	193+17	A	Lt. 2	65		34.6	89									55	22	33
R-09-014	14-Jun-09	193+17	A	Lt. 2	75	3,750	28.6	94											
R-09-014	14-Jun-09	193+17	A	Lt. 2	86		13.8	115											
R-09-014	14-Jun-09	193+17	A	Lt. 2	90		46.3	70											
R-09-015	16-Jun-09	194+32	A	Rt. 21	10		7.1	128											
R-09-015	16-Jun-09	194+32	A	Rt. 21	15		11.6	123											
R-09-015	16-Jun-09	194+32	A	Rt. 21	25	1,780	22.1	100											
R-09-015	16-Jun-09	194+32	A	Rt. 21	36.2		19.1	109											
R-09-015	16-Jun-09	194+32	A	Rt. 21	45		18.5	106											
R-09-015	16-Jun-09	194+32	A	Rt. 21	65	3,230	21.0	105											
R-09-015	16-Jun-09	194+32	A	Rt. 21	75	2,910	45.5	75									78	27	51
R-09-015	16-Jun-09	194+32	A	Rt. 21	85	1,490	41.5	78											

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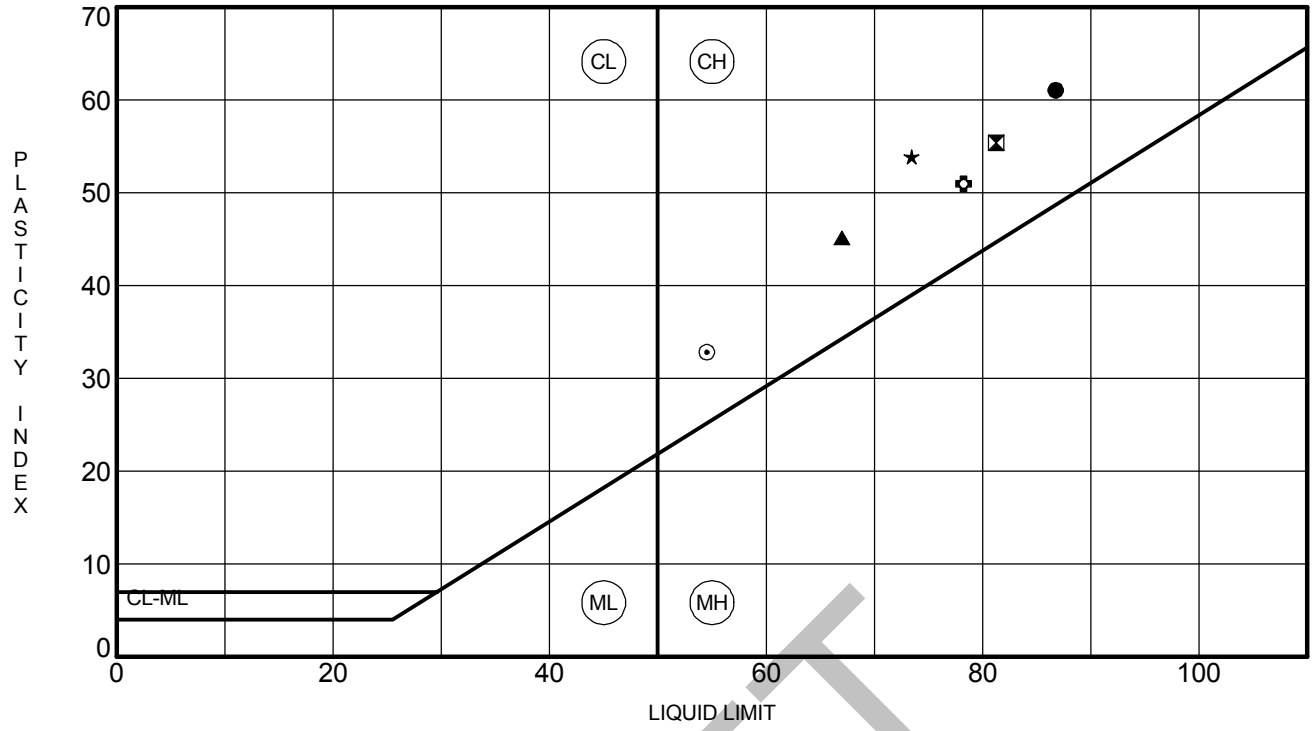

	Specimen Identification		LL	PL	PI	Fines	Classification
●	**R-09-012**	**20.0**	**87**	**26**	**61**		**Fat CLAY with SAND**
⊠	**R-09-012**	**45.0**	**81**	**26**	**55**		**Fat CLAY**
▲	**R-09-013**	**14.0**	**67**	**22**	**45**		**Fat CLAY**
★	**R-09-014**	**11.2**	**73**	**20**	**53**		**Fat CLAY**
⊙	**R-09-014**	**65.0**	**55**	**22**	**33**		**Fat CLAY**
✿	**R-09-015**	**75.0**	**78**	**27**	**51**		**Fat CLAY**

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URS

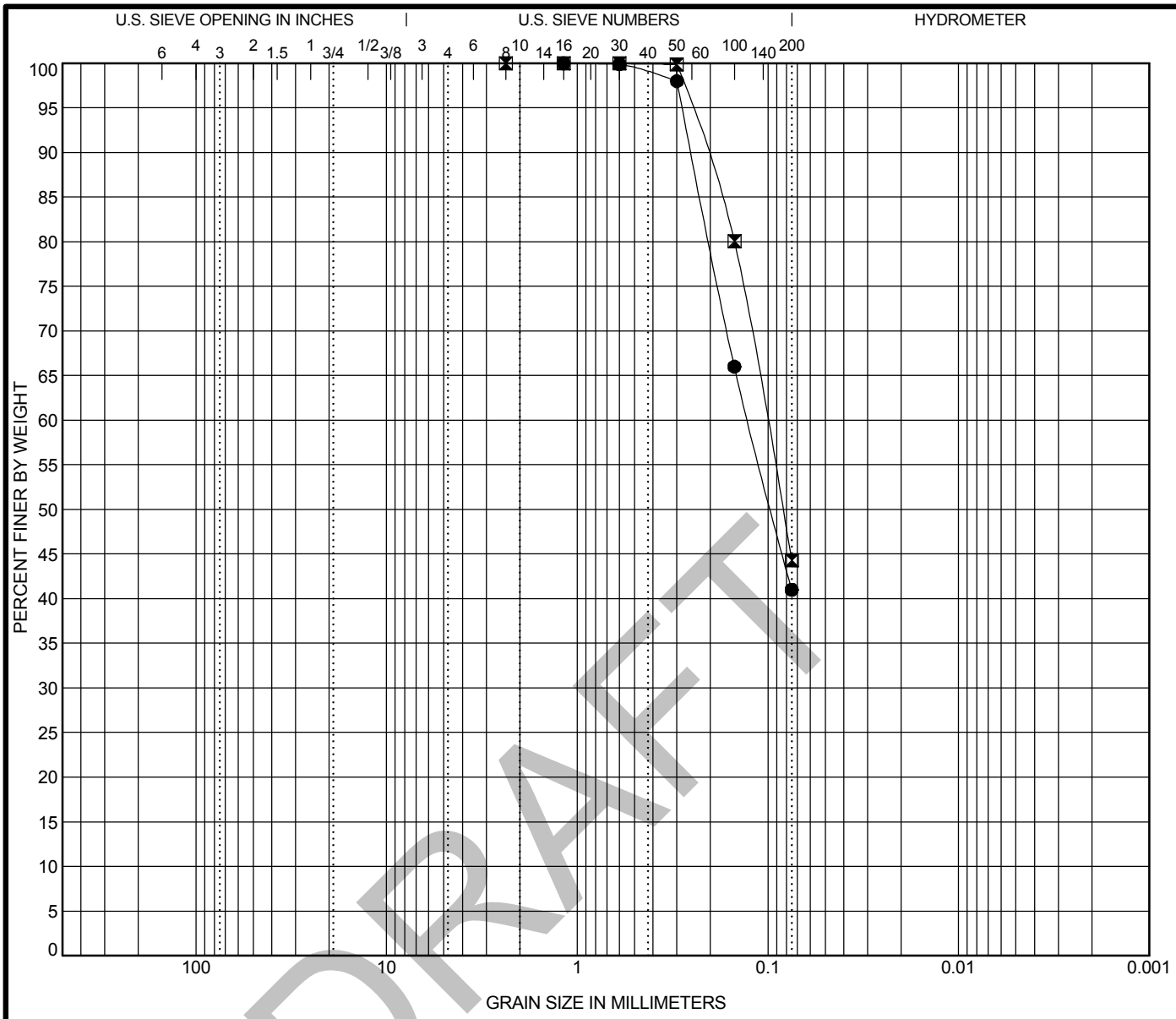
55 S. Market St, Ste 1500
San Jose, CA 95113

ATTERBERG LIMITS' RESULTS

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-1

URS ATTERBERG LIMITS 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 9/29/09



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**R-09-013**	**26.0**	**SILTY SAND**					
⧗	**R-09-014**	**15.0**	**Silty SAND (SM)**					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**R-09-013**	**26.0**	**1.18**	**0.127**			**0.0**	**59.0**	**41.0**	
⧗	**R-09-014**	**15.0**	**2.36**	**0.102**			**0.0**	**55.7**	**44.3**	

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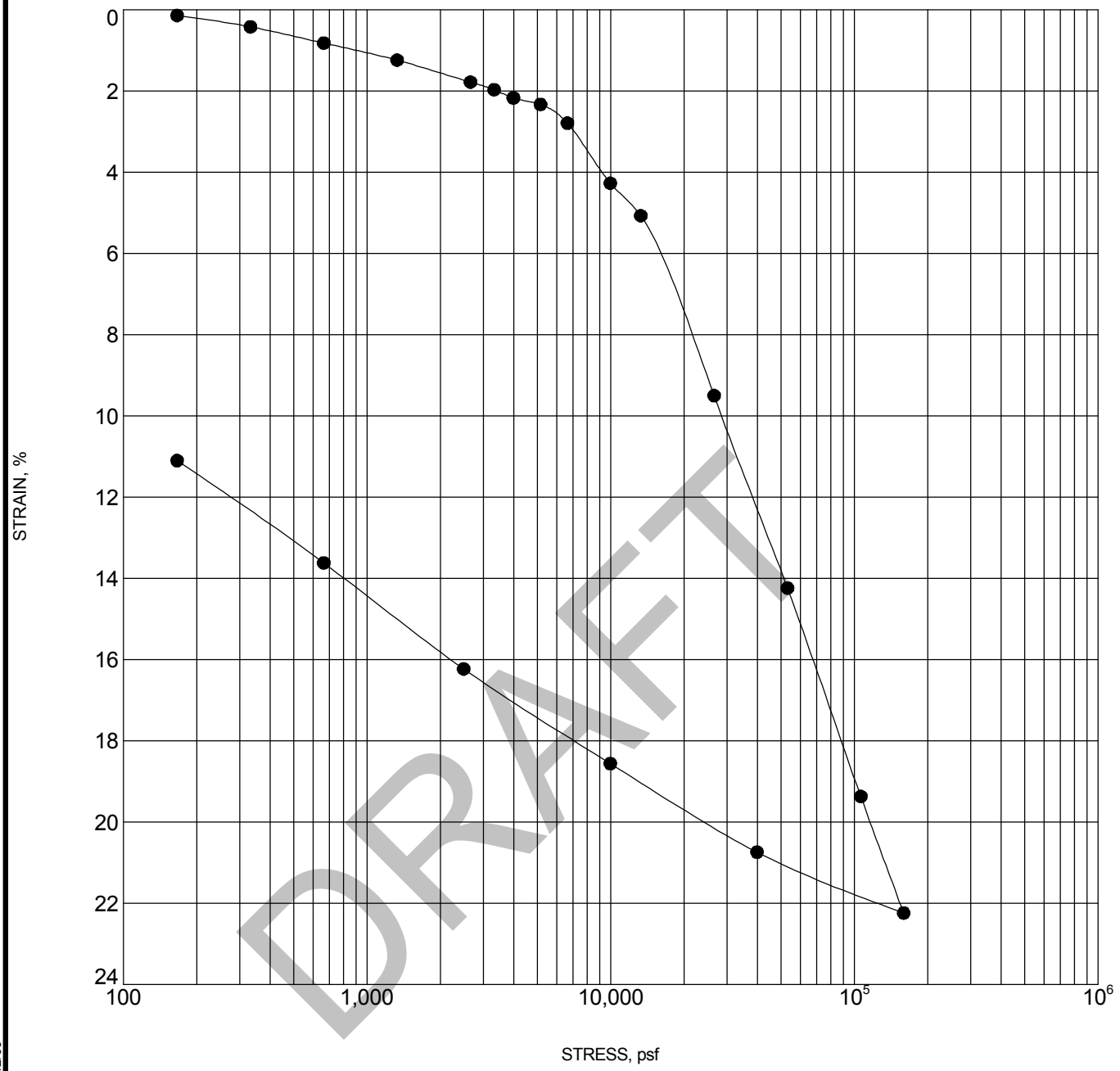
GRAIN SIZE DISTRIBUTION

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-2

URS GRAIN SIZE 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 12/2/09



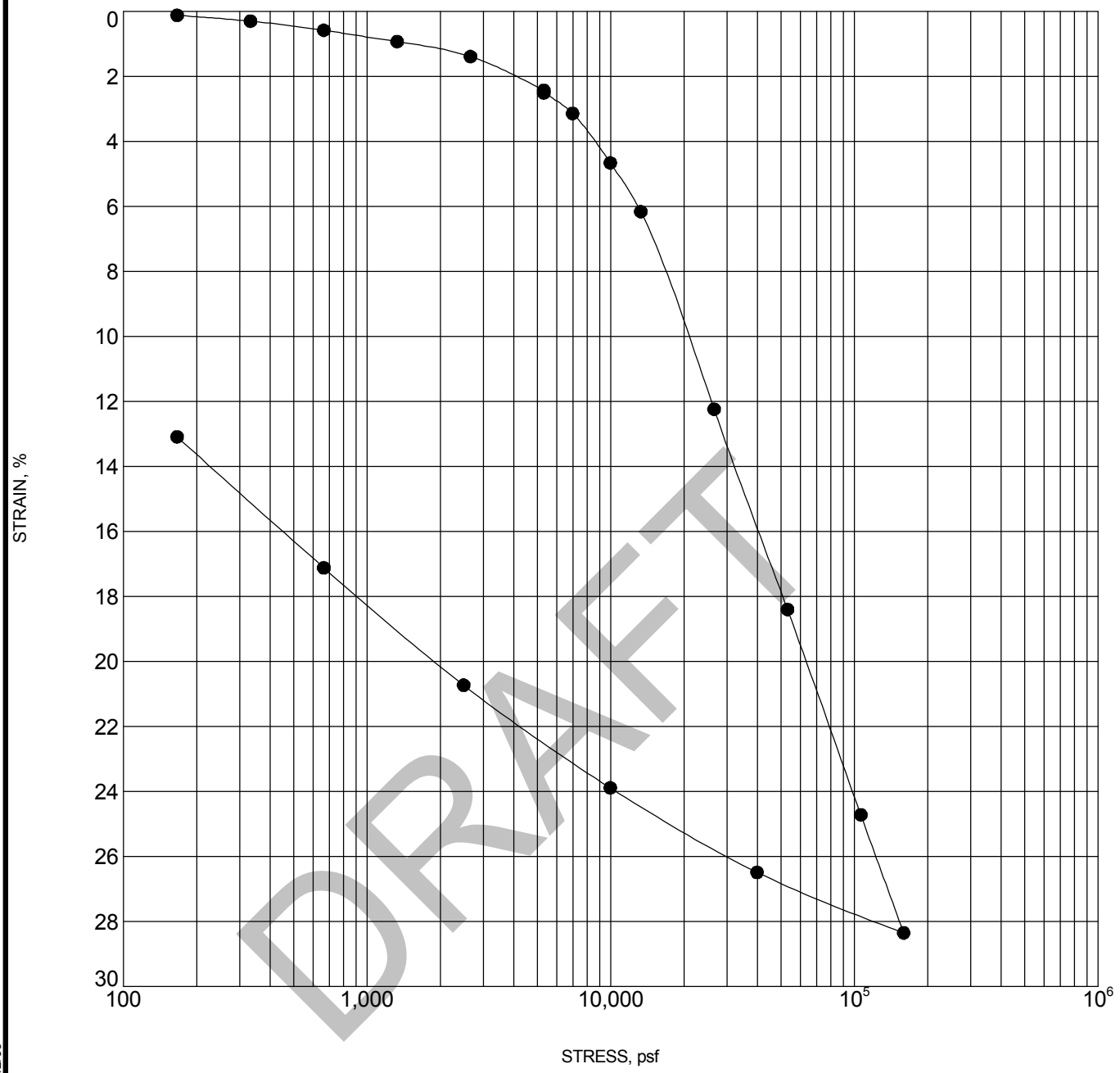
Specimen Identification			Classification	γ_d	MC%
●	**R-09-011**	**78.0**	**Lean CLAY**	**108**	**25**

CONSOLIDATION TEST

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-3

US EM CONSOL STRAIN 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 12/2/09



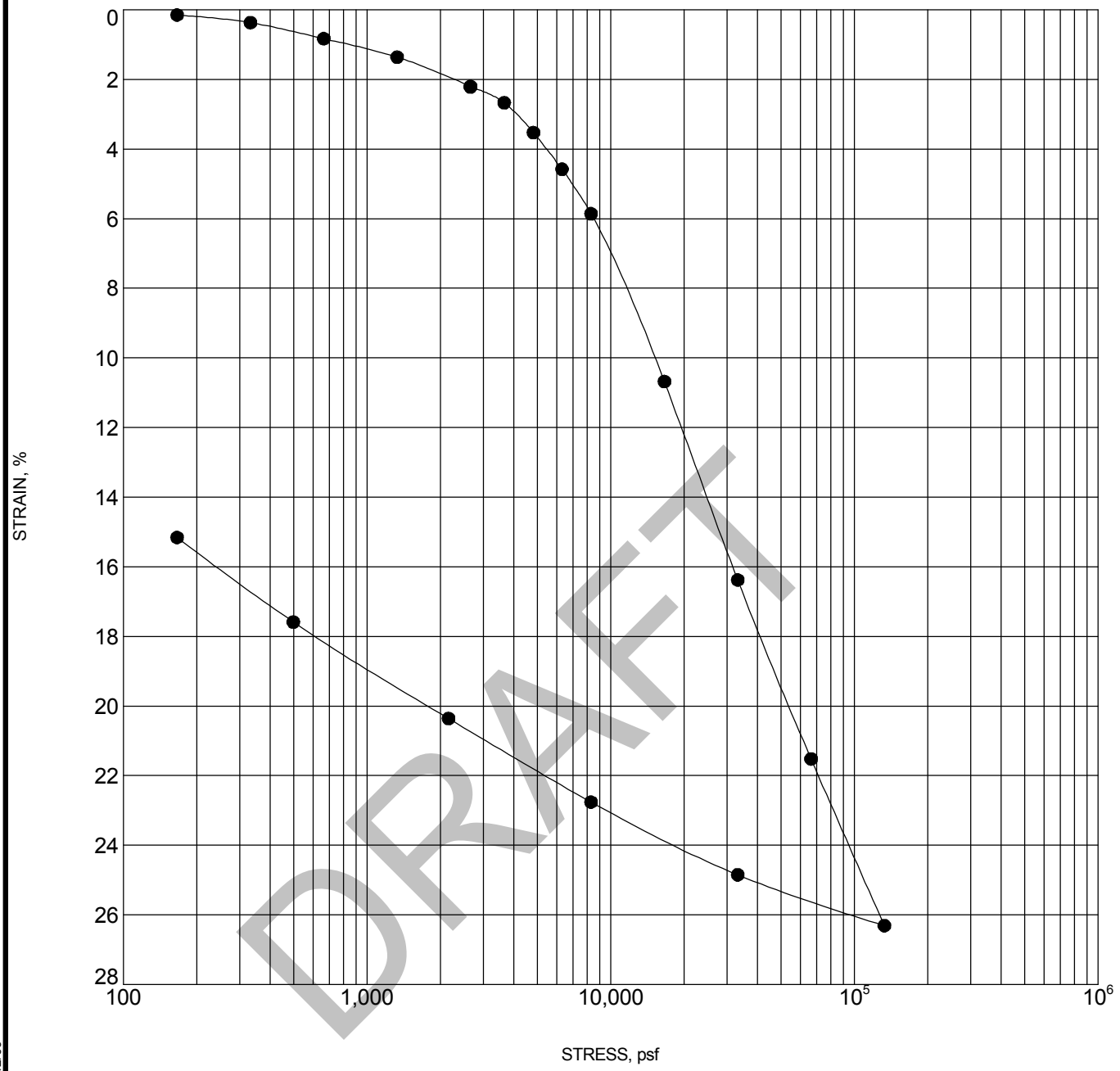
Specimen Identification			Classification	γ_d	MC%
●	**R-09-012**	**15.0**	**Fat CLAY**	**99**	**31**

CONSOLIDATION TEST

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-4

US EM CONSOL STRAIN 28645040 MSNB4PETRIVER.GPJ SNJ_CT.GLB 12/2/09



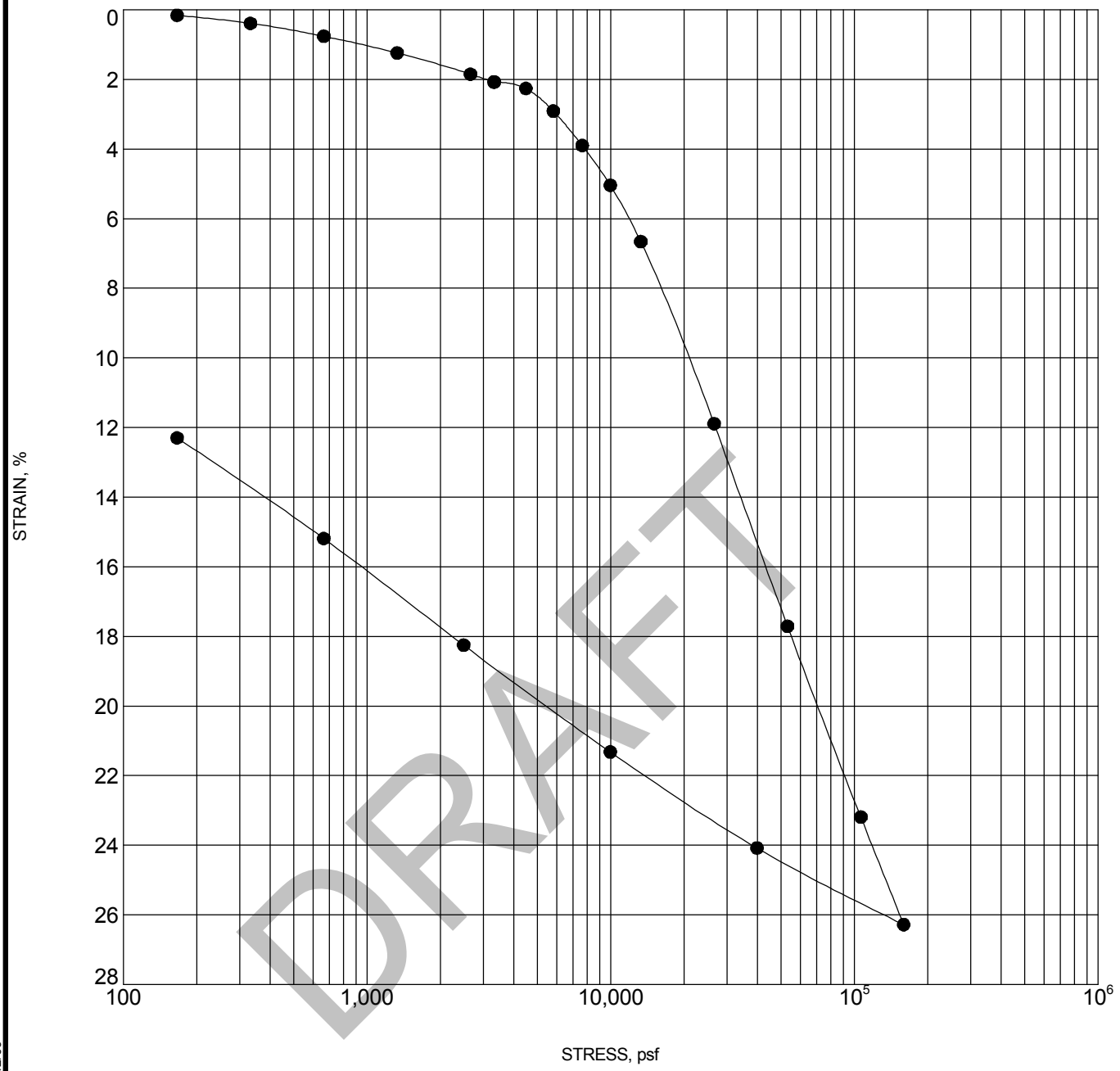
Specimen Identification			Classification	γ_d	MC%
●	**R-09-014**	**30.0**	**Lean CLAY**	**101**	**27**

CONSOLIDATION TEST

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-5

US EM CONSOL STRAIN 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 12/2/09



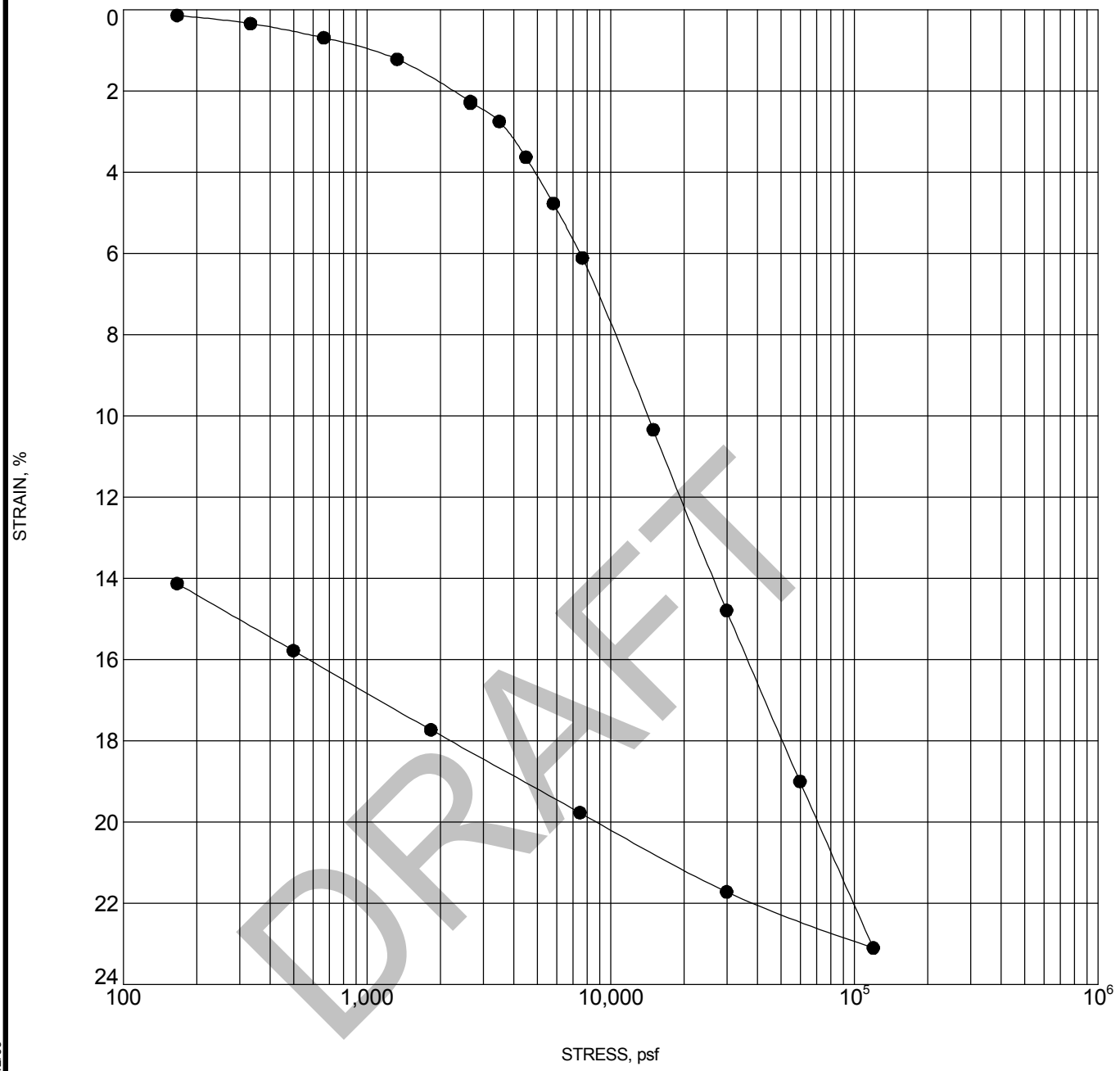
Specimen Identification			Classification	γ_d	MC%
●	**R-09-014**	**65.0**	**Fat CLAY**	**100**	**29**

CONSOLIDATION TEST

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-6

US EM CONSOL STRAIN 28645040 MSNB4PETRIVER.GPJ SNJ_CT.GLB 12/2/09



Specimen Identification			Classification	γ_d	MC%
●	**R-09-015**	**25.0**	**Lean CLAY**	**101**	**25**

CONSOLIDATION TEST

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-7

US EM CONSOL STRAIN 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 12/2/09

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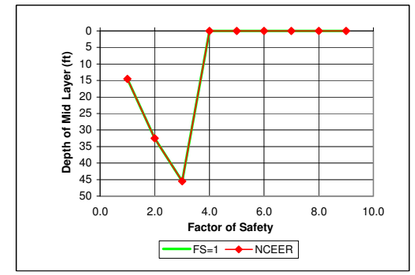
LIQUEFACTION ANALYSIS

Project	101 MSN Petaluma
Project No.	28645045
Boring No.	R-09-012

PGA =	0.6	
M_w =	7.0	
GWT during EQ	6.0	ft
Sampler:	Symbol	Corr. Factor
SPT	S	1
Mod.Cal	M	0.8
California	C	0.7
Mag. Weighting Factor($CSR_M/CSR_{M=7.5}$)		0.82

Note: Cells in Red must be input

Hammer type :	Type		C_E	Code	C_E
	Donut		0.75	1	3
	Safety		1	2	
	Auto		1.16	3	
Borehole Diameter:	(inch)	(mm)	C_B		C_B
	2.5-4.5	65-115	1	1	1
	6	150	1.05	2	
	8	200	1.15	3	
Rod Length:	(feet)	(m)	C_R		
	Default			999	
Sampling Method:	Type		Cs		
	Stand		1		
	No liners		1.2		



Note: F.S. greater than 2 is set to be equal to 2

Layer Number	Soil Type	γ_m	At Bottom of Layer: Depth		At Center of Layer: Depth		σ_o	EQ: u	EQ: σ'_o	r_d	EQ CSR	N raw	Sampler	N SPT	Fines Content	$N_{60\text{-}cs}$	C_N	C_E	C_B	C_R	C_S	$(N_1)_{60\text{-}cs}$	$CRR^*_{7.5,1tsf}$	Magnitude Scaling Factor NCEER K_m: Lower	Upper	Middle	Overburden Correction K_σ	Above GWT?	F.S.	Liquefy ?	F.S=1.0
	(USCS)	pcf	ft	m	ft	m	psf	psf	psf						%	FC< 5%	EQ					during EQ	Critical						NCEER	NCEER	
1	CL/CH	120	29.0	8.84	14.5	4.42	1,740	530	1,210	0.970	0.544			0		0.0	1.32	1.16	1.00	0.85	1.00	0		1.19	1.26	1.22	1.000	N	2.00	N	1
2	SP-SM	125	36.0	10.97	32.5	9.91	3,918	1,654	2,264	0.907	0.612	16	S	16	12	18.1	0.97	1.16	1.00	0.95	1.20	23	0.254	1.19	1.26	1.22	0.989	N	0.50	Liquef	1
3	CL/CH	120	55.0	16.76	45.5	13.87	5,495	2,465	3,030	0.799	0.565			0		0.0	0.84	1.16	1.00	1.00	1.00	0		1.19	1.26	1.22	0.944	N	2.00	N	1

Layer Number	Depth to Bot. Layer	Thickness	σ_o	u	σ'_o	r_d	$(N_1)_{60\text{-}cs}$	Liquefy ?	τ_{cyc}	$CSR_{M=7.5}$	CSR_M	Volumetric Strain**			Settl.
	ft	ft	psf	psf	psf			NCEER	psf	τ_{cyc}/σ'_o	τ_{cyc}/σ'_o		%		in
1	29.0	29.0	1,740	530	1,210	0.970	0.0	N	658.0	0.544	0.44				0.00
2	36.0	7.0	3,918	1,654	2,264	0.907	23.1	Liquef	1385.4	0.612	0.50		1.1		0.92
3	55.0	19.0	5,495	2,465	3,030	0.799	0.0	N	1711.5	0.565	0.46				0.00
4															
5															
6															
7															
8															
9															

Total Settlement (inch) = 0.9

* Note: The equation used to obtain $CRR_{7.5}$ is not valid for corrected $(N_1)_{60}$ higher than 30. According to NCEER 1997, the soil layer with corrected $(N_1)_{60}$ higher than 30 blows per foot is unlikely to be susceptible to liquefaction.

** Note: These values were obtained from a chart for estimation of volumetric strain in saturated sands based on a cyclic stress ratio and standard penetration resistance (Tokimatsu and Seed, 1987).
See figure 9.53 from "Geotechnical Earthquake Engineering" by S. Kramer.

DRAFT

LIQUEFACTION ANALYSIS

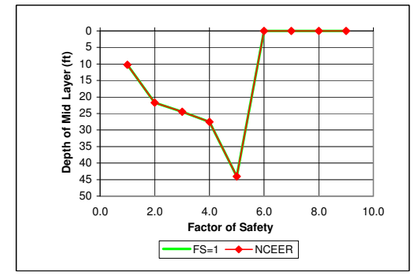
Project	101 MSN Petaluma
Project No.	28645045
Boring No.	R-09-013

PGA =	0.6	
M_w =	7.0	
GWT during EQ	5.0	ft
Sampler:	Symbol	Corr. Factor
SPT	S	1
Mod.Cal	M	0.8
California	C	0.7
Mag. Weighting Factor($CSR_M/CSR_{M=7.5}$)		0.82

Note: Cells in Red must be input

Hammer type :	Type		C_E	Code	C_E
	Donut		0.75	1	3
	Safety		1	2	
	Auto		1.41	3	
Borehole Diameter:	(inch)	(mm)	C_B		C_B
	2.5-4.5	65-115	1	1	1
	6	150	1.05	2	
	8	200	1.15	3	
Rod Length:	(feet)	(m)	C_R		
	Default			999	
Sampling Method:	Type		Cs		
	Stand		1		
	No liners		1.2		

Hammer Eff. (85/60) = 1.41



Note: F.S. greater than 2 is set to be equal to 2

Layer Number	Soil Type	γ_m	At Bottom of Layer Depth		At Center of Layer Depth		σ_o	EQ u	EQ σ'_o	r_d	EQ CSR	N raw	Sampler	N SPT	Fines Content	$N_{60\text{-}cs}$	C_N	C_E	C_B	C_R	C_S	$(N_1)_{60\text{-}cs}$	$CRR^*_{7.5,1tsf}$	Magnitude Scaling Factor NCEER K_m Lower	Upper	Middle	Overburden Correction K_σ	Above GWT?	F.S.	Liquefy ?	F.S=1.0
	(USCS)	pcf	ft	m	ft	m	psf	psf	psf						%	FC< 5%	EQ					during EQ	Critical						NCEER	NCEER	
1	CL	120	20.5	6.25	10.25	3.12	1,230	328	902	0.979	0.520			0		0.0	1.53	1.41	1.00	0.75	1.00	0		1.19	1.26	1.22	1.000	N	2.00	N	1
2	SM	125	23.0	7.01	21.8	6.63	2,616	1,045	1,571	0.952	0.618	18	M	14.4	41	22.3	1.16	1.41	1.00	0.95	1.00	35	0.459	1.19	1.26	1.22	1.000	N	2.00	N	1
3	CL	125	26.0	7.92	24.5	7.47	2,960	1,217	1,743	0.944	0.625			0		0.0	1.10	1.41	1.00	0.95	1.00	0		1.19	1.26	1.22	1.000	N	2.00	N	1
4	SM	125	29.0	8.84	27.5	8.38	3,335	1,404	1,931	0.932	0.628	10	M	8	41	14.6	1.05	1.41	1.00	0.95	1.00	20	0.222	1.19	1.26	1.22	1.000	N	0.43	Liquef	1
5	CL	120	59.0	17.98	44.0	13.41	5,323	2,434	2,889	0.814	0.585					0.0	0.86	1.41	1.00	1.00	1.00	0		1.19	1.26	1.22	0.952	N	2.00	N	1

Layer Number	Depth to Bot. Layer	Thickness	σ_o	u	σ'_o	r_d	$(N_1)_{60\text{-}cs}$	Liquefy ?	τ_{cyc}	$CSR_{M=7.5}$	CSR_M	Volumetric Strain**	Settl.
	ft	ft	psf	psf	psf			NCEER	psf	τ_{cyc}/σ'_o	τ_{cyc}/σ'_o	%	in
1	20.5	20.5	1,230	328	902	0.979	0.0	N	469.4	0.520	0.42		0.00
2	23.0	2.5	2,616	1,045	1,571	0.952	34.6	N	971.5	0.618	0.51		0.00
3	26.0	3.0	2,960	1,217	1,743	0.944	0.0	N	1089.3	0.625	0.51		0.00
4	29.0	3.0	3,335	1,404	1,931	0.932	20.5	Liquef	1212.4	0.628	0.51	1.4	0.50
5	59.0	30.0	5,323	2,434	2,889	0.814	0.0	N	1688.8	0.585	0.48		0.00
6													
7													
8													
9													

Total Settlement (inch) = 0.50

* Note: The equation used to obtain $CRR_{7.5}$ is not valid for corrected $(N_1)_{60}$ higher than 30. According to NCEER 1997, the soil layer with corrected $(N_1)_{60}$ higher than 30 blows per foot is unlikely to be susceptible to liquefaction.

** Note: These values were obtained from a chart for estimation of volumetric strain in saturated sands based on a cyclic stress ratio and standard penetration resistance (Tokimatsu and Seed, 1987).
See figure 9.53 from "Geotechnical Earthquake Engineering" by S. Kramer.

DRAFT

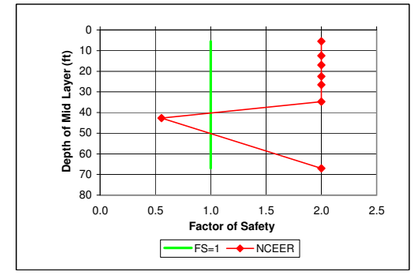
LIQUEFACTION ANALYSIS

Project	101 MSN Petaluma
Project No.	28645045
Boring No.	R-09-014

PGA =	0.6	
M_w =	7.0	
GWT during EQ	9.0	ft
Sampler:	Symbol	Corr. Factor
SPT	S	1
Mod.Cal	M	0.8
California	C	0.7
Mag. Weighting Factor($CSR_M/CSR_{M=7.5}$)		0.82

Note: Cells in Red must be input

Hammer type :	Type		C_E	Code	C_E
	Donut		0.75	1	3
	Safety		1	2	
	Auto		1.41	3	
Borehole Diameter:	(inch)	(mm)	C_B		C_B
	2.5-4.5	65-115	1	1	1
	6	150	1.05	2	
	8	200	1.15	3	
Rod Length:	(feet)	(m)	C_R		
	Default			999	
Sampling Method:	Type		Cs		
	Stand		1		
	No liners		1.2		



Note: F.S. greater than 2 is set to be equal to 2

Layer Number	Soil Type	γ_m	At Bottom of Layer: Depth		At Center of Layer: Depth		σ_o	EQ: u	EQ: σ'_o	r_d	EQ CSR	N raw	Sampler	N SPT	Fines Content	N_{60-cs}	C_N	C_E	C_B	C_R	C_S	$(N_1)_{60-cs}$	CRR*$_{7.5,1tsf}$	Magnitude Scaling Factor NCEER K_m: Lower	Upper	Middle	Overburden Correction K_σ	Above GWT?	F.S.	Liquefy ?	F.S=1.0
	(USCS)	pcf	ft	m	ft	m	psf	psf	psf						%	FC< 5%	EQ					during EQ	Critical						NCEER	NCEER	
1	SM	125	11.0	3.35	5.5	1.68	688	0	688	0.989	0.386	41	M	32.8	25	40.9	1.75	1.41	1.00	0.75	1.00	76	0.459	1.19	1.26	1.22	1.000	Y	2.00	N	1
2	CL	120	14.0	4.27	12.5	3.81	1,555	218	1,337	0.974	0.442					0.0	1.26	1.41	1.00	0.75	1.00	0		1.19	1.26	1.22	1.000	N	2.00	N	1
3	SM	125	20.0	6.10	17.0	5.18	2,110	499	1,611	0.964	0.493	18	M	14.4	44	22.3	1.15	1.41	1.00	0.85	1.00	31	0.459	1.19	1.26	1.22	1.000	N	2.00	N	1
4	SM	125	25.0	7.62	22.5	6.86	2,798	842	1,955	0.950	0.530	36	M	28.8	44	39.6	1.04	1.41	1.00	0.95	1.00	55	0.459	1.19	1.26	1.22	1.000	N	2.00	N	1
5	SM	130	28.0	8.53	26.5	8.08	3,305	1,092	2,213	0.936	0.545	59	M	47.2	44	61.6	0.98	1.41	1.00	0.95	1.00	81	0.459	1.19	1.26	1.22	0.992	N	2.00	N	1
6	CL	125	41.5	12.65	34.8	10.59	4,344	1,607	2,737	0.892	0.552			0		0.0	0.88	1.41	1.00	1.00	1.00	0		1.19	1.26	1.22	0.961	N	2.00	N	1
7	SP-SM	130	44.0	13.41	42.8	13.03	5,350	2,106	3,244	0.826	0.531	24	M	19.2	10	20.5	0.81	1.41	1.00	1.00	1.00	23	0.258	1.19	1.26	1.22	0.932	N	0.55	Liquef	1
8	CL	120	90.0	27.43	67.0	20.42	8,273	3,619	4,653	0.609	0.422			0		0.0	0.67	1.41	1.00	1.00	1.00	0		1.19	1.26	1.22	0.862	N	2.00	N	1

Layer Number	Depth to Bot. Layer	Thickness	σ_o	u	σ'_o	r_d	$(N_1)_{60-cs}$	Liquefy ?	τ_{cyc}	$CSR_{M=7.5}$	CSR_M	Volumetric Strain**			Settl.
	ft	ft	psf	psf	psf			NCEER	psf	τ_{cyc}/σ'_o	τ_{cyc}/σ'_o		%		in
1	11.0	11.0	688	0	688	0.989	75.8	N	265.2	0.386	0.32				0.00
2	14.0	3.0	1,555	218	1,337	0.974	0.0	N	590.6	0.442	0.36				0.00
3	20.0	6.0	2,110	499	1,611	0.964	30.6	N	793.4	0.493	0.40				0.00
4	25.0	5.0	2,798	842	1,955	0.950	55.1	N	1036.4	0.530	0.43				0.00
5	28.0	3.0	3,305	1,092	2,213	0.936	80.7	N	1206.8	0.545	0.45				0.00
6	41.5	13.5	4,344	1,607	2,737	0.892	0.0	N	1511.7	0.552	0.45				0.00
7	44.0	2.5	5,350	2,106	3,244	0.826	23.3	Liquef	1722.8	0.531	0.43		1.2		0.36
8	90.0	46.0	8,273	3,619	4,653	0.609	0.0	N	1965.5	0.422	0.35				0.00

Total Settlement (inch) = 0.4

* Note: The equation used to obtain $CRR_{7.5}$ is not valid for corrected $(N_1)_{60}$ higher than 30. According to NCEER 1997, the soil layer with corrected $(N_1)_{60}$ higher than 30 blows per foot is unlikely to be susceptible to liquefaction.

** Note: These values were obtained from a chart for estimation of volumetric strain in saturated sands based on a cyclic stress ratio and standard penetration resistance (Tokimatsu and Seed, 1987).
See figure 9.53 from "Geotechnical Earthquake Engineering" by S. Kramer.

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LIQUEFACTION ANALYSIS

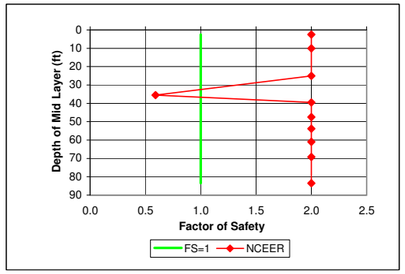
Project	101 MSN Petaluma
Project No.	28645045
Boring No.	R-09-015

PGA =	0.6	
M_w =	7.0	
GWT during EQ	29.0	ft
Sampler:	Symbol	Corr. Factor
SPT	S	1
Mod.Cal	M	0.8
California	C	0.7
Mag. Weighting Factor($CSR_M/CSR_{M=7.5}$)		0.82

Note: Cells in Red must be input

Hammer type :	Type	C_E	Code	C_E
	Donut	0.75	1	3
	Safety	1	2	
	Auto	1.41	3	
Borehole Diameter:	(inch) (mm)	C_B		C_B
	2.5-4.5 65-115	1	1	1
	6 150	1.05	2	
	8 200	1.15	3	
Rod Length:	(feet) (m)	C_R		
	Default		999	
Sampling Method:	Type	Cs		
	Stand	1		
	No liners	1.2		

Hammer Efficiency
85%
(85/60 = 1.41)



Note: F.S. greater than 2 is set to be equal to 2

Layer Number	Soil Type	γ_m	At Bottom of Layer Depth		At Center of Layer Depth		σ_o	EQ u	EQ σ'_o	r_d	EQ CSR	N raw	Sampler	N SPT	Fines Content	N_{60-cs}	C_N	C_E	C_B	C_R	C_S	$(N_1)_{60-cs}$	CRR*$_{7.5,1tsf}$	Magnitude Scaling Factor NCEER K_m Lower	Upper	Middle	Overburden Correction K_σ	Above GWT?	F.S.	Liquefy ?	F.S=1.0
	(USCS)	pcf	ft	m	ft	m	psf	psf	psf						%	FC< 5%	EQ					during EQ	Critical						NCEER	NCEER	
1	GM	135	5.0	1.52	2.5	0.76	338	0	338	0.996	0.388	43	M	34.4	45	46.3	2.00	1.41	1.00	0.75	1.00	98	0.459	1.19	1.26	1.22	1.000	Y	2.00	N	1
2	SM	135	15.0	4.57	10.0	3.05	1,350	0	1,350	0.979	0.382	17	M	13.6	25	19.5	1.25	1.41	1.00	0.75	1.00	26	0.295	1.19	1.26	1.22	1.000	Y	2.00	N	1
3	CL	120	35.0	10.67	25.0	7.62	3,225	0	3,225	0.942	0.367					0.0	0.81	1.41	1.00	0.95	1.00	0		1.19	1.26	1.22	0.933	Y	2.00	N	1
4	SP-SM	130	36.0	10.97	35.5	10.82	4,490	406	4,084	0.887	0.380	22	M	17.6	10	18.8	0.72	1.41	1.00	1.00	1.00	19	0.206	1.19	1.26	1.22	0.889	N	0.59	Liquef	1
5	CL	130	43.0	13.11	39.5	12.04	5,010	655	4,355	0.855	0.384					0.0	0.70	1.41	1.00	1.00	1.00	0		1.19	1.26	1.22	0.876	N	2.00	N	1
6	SP-SM	125	52.0	15.85	47.5	14.48	6,028	1,154	4,873	0.778	0.375	40	M	32	10	33.6	0.66	1.41	1.00	1.00	1.00	31	0.459	1.19	1.26	1.22	0.852	N	2.00	N	1
7	SC-SM	125	55.5	16.92	53.8	16.38	6,809	1,544	5,264	0.715	0.361	30	M	24	40	33.8	0.63	1.41	1.00	1.00	1.00	30	0.459	1.19	1.26	1.22	0.835	N	2.00	N	1
8	CL	125	66.5	20.27	61.0	18.59	7,715	1,997	5,718	0.651	0.343			0		0.0	0.61	1.41	1.00	1.00	1.00	0		1.19	1.26	1.22	0.817	N	2.00	N	1
9	SC-SM	125	72.0	21.95	69.3	21.11	8,746	2,512	6,235	0.596	0.326	35	M	28	40	38.6	0.58	1.41	1.00	1.00	1.00	32	0.459	1.19	1.26	1.22	0.797	N	2.00	N	1
10	CL	110	95.0	28.96	83.5	25.45	10,355	3,401	6,954	0.537	0.312					0.0	0.55	1.41	1.00	1.00	1.00	0		1.19	1.26	1.22	0.772	N	2.00	N	1

Layer Number	Depth to Bot. Layer	Thickness	σ_o	u	σ'_o	r_d	$(N_1)_{60-cs}$	Liquefy ?	τ_{cyc}	$CSR_{M=7.5}$	CSR_M	Volumetric Strain**			Settl.
	ft	ft	psf	psf	psf			NCEER	psf	τ_{cyc}/σ'_o	τ_{cyc}/σ'_o		%		in
1	5.0	5.0	338	0	338	0.996	97.9	N	131.1	0.388	0.32				0.00
2	15.0	10.0	1,350	0	1,350	0.979	25.8	N	515.5	0.382	0.31				0.00
3	35.0	20.0	3,225	0	3,225	0.942	0.0	N	1184.6	0.367	0.30				0.00
4	36.0	1.0	4,490	406	4,084	0.887	19.1	Liquef	1553.4	0.380	0.31		1.2		0.14
5	43.0	7.0	5,010	655	4,355	0.855	0.0	N	1671.4	0.384	0.31				0.00
6	52.0	9.0	6,028	1,154	4,873	0.778	31.2	N	1829.5	0.375	0.31				0.00
7	55.5	3.5	6,809	1,544	5,264	0.715	30.2	N	1899.4	0.361	0.29				0.00
8	66.5	11.0	7,715	1,997	5,718	0.651	0.0	N	1959.5	0.343	0.28				0.00
9	72.0	5.5	8,746	2,512	6,235	0.596	31.7	N	2033.0	0.326	0.27				0.00
10	95.0	23.0	10,355	3,401	6,954	0.537	0.0	N	2167.9	0.312	0.25				0.00

Total Settlement (inch) = 0.14

* Note: The equation used to obtain $CRR_{7.5}$ is not valid for corrected $(N_1)_{60}$ higher than 30. According to NCEER 1997, the soil layer with corrected $(N_1)_{60}$ higher than 30 blows per foot is unlikely to be susceptible to liquefaction.

** Note: These values were obtained from a chart for estimation of volumetric strain in saturated sands based on a cyclic stress ratio and standard penetration resistance (Tokimatsu and Seed, 1987).
See figure 9.53 from "Geotechnical Earthquake Engineering" by S. Kramer.

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Results of Seismic Compaction Analysis

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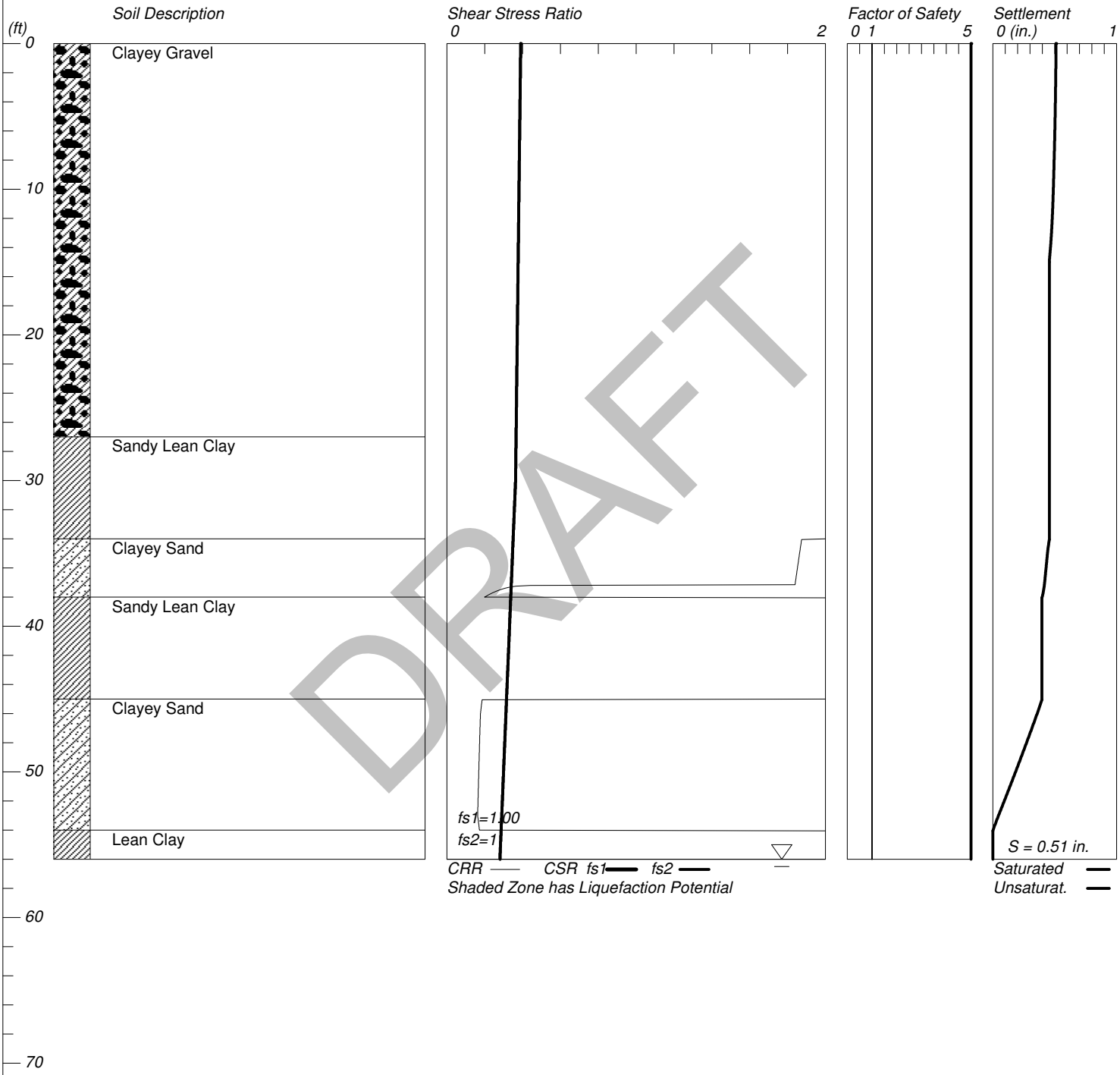
LIQUEFACTION ANALYSIS

101 MSN-B4 Petaluma

Hole No.=R-09-011 Water Depth=56 ft Surface Elev.=51

Magnitude=7
Acceleration=0.6g



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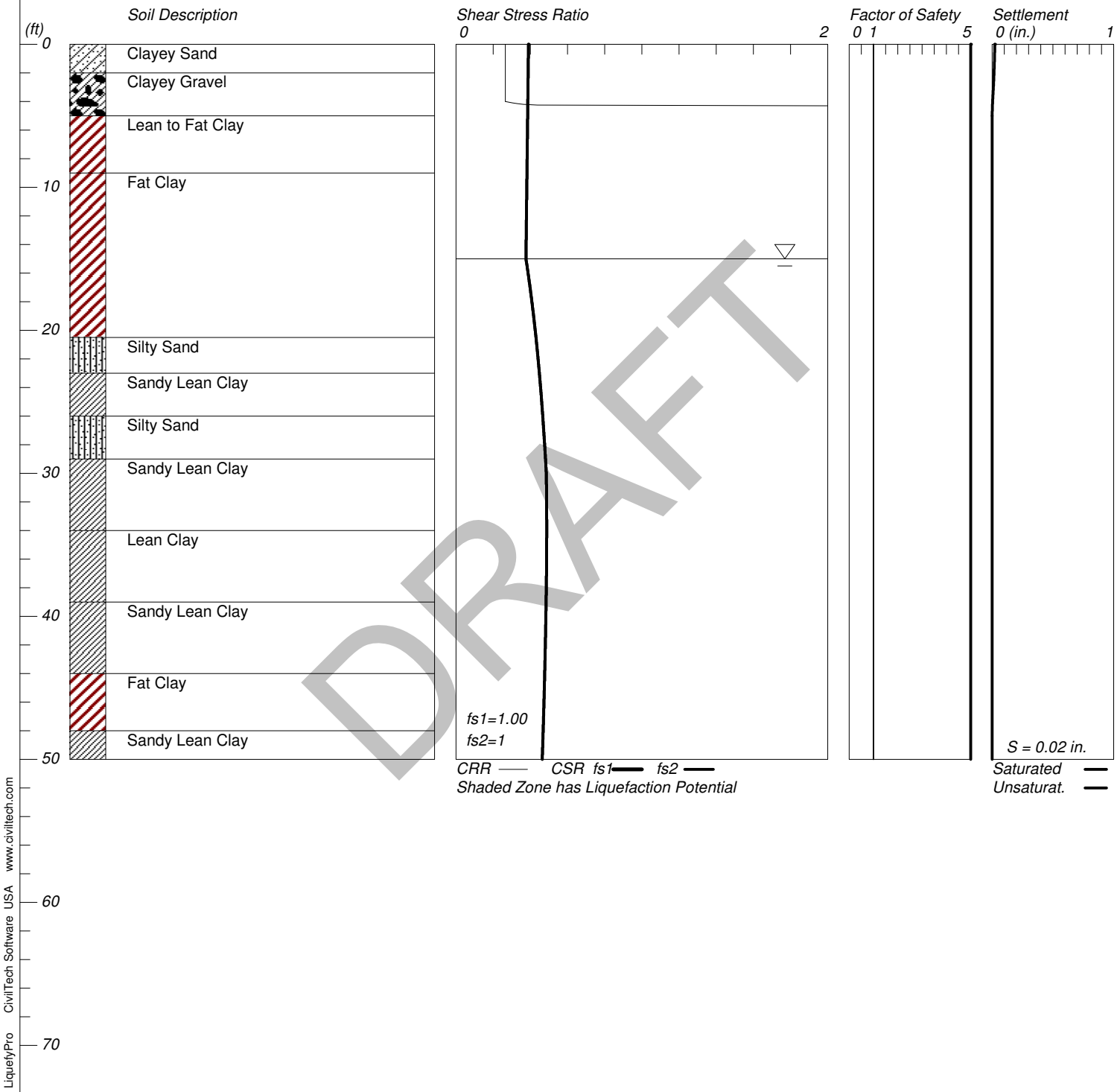
LiquefyPro CivilTech Software USA www.civiltech.com

LIQUEFACTION ANALYSIS

101 MSN-B4 Petaluma

Hole No.=R-09-013 Water Depth=15 ft Surface Elev.=10

Magnitude=7
Acceleration=0.6g



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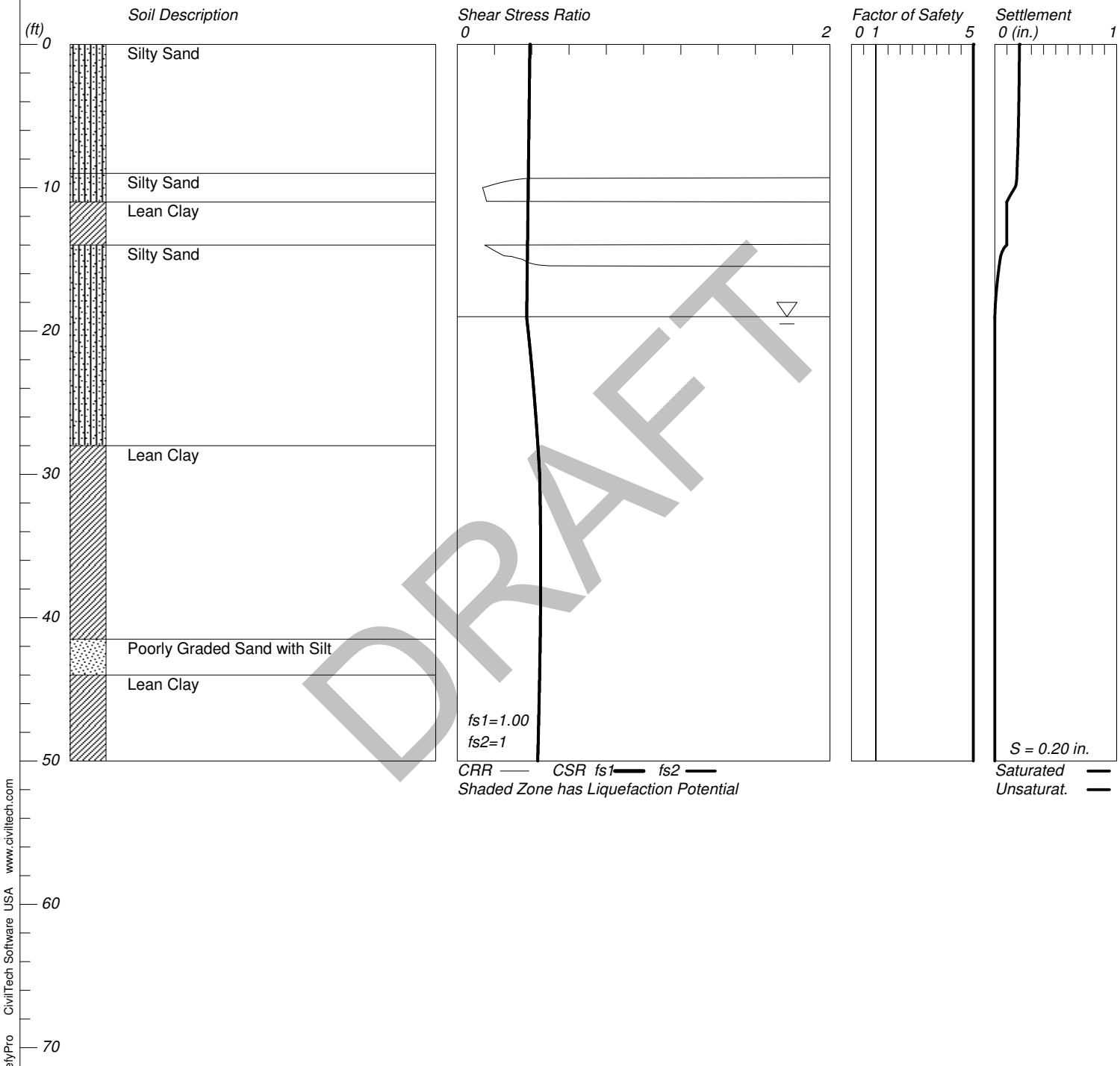
LIQUEFACTION ANALYSIS

101 MSN-B4 Petaluma

Hole No.=R-09-014 Water Depth=19 ft Surface Elev.=14

Magnitude=7
Acceleration=0.6g



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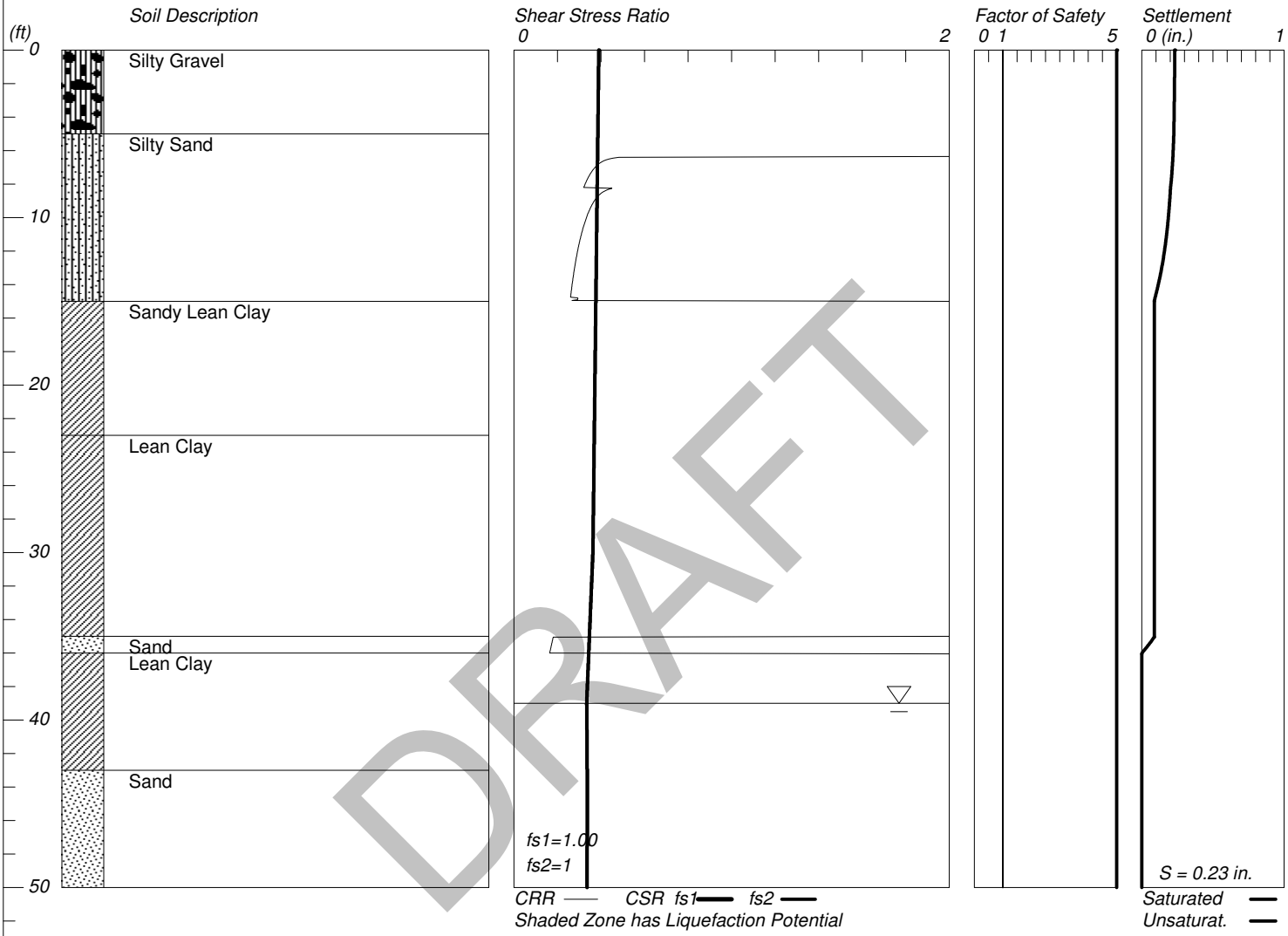
LIQUEFACTION ANALYSIS

101 MSN-B4 Petaluma

Hole No.=R-09-015 Water Depth=39 ft Surface Elev.=34

Magnitude=7
Acceleration=0.6g



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US 101 MARIN SONOMA NARROW HOV WIDENING PROJECT

IN AND NEAR PETALUMA
FROM 0.4 MILE SOUTH OF PETALUMA BOULEVARD SOUTH OVERCROSSING TO 0.2 MILE NORTH OF CAULFIELD LANE OVERCROSSING

Proposed

SOUTHBOUND US 101 / SR 116 SEPARATION FOUNDATION INVESTIGATION REPORT

DRAFT

Prepared for:

URS Corporation
55 South Market Street, Suite 1500
San Jose, CA 95113

Prepared by:

V&A
155 Grand Avenue, Suite 700
Oakland, CA 94612

January 2010

09-0597 US 101 Marin Sonoma Narrow HOV Widening Project, Southbound US 101 / SR 116 Separation Foundation Report.doc

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INTRODUCTION

V&A was retained by URS Corporation to perform a corrosion survey on US 101, in and near Petaluma, CA, from 0.4 miles south of Petaluma Boulevard South overcrossing to 0.2 miles north of Caulfield Lane overcrossing. The objective of this investigation was to measure various soil parameters and evaluate the results with respect to possible levels of corrosion at the site. The soil was tested at depths ranging from 0 to 30.5 meters below existing grade. This report provides recommendations for corrosion control of structural foundation materials under consideration for the proposed Southbound US 101 / SR 116 Separation (Figure 1) on US 101 in Petaluma, CA. The materials being considered as part of this investigation include buried reinforced concrete, prestressed concrete piles and steel piles.

The investigation was conducted in accordance with California Department of Transportation's Division of Engineering Services, Materials Engineering and Testing Services Corrosion Technology Branch "Corrosion Guidelines" (Guidelines) dated September 2003. These Guidelines consider representative soil or water samples to be corrosive to structural elements if one or more of the following conditions exist:

1) **The chloride concentration is 500 ppm or greater**
2) **The sulfate concentration is 2,000 ppm or greater**
3) **The pH is 5.5 or less.**

Evaluation of the soil environment was made in terms of potential corrosion damage to concrete and metal structures. Soil resistivity measurements were conducted in the field during the initial stages of the work. In addition, two soil samples taken during the geotechnical investigation were provided to V&A for laboratory testing. The soil samples were analyzed for minimum (saturated) resistivity, as well as for pH, chloride and sulfate ion concentrations. All of these affect the corrosion rate of buried structures.

The minimum (saturated) resistivity of soil samples selected from the Borings R-09-011 and R-09-015 measured 116 and 388 ohm-cm, respectively. The soil pH measured 8.3 and 6.8 and the water-soluble chloride concentrations measured 4,813 and 83 mg/kg. The water-soluble sulfate concentrations measured 825 and 2,325 mg/kg. The chloride and sulfate ion concentrations indicate the sampled soils are *corrosive*, as defined by the Guidelines.

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CONCLUSIONS

- The soil boring chemical analyses gave pH values higher than 5.5, <u>soluble chloride concentrations greater than 500 mg/kg and soluble sulfate concentrations greater than 2,000 mg/kg</u>. According to the Guidelines, the soil and water are considered *corrosive*.
- This structure is not within 300 meters (1,000 feet) of salt or brackish water.

RECOMMENDATIONS

The test data and a review of the project requirements were used to make recommendations for each structural foundation material alternative listed below.

Buried Reinforced Concrete Structures, Pre-Cast and Cast-in-Place Piles (Corrosive Soil)

Buried concrete structures should be constructed per the minimum concrete cover requirements established by CALTRANS. See Bridge Design Specs (BDS) Section 8.22 and Table 8.22.1 for complete information regarding the minimum concrete cover for footing, columns, cast-in-place piles, precast piles and concrete surfaces.

- The water/cement ratio should not exceed 0.40.[1]
- Use pre-fabricated epoxy coated reinforcing bars.[1]
- A minimum of 3 inches of concrete cover is required for the footing, columns and cast-in-place piles. For precast piles and pile extensions use a minimum of 2 inches of concrete cover.[1]
- For the precast piles and pile extensions, mineral admixtures conforming to ASTM Designation C1240 and /or ASTM Designation C618 Type F and/or N, may be required.[1]
- Concrete in a corrosive environment shall contain not less than 675 pounds of cementitious material per cubic yard. Reduction in the cementitious material content specified or ordered, in conformance with the provisions in Section 90-4.05, "Optional Use of Chemical Admixtures," of the Standard Specifications, is not permitted for concrete in a corrosive environment.[2]
- For concrete in a corrosive environment, the amount of Portland cement shall be 75 percent by weight, and the amount of supplementary cementitious material shall be 25 percent by weight of the total amount of cementitious material to be used in the concrete mix.[2]
- Type II modified or Type V cement shall be used when the sulfate concentrations exceed 2, 000 ppm.[3]

Steel Piles

According to the CALTRANS Guidelines the soil tested at this site is considered *corrosive* therefore corrosion mitigation is required.

- Steel vertical support elements should be protected over their exposed height and a nominal distance below finished grade with an appropriate coating system[4].
- Steel facing elements and fasteners should be protected with an appropriate coating system[4].
- Extra metal thickness shall be added to all surfaces of the pile exposed to the corrosive soil[5].
- Corrosion rate of 0.100 mm/year shall be used per the Guidelines[5].

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[1]CALTRANS – Bridge Design Specs, Table 8.22.1
[2]CALTRANS – Structure Reference Specification S8-C04 (90CORR)
[1]CALTRANS – Bridge Design Specs, Table 8.22.2
[4]CALTRANS – Bridge Design Specs – Retaining Walls - 5.7.10 – Corrosion Protection
[5]CALTRANS – Corrosion Guidelines – September 2003 – Volume 1.0 – 10.1

TEST METHODS

When predicting potential corrosion problems associated with a particular type of structure prior to installation, it is necessary to investigate the soil conditions the structure will encounter. Since corrosion is an electrochemical process accompanied by current flow, the electrochemical characteristics of a soil are of primary importance. Test methods utilized during this investigation reflect the most practical methods of evaluating corrosivity.

Resistivity is a measure of the ability of a soil to conduct an electric current. The higher the resistivity the more difficult it is for the soil to conduct current. Resistivity is primarily dependent on the soluble chemical and moisture content of the soil. Soils with high dissolved ion contents generally have low resistivity. As moisture is added to a soil, its resistivity will decrease as more ions are taken into solution. The soil resistivity decreases until the maximum solubility of the dissolved ions is reached. Increasing the moisture content beyond this point increases the soil resistivity by diluting the solution. Since corrosion rate depends on current flow through the soil, corrosivity normally increases as soil resistivity decreases.

Soils can contain a wide variety of soluble salts. Therefore, soils with similar resistivities can have significantly different corrosion characteristics, depending on the ions present. In most soils, the principal agents of corrosion are the chloride and sulfate ions, as well as pH. Chloride ions break down the protective surface films on metals and can corrode reinforcing steel in concrete structures. Sulfates attack the Portland cement in concrete. This is an expansive reaction that disrupts the concrete matrix and softens the surface. A high bicarbonate ion concentration lowers soil resistivity and facilitates other forms of corrosion; however, bicarbonate is not corrosive to metals. Soil pH is another measure of corrosivity. Acid (low pH) soils are corrosive to buried metallic and concrete structures. Neutral (pH 7) and alkaline (pH greater than 7) soils are passive to metal surfaces; therefore, corrosion rates become negligible.

Field Soil Resistivity

Field (in-situ) soil resistivity was measured at two locations along the US 101 project site. At US 101 / RS 116 one resistivity station was set up at each side of RS 116. Figure 2 shows the soil resistivity test locations and the soil boring locations.

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Figure 1. Project Site Map* for Southbound US 101 / SR 116 Separation Foundation Investigation, Petaluma, CA

*Map courtesy of www.google.com

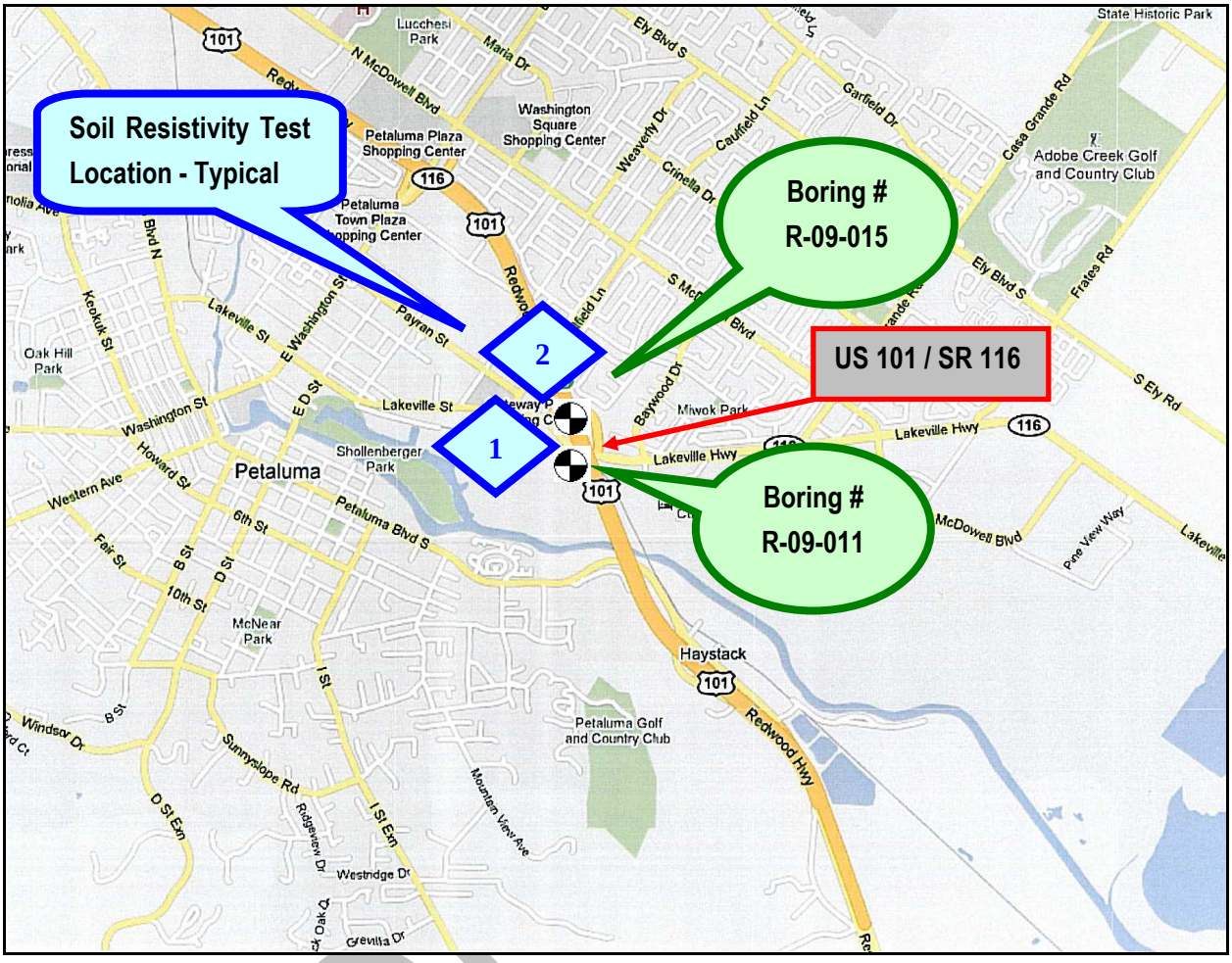

Figure 2. In-Situ Soil Resistivity Test and Boring Locations*

*Locations are approximate. Map courtesy of www.google.com

In-situ soil resistivity measurements were conducted by the Wenner Electrode Method, using an AEMC Soil Resistance Meter, Model 4500. The Wenner Electrode Method uses four equally spaced metal pins, driven into the ground in a straight line, as electrodes (see Figure 3).

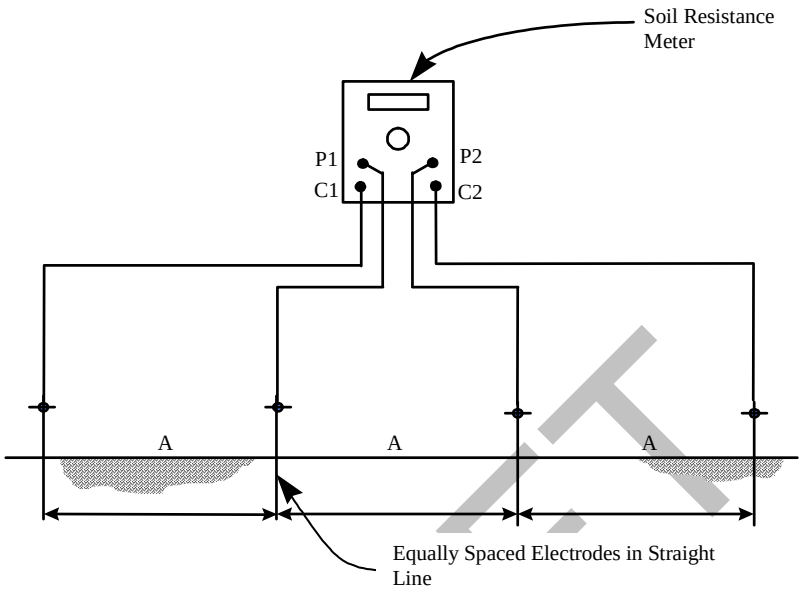

Figure 3. Wenner Four Electrode Method for Soil Resistivity Measurement

An alternating current from the soil resistance meter causes a current to flow through the soil between the outside electrodes, C1 and C2. Due to the resistance of the soil, the current creates a voltage gradient, which is proportional to the average resistance of the soil mass to a depth equal to the distance between electrodes. The voltage drop is measured across electrodes P1 and P2. Resistivity of the soil is then computed from the instrument reading according to the following formula:

$$\rho = 2\pi AR$$

where: ρ = soil resistivity in ohm-cm
A = the distance between probes in cm
R = soil resistance in ohms (instrument reading)
π = 3.1416

Soil resistance is measured with electrodes spaced 0.8, 1.5, 2.3, 3, 4.6, 7.6, 15.2, 23.0 and 30.5 meters (2.5, 5, 7.5, 10, 15, 25, 50, 75 and 100 feet) apart. The resistivity values obtained represent the average resistivity of the soil to a depth equal to the electrode spacing. An additional method of calculating the soil resistivity using the data from the Wenner Method is the Barnes-Layer resistivity calculation. The Barnes Layer calculation is used to determine the resistivity of the soil for each soil layer. While the Wenner Method at 3 meters will consider all 3 meters of soil below the surface, the Barnes-Layer method will only consider the resistivity of the layer of soil between 2.3 meters and 3 meters below the surface. This

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method assumes the soil layers are of uniform thickness and parallel to the surface, which may not always be true.

The Barnes-Layer method uses the following parameters to calculate layer resistivities:

$$\rho_{b-a} = KR_{b-a}$$

and

$$\frac{1}{R_{b-a}} = \frac{1}{R_a} - \frac{1}{R_b}$$

where:

ρ_{b-a}	=	Soil resistivity of layer depth b-a (ohm-cm)
a	=	Soil depth to top of layer (cm)
b	=	Soil depth to bottom of layer (cm)
R_a	=	Soil resistance read at depth a (ohms)
R_b	=	Soil resistance read at depth b (ohms)
R_{b-a}	=	Resistance of soil layer from a to b (ohms)
K	=	Layer constant (cm)
	=	$2\pi(b-a)$

Laboratory Soil Analysis

To supplement the field resistivity test data, two soil samples were obtained from Soil Borings R-09-011 and R-09-015 for laboratory soil resistivity analysis. A soil box was used in accordance with California Test Method 643. This apparatus is shown in Figure 4.

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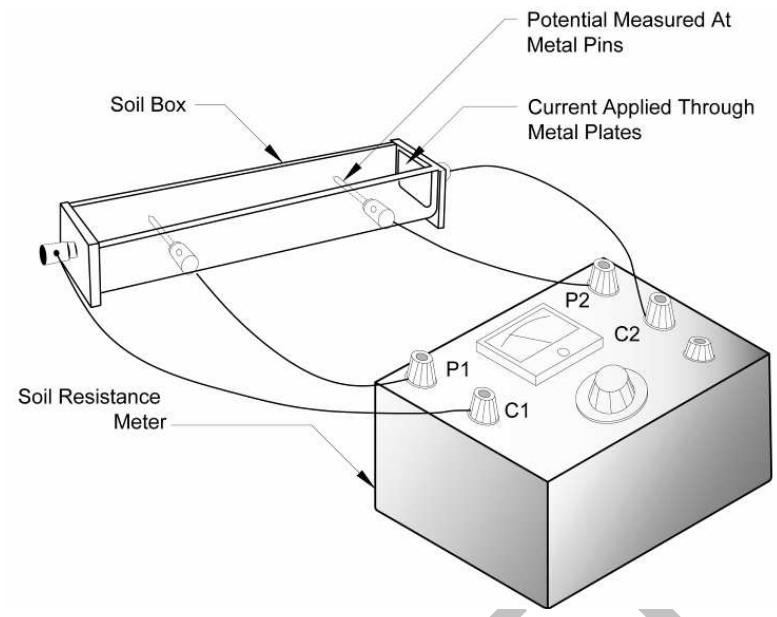

Figure 4. Soil Resistivity Measurement Using the Soil Box Method

This apparatus consists of a small plastic box with metal end plates for passing current through a tightly packed soil sample. Current is passed through the sample, causing a voltage drop across the sample. The soil resistivity is measured with a soil resistance meter, similar to the AEMC Model 4500.

Soil resistivity is first measured in the "as-received" state. Distilled water is then added to the soil sample in 10-mL increments. The resistivity is measured after each addition. As the soil sample becomes more saturated, the soil resistivity decreases until the minimum soil resistivity is reached.

Soil boring samples from this study were forwarded to Cooper Testing Labs, Inc., in Palo Alto, CA, for minimum resistivity measurement, pH analysis and analysis of water soluble chloride and sulfate ion concentrations. The analytical procedures followed California Test Methods 417, 422 and 643.

TEST RESULTS

Table 1 and Table 2 list the field soil resistivity measurements and the calculated Barnes-Layer resistivities. Table 3 lists the minimum resistivities and chemical analyses for the soil boring samples.

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Table 1. Field Soil Resistivity Data, Site 1

Test Location No.	Site	Survey Station	Depth (meters)	Resistivity (ohm-cm)	Layer (meters)	Layer Resistivity (ohm-cm)
1	US 101 / SR 116 Separation, South Bound, South of SR 116	190+00	0.8	2,868	0 - 0.8	
			1.5	2,087	0.8 - 1.5	1,641
			2.3	945	1.5 - 2.3	451
			3.1	695	2.3 - 3	388
			4.6	511	3 - 4.6	334
			7.6	139	4.6 – 7.6	66
			15.2	354	7.6 – 15.2	642
			23.0	546	15.2 – 23.0	6,732
			30.5	1,724	23.0 – 30.5	315

Table 2. Field Soil Resistivity Data, Site 2

Test Location No.	Site	Survey Station	Depth (meters)	Resistivity (ohm-cm)	Layer (meters)	Layer Resistivity (ohm-cm)
2	US 101 / SR 116 Separation, South Bound, North of SR 116	194+00	0.8	13,310	0 - 0.8	
			1.5	8,953	0.8 - 1.5	6,745
			2.3	4,007	1.5 - 2.3	1,904
			3.1	2,312	2.3 - 3	1,019
			4.6	1,514	3 - 4.6	896
			7.6	11,443	4.6 – 7.6	1,295
			15.2	13,837	7.6 – 15.2	17,497
			23.0	15,900	15.2 – 23.0	22,659
			30.5	24,724	23.0 – 30.5	37,187

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Table 3. Laboratory Soil Resistivity and Chemical Data

Item No.	Boring No.	Station	Depth (meters)	Minimum Soil Resistivity (ohm-cm)	Chemical Data		
					pH	Sulfate (mg/kg)	Chloride (mg/kg)
1	R-09-011	186+35	3.1	116	8.3	825	4,813
2	R-09-015	194+32	25.9	388	6.8	2,325	38

Appendix 1
Soil and Water Sample Minimum Resistivity and Chemical Analysis

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Corrosivity Test Summary

CTL # 632-008 Date: 1/13/2010 Tested By: PJ Checked: PJ
Client: V & A Project: URS Caltrans 101 Marin/Sonoma Proj. No: 09-0597
Remarks:

Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate		pH	ORP	Moisture	Soil Visual Description
Boring	Sample, No.	Depth, ft.	As Rec.	Minimum	Saturated	mg/kg Dry Wt.	mg/kg Dry Wt.	% Dry Wt.		(Redox) mv	As Received %	
			ASTM G57	Cal 643	ASTM G57	Cal 422-mod.	Cal 417-mod.	Cal 417-mod.	Cal 643	SM 2580B	ASTM D2216	
A-09-106	-	28.5	-	2542	-	<2	<5	<0.0005	8.1	-	8.5	Greenish Gray Silty SAND w/ Gravel (slightly plastic)
R-09-003	-	55	-	1556	-	4	154	0.0154	7.6	-	3.7	Bluish Gray Silty SAND w/ Gravel (slightly plastic)
R-09-007	-	68.5	-	520	-	199	356	0.0356	8.4	-	15.5	Greenish Gray Clayey SAND
R-09-008	-	88.5	-	173	-	2,259	495	0.0495	9.0	-	21.6	Bluish Gray CLAY w/ Sand
R-09-010	-	10	-	1762	-	12	<5	<0.0005	7.6	-	11.3	Brown Clayey SAND w/ Gravel
R-09-011	-	98	-	116	-	4,813	825	0.0825	8.3	-	23.0	Greenish Brown Clayey SAND
R-09-012	-	55	-	268	-	2,225	187	0.0187	8.0	-	13.7	Greenish Gray Silty SAND (slightly plastic)
R-09-015	-	85	-	388	-	38	2,325	0.2325	6.8	-	26.9	Greenish Brown Clayey SAND
R-09-101	-	8.5	-	1523	-	183	91	0.0091	7.4	-	4.1	Brown Silty SAND (slightly plastic)
R-09-103	-	10	-	1093	-	30	<5	<0.0005	8.2	-	6.0	Light Olive Brown Sandy CLAY
Petaluma Crk	-	Water Sample	-	49	-	2456 mg/L	251 mg/L	-	6.9	-	N/A	Water

DRAFT

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	1	148

ACNH-Q101(058)E

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON
STATE HIGHWAY

IN SONOMA COUNTY
IN PETALUMA FROM PETALUMA RIVER BRIDGE
TO 0.2 KM NORTH OF ROUTE 101/116
SEPARATION AND OVERHEAD

To be supplemented by Standard Plans dated July, 1999

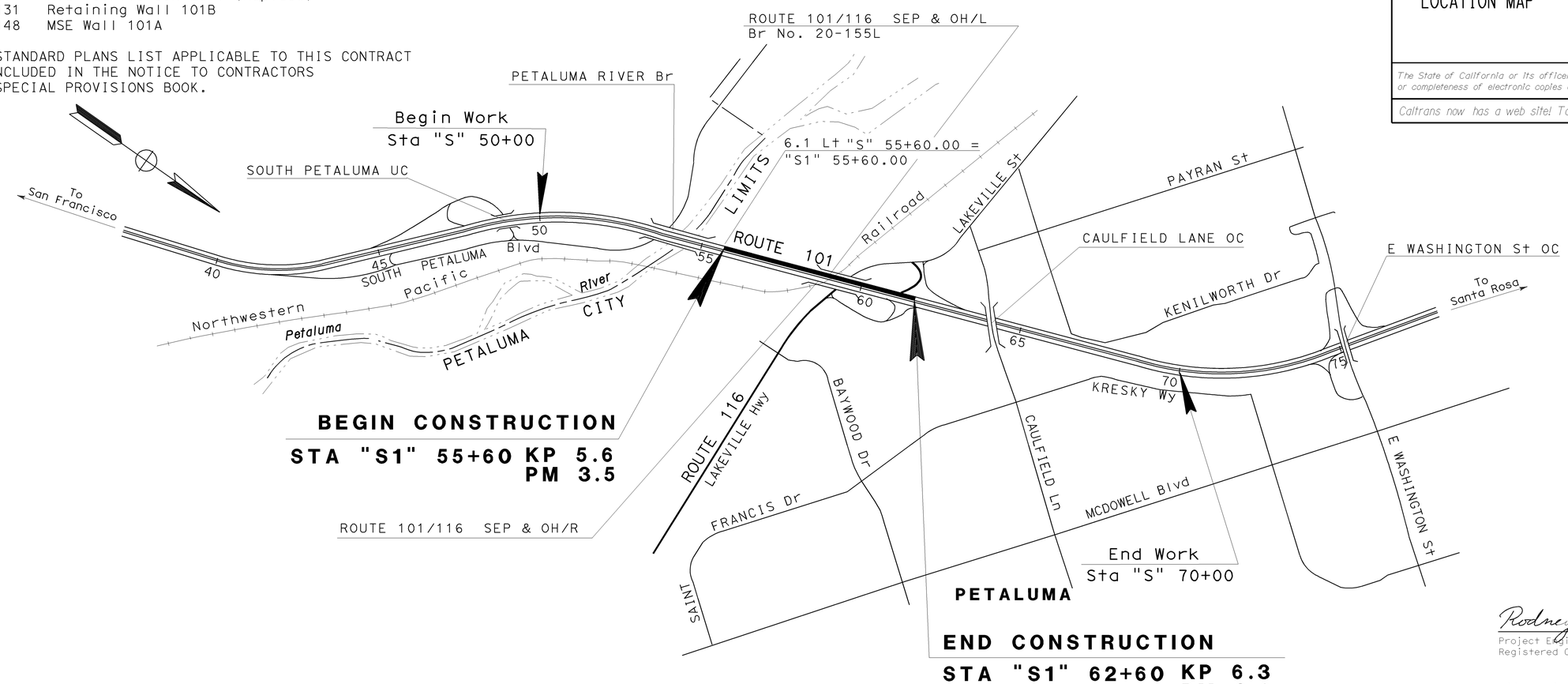
INDEX OF SHEETS

Sheet No.	Description
1	Title and Location Map
2-3	Typical Cross Sections
4-5	Layouts
6-7	Profiles
8-9	Superelevation Diagrams
10	Construction Details
11-18	Water Pollution Control Details
19-23	Erosion Control Plans and Deatils
24-25	Drainage Plan, Utility Plan and Contour Grading Plan
26-30	Drainage Profiles, Details, and Quantities
31-45	Stage Construction Plans and Quantities
46-47	Traffic Handling Plans
48	Construction Area Signs
49-51	Pavement Delineation Plans, Details and Quantities
52-53	Summary of Quantities
54-59	Sign Plans, Details and Quantities
60-64	Highway Planting
65-80	Electrical Plans
81-94	Revised Standard Plans

STRUCTURE PLANS

95-121	Rte 101/116 SOH Left (Replace)
122-131	Retaining Wall 101B
132-148	MSE Wall 101A

THE STANDARD PLANS LIST APPLICABLE TO THIS CONTRACT IS INCLUDED IN THE NOTICE TO CONTRACTORS AND SPECIAL PROVISIONS BOOK.



NO SCALE

LOCATION MAP

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Caltrans Metric

4-01-03
Rodney J. Noda
Project Engineer Date
Registered Civil Engineer

REGISTERED PROFESSIONAL ENGINEER
R.J. Noda
No. 39809
Exp. 12-31-05
CIVIL
STATE OF CALIFORNIA

March 15, 2004
Plans Approval Date

PROJECT ENGINEER	DATE	PROJECT MANAGER	DATE
R.J. NODA	4/03	L. ACORDA	4/03

The Contractor shall possess the Class (or Classes) of license as specified in the ''Notice to Contractors''.

Contract No. **04-276004**

LAST REVISION 03-19-03 DATE PLOTTED => 23-MAR-2004 TIME PLOTTED => 12:54

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	95	148

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REGISTERED CIVIL ENGINEER 3-26-03 DATE

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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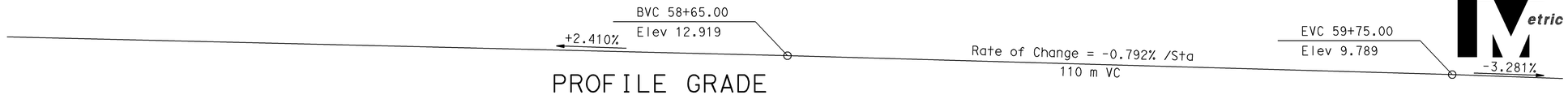
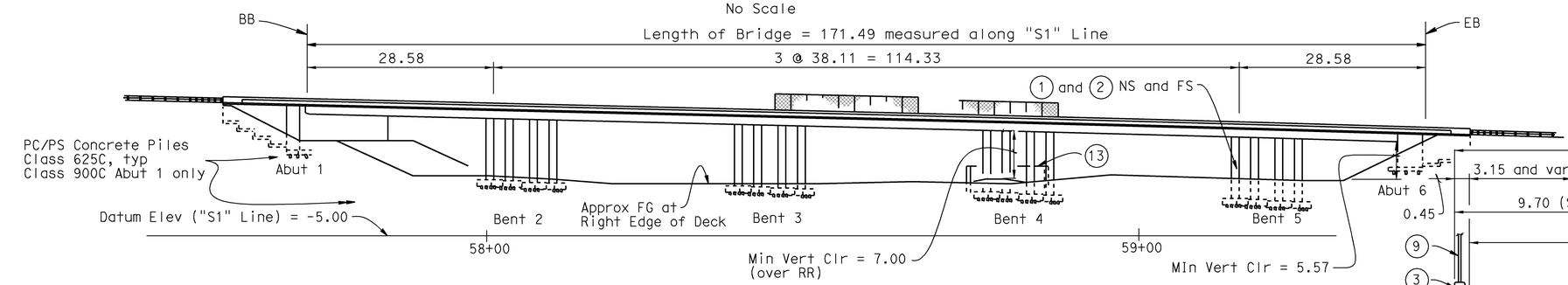


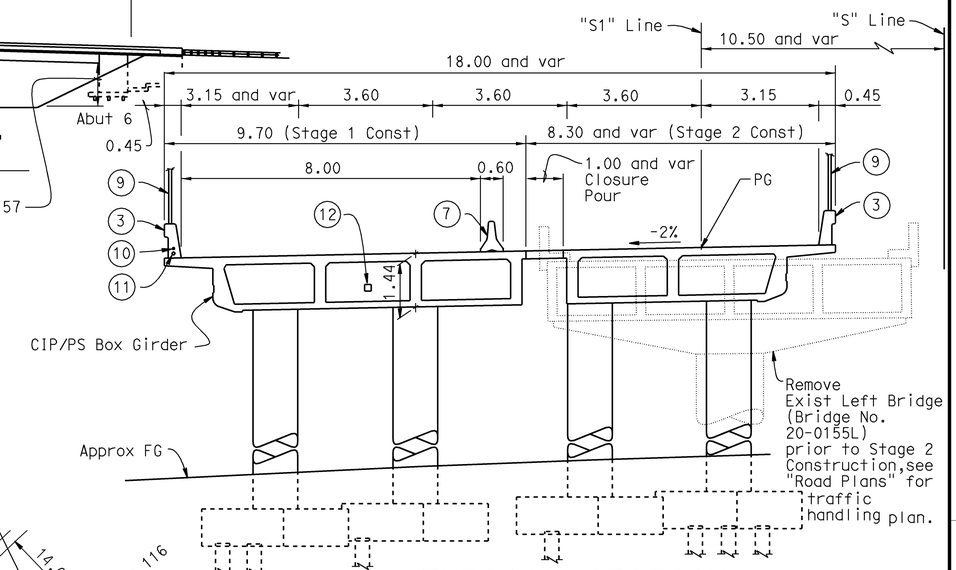
PROFILE GRADE

No Scale



ELEVATION

1:400

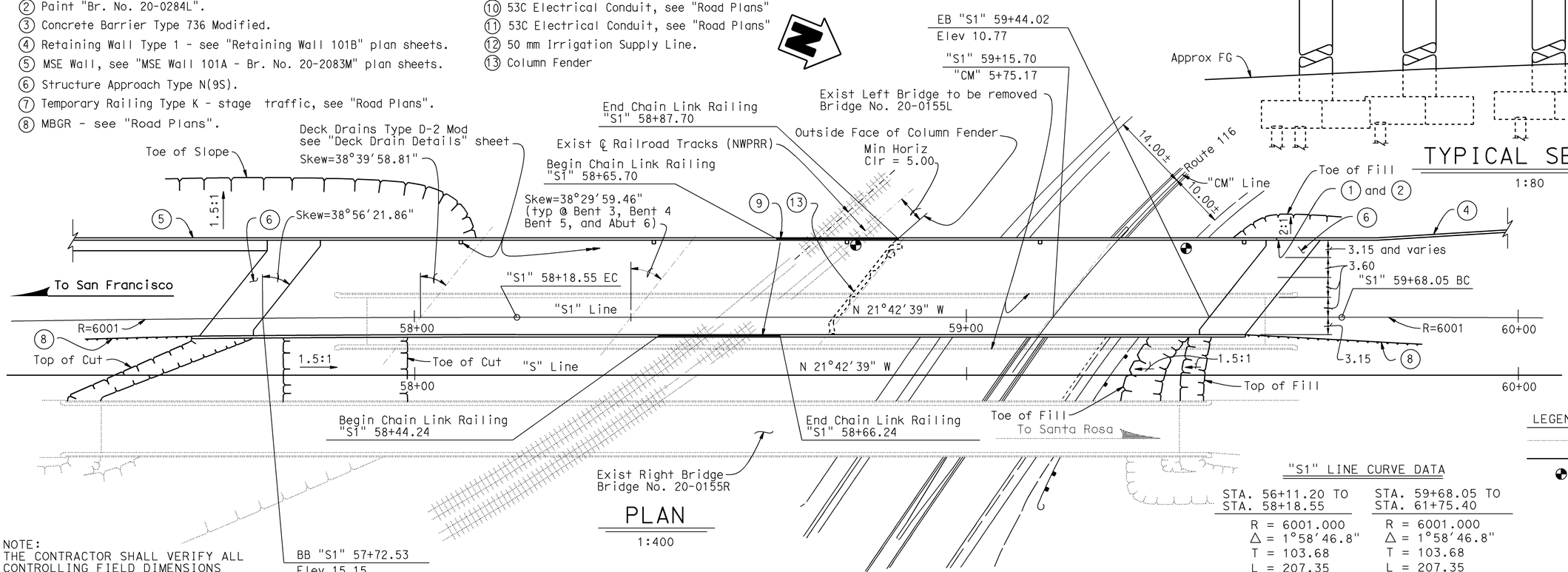


TYPICAL SECTION

1:80

NOTES:

1. Paint Br. Name: "101/116 SOH LEFT".
2. Paint "Br. No. 20-0284L".
3. Concrete Barrier Type 736 Modified.
4. Retaining Wall Type 1 - see "Retaining Wall 101B" plan sheets.
5. MSE Wall, see "MSE Wall 101A - Br. No. 20-2083M" plan sheets.
6. Structure Approach Type N(9S).
7. Temporary Railing Type K - stage traffic, see "Road Plans".
8. MBGR - see "Road Plans".
9. Chain Link Railing Type 7 Modified.
10. 53C Electrical Conduit, see "Road Plans"
11. 53C Electrical Conduit, see "Road Plans"
12. 50 mm Irrigation Supply Line.
13. Column Fender



PLAN

1:400

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

For General Notes, Index to Plans, Standard Plans, Pile Data Table and Quantities, see "Index To Plans" sheet.

LEGEND:

- Indicates existing structure.
- Indicates new structure.
- Indicates points of minimum vertical clearance.

"S1" LINE CURVE DATA

STA. 56+11.20 TO STA. 58+18.55	STA. 59+68.05 TO STA. 61+75.40
R = 6001.000	R = 6001.000
Δ = 1°58'46.8"	Δ = 1°58'46.8"
T = 103.68	T = 103.68
L = 207.35	L = 207.35

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

GUDMUND SETBERG DESIGN ENGINEER	DESIGN	BY A. Gilani	CHECKED D. Abellon	LOAD FACTOR DESIGN	LIVE LOADING: HS20-44 AND ALTERNATIVE AND PERMIT DESIGN LOAD		
	DETAILS	BY E. Montevirgen	CHECKED D. Abellon	LAYOUT	BY A. Gilani	CHECKED D. Abellon	
	QUANTITIES	BY S. Davis	CHECKED N. Nguyen	SPECIFICATIONS	BY K. Meier	PLANS AND SPECS COMPARED K. Meier	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)

GENERAL PLAN

STRUCTURES DESIGN GENERAL PLAN SHEET (METRIC) (REV.12-1-01)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 4-18-02 1-14-03 2-3-03 2-26-03 3-03-03 3-03-26

SHEET 1 OF 27

USERNAME => trbing DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:28

FILE => aagp.dgn

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	96	148

Caltrans Metric

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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GENERAL NOTES
LOAD FACTOR DESIGN

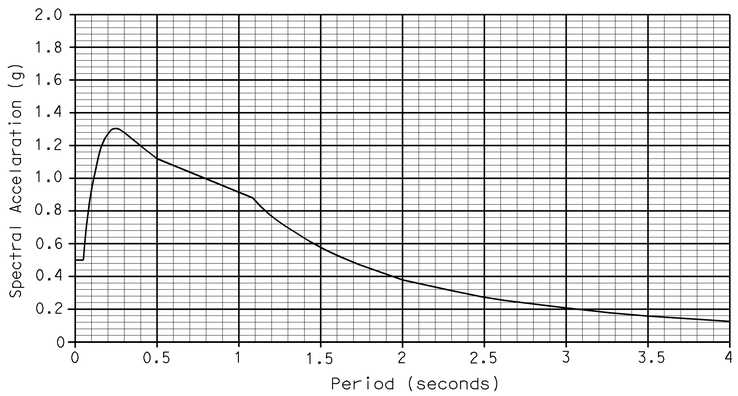
DESIGN: BRIDGE DESIGN SPECIFICATIONS (1996 AASHTO with Interims through 1998 and Revisions by CALTRANS)

DEAD LOAD: Includes 1675 Pa for future wearing surfaces.

LIVE LOADING: HS20-44 and alternative and permit design load.

SEISMIC DESIGN: Caltrans Seismic Design Criteria (SDC), Version 1.1 July 1999.

SEISMIC LOADING: Site Specific Acceleration Response Spectra Curve.

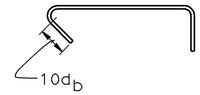


REINFORCED CONCRETE: f_y = 420 MPa

f'_c = see Concrete Strength and Type Limits on "Deck Contours" sheet.

Transverse Deck Slabs (Working Stress Design)
f_s = 140 MPa
f_c = 9 MPa
n = 8

PRESTRESSED CONCRETE: see "Prestressing Notes" on "Deck Contours" sheet.



Typical all 135° hooks

PILE DATA TABLE

Location	Pile Type	Design Loading (kN)	Nominal Resistance Compression (kN)	Nominal Resistance Tension (kN)	Design Pile Tip Elevations (m)	Specified Pile Tip Elevations (m)
Abut 1	Class 900C Alt."X"	900	1800	0	-12.5(1)	-12.5
Bent 2	Class 625C Alt."X"	625	1250	390	-12.2(1)	-12.2
Bent 3	Class 625C Alt."X"	625	1250	390	-13.7(1)	-13.7
Bent 4	Class 625C Alt."X"	625	1250	390	-17.0(1)	-17.0
Bent 5	Class 625C Alt."X"	625	1250	390	-14.6(1)	-14.6
Abut 6	Class 625C Alt."X"	625	1250	0	-16.0(1)	-16.0
Abut 1 Retaining Wall	Class 400C Alt."X"	400	800	0	-12.0(1)	-12.0
Abut 6 Retaining Wall	Class 400C Alt."X"	400	800	0	-12.0(1)	-12.0

Notes:
(1) Design tip elevations are controlled by compression.

101/116 SOH — BR NO 20-0284L

QUANTITIES

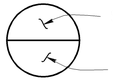
BRIDGE REMOVAL	LUMP SUM	
STRUCTURE EXCAVATION (BRIDGE)	530	m^3
STRUCTURE EXCAVATION (TYPE D)	300	m^3
STRUCTURE EXCAVATION (TYPE DR)	208	m^3
STRUCTURE BACKFILL (BRIDGE)	860	m^3
NPS 2 SUPPLY LINE (BRIDGE)	190	m
FURNISH PILING (CLASS 900C) (ALTERNATIVE X)	554	m
DRIVE PILE (CLASS 900C)(ALTERNATIVE X)	27	EA
FURNISH PILING (CLASS 625C) (ALTERNATIVE X)	2 838	m
DRIVE PILE (CLASS 625C)(ALTERNATIVE X)	173	EA
FURNISH PILING (CLASS 400C) (ALTERNATIVE X)	583	m
DRIVE PILE (CLASS 400C)(ALTERNATIVE X)	28	EA
PRESTRESSING CAST-IN-PLACE CONCRETE	LUMP SUM	
STRUCTURAL CONCRETE, BRIDGE FOOTING	262	m^3
STRUCTURAL CONCRETE, BRIDGE	2 242	m^3
STRUCTURAL CONCRETE, APPROACH SLAB (TYPE N)	98	m^3
JOINT SEAL ASSEMBLY (MR 90 MM)	47	m
BAR REINFORCING STEEL (BRIDGE)	450 050	kg
ROCK SLOPE PROTECTION (BACKING NO. 2, METHOD B)	2.7	m^3
MISCELLANEOUS METAL (BRIDGE)	1 320	kg
CHAIN LINK RAILING (TYPE 7 MODIFIED)	44	m
CONCRETE BARRIER (TYPE 736 MODIFIED)	364	m

INDEX TO PLANS

SHEET NO.	TITLE
1.	GENERAL PLAN
2.	INDEX TO PLANS
3.	DECK CONTOURS
4.	FOUNDATION PLAN NO. 1
5.	FOUNDATION PLAN NO. 2
6.	ABUTMENT 1 LAYOUT
7.	ABUTMENT 6 LAYOUT
8.	ABUTMENT DETAILS NO. 1
9.	ABUTMENT DETAILS NO. 2
10.	ABUTMENT DETAILS NO. 3
11.	ABUTMENT 1 AND 6 RETAINING WALL DETAILS
12.	BENT DETAILS NO. 1
13.	BENT DETAILS NO. 2
14.	BENT DETAILS NO. 3
15.	TYPICAL SECTION
16.	GIRDER LAYOUT
17.	ADDITIONAL GIRDER REINFORCEMENT
18.	DECK DRAIN LAYOUT
19.	MISCELLANEOUS DETAILS
20.	CHAIN LINK RAILING TYPE 7 MODIFIED
21.	ARCHITECTURAL DETAILS
22.	JOINT SEAL ASSEMBLY (MAXIMUM MOVEMENT RATING = 90 mm)
23.	DECK DRAIN TYPE D-2 MODIFIED
24.	STRUCTURE APPROACH DRAINAGE DETAILS
25.	STRUCTURE APPROACH TYPE N(9S)
26.	LOG OF TEST BORINGS SHEET 1 OF 2
27.	LOG OF TEST BORINGS SHEET 2 OF 2

STANDARD PLANS DATED JULY 1999 (AND ERRATUM NO. 99-1)

A10A	ABBREVIATIONS
A10B	SYMBOLS
A62C	LIMITS OF PAYMENTS FOR EXCAVATION AND BACKFILL BRIDGE
B0-1	BRIDGE DETAILS
RSP B0-3	BRIDGE DETAILS
B0-5	BRIDGE DETAILS
B0-13	BRIDGE DETAILS
B2-6	PILE DETAILS CLASS 400C AND CLASS 625C
B2-8	PILE DETAILS CLASS 900 AND 900C
RSP B3-1	RETAINING WALL TYPE 1 , H=1200 THROUGH 9100 mm
RSP B3-8	RETAINING WALL DETAILS NO. 1
B7-1	BOX GIRDER DETAILS
B7-10	UTILITY OPENING BOX GIRDER
B8-5	CAST-IN-PLACE PRESTRESSED GIRDER DETAILS
RSP B11-56	CONCRETE BARRIER TYPE 736
B14-3	COMMUNICATION AND SPRINKLER CONTROL CONDUITS
B14-4	WATER SUPPLY LINE (BRIDGE) (PIPE SIZES LESS THAN NPS 4)
B14-5	WATER SUPPLY LINE (DETAILS) (PIPE SIZES LESS THAN NPS 4)



ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

	BY	CHECKED
DESIGN	A. Gilani	D. Abellon
DETAILS	E. Montevirgen/DE	D. Abellon
QUANTITIES	S. Davis	N. Nguyen

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
INDEX TO PLANS

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 8-08-02 8-29-02 12-18-02 3-1-03 3-03-03

SHEET 2 OF 27

FILE => aaitp.dgn

USERNAME => trbing DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:28

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	97	148

Caltrans Metric

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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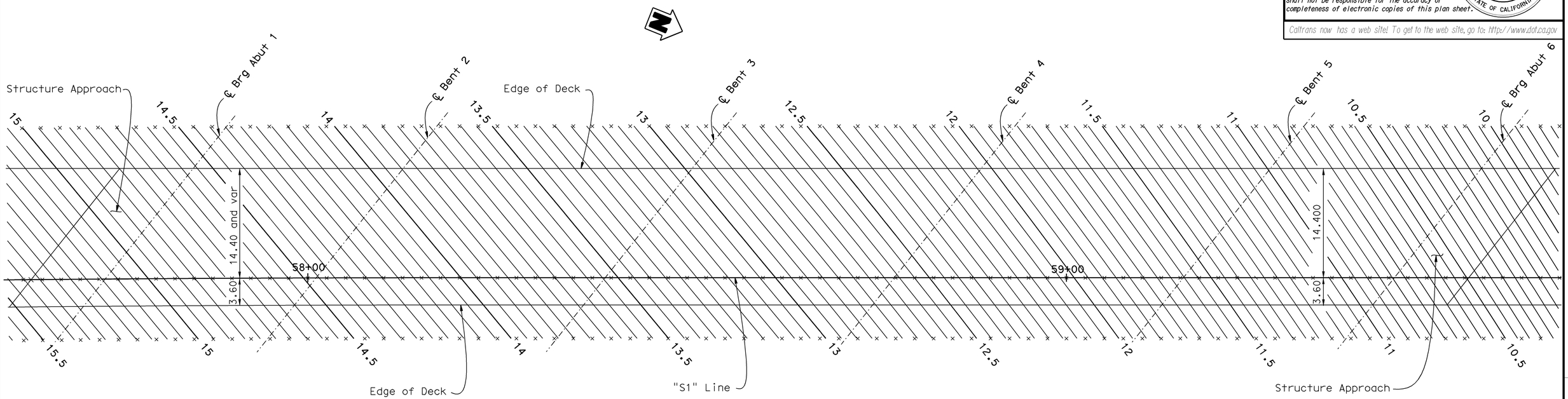
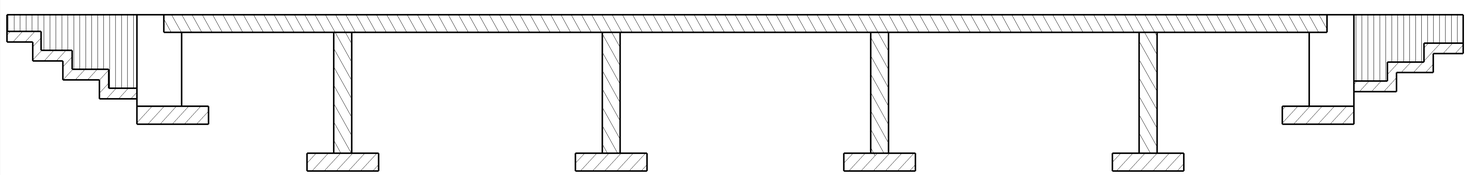


PLAN

1:250

NOTES:

1. X = Indicates 2.5 m station intervals.
2. Contours do not include camber.



CONCRETE STRENGTH AND TYPE LIMITS

- STRUCTURE CONCRETE BRIDGE (28 MPa @ 28 days)
- STRUCTURE CONCRETE BRIDGE (35 MPa @ 28 days)
- STRUCTURE CONCRETE BRIDGE FOOTING (28 MPa @ 28 days)
- STRUCTURE CONCRETE, BRIDGE

PRESTRESSING NOTES

STAGE 1

1860 MPa Low Relaxation Strand:

P_{jack} = 27000 kN

Anchor Set = 10 mm

Total Number of Girders = 4

Distribution of prestress force (Pjack) between girders shall not exceed the ratio of 3:2. Maximum final force variation between girders shall not exceed 3200 kN.

Concrete: f'_c = 35 MPa @ 28 days

f'_{ci} = 25 MPa @ time of stressing

Contractor shall submit elongation calculations based on initial stress at

⊠ = 0.729 times jacking stress.

One end stressing only.

STAGE 2

1860 MPa Low Relaxation Strand:

P_{jack} = 21000 kN

Anchor Set = 10 mm

Total Number of Girders = 3

Distribution of prestress force (Pjack) between girders shall not exceed the ratio of 3:2. Maximum final force variation between girders shall not exceed 3200 kN.

Concrete: f'_c = 35 MPa @ 28 days

f'_{ci} = 25 MPa @ time of stressing

Contractor shall submit elongation calculations based on initial stress at

⊠ = 0.723 times jacking stress.

One end stressing only.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

	BY	CHECKED
DESIGN	A. Gilani	D. Abellon
DETAILS	E. Montevirgen	D. Abellon
QUANTITIES	S. Davis	N. Nguyen

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)

DECK CONTOURS

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 6-28-02 10-23-02 2-28-03 3-04-03 3-03-03

SHEET 3 OF 27

FILE => abdc.dgn

USERNAME => trbing DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:28

NO	R	Δ	T	L
1	6001.000	1°58′46.8"	103.683	207.345

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	98	148

REGISTERED CIVIL ENGINEER 3-26-03 DATE

3-15-04
PLANS APPROVAL DATE

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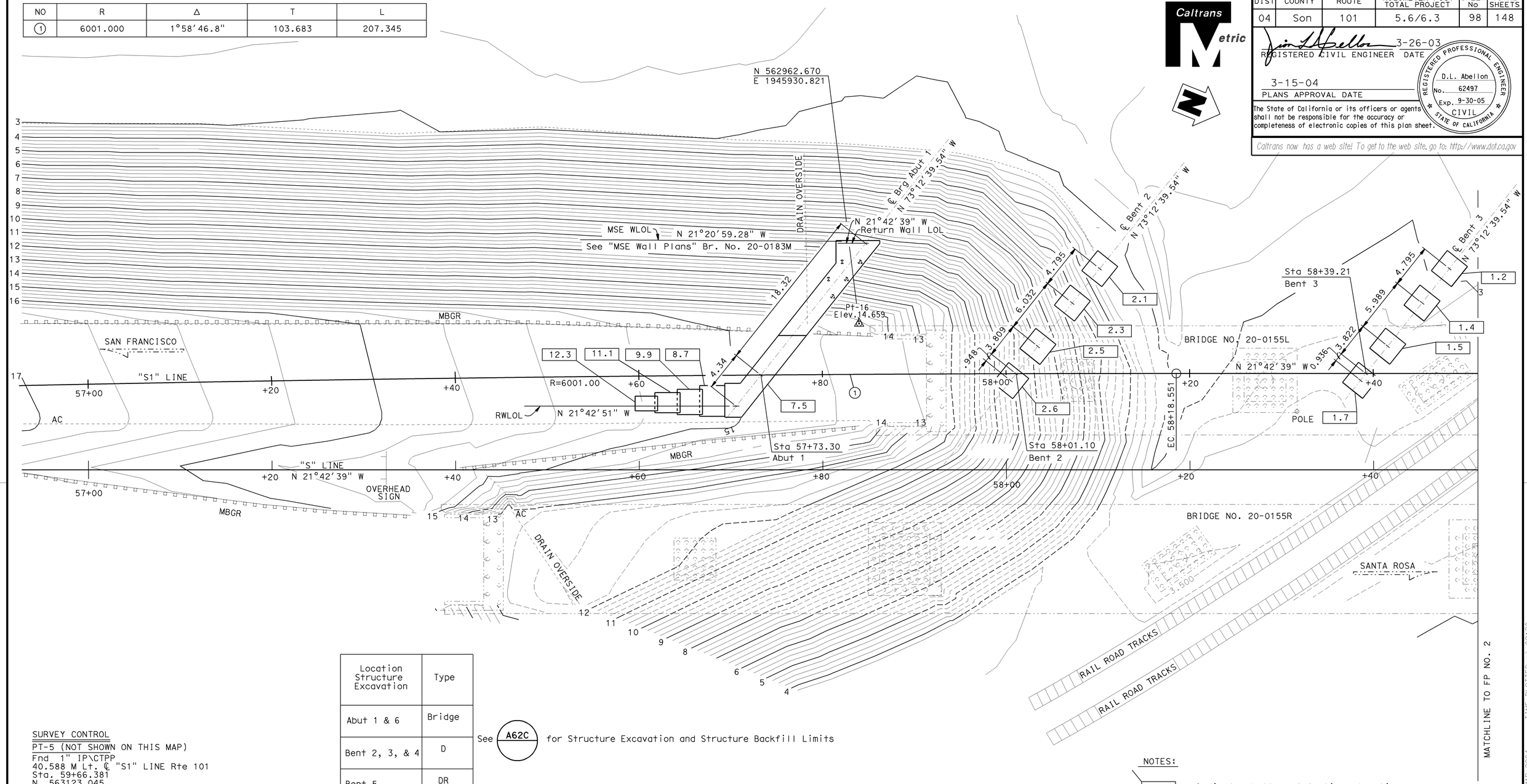

Location Structure Excavation	Type
Abut 1 & 6	Bridge
Bent 2, 3, & 4	D
Bent 5	DR

See A62C for Structure Excavation and Structure Backfill Limits

SURVEY CONTROL

PT-5 (NOT SHOWN ON THIS MAP)
Fnd 1" IP\CTPP
40.588 M Lt. ℄ "S1" LINE Rte 101
Sta. 59+66.381
N 563123.045
E 1945840.431
Elev. = 3.861

PT-16
Fnd PN\CTBRSHN
15.936 M Lt. ℄ "S1" LINE Rte 101
Sta. 57+83.945
N 562962.670
E 1945930.821
Elev. = 14.659

NOTES:

= Indicates bottom of footing elevation.

See "Road Plans" for Utility Layout.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

PRELIMINARY INVESTIGATION SECTION

SCALE 1:200	VERT. DATUM NAVD 88	PHOTOGRAMMETRY AS OF:	
	HORZ. DATUM NAD 83 (1991.35)	SURVEYED BY C. SCHENDEL 1/02	DRAFTED BY F. BANDA 4/02
ALIGNMENT TIES DIST. TRAVERSE SHEET		FIELD CHECKED BY	CHECKED BY J. RING 4/02

STRUCTURES FOUNDATION PLAN SHEET (METRIC) (REV.12-1-01)

	BY	CHECKED
DESIGN	A. Gilani	D. Abellon
DETAILS	E. Montevirgen	D. Abellon
QUANTITIES	S. Davis	N. Nguyen

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN

CU 04
EA 276001

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
FOUNDATION PLAN NO.1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 04/25/02 10/18/02 12/11/02 2/03/03 2/26/03 3/04/03 3/05/03 3/26/03

SHEET 4 OF 27

USERNAME => trbling DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:28

FILE => acfp01.dgn

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	99	148

REGISTERED CIVIL ENGINEER 3-26-03 DATE

3-15-04
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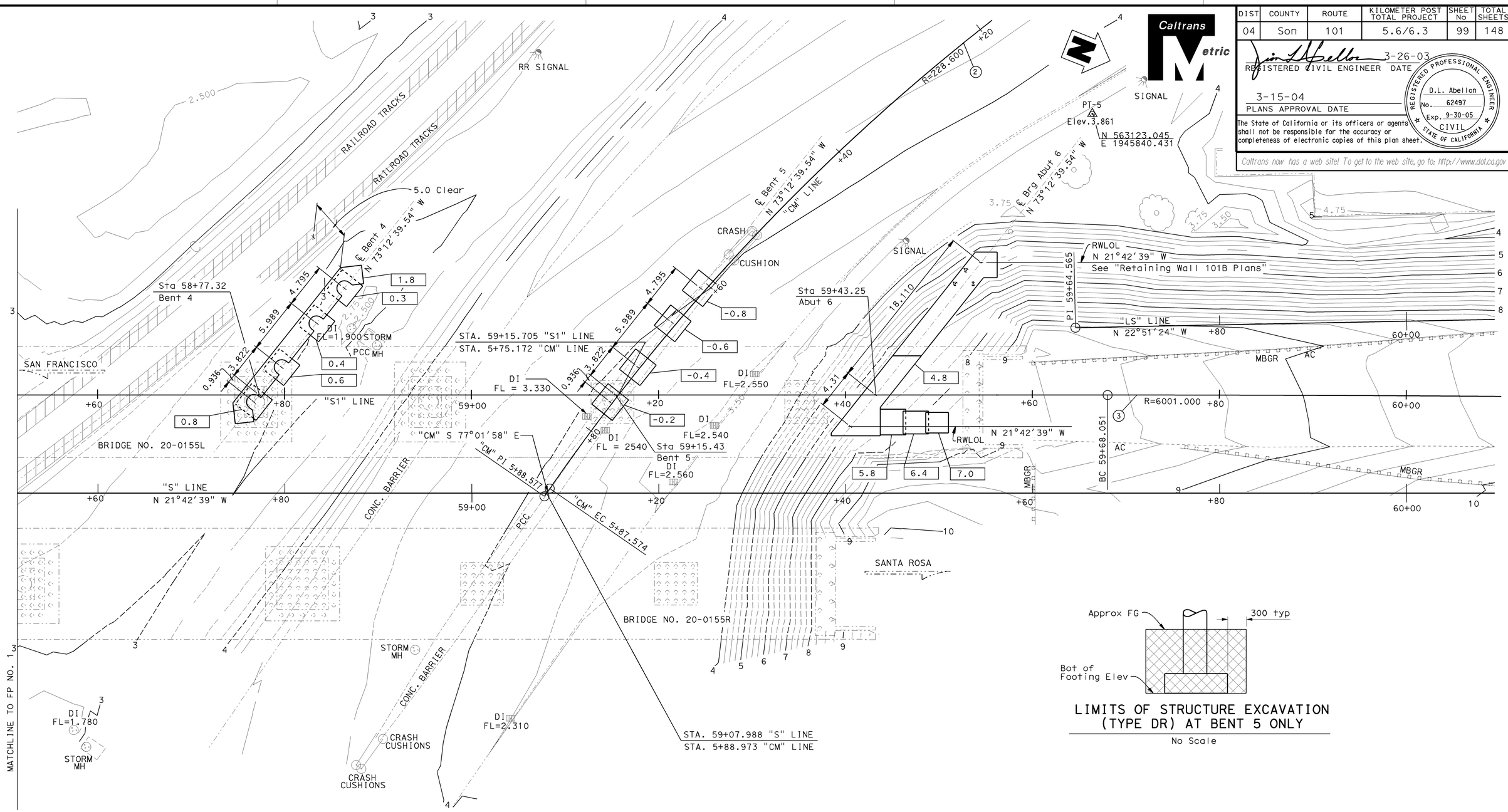

LIMITS OF STRUCTURE EXCAVATION (TYPE DR) AT BENT 5 ONLY

No Scale

NO	R	Δ	T	L
2	228.600	37°28'11.7"	77.532	149.498
3	6001.000	1°58'46.8"	103.683	207.345

NOTES:

= Indicates bottom of footing elevation.

See "Road Plans" for Utility Layout.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

PRELIMINARY INVESTIGATION SECTION

SCALE	VERT. DATUM NAVD 88	PHOTOGRAMMETRY AS OF:			
1:200	HORZ. DATUM NAD 83 (1991.35)	SURVEYED	BY C. SCHENDEL 1/02	DRAFTED	BY F. BANDA 4/02
ALIGNMENT TIES DIST TRAVERSE SHEET		FIELD CHECKED	BY	CHECKED	BY J. RING 4/02

STRUCTURES FOUNDATION PLAN SHEET (METRIC) (REV.12-1-01)

	BY	CHECKED
DESIGN	A. Gilani	D. Abellon
DETAILS	E. Montevirgen	D. Abellon
QUANTITIES	S. Davis	N. Nguyen

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN

CU 04276
EA 276001

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
FOUNDATION PLAN NO.2

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 04/05/02 10/15/02 12/12/02 2/18/03 2/28/03 3/03/03

SHEET 5 OF 27

FILE => acfp02.dgn

USERNAME => rrbing DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:28

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	100	148

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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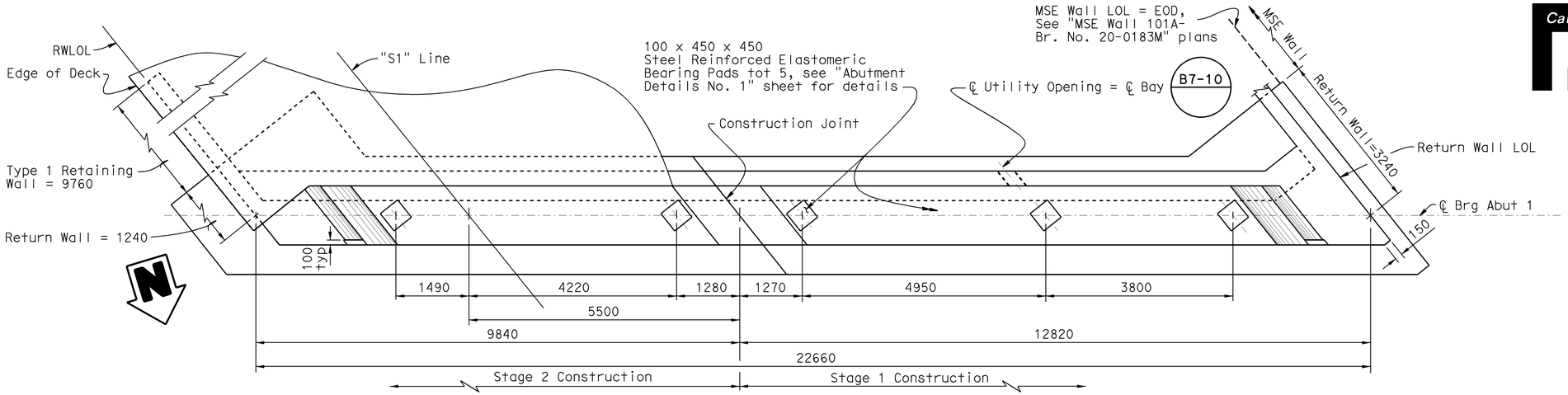
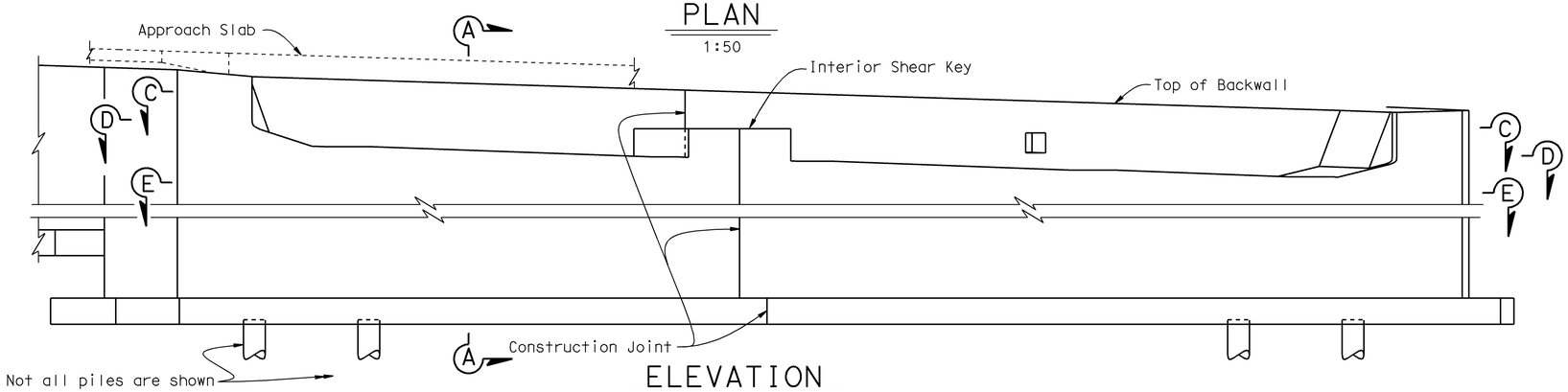
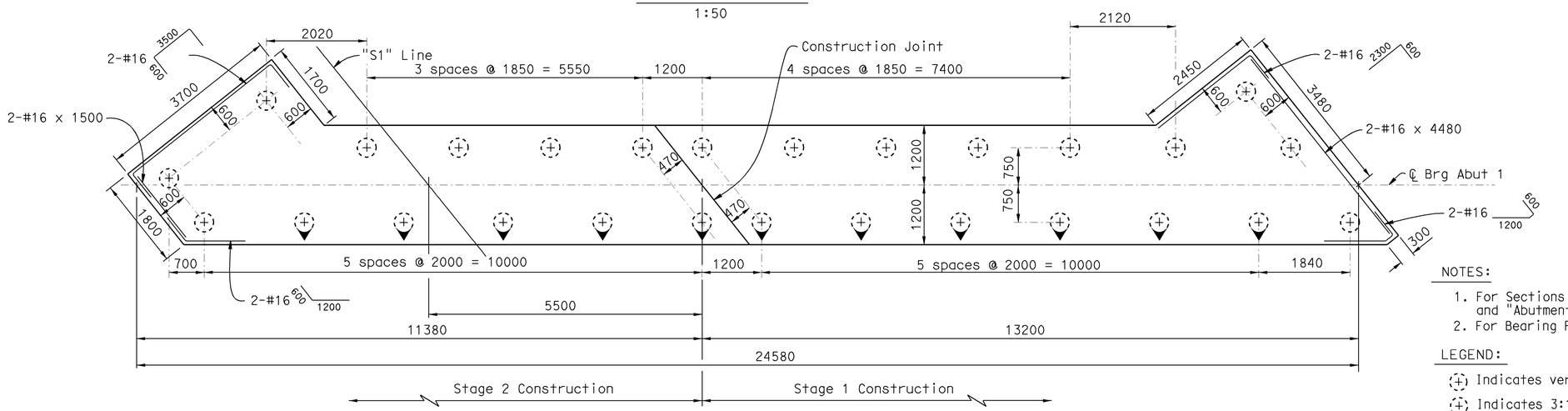
Caltrans Metric



PLAN
1:50



ELEVATION
1:50



FOOTING PLAN
1:50

NOTES:

1. For Sections A-A, C-C, D-D and E-E, see "Abutment Details No. 1" and "Abutment Details No. 2" sheet.
2. For Bearing Pad Details, see "Abutment Details No. 1" sheet.

LEGEND:

Indicates vertical piles.

Indicates 3:1 battered piles.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

DESIGN	BY A. Gilani/T. Shi	CHECKED D. Abellon	
DETAILS	BY E. Montevirgen	CHECKED D. Abellon	
QUANTITIES	BY S. Davis/M. Keo	CHECKED N. Nguyen/M. Abdi	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
ABUTMENT 1 LAYOUT

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 7-15-02 7-31-02 10-25-02 12-13-02 2-18-03 2-25-03 3-03-03 3-03-03

SHEET 6 OF 27

FILE => adabut01io.dgn

USERNAME => trbing DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:29

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	101	148

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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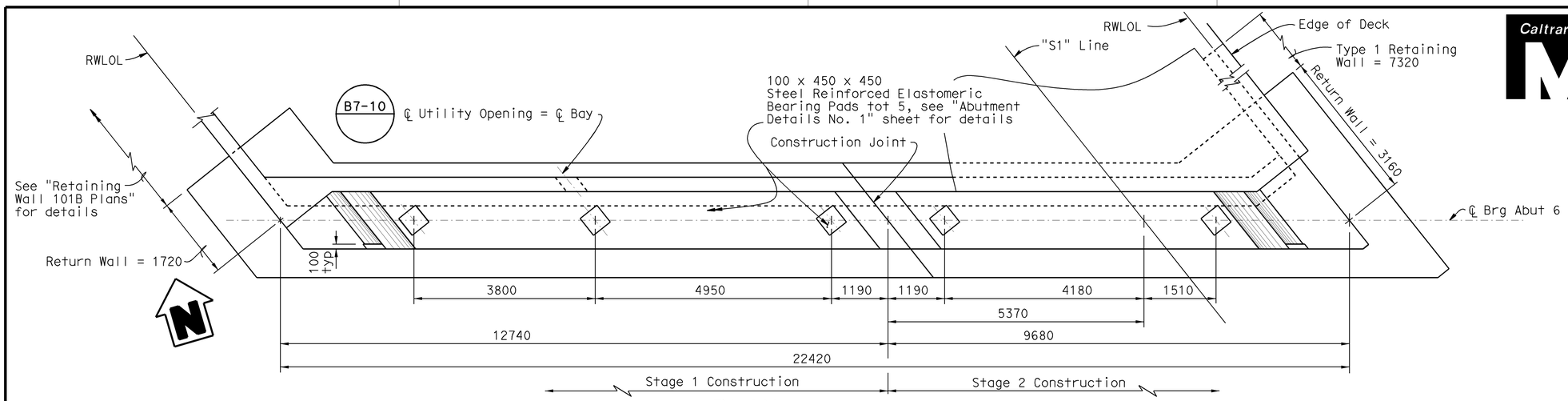
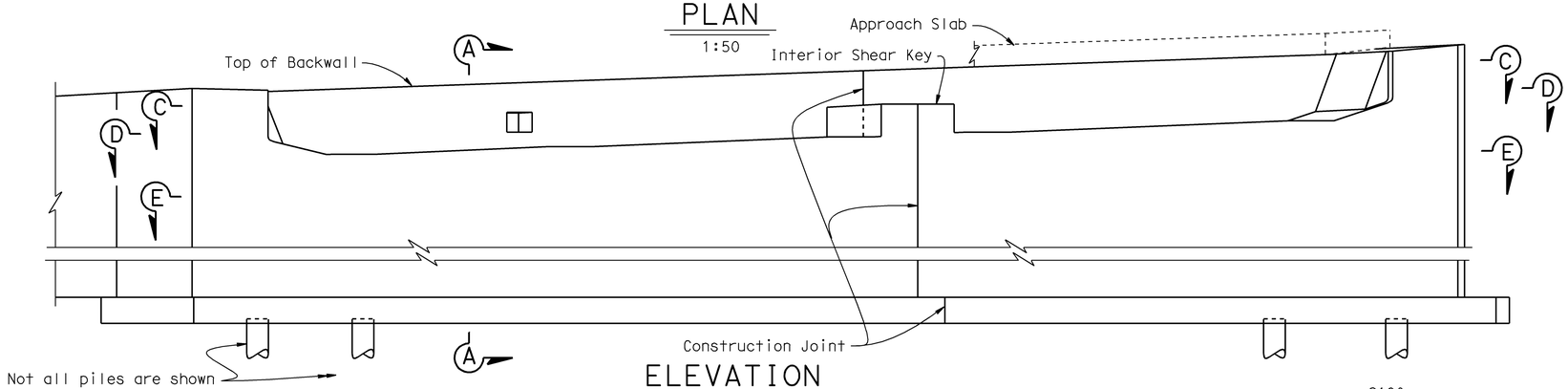
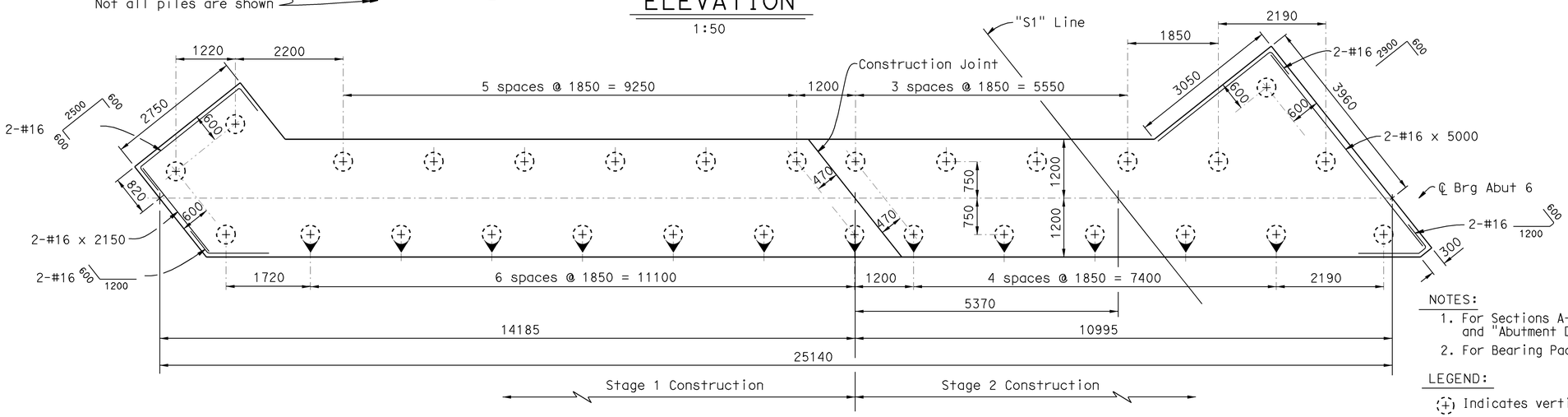


PLAN
1:50



ELEVATION
1:50



FOOTING PLAN
1:50

NOTES:

1. For Sections A-A, C-C, D-D and E-E, see "Abutment Details No. 1" and "Abutment Details No. 2" sheet.
2. For Bearing Pad Details, see "Abutment Details No. 1" sheet.

LEGEND:

Indicates vertical piles.

Indicates 3:1 battered piles.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

DESIGN	BY A. Gilani/T. Shi	CHECKED D. Abellon	
DETAILS	BY E. Montevirgen	CHECKED D. Abellon	
QUANTITIES	BY S. Davis/M. Keo	CHECKED N. Nguyen/M. Abdi	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
ABUTMENT 6 LAYOUT

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 7-15-02 7-15-02 10-15-02 1-15-03 2-15-03 3-15-03 3-03-03

SHEET 7 OF 27

FILE => adabut06lo.dgn

USERNAME => trmartok DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:08

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	102	148

Caltrans Metric

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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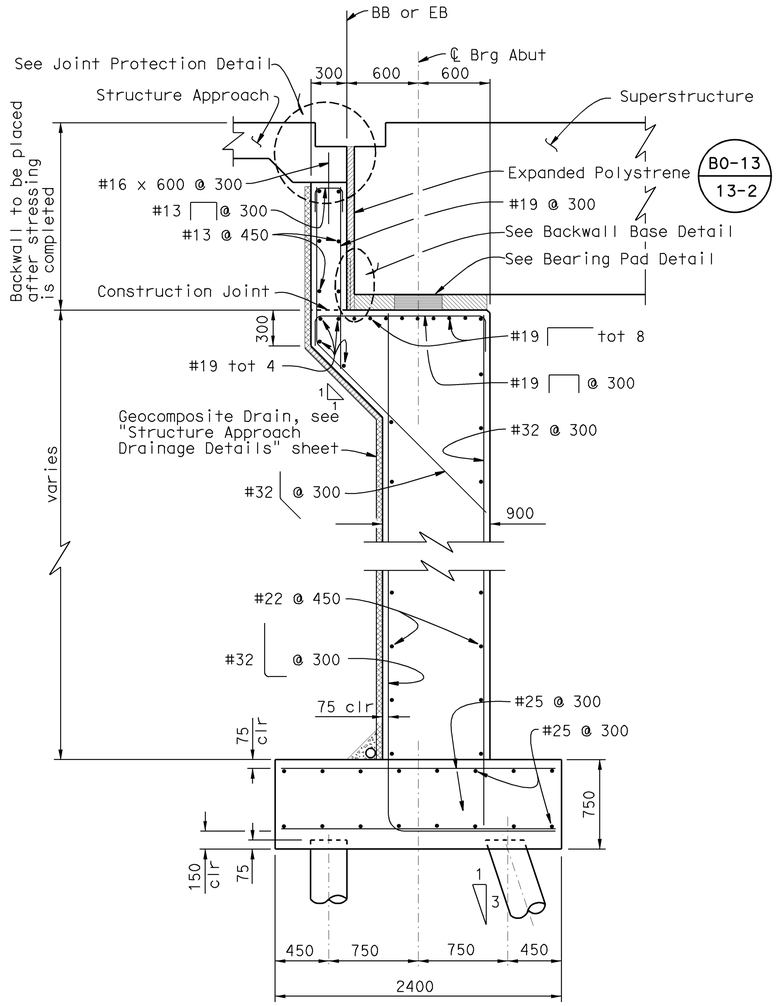
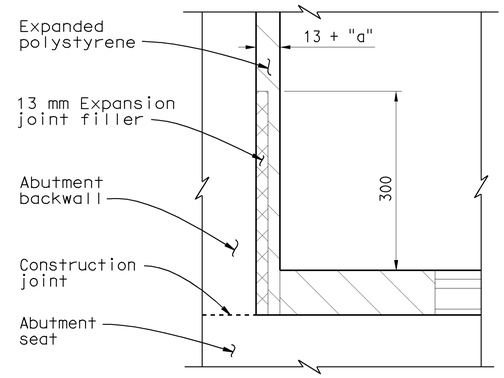


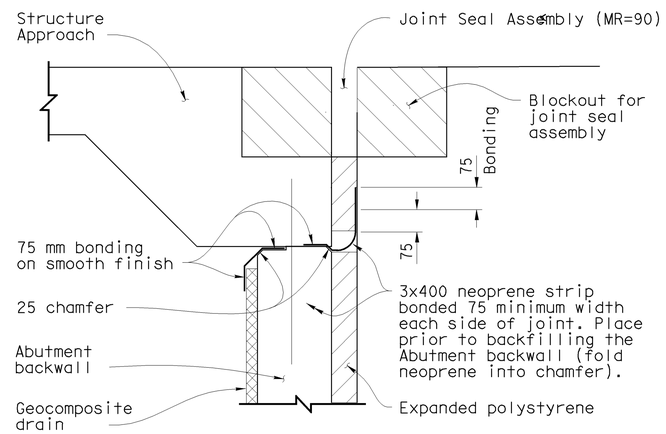
SECTION A-A

1:25



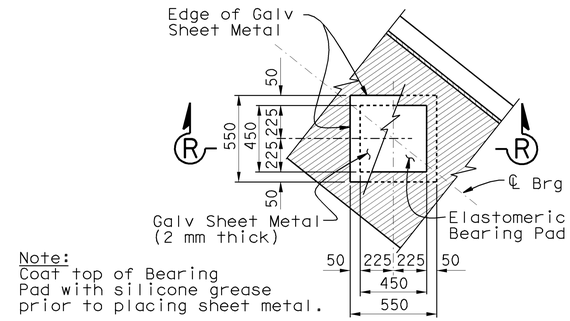
BACKWALL BASE DETAIL

No Scale



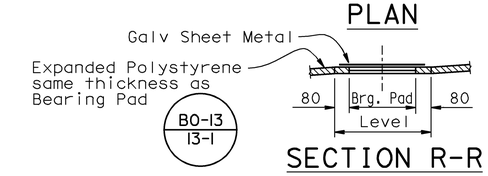
JOINT PROTECTION DETAIL

No Scale



Note:
Coat top of Bearing Pad with silicone grease prior to placing sheet metal.

PLAN



SECTION R-R

BEARING PAD DETAIL

No Scale
Details typical at all bearing pads

NOTES:

1. For location of Section A-A, see "Abutment 1 Layout" and "Abutment 6 Layout" sheets.
1. For Dimension "a", see "Joint Seal Assembly (Maximum Movement Rating = 90 mm)" sheet.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

DESIGN	BY A. Gilani/T. Shi	CHECKED D. Abellon	
DETAILS	BY E. Montevirgen	CHECKED D. Abellon	
QUANTITIES	BY S. Davis/M. Keo	CHECKED N. Nguyen/M. Abdi	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)

ABUTMENT DETAILS NO. 1

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 7-18-02 10-21-02 11-19-02 12-16-02 2-18-03 3-26-03 3-01-03

SHEET 8 OF 27

FILE => geabutdet01.dgn

USERNAME => trmartok DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:09

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	103	148

Caltrans Metric

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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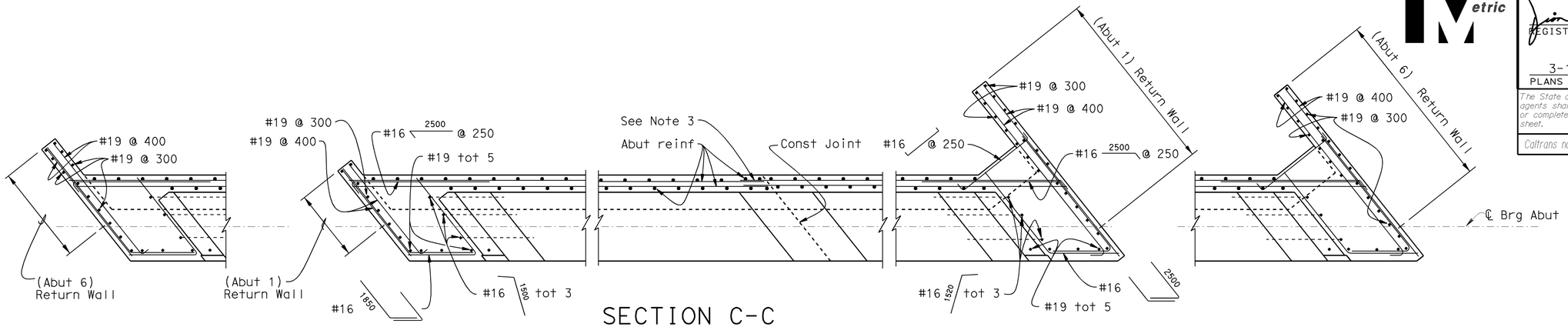
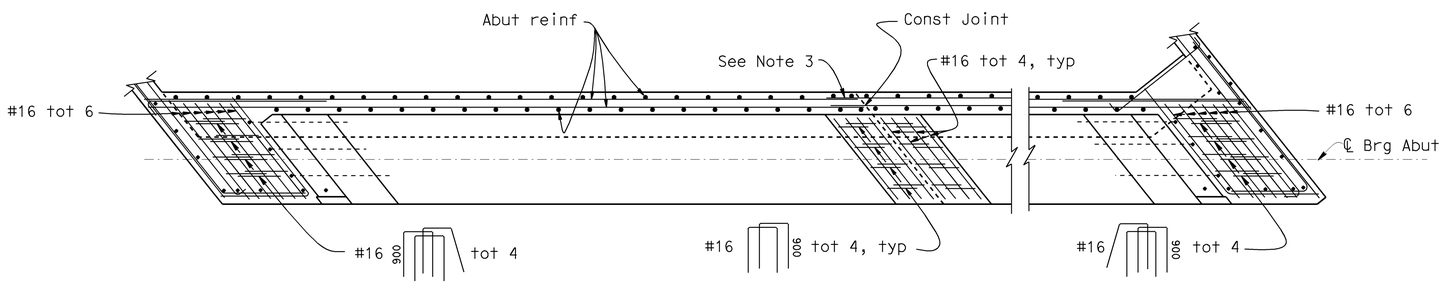
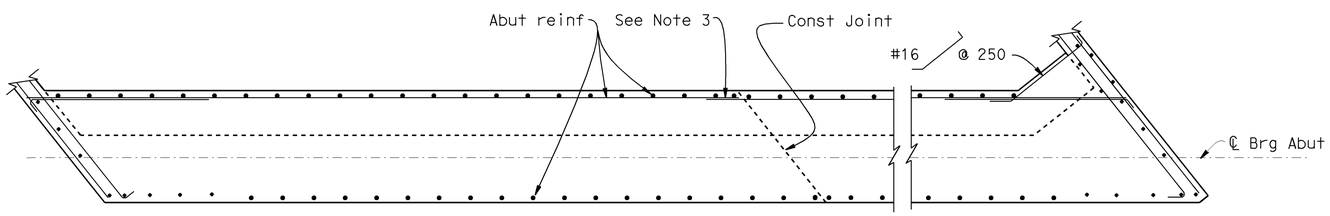


SECTION C-C
1:40



SECTION D-D
1:40



SECTION E-E
1:40

NOTES:

1. For location of Sections C-C, D-D and E-E, see "Abutment 1 Layout" and "Abutment 6 Layout" sheets.
2. See "Abutment Details No. 3" sheet for Shear Key Details.
3. Lap splice continuous bar reinforcing steel through construction joint.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

DESIGN	BY A. Gilani/T.Shi	CHECKED D. Abellon	
DETAILS	BY E. Montevirgen	CHECKED D. Abellon	
QUANTITIES	BY M. Keo/S. Davis	CHECKED M. Abdi/N. Nguyen	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
ABUTMENT DETAILS NO. 2

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 7-15-02 10-11-02 11-14-02 12-1-02 2-18-03 3-01-03

SHEET 9 OF 27

FILE => aeabutdet02.dgn

USERNAME => trmortok DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:09

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	104	148

Caltrans Metric

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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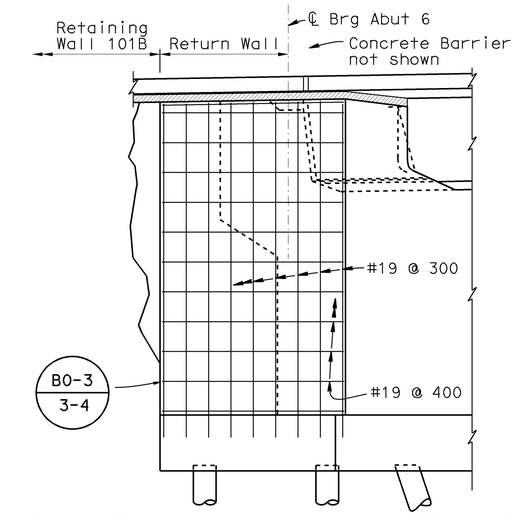
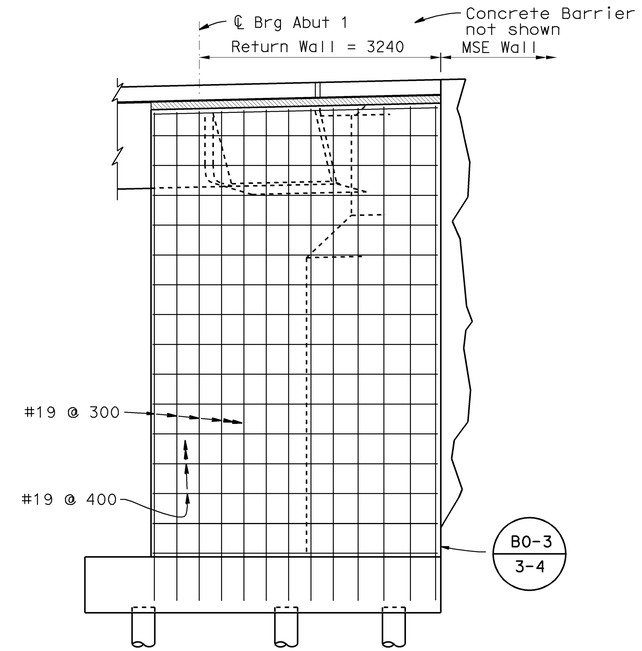


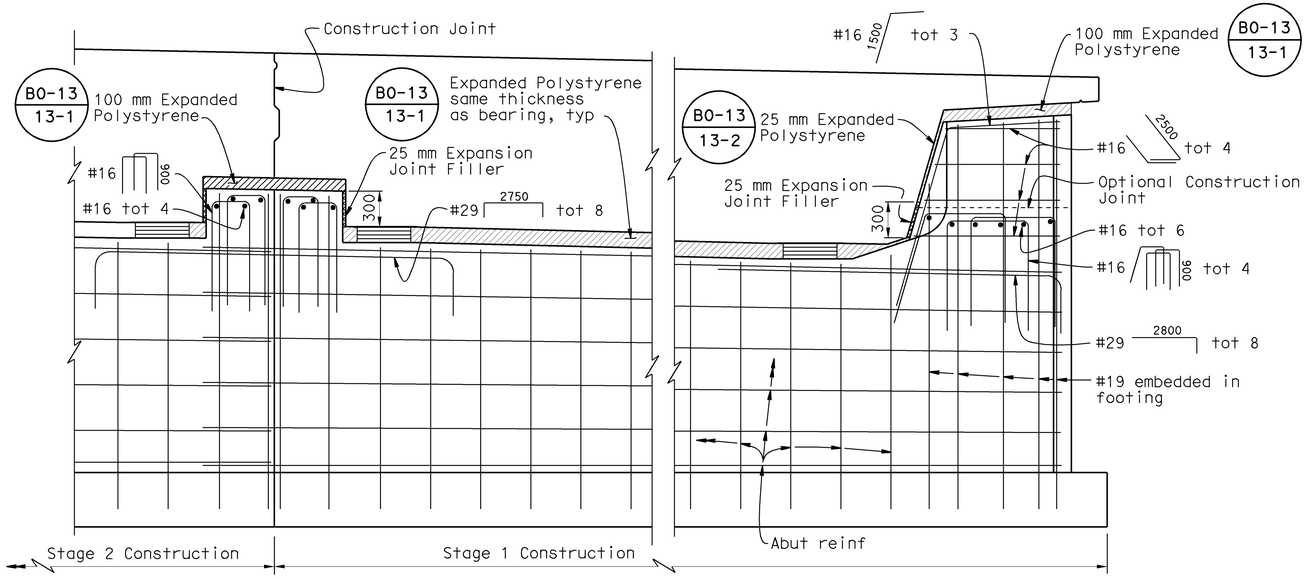
RETURN WALL ELEVATION-ABUT 6

1:40



RETURN WALL ELEVATION-ABUT 1

1:40



PART ELEVATION-SHEAR KEY DETAILS

1:25

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

DESIGN	BY A. Gilani	CHECKED D. Abellon	
DETAILS	BY E. Montevirgen	CHECKED D. Abellon	
QUANTITIES	BY M. Keo	CHECKED M. Abdi	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)

ABUTMENT DETAILS NO. 3

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 7-17-02 10-28-02 11-15-02 12-16-02 2-24-03 3-01-03

SHEET 10 OF 27

FILE => aeabutdet03.dgn

USERNAME => trmartok DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:09

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	105	148

Caltrans Metric

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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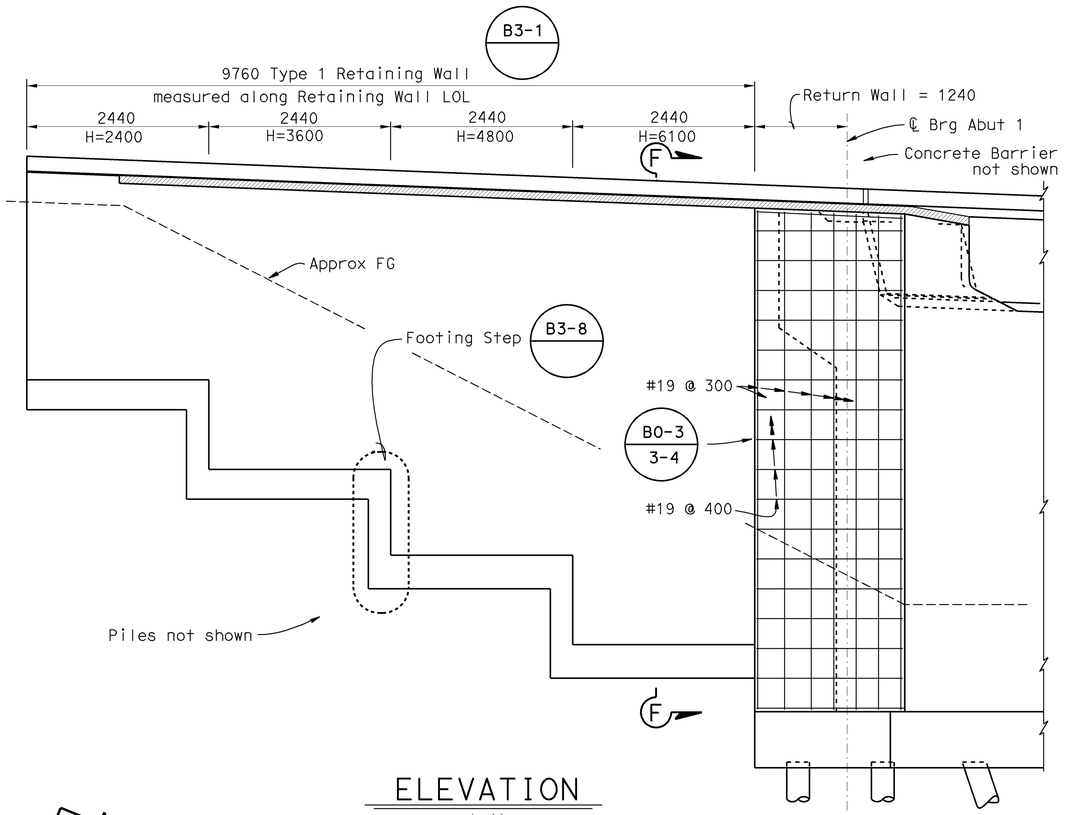
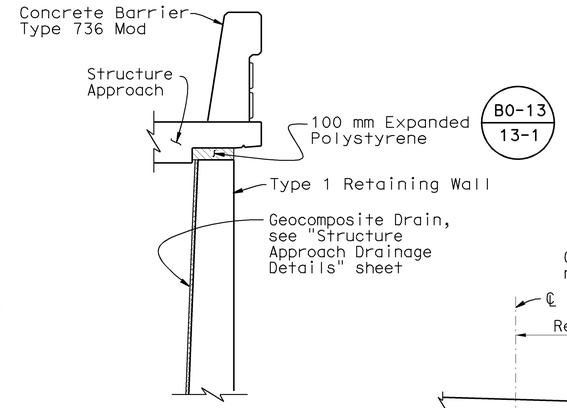
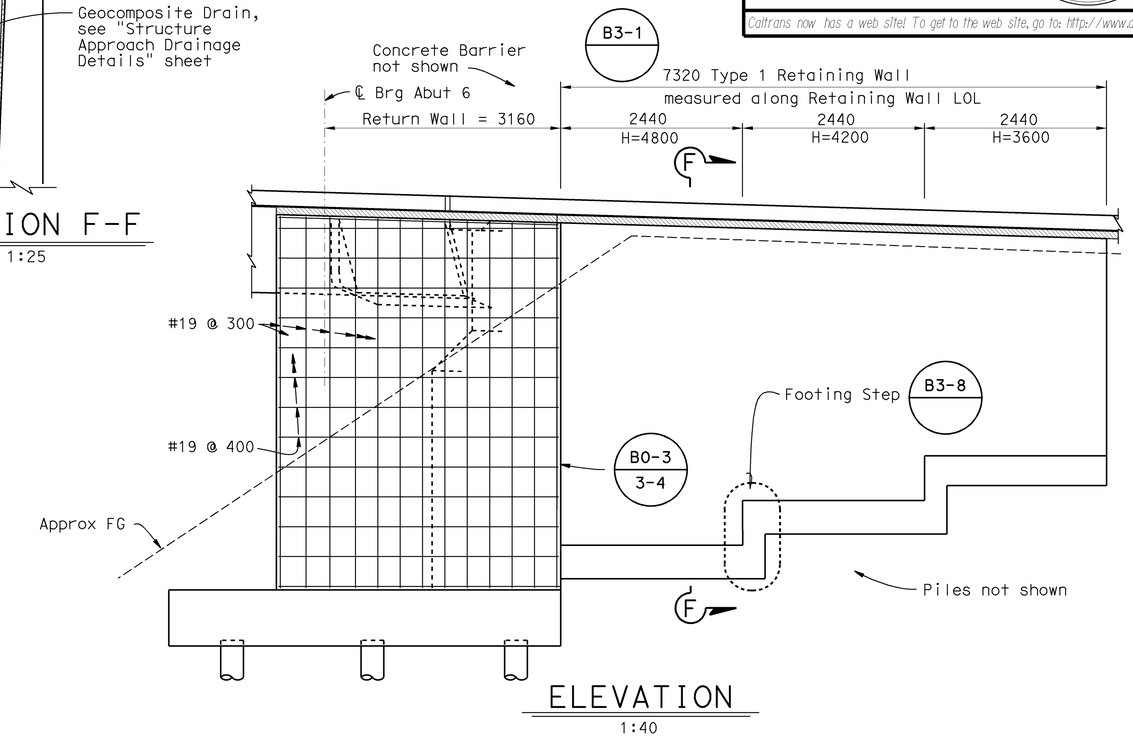


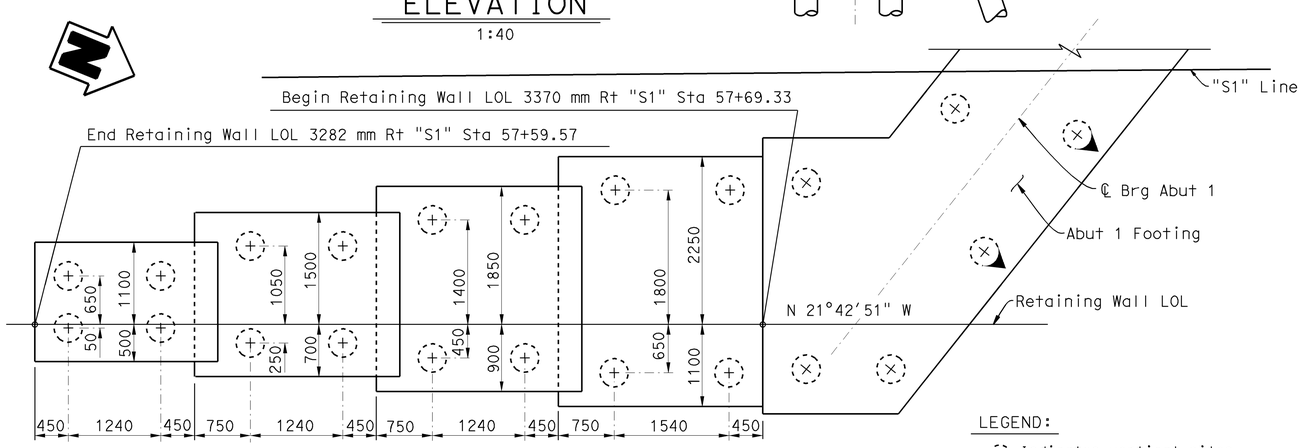
ELEVATION
1:40



SECTION F-F
1:25

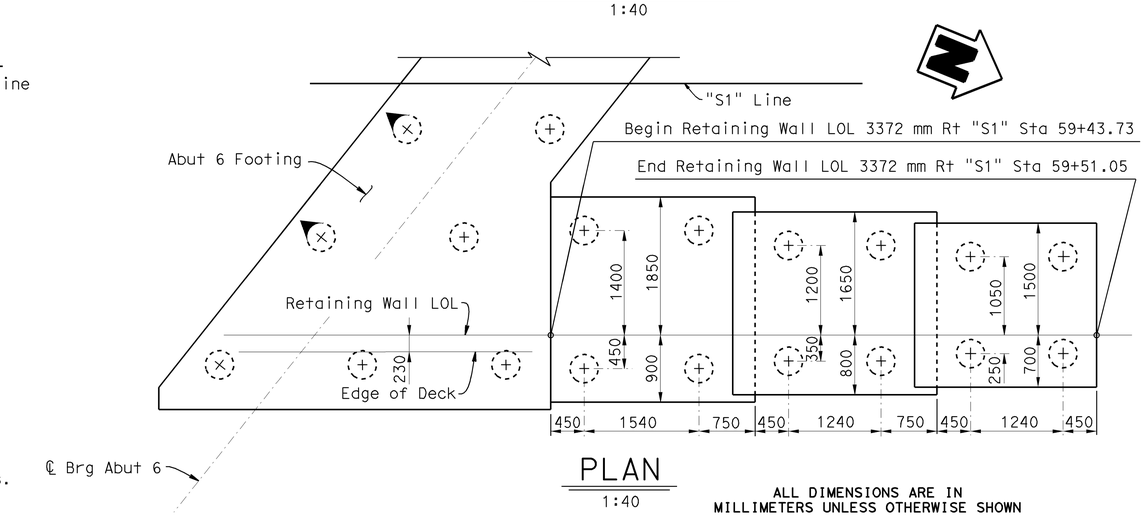


ELEVATION
1:40



PLAN
1:40

LEGEND:
Indicates vertical piles.
Indicates 3:1 battered piles.



PLAN
1:40

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

DESIGN	BY T. Shi	CHECKED D. Abellon	
DETAILS	BY E. Montevirgen	CHECKED D. Abellon	
QUANTITIES	BY M. Keo/S. Davis	CHECKED M. Abdi/N. Nguyen	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
ABUTMENT 1 AND 6 RETAINING WALL DETAILS

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 1-29-03 2-28-03 3-01-03

SHEET 11 OF 27

FILE => afabut0106rwd.dgn

USERNAME => trrene DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:31

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DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	106	148

Caltrans Metric

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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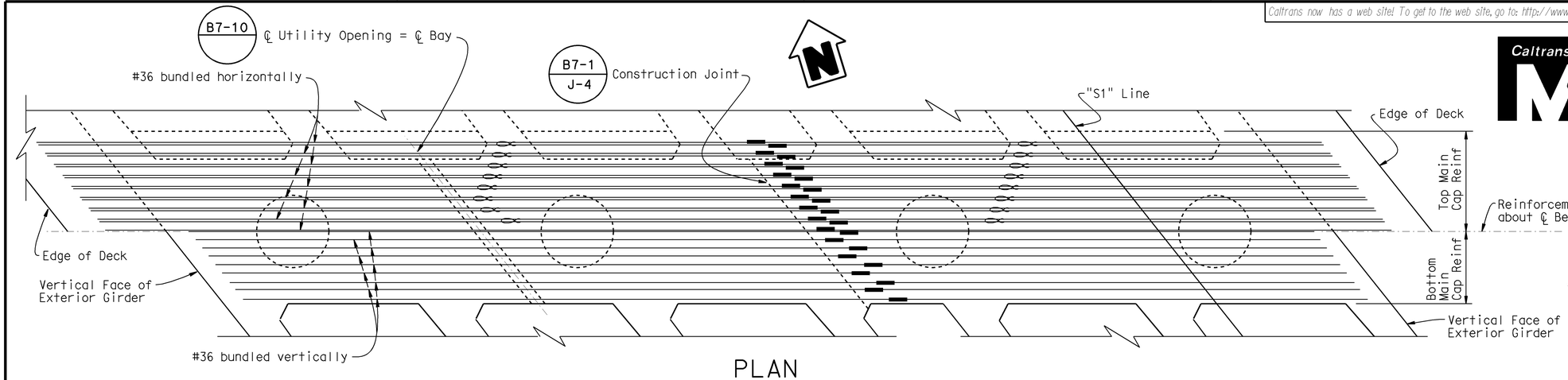


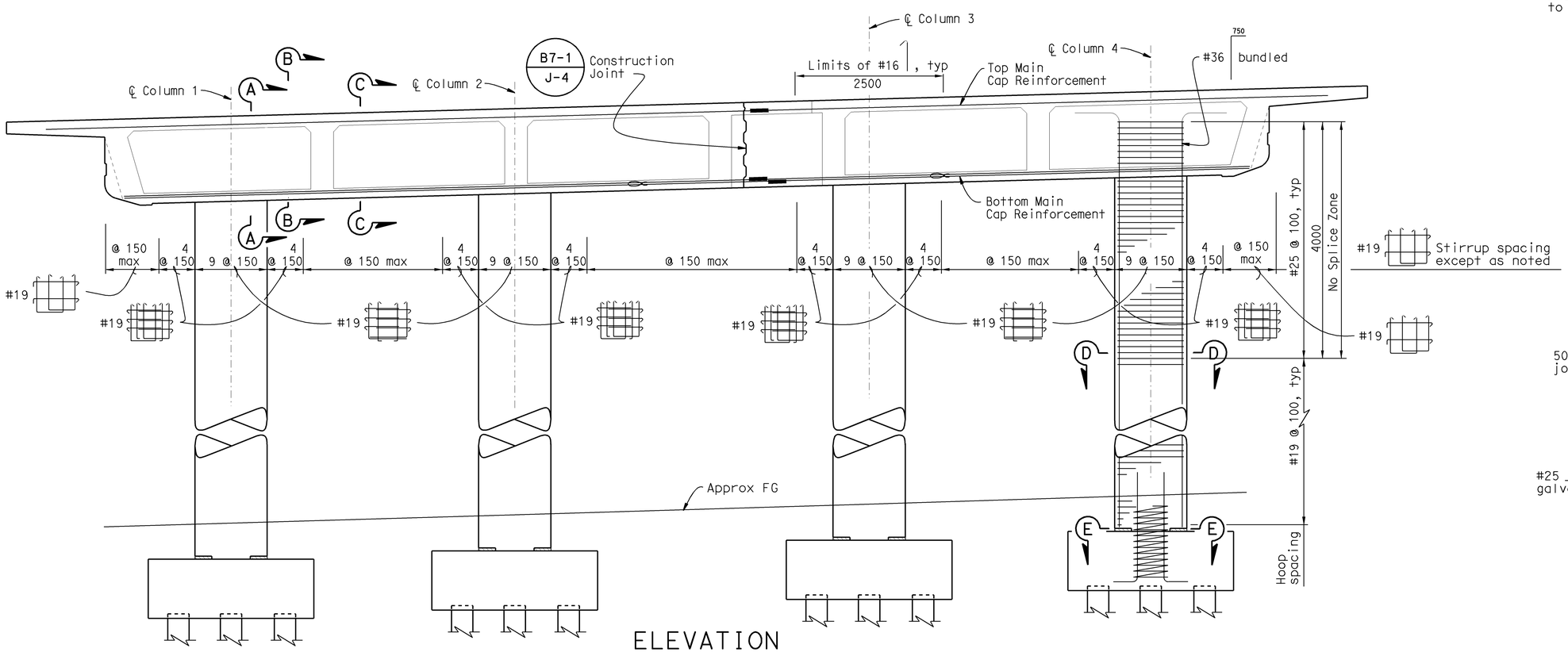
PLAN

1:40

Bent 3 shown, Bents 2, 4 and 5 similar except as noted

NOTES:

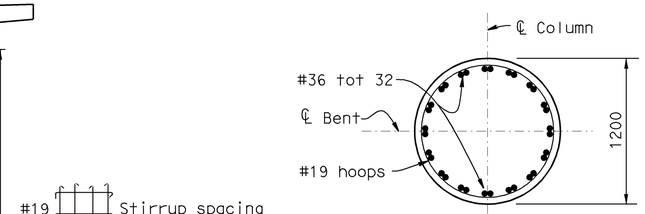
1. For Sections A-A, B-B and C-C, see "Bent Details No. 2" sheet.
2. = bundled bars.
3. All splices shall be ultimate butt splices and shall be staggered.
4. For additional stem reinforcement, see "Additional Girder Reinforcement" sheet.
5. Main column reinforcement and hoops may be adjusted to clear longitudinal P/S ducts and deck drain pipes subject to approval by the Engineer.



ELEVATION

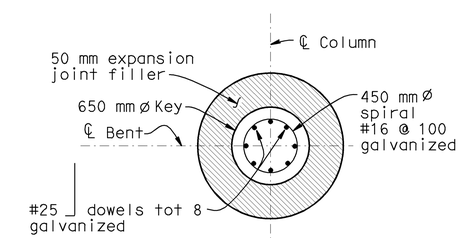
1:40

Bent 3 shown, Bents 2, 4 and 5 similar except as noted



SECTION D-D

1:25



SECTION E-E

1:25

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

DESIGN	BY A. Gilani	CHECKED D. Abellon	
DETAILS	BY E. Montevirgen	CHECKED D. Abellon	
QUANTITIES	BY S. Davis/M. Keo	CHECKED N. Nguyen/M. Abdi	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
BENT DETAILS NO. 1

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 1-18-02 1-15-02 2-14-03 3-03-03 3-03-03

SHEET 12 OF 27

FILE => agbd01.dgn

USERNAME => ttrene DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:31

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	107	148

Caltrans Metric

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

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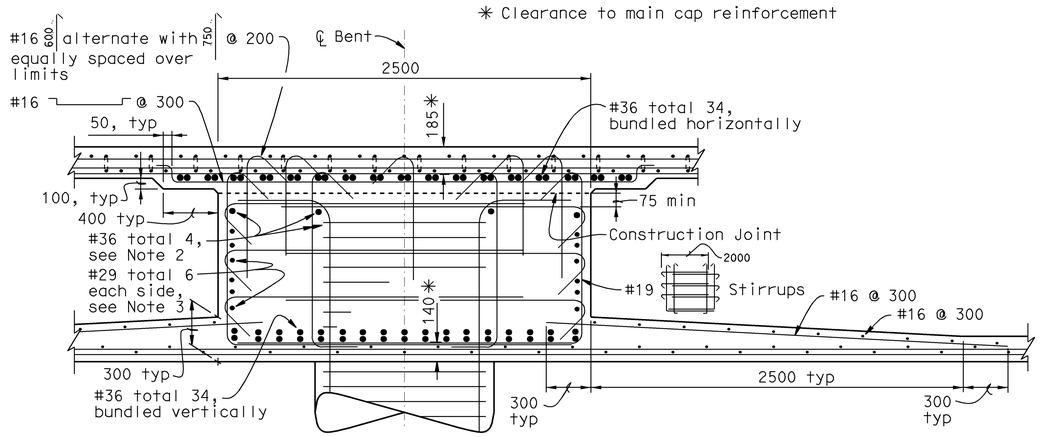
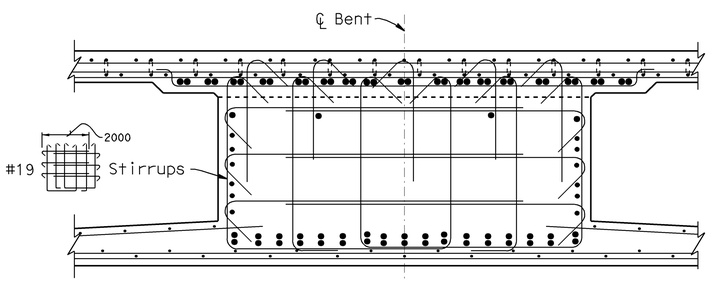
NOTES:

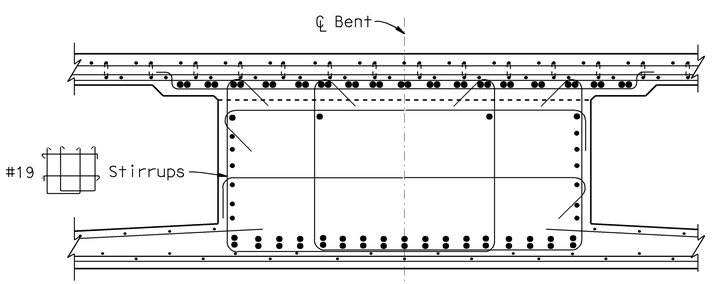
1. For location of Sections A-A, B-B, and C-C, see "Bent details No. 1" sheet.
2. Reinforcement may be bent or lowered to clear Prestressing Ducts. Subject to approval by the Engineer.
3. Side Reinforcement shall be continuous. All splices shall be ultimate butt splices.
4. No lap splices allowed in Main Cap reinforcement. All splices shall be ultimate butt splices.



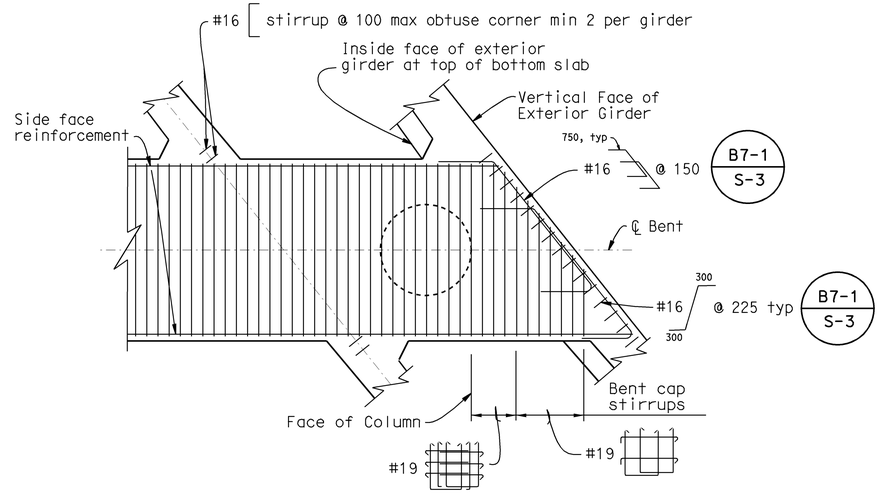
SECTION A-A
1:20



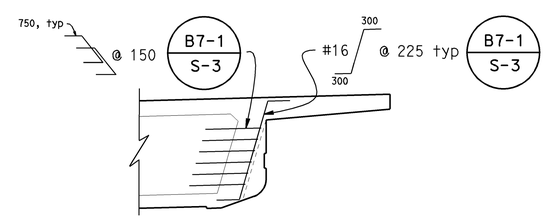
SECTION B-B
1:20
See Section A-A for Notes and Dimensions



SECTION C-C
1:20
See Section A-A for Notes and Dimensions

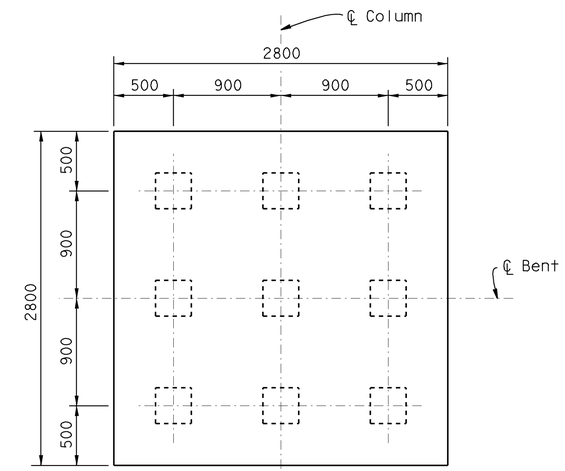


PLAN

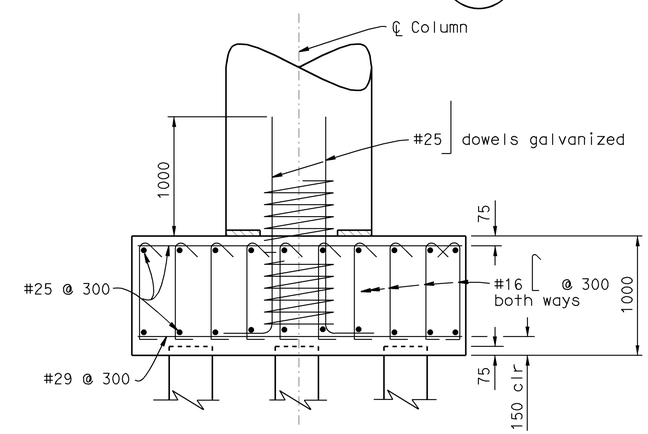


ELEVATION

BENT CAP CORNER REINFORCEMENT DETAILS
1:40



FOOTING PLAN B2-6
1:25



FOOTING ELEVATION
1:25

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

	BY	CHECKED
DESIGN	A. Gilani	D. Abellon
DETAILS	E. Montevirgen	D. Abellon
QUANTITIES	S. Davis/M. Keo	N. Nguyen/M. Abdi

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
BENT DETAILS NO. 2

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 1-18-02 1-18-02 1-14-03 2-24-03 3-11-03 3-03-03

SHEET 13 OF 27

FILE => agbd02.dgn

USERNAME => ttrene DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:31

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	108	148

REGISTERED CIVIL ENGINEER 3-26-03

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER D.L. Abellon No. 62497 Exp. 9-30-05 CIVIL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

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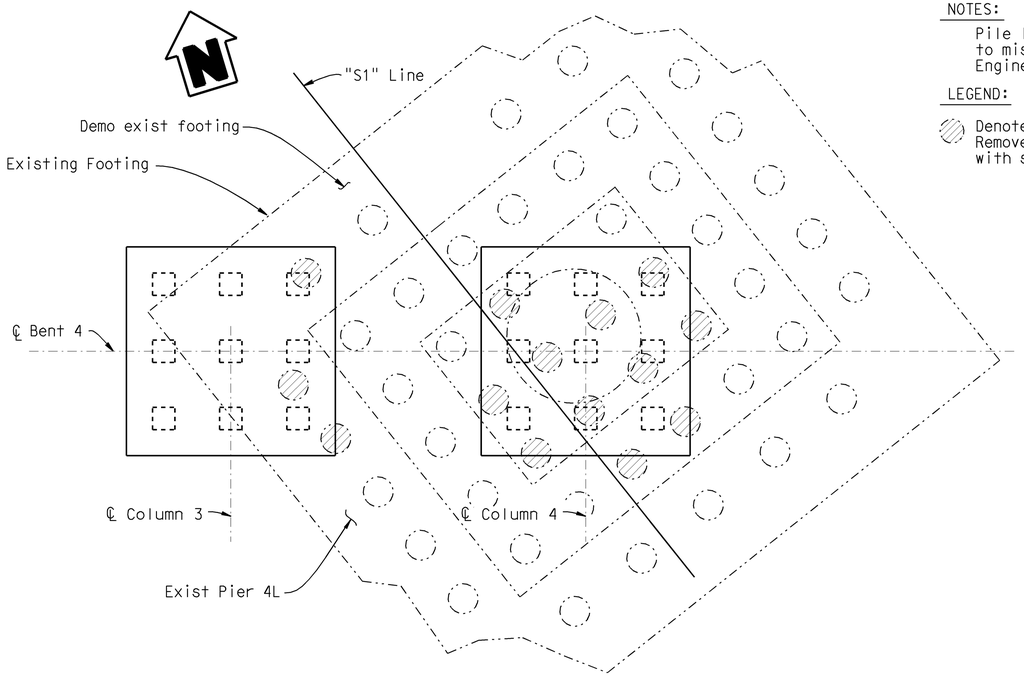
NOTES:

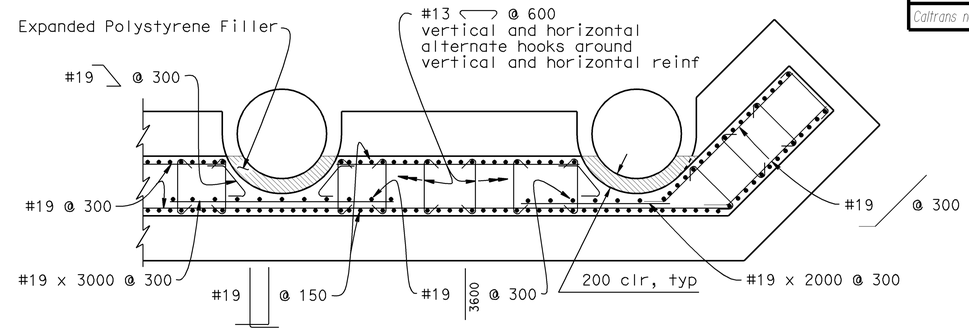
Pile layout shall be adjusted as directed by the Engineer to miss existing piles.
Engineer shall approve pile layout prior to driving.

LEGEND:

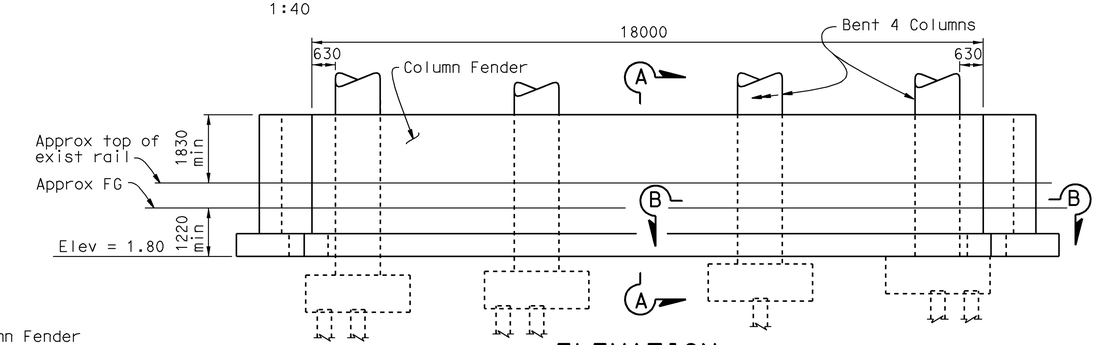
Denotes existing piles to be exposed 1500 mm max below bottom of new footing elevation. Remove existing piles a minimum of 300 mm below bottom of new footing elevation and backfill with structure backfill.



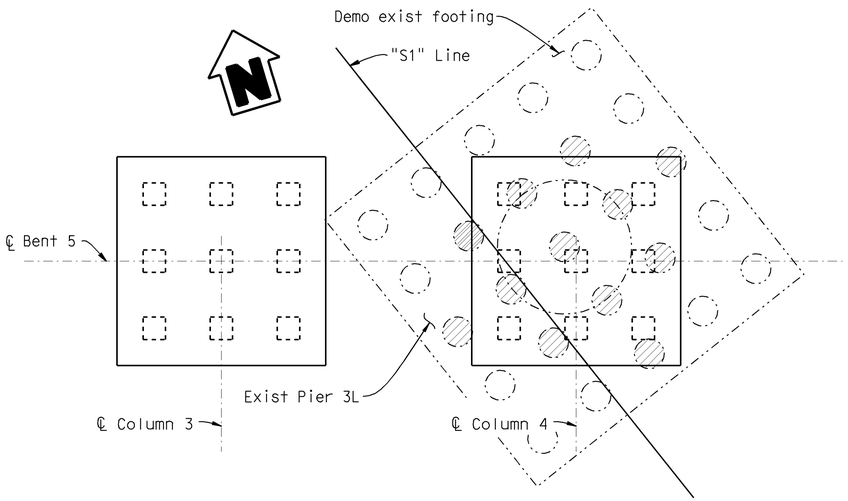
FOOTING PLAN AT BENT 4
1:40



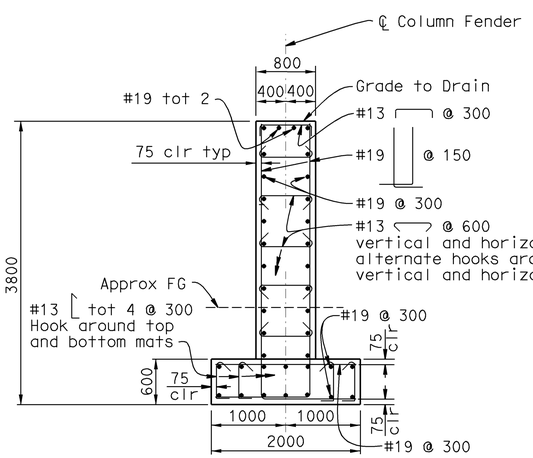
PART SECTION B-B
1:40



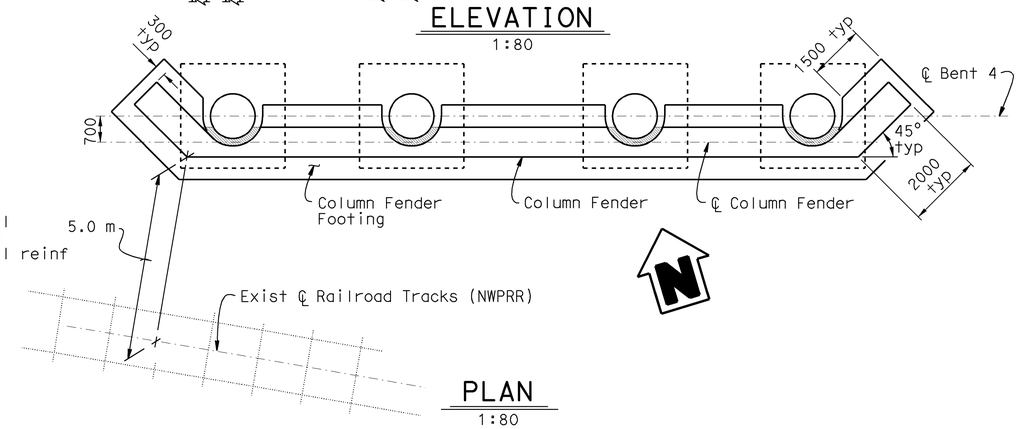
ELEVATION
1:80



FOOTING PLAN AT BENT 5
1:40



SECTION A-A
1:40



PLAN
1:80

COLUMN FENDER DETAILS

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

	BY	CHECKED
DESIGN	A. Gilani	D. Abellon
DETAILS	E. Montevirgen	D. Abellon
QUANTITIES	S. Davis/M. Keo	N. Nguyen/M. Abdi

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES STRUCTURE DESIGN 2

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RTE 101/116 SOH LEFT (REPLACE)
BENT DETAILS NO. 3

STRUCTURES DESIGN DETAIL SHEET (METRIC) (REV. 4/20/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 1-14-03 2-28-03 3-04-03 3-14-03 3-19-03

SHEET 14 OF 27

FILE => agbd03.dgn

USERNAME => trrene DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:32

DRAFT

MSN B4 - U.S. 101/ SR116 SOH

10/6/2010

Pile Design Spreadsheet

Abut - 1 (R-09-011)

NAVFAC Design Method For a Single Pile

Project Name:	101 MSN Petaluma
Project Number:	28645045
Bridge Name:	US 101/SR 116 SOH (Widen)
Boring Surface El. (m)	9.5
Boring Surface El. (ft)	31.0
Design GWS El. (ft)	5.0
Unit Weight of Water (pcf)	62.4
Depth with no strength	
Convert. Factor	3.281
Bottom of Pile Cap El. (m)	7.50
Bottom of Pile Cap El. (ft)	24.60

Nominal axial compress. Capacity (ult.)	160	ton
Nominal axial compress. Capacity (ult.)	1424	kN
Pile Width	14	inch
Pile Width	356	mm
Pile Width	1.17	ft
Crit depth ratio	20	-
Crit depth	23.3	ft
Crit. Depth. Elev	7.7	ft
Crit. Depth. Elev	2.3	m
Crit. Eff. Vert. Str.	2913	psf

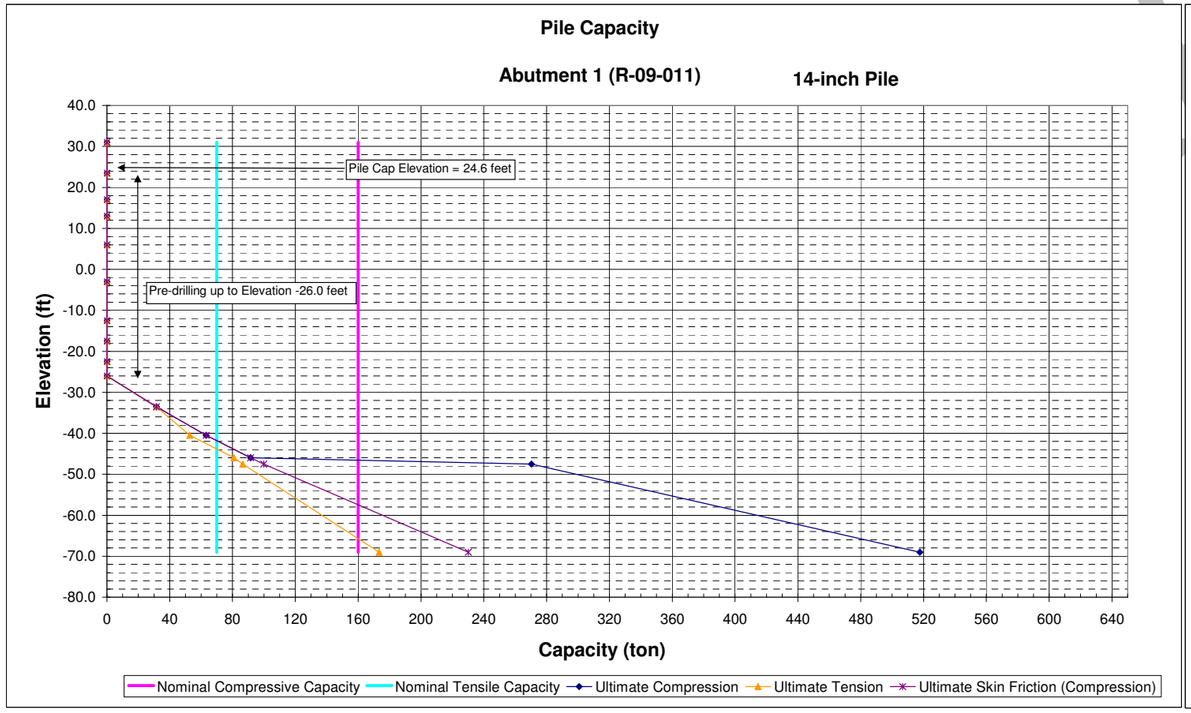
Skin Resistance (Friction) of Pile in Granular Material:

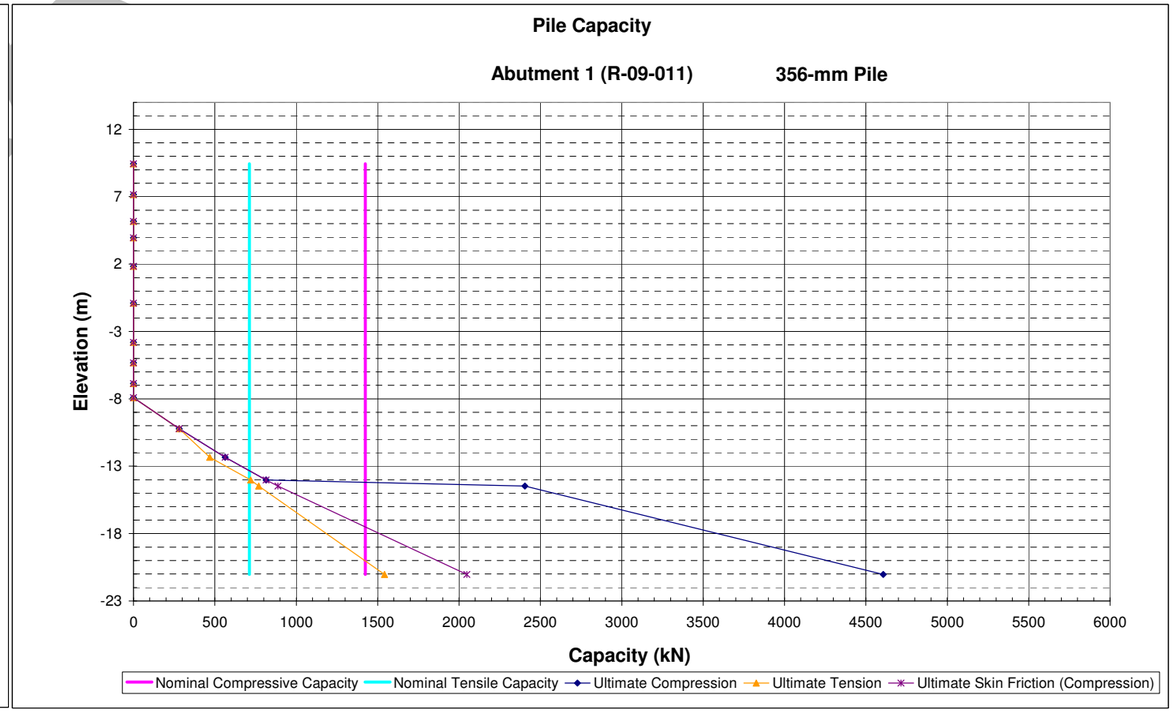
Type (Steel=S,Concrete=C,Timber=T)	C	
Earth Press. Coefficient * (Comp.)	1.5	
Earth Press. Coefficient * (Tens)	1.0	
Minimum Adhesion	500	psf

Pile Shape	Square	(Square, Circular or Octogonal)		
Pile Surface Area	1.42	sq. m/m	Pile Tip Area	0.13 sq. m
Pile Surface Area	4.67	sq. ft/ft	Pile Tip Area	1.36 sq. ft.

* Note: Appropriate tension/compresion ratios for skin friction for granular soils applied is 0.65 and 1.0 for cohesive soil.

Layer No.	Layer Elevation Top (m)	Top (feet)	Bot. (m)	Bot. (feet)	Lateral Resists?	Cohesion c (kPa)	Cohesion c (psf)	Adhesion Ratio c_a/c	Adhesion c_a (psf)	Friction Angle ϕ (deg)	Friction Angle δ (deg)	Layer Thickness (feet)	Internal Depth to Layer Top (feet)	Effective Vert. Stress (Bot. Lay.) (psf)	Design Effective Vert. Stress (Bot. Lay.) (psf)	delta Lat. Res. Cohesive (ton)	delta Lat. Res. Friction (comp) (ton)	delta Lat. Res. Friction (tensile) (ton)	Nq (granular) (-)	z/B (-)	Nc (cohesive) (-)	Soil Type G= gran. C=cohes.	Bearing Capacity (B.C.) (ton)	Include B.C.?	Elevation to midlayer (ft)	Compression Cumulative Axial Res. (skin) (ton)	Compression Cumulative Axial Res. (skin) (kN)	Compression Cumulative Axial Res. (Tot) (ton)	Compression Cumulative Axial Res. (Tot) (kN)	Compression Nominal Axial Capacity (ton)	Compression Nominal Axial Capacity (kN)	Tension Cumulative Axial Res. (Skin) (ton)	Tension Cumulative Axial Res. (Skin) (kN)	Tension Nominal Axial Capacity (ton)	Tension Nominal Axial Capacity (kN)
			9.45	31.0										0	0					0.0	6.25	g	0	n	31.0	0	0	0.0	0	160	1424	0	0	70	712
1	9.45	31.0	7.16	23.5	n	0	0	0.00	0	32	24	7.5	0.0	1793	1793	0.0	0.0	0.0	29	3.2	8.89	g	35	n	27.3	0.0	0	0.0	0	160	1424	0.0	0	70	712
2	7.16	23.5	5.18	17.0	n	38	800	1.00	0	0	0	6.5	7.5	2313	2313	0.0	0.0	0.0	0	9.2	9.00	c	5	n	20.3	0.0	0	0.0	0	160	1424	0.0	0	70	712
3	5.18	17.0	3.96	13.0	n	0	0	0.00	0	30	22.5	4.0	14.0	2313	2313	0.0	0.0	0.0	21	13.7	9.00	g	33	n	15.0	0.0	0	0.0	0	160	1424	0.0	0	70	712
4	3.96	13.0	1.83	6.0	n	38	800	1.00	0	0	0	7.0	18.0	3153	2913	0.0	0.0	0.0	0	18.4	9.00	c	5	n	9.5	0.0	0	0.0	0	160	1424	0.0	0	70	712
5	1.83	6.0	-0.91	-3.0	n	0	0	0.00	0	30	22.5	9.0	25.0	3823	2913	0.0	0.0	0.0	21	25.3	9.00	g	42	n	1.5	0.0	0	0.0	0	160	1424	0.0	0	70	712
6	-0.91	-3.0	-3.81	-12.5	n	96	2000	0.90	0	0	0	9.5	34.0	4432	2913	0.0	0.0	0.0	0	33.2	9.00	c	12	n	-7.8	0.0	0	0.0	0	160	1424	0.0	0	70	712
7	-3.81	-12.5	-5.33	-17.5	n	0	0	0.00	0	32	24	5.0	43.5	4770	2913	0.0	0.0	0.0	29	39.4	9.00	g	57	n	-15.0	0.0	0	0.0	0	160	1424	0.0	0	70	712
8	-5.33	-17.5	-6.86	-22.5	n	96	2000	0.90	0	0	0	5.0	48.5	5108	2913	0.0	0.0	0.0	0	43.7	9.00	c	12	n	-20.0	0.0	0	0.0	0	160	1424	0.0	0	70	712
9	-6.86	-22.5	-7.92	-26.0	n	0	0	0.00	0	32	24	3.5	53.5	5378	2913	0.0	0.0	0.0	29	47.4	9.00	g	57	n	-24.3	0.0	0	0.0	0	160	1424	0.0	0	70	712
10	-7.92	-26.0	-10.21	-33.5	Y	96	2000	0.90	1800	0	0	7.5	57.0	5816	2913	31.5	0.0	0.0	0	52.1	9.00	c	12	n	-29.8	31.5	280	31.5	280	160	1424	31.5	280	70	712
11	-10.21	-33.5	-12.34	-40.5	Y	0	0	0.00	0	32	24	7.0	64.5	6287	2913	0.0	31.8	21.2	29	58.3	9.00	g	57	n	-37.0	63.3	563	63.3	563	160	1424	52.7	469	70	712
12	-12.34	-40.5	-14.02	-46.0	Y	192	4000	0.55	2200	0	0	5.5	71.5	6665	2913	28.2	0.0	0.0	0	63.6	9.00	c	25	n	-43.3	91.5	814	91.5	814	160	1424	80.9	720	70	712
13	-14.02	-46.0	-14.48	-47.5	Y	0	0	0.00	0	38	28.5	1.5	77.0	6738	2913	0.0	8.3	5.5	86	66.6	9.00	g	170	y	-46.8	99.8	888	270.3	2405	160	1424	86.4	769	70	712
14	-14.48	-47.5	-21.03	-69.0	Y	0	0	0.00	0	41	30.75	21.5	78.5	8657	2913	0.0	130.4	86.9	145	76.5	9.00	g	287	y	-58.3	230.2	2049	517.6	4607	160	1424	173.4	1542	70	712
Bottom	-21.03	-69.0																																	





MSN B4 - US 101/SR116 SOH

10/6/2010

Pile Design Spreadsheet

Bent 2_R-09-012

NAVFAC Design Method For a Single Pile

Project Name:	101 MSN Petaluma
Project Number:	28645045
Bridge Name:	U.S. 101/SR116 SOH (Widen)
Ground Surface El. (m)	4.1
Ground Surface El. (ft)	13.5
Design GWS El. (ft)	5.0
Unit Weight of Water (pcf)	62.4
Depth with no strength	
Convert. Factor	3.281
Bottom of Pile Cap El. (m)	4.11
Bottom of Pile Cap El. (ft)	13.50

Nominal axial compress. Capacity (ult.)	150	ton
Nominal axial compress. Capacity (ult.)	1335	kN
Pile Width	14	inch
Pile Width	356	mm
Pile Width	1.17	ft
Crit depth ratio	20	-
Crit depth	23.3	ft
Crit. Depth. Elev	-9.8	ft
Crit. Depth. Elev	-3.0	m
Crit. Eff. Vert. Str.	1855	psf

Skin Resistance (Friction) of Pile in Granular Material:

Type (Steel=S,Concrete=C,Timber=T)	C	
Earth Press. Coefficient * (Comp.)	1.5	
Earth Press. Coefficient * (Tens)	1.0	
Minimum Adhesion	500	psf

Pile Shape	Square	(Square, Circular or Octogonal)			
Pile Surface Area	1.42	sq. m/m	Pile Tip Area	0.13	sq. m
Pile Surface Area	4.67	sq. ft/ft	Pile Tip Area	1.36	sq. ft.

* Note: Appropriate tension/compresion ratios for skin friction for granular soils applied is 0.65 and 1.0 for cohesive soil.

Layer No.	Layer Elevation Top (m)	Layer Elevation Top (feet)	Layer Elevation Bot. (m)	Layer Elevation Bot. (feet)	Lateral Resists?	Cohesion c (kPa)	Cohesion c (psf)	Adhesion Ratio c_a/c	Adhesion c_a (psf)	Friction Angle ϕ (deg)	Friction Angle δ (deg)	Layer Thickness (feet)	Internal Depth to Layer Top (feet)	Effective Vert. Stress (Bot. Lay.) (psf)	Design Effective Vert. Stress (Bot. Lay.) (psf)	delta Lat. Res. Cohesive (ton)	delta Lat. Res. Friction (comp) (ton)	delta Lat. Res. Friction (tensile) (ton)	Nq (granular) (-)	z/B (-)	Nc (cohesive) (-)	Soil Type G= gran. C=cohes.	Bearing Capacity (B.C.) (ton)	Include B.C.?	Elevation to midlayer (ft)	Compression Cumulative Axial Res. (skin) (ton)	Compression Cumulative Axial Res. (skin) (kN)	Compression Cumulative Axial Res. (Tot) (ton)	Compression Cumulative Axial Res. (Tot) (kN)	Compression Nominal Axial Capacity (ton)	Compression Nominal Axial Capacity (kN)	Tension Cumulative Axial Res. (Skin) (ton)	Tension Cumulative Axial Res. (Skin) (kN)	Tension Nominal Axial Capacity (ton)	Tension Nominal Axial Capacity (kN)
			4.11	13.5										0	0					0.0	6.25	c	0	N	13.5	0	0	0.0	0	150	1335	0	0	55	668
1	4.11	13.5	1.22	4.0	Y	48	1000	1.00	1000	0	0	9.5	0.0	1222	1222	22.2	0.0	0.0	0	4.1	9.00	c	6	N	8.8	22.2	197	22.2	197	150	1335	22.2	197	55	668
2	1.22	4.0	0.3	1.0	Y	38	800	1.00	800	0	0	3.0	9.5	1452	1452	5.6	0.0	0.0	0	9.4	9.00	c	5	N	2.5	27.8	247	27.8	247	150	1335	27.8	247	55	668
3	0.3	1.0	-0.76	-2.5	Y	38	800	1.00	800	0	0	3.5	12.5	1452	1452	6.5	0.0	0.0	0	12.2	9.00	c	5	N	-0.8	34.3	305	34.3	305	150	1335	34.3	305	55	668
4	-0.76	-2.5	-2.29	-7.5	Y	96	2000	0.90	1800	0	0	5.0	16.0	1740	1740	21.0	0.0	0.0	0	15.9	9.00	c	12	N	-5.0	55.3	492	55.3	492	150	1335	55.3	492	55	668
5	-2.29	-7.5	-5.79	-19.0	Y	67	1400	1.00	1400	0	0	11.5	21.0	2374	1855	37.6	0.0	0.0	0	22.9	9.00	c	9	N	-13.3	92.9	827	92.9	827	150	1335	92.9	826	55	668
6	-5.79	-19.0	-7.92	-26.0	Y	0	0	0.00	0	34	25.5	7.0	32.5	2842	1855	0.0	21.7	14.5	42	30.9	9.00	g	53	n	-22.5	114.5	1019	114.5	1019	150	1335	107.3	955	55	668
7	-7.92	-26.0	-10.97	-36.0	Y	48	1000	1.00	1000	0	0	10.0	39.5	3423	1855	23.3	0.0	0.0	0	38.1	9.00	c	6	n	-31.0	137.9	1227	137.9	1227	150	1335	130.7	1162	55	668
8	-10.97	-36.0	-13.72	-45.0	Y	62	1300	1.00	1300	0	0	9.0	49.5	3941	1855	27.3	0.0	0.0	0	46.3	9.00	c	8	n	-40.5	165.2	1470	165.2	1470	150	1335	158.0	1405	55	668
9	-13.72	-45.0	-22.86	-75.0	Y	0	0	0.00	0	41	30.75	30.0	58.5	6407	1855	0.0	115.9	77.3	145	63.0	9.00	g	183	y	-60.0	281.1	2502	464.1	4131	150	1335	235.2	2092	55	668
Bottom	-22.86	-75.0																																	

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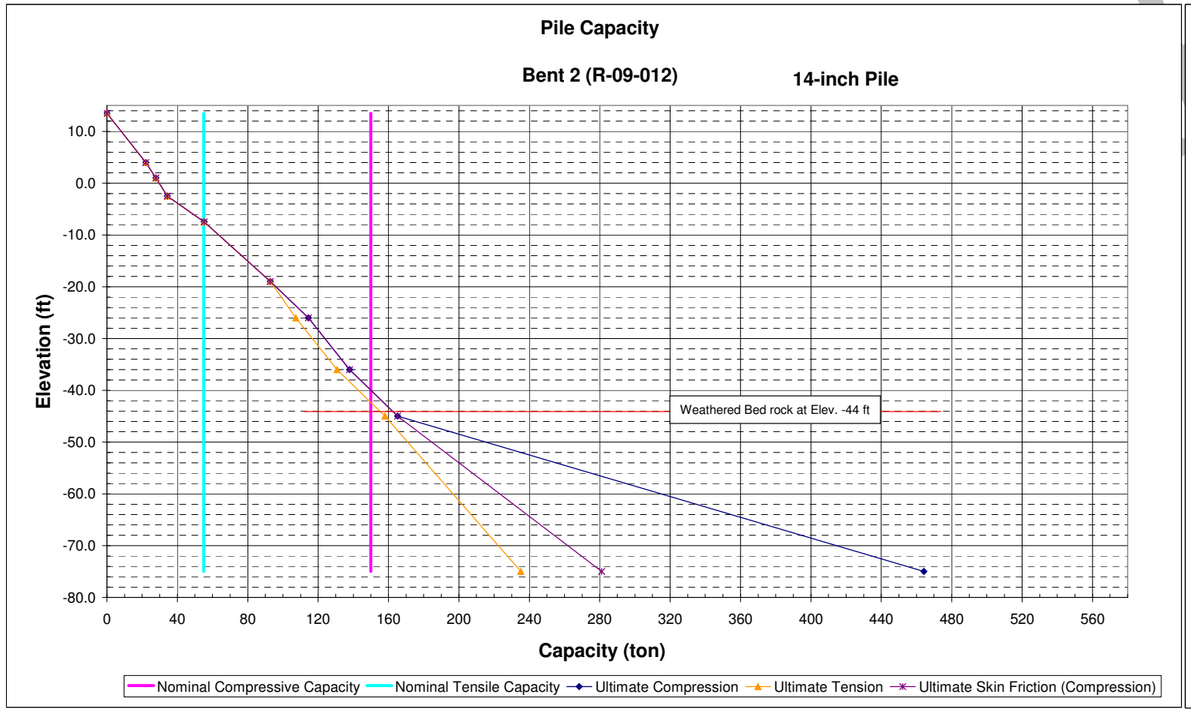

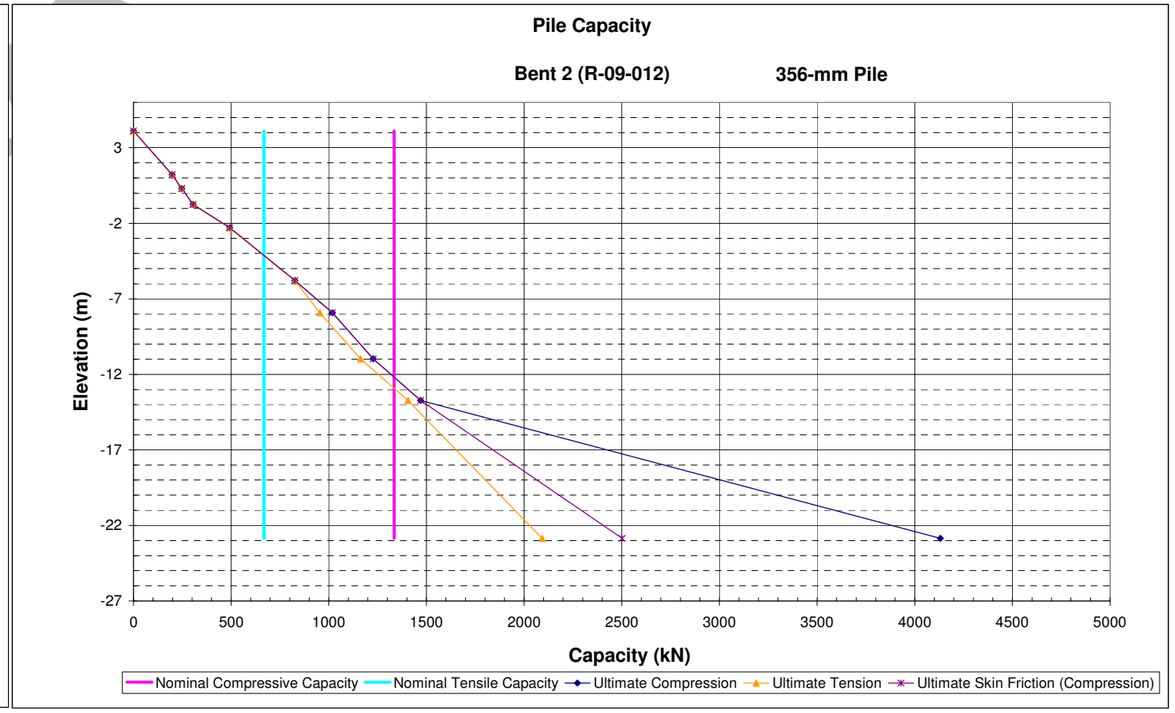

MSN B4 - US 101/SR116 SOH

10/6/2010

Pile Design Spreadsheet

Bent 3_R-09-012

NAVFAC Design Method For a Single Pile

Project Name:	101 MSN Petaluma
Project Number:	28645045
Bridge Name:	U.S. 101/SR116 SOH (Widen)
Boring Surface El. (m)	3.4
Boring Surface El. (ft)	11.0
Design GWS El. (ft)	5.0
Unit Weight of Water (pcf)	62.4
Depth with no strength	
Convert. Factor	3.281
Bottom of Pile Cap El. (m)	0.43
Bottom of Pile Cap El. (ft)	1.40

Nominal axial compress. Capacity (ult.)	150	ton
Nominal axial compress. Capacity (ult.)	1335	kN
Pile Width	14	inch
Pile Width	356	mm
Pile Width	1.17	ft
Crit depth ratio	20	-
Crit depth	23.3	ft
Crit. Depth. Elev	-12.3	ft
Crit. Depth. Elev	-3.8	m
Crit. Eff. Vert. Str.	1699	psf

Skin Resistance (Friction) of Pile in Granular Material:

Type (Steel=S,Concrete=C,Timber=T)	C	
Earth Press. Coefficient * (Comp.)	1.5	
Earth Press. Coefficient * (Tens)	1.0	
Minimum Adhesion	500	psf

Pile Shape	Square	(Square, Circular or Octogonal)			
Pile Surface Area	1.42	sq. m/m	Pile Tip Area	0.13	sq. m
Pile Surface Area	4.67	sq. ft/ft	Pile Tip Area	1.36	sq. ft.

* Note: Appropriate tension/compresion ratios for skin friction for granular soils applied is 0.65 and 1.0 for cohesive soil.

Layer No.	Layer Elevation Top (m)	Layer Elevation Top (feet)	Layer Elevation Bot. (m)	Layer Elevation Bot. (feet)	Lateral Resists?	Cohesion c (kPa)	Cohesion c (psf)	Adhesion Ratio c_a/c	Adhesion c_a (psf)	Friction Angle ϕ (deg)	Friction Angle δ (deg)	Layer Thickness (feet)	Internal Depth to Layer Top (feet)	Effective Vert. Stress (Bot. Lay.) (psf)	Design Effective Vert. Stress (Bot. Lay.) (psf)	delta Lat. Res. Cohesive (ton)	delta Lat. Res. Friction (comp) (ton)	delta Lat. Res. Friction (tensile) (ton)	Nq (granular) (-)	z/B (-)	Nc (cohesive) (-)	Soil Type G= gran. C=cohes.	Bearing Capacity (B.C.) (ton)	Include B.C.?	Elevation to midlayer (ft)	Compression Cumulative Axial Res. (skin) (ton)	Compression Cumulative Axial Res. (skin) (kN)	Compression Cumulative Axial Res. (Tot) (ton)	Compression Cumulative Axial Res. (Tot) (kN)	Compression Nominal Axial Capacity (ton)	Compression Nominal Axial Capacity (kN)	Tension Cumulative Axial Res. (Skin) (ton)	Tension Cumulative Axial Res. (Skin) (kN)	Tension Nominal Axial Capacity (ton)	Tension Nominal Axial Capacity (kN)
			3.35	11.0										0	0					0.0	6.25	c	0	N	11.0	0	0	0.0	0	150	1335	0	0	70	668
1	3.35	11.0	1.52	5.0	N	48	1000	1.00	0	0	0	6.0	0.0	893	893	0.0	0.0	0.0	0	2.6	8.63	c	6	N	8.0	0.0	0	0.0	0	150	1335	0.0	0	70	668
2	1.52	5.0	0.43	1.4	N	38	800	1.00	0	0	0	3.6	6.0	1066	1066	0.0	0.0	0.0	0	6.7	9.00	c	5	N	3.2	0.0	0	0.0	0	150	1335	0.0	0	70	668
3	0.43	1.4	-0.46	-1.5	Y	38	800	1.00	800	0	0	2.9	9.6	1066	1066	5.4	0.0	0.0	0	9.5	9.00	c	5	N	0.0	5.4	48	5.4	48	150	1335	5.4	48	70	668
4	-0.46	-1.5	-1.98	-6.5	Y	96	2000	0.90	1800	0	0	5.0	12.5	1354	1354	21.0	0.0	0.0	0	12.9	9.00	c	12	N	-4.0	26.4	235	26.4	235	150	1335	26.4	235	70	668
5	-1.98	-6.5	-5.49	-18.0	Y	67	1400	1.00	1400	0	0	11.5	17.5	2045	1699	37.6	0.0	0.0	0	19.9	9.00	c	9	N	-12.3	64.0	569	64.0	569	150	1335	64.0	569	70	668
6	-5.49	-18.0	-7.62	-25.0	Y	0	0	0.00	0	34	25.5	7.0	29.0	2518	1699	0.0	19.9	13.2	42	27.9	9.00	g	49	n	-21.5	83.8	746	83.8	746	150	1335	77.2	687	70	668
7	-7.62	-25.0	-10.67	-35.0	Y	48	1000	1.00	1000	0	0	10.0	36.0	3094	1699	23.3	0.0	0.0	0	35.1	9.00	c	6	n	-30.0	107.2	954	107.2	954	150	1335	100.6	895	70	668
8	-10.67	-35.0	-13.41	-44.0	Y	62	1300	1.00	1300	0	0	9.0	46.0	3612	1699	27.3	0.0	0.0	0	43.3	9.00	c	8	n	-39.5	134.5	1197	134.5	1197	150	1335	127.9	1137	70	668
9	-13.41	-44.0	-22.55	-74.0	Y	0	0	0.00	0	41	30.75	30.0	55.0	6090	1699	0.0	106.1	70.8	145	60.0	9.00	g	168	y	-59.0	240.6	2141	408.3	3634	150	1335	198.6	1767	70	668
Bottom	-22.55	-74.0																																	

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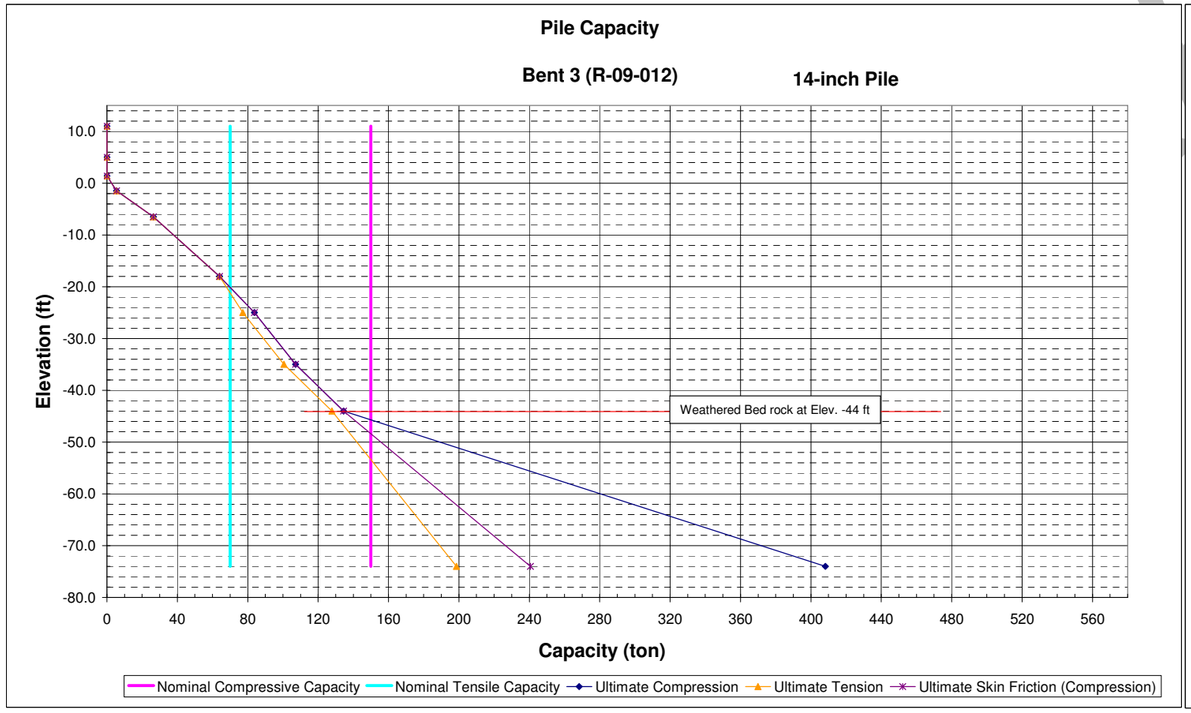
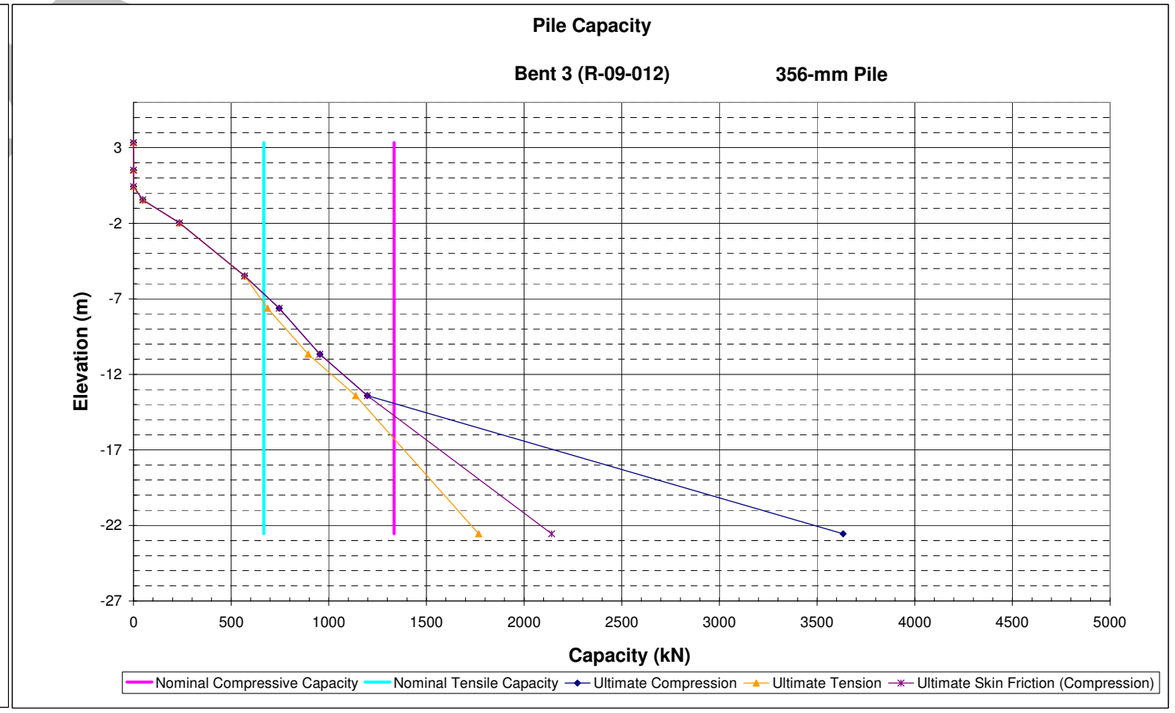




MSN B4 - US101/SR116 SOH

10/6/2010

Pile Design Spreadsheet

Bent 4_R-09-013

NAVFAC Design Method For a Single Pile

Project Name:	101 MSN Petaluma
Project Number:	28645045
Bridge Name:	US 101/SR116 SOH (Widen)
Boring Surface El. (m)	3.1
Boring Surface El. (ft)	10.0
Design GWS El. (ft)	5.0
Unit Weight of Water (pcf)	62.4
Depth with no strength	
Convert. Factor	3.281
Bottom of Pile Cap El. (m)	0.43
Bottom of Pile Cap El. (ft)	1.40

Nominal axial compress. Capacity (ult.)	150	ton
Nominal axial compress. Capacity (ult.)	1335	kN
Pile Width	14	inch
Pile Width	356	mm
Pile Width	1.17	ft
Crit depth ratio	20	-
Crit depth	23.3	ft
Crit. Depth. Elev	-13.3	ft
Crit. Depth. Elev	-4.1	m
Crit. Eff. Vert. Str.	1704	psf

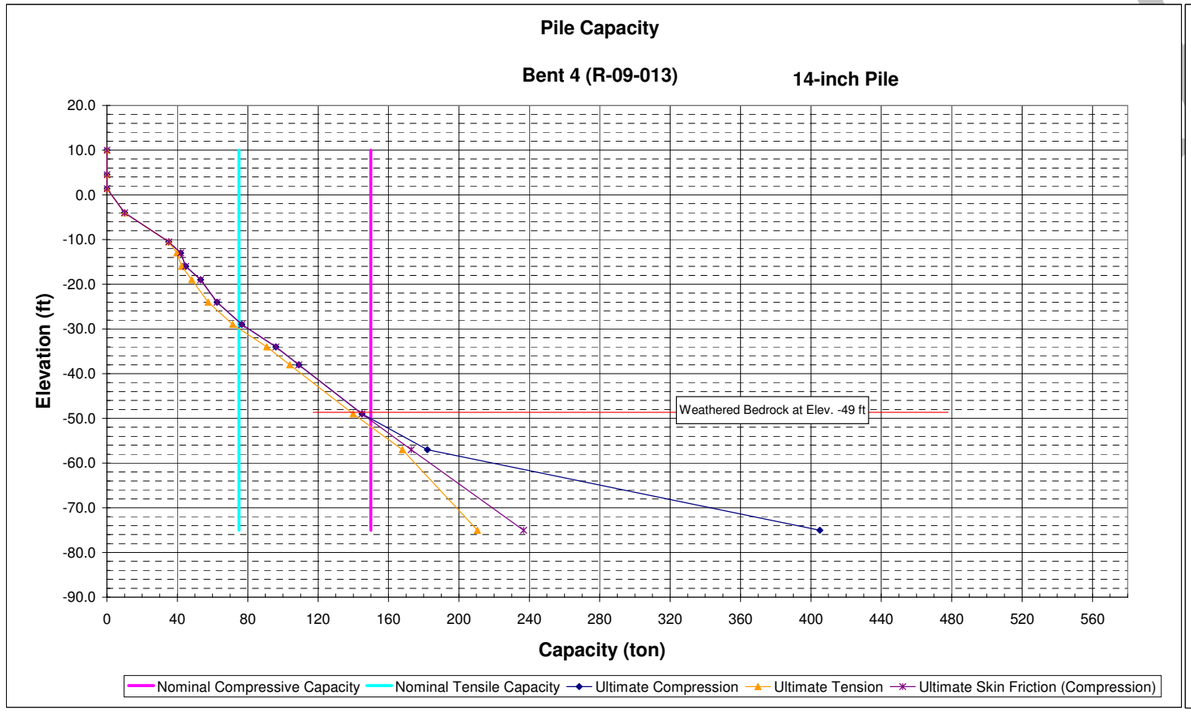
Skin Resistance (Friction) of Pile in Granular Material:

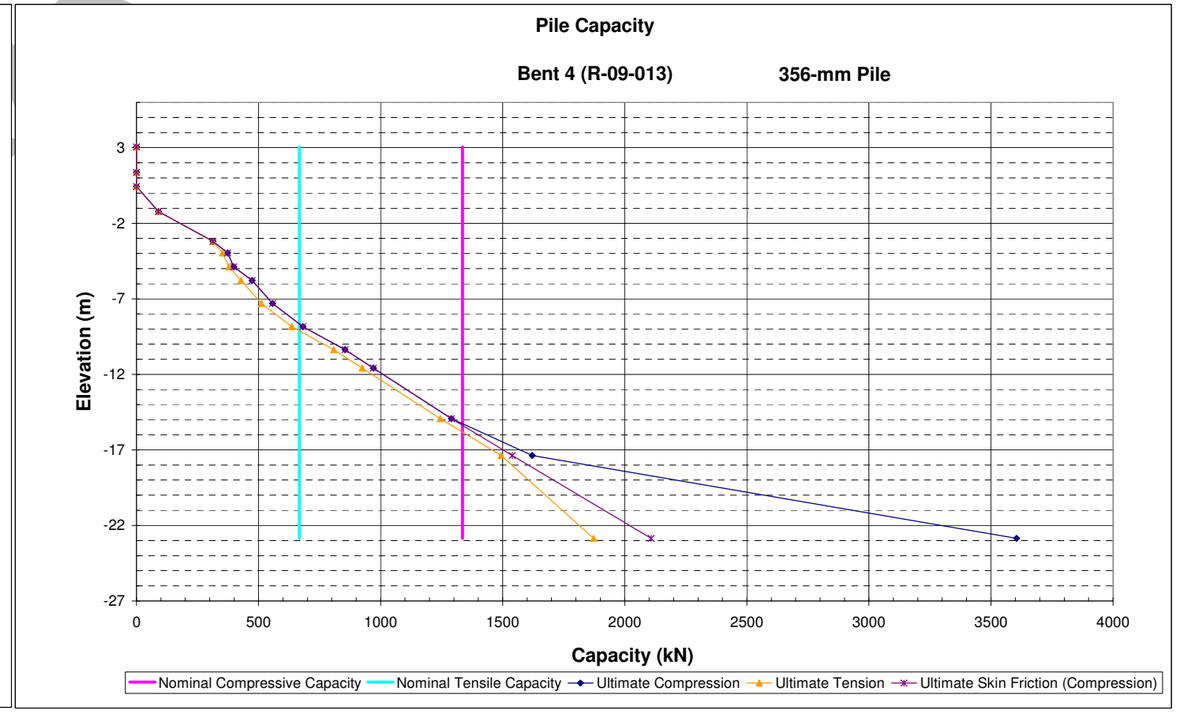
Type (Steel=S,Concrete=C,Timber=T)	C	
Earth Press. Coefficient * (Comp.)	1.5	
Earth Press. Coefficient * (Tens)	1.0	
Minimum Adhesion	500	psf

Pile Shape	Square	(Square, Circular or Octogonal)		
Pile Surface Area	1.42	sq. m/m	Pile Tip Area	0.13 sq. m
Pile Surface Area	4.67	sq. ft/ft	Pile Tip Area	1.36 sq. ft.

* Note: Appropriate tension/compresion ratios for skin friction for granular soils applied is 0.65 and 1.0 for cohesive soil.

Layer No.	Layer Elevation Top (m)	Layer Elevation Top (feet)	Layer Elevation Bot. (m)	Layer Elevation Bot. (feet)	Lateral Resists?	Cohesion c (kPa)	Cohesion c (psf)	Adhesion Ratio c_a/c	Adhesion c_a (psf)	Friction Angle ϕ (deg)	Friction Angle δ (deg)	Layer Thickness (feet)	Internal Depth to Layer Top (feet)	Effective Vert. Stress (Bot. Lay.) (psf)	Design Effective Vert. Stress (Bot. Lay.) (psf)	delta Lat. Res. Cohesive (ton)	delta Lat. Res. Friction (comp) (ton)	delta Lat. Res. Friction (tensile) (ton)	Nq (granular) (-)	z/B (-)	Nc (cohesive) (-)	Soil Type G= gran. C=cohes.	Bearing Capacity (B.C.) (ton)	Include B.C.?	Elevation to midlayer (ft)	Compression Cumulative Axial Res. (skin) (ton)	Compression Cumulative Axial Res. (skin) (kN)	Compression Cumulative Axial Res. (Tot) (ton)	Compression Cumulative Axial Res. (Tot) (kN)	Compression Nominal Axial Capacity (ton)	Compression Nominal Axial Capacity (kN)	Tension Cumulative Axial Res. (Skin) (ton)	Tension Cumulative Axial Res. (Skin) (kN)	Tension Nominal Axial Capacity (ton)	Tension Nominal Axial Capacity (kN)
			3.05	10.0										0	0					0.0	6.25	g	0	n	10.0	0	0	0.0	0	150	1335	0	0	75	668
1	3.05	10.0	1.37	4.5	n	0	0	0.00	0	32	24	5.5	0.0	828	828	0.0	0.0	0.0	29	2.4	8.54	g	16	n	7.3	0.0	0	0.0	0	150	1335	0.0	0	75	668
2	1.37	4.5	0.43	1.4	n	38	800	1.00	0	0	0	3.1	5.5	1173	1173	0.0	0.0	0.0	0	6.0	9.00	c	5	n	3.0	0.0	0	0.0	0	150	1335	0.0	0	75	668
3	0.43	1.4	-1.22	-4.0	Y	38	800	1.00	800	0	0	5.4	8.6	1173	1173	10.1	0.0	0.0	0	9.7	9.00	c	5	n	-1.3	10.1	90	10.1	90	150	1335	10.1	90	75	668
4	-1.22	-4.0	-3.2	-10.5	Y	81	1700	0.98	1658	0	0	6.5	14.0	1519	1519	25.1	0.0	0.0	0	14.8	9.00	c	10	n	-7.3	35.2	313	35.2	313	150	1335	35.2	313	75	668
5	-3.2	-10.5	-3.96	-13.0	Y	0	0	0.00	0	34	25.5	2.5	20.5	1704	1704	0.0	6.7	4.5	42	18.6	9.00	g	49	n	-11.8	41.9	373	41.9	373	150	1335	39.7	353	75	668
6	-3.96	-13.0	-4.88	-16.0	Y	19	400	1.00	400	0	0	3.0	23.0	1892	1704	2.8	0.0	0.0	0	21.0	9.00	c	2	n	-14.5	44.7	398	44.7	398	150	1335	42.5	378	75	668
7	-4.88	-16.0	-5.79	-19.0	Y	0	0	0.00	0	34	25.5	3.0	26.0	2080	1704	0.0	8.5	5.7	42	23.6	9.00	g	49	n	-17.5	53.3	474	53.3	474	150	1335	48.2	429	75	668
8	-5.79	-19.0	-7.31	-24.0	Y	38	800	1.00	800	0	0	5.0	29.0	2393	1704	9.3	0.0	0.0	0	27.0	9.00	c	5	n	-21.5	62.6	557	62.6	557	150	1335	57.5	512	75	668
9	-7.31	-24.0	-8.84	-29.0	Y	57	1200	1.00	1200	0	0	5.0	34.0	2706	1704	14.0	0.0	0.0	0	31.3	9.00	c	7	n	-26.5	76.6	682	76.6	682	150	1335	71.5	636	75	668
10	-8.84	-29.0	-10.36	-34.0	Y	81	1700	0.98	1658	0	0	5.0	39.0	3019	1704	19.3	0.0	0.0	0	35.6	9.00	c	10	n	-31.5	96.0	854	96.0	854	150	1335	90.9	808	75	668
11	-10.36	-34.0	-11.58	-38.0	Y	67	1400	1.00	1400	0	0	4.0	44.0	3245	1704	13.1	0.0	0.0	0	39.4	9.00	c	9	n	-36.0	109.0	970	109.0	970	150	1335	103.9	925	75	668
12	-11.58	-38.0	-14.93	-49.0	Y	67	1400	1.00	1400	0	0	11.0	48.0	3879	1704	35.9	0.0	0.0	0	45.9	9.00	c	9	n	-43.5	145.0	1290	145.0	1290	150	1335	139.9	1244	75	668
13	-14.93	-49.0	-17.37	-57.0	Y	72	1500	1.00	1500	0	0	8.0	59.0	4460	1704	28.0	0.0	0.0	0	54.0	9.00	c	9	y	-53.0	173.0	1539	182.1	1621	150	1335	167.9	1493	75	668
14	-17.37	-57.0	-22.86	-75.0	Y	0	0	0.00	0	41	30.75	18.0	67.0	5767	1704	0.0	63.9	42.6	145	65.1	9.00	g	168	y	-66.0	236.8	2108	405.0	3605	150	1335	210.5	1872	75	668
Bottom	-22.86	-75.0																																	





14-inch Class 200 Pile

MSN B4 - U.S.101/SR116 SOH

10/6/2010

Pile Design Spreadsheet

Bent 5_R-09-014

NAVFAC Design Method For a Single Pile

Project Name:	101 MSN Petaluma
Project Number:	28645045
Bridge Name:	U.S.101/SR116 SOH (Widen)
Boring Surface El. (m)	4.3
Boring Surface El. (ft)	14.0
Design GWS El. (ft)	5.0
Unit Weight of Water (pcf)	62.4
Depth with no strength	
Convert. Factor	3.281
Bottom of Pile Cap El. (m)	1.31
Bottom of Pile Cap El. (ft)	4.30

Nominal axial compress. Capacity (ult.)	160	ton
Nominal axial compress. Capacity (ult.)	1424	kN
Pile Width	14	inch
Pile Width	356	mm
Pile Width	1.17	ft
Crit depth ratio	20	-
Crit depth	23.3	ft
Crit. Depth. Elev	-9.3	ft
Crit. Depth. Elev	-2.8	m
Crit. Eff. Vert. Str.	2041	psf

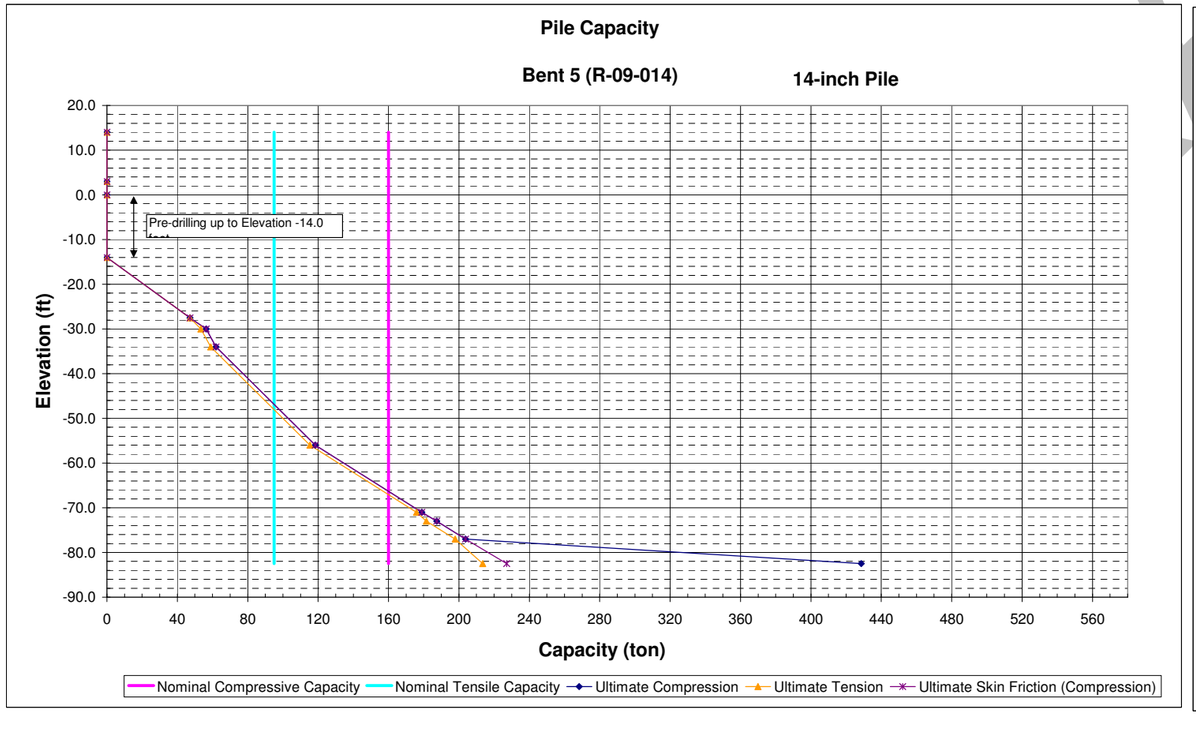
Skin Resistance (Friction) of Pile in Granular Material:

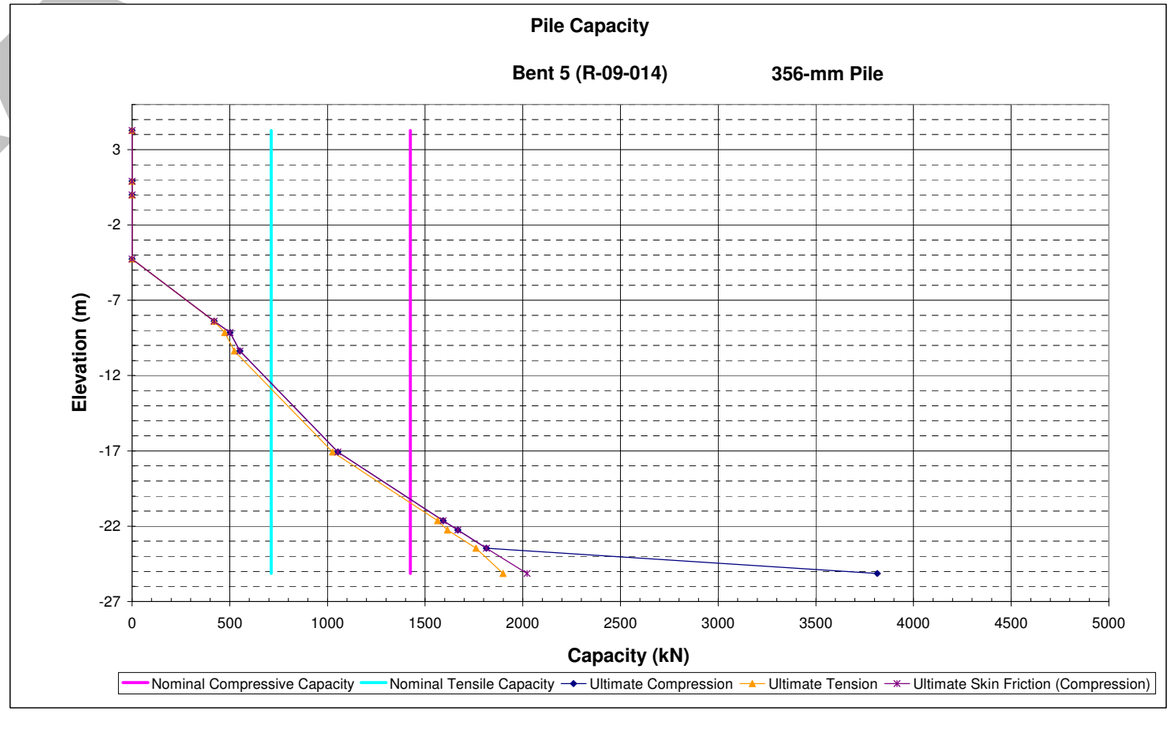
Type (Steel=S,Concrete=C,Timber=T)	C	
Earth Press. Coefficient * (Comp.)	1.5	
Earth Press. Coefficient * (Tens)	1.0	
Minimum Adhesion	500	psf

Pile Shape	Square	(Square, Circular or Octogonal)		
Pile Surface Area	1.42	sq. m/m	Pile Tip Area	0.13 sq. m
Pile Surface Area	4.67	sq. ft/ft	Pile Tip Area	1.36 sq. ft.

* Note: Appropriate tension/compresion ratios for skin friction for granular soils applied is 0.65 and 1.0 for cohesive soil.

Layer No.	Layer Elevation Top (-)	Top (m)	Top (feet)	Bot. (m)	Bot. (feet)	Lateral Resists?	Cohesion c (kPa)	Cohesion c (psf)	Adhesion Ratio c_a/c	Adhesion c_a (psf)	Friction Angle ϕ (deg)	Friction Angle δ (deg)	Layer Thickness (feet)	Internal Depth to Layer Top (feet)	Effective Vert. Stress (Bot. Lay.) (psf)	Design Effective Vert. Stress (Bot. Lay.) (psf)	delta Lat. Res. Cohesive (ton)	delta Lat. Res. Friction (comp) (ton)	delta Lat. Res. Friction (tensile) (ton)	Nq (granular) (-)	z/B (-)	Nc (cohesive) (-)	Soil Type C=cohes. G= gran.	Bearing Capacity (B.C.) (ton)	Include B.C.?	Elevation to midlayer (ft)	Compression Cumulative Axial Res. (skin) (ton)	Compression Cumulative Axial Res. (skin) (kN)	Compression Cumulative Axial Res. (Tot) (ton)	Compression Cumulative Axial Res. (Tot) (kN)	Compression Nominal Axial Capacity (ton)	Compression Nominal Axial Capacity (kN)	Tension Cumulative Axial Res. (Skin) (ton)	Tension Cumulative Axial Res. (Skin) (kN)	Tension Nominal Axial Capacity (ton)	Tension Nominal Axial Capacity (kN)
			4.27	14.0											0	0					0.0	6.25	g	0	n	14.0	0	0	0.0	0	160	1424	0	0	95	712
1	4.27	14.0	0.91	3.0	N	0	0	0.00	0	32	24	11.0	0.0	1478	1478	0.0	0.0	0.0	29	4.7	9.00	g	29	n	8.5	0.0	0	0.0	0	160	1424	0.0	0	95	712
2	0.91	3.0	0	0.0	N	60	1250	1.00	0	0	0	3.0	11.0	2354	2041	0.0	0.0	0.0	0	10.7	9.00	c	8	n	1.5	0.0	0	0.0	0	160	1424	0.0	0	95	712
3	0	0.0	-4.27	-14.0	N	0	0	0.00	0	36	27	14.0	14.0	2354	2041	0.0	0.0	0.0	62	18.0	9.00	g	86	n	-7.0	0.0	0	0.0	0	160	1424	0.0	0	95	712
4	-4.27	-14.0	-8.38	-27.5	Y	72	1500	1.00	1500	0	0	13.5	28.0	3168	2041	47.3	0.0	0.0	0	29.8	9.00	c	9	n	-20.8	47.3	421	47.3	421	160	1424	47.3	420	95	712
5	-8.38	-27.5	-9.14	-30.0	Y	0	0	0.00	0	36	27	2.5	41.5	3369	2041	0.0	9.1	6.1	62	36.6	9.00	g	86	n	-28.8	56.4	502	56.4	502	160	1424	53.3	474	95	712
6	-9.14	-30.0	-10.36	-34.0	Y	29	600	1.00	600	0	0	4.0	44.0	3619	2041	5.6	0.0	0.0	0	39.4	9.00	c	4	n	-32.0	62.0	551	62.0	551	160	1424	58.9	524	95	712
7	-10.36	-34.0	-17.07	-56.0	Y	53	1100	1.00	1100	0	0	22.0	48.0	4886	2041	56.5	0.0	0.0	0	50.6	9.00	c	7	n	-45.0	118.4	1054	118.4	1054	160	1424	115.4	1026	95	712
8	-17.07	-56.0	-21.64	-71.0	Y	86	1800	0.96	1728	0	0	15.0	70.0	5750	2041	60.5	0.0	0.0	0	66.4	9.00	c	11	n	-63.5	178.9	1592	178.9	1592	160	1424	175.9	1564	95	712
9	-21.64	-71.0	-22.25	-73.0	Y	0	0	0.00	0	41	30.75	2.0	85.0	5885	2041	0.0	8.5	5.7	145	73.7	9.00	g	201	n	-72.0	187.4	1668	187.4	1668	160	1424	181.5	1615	95	712
10	-22.25	-73.0	-23.47	-77.0	Y	120	2500	0.70	1750	0	0	4.0	87.0	6076	2041	16.3	0.0	0.0	0	76.3	9.00	c	15	n	-75.0	203.7	1813	203.7	1813	160	1424	197.9	1760	95	712
11	-23.47	-77.0	-25.14	-82.5	Y	0	0	0.00	0	41	30.75	5.5	91.0	6364	2041	0.0	23.4	15.6	145	80.4	9.00	g	201	y	-79.8	227.1	2021	428.6	3814	160	1424	213.5	1899	95	712
Bottom	-25.14	-82.5																																		





14-inch Class 200 Pile

MSN B4 - U.S.101/SR116 SOH

10/6/2010

Pile Design Spreadsheet

Abut 6_R-09-015

NAVFAC Design Method For a Single Pile

Project Name:	101 MSN Petaluma
Project Number:	28645045
Bridge Name:	U.S.101/SR116 SOH (Widen)
Boring Surface El. (m)	4.7
Boring Surface El. (ft)	15.5
Design GWS El. (ft)	5.0
Unit Weight of Water (pcf)	62.4
Depth with no strength	
Convert. Factor	3.281
Bottom of Pile Cap El. (m)	4.72
Bottom of Pile Cap El. (ft)	15.50

Nominal axial compress. Capacity (ult.)	180	ton
Nominal axial compress. Capacity (ult.)	1602	kN
Pile Width	14	inch
Pile Width	356	mm
Pile Width	1.17	ft
Crit depth ratio	20	-
Crit depth	23.3	ft
Crit. Depth. Elev	-7.8	ft
Crit. Depth. Elev	-2.4	m
Crit. Eff. Vert. Str.	2045	psf

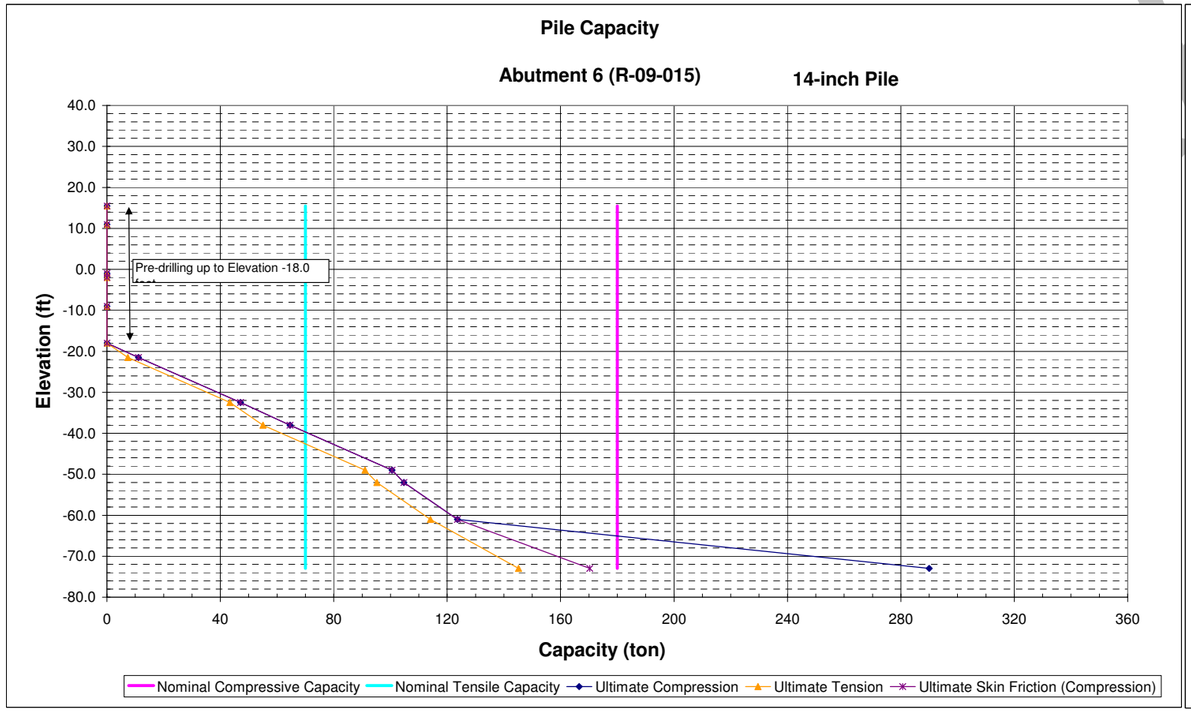
Skin Resistance (Friction) of Pile in Granular Material:

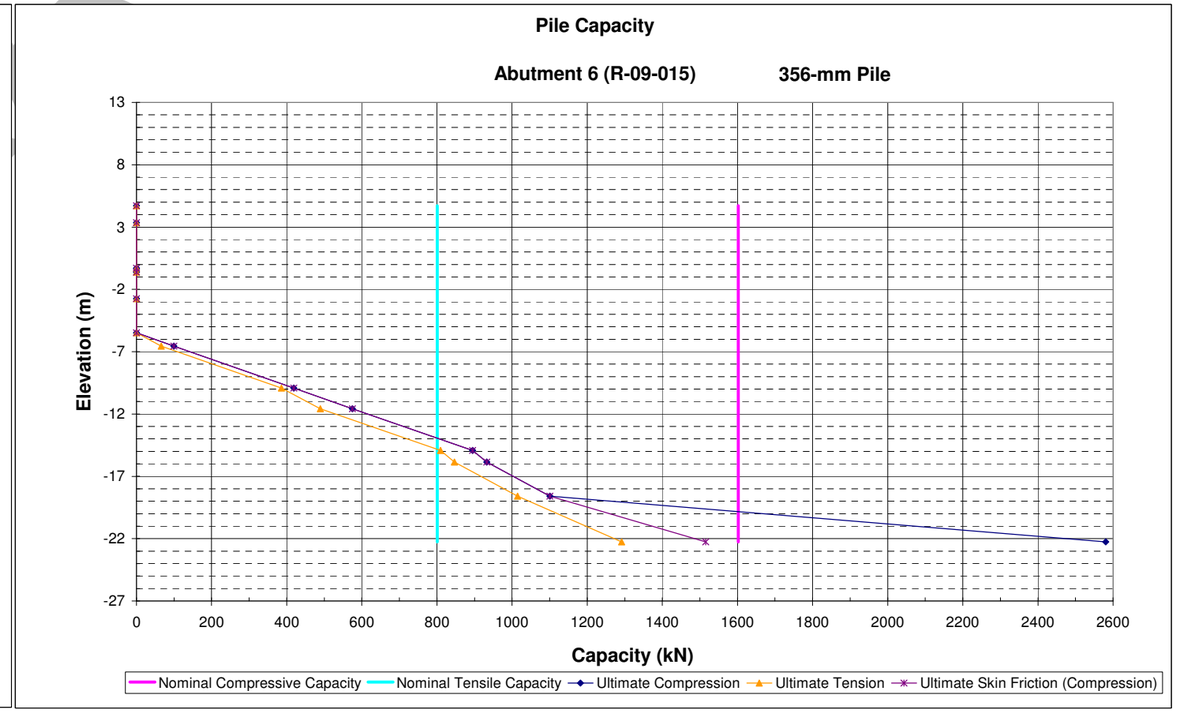
Type (Steel=S,Concrete=C,Timber=T)	C	
Earth Press. Coefficient * (Comp.)	1.5	
Earth Press. Coefficient * (Tens)	1.0	
Minimum Adhesion	500	psf

Pile Shape	Square	(Square, Circular or Octogonal)			
Pile Surface Area	1.42	sq. m/m	Pile Tip Area	0.13	sq. m
Pile Surface Area	4.67	sq. ft/ft	Pile Tip Area	1.36	sq. ft.

* Note: Appropriate tension/compresion ratios for skin friction for granular soils applied is 0.65 and 1.0 for cohesive soil.

Layer No.	Layer Elevation Top (m)	Layer Elevation Top (feet)	Layer Elevation Bot. (m)	Layer Elevation Bot. (feet)	Lateral Resists?	Cohesion c (kPa)	Cohesion c (psf)	Adhesion Ratio c_a/c	Adhesion c_a (psf)	Friction Angle ϕ (deg)	Friction Angle δ (deg)	Layer Thickness (feet)	Internal Depth to Layer Top (feet)	Effective Vert. Stress (Bot. Lay.) (psf)	Design Effective Vert. Stress (Bot. Lay.) (psf)	delta Lat. Res. Cohesive (ton)	delta Lat. Res. Friction (comp) (ton)	delta Lat. Res. Friction (tensile) (ton)	Nq (granular) (-)	z/B (-)	Nc (cohesive) (-)	Soil Type G= gran. C=cohes.	Bearing Capacity (B.C.) (ton)	Include B.C.?	Elevation to midlayer (ft)	Compression Cumulative Axial Res. (skin) (ton)	Compression Cumulative Axial Res. (skin) (kN)	Compression Cumulative Axial Res. (Tot) (ton)	Compression Cumulative Axial Res. (Tot) (kN)	Compression Nominal Axial Capacity (ton)	Compression Nominal Axial Capacity (kN)	Tension Cumulative Axial Res. (Skin) (ton)	Tension Cumulative Axial Res. (Skin) (kN)	Tension Nominal Axial Capacity (ton)	Tension Nominal Axial Capacity (kN)
			4.72	15.5										0	0					0.0	6.25	g	0	n	15.5	0	0	0.0	0	180	1602	0	0	70	801
1	4.72	15.5	3.35	11.0	n	48	1000	1.00	0	0	0	4.5	0.0	1561	1561	0.0	0.0	0.0	0	1.9	8.37	g	0	n	13.3	0.0	0	0.0	0	180	1602	0.0	0	70	801
2	3.35	11.0	-0.3	-1.0	n	43	900	1.00	0	0	0	12.0	4.5	1639	1639	0.0	0.0	0.0	0	9.0	9.00	c	6	n	5.0	0.0	0	0.0	0	180	1602	0.0	0	70	801
3	-0.3	-1.0	-0.61	-2.0	n	0	0	0.00	0	32	24	1.0	16.5	1639	1639	0.0	0.0	0.0	29	14.6	9.00	c	0	n	-1.5	0.0	0	0.0	0	180	1602	0.0	0	70	801
4	-0.61	-2.0	-2.74	-9.0	n	43	900	1.00	0	0	0	7.0	17.5	2113	2045	0.0	0.0	0.0	0	18.0	9.00	g	0	n	-5.5	0.0	0	0.0	0	180	1602	0.0	0	70	801
5	-2.74	-9.0	-5.49	-18.0	n	0	0	0.00	0	32	24	9.0	24.5	2679	2045	0.0	0.0	0.0	29	24.9	9.00	c	0	n	-13.5	0.0	0	0.0	0	180	1602	0.0	0	70	801
6	-5.49	-18.0	-6.55	-21.5	Y	0	0	0.00	0	32	24	3.5	33.5	2929	2045	0.0	11.2	7.4	29	30.2	9.00	g	40	n	-19.8	11.2	99	11.2	99	180	1602	7.4	66	70	801
7	-6.55	-21.5	-9.91	-32.5	Y	67	1400	1.00	1400	0	0	11.0	37.0	3618	2045	35.9	0.0	0.0	0	36.4	9.00	g	0	n	-27.0	47.1	419	47.1	419	180	1602	43.4	386	70	801
8	-9.91	-32.5	-11.58	-38.0	Y	0	0	0.00	0	32	24	5.5	48.0	3931	2045	0.0	17.5	11.7	29	43.5	9.00	c	0	n	-35.3	64.6	575	64.6	575	180	1602	55.1	490	70	801
9	-11.58	-38.0	-14.93	-49.0	Y	67	1400	1.00	1400	0	0	11.0	53.5	4462	2045	35.9	0.0	0.0	0	50.6	9.00	g	0	n	-43.5	100.5	895	100.5	895	180	1602	91.0	809	70	801
10	-14.93	-49.0	-15.85	-52.0	Y	29	600	1.00	600	0	0	3.0	64.5	4604	2045	4.2	0.0	0.0	0	56.6	9.00	c	4	n	-50.5	104.7	932	104.7	932	180	1602	95.2	847	70	801
11	-15.85	-52.0	-18.59	-61.0	Y	43	900	1.00	900	0	0	9.0	67.5	5033	2045	18.9	0.0	0.0	0	61.7	9.00	c	6	n	-56.5	123.6	1100	123.6	1100	180	1602	114.1	1015	70	801
12	-18.59	-61.0	-22.25	-73.0	Y	0	0	0.00	0	38	28.5	12.0	76.5	5777	2045	0.0	46.6	31.1	86	70.7	9.00	g	120	y	-67.0	170.3	1516	290.0	2581	180	1602	145.2	1291	70	801
Bottom	-22.25	-73.0																																	





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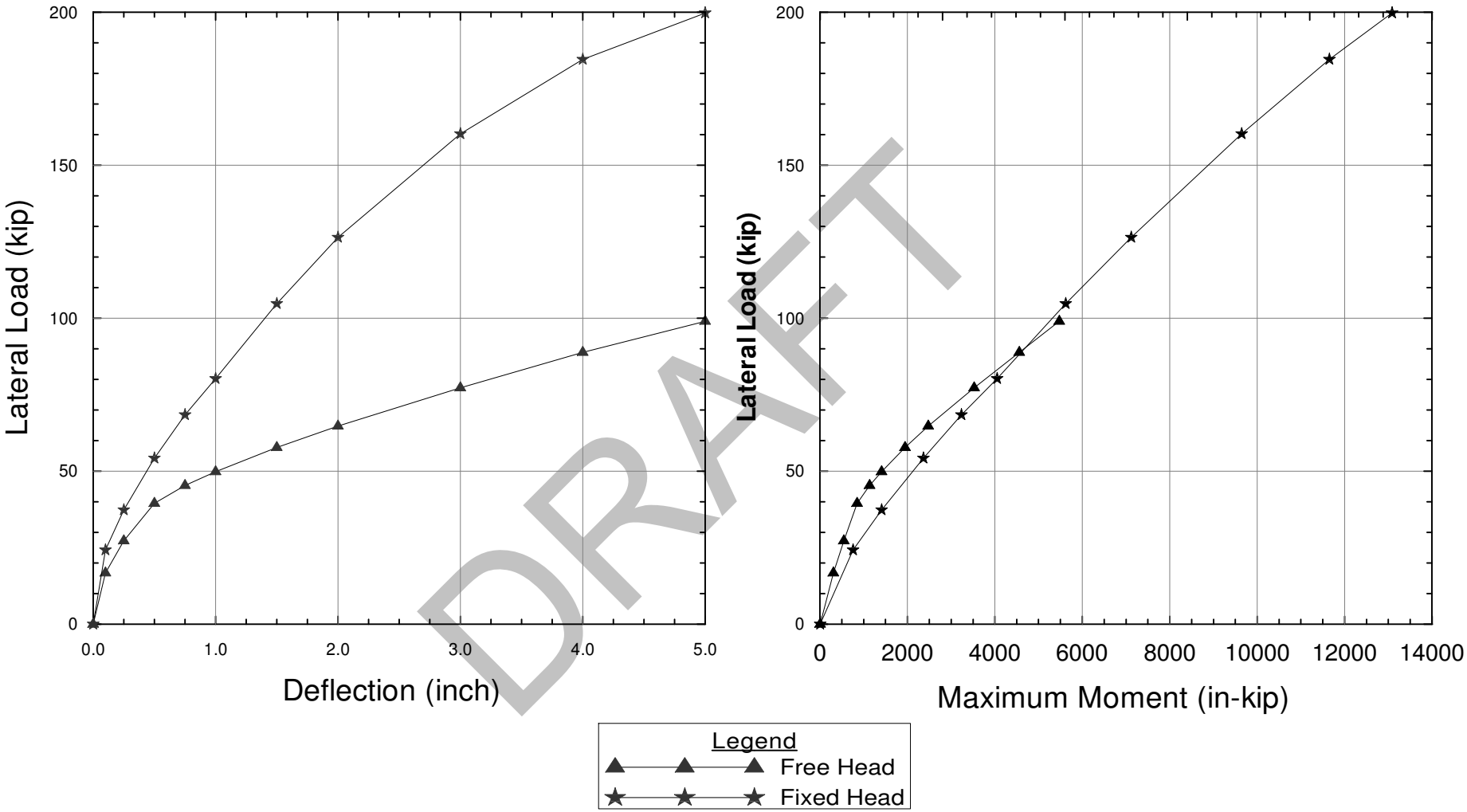

DRAFT

Project No. 28645045	MSN B4 Petaluma, California	U.S. 101S/SR116 SOH (Widen) Pile Lateral Resistance - Class200 Pile Abutment 1	Figure G-1
	URS		

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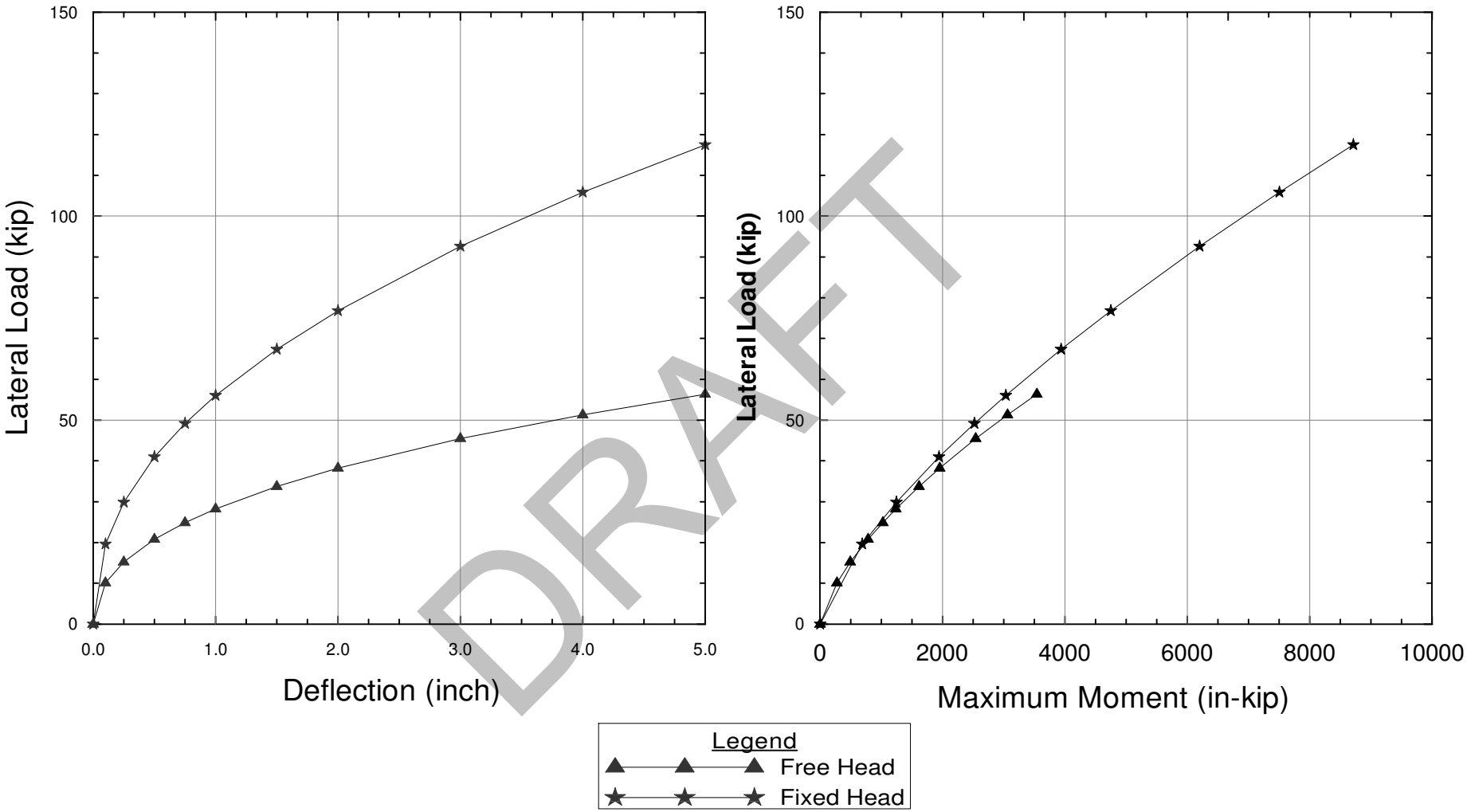

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Project No. 28645045	MSN B4 Petaluma, California	U.S. 101S/SR116 SOH (Widen) Bent 2 Pile Lateral Resistance Class200 Pile	Figure G-2
	URS		

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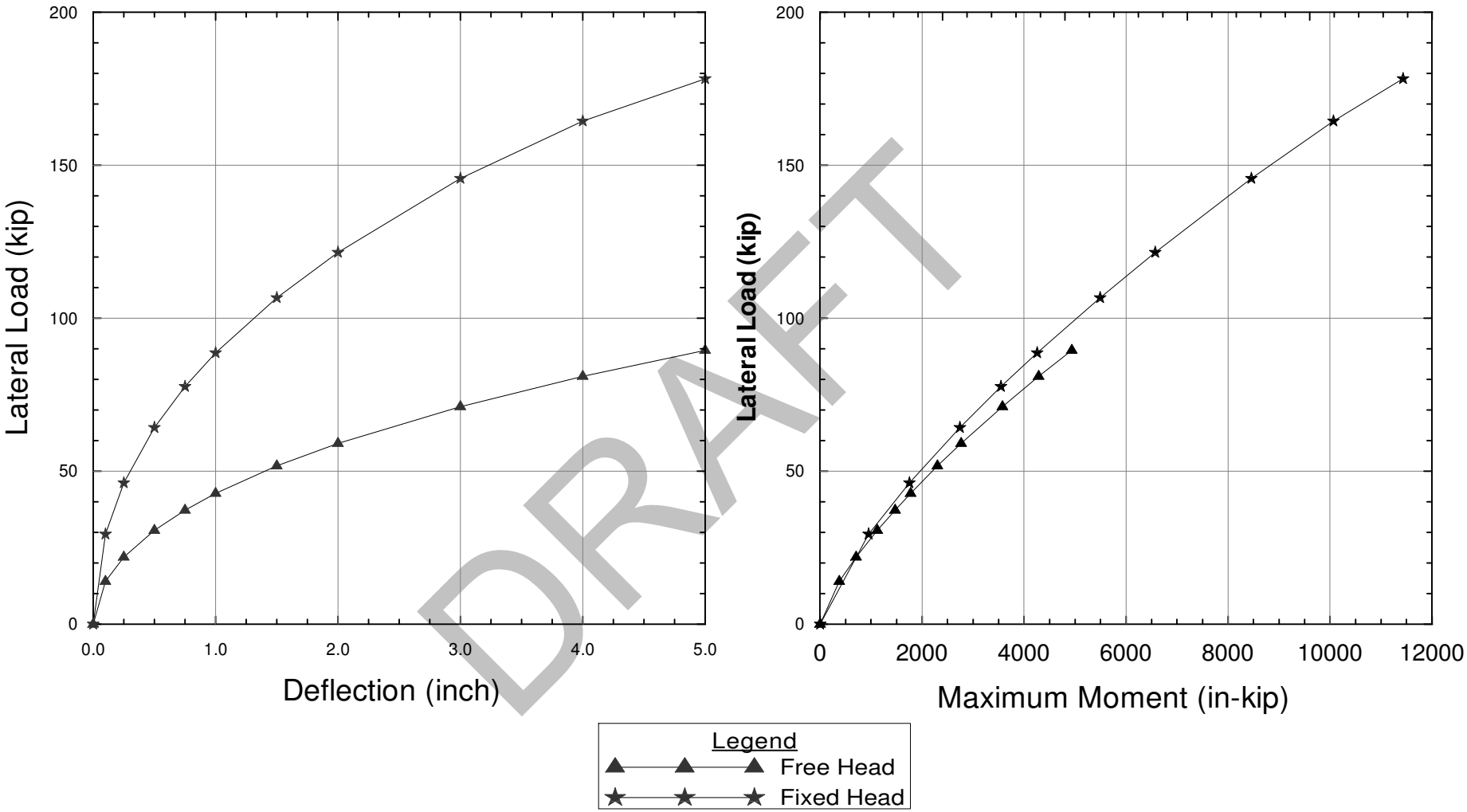

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Project No. 28645045	MSN B4 Petaluma, California	U.S. 101S/SR116 SOH (Widen) Bent 3 Pile Lateral Resistance Class200 Pile	Figure G-3
	URS		

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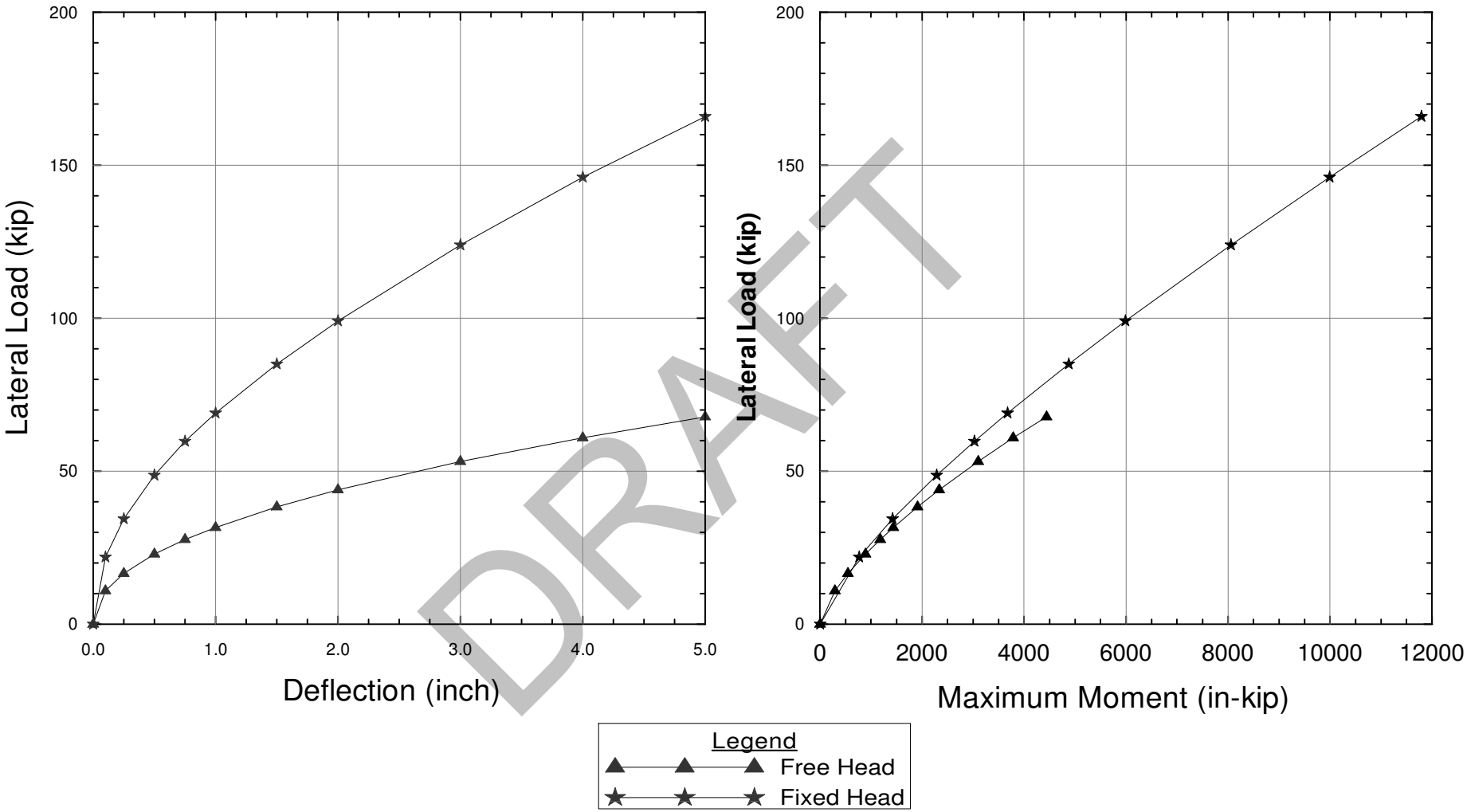

DRAFT

Project No. 28645045	MSN B4 Petaluma, California	U.S. 101S/SR116 SOH (Widen) Bent 4 Pile Lateral Resistance Class200 Pile	Figure G-4
	URS		

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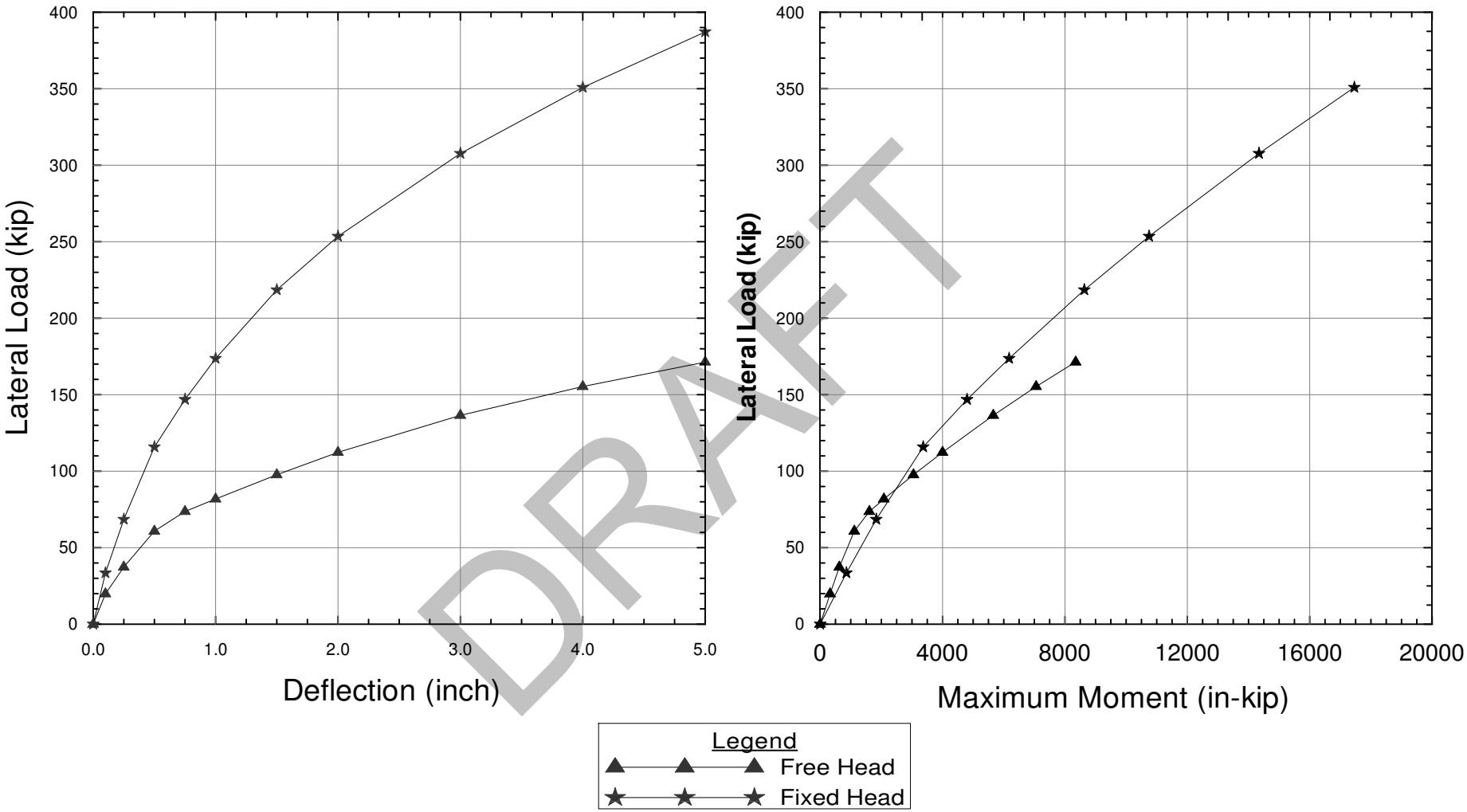

DRAFT

Project No. 28645045	MSN B4 Petaluma, California	U.S. 101S/SR116 SOH (Widen) Bent 5 Pile Lateral Resistance Class200 Pile	Figure G-5
	URS		

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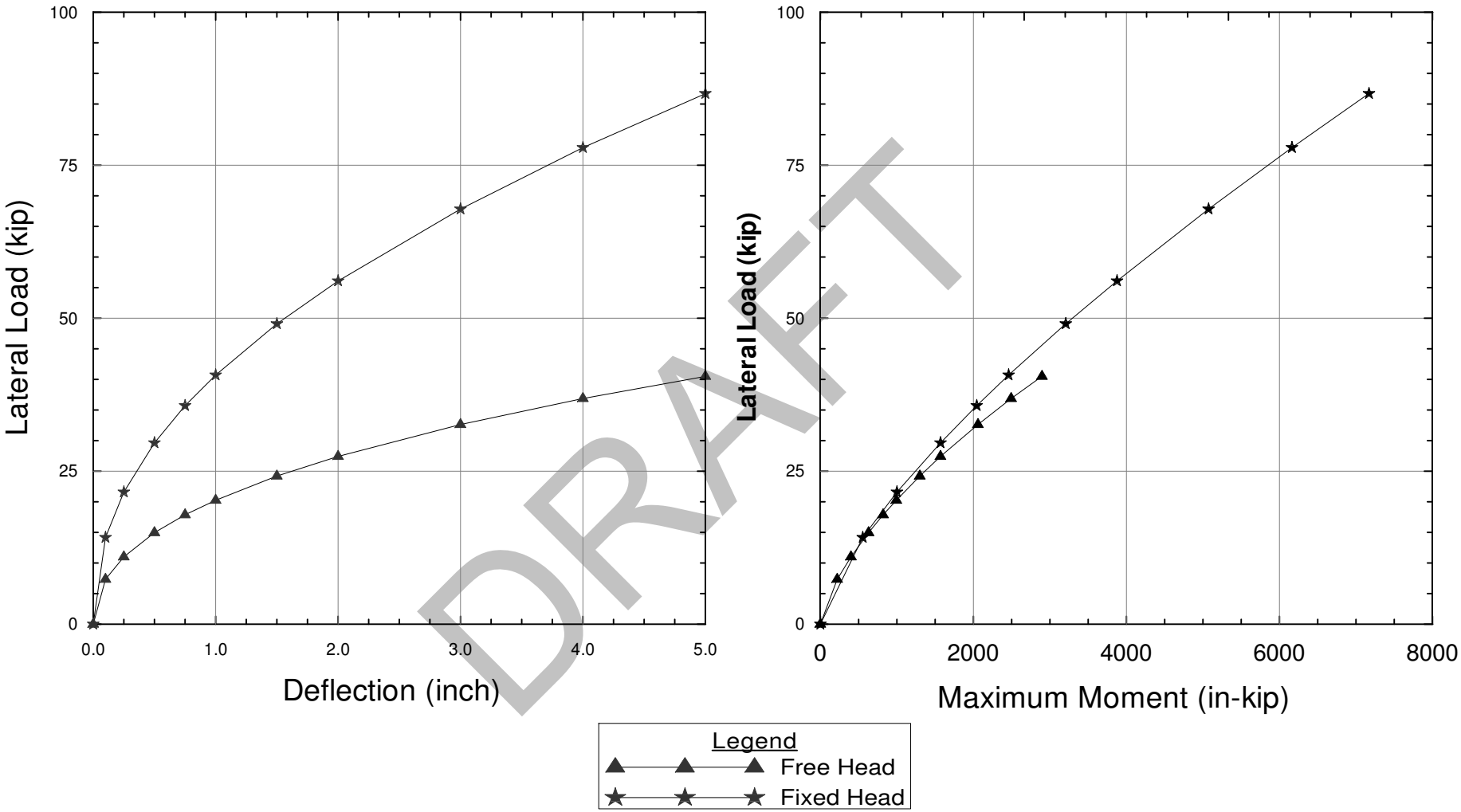

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Project No. 28645045	MSN B4 Petaluma, California	U.S. 101S/SR116 SOH (Widen) Abutment 6 Pile Lateral Resistance Class200 Pile	Figure G-6
URS			

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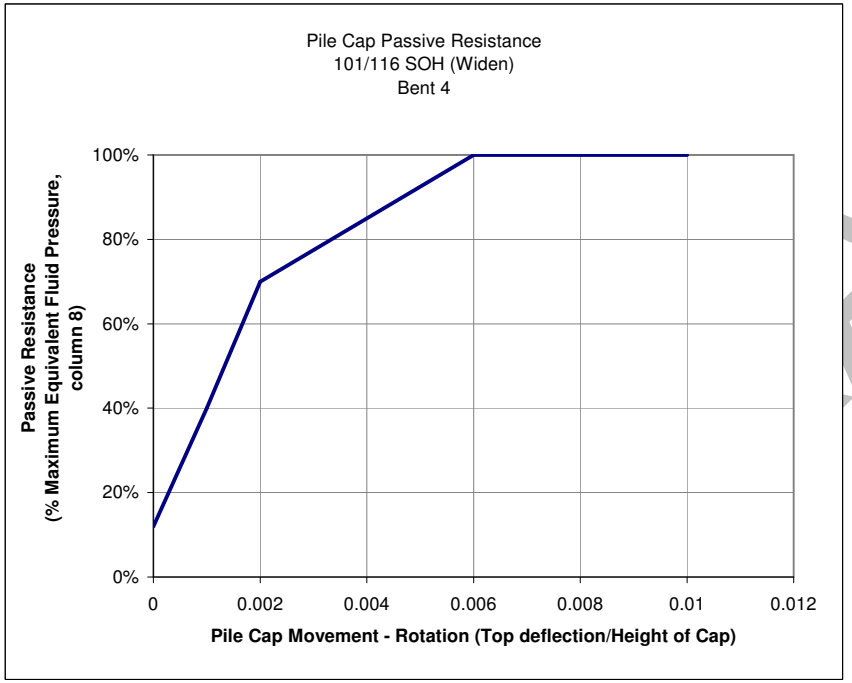
101/116 Widen

	1	2	3	4	5	6	7	8	9	10
	Ground Surf	Bottom Pile Cap	Soil Type					Equivalent Fluid Pressure	At-rest Pressure Coefficent	At-rest Equivalent Fluid Pressure
Abut / Bent				Unit Wt	Su	ϕ	Kp	Pp	Ko	Po = Ko γ
				pcf				psf/ft		psf/ft
Bent 2	11	8.5	Clay	120	1000	30	3	300	0.5	60
Bent 3	11	4.5	Clay	120	2000	31	3.12	300	0.48	60
Bent 4	10	1.5	Sand/Gravel	125		32	3.25	400	0.47	60
Bent 5	14	0	Clay	115	1250	30	3	300	0.5	60



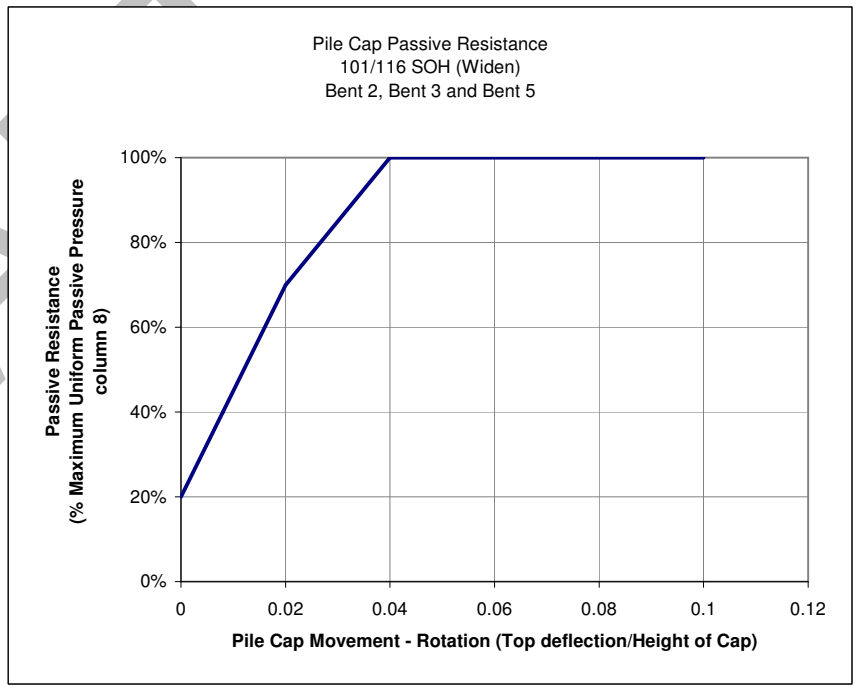
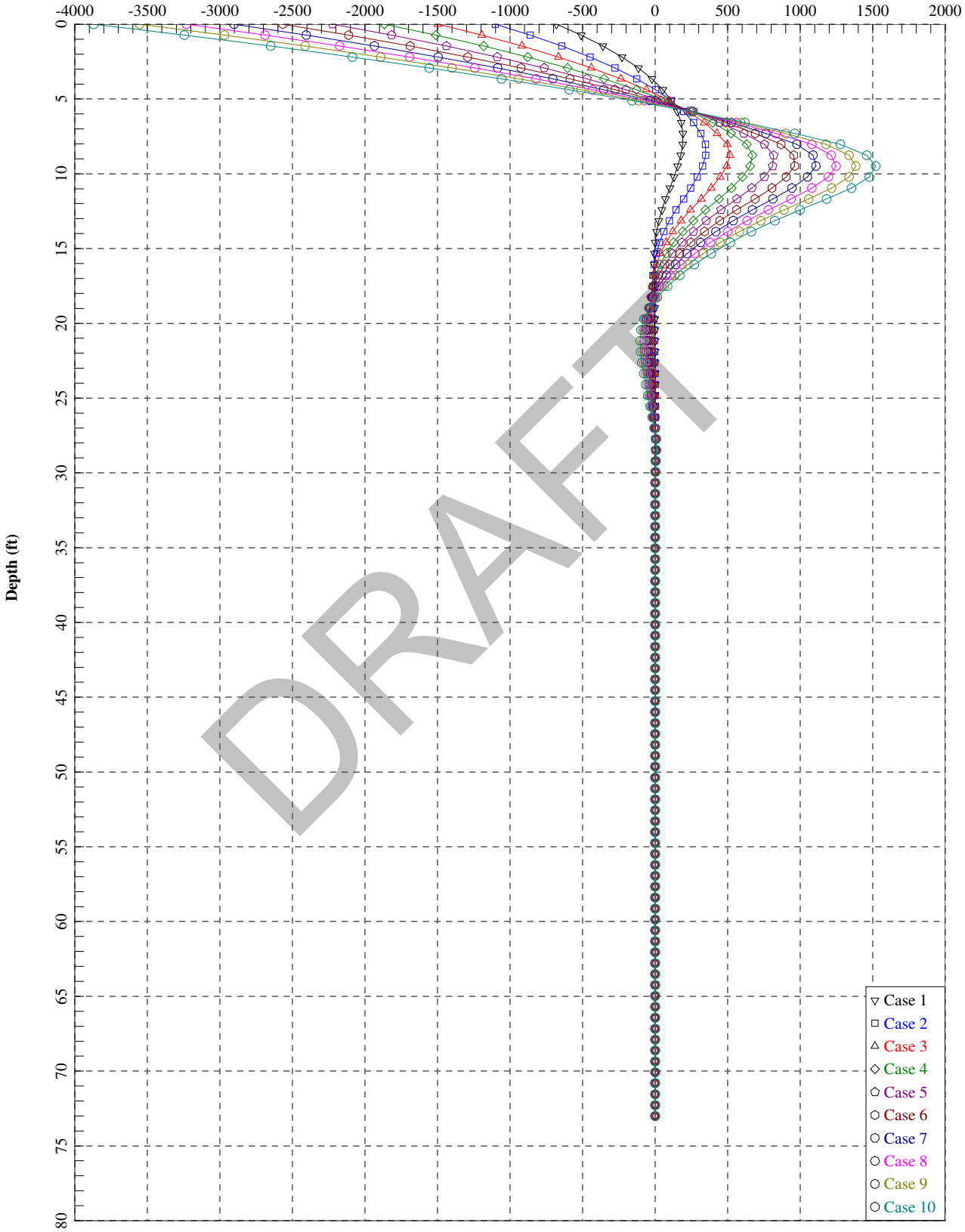


FIGURE G-7

US 101/SR116 SOH (Widen) Abutment 1_R-09-011 -Fixed

Bending Moment (in-kips)



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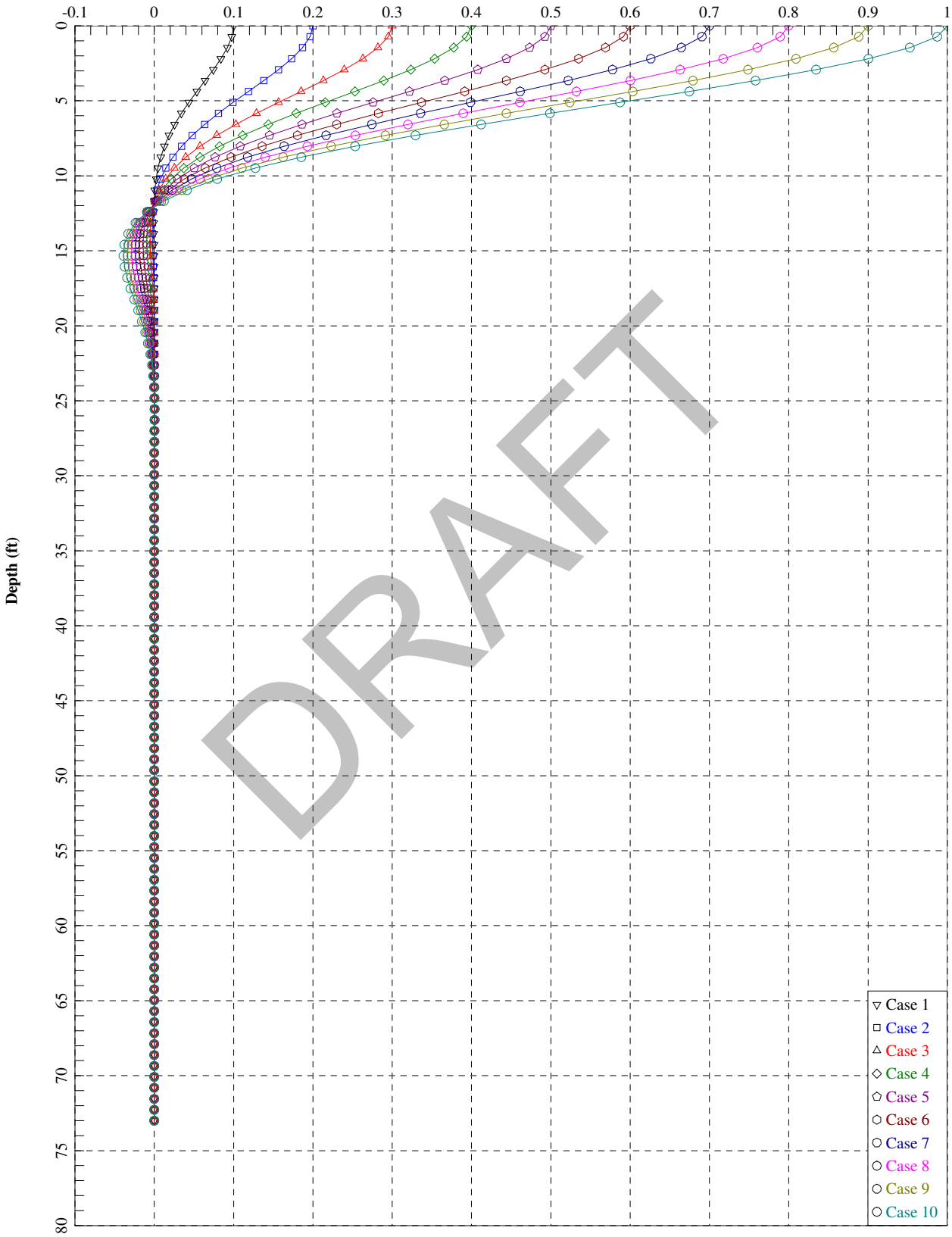
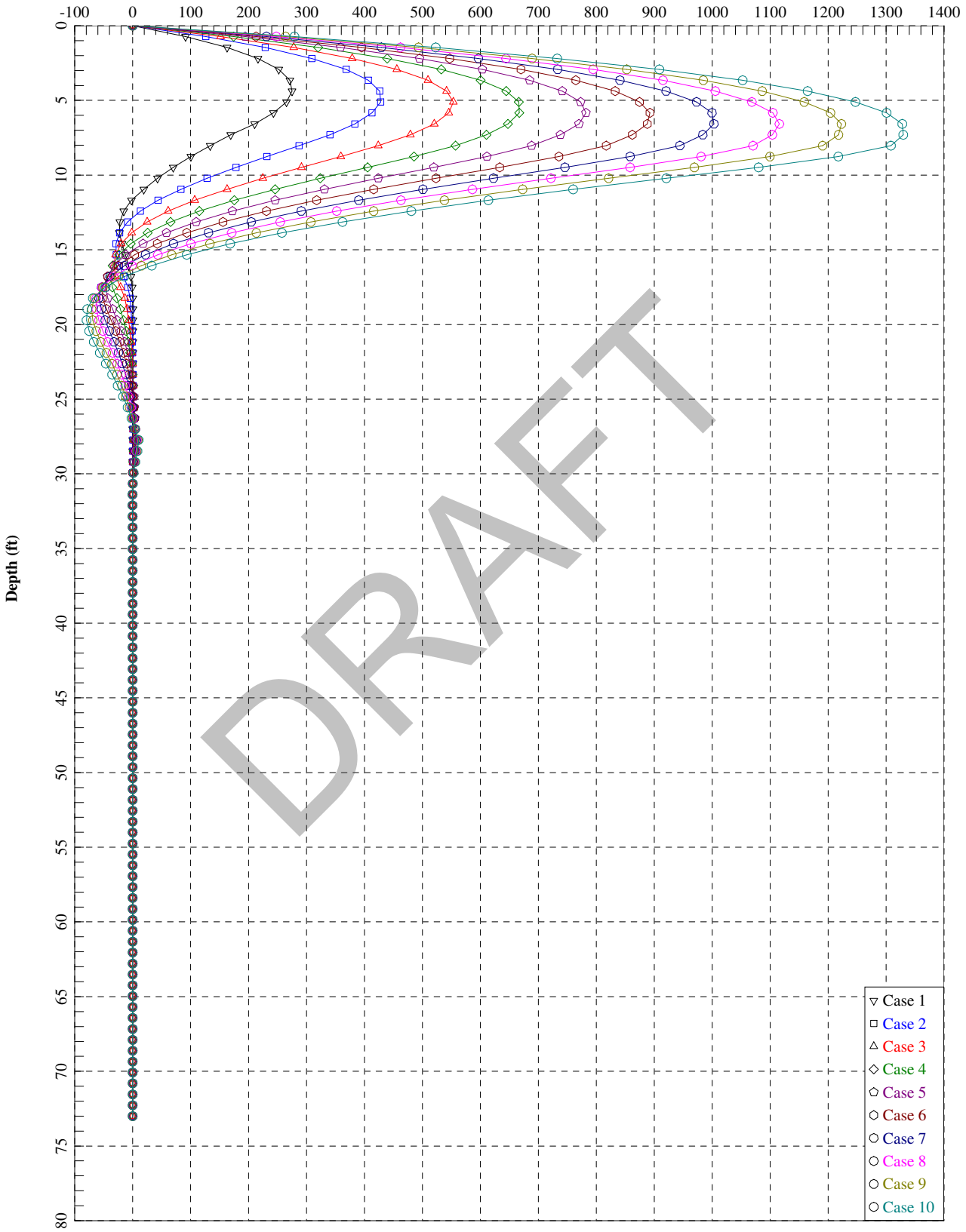
US 101/SR116 SOH (Widen) Abutment 1_R-09-011 -Fixed

Lateral Deflection (in)



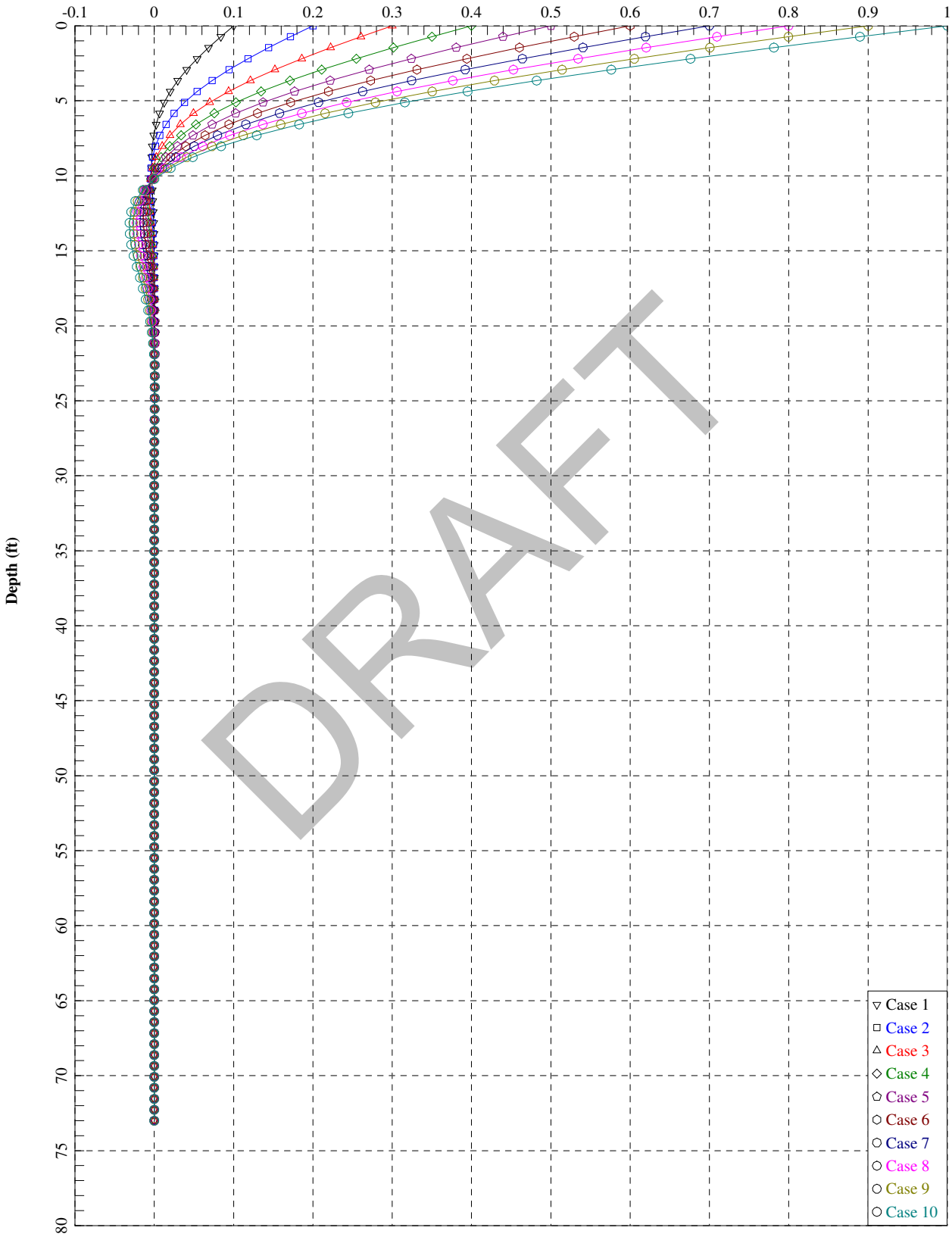
US 101/SR116 SOH (Widen) Abutment 1_R-09-011 -Free

Bending Moment (in-kips)



US 101/SR116 SOH (Widen) Abutment 1_R-09-011 -Free

Lateral Deflection (in)



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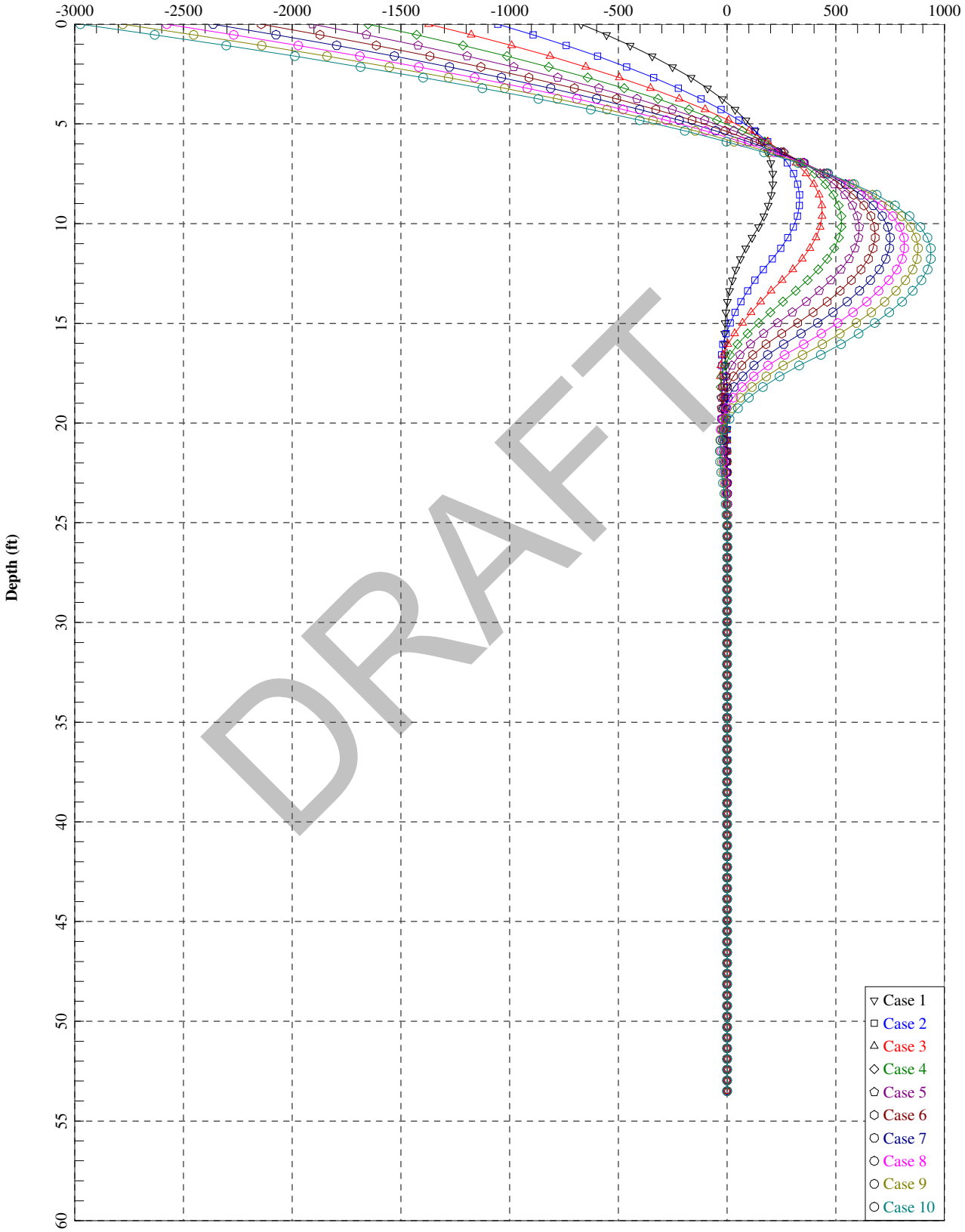
US 101/SR116 SOH (Widen) Bent 2_R-09-012 - Fixed

Bending Moment (in-kips)



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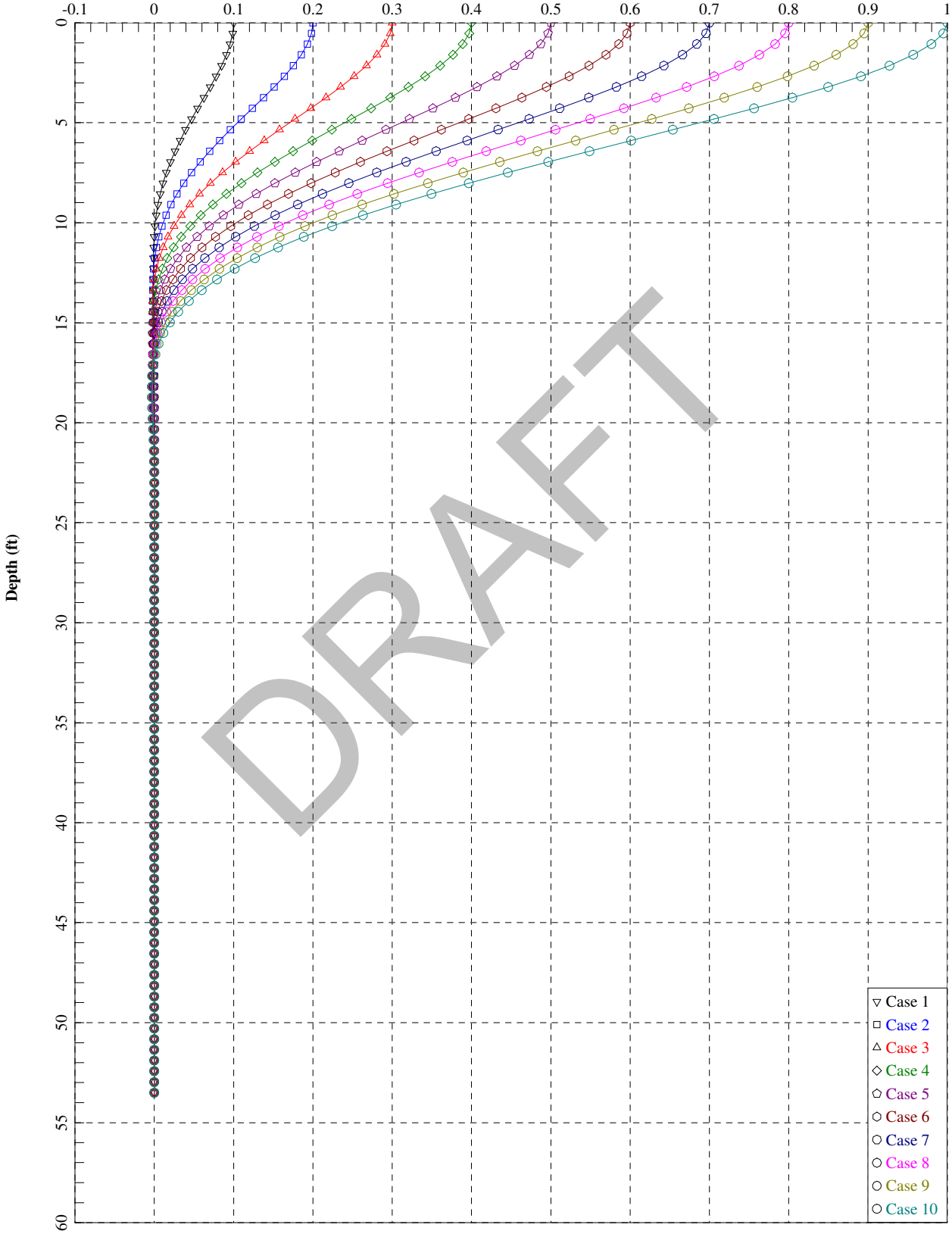
US 101/SR116 SOH (Widen) Bent 2_R-09-012 - Fixed

Lateral Deflection (in)



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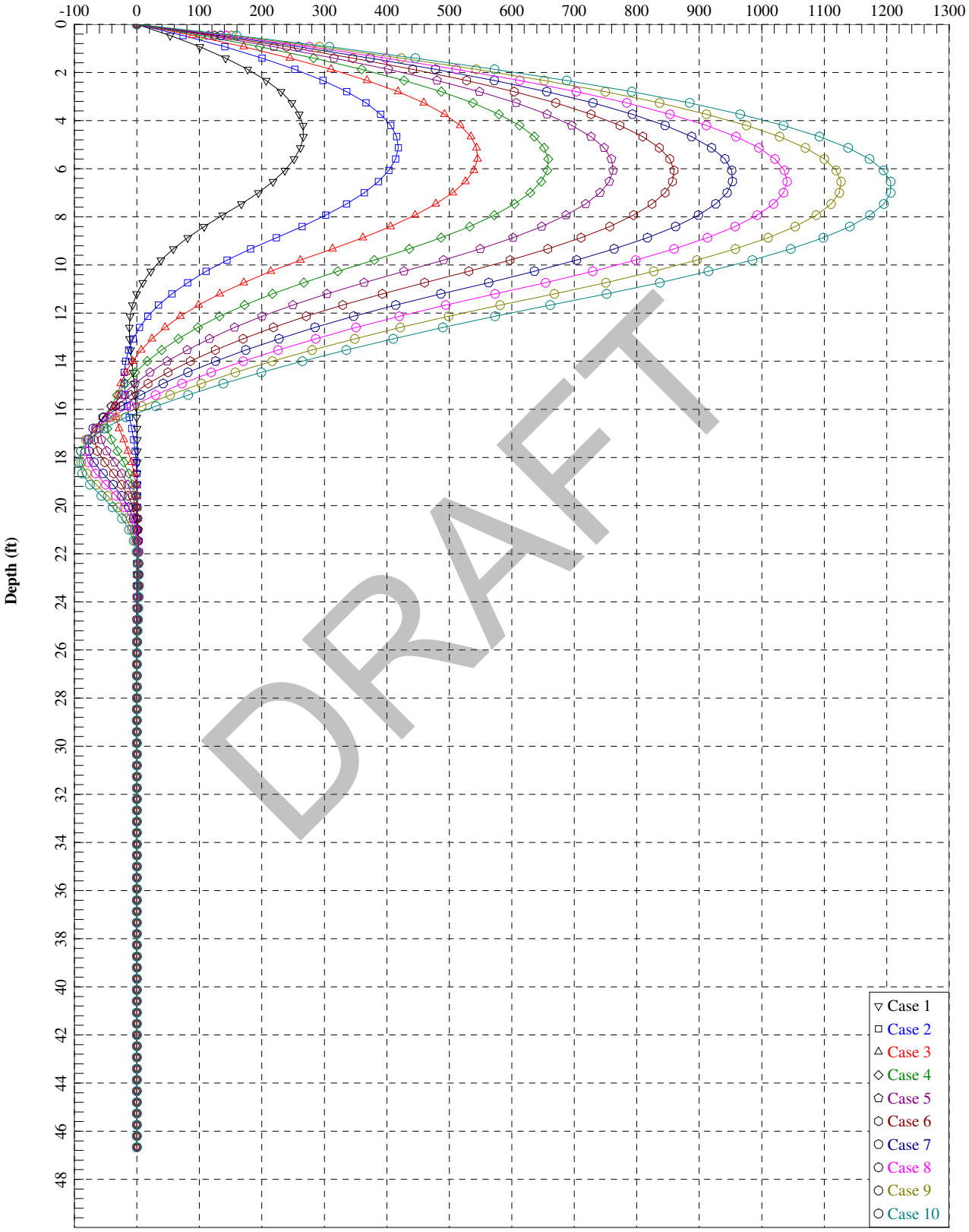
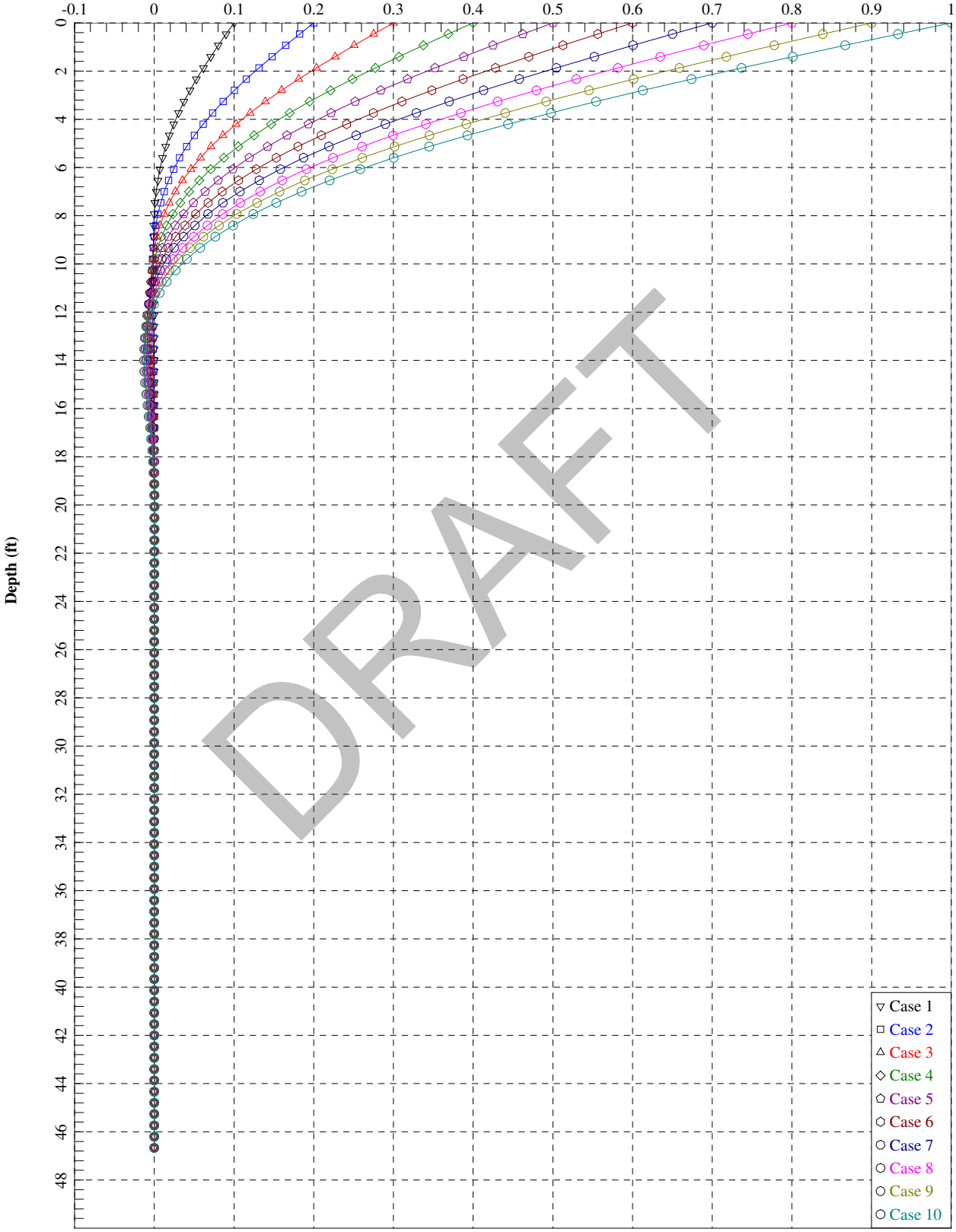
US 101/SR116 SOH (Widen) Bent 2_R-09-012 - Free

Bending Moment (in-kips)



US 101/SR116 SOH (Widen) Bent 2_R-09-012 - Free

Lateral Deflection (in)



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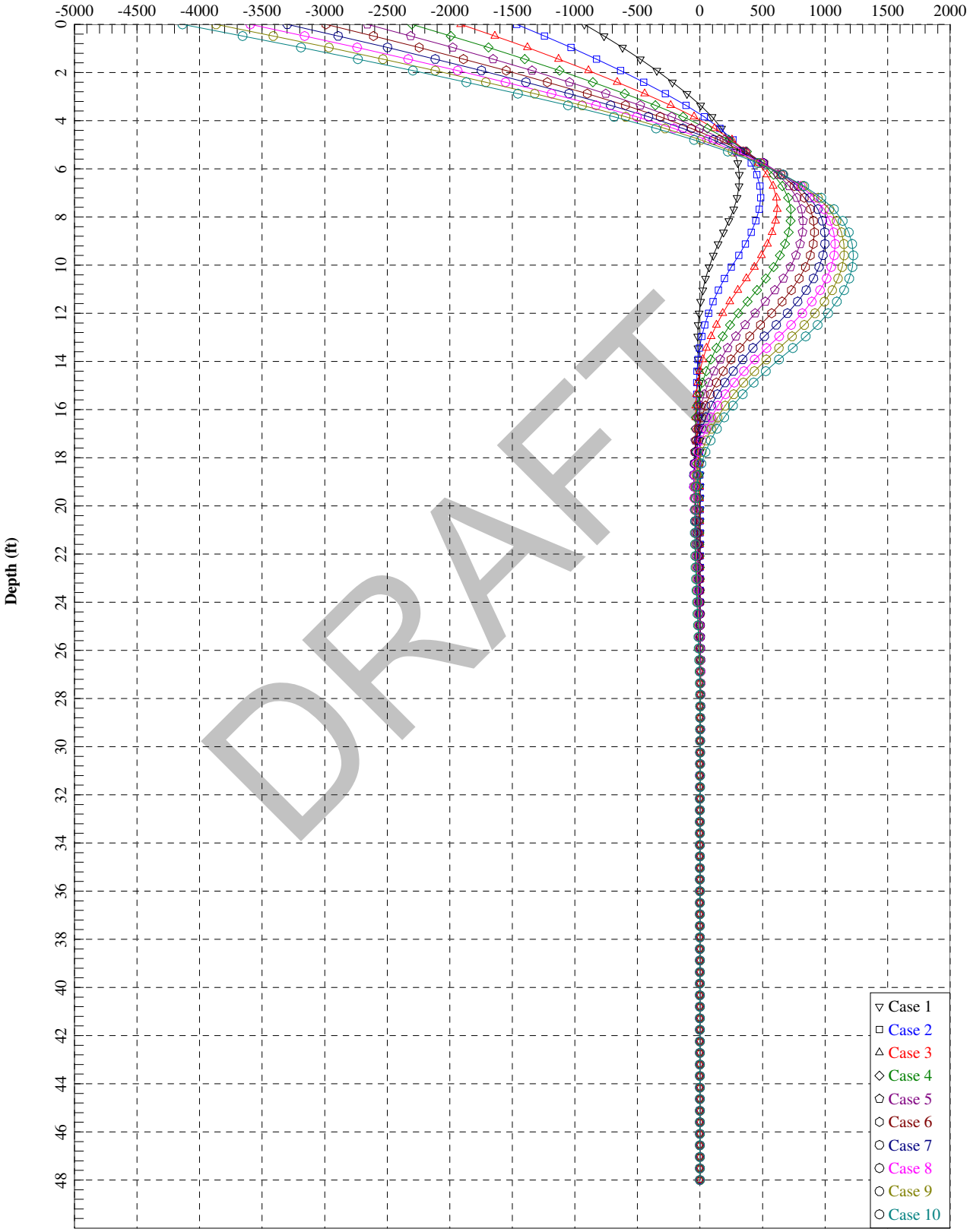
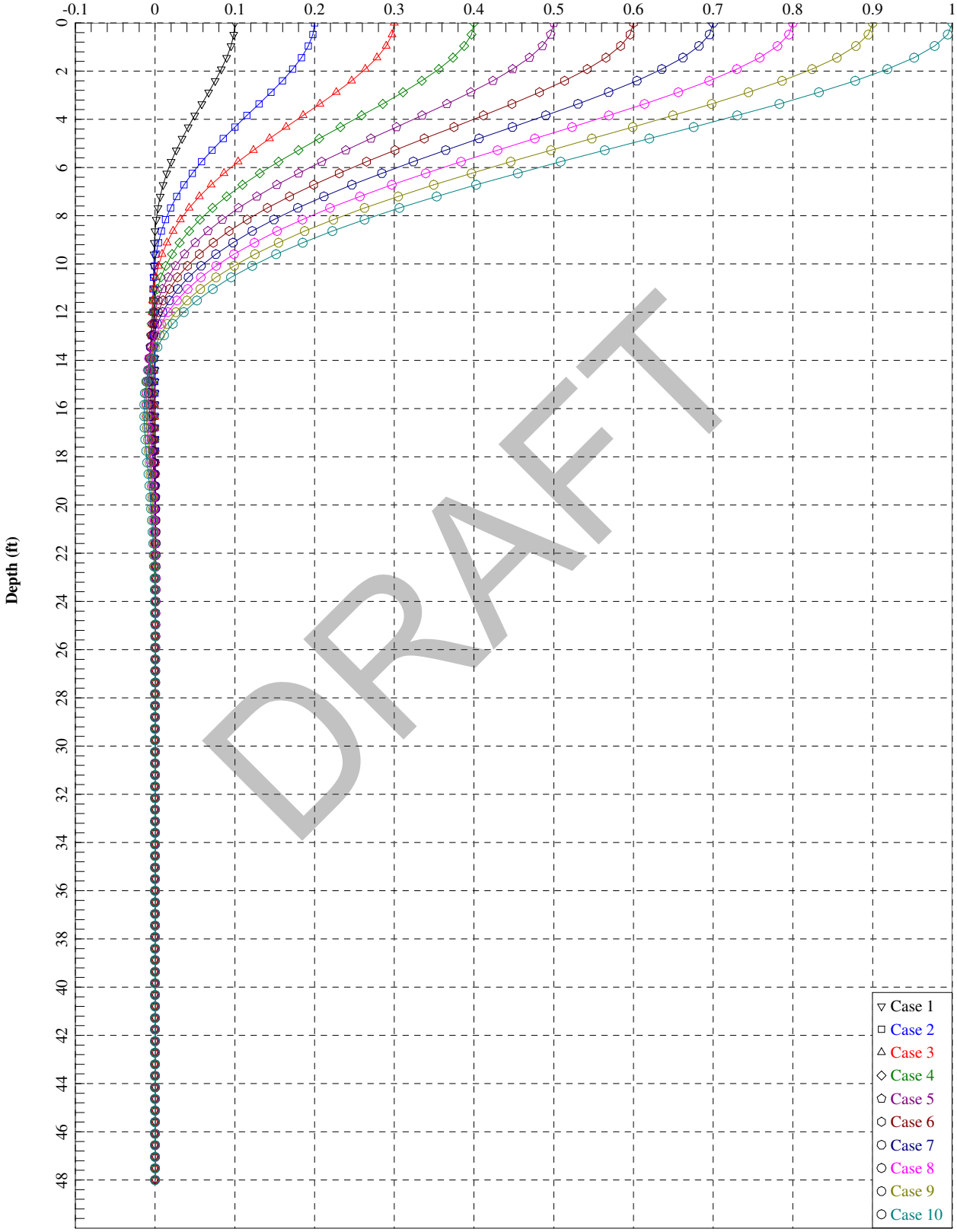
US 101/SR116 SOH (Widen) Bent 3_R-09-012 - Fixed

Bending Moment (in-kips)



US 101/SR116 SOH (Widen) Bent 3_R-09-012 - Fixed

Lateral Deflection (in)



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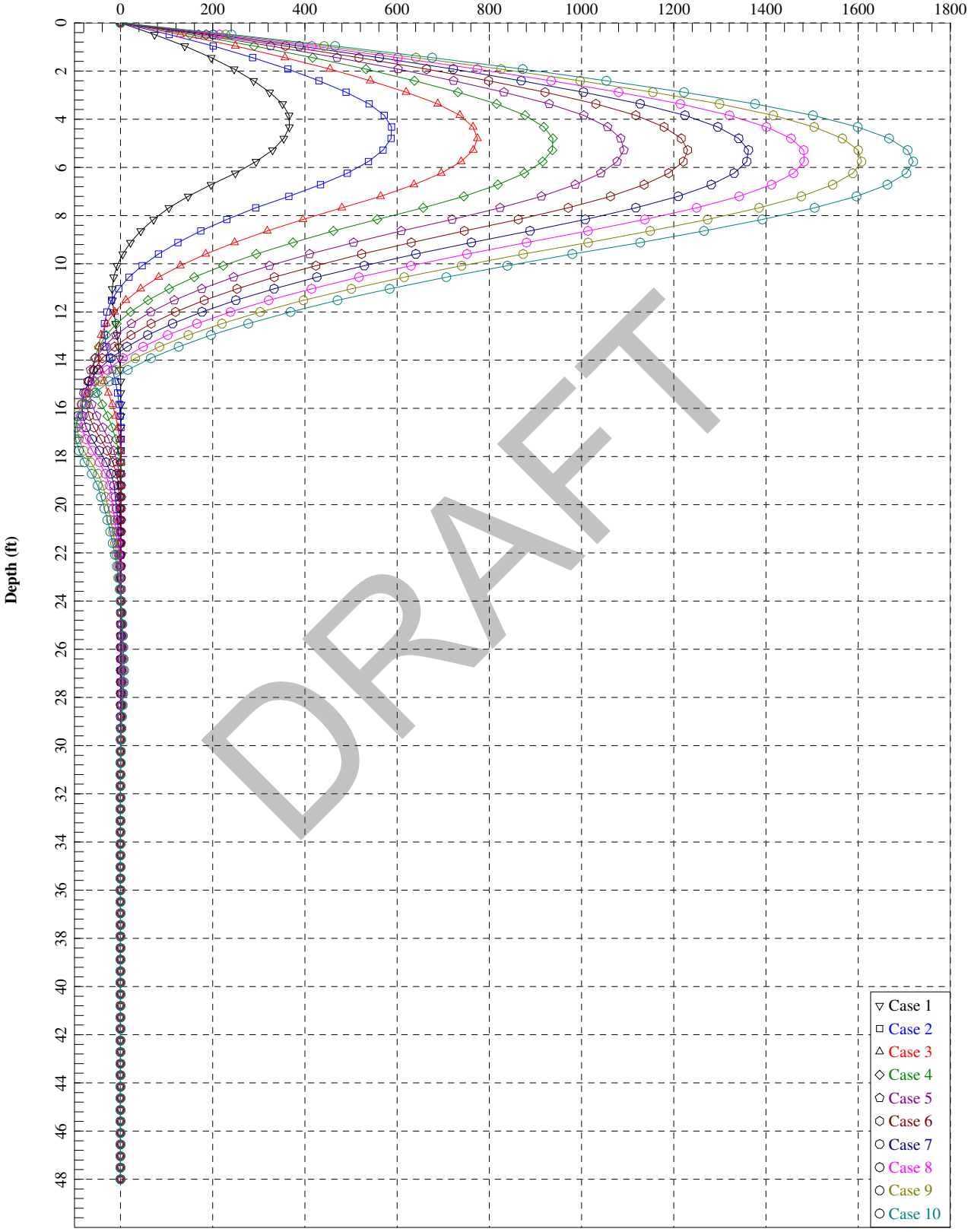
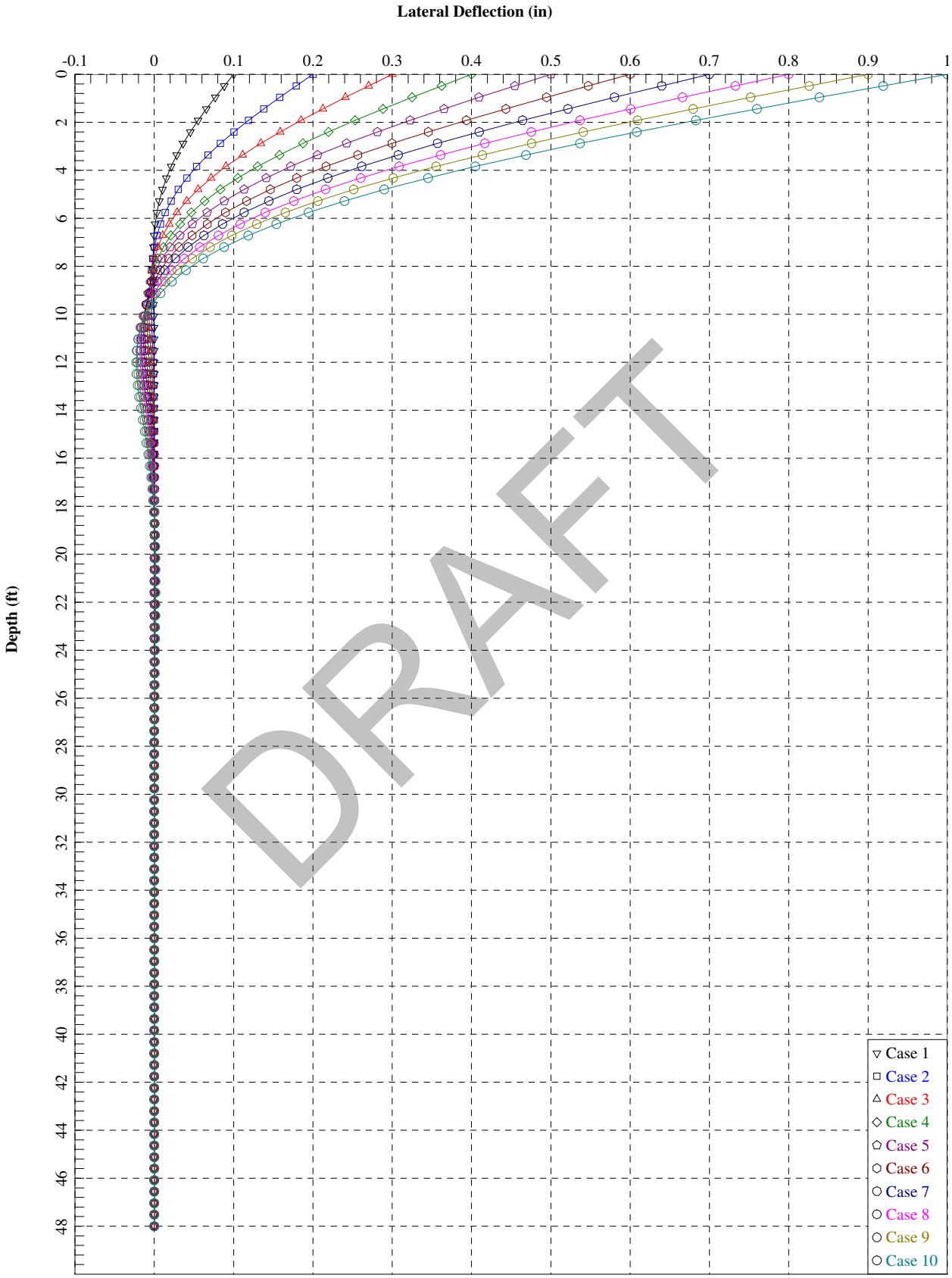
US 101/SR116 SOH (Widen) Bent 3_R-09-012 - Free

Bending Moment (in-kips)

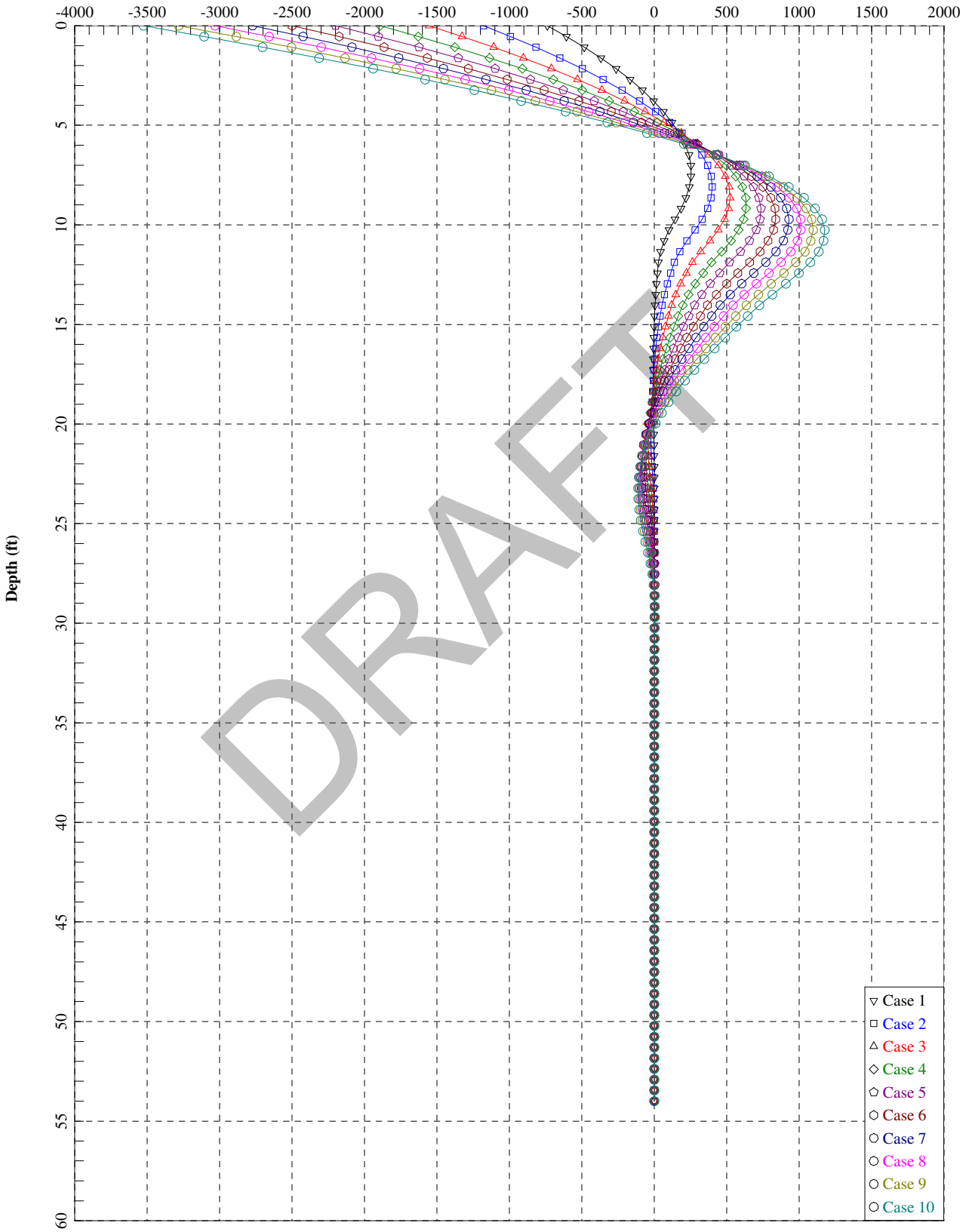


US 101/SR116 SOH (Widen) Bent 3_R-09-012 - Free



US 101/SR116 SOH (Widen) Bent 4_R-09-013 - Fixed

Bending Moment (in-kips)



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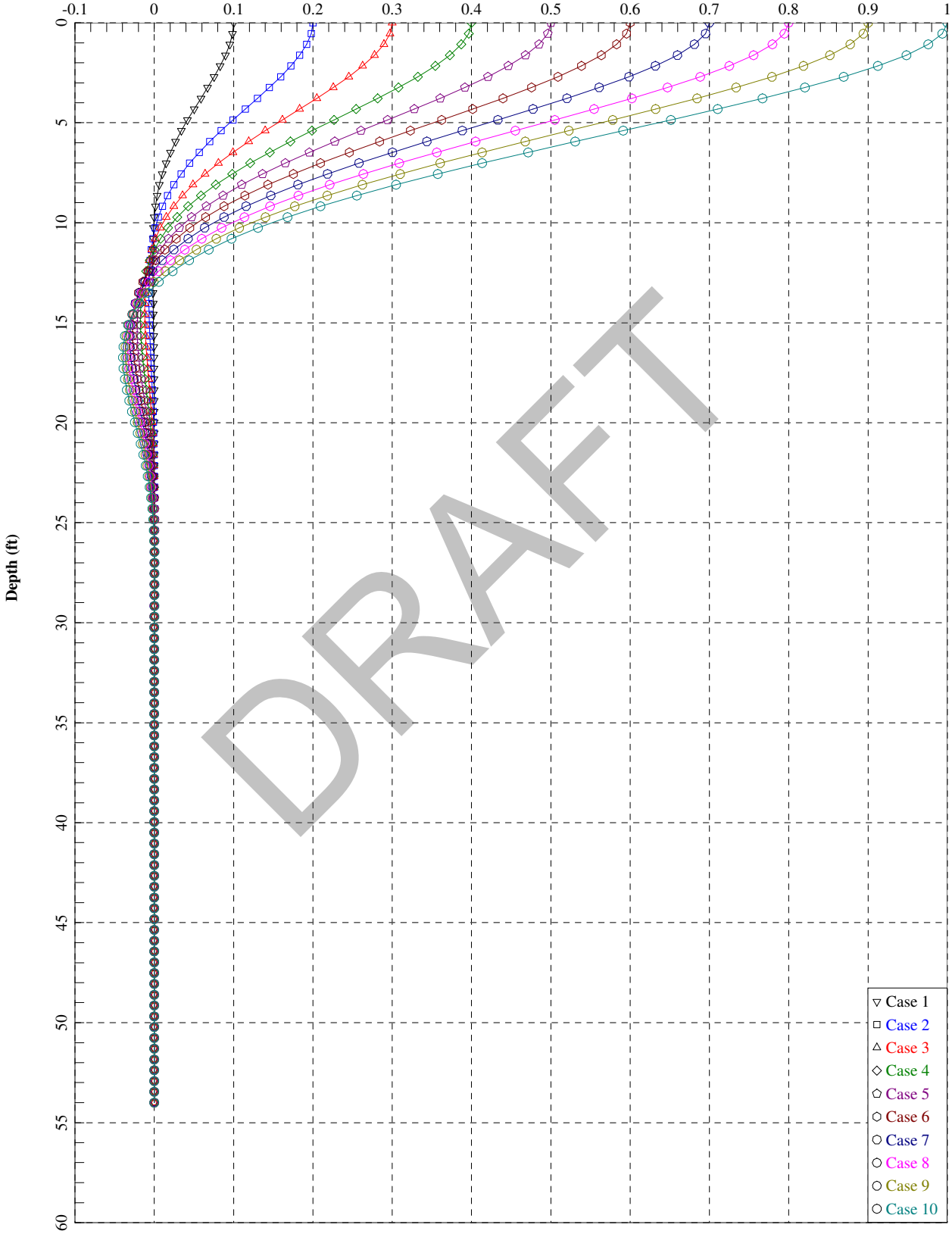
US 101/SR116 SOH (Widen) Bent 4_R-09-013 - Fixed

Lateral Deflection (in)



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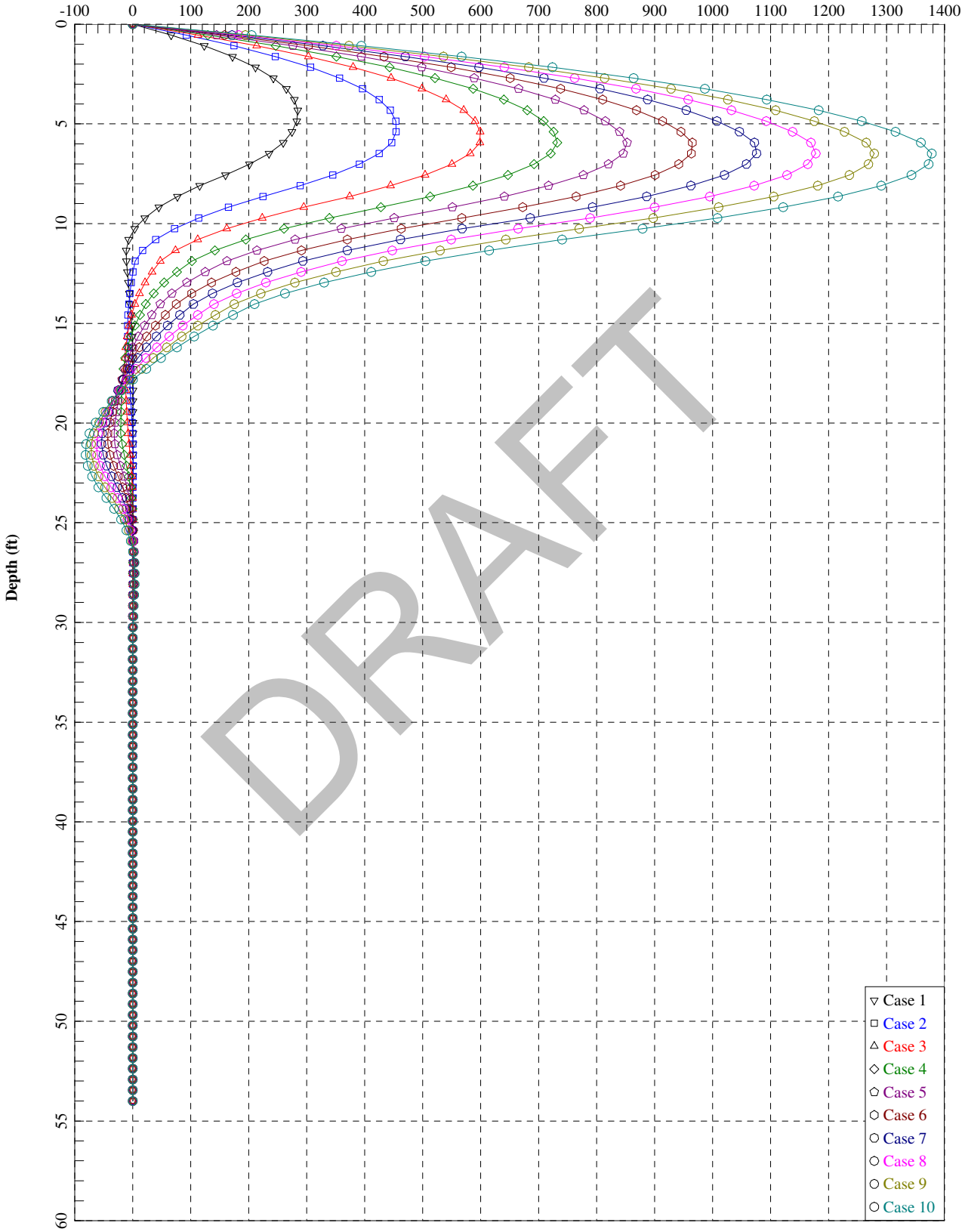
US 101/SR116 SOH (Widen) Bent 4_R-09-013 - Free

Bending Moment (in-kips)



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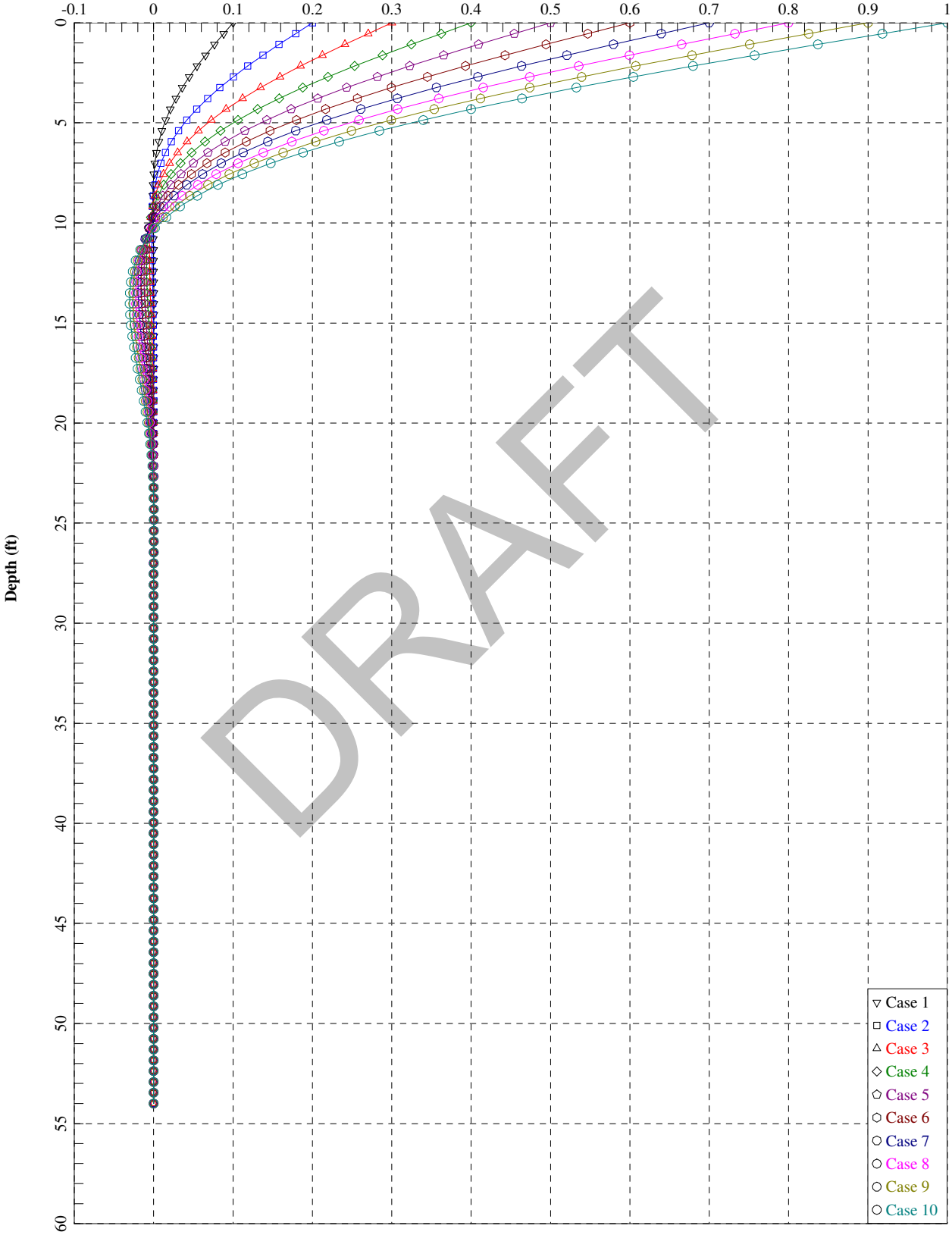
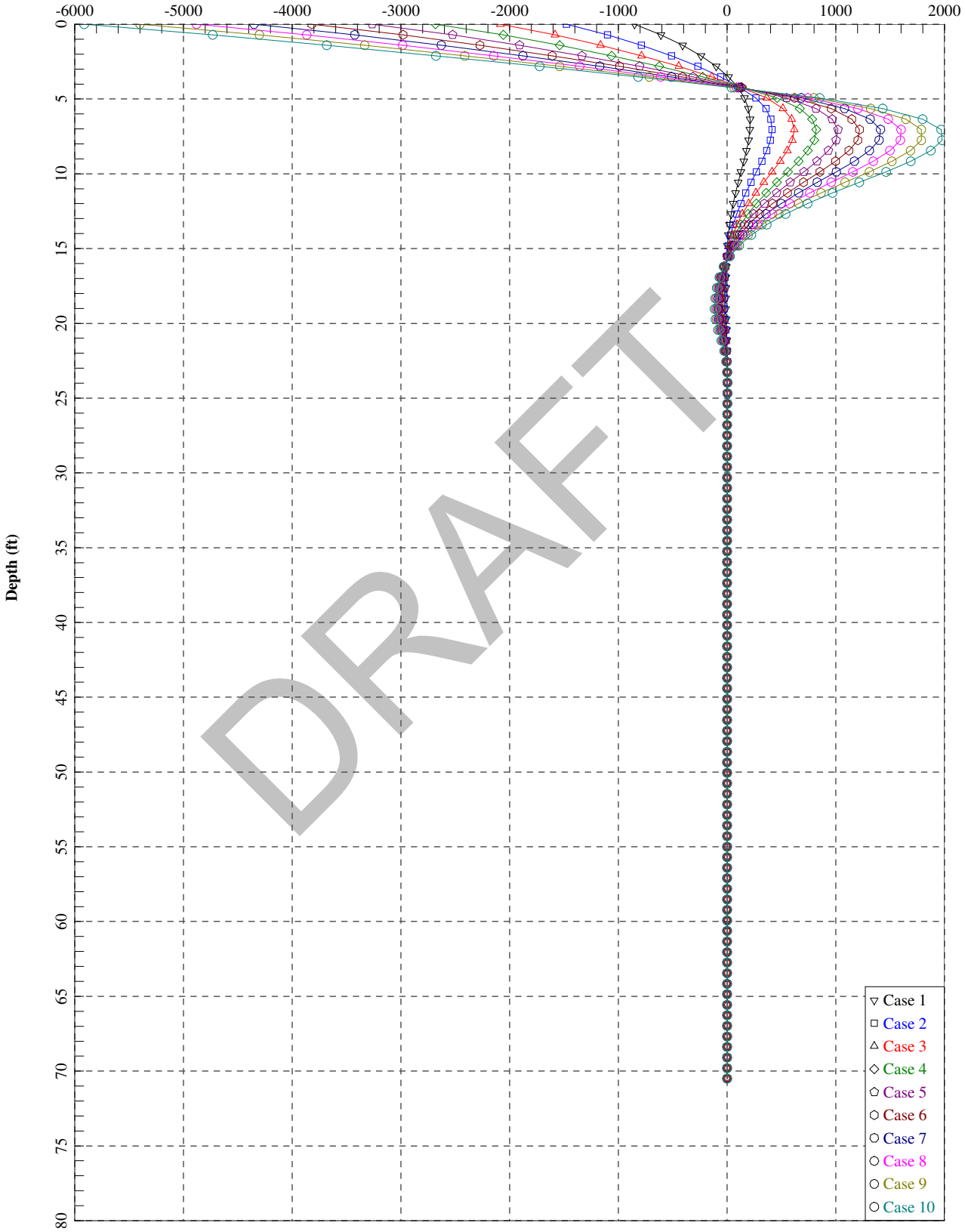
US 101/SR116 SOH (Widen) Bent 4_R-09-013 - Free



US 101/SR116 SOH (Widen) Bent 5_R-09-014 - Fixed

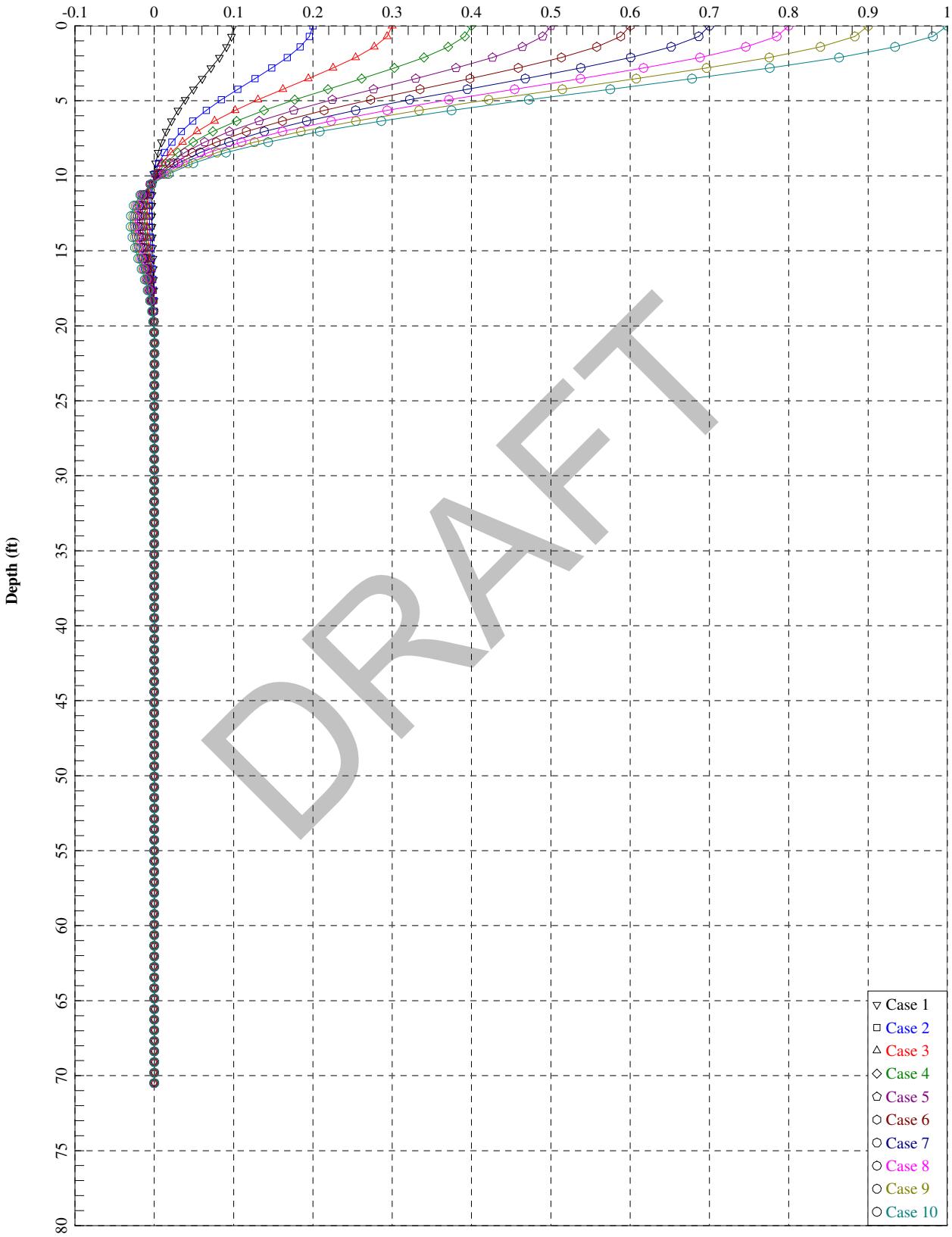
Bending Moment (in-kips)



DRAFT

US 101/SR116 SOH (Widen) Bent 5_R-09-014 - Fixed

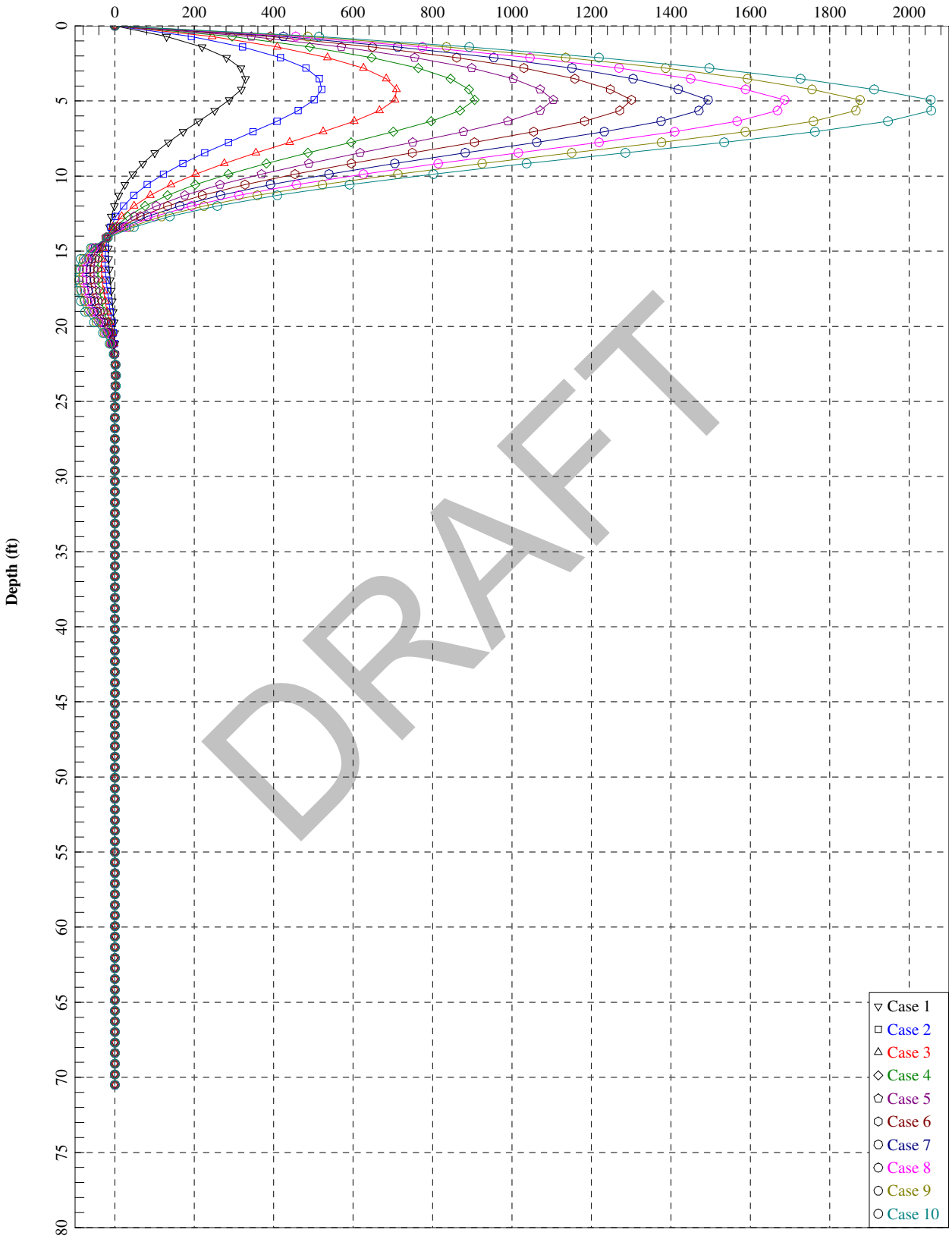
Lateral Deflection (in)



DRAFT

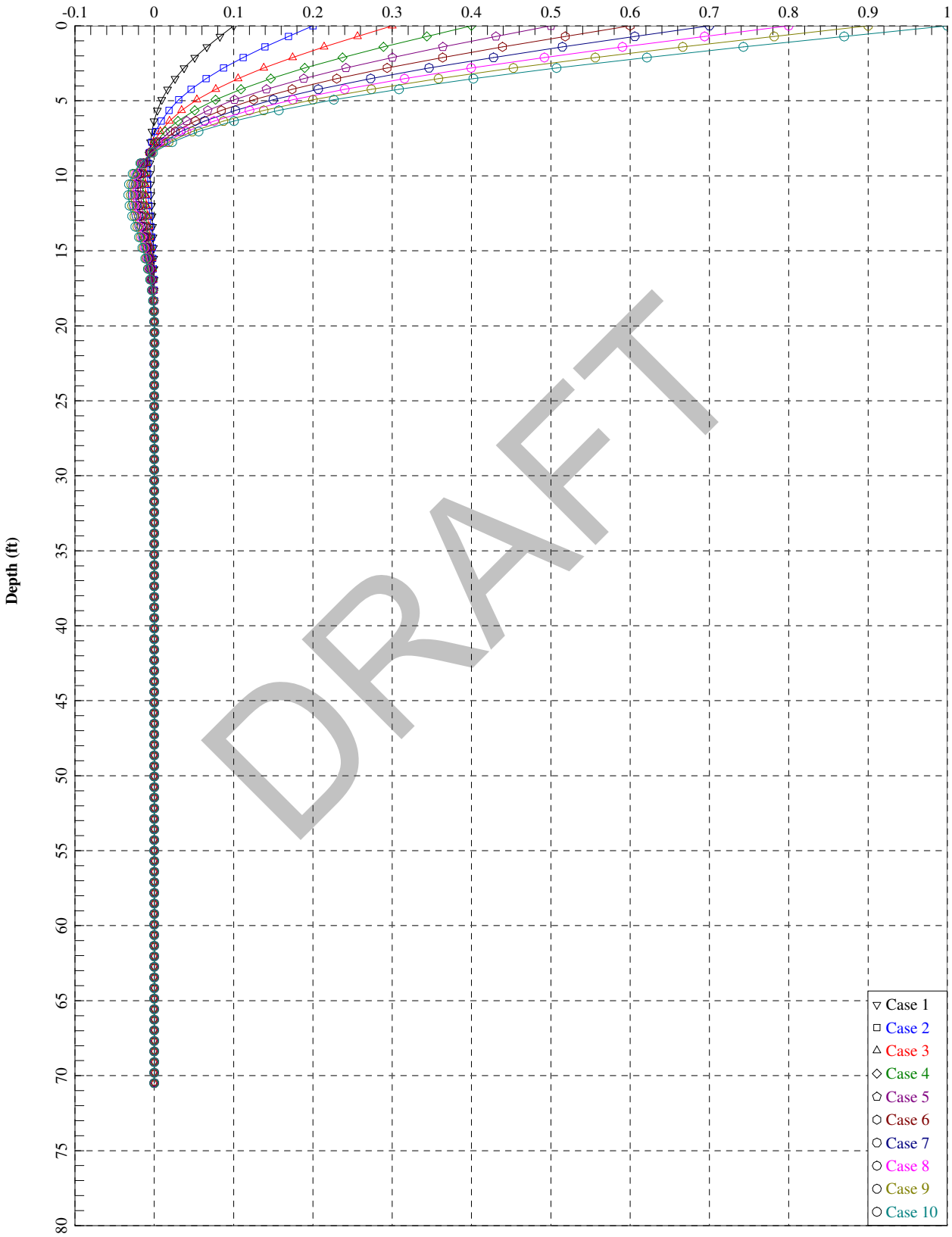
US 101/SR116 SOH (Widen) Bent 5_R-09-014 - Free

Bending Moment (in-kips)



US 101/SR116 SOH (Widen) Bent 5_R-09-014 - Free

Lateral Deflection (in)



US 101/SR116 SOH (Widen) Abutment 6_R-09-105 - Fixed

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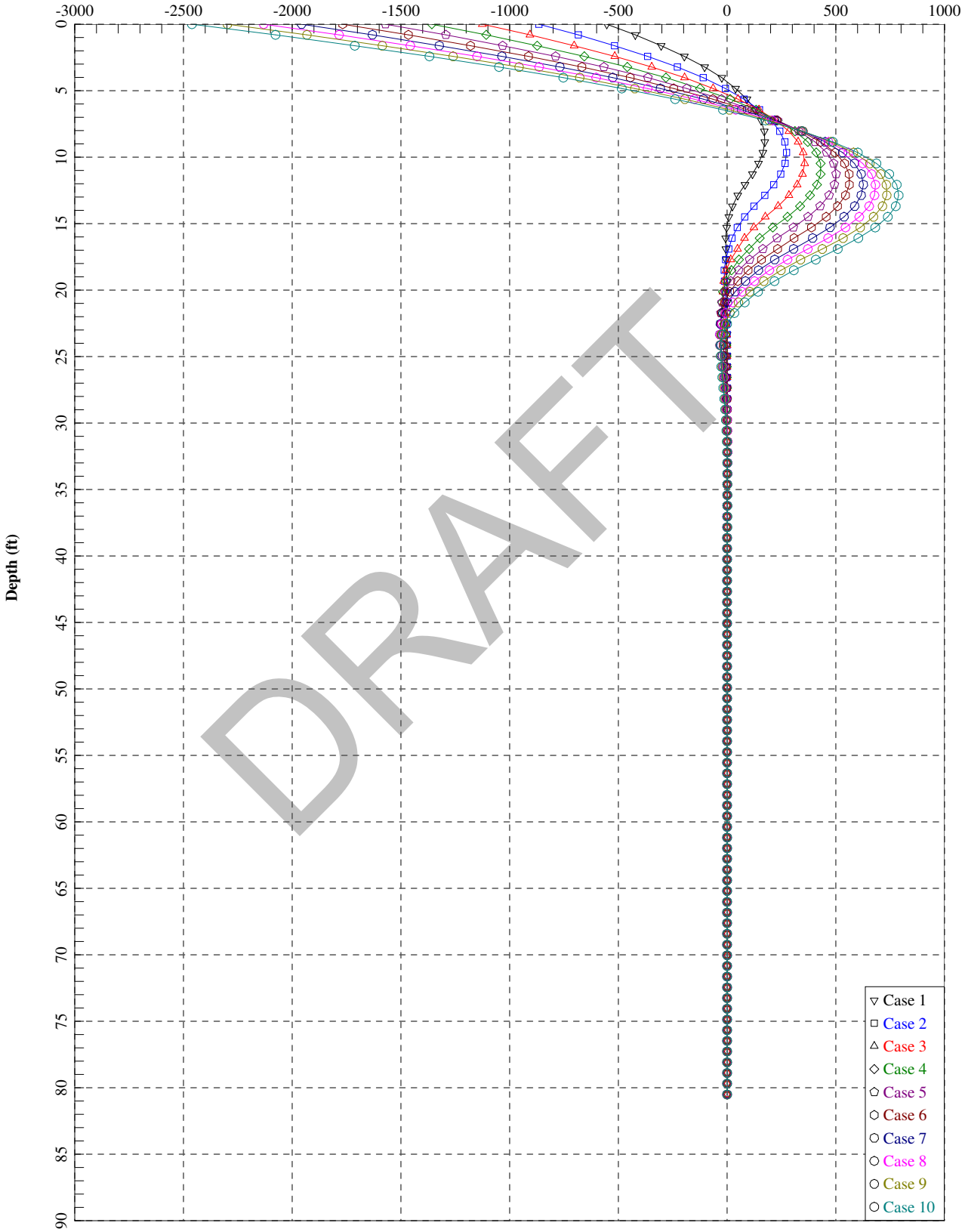

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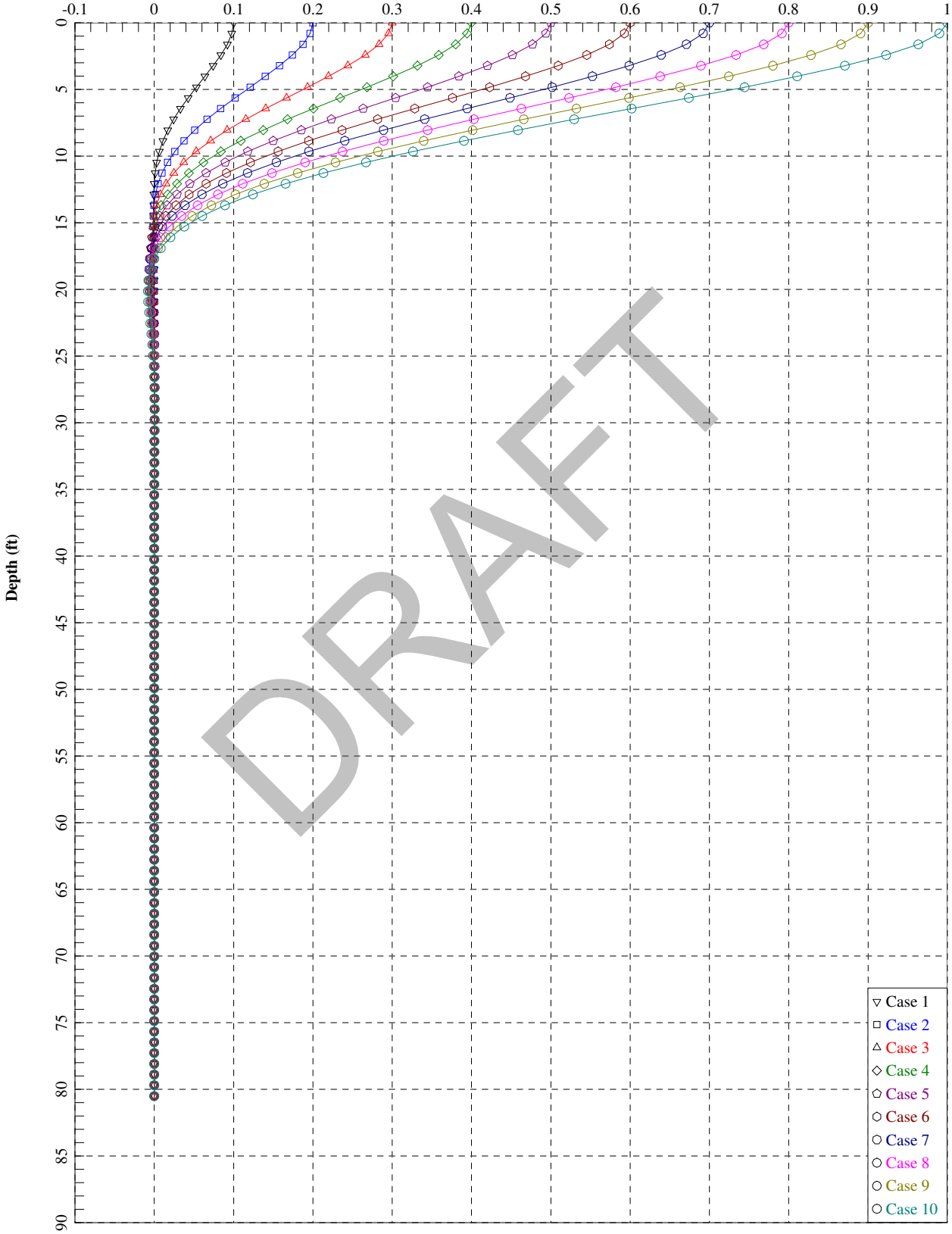
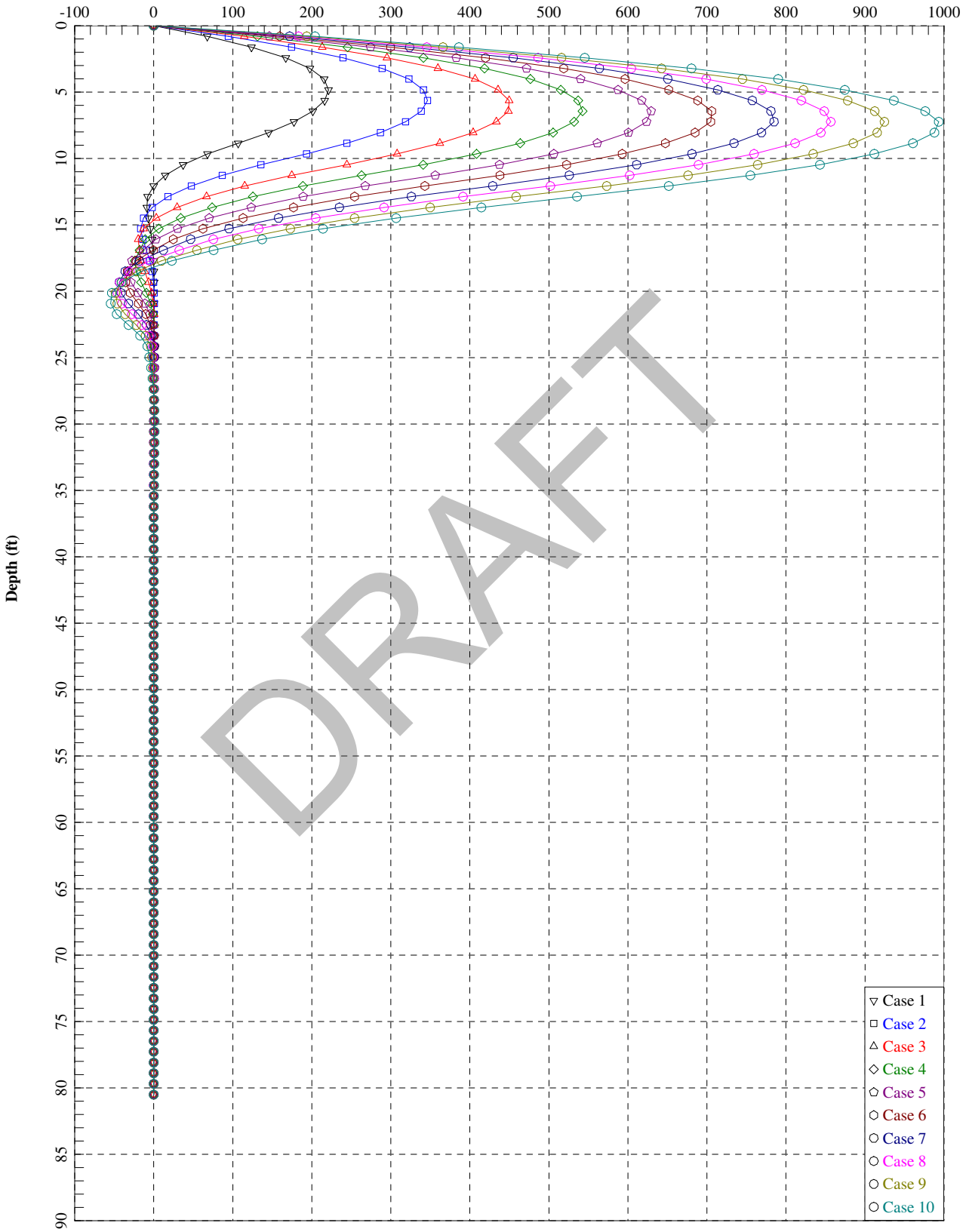


US 101/SR116 SOH (Widen) Abutment 6_R-09-105 - Free

Bending Moment (in-kips)



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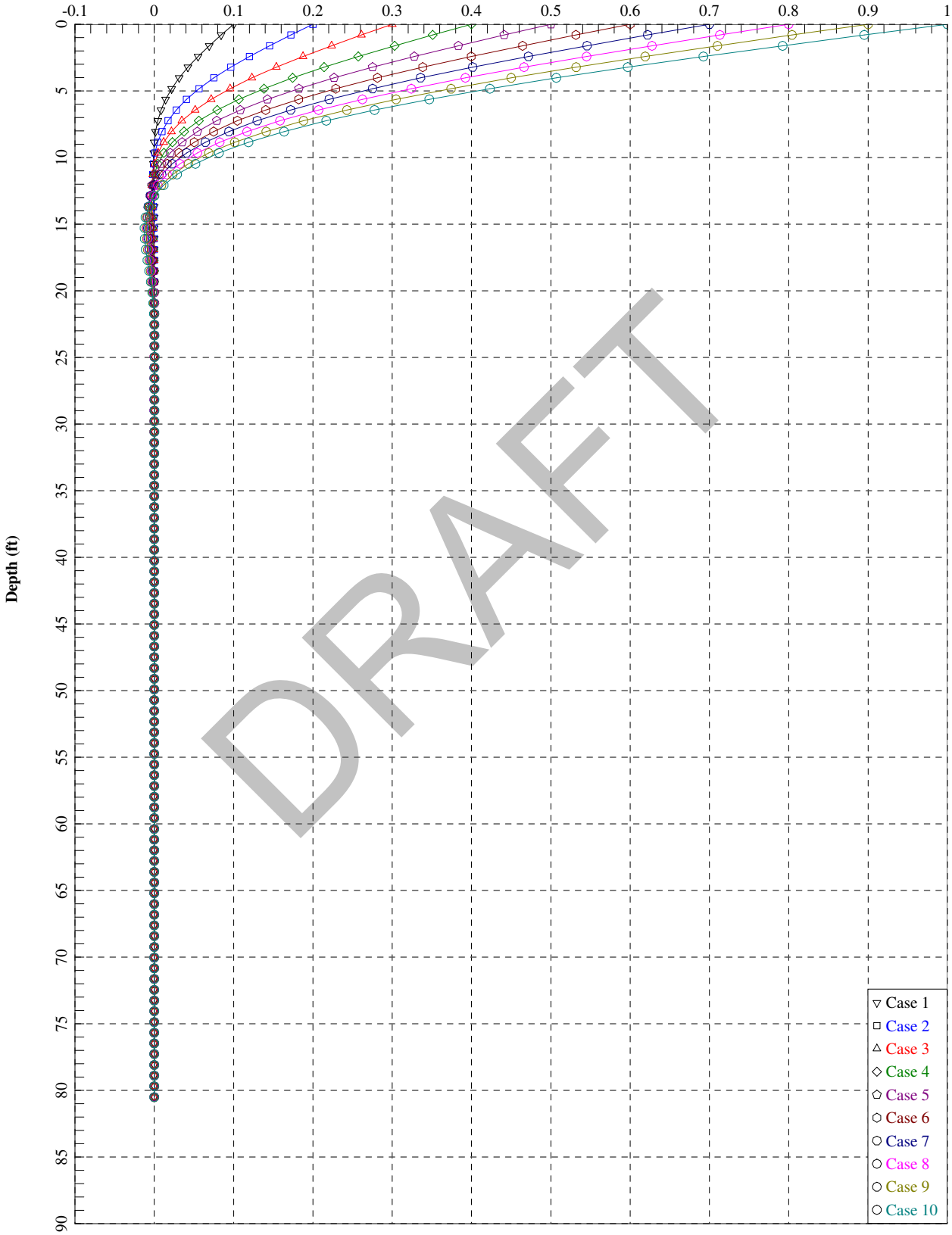
US 101/SR116 SOH (Widen) Abutment 6_R-09-105 - Free

Lateral Deflection (in)



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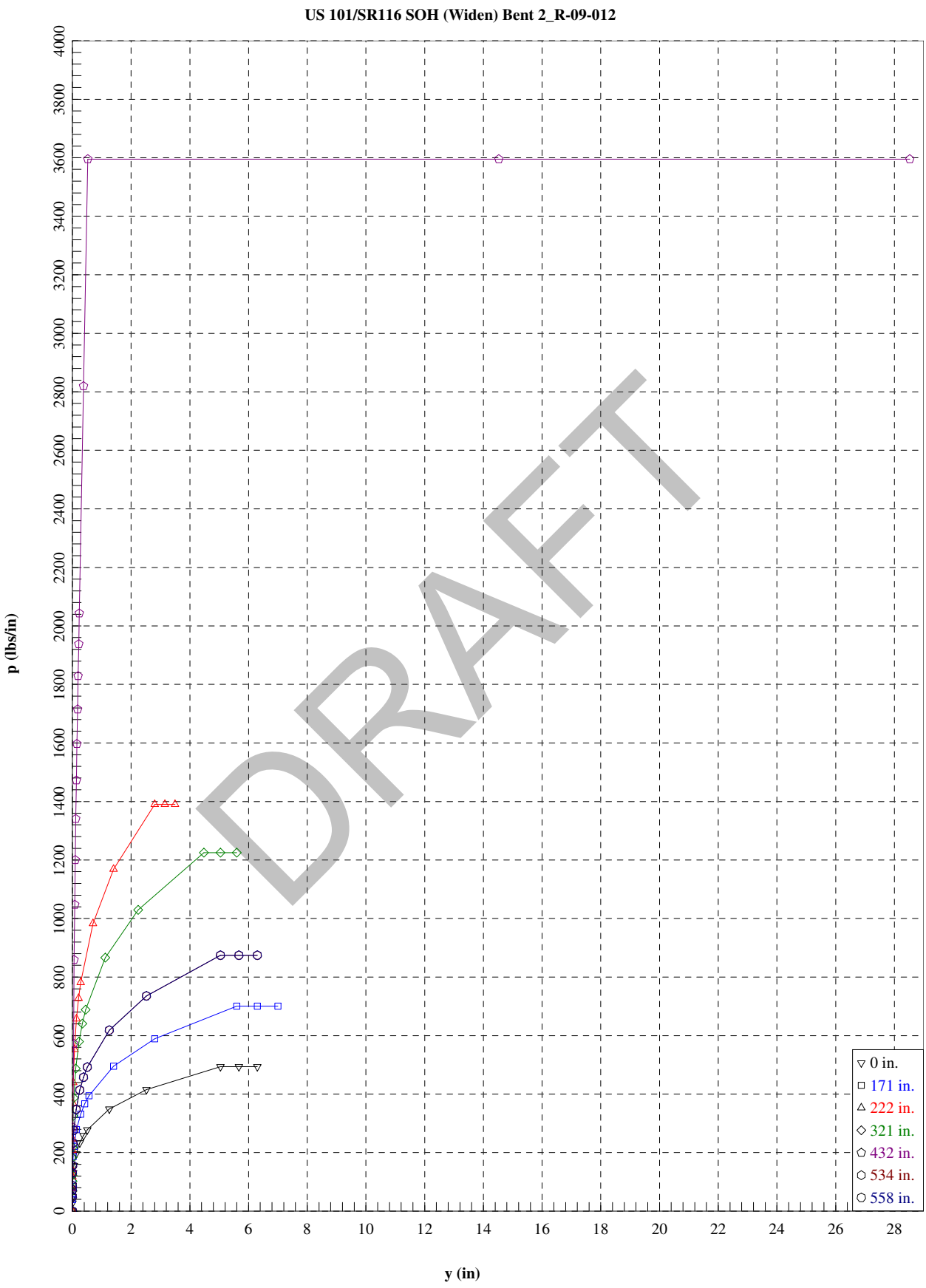
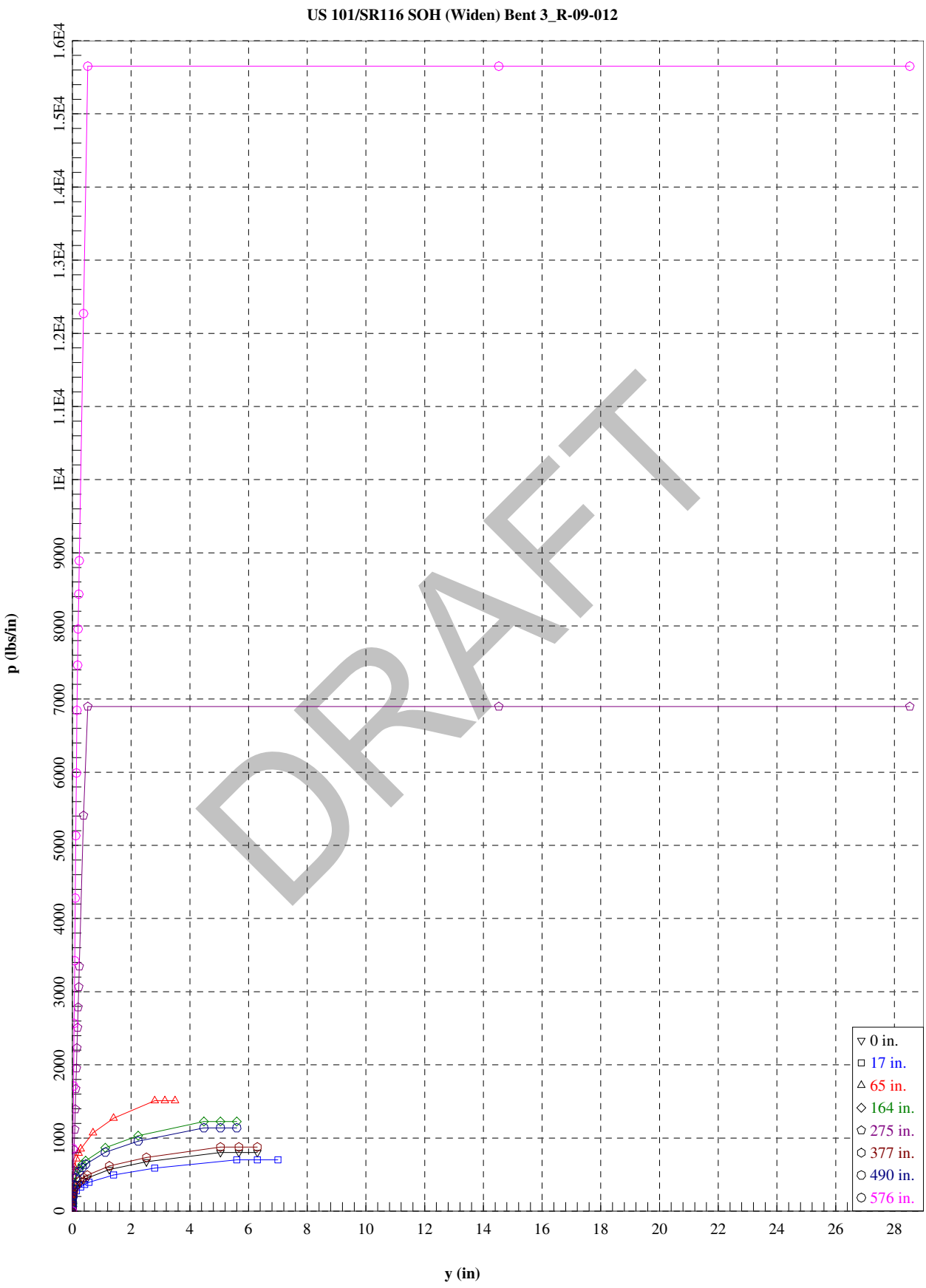
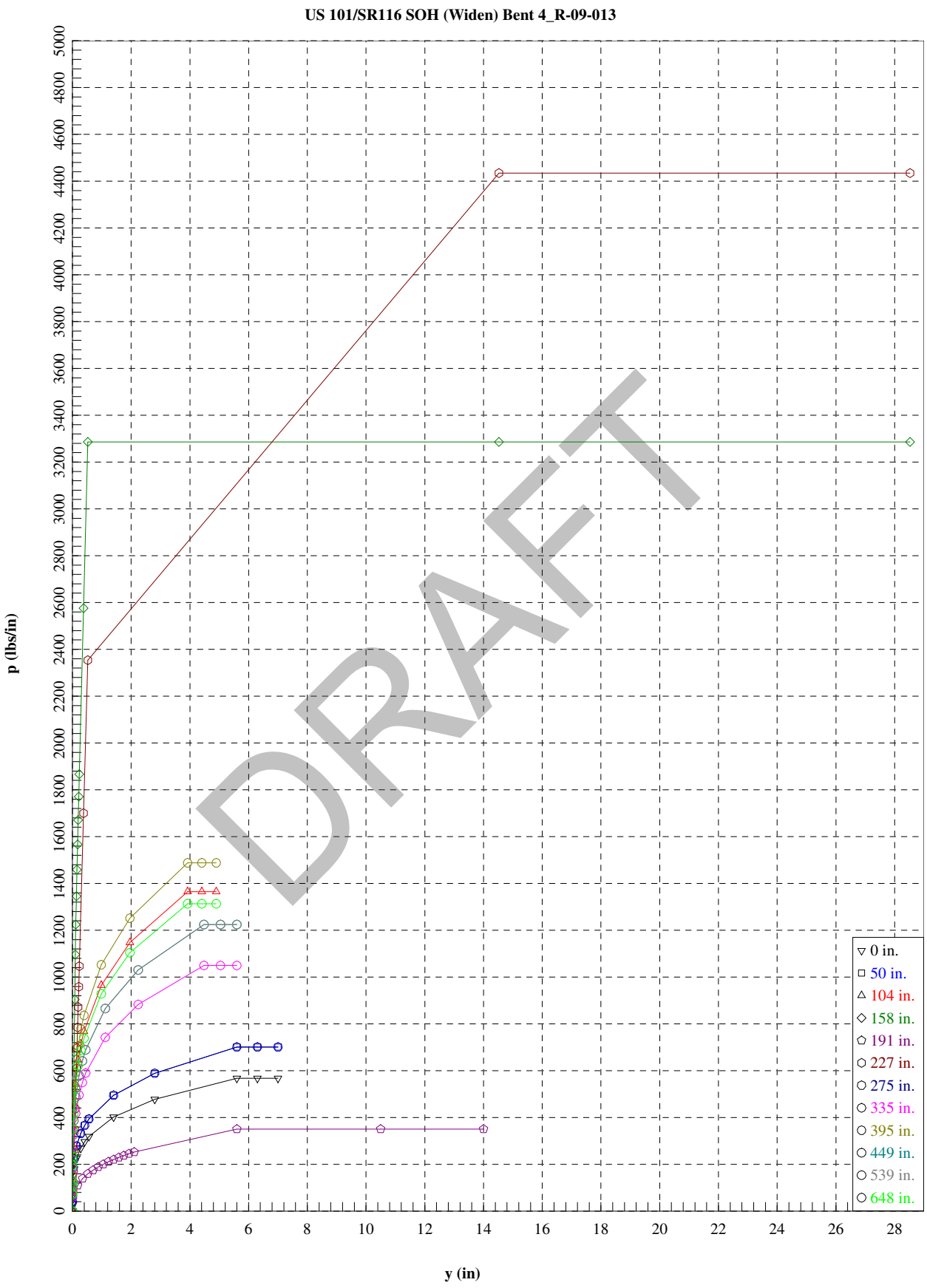

US 101/SR116 SOH (Widen) Bent 2_R-09-012
p (lbs/in)
y (in)
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
0 in.
171 in.
222 in.
321 in.
432 in.
534 in.
558 in.
DRAFT


US 101/SR116 SOH (Widen) Bent 3_R-09-012
p (lbs/in)
y (in)
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
1E4
1.1E4
1.2E4
1.3E4
1.4E4
1.5E4
1.6E4
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
0 in.
17 in.
65 in.
164 in.
275 in.
377 in.
490 in.
576 in.
DRAFT


US 101/SR116 SOH (Widen) Bent 4_R-09-013
p (lbs/in)
y (in)
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200
400
600
800
1000
1200
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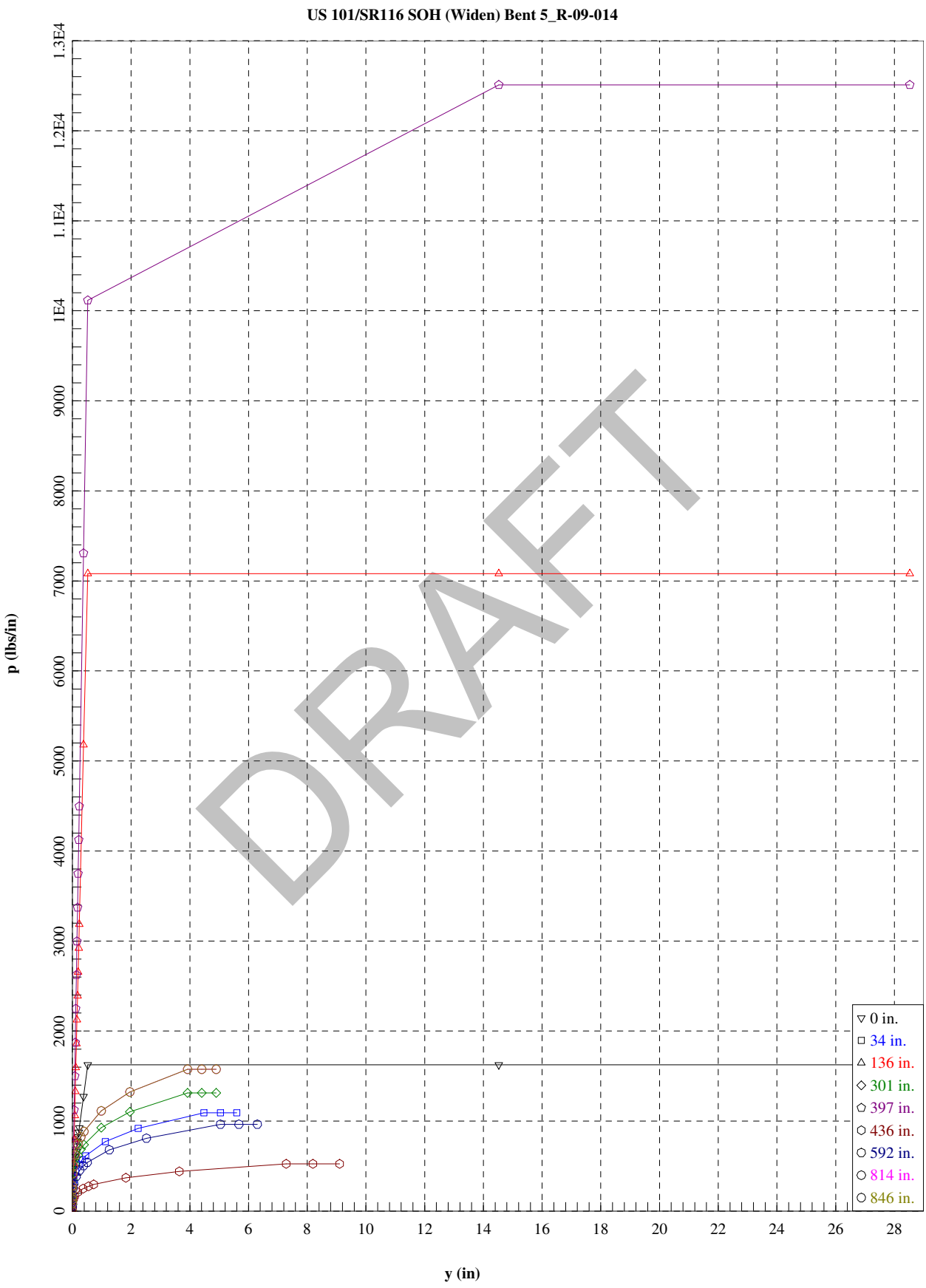
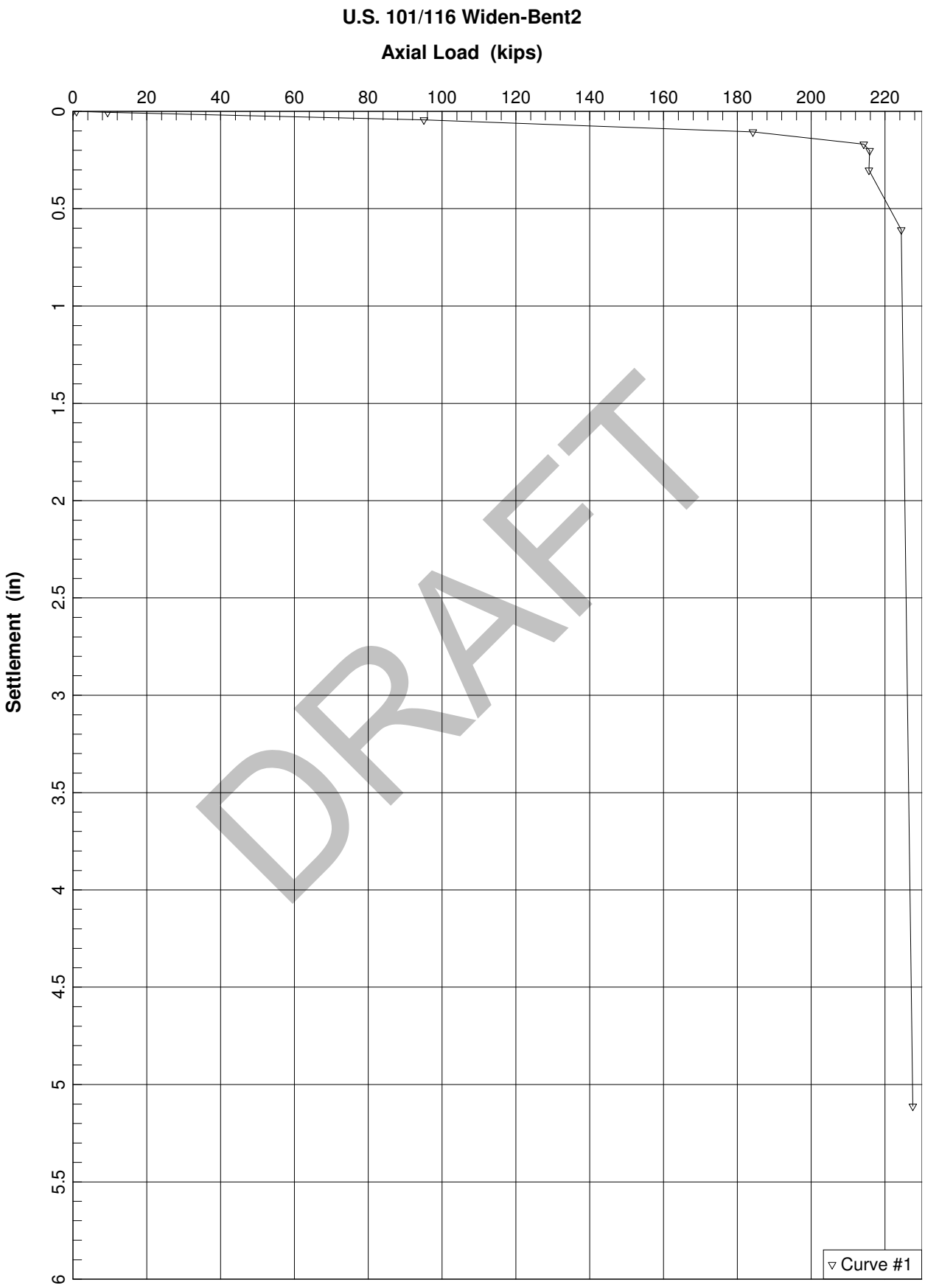
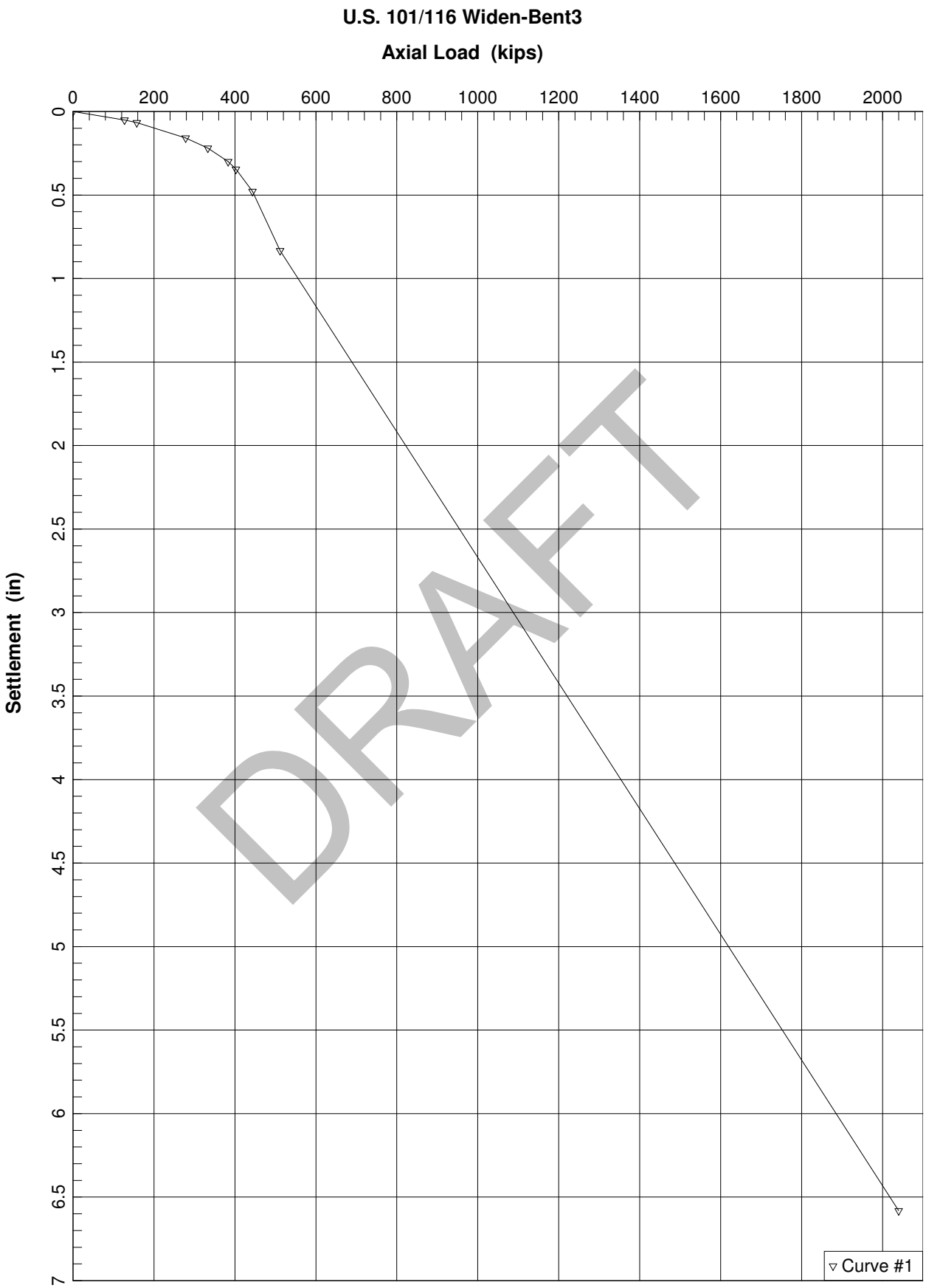
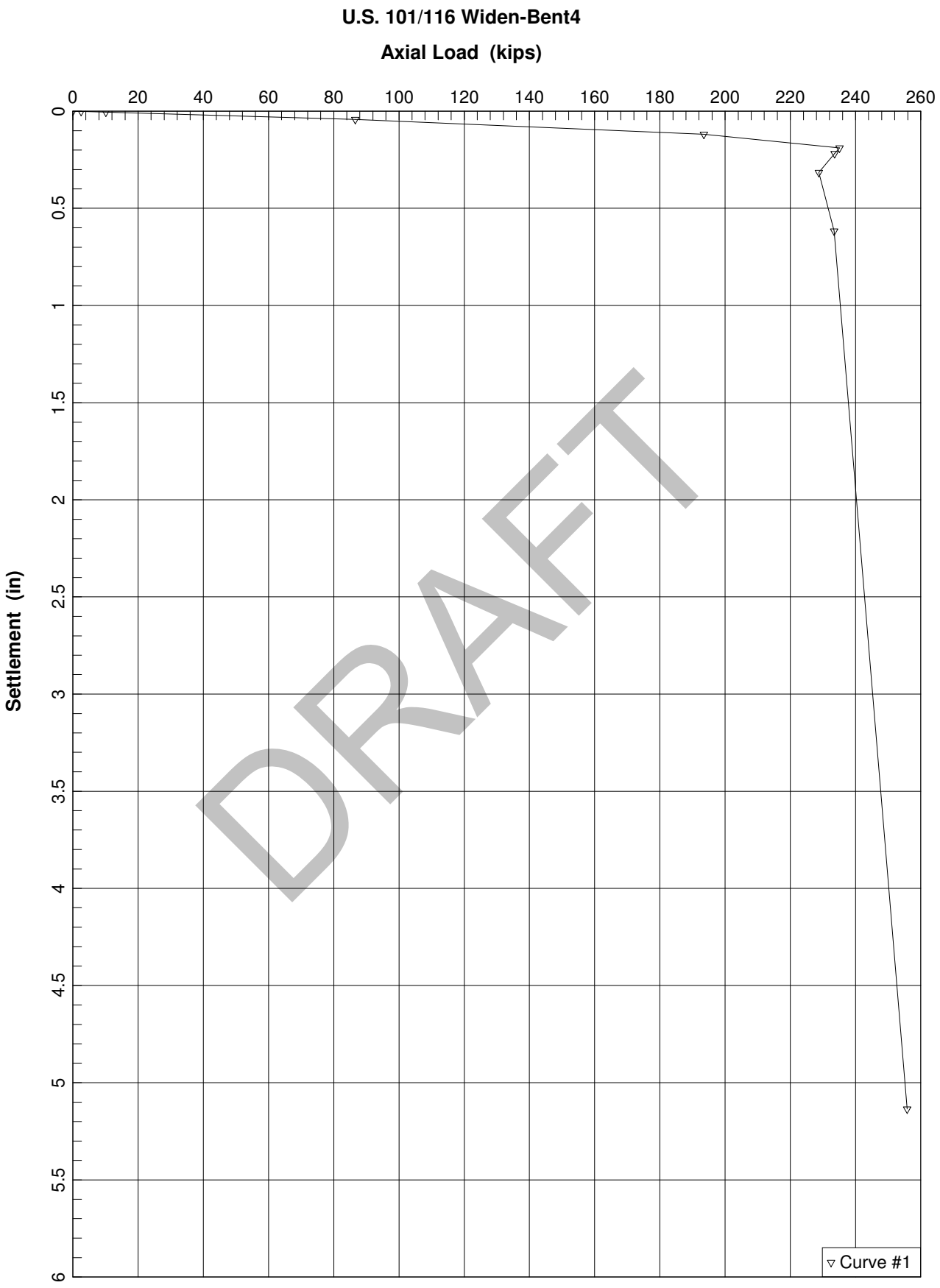
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
4200
4400
4600
4800
5000
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
0 in.
50 in.
104 in.
158 in.
191 in.
227 in.
275 in.
335 in.
395 in.
449 in.
539 in.
648 in.
DRAFT

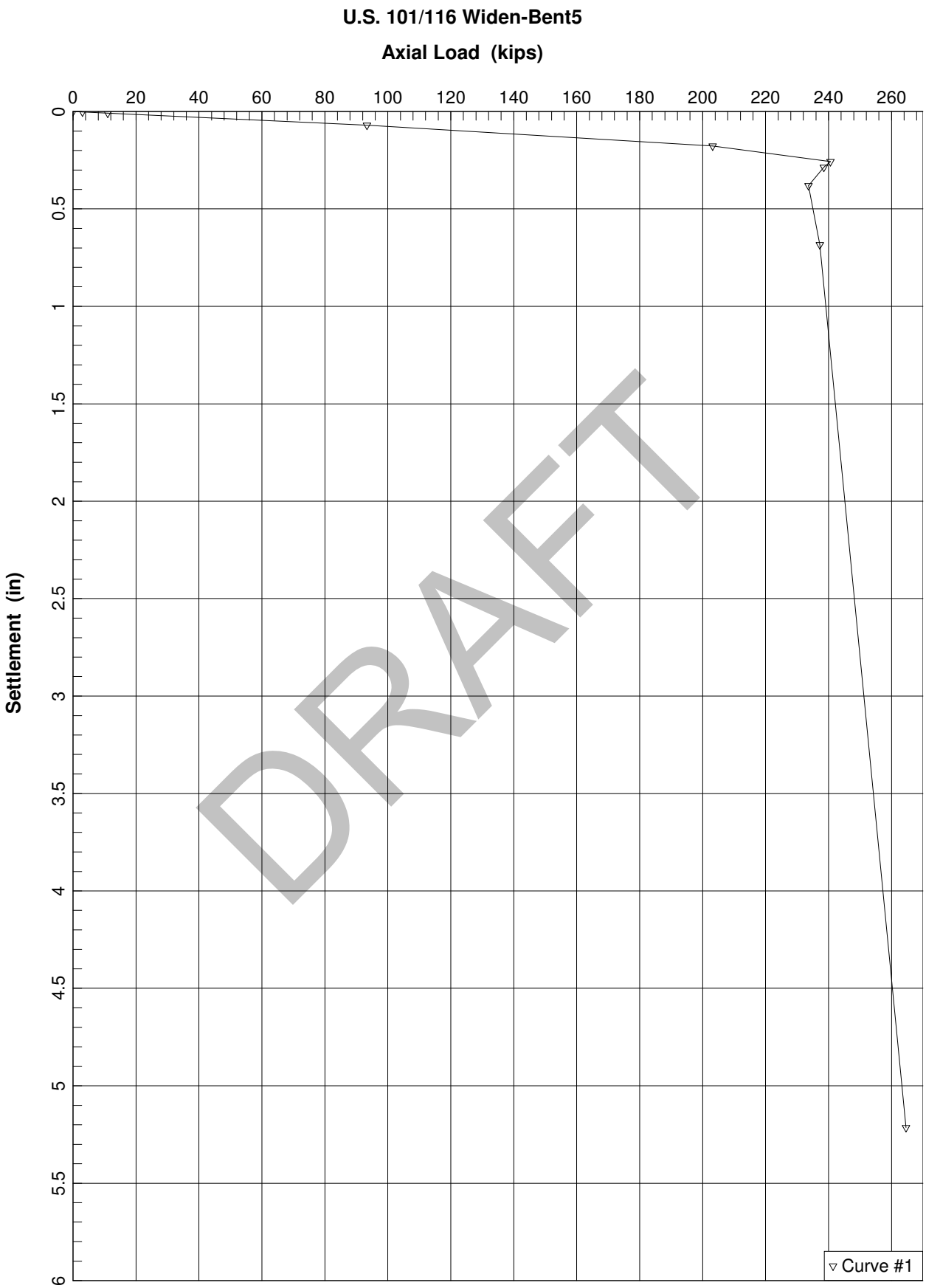

US 101/SR116 SOH (Widen) Bent 5_R-09-014
p (lbs/in)
y (in)
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
1E4
1.1E4
1.2E4
1.3E4
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
0 in.
34 in.
136 in.
301 in.
397 in.
436 in.
592 in.
814 in.
846 in.
DRAFT

DRAFT


U.S. 101/116 Widen-Bent2
Axial Load (kips)
0
20
40
60
80
100
120
140
160
180
200
220
Settlement (in)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
Curve #1
DRAFT


U.S. 101/116 Widen-Bent3
Axial Load (kips)
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Settlement (in)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
Curve #1
DRAFT


U.S. 101/116 Widen-Bent4
Axial Load (kips)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Settlement (in)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
Curve #1
DRAFT


U.S. 101/116 Widen-Bent5
Axial Load (kips)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
Settlement (in)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
Curve #1
DRAFT

DRAFT

OSFP Review Comment & Response Form

General Project Information	Review Phase		Reviewer Information
Dist: 04 EA: 2640C1 **Project Name: MSN B4** **OSFP Liaison: Tracy Bertram** **Phone: 916-227-8379** **e-mail: tracy.bertram@dot.ca.gov**	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection	☐ 65% PS&E Unchecked Details ☒ PS&E (Review No. 1) ☐ Construction Support ☐ Other:FR	**Reviewer Name:M.Zabolzadeh/R.Nashed** **Functional Unit:GDW-GS** **Phone Number: ((510)2864831** **e-mail: Mohammadzabolzadeh@dot.ca.gov** **Date of Review: 12/2/2010**
	Structure Information (Use when necessary to document comments by individual structure) **Structure Name: 101S/116 SOH (Widen)** **Br No: 20-0284L**		

Consultant Information (to be filled in by Consultant)

Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
1	FR	N/A	FR prepared by URS Corporation dated 9/2/2010.	No comment.	
2	FR	Section 3.1.1	All our comments dated May 28, 2010 have been addressed.	No comment.	
3	FR	N/A	C1- Approved as submitted.	No comment.	

DRAFT

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

OSFP Review Comment & Response Form

General Project Information	Review Phase	Reviewer Information
Dist: 04 EA: 2640C1 **Project Name: Petaluma River Bridge** **OSFP Liaison: Tracy Bertram** **Phone: 916-227-8379** **e-mail: TracyBertram/HQ/Caltrans/CAGov**	☐ PSR/PDS (Review No.) ☐ APS/PSR (Review No.) ☐ APS/PR (Review No.) ☐ Type Selection ☒ 65% PS&E Unchecked Details ☐ PS&E (Review No.) ☐ Construction Support ☐ Other:FR **Structure Information** (Use when necessary to document comments by individual structure) **Structure Name: U.S. 101/SR116 SOH (Replace** **Br No: 20-0284L**	**Reviewer Name:M.Zabolzadeh/R.Nashed** **Functional Unit:GDW-GS** **Phone Number: ((510)2864831** **e-mail: Mohammadzabolzadeh@dot.ca.gov** **Date of Review: 5/28/2010**

Consultant Information (to be filled in by Consultant)

Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
1	FR	N/A	FR prepared by URS Corporation dated 4/19/2010.		
2	FR	Section 3.1.1	The second and the third paragraphs " The north abutment of the Petaluma……the south abutment of the Petaluma River Bridge" should be moved under **"Local Geology"** section.	Will modify.	
3	FR	Section 3.1.1	The statement "the southern abutment (abutment 1)" should replace "The north abutment of the Petaluma River Bridge"statement. This to be more specific to the job under study.	Will revise.	
4	FR	Section 3.1.1	Add the following statement: "The northern abutment (abutment 6) is underlain by Holocene Bay Mud deposits.	Will add statement.	
5	FR	Section 3.1.3	It should be noted that this report	Will modify.	

DRAFT

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RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

			dedicated to widening part of 101/SR 116 SOH, <u>not to replace</u> part of the project. All discussion should be about widening part.		
6	FR	Section 3.1.3	The borings list should be omitted from this sector, since it is repeated properly under "Field Exploration" section.	Will revise.	
7	FR	Section 3.2.4	As–built Boreholes (drilled in 1952) No. B2, B3, B7 and B8 should be taken into consideration and described in subsurface conditions.	As-built boring information has been incorporated in the evaluation of the subsurface conditions. Will add reference to 1952 boring data in updated report.	
8	FR	Appendix E	Why are Rte. 101/116 SOH LEFT (Replace) sheets included in this report, which are specified in the widening portion?	Will replace with appropriately labeled structure sheets.	
9	FR	Figure 2-2	Figure 2-2 shows the use of SDC version 1.4. This is an old version. Use the new version 1.5.	Will update.	
10	FR	N/A	C3- Not approved. Resubmitted to GS is required.		
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					

DRAFT

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

OSFP Review Comment & Response Form

General Project Information	Review Phase		Reviewer Information
Dist: 04 EA: 2640C1 **Project Name: 101/116 Separation & OH (Widen)** **OSFP Liaison: _____** **Phone: _____** **e-mail: _____**	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☒ Type Selection	☐ 65% PS&E Unchecked Details ☐ PS&E (Review No. _) ☐ Construction Support ☐ Other: Borings Work Plan	**Reviewer Name: M.Zabolzadeh/ R. Nashed** **Functional Unit: GS-GDW** **Phone Number: ((510)2864831** **e-mail: Mohammad.abolzadeh@dot.ca.gov** **Date of Review: 11/2/09**
	Structure Information (Use when necessary to document comments by individual structure) **Structure Name: _____** **Br No: 20-0284L**		

Consultant Information (to be filled in by Consultant)

Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date
_____	_____	_____	_____	_____

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
1	TS	General	Geotechnical Report including the geologic setting, rock units covering the project area, the subsurface conditions and the boreholes logs should be attached as an Appendix to the Type Selection Report.	Will be included in geotechnical foundation report.	
2	TS	Pag. 15 **4.0 Geology and Geotechnical Recommendations**	Insufficient – the subsurface conditions, foundation materials and groundwater elevation should be discussed	More details will be included in geotechnical foundation report.	
3		Page 9 Section 3.2.5	Recommends driven precast prestressed concrete piles. Explain your Reasoning for this recommendation. Also, other types of piles considered for this project should be discussed.	Recommendation for driven precast prestressed concrete pile and other types of piles considered are provided in the Preliminary Foundation Report, dated August 2009.	
4					
5					
6					
7					

DRAFT

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

04-SON-101, PM2.5/4.1
EA#04-2640C4
MAY 20, 2011

FOUNDATION REPORT

RETAINING WALL 293
PETALUMA, CALIFORNIA

Prepared for
Sonoma County Transportation Authority
490 Mendocino Avenue, Suite 240
Santa Rosa, CA 95401

URS

100 West San Fernando Street, Suite 200
San Jose, California 95113

Project No: 28645045

May 20, 2011 File No.04-SON-101-PM 2.5/4.1
Project 28645045 EA 2640C4 CU 04

Mr. Guy Preston
Project Manager
Sonoma County Transportation Authority (SCTA)
490 Mendocino Avenue, Suite 240
Santa Rosa, CA 95401

Subject: **Foundation Report**
Retaining Wall No. 293
U.S. 101 Marin Sonoma Narrows-Contract 4 (MSN B4)
Petaluma, California

Dear Mr. Preston:

URS has completed the accompanying Foundation Report for the proposed retaining wall in the City of Petaluma, California. The report was prepared in accordance with Caltrans Guidelines for Foundation Investigation Reports, Version 2.0, updated December 2009.

The Foundation Report presents our engineering opinions and recommendations regarding the geotechnical factors influencing the design and construction of the proposed retaining wall. The opinions and recommendations have been based upon the results of our field investigation, laboratory testing, engineering judgment and local experience. Mr. Madhu Thummaluru, P.E., performed the engineering analysis and assisted with the preparation of this report. Mr. Mark Schmoll, C.E.G, prepared the site geology and geologic hazards portion of this report.

If any questions should arise, or if we can be of further service, please contact the undersigned at (408) 297-9585.

Sincerely,

Jose I. Landazuri,G.E. 501
Geotechnical Task Leader

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1.1 GENERAL

The Marin Sonoma Narrows (MSN) HOV Widening project proposes to add high occupancy vehicle (HOV) facilities to U.S. 101 from the junction of State Route 37 (SR 37) in the City of Novato to just north of the Corona Road Overcrossing in the City of Petaluma, a distance of approximately 16 miles. The project has been divided into three main segments. Segments A and C consist of the existing freeway in the cities of Novato and Petaluma, respectively. Segment B is the existing expressway between the two cities. Retaining Wall No. 293 will be located in segment B4, which is part of Segment B.

The planned improvements in Segment B4 include the following structures:

- U.S. 101/SR 116 SOH Left (Widen) – the recently constructed (completed in 2007) five span structure will be widened by 24 feet along the eastern edge of the deck
- U.S. 101/SR 116 SOH Right (Replace) – the existing four span structure (constructed in 1955) will be replaced
- Petaluma River Bridge (Replace) – the existing nine span twin-structure (constructed in 1955) will be replaced
- Retaining Wall (RW152) along NB 101 – the new retaining wall along the eastern edge of NB 101
- Retaining Wall (RW168) along NB 101 – the new retaining wall along the eastern edge of NB 101 will connect to the new Petaluma River Bridge
- Retaining Wall (RW180) along SB 101 – the new retaining wall along the western edge of SB 101 will span from the new Petaluma River Bridge to the end of existing retaining wall
- Retaining Wall (RW179) along NB 101 – the new retaining wall along the eastern edge of NB 101 will connect the new Petaluma River Bridge with the new U.S. 101/SR 116 SOH Right structure
- **Retaining Wall (RW293) along northbound on-ramp to U.S. 101 from SR 116**
- Sound Wall (SW297) along NB on-ramp – the new sound wall along northbound on-ramp to U.S. 101 from SR116
- Sound Wall (SW211) along NB 101 – the new sound wall along the eastern edge of NB 101.

The subject of this foundation report (FR) is the construction of the proposed Retaining Wall (RW293), located in Petaluma, California. Figure 1-1 shows the location of the project site relative to the U.S. 101 MSN-B4 Project alignment and the approximate location of RW293. Please note that figure numbers used in the report corresponds to the specific sections.

1.2 SCOPE OF INVESTIGATION

The geotechnical services performed for the RW 293 were as follows:

- Reviewed construction plans for existing bridge and available subsurface data
- Site geologic reconnaissance
- Geotechnical field investigation including auger boring A-09-101 and CPT-09-102
- Conducted laboratory testing to estimate pertinent engineering properties
- Design recommendations and opinions were developed for the following topics:
  - Class 90 concrete piles
  - Resistance to lateral loads
  - Retaining wall backfill settlement
  - Earthquake information consistent with Caltrans Response Spectra Design Techniques
  - Assessment of the potential for earthquake induced liquefaction, settlement, and lateral spreading
  - Corrosion testing and analysis
  - Construction Considerations

1.3 CALTRANS REVIEW COMMENTS

We reviewed the comments prepared by Caltrans for the RW 293 dated May 25, 2010 and December 2, 2010. The review comments and our responses are presented in Appendix J.

2.1 RETAINING WALL NO. 293 (RW 293)

Five retaining walls and two sound walls are planned in addition to the bridge structures. All retaining walls are planned to be standard Caltrans Type I walls on spread footing foundations except RW 293 which will be supported on piles. The approximate locations of the proposed structures are shown on the Project Vicinity Map, Figure 1-1.

RW 293 will retain new fill constructed to raise and widen the northbound U.S. 101 on-ramp from SR 116. The wall will be located along the eastern side of the on-ramp between 'R6' line Stations 293+30 and 297+13.07 for a total length of approximately 408 feet. The retaining wall will range from 8 to 14 feet in height, and will be located approximately 300 feet east of the U.S.101/SR116 bridge north abutment. A 12-foot high sound wall is planned on top of Retaining Wall 293. Bottom of footings are anticipated to range from about Elevation 5.0 to 12.0 feet. The profile, elevation, typical section, and pile layout drawings for RW 293 are shown in Figures 2-1, 2-2 and 2-3.

3.1 GEOLOGIC SETTING

3.1.1 Regional Geology

The project is located along the western margins of the Petaluma Valley within the central portion of the Coast Ranges geomorphic province of California. Northwest-southeast-trending valleys and ridges characterize the regional morphology of the Coast Ranges province. These topographic features are controlled by folds and faults that resulted from the collision of the Farallon and North American plates and subsequent predominantly strike-slip faulting along the San Andreas fault system between the Pacific and North American plates. Regional geologic mapping shows the project alignment to be underlain by manmade fill, Holocene Bay Mud deposits, Holocene alluvial fan deposits, Tertiary age volcanic rocks, and Jurassic-Cretaceous age Franciscan Complex rocks (Wagner et al, 2000; Armstrong, 1980). The Regional Geologic Map (Figure 3-1) shows the approximate areal extent of these various geologic units.

3.1.2 Regional Tectonic Setting and Seismicity

The project alignment lies between known active and potentially active geologic faults. In general, earthquakes occur as a result of movement along active faults. For the purpose of activity classification, faults are generally grouped into the following categories by the California Division of Mines and Geology (renamed the California Geological Survey, CGS) (Jennings, 1994):

- Holocene: displacement has occurred within the last 10,000 to 11,000 years.
- Late Quaternary: displacement has occurred within the last 700,000 years, but evidence of Holocene activity is lacking.
- Quaternary: evidence of displacement within the last 1.6 million years, but evidence of Holocene activity is lacking.
- Pre-quaternary: no recognized evidence of displacement in the last 1.6 million years.

Generally, faults with Holocene movement are considered to be “active” while faults with late Quaternary to Quaternary movement are considered to be “potentially active”.

The closest active faults to the project alignment are the Rodgers Creek-Healdsburg fault, San Andreas (north) fault, the northern end of the Hayward fault and the Maacama-Brush fault (Merriam and Shantz, 2007). The nearest potentially active fault is the Late Quaternary Tolay fault located 2.3 miles northeast of the site. The California Geological Survey (2000) has produced maps showing Alquist-Priolo Earthquake Fault Zones along faults with known Holocene activity that pose a potential surface faulting hazard. With the exception of the Tolay fault, all of these faults are included as Alquist-Priolo (A-P) zoned faults. The Rodgers Creek-Healdsburg fault is located about 4.6 miles northeast of the site and the San Andreas (north) fault is located about 15.8 miles southwest of the project alignment. More distant active faults include the north end of Hayward fault located about 18.6 miles southeast of the site, and the Maacama-Garberville fault (referred to as the Maacama-Brush fault on the Caltrans Seismic map by Mualchin, 1996) located about 21.5 miles northeast of the site. Figure 3-2 shows active faults within the site region relative to the project. The project alignment does not cross any mapped A-P zoned faults.

The site is within an area of high seismic activity. The major active faults extending through the region have the potential of generating damaging earthquakes. There is a potential that the site will be subject to moderate to strong seismic ground shaking one or more times during the life of the project. The nearest significant earthquake epicenter to the site was the 1969 Santa Rosa earthquake series on the Rodgers Creek-Healdsburg fault. Other large magnitude historic earthquakes have occurred on the San Andreas fault and the Hayward fault.

3.1.3 Local Geology

The north abutment of the SR 116 bridges are made of man-made fill constructed on the underlying Bay Mud and alluvial fan deposits. Man-made fill also underlies the Northwestern Pacific railroad tracks and SR 116 including the on-ramps and off-ramps to U.S. 101. Holocene alluvial fan deposits underlie portions of the Bay Mud deposits, south of the alignment of Retaining Wall (RW) 293. The "bedrock" that underlies the alluvial fan deposits and portions of the Bay Mud is the Jurassic-Cretaceous age Franciscan Complex. This unit is mapped by Wagner, et al. (2000) as schist and phyllite; however, based on review of the 2009 URS borings, the existing Caltrans LOTBs and site geologic mapping, this unit appears to be composed mainly of mélange consisting of tectonic mixtures of sheared shale, greenstone, greywacke and serpentinite with scattered blocks of blueschist. A geologic map of the site by Wentworth (1997) shows this area as mélange. The only surface outcrops of the Franciscan Complex rocks occur near the south abutment of the Petaluma River Bridge, about half a mile north of RW 293.

The exploration completed for RW 293, U.S. 101N/SR116 SOH (Replace/Widen) and available LOTBs were reviewed to characterize the subsurface conditions along the project alignment. The soil profile for RW293 consists of alluvial fan deposits and Franciscan Complex bedrock. Bay mud was encountered in all of the borings completed in 1952, but were absent in two of the three borings completed in 2002 and all borings completed in 2009. The northern limits of Bay Mud as mapped by Wagner, et al. (2000) and Armstrong (1980), only extend to about SR 116. Alluvial fan deposits range from medium stiff to very stiff lean clay to fat clay and gravelly lean clay and loose to dense silty to clayey sand and poorly graded sand. The alluvial fan deposits extend deeper than Elevation -80 feet. The Franciscan Complex bedrock underlies the alluvial fan deposits. The 1952 borings were terminated a few feet into the bedrock; however, the 2002 borings and 2009 exploration completed for U.S. 101/SR116 SOH (Replace/Widen) were drilled as much as 40 feet into the Franciscan Complex bedrock. The Franciscan Complex was classified as completely to highly weathered in the upper 10 to 25 feet, becoming moderately to slightly weathered below this depth. The top of the moderately to slightly weathered bedrock ranged from about Elevation –50 feet to –80 feet. Bedrock was not encountered in either Boring A-09-101 or CPT-09-102 that were drilled/advanced in 2009 in close proximity to the RW 293 alignment and extended to maximum depth of 80 feet (Elevation -66 feet).

3.2 SITE AND SUBSURFACE CONDITIONS

3.2.1 Site Topography

The proposed RW 293 will be located along the east side of the U.S. 101 on-ramp from State Route 116. The site is located approximately 300 feet east of the U.S. 101/SR 116 bridge north abutment. Existing grade around the retaining wall site near the on-ramp varies from Elevation

+4 feet to +16 feet. An existing drainage facility/ditch, located along the east side of the on-ramp drains into the Petaluma River and runs parallel to the proposed RW 293. Fill soils up to about 5 feet in thickness, appear to be present along the northern section of the wall alignment where ground elevations are greater than about +11 feet.

Development along the project is mixed, including an abandoned quarry west of U.S. 101 and south of Petaluma Boulevard, a park and marina (Hollen Berger Park) located east of U.S. 101 between the Petaluma River and SR 116, and scattered commercial and industrial development both east and west of U.S. 101 and north of SR 116. Open space and farm land are located in the area west of U.S. 101 between the Petaluma River and SR 116.

3.2.2 Field Exploration

A review of the following existing LOTBs was completed to characterize the subsurface conditions along the project alignment.

- Borings B-3 and B-9 completed for the U.S. 101/SR 116 northbound and southbound bridges (Bridge No. 20-284L and 20-155R), dated 1952, completed by Caltrans;
- Borings 01-B-2, 01-B-5 and 01-B-6 completed for the retaining wall located along the west side of southbound U.S. 101 completed by Caltrans in 2001; and

The above explorations included both penetration borings without sampling and rotary wash borings with split spoon drive samples. Borings performed in 1952 were extended to maximum termination depth of 60 feet (Elevation -55 feet). Borings performed in 2001 were extended to maximum termination depth of 111 feet (Elevation -97 feet). Copies of the LOTBs are included in Appendix C.

To supplement available data, URS performed one exploratory Boring, A-09-101, and one cone penetration test, CPT-09-102, to terminal depths of approximately 51½ and 80 feet, respectively. The field exploration was performed on June 8 and 22, 2009. The locations of the borings and CPT are shown on the Site and Boring Location Plan, Figure 3-3, as well as on the LOTB, Appendix A. The LOTBs present descriptions of the soils encountered along with the results of laboratory tests.

A representative of URS supervised the drilling operations and soil sampling. Visual classifications of the soils encountered were made from cuttings and soil samples. The soil samples collected from the boring were labeled and sealed immediately to preserve their natural moisture content. At completion of the exploration, samples were delivered to the laboratory for further examination and testing. The boring was backfilled with a mixture of cement and bentonite in accordance with the requirements of the Sonoma County Health Department. A detailed discussion of the field exploration program is presented in Appendix B.

The Unified Soil Classification System and the guidelines summarizing soil consistency and relative density are presented on the Log of Test Borings (LOTBs) legend in Appendix A – LOTB 1 of 3 and 2 of 3. Descriptions of the soils encountered in the boring and CPT are presented in LOTB 3 of 3. The logging method used in preparing the LOTBs is consistent with Caltrans Soil and Rock Logging, Classification and Presentation Manual, dated June 2007. These logs also illustrate the notation used for the size of samplers and the methods of advancing them.

3.2.3 Laboratory Testing

The water content, dry density, grain size distribution and Unconfined Compressive Strength were determined for selected samples to estimate the strength and compressibility of the underlying soils. The locations of these tests, together with the resistance to penetration of the samplers, are shown at the corresponding locations on the LOTBs. The laboratory test results are provided in tabular form in Appendix B.

3.2.4 Soil Conditions

The subsurface alluvial soil profile at the retaining wall site consists primarily of stiff to very stiff fat clay to a depth of about 15 feet underlain by very loose to medium dense clayey sand and silty and clayey sand to a depth of about 30 feet; the fat clay is consistent with alluvial fan deposits encountered in borings performed in 1952. Fill soils up to about 5 feet in thickness may be present along the northern section of the wall alignment. The sand was underlain by medium to very stiff lean clay and gravelly lean clay to a depth of about 66 feet, underlain by medium dense to dense sand deposits to a depth of about 80 feet, the maximum depth of CPT. The Franciscan Complex bedrock underlies the alluvial fan deposits at a depth greater than 100 feet. Bedrock was not encountered in either Boring A-09-101 or CPT-09-102 that were drilled/advanced in 2009 in close proximity to the RW 293 alignment and extended to a maximum depth of 80 feet (Elevation -66 feet). Based on Boring A-09-101 and CPT CPT-09-102, a generalized soil profile along the alignment is presented in Figure 3-4.

3.2.5 Groundwater

All of the borings from previous studies were completed using rotary wash drilling or wireline coring methods. Groundwater levels were measured in few of the borings from Elevation +1.7 to +9.5 feet. These water level measurements were made in June 1952, December 2001, and September 2002. (The 1952 plan elevations have been converted as follows: NAVD 88 Elevation = NGVD29 Elevation + 2.28)

All of the borings performed in 2009 for the U.S. 101/SR 116 bridge investigations were initially drilled with hollow stem auger and then switched to rotary wash drilling method, thereby precluding a reliable groundwater measurement. Borings R-09-011, R-09-012, R-09-013, and R-09-015 were dry to depths of 19 feet (Elevation +32), 21 feet (Elevation -10), 19 feet (Elevation -9), and 22 feet (Elevation +12), respectively. However, groundwater was encountered in Boring R-09-014 at a depth of 18 feet (Elevation -4).

Groundwater was encountered at depth of 10 feet (Elevation -3 feet) in Boring A-09-101. During the field exploration of the above mentioned 2009 borings, our field personnel observed 6 to 8 inches of standing water in the drainage facility/ditch located to the east of the on-ramp.

Considering the previous measurements, we believe a design groundwater level at Elevation +5 feet would be reasonable for the site.

3.3 GEOLOGIC HAZARDS

3.3.1 Surface Fault Displacement and Ground Shaking

The project alignment does not cross any Alquist-Priolo Earthquake Fault Zones (Hart, 1975). Therefore, surface rupture due to faulting along the alignment is not expected to occur. However, the short distance to nearby active faults including the Rodgers Creek-Healdsburg fault, San Andreas (north) fault, and the northern end of the Hayward fault does create a high risk for ground shaking from fault movement. The intensity of the ground shaking is dependent upon the size of the earthquake, the distance of the epicenter from the site, the direction that the earthquake propagates along the fault, and the site geologic conditions.

3.3.2 Landslide and Slope Failure

The project alignment is on relatively flat ground and is not subject to landsliding. Regional geologic maps by Wagner et al (2000) and Wentworth (1997), as well as the landslide hazard area maps in the Sonoma County Hazard Mitigation Plan (2006), do not show any mapped landslides near the project site.

3.3.3 Scour

No creeks or active channels cross the proposed retaining wall alignment. Therefore, scour is not a potential hazard at the site.

3.3.4 Flooding

The Petaluma River Channel is within a floodplain. Federal Emergency Management Agency (FEMA) defines the area as Zone AE. Zone AE is defined as an area with a 1% annual chance of flooding. With the exception of the active channel of the Petaluma River and the low lying area south of SR 116 below about Elevation +9 feet, the retaining wall alignment is located outside of Zone AE.

3.3.5 Subsidence, Consolidation Settlement and Seismic Compaction

Subsidence typically occurs as a result of subsurface fluid extraction (e.g. groundwater or petroleum) or compression of soft, geologically young sediments. Groundwater extraction for high volume municipal and agricultural use has the potential to cause future ground subsidence in the region. However, we are not aware of subsidence in the area. No active petroleum wells are present within many miles of the site (California Division of Oil, Gas, and Geothermal Resources, 2001).

Settlement can occur when soil is loaded by a structure or by the placement of fill on top of soil. It can occur quickly (elastic deformation) and/or gradually (consolidation) when soil pore pressures, increased by vertical loading, gradually dissipate over time. The Fat and Lean Clay found at the site range from stiff to very stiff and are subject to settlement. The retaining wall fill height will range from 6 to 12 feet. These fills will result in elastic and consolidation settlement of the native clays. We estimate that this settlement will be on the order of 2 to 4 inches, and

that approximately 90 percent of the settlement would occur within 3 months of fill placement assuming the full embankment width is constructed at one time.

Compaction settlement, or seismic densification, occurs when loose granular soils above the water table densify as a result of earthquake shaking. The soil densification can result in differential settlement because of variations in soil composition, thickness, and initial density. At Boring A-09-101 and CPT-09-102, the soils above the groundwater table are primarily cohesive fine soil; therefore, seismic compaction is not expected.

3.3.6 Liquefaction Potential

Liquefaction is a phenomenon whereby sediments temporarily lose shear strength and collapse. This condition is caused by cyclic loading during earthquake shaking that generates high pore water pressures within the sediments. The soil type most susceptible to liquefaction is loose, cohesionless, granular soil below the water table and within about 50 feet of the ground surface. Liquefaction can result in loss of foundation support and settlement of overlying structures, ground subsidence and translation due to lateral spreading, lurch cracking, and differential settlement of affected deposits. Lateral spreading occurs when a layer liquefies at depth and causes horizontal movement or displacement of the overburden mass toward a free face such as a stream bank or excavation, or toward an open body of water.

In a regional study of the nine-county San Francisco Bay region for the U.S. Geological Survey, Witter et al. (2006) mapped the liquefaction susceptibility of the site soils along the project alignment. The alluvial fan and Bay Mud deposits found from the south bank of the Petaluma River and extending north past SR 116 have been mapped as having a “moderate” liquefaction susceptibility (see Figure 3-5). The Sonoma County Hazard Mitigation Plan (2006) shows these deposits as having a “high” liquefaction hazard.

Based on a review of the boring and CPT completed for this study, potentially liquefiable sands were encountered at depths of approximately 8.5, and 15 feet. We estimated the post-liquefaction settlement at CPT-09-102 using the computer program LIQUEFY PRO for a peak ground acceleration (PGA) of 0.6g and design earthquake moment magnitude, **M** 7.0. Based on that analysis, we estimate that total post-liquefaction settlement on the order of 1½ inches could occur. In addition, we analyzed post-liquefaction settlement of the medium dense sand layers encountered in Boring A-09-101 for the same PGA and design earthquake, adjusting the measured driving resistance (blow counts) in the field for hammer type, sampler size, overburden pressure, rod length, and fines content; the magnitude of settlement at this boring location is estimated to be 2½ inches. Copies of these calculations are included in Appendix D. Since ground surface settlement at CPT-09-002 and Boring A-09-101 could exceed ½ inch, downdrag on the Class 90 concrete pile is a design consideration at this location.

3.4 GEOLOGICAL PROFILES AND ENGINEERING PARAMETERS

A generalized soil profile is presented as Figure 3-4 illustrating the layering of various soil strata and summarizing the corresponding geotechnical parameters. It should be noted that this profile was developed based on extrapolation of available data from the borings drilled for this investigation and, therefore may differ from actual conditions. Engineering soil parameters

presented on the profile were selected from laboratory test results as well as engineering judgment and local experience.

The undrained shear strength, relative density, dry unit weight and moisture content are the engineering soil parameters used in our foundation design and analysis. Particle size analyses were performed for classification of soils. In general, unconfined compression tests were performed on cohesive soil samples to estimate the undrained shear strength. Some disturbance may occur while sampling cohesive soils; therefore unconfined compressive strengths in localized areas can be less than the insitu conditions. Consequently, engineering judgment and local experience were applied in out interpretation of the laboratory test results. The relative density of cohesionless soils was estimated from vertical effective stress and Standard Penetration Resistance, N blows per 1 foot based on correlations developed by Gibbs and Holtz (DM 7.1 – 87, 1986). Where non-standard sampler sizes were used, such as the modified California sampler (2½ inch outside diameter), a correction factor was applied to the observed blows per foot to estimate the Standard Penetration Resistance, N values.

4.1 CORROSION EVALUATION

An assessment of the potential for corrosion of various buried foundation and pipe structures was performed by V&A Consulting Engineers (V&A). The results of their investigation are presented in Appendix E, and summarized below.

4.2 SUMMARY

V&A was retained by URS Corporation to perform a corrosion survey along U.S. 101 and associated ramps, in and near Petaluma, California from 0.4 mile south of Petaluma Boulevard South over crossing to 0.2 mile north of Caulfield Lane overcrossing. The objective was to measure various soil parameters and evaluate the results with respect to possible levels of corrosion at the proposed Retaining Wall site. Corrosivity was evaluated for materials within a depth range of 0 to 30 feet below grade.

The California Department of Transportation, Division of Engineering Services, Materials Engineering and Testing Services, Corrosion Technology Branch has published "Corrosion Guidelines" (Guidelines) to define what constitutes corrosive soil. The Guidelines consider soil to be corrosive to structural elements (steel reinforced concrete) if one or more of the following conditions exist for water or soil samples:

1) The chloride concentration is 500 ppm (mg/kg) or greater,
2) The sulfate concentration is 2,000 mg/kg or greater, or
3) The pH is 5.5 or less.

Also, a minimum resistivity value of less than 1,000 ohm-cm indicates the presence of high quantities of soluble salts and a higher propensity for corrosion. A wide variety of soluble salts are typically found in soils. Two soils having the same resistivity may have significantly different corrosion characteristics, depending on the specific ions available. The major constituents that accelerate corrosion are chlorides, sulfates and the acidity (pH) of the soil. Chloride ions tend to break down otherwise protective surface deposits, and can result in corrosion of reinforcing steel in concrete structures. Sulfates in soil can be highly aggressive to Portland cement concrete by combining chemically with certain constituents of the concrete, principally tricalcium aluminate. The reaction is accompanied by expansion and eventual disruption of the concrete matrix. High concentrations of bicarbonates tend to decrease soil resistivities. Although bicarbonates are not aggressive to concrete, lower resistivity environments can promote corrosion activity.

Acidity, as indicated by the pH value, is another measure of corrosivity. The lower the pH (the more acidic the environment), the higher will be the corrosivity with respect to buried metallic and concrete structures. As pH increases above 7 (the neutral value), conditions become increasingly more alkaline and passive to buried structures.

Evaluation of the in-situ soil environment was made in terms of potential damage to structures due to corrosion. Soil resistivity measurements were conducted in the field during the initial stages of the work. In addition, soil samples collected by URS during the geotechnical investigation were forwarded to Cooper Testing Laboratory in Palo Alto, California for chemical analysis. The soil samples were analyzed for minimum resistivity, pH, water soluble chloride ion concentration, and water soluble sulfate ion concentration in accordance with the Guidelines.

A soil sample was selected from boring A-09-101. The pH of the soil sample analyzed was 7.4 with water soluble chloride and sulfate ion concentrations of 183 mg/kg and 91 mg/kg. The minimum resistivity of the soil sample was 1523 ohm-cm.

4.3 CONCLUSIONS

Soil boring chemical analyses resulted in the pH value higher than 5.5, soluble chloride concentrations less than 500 mg/kg, soluble sulfate concentrations less than 2,000 mg/kg, and minimum soil resistivity greater than 1,000 ohm-cm. Therefore, according to the Guidelines, the soil at the site is considered non-corrosive.

5.1 SEISMIC DESIGN METHODOLOGY AND RESOURCES

The seismic design methodology adopted for this project is based on the following current Caltrans standards:

1. Development of the 2007 Caltrans Deterministic PGA Map and Caltrans ARS Online, July 2009
2. Seismic Design Criteria (SDC), v 1.5, August 2009
3. Guidelines for Foundation Investigations and Reports, v 2.0, dated March 2006

5.2 PEAK BEDROCK ACCELERATION

The closest active faults to the project alignment are the Rodgers Creek-Healdsburg fault, San Andreas (north) fault, the northern end of the Hayward fault and the Maacama-Garberville fault. The nearest potentially active fault is the Late Quaternary Tolay fault located 2.3 miles northeast of the site. The California Geological Survey (2000) has produced maps showing Alquist-Priolo Earthquake Fault Zones along faults with known Holocene activity that pose a potential surface faulting hazard. With the exception of the Tolay fault, all of these faults are included as Alquist-Priolo (A-P) zoned faults. The Rodgers Creek-Healdsburg fault is located about 4.5 miles (7.2 km) northeast of the site with a corresponding PGA [V_s=2,500 feet per second (fps)] contour of 0.6g based on the 2007 Caltrans Deterministic PGA map. San Andreas (north) fault is located about 15.8 miles (25.4 km) southwest of the project alignment. More distant active faults include the north end of Hayward fault located about 18.6 miles (30.0 km) southeast of the site, and the Maacama-Garberville fault located about 21.5 miles (34.6 km) northeast of the site. Figure 3-2 shows active faults within the site region relative to the project. The project alignment does not cross any mapped A-P zoned faults.

Table 5-1: Seismic Source Parameters

Fault	Type	M_{Max}	Distance (miles)	Near Field Effects ?
Rodgers Creek-Healdsburg	strike-slip	7.1	4.5	Yes
San Andreas (north)	strike-slip	7.9	15.8	No
Hayward	strike-slip	7.3	18.6	No

Note: The distances are based on Caltrans ARS Online (2009).

5.3 FAULT TYPE, NEAR-FIELD, AND SPECTRAL ACCELERATION INCREASES

The technical report that accompanies the 2007 Caltrans Deterministic PGA Map (Merriam and Shantz, 2007) indicates that the controlling fault (Rodgers Creek-Healdsburg) has strike-slip displacement. Therefore, in accordance with Caltrans design procedures referenced above, an increase in design spectral accelerations is not required for fault type. However, since the project

site is less than 9.3 miles (15 km) from the nearest active fault, design spectral accelerations should be modified to account for near-fault effects as follows:

Table 5-2: Spectral Acceleration Increase for Near Field Effects

Period (sec)	Increase in Spectral Acceleration (%)
< 0.5	0
0.5 – 1.0	0 – 20 (determined by linear interpolation)
≥1	20

At the time of this study, no bridge structures with a fundamental period of vibration greater than 1.5 seconds were anticipated; therefore no adjustments are required for long period effects.

5.4 SITE SOIL PROFILE

The logs of 2009 Borings A-09-101, A-09-103, and R-09-011 through R-09-015 reveal that the soils at the general site area consist of fine and coarse-grained alluvium that becomes denser and stiffer with depth terminating mostly in bedrock; the weighted average of the recorded standard penetration test (SPT) blow counts in soil in these seven borings was used to determine the average SPT resistance value (N) of 15, 17, 29, 15, 15, 26, and 24. In addition, the undrained shear strength of clay deposits in these borings ranges from about 400 to 4,100 pounds per square foot (psf). These two parameters are indicative of soil profile Type D based on the guidelines given in SDC Figure B.12. Furthermore, the shear wave velocity (Vs) is estimated to be about 1,000 fps or 305 meters per second (mps), which falls within the soil profile Type D Vs range of 600 to 1,200 fps. Therefore, Soil Profile Type D should be used for design.

5.5 DESIGN ACCELERATION RESPONSE SPECTRA

The design response spectrum for the site is estimated with spectral acceleration values generated using Caltrans ARS Online (2009). This method was developed by Caltrans Geo Research Group in partnership with United States Geological Survey (USGS), Pacific Earthquake Engineering Research (PEER) and California Department of Conservation. This web-based tool calculates both deterministic and probabilistic acceleration response spectra for any location in California based on criteria provided in Appendix B of Caltrans SDC.

The deterministic spectrum is determined as the average of median response spectra calculated using the Campbell-Bozorgnia (2008) and Chiou-Youngs (2008) ground motion prediction equations developed under the "Next Generation Attenuation" project coordinated through the PEER-Lifelines program. These equations are applied to all faults considered to be active in the last 750,000 years (late-Quaternary age) that are capable of producing a moment magnitude earthquake of 6.0 or greater. The probabilistic spectrum is obtained from the USGS (2008) National Hazard Map for 5% probability of exceedance in 50 years. Caltrans design spectrum is based on the larger of the deterministic and probabilistic spectral values. Both the deterministic and probabilistic spectra account for soil effects through incorporation of the parameter Vs30, the average shear wave velocity in the upper 30 meters (100 feet) of the soil profile.

The input values selected for use in Caltrans ARS Online included:

- Vs30 of 1,000 fps (305 mps)
- Maximum Moment (MMax) Magnitude 7.1 (Rodgers Creek-Healdsburg fault)

- No ARS increase for fault-type or long period structure
- ARS increase for near-field effects

The calculated spectra for both deterministic and probabilistic methods are presented graphically in Figure 5-1. Since the maximum spectral acceleration curve is the USGS 5% in 50 years hazard, this curve is presented in Figure 5-2 as the design curve. Spectral values (from Figure 5-2) are provided below in Table 5-3.

Table 5-3: Spectral Acceleration Values
(Vs= 305 mps, Lat. = 38.233832, Long. = -122.61696)

Period (seconds)	Sa (g)	Sa* (g)
0.010	0.613	0.613
0.020	0.714	0.714
0.030	0.781	0.781
0.050	0.873	0.873
0.075	0.954	0.954
0.100	1.017	1.017
0.120	1.070	1.070
0.150	1.140	1.140
0.170	1.181	1.181
0.200	1.236	1.236
0.240	1.269	1.269
0.300	1.309	1.309
0.400	1.279	1.279
0.500	1.256	1.256
0.750	1.083	1.191
1.000	0.888	1.066
1.500	0.640	0.768
2.000	0.507	0.609
3.000	0.330	0.396
4.000	0.237	0.284
5.000	0.191	0.229

*Modified with near-fault factors outlined in Section 3.4.

U.S.101/SR116 northbound and southbound bridges are located approximately 300 feet southwest of the proposed RW293 and previous as-built plans from Caltrans were reviewed including:

1. Bridge No. 20-0155L (Contract Number unknown) date unknown; apparently constructed in about 1952 at location of proposed widening. Only LOTB sheet was provided.
2. Bridge No. 20-0155R/L (Contract No: 04-147204) dated October 24, 1996 was Earthquake Retrofit Project No. 693. The pile caps of Piers 4, 5 and 7 of both bridges were increased in width and length and supported on Class 70 Modified (70-ton service load) concrete piles.
3. Bridge No. 20-0284L (Contract Number unknown) dated March 3, 2003. Original 1952 bridge was replaced with a new bridge, U.S. 101/116 SOH Left (Replace).

The 1952 LOTB indicates that the original bridge is supported on a total of 455 Raymond step-taper piles (32-ton design capacity) at the abutments and bents. The pile diameter increases from 10 inches at the tip to a maximum of 15½ inches at the butt. At Bents 7R and 8R, steel H piles (10 BP 42) were driven to reach specified tip. Average pile tips range from about Elevation -38 to -57 feet.

The 1996 earthquake retrofit project at this bridge (20-0155R/L) is supported on driven concrete piles at Piers 4, 5 and 7. Available data for modified bents are summarized in the following table.

Table 6.1: Pile Data Table for 1996 Earthquake Retrofit at U.S. 101/116 SOH

Location		Pile Type	Specified Pile Tip Elevation (feet)
Bridge No.	Abut/Pier No.		
20-0155 R/L	Piers 4, 5 and 7	Class 70C Modified Concrete Pile	-42.0

The 2003 replacement bridge (20-0284L) is supported on driven precast prestressed concrete (PCPS) piles at 2 abutments, 4 bents and 2 retaining walls. Except for Abutment 1, which is supported on Class 900C (100-ton) piles, the remainder of the bridge is supported on Class 625C (70-ton) piles. Retaining walls at abutments were supported on Class 400C (45-ton) piles. Design pile data for the abutments and bents are summarized in the following Table 6-2.

Table 6-2: Pile Data Table for U.S. 101/SR116 SOH Left

Location		Pile Type	Specified Pile Tip Elevation (feet)
Bridge No.	Abut/Pier No.		
20-0284L	Abut 1	PCPS	-41.0
20-0284L	Bent 2	PCPS	-40.0
20-0284L	Bent 3	PCPS	-44.9
20-0284L	Bent 4	PCPS	-55.8
20-0284L	Bent 5	PCPS	-47.9
20-0284L	Abut 6	PCPS	-52.5
20-0284L	Abut 1 Retaining Wall	PCPS	-39.4
20-0284L	Abut 6 Retaining Wall	PCPS	-39.4

It should be noted that as-built pile tip elevations were not available.

7.1 DISCUSSION

New embankment fills are planned as part of the proposed improvements to the on-ramp. The Caltrans Type 1SWBP retaining wall at RW 293 will be used to retain new proposed fill with a proposed maximum differential soil height of about 12 feet at 'R6' Line Station 296+00. The principal geotechnical issues at the site are:

- Selection of the type of foundation that will be compatible with the underlying soils,
- Consolidation settlement of underlying cohesive soils, and
- Post-liquefaction settlement of potentially liquefiable soils encountered at the retaining wall site.

We understand that 12-inch square, Class 90 driven precast prestressed concrete piles will be used to support RW 293.

Fill heights ranging from 6 to 12 feet are planned for the on-ramp and will be retained by RW 293. These fills will result in elastic and consolidation settlements of the native clays. We estimate that the settlement will be on the order of 2 to 4 inches, and that approximately 90% of the settlement would occur within 3 months of fill placement, assuming the full embankment width is constructed at one time. No downdrag force is anticipated from the consolidation settlement assuming the piles are driven after 90% of consolidation settlement is completed.

Because of potentially liquefiable soils were encountered in the explorations, we have included the estimated average downdrag force down to approximately Elevation -17.0 feet associated with post-liquefaction settlement in the design pile tip elevations presented in Section 7.2.1. The inclusion of potential downdrag force to the pile design capacity is consistent with Caltrans' Guidelines for Structure Foundation Reports, dated March 2006. The maximum downdrag force is estimated to be approximately 45 tons.

The following sections present the geotechnical design parameters for the design of the retaining wall consistent with Caltrans design procedures.

7.2 PILE DESIGN CAPACITY AND TIP ELEVATION

7.2.1 Axial Pile Capacity Analysis

The specified tip elevations presented in the following "Pile Data Table" (Table 7-1) are based on frictional resistance developed in the subgrade soils that underlie the site. The corresponding design loading conditions and nominal resistance are developed in accordance with Caltrans design procedures.

Table 7-1: Pile Data Table

Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevation (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance (kips)
		Compression	Tension			
Station 193+30 to 197+38	Class 90	180	90	-62.0 (a) -36.0 (b) -15.0 (c)	-62.0	270

Design tip elevation is controlled by the following demands:
(a) Compression (b) Tension and (c) Lateral

Downdrag was considered to act to approximately Elevation -17.0 feet along the entire length of the wall due to liquefaction settlement. The estimated magnitude of downdrag loads on the piles is about 90 kips. The results of our axial capacity analysis, which form the basis for the design tip elevation provided above, are presented in Appendix F.

No group reduction factor needs to be applied to single pile compression load capacities presented above, provided a center-to-center spacing of at least three pile diameters is used.

7.2.2 Earthquake Loading

Walls will also experience increased loads during earthquake shaking. The additional force to simulate earthquake loads is dependent upon the magnitude of ground surface acceleration and the height of the wall. To estimate the seismically induced force, we recommend that the magnitude of the dynamic lateral force developed during seismic loading be computed using the following equation:

$$\Delta P_{ae} = 12H^2$$

The units of the dynamic lateral force (ΔP_{ae}) are pounds per linear foot of wall. H is the wall height in units of feet. The dynamic lateral force should be assumed to act at 0.6H from the bottom of the wall and represent the resultant of a triangular pressure distribution.

7.2.3 Lateral Load Capacity Analysis

The driven piles are capable of resisting lateral loads. Resistance to lateral loads can be developed by bending of the pile and by pile-soil interaction. The magnitude of the lateral load resistance that can develop depends upon several factors such as the pile size, the physical properties of the surrounding soils, the structural design of the pile, and the direction of loading. We used LPILE 5.0 (Reese et al., July 2004) to assist in estimating the lateral load resistance of 12-inch Class 90 piles. Output files for analysis of piles at retaining wall are presented in Appendix G and include bending moment versus depth, and shear versus depth. The estimated load versus deflection for free and fixed head conditions at top of pile are shown in figure G-1, included in Appendix G.

We recommend that a group efficiency factor of 0.6 be applied to the lateral capacity of individual piles in trailing rows for a minimum center-to-center spacing of at least three times the pile diameter in the loaded direction.

7.2.4 Batter Piles

Batter piles are currently proposed to resists lateral loads. Post-construction settlements could result in additional loads on the batter piles. The increased shear forces and bending stresses along the batter pile shafts should be determined using the component of overburden soil weight acting normal to the pile shaft to the depth of downdrag (Elevation -17 feet). The radius of influence of downdrag should be considered as three times the pile diameter. If batter piles cannot accommodate the additional bending stresses and shear forces and shear forces associated with post-construction settlement, then only vertical piles should be used to provide the required lateral resistance for the retaining wall.

7.3 PILE INSTALLATION

All piles should be installed under the direct observation of the Geotechnical Engineer and in accordance with Section 49 (Piling) of the Caltrans Standard Specifications. Specific additions and modifications to these requirements are discussed below.

The Contractor should submit evidence of compatibility of the proposed pile hammer with the pile type and soil conditions at the site. The Contractor's hammer submittal should include, as a minimum, a dynamic analysis of the pile driving system that is based on wave equation analysis using computer programs such as WEAP. Acceptance criteria for driven piles should follow Caltrans Standard Specifications Section 49-1.08, Pile Driving Acceptance Criteria. Driven piles reaching refusal within 10 feet of the specified tip elevation and meeting the acceptance criteria may be cut-off above the tip elevation required by the controlling loads. Preliminarily, we recommend that the refusal criteria be two times the minimum required blowcount as determined using the pile nominal resistance formula outlined in Section 49-1.08 of the Standard Specifications. Refusal criteria should be defined later based on the pile driving system proposed by the Contractor and evaluated by WEAP analysis.

7.4 GLOBAL STABILITY

The global stability of RW 293 was evaluated using a limit equilibrium method based on Spencer's procedure of slices as coded in the program SLOPE/W (Version 4). In Spencer's procedure, all forces are assumed to have the same inclination, an all requirements for static equilibrium are satisfied. URS performed the analyses using the maximum wall height, which in our opinion, represents the critical section. On this basis the cross sections were selected at Station 'R6' 296+60. A design groundwater at Elevation 5.0 feet was used for the analysis.

Caltrans requires a minimum factor of safety of 1.3 for retaining walls under static loading conditions (Bridge Design Specifications, Section 5.2.2.3, August 2004). The results of our analyses are summarized in the following paragraphs and include the following cases: (1) Static and (2) pseudo-static condition. A copy of our global slope stability calculations are presented in Appendix H.

7.4.1 Static Conditions

The static condition represents the condition immediately following construction when excess pore pressures have been induced by the placement of fill loads, and insufficient time has passed for dissipation to occur. For this reason, undrained conditions were assumed for impervious clay soils, whereas drained strengths were used for granular soils. Soil strength parameters from laboratory unconfined compressive strength tests were used for fine grained soils and the estimated friction angle was used for the granular soils. The factor of safety for long term (drained) condition is generally higher than for the undrained condition in cohesive soils. Therefore, no stability analysis was performed for the long term condition.

Based on our analysis, the computed minimum (critical) factor of safety for the static condition is 4.2, which exceeds the minimum required value of 1.3.

7.4.2 Pseudo-Static Condition

For the earthquake (or pseudo-static) loading, drained shear strengths for pervious materials and reduced undrained shear strengths for impervious materials were selected to evaluate the stability of the embankments during the potential earthquake. Undrained strengths for impervious materials were used because no significant dissipation of pore pressures is expected during the rapid earthquake loading. A reduction of undrained shear strengths on the order of 20 percent of the static undrained shear strengths was used to account for the strength loss of cohesive soils during cyclical loading. This reduction in strength is recommended in the report, "A Simplified Procedure for Estimation Earthquake Induced Deformations in Dams and Embankments" by Makdisi and Seed (1978). This is a conservative approach as soil strengths typically increase over time with pore pressure dissipation. To compute the factor of safety of the slope during earthquake loading, we applied a pseudo-static seismic coefficient of 0.2g to the center of the slice for the slip surfacehaving the minimum computed static factor of safety. This pseudo-static seismic coefficient is equal to approximately one-third of the peak horizontal ground acceleration, 0.6g, anticipated at the site. The seismic stability screening approach is consistent with Section 3.10 of the March 2006 Guidelines for Structure Foundation Reports.

Based on out analysis, the computed minimum (critical) factor of safety for the pseudo-static condition is 1.3, which exceeds the minimum required value of 1.0.

7.5 EARTHWORK

7.5.1 General

All earthwork should be performed according to the current Standard Specifications of the State of California, Department of Transportation (Caltrans). Specifically, Section 16 "Clearing and Grubbing" and Section 19 "Earthwork" of these Specifications should be followed. Specific additions and modifications to these specification requirements are discussed in the following sections.

7.5.2 Site Preparation

Site preparation essentially consists of clearing and grubbing the site prior to construction of the retaining wall; these recommendations should be used in conjunction with the requirements presented in Section 16 of the Caltrans Standard Specifications.

All unsuitable material within the retaining wall area should be removed prior to grading operations. Areas to be filled should be cleared of existing structures. Also, tree stumps and roots over 1-inch in diameter should be excavated along with underground utilities. The resulting holes should be cleared of all loosened soils and backfilled with engineered fill. Before, placing fill, the area should be stripped to a sufficient depth to remove all surface vegetation, organic laden topsoil, and debris. We estimate that stripping depths could vary between approximately 3 to 4 inches and the actual stripping depth should be determined in the field at the time of construction. Any stripped organic material should not be used as engineered fill. After the site has been properly stripped, the exposed surfaces in all areas to be filled should be scarified to a minimum depth of 6 inches and recompacted to the requirements for engineered fill.

7.5.3 Fill Material

In general, materials intended for use as fill should be a soil or soil/rock mixture that is free of organic matter and other deleterious substances, in accordance with the requirements of Section 19 of the Caltrans Standard Specifications. In addition, no rock fragments greater than 6 incehs in largest dimension or soil having a PI of more than 15 should be allowed in the fill. All import material should meet these requirements and should be approved by the Geotechnical Engineer prior to construction.

7.5.4 Placement and Compaction of Fills

Subgrade preparation should consist of moisture conditioning the exposed subgrade and compacting to a minimum relative compaction of 95 percent in accordance with the provisions of Section 19-5 of the Standard Specifications. All embankment fill should be placed in thin lifts and compacted to a minimum relative compaction of 95 percent (Caltrans 216 using the dry weight basis) in accordance with Sections 19-3, 19-5 and 19-6 of the Standard Specifications. We recommend that the relative compaction be measured on the basis of dry density.

7.5.5 Keying and Benching

Where fills are placed on slopes steeper than 6:1 (horizontal to vertical), the fill should be keyed and benched into the slope. All keying and benching should be performed in accordance with Section 19 of Caltrans Standard Specifications. In addition, the keyway at the toe of the embankment should extend at least 3 feet below the grubbing depth and should be at least 10 feet wide (typical equipment width). As the embankment is brought up in layers, horizontal benches should be cut into the existing slope a minimum of 1 feet wide and at least 1 feet below the grubbing depth.

8.1 TEMPORARY CONSTRUCTION EXCAVATIONS

We anticipate that excavations into the native soils for construction of the retaining wall could result in temporary near vertical unsupported soil faces as high as about 5 feet. Safety standards set by OSHA limit the height of unshored vertical excavations to 5 feet if construction personnel will be working in the excavations. The set of guidelines published by OSHA (Department of Labor, Occupational Safety and Health Administration, 1989), classifies soils in detail as Type A, B or C. In general, Type A soils are stronger and more cohesive, Type B soils are intermediate, and Type C soils are weaker or more granular. Based on the soil type, depth, duration the excavation is open, and sequence of soils exposed in the excavation, OSHA recommends maximum allowable slopes. For example, for excavations 20 feet or less in depth through homogeneous soils, they state that maximum allowable slopes (horizontal to vertical) should be ¾:1, 1:1, and 1½:1 for Type A, B, and C soils, respectively. Based on the strengths of the soils encountered in our boring, the native alluvial soils are generally considered to be OSHA Type B. On this basis, we recommend that temporary slopes in these soils be cut at no steeper than 1:1 (horizontal:vertical).

We anticipate that groundwater will be encountered in the footing excavations; therefore, we recommend footing excavations be classified as "Structure Excavation Type A" in accordance with Section 11 of Bridge Design Aids, March 2005.

8.2 CONSTRUCTION DEWATERING

Bottom of footings are planned between approximately Elevation +5.0 to Elevation +12.0 feet. Free groundwater was encountered in the Boring A-09-101 at a depth of about 10 feet (Elevation -3.0 feet); however, groundwater levels were measured in few of the borings from previous studies (June 1952, December 2001 and September 2002) at Elevations ranging from +1.7 to +9.5 feet. Therefore, depending on the time of year, groundwater could be encountered during footing excavation for the retaining wall.

The opinions, conclusions, and recommendations presented herein are based on available subsurface information developed by others and a supplementary new boring and CPT. The recommendations presented in this report are based on the assumption that the soil and geologic conditions do not deviate substantially from those anticipated by the information contained in the logs of test borings. If any variations are encountered during construction, URS should be contacted so that supplementary recommendations can be made.

If the planned construction is changed from that presently conceived, URS should be retained to review the changes and make modifications to the original recommendations represented in this report in order to meet the project needs.

The Geotechnical Engineer should review the final specifications and drawings to verify that these documents are consistent with the intent of the geotechnical recommendations. Geotechnical issues may arise which are not apparent at this time. URS should be retained during construction to review the soil conditions encountered and the construction procedures. All retaining wall excavations should be completed under the direct observation of a representative of our firm.

Specific review and investigation for environmental issues and subsurface environmental contamination were beyond the scope of the geotechnical services.

The elevations shown on the new LOTBs are based on interpolation from spot and contour elevations shown on available topographic maps.

The opinions and recommendations presented in this Foundation Report were developed with the standard of care commonly used as state of the practice in the profession. No other warranties are included, either express or implied, as to the professional advice provided in this report.

ABAG, 2007, Floodplain Maps, http://abag.ca.gov/bayarea/eqmaps/eqfloods/floods

Armstrong, C.F. and Huffman, M.E., 1980, Geology for planning in Sonoma County, California Division of Mines and Geology Special Report 120, Plate 2b and 3B, scale 1:62,500.

California Division of Mines and Geology, 1982, Alquist-Priolo Special Studies Zone revised official map of the Petaluma River quadrangle, scale 1: 24,000, January 1.

California Division of Oil, Gas, and Geothermal Resources, 2001, Oil, Gas, & Geothermal Fields in California, scale 1: 1,500,000: ftp://ftp.consrv.ca.gov/pub/oil/maps/Map_S-1, accessed 7-17-09

City of Petaluma, 2008, Final General Plan 2025, May, http://cityofpetaluma.net/genplan/finalgp2025.html, accessed 7-15-09

California Department of Transportation: Caltrans ARS Online, 2009: Web-based tool calculates both deterministic and probabilistic acceleration response spectra: http://dap3.dot.ca.gov/shake_stable/

Campbell-Bozorgnia (2008) and Chiou-Youngs (2008) ground motion prediction equations: "Next Generation Attenuation" project: PEER-Lifelines program: http://peer.berkeley.edu/products/nga_project.html

Hart, E.W., 1975 (revised 1997), Fault-rupture hazard zones in California: California Division of Mines and Geology Special Publication 42.

Jennings, C.W., 1994, Fault activity map of California and adjacent areas with locations and ages of recent volcanic eruptions: California Division of Mines and Geology Geologic Data Map No. 6, scale 1: 750,000.

Merriam, M. and Shantz, T., 2007, Caltrans Deterministic PGA Map, California Department of Transportation. http://dap3.dot.ca.gov/shake_stable/references/Deterministic_PGA_Map_8-12-09.pdf

Sonoma County Hazard Mitigation Plan, 2006 Landslide hazard areas, September 19, http://www.sonoma-county.org/PRMD/docs/hmp/fig_2-04.pdf, accessed 7-17-09.

Wagner, D.L., Rice, S.R., Bezore, S., Randolph-Loar, C.E., Allen, J., and Witter, R.C., 2002, Geologic map of the Petaluma River 7 ½' quadrangle, Marin and Sonoma counties, California, a digital database: California Geological Survey.

Wentworth, C.M., 1997, Geologic materials of the San Francisco Bay Region, U. S. Geological Survey OFR 97-744, compiled from the work of Brabb (1989) , Ellen and Wentworth (1995) and Helley and Lajoie (1979) a digital database

Witter, R.C., Knudsen, K.L., Sowers, J.M., Wentworth, C.M., Koehler, R.D., and Randolph, C.E., 2006, Maps of Quaternary deposits and liquefaction susceptibility in the central San Francisco Bay region, California, in cooperation with the California Geological Survey: A digital database, U.S. Geological Survey, Open-File Report 2006-1037.

California Department of Transportation: Caltrans ARS Online, 2009: Web-based tool calculates both deterministic and probabilistic acceleration response spectra: http://dap3.dot.ca.gov/shake_stable/

Campbell-Bozorgnia (2008) and Chiou-Youngs (2008) ground motion prediction equations: "Next Generation Attenuation" project: PEER-Lifelines program: http://peer.berkeley.edu/products/nga_project.html

City of Petaluma, 2008, Final General Plan 2025, May, http://cityofpetaluma.net/genplan/finalgp2025.html, accessed 7-15-09

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	2.5/4.1		

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON

STATE HIGHWAY

IN SONOMA COUNTY IN AND NEAR PETALUMA FROM 0.4 MILES SOUTH OF SOUTH PETALUMA UNDERCROSSING TO 0.2 MILE NORTH OF CAULFIELD LANE OVERCROSSING

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

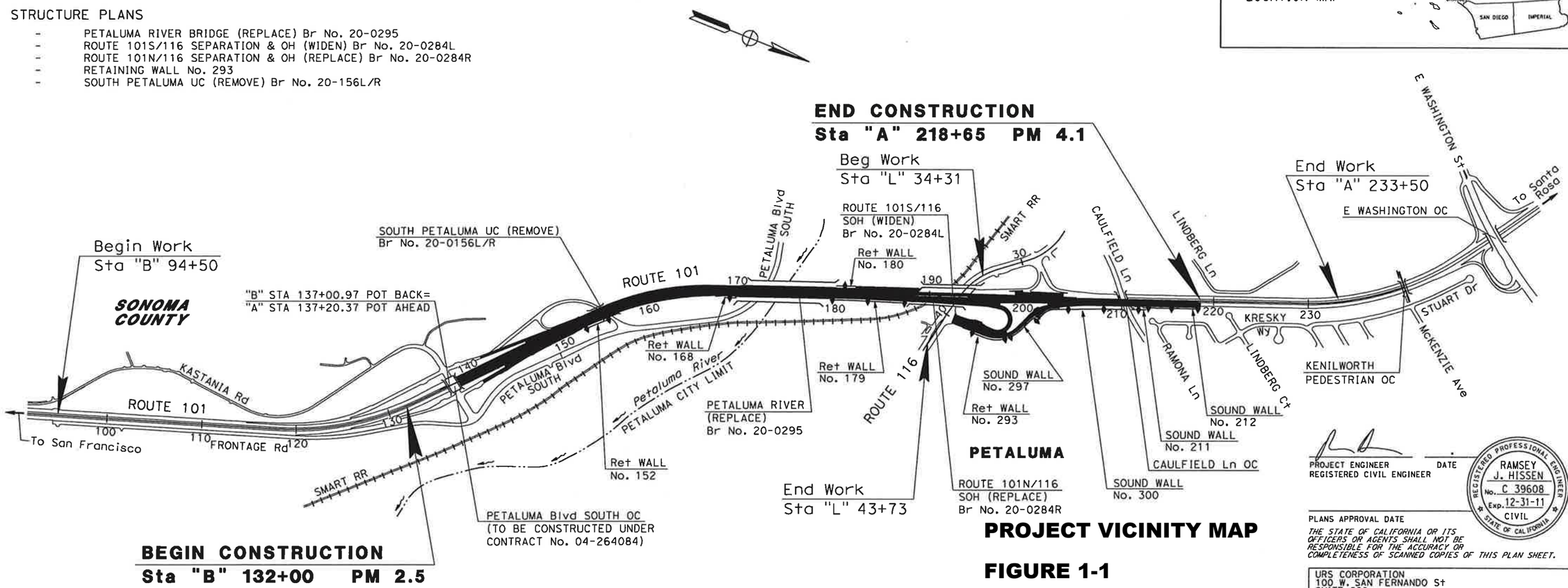
INDEX OF PLANS

SHEET No.
- TITLE
- TYPICAL CROSS SECTIONS
- KEY MAP AND LINE INDEX
- LAYOUTS
- PROFILES AND SUPERELEVATION DIAGRAMS
- CONSTRUCTION DETAILS
- TEMPORARY WATER POLLUTION CONTROL PLANS AND QUANTITIES
- EROSION CONTROL PLANS, DETAILS AND QUANTITIES
- CONTOUR GRADING AND PAVEMENT ELEVATIONS
- DRAINAGE PLANS, PROFILES, DETAILS AND QUANTITIES
- SANITARY SEWER PLANS, PROFILES, DETAILS AND QUANTITIES
- UTILITY PLANS
- CONSTRUCTION AREA SIGNS
- STAGE CONSTRUCTION PLANS
- TRAFFIC HANDLING PLANS AND QUANTITIES
- DETOUR LAYOUTS
- PAVEMENT DELINEATION PLANS AND QUANTITIES
- SIGN PLANS, DETAILS AND QUANTITIES
- SUMMARY OF QUANTITIES
- RETAINING WALL PLANS, DETAILS, QUANTITIES AND LOG OF TEST BORINGS
- SOUND WALL PLANS, DETAILS AND QUANTITES
- PLANT REMOVAL PLANS
- ELECTRICAL PLANS

STRUCTURE PLANS

- PETALUMA RIVER BRIDGE (REPLACE) Br No. 20-0295
- ROUTE 101S/116 SEPARATION & OH (WIDEN) Br No. 20-0284L
- ROUTE 101N/116 SEPARATION & OH (REPLACE) Br No. 20-0284R
- RETAINING WALL No. 293
- SOUTH PETALUMA UC (REMOVE) Br No. 20-156L/R

LOCATION MAP



PROJECT VICINITY MAP

FIGURE 1-1

101 MSN CONTRACT B4
95% PS&E SUBMITTAL
NOVEMBER 30, 2010

NO SCALE

THE CONTRACTOR SHALL POSSESS THE CLASS (OR CLASSES) OF LICENSE AS SPECIFIED IN THE "NOTICE TO BIDDERS."

PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER RAMSEY J. HISSEN No. C 39608 Exp. 12-31-11 CIVIL STATE OF CALIFORNIA

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

URS CORPORATION
100 W. SAN FERNANDO St
SUITE 200
SAN JOSE, CA 95113

SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401

CONTRACT No.	04-2640C4
PROJECT ID	0400000736

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER	CALTRANS DESIGN OVERSIGHT APPROVAL	REGISTRATION No.	LICENSE Exp DATE	DATE	DATE SIGNED
RAMSEY J. HISSEN	TUNG LY				

LAST REVISION 11-22-10 | DATE PLOTTED => 11/29/2010 TIME PLOTTED => 10:06:52 AM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER David W. Harnagel No. C36542 Exp. 6/30/12 CIVIL STATE OF CALIFORNIA

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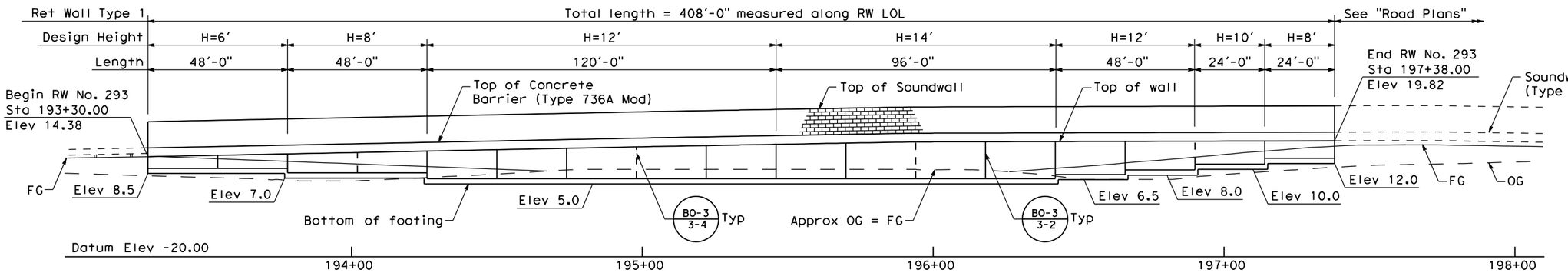
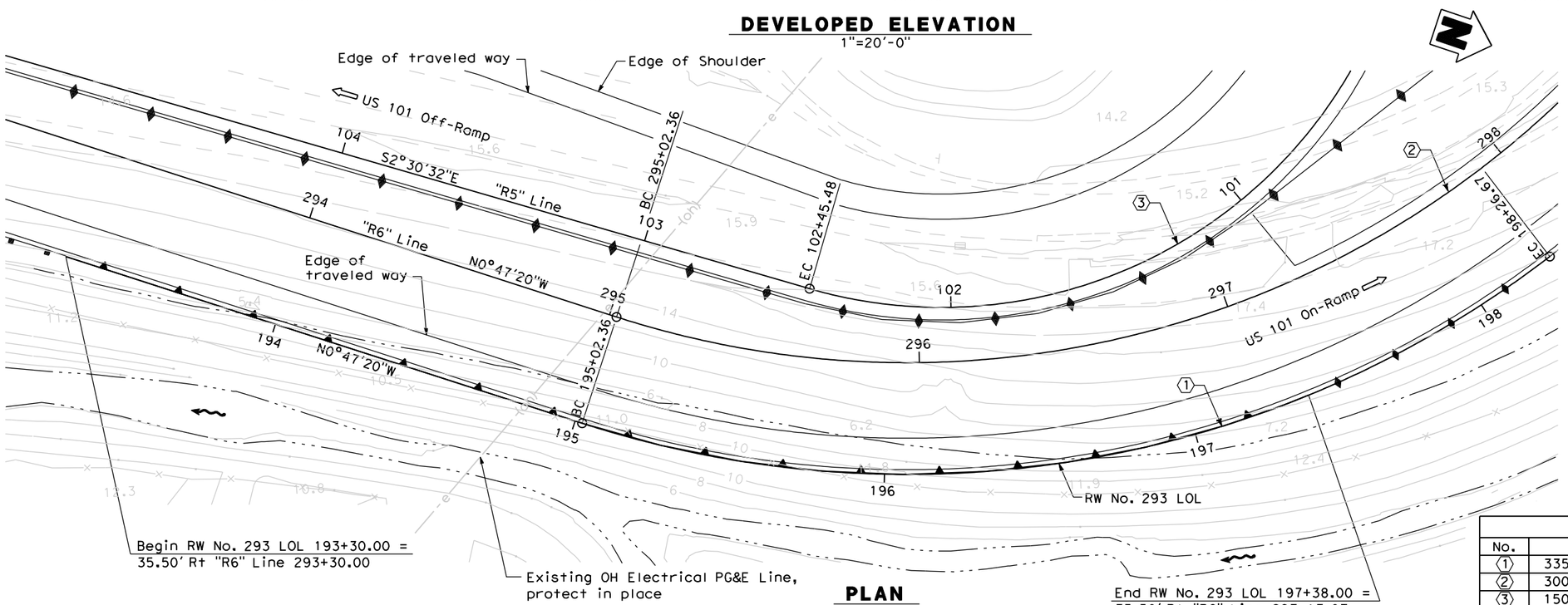
ROSEVILLE, CA 95661-2997

SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401



DEVELOPED ELEVATION

1"=20'-0"



PLAN

1"=20'-0"

TOP OF WALL ELEVATION	
Sta	Elev
193+30	14.38
193+50	14.78
193+70	15.18
193+90	15.58
194+10	15.98
194+30	16.38
194+50	16.78
194+70	17.18
194+90	17.58
195+10	17.96
195+30	18.32
195+50	18.68
195+70	19.04
195+90	19.39
196+10	19.48
196+30	19.53
196+50	19.58
196+70	19.64
196+90	19.69
197+10	19.74
197+30	19.80

FIGURE 2-1

CURVE DATA				
No.	R	Δ	T	L
1	335.50'	55°23'05"	176.08'	324.31'
2	300.00'	67°08'02"	199.07'	351.51'
3	150.00'	195°25'49"	N/A	511.63'

DESIGN OVERSIGHT	DESIGN	BY D. Harnagel	CHECKED D. Anderson	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE		
	DETAILS	BY L. Davis	CHECKED D. Anderson	LAYOUT	BY D. Harnagel	CHECKED D. Anderson	
SIGN OFF DATE	QUANTITIES	BY M. Jackson	CHECKED D. Anderson	SPECIFICATIONS	BY D. Harnagel	PLANS AND SPECS COMPARED D. Anderson	

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Walt LaFranchi
PROJECT ENGINEER

BRIDGE NO. 20ER293
POST MILES 3.7

RETAINING WALL No. 293
GENERAL PLAN No. 1

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV.7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 04000007361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 6-18-10 9-24-10 11-28-10 SHEET 1 OF 10

FILE => 293-a-gp01.dgn

USERNAME => Lynette_Davis DATE PLOTTED => 5/3/2011 TIME PLOTTED => 9:24:17 AM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER David W. Harnagel No. C36542 Exp. 6/30/12 CIVIL STATE OF CALIFORNIA

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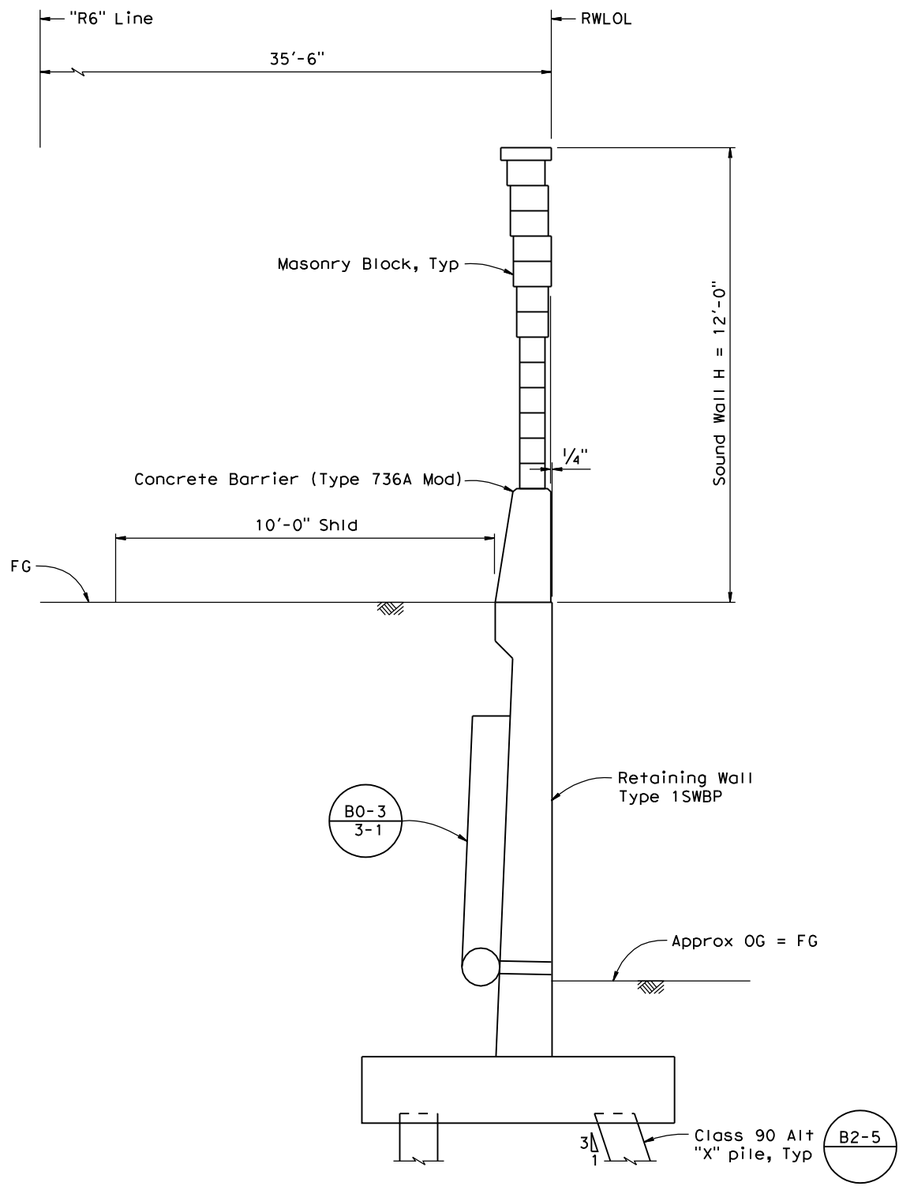

TYPICAL SECTION

1/2" = 1'-0"

INDEX TO PLANS

SHEET NO.	TITLE
1	GENERAL PLAN No. 1
2	GENERAL PLAN No. 2
3	PILE LAYOUT
4	RETAINING WALL TYPE 1SWBP - DETAIL No. 1
5	RETAINING WALL TYPE 1SWBP - DETAIL No. 2
6	SOUND WALL AESTHETICS No. 1
7	SOUND WALL AESTHETICS No. 2
8	LOG OF TEST BORINGS 1 OF 3
9	LOG OF TEST BORINGS 2 OF 3
10	LOG OF TEST BORINGS 3 OF 3

STANDARD PLANS DATED MAY 2006

A10A	ACRONYMS AND ABBREVIATIONS (SHEET 1 OF 2)
A10B	ACRONYMS AND ABBREVIATIONS (SHEET 2 OF 2)
A10C	SYMBOLS (SHEET 1 OF 2)
A10D	SYMBOLS (SHEET 2 OF 2)
A62B	LIMITS OF PAYMENT FOR EXCAVATION AND BACKFILL BRIDGE SURCHARGE AND WALL
B0-3	BRIDGE DETAILS
B2-5	PILE DETAILS CLASS 90 AND CLASS 140
B3-8	RETAINING WALL DETAILS No. 1
B11-56	CONCRETE BARRIER TYPE 736
RSP B15-6	SOUND WALL MASONRY BLOCK ON TYPE 736S/SV BARRIER DETAILS (1)
RSP B15-7	SOUND WALL MASONRY BLOCK ON TYPE 736S/SV BARRIER DETAILS (2)

STANDARD PLAN SHEET No.

DETAIL No.

FIGURE 2-2

DESIGN	BY D. Harnagel	CHECKED D. Anderson	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE
DETAILS	BY L. Davis	CHECKED D. Anderson	LAYOUT	BY D. Harnagel / CHECKED D. Anderson
QUANTITIES	BY M. Jackson	CHECKED D. Anderson	SPECIFICATIONS	BY D. Harnagel / PLANS AND SPECS COMPARED D. Anderson

DESIGN OVERSIGHT

SIGN OFF DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Walt LaFranchi
PROJECT ENGINEER

BRIDGE NO. 20ER293
POST MILES 3.7

RETAINING WALL No. 293
GENERAL PLAN No. 2

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV.7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 04000007361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 6-18-10 9-24-10 11-28-10

SHEET 2 OF 10

FILE => 293-a-gp02.dgn

USERNAME => Lynette_D@ DATE PLOTTED => 5/3/2011 TIME PLOTTED => 9:24:19 AM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	2.5/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER David W. Harnagel No. C36542 Exp. 6/30/12 CIVIL STATE OF CALIFORNIA

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URS CORPORATION
1380 LEAD HILL BLVD, SUITE 100
ROSEVILLE, CA 95661-2997

SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401

PILE DATA TABLE

Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevation (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance (kips)
		Compression	Tension			
Station 193+30 to 197+38.00	Class 90 Alt "X"	180	90	-62.0 (a), -36.0 (b)	-62.0	270

Notes: Design tip elevation are controlled by: (a) Compression, (b) Tension.

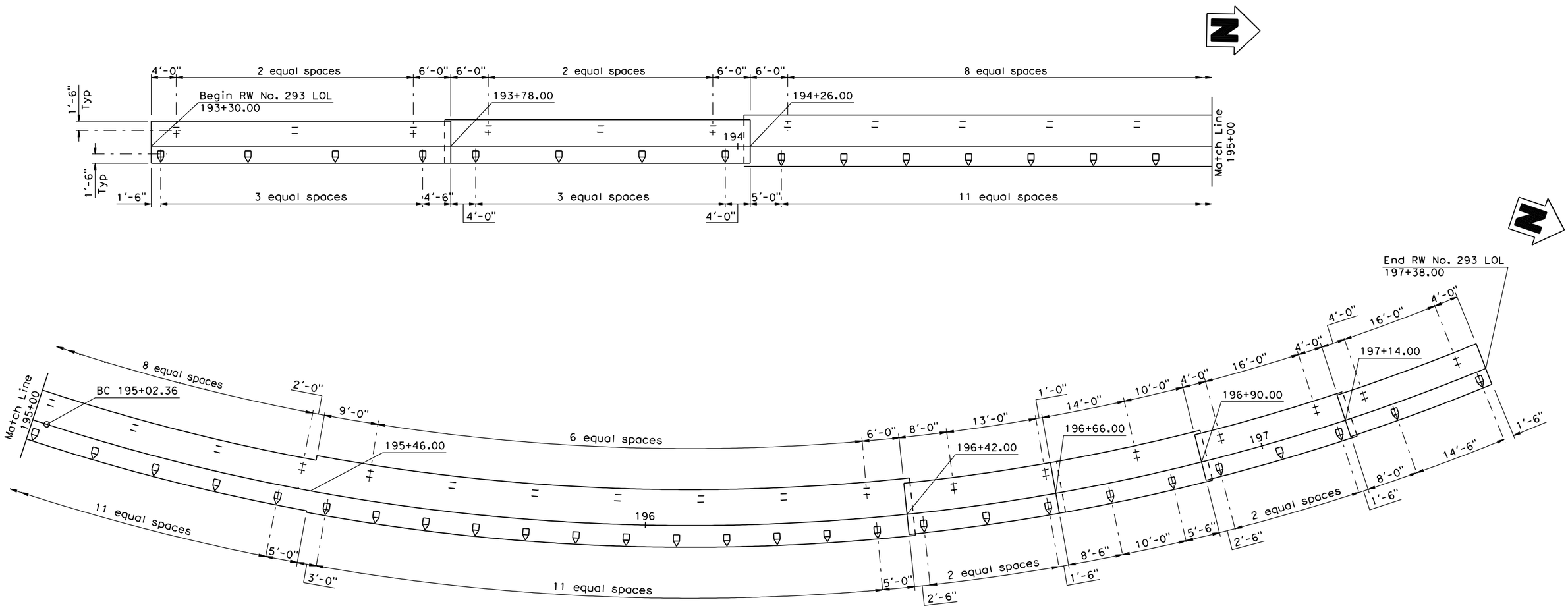
LEGEND:

Indicates vertical piles

Indicates 3:1 battered piles

NOTE:

1. All dimensions are measured along RWLOL.



PILE LAYOUT

1/8" = 1'-0"

FIGURE 2-3

DESIGN OVERSIGHT	DESIGN	BY D. Harnagel	CHECKED D. Anderson	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Walt LaFranchi, PROJECT ENGINEER
SIGN OFF DATE	DETAILS	BY L. Davis	CHECKED D. Anderson		BRIDGE NO. 20ER293
	QUANTITIES	BY M. Jackson	CHECKED D. Anderson		POST MILE 3.7

RETAINING WALL No. 293

PILE LAYOUT

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV.7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 04000007361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 4-19-10 9-23-10 11-28-10

SHEET 3 OF 10

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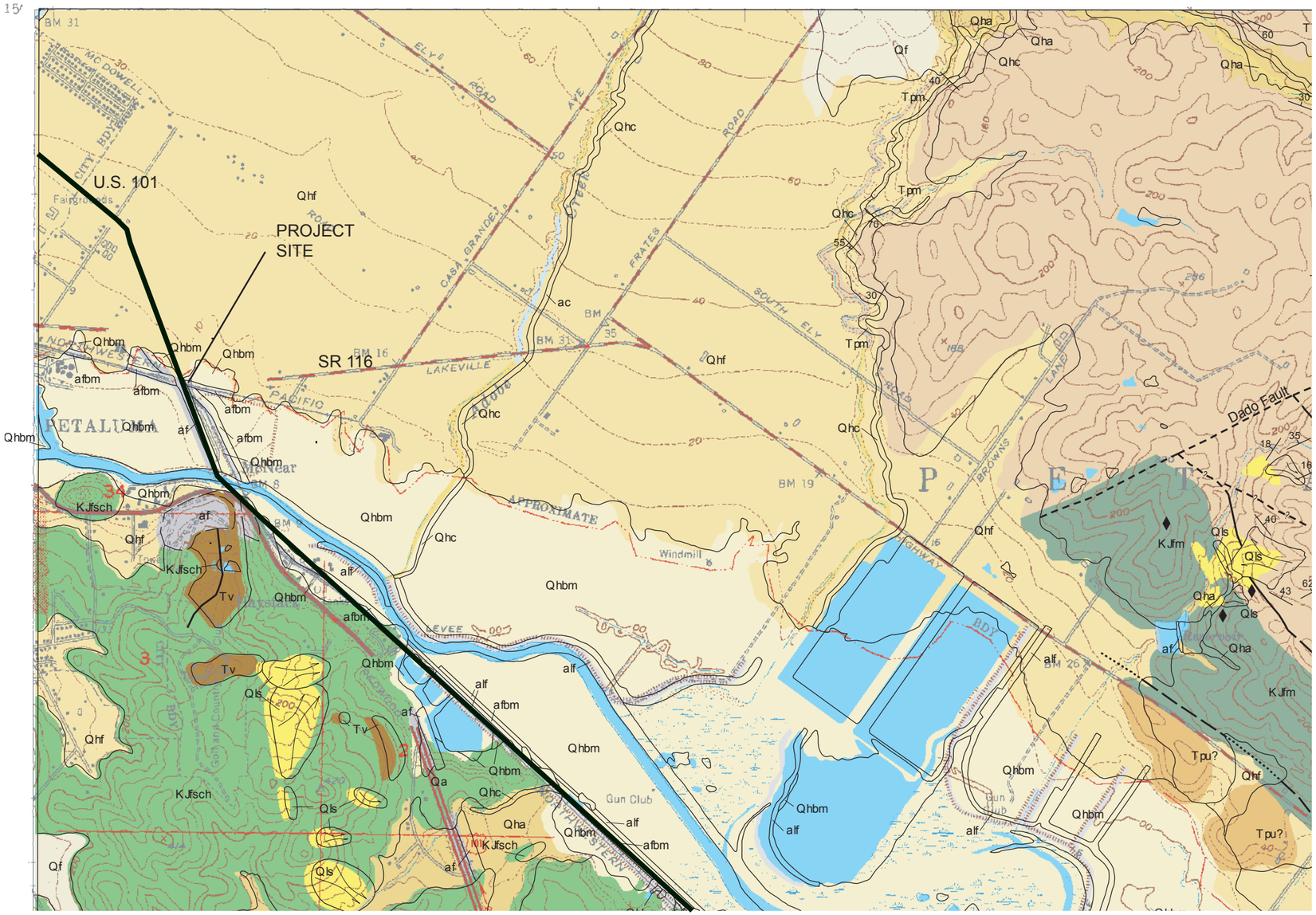


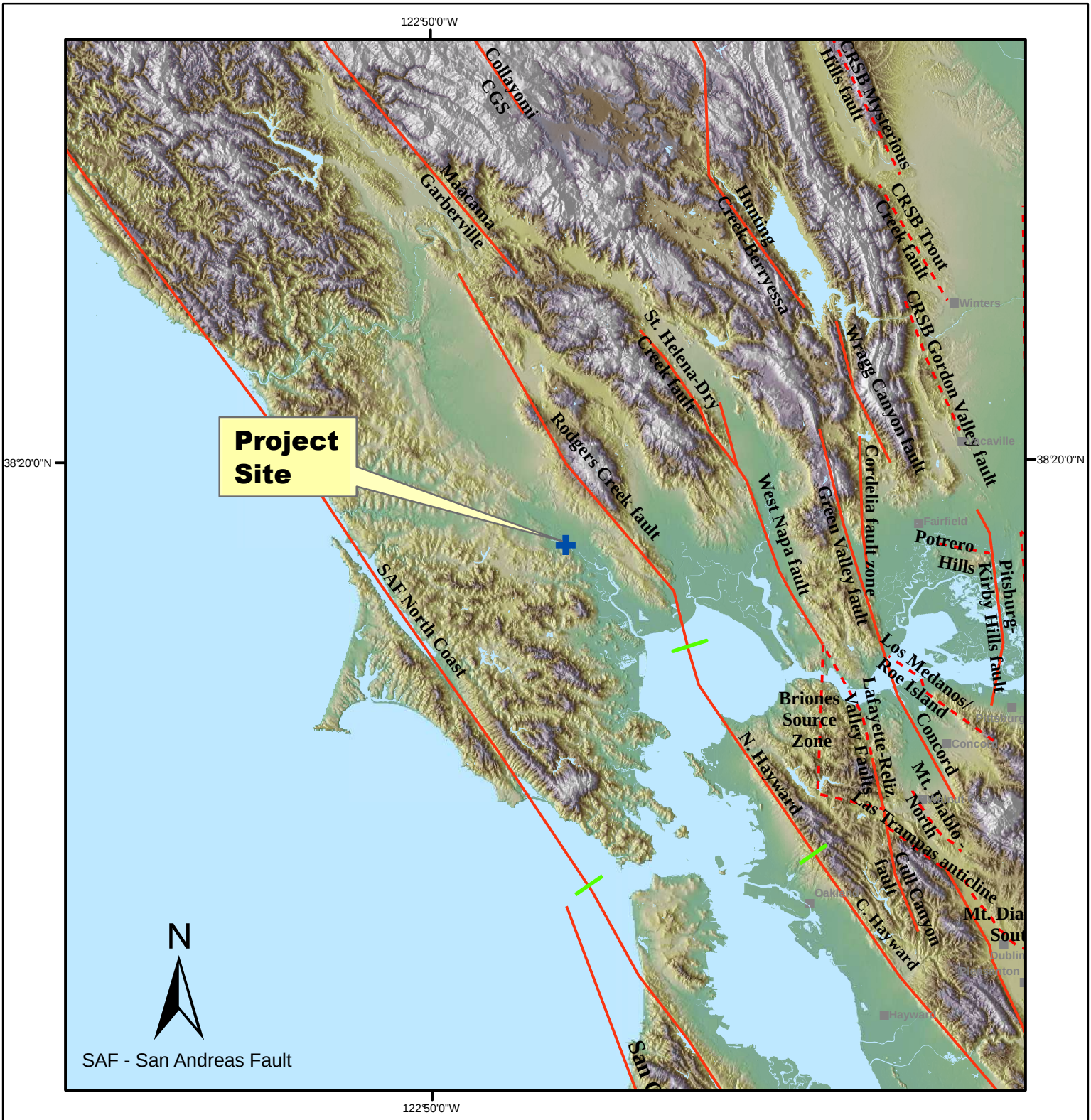
LEGEND

af	Artificial Fill
afbm	Artificial Fill placed over Bay Mud
alf	Artificial Levee Fill
Qhc	Late Holocene to modern stream channel deposits
Qhbm	Holocene Bay Mud deposits
Qhf	Holocene alluvial fan desposits
Qls	Landslides
Tv	Tertiary Volcanic Rock
KJfsch	Franciscan Complex Rock

Source:
Wagner, D. L., Rice, S.R., Bezore S., Randolph-Loar, C.E., Allen J., and Witter R.C., 2002, Geologic map of the Petaluma River 7 1/2' quadrangle, Marin and Sonoma counties, California, a digital database: California Geological Survey.

0 0.1 0.2 0.3 0.4 0.5 mile

URS	Highway 101 Widening Petaluma, California Project Number: 28645045	Regional Geologic Map Sonoma County, California	Figure 3-1



7 3.5 0 7 Miles

0 4.5 9 18 27 36 Kilometers

Faults with surface rupture

Blind faults and zones

Segment boundary

Fault Source: URS Seismic Source Model

URS	Project No. 28645045 Marin Sonoma Narrows Project, Petaluma Bridge, Phase B4	ACTIVE FAULTS IN THE SAN FRANCISCO BAY REGION	Figure 3-2

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	0.9/2.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

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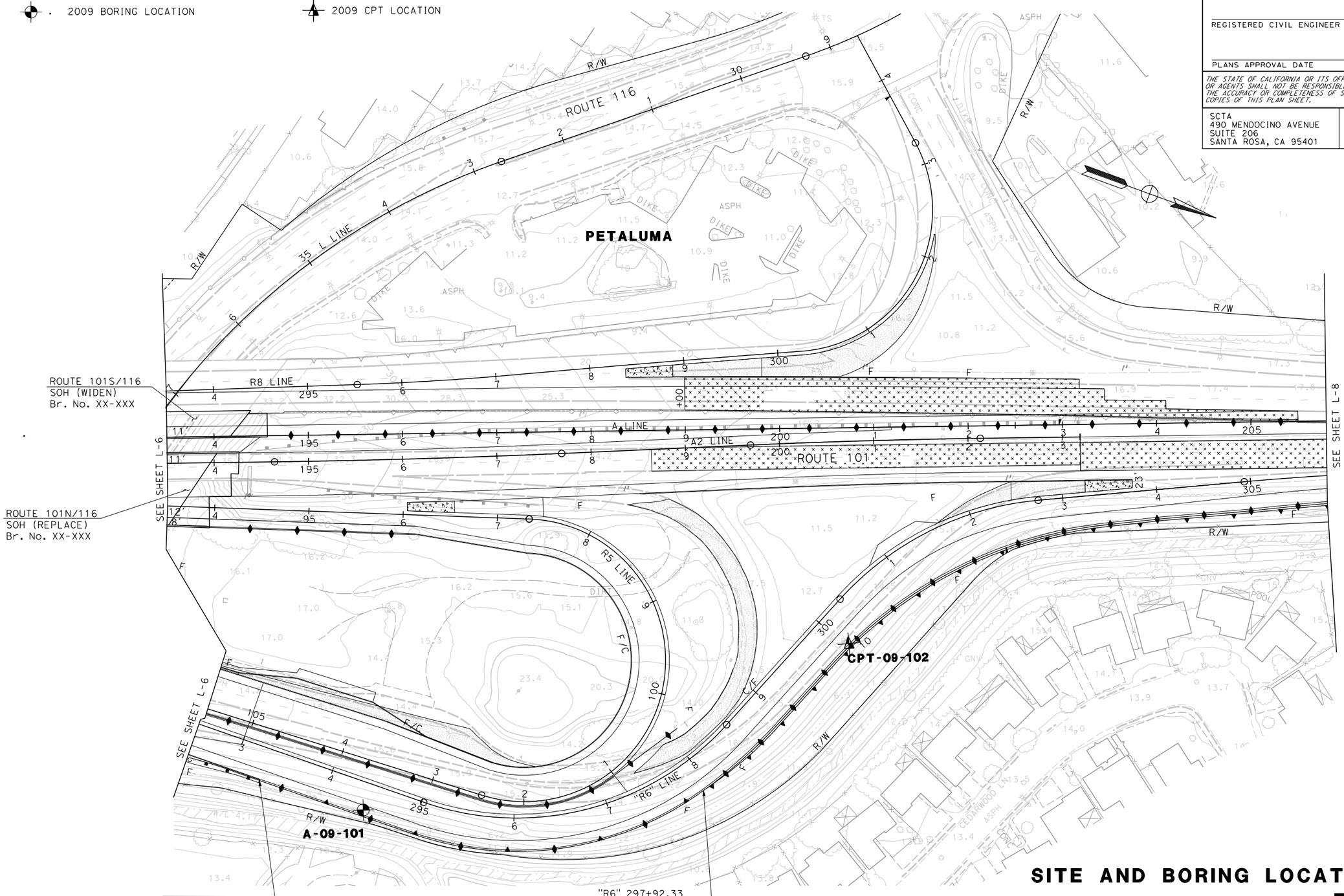
SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401

URS CORPORATION
55 South Market Street
Suite 1500
San Jose, CA 95113

LEGEND:

2009 BORING LOCATION

2009 CPT LOCATION



SITE AND BORING LOCATION PLAN

Figure 3-3

SCALE: 1" = 50'

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR

CALCULATED-DESIGNED BY

CHECKED BY

REVISED BY

DATE REVISED

LAST REVISION 00-00-00

DATE PLOTTED => 2/9/2010
TIME PLOTTED => 7:19:56 PM

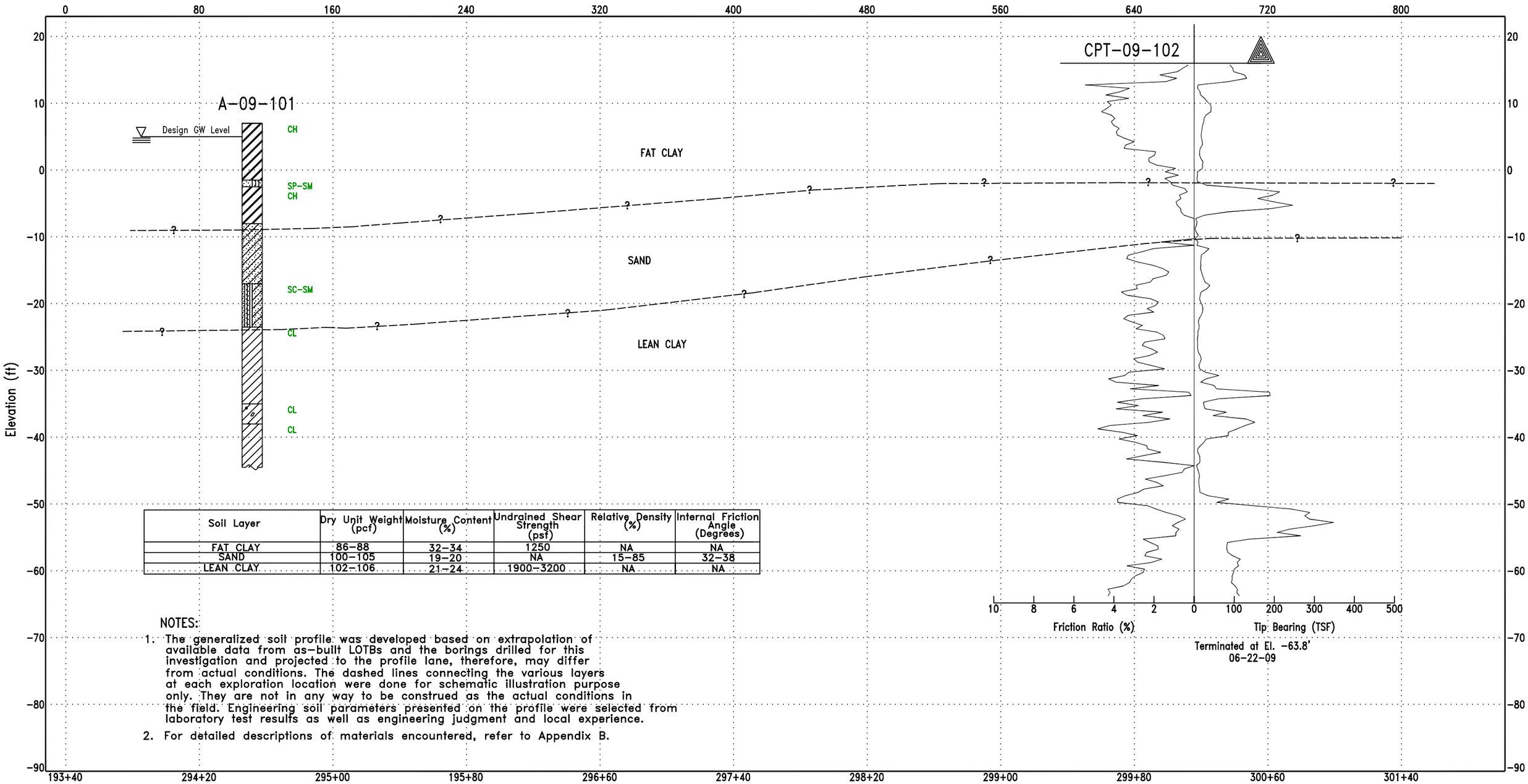
BORDER LAST REVISED 4/11/2008

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME => manoharan_selvendran
DGN FILE => ...\fig_bor_Location_RW293_L-07.dgn

CU 00000

EA 2640C1



Soil Layer	Dry Unit Weight (pcf)	Moisture Content (%)	Undrained Shear Strength (psf)	Relative Density (%)	Internal Friction Angle (Degrees)
FAT CLAY	86–88	32–34	1250	NA	NA
SAND	100–105	19–20	NA	15–85	32–38
LEAN CLAY	102–106	21–24	1900–3200	NA	NA

NOTES:

1. The generalized soil profile was developed based on extrapolation of available data from as-built LOTBs and the borings drilled for this investigation and projected to the profile lane, therefore, may differ from actual conditions. The dashed lines connecting the various layers at each exploration location were done for schematic illustration purpose only. They are not in any way to be construed as the actual conditions in the field. Engineering soil parameters presented on the profile were selected from laboratory test results as well as engineering judgment and local experience.
2. For detailed descriptions of materials encountered, refer to Appendix B.

FIGURE 3-4

URS CORPORATION – SAN JOSE
100 W. SAN FERNANDO ST, SUITE 200
SAN JOSE, CA 95113

LITHOLOGY GRAPHICS

Asphalt
USCS Silty Gravel with sand
USCS Silty Sand
USCS Fat Clay
USCS Lean Clay
USCS Lean Clay with gravel
USCS Sandy Lean Clay with gravel
USCS Sandy Fat Clay
USCS Lean to Fat Clay (borderline CL/CH)
USCS Sandy Lean Clay
USCS Clayey Sand with gravel
USCS Lean Clay with sand
USCS Fat Clay with sand
USCS Clayey Sand
USCS Well-graded Sand with silt and gravel

GENERALIZED SOIL PROFILE
RETAINING WALL 293
US 101 MSN B-4
PETALUMA, CALIFORNIA

Liquefaction Susceptibility Map

Susceptibility Level

- Very High
- High
- Moderate
- Low
- Very Low

Major Roads

Local Roads

Scale: 1 inch = 0.32 miles

This map is intended for planning use only and is not intended to be site-specific. Rather, it depicts the general risk within neighborhoods and the relative risk from community to community. More detailed maps are needed for site development decisions.

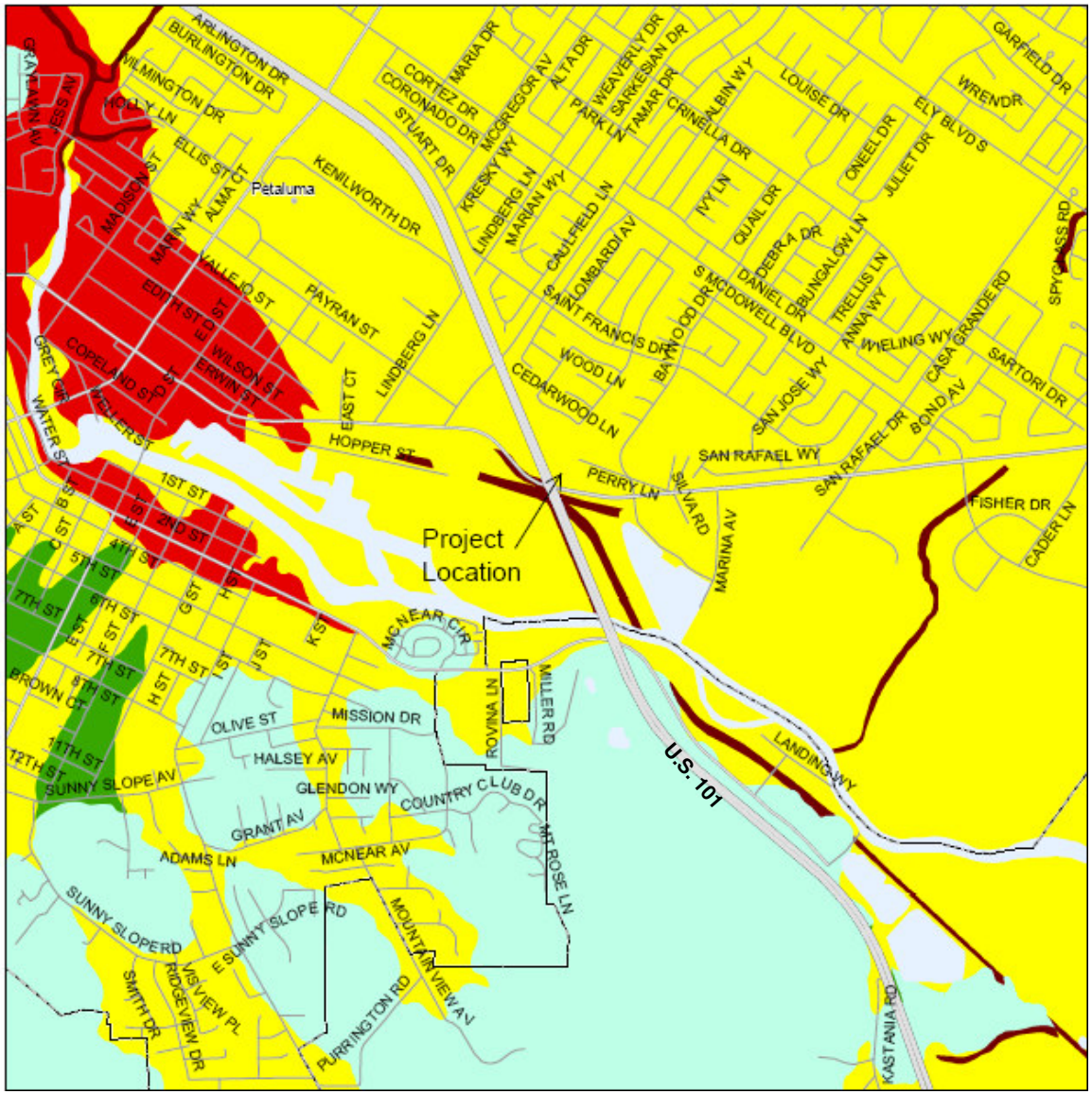
This map is available at http://quake.abag.ca.gov

Sources:
This map is based on work by William Lettis & Associates, Inc. and USGS. USGS Open-File Report 00-444, Knudsen & others, 2000 and USGS Open-File Report 2006-1037, Witter & others, 2006

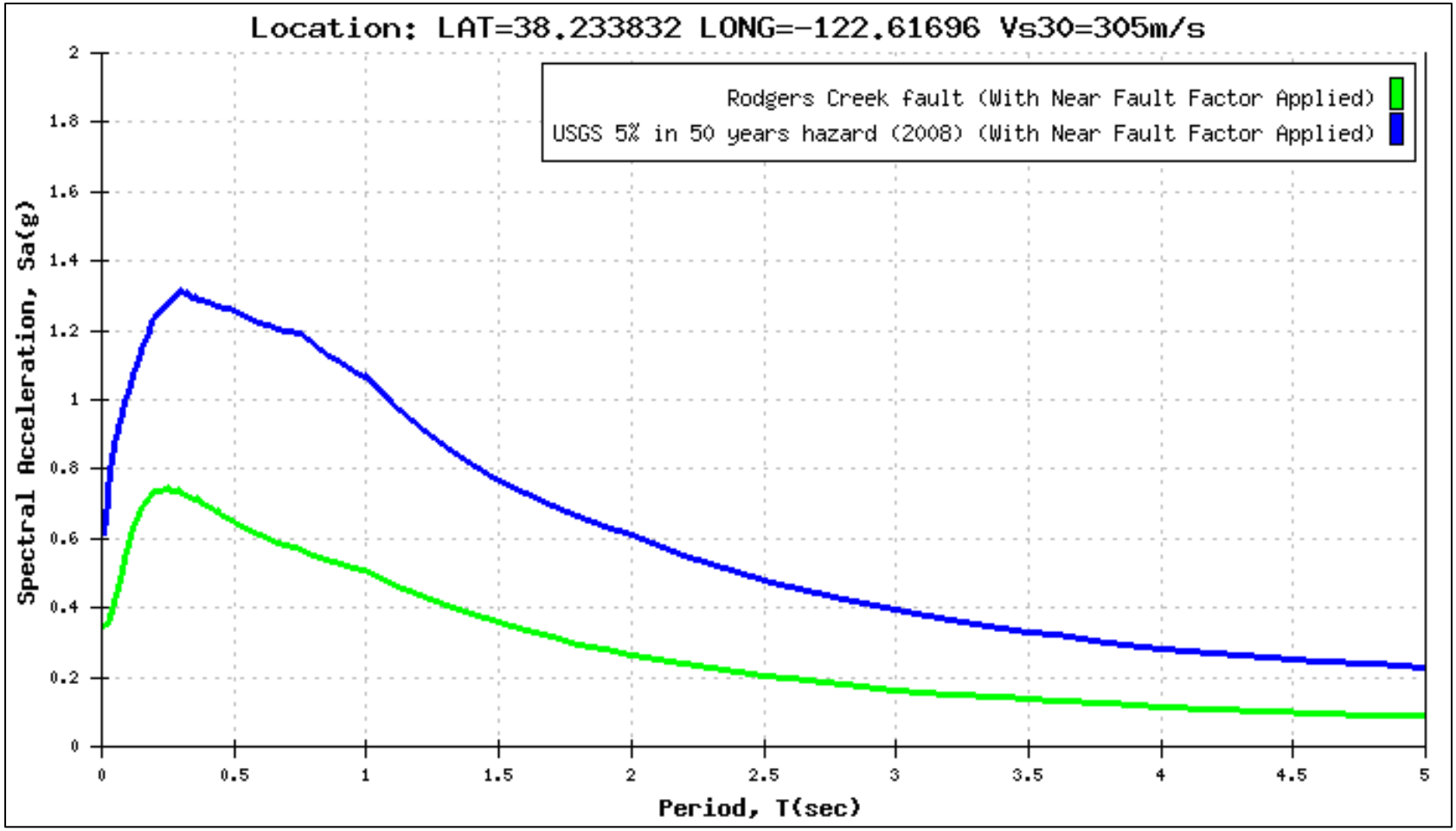
For more information visit:
http://pubs.usgs.gov/of/2000/of00-444/
http://pubs.usgs.gov/of/2006/1037/

Map Prepared by the ABAG Earthquake Program. June 2009.

ABAG Geographic Information Systems

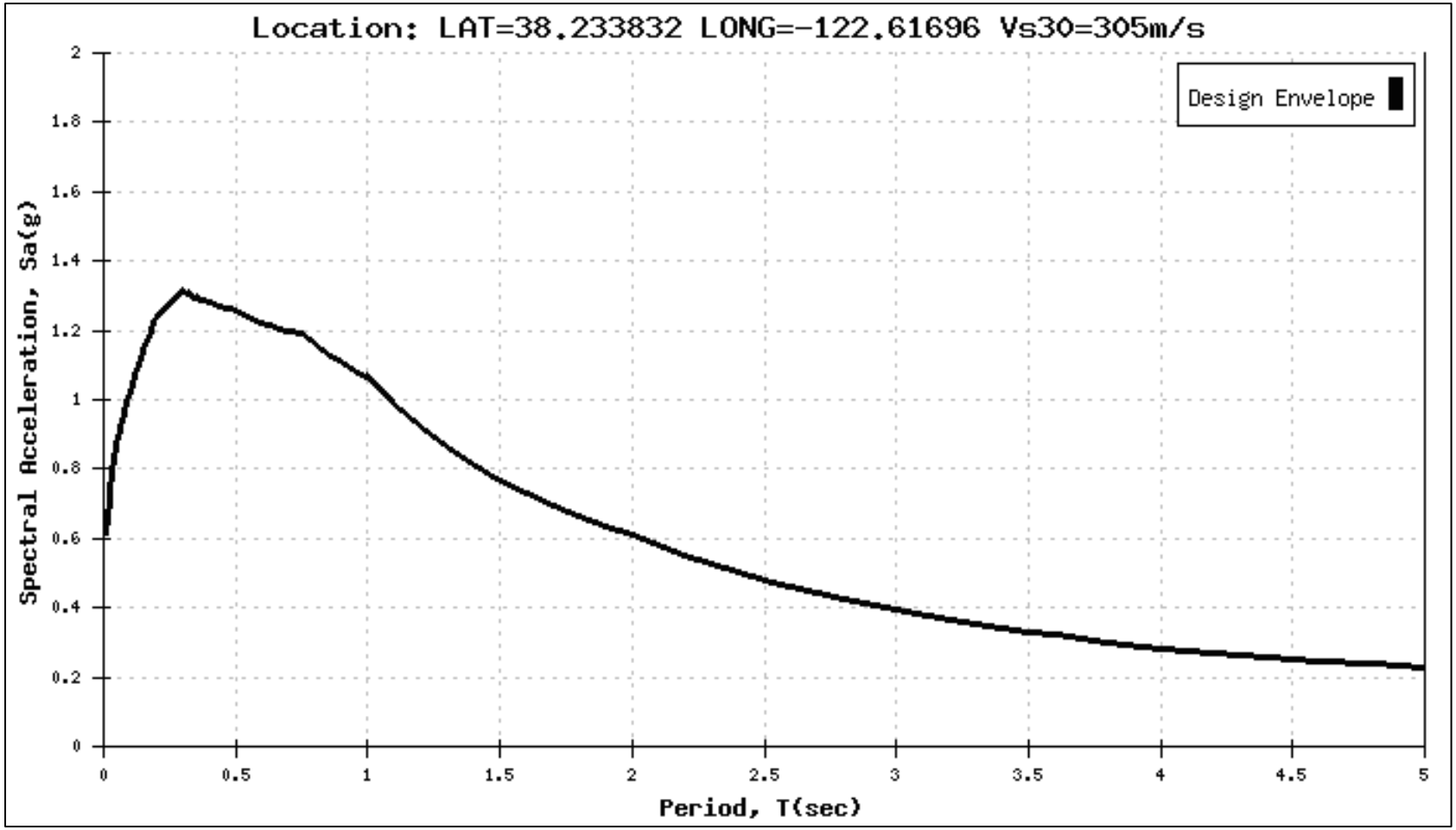


URS 100 W. San Fernando Street, Suite 200 San Jose, CA 95113 PHONE: (408) 297-9585 FAX: (408) 297-6962	Marin Sonoma Narrows Segment B4 Petaluma, CA Project No: 28645045	**Liquefaction Susceptibility Map Retaining Wall 293**	**FIGURE 3-5** February, 2010



Reference: Caltrans ARS Online (2009)

URS 100 W. San Fernando Street, Suite 200 San Jose, CA 95113 PHONE: (408) 297-9585 FAX: (408) 297-6962	PROJECT No 28645045	CALCULATED BY S. Manoharan	**Marin Sonoma Narrows-B4** **Retaining Wall 293** **Petaluma, CA** **Calculated Spectra**	**FIGURE** **5-1**
	Date August, 2009			



Reference: Caltrans ARS Online (2009)

URS 100 W. San Fernando Street, Suite 200 San Jose, CA 95113 PHONE: (408) 297-9585 FAX: (408) 297-6962	PROJECT No 28645045	CALCULATED BY S. Manoharan	**Marin Sonoma Narrows-B4** **Retaining Wall 293** **Petaluma, CA**	**FIGURE** **5-2**
	Date August, 2009		**Calculated Spectra Design Curve**	

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SON	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. C 42289 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

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URS CORPORATION
100 WEST SAN FERNANDO STREET, SUITE 200
SAN JOSE, CA 95113

SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

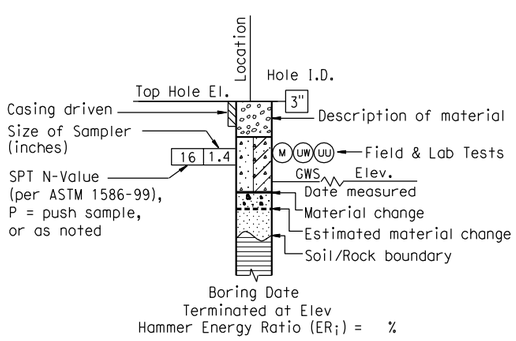
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
⬚	O	Other

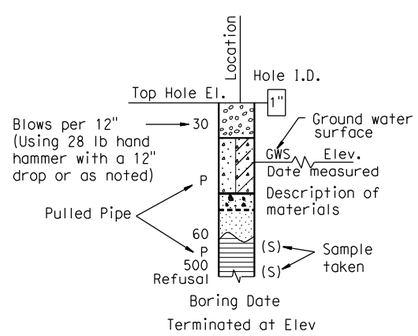
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

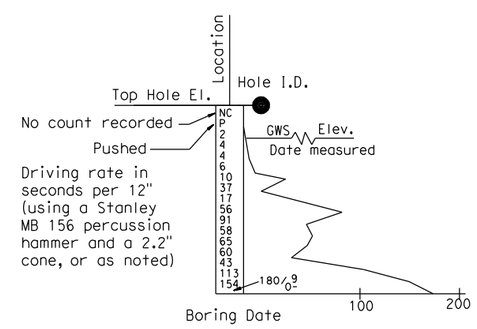
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.



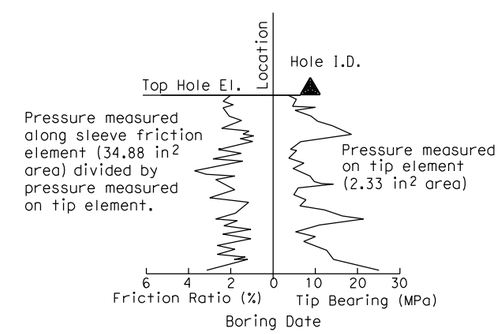
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

SOIL LEGEND

DESIGN OVERSIGHT	DRAWN BY	A. CHEUNG	C. RAMBO	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	S. HUANG	BRIDGE NO. 20ER293	RETAINING WALL No. 293
SIGN OFF DATE	CHECKED BY	MANOHARAN	FIELD INVESTIGATION BY: DATE:		PROJECT ENGINEER	POST MILES 3.7	LOG OF TEST BORINGS 1 OF 3

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 040000077361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 4-15-10 9-24-10 11-28-10 SHEET OF

FILE => ...\LOTB\RW293\293-z-ltb01.dgn

USERNAME => madhu_thuba DATE PLOTTED => 5/17/2011 TIME PLOTTED => 10:30:26 AM

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic/Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SON	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. C 42289 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

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URS CORPORATION
100 WEST SAN FERNANDO STREET, SUITE 200
SAN JOSE, CA 95113

SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

SOIL LEGEND

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY A. CHEUNG

CHECKED BY MANOHARAN

C. RAMBO
FIELD INVESTIGATION BY:
DATE:

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. HUANG
PROJECT ENGINEER

BRIDGE NO. 20ER293
POST MILES 3.7

RETAINING WALL No. 293

LOG OF TEST BORINGS 2 OF 3

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 040000077361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 4-15-10 9-27-10 11-28-10

SHEET OF

FILE => ...\LOTB\RW293\293-z-ltb02.dgn

USERNAME => mdahu_thu DATE PLOTTED => 5/17/2011 TIME PLOTTED => 10:31:38 AM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SON	101	2.5/4.1		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. C 42289 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

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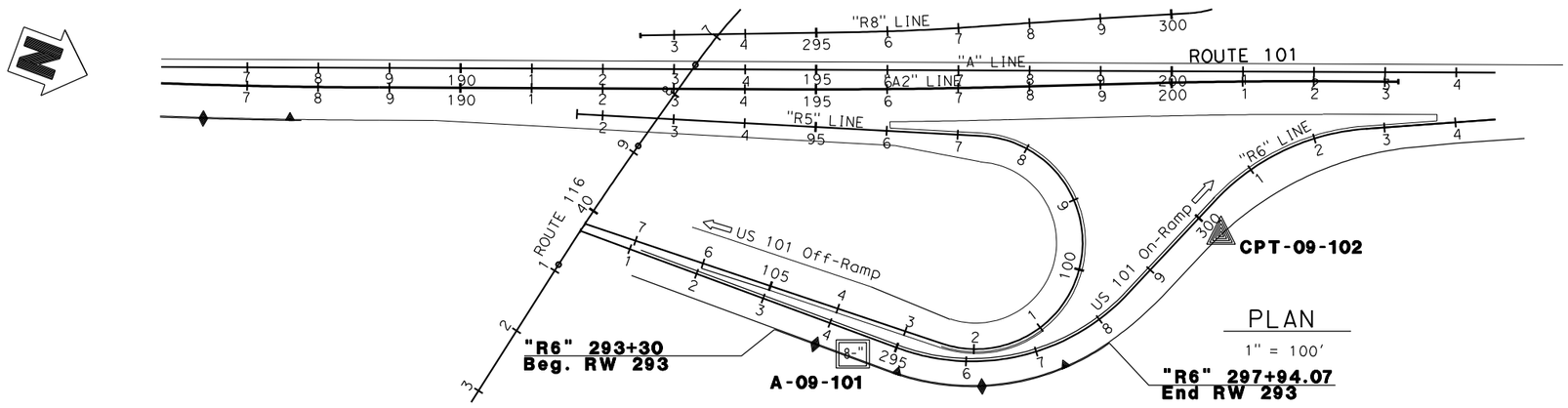
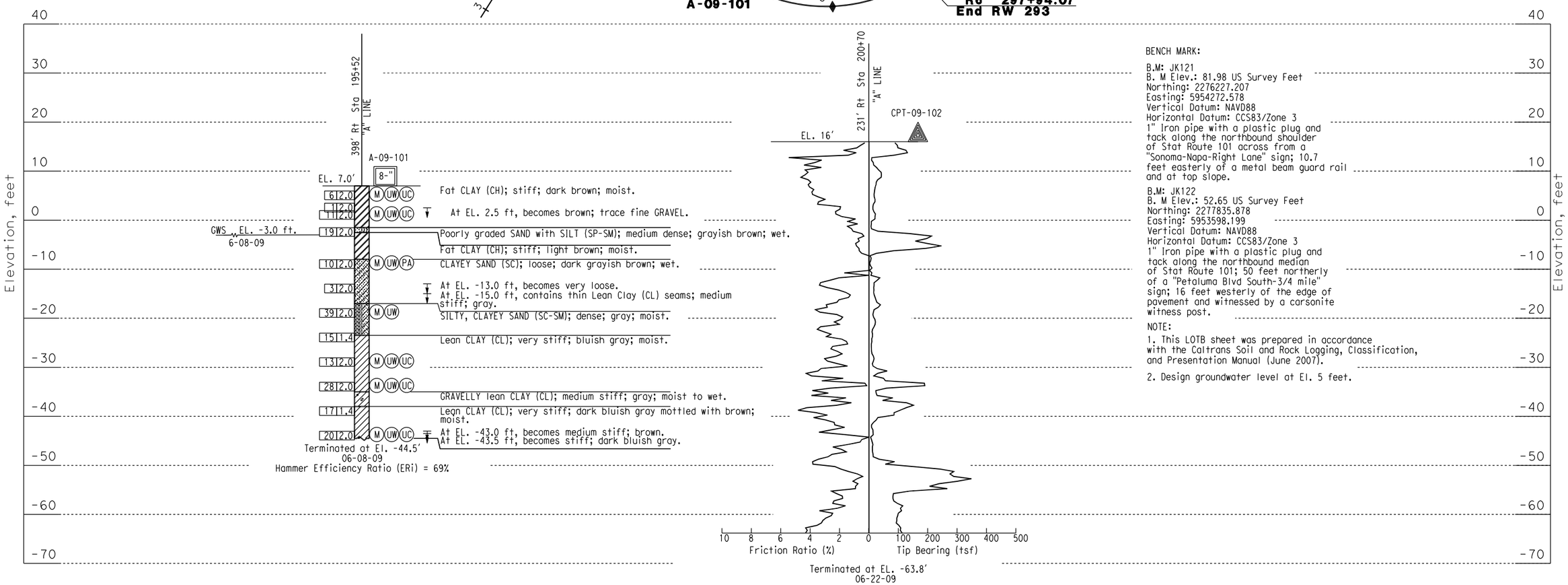
URS CORPORATION
100 WEST SAN FERNANDO STREET, SUITE 200
SAN JOSE, CA 95113

SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401



PLAN
1" = 100'



BENCH MARK:

B.M: JK121
B. M Elev.: 81.98 US Survey Feet
Northing: 2276227.207
Easting: 5954272.578
Vertical Datum: NAVD88
Horizontal Datum: CCS83/Zone 3
1" Iron pipe with a plastic plug and tack along the northbound shoulder of Stat Route 101 across from a "Sonoma-Napa-Right Lane" sign; 10.7 feet easterly of a metal beam guard rail and at top slope.

B.M: JK122
B. M Elev.: 52.65 US Survey Feet
Northing: 2277835.878
Easting: 5953598.199
Vertical Datum: NAVD88
Horizontal Datum: CCS83/Zone 3
1" Iron pipe with a plastic plug and tack along the northbound median of Stat Route 101; 50 feet northerly of a "Petaluma Blvd South-3/4 mile" sign; 16 feet westerly of the edge of pavement and witnessed by a carsonite witness post.

NOTE:

1. This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (June 2007).

2. Design groundwater level at El. 5 feet.

PROFILE
Ver. 1" = 10'
Hor. 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	A. CHEUNG	C. RAMBO	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	S. HUANG	BRIDGE NO. 20ER293	RETAINING WALL No. 293
SIGN OFF DATE	CHECKED BY	S. MANOHARAN	FIELD INVESTIGATION BY: DATE:		PROJECT ENGINEER	POST MILES 3.7	LOG OF TEST BORINGS 3 OF 3

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 040000077361 CONTRACT NO.: 04-2640C4

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 4-18-10 9-21-10 11-28-10 SHEET OF

FILE => ...\LOTB\RW293\293-z-1tb03.dgn

USERNAME => madhu_thu DATE PLOTTED => 5/17/2011 TIME PLOTTED => 10:32:52 AM

FIELD EXPLORATION PROGRAM

The geotechnical field investigation consisted of one boring and one cone penetration test (CPT), extending to depths of 51.5 and 80 feet below the existing ground surface, respectively. The explorations were performed on June 8 and June 22, 2009, by WDC Exploration & Wells, Richmond, California (Hollow Stem Auger boring), and Lankelma Inc., Richmond, California (CPT).

The boring and CPT locations were selected to obtain supplemental subsurface information to provide geotechnical design recommendations for the proposed retaining wall while avoiding underground utilities and subsurface obstructions. The exploration locations were checked to avoid underground utilities by contacting Underground Service Alert (USA) Network and a private utility locator. USA, in turn, alerted the various municipalities and utility companies that a subsurface investigation was to be conducted near their utilities.

After underground utility clearance, URS obtained permits from the County of Sonoma, Permit and Resource Management Department, Well and Permit Section, and coordinated with appropriate personnel to accommodate the required inspection during and following exploration.

Hollow Stem Auger Boring (A-09-101)

The hollow stem auger boring was drilled to provide the necessary information to evaluate the subsurface stratigraphy and to enable retrieval of soil samples for laboratory testing. The boring was drilled and sampled at the location indicated on the Site and Boring Location Plan, Figure 3-3. The boring was advanced to a depth of 51½ feet below existing ground surface using a crawler drill rig (limited-low access) under the supervision of a URS engineer who maintained a record of all field activities, classified the soils encountered using the Unified Soil Classification System (USCS), and prepared a log of the boring.

The drilling operation proceeded carefully, with particular attention to potential interference with utilities or other buried structures. During drilling, samples were obtained for identification and laboratory testing. Soil samples were generally obtained at 5-foot intervals and at changes in strata. Samples were obtained using a lined Modified California (MC) sampler, having an outside diameter of 2½ inches. A 140-pound hammer falling through a distance of 30 inches was used to drive the samplers. The blow count recorded on the boring logs adjacent to the sample depth is the number of blows required to drive the sampler for the final 1 foot of a maximum 18 inch drive.

One of the objectives of the field investigation was to obtain undisturbed samples for laboratory testing. Effort was made to minimize sample disturbance during sample handling and transportation. After careful withdrawal from the ground, the sample was placed upright and the ends of the sample were cleaned of disturbed soil. Both ends of the samples were covered with plastic caps, and carefully transported to URS' laboratory in San Jose.

Cone Penetration Test (CPT-09-102)

A CPT was advanced to a depth of 100 feet below existing ground surface by Lankelma Inc at the location shown on the Site and Boring Location Plan, Figure 3-3.

The Cone Penetration Test (CPT) consists of pushing a cone-tipped probe into the soil while simultaneously recording the cone tip resistance and side friction resistance to penetration. The CPT was conducted in general accordance with ASTM specifications (ASTM D3441-79) using an electric cone penetrometer. The CPT equipment consists of a cone assembly mounted at the end of a series of hollow rods. A set of hydraulic rams is used to push the cone and rods into the soil while a continuous record of come and friction resistance versus depth is obtained in both analog and digital form at the ground surface. A specially designed all-wheel drive truck is used to transport and house the test equipment and to provide a 178 kN reaction to the thrust of the hydraulic rams.

The cone penetrometer assembly consists of a conical tip and a cylindrical friction sleeve. The conical tip has a 60-degree apex angle and a projected cross-sectional area of 15 cm^2. The cylindrical friction sleeve has a surface area of 225 cm^2. Both the conical tip and the cylindrical friction sleeve have outer diameters of 4.37 centimeters. The interior of the cone penetrometer is instrumented with strain gauges that allow simultaneous measurement of cone tip and friction sleeve resistance during penetration. Continuous electric signals from the strain gauges are transmitted by a cable in the sounding rods to analog and digital data recorders in the CPT truck.

Data obtained during a CPT consists of continuous stratigraphic information with close vertical resolution. Stratigraphic interpretation is based on relationships between cone tip resistance and friction resistance. The calculated friction ratio (CPT friction sleeve resistance divided by cone tip resistance) is used as an indicator of soil type. Granular soils typically have low friction ratios and high cone resistance, while cohesive or organic soils have high friction ratios and low cone resistance. These stratigraphic material categories form the basis for all subsequent calculations that utilize the CPT data. Soil interpretation presented on the CPT logs from this investigation was based on recent correlations developed by Robertson, 1986, presented on Figure B-1.

LABORATORY TESTING PROGRAM

A laboratory testing program was carried out to determine the index and engineering properties of the major subsurface strata encountered at the site. The laboratory testing program included tests to confirm the existing information on the engineering characteristics of the major strata and to estimate some of the engineering parameters. These tests were performed at the URS' laboratory.

Index Tests

Index tests were performed on cohesive soil samples to aid in soil classification and in correlation with other engineering parameters. Index tests included moisture content and dry density determinations. The moisture content tests were performed in accordance with ASTM D 2216. Dry density was determined in accordance with ASTM D 2937. The locations of these tests are indicated on the Logs of Test Borings adjacent to the appropriate sample depths. The results are summarized in Table B-1. Grain size distribution is presented graphically on Figure B-2.

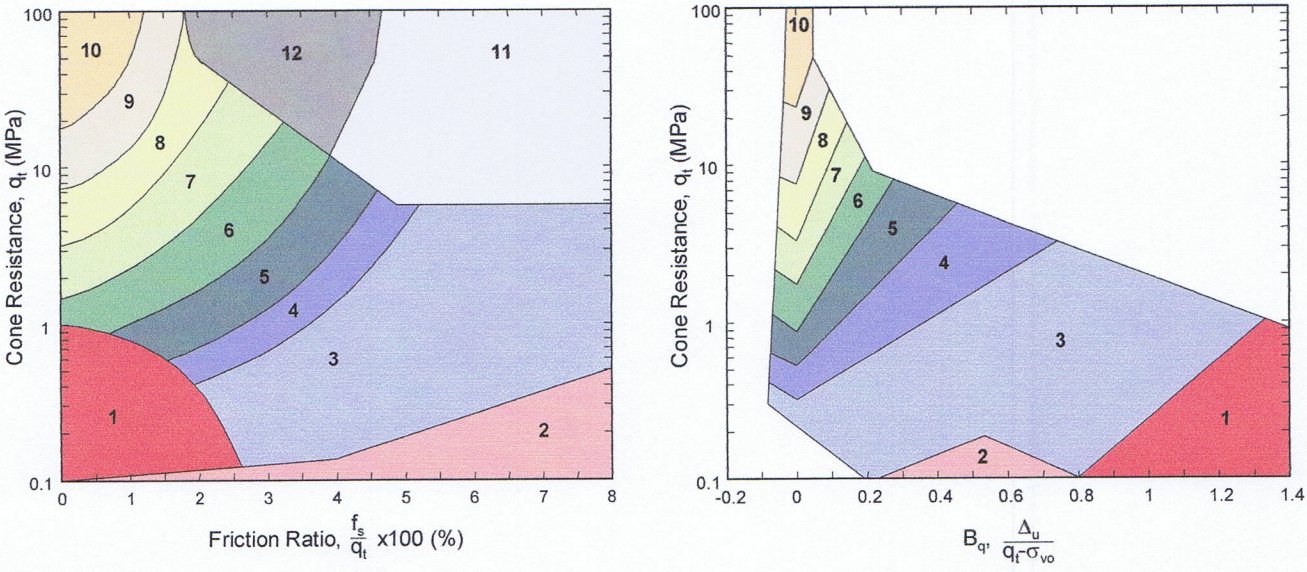
Unconfined Compression Tests

Unconfined compression tests were performed on select cohesive soil samples to assist in determining shear strength parameters. These tests were performed in accordance with ASTM D 2166. The locations of these tests are indicated on the Logs of Test Borings adjacent to the appropriate sample depths. The results are summarized in Table B-1.

TABLE B-1
SUMMARY OF LABORATORY TEST RESULTS

Boring or Sample No.	Date Sampled	Station	Line	Distance from Line (feet)	Depth (feet)	Unconfined Compressive Strength (psf)	In-Place Conditions		Sieve Analysis Results (Percent Passing)								
							Water Content (%)	Dry Unit Weight (pcf)	%<1/2-in	%<3/8-in	%<#4	%<#8	%<#16	%<#30	%<#50	%<#100	%<#200
A-09-101	8-Jun-09	195+36	A	Rt. 398	1	2,530	33.6	86									
A-09-101	8-Jun-09	195+36	A	Rt. 398	5	2,650	31.6	88									
A-09-101	8-Jun-09	195+36	A	Rt. 398	15		20.5	104	100	100	95	83	67	56	38	22	17
A-09-101	8-Jun-09	195+36	A	Rt. 398	25		19.3	105									
A-09-101	8-Jun-09	195+36	A	Rt. 398	35	5,940	21.4	106									
A-09-101	8-Jun-09	195+36	A	Rt. 398	40	6,500	23.9	102									
A-09-101	8-Jun-09	195+36	A	Rt. 398	50	3,760	21.2	105									

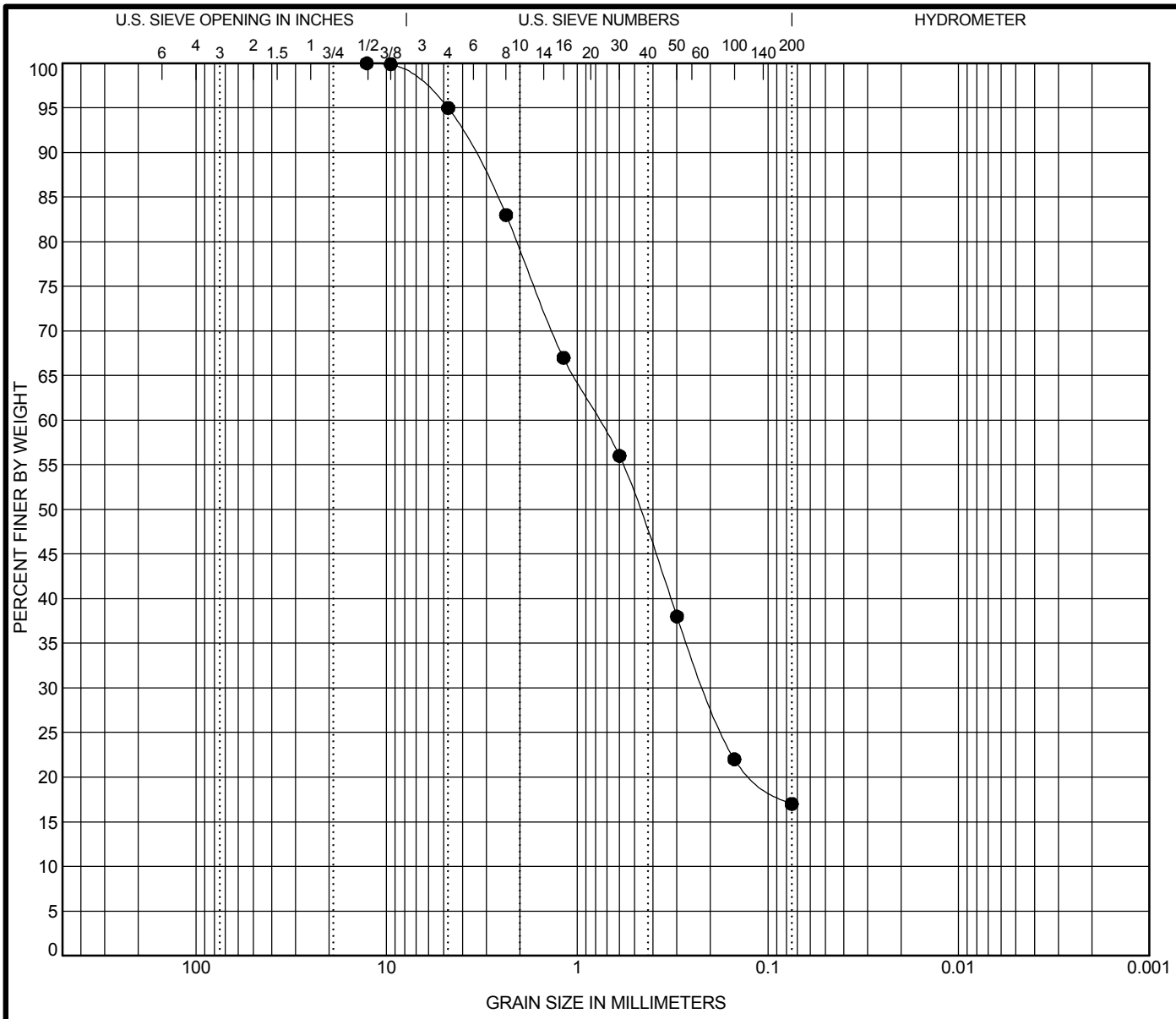
CPT Soil Behavior Type Legend
(Robertson et al. 1986)



Zone	Soil Behavior Type
1	Sensitive, Fine Grained
2	Organic Material
3	Clay
4	Silty Clay to Clay
5	Clayey Silt to Silty Clay
6	Sandy Silt to Clayey Silt
7	Silty Sand to Sandy Silt
8	Sand to Silty Sand
9	Sand
10	Gravelly Sand to Sand
11	Very Stiff Fine Grained*
12	Sand to Clayey Sand*

*Overconsolidated or Cemented

FIGURE B-1



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**A-09-101**	**15.0**	**Clayey SAND (SC)**					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**A-09-101**	**15.0**	**12.7**	**0.767**	**0.212**		**5.0**	**78.0**	**17.0**	

URS

55 S. Market St, Ste 1500
San Jose, CA 95113

GRAIN SIZE DISTRIBUTION

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

FIGURE B-2

URS GRAIN SIZE 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 2/5/10

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	5.6/6.3	120	148

Caltrans Metric

GEOTECHNICAL PROFESSIONAL

3-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/05 — STATE OF CALIFORNIA

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PARIKH CONSULTANTS, INC.
356 SOUTH MILPITAS BLVD.
MILPITAS CA 95035

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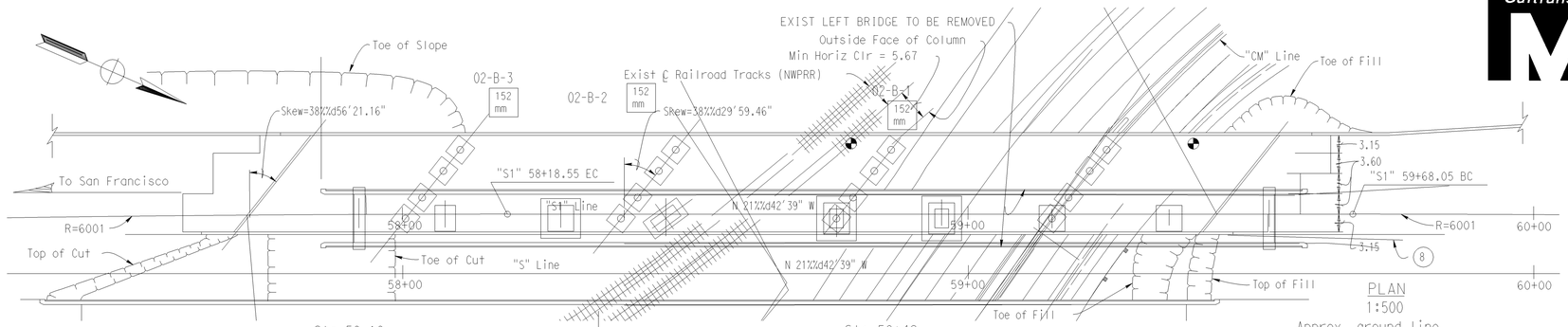

PLAN
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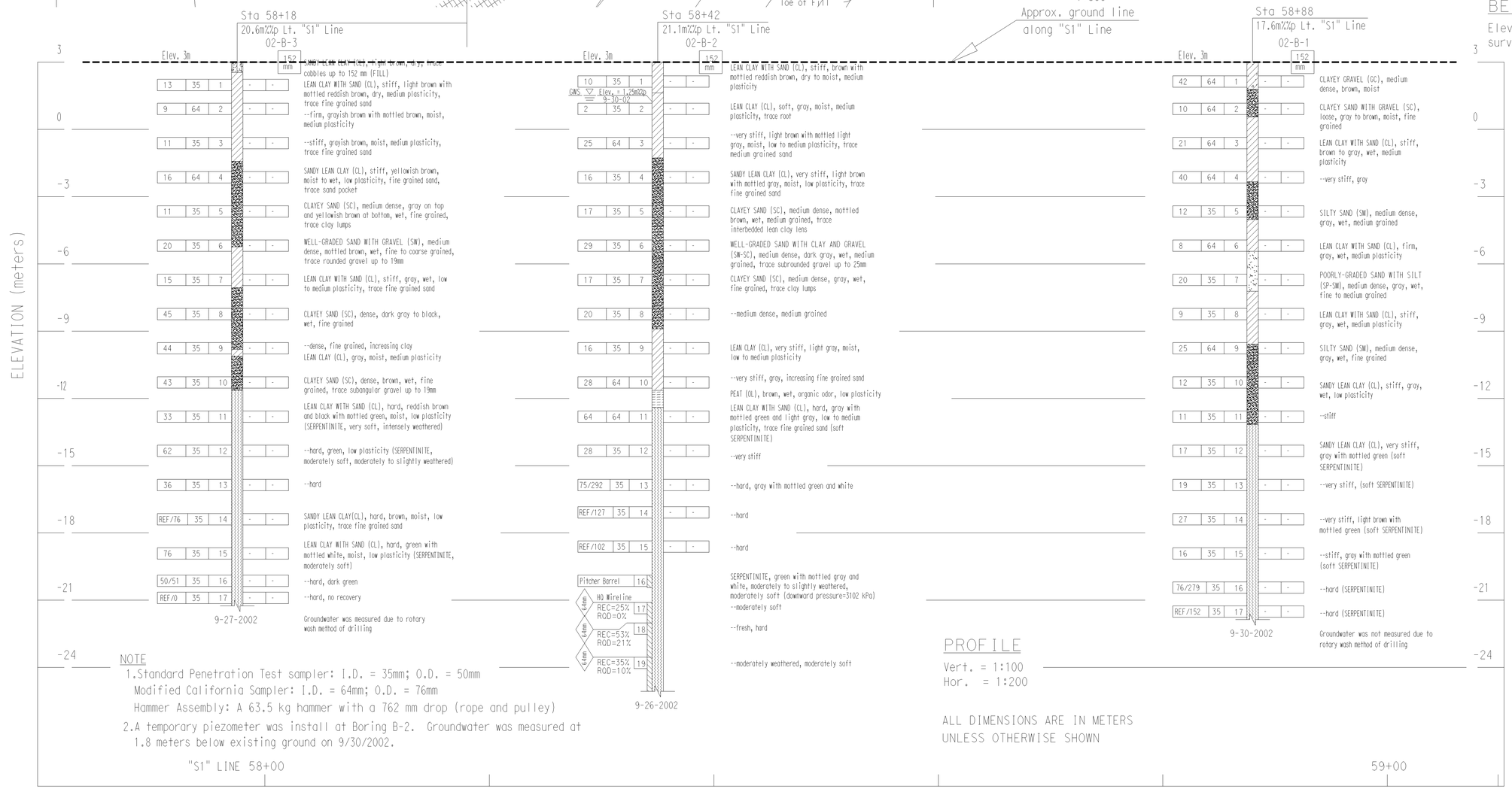


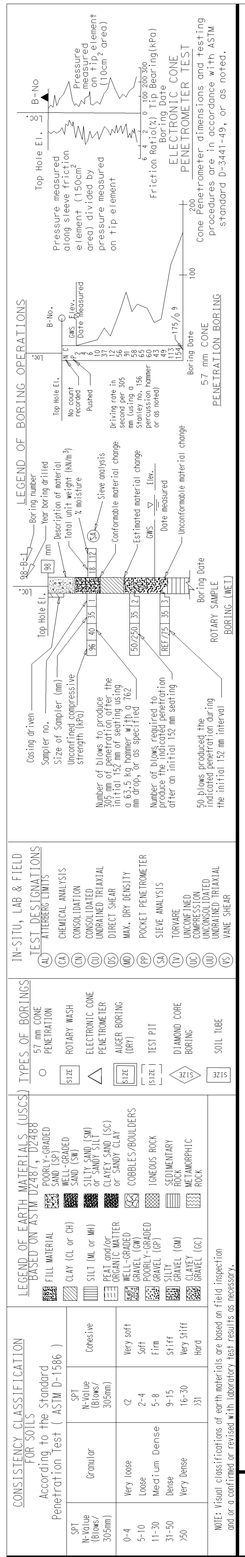
BENCHMARK:
Elevations based on surveyed topography.

NOTE
1. Standard Penetration Test sampler: I.D. = 35mm; O.D. = 50mm
   Modified California Sampler: I.D. = 64mm; O.D. = 76mm
   Hammer Assembly: A 63.5 kg hammer with a 762 mm drop (rope and pulley)
2. A temporary piezometer was install at Boring B-2. Groundwater was measured at 1.8 meters below existing ground on 9/30/2002.

PROFILE
Vert. = 1:100
Hor. = 1:200

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

"S1" LINE 58+00 — 59+00



DESIGN OVERSIGHT	DRAWN BY	F. WANG	F. WANG/E. BHANGOO FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	CHRISTOPHER KOEPKE PROJECT ENGINEER	BRIDGE NO. 20-0284L	101/116 SOH REPLACE
SIGN OFF DATE	CHECKED BY	Y. DAVID WANG	DATE: 9/26-9/30			KILOMETER POST 5.6/6.3	LOG OF TEST BORINGS

GEOTECHNICAL LOG OF TEST BORINGS SHEET (METRIC) (REV 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04276
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES (PRELIMINARY STAGE ONLY): ~~12/11/02~~ 3/01/03

SHEET 26 OF 27

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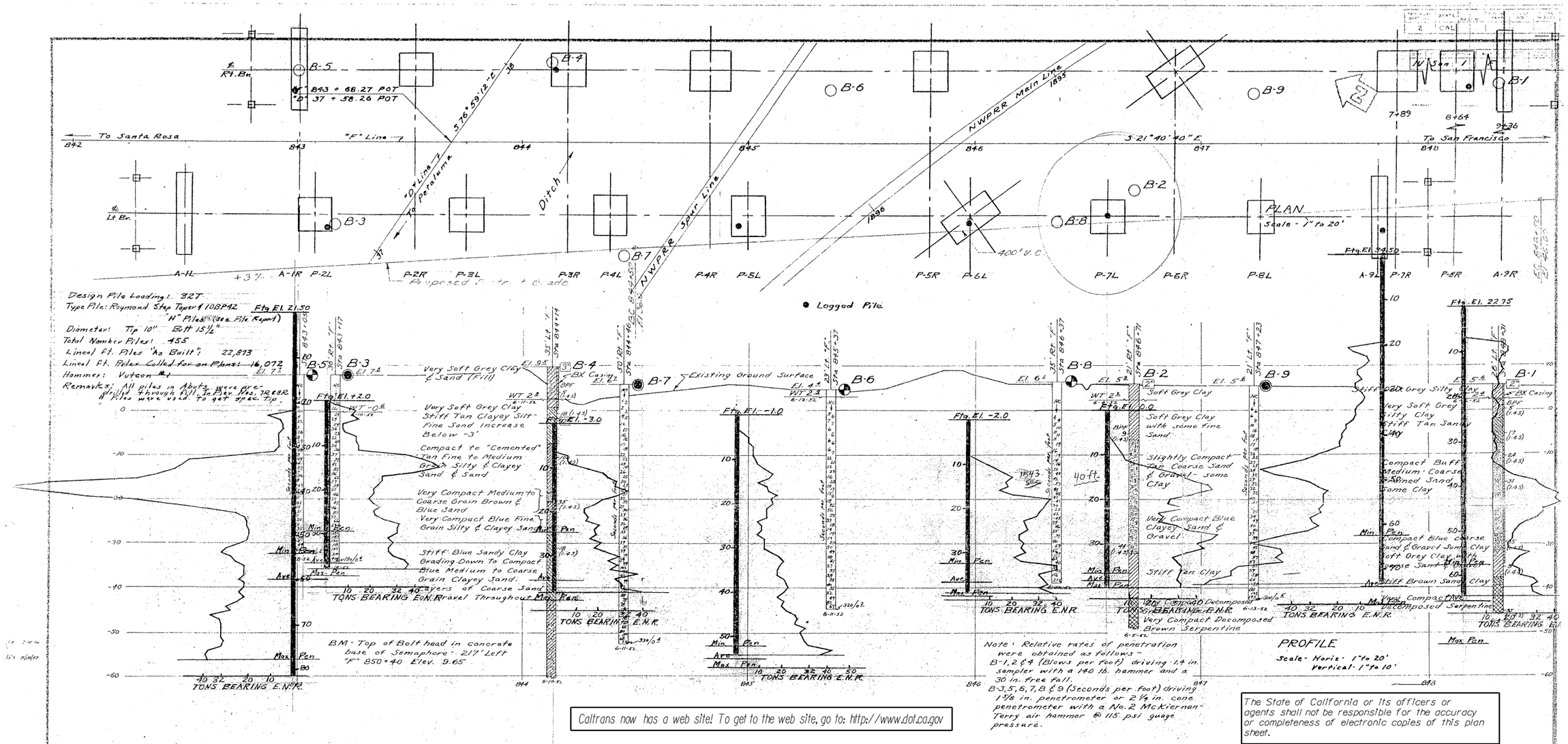
USERNAME => trlim DATE PLOTTED => 19-MAR-2004 TIME PLOTTED => 08:49



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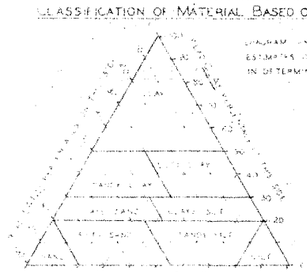
CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS



LEGEND OF BORING OPERATIONS

- Plan or Air Boring
- "P" Sampler Boring
- Rotary Wash Boring
- "F" Cutting Sampler Driven
- Auger Boring
- 2½" Penetrometer Driven
- 1⅛" Sampler Boring
- 2¼" Cone Auger Boring
- 3" Cone Auger Boring
- Casing
- Jet Bor
- Sample
- 1⅛" A-F
- 2¼" Con

The appropriate symbols designating method of operation are shown at the hand corner of the respective boring. Where tool changes were made during the boring operation symbols are shown at the point of changes.

Clayey Silt - CSt

Sandy Clay - SC

Rock - R

Fill Material

Revisions made to this Log of Test Borings from the original 1952 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from "S" Line
B-1	57+76	7.9 m Left
B-2	58+25	6.4 m Right
B-3	59+33	10.9 m Right
B-4	59+03	10.7 m Left
B-5	59+38	9.4 m Left
B-6	58+65	7.0 m Left
B-7	58+93	15.2 m Right
B-8	58+35	10.7 m Right
B-9	58+09	6.4 m Left

Notes:

1. See the General Plan and/or Foundation Plan for Metric Stationing.
2. Structure Design produced the data presented in the table above. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.

DIVISION OF ENGINEERING SERVICES - OFFICE OF GEOTECHNICAL SERVICES

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. It does not attest to the accuracy or validity of the information contained in the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	KILOMETER POST - TOTAL PROJECT	Sheet No.	Total Sheets
04	Son	101	5.6/6.3	121	148

CERTIFIED ENGINEERING GEOLOGIST

REGISTERED GEOLOGIST Christopher W. Koepke No. 2207 Exp. 10-31-04 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

101 / 116 SOH (REPLACE)

LOG OF TEST BORINGS

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: 04
EA: 276001

BRIDGE No. 20-0155L

Sheet 27 of 27

To accompany plans dated 3-15-04

NOTES

THE CONTRACTOR'S ATTENTION IS DIRECTED TO SECTION 2, ARTICLE (L) OF THE STANDARD SPECIFICATIONS AND TO THE SPECIAL PROVISIONS ACCOMPANYING THIS SET OF PLANS.

CLASSIFICATION OF EARTH MATERIAL AS SHOWN ON THIS SHEET IS BASED UPON FIELD INSPECTION AND IS NOT TO BE CONSTRUED TO IMPLY MECHANICAL ANALYSIS.

Alinement & Profile data was obtained from District 10 "Proposed Plans" Dwg. #0.0097(10) & PP 2202-2

FOR PRELIMINARY PURPOSES

ROUTE 101 SEPARATION AND OVERHEAD

LOG OF TEST BORINGS

SCALE: as noted

BRIDGE No. 20-155

DRAWING No. PP 2202-2

aslotb02.tif

DIST.	COUNTY	ROUTE	KILOMETER POSTS TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Son	101	5.6/6.3	130	148

Caltrans Metric

05-20-02
M. Momenzadeh
REGISTERED ENGINEER - CIVIL

03-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
M. Momenzadeh
No. 57482
Exp. 12-31-05
CIVIL
STATE OF CALIFORNIA

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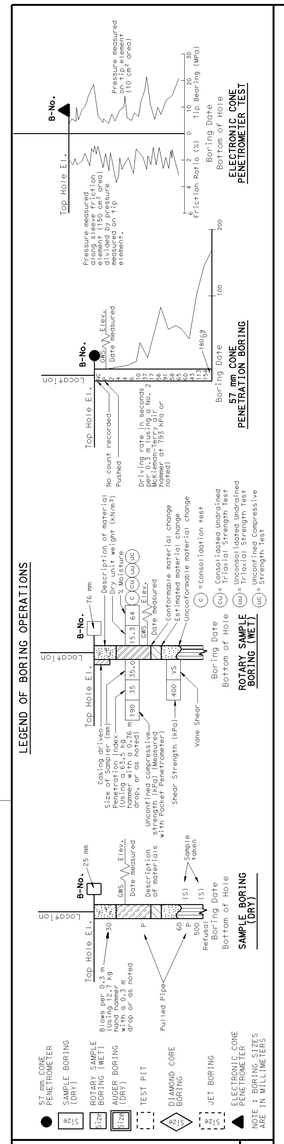
All Dimensions are in Meters unless otherwise shown

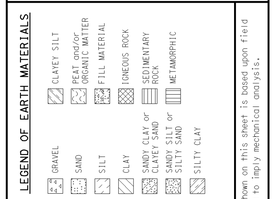
For boring location see PLAN, Log of Test Borings 2 Sheet

PROFILE
HORIZ. NO SCALE
VERT. 1 : 100

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS



CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

SPT N-Value (Blows/ 0.3 m)	Granular	SPT N-Value (Blows/ 0.3 m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very Stiff
		>31	Hard

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

DIVISION OF ENGINEERING SERVICES	
DRAWN BY	M. Reynolds 04/02
CHECKED BY	M. Momenzadeh

FIELD INVESTIGATION BY: M. Momenzadeh

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

GEOTECHNICAL SERVICES
OFFICE OF GEOTECHNICAL DESIGN - WEST

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RETAINING WALL 101B
LOG OF TEST BORINGS 1 OF 2

(Rev 01/02)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES 3-26-03

REVISION DATES (PRELIMINARY STAGE ONLY) | SHEET 9 | OF 10

USERNAME => trpierce
DGN FILE => bfflotb01.dgn

DATE PLOTTED => 19-MAR-2004
TIME PLOTTED => 09:03

DIST.	COUNTY	ROUTE	KILOMETER POSTS TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Son	101	5.6/6.3	131	148

Caltrans Metric

05-20-02
M. Momenzadeh
REGISTERED ENGINEER - CIVIL

03-15-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
M. Momenzadeh
No. 57482
Exp. 12-31-05
CIVIL
STATE OF CALIFORNIA

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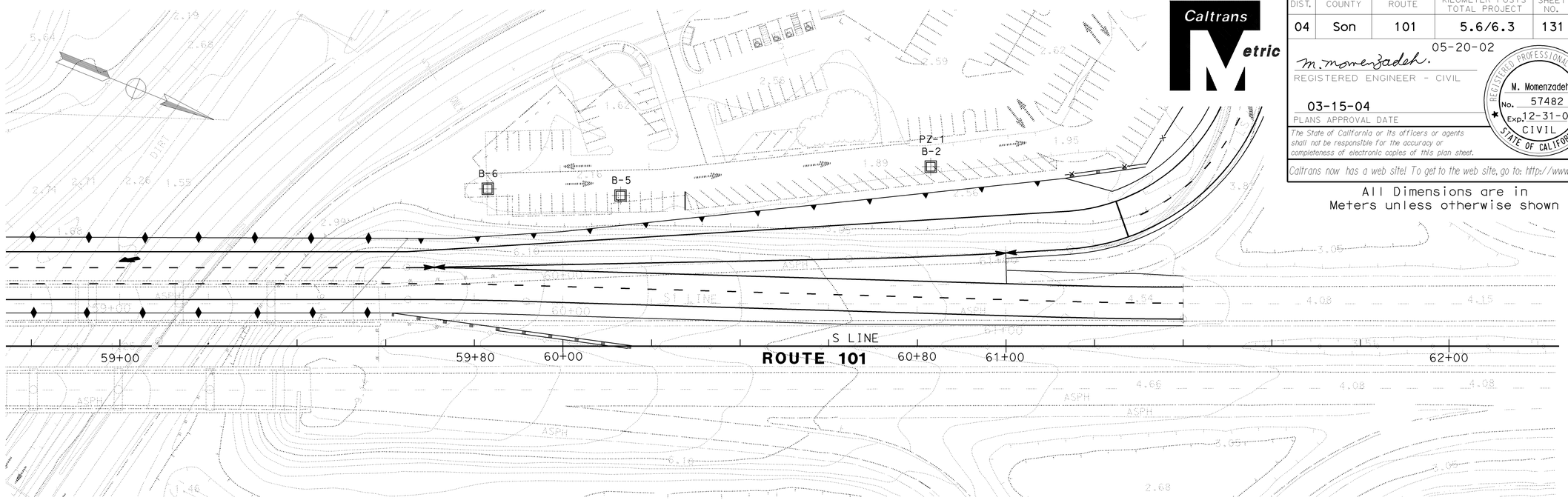
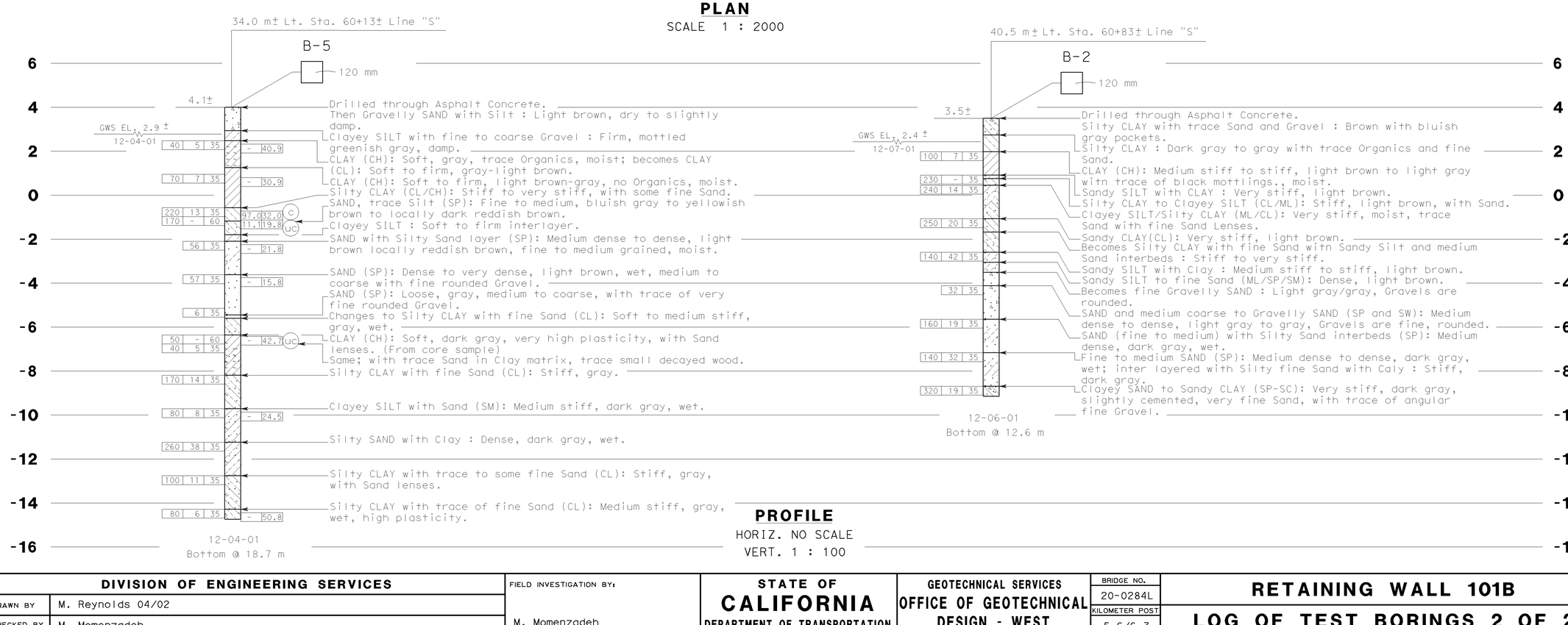


PLAN

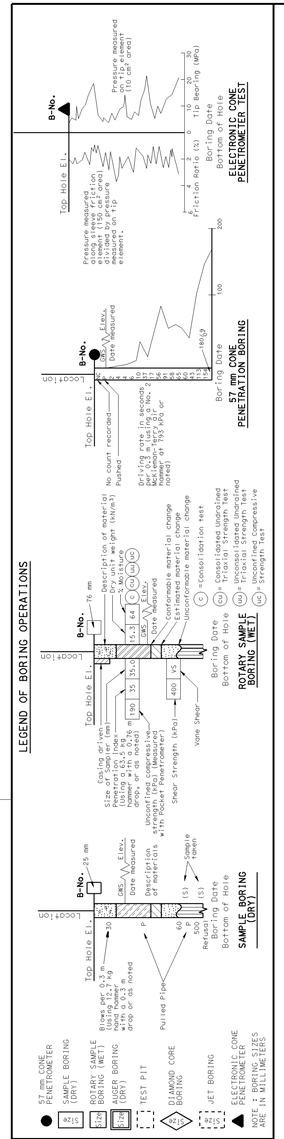
SCALE 1 : 2000



PROFILE

HORIZ. NO SCALE
VERT. 1 : 100

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

GRAVEL · SAND · SILT · CLAY · SANDY CLAY or CLAYEY SAND · SANDY SILT or SILTY SAND · SILTY CLAY · CLAYEY SILT · PEAT and/or ORGANIC MATTER · FILL MATERIAL · IGNEOUS ROCK · SEDIMENTARY ROCK · METAMORPHIC ROCK

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

SPT N-Value (Blows/ 0.3 m)	Granular	SPT N-Value (Blows/ 0.3 m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
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31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very Stiff
		>31	Hard

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

DIVISION OF ENGINEERING SERVICES	
DRAWN BY	M. Reynolds 04/02
CHECKED BY	M. Momenzadeh

FIELD INVESTIGATION BY: M. Momenzadeh

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

GEOTECHNICAL SERVICES
OFFICE OF GEOTECHNICAL DESIGN - WEST

BRIDGE NO. 20-0284L
KILOMETER POST 5.6/6.3

RETAINING WALL 101B

LOG OF TEST BORINGS 2 OF 2

(Rev 01/02)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 276001

DISREGARD PRINTS BEARING EARLIER REVISION DATES 3-26-03

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 10 OF 10

USERNAME => trpierce
DGN FILE => bfflotb02.dgn

DATE PLOTTED => 22-MAR-2004
TIME PLOTTED => 06:56

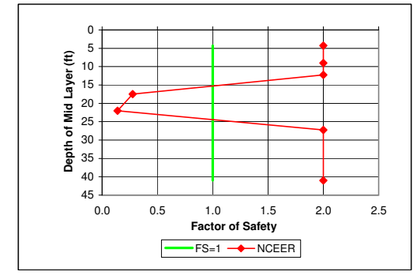
LIQUEFACTION ANALYSIS

Project	101 MSN Petaluma
Project No.	28645045
Boring No.	A-09-101

PGA =	0.6	
M_w =	7.0	
GWT during EQ	0.0	ft
Sampler:	Symbol	Corr. Factor
SPT	S	1
Mod.Cal	M	0.8
California	C	0.7
Mag. Weighting Factor($CSR_M/CSR_{M=7.5}$)		0.82

Note: Cells in Red must be input

Hammer type :	Type		C_E	Code	C_E
	Donut		0.75	1	3
	Safety		1	2	
	Auto		1.16	3	
Borehole Diameter:	(inch)	(mm)	C_B		C_B
	2.5-4.5	65-115	1	1	1
	6	150	1.05	2	
	8	200	1.15	3	
Rod Length:	(feet)	(m)	C_R		
	Default			999	
Sampling Method:	Type		Cs		
	Stand		1		
	No liners		1.2		



Note: F.S. greater than 2 is set to be equal to 2

Layer Number	Soil Type	γ_m	At Bottom of Layer Depth		At Center of Layer Depth		EQ σ_o	EQ u	EQ σ'_o	r_d	EQ CSR	N raw	Sampler	N SPT	Fines Content	N_{60-cs}	C_N	C_E	C_B	C_R	C_S	$(N_1)_{60-cs}$	CRR*$_{7.5,1tsf}$	Magnitude Scaling Factor NCEER K_m Lower	Upper	Middle	Overburden Correction K_σ	Above GWT?	F.S.	Liquefy ?	F.S=1.0
	(USCS)	pcf	ft	m	ft	m	psf	psf	psf						%	FC< 5%	EQ					during EQ	Critical						NCEER	NCEER	
1	CL	115	8.5	2.59	4.25	1.30	489	265	224	0.992	0.846			0		0.0	2.00	1.16	1.00	0.75	1.00	0		1.19	1.26	1.22	1.000	N	2.00	N	1
2	SP-SM	120	9.5	2.90	9.0	2.74	1,038	562	476	0.981	0.834	22	m	17.6	10	18.8	2.00	1.16	1.00	0.75	1.00	33	0.459	1.19	1.26	1.22	1.000	N	2.00	N	1
3	CL	115	15.0	4.57	12.3	3.73	1,414	764	649	0.974	0.827					0.0	1.81	1.16	1.00	0.75	1.00	0		1.19	1.26	1.22	1.000	N	2.00	N	1
4	SC	125	20.0	6.10	17.5	5.33	2,043	1,092	951	0.963	0.807	10	m	8	17	11.5	1.49	1.16	1.00	0.85	1.00	17	0.182	1.19	1.26	1.22	1.000	N	0.28	Liquef	1
5	SC	125	24.0	7.32	22.0	6.71	2,605	1,373	1,232	0.951	0.784	3	m	2.4	17	5.6	1.31	1.16	1.00	0.95	1.00	8	0.089	1.19	1.26	1.22	1.000	N	0.14	Liquef	1
6	SC-SM	130	30.5	9.30	27.3	8.31	3,278	1,700	1,577	0.933	0.756	39	m	31.2	17	36.1	1.16	1.16	1.00	0.95	1.00	46	0.459	1.19	1.26	1.22	1.000	N	2.00	N	1
7	CL	125	51.5	15.70	41.0	12.50	5,013	2,558	2,454	0.842	0.671					0.0	0.93	1.16	1.00	1.00	1.00	0		1.19	1.26	1.22	0.977	N	2.00	N	1

Layer Number	Depth to Bot. Layer	Thickness	σ_o	u	σ'_o	r_d	$(N_1)_{60-cs}$	Liquefy ?	τ_{cyc}	$CSR_{M=7.5}$	CSR_M	Volumetric Strain**		Settl.
	ft	ft	psf	psf	psf			NCEER	psf	τ_{cyc}/σ'_o	τ_{cyc}/σ'_o		%	in
1	8.5	8.5	489	265	224	0.992	0.0	N	189.1	0.846	0.69			0.00
2	9.5	1.0	1,038	562	476	0.981	32.8	N	397.1	0.834	0.68			0.00
3	15.0	5.5	1,414	764	649	0.974	0.0	N	537.2	0.827	0.68			0.00
4	20.0	5.0	2,043	1,092	951	0.963	16.9	Liquef	767.1	0.807	0.66		1.8	1.08
5	24.0	4.0	2,605	1,373	1,232	0.951	8.0	Liquef	966.6	0.784	0.64		2.9	1.39
6	30.5	6.5	3,278	1,700	1,577	0.933	46.1	N	1192.8	0.756	0.62			0.00
7	51.5	21.0	5,013	2,558	2,454	0.842	0.0	N	1646.1	0.671	0.55			0.00
8														
9														

Total Settlement (inch) = 2.5

* Note: The equation used to obtain $CRR_{7.5}$ is not valid for corrected $(N_1)_{60}$ higher than 30. According to NCEER 1997, the soil layer with corrected $(N_1)_{60}$ higher than 30 blows per foot is unlikely to be susceptible to liquefaction.

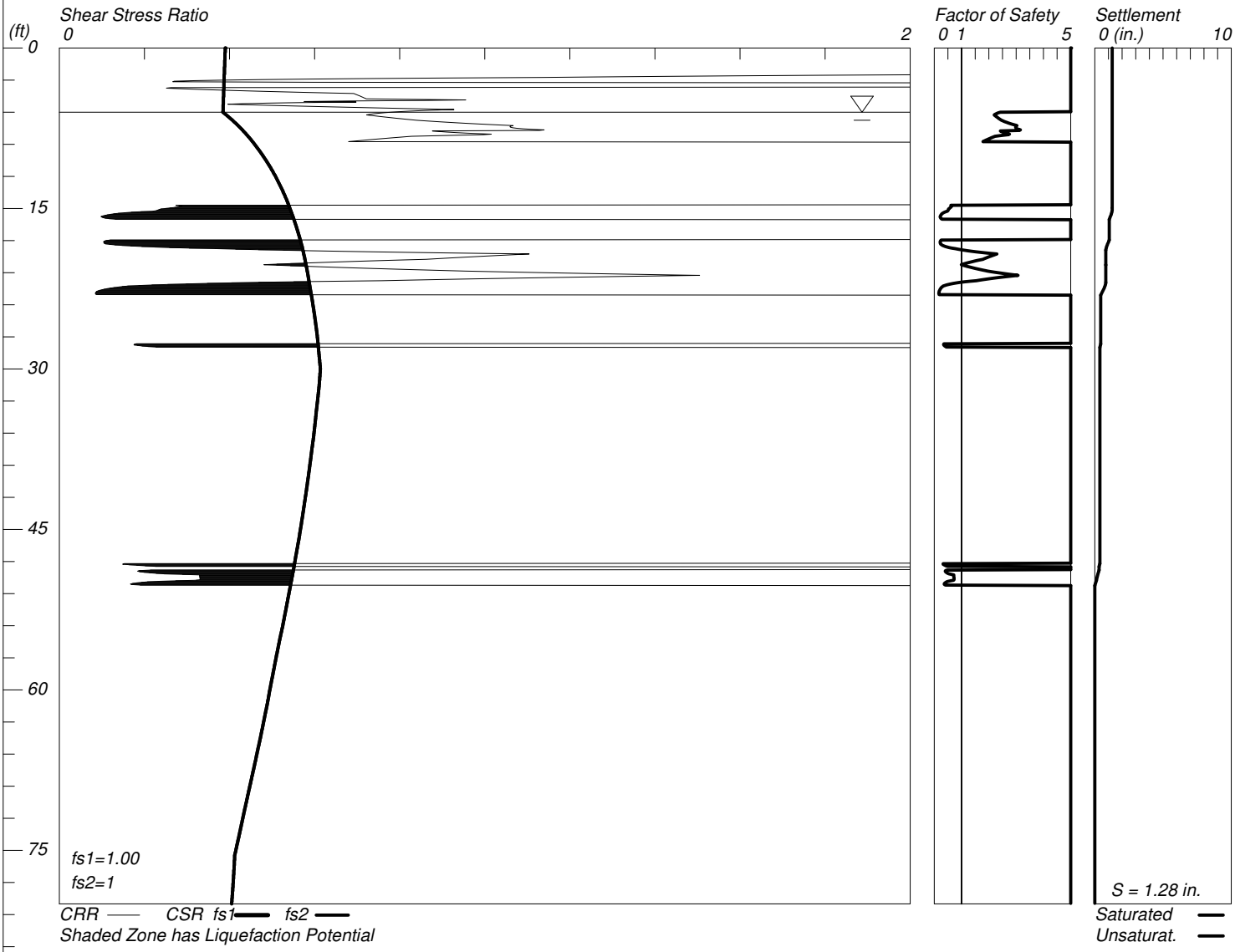
** Note: These values were obtained from a chart for estimation of volumetric strain in saturated sands based on a cyclic stress ratio and standard penetration resistance (Tokimatsu and Seed, 1987).
See figure 9.53 from "Geotechnical Earthquake Engineering" by S. Kramer.

LIQUEFACTION ANALYSIS

101 MSN Petaluma

Hole No.=CPT-09-102 Water Depth=6 ft

Magnitude=7
Acceleration=0.6g



LiquefyPro CivilTech Software USA www.civiltech.com

US 101 MARIN SONOMA NARROWS HOV WIDENING PROJECT

IN AND NEAR PETALUMA
FROM 0.4 MILE SOUTH OF PETALUMA BOULEVARD SOUTH OVERCROSSING TO 0.2 MILE NORTH OF CAULFIELD LANE OVERCROSSING

PROPOSED RETAINING WALLS No. 152, 168, 179, 180 AND 293

FOUNDATION INVESTIGATION REPORT

Prepared for:

URS Corporation
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Prepared by:

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155 Grand Avenue, Suite 700
Oakland, CA 94612

January 2010

09-0597 US 101 Marin Sonoma Narrow HOV Widening Project –Proposed Retaining Wall Foundation Report.doc

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Appendix 1 Soil and Water Sample Minimum Resistivity and Chemical Analysis 1

INTRODUCTION

V&A was retained by URS Corporation to perform a corrosion survey on US 101, in and near Petaluma, CA, from 0.4 mile south of Petaluma Boulevard South overcrossing to 0.2 mile north of Caulfield Lane overcrossing. The objective of this investigation was to measure various soil parameters and evaluate the results with respect to possible levels of corrosion at the site. The soil was tested at depths ranging from 0 to 30.5 meters (0 to 100 feet) below existing grade. This report provides recommendations for corrosion control of structural foundation materials under consideration for the proposed Retaining Walls No. 152, 168, 179, 180 and 293 (Figure 1) on US 101 in Petaluma. The materials being considered as part of this investigation include buried reinforced concrete, prestressed concrete piles and steel piles.

The investigation was conducted in accordance with California Department of Transportation's Division of Engineering Services, Materials Engineering and Testing Services Corrosion Technology Branch "Corrosion Guidelines" (Guidelines) dated September 2003. These Guidelines consider representative soil or water samples to be corrosive to structural elements if one or more of the following conditions exist:

1) **The chloride concentration is 500 ppm or greater**
2) **The sulfate concentration is 2,000 ppm or greater**
3) **The pH is 5.5 or less.**

Evaluation of the soil environment was made in terms of potential corrosion damage to concrete and metal structures. Soil resistivity measurements were conducted in the field during the initial stages of the work. In addition, soil samples taken during a geotechnical investigation were provided to V&A for laboratory testing. The soil samples were analyzed for minimum (saturated) resistivity, as well as for pH, chloride and sulfate ion concentrations. All of these affect the corrosion rate of buried structures.

The minimum (saturated) resistivity of the soil samples selected from borings at Stations 154+55, 179+54, 186+50 and 195+50 (Retaining Walls) was measured at 2,542, 173, 1,762 and 1,523 ohm-cm respectively. The soil pH was measured to be 8.1, 9.0, 7.6 and 7.4. A water-soluble chloride concentration less than 2, 2,259, 12 and 183 mg/kg and a water-soluble sulfate concentration of less than 5, 495, less than 5 and 91 mg/kg were also recorded during the chemical analysis. The minimum soil resistivity, pH, chloride and sulfate ion concentrations indicate the sampled soil at Station 179+54 (Retaining Walls No. 179 and 180) is *corrosive*, as defined by the Guidelines. The minimum soil resistivity, pH, chloride and sulfate ion concentrations indicate the sampled soils at Stations 154+55, 186+50 and 195+50 are *non-corrosive* as defined by the Guidelines.

CONCLUSIONS

- Retaining Wall No. 152 - The soil boring chemical analysis gave pH values higher than 5.5, soluble chloride concentrations less than 500 mg/kg and soluble sulfate concentrations less than 2,000 mg/kg. According to the CALTRANS Guidelines, the soil is considered *non-corrosive*.
- Retaining Wall No. 168 - The soil boring chemical analysis gave pH values higher than 5.5, soluble chloride concentrations less than 500 mg/kg and soluble sulfate concentrations less than 2,000 mg/kg. According to the CALTRANS Guidelines, the soil is considered *non-corrosive*.

- Retaining Wall No. 179 - The soil boring chemical analysis of two samples gave pH values higher than 5.5, soluble chloride concentrations ranged from 12 to 2,259 mg/kg and soluble sulfate concentrations less than 2,000 mg/kg. According to the CALTRANS Guidelines, the soil is considered *corrosive*.
- Retaining Wall No. 180 - The soil boring chemical analysis gave pH values higher than 5.5, soluble chloride concentrations of 2,259 mg/kg and soluble sulfate concentrations less than 2,000 mg/kg. According to the CALTRANS Guidelines, the soil is considered *corrosive*.
- The minimum resistivity of 173 ohm-cm at Retaining Walls No. 179 and 180 indicates the presence of *corrosive* soil according to the CALTRANS Guidelines.
- Corrosion mitigation is required by the Guidelines for corrosive soil conditions at the proposed Retaining Wall No. 179 and 180.
- These structures are not within 300 meters (1,000 feet) of salt or brackish water.

RECOMMENDATIONS

The test data and a review of the project requirements were used to make recommendations for each structural foundation material alternative listed below.

Buried Reinforced Concrete Structures (Non-Corrossive Soil)

Buried concrete structures should be constructed of durable concrete as described in ACI Standards 201.2R and 222R. These recommendations include, but are not limited to, the following for installations in *non-corrosive* soil:

- The water/cement ratio should not exceed 0.50.
- A minimum concrete cover of 5.1 centimeters should be applied over all steel reinforcement.
- Sand and water used in concrete mixtures should contain a maximum of 100 ppm of water-soluble chloride ions and water-soluble sulfate ions. They should also have a pH in the range of 6.5 to 8.0. Potable water should be used in concrete mixtures.
- Type I-P (MS) modified or Type II modified cement should be used.

Buried Reinforced Concrete Structures (Corrosive Soil)

Buried concrete structures should be constructed per the minimum concrete cover requirements established by CALTRANS. See Bridge Design Specs (BDS) Section 8.22 and Table 8.22.1 for complete information regarding the minimum concrete cover for footings, columns, cast-in-place piles, precast piles and concrete surfaces pertaining to the construction of retaining walls.

- The water/cement ratio should not exceed 0.40.[1]
- Use pre-fabricated epoxy coated reinforcing bars.[1]
- A minimum of 3 inches of concrete cover is required for the footing, columns and cast-in-place piles. For Precast piles and pile extensions use a minimum of 2 inches of concrete cover.[1]
- For the precast piles and pile extensions mineral admixtures conforming to ASTM Designation C1240 and /or ASTM Designation C618 Type F and/or N, may be required.[1]
- Concrete in a corrosive environment shall contain not less than 675 pounds of cementitious material per cubic yard. Reduction in the cementitious material content specified or ordered, in conformance with the provisions in Section 90-4.05, "Optional Use of Chemical Admixtures," of

the Standard Specifications, is not permitted for concrete in a corrosive environment.[2]

- For concrete in a corrosive environment the amount of portland cement shall be 75 percent by weight, and the amount of supplementary cementitious material shall be 25 percent by weight, of the total amount of cementitious material to be used in the concrete mix.[2]

Prestressed Concrete Piles

Prestressed concrete piles should be constructed of durable concrete as described in ACI Standards 201.2R and 222R. These recommendations include, but are not limited to, the following:

- The water/cement ratio should not exceed 0.40.
- A minimum concrete cover of 5.1 centimeters should be applied over all steel reinforcement.
- The Corrosion Guidelines allow the use of mineral admixtures (such as flyash, silica fume, metakaolin, etc.), reduced water content, and increased cementitious material content resulting in high density and durable concrete[3].
- Sand and water used in concrete mixtures should contain a maximum of 100 ppm of water-soluble chloride ions and water-soluble sulfate ions. They should also have a pH in the range of 6.5 to 8.0. Potable water should be used in concrete mixtures.
- Type I-P (MS) modified or Type II modified cement should be used.

Steel Piles

According to the CALTRANS Guidelines the soils tested at these sites are considered to be *corrosive* to *non-corrosive* therefore corrosion mitigation is required for Retaining Walls No. 179 and 180.

- Steel vertical support elements should be protected over their exposed height and a nominal distance below finished grade with an appropriate coating system[3].
- Steel facing elements and fasteners should be protected with an appropriate coating system[3].
- Extra metal thickness shall be added to all surfaces of the pile exposed to the corrosive soil[4].
- Corrosion rate of 0.100 mm shall be used per the Guidelines[4].

Corrosion Mitigation for Tie Rods

Tie rods should be protected from corrosion by complete full-length encapsulation and electrical isolation from the wall and structural anchor at the connections to these members[5].

Corrosion Mitigation for Ground Anchors

Ground anchors should be protected from corrosion by complete full-length encapsulation. Encapsulation continuity shall be maintained at transitions in type of encapsulation including at the wall anchorage[6].

[1]CALTRANS – Bridge Design Specs, Table 8.22.1
[2]CALTRANS – Structure Reference Specification S8-C04 (90CORR)
[3]CALTRANS – Bridge Design Specs – Retaining Walls - 5.7.10 – Corrosion Protection
[4]CALTRANS – Corrosion Guidelines – September 2003 – Volume 1.0 – 10.1
[5]CALTRANS – Bridge Design Specs – Retaining Walls - 5.8.10.1 – Corrosion Protection
[6]CALTRANS – Bridge Design Specs – Retaining Walls - 5.8.10.2 – Corrosion Protection

TEST METHODS

When predicting potential corrosion problems associated with a particular type of structure prior to installation, it is necessary to investigate the soil conditions the structure will encounter. Since corrosion is an electrochemical process accompanied by current flow, the electrochemical characteristics of a soil are of primary importance. Test methods utilized during this investigation reflect the most practical methods of evaluating corrosivity.

Resistivity is a measure of the ability of a soil to conduct an electric current. The higher the resistivity the more difficult it is for the soil to conduct current. Resistivity is primarily dependent on the soluble chemical and moisture content of the soil. Soils with high dissolved ion contents generally have low resistivity. As moisture is added to a soil, its resistivity will decrease as more ions are taken into solution. The soil resistivity decreases until the maximum solubility of the dissolved ions is reached. Increasing the moisture content beyond this point increases the soil resistivity by diluting the solution. Since corrosion rate depends on current flow through the soil, corrosivity normally increases as soil resistivity decreases.

Soils can contain a wide variety of soluble salts. Therefore, soils with similar resistivities can have significantly different corrosion characteristics, depending on the ions present. In most soils, the principal agents of corrosion are the chloride and sulfate ions, as well as pH. Chloride ions break down the protective surface films on metals and can corrode reinforcing steel in concrete structures. Sulfates attack the Portland cement in concrete. This is an expansive reaction that disrupts the concrete matrix and softens the surface. A high bicarbonate ion concentration lowers soil resistivity and facilitates other forms of corrosion; however, bicarbonate is not corrosive to metals. Soil pH is another measure of corrosivity. Acid (low pH) soils are corrosive to buried metallic and concrete structures. Neutral (pH 7) and alkaline (pH greater than 7) soils are passive to metal surfaces; therefore, corrosion rates become negligible.

Field Soil Resistivity

Field (in-situ) soil resistivity was measured at Locations No. 1 through 5 along the US 101 Marin Sonoma Narrows project at the proposed retaining wall location. Figure 2 shows the soil resistivity test sites and the soil boring locations.

Figure 1. Project Site Map* for the Proposed Retaining Wall Foundation Investigation, Petaluma, CA**

*www.google.com
**Wall locations are approximate

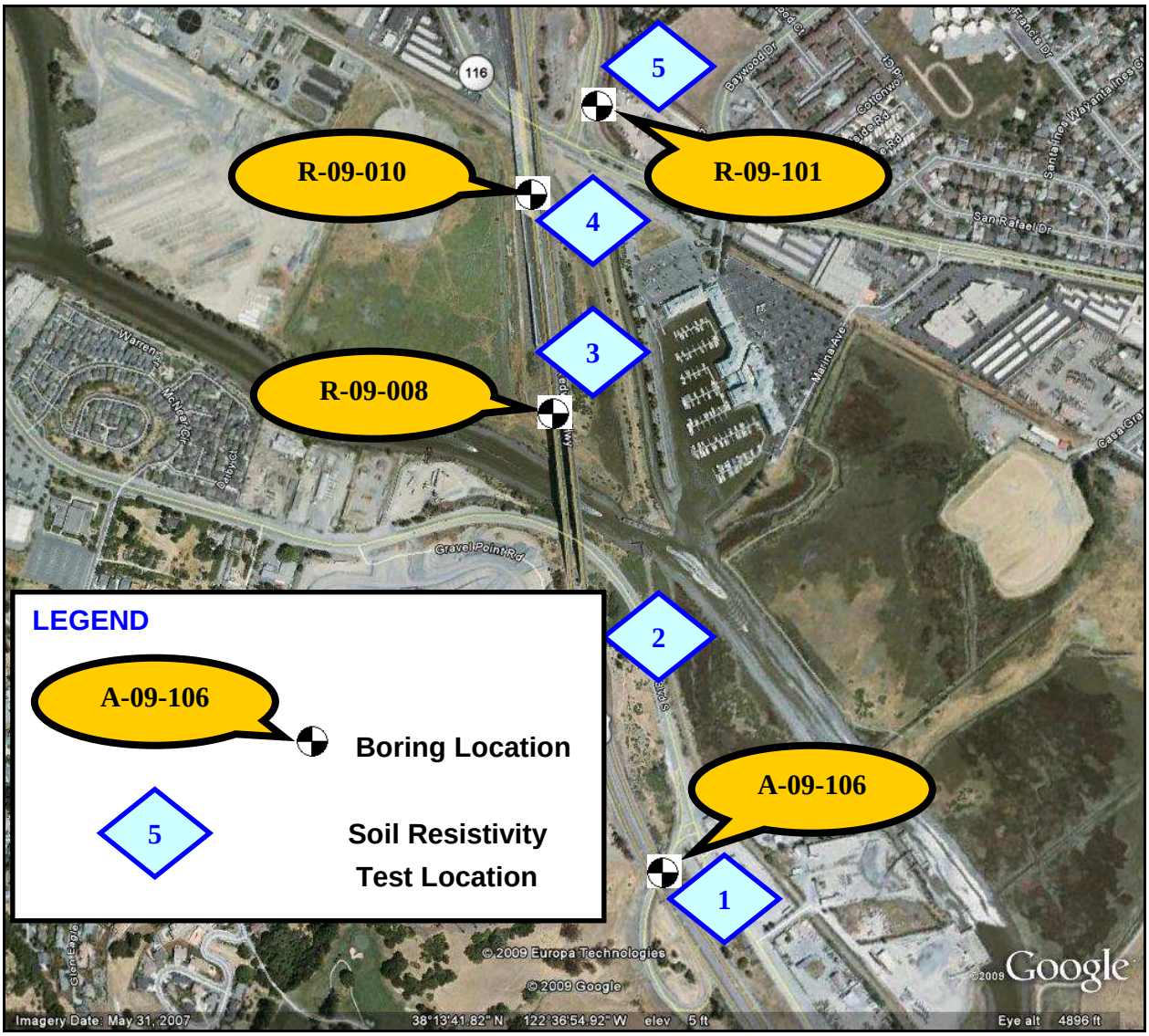

Figure 2. In-Situ Soil Resistivity Test and Boring Locations*

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*Locations are approximate, map courtesy of www.google.com

In-situ soil resistivity measurements were conducted by the Wenner Electrode Method, using an AEMC Soil Resistance Meter, Model 4500. The Wenner Electrode Method uses four equally spaced metal pins, driven into the ground in a straight line, as electrodes (see Figure 3).

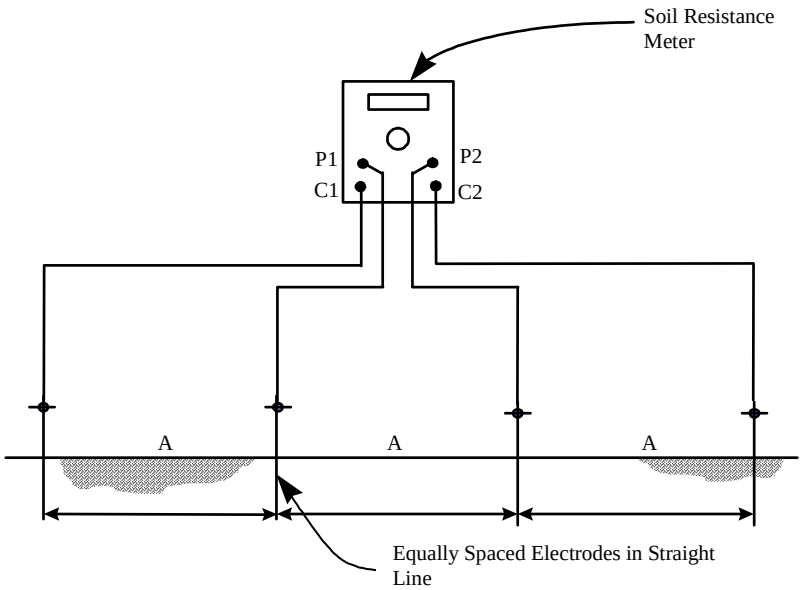


Figure 3. Wenner Four Electrode Method for Soil Resistivity Measurement

An alternating current from the soil resistance meter causes a current to flow through the soil between the outside electrodes, C1 and C2. Due to the resistance of the soil, the current creates a voltage gradient, which is proportional to the average resistance of the soil mass to a depth equal to the distance between electrodes. The voltage drop is then measured across electrodes P1 and P2. Resistivity of the soil is then computed from the instrument reading according to the following formula:

$$\rho = 2\pi AR$$

where: ρ = soil resistivity in ohm-cm
A = the distance between probes in cm
R = soil resistance in ohms (instrument reading)
π = 3.1416

Soil resistance is measured with electrodes spaced 0.8, 1.5, 2.3, 3, 4.6, 7.6, 15.2, 23.0 and 30.5 meters (2.5, 5, 7.5, 10, 15, 25, 50, 75 and 100 feet) apart. Resistivity values obtained represent the average resistivity of the soil to a depth equal to the electrode spacing. An additional method of calculating the soil resistivity using the data from the Wenner Method is the Barnes-Layer resistivity calculation. The Barnes Layer calculation is used to determine the resistivity of the soil for each soil layer. While the Wenner Method at 3 meters will consider all 3 meters of soil below the surface, the Barnes-Layer method will only consider the resistivity of only the layer of soil between 2.3 meters and 3 meters below the surface. This

method assumes the soil layers are of a uniform thickness and parallel to the surface, which may not always be true.

The Barnes-Layer method uses the following parameters to calculate layer resistivities:

$$\rho_{b-a} = KR_{b-a}$$

and

$$\frac{1}{R_{b-a}} = \frac{1}{R_a} - \frac{1}{R_b}$$

where:

ρ_{b-a}	=	Soil resistivity of layer depth b-a (ohm-cm)
a	=	Soil depth to top of layer (cm)
b	=	Soil depth to bottom of layer (cm)
R_a	=	Soil resistance read at depth a (ohms)
R_b	=	Soil resistance read at depth b (ohms)
R_{b-a}	=	Resistance of soil layer from a to b (ohms)
K	=	Layer constant (cm)
	=	$2\pi(b-a)$

Soil resistance measured at the proposed retaining wall location and Barnes-Layer resistivities calculated from this data are listed in Table 1.

Laboratory Soil Analysis

To supplement the field resistivity test data, four soil samples were obtained from Soil Borings A-09-106, R-09-008, R-09-010 and R-09-101 for laboratory soil resistivity analysis (Appendix 1). A soil box was used in accordance with California Test Method 643. This apparatus is shown in Figure 4.

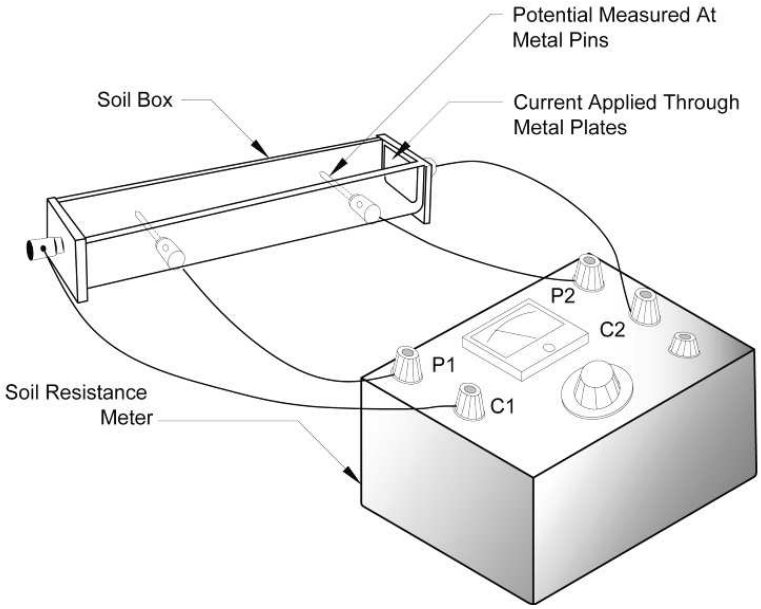


Figure 4. Soil Resistivity Measurement Using the Soil Box Method

This apparatus consists of a small plastic box with metal end plates for passing current through a tightly packed soil sample. Current is passed through the sample, causing a voltage drop across the sample. The soil resistivity is measured with a soil resistance meter, similar to the AEMC Model 4500.

Soil resistivity is first measured in the "as-received" state. Distilled water is then added to the soil sample in 10-mL increments. The resistivity is measured after each addition. As the soil sample becomes more saturated, the soil resistivity decreases until the minimum soil resistivity is reached.

Soil boring samples from this study were forwarded to Cooper Testing Labs, Inc., in Palo Alto, CA, for minimum resistivity measurement, pH analysis and analysis of water soluble chloride and sulfate ion concentrations. The analytical procedures followed California Test Methods 417, 422 and 643.

TEST RESULTS

Table 1 lists the field soil resistivity measurements from the proposed retaining wall site and the calculated Barnes-Layer resistivities. Table 2 lists the minimum resistivity and chemical analysis for the soil boring samples.

Table 1. Field Soil Resistivity Data

Site No.*	Station**No.	Depth (meters)	Resistivity (ohm-cm)	Layer (meters)	Layer Resistivity (ohm-cm)
1	155+00	0.8	1,858	0 - 0.8	
		1.5	1,036	0.8 - 1.5	718
		2.3	756	1.5 - 2.3	490
		3.1	718	2.3 – 3.1	625
		4.6	888	3.1 - 4.6	1,681
2	168+00	0.8	3,797	0 - 0.8	
		1.5	2,212	0.8 - 1.5	1,561
		2.3	1,541	1.5 - 2.3	959
		3.1	1,563	2.3 – 3.1	1,631
		4.6	2,086	3.1 - 4.6	6,303
3	184+00	0.8	1,963	0 - 0.8	
		1.5	1,111	0.8 - 1.5	775
		2.3	575	1.5 - 2.3	292
		3.1	454	2.3 – 3.1	278
		4.6	399	3.1 - 4.6	322
4	189+00	0.8	4,079	0 - 0.8	
		1.5	1,580	0.8 - 1.5	980
		2.3	539	1.5 - 2.3	232
		3.1	347	2.3 – 3.1	168
		4.6	396	3.1 - 4.6	556
		7.6	12,831	4.6 – 7.6	279
		15.2	14,660	7.6 – 15.2	17,097
		23.0	23,972	15.2 – 23.0	88,652
		30.5	34,261	23.0 – 30.5	119,130
+5	197+00	0.8	1,858	0 - 0.8	
		1.5	1,036	0.8 - 1.5	718
		2.3	756	1.5 - 2.3	490
		3.1	718	2.3 – 3.1	625
		4.6	888	3.1 - 4.6	1,681

*See Figure 2

**Stationing numbers are approximate.

Table 2. Laboratory Soil Resistivity and Chemical Data

Item No.	Boring No.*	Boring Station** No.	Depth (meters)	Minimum Soil Resistivity (ohm-cm)	Chemical Data		
					pH	Sulfate (mg/kg)	Chloride (mg/kg)
1	A-09-106	154+55	28.5	2,542	8.1	<5	<2
2	R-09-008	179+54	88.5	173	9.0	495	2,259
3	R-09-010	186+50	10	1,762	7.6	<5	12
4	R-09-101	195+50	8.5	1,523	7.4	91	183

Based on the Guidelines, the analyzed soil samples are considered *non-corrosive to corrosive* to buried metallic objects and reinforced concrete structures in regards to chloride and sulfate contents, pH and minimum soil resistivity.

*See Figure 2
**Stationing numbers are approximate.

Appendix 1 Soil and Water Sample Minimum Resistivity and Chemical Analysis

Corrosivity Test Summary

CTL # 632-008 Date: 1/13/2010 Tested By: PJ Checked: PJ
Client: V & A Project: URS Caltrans 101 Marin/Sonoma Proj. No: 09-0597
Remarks:

Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate		pH	ORP	Moisture	Soil Visual Description
Boring	Sample, No.	Depth, ft.	As Rec.	Minimum	Saturated	mg/kg Dry Wt.	mg/kg Dry Wt.	% Dry Wt.		(Redox) mv	As Received %	
			ASTM G57	Cal 643	ASTM G57	Cal 422-mod.	Cal 417-mod.	Cal 417-mod.	Cal 643	SM 2580B	ASTM D2216	
A-09-106	-	28.5	-	2542	-	<2	<5	<0.0005	8.1	-	8.5	Greenish Gray Silty SAND w/ Gravel (slightly plastic)
R-09-003	-	55	-	1556	-	4	154	0.0154	7.6	-	3.7	Bluish Gray Silty SAND w/ Gravel (slightly plastic)
R-09-007	-	68.5	-	520	-	199	356	0.0356	8.4	-	15.5	Greenish Gray Clayey SAND
R-09-008	-	88.5	-	173	-	2,259	495	0.0495	9.0	-	21.6	Bluish Gray CLAY w/ Sand
R-09-010	-	10	-	1762	-	12	<5	<0.0005	7.6	-	11.3	Brown Clayey SAND w/ Gravel
R-09-011	-	98	-	116	-	4,813	825	0.0825	8.3	-	23.0	Greenish Brown Clayey SAND
R-09-012	-	55	-	268	-	2,225	187	0.0187	8.0	-	13.7	Greenish Gray Silty SAND (slightly plastic)
R-09-015	-	85	-	388	-	38	2,325	0.2325	6.8	-	26.9	Greenish Brown Clayey SAND
R-09-101	-	8.5	-	1523	-	183	91	0.0091	7.4	-	4.1	Brown Silty SAND (slightly plastic)
R-09-103	-	10	-	1093	-	30	<5	<0.0005	8.2	-	6.0	Light Olive Brown Sandy CLAY
Petaluma Crk	-	Water Sample	-	49	-	2456 mg/L	251 mg/L	-	6.9	-	N/A	Water

US 101 MSN B4 - Retaining Wall 293

4/7/2010

Pile Design Spreadsheet

Retaining Wall

NAVFAC Design Method For a Single Pile

Project Name:	101 MSN Petaluma
Project Number:	28645045
Bridge Name:	N/A
Boring Surface El. (m)	2.1
Boring Surface El. (ft)	7.0
Design GWS El. (ft)	5.0
Unit Weight of Water (pcf)	62.4
Depth with no strength	
Convert. Factor	3.281
Bottom of Pile Cap El. (m)	0.91
Bottom of Pile Cap El. (ft)	3.00 (varies from 2.25 to 10.0 feet)

Nominal axial compress. Capacity (ult.)	180	ton	(including downdrag)
Nominal axial compress. Capacity (ult.)	1602	kN	
Pile Width	12	inch	
Pile Width	305	mm	
Pile Width	1.00	ft	
Crit depth ratio	20	-	
Crit depth	20.0	ft	
Crit. Depth. Elev	-13.0	ft	
Crit. Depth. Elev	-4.0	m	
Crit. Eff. Vert. Str.	1697	psf	

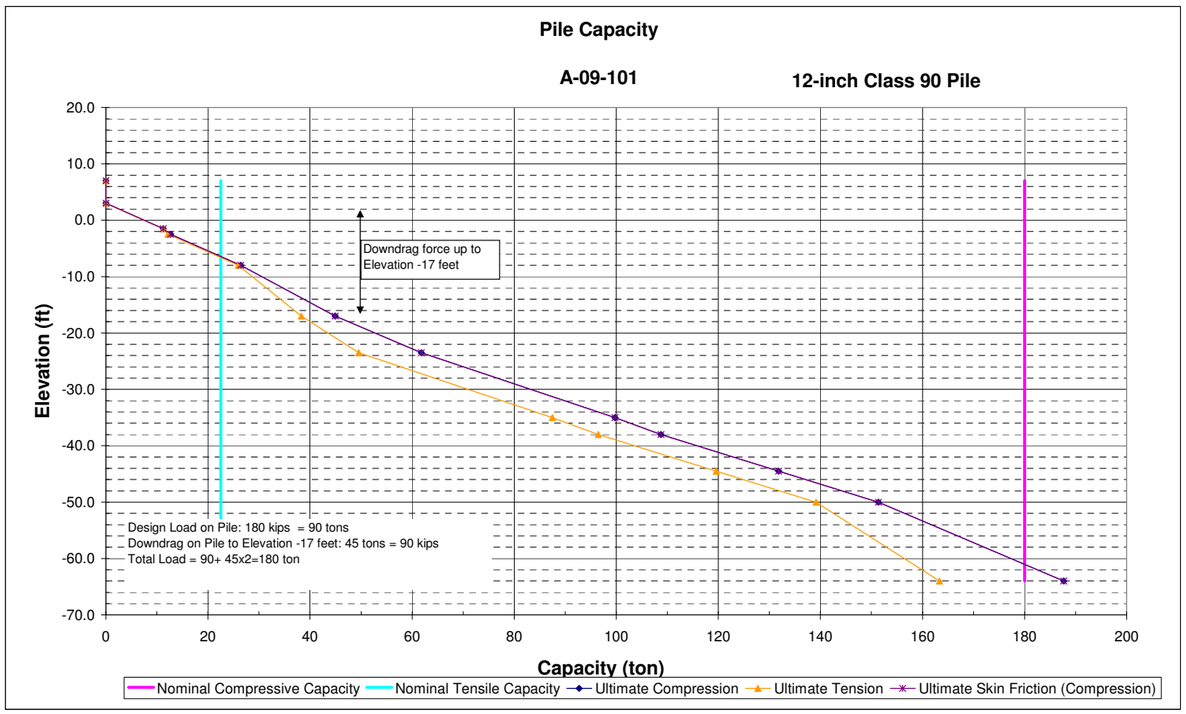
Pile Shape	Square	(Square, Circular or Octogonal)			
Pile Surface Area	1.22	sq. m/m	Pile Tip Area	0.09	sq. m
Pile Surface Area	4.00	sq. ft/ft	Pile Tip Area	1.00	sq. ft.

Skin Resistance (Friction) of Pile in Granular Material:

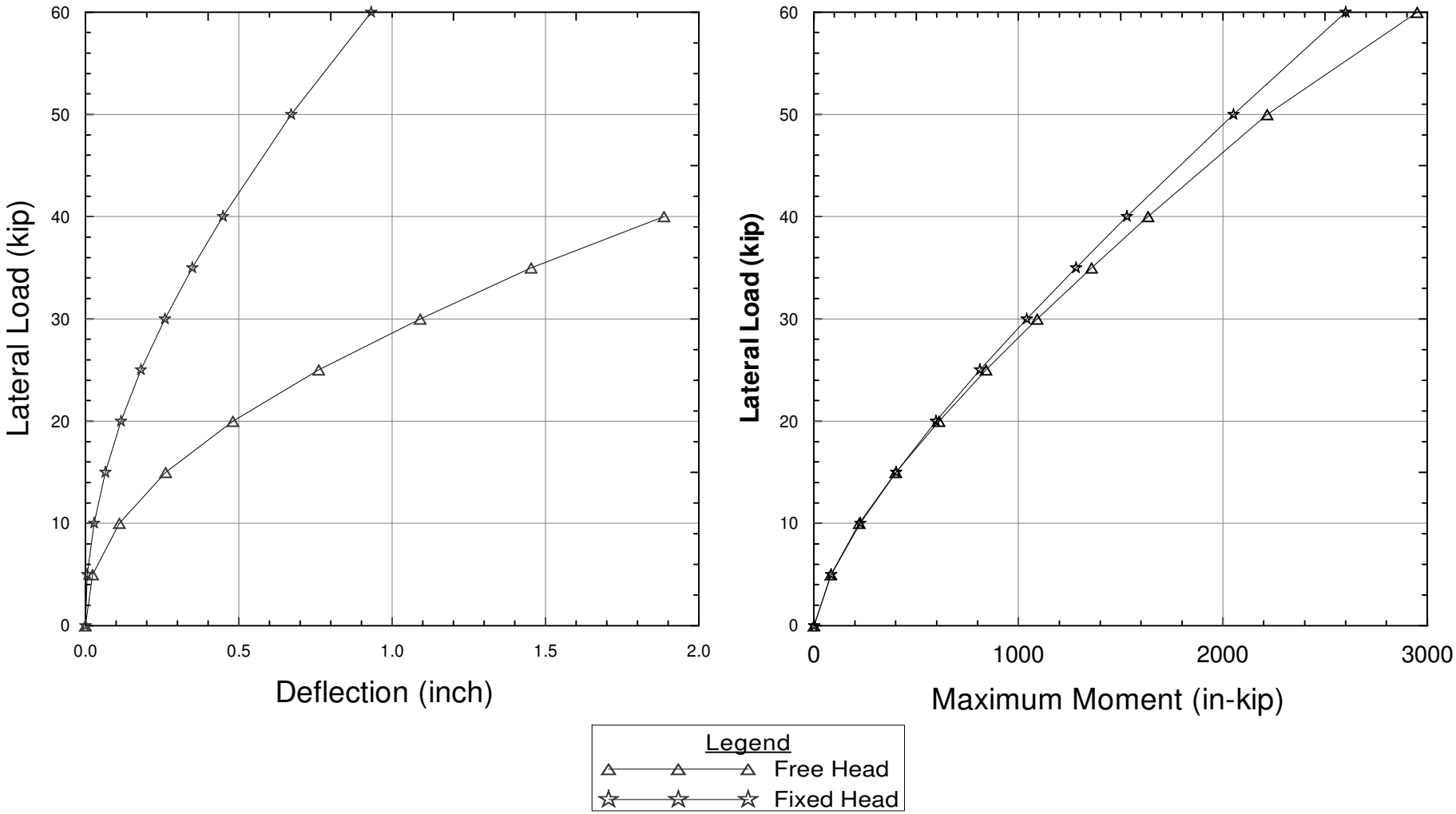
Type (Steel=S,Concrete=C,Timber=T)		C
Earth Press. Coefficient *	(Comp.)	1.5
Earth Press. Coefficient *	(Tens)	1.0
Minimum Adhesion		500 psf

* Note: Appropriate tension/compresion ratios for skin friction for granular soils applied is 0.65 and 1.0 for cohesive soil.

Layer No.	Layer Elevation Top (m)	Top (feet)	Bot. (m)	Bot. (feet)	Lateral Resists?	Cohesion c (kPa)	Cohesion c (psf)	Adhesion Ratio c_a/c	Adhesion c_a (psf)	Friction Angle ϕ (deg)	Friction Angle δ (deg)	Layer Thickness (feet)	Internal Depth to Layer Top (feet)	Effective Vert. Stress (Bot. Lay.) (psf)	Design Effective Vert. Stress (Bot. Lay.) (psf)	delta Lat. Res. Cohesive (ton)	delta Lat. Res. Friction (comp) (ton)	delta Lat. Res. Friction (tensile) (ton)	Nq (granular) (-)	z/B (-)	Nc (cohesive) (-)	Soil Type G= gran. C=cohes.	Bearing Capacity (B.C.) (ton)	Include B.C.?	Elevation to midlayer (ft)	Compression Cumulative Axial Res. (skin) (ton)	Compression Cumulative Axial Res. (skin) (kN)	Compression Cumulative Axial Res. (Tot) (ton)	Compression Cumulative Axial Res. (Tot) (kN)	Compression Nominal Axial Capacity (ton)	Compression Nominal Axial Capacity (kN)	Tension Cumulative Axial Res. (Skin) (ton)	Tension Cumulative Axial Res. (Skin) (kN)	Tension Nominal Axial Capacity (ton)	Tension Nominal Axial Capacity (kN)
			2.13	7.0										0	0					0.0	6.25	c	0	n	7.0	0	0	0.0	0	180	1602	0	0	23	801
1	2.13	7.0	0.91	3.0	N	60	1250	1.00	0	0	0	4.0	0.0	954	954	0.0	0.0	0.0	0	2.0	8.40	c	5	n	5.0	0.0	0	0.0	0	180	1602	0.0	0	23	801
2	0.91	3.0	-0.46	-1.5	Y	60	1250	1.00	1250	0	0	4.5	4.0	1063	1063	11.3	0.0	0.0	0	6.3	9.00	c	6	n	0.8	11.3	100	11.3	100	180	1602	11.3	100	23	801
3	-0.46	-1.5	-0.76	-2.5	Y	0	0	0.00	0	32	24	1.0	8.5	1063	1063	0.0	1.4	0.9	29	9.0	9.00	g	15	n	-2.0	12.7	113	12.7	113	180	1602	12.2	109	23	801
4	-0.76	-2.5	-2.44	-8.0	Y	60	1250	1.00	1250	0	0	5.5	9.5	1384	1384	13.8	0.0	0.0	0	12.3	9.00	c	6	n	-5.3	26.4	235	26.4	235	180	1602	25.9	231	23	801
5	-2.44	-8.0	-5.18	-17.0	Y	0	0	0.00	0	32	24	9.0	15.0	1947	1697	0.0	18.5	12.3	29	19.5	9.00	g	25	n	-12.5	44.9	400	44.9	400	180	1602	38.3	341	23	801
6	-5.18	-17.0	-7.16	-23.5	Y	0	0	0.00	0	36	27	6.5	24.0	2323	1697	0.0	16.9	11.2	62	27.3	9.00	g	53	n	-20.3	61.8	550	61.8	550	180	1602	49.5	441	23	801
7	-7.16	-23.5	-10.67	-35.0	Y	144	3000	0.55	1650	0	0	11.5	30.5	3074	1697	38.0	0.0	0.0	0	36.3	9.00	c	14	n	-29.3	99.7	888	99.7	888	180	1602	87.5	778	23	801
8	-10.67	-35.0	-11.58	-38.0	Y	72	1500	1.00	1500	0	0	3.0	42.0	3292	1697	9.0	0.0	0.0	0	43.5	9.00	c	7	n	-36.5	108.7	968	108.7	968	180	1602	96.5	858	23	801
9	-11.58	-38.0	-13.56	-44.5	Y	91	1900	0.94	1777	0	0	6.5	45.0	3667	1697	23.1	0.0	0.0	0	48.3	9.00	c	9	n	-41.3	131.8	1173	131.8	1173	180	1602	119.6	1064	23	801
10	-13.56	-44.5	-15.24	-50.0	y	91	1900	0.94	1777	0	0	5.5	51.5	4043	1697	19.5	0.0	0.0	0	54.3	9.00	c	9	n	-47.3	151.4	1347	151.4	1347	180	1602	139.1	1238	23	801
11	-15.24	-50.0	-19.51	-64.0	y	0	0	0.00	0	36	27	14.0	57.0	4479	1697	0.0	36.3	24.2	62	64.0	9.00	g	53	n	-57.0	187.7	1670	187.7	1670	180	1602	163.3	1453	23	801
Bottom	-19.51	-64.0																																	



Class 90 Pile with 45 tons Allowable Bearing Capacity



Project No. 28645045	US 101 MSN B4 Petaluma, California	**Retaining Wall 293 Pile Lateral Resistance Class 90 Pile**	Figure G-1
	URS		

X:/101_MSN_SCTA/450_Geotech/Analysis/Pile/Lateral/RE293_A-09-101

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\RW 293\
Name of input data file: RW293_A-09-101_fixed.lpd
Name of output file: RW293_A-09-101_fixed.lpo
Name of plot output file: RW293_A-09-101_fixed.lpp
Name of runtime file: RW293_A-09-101_fixed.lpr

Time and Date of Analysis

Date: April 6, 2010 Time: 15:34:20

Problem Title

RW293_MSN B4_Petaluma_Fixed

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length

- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 720.00 in

Depth of ground surface below top of pile = -48.00 in

Slope angle of ground surface = 0.00 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	12.00000000	1728.0000	144.0000	3600000.
2	720.0000	12.00000000	1728.0000	144.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 8 layers

Layer 1 is stiff clay without free water
Distance from top of pile to top of layer = -48.000 in
Distance from top of pile to bottom of layer = 54.000 in

Layer 2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 54.000 in
Distance from top of pile to bottom of layer = 66.000 in
p-y subgrade modulus k for top of soil layer = 60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 60.000 lbs/in**3

Layer 3 is stiff clay without free water
Distance from top of pile to top of layer = 66.000 in
Distance from top of pile to bottom of layer = 132.000 in

Layer 4 is soft clay, p-y criteria by Matlock, 1970
Distance from top of pile to top of layer = 132.000 in
Distance from top of pile to bottom of layer = 240.000 in

Layer 5 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 240.000 in
Distance from top of pile to bottom of layer = 318.000 in
p-y subgrade modulus k for top of soil layer = 100.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 100.000 lbs/in**3

Layer 6 is stiff clay without free water
Distance from top of pile to top of layer = 318.000 in
Distance from top of pile to bottom of layer = 456.000 in

Layer 7 is stiff clay without free water
Distance from top of pile to top of layer = 456.000 in
Distance from top of pile to bottom of layer = 492.000 in

Layer 8 is stiff clay without free water
Distance from top of pile to top of layer = 492.000 in
Distance from top of pile to bottom of layer = 720.000 in

(Depth of lowest layer extends 0.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 16 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-48.00	0.03040
2	54.00	0.03040
3	54.00	0.03620
4	66.00	0.03620
5	66.00	0.03040
6	132.00	0.03040
7	132.00	0.03620
8	240.00	0.03620
9	240.00	0.03910
10	318.00	0.03910
11	318.00	0.03620
12	456.00	0.03620
13	456.00	0.03620
14	492.00	0.03620
15	492.00	0.03620
16	720.00	0.03620

Shear Strength of Soils

Shear strength parameters with depth defined using 16 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-48.000	8.68000	0.00	0.00700	0.0
2	54.000	8.68000	0.00	0.00700	0.0
3	54.000	0.00000	32.00	------	------
4	66.000	0.00000	32.00	------	------
5	66.000	8.68000	0.00	0.00700	0.0
6	132.000	8.68000	0.00	0.00700	0.0
7	132.000	2.08000	0.00	0.02000	0.0
8	240.000	2.08000	0.00	0.02000	0.0
9	240.000	0.00000	36.00	------	------
10	318.000	0.00000	36.00	------	------
11	318.000	20.83000	0.00	0.00500	0.0
12	456.000	20.83000	0.00	0.00500	0.0
13	456.000	8.68000	0.00	0.00700	0.0
14	492.000	8.68000	0.00	0.00700	0.0
15	492.000	13.19000	0.00	0.00600	0.0
16	720.000	13.19000	0.00	0.00600	0.0

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head = 5000.000 lbs
Slope at pile head = 0.000 in/in
Axial load at pile head = 90000.000 lbs

(Zero slope for this load indicates fixed-head condition)

Load Case Number 2

```
Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head    =       10000.000 lbs
Slope at pile head          =           0.000 in/in
Axial load at pile head     =       90000.000 lbs

(Zero slope for this load indicates fixed-head condition)

Load Case Number  3

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head    =       15000.000 lbs
Slope at pile head          =           0.000 in/in
Axial load at pile head     =       90000.000 lbs

(Zero slope for this load indicates fixed-head condition)

Load Case Number  4

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head    =       20000.000 lbs
Slope at pile head          =           0.000 in/in
Axial load at pile head     =       90000.000 lbs

(Zero slope for this load indicates fixed-head condition)

Load Case Number  5

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head    =       25000.000 lbs
Slope at pile head          =           0.000 in/in
Axial load at pile head     =       90000.000 lbs

(Zero slope for this load indicates fixed-head condition)

Load Case Number  6

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head    =       30000.000 lbs
Slope at pile head          =           0.000 in/in
Axial load at pile head     =       90000.000 lbs

(Zero slope for this load indicates fixed-head condition)

Load Case Number  7

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head    =       35000.000 lbs
Slope at pile head          =           0.000 in/in
Axial load at pile head     =       90000.000 lbs

(Zero slope for this load indicates fixed-head condition)

Load Case Number  8

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head    =       40000.000 lbs
```

```
Slope at pile head          =           0.000 in/in
Axial load at pile head     =       90000.000 lbs

(Zero slope for this load indicates fixed-head condition)

Load Case Number  9

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head    =       50000.000 lbs
Slope at pile head          =           0.000 in/in
Axial load at pile head     =       90000.000 lbs

(Zero slope for this load indicates fixed-head condition)

Load Case Number 10

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head    =       60000.000 lbs
Slope at pile head          =           0.000 in/in
Axial load at pile head     =       90000.000 lbs

(Zero slope for this load indicates fixed-head condition)



--------------------------------------------------------------------------------
             Computed Values of Load Distribution and Deflection
                 for Lateral Loading for Load Case Number  1
--------------------------------------------------------------------------------

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head  =        5000.000 lbs
Specified slope at pile head        =       0.000E+00 in/in
Specified axial load at pile head   =       90000.000 lbs

(Zero slope for this load indicates fixed-head conditions)

  Depth   Deflect.    Moment      Shear       Slope      Total       Soil Res.
Es*h
    X        y          M           V           S        Stress          p
F/L
    in       in        lbs-in        lbs         Rad.   lbs/in**2    lbs/in
lbs/in
-------- --------- ----------- ----------- ----------- ----------- ----------- -
----------
   0.000  0.005760 -84818.1233   5000.0000      0.0000    919.5074   -109.6363
68523.6202
   7.200  0.005407 -51628.0891   4192.3509 -7.8962E-05    804.2642   -114.7107
152763.
  14.400  0.004623 -24345.9350   3358.7280  -0.0001229    709.5345   -116.8512
181993.
  21.600  0.003636  -3103.0902   2519.6726  -0.0001388    635.7746   -116.2197
230116.
  28.800  0.002624  12117.2520   1695.1213  -0.0001336    667.0738   -112.8223
309578.
  36.000  0.001713  21479.7973    905.3396  -0.0001142    699.5826   -106.5615
448012.
```

43.200	0.000980	25302.0863	171.7465	-8.7081E-05	712.8545	-97.2144	714125.
50.400	0.000459	24065.8036	-481.5053	-5.8512E-05	708.5618	-84.2444	1322682.
57.600	0.000138	18444.2419	-788.7853	-3.3911E-05	689.0425	-1.1112	58154.3278
64.800	-2.97E-05	12751.2437	-791.8747	-1.5858E-05	669.2752	0.2530199	61264.7278
72.000	-9.08E-05	7061.7987	-680.9030	-4.3922E-06	649.5201	30.5724	2424687.
79.200	-9.30E-05	2951.9329	-453.7712	1.4028E-06	635.2498	32.5197	2518112.
86.400	-7.06E-05	525.6748	-245.4562	3.4153E-06	626.8253	25.3456	2585430.
93.600	-4.38E-05	-587.0631	-97.5876	3.3798E-06	627.0384	15.7290	2585430.
100.800	-2.19E-05	-883.9670	-12.6338	2.5285E-06	628.0693	7.8692	2585430.
108.000	-7.39E-06	-772.2663	25.2521	1.5700E-06	627.6815	2.6546	2585430.
115.200	6.94E-07	-522.3710	33.9121	8.2080E-07	626.8138	-0.2490782	2585430.
122.400	4.43E-06	-284.9961	27.2927	3.5358E-07	625.9896	-1.5896	2585430.
129.600	5.79E-06	-129.8142	14.0915	1.1352E-07	625.4507	-2.0774	2585430.
136.800	6.06E-06	-82.2257	5.8605	-9.1843E-09	625.2855	-0.2090200	248274.
144.000	5.65E-06	-45.4113	4.4063	-8.3048E-08	625.1577	-0.1949258	248274.
151.200	4.87E-06	-18.6677	3.1005	-1.2013E-07	625.0648	-0.1677825	248274.
158.400	3.92E-06	-0.6079292	2.0095	-1.3129E-07	625.0021	-0.1352749	248274.
165.600	2.98E-06	10.4396	1.1532	-1.2560E-07	625.0362	-0.1025926	248274.
172.800	2.11E-06	16.1609	0.5213909	-1.1020E-07	625.0561	-0.0729102	248274.
180.000	1.39E-06	18.0905	0.0865757	-9.0381E-08	625.0628	-0.0478718	248274.
187.200	8.13E-07	17.5248	-0.1866766	-6.9770E-08	625.0608	-0.0280317	248274.
194.400	3.84E-07	15.4928	-0.3352091	-5.0663E-08	625.0538	-0.0132274	248274.
201.600	8.34E-08	12.7634	-0.3931777	-3.4311E-08	625.0443	-0.0028750	248274.
208.800	-1.10E-07	9.8755	-0.3898127	-2.1210E-08	625.0343	0.0038097	248274.
216.000	-2.22E-07	7.1776	-0.3485335	-1.1341E-08	625.0249	0.0076567	248274.
223.200	-2.74E-07	4.8713	-0.2869810	-4.3685E-09	625.0169	0.0094412	248274.
230.400	-2.85E-07	3.0507	-0.2176196	2.1603E-10	625.0106	0.0098259	248274.
237.600	-2.71E-07	1.7373	-0.1486443	2.9869E-09	625.0060	0.0093339	248274.

244.800	-2.42E-07	0.9063826	-0.1006740	4.5168E-09	625.0031	0.0039912	118775.
252.000	-2.06E-07	0.2817147	-0.0735600	5.2043E-09	625.0010	0.0035405	123959.
259.200	-1.67E-07	-0.1596264	-0.0500309	5.2750E-09	625.0006	0.0029954	129143.
266.400	-1.30E-07	-0.4455673	-0.0305375	4.9247E-09	625.0015	0.0024195	134327.
273.600	-9.61E-08	-0.6057491	-0.0151252	4.3163E-09	625.0021	0.0018618	139511.
280.800	-6.75E-08	-0.6689634	-0.0035373	3.5787E-09	625.0023	0.0013571	144695.
288.000	-4.46E-08	-0.6613238	0.0046869	2.8088E-09	625.0023	0.0009274	149879.
295.200	-2.71E-08	-0.6051126	0.0101252	2.0759E-09	625.0021	0.0005833	155063.
302.400	-1.47E-08	-0.5182113	0.0133993	1.4259E-09	625.0018	0.0003262	160247.
309.600	-6.55E-09	-0.4140102	0.0151155	8.8637E-10	625.0014	0.0001505	165431.
316.800	-1.89E-09	-0.3016967	0.0158188	4.7219E-10	625.0010	4.4867E-05	170615.
324.000	2.49E-10	-0.1868311	0.0151391	1.8948E-10	625.0006	-0.0002337	6748920.
331.200	8.35E-10	-0.0839389	0.0114801	3.2780E-11	625.0003	-0.0007827	6748920.
338.400	7.21E-10	-0.0215607	0.0062281	-2.8273E-11	625.0001	-0.0006761	6748920.
345.600	4.28E-10	0.0057831	0.0023501	-3.7404E-11	625.0000	-0.0004011	6748920.
352.800	1.83E-10	0.0123291	0.0002896	-2.6922E-11	625.0000	-0.0001713	6748920.
360.000	4.02E-11	0.0099879	-0.0004627	-1.4007E-11	625.0000	-3.7717E-05	6748920.
367.200	-1.90E-11	0.0056838	-0.0005344	-4.9379E-12	625.0000	1.7807E-05	6748920.
374.400	-3.09E-11	0.0022987	-0.0003661	-3.1845E-13	625.0000	2.8934E-05	6748920.
381.600	-2.36E-11	0.0004117	-0.0001824	1.2501E-12	625.0000	2.2106E-05	6748920.
388.800	-1.29E-11	-0.0003295	-5.9399E-05	1.2976E-12	625.0000	1.2061E-05	6748920.
396.000	-4.90E-12	-0.0004453	5.4927E-07	8.4922E-13	625.0000	4.5909E-06	6748920.
403.200	-6.39E-13	-0.0003227	1.9232E-05	4.0476E-13	625.0000	5.9872E-07	6748920.
410.400	9.31E-13	-0.0001689	1.8246E-05	1.2026E-13	625.0000	-8.7252E-07	6748920.
417.600	1.09E-12	-6.0140E-05	1.1417E-05	-1.2273E-14	625.0000	-1.0246E-06	6748920.
424.800	7.54E-13	-4.4680E-06	5.1833E-06	-4.9662E-14	625.0000	-7.0687E-07	6748920.
432.000	3.78E-13	1.4564E-05	1.3633E-06	-4.3819E-14	625.0000	-3.5426E-07	6748920.
439.200	1.23E-13	1.5220E-05	-3.2750E-07	-2.6583E-14	625.0000	-1.1540E-07	6748920.

446.400	-4.86E-15	9.8823E-06	-7.2654E-07	-1.2056E-14	625.0000	4.5586E-09	6748920.
453.600	-5.05E-14	4.7734E-06	-5.3975E-07	-3.5749E-15	625.0000	4.7329E-08	6748920.
460.800	-5.63E-14	2.1145E-06	-2.9653E-07	4.1116E-16	625.0000	2.0232E-08	2585430.
468.000	-4.46E-14	5.0286E-07	-1.6608E-07	1.9259E-15	625.0000	1.6005E-08	2585430.
475.200	-2.86E-14	-2.7949E-07	-7.1476E-08	2.0551E-15	625.0000	1.0274E-08	2585430.
482.400	-1.50E-14	-5.2905E-07	-1.5129E-08	1.5872E-15	625.0000	5.3783E-09	2585430.
489.600	-5.75E-15	-4.9941E-07	1.1671E-08	9.9204E-16	625.0000	2.0662E-09	2585430.
496.800	-6.92E-16	-3.6228E-07	2.0523E-08	4.9338E-16	625.0000	3.9262E-10	4083142.
504.000	1.35E-15	-2.0452E-07	1.9179E-08	1.6537E-16	625.0000	-7.6588E-10	4083142.
511.200	1.69E-15	-8.6310E-08	1.2974E-08	-2.9322E-18	625.0000	-9.5785E-10	4083142.
518.400	1.31E-15	-1.7692E-08	6.8546E-09	-6.3119E-17	625.0000	-7.4193E-10	4083142.
525.600	7.80E-16	1.2477E-08	2.5909E-09	-6.6137E-17	625.0000	-4.4241E-10	4083142.
532.800	3.56E-16	1.9703E-08	2.7164E-10	-4.7514E-17	625.0000	-2.0184E-10	4083142.
540.000	9.59E-17	1.6450E-08	-6.5078E-10	-2.6593E-17	625.0000	-5.4389E-11	4083142.
547.200	-2.70E-17	1.0366E-08	-7.9142E-10	-1.1074E-17	625.0000	1.5322E-11	4083142.
554.400	-6.36E-17	5.0681E-09	-6.0650E-10	-2.1424E-18	625.0000	3.6045E-11	4083142.
561.600	-5.79E-17	1.6351E-09	-3.5859E-10	1.7368E-18	625.0000	3.2818E-11	4083142.
568.800	-3.86E-17	-9.7891E-11	-1.6174E-10	2.6263E-18	625.0000	2.1863E-11	4083142.
576.000	-2.00E-17	-6.9743E-10	-4.2106E-11	2.1661E-18	625.0000	1.1370E-11	4083142.
583.200	-7.36E-18	-7.0702E-10	1.3852E-11	1.3533E-18	625.0000	4.1737E-12	4083142.
590.400	-5.62E-19	-4.9971E-10	3.0024E-11	6.5499E-19	625.0000	3.1849E-13	4083142.
597.600	2.07E-18	-2.7552E-10	2.6940E-11	2.0636E-19	625.0000	-1.1751E-12	4083142.
604.800	2.41E-18	-1.1204E-10	1.7790E-11	-1.7929E-20	625.0000	-1.3667E-12	4083142.
612.000	1.81E-18	-1.9329E-11	9.1661E-12	-9.3955E-20	625.0000	-1.0287E-12	4083142.
619.200	1.06E-18	2.0070E-11	3.3048E-12	-9.3526E-20	625.0000	-5.9942E-13	4083142.
626.400	4.67E-19	2.8381E-11	1.9304E-13	-6.5488E-20	625.0000	-2.6496E-13	4083142.
633.600	1.14E-19	2.2935E-11	-9.9345E-13	-3.5792E-20	625.0000	-6.4623E-14	4083142.
640.800	-4.82E-20	1.4121E-11	-1.1277E-12	-1.4347E-20	625.0000	2.7326E-14	4083142.

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 648.000 -9.26E-20  6.7140E-12 -8.4021E-13 -2.2897E-21    625.0000  5.2539E-14
4083142.
 655.200 -8.12E-20  2.0252E-12 -4.8538E-13  2.7677E-21    625.0000  4.6024E-14
4083142.
 662.400 -5.28E-20 -2.7915E-13 -2.1192E-13  3.7782E-21    625.0000  2.9937E-14
4083142.
 669.600 -2.67E-20 -1.0314E-12 -4.9539E-14  3.0198E-21    625.0000  1.5170E-14
4083142.
 676.800 -9.30E-21 -9.9643E-13  2.4068E-14  1.8463E-21    625.0000  5.2767E-15
4083142.
 684.000 -1.63E-22 -6.8719E-13  4.3398E-14  8.7196E-22    625.0000  9.2602E-17
4083142.
 691.200  3.25E-21 -3.7263E-13  3.7093E-14  2.5864E-22    625.0000 -1.8440E-15
4083142.
 698.400  3.56E-21 -1.5339E-13  2.3185E-14 -4.5771E-23    625.0000 -2.0195E-15
4083142.
 705.600  2.59E-21 -3.8717E-14  1.0622E-14 -1.5694E-22    625.0000 -1.4702E-15
4083142.
 712.800  1.30E-21 -2.3261E-16  2.6725E-15 -1.7948E-22    625.0000 -7.3788E-16
4083142.
 720.000  7.91E-24      0.0000      0.0000 -1.7962E-22    625.0000 -4.4835E-18
2041571.

Output Verification:

Computed forces and moments are within specified convergence limits.


Output Summary for Load Case No.  1:

Pile-head deflection             =     0.00575992 in
Computed slope at pile head      =        0.00000
Maximum bending moment           =   -84818.12328 lbs-in
Maximum shear force              =     5000.00000 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             13
Number of zero deflection points =             13




--------------------------------------------------------------------------------
             Computed Values of Load Distribution and Deflection
                 for Lateral Loading for Load Case Number  2
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Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head  =       10000.000 lbs
Specified slope at pile head        =       0.000E+00 in/in
Specified axial load at pile head   =       90000.000 lbs

(Zero slope for this load indicates fixed-head conditions)

  Depth   Deflect.    Moment      Shear       Slope      Total       Soil Res.
Es*h
```

X	y	M	V	S	Stress	p	F/L
in	in	lbs-in	lbs	Rad.	lbs/in**2	lbs/in	lbs/in
0.000	0.027910	-226785.	10000.0000	9.6374E-19	1412.4467	-162.5545	20967.6014
7.200	0.026965	-158913.	8798.1120	-0.0002232	1176.7813	-171.3033	45740.8363
14.400	0.024695	-99802.5691	7542.4081	-0.0003729	971.5367	-177.5034	51751.5197
21.600	0.021594	-49819.0372	6250.9105	-0.0004595	797.9828	-181.2460	60430.7190
28.800	0.018078	-9193.9314	4941.2363	-0.0004937	656.9234	-182.5524	72704.1541
36.000	0.014486	21974.5517	3630.9847	-0.0004863	701.3005	-181.4063	90166.1621
43.200	0.011076	43722.4487	2337.9724	-0.0004482	776.8141	-177.7637	115554.
50.400	0.008031	56222.2822	1080.4796	-0.0003904	820.2163	-171.5398	153790.
57.600	0.005454	59787.3241	304.3397	-0.0003233	832.5949	-44.0546	58154.3278
64.800	0.003376	61023.7359	42.3320	-0.0002534	836.8880	-28.7253	61264.7278
72.000	0.001806	60725.2591	-543.4226	-0.0001829	835.8516	-133.9843	534169.
79.200	0.000742	53435.4925	-1427.0083	-0.0001168	810.5399	-111.4562	1081398.
86.400	0.000123	40327.7607	-1987.8997	-6.2576E-05	765.0269	-44.3470	2585430.
93.600	-0.000159	24890.8358	-1941.9841	-2.4834E-05	711.4265	57.1013	2585430.
100.800	-0.000234	12395.3752	-1433.7803	-3.2564E-06	668.0395	84.0664	2585430.
108.000	-0.000206	4248.6194	-864.9588	6.3756E-06	639.7522	73.9396	2585430.
115.200	-0.000142	-68.2944	-414.8190	8.7947E-06	625.2371	51.0992	2585430.
122.400	-7.93E-05	-1736.1721	-128.3940	7.7505E-06	631.0284	28.4633	2585430.
129.600	-3.07E-05	-1927.2121	13.7551	5.6305E-06	631.6917	11.0226	2585430.
136.800	1.81E-06	-1545.3953	53.2114	3.6209E-06	630.3660	-0.0625231	248274.
144.000	2.14E-05	-1165.6606	50.3243	2.0520E-06	629.0474	-0.7394505	248274.
151.200	3.14E-05	-823.3849	43.7692	9.0089E-07	627.8590	-1.0814	248274.
158.400	3.44E-05	-536.5523	35.6036	1.1389E-07	626.8630	-1.1868	248274.
165.600	3.30E-05	-310.8404	27.2345	-3.7650E-07	626.0793	-1.1380	248274.
172.800	2.90E-05	-143.8879	19.5384	-6.3965E-07	625.4996	-0.9998361	248274.

180.000	2.38E-05	-28.6589	12.9857	-7.3951E-07	625.0995	-0.8203534	248274.
187.200	1.83E-05	44.0645	7.7549	-7.3059E-07	625.1530	-0.6326355	248274.
194.400	1.33E-05	83.9590	3.8302	-6.5650E-07	625.2915	-0.4575797	248274.
201.600	8.89E-06	100.0696	1.0789	-5.5001E-07	625.3475	-0.3066499	248274.
208.800	5.35E-06	100.2084	-0.6891220	-4.3410E-07	625.3479	-0.1844755	248274.
216.000	2.64E-06	90.7088	-1.6812	-3.2362E-07	625.3150	-0.0910964	248274.
223.200	6.90E-07	76.4188	-2.0947	-2.2690E-07	625.2653	-0.0237830	248274.
230.400	-6.26E-07	60.8385	-2.1027	-1.4747E-07	625.2112	0.0215712	248274.
237.600	-1.43E-06	46.3309	-1.8471	-8.5451E-08	625.1609	0.0494432	248274.
244.800	-1.86E-06	34.3516	-1.5588	-3.8760E-08	625.1193	0.0306186	118775.
252.000	-1.99E-06	23.9339	-1.3251	-5.0297E-09	625.0831	0.0342953	123959.
259.200	-1.93E-06	15.2761	-1.0772	1.7661E-08	625.0530	0.0345904	129143.
266.400	-1.74E-06	8.4000	-0.8359220	3.1363E-08	625.0292	0.0324190	134327.
273.600	-1.48E-06	3.1981	-0.6161939	3.8075E-08	625.0111	0.0286166	139511.
280.800	-1.19E-06	-0.5225770	-0.4271238	3.9623E-08	625.0018	0.0239029	144695.
288.000	-9.06E-07	-3.0038	-0.2731557	3.7582E-08	625.0104	0.0188660	149879.
295.200	-6.48E-07	-4.5047	-0.1549804	3.3237E-08	625.0156	0.0139605	155063.
302.400	-4.28E-07	-5.2786	-0.0704549	2.7575E-08	625.0183	0.0095188	160247.
309.600	-2.51E-07	-5.5550	-0.0154140	2.1306E-08	625.0193	0.0057703	165431.
316.800	-1.21E-07	-5.5282	0.0156712	1.4892E-08	625.0192	0.0028645	170615.
324.000	-3.67E-08	-5.3486	0.1498058	8.5976E-09	625.0186	0.0343951	6748920.
331.200	2.92E-09	-3.3821	0.2637659	3.5451E-09	625.0117	-0.0027395	6748920.
338.400	1.44E-08	-1.5550	0.2054626	6.8796E-10	625.0054	-0.0134558	6748920.
345.600	1.28E-08	-0.4243216	0.1137298	-4.5749E-10	625.0015	-0.0120255	6748920.
352.800	7.77E-09	0.0832879	0.0442275	-6.5485E-10	625.0003	-0.0072807	6748920.
360.000	3.40E-09	0.2134037	0.0065457	-4.8315E-10	625.0007	-0.0031865	6748920.
367.200	8.10E-10	0.1781728	-0.0076587	-2.5654E-10	625.0006	-0.0007592	6748920.
374.400	-2.95E-10	0.1034514	-0.0093970	-9.3567E-11	625.0004	0.0002763	6748920.

381.600	-5.37E-10	0.0429769	-0.0065888	-8.8285E-12	625.0001	0.0005038	6748920.
388.800	-4.22E-10	0.0085849	-0.0033515	2.1010E-11	625.0000	0.0003955	6748920.
396.000	-2.35E-10	-0.0053116	-0.0011352	2.2905E-11	625.0000	0.0002202	6748920.
403.200	-9.21E-11	-0.0077910	-3.1815E-05	1.5322E-11	625.0000	8.6323E-05	6748920.
410.400	-1.42E-11	-0.0057896	0.0003270	7.4631E-12	625.0000	1.3343E-05	6748920.
417.600	1.54E-11	-0.0030921	0.0003231	2.3232E-12	625.0000	-1.4412E-05	6748920.
424.800	1.92E-11	-0.0011395	0.0002064	-1.2570E-13	625.0000	-1.8015E-05	6748920.
432.000	1.36E-11	-0.0001199	9.5765E-05	-8.5452E-13	625.0000	-1.2716E-05	6748920.
439.200	6.91E-12	0.0002406	2.6658E-05	-7.8466E-13	625.0000	-6.4804E-06	6748920.
446.400	2.27E-12	0.0002650	-4.3200E-06	-4.9206E-13	625.0000	-2.1246E-06	6748920.
453.600	-1.72E-13	0.0001790	-1.1388E-05	-2.3509E-13	625.0000	1.6130E-07	6748920.
460.800	-1.12E-12	0.0001013	-9.3610E-06	-7.2843E-14	625.0000	4.0171E-07	2585430.
468.000	-1.22E-12	4.4341E-05	-6.3364E-06	1.1451E-14	625.0000	4.3845E-07	2585430.
475.200	-9.54E-13	1.0060E-05	-3.5249E-06	4.2934E-14	625.0000	3.4250E-07	2585430.
482.400	-6.03E-13	-6.4734E-06	-1.5127E-06	4.5010E-14	625.0000	2.1645E-07	2585430.
489.600	-3.06E-13	-1.1782E-05	-3.3839E-07	3.4445E-14	625.0000	1.0976E-07	2585430.
496.800	-1.07E-13	-1.1391E-05	2.7470E-07	2.1035E-14	625.0000	6.0540E-08	4083142.
504.000	-2.76E-15	-7.8531E-06	4.9828E-07	9.8990E-15	625.0000	1.5649E-09	4083142.
511.200	3.58E-14	-4.2283E-06	4.3084E-07	2.9075E-15	625.0000	-2.0298E-08	4083142.
518.400	3.91E-14	-1.6527E-06	2.7793E-07	-4.9587E-16	625.0000	-2.2178E-08	4083142.
525.600	2.87E-14	-2.2551E-07	1.3959E-07	-1.5828E-15	625.0000	-1.6249E-08	4083142.
532.800	1.63E-14	3.5950E-07	4.7786E-08	-1.5052E-15	625.0000	-9.2530E-09	4083142.
540.000	6.98E-15	4.6456E-07	2.3239E-10	-1.0283E-15	625.0000	-3.9564E-09	4083142.
547.200	1.51E-15	3.6418E-07	-1.7089E-08	-5.4875E-16	625.0000	-8.5525E-10	4083142.
554.400	-9.25E-16	2.1919E-07	-1.8279E-08	-2.1115E-16	625.0000	5.2483E-10	4083142.
561.600	-1.53E-15	1.0124E-07	-1.3261E-08	-2.5718E-17	625.0000	8.6905E-10	4083142.
568.800	-1.30E-15	2.8263E-08	-7.4869E-09	4.9224E-17	625.0000	7.3485E-10	4083142.
576.000	-8.24E-16	-6.6387E-09	-3.1600E-09	6.1738E-17	625.0000	4.6708E-10	4083142.

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 583.200 -4.07E-16 -1.7322E-08 -6.4810E-10  4.7872E-17    625.0000  2.3068E-10
4083142.
 590.400 -1.34E-16 -1.6033E-08  4.5645E-10  2.8569E-17    625.0000  7.6140E-11
4083142.
 597.600  4.63E-18 -1.0786E-08  7.2110E-10  1.3049E-17    625.0000 -2.6262E-12
4083142.
 604.800  5.36E-17 -5.6665E-09  6.0213E-10  3.5277E-18    625.0000 -3.0420E-11
4083142.
 612.000  5.54E-17 -2.1198E-09  3.7946E-10 -9.7829E-19    625.0000 -3.1434E-11
4083142.
 619.200  3.96E-17 -2.0109E-10  1.8554E-10 -2.3214E-18    625.0000 -2.2431E-11
4083142.
 626.400  2.20E-17  5.5498E-10  5.9873E-11 -2.1166E-18    625.0000 -1.2477E-11
4083142.
 633.600  9.07E-18  6.6383E-10 -3.5696E-12 -1.4113E-18    625.0000 -5.1460E-12
4083142.
 640.800  1.68E-18  5.0541E-10 -2.5522E-11 -7.3465E-19    625.0000 -9.5205E-13
4083142.
 648.000 -1.50E-18  2.9725E-10 -2.5878E-11 -2.7014E-19    625.0000  8.5337E-13
4083142.
 655.200 -2.21E-18  1.3312E-10 -1.8291E-11 -2.1085E-20    625.0000  1.2540E-12
4083142.
 662.400 -1.81E-18  3.3888E-11 -1.0085E-11  7.5562E-20    625.0000  1.0256E-12
4083142.
 669.600 -1.12E-18 -1.2202E-11 -4.0998E-12  8.8112E-20    625.0000  6.3694E-13
4083142.
 676.800 -5.40E-19 -2.5264E-11 -7.0522E-13  6.6430E-20    625.0000  3.0600E-13
4083142.
 684.000 -1.67E-19 -2.2443E-11  7.3644E-13  3.8822E-20    625.0000  9.4458E-14
4083142.
 691.200  1.94E-20 -1.4709E-11  1.0368E-12  1.7321E-20    625.0000 -1.1025E-14
4083142.
 698.400  8.29E-20 -7.5359E-12  8.2793E-13  4.4479E-21    625.0000 -4.6993E-14
4083142.
 705.600  8.35E-20 -2.7929E-12  4.8831E-13 -1.5294E-21    625.0000 -4.7348E-14
4083142.
 712.800  6.08E-20 -5.0230E-13  1.9364E-13 -3.4363E-21    625.0000 -3.4504E-14
4083142.
 720.000  3.40E-20      0.0000      0.0000 -3.7270E-21    625.0000 -1.9286E-14
2041571.

Output Verification:

Computed forces and moments are within specified convergence limits.


Output Summary for Load Case No.  2:

Pile-head deflection             =     0.02790954 in
Computed slope at pile head      =   9.637353E-19
Maximum bending moment           =  -226784.65549 lbs-in
Maximum shear force              =    10000.00000 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             17
Number of zero deflection points =             12
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 3

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head = 15000.000 lbs
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = 90000.000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res. p lbs/in	Es*h F/L lbs/in
0.000	0.065237	-401265.	15000.0000	7.7099E-18	2018.2828	-200.9581	11089.5403
7.200	0.063565	-298324.	13512.5504	-0.0004049	1660.8466	-212.2223	24038.3386
14.400	0.059407	-206160.	11952.8876	-0.0006968	1340.8334	-221.0173	26786.7443
21.600	0.053531	-125299.	10338.6790	-0.0008886	1060.0666	-227.3739	30582.0194
28.800	0.046611	-56131.4041	8687.5676	-0.0009936	819.9007	-231.2681	35723.9197
36.000	0.039223	1089.5238	7017.4961	-0.0010255	628.7831	-232.6406	42704.6578
43.200	0.031844	46249.5438	5346.9382	-0.0009981	785.5887	-231.4032	52320.1805
50.400	0.024851	79378.9337	3695.1292	-0.0009254	900.6213	-227.4326	65893.3998
57.600	0.018519	100659.	2337.8901	-0.0008212	974.5093	-149.5783	58154.3278
64.800	0.013026	114109.	1400.3920	-0.0006969	1021.2111	-110.8379	61264.7278
72.000	0.008484	121728.	291.7489	-0.0005604	1047.6649	-197.1185	167290.
79.200	0.004956	119036.	-1062.2174	-0.0004211	1038.3204	-178.9832	260024.
86.400	0.002420	106977.	-2259.6613	-0.0002903	996.4489	-153.6401	457075.
93.600	0.000776	86873.3728	-3229.1016	-0.0001781	926.6437	-115.6489	1073233.
100.800	-0.000145	60709.0575	-3458.5890	-9.2700E-05	835.7953	51.9024	2585430.
108.000	-0.000559	37189.8300	-2888.4155	-3.6045E-05	754.1314	106.4791	1371407.
115.200	-0.000664	19162.5885	-2104.8521	-3.4341E-06	691.5368	111.1774	1206276.

122.400	-0.000608	6884.4109	-1312.8523	1.1639E-05	648.9042	108.8225	1287683.
129.600	-0.000496	242.4305	-548.7363	1.5764E-05	625.8418	103.4319	1501475.
136.800	-0.000381	-1037.8219	-141.5717	1.5303E-05	628.6035	9.6694	182500.
144.000	-0.000276	-1816.0355	-75.5166	1.3652E-05	631.3057	8.6793	226732.
151.200	-0.000185	-2142.9538	-21.3197	1.1361E-05	632.4408	6.3754	248274.
158.400	-0.000112	-2137.7632	15.5375	8.8836E-06	632.4228	3.8627	248274.
165.600	-5.70E-05	-1930.7266	36.5147	6.5291E-06	631.7039	1.9643	248274.
172.800	-1.80E-05	-1620.4135	45.8205	4.4741E-06	630.6264	0.6206697	248274.
180.000	7.46E-06	-1276.7095	47.1286	2.7975E-06	629.4330	-0.2573132	248274.
187.200	2.23E-05	-945.3871	43.4359	1.5116E-06	628.2826	-0.7684279	248274.
194.400	2.92E-05	-653.1909	37.0412	5.8647E-07	627.2680	-1.0079	248274.
201.600	3.07E-05	-412.7534	29.5982	-3.0398E-08	626.4332	-1.0596	248274.
208.800	2.88E-05	-226.9380	22.2094	-4.0059E-07	625.7880	-0.9927871	248274.
216.000	2.50E-05	-92.4184	15.5368	-5.8540E-07	625.3209	-0.8607250	248274.
223.200	2.04E-05	-2.4495	9.9106	-6.4030E-07	625.0085	-0.7021060	248274.
230.400	1.57E-05	51.1240	5.4290	-6.1214E-07	625.1775	-0.5427832	248274.
237.600	1.15E-05	76.5213	2.0416	-5.3827E-07	625.2657	-0.3981511	248274.
244.800	7.99E-06	81.2211	0.1337973	-4.4698E-07	625.2820	-0.1318032	118775.
252.000	5.11E-06	79.0273	-0.6574050	-3.5424E-07	625.2744	-0.0879752	123959.
259.200	2.89E-06	72.2136	-1.1606	-2.6672E-07	625.2507	-0.0518124	129143.
266.400	1.27E-06	62.6597	-1.4324	-1.8867E-07	625.2176	-0.0236781	134327.
273.600	1.72E-07	51.8314	-1.5296	-1.2241E-07	625.1800	-0.0033295	139511.
280.800	-4.94E-07	40.7917	-1.5059	-6.8811E-08	625.1416	0.0099191	144695.
288.000	-8.19E-07	30.2355	-1.4088	-2.7707E-08	625.1050	0.0170497	149879.
295.200	-8.93E-07	20.5405	-1.2782	1.6770E-09	625.0713	0.0192226	155063.
302.400	-7.95E-07	11.8266	-1.1454	2.0408E-08	625.0411	0.0176916	160247.
309.600	-5.99E-07	4.0210	-1.0321	2.9579E-08	625.0140	0.0137556	165431.
316.800	-3.69E-07	-3.0746	-0.9511468	3.0127E-08	625.0107	0.0087430	170615.

324.000	-1.65E-07	-9.7146	-0.3633705	2.2726E-08	625.0337	0.1545282	6748920.
331.200	-4.17E-08	-8.3365	0.3336751	1.2279E-08	625.0289	0.0390956	6748920.
338.400	1.20E-08	-4.9256	0.4340345	4.6046E-09	625.0171	-0.0112180	6748920.
345.600	2.46E-08	-2.0924	0.3106443	5.4331E-10	625.0073	-0.0230570	6748920.
352.800	1.98E-08	-0.4529790	0.1608532	-9.2971E-10	625.0016	-0.0185516	6748920.
360.000	1.12E-08	0.2250788	0.0562390	-1.0616E-09	625.0008	-0.0105079	6748920.
367.200	4.50E-09	0.3582387	0.0032103	-7.2403E-10	625.0012	-0.0042223	6748920.
374.400	7.84E-10	0.2722452	-0.0146361	-3.5917E-10	625.0009	-0.0007350	6748920.
381.600	-6.68E-10	0.1479438	-0.0150298	-1.1600E-10	625.0005	0.0006257	6748920.
388.800	-8.86E-10	0.0559670	-0.0097865	2.0004E-12	625.0002	0.0008308	6748920.
396.000	-6.39E-10	0.0070154	-0.0046405	3.8448E-11	625.0000	0.0005987	6748920.
403.200	-3.33E-10	-0.0109057	-0.0013627	3.6197E-11	625.0000	0.0003118	6748920.
410.400	-1.17E-10	-0.0126548	0.0001561	2.2563E-11	625.0000	0.0001101	6748920.
417.600	-7.74E-12	-0.0086868	0.0005786	1.0212E-11	625.0000	7.2528E-06	6748920.
424.800	2.96E-11	-0.0043363	0.0005048	2.6757E-12	625.0000	-2.7741E-05	6748920.
432.000	3.08E-11	-0.0014206	0.0003011	-6.5589E-13	625.0000	-2.8863E-05	6748920.
439.200	2.02E-11	-1.5705E-07	0.0001292	-1.4781E-12	625.0000	-1.8888E-05	6748920.
446.400	9.51E-12	0.0004412	2.9080E-05	-1.2229E-12	625.0000	-8.9118E-06	6748920.
453.600	2.54E-12	0.0004202	-1.1577E-05	-7.2443E-13	625.0000	-2.3816E-06	6748920.
460.800	-9.24E-13	0.0002754	-1.8955E-05	-3.2189E-13	625.0000	3.3192E-07	2585430.
468.000	-2.09E-12	0.0001476	-1.5053E-05	-7.7080E-14	625.0000	7.5210E-07	2585430.
475.200	-2.03E-12	5.8742E-05	-9.7156E-06	4.2351E-14	625.0000	7.3049E-07	2585430.
482.400	-1.48E-12	7.6750E-06	-5.1666E-06	8.0787E-14	625.0000	5.3311E-07	2585430.
489.600	-8.71E-13	-1.5761E-05	-2.1215E-06	7.6107E-14	625.0000	3.1276E-07	2585430.
496.800	-3.89E-13	-2.2973E-05	-2.0202E-07	5.3691E-14	625.0000	2.2042E-07	4083142.
504.000	-9.78E-14	-1.8740E-05	7.9122E-07	2.9552E-14	625.0000	5.5477E-08	4083142.
511.200	3.69E-14	-1.1618E-05	9.1568E-07	1.1984E-14	625.0000	-2.0905E-08	4083142.
518.400	7.47E-14	-5.5699E-06	6.8784E-07	2.0372E-15	625.0000	-4.2384E-08	4083142.

525.600	6.62E-14	-1.7152E-06	4.0012E-07	-2.1788E-15	625.0000	-3.7541E-08	4083142.
532.800	4.34E-14	1.9461E-07	1.7644E-07	-3.0587E-15	625.0000	-2.4591E-08	4083142.
540.000	2.22E-14	8.2949E-07	4.2688E-08	-2.4661E-15	625.0000	-1.2562E-08	4083142.
547.200	7.85E-15	8.1252E-07	-1.8564E-08	-1.5159E-15	625.0000	-4.4526E-09	4083142.
554.400	3.23E-16	5.6413E-07	-3.5252E-08	-7.1919E-16	625.0000	-1.8299E-10	4083142.
561.600	-2.50E-15	3.0583E-07	-3.0797E-08	-2.1574E-16	625.0000	1.4206E-09	4083142.
568.800	-2.78E-15	1.2094E-07	-1.9999E-08	3.1229E-17	625.0000	1.5788E-09	4083142.
576.000	-2.06E-15	1.7805E-08	-1.0119E-08	1.1152E-16	625.0000	1.1655E-09	4083142.
583.200	-1.18E-15	-2.4920E-08	-3.5179E-09	1.0740E-16	625.0000	6.6812E-10	4083142.
590.400	-5.09E-16	-3.2992E-08	-7.4163E-11	7.3888E-17	625.0000	2.8847E-10	4083142.
597.600	-1.14E-16	-2.6084E-08	1.1973E-09	3.9701E-17	625.0000	6.4727E-11	4083142.
604.800	6.30E-17	-1.5802E-08	1.3017E-09	1.5462E-17	625.0000	-3.5744E-11	4083142.
612.000	1.09E-16	-7.3601E-09	9.5146E-10	2.0580E-18	625.0000	-6.1538E-11	4083142.
619.200	9.27E-17	-2.1032E-09	5.4074E-10	-3.4184E-18	625.0000	-5.2550E-11	4083142.
626.400	5.93E-17	4.3100E-10	2.3052E-10	-4.3861E-18	625.0000	-3.3622E-11	4083142.
633.600	2.95E-17	1.2219E-09	4.9245E-11	-3.4296E-18	625.0000	-1.6731E-11	4083142.
640.800	9.90E-18	1.1446E-09	-3.1203E-11	-2.0601E-18	625.0000	-5.6153E-12	4083142.
648.000	-1.62E-19	7.7526E-10	-5.1088E-11	-9.4908E-19	625.0000	9.1838E-14	4083142.
655.200	-3.77E-18	4.1014E-10	-4.3071E-11	-2.6308E-19	625.0000	2.1352E-12	4083142.
662.400	-3.95E-18	1.5539E-10	-2.7319E-11	6.4192E-20	625.0000	2.2402E-12	4083142.
669.600	-2.84E-18	1.6657E-11	-1.3455E-11	1.6375E-19	625.0000	1.6109E-12	4083142.
676.800	-1.59E-18	-3.8576E-11	-4.4049E-12	1.5107E-19	625.0000	9.0296E-13	4083142.
684.000	-6.65E-19	-4.6970E-11	2.0387E-13	1.0156E-19	625.0000	3.7727E-13	4083142.
691.200	-1.30E-19	-3.5772E-11	1.8268E-12	5.3681E-20	625.0000	7.3556E-14	4083142.
698.400	1.08E-19	-2.0733E-11	1.8717E-12	2.0981E-20	625.0000	-6.1103E-14	4083142.
705.600	1.72E-19	-8.8470E-12	1.2997E-12	3.8626E-21	625.0000	-9.7780E-14	4083142.
712.800	1.63E-19	-2.0229E-12	6.1416E-13	-2.4279E-21	625.0000	-9.2646E-14	4083142.
720.000	1.37E-19	0.0000	0.0000	-3.5985E-21	625.0000	-7.7953E-14	2041571.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =     0.06523709 in
Computed slope at pile head      =   7.709882E-18
Maximum bending moment           =  -401265.44792 lbs-in
Maximum shear force              =    15000.00000 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             19
Number of zero deflection points =             12
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 4

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head = 20000.000 lbs
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = 90000.000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res. p lbs/in	Es*h F/L lbs/in
0.000	0.115778	-597240.	20000.0000	-2.8912E-18	2698.7508	-231.9400	7211.9160
7.200	0.113290	-459028.	18282.2956	-0.0006113	2218.8478	-245.2001	15583.3916
14.400	0.106976	-333183.	16477.9020	-0.0010697	1781.8853	-256.0204	17231.3783
21.600	0.097886	-220360.	14604.4041	-0.0013901	1390.1389	-264.3957	19447.6379
28.800	0.086959	-121078.	12679.5862	-0.0015877	1045.4099	-270.2759	22378.1275
36.000	0.075024	-35716.3680	10721.7066	-0.0016784	749.0152	-273.5796	26255.3357
43.200	0.062791	35489.7262	8749.6980	-0.0016785	748.2282	-274.2006	31441.7633
50.400	0.050853	92454.6445	6783.3515	-0.0016045	946.0231	-272.0068	38511.9284
57.600	0.039686	135249.	4854.2666	-0.0014727	1094.6159	-263.8502	47868.7662

64.800	0.029646	164265.	3034.4940	-0.0012994	1195.3636	-241.6422	58686.4366
72.000	0.020975	180630.	1274.7708	-0.0010998	1252.1878	-247.1698	84844.7860
79.200	0.013809	184047.	-447.5184	-0.0008887	1264.0511	-231.2439	120568.
86.400	0.008177	175338.	-2029.9137	-0.0006808	1233.8112	-208.3104	183418.
93.600	0.004006	155698.	-3407.4967	-0.0004892	1165.6189	-174.3516	313347.
100.800	0.001133	126904.	-4493.7751	-0.0003257	1065.6378	-127.3924	809734.
108.000	-0.000683	91409.9235	-4551.1329	-0.0001993	942.3956	111.4597	1174677.
115.200	-0.001737	61625.6774	-3641.7499	-0.0001108	838.9780	141.1467	584947.
122.400	-0.002278	39112.2575	-2589.6131	-5.2453E-05	760.8064	151.1135	477625.
129.600	-0.002493	24403.2270	-1489.0892	-1.5696E-05	709.7334	154.5876	446522.
136.800	-0.002504	17689.7150	-867.5124	8.6634E-06	686.4226	18.0726	51966.0594
144.000	-0.002368	11899.8207	-738.5856	2.5787E-05	666.3188	17.7404	53942.3097
151.200	-0.002133	7020.6632	-613.0408	3.6736E-05	649.3773	17.1332	57842.4846
158.400	-0.001839	3024.4228	-492.6528	4.2549E-05	635.5015	16.3080	63851.5402
165.600	-0.001520	-128.6808	-378.8457	4.4225E-05	625.4468	15.3051	72500.0273
172.800	-0.001202	-2488.2713	-272.7928	4.2711E-05	633.6398	14.1540	84778.0889
180.000	-0.000905	-4112.2497	-175.4841	3.8891E-05	639.2786	12.8761	102449.
187.200	-0.000642	-5065.6457	-87.7857	3.3580E-05	642.5890	11.4846	128791.
194.400	-0.000421	-5419.8833	-10.5106	2.7512E-05	643.8190	9.9808	170542.
201.600	-0.000246	-5252.6531	55.4467	2.1335E-05	643.2384	8.3407	244246.
208.800	-0.000114	-4649.1022	99.6423	1.5605E-05	641.1427	3.9359	248274.
216.000	-2.12E-05	-3838.0283	116.4376	1.0694E-05	638.3265	0.7294627	248274.
223.200	3.98E-05	-2986.2605	114.1169	6.7445E-06	635.3690	-1.3741	248274.
230.400	7.60E-05	-2203.4855	99.7400	3.7412E-06	632.6510	-2.6195	248274.
237.600	9.37E-05	-1554.8534	78.6754	1.5662E-06	630.3988	-3.2318	248274.
244.800	9.85E-05	-1072.5897	61.1902	4.5707E-08	628.7243	-1.6252	118775.
252.000	9.44E-05	-673.7737	49.4898	-9.6492E-07	627.3395	-1.6249	123959.
259.200	8.46E-05	-358.6866	38.1758	-1.5624E-06	626.2454	-1.5179	129143.

266.400	7.19E-05	-122.0172	27.8837	-1.8406E-06	625.4237	-1.3411	134327.
273.600	5.81E-05	45.2237	19.0017	-1.8850E-06	625.1570	-1.1262	139511.
280.800	4.47E-05	154.0499	11.7109	-1.7697E-06	625.5349	-0.8990502	144695.
288.000	3.26E-05	216.1538	6.0285	-1.5555E-06	625.7505	-0.6793797	149879.
295.200	2.23E-05	242.8766	1.8509	-1.2898E-06	625.8433	-0.4810783	155063.
302.400	1.41E-05	244.4781	-1.0078	-1.0078E-06	625.8489	-0.3129932	160247.
309.600	7.83E-06	229.6707	-2.7818	-7.3341E-07	625.7975	-0.1798028	165431.
316.800	3.50E-06	205.3701	-3.7279	-4.8165E-07	625.7131	-0.0829837	170615.
324.000	8.90E-07	176.6135	-7.0292	-2.6059E-07	625.6132	-0.8340398	6748920.
331.200	-2.51E-07	104.4879	-9.1861	-9.7918E-08	625.3628	0.2348922	6748920.
338.400	-5.20E-07	44.4607	-6.5850	-1.1721E-08	625.1544	0.4876433	6748920.
345.600	-4.19E-07	9.6796	-3.4143	1.9610E-08	625.0336	0.3931009	6748920.
352.800	-2.38E-07	-4.7305	-1.1965	2.2474E-08	625.0164	0.2229491	6748920.
360.000	-9.57E-08	-7.5792	-0.0707961	1.5351E-08	625.0263	0.0897481	6748920.
367.200	-1.68E-08	-5.7698	0.3089984	7.6254E-09	625.0200	0.0157504	6748920.
374.400	1.41E-08	-3.1396	0.3182599	2.4695E-09	625.0109	-0.0131778	6748920.
381.600	1.88E-08	-1.1901	0.2075243	-3.6100E-11	625.0041	-0.0175821	6748920.
388.800	1.35E-08	-0.1511570	0.0985429	-8.1228E-10	625.0005	-0.0126905	6748920.
396.000	7.06E-09	0.2299974	0.0290318	-7.6665E-10	625.0008	-0.0066181	6748920.
403.200	2.50E-09	0.2678946	-0.0032261	-4.7852E-10	625.0009	-0.0023424	6748920.
410.400	1.70E-10	0.1841623	-0.0122317	-2.1691E-10	625.0006	-0.0001592	6748920.
417.600	-6.25E-10	0.0920397	-0.0106971	-5.7072E-11	625.0003	0.0005855	6748920.
424.800	-6.52E-10	0.0301983	-0.0063892	1.3668E-11	625.0001	0.0006112	6748920.
432.000	-4.28E-10	1.6921E-05	-0.0027455	3.1153E-11	625.0000	0.0004010	6748920.
439.200	-2.03E-10	-0.0093779	-0.0006157	2.5736E-11	625.0000	0.0001907	6748920.
446.400	-5.72E-11	-0.0088819	0.0002637	1.5169E-11	625.0000	5.3595E-05	6748920.
453.600	1.50E-11	-0.0056008	0.0004059	6.7879E-12	625.0000	-1.4091E-05	6748920.
460.800	4.06E-11	-0.0030461	0.0003027	1.7839E-12	625.0000	-1.4568E-05	2585430.

468.000	4.07E-11	-0.0012443	0.0001976	-6.9890E-13	625.0000	-1.4623E-05	2585430.
475.200	3.05E-11	-0.0001996	0.0001055	-1.5344E-12	625.0000	-1.0954E-05	2585430.
482.400	1.86E-11	0.0002774	4.2023E-05	-1.4894E-12	625.0000	-6.6883E-06	2585430.
489.600	9.06E-12	0.0004075	6.2352E-06	-1.0930E-12	625.0000	-3.2527E-06	2585430.
496.800	2.89E-12	0.0003686	-1.1368E-05	-6.4385E-13	625.0000	-1.6370E-06	4083142.
504.000	-2.13E-13	0.0002446	-1.6826E-05	-2.8894E-13	625.0000	1.2082E-07	4083142.
511.200	-1.27E-12	0.0001267	-1.3790E-05	-7.4039E-14	625.0000	7.2255E-07	4083142.
518.400	-1.28E-12	4.6155E-05	-8.5774E-06	2.6001E-14	625.0000	7.2545E-07	4083142.
525.600	-9.00E-13	3.1674E-06	-4.1290E-06	5.4545E-14	625.0000	5.1022E-07	4083142.
532.800	-4.94E-13	-1.3373E-05	-1.2841E-06	4.8639E-14	625.0000	2.8002E-07	4083142.
540.000	-1.99E-13	-1.5387E-05	1.3084E-07	3.1995E-14	625.0000	1.1302E-07	4083142.
547.200	-3.30E-14	-1.1530E-05	6.0518E-07	1.6418E-14	625.0000	1.8739E-08	4083142.
554.400	3.71E-14	-6.6935E-06	5.9685E-07	5.8720E-15	625.0000	-2.1054E-08	4083142.
561.600	5.15E-14	-2.9432E-06	4.1589E-07	2.9525E-16	625.0000	-2.9214E-08	4083142.
568.800	4.14E-14	-7.0512E-07	2.2624E-07	-1.8160E-15	625.0000	-2.3465E-08	4083142.
576.000	2.54E-14	3.1708E-07	8.9991E-08	-2.0406E-15	625.0000	-1.4383E-08	4083142.
583.200	1.20E-14	5.9340E-07	1.3729E-08	-1.5137E-15	625.0000	-6.8005E-09	4083142.
590.400	3.57E-15	5.1674E-07	-1.8032E-08	-8.7127E-16	625.0000	-2.0220E-09	4083142.
597.600	-5.55E-16	3.3487E-07	-2.4179E-08	-3.7843E-16	625.0000	3.1447E-10	4083142.
604.800	-1.88E-15	1.6905E-07	-1.9201E-08	-8.6811E-17	625.0000	1.0684E-09	4083142.
612.000	-1.80E-15	5.8494E-08	-1.1670E-08	4.4871E-17	625.0000	1.0234E-09	4083142.
619.200	-1.24E-15	9.4418E-10	-5.4589E-09	7.9268E-17	625.0000	7.0197E-10	4083142.
626.400	-6.63E-16	-2.0217E-08	-1.5779E-09	6.8115E-17	625.0000	3.7607E-10	4083142.
633.600	-2.57E-16	-2.1866E-08	3.0050E-10	4.3762E-17	625.0000	1.4572E-10	4083142.
640.800	-3.30E-17	-1.5946E-08	8.9241E-10	2.1880E-17	625.0000	1.8701E-11	4083142.
648.000	5.81E-17	-9.0440E-09	8.4110E-10	7.4178E-18	625.0000	-3.2957E-11	4083142.
655.200	7.38E-17	-3.8438E-09	5.7170E-10	-4.0451E-20	625.0000	-4.1874E-11	4083142.
662.400	5.75E-17	-8.1146E-10	3.0350E-10	-2.7345E-18	625.0000	-3.2627E-11	4083142.

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 669.600  3.45E-17  5.3013E-10  1.1569E-10 -2.8973E-18    625.0000 -1.9544E-11
4083142.
 676.800  1.58E-17  8.5817E-10  1.3048E-11 -2.0939E-18    625.0000 -8.9666E-12
4083142.
 684.000  4.31E-18  7.2074E-10 -2.8033E-11 -1.1801E-18    625.0000 -2.4449E-12
4083142.
 691.200 -1.18E-18  4.5603E-10 -3.4420E-11 -4.9913E-19    625.0000  6.7073E-13
4083142.
 698.400 -2.88E-18  2.2574E-10 -2.6133E-11 -1.0459E-19    625.0000  1.6312E-12
4083142.
 705.600 -2.69E-18  7.9852E-11 -1.4771E-11  7.2263E-20    625.0000  1.5248E-12
4083142.
 712.800 -1.84E-18  1.2946E-11 -5.5340E-12  1.2597E-19    625.0000  1.0411E-12
4083142.
 720.000 -8.75E-19      0.0000      0.0000  1.3346E-19    625.0000  4.9614E-13
2041571.

Output Verification:

Computed forces and moments are within specified convergence limits.


Output Summary for Load Case No.  4:

Pile-head deflection             =     0.11577839 in
Computed slope at pile head      =  -2.891206E-18
Maximum bending moment           =  -597240.23403 lbs-in
Maximum shear force              =    20000.00000 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             22
Number of zero deflection points =             12



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             Computed Values of Load Distribution and Deflection
                 for Lateral Loading for Load Case Number  5
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Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head  =       25000.000 lbs
Specified slope at pile head        =       0.000E+00 in/in
Specified axial load at pile head   =       90000.000 lbs

(Zero slope for this load indicates fixed-head conditions)

  Depth   Deflect.    Moment      Shear       Slope      Total       Soil Res.
Es*h
    X        y          M           V           S        Stress          p
F/L
    in       in        lbs-in        lbs         Rad.   lbs/in**2    lbs/in
lbs/in
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0.000	0.180991	-812253.	25000.0000	1.9275E-18	3445.3228	-259.3436	5158.4837
7.200	0.177606	-638671.	23078.6466	-0.0008397	2842.6061	-274.3657	11122.5483
14.400	0.168900	-478832.	21057.8019	-0.0014864	2287.6120	-286.9800	12233.6425
21.600	0.156203	-333512.	18954.9053	-0.0019565	1783.0274	-297.1579	13697.1910
28.800	0.140726	-203346.	16787.7395	-0.0022671	1331.0626	-304.8326	15596.1783
36.000	0.123556	-88830.2114	14574.6636	-0.0024362	933.4382	-309.9107	18059.5233
43.200	0.105645	9686.4692	12334.7870	-0.0024820	658.6336	-312.2772	21282.6156
50.400	0.087814	92007.4327	10088.1234	-0.0024232	944.4703	-311.7960	25564.4774
57.600	0.070751	158096.	7615.7310	-0.0022784	1173.9441	-374.9797	38159.9690
64.800	0.055005	204627.	4999.1397	-0.0020685	1335.5098	-351.8513	46056.4442
72.000	0.040964	232764.	2680.7253	-0.0018154	1433.2094	-292.1527	51349.9107
79.200	0.028863	245582.	628.2385	-0.0015386	1477.7154	-277.9825	69344.1715
86.400	0.018808	243805.	-1295.6750	-0.0012554	1471.5450	-256.4379	98167.0380
93.600	0.010785	228551.	-3022.2153	-0.0009820	1418.5809	-223.1566	148973.
100.800	0.004667	201558.	-4477.1658	-0.0007331	1324.8534	-180.9963	279229.
108.000	0.000228	165030.	-5423.9822	-0.0005210	1198.0217	-82.0082	2585430.
115.200	-0.002835	124128.	-5143.9599	-0.0003536	1055.9987	159.7922	405816.
122.400	-0.004864	91415.5419	-3910.3256	-0.0002289	942.4151	182.8840	270713.
129.600	-0.006131	68115.6007	-2554.3132	-0.0001366	861.5125	193.7861	227564.
136.800	-0.006831	54810.4460	-1765.7036	-6.5447E-05	815.3140	25.2721	26637.7125
144.000	-0.007074	42774.2882	-1582.6772	-8.9743E-06	773.5218	25.5686	26025.0221
151.200	-0.006960	32031.5243	-1399.0770	3.4316E-05	736.2206	25.4315	26308.0318
158.400	-0.006580	22583.1053	-1217.6680	6.5922E-05	703.4136	24.9599	27313.5485
165.600	-0.006011	14411.6706	-1040.6216	8.7331E-05	675.0405	24.2196	29011.1905
172.800	-0.005322	7484.9736	-869.7040	0.0001000	650.9895	23.2575	31464.4231
180.000	-0.004571	1758.3299	-706.3878	0.0001054	631.1053	22.1081	34825.1052
187.200	-0.003805	-2823.5472	-551.9252	0.0001047	634.8040	20.7982	39355.8636
194.400	-0.003063	-6325.1304	-407.3998	9.9441E-05	646.9623	19.3478	45485.4448

201.600	-0.002373	-8818.9793	-273.7690	9.0677E-05	655.6215	17.7718	53922.3407
208.800	-0.001757	-10384.9214	-151.9064	7.9563E-05	661.0588	16.0789	65894.6647
216.000	-0.001227	-11109.5454	-42.6551	6.7125E-05	663.5748	14.2687	83709.2541
223.200	-0.000790	-11086.1486	53.0787	5.4280E-05	663.4936	12.3240	112282.
230.400	-0.000446	-10415.5593	134.1138	4.1837E-05	661.1651	10.1857	164563.
237.600	-0.000188	-9209.1300	194.0981	3.0480E-05	656.9761	6.4766	248274.
244.800	-6.74E-06	-7660.0479	217.8140	2.0718E-05	651.5974	0.1111628	118775.
252.000	0.000111	-6099.4580	211.3648	1.2755E-05	646.1787	-1.9026	123959.
259.200	0.000177	-4632.9251	193.0906	6.5440E-06	641.0865	-3.1735	129143.
266.400	0.000205	-3327.4339	167.9145	1.9373E-06	636.5536	-3.8198	134327.
273.600	0.000205	-2217.4669	139.8752	-1.2715E-06	632.6995	-3.9689	139511.
280.800	0.000186	-1311.5837	112.0991	-3.3138E-06	629.5541	-3.7467	144695.
288.000	0.000157	-598.9457	86.8371	-4.4194E-06	627.0797	-3.2705	149879.
295.200	0.000123	-55.4016	65.5428	-4.7981E-06	625.1924	-2.6446	155063.
302.400	8.80E-05	351.0884	48.9699	-4.6270E-06	626.2191	-1.9590	160247.
309.600	5.62E-05	655.7611	37.2716	-4.0443E-06	627.2769	-1.2905	165431.
316.800	2.98E-05	893.0407	30.0852	-3.1480E-06	628.1008	-0.7057008	170615.
324.000	1.08E-05	1093.0671	-9.0215	-1.9986E-06	628.7954	-10.1573	6748920.
331.200	1.00E-06	765.7208	-48.9635	-9.2295E-07	627.6588	-0.9377131	6748920.
338.400	-2.45E-06	389.1891	-44.0571	-2.5460E-07	626.3514	2.3006	6748920.
345.600	-2.67E-06	131.6290	-26.7789	4.6797E-08	625.4570	2.4989	6748920.
352.800	-1.78E-06	3.5119	-11.7748	1.2500E-07	625.0122	1.6690	6748920.
360.000	-8.66E-07	-38.0894	-2.8448	1.0499E-07	625.1323	0.8116003	6748920.
367.200	-2.69E-07	-37.5887	0.9833857	6.1198E-08	625.1305	0.2517731	6748920.
374.400	1.54E-08	-24.0079	1.8378	2.5552E-08	625.0834	-0.0144392	6748920.
381.600	9.93E-08	-11.1577	1.4506	5.2012E-09	625.0387	-0.0931196	6748920.
388.800	9.03E-08	-3.1264	0.8106250	-3.0650E-09	625.0109	-0.0846445	6748920.
396.000	5.52E-08	0.5192881	0.3196103	-4.5738E-09	625.0018	-0.0517485	6748920.

403.200	2.44E-08	1.4819	0.0508446	-3.4156E-09	625.0051	-0.0229087	6748920.
410.400	6.02E-09	1.2559	-0.0519474	-1.8313E-09	625.0044	-0.0056446	6748920.
417.600	-1.93E-09	0.7362620	-0.0657542	-6.7841E-10	625.0026	0.0018094	6748920.
424.800	-3.75E-09	0.3098952	-0.0465958	-7.2990E-11	625.0011	0.0035124	6748920.
432.000	-2.98E-09	0.0653766	-0.0238907	1.4418E-10	625.0002	0.0027946	6748920.
439.200	-1.67E-09	-0.0343172	-0.0081916	1.6215E-10	625.0001	0.0015662	6748920.
446.400	-6.46E-10	-0.0527919	-0.0003719	1.1174E-10	625.0002	0.0006059	6748920.
453.600	-6.18E-11	-0.0398177	0.0020178	5.8151E-11	625.0001	5.7920E-05	6748920.
460.800	1.91E-10	-0.0238111	0.0019794	2.1329E-11	625.0001	-6.8582E-05	2585430.
468.000	2.45E-10	-0.0113418	0.0014154	9.8574E-13	625.0000	-8.8100E-05	2585430.
475.200	2.05E-10	-0.0034311	0.0008330	-7.5634E-12	625.0000	-7.3679E-05	2585430.
482.400	1.36E-10	0.0006626	0.0003913	-9.1656E-12	625.0000	-4.8990E-05	2585430.
489.600	7.32E-11	0.0022162	0.0001204	-7.4996E-12	625.0000	-2.6285E-05	2585430.
496.800	2.84E-11	0.0024055	-3.2320E-05	-4.8251E-12	625.0000	-1.6126E-05	4083142.
504.000	3.72E-12	0.0017570	-9.7964E-05	-2.4162E-12	625.0000	-2.1084E-06	4083142.
511.200	-6.36E-12	0.0009979	-9.2573E-05	-8.2195E-13	625.0000	3.6058E-06	4083142.
518.400	-8.12E-12	0.0004250	-6.3019E-05	1.5097E-15	625.0000	4.6039E-06	4083142.
525.600	-6.34E-12	9.0452E-05	-3.3508E-05	2.9981E-13	625.0000	3.5934E-06	4083142.
532.800	-3.80E-12	-5.7894E-05	-1.2812E-05	3.1865E-13	625.0000	2.1555E-06	4083142.
540.000	-1.75E-12	-9.4454E-05	-1.4837E-06	2.3049E-13	625.0000	9.9122E-07	4083142.
547.200	-4.82E-13	-7.9559E-05	3.0685E-06	1.2979E-13	625.0000	2.7330E-07	4083142.
554.400	1.21E-13	-5.0436E-05	3.8053E-06	5.4558E-14	625.0000	-6.8646E-08	4083142.
561.600	3.04E-13	-2.4833E-05	2.9381E-06	1.1000E-14	625.0000	-1.7224E-07	4083142.
568.800	2.79E-13	-8.1411E-06	1.7475E-06	-8.0828E-15	625.0000	-1.5847E-07	4083142.
576.000	1.87E-13	3.4196E-07	7.9461E-07	-1.2596E-14	625.0000	-1.0623E-07	4083142.
583.200	9.81E-14	3.3177E-06	2.1199E-07	-1.0478E-14	625.0000	-5.5608E-08	4083142.
590.400	3.64E-14	3.4082E-06	-6.2590E-08	-6.5860E-15	625.0000	-2.0663E-08	4083142.
597.600	3.22E-15	2.4249E-06	-1.4355E-07	-3.2104E-15	625.0000	-1.8248E-09	4083142.

604.800	-9.79E-15	1.3452E-06	-1.3012E-07	-1.0286E-15	625.0000	5.5538E-09	4083142.
612.000	-1.16E-14	5.5248E-07	-8.6459E-08	6.9616E-17	625.0000	6.5751E-09	4083142.
619.200	-8.79E-15	1.0015E-07	-4.4841E-08	4.4730E-16	625.0000	4.9853E-09	4083142.
626.400	-5.15E-15	-9.3811E-08	-1.6374E-08	4.5097E-16	625.0000	2.9223E-09	4083142.
633.600	-2.30E-15	-1.3621E-07	-1.1642E-09	3.1785E-16	625.0000	1.3026E-09	4083142.
640.800	-5.76E-16	-1.1099E-07	4.7010E-09	1.7480E-16	625.0000	3.2662E-10	4083142.
648.000	2.20E-16	-6.8746E-08	5.4273E-09	7.0785E-17	625.0000	-1.2485E-10	4083142.
655.200	4.43E-16	-3.2925E-08	4.0727E-09	1.1947E-17	625.0000	-2.5143E-10	4083142.
662.400	3.92E-16	-1.0114E-08	2.3669E-09	-1.2960E-17	625.0000	-2.2241E-10	4083142.
669.600	2.57E-16	1.1746E-09	1.0420E-09	-1.8133E-17	625.0000	-1.4560E-10	4083142.
676.800	1.31E-16	4.9146E-09	2.5028E-10	-1.4609E-17	625.0000	-7.4333E-11	4083142.
684.000	4.64E-17	4.7975E-09	-1.1198E-10	-8.9890E-18	625.0000	-2.6294E-11	4083142.
691.200	1.63E-18	3.3138E-09	-2.0997E-10	-4.2949E-18	625.0000	-9.2684E-13	4083142.
698.400	-1.55E-17	1.7795E-09	-1.8170E-10	-1.3474E-18	625.0000	8.7797E-12	4083142.
705.600	-1.78E-17	6.9902E-10	-1.1382E-10	8.6909E-20	625.0000	1.0077E-11	4083142.
712.800	-1.42E-17	1.4039E-10	-4.8492E-11	5.7268E-19	625.0000	8.0700E-12	4083142.
720.000	-9.52E-18	0.0000	0.0000	6.5392E-19	625.0000	5.3999E-12	2041571.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 5:

```
Pile-head deflection             =     0.18099055 in
Computed slope at pile head      =   1.927471E-18
Maximum bending moment           =  -812252.95868 lbs-in
Maximum shear force              =    25000.00000 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             21
Number of zero deflection points =             11
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 6

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head = 30000.000 lbs
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = 90000.000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res. p lbs/in	Es*h F/L lbs/in
0.000	0.259242	-1040077.	30000.0000	7.7099E-18	4236.3780	-283.7163	3939.8721
7.200	0.254908	-831041.	27897.5352	-0.0010828	3510.5582	-300.3017	8482.1696
14.400	0.243649	-636949.	25684.2185	-0.0019324	2836.6285	-314.5085	9293.9510
21.600	0.227082	-458684.	23377.3333	-0.0025664	2217.6517	-326.2929	10345.6415
28.800	0.206693	-296989.	20994.5915	-0.0030037	1656.2130	-335.5798	11689.6903
36.000	0.183829	-152469.	18554.3246	-0.0032638	1154.4054	-342.2722	13405.7475
43.200	0.159694	-25577.1781	16075.6195	-0.0033669	713.8096	-346.2570	15611.4387
50.400	0.135346	83383.6112	13578.4259	-0.0033334	914.5264	-347.4079	18481.0625
57.600	0.111693	174272.	10545.8985	-0.0031843	1230.1119	-494.9608	31906.3935
64.800	0.089492	239371.	7061.1545	-0.0029449	1456.1507	-473.0236	38056.6345
72.000	0.069286	279769.	4158.8163	-0.0026445	1596.4218	-333.1814	34623.1724
79.200	0.051412	302686.	1803.1998	-0.0023074	1675.9917	-321.1565	44976.7798
86.400	0.036059	308726.	-439.3577	-0.0019536	1696.9651	-301.7762	60255.8824
93.600	0.023280	298891.	-2499.6567	-0.0016020	1662.8149	-270.5291	83669.2765
100.800	0.012991	274807.	-4315.4753	-0.0012700	1579.1911	-233.8650	129614.
108.000	0.004992	238394.	-5820.7290	-0.0009730	1452.7560	-184.2611	265737.
115.200	-0.001020	192250.	-6041.0533	-0.0007238	1292.5330	123.0599	868993.
122.400	-0.005430	152341.	-4922.0688	-0.0005243	1153.9602	187.7692	248995.
129.600	-0.008570	122051.	-3488.1337	-0.0003655	1048.7891	210.5461	176887.
136.800	-0.010693	102585.	-2624.5893	-0.0002355	981.1985	29.3273	19746.3691

144.000	-0.011962	84562.4488	-2409.4056	-0.0001272	918.6196	30.4459	18325.6445
151.200	-0.012526	68054.6303	-2188.4951	-3.8925E-05	861.3008	30.9181	17772.1876
158.400	-0.012522	53098.5664	-1965.8917	3.1187E-05	809.3700	30.9162	17775.7395
165.600	-0.012077	39705.3721	-1744.6303	8.4893E-05	762.8659	30.5453	18210.8160
172.800	-0.011300	27865.8684	-1527.1126	0.0001240	721.7565	29.8763	19036.1673
180.000	-0.010291	17554.2509	-1315.3041	0.0001503	685.9523	28.9594	20260.9300
187.200	-0.009136	8730.7254	-1110.8523	0.0001655	655.3150	27.8327	21934.7749
194.400	-0.007908	1343.4992	-915.1635	0.0001713	629.6649	26.5253	24150.3667
201.600	-0.006669	-4669.6629	-729.4548	0.0001694	641.2141	25.0604	27056.1004
208.800	-0.005469	-9380.1899	-554.7938	0.0001613	657.5701	23.4565	30882.3557
216.000	-0.004347	-12867.6960	-392.1298	0.0001484	669.6795	21.7279	35990.9383
223.200	-0.003332	-15219.1752	-242.3233	0.0001321	677.8444	19.8850	42970.3844
230.400	-0.002444	-16528.4026	-106.1787	0.0001138	682.3903	17.9330	52832.6347
237.600	-0.001694	-16895.5893	15.5096	9.4423E-05	683.6652	15.8694	67463.4719
244.800	-0.001084	-16427.4367	137.0271	7.5139E-05	682.0397	17.8855	118775.
252.000	-0.000612	-15019.7790	239.3245	5.6940E-05	677.1520	10.5304	123959.
259.200	-0.000264	-13054.9585	294.2978	4.0693E-05	670.3297	4.7399	129143.
266.400	-2.57E-05	-10834.6299	313.0851	2.6868E-05	662.6202	0.4788105	134327.
273.600	0.000123	-8581.3537	306.2539	1.5632E-05	654.7964	-2.3764	139511.
280.800	0.000199	-6444.8337	283.2699	6.9365E-06	647.3779	-4.0080	144695.
288.000	0.000223	-4511.2564	252.1649	5.9618E-07	640.6641	-4.6323	149879.
295.200	0.000208	-2814.4325	219.3603	-3.6432E-06	634.7723	-4.4801	155063.
302.400	0.000170	-1347.7467	189.6056	-6.0519E-06	629.6797	-3.7851	160247.
309.600	0.000121	-76.2687	165.9809	-6.8760E-06	625.2648	-2.7773	165431.
316.800	7.11E-05	1051.2899	149.9213	-6.3117E-06	628.6503	-1.6837	170615.
324.000	3.00E-05	2090.7776	42.6665	-4.4934E-06	632.2596	-28.1093	6748920.
331.200	6.35E-06	1671.5106	-79.9452	-2.3162E-06	630.8039	-5.9495	6748920.
338.400	-3.36E-06	942.5692	-90.0097	-8.0338E-07	628.2728	3.1538	6748920.

345.600	-5.22E-06	376.4122	-61.0364	-4.0077E-08	626.3070	4.8944	6748920.
352.800	-3.94E-06	63.6973	-30.1156	2.1462E-07	625.2212	3.6947	6748920.
360.000	-2.13E-06	-57.5307	-9.6235	2.1818E-07	625.1998	1.9975	6748920.
367.200	-8.00E-07	-75.1638	0.2665552	1.4139E-07	625.2610	0.7497105	6748920.
374.400	-9.50E-08	-53.8755	3.2860	6.6718E-08	625.1871	0.0890185	6748920.
381.600	1.61E-07	-27.9322	3.0634	1.9376E-08	625.0970	-0.1508383	6748920.
388.800	1.84E-07	-9.7873	1.8994	-2.4528E-09	625.0340	-0.1725099	6748920.
396.000	1.26E-07	-0.5779835	0.8545091	-8.4512E-09	625.0020	-0.1177306	6748920.
403.200	6.23E-08	2.5286	0.2203074	-7.3224E-09	625.0088	-0.0584365	6748920.
410.400	2.02E-08	2.6039	-0.0580823	-4.3522E-09	625.0090	-0.0188940	6748920.
417.600	-3.29E-10	1.6979	-0.1249896	-1.8627E-09	625.0059	0.0003086	6748920.
424.800	-6.67E-09	0.8064974	-0.1013826	-4.1345E-10	625.0028	0.0062489	6748920.
432.000	-6.28E-09	0.2384784	-0.0576851	1.9128E-10	625.0008	0.0058893	6748920.
439.200	-3.91E-09	-0.0244157	-0.0232822	3.1516E-10	625.0001	0.0036670	6748920.
446.400	-1.74E-09	-0.0971932	-0.0041934	2.4478E-10	625.0003	0.0016354	6748920.
453.600	-3.87E-10	-0.0851184	0.0030008	1.3928E-10	625.0003	0.0003630	6748920.
460.800	2.61E-10	-0.0541621	0.0039703	5.8675E-11	625.0002	-9.3679E-05	2585430.
468.000	4.58E-10	-0.0280214	0.0030415	1.1115E-11	625.0001	-0.0001643	2585430.
475.200	4.21E-10	-0.0103792	0.0019057	-1.1107E-11	625.0000	-0.0001512	2585430.
482.400	2.98E-10	-0.0005650	0.0009767	-1.7441E-11	625.0000	-0.0001069	2585430.
489.600	1.70E-10	0.0037075	0.0003723	-1.5622E-11	625.0000	-6.0970E-05	2585430.
496.800	7.28E-11	0.0048165	4.2775E-06	-1.0689E-11	625.0000	-4.1262E-05	4083142.
504.000	1.59E-11	0.0037829	-0.0001767	-5.7129E-12	625.0000	-8.9962E-06	4083142.
511.200	-9.51E-12	0.0022801	-0.0001896	-2.2043E-12	625.0000	5.3918E-06	4083142.
518.400	-1.59E-11	0.0010551	-0.0001378	-2.7414E-13	625.0000	9.0043E-06	4083142.
525.600	-1.35E-11	0.0002961	-7.7916E-05	5.0784E-13	625.0000	7.6305E-06	4083142.
532.800	-8.56E-12	-6.7518E-05	-3.2960E-05	6.4014E-13	625.0000	4.8572E-06	4083142.
540.000	-4.24E-12	-0.0001793	-6.8237E-06	4.9729E-13	625.0000	2.4029E-06	4083142.

547.200	-1.40E-12	-0.0001664	4.6930E-06	2.9721E-13	625.0000	7.9614E-07	4083142.
554.400	4.26E-14	-0.0001121	7.4722E-06	1.3601E-13	625.0000	-2.4160E-08	4083142.
561.600	5.55E-13	-5.9000E-05	6.2527E-06	3.6979E-14	625.0000	-3.1456E-07	4083142.
568.800	5.75E-13	-2.2136E-05	3.9462E-06	-9.9746E-15	625.0000	-3.2614E-07	4083142.
576.000	4.11E-13	-2.1619E-06	1.9329E-06	-2.4036E-14	625.0000	-2.3311E-07	4083142.
583.200	2.29E-13	5.7292E-06	6.2621E-07	-2.1971E-14	625.0000	-1.2986E-07	4083142.
590.400	9.47E-14	6.8840E-06	-3.4550E-08	-1.4672E-14	625.0000	-5.3685E-08	4083142.
597.600	1.77E-14	5.2507E-06	-2.6398E-07	-7.6496E-15	625.0000	-1.0044E-08	4083142.
604.800	-1.55E-14	3.0927E-06	-2.6851E-07	-2.8213E-15	625.0000	8.7837E-09	4083142.
612.000	-2.29E-14	1.3877E-06	-1.9011E-07	-2.2846E-16	625.0000	1.2996E-08	4083142.
619.200	-1.88E-14	3.5546E-07	-1.0498E-07	7.8034E-16	625.0000	1.0649E-08	4083142.
626.400	-1.17E-14	-1.2503E-07	-4.2802E-08	9.1369E-16	625.0000	6.6232E-09	4083142.
633.600	-5.62E-15	-2.6208E-07	-7.4819E-09	6.8967E-16	625.0000	3.1879E-09	4083142.
640.800	-1.75E-15	-2.3366E-07	7.5630E-09	4.0279E-16	625.0000	9.9119E-10	4083142.
648.000	1.79E-16	-1.5369E-07	1.0767E-08	1.7862E-16	625.0000	-1.0131E-10	4083142.
655.200	8.24E-16	-7.8854E-08	8.7189E-09	4.4049E-17	625.0000	-4.6750E-10	4083142.
662.400	8.13E-16	-2.8195E-08	5.3762E-09	-1.7901E-17	625.0000	-4.6103E-10	4083142.
669.600	5.67E-16	-1.4139E-09	2.5598E-09	-3.5035E-17	625.0000	-3.2131E-10	4083142.
676.800	3.08E-16	8.7112E-09	7.7332E-10	-3.0812E-17	625.0000	-1.7492E-10	4083142.
684.000	1.23E-16	9.7619E-09	-1.0728E-10	-2.0122E-17	625.0000	-6.9692E-11	4083142.
691.200	1.87E-17	7.1924E-09	-3.9632E-10	-1.0311E-17	625.0000	-1.0597E-11	4083142.
698.400	-2.56E-17	4.0682E-09	-3.8225E-10	-3.7940E-18	625.0000	1.4507E-11	4083142.
705.600	-3.59E-17	1.6930E-09	-2.5663E-10	-4.5994E-19	625.0000	2.0385E-11	4083142.
712.800	-3.22E-17	3.7326E-10	-1.1750E-10	7.3580E-19	625.0000	1.8263E-11	4083142.
720.000	-2.54E-17	0.0000	0.0000	9.5180E-19	625.0000	1.4377E-11	2041571.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 6:

```
Pile-head deflection             =     0.25924157 in
Computed slope at pile head      =   7.709882E-18
Maximum bending moment           =      -1040077. lbs-in
Maximum shear force              =    30000.00000 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             25
Number of zero deflection points =             11
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 7

```
Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head  =       35000.000 lbs
Specified slope at pile head        =       0.000E+00 in/in
Specified axial load at pile head   =       90000.000 lbs

(Zero slope for this load indicates fixed-head conditions)
```

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res. p lbs/in	Es*h F/L lbs/in
0.000	0.347930	-1281896.	35000.0000	2.3130E-17	5076.0274	-305.3715	3159.6516
7.200	0.342589	-1037330.	32736.6568	-0.0013421	4226.8417	-323.3349	6795.3531
14.400	0.328603	-808749.	30352.5133	-0.0024105	3433.1549	-338.9271	7426.2098
21.600	0.307878	-597130.	27864.8523	-0.0032241	2698.3689	-352.0898	8233.9360
28.800	0.282177	-403316.	25291.4783	-0.0038030	2025.4040	-362.7363	9255.5574
36.000	0.253114	-228004.	22650.8911	-0.0041684	1416.6813	-370.7602	10546.5135
43.200	0.222152	-71741.3024	19962.4120	-0.0043418	874.1017	-376.0396	12187.5367
50.400	0.190592	65081.5320	17246.2843	-0.0043457	850.9775	-378.4403	14296.3672
57.600	0.159574	182237.	13670.4482	-0.0042026	1257.7681	-614.8475	27742.0020
64.800	0.130075	267383.	9319.4140	-0.0039424	1553.4115	-593.7731	32866.9807
72.000	0.102804	321546.	5858.0790	-0.0036016	1741.4795	-367.7088	25752.9645
79.200	0.078212	356406.	3250.3791	-0.0032092	1862.5225	-356.6523	32832.3398

86.400	0.056591	372511.	750.5783	-0.0027874	1918.4399	-337.7369	42969.8040
93.600	0.038074	370827.	-1566.4687	-0.0023572	1912.5947	-305.8873	57845.0943
100.800	0.022647	353009.	-3634.7955	-0.0019383	1850.7240	-268.6479	85409.2737
108.000	0.010162	320998.	-5393.6139	-0.0015483	1739.5774	-219.9128	155815.
115.200	0.000352	277347.	-6529.7733	-0.0012020	1588.0106	-95.6871	1958992.
122.400	-0.007147	228527.	-6149.7766	-0.0009093	1418.4978	201.2417	202727.
129.600	-0.012742	189969.	-4588.0076	-0.0006671	1284.6135	232.5830	131425.
136.800	-0.016753	163325.	-3628.0527	-0.0004626	1192.0993	34.0711	14642.6328
144.000	-0.019404	138324.	-3376.5824	-0.0002881	1105.2927	35.7817	13277.2624
151.200	-0.020901	115075.	-3115.7191	-0.0001414	1024.5665	36.6803	12635.3889
158.400	-0.021440	93641.2249	-2850.4943	-2.0640E-05	950.1431	36.9933	12422.9656
165.600	-0.021199	74054.7905	-2584.6437	7.6407E-05	882.1347	36.8541	12517.2763
172.800	-0.020340	56323.3330	-2321.1092	0.0001519	820.5671	36.3499	12867.2271
180.000	-0.019012	40434.0119	-2062.3015	0.0002079	765.3959	35.5411	13459.7517
187.200	-0.017347	26356.8165	-1810.2546	0.0002465	716.5167	34.4719	14307.8688
194.400	-0.015462	14046.8774	-1566.7239	0.0002699	673.7739	33.1755	15448.1367
201.600	-0.013461	3446.2219	-1333.2534	0.0002800	636.9660	31.6774	16944.0669
208.800	-0.011430	-5514.8613	-1111.2247	0.0002788	644.1488	29.9972	18895.5787
216.000	-0.009446	-12916.7523	-901.8951	0.0002681	669.8498	28.1499	21457.2409
223.200	-0.007569	-18849.6651	-706.4285	0.0002498	690.4502	26.1464	24871.9862
230.400	-0.005849	-23413.0134	-525.9237	0.0002253	706.2952	23.9939	29535.1007
237.600	-0.004325	-26714.9600	-361.4394	0.0001963	717.7603	21.6962	36122.4311
244.800	-0.003023	-28872.1376	-103.8326	0.0001641	725.2505	49.8612	118775.
252.000	-0.001961	-28422.8563	197.2173	0.0001310	723.6905	33.7638	123959.
259.200	-0.001137	-26201.9441	392.1575	9.9357E-05	715.9790	20.3863	129143.
266.400	-0.000530	-22904.5550	501.1706	7.0939E-05	704.5297	9.8951	134327.
273.600	-0.000115	-19077.0251	544.8188	4.6644E-05	691.2397	2.2294	139511.
280.800	0.000141	-15119.6148	542.6225	2.6855E-05	677.4987	-2.8395	144695.

288.000	0.000272	-11298.0650	512.0431	1.1567E-05	664.2294	-5.6548	149879.
295.200	0.000308	-7761.1848	467.8177	5.3691E-07	651.9486	-6.6301	155063.
302.400	0.000279	-4562.1860	421.5646	-6.5947E-06	640.8409	-6.2180	160247.
309.600	0.000213	-1682.1074	381.5706	-1.0208E-05	630.8407	-4.8914	165431.
316.800	0.000132	945.6601	352.6683	-1.0634E-05	628.2835	-3.1370	170615.
324.000	5.98E-05	3410.0984	139.7411	-8.1138E-06	636.8406	-56.0095	6748920.
331.200	1.55E-05	2968.4467	-114.3414	-4.4225E-06	635.3071	-14.5690	6748920.
338.400	-3.93E-06	1769.3138	-153.5262	-1.6807E-06	631.1435	3.6843	6748920.
345.600	-8.66E-06	759.8479	-111.0415	-2.1708E-07	627.6384	8.1170	6748920.
352.800	-7.06E-06	170.5978	-58.0086	3.2138E-07	625.5924	6.6143	6748920.
360.000	-4.03E-06	-75.8924	-20.5921	3.7618E-07	625.2635	3.7791	6748920.
367.200	-1.64E-06	-126.4165	-1.4553	2.5911E-07	625.4389	1.5367	6748920.
374.400	-3.01E-07	-97.1838	5.0911	1.2971E-07	625.3374	0.2817379	6748920.
381.600	2.28E-07	-53.2730	5.3346	4.2638E-08	625.1850	-0.2140865	6748920.
388.800	3.13E-07	-20.4204	3.5063	-8.6860E-12	625.0709	-0.2937823	6748920.
396.000	2.28E-07	-2.7822	1.6784	-1.3436E-08	625.0097	-0.2139692	6748920.
403.200	1.20E-07	3.7660	0.5033845	-1.2867E-08	625.0131	-0.1124240	6748920.
410.400	4.30E-08	4.4832	-0.0464062	-8.0929E-09	625.0156	-0.0402957	6748920.
417.600	3.40E-09	3.1082	-0.2029442	-3.6997E-09	625.0108	-0.0031871	6748920.
424.800	-1.03E-08	1.5656	-0.1797049	-9.9493E-10	625.0054	0.0096424	6748920.
432.000	-1.09E-08	0.5217533	-0.1081197	2.1305E-10	625.0018	0.0102424	6748920.
439.200	-7.22E-09	0.0084396	-0.0468870	5.1987E-10	625.0000	0.0067667	6748920.
446.400	-3.44E-09	-0.1540927	-0.0109160	4.3558E-10	625.0005	0.0032252	6748920.
453.600	-9.47E-10	-0.1493151	0.0038890	2.6000E-10	625.0005	0.0008873	6748920.
460.800	3.03E-10	-0.0984275	0.0066914	1.1663E-10	625.0003	-0.0001089	2585430.
468.000	7.33E-10	-0.0531107	0.0053520	2.8934E-11	625.0002	-0.0002632	2585430.
475.200	7.20E-10	-0.0213964	0.0034740	-1.4183E-11	625.0001	-0.0002585	2585430.
482.400	5.29E-10	-0.0030668	0.0018600	-2.8340E-11	625.0000	-0.0001898	2585430.

489.600	3.12E-10	0.0054246	0.0007736	-2.6976E-11	625.0000	-0.0001120	2585430.
496.800	1.40E-10	0.0081079	8.4359E-05	-1.9144E-11	625.0000	-7.9494E-05	4083142.
504.000	3.61E-11	0.0066642	-0.0002756	-1.0595E-11	625.0000	-2.0484E-05	4083142.
511.200	-1.24E-11	0.0041536	-0.0003240	-4.3351E-12	625.0000	7.0320E-06	4083142.
518.400	-2.63E-11	0.0020044	-0.0002450	-7.7144E-13	625.0000	1.4918E-05	4083142.
525.600	-2.35E-11	0.0006271	-0.0001433	7.5146E-13	625.0000	1.3332E-05	4083142.
532.800	-1.55E-11	-5.9525E-05	-6.3655E-05	1.0799E-12	625.0000	8.7816E-06	4083142.
540.000	-7.96E-12	-0.0002909	-1.5796E-05	8.7715E-13	625.0000	4.5127E-06	4083142.
547.200	-2.85E-12	-0.0002881	6.2772E-06	5.4207E-13	625.0000	1.6186E-06	4083142.
554.400	-1.52E-13	-0.0002012	1.2414E-05	2.5890E-13	625.0000	8.6028E-08	4083142.
561.600	8.74E-13	-0.0001097	1.0939E-05	7.8974E-14	625.0000	-4.9563E-07	4083142.
568.800	9.86E-13	-4.3788E-05	7.1429E-06	-9.8464E-15	625.0000	-5.5890E-07	4083142.
576.000	7.32E-13	-6.8228E-06	3.6361E-06	-3.9135E-14	625.0000	-4.1522E-07	4083142.
583.200	4.22E-13	8.6223E-06	1.2798E-06	-3.8094E-14	625.0000	-2.3931E-07	4083142.
590.400	1.84E-13	1.1655E-05	4.3355E-08	-2.6359E-14	625.0000	-1.0414E-07	4083142.
597.600	4.24E-14	9.2808E-06	-4.1814E-07	-1.4243E-14	625.0000	-2.4054E-08	4083142.
604.800	-2.15E-14	5.6525E-06	-4.6091E-07	-5.6012E-15	625.0000	1.2173E-08	4083142.
612.000	-3.82E-14	2.6509E-06	-3.3902E-07	-7.9597E-16	625.0000	2.1687E-08	4083142.
619.200	-3.29E-14	7.7163E-07	-1.9372E-07	1.1847E-15	625.0000	1.8673E-08	4083142.
626.400	-2.12E-14	-1.4023E-07	-8.3254E-08	1.5501E-15	625.0000	1.2013E-08	4083142.
633.600	-1.06E-14	-4.2924E-07	-1.8355E-08	1.2205E-15	625.0000	6.0149E-09	4083142.
640.800	-3.61E-15	-4.0612E-07	1.0663E-08	7.3707E-16	625.0000	2.0457E-09	4083142.
648.000	7.54E-18	-2.7665E-07	1.8012E-08	3.4195E-16	625.0000	-4.2735E-12	4083142.
655.200	1.32E-15	-1.4720E-07	1.5308E-08	9.6660E-17	625.0000	-7.4677E-10	4083142.
662.400	1.40E-15	-5.6346E-08	9.7625E-09	-2.1132E-17	625.0000	-7.9363E-10	4083142.
669.600	1.01E-15	-6.5915E-09	4.8383E-09	-5.7554E-17	625.0000	-5.7420E-10	4083142.
676.800	5.71E-16	1.3401E-08	1.6062E-09	-5.3613E-17	625.0000	-3.2362E-10	4083142.
684.000	2.40E-16	1.6607E-08	-4.9820E-11	-3.6248E-17	625.0000	-1.3638E-10	4083142.

```
 691.200  4.87E-17  1.2731E-08 -6.4020E-10 -1.9270E-17    625.0000 -2.7615E-11
4083142.
 698.400 -3.70E-17  7.4132E-09 -6.6407E-10 -7.6124E-18    625.0000  2.0984E-11
4083142.
 705.600 -6.09E-17  3.1780E-09 -4.6415E-10 -1.4832E-18    625.0000  3.4550E-11
4083142.
 712.800 -5.84E-17  7.3139E-10 -2.2062E-10  7.7911E-19    625.0000  3.3097E-11
4083142.
 720.000 -4.97E-17      0.0000      0.0000  1.2024E-18    625.0000  2.8187E-11
2041571.
```

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 7:

```
Pile-head deflection             =     0.34792997 in
Computed slope at pile head      =   2.312965E-17
Maximum bending moment           =      -1281896. lbs-in
Maximum shear force              =    35000.00000 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             22
Number of zero deflection points =             11
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 8

```
Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head  =       40000.000 lbs
Specified slope at pile head        =       0.000E+00 in/in
Specified axial load at pile head   =       90000.000 lbs
```

(Zero slope for this load indicates fixed-head conditions)

```
  Depth   Deflect.    Moment      Shear       Slope      Total       Soil Res.
Es*h
    X        y          M           V           S        Stress          p
F/L
    in       in        lbs-in        lbs         Rad.   lbs/in**2    lbs/in
lbs/in
-------- --------- ----------- ----------- ----------- ----------- ----------- -
----------
   0.000  0.448247   -1530583.  40000.0000 -3.8549E-17   5939.5240   -325.3368
2612.8749
   7.200  0.441869   -1250442.  37588.3251  -0.0016094   4966.8114   -344.5729
5614.6133
  14.400  0.425071    -987225.  35046.6307  -0.0029043   4052.8655   -361.4533
6122.4154
```

21.600	0.400047	-742006.	32392.1199	-0.0039050	3201.4103	-375.9108	6765.6029
28.800	0.368839	-515718.	29642.5670	-0.0046329	2415.6868	-387.8539	7571.1892
36.000	0.333333	-309149.	26816.4636	-0.0051103	1698.4340	-397.1748	8578.9829
43.200	0.295251	-122938.	23933.1188	-0.0053603	1051.8675	-403.7543	9845.9598
50.400	0.256145	42434.8809	21012.7273	-0.0054069	772.3433	-407.4656	11453.4942
57.600	0.217392	186653.	16872.4180	-0.0052743	1273.0999	-742.6203	24595.5125
64.800	0.180195	292233.	11592.9290	-0.0049972	1639.6987	-723.9044	28924.9044
72.000	0.145433	360067.	7543.2025	-0.0046197	1875.2336	-401.0197	19853.4777
79.200	0.113671	406842.	4689.7892	-0.0041759	2037.6474	-391.5951	24803.9027
86.400	0.085300	433012.	1932.8527	-0.0036899	2128.5145	-374.2206	31587.2493
93.600	0.060537	439458.	-650.8908	-0.0031850	2150.8944	-343.4859	40852.5830
100.800	0.039437	427767.	-2998.4150	-0.0026831	2110.3023	-308.6041	56342.3620
108.000	0.021901	399758.	-5068.5630	-0.0022042	2013.0475	-266.4370	87592.8305
115.200	0.007696	357636.	-6766.6065	-0.0017659	1866.7930	-205.2418	192009.
122.400	-0.003528	304607.	-6898.9796	-0.0013826	1682.6637	168.4715	343815.
129.600	-0.012214	260083.	-5464.2060	-0.0010559	1528.0659	230.0768	135629.
136.800	-0.018732	227291.	-4508.6391	-0.0007738	1414.2047	35.3585	13590.4498
144.000	-0.023357	196161.	-4244.3351	-0.0005288	1306.1161	38.0593	11732.2276
151.200	-0.026346	166858.	-3964.6909	-0.0003187	1204.3674	39.6197	10827.3294
158.400	-0.027946	139483.	-3676.5968	-0.0001414	1109.3156	40.4064	10410.4208
165.600	-0.028383	114098.	-3384.9144	5.3524E-06	1021.1738	40.6164	10303.4546
172.800	-0.027869	90733.1940	-3093.3626	0.0001239	940.0458	40.3702	10429.8408
180.000	-0.026599	69393.0725	-2804.9387	0.0002166	865.9482	39.7476	10759.3355
187.200	-0.024750	50061.4224	-2522.1495	0.0002857	798.8244	38.8049	11288.6039
194.400	-0.022485	32703.8736	-2247.1530	0.0003336	738.5551	37.5830	12034.7310
201.600	-0.019947	17270.0987	-1981.8505	0.0003625	684.9656	36.1122	13035.1370
208.800	-0.017265	3695.4260	-1727.9518	0.0003746	637.8313	34.4152	14352.3820
216.000	-0.014552	-8097.9323	-1487.0240	0.0003721	653.1178	32.5091	16084.8395

223.200	-0.011907	-18199.9428	-1260.5286	0.0003569	688.1942	30.4062	18386.7269
230.400	-0.009413	-26712.0438	-1049.8509	0.0003309	717.7502	28.1154	21505.2491
237.600	-0.007142	-33746.6106	-856.3195	0.0002959	742.1757	25.6434	25851.3593
244.800	-0.005152	-39426.5154	-458.0226	0.0002535	761.8976	84.9947	118775.
252.000	-0.003491	-40670.7269	64.3317	0.0002072	766.2178	60.1038	123959.
259.200	-0.002169	-38768.6566	420.7444	0.0001612	759.6134	38.8998	129143.
266.400	-0.001170	-34820.9459	639.3322	0.0001186	745.9061	21.8190	134327.
273.600	-0.000460	-29716.0201	749.9999	8.1284E-05	728.1806	8.9220	139511.
280.800	9.72E-07	-24126.2912	782.0487	5.0125E-05	708.7718	-0.0195437	144695.
288.000	0.000261	-18519.4807	762.3932	2.5446E-05	689.3038	-5.4403	149879.
295.200	0.000367	-13180.8073	714.3235	7.1008E-06	670.7667	-7.9123	155063.
302.400	0.000364	-8242.4243	656.7064	-5.2969E-06	653.6195	-8.0924	160247.
309.600	0.000291	-3717.3705	603.4939	-1.2218E-05	637.9075	-6.6888	165431.
316.800	0.000188	463.7220	563.4055	-1.4101E-05	626.6101	-4.4468	170615.
324.000	8.81E-05	4413.9436	250.2350	-1.1278E-05	640.3262	-82.5450	6748920.
331.200	2.52E-05	4081.7227	-132.1314	-6.3618E-06	639.1726	-23.6679	6748920.
338.400	-3.55E-06	2519.4961	-205.3630	-2.5417E-06	633.7483	3.3258	6748920.
345.600	-1.14E-05	1127.7897	-155.0893	-4.3097E-07	628.9159	10.6391	6748920.
352.800	-9.75E-06	286.7692	-83.8738	3.8764E-07	625.9957	9.1430	6748920.
360.000	-5.77E-06	-80.4949	-31.4946	5.0701E-07	625.2795	5.4068	6748920.
367.200	-2.45E-06	-167.4100	-3.7523	3.6355E-07	625.5813	2.2994	6748920.
374.400	-5.33E-07	-134.9988	6.3244	1.8854E-07	625.4687	0.4996769	6748920.
381.600	2.62E-07	-76.5830	7.2393	6.6101E-08	625.2659	-0.2455355	6748920.
388.800	4.19E-07	-30.8384	4.9422	3.9355E-09	625.1071	-0.3925391	6748920.
396.000	3.19E-07	-5.4198	2.4539	-1.7047E-08	625.0188	-0.2986564	6748920.
403.200	1.73E-07	4.5204	0.7939974	-1.7568E-08	625.0157	-0.1624380	6748920.
410.400	6.56E-08	6.0365	-0.0122863	-1.1458E-08	625.0210	-0.0615297	6748920.
417.600	8.29E-09	4.3583	-0.2617798	-5.4429E-09	625.0151	-0.0077740	6748920.

424.800	-1.27E-08	2.2739	-0.2467911	-1.6048E-09	625.0079	0.0119375	6748920.
432.000	-1.48E-08	0.8066326	-0.1538229	1.7795E-10	625.0028	0.0138870	6748920.
439.200	-1.02E-08	0.0586402	-0.0695018	6.7869E-10	625.0002	0.0095356	6748920.
446.400	-5.04E-09	-0.1950723	-0.0181597	5.9974E-10	625.0007	0.0047261	6748920.
453.600	-1.54E-09	-0.2036365	0.0040399	3.6900E-10	625.0007	0.0014404	6748920.
460.800	2.72E-10	-0.1373760	0.0088743	1.7166E-10	625.0005	-9.7535E-05	2585430.
468.000	9.35E-10	-0.0760686	0.0073143	4.8135E-11	625.0003	-0.0003358	2585430.
475.200	9.65E-10	-0.0321121	0.0048583	-1.4469E-11	625.0001	-0.0003464	2585430.
482.400	7.27E-10	-0.0060906	0.0026716	-3.6577E-11	625.0000	-0.0002610	2585430.
489.600	4.38E-10	0.0064063	0.0011658	-3.6395E-11	625.0000	-0.0001573	2585430.
496.800	2.03E-10	0.0107440	0.0001857	-2.6470E-11	625.0000	-0.0001150	4083142.
504.000	5.69E-11	0.0091146	-0.0003443	-1.4978E-11	625.0000	-3.2258E-05	4083142.
511.200	-1.30E-11	0.0058061	-0.0004339	-6.3429E-12	625.0000	7.3599E-06	4083142.
518.400	-3.45E-11	0.0028748	-0.0003371	-1.3192E-12	625.0000	1.9539E-05	4083142.
525.600	-3.20E-11	0.0009543	-0.0002014	8.9671E-13	625.0000	1.8133E-05	4083142.
532.800	-2.15E-11	-2.7021E-05	-9.2178E-05	1.4333E-12	625.0000	1.2216E-05	4083142.
540.000	-1.13E-11	-0.0003750	-2.5059E-05	1.2007E-12	625.0000	6.4279E-06	4083142.
547.200	-4.25E-12	-0.0003894	6.7634E-06	7.5831E-13	625.0000	2.4115E-06	4083142.
554.400	-4.15E-13	-0.0002786	1.6292E-05	3.7175E-13	625.0000	2.3537E-07	4083142.
561.600	1.10E-12	-0.0001553	1.4892E-05	1.2067E-13	625.0000	-6.2430E-07	4083142.
568.800	1.32E-12	-6.4275E-05	9.9442E-06	-6.3953E-15	625.0000	-7.5007E-07	4083142.
576.000	1.01E-12	-1.2091E-05	5.1845E-06	-5.0589E-14	625.0000	-5.7208E-07	4083142.
583.200	5.94E-13	1.0447E-05	1.9120E-06	-5.1540E-14	625.0000	-3.3695E-07	4083142.
590.400	2.67E-13	1.5509E-05	1.5470E-07	-3.6519E-14	625.0000	-1.5119E-07	4083142.
597.600	6.83E-14	1.2722E-05	-5.2897E-07	-2.0182E-14	625.0000	-3.8720E-08	4083142.
604.800	-2.40E-14	7.9178E-06	-6.1930E-07	-8.2383E-15	625.0000	1.3627E-08	4083142.
612.000	-5.04E-14	3.8144E-06	-4.6744E-07	-1.4488E-15	625.0000	2.8556E-08	4083142.
619.200	-4.49E-14	1.1885E-06	-2.7299E-07	1.4463E-15	625.0000	2.5459E-08	4083142.

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 626.400 -2.95E-14 -1.1853E-07 -1.2105E-07  2.0655E-15    625.0000  1.6745E-08
4083142.
 633.600 -1.51E-14 -5.5737E-07 -2.9841E-08  1.6743E-15    625.0000  8.5915E-09
4083142.
 640.800 -5.42E-15 -5.5041E-07  1.2148E-08  1.0333E-15    625.0000  3.0720E-09
4083142.
 648.000 -2.71E-16 -3.8378E-07  2.3760E-08  4.9264E-16    625.0000  1.5361E-10
4083142.
 655.200  1.68E-15 -2.0891E-07  2.0889E-08  1.4965E-16    625.0000 -9.5105E-10
4083142.
 662.400  1.88E-15 -8.3174E-08  1.3619E-08 -1.9380E-17    625.0000 -1.0685E-09
4083142.
 669.600  1.40E-15 -1.2769E-08  6.9184E-09 -7.4903E-17    625.0000 -7.9279E-10
4083142.
 676.800  8.05E-16  1.6548E-08  2.4200E-09 -7.2715E-17    625.0000 -4.5678E-10
4083142.
 684.000  3.51E-16  2.2173E-08  5.9254E-11 -5.0307E-17    625.0000 -1.9898E-10
4083142.
 691.200  8.10E-17  1.7467E-08 -8.2251E-10 -2.7368E-17    625.0000 -4.5958E-11
4083142.
 698.400 -4.32E-17  1.0365E-08 -8.9971E-10 -1.1262E-17    625.0000  2.4514E-11
4083142.
 705.600 -8.11E-17  4.5254E-09 -6.4584E-10 -2.6446E-18    625.0000  4.6006E-11
4083142.
 712.800 -8.13E-17  1.0679E-09 -3.1421E-10  5.9224E-19    625.0000  4.6111E-11
4083142.
 720.000 -7.26E-17      0.0000      0.0000  1.2102E-18    625.0000  4.1170E-11
2041571.

Output Verification:

Computed forces and moments are within specified convergence limits.


Output Summary for Load Case No.  8:

Pile-head deflection             =     0.44824665 in
Computed slope at pile head      =  -3.854941E-17
Maximum bending moment           =      -1530583. lbs-in
Maximum shear force              =    40000.00000 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             27
Number of zero deflection points =             11



--------------------------------------------------------------------------------
             Computed Values of Load Distribution and Deflection
                 for Lateral Loading for Load Case Number  9
--------------------------------------------------------------------------------

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head  =       50000.000 lbs
Specified slope at pile head        =       0.000E+00 in/in
Specified axial load at pile head   =       90000.000 lbs
```

(Zero slope for this load indicates fixed-head conditions)

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res. p lbs/in	Es*h F/L lbs/in
0.000	0.670782	-2051288.	50000.0000	3.8549E-17	7747.5281	-359.8295	1931.1575
7.200	0.662235	-1699846.	47332.1194	-0.0021708	6527.2418	-381.2485	4145.0366
14.400	0.639523	-1366892.	44518.5036	-0.0039455	5371.1536	-400.3115	4506.8646
21.600	0.605420	-1053666.	41576.4165	-0.0053463	4283.5618	-416.9350	4958.4318
28.800	0.562536	-761263.	38523.7931	-0.0063966	3268.2743	-431.0160	5516.6531
36.000	0.513308	-490633.	35379.3563	-0.0071211	2328.5873	-442.4387	6205.9369
43.200	0.459992	-242571.	32162.6919	-0.0075454	1467.2616	-451.0792	7060.4915
50.400	0.404654	-17711.5375	28894.2897	-0.0076960	686.4984	-456.8103	8128.0076
57.600	0.349169	183480.	23559.1673	-0.0076001	1262.0851	-1025.1681	21139.3512
64.800	0.295213	331390.	16288.2736	-0.0073021	1775.6604	-994.5246	24255.6290
72.000	0.244018	427495.	11064.9401	-0.0068630	2109.3584	-456.4014	13466.5704
79.200	0.196386	499620.	7805.7012	-0.0063264	2359.7908	-448.9427	16459.3417
86.400	0.152918	548096.	4630.7043	-0.0057201	2528.1125	-433.0009	20387.5059
93.600	0.114016	573715.	1623.3819	-0.0050709	2617.0666	-402.3664	25408.9824
100.800	0.079896	578045.	-1150.4638	-0.0044044	2632.1007	-368.1463	33176.2695
108.000	0.050593	562857.	-3658.0998	-0.0037442	2579.3632	-328.4193	46738.1979
115.200	0.025980	530221.	-5841.3607	-0.0031116	2466.0445	-278.0421	77055.1893
122.400	0.005786	482774.	-7530.4203	-0.0025254	2301.2974	-191.1411	237857.
129.600	-0.010385	425056.	-7423.1980	-0.0020000	2100.8876	220.9251	153166.
136.800	-0.023014	378472.	-6491.5274	-0.0015350	1939.1375	37.8723	11848.3550
144.000	-0.032489	333567.	-6202.2315	-0.0011229	1783.2188	42.4877	9415.7760
151.200	-0.039185	290615.	-5886.4574	-0.0007617	1634.0792	45.2273	8310.3271
158.400	-0.043458	249789.	-5555.1020	-0.0004490	1492.3237	46.8159	7756.3001

165.600	-0.045650	211203.	-5215.2389	-0.0001822	1358.3445	47.5906	7506.0590
172.800	-0.046082	174926.	-4872.0469	4.1240E-05	1232.3817	47.7405	7459.1345
180.000	-0.045056	140992.	-4529.5990	0.0002241	1114.5566	47.3839	7571.9613
187.200	-0.042855	109409.	-4191.2582	0.0003690	1004.8935	46.5997	7829.0460
194.400	-0.039743	80160.0021	-3859.9038	0.0004787	903.3333	45.4432	8232.6659
201.600	-0.035963	53206.3412	-3538.0732	0.0005559	809.7442	43.9542	8799.9808
208.800	-0.031739	28491.3591	-3228.0577	0.0006031	723.9283	42.1613	9564.3792
216.000	-0.027277	5940.6490	-2931.9698	0.0006231	645.6273	40.0854	10580.7071
223.200	-0.022767	-14536.4911	-2651.7933	0.0006181	675.4739	37.7414	11935.8010
230.400	-0.018377	-33046.2129	-2389.4175	0.0005905	739.7438	35.1407	13767.9231
237.600	-0.014263	-49709.4541	-2146.6526	0.0005427	797.6023	32.2939	16302.3464
244.800	-0.010563	-64661.2954	-1403.1012	0.0004765	849.5184	174.2481	118775.
252.000	-0.007402	-70531.6178	-317.0634	0.0003982	869.9015	127.4290	123959.
259.200	-0.004828	-69743.1212	453.4419	0.0003171	867.1636	86.6002	129143.
266.400	-0.002836	-64412.9608	955.6743	0.0002394	848.6561	52.9088	134327.
273.600	-0.001381	-56291.7003	1242.4434	0.0001696	820.4573	26.7493	139511.
280.800	-0.000394	-46741.5367	1367.2574	0.0001099	787.2970	7.9212	144695.
288.000	0.000203	-36745.6796	1380.5859	6.1628E-05	752.5892	-4.2189	149879.
295.200	0.000493	-26940.9698	1327.1528	2.4773E-05	718.5450	-10.6236	155063.
302.400	0.000559	-17666.7842	1244.0871	-1.0422E-06	686.3430	-12.4501	160247.
309.600	0.000478	-9024.7642	1159.7056	-1.6489E-05	656.3360	-10.9892	165431.
316.800	0.000322	-945.6545	1092.6792	-2.2259E-05	628.2835	-7.6293	170615.
324.000	0.000158	6738.6635	532.8738	-1.8906E-05	648.3981	-147.8722	6748920.
331.200	4.97E-05	6752.2303	-167.2082	-1.1099E-05	648.4452	-46.5950	6748920.
338.400	-2.07E-06	4345.2497	-327.9699	-4.6767E-06	640.0877	1.9389	6748920.
345.600	-1.76E-05	2035.5250	-261.4780	-9.8417E-07	632.0678	16.5310	6748920.
352.800	-1.62E-05	581.2420	-147.1631	5.3016E-07	627.0182	15.2231	6748920.
360.000	-1.00E-05	-84.3107	-58.6100	8.1774E-07	625.2927	9.3750	6748920.

367.200	-4.47E-06	-263.8014	-9.7926	6.1628E-07	625.9160	4.1854	6748920.
374.400	-1.13E-06	-226.1226	9.0782	3.3276E-07	625.7851	1.0565	6748920.
381.600	3.27E-07	-133.5072	11.7791	1.2465E-07	625.4636	-0.3061865	6748920.
388.800	6.68E-07	-56.6644	8.4234	1.4592E-08	625.1968	-0.6259767	6748920.
396.000	5.37E-07	-12.2297	4.3585	-2.5277E-08	625.0425	-0.5031471	6748920.
403.200	3.04E-07	6.1309	1.5219	-2.8807E-08	625.0213	-0.2847880	6748920.
410.400	1.22E-07	9.7236	0.0851606	-1.9632E-08	625.0338	-0.1143192	6748920.
417.600	2.11E-08	7.3827	-0.3976828	-9.7321E-09	625.0256	-0.0198040	6748920.
424.800	-1.82E-08	4.0096	-0.4076225	-3.1393E-09	625.0139	0.0170430	6748920.
432.000	-2.41E-08	1.5170	-0.2650155	5.8947E-11	625.0053	0.0225700	6748920.
439.200	-1.73E-08	0.1933023	-0.1252729	1.0487E-09	625.0007	0.0162473	6748920.
446.400	-8.98E-09	-0.2882836	-0.0364895	9.9374E-10	625.0010	0.0084147	6748920.
453.600	-3.02E-09	-0.3334338	0.0040058	6.3395E-10	625.0012	0.0028340	6748920.
460.800	1.52E-10	-0.2314211	0.0140119	3.0707E-10	625.0008	-5.4499E-05	2585430.
468.000	1.40E-09	-0.1320600	0.0120080	9.6721E-11	625.0005	-0.0005022	2585430.
475.200	1.54E-09	-0.0586316	0.0082035	-1.3633E-11	625.0002	-0.0005546	2585430.
482.400	1.20E-09	-0.0139112	0.0046529	-5.5613E-11	625.0000	-0.0004317	2585430.
489.600	7.44E-10	0.0084422	0.0021375	-5.8778E-11	625.0000	-0.0002671	2585430.
496.800	3.56E-10	0.0169449	0.0004499	-4.4087E-11	625.0001	-0.0002017	4083142.
504.000	1.09E-10	0.0149778	-0.0004986	-2.5613E-11	625.0001	-6.1743E-05	4083142.
511.200	-1.31E-11	0.0097988	-0.0006940	-1.1275E-11	625.0000	7.4471E-06	4083142.
518.400	-5.35E-11	0.0049986	-0.0005580	-2.7113E-12	625.0000	3.0329E-05	4083142.
525.600	-5.22E-11	0.0017668	-0.0003423	1.2038E-12	625.0000	2.9589E-05	4083142.
532.800	-3.61E-11	6.7548E-05	-0.0001620	2.2653E-12	625.0000	2.0499E-05	4083142.
540.000	-1.96E-11	-0.0005691	-4.8289E-05	1.9751E-12	625.0000	1.1090E-05	4083142.
547.200	-7.71E-12	-0.0006304	7.3642E-06	1.2809E-12	625.0000	4.3698E-06	4083142.
554.400	-1.11E-12	-0.0004647	2.5360E-05	6.4722E-13	625.0000	6.2905E-07	4083142.
561.600	1.61E-12	-0.0002660	2.4328E-05	2.2435E-13	625.0000	-9.1563E-07	4083142.

568.800	2.12E-12	-0.0001147	1.6701E-05	4.0463E-15	625.0000	-1.2031E-06	4083142.
576.000	1.67E-12	-2.5547E-05	8.9547E-06	-7.7087E-14	625.0000	-9.4868E-07	4083142.
583.200	1.01E-12	1.4396E-05	3.4746E-06	-8.3540E-14	625.0000	-5.7355E-07	4083142.
590.400	4.70E-13	2.4596E-05	4.5057E-07	-6.0976E-14	625.0000	-2.6646E-07	4083142.
597.600	1.33E-13	2.0963E-05	-7.8089E-07	-3.4610E-14	625.0000	-7.5610E-08	4083142.
604.800	-2.85E-14	1.3396E-05	-9.9486E-07	-1.4727E-14	625.0000	1.6174E-08	4083142.
612.000	-7.87E-14	6.6565E-06	-7.7589E-07	-3.1222E-15	625.0000	4.4651E-08	4083142.
619.200	-7.35E-14	2.2270E-06	-4.6513E-07	2.0187E-15	625.0000	4.1671E-08	4083142.
626.400	-4.97E-14	-4.3993E-08	-2.1372E-07	3.2820E-15	625.0000	2.8166E-08	4083142.
633.600	-2.62E-14	-8.5478E-07	-5.8786E-08	2.7618E-15	625.0000	1.4870E-08	4083142.
640.800	-9.90E-15	-8.9410E-07	1.4949E-08	1.7497E-15	625.0000	5.6124E-09	4083142.
648.000	-1.02E-15	-6.4179E-07	3.7244E-08	8.6093E-16	625.0000	5.8065E-10	4083142.
655.200	2.50E-15	-3.5890E-07	3.4229E-08	2.8182E-16	625.0000	-1.4181E-09	4083142.
662.400	3.03E-15	-1.4926E-07	2.2929E-08	-1.2246E-17	625.0000	-1.7208E-09	4083142.
669.600	2.32E-15	-2.8709E-08	1.1989E-08	-1.1524E-16	625.0000	-1.3181E-09	4083142.
676.800	1.38E-15	2.3529E-08	4.4361E-09	-1.1823E-16	625.0000	-7.7977E-10	4083142.
684.000	6.22E-16	3.5325E-08	3.5958E-10	-8.4174E-17	625.0000	-3.5260E-10	4083142.
691.200	1.63E-16	2.8816E-08	-1.2424E-09	-4.7056E-17	625.0000	-9.2378E-11	4083142.
698.400	-5.58E-17	1.7496E-08	-1.4609E-09	-2.0255E-17	625.0000	3.1669E-11	4083142.
705.600	-1.29E-16	7.8048E-09	-1.0840E-09	-5.6138E-18	625.0000	7.3034E-11	4083142.
712.800	-1.37E-16	1.8940E-09	-5.4200E-10	-1.0887E-21	625.0000	7.7514E-11	4083142.
720.000	-1.29E-16	0.0000	0.0000	1.0950E-18	625.0000	7.3043E-11	2041571.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 9:

```
Pile-head deflection             =     0.67078221 in
Computed slope at pile head      =   3.854941E-17
Maximum bending moment           =      -2051288. lbs-in
Maximum shear force              =    50000.00000 lbs
Depth of maximum bending moment  =        0.00000 in
```

```
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             28
Number of zero deflection points =             11



-------------------------------------------------------------------------------
             Computed Values of Load Distribution and Deflection
                 for Lateral Loading for Load Case Number 10
-------------------------------------------------------------------------------

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head  =       60000.000 lbs
Specified slope at pile head        =       0.000E+00 in/in
Specified axial load at pile head   =       90000.000 lbs

(Zero slope for this load indicates fixed-head conditions)

  Depth   Deflect.    Moment      Shear       Slope      Total       Soil Res.
Es*h
    X        y          M           V           S        Stress          p
F/L
    in       in        lbs-in        lbs         Rad.   lbs/in**2    lbs/in
lbs/in
-------- --------- ----------- ----------- ----------- ----------- ----------- -
----------
   0.000  0.931592   -2599878.  60000.0000  6.9389E-17   9652.3526   -390.6231
1509.5046
   7.200  0.920760   -2177028.  57103.3865  -0.0027644   8184.1235   -413.9918
3237.2625
  14.400  0.891785   -1774006.  54046.9806  -0.0050509   6784.7435   -435.0099
3512.1372
  21.600  0.848027   -1392205.  50848.0469  -0.0068832   5459.0454   -453.5828
3851.0532
  28.800  0.792667   -1032874.  47524.5872  -0.0082866   4211.3668   -469.6004
4265.5025
  36.000  0.728700    -697112.  44095.4319  -0.0092877   3045.5264   -482.9427
4771.7687
  43.200  0.658924    -385862.  40580.2932  -0.0099145   1964.8003   -493.4847
5392.2642
  50.400  0.585932 -99906.2424  36999.7809  -0.0101956    971.8967   -501.1020
6157.6027
  57.600  0.512107     160148.  30726.8327  -0.0101607   1181.0688  -1241.3836
17453.3007
  64.800  0.439617     355728.  21458.6753  -0.0098622   1860.1682  -1333.1046
21833.4241
  72.000  0.370092     481934.  14836.1506  -0.0093774   2298.3824   -506.4856
9853.4883
  79.200  0.304583     581522.  11209.2058  -0.0087620   2644.1741   -500.9990
11843.0704
  86.400  0.243919     654702.   7653.8089  -0.0080466   2898.2716   -486.6112
14363.7721
  93.600  0.188712     702165.   4259.0523  -0.0072614   3063.0742   -456.3768
17412.3336
 100.800  0.139356     725443.   1093.0525  -0.0064352   3143.9003   -423.0676
21858.3602
```

108.000	0.096045	726245.	-1817.7306	-0.0055951	3146.6852	-385.4832	28897.7071
115.200	0.058786	706519.	-4432.9791	-0.0047660	3078.1917	-340.9747	41761.7562
122.400	0.027415	668587.	-6674.9856	-0.0039702	2946.4830	-281.8049	74009.7576
129.600	0.001616	615545.	-8190.9576	-0.0032270	2762.3082	-139.2984	620725.
136.800	-0.019054	554820.	-8564.4154	-0.0025497	2551.4568	35.5601	13437.1190
144.000	-0.035101	495522.	-8279.4495	-0.0019419	2345.5613	43.5971	8942.8335
151.200	-0.047018	438112.	-7949.4820	-0.0014016	2146.2229	48.0606	7359.7063
158.400	-0.055284	382866.	-7593.8450	-0.0009265	1954.3945	50.7274	6606.5886
165.600	-0.060359	329962.	-7223.1795	-0.0005140	1770.7000	52.2352	6230.8987
172.800	-0.062685	279518.	-6844.6994	-0.0001613	1595.5485	52.8981	6075.8430
180.000	-0.062682	231607.	-6463.8355	0.0001345	1429.1908	52.8974	6076.0935
187.200	-0.060749	186264.	-6084.9516	0.0003763	1271.7515	52.3481	6204.3659
194.400	-0.057263	143496.	-5711.7206	0.0005672	1123.2497	51.3272	6453.6753
201.600	-0.052581	103281.	-5347.3434	0.0007100	983.6132	49.8887	6831.2792
208.800	-0.047039	65574.0594	-4994.6903	0.0008077	852.6877	48.0705	7357.8438
216.000	-0.040951	30310.3058	-4656.3962	0.0008632	730.2441	45.9001	8070.1972
223.200	-0.034610	-2596.7213	-4334.9271	0.0008792	634.0164	43.3969	9028.0744
230.400	-0.028290	-33252.1052	-4032.6237	0.0008585	740.4587	40.5763	10326.9191
237.600	-0.022248	-61779.0771	-3751.7176	0.0008035	839.5107	37.4532	12120.9894
244.800	-0.016720	-88318.1394	-2623.9272	0.0007166	931.6602	275.8219	118775.
252.000	-0.011928	-100492.	-891.6522	0.0006073	973.9318	205.3656	123959.
259.200	-0.007974	-101945.	362.5722	0.0004902	978.9759	143.0301	129143.
266.400	-0.004870	-95906.6093	1204.5405	0.0003757	958.0091	90.8500	134327.
273.600	-0.002564	-85086.5726	1710.4679	0.0002710	920.4395	49.6854	139511.
280.800	-0.000968	-71627.0306	1959.3570	0.0001803	873.7050	19.4505	144695.
288.000	3.16E-05	-57105.4548	2027.0102	0.0001058	823.2828	-0.6579582	149879.
295.200	0.000555	-42575.1585	1981.5968	4.8082E-05	772.8304	-11.9569	155063.
302.400	0.000724	-28632.7752	1880.5441	6.8733E-06	724.4194	-16.1133	160247.

309.600	0.000654	-15504.2309	1768.4266	-1.8669E-05	678.8341	-15.0305	165431.
316.800	0.000455	-3143.2371	1675.4894	-2.9460E-05	635.9140	-10.7854	170615.
324.000	0.000230	8660.9973	860.7461	-2.6267E-05	655.0729	-215.5321	6748920.
331.200	7.69E-05	9285.5497	-174.6706	-1.5881E-05	657.2415	-72.0836	6748920.
338.400	1.24E-06	6166.3228	-438.3724	-6.9394E-06	646.4108	-1.1669	6748920.
345.600	-2.30E-05	2981.9810	-364.8735	-1.6452E-06	635.3541	21.5832	6748920.
352.800	-2.24E-05	914.2763	-211.4289	6.0954E-07	628.1746	21.0403	6748920.
360.000	-1.42E-05	-63.3856	-87.6033	1.1020E-06	625.2201	13.3557	6748920.
367.200	-6.58E-06	-348.6394	-17.3241	8.6351E-07	626.2106	6.1663	6748920.
374.400	-1.81E-06	-313.9718	10.9950	4.8006E-07	626.0902	1.7001	6748920.
381.600	3.34E-07	-190.9334	15.9870	1.8787E-07	625.6630	-0.3134787	6748920.
388.800	8.92E-07	-84.0025	11.8501	2.8762E-08	625.2917	-0.8356722	6748920.
396.000	7.49E-07	-20.3298	6.3155	-3.1616E-08	625.0706	-0.7017012	6748920.
403.200	4.36E-07	6.9819	2.3172	-3.9340E-08	625.0242	-0.4089289	6748920.
410.400	1.82E-07	13.0895	0.2306044	-2.7725E-08	625.0454	-0.1706942	6748920.
417.600	3.70E-08	10.3385	-0.5088326	-1.4167E-08	625.0359	-0.0347050	6748920.
424.800	-2.19E-08	5.7807	-0.5598730	-4.8385E-09	625.0201	0.0205271	6748920.
432.000	-3.27E-08	2.2826	-0.3757983	-1.7224E-10	625.0079	0.0306047	6748920.
439.200	-2.44E-08	0.3694321	-0.1833539	1.3625E-09	625.0013	0.0228520	6748920.
446.400	-1.30E-08	-0.3594133	-0.0571178	1.3683E-09	625.0012	0.0122136	6748920.
453.600	-4.68E-09	-0.4548377	0.0026283	8.9712E-10	625.0016	0.0043826	6748920.
460.800	-1.11E-10	-0.3227279	0.0185497	4.4714E-10	625.0011	4.0014E-05	2585430.
468.000	1.76E-09	-0.1883018	0.0164144	1.5140E-10	625.0007	-0.0006332	2585430.
475.200	2.07E-09	-0.0865573	0.0114607	-7.6616E-12	625.0003	-0.0007429	2585430.
482.400	1.65E-09	-0.0232575	0.0066497	-7.1212E-11	625.0001	-0.0005935	2585430.
489.600	1.04E-09	0.0092906	0.0031643	-7.9295E-11	625.0000	-0.0003746	2585430.
496.800	5.11E-10	0.0224109	0.0007722	-6.0949E-11	625.0001	-0.0002898	4083142.
504.000	1.66E-10	0.0204895	-0.0006093	-3.6122E-11	625.0001	-9.3923E-05	4083142.

511.200	-9.09E-12	0.0136839	-0.0009289	-1.6346E-11	625.0000	5.1542E-06	4083142.
518.400	-6.98E-11	0.0071352	-0.0007679	-4.2978E-12	625.0000	3.9563E-05	4083142.
525.600	-7.10E-11	0.0026321	-0.0004805	1.3546E-12	625.0000	4.0251E-05	4083142.
532.800	-5.03E-11	0.0002137	-0.0002330	3.0014E-12	625.0000	2.8501E-05	4083142.
540.000	-2.78E-11	-0.0007275	-7.3762E-05	2.7041E-12	625.0000	1.5741E-05	4083142.
547.200	-1.13E-11	-0.0008520	6.0126E-06	1.7900E-12	625.0000	6.4187E-06	4083142.
554.400	-1.98E-12	-0.0006432	3.3162E-05	9.2476E-13	625.0000	1.1229E-06	4083142.
561.600	2.00E-12	-0.0003757	3.3126E-05	3.3513E-13	625.0000	-1.1331E-06	4083142.
568.800	2.85E-12	-0.0001666	2.3237E-05	2.1300E-14	625.0000	-1.6138E-06	4083142.
576.000	2.30E-12	-4.1099E-05	1.2721E-05	-9.8908E-14	625.0000	-1.3071E-06	4083142.
583.200	1.42E-12	1.6693E-05	5.1136E-06	-1.1303E-13	625.0000	-8.0612E-07	4083142.
590.400	6.77E-13	3.2683E-05	8.2906E-07	-8.4458E-14	625.0000	-3.8404E-07	4083142.
597.600	2.05E-13	2.8741E-05	-9.7256E-07	-4.8912E-14	625.0000	-1.1641E-07	4083142.
604.800	-2.71E-14	1.8742E-05	-1.3362E-06	-2.1433E-14	625.0000	1.5389E-08	4083142.
612.000	-1.03E-13	9.5267E-06	-1.0698E-06	-5.0742E-15	625.0000	5.8619E-08	4083142.
619.200	-1.00E-13	3.3432E-06	-6.5420E-07	2.3737E-15	625.0000	5.6827E-08	4083142.
626.400	-6.92E-14	1.0314E-07	-3.0838E-07	4.3681E-15	625.0000	3.9235E-08	4083142.
633.600	-3.73E-14	-1.1031E-06	-9.0979E-08	3.7894E-15	625.0000	2.1155E-08	4083142.
640.800	-1.46E-14	-1.2119E-06	1.5020E-08	2.4498E-15	625.0000	8.2889E-09	4083142.
648.000	-2.03E-15	-8.9001E-07	4.9000E-08	1.2334E-15	625.0000	1.1498E-09	4083142.
655.200	3.14E-15	-5.0787E-07	4.6719E-08	4.2443E-16	625.0000	-1.7833E-09	4083142.
662.400	4.08E-15	-2.1780E-07	3.1961E-08	4.4760E-18	625.0000	-2.3162E-09	4083142.
669.600	3.21E-15	-4.7641E-08	1.7071E-08	-1.4914E-16	625.0000	-1.8198E-09	4083142.
676.800	1.94E-15	2.8218E-08	6.5662E-09	-1.6038E-16	625.0000	-1.0983E-09	4083142.
684.000	9.00E-16	4.7120E-08	7.7591E-10	-1.1678E-16	625.0000	-5.1012E-10	4083142.
691.200	2.55E-16	3.9542E-08	-1.5812E-09	-6.6629E-17	625.0000	-1.4463E-10	4083142.
698.400	-5.99E-17	2.4437E-08	-1.9795E-09	-2.9604E-17	625.0000	3.3993E-11	4083142.
705.600	-1.71E-16	1.1076E-08	-1.5074E-09	-9.0530E-18	625.0000	9.7129E-11	4083142.

```
 712.800 -1.90E-16  2.7416E-09 -7.6925E-10 -1.0568E-18    625.0000  1.0792E-10
4083142.
 720.000 -1.86E-16      0.0000      0.0000  5.2983E-19    625.0000  1.0576E-10
2041571.
```

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 10:

```
Pile-head deflection             =     0.93159247 in
Computed slope at pile head      =   6.938894E-17
Maximum bending moment           =      -2599878. lbs-in
Maximum shear force              =    60000.00000 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             28
Number of zero deflection points =             11
```

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

```
Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad
```

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
2	V= 5000.000	S= 0.000	90000.0000	0.0057599	-84818.1233	5000.0000
2	V= 10000.	S= 0.000	90000.0000	0.0279095	-226785.	10000.0000
2	V= 15000.	S= 0.000	90000.0000	0.0652371	-401265.	15000.0000
2	V= 20000.	S= 0.000	90000.0000	0.1157784	-597240.	20000.0000
2	V= 25000.	S= 0.000	90000.0000	0.1809905	-812253.	25000.0000
2	V= 30000.	S= 0.000	90000.0000	0.2592416	-1040077.	30000.0000
2	V= 35000.	S= 0.000	90000.0000	0.3479300	-1281896.	35000.0000
2	V= 40000.	S= 0.000	90000.0000	0.4482467	-1530583.	40000.0000
2	V= 50000.	S= 0.000	90000.0000	0.6707822	-2051288.	50000.0000
2	V= 60000.	S= 0.000	90000.0000	0.9315925	-2599878.	60000.0000

Pile-head Deflection vs. Pile Length

Boundary Condition Type 2, Shear and Slope

Shear = 5000. lbs
Slope = 0.00000
Axial Load = 90000. lbs

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
720.000	0.00575992	-84818.12328	5000.00000
684.000	0.00587324	-84758.16879	5000.00000
648.000	0.00569722	-84941.37115	5000.00000
612.000	0.00581492	-84871.63838	5000.00000
576.000	0.00569221	-84983.92788	5000.00000
540.000	0.00583024	-84922.36344	5000.00000
504.000	0.00574056	-85019.23858	5000.00000
468.000	0.00568957	-85067.50951	5000.00000
432.000	0.00567815	-85097.88534	5000.00000
396.000	0.00569411	-85097.57116	5000.00000

This analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.41)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This program is licensed to:

Madhu Thummaluru
URS Corporation

Path to file locations:
X:\101_MSN_SCTA\450_Geotech\Analysis\Pile\Lateral\RW 293\
Name of input data file: RW293_A-09-101_free.lpd
Name of output file: RW293_A-09-101_free.lpo
Name of plot output file: RW293_A-09-101_free.lpp
Name of runtime file: RW293_A-09-101_free.lpr

Time and Date of Analysis

Date: April 6, 2010 Time: 16:05:28

Problem Title

RW293_MSN B4_Petaluma_Fixed

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis includes automatic computation of pile-top deflection vs. pile embedment length

- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 720.00 in

Depth of ground surface below top of pile = -48.00 in

Slope angle of ground surface = 0.00 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	12.00000000	1728.0000	144.0000	3600000.
2	720.0000	12.00000000	1728.0000	144.0000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 8 layers

Layer 1 is stiff clay without free water
Distance from top of pile to top of layer = -48.000 in
Distance from top of pile to bottom of layer = 54.000 in

Layer 2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 54.000 in
Distance from top of pile to bottom of layer = 66.000 in
p-y subgrade modulus k for top of soil layer = 60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 60.000 lbs/in**3

Layer 3 is stiff clay without free water
Distance from top of pile to top of layer = 66.000 in
Distance from top of pile to bottom of layer = 132.000 in

Layer 4 is soft clay, p-y criteria by Matlock, 1970
Distance from top of pile to top of layer = 132.000 in
Distance from top of pile to bottom of layer = 240.000 in

Layer 5 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 240.000 in
Distance from top of pile to bottom of layer = 318.000 in
p-y subgrade modulus k for top of soil layer = 100.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 100.000 lbs/in**3

Layer 6 is stiff clay without free water
Distance from top of pile to top of layer = 318.000 in
Distance from top of pile to bottom of layer = 456.000 in

Layer 7 is stiff clay without free water
Distance from top of pile to top of layer = 456.000 in
Distance from top of pile to bottom of layer = 492.000 in

Layer 8 is stiff clay without free water
Distance from top of pile to top of layer = 492.000 in
Distance from top of pile to bottom of layer = 720.000 in

(Depth of lowest layer extends 0.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 16 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-48.00	0.03040
2	54.00	0.03040
3	54.00	0.03620
4	66.00	0.03620
5	66.00	0.03040
6	132.00	0.03040
7	132.00	0.03620
8	240.00	0.03620
9	240.00	0.03910
10	318.00	0.03910
11	318.00	0.03620
12	456.00	0.03620
13	456.00	0.03620
14	492.00	0.03620
15	492.00	0.03620
16	720.00	0.03620

Shear Strength of Soils

Shear strength parameters with depth defined using 16 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-48.000	8.68000	0.00	0.00700	0.0
2	54.000	8.68000	0.00	0.00700	0.0
3	54.000	0.00000	32.00	------	------
4	66.000	0.00000	32.00	------	------
5	66.000	8.68000	0.00	0.00700	0.0
6	132.000	8.68000	0.00	0.00700	0.0
7	132.000	2.08000	0.00	0.02000	0.0
8	240.000	2.08000	0.00	0.02000	0.0
9	240.000	0.00000	36.00	------	------
10	318.000	0.00000	36.00	------	------
11	318.000	20.83000	0.00	0.00500	0.0
12	456.000	20.83000	0.00	0.00500	0.0
13	456.000	8.68000	0.00	0.00700	0.0
14	492.000	8.68000	0.00	0.00700	0.0
15	492.000	13.19000	0.00	0.00600	0.0
16	720.000	13.19000	0.00	0.00600	0.0

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head = 5000.000 lbs
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 90000.000 lbs

(Zero moment at pile head for this load indicates a free-head condition)

Load Case Number 2

```
Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head    =       10000.000 lbs
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =       90000.000 lbs

(Zero moment at pile head for this load indicates a free-head condition)

Load Case Number  3

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head    =       15000.000 lbs
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =       90000.000 lbs

(Zero moment at pile head for this load indicates a free-head condition)

Load Case Number  4

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head    =       20000.000 lbs
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =       90000.000 lbs

(Zero moment at pile head for this load indicates a free-head condition)

Load Case Number  5

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head    =       25000.000 lbs
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =       90000.000 lbs

(Zero moment at pile head for this load indicates a free-head condition)

Load Case Number  6

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head    =       30000.000 lbs
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =       90000.000 lbs

(Zero moment at pile head for this load indicates a free-head condition)

Load Case Number  7

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head    =       35000.000 lbs
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =       90000.000 lbs

(Zero moment at pile head for this load indicates a free-head condition)

Load Case Number  8

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head    =       40000.000 lbs
```

```
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =       90000.000 lbs

(Zero moment at pile head for this load indicates a free-head condition)

Load Case Number  9

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head    =       50000.000 lbs
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =       90000.000 lbs

(Zero moment at pile head for this load indicates a free-head condition)

Load Case Number 10

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head    =       60000.000 lbs
Bending moment at pile head =           0.000 in-lbs
Axial load at pile head     =       90000.000 lbs

(Zero moment at pile head for this load indicates a free-head condition)



--------------------------------------------------------------------------------
             Computed Values of Load Distribution and Deflection
                 for Lateral Loading for Load Case Number  1
--------------------------------------------------------------------------------

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head  =        5000.000 lbs
Specified moment at pile head       =           0.000 in-lbs
Specified axial load at pile head   =       90000.000 lbs

(Zero moment for this load indicates free-head conditions)

  Depth   Deflect.    Moment      Shear       Slope      Total       Soil Res.
Es*h
    X        y          M           V           S        Stress          p
F/L
    in       in        lbs-in        lbs         Rad.   lbs/in**2    lbs/in
lbs/in
-------- --------- ----------- ----------- ----------- ----------- ----------- -
----------
   0.000  0.022740  8.3267E-10   5000.0000  -0.0006462    625.0000   -154.4367
24449.5179
   7.200  0.018087  32415.7193   3885.9200  -0.0006274    737.5546   -155.0300
61713.1419
  14.400  0.013705  56770.3720   2776.2490  -0.0005758    822.1193   -153.2119
80491.4976
  21.600  0.009796  73139.9406   1689.1505  -0.0005006    878.9581   -148.7599
109341.
  28.800  0.006496  81742.9418    644.6984  -0.0004110    908.8297   -141.3657
156687.
  36.000  0.003877  82956.2380   -334.1364  -0.0003157    913.0425   -130.5329
242386.
```

43.200	0.001950	77340.4932	-1218.9381	-0.0002229	893.5434	-115.2454	425471.
50.400	0.000668	65692.4222	-1966.2086	-0.0001401	853.0987	-92.3297	995888.
57.600	-6.78E-05	49208.7081	-2296.6255	-7.3644E-05	795.8636	0.5472544	58154.3278
64.800	-0.000393	32716.4571	-2282.6183	-2.6234E-05	738.5988	3.3437	61264.7278
72.000	-0.000446	16373.0039	-1931.4954	2.1746E-06	681.8507	94.1905	1522204.
79.200	-0.000362	4900.1044	-1258.0014	1.4485E-05	642.0143	92.8912	1849392.
86.400	-0.000237	-1760.9900	-617.3113	1.6302E-05	631.1145	85.0783	2585430.
93.600	-0.000127	-4010.3052	-146.9944	1.2962E-05	638.9247	45.5653	2585430.
100.800	-5.03E-05	-3894.5083	82.0303	8.3876E-06	638.5226	18.0527	2585430.
108.000	-6.11E-06	-2839.9387	154.9185	4.4904E-06	634.8609	2.1940	2585430.
115.200	1.44E-05	-1669.5008	144.2179	1.8808E-06	630.7969	-5.1664	2585430.
122.400	2.10E-05	-765.6386	98.5068	4.7153E-07	627.6585	-7.5311	2585430.
129.600	2.12E-05	-251.6134	44.0183	-1.1716E-07	625.8737	-7.6046	2585430.
136.800	1.93E-05	-131.6237	14.2475	-3.3894E-07	625.4570	-0.6650209	248274.
144.000	1.63E-05	-46.0099	9.8304	-4.4174E-07	625.1598	-0.5619594	248274.
151.200	1.29E-05	10.5063	6.2029	-4.6228E-07	625.0365	-0.4456768	248274.
158.400	9.64E-06	43.9109	3.4018	-4.3079E-07	625.1525	-0.3324131	248274.
165.600	6.72E-06	60.0501	1.3707	-3.7063E-07	625.2085	-0.2317675	248274.
172.800	4.30E-06	64.1295	0.0021965	-2.9877E-07	625.2227	-0.1483776	248274.
180.000	2.42E-06	60.4690	-0.8322586	-2.2666E-07	625.2100	-0.0834155	248274.
187.200	1.04E-06	52.4388	-1.2615	-1.6132E-07	625.1821	-0.0358295	248274.
194.400	9.60E-08	42.5119	-1.4025	-1.0637E-07	625.1476	-0.0033120	248274.
201.600	-4.93E-07	32.3814	-1.3532	-6.3031E-08	625.1124	0.0169895	248274.
208.800	-8.12E-07	23.1073	-1.1913	-3.0920E-08	625.0802	0.0279861	248274.
216.000	-9.38E-07	15.2667	-0.9741147	-8.7127E-09	625.0530	0.0323427	248274.
223.200	-9.37E-07	9.0913	-0.7413563	5.3834E-09	625.0316	0.0323124	248274.
230.400	-8.60E-07	4.5842	-0.5182211	1.3298E-08	625.0159	0.0296696	248274.
237.600	-7.46E-07	1.6117	-0.3188563	1.6883E-08	625.0056	0.0257095	248274.

244.800	-6.17E-07	-0.0291955	-0.1896418	1.7799E-08	625.0001	0.0101834	118775.
252.000	-4.89E-07	-1.1422	-0.1226565	1.7121E-08	625.0040	0.0084236	123959.
259.200	-3.71E-07	-1.8176	-0.0683908	1.5408E-08	625.0063	0.0066502	129143.
266.400	-2.67E-07	-2.1470	-0.0264908	1.3114E-08	625.0075	0.0049887	134327.
273.600	-1.82E-07	-2.2161	0.0041587	1.0589E-08	625.0077	0.0035250	139511.
280.800	-1.15E-07	-2.1008	0.0251628	8.0907E-09	625.0073	0.0023094	144695.
288.000	-6.54E-08	-1.8642	0.0383790	5.7961E-09	625.0065	0.0013618	149879.
295.200	-3.15E-08	-1.5557	0.0457200	3.8170E-09	625.0054	0.0006774	155063.
302.400	-1.05E-08	-1.2108	0.0489960	2.2160E-09	625.0042	0.0002326	160247.
309.600	4.58E-10	-0.8530034	0.0497956	1.0217E-09	625.0030	-1.0519E-05	165431.
316.800	4.26E-09	-0.4950896	0.0493944	2.4153E-10	625.0017	-0.0001009	170615.
324.000	3.94E-09	-0.1420374	0.0357496	-1.2718E-10	625.0005	-0.0036893	6748920.
331.200	2.43E-09	0.0198695	0.0142738	-1.9788E-10	625.0001	-0.0022762	6748920.
338.400	1.09E-09	0.0637623	0.0024133	-1.4948E-10	625.0002	-0.0010184	6748920.
345.600	2.76E-10	0.0548154	-0.0021836	-8.0858E-11	625.0002	-0.0002586	6748920.
352.800	-7.79E-11	0.0324230	-0.0028515	-3.0373E-11	625.0001	7.3041E-05	6748920.
360.000	-1.62E-10	0.0137927	-0.0020436	-3.6274E-12	625.0000	0.0001514	6748920.
367.200	-1.30E-10	0.0030001	-0.0010594	6.0907E-12	625.0000	0.0001220	6748920.
374.400	-7.38E-11	-0.0014701	-0.0003711	6.9761E-12	625.0000	6.9180E-05	6748920.
381.600	-2.97E-11	-0.0023529	-2.1834E-05	4.7637E-12	625.0000	2.7840E-05	6748920.
388.800	-5.21E-12	-0.0017907	9.5958E-05	2.3659E-12	625.0000	4.8796E-06	6748920.
396.000	4.37E-12	-0.0009741	9.8786E-05	7.6587E-13	625.0000	-4.0939E-06	6748920.
403.200	5.82E-12	-0.0003691	6.4399E-05	-1.1489E-14	625.0000	-5.4580E-06	6748920.
410.400	4.20E-12	-4.6783E-05	3.0571E-05	-2.5218E-13	625.0000	-3.9388E-06	6748920.
417.600	2.19E-12	7.1412E-05	8.9960E-06	-2.3793E-13	625.0000	-2.0541E-06	6748920.
424.800	7.76E-13	8.3067E-05	-1.0172E-06	-1.4853E-13	625.0000	-7.2730E-07	6748920.
432.000	5.26E-14	5.6957E-05	-3.8130E-06	-6.7498E-14	625.0000	-4.9308E-08	6748920.
439.200	-1.96E-13	2.8248E-05	-3.3289E-06	-1.8190E-14	625.0000	1.8378E-07	6748920.

446.400	-2.09E-13	9.0442E-06	-1.9609E-06	3.3911E-15	625.0000	1.9621E-07	6748920.
453.600	-1.47E-13	5.8407E-09	-7.5773E-07	8.6283E-15	625.0000	1.3801E-07	6748920.
460.800	-8.51E-14	-1.8783E-06	-1.5092E-07	7.5447E-15	625.0000	3.0552E-08	2585430.
468.000	-3.86E-14	-2.1772E-06	8.9429E-09	5.1978E-15	625.0000	1.3856E-08	2585430.
475.200	-1.02E-14	-1.7563E-06	7.2051E-08	2.9215E-15	625.0000	3.6745E-09	2585430.
482.400	3.48E-15	-1.1435E-06	8.0775E-08	1.2434E-15	625.0000	-1.2511E-09	2585430.
489.600	7.67E-15	-5.9470E-07	6.6354E-08	2.3751E-16	625.0000	-2.7549E-09	2585430.
496.800	6.90E-15	-1.8829E-07	4.2341E-08	-2.1561E-16	625.0000	-3.9153E-09	4083142.
504.000	4.57E-15	1.5294E-08	1.8922E-08	-3.1572E-16	625.0000	-2.5901E-09	4083142.
511.200	2.36E-15	8.4594E-08	4.7839E-09	-2.5791E-16	625.0000	-1.3371E-09	4083142.
518.400	8.53E-16	8.4516E-08	-1.7716E-09	-1.6005E-16	625.0000	-4.8387E-10	4083142.
525.600	5.30E-17	5.9291E-08	-3.6217E-09	-7.6829E-17	625.0000	-3.0065E-11	4083142.
532.800	-2.53E-16	3.2463E-08	-3.2132E-09	-2.3731E-17	625.0000	1.4354E-10	4083142.
540.000	-2.89E-16	1.3051E-08	-2.1070E-09	2.6079E-18	625.0000	1.6373E-10	4083142.
547.200	-2.16E-16	2.1177E-09	-1.0776E-09	1.1386E-17	625.0000	1.2224E-10	4083142.
554.400	-1.25E-16	-2.4803E-09	-3.8280E-10	1.1176E-17	625.0000	7.0746E-11	4083142.
561.600	-5.46E-17	-3.4090E-09	-1.6615E-11	7.7683E-18	625.0000	3.0971E-11	4083142.
568.800	-1.29E-17	-2.7296E-09	1.2119E-10	4.2158E-18	625.0000	7.3077E-12	4083142.
576.000	6.09E-18	-1.6694E-09	1.3506E-10	1.6701E-18	625.0000	-3.4562E-12	4083142.
583.200	1.12E-17	-7.8700E-10	9.9821E-11	2.4862E-19	625.0000	-6.3310E-12	4083142.
590.400	9.67E-18	-2.3225E-10	5.7279E-11	-3.4123E-19	625.0000	-5.4865E-12	4083142.
597.600	6.25E-18	3.8255E-11	2.4768E-11	-4.5349E-19	625.0000	-3.5444E-12	4083142.
604.800	3.14E-18	1.2499E-10	5.5884E-12	-3.5902E-19	625.0000	-1.7831E-12	4083142.
612.000	1.08E-18	1.1919E-10	-3.0358E-12	-2.1771E-19	625.0000	-6.1252E-13	4083142.
619.200	9.19E-21	8.1556E-11	-5.2597E-12	-1.0154E-19	625.0000	-5.2112E-15	4083142.
626.400	-3.82E-19	4.3586E-11	-4.4984E-12	-2.9119E-20	625.0000	2.1668E-13	4083142.
633.600	-4.10E-19	1.6816E-11	-2.8811E-12	5.8365E-21	625.0000	2.3258E-13	4083142.
640.800	-2.98E-19	2.0911E-12	-1.4353E-12	1.6778E-20	625.0000	1.6901E-13	4083142.

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 648.000 -1.69E-19 -3.8742E-12 -4.8287E-13  1.5746E-20    625.0000  9.5563E-14
4083142.
 655.200 -7.13E-20 -4.8826E-12  6.6857E-15  1.0679E-20    625.0000  4.0423E-14
4083142.
 662.400 -1.47E-20 -3.7918E-12  1.8230E-13  5.6589E-21    625.0000  8.3574E-15
4083142.
 669.600  1.02E-20 -2.2649E-12  1.9154E-13  2.1539E-21    625.0000 -5.7889E-15
4083142.
 676.800  1.63E-20 -1.0364E-12  1.3747E-13  2.4340E-22    625.0000 -9.2316E-15
4083142.
 684.000  1.37E-20 -2.8565E-13  7.6239E-14 -5.2166E-22    625.0000 -7.7766E-15
4083142.
 691.200  8.77E-21  6.2149E-14  3.0346E-14 -6.5100E-22    625.0000 -4.9716E-15
4083142.
 698.400  4.34E-21  1.5217E-13  3.5911E-15 -5.2697E-22    625.0000 -2.4603E-15
4083142.
 705.600  1.18E-21  1.1454E-13 -7.6716E-15 -3.7262E-22    625.0000 -6.6821E-16
4083142.
 712.800 -1.03E-21  4.2187E-14 -7.9798E-15 -2.8192E-22    625.0000  5.8259E-16
4083142.
 720.000 -2.88E-21      0.0000      0.0000 -2.5750E-22    625.0000  1.6340E-15
2041571.

Output Verification:

Computed forces and moments are within specified convergence limits.


Output Summary for Load Case No.  1:

Pile-head deflection             =     0.02273959 in
Computed slope at pile head      =    -0.00064617
Maximum bending moment           =    82956.23803 lbs-in
Maximum shear force              =     5000.00000 lbs
Depth of maximum bending moment  =    36.00000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             20
Number of zero deflection points =             13



--------------------------------------------------------------------------------
             Computed Values of Load Distribution and Deflection
                 for Lateral Loading for Load Case Number  2
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Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head  =       10000.000 lbs
Specified moment at pile head       =           0.000 in-lbs
Specified axial load at pile head   =       90000.000 lbs

(Zero moment for this load indicates free-head conditions)

  Depth   Deflect.    Moment      Shear       Slope      Total       Soil Res.
Es*h
```

X	y	M	V	S	Stress	p	F/L
in	in	lbs-in	lbs	Rad.	lbs/in**2	lbs/in	lbs/in
0.000	0.110522	0.0000	10000.0000	-0.0023211	625.0000	-229.2656	7467.8082
7.200	0.093810	67561.5275	8332.5754	-0.0022820	859.5886	-233.9079	17952.6906
14.400	0.077661	122947.	6639.7255	-0.0021718	1051.8979	-236.3281	21910.2347
21.600	0.062536	165988.	4937.9535	-0.0020046	1201.3479	-236.3863	27215.9955
28.800	0.048795	196651.	3244.8062	-0.0017947	1307.8162	-233.9324	34518.3310
36.000	0.036692	215039.	1578.9785	-0.0015565	1371.6645	-228.7975	44896.2651
43.200	0.026382	221406.	-39.4857	-0.0013039	1393.7692	-220.7759	60253.5612
50.400	0.017916	216161.	-1588.7759	-0.0010507	1375.5577	-209.5825	84225.5872
57.600	0.011252	199889.	-2670.4465	-0.0008099	1319.0584	-90.8816	58154.3278
64.800	0.006253	178756.	-3189.1788	-0.0005908	1245.6799	-53.2107	61264.7278
72.000	0.002745	154730.	-3916.2283	-0.0003978	1162.2580	-148.7475	390206.
79.200	0.000525	122878.	-4820.5268	-0.0002371	1051.6586	-102.4466	1404264.
86.400	-0.000670	85622.0534	-4789.1525	-0.0001165	922.2988	111.1617	1194319.
93.600	-0.001152	54064.8360	-3930.1950	-3.5642E-05	812.7251	127.4376	796460.
100.800	-0.001183	29073.4373	-3009.4262	1.2470E-05	725.9494	128.3315	780796.
108.000	-0.000972	10712.9368	-2107.5147	3.5495E-05	662.1977	122.1995	904749.
115.200	-0.000672	-1320.7753	-1266.4381	4.0930E-05	629.5860	111.4329	1193451.
122.400	-0.000383	-7576.8172	-516.7216	3.5781E-05	651.3084	96.8217	1819802.
129.600	-0.000157	-8807.9378	34.8187	2.6299E-05	655.5831	56.3839	2585430.
136.800	-4.37E-06	-7109.5113	238.3428	1.7088E-05	649.6858	0.1505706	248274.
144.000	8.90E-05	-5397.9472	227.8316	9.8494E-06	643.7429	-3.0704	248274.
151.200	0.000137	-3841.5018	199.7137	4.5025E-06	638.3385	-4.7402	248274.
158.400	0.000154	-2527.9050	163.5472	8.1654E-07	633.7774	-5.3061	248274.
165.600	0.000149	-1487.4798	125.9211	-1.5072E-06	630.1649	-5.1456	248274.
172.800	0.000132	-712.6874	90.9892	-2.7804E-06	627.4746	-4.5577	248274.

180.000	0.000109	-173.6317	61.0275	-3.2933E-06	625.6029	-3.7650	248274.
187.200	8.48E-05	170.3768	36.9529	-3.2952E-06	625.5916	-2.9224	248274.
194.400	6.17E-05	362.7603	18.7687	-2.9867E-06	626.2596	-2.1288	248274.
201.600	4.17E-05	444.5169	5.9235	-2.5195E-06	626.5435	-1.4394	248274.
208.800	2.55E-05	451.3236	-2.4179	-2.0011E-06	626.5671	-0.8776966	248274.
216.000	1.29E-05	412.2921	-7.1822	-1.5013E-06	626.4316	-0.4457220	248274.
223.200	3.83E-06	349.8451	-9.2628	-1.0603E-06	626.2147	-0.1322214	248274.
230.400	-2.34E-06	280.2813	-9.4481	-6.9561E-07	625.9732	0.0807497	248274.
237.600	-6.18E-06	214.6934	-8.3900	-4.0916E-07	625.7455	0.2131807	248274.
244.800	-8.23E-06	159.9958	-7.1336	-1.9233E-07	625.5555	0.1358270	118775.
252.000	-8.95E-06	112.2194	-6.0898	-3.4796E-08	625.3897	0.1541186	123959.
259.200	-8.73E-06	72.3484	-4.9709	7.2014E-08	625.2512	0.1566709	129143.
266.400	-7.91E-06	40.5450	-3.8753	1.3735E-07	625.1408	0.1476624	134327.
273.600	-6.76E-06	16.3659	-2.8724	1.7028E-07	625.0568	0.1309265	139511.
280.800	-5.46E-06	-1.0382	-2.0058	1.7915E-07	625.0036	0.1097824	144695.
288.000	-4.18E-06	-12.7504	-1.2976	1.7117E-07	625.0443	0.0869548	149879.
295.200	-3.00E-06	-19.9453	-0.7521171	1.5225E-07	625.0693	0.0645643	155063.
302.400	-1.98E-06	-23.7782	-0.3606559	1.2695E-07	625.0826	0.0441749	160247.
309.600	-1.17E-06	-25.3032	-0.1048605	9.8543E-08	625.0879	0.0268794	165431.
316.800	-5.66E-07	-25.4159	0.0401709	6.9192E-08	625.0882	0.0134071	170615.
324.000	-1.73E-07	-24.8144	0.6739024	4.0124E-08	625.0862	0.1626295	6748920.
331.200	1.20E-08	-15.7637	1.2189	1.6641E-08	625.0547	-0.0112461	6748920.
338.400	6.61E-08	-7.2841	0.9552410	3.3031E-09	625.0253	-0.0619876	6748920.
345.600	5.96E-08	-2.0125	0.5310930	-2.0768E-09	625.0070	-0.0558313	6748920.
352.800	3.62E-08	0.3663366	0.2078629	-3.0295E-09	625.0013	-0.0339549	6748920.
360.000	1.59E-08	0.9846644	0.0318412	-2.2476E-09	625.0034	-0.0149400	6748920.
367.200	3.86E-09	0.8277623	-0.0349629	-1.1988E-09	625.0029	-0.0036166	6748920.
374.400	-1.32E-09	0.4827523	-0.0435157	-4.4038E-10	625.0017	0.0012409	6748920.

381.600	-2.48E-09	0.2017074	-0.0306695	-4.4279E-11	625.0007	0.0023275	6748920.
388.800	-1.96E-09	0.0411694	-0.0156717	9.6275E-11	625.0001	0.0018386	6748920.
396.000	-1.10E-09	-0.0240892	-0.0053520	1.0616E-10	625.0001	0.0010280	6748920.
403.200	-4.33E-10	-0.0360377	-0.0001909	7.1363E-11	625.0001	0.0004056	6748920.
410.400	-6.91E-11	-0.0269312	0.0015025	3.4923E-11	625.0001	6.4755E-05	6748920.
417.600	7.01E-11	-0.0144476	0.0014989	1.0977E-11	625.0001	-6.5755E-05	6748920.
424.800	8.90E-11	-0.0053619	0.0009619	-4.8673E-13	625.0000	-8.3411E-05	6748920.
432.000	6.31E-11	-0.0005962	0.0004485	-3.9347E-12	625.0000	-5.9185E-05	6748920.
439.200	3.23E-11	0.0011018	0.0001264	-3.6421E-12	625.0000	-3.0302E-05	6748920.
446.400	1.07E-11	0.0012281	-1.8816E-05	-2.2938E-12	625.0000	-1.0025E-05	6748920.
453.600	-7.04E-13	0.0008338	-5.2530E-05	-1.1006E-12	625.0000	6.5950E-07	6748920.
460.800	-5.15E-12	0.0004731	-4.3494E-05	-3.4424E-13	625.0000	1.8505E-06	2585430.
468.000	-5.66E-12	0.0002079	-2.9515E-05	4.9877E-14	625.0000	2.0327E-06	2585430.
475.200	-4.44E-12	4.8017E-05	-1.6464E-05	1.9800E-13	625.0000	1.5926E-06	2585430.
482.400	-2.81E-12	-2.9387E-05	-7.0985E-06	2.0878E-13	625.0000	1.0088E-06	2585430.
489.600	-1.43E-12	-5.4472E-05	-1.6199E-06	1.6026E-13	625.0000	5.1300E-07	2585430.
496.800	-5.02E-13	-5.2922E-05	1.2512E-06	9.8106E-14	625.0000	2.8454E-07	4083142.
504.000	-1.59E-14	-3.6582E-05	2.3079E-06	4.6310E-14	625.0000	9.0084E-09	4083142.
511.200	1.65E-13	-1.9748E-05	2.0033E-06	1.3712E-14	625.0000	-9.3640E-08	4083142.
518.400	1.82E-13	-7.7527E-06	1.2955E-06	-2.2030E-15	625.0000	-1.0296E-07	4083142.
525.600	1.33E-13	-1.0896E-06	6.5249E-07	-7.3200E-15	625.0000	-7.5650E-08	4083142.
532.800	7.62E-14	1.6526E-06	2.2468E-07	-6.9941E-15	625.0000	-4.3187E-08	4083142.
540.000	3.27E-14	2.1548E-06	2.4819E-09	-4.7908E-15	625.0000	-1.8534E-08	4083142.
547.200	7.17E-15	1.6946E-06	-7.8870E-08	-2.5631E-15	625.0000	-4.0641E-09	4083142.
554.400	-4.23E-15	1.0224E-06	-8.4871E-08	-9.9075E-16	625.0000	2.3971E-09	4083142.
561.600	-7.10E-15	4.7373E-07	-6.1746E-08	-1.2493E-16	625.0000	4.0266E-09	4083142.
568.800	-6.03E-15	1.3343E-07	-3.4947E-08	2.2644E-16	625.0000	3.4173E-09	4083142.
576.000	-3.84E-15	-2.9808E-08	-1.4806E-08	2.8641E-16	625.0000	2.1775E-09	4083142.

```
 583.200 -1.90E-15 -8.0145E-08 -3.0845E-09  2.2278E-16    625.0000  1.0785E-09
4083142.
 590.400 -6.32E-16 -7.4514E-08  2.0876E-09  1.3327E-16    625.0000  3.5823E-10
4083142.
 597.600  1.74E-17 -5.0256E-08  3.3417E-09  6.1070E-17    625.0000 -9.8759E-12
4083142.
 604.800  2.48E-16 -2.6472E-08  2.8004E-09  1.6667E-17    625.0000 -1.4048E-10
4083142.
 612.000  2.57E-16 -9.9512E-09  1.7692E-09 -4.4113E-18    625.0000 -1.4598E-10
4083142.
 619.200  1.84E-16 -9.9065E-10  8.6756E-10 -1.0743E-17    625.0000 -1.0446E-10
4083142.
 626.400  1.03E-16  2.5556E-09  2.8182E-10 -9.8378E-18    625.0000 -5.8250E-11
4083142.
 633.600  4.25E-17  3.0803E-09 -1.4710E-11 -6.5763E-18    625.0000 -2.4119E-11
4083142.
 640.800  8.02E-18  2.3523E-09 -1.1791E-10 -3.4324E-18    625.0000 -4.5460E-12
4083142.
 648.000 -6.90E-18  1.3869E-09 -1.2019E-10 -1.2685E-18    625.0000  3.9107E-12
4083142.
 655.200 -1.03E-17  6.2317E-10 -8.5187E-11 -1.0529E-19    625.0000  5.8131E-12
4083142.
 662.400 -8.41E-18  1.6034E-10 -4.7086E-11  3.4813E-19    625.0000  4.7705E-12
4083142.
 669.600 -5.24E-18 -5.5321E-11 -1.9220E-11  4.0891E-19    625.0000  2.9701E-12
4083142.
 676.800 -2.52E-18 -1.1697E-10 -3.3756E-12  3.0920E-19    625.0000  1.4312E-12
4083142.
 684.000 -7.85E-19 -1.0433E-10  3.3790E-12  1.8114E-19    625.0000  4.4506E-13
4083142.
 691.200  8.47E-20 -6.8543E-11  4.8082E-12  8.1098E-20    625.0000 -4.8041E-14
4083142.
 698.400  3.83E-19 -3.5196E-11  3.8533E-12  2.1064E-20    625.0000 -2.1721E-13
4083142.
 705.600  3.88E-19 -1.3083E-11  2.2792E-12 -6.8750E-21    625.0000 -2.2006E-13
4083142.
 712.800  2.84E-19 -2.3672E-12  9.0709E-13 -1.5816E-20    625.0000 -1.6107E-13
4083142.
 720.000  1.60E-19      0.0000      0.0000 -1.7186E-20    625.0000 -9.0899E-14
2041571.

Output Verification:

Computed forces and moments are within specified convergence limits.


Output Summary for Load Case No.  2:

Pile-head deflection             =     0.11052186 in
Computed slope at pile head      =    -0.00232113
Maximum bending moment           =   221405.52873 lbs-in
Maximum shear force              =    10000.00000 lbs
Depth of maximum bending moment  =    43.20000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             22
Number of zero deflection points =             12
```

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--------------------------------------------------------------------------------
             Computed Values of Load Distribution and Deflection
                 for Lateral Loading for Load Case Number  3
--------------------------------------------------------------------------------

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head  =       15000.000 lbs
Specified moment at pile head       =           0.000 in-lbs
Specified axial load at pile head   =       90000.000 lbs

(Zero moment for this load indicates free-head conditions)

  Depth   Deflect.    Moment      Shear       Slope      Total       Soil Res.
Es*h
    X        y          M           V           S        Stress          p
F/L
    in       in        lbs-in        lbs         Rad.   lbs/in**2    lbs/in
lbs/in
-------- --------- ----------- ----------- ----------- ----------- ----------- -
----------
   0.000  0.261886  3.9968E-08  15000.0000  -0.0048083    625.0000   -284.4358
3909.9801
   7.200  0.227266     103743.  12925.5301  -0.0047483    985.2195   -291.8059
9244.6812
  14.400  0.193511     192281.  10806.1741  -0.0045770   1292.6437   -296.9041
11046.9819
  21.600  0.161358     265284.   8658.8425  -0.0043122   1546.1245   -299.5769
13367.5232
  28.800  0.131415     322557.   6501.5991  -0.0039720   1744.9906   -299.6574
16417.6498
  36.000  0.104161     364055.   4353.7871  -0.0035746   1889.0784   -296.9571
20526.7582
  43.200  0.079941     389885.   2236.2382  -0.0031383   1978.7659   -291.2509
26232.0483
  50.400  0.058969     400324.    171.6359  -0.0026810   2015.0128   -282.2497
34462.0471
  57.600  0.041334     395831.  -1818.0761  -0.0022203   1999.4123   -270.4481
47109.8829
  64.800  0.026997     377021.  -3613.4371  -0.0017730   1934.1004   -228.2633
60877.3279
  72.000  0.015802     346095.  -5264.0872  -0.0013546   1826.7192   -230.2506
104912.
  79.200  0.007491     302974.  -6807.3391  -0.0009790   1676.9916   -198.4305
190724.
  86.400  0.001705     249338.  -8028.4896  -0.0006593   1490.7576   -140.7780
594552.
  93.600 -0.002003     188218.  -8008.1315  -0.0004061   1278.5341    146.4331
526243.
 100.800 -0.004143     134547.  -6848.6467  -0.0002193   1092.1785    175.6460
305228.
 108.000 -0.005162  89881.5760  -5548.2318 -8.9455E-05    937.0888    185.5803
258855.
 115.200 -0.005431  54768.8104  -4203.4728 -5.7458E-06    815.1695    187.9639
249167.
```

122.400	-0.005245	29359.0145	-2856.0107	4.2939E-05	726.9410	186.3312	255802.
129.600	-0.004813	13586.6067	-1528.6550	6.7792E-05	672.1757	182.3788	272822.
136.800	-0.004268	7258.5241	-794.3209	7.9855E-05	650.2032	21.6029	36439.9915
144.000	-0.003663	2044.8927	-642.6428	8.5239E-05	632.1003	20.5299	40351.2741
151.200	-0.003041	-2106.0024	-499.2728	8.5204E-05	632.3125	19.2951	45684.3527
158.400	-0.002436	-5255.0598	-365.2946	8.0944E-05	643.2467	17.9211	52962.6233
165.600	-0.001875	-7471.1481	-241.6497	7.3579E-05	650.9415	16.4247	63058.3190
172.800	-0.001377	-8830.1744	-129.1782	6.4146E-05	655.6603	14.8173	77491.1645
180.000	-0.000952	-9414.4467	-28.6681	5.3587E-05	657.6891	13.1021	99124.9160
187.200	-0.000605	-9312.4443	59.0616	4.2750E-05	657.3349	11.2672	134072.
194.400	-0.000336	-8619.3634	132.9711	3.2373E-05	654.9283	9.2632	198449.
201.600	-0.000139	-7439.6157	183.5623	2.3079E-05	650.8320	4.7900	248274.
208.800	-3.74E-06	-6005.9772	201.2699	1.5298E-05	645.8541	0.1288201	248274.
216.000	8.14E-05	-4561.1561	191.6304	9.1832E-06	640.8373	-2.8065	248274.
223.200	0.000129	-3258.4014	165.5752	4.6580E-06	636.3139	-4.4311	248274.
230.400	0.000148	-2182.9104	131.1935	1.5091E-06	632.5795	-5.1194	248274.
237.600	0.000150	-1371.1711	94.1142	-5.4767E-07	629.7610	-5.1804	248274.
244.800	0.000141	-826.9563	67.1162	-1.8197E-06	627.8714	-2.3190	118775.
252.000	0.000124	-402.3394	51.0805	-2.5311E-06	626.3970	-2.1353	123959.
259.200	0.000104	-88.1168	36.6696	-2.8150E-06	625.3060	-1.8677	129143.
266.400	8.35E-05	129.3505	24.3382	-2.7911E-06	625.4491	-1.5577	134327.
273.600	6.39E-05	265.9701	14.2706	-2.5623E-06	625.9235	-1.2389	139511.
280.800	4.66E-05	338.1675	6.4396	-2.2127E-06	626.1742	-0.9364114	144695.
288.000	3.21E-05	361.5678	0.6649565	-1.8078E-06	626.2554	-0.6676527	149879.
295.200	2.06E-05	350.0858	-3.3329	-1.3959E-06	626.2156	-0.4428724	155063.
302.400	1.20E-05	315.3827	-5.8865	-1.0108E-06	626.0951	-0.2664492	160247.
309.600	6.01E-06	266.6304	-7.3427	-6.7402E-07	625.9258	-0.1380400	165431.
316.800	2.27E-06	210.5220	-8.0329	-3.9789E-07	625.7310	-0.0536945	170615.

324.000	2.78E-07	151.4723	-9.1654	-1.8840E-07	625.5259	-0.2608855	6748920.
331.200	-4.47E-07	78.7847	-8.5961	-5.5148E-08	625.2736	0.4190062	6748920.
338.400	-5.16E-07	27.7592	-5.3472	6.5095E-09	625.0964	0.4834913	6748920.
345.600	-3.53E-07	1.7771	-2.4145	2.3602E-08	625.0062	0.3311421	6748920.
352.800	-1.76E-07	-7.0399	-0.6286857	2.0557E-08	625.0244	0.1649114	6748920.
360.000	-5.73E-08	-7.3026	0.1582096	1.2257E-08	625.0254	0.0536707	6748920.
367.200	5.63E-10	-4.7775	0.3495243	5.2659E-09	625.0166	-0.0005277	6748920.
374.400	1.86E-08	-2.2763	0.2849570	1.1839E-09	625.0079	-0.0174076	6748920.
381.600	1.76E-08	-0.6756816	0.1628636	-5.2444E-10	625.0023	-0.0165072	6748920.
388.800	1.10E-08	0.0696632	0.0662540	-8.7515E-10	625.0002	-0.0103288	6748920.
396.000	5.01E-09	0.2795094	0.0121696	-6.7308E-10	625.0010	-0.0046946	6748920.
403.200	1.33E-09	0.2457771	-0.0092085	-3.6909E-10	625.0009	-0.0012437	6748920.
410.400	-3.07E-10	0.1473859	-0.0126514	-1.4157E-10	625.0005	0.0002873	6748920.
417.600	-7.12E-10	0.0637799	-0.0092153	-1.9366E-11	625.0002	0.0006671	6748920.
424.800	-5.85E-10	0.0147106	-0.0048382	2.6057E-11	625.0001	0.0005487	6748920.
432.000	-3.37E-10	-0.0059233	-0.0017272	3.1142E-11	625.0000	0.0003154	6748920.
439.200	-1.37E-10	-0.0102010	-0.0001295	2.1811E-11	625.0000	0.0001284	6748920.
446.400	-2.24E-11	-0.0078157	0.0004084	1.1385E-11	625.0000	2.1022E-05	6748920.
453.600	2.70E-11	-0.0043347	0.0003931	4.3534E-12	625.0000	-2.5288E-05	6748920.
460.800	4.03E-11	-0.0021614	0.0002500	5.9411E-13	625.0000	-1.4457E-05	2585430.
468.000	3.55E-11	-0.0007359	0.0001520	-1.0826E-12	625.0000	-1.2760E-05	2585430.
475.200	2.47E-11	2.8621E-05	7.4157E-05	-1.4919E-12	625.0000	-8.8596E-06	2585430.
482.400	1.41E-11	0.0003339	2.4100E-05	-1.2821E-12	625.0000	-5.0452E-06	2585430.
489.600	6.21E-12	0.0003773	-2.0908E-06	-8.7055E-13	625.0000	-2.2299E-06	2585430.
496.800	1.51E-12	0.0003049	-1.3210E-05	-4.7576E-13	625.0000	-8.5870E-07	4083142.
504.000	-6.41E-13	0.0001877	-1.4993E-05	-1.9069E-13	625.0000	3.6345E-07	4083142.
511.200	-1.23E-12	8.9239E-05	-1.1170E-05	-3.0412E-14	625.0000	6.9849E-07	4083142.
518.400	-1.08E-12	2.6907E-05	-6.4528E-06	3.6802E-14	625.0000	6.1180E-07	4083142.

525.600	-7.02E-13	-3.7286E-06	-2.8176E-06	5.0216E-14	625.0000	3.9795E-07	4083142.
532.800	-3.56E-13	-1.3732E-05	-6.5878E-07	4.0111E-14	625.0000	2.0173E-07	4083142.
540.000	-1.24E-13	-1.3267E-05	3.2086E-07	2.4487E-14	625.0000	7.0395E-08	4083142.
547.200	-3.10E-15	-9.1431E-06	5.8062E-07	1.1518E-14	625.0000	1.7600E-09	4083142.
554.400	4.17E-14	-4.9211E-06	5.0176E-07	3.3791E-15	625.0000	-2.3665E-08	4083142.
561.600	4.56E-14	-1.9222E-06	3.2356E-07	-5.8119E-16	625.0000	-2.5834E-08	4083142.
568.800	3.34E-14	-2.6114E-07	1.6244E-07	-1.8447E-15	625.0000	-1.8919E-08	4083142.
576.000	1.90E-14	4.1935E-07	5.5562E-08	-1.7531E-15	625.0000	-1.0770E-08	4083142.
583.200	8.12E-15	5.4122E-07	2.2010E-10	-1.1973E-15	625.0000	-4.6026E-09	4083142.
590.400	1.75E-15	4.2407E-07	-1.9923E-08	-6.3864E-16	625.0000	-9.9285E-10	4083142.
597.600	-1.08E-15	2.5515E-07	-2.1292E-08	-2.4558E-16	625.0000	6.1277E-10	4083142.
604.800	-1.79E-15	1.1779E-07	-1.5440E-08	-2.9758E-17	625.0000	1.0126E-09	4083142.
612.000	-1.51E-15	3.2841E-08	-8.7143E-09	5.7414E-17	625.0000	8.5578E-10	4083142.
619.200	-9.59E-16	-7.7696E-09	-3.6760E-09	7.1923E-17	625.0000	5.4374E-10	4083142.
626.400	-4.73E-16	-2.0187E-08	-7.5221E-10	5.5744E-17	625.0000	2.6843E-10	4083142.
633.600	-1.56E-16	-1.8674E-08	5.3282E-10	3.3256E-17	625.0000	8.8520E-11	4083142.
640.800	5.54E-18	-1.2557E-08	8.4017E-10	1.5182E-17	625.0000	-3.1438E-12	4083142.
648.000	6.25E-17	-6.5947E-09	7.0119E-10	4.0989E-18	625.0000	-3.5463E-11	4083142.
655.200	6.46E-17	-2.4655E-09	4.4170E-10	-1.1443E-18	625.0000	-3.6617E-11	4083142.
662.400	4.61E-17	-2.3273E-10	2.1586E-10	-2.7058E-18	625.0000	-2.6118E-11	4083142.
669.600	2.56E-17	6.4629E-10	6.9557E-11	-2.4665E-18	625.0000	-1.4520E-11	4083142.
676.800	1.05E-17	7.7209E-10	-4.2307E-12	-1.6457E-18	625.0000	-5.9764E-12	4083142.
684.000	1.91E-18	5.8750E-10	-2.9639E-11	-8.5885E-19	625.0000	-1.0814E-12	4083142.
691.200	-1.83E-18	3.4641E-10	-2.9798E-11	-3.1839E-19	625.0000	1.0372E-12	4083142.
698.400	-2.68E-18	1.5883E-10	-2.0597E-11	-2.6008E-20	625.0000	1.5187E-12	4083142.
705.600	-2.20E-18	4.9853E-11	-1.0631E-11	9.4756E-20	625.0000	1.2496E-12	4083142.
712.800	-1.31E-18	5.6214E-12	-3.4506E-12	1.2686E-19	625.0000	7.4489E-13	4083142.
720.000	-3.77E-19	0.0000	0.0000	1.3011E-19	625.0000	2.1362E-13	2041571.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =     0.26188593 in
Computed slope at pile head      =    -0.00480831
Maximum bending moment           =   400323.69848 lbs-in
Maximum shear force              =    15000.00000 lbs
Depth of maximum bending moment  =    50.40000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             25
Number of zero deflection points =             12
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 4

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head = 20000.000 lbs
Specified moment at pile head = 0.000 in-lbs
Specified axial load at pile head = 90000.000 lbs

(Zero moment for this load indicates free-head conditions)

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res. p lbs/in	Es*h F/L lbs/in
0.000	0.481175	0.0000	20000.0000	-0.0080537	625.0000	-331.1535	2477.5871
7.200	0.423188	140635.	17580.7092	-0.0079723	1113.3171	-340.8717	5799.4921
14.400	0.366373	263494.	15099.7945	-0.0077385	1539.9110	-348.2713	6844.2574
21.600	0.311754	368101.	12574.5291	-0.0073730	1903.1299	-353.1914	8156.9954
28.800	0.260203	454123.	10023.3961	-0.0068971	2201.8157	-355.4567	9835.7480
36.000	0.212436	521377.	7466.2229	-0.0063326	2435.3368	-354.8692	12027.4537
43.200	0.169013	569844.	4924.3917	-0.0057011	2603.6236	-351.1950	14960.9910
50.400	0.130339	599677.	2421.1809	-0.0050243	2707.2114	-344.1413	19010.4927
57.600	0.096663	611220.	-449.6711	-0.0043236	2747.2920	-453.3176	33765.5918

64.800	0.068080	598805.	-3523.6207	-0.0036233	2704.1838	-400.5573	42361.9700
72.000	0.044487	565176.	-6039.2581	-0.0029497	2587.4159	-298.2309	48266.7505
79.200	0.025604	515662.	-8084.0588	-0.0023242	2415.4946	-269.7693	75859.6637
86.400	0.011019	451778.	-9862.8475	-0.0017644	2193.6720	-224.3387	146593.
93.600	0.000198	375924.	-10925.7793	-0.0012854	1930.2919	-70.9202	2585430.
100.800	-0.007491	296112.	-10447.7377	-0.0008965	1653.1672	203.7095	195801.
108.000	-0.012712	226638.	-8877.3685	-0.0005939	1411.9391	232.5041	131694.
115.200	-0.016044	169048.	-7153.1736	-0.0003650	1211.9715	246.4389	110596.
122.400	-0.017967	124106.	-5353.3367	-0.0001953	1055.9227	253.5158	101593.
129.600	-0.018856	92212.8741	-3516.9296	-7.0126E-05	945.1836	256.5973	97978.9585
136.800	-0.018977	73552.8453	-2465.2962	2.5803E-05	880.3918	35.5231	13477.8461
144.000	-0.018485	56679.1680	-2210.6447	0.0001012	821.8027	35.2135	13716.1669
151.200	-0.017520	41588.4469	-1959.3515	0.0001580	769.4043	34.5902	14215.1968
158.400	-0.016209	28259.6909	-1713.4883	0.0001985	723.1239	33.7051	14971.9255
165.600	-0.014662	16657.0137	-1474.7994	0.0002245	682.8369	32.5973	16007.2589
172.800	-0.012977	6731.6896	-1244.7783	0.0002380	648.3739	31.2974	17365.0941
180.000	-0.011235	-1576.2247	-1024.7199	0.0002410	630.4730	29.8299	19116.3944
187.200	-0.009507	-8336.5746	-815.7594	0.0002352	653.9464	28.2147	21368.6523
194.400	-0.007848	-13628.0225	-618.9017	0.0002225	672.3195	26.4680	24283.2665
201.600	-0.006302	-17537.1489	-435.0473	0.0002045	685.8929	24.6027	28106.6901
208.800	-0.004903	-20157.7192	-265.0161	0.0001827	694.9921	22.6282	33228.2077
216.000	-0.003672	-21590.1258	-109.5764	0.0001585	699.9657	20.5495	40294.3223
223.200	-0.002621	-21941.0526	30.5154	0.0001333	701.1842	18.3649	50457.5956
230.400	-0.001752	-21323.4891	154.4432	0.0001083	699.0399	16.0595	65995.7387
237.600	-0.001061	-19857.4078	261.1792	8.4453E-05	693.9493	13.5894	92195.7381
244.800	-0.000536	-17671.9600	341.9288	6.2735E-05	686.3610	8.8411	118775.
252.000	-0.000158	-15014.9373	383.5419	4.3819E-05	677.1352	2.7181	123959.
259.200	9.51E-05	-12205.7453	387.1896	2.8066E-05	667.3811	-1.7049	129143.

266.400	0.000246	-9475.7812	364.5116	1.5519E-05	657.9020	-4.5945	134327.
273.600	0.000319	-6976.8906	325.7527	5.9975E-06	649.2253	-6.1718	139511.
280.800	0.000333	-4792.7157	279.4688	-8.1359E-07	641.6414	-6.6848	144695.
288.000	0.000307	-2951.4851	232.4117	-5.2952E-06	635.2482	-6.3866	149879.
295.200	0.000256	-1439.1242	189.5421	-7.8360E-06	629.9970	-5.5216	155063.
302.400	0.000194	-211.9235	154.1230	-8.7915E-06	625.7358	-4.3170	160247.
309.600	0.000130	791.6409	127.8464	-8.4560E-06	627.7488	-2.9820	165431.
316.800	7.22E-05	1640.0239	110.9519	-7.0488E-06	630.6945	-1.7109	170615.
324.000	2.83E-05	2398.4837	9.3542	-4.7117E-06	633.3281	-26.5107	6748920.
331.200	4.35E-06	1780.8310	-100.7695	-2.2931E-06	631.1834	-4.0793	6748920.
338.400	-4.74E-06	950.3743	-99.4649	-7.1257E-07	628.2999	4.4417	6748920.
345.600	-5.91E-06	349.4606	-63.5346	3.9645E-08	626.2134	5.5390	6748920.
352.800	-4.17E-06	35.4245	-29.5308	2.6238E-07	625.1230	3.9065	6748920.
360.000	-2.13E-06	-76.1232	-8.2766	2.3883E-07	625.2643	1.9974	6748920.
367.200	-7.29E-07	-84.0683	1.3725	1.4612E-07	625.2919	0.6828918	6748920.
374.400	-2.67E-08	-56.5492	3.9211	6.4748E-08	625.1964	0.0250558	6748920.
381.600	2.04E-07	-27.6888	3.3235	1.5999E-08	625.0961	-0.1910601	6748920.
388.800	2.04E-07	-8.7122	1.9484	-5.0667E-09	625.0303	-0.1908918	6748920.
396.000	1.31E-07	0.3751040	0.8196038	-9.8914E-09	625.0013	-0.1226703	6748920.
403.200	6.12E-08	3.1029	0.1714275	-7.8787E-09	625.0108	-0.0573787	6748920.
410.400	1.74E-08	2.8539	-0.0939052	-4.4315E-09	625.0099	-0.0163248	6748920.
417.600	-2.60E-09	1.7564	-0.1439018	-1.7635E-09	625.0061	0.0024369	6748920.
424.800	-7.98E-09	0.7839702	-0.1082058	-2.9337E-10	625.0027	0.0074787	6748920.
432.000	-6.82E-09	0.1986323	-0.0582542	2.7526E-10	625.0007	0.0063968	6748920.
439.200	-4.01E-09	-0.0552469	-0.0216782	3.5824E-10	625.0002	0.0037632	6748920.
446.400	-1.67E-09	-0.1139984	-0.0025100	2.6030E-10	625.0004	0.0015613	6748920.
453.600	-2.66E-10	-0.0917278	0.0040098	1.4124E-10	625.0003	0.0002498	6748920.
460.800	3.68E-10	-0.0564398	0.0044330	5.5498E-11	625.0002	-0.0001322	2585430.

468.000	5.33E-10	-0.0279649	0.0032683	6.6529E-12	625.0001	-0.0001913	2585430.
475.200	4.64E-10	-0.0093853	0.0019797	-1.4962E-11	625.0000	-0.0001666	2585430.
482.400	3.17E-10	0.0005625	0.0009697	-2.0068E-11	625.0000	-0.0001139	2585430.
489.600	1.75E-10	0.0046043	0.0003332	-1.7078E-11	625.0000	-6.2878E-05	2585430.
496.800	7.13E-11	0.0053830	-3.8765E-05	-1.1298E-11	625.0000	-4.0452E-05	4083142.
504.000	1.24E-11	0.0040607	-0.0002097	-5.8327E-12	625.0000	-7.0409E-06	4083142.
511.200	-1.27E-11	0.0023703	-0.0002092	-2.1111E-12	625.0000	7.1798E-06	4083142.
518.400	-1.80E-11	0.0010504	-0.0001467	-1.3145E-13	625.0000	1.0199E-05	4083142.
525.600	-1.46E-11	0.0002584	-8.0250E-05	6.2594E-13	625.0000	8.2533E-06	4083142.
532.800	-8.97E-12	-0.0001060	-3.2225E-05	7.1411E-13	625.0000	5.0870E-06	4083142.
540.000	-4.27E-12	-0.0002066	-5.1946E-06	5.3320E-13	625.0000	2.4216E-06	4083142.
547.200	-1.29E-12	-0.0001815	6.1610E-06	3.0860E-13	625.0000	7.3268E-07	4083142.
554.400	1.74E-13	-0.0001183	8.4440E-06	1.3511E-13	625.0000	-9.8507E-08	4083142.
561.600	6.54E-13	-6.0085E-05	6.7549E-06	3.1890E-14	625.0000	-3.7070E-07	4083142.
568.800	6.33E-13	-2.1057E-05	4.1282E-06	-1.5067E-14	625.0000	-3.5893E-07	4083142.
576.000	4.37E-13	-6.1952E-07	1.9445E-06	-2.7611E-14	625.0000	-2.4765E-07	4083142.
583.200	2.35E-13	6.9798E-06	5.7253E-07	-2.3931E-14	625.0000	-1.3345E-07	4083142.
590.400	9.21E-14	7.6560E-06	-9.5907E-08	-1.5461E-14	625.0000	-5.2230E-08	4083142.
597.600	1.27E-14	5.6188E-06	-3.0983E-07	-7.7785E-15	625.0000	-7.1921E-09	4083142.
604.800	-1.99E-14	3.2046E-06	-2.9507E-07	-2.6724E-15	625.0000	1.1292E-08	4083142.
612.000	-2.58E-14	1.3733E-06	-2.0174E-07	-2.3157E-17	625.0000	1.4631E-08	4083142.
619.200	-2.02E-14	2.9949E-07	-1.0774E-07	9.4489E-16	625.0000	1.1481E-08	4083142.
626.400	-1.22E-14	-1.7938E-07	-4.1514E-08	1.0144E-15	625.0000	6.9151E-09	4083142.
633.600	-5.64E-15	-2.9963E-07	-5.1109E-09	7.3720E-16	625.0000	3.1970E-09	4083142.
640.800	-1.58E-15	-2.5393E-07	9.6201E-09	4.1685E-16	625.0000	8.9495E-10	4083142.
648.000	3.65E-16	-1.6164E-07	1.2097E-08	1.7635E-16	625.0000	-2.0707E-10	4083142.
655.200	9.61E-16	-7.9970E-08	9.3884E-09	3.6527E-17	625.0000	-5.4518E-10	4083142.
662.400	8.91E-16	-2.6498E-08	5.6065E-09	-2.5086E-17	625.0000	-5.0536E-10	4083142.

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 669.600  6.00E-16  7.9660E-10  2.5621E-09 -3.9960E-17    625.0000 -3.4031E-10
4083142.
 676.800  3.16E-16  1.0449E-08  6.9249E-10 -3.3452E-17    625.0000 -1.7903E-10
4083142.
 684.000  1.18E-16  1.0812E-08 -1.9370E-10 -2.1149E-17    625.0000 -6.7132E-11
4083142.
 691.200  1.12E-17  7.6867E-09 -4.5815E-10 -1.0444E-17    625.0000 -6.3265E-12
4083142.
 698.400 -3.20E-17  4.2279E-09 -4.1558E-10 -3.5485E-18    625.0000  1.8153E-11
4083142.
 705.600 -3.99E-17  1.7070E-09 -2.6869E-10 -1.1391E-19    625.0000  2.2651E-11
4083142.
 712.800 -3.36E-17  3.5900E-10 -1.1844E-10  1.0817E-18    625.0000  1.9083E-11
4083142.
 720.000 -2.44E-17      0.0000      0.0000  1.2894E-18    625.0000  1.3818E-11
2041571.

Output Verification:

Computed forces and moments are within specified convergence limits.


Output Summary for Load Case No.  4:

Pile-head deflection             =     0.48117492 in
Computed slope at pile head      =    -0.00805372
Maximum bending moment           =   611220.10907 lbs-in
Maximum shear force              =    20000.00000 lbs
Depth of maximum bending moment  =    57.60000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             25
Number of zero deflection points =             11




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             Computed Values of Load Distribution and Deflection
                 for Lateral Loading for Load Case Number  5
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Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head  =       25000.000 lbs
Specified moment at pile head       =           0.000 in-lbs
Specified axial load at pile head   =       90000.000 lbs

(Zero moment for this load indicates free-head conditions)

  Depth   Deflect.    Moment      Shear       Slope      Total       Soil Res.
Es*h
    X        y          M           V           S        Stress          p
F/L
    in       in        lbs-in        lbs         Rad.   lbs/in**2    lbs/in
lbs/in
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0.000	0.761263	-5.3291E-08	25000.0000	-0.0119120	625.0000	-371.3947	1756.3184
7.200	0.675497	178092.	22283.6609	-0.0118089	1243.3764	-383.1439	4083.8591
14.400	0.591215	336189.	19491.2382	-0.0115113	1792.3230	-392.5290	4780.3366
21.600	0.509735	473685.	16640.3468	-0.0110426	2269.7390	-399.3853	5641.3100
28.800	0.432202	590121.	13749.8389	-0.0104270	2674.0320	-403.5336	6722.4148
36.000	0.359587	685196.	10839.9326	-0.0096889	3004.1523	-404.7737	8104.7753
43.200	0.292681	758773.	7932.4066	-0.0088533	3259.6289	-402.8724	9910.7113
50.400	0.232099	810896.	5050.8983	-0.0079449	3440.6125	-397.5465	12332.3757
57.600	0.178274	841803.	1252.0092	-0.0069885	3547.9260	-657.7004	26562.6546
64.800	0.131465	837982.	-3267.1556	-0.0060164	3534.6612	-597.6231	32730.3487
72.000	0.091638	802553.	-6704.8537	-0.0050670	3411.6421	-357.2930	28072.4711
79.200	0.058500	747999.	-9185.1726	-0.0041697	3222.2202	-331.6844	40823.0124
86.400	0.031594	675690.	-11430.2967	-0.0033458	2971.1471	-291.9611	66534.8658
93.600	0.010320	587739.	-13276.1741	-0.0026147	2665.7615	-220.7826	154038.
100.800	-0.006057	487902.	-13376.0993	-0.0019922	2319.1045	193.0256	229452.
108.000	-0.018368	397705.	-11763.7641	-0.0014797	2005.9214	254.8453	99896.7041
115.200	-0.027364	320422.	-9832.6508	-0.0010641	1737.5748	281.5751	74086.5721
122.400	-0.033691	257494.	-7751.1737	-0.0007297	1519.0773	296.6130	63388.3587
129.600	-0.037872	209750.	-5583.8527	-0.0004593	1353.2996	305.4206	58065.3266
136.800	-0.040304	177682.	-4319.9784	-0.0002351	1241.9514	45.6556	8155.9438
144.000	-0.041256	147847.	-3989.9728	-4.6673E-05	1138.3585	46.0126	8030.0354
151.200	-0.040976	120287.	-3659.0566	0.0001085	1042.6628	45.9085	8066.6125
158.400	-0.039694	95016.2147	-3330.2570	0.0002331	954.9174	45.4247	8239.4563
165.600	-0.037620	72029.0968	-3006.0981	0.0003298	875.1010	44.6194	8539.6185
172.800	-0.034946	51301.0281	-2688.7383	0.0004011	803.1286	43.5361	8969.9591
180.000	-0.031844	32791.3944	-2380.0600	0.0004498	738.8590	42.2079	9543.4228
187.200	-0.028468	16445.2244	-2081.7331	0.0004783	682.1015	40.6607	10283.5730
194.400	-0.024956	2194.5700	-1795.2619	0.0004891	632.6200	38.9147	11227.1086

201.600	-0.021426	-10040.3938	-1522.0210	0.0004845	659.8625	36.9856	12428.8488
208.800	-0.017979	-20350.4951	-1263.2861	0.0004670	695.6614	34.8852	13970.5464
216.000	-0.014702	-28836.8831	-1020.2604	0.0004385	725.1281	32.6219	15976.3997
223.200	-0.011665	-35610.5244	-794.1004	0.0004012	748.6477	30.2003	18641.2407
230.400	-0.008924	-40791.8733	-585.9417	0.0003570	766.6384	27.6216	22284.4727
237.600	-0.006524	-44510.7271	-396.9267	0.0003076	779.5511	24.8826	27460.4073
244.800	-0.004495	-46906.2830	-40.4168	0.0002547	787.8690	74.1479	118775.
252.000	-0.002856	-45422.8310	403.5480	0.0002013	782.7182	49.1756	123959.
259.200	-0.001596	-41356.0474	683.6603	0.0001511	768.5974	28.6333	129143.
266.400	-0.000681	-35773.8947	832.4833	0.0001064	749.2149	12.7064	134327.
273.600	-6.39E-05	-29506.2122	882.6825	6.8645E-05	727.4521	1.2378	139511.
280.800	0.000307	-23152.2300	864.8980	3.8171E-05	705.3897	-6.1780	144695.
288.000	0.000486	-17101.1517	806.2528	1.4877E-05	684.3790	-10.1123	149879.
295.200	0.000522	-11561.4698	729.4050	-1.7106E-06	665.1440	-11.2343	155063.
302.400	0.000461	-6595.5031	652.0125	-1.2218E-05	647.9011	-10.2636	160247.
309.600	0.000346	-2156.6555	586.4688	-1.7283E-05	632.4884	-7.9430	165431.
316.800	0.000212	1872.0459	539.7653	-1.7448E-05	631.5002	-5.0302	170615.
324.000	9.45E-05	5638.5773	202.9278	-1.3101E-05	644.5784	-88.5358	6748920.
331.200	2.36E-05	4811.1855	-195.4997	-7.0539E-06	641.7055	-22.1385	6748920.
338.400	-7.12E-06	2832.5232	-251.1602	-2.6305E-06	634.8351	6.6773	6748920.
345.600	-1.43E-05	1197.8878	-178.9985	-2.9809E-07	629.1593	13.3676	6748920.
352.800	-1.14E-05	255.3308	-92.3519	5.4289E-07	625.8866	10.7009	6748920.
360.000	-6.44E-06	-132.6828	-32.0855	6.1387E-07	625.4607	6.0398	6748920.
367.200	-2.58E-06	-207.4958	-1.6483	4.1700E-07	625.7205	2.4150	6748920.
374.400	-4.39E-07	-156.9585	8.5257	2.0609E-07	625.5450	0.4110915	6748920.
381.600	3.91E-07	-84.9925	8.6852	6.6076E-08	625.2951	-0.3667972	6748920.
388.800	5.13E-07	-31.9775	5.6339	-1.6153E-09	625.1110	-0.4807882	6748920.
396.000	3.68E-07	-3.8626	2.6611	-2.2356E-08	625.0134	-0.3449947	6748920.

403.200	1.91E-07	6.3707	0.7745704	-2.0905E-08	625.0221	-0.1790295	6748920.
410.400	6.70E-08	7.3183	-0.0961133	-1.2983E-08	625.0254	-0.0628271	6748920.
417.600	4.04E-09	5.0035	-0.3359344	-5.8521E-09	625.0174	-0.0037898	6748920.
424.800	-1.72E-08	2.4884	-0.2913870	-1.5166E-09	625.0086	0.0161641	6748920.
432.000	-1.78E-08	0.8094621	-0.1731471	3.9195E-10	625.0028	0.0166803	6748920.
439.200	-1.16E-08	-0.0054000	-0.0739527	8.5726E-10	625.0000	0.0108736	6748920.
446.400	-5.45E-09	-0.2565684	-0.0164147	7.0566E-10	625.0009	0.0051091	6748920.
453.600	-1.44E-09	-0.2426867	0.0068337	4.1674E-10	625.0008	0.0013488	6748920.
460.800	5.50E-10	-0.1587035	0.0109776	1.8445E-10	625.0006	-0.0001977	2585430.
468.000	1.22E-09	-0.0848477	0.0086926	4.3510E-11	625.0003	-0.0004371	2585430.
475.200	1.18E-09	-0.0335871	0.0055975	-2.5029E-11	625.0001	-0.0004226	2585430.
482.400	8.57E-10	-0.0042107	0.0029684	-4.6903E-11	625.0000	-0.0003077	2585430.
489.600	5.02E-10	0.0092192	0.0012124	-4.4004E-11	625.0000	-0.0001801	2585430.
496.800	2.23E-10	0.0133053	0.0001085	-3.0969E-11	625.0000	-0.0001266	4083142.
504.000	5.56E-11	0.0108210	-0.0004607	-1.7007E-11	625.0000	-3.1539E-05	4083142.
511.200	-2.17E-11	0.0066937	-0.0005298	-6.8714E-12	625.0000	1.2334E-05	4083142.
518.400	-4.33E-11	0.0032006	-0.0003969	-1.1455E-12	625.0000	2.4574E-05	4083142.
525.600	-3.82E-11	0.0009792	-0.0002304	1.2734E-12	625.0000	2.1689E-05	4083142.
532.800	-2.50E-11	-0.0001187	-0.0001013	1.7713E-12	625.0000	1.4176E-05	4083142.
540.000	-1.27E-11	-0.0004816	-2.4247E-05	1.4239E-12	625.0000	7.2238E-06	4083142.
547.200	-4.49E-12	-0.0004697	1.0932E-05	8.7332E-13	625.0000	2.5480E-06	4083142.
554.400	-1.62E-13	-0.0003253	2.0435E-05	4.1322E-13	625.0000	9.1943E-08	4083142.
561.600	1.46E-12	-0.0001760	1.7791E-05	1.2310E-13	625.0000	-8.2651E-07	4083142.
568.800	1.61E-12	-6.9322E-05	1.1527E-05	-1.8857E-14	625.0000	-9.1332E-07	4083142.
576.000	1.19E-12	-9.9594E-06	5.8184E-06	-6.4737E-14	625.0000	-6.7253E-07	4083142.
583.200	6.78E-13	1.4547E-05	2.0125E-06	-6.2082E-14	625.0000	-3.8466E-07	4083142.
590.400	2.92E-13	1.9101E-05	3.1702E-08	-4.2610E-14	625.0000	-1.6555E-07	4083142.
597.600	6.47E-14	1.5058E-05	-6.9637E-07	-2.2843E-14	625.0000	-3.6696E-08	4083142.

604.800	-3.70E-14	9.1024E-06	-7.5291E-07	-8.8606E-15	625.0000	2.0992E-08	4083142.
612.000	-6.29E-14	4.2279E-06	-5.4895E-07	-1.1464E-15	625.0000	3.5662E-08	4083142.
619.200	-5.35E-14	1.1989E-06	-3.1130E-07	1.9942E-15	625.0000	3.0353E-08	4083142.
626.400	-3.42E-14	-2.5741E-07	-1.3227E-07	2.5390E-15	625.0000	1.9378E-08	4083142.
633.600	-1.70E-14	-7.0903E-07	-2.7883E-08	1.9797E-15	625.0000	9.6186E-09	4083142.
640.800	-5.66E-15	-6.6149E-07	1.8302E-08	1.1866E-15	625.0000	3.2104E-09	4083142.
648.000	1.26E-16	-4.4703E-07	2.9601E-08	5.4511E-16	625.0000	-7.1620E-11	4083142.
655.200	2.19E-15	-2.3594E-07	2.4876E-08	1.4987E-16	625.0000	-1.2411E-09	4083142.
662.400	2.28E-15	-8.9013E-08	1.5744E-08	-3.8176E-17	625.0000	-1.2955E-09	4083142.
669.600	1.64E-15	-9.1804E-09	7.7342E-09	-9.5001E-17	625.0000	-9.2933E-10	4083142.
676.800	9.16E-16	2.2482E-08	2.5175E-09	-8.7303E-17	625.0000	-5.1974E-10	4083142.
684.000	3.82E-16	2.7185E-08	-1.3257E-10	-5.8560E-17	625.0000	-2.1639E-10	4083142.
691.200	7.32E-17	2.0649E-08	-1.0611E-09	-3.0879E-17	625.0000	-4.1519E-11	4083142.
698.400	-6.31E-17	1.1946E-08	-1.0817E-09	-1.2016E-17	625.0000	3.5770E-11	4083142.
705.600	-9.98E-17	5.0876E-09	-7.4919E-10	-2.1585E-18	625.0000	5.6606E-11	4083142.
712.800	-9.42E-17	1.1602E-09	-3.5318E-10	1.4571E-18	625.0000	5.3398E-11	4083142.
720.000	-7.88E-17	0.0000	0.0000	2.1285E-18	625.0000	4.4707E-11	2041571.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 5:

```
Pile-head deflection             =     0.76126346 in
Computed slope at pile head      =    -0.01191195
Maximum bending moment           =   841802.68541 lbs-in
Maximum shear force              =    25000.00000 lbs
Depth of maximum bending moment  =    57.60000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             26
Number of zero deflection points =             11
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 6

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head = 30000.000 lbs
Specified moment at pile head = 0.000 in-lbs
Specified axial load at pile head = 90000.000 lbs

(Zero moment for this load indicates free-head conditions)

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res. p lbs/in	Es*h F/L lbs/in
0.000	1.092	1.8652E-07	30000.0000	-0.0162743	625.0000	-406.4301	1340.1215
7.200	0.974628	216011.	27025.1514	-0.0161493	1375.0385	-419.9167	3102.1086
14.400	0.859253	410092.	23961.9034	-0.0157870	2048.9295	-430.9855	3611.3894
21.600	0.747295	581522.	20828.2774	-0.0152131	2644.1752	-439.4662	4234.1473
28.800	0.640183	729735.	17643.5721	-0.0144543	3158.8025	-445.1742	5006.7761
36.000	0.539153	854323.	14428.4931	-0.0135376	3591.3982	-447.9033	5981.4289
43.200	0.445242	955050.	11205.3438	-0.0124905	3941.1465	-447.4160	7235.1614
50.400	0.359289	1031867.	7998.3073	-0.0113407	4207.8727	-443.4275	8886.0949
57.600	0.281936	1084923.	3230.3511	-0.0101157	4392.0949	-881.0048	22498.8674
64.800	0.213623	1091494.	-2832.8528	-0.0088562	4414.9109	-803.2185	27071.8354
72.000	0.154407	1055608.	-7189.8308	-0.0076137	4290.3051	-407.0531	18980.9442
79.200	0.103987	997828.	-10033.8627	-0.0064253	4089.6808	-382.9557	26515.7296
86.400	0.061882	919447.	-12655.7452	-0.0053158	3817.5259	-345.3450	40181.1124
93.600	0.027439	822475.	-14913.5014	-0.0043077	3480.8146	-281.8095	73946.2067
100.800	-0.000149	710276.	-15734.8271	-0.0034207	3091.2357	53.6635	2585430.
108.000	-0.021819	600326.	-14583.6187	-0.0026623	2709.4665	266.1166	87814.4804
115.200	-0.038486	503722.	-12521.5418	-0.0020234	2374.0350	306.6825	57374.1943
122.400	-0.050956	422638.	-10233.1803	-0.0014873	2092.4945	328.9734	46483.8541
129.600	-0.059903	358292.	-7815.6926	-0.0010353	1869.0687	342.5509	41172.7714
136.800	-0.065864	311434.	-6388.8980	-0.0006478	1706.3689	53.7809	5879.0812

144.000	-0.069231	267131.	-5998.4318	-0.0003130	1552.5387	54.6820	5686.9274
151.200	-0.070371	225462.	-5603.6467	-2.7885E-05	1407.8556	54.9805	5625.3336
158.400	-0.069632	186475.	-5208.4817	0.0002105	1272.4819	54.7875	5665.0480
165.600	-0.067340	150187.	-4816.2003	0.0004053	1146.4843	54.1795	5792.9113
172.800	-0.063795	116596.	-4429.5912	0.0005597	1029.8479	53.2119	6005.5259
180.000	-0.059280	85675.9561	-4051.0967	0.0006768	922.4860	51.9255	6306.7747
187.200	-0.054050	57383.2889	-3682.9003	0.0007596	824.2475	50.3513	6707.3061
194.400	-0.048342	31657.7949	-3326.9906	0.0008111	734.9229	48.5125	7225.4062
201.600	-0.042370	8423.4463	-2985.2101	0.0008343	654.2481	46.4265	7889.3005
208.800	-0.036328	-12410.4698	-2659.2944	0.0008320	668.0919	44.1056	8741.4412
216.000	-0.030390	-30948.6419	-2350.9053	0.0008069	732.4606	41.5580	9846.0536
223.200	-0.024709	-47309.2347	-2061.6593	0.0007616	789.2682	38.7881	11302.5454
230.400	-0.019423	-61623.5718	-1793.1523	0.0006986	838.9707	35.7972	13270.1352
237.600	-0.014650	-74035.9643	-1546.9749	0.0006201	882.0693	32.5854	16015.0364
244.800	-0.010494	-84703.6018	-806.4708	0.0005282	919.1097	173.1102	118775.
252.000	-0.007044	-86333.6805	253.2903	0.0004292	924.7697	121.2679	123959.
259.200	-0.004313	-81612.4805	968.3577	0.0003320	908.3767	77.3619	129143.
266.400	-0.002263	-72819.6281	1398.8249	0.0002427	877.8459	42.2123	134327.
273.600	-0.000819	-61783.8773	1607.9142	0.0001648	839.5274	15.8681	139511.
280.800	0.000110	-49879.1861	1657.0908	0.0001001	798.1916	-2.2079	144695.
288.000	0.000623	-38051.5453	1602.4542	4.9249E-05	757.1234	-12.9689	149879.
295.200	0.000819	-26867.6729	1492.2636	1.1680E-05	718.2905	-17.6396	155063.
302.400	0.000791	-16578.0874	1365.3668	-1.3462E-05	682.5628	-17.6095	160247.
309.600	0.000625	-7188.9441	1250.2586	-2.7216E-05	649.9616	-14.3650	165431.
316.800	0.000399	1460.9080	1164.4815	-3.0531E-05	630.0726	-9.4619	170615.
324.000	0.000186	9619.1581	504.2482	-2.4119E-05	658.3999	-173.9362	6748920.
331.200	5.20E-05	8753.3393	-297.3488	-1.3487E-05	655.3935	-48.7296	6748920.
338.400	-8.64E-06	5354.8138	-443.6062	-5.3221E-06	643.5931	8.1025	6748920.

345.600	-2.47E-05	2372.3078	-331.2523	-8.5036E-07	633.2372	23.1069	6748920.
352.800	-2.09E-05	585.8832	-177.5776	8.6156E-07	627.0343	19.5805	6748920.
360.000	-1.22E-05	-185.9262	-65.7680	1.0930E-06	625.6456	11.4777	6748920.
367.200	-5.15E-06	-362.5923	-7.0704	7.7559E-07	626.2590	4.8272	6748920.
374.400	-1.08E-06	-288.7452	13.9397	3.9865E-07	626.0026	1.0090	6748920.
381.600	5.91E-07	-162.3768	15.5784	1.3759E-07	625.5638	-0.5537877	6748920.
388.800	9.05E-07	-64.5949	10.5313	6.2389E-09	625.2243	-0.8481767	6748920.
396.000	6.81E-07	-10.7341	5.1811	-3.7354E-08	625.0373	-0.6379988	6748920.
403.200	3.67E-07	10.0610	1.6460	-3.7744E-08	625.0349	-0.3439743	6748920.
410.400	1.37E-07	13.0168	-0.0550756	-2.4389E-08	625.0452	-0.1285386	6748920.
417.600	1.58E-08	9.2995	-0.5710244	-1.1474E-08	625.0323	-0.0147805	6748920.
424.800	-2.81E-08	4.8089	-0.5294214	-3.3095E-09	625.0167	0.0263369	6748920.
432.000	-3.19E-08	1.6801	-0.3270025	4.4574E-10	625.0058	0.0298905	6748920.
439.200	-2.17E-08	0.0995303	-0.1462432	1.4756E-09	625.0003	0.0203204	6748920.
446.400	-1.06E-08	-0.4277095	-0.0371876	1.2857E-09	625.0015	0.0099728	6748920.
453.600	-3.16E-09	-0.4376379	0.0093927	7.8492E-10	625.0015	0.0029662	6748920.
460.800	6.64E-10	-0.2934712	0.0192132	3.6183E-10	625.0010	-0.0002383	2585430.
468.000	2.05E-09	-0.1614361	0.0157107	9.8572E-11	625.0006	-0.0007347	2585430.
475.200	2.08E-09	-0.0673645	0.0103733	-3.3836E-11	625.0002	-0.0007480	2585430.
482.400	1.56E-09	-0.0120168	0.0056657	-7.9774E-11	625.0000	-0.0005597	2585430.
489.600	9.34E-10	0.0143254	0.0024432	-7.8438E-11	625.0000	-0.0003355	2585430.
496.800	4.29E-10	0.0232664	0.0003594	-5.6684E-11	625.0001	-0.0002434	4083142.
504.000	1.18E-10	0.0195738	-0.0007576	-3.1892E-11	625.0001	-6.6897E-05	4083142.
511.200	-3.01E-11	0.0123985	-0.0009370	-1.3390E-11	625.0000	1.7071E-05	4083142.
518.400	-7.48E-11	0.0060990	-0.0007227	-2.6849E-12	625.0000	4.2445E-05	4083142.
525.600	-6.88E-11	0.0019952	-0.0004295	1.9992E-12	625.0000	3.8997E-05	4083142.
532.800	-4.61E-11	-8.8517E-05	-0.0001951	3.1026E-12	625.0000	2.6120E-05	4083142.
540.000	-2.41E-11	-0.0008181	-5.1877E-05	2.5779E-12	625.0000	1.3661E-05	4083142.

547.200	-8.94E-12	-0.0008389	1.5546E-05	1.6190E-12	625.0000	5.0678E-06	4083142.
554.400	-7.75E-13	-0.0005963	3.5372E-05	7.8843E-13	625.0000	4.3947E-07	4083142.
561.600	2.42E-12	-0.0003305	3.2020E-05	2.5205E-13	625.0000	-1.3707E-06	4083142.
568.800	2.85E-12	-0.0001356	2.1257E-05	-1.7698E-14	625.0000	-1.6188E-06	4083142.
576.000	2.16E-12	-2.4418E-05	1.1015E-05	-1.1029E-13	625.0000	-1.2262E-06	4083142.
583.200	1.27E-12	2.3189E-05	4.0154E-06	-1.1100E-13	625.0000	-7.1819E-07	4083142.
590.400	5.64E-13	3.3547E-05	2.7874E-07	-7.8163E-14	625.0000	-3.1977E-07	4083142.
597.600	1.41E-13	2.7304E-05	-1.1600E-06	-4.2948E-14	625.0000	-7.9888E-08	4083142.
604.800	-5.46E-14	1.6899E-05	-1.3362E-06	-1.7368E-14	625.0000	3.0959E-08	4083142.
612.000	-1.09E-13	8.0856E-06	-1.0017E-06	-2.9095E-15	625.0000	6.1944E-08	4083142.
619.200	-9.65E-14	2.4776E-06	-5.8174E-07	3.2035E-15	625.0000	5.4718E-08	4083142.
626.400	-6.31E-14	-2.9561E-07	-2.5593E-07	4.4662E-15	625.0000	3.5784E-08	4083142.
633.600	-3.22E-14	-1.2136E-06	-6.1429E-08	3.5928E-15	625.0000	1.8246E-08	4083142.
640.800	-1.14E-14	-1.1848E-06	2.7453E-08	2.2048E-15	625.0000	6.4435E-09	4083142.
648.000	-4.24E-16	-8.2115E-07	5.1515E-08	1.0440E-15	625.0000	2.4051E-10	4083142.
655.200	3.67E-15	-4.4438E-07	4.4886E-08	3.1159E-16	625.0000	-2.0818E-09	4083142.
662.400	4.06E-15	-1.7519E-07	2.9097E-08	-4.6956E-17	625.0000	-2.3040E-09	4083142.
669.600	2.99E-15	-2.5317E-08	1.4689E-08	-1.6299E-16	625.0000	-1.6983E-09	4083142.
676.800	1.72E-15	3.6536E-08	5.0718E-09	-1.5650E-16	625.0000	-9.7301E-10	4083142.
684.000	7.41E-16	4.7920E-08	5.5839E-11	-1.0763E-16	625.0000	-4.2032E-10	4083142.
691.200	1.66E-16	3.7479E-08	-1.7961E-09	-5.8205E-17	625.0000	-9.4106E-11	4083142.
698.400	-9.70E-17	2.2132E-08	-1.9369E-09	-2.3708E-17	625.0000	5.4991E-11	4083142.
705.600	-1.75E-16	9.6181E-09	-1.3808E-09	-5.3341E-18	625.0000	9.9498E-11	4083142.
712.800	-1.74E-16	2.2555E-09	-6.6779E-10	1.5372E-18	625.0000	9.8551E-11	4083142.
720.000	-1.53E-16	0.0000	0.0000	2.8424E-18	625.0000	8.6945E-11	2041571.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 6:

```
Pile-head deflection             =     1.09180275 in
Computed slope at pile head      =    -0.01627433
Maximum bending moment           =       1091494. lbs-in
Maximum shear force              =    30000.00000 lbs
Depth of maximum bending moment  =    64.80000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             24
Number of zero deflection points =             11
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 7

```
Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head  =       35000.000 lbs
Specified moment at pile head       =           0.000 in-lbs
Specified axial load at pile head   =       90000.000 lbs

(Zero moment for this load indicates free-head conditions)
```

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res. p lbs/in	Es*h F/L lbs/in
0.000	1.453	5.3291E-08	35000.0000	-0.0209908	625.0000	-436.5380	1081.5225
7.200	1.302	254287.	31803.2730	-0.0208437	1507.9410	-451.4418	2496.5595
14.400	1.153	484981.	28508.2002	-0.0204159	2308.9602	-463.8562	2896.7654
21.600	1.008	691264.	25133.3509	-0.0197352	3025.2224	-473.6019	3383.0196
28.800	0.868743	872478.	21698.6470	-0.0188302	3654.4360	-480.4825	3982.1624
36.000	0.736800	1028129.	18225.5074	-0.0177303	4194.8907	-484.2785	4732.3604
43.200	0.613426	1157903.	14737.0563	-0.0164653	4645.4979	-484.7357	5689.5181
50.400	0.499700	1261681.	11258.4257	-0.0150650	5005.8373	-481.5506	6938.4845
57.600	0.396489	1339549.	5468.9755	-0.0135597	5276.2119	-1126.6301	20458.9127
64.800	0.304441	1358008.	-2245.0734	-0.0119986	5340.3047	-1016.1613	24032.1395
72.000	0.223709	1322770.	-7510.9986	-0.0104472	5217.9520	-446.5957	14373.5352
79.200	0.154000	1263389.	-10639.6459	-0.0089506	5011.7674	-422.4730	19751.9344

86.400	0.094820	1181159.	-13543.8430	-0.0075360	4726.2475	-384.2485	29177.2715
93.600	0.045483	1078124.	-16078.4191	-0.0062285	4368.4870	-319.8004	50625.1204
100.800	0.005130	957702.	-17897.5827	-0.0050504	3950.3548	-185.5228	260403.
108.000	-0.027243	826944.	-17553.0053	-0.0040176	3496.3345	281.2387	74329.2570
115.200	-0.052724	710146.	-15346.2440	-0.0031281	3090.7837	331.7506	45304.3429
122.400	-0.072287	610012.	-12859.5577	-0.0023641	2743.0986	358.9956	35757.2372
129.600	-0.086766	528032.	-10214.4104	-0.0017055	2458.4441	375.7675	31181.7878
136.800	-0.096846	465135.	-8641.4991	-0.0011307	2240.0527	61.1523	4546.3759
144.000	-0.103049	405060.	-8196.5979	-0.0006272	2031.4575	62.4314	4362.0652
151.200	-0.105877	347917.	-7745.0540	-0.0001914	1833.0450	62.9975	4284.0633
158.400	-0.105805	293779.	-7291.5224	0.0001799	1645.0661	62.9835	4286.0063
165.600	-0.103285	242686.	-6839.8552	0.0004904	1467.6591	62.4796	4355.4416
172.800	-0.098743	194650.	-6393.3484	0.0007435	1300.8665	61.5501	4488.0094
180.000	-0.092579	149658.	-5954.8978	0.0009427	1144.6460	60.2418	4685.0839
187.200	-0.085168	107677.	-5527.1058	0.0010917	998.8793	58.5894	4953.0906
194.400	-0.076859	68652.9304	-5112.3570	0.0011937	863.3782	56.6186	5303.9146
201.600	-0.067978	32512.2470	-4712.8767	0.0012523	737.8897	54.3481	5756.3421
208.800	-0.058827	-835.4133	-4330.7765	0.0012706	627.9007	51.7908	6338.8593
216.000	-0.049682	-31497.6111	-3968.0926	0.0012519	734.3667	48.9547	7094.6085
223.200	-0.040800	-59598.3737	-3626.8180	0.0011992	831.9388	45.8438	8090.1461
230.400	-0.032414	-85277.8940	-3308.9265	0.0011153	921.1038	42.4594	9431.3051
237.600	-0.024739	-108692.	-3016.3846	0.0010031	1002.4040	38.8023	11292.8782
244.800	-0.017970	-130014.	-1809.5052	0.0008649	1076.4368	296.4420	118775.
252.000	-0.012284	-135870.	19.0581	0.0007111	1096.7715	211.4923	123959.
259.200	-0.007731	-130661.	1279.6195	0.0005568	1078.6837	138.6637	129143.
266.400	-0.004266	-118165.	2065.3402	0.0004128	1035.2961	79.5921	134327.
273.600	-0.001786	-101455.	2476.4737	0.0002857	977.2743	34.6116	139511.
280.800	-0.000152	-82874.3591	2612.0588	0.0001790	912.7582	3.0509	144695.

288.000	0.000792	-64073.4024	2563.6880	9.4009E-05	847.4771	-16.4872	149879.
295.200	0.001202	-46079.0882	2411.1474	3.0264E-05	784.9968	-25.8852	155063.
302.400	0.001228	-29392.1012	2219.5836	-1.3412E-05	727.0559	-27.3270	160247.
309.600	0.001009	-14099.7022	2037.7640	-3.8581E-05	673.9573	-23.1784	165431.
316.800	0.000672	1.7015	1896.9730	-4.6739E-05	625.0059	-15.9302	170615.
324.000	0.000336	13277.2838	958.9041	-3.9055E-05	671.1017	-244.6445	5246404.
331.200	0.000110	13860.5361	-292.5689	-2.3350E-05	673.1269	-102.9869	6748920.
338.400	-4.97E-07	9094.5537	-661.6429	-1.0066E-05	656.5783	0.4663166	6748920.
345.600	-3.51E-05	4345.9242	-541.5973	-2.2877E-06	640.0900	32.8797	6748920.
352.800	-3.34E-05	1298.5175	-310.3851	9.7871E-07	629.5087	31.3459	6748920.
360.000	-2.10E-05	-124.8903	-126.7309	1.6579E-06	625.4336	19.6691	6748920.
367.200	-9.57E-06	-528.5565	-23.6376	1.2797E-06	626.8353	8.9679	6748920.
374.400	-2.56E-06	-466.9306	17.2700	7.0365E-07	626.6213	2.3953	6748920.
381.600	5.65E-07	-280.7800	23.9856	2.7095E-07	625.9749	-0.5299015	6748920.
388.800	1.35E-06	-121.8890	17.5351	3.7924E-08	625.4232	-1.2619	6748920.
396.000	1.11E-06	-28.3234	9.2418	-4.9004E-08	625.0983	-1.0418	6748920.
403.200	6.41E-07	11.2567	3.3298	-5.8881E-08	625.0391	-0.6004464	6748920.
410.400	2.64E-07	19.7013	0.2788472	-4.0965E-08	625.0684	-0.2470276	6748920.
417.600	5.07E-08	15.3252	-0.7814546	-2.0696E-08	625.0532	-0.0475007	6748920.
424.800	-3.45E-08	8.4752	-0.8361153	-6.9221E-09	625.0294	0.0323172	6748920.
432.000	-4.90E-08	3.2941	-0.5544139	-1.1119E-10	625.0114	0.0459332	6748920.
439.200	-3.61E-08	0.4917704	-0.2673094	2.0797E-09	625.0017	0.0338180	6748920.
446.400	-1.91E-08	-0.5578263	-0.0812631	2.0415E-09	625.0019	0.0178615	6748920.
453.600	-6.68E-09	-0.6810643	0.0055825	1.3245E-09	625.0024	0.0062623	6748920.
460.800	1.81E-11	-0.4791542	0.0281034	6.5312E-10	625.0017	-6.4926E-06	2585430.
468.000	2.72E-09	-0.2772214	0.0245586	2.1540E-10	625.0010	-0.0009782	2585430.
475.200	3.12E-09	-0.1257892	0.0170041	-1.7822E-11	625.0004	-0.0011203	2585430.
482.400	2.47E-09	-0.0323392	0.0097813	-1.0933E-10	625.0001	-0.0008860	2585430.

489.600	1.55E-09	0.0152039	0.0045938	-1.1925E-10	625.0001	-0.0005550	2585430.
496.800	7.50E-10	0.0339662	0.0010643	-9.0793E-11	625.0001	-0.0004255	4083142.
504.000	2.38E-10	0.0306468	-0.0009534	-5.3401E-11	625.0001	-0.0001350	4083142.
511.200	-1.87E-11	0.0203058	-0.0014012	-2.3915E-11	625.0001	1.0624E-05	4083142.
518.400	-1.06E-10	0.0105002	-0.0011459	-6.0875E-12	625.0000	6.0291E-05	4083142.
525.600	-1.06E-10	0.0038123	-0.0007117	2.1953E-12	625.0000	6.0336E-05	4083142.
532.800	-7.47E-11	0.0002494	-0.0003419	4.5458E-12	625.0000	4.2364E-05	4083142.
540.000	-4.09E-11	-0.0011176	-0.0001059	4.0433E-12	625.0000	2.3214E-05	4083142.
547.200	-1.65E-11	-0.0012804	1.1345E-05	2.6556E-12	625.0000	9.3453E-06	4083142.
554.400	-2.69E-12	-0.0009577	5.0488E-05	1.3604E-12	625.0000	1.5277E-06	4083142.
561.600	3.11E-12	-0.0005551	4.9637E-05	4.8492E-13	625.0000	-1.7640E-06	4083142.
568.800	4.29E-12	-0.0002436	3.4530E-05	2.2731E-14	625.0000	-2.4324E-06	4083142.
576.000	3.44E-12	-5.7912E-05	1.8755E-05	-1.5173E-13	625.0000	-1.9497E-06	4083142.
583.200	2.10E-12	2.6706E-05	7.4399E-06	-1.6979E-13	625.0000	-1.1933E-06	4083142.
590.400	9.93E-13	4.9443E-05	1.1169E-06	-1.2572E-13	625.0000	-5.6311E-07	4083142.
597.600	2.94E-13	4.2952E-05	-1.5101E-06	-7.2252E-14	625.0000	-1.6661E-07	4083142.
604.800	-4.75E-14	2.7792E-05	-2.0130E-06	-3.1313E-14	625.0000	2.6919E-08	4083142.
612.000	-1.57E-13	1.4006E-05	-1.5953E-06	-7.1246E-15	625.0000	8.9105E-08	4083142.
619.200	-1.50E-13	4.8287E-06	-9.6814E-07	3.7750E-15	625.0000	8.5101E-08	4083142.
626.400	-1.03E-13	5.9693E-08	-4.5198E-07	6.6039E-15	625.0000	5.8277E-08	4083142.
633.600	-5.50E-14	-1.6883E-06	-1.2996E-07	5.6614E-15	625.0000	3.1171E-08	4083142.
640.800	-2.12E-14	-1.8191E-06	2.5610E-08	3.6317E-15	625.0000	1.2044E-08	4083142.
648.000	-2.67E-15	-1.3242E-06	7.4419E-08	1.8126E-15	625.0000	1.5140E-09	4083142.
655.200	4.86E-15	-7.4985E-07	6.9940E-08	6.1231E-16	625.0000	-2.7580E-09	4083142.
662.400	6.15E-15	-3.1789E-07	4.7461E-08	-5.5980E-18	625.0000	-3.4863E-09	4083142.
669.600	4.78E-15	-6.6413E-08	2.5146E-08	-2.2799E-16	625.0000	-2.7123E-09	4083142.
676.800	2.86E-15	4.4504E-08	9.5331E-09	-2.4067E-16	625.0000	-1.6245E-09	4083142.
684.000	1.32E-15	7.1176E-08	9.9609E-10	-1.7373E-16	625.0000	-7.4693E-10	4083142.

```
 691.200  3.63E-16  5.9073E-08 -2.4336E-09 -9.8352E-17    625.0000 -2.0575E-10
4083142.
 698.400 -9.92E-17  3.6260E-08 -2.9718E-09 -4.3183E-17    625.0000  5.6247E-11
4083142.
 705.600 -2.59E-16  1.6335E-08 -2.2405E-09 -1.2746E-17    625.0000  1.4689E-10
4083142.
 712.800 -2.83E-16  4.0135E-09 -1.1345E-09 -9.6955E-19    625.0000  1.6033E-10
4083142.
 720.000 -2.73E-16      0.0000      0.0000  1.3531E-18    625.0000  1.5481E-10
2041571.
```

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 7:

```
Pile-head deflection             =     1.45307804 in
Computed slope at pile head      =    -0.02099084
Maximum bending moment           =       1358008. lbs-in
Maximum shear force              =    35000.00000 lbs
Depth of maximum bending moment  =    64.80000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             26
Number of zero deflection points =             11
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 8

```
Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head  =       40000.000 lbs
Specified moment at pile head       =           0.000 in-lbs
Specified axial load at pile head   =       90000.000 lbs
```

(Zero moment for this load indicates free-head conditions)

```
  Depth   Deflect.    Moment      Shear       Slope      Total       Soil Res.
Es*h
    X        y          M           V           S        Stress          p
F/L
    in       in        lbs-in        lbs         Rad.   lbs/in**2    lbs/in
lbs/in
-------- --------- ----------- ----------- ----------- ----------- ----------- -
----------
   0.000     1.887  5.8620E-07  40000.0000  -0.0262321    625.0000   -466.0344
888.8868
   7.200     1.699     292919.  36585.3682  -0.0260626   1642.0791   -482.4744
2045.1380
  14.400     1.512     560606.  33061.4257  -0.0255686   2571.5499   -496.3985
2363.5789
```

21.600	1.330	802140.	29446.9257	-0.0247800	3410.2092	-507.6293	2747.2738
28.800	1.155	1016757.	25761.9503	-0.0237274	4155.4062	-515.9750	3215.6017
36.000	0.988710	1203863.	22028.0367	-0.0224423	4805.0799	-521.2232	3795.6595
43.200	0.832142	1363046.	18268.3537	-0.0209568	5357.7984	-523.1332	4526.3435
50.400	0.686932	1494087.	14507.9491	-0.0193034	5812.8034	-521.4236	5465.2446
57.600	0.554173	1596978.	8161.8729	-0.0175146	6170.0612	-1241.3753	16128.3701
64.800	0.434722	1634317.	-1064.9238	-0.0156446	6299.7127	-1321.6238	21889.1549
72.000	0.328890	1601918.	-7593.0932	-0.0137718	6187.2158	-491.7566	10765.4448
79.200	0.236408	1542825.	-11056.2993	-0.0119519	5982.0311	-470.2450	14321.7158
86.400	0.156782	1458197.	-14317.7257	-0.0102152	5688.1845	-435.7067	20009.2046
93.600	0.089308	1349889.	-17248.9795	-0.0085902	5312.1134	-378.5304	30516.9236
100.800	0.033084	1220945.	-19674.8850	-0.0071024	4864.3914	-295.3322	64273.1002
108.000	-0.012967	1075775.	-19897.1708	-0.0057733	4360.3300	233.5862	129705.
115.200	-0.050052	941908.	-17877.3314	-0.0046057	3895.5127	327.4804	47108.2519
122.400	-0.079288	824310.	-15375.7480	-0.0035835	3487.1890	367.4039	33363.2396
129.600	-0.101655	725141.	-12645.6500	-0.0026869	3142.8513	390.9567	27690.5890
136.800	-0.117979	645695.	-11003.0792	-0.0018936	2866.9974	65.3130	3985.9056
144.000	-0.128922	569151.	-10525.7689	-0.0011905	2601.2184	67.2732	3757.0433
151.200	-0.135123	495667.	-10037.5793	-0.0005743	2346.0664	68.3350	3641.2209
158.400	-0.137193	425354.	-9544.3173	-4.1320E-05	2101.9238	68.6823	3604.5107
165.600	-0.135718	358282.	-9050.6940	0.0004122	1869.0364	68.4353	3630.5807
172.800	-0.131257	294490.	-8560.6885	0.0007899	1647.5344	67.6773	3712.3768
180.000	-0.124343	233985.	-8077.7674	0.0010958	1437.4473	66.4674	3848.7624
187.200	-0.115478	176750.	-7605.0286	0.0013335	1238.7151	64.8489	4043.2888
194.400	-0.105141	122744.	-7145.3014	0.0015068	1051.1953	62.8531	4304.1496
201.600	-0.093781	71904.8118	-6701.2210	0.0016194	874.6695	60.5026	4645.0794
208.800	-0.081821	24147.8985	-6275.2850	0.0016750	708.8469	57.8129	5087.3490
216.000	-0.069661	-20630.1029	-5869.9004	0.0016770	696.6323	54.7939	5663.4064

223.200	-0.057672	-62552.1159	-5487.4199	0.0016289	842.1948	51.4507	6423.3289
230.400	-0.046204	-101760.	-5130.1689	0.0015338	978.3334	47.7857	7446.4218
237.600	-0.035585	-138414.	-4800.4540	0.0013948	1105.6055	43.8018	8862.5678
244.800	-0.026119	-172694.	-3091.6410	0.0012148	1224.6328	430.8685	118775.
252.000	-0.018092	-184508.	-419.1911	0.0010081	1265.6541	311.4787	123959.
259.200	-0.011603	-180037.	1451.3235	0.0007971	1250.1287	208.1087	129143.
266.400	-0.006613	-164642.	2644.6994	0.0005976	1196.6749	123.3846	134327.
273.600	-0.002996	-142728.	3297.9042	0.0004198	1120.5831	58.0612	139511.
280.800	-0.000569	-117697.	3548.0797	0.0002691	1033.6686	11.4320	144695.
288.000	0.000878	-91984.2865	3523.4414	0.0001477	944.3899	-18.2760	149879.
295.200	0.001558	-67150.4469	3336.8357	5.5623E-05	858.1613	-33.5589	155063.
302.400	0.001679	-44005.9396	3081.5023	-8.7037E-06	777.7984	-37.3670	160247.
309.600	0.001433	-22765.5344	2828.4579	-4.7345E-05	704.0470	-32.9231	165431.
316.800	0.000997	-3214.7867	2624.8694	-6.2380E-05	636.1625	-23.6293	170615.
324.000	0.000535	15113.4291	1550.4071	-5.5494E-05	677.4772	-274.8325	3701192.
331.200	0.000198	19182.9949	-107.3171	-3.5646E-05	691.6076	-185.6465	6748920.
338.400	2.13E-05	13614.2608	-847.6234	-1.6666E-05	672.2717	-19.9942	6748920.
345.600	-4.19E-05	6998.8170	-778.0733	-4.7375E-06	649.3014	39.3137	6748920.
352.800	-4.69E-05	2416.1454	-478.3167	7.1096E-07	633.3894	43.9520	6748920.
360.000	-3.17E-05	110.1359	-213.1070	2.1729E-06	625.3824	29.7173	6748920.
367.200	-1.56E-05	-655.4116	-53.4846	1.8574E-06	627.2757	14.6222	6748920.
374.400	-4.96E-06	-662.4502	15.8839	1.0947E-06	627.3002	4.6468	6748920.
381.600	1.64E-07	-428.1027	32.0575	4.6361E-07	626.4865	-0.1541178	6748920.
388.800	1.72E-06	-201.4237	25.7030	9.9304E-08	625.6994	-1.6110	6748920.
396.000	1.59E-06	-58.1078	14.5232	-5.0887E-08	625.2018	-1.4945	6748920.
403.200	9.86E-07	7.7761	5.8161	-8.0014E-08	625.0270	-0.9241321	6748920.
410.400	4.42E-07	25.7471	0.9970086	-6.0615E-08	625.0894	-0.4144910	6748920.
417.600	1.13E-07	22.2115	-0.8766390	-3.2861E-08	625.0771	-0.1059666	6748920.

424.800	-3.10E-08	13.1660	-1.1535	-1.2388E-08	625.0457	0.0290579	6748920.
432.000	-6.53E-08	5.6170	-0.8284407	-1.5178E-09	625.0195	0.0612393	6748920.
439.200	-5.29E-08	1.2385	-0.4296190	2.4495E-09	625.0043	0.0495445	6748920.
446.400	-3.01E-08	-0.5726538	-0.1498255	2.8348E-09	625.0020	0.0281759	6748920.
453.600	-1.20E-08	-0.9227008	-0.0077830	1.9695E-09	625.0032	0.0112804	6748920.
460.800	-1.70E-09	-0.6872809	0.0350224	1.0378E-09	625.0024	0.0006100	2585430.
468.000	2.91E-09	-0.4197233	0.0334572	3.9714E-10	625.0015	-0.0010448	2585430.
475.200	4.02E-09	-0.2060114	0.0244993	3.5023E-11	625.0007	-0.0014435	2585430.
482.400	3.41E-09	-0.0669786	0.0148894	-1.2296E-10	625.0002	-0.0012259	2585430.
489.600	2.25E-09	0.0085556	0.0075684	-1.5677E-10	625.0000	-0.0008078	2585430.
496.800	1.16E-09	0.0422094	0.0022996	-1.2739E-10	625.0001	-0.0006558	4083142.
504.000	4.15E-10	0.0418351	-0.0009086	-7.8752E-11	625.0001	-0.0002354	4083142.
511.200	2.24E-11	0.0292270	-0.0018017	-3.7628E-11	625.0001	-1.2686E-05	4083142.
518.400	-1.27E-10	0.0159392	-0.0015886	-1.1490E-11	625.0001	7.1892E-05	4083142.
525.600	-1.43E-10	0.0063664	-0.0010376	1.4184E-12	625.0000	8.1144E-05	4083142.
532.800	-1.06E-10	0.0009954	-0.0005284	5.6787E-12	625.0000	6.0309E-05	4083142.
540.000	-6.13E-11	-0.0012500	-0.0001861	5.5314E-12	625.0000	3.4770E-05	4083142.
547.200	-2.67E-11	-0.0016920	-6.4526E-06	3.8288E-12	625.0000	1.5138E-05	4083142.
554.400	-6.18E-12	-0.0013479	6.0656E-05	2.0697E-12	625.0000	3.5028E-06	4083142.
561.600	3.11E-12	-0.0008212	6.6920E-05	8.1439E-13	625.0000	-1.7629E-06	4083142.
568.800	5.55E-12	-0.0003853	4.9241E-05	1.1619E-13	625.0000	-3.1477E-06	4083142.
576.000	4.78E-12	-0.0001123	2.8147E-05	-1.7176E-13	625.0000	-2.7117E-06	4083142.
583.200	3.08E-12	2.0245E-05	1.2103E-05	-2.2502E-13	625.0000	-1.7451E-06	4083142.
590.400	1.54E-12	6.2290E-05	2.6735E-06	-1.7726E-13	625.0000	-8.7412E-07	4083142.
597.600	5.25E-13	5.8973E-05	-1.5445E-06	-1.0708E-13	625.0000	-2.9753E-07	4083142.
604.800	-6.33E-16	4.0188E-05	-2.6143E-06	-4.9700E-14	625.0000	3.5898E-10	4083142.
612.000	-1.91E-13	2.1392E-05	-2.2230E-06	-1.4063E-14	625.0000	1.0833E-07	4083142.
619.200	-2.03E-13	8.1946E-06	-1.4183E-06	3.0584E-15	625.0000	1.1520E-07	4083142.

```
 626.400 -1.47E-13  9.6368E-07 -7.0353E-07  8.3583E-15    625.0000  8.3352E-08
4083142.
 633.600 -8.28E-14 -1.9470E-06 -2.3445E-07  7.7893E-15    625.0000  4.6947E-08
4083142.
 640.800 -3.48E-14 -2.4225E-06  5.6293E-09  5.2606E-15    625.0000  1.9743E-08
4083142.
 648.000 -7.03E-15 -1.8728E-06  9.1055E-08  2.7749E-15    625.0000  3.9869E-09
4083142.
 655.200  5.15E-15 -1.1149E-06  9.4902E-08  1.0459E-15    625.0000 -2.9183E-09
4083142.
 662.400  8.03E-15 -5.0753E-07  6.8000E-08  1.0703E-16    625.0000 -4.5546E-09
4083142.
 669.600  6.69E-15 -1.3586E-07  3.7951E-08 -2.6530E-16    625.0000 -3.7924E-09
4083142.
 676.800  4.21E-15  3.9311E-08  1.5701E-08 -3.2117E-16    625.0000 -2.3881E-09
4083142.
 684.000  2.06E-15  9.0655E-08  2.8938E-09 -2.4596E-16    625.0000 -1.1696E-09
4083142.
 691.200  6.69E-16  8.1301E-08 -2.6828E-09 -1.4645E-16    625.0000 -3.7948E-10
4083142.
 698.400 -4.65E-17  5.2213E-08 -3.9539E-09 -6.9184E-17    625.0000  2.6382E-11
4083142.
 705.600 -3.27E-16  2.4454E-08 -3.1912E-09 -2.4817E-17    625.0000  1.8550E-10
4083142.
 712.800 -4.04E-16  6.2926E-09 -1.6988E-09 -7.0237E-18    625.0000  2.2904E-10
4083142.
 720.000 -4.28E-16      0.0000      0.0000 -3.3822E-18    625.0000  2.4285E-10
2041571.

Output Verification:

Computed forces and moments are within specified convergence limits.


Output Summary for Load Case No.  8:

Pile-head deflection             =     1.88744377 in
Computed slope at pile head      =    -0.02623207
Maximum bending moment           =       1634317. lbs-in
Maximum shear force              =    40000.00000 lbs
Depth of maximum bending moment  =    64.80000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             33
Number of zero deflection points =             11



--------------------------------------------------------------------------------
             Computed Values of Load Distribution and Deflection
                 for Lateral Loading for Load Case Number  9
--------------------------------------------------------------------------------

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head  =       50000.000 lbs
Specified moment at pile head       =           0.000 in-lbs
Specified axial load at pile head   =       90000.000 lbs
```

(Zero moment for this load indicates free-head conditions)

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res. p lbs/in	Es*h F/L lbs/in
0.000	3.189	5.8620E-07	50000.0000	-0.0402788	625.0000	-531.3286	599.8028
7.200	2.899	372329.	46101.9559	-0.0400633	1917.8076	-551.4614	1369.6118
14.400	2.612	715790.	42067.9786	-0.0394336	3110.3826	-569.0878	1568.6302
21.600	2.331	1029213.	37916.7068	-0.0384237	4198.6577	-584.0432	1803.8635
28.800	2.059	1311588.	33668.0048	-0.0370691	5179.1248	-596.1518	2084.8450
36.000	1.797	1562074.	29343.0578	-0.0354061	6048.8689	-605.2224	2424.4265
43.200	1.549	1780014.	24964.5036	-0.0334720	6805.6052	-611.0427	2840.3001
50.400	1.315	1964943.	20556.6146	-0.0313048	7447.7183	-613.3709	3357.4192
57.600	1.098	2116601.	13879.5564	-0.0289428	7974.3076	-1241.3674	8138.8599
64.800	0.898600	2202318.	4523.8118	-0.0264434	8271.9388	-1357.4505	10876.5211
72.000	0.717384	2216014.	-2514.4259	-0.0238865	8319.4936	-597.6155	5997.9501
79.200	0.554634	2197068.	-6760.9571	-0.0213327	8253.7068	-581.9765	7554.9457
86.400	0.410193	2146304.	-10850.9301	-0.0188191	8077.4428	-554.1271	9726.4260
93.600	0.283638	2065204.	-14664.8906	-0.0163819	7795.8465	-505.3063	12826.9112
100.800	0.174294	1956360.	-18094.5971	-0.0140546	7417.9169	-447.3899	18481.4979
108.000	0.081252	1822856.	-21036.0640	-0.0118676	6954.3625	-369.6842	32758.9874
115.200	0.003400	1668821.	-22969.2763	-0.0098469	6419.5178	-167.3192	354280.
122.400	-0.060544	1504860.	-22335.2121	-0.0080103	5850.2099	343.4482	40843.3842
129.600	-0.111948	1357575.	-19656.9892	-0.0063538	5338.8037	400.5026	25758.5220
136.800	-0.152039	1230034.	-17959.3075	-0.0048564	4895.9526	71.0756	3365.8750
144.000	-0.181880	1105255.	-17431.8118	-0.0035049	4462.6919	75.4510	2986.8480
151.200	-0.202510	983559.	-16878.6601	-0.0022961	4040.1341	78.2023	2780.3907
158.400	-0.214944	865178.	-16309.9557	-0.0012262	3629.0914	79.7712	2672.1075

165.600	-0.220168	750284.	-15733.2950	-0.0002914	3230.1544	80.4123	2629.6723
172.800	-0.219139	638996.	-15154.7774	0.0005126	2843.7378	80.2870	2637.8942
180.000	-0.212786	531391.	-14579.5316	0.0011899	2470.1087	79.5035	2690.1454
187.200	-0.202004	427509.	-14012.0243	0.0017448	2109.4065	78.1374	2785.0353
194.400	-0.187660	327357.	-13456.2572	0.0021817	1761.6557	76.2424	2925.2066
201.600	-0.170588	230912.	-12915.9014	0.0025048	1426.7761	73.8565	3117.2550
208.800	-0.151592	138122.	-12394.3951	0.0027183	1104.5892	71.0064	3372.5208
216.000	-0.131444	48909.2763	-11895.0159	0.0028266	794.8239	67.7100	3708.8892
223.200	-0.110889	-36829.7432	-11420.9363	0.0028335	752.8811	63.9787	4154.1164
230.400	-0.090641	-119224.	-10975.2600	0.0027432	1038.9739	59.8202	4751.7619
237.600	-0.071387	-198429.	-10561.0320	0.0025594	1313.9886	55.2431	5571.7778
244.800	-0.053786	-274620.	-7818.6850	0.0022857	1578.5428	706.5199	94577.9935
252.000	-0.038473	-313980.	-3012.3391	0.0019450	1715.2083	628.5762	117634.
259.200	-0.025777	-320519.	915.0087	0.0015778	1737.9124	462.3538	129143.
266.400	-0.015752	-302849.	3637.4593	0.0012171	1676.5582	293.8825	134327.
273.600	-0.008251	-269717.	5270.9919	0.0008858	1561.5164	159.8765	139511.
280.800	-0.002997	-228094.	6063.4059	0.0005977	1416.9945	60.2384	144695.
288.000	0.000355	-183178.	6253.6347	0.0003597	1261.0356	-7.3971	149879.
295.200	0.002182	-138508.	6057.8571	0.0001735	1105.9312	-46.9856	155063.
302.400	0.002854	-96169.9714	5660.0561	3.7692E-05	958.9235	-63.5147	160247.
309.600	0.002724	-57052.2298	5206.0505	-5.0978E-05	823.0980	-62.5979	165431.
316.800	0.002120	-21136.7760	4799.8744	-9.6227E-05	698.3916	-50.2288	170615.
324.000	0.001339	12190.6707	3374.4297	-0.0001014	667.3287	-345.7281	1859352.
331.200	0.000659	27586.4304	1087.1147	-7.8385E-05	720.7862	-289.6372	3162288.
338.400	0.000210	27946.7086	-664.3124	-4.6248E-05	722.0372	-196.8703	6748920.
345.600	-6.51E-06	18080.2680	-1351.0822	-1.9612E-05	687.7787	6.1010	6748920.
352.800	-7.24E-05	8516.5417	-1084.8846	-4.2198E-06	654.5713	67.8428	6748920.
360.000	-6.73E-05	2463.3989	-613.6352	2.1343E-06	633.5535	63.0598	6748920.

367.200	-4.16E-05	-322.5716	-246.0955	3.3732E-06	626.1200	39.0346	6748920.
374.400	-1.87E-05	-1084.7482	-42.4666	2.5588E-06	628.7665	17.5290	6748920.
381.600	-4.80E-06	-937.4068	36.8261	1.3885E-06	628.2549	4.4967	6748920.
388.800	1.29E-06	-556.2525	48.6465	5.2415E-07	626.9314	-1.2133	6748920.
396.000	2.75E-06	-237.5768	34.9971	6.4762E-08	625.8249	-2.5782	6748920.
403.200	2.23E-06	-52.3781	18.2008	-1.0304E-07	625.1819	-2.0874	6748920.
410.400	1.27E-06	24.6484	6.4113	-1.1908E-07	625.0856	-1.1875	6748920.
417.600	5.12E-07	40.0986	0.4082827	-8.1614E-08	625.1392	-0.4800408	6748920.
424.800	9.16E-08	30.6335	-1.6289	-4.0681E-08	625.1064	-0.0858435	6748920.
432.000	-7.37E-08	16.6952	-1.6893	-1.3292E-08	625.0580	0.0690682	6748920.
439.200	-9.98E-08	6.3249	-1.1038	2.9827E-11	625.0220	0.0935696	6748920.
446.400	-7.33E-08	0.8004992	-0.5197487	4.1533E-09	625.0028	0.0686656	6748920.
453.600	-4.00E-08	-1.1649	-0.1375210	3.9425E-09	625.0040	0.0375088	6748920.
460.800	-1.65E-08	-1.1849	0.0188192	2.5826E-09	625.0041	0.0059191	2585430.
468.000	-2.83E-09	-0.8972206	0.0437810	1.3777E-09	625.0031	0.0010147	2585430.
475.200	3.36E-09	-0.5562514	0.0430970	5.3656E-10	625.0019	-0.0012048	2585430.
482.400	4.90E-09	-0.2773195	0.0324248	5.4169E-11	625.0010	-0.0017597	2585430.
489.600	4.14E-09	-0.0894039	0.0207443	-1.5806E-10	625.0003	-0.0014849	2585430.
496.800	2.62E-09	0.0216039	0.0100406	-1.9729E-10	625.0001	-0.0014884	4083142.
504.000	1.29E-09	0.0554369	0.0020404	-1.5271E-10	625.0002	-0.0007339	4083142.
511.200	4.26E-10	0.0511841	-0.0014704	-9.1006E-11	625.0002	-0.0002413	4083142.
518.400	-1.64E-11	0.0343816	-0.0023057	-4.1488E-11	625.0001	9.2994E-06	4083142.
525.600	-1.72E-10	0.0180354	-0.0019214	-1.1154E-11	625.0001	9.7461E-05	4083142.
532.800	-1.77E-10	0.0067280	-0.0012091	3.1762E-12	625.0000	0.0001004	4083142.
540.000	-1.26E-10	0.0006199	-0.0005902	7.4285E-12	625.0000	7.1523E-05	4083142.
547.200	-7.01E-11	-0.0017810	-0.0001897	6.7565E-12	625.0000	3.9727E-05	4083142.
554.400	-2.88E-11	-0.0021210	1.2134E-05	4.4984E-12	625.0000	1.6347E-05	4083142.
561.600	-5.28E-12	-0.0016121	8.1755E-05	2.3381E-12	625.0000	2.9916E-06	4083142.

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 568.800  4.84E-12  -0.0009468  8.2640E-05  8.5723E-13    625.0000 -2.7458E-06
4083142.
 576.000  7.07E-12  -0.0004232  5.8323E-05  6.4410E-14    625.0000 -4.0087E-06
4083142.
 583.200  5.77E-12  -0.0001070  3.2113E-05 -2.4243E-13    625.0000 -3.2718E-06
4083142.
 590.400  3.58E-12  3.9568E-05  1.3030E-05 -2.8147E-13    625.0000 -2.0290E-06
4083142.
 597.600  1.72E-12  8.0960E-05  2.2222E-06 -2.1172E-13    625.0000 -9.7322E-07
4083142.
 604.800  5.29E-13  7.1841E-05 -2.3615E-06 -1.2330E-13    625.0000 -3.0002E-07
4083142.
 612.000 -5.93E-14  4.7114E-05 -3.3204E-06 -5.4457E-14    625.0000  3.3658E-08
4083142.
 619.200 -2.55E-13  2.4097E-05 -2.6784E-06 -1.3246E-14    625.0000  1.4468E-07
4083142.
 626.400 -2.50E-13  8.5625E-06 -1.6470E-06  5.6541E-15    625.0000  1.4183E-07
4083142.
 633.600 -1.74E-13  3.7369E-07 -7.8173E-07  1.0825E-14    625.0000  9.8511E-08
4083142.
 640.800 -9.42E-14 -2.7085E-06 -2.3476E-07  9.4743E-15    625.0000  5.3426E-08
4083142.
 648.000 -3.73E-14 -3.0191E-06  3.3681E-08  6.1597E-15    625.0000  2.1141E-08
4083142.
 655.200 -5.51E-15 -2.2315E-06  1.2104E-07  3.1211E-15    625.0000  3.1245E-09
4083142.
 662.400  7.66E-15 -1.2802E-06  1.1664E-07  1.0888E-15    625.0000 -4.3465E-09
4083142.
 669.600  1.02E-14 -5.5333E-07  8.0229E-08  2.7741E-17    625.0000 -5.7672E-09
4083142.
 676.800  8.06E-15 -1.2497E-07  4.3004E-08 -3.6479E-16    625.0000 -4.5730E-09
4083142.
 684.000  4.92E-15  6.6409E-08  1.6504E-08 -3.9868E-16    625.0000 -2.7882E-09
4083142.
 691.200  2.32E-15  1.1320E-07  1.7240E-09 -2.9474E-16    625.0000 -1.3173E-09
4083142.
 698.400  6.72E-16  9.1616E-08 -4.3907E-09 -1.7622E-16    625.0000 -3.8126E-10
4083142.
 705.600 -2.15E-16  5.0200E-08 -5.3249E-09 -9.4148E-17    625.0000  1.2178E-10
4083142.
 712.800 -6.83E-16  1.5060E-08 -3.4912E-09 -5.6382E-17    625.0000  3.8758E-10
4083142.
 720.000 -1.03E-15      0.0000      0.0000 -4.7666E-17    625.0000  5.8220E-10
2041571.

Output Verification:

Computed forces and moments are within specified convergence limits.


Output Summary for Load Case No.  9:

Pile-head deflection             =     3.18901986 in
Computed slope at pile head      =    -0.04027875
Maximum bending moment           =       2216014. lbs-in
Maximum shear force              =    50000.00000 lbs
Depth of maximum bending moment  =    72.00000000 in
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Depth of maximum shear force     =        0.00000 in
Number of iterations             =             39
Number of zero deflection points =             11



-------------------------------------------------------------------------------
             Computed Values of Load Distribution and Deflection
                 for Lateral Loading for Load Case Number 10
-------------------------------------------------------------------------------

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head  =       60000.000 lbs
Specified moment at pile head       =           0.000 in-lbs
Specified axial load at pile head   =       90000.000 lbs

(Zero moment for this load indicates free-head conditions)

  Depth   Deflect.    Moment      Shear       Slope      Total       Soil Res.
Es*h
    X        y          M           V           S        Stress          p
F/L
    in       in        lbs-in        lbs         Rad.   lbs/in**2    lbs/in
lbs/in
-------- --------- ----------- ----------- ----------- ----------- ----------- -
----------
   0.000     5.118 -2.1316E-07  60000.0000  -0.0587977    625.0000   -538.3113
378.6320
   7.200     4.695     456148.  56002.2101  -0.0585337   2208.8468   -572.1859
877.4973
  14.400     4.275     882292.  51760.5227  -0.0577591   3688.5122   -606.0606
1020.6545
  21.600     3.863    1276355.  47274.9376  -0.0565099   5056.7890   -639.9353
1192.6909
  28.800     3.462    1636287.  42545.4549  -0.0548244   6306.5537   -673.8100
1401.5045
  36.000     3.074    1960062.  37628.1777  -0.0527431   7430.7714   -692.1004
1621.2285
  43.200     2.702    2246488.  32608.5516  -0.0503088   8425.3068   -702.2402
1871.1943
  50.400     2.349    2494826.  27527.8238  -0.0475650   9287.5886   -709.0730
2173.1967
  57.600     2.017    2704533.  20506.2511  -0.0445561  10015.7404  -1241.3638
4430.9121
  64.800     1.708    2847860.  11150.5364  -0.0413429  10513.4036  -1357.4458
5723.5402
  72.000     1.422    2918681.   3711.0551  -0.0380058  10759.3103   -709.0768
3590.7336
  79.200     1.160    2950555.  -1361.3294  -0.0346092  10869.9824   -699.9189
4343.0779
  86.400  0.923440    2943932.  -6324.5506  -0.0311981  10846.9854   -678.7537
5292.1955
  93.600  0.711081    2899914. -11057.0461  -0.0278162  10694.1462   -635.8284
6438.0397
 100.800  0.522887    2820760. -15465.6826  -0.0245056  10419.3061   -588.7928
8107.5086
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108.000	0.358199	2708968.	-19513.7267	-0.0213056	10031.1375	-535.6639	10767.1378
115.200	0.216086	2567375.	-23141.6194	-0.0182521	9539.4949	-472.0841	15729.8417
122.400	0.095368	2399383.	-26226.3461	-0.0153779	8956.1912	-384.7845	29049.9446
129.600	-0.005355	2209645.	-26937.4726	-0.0127106	8297.3779	187.2494	251780.
136.800	-0.087664	2027956.	-26050.4088	-0.0102583	7666.5152	59.1573	4858.6869
144.000	-0.153074	1847814.	-25580.9903	-0.0080154	7041.0197	71.2367	3350.7003
151.200	-0.203085	1669978.	-25042.7430	-0.0059796	6423.5348	78.2764	2775.1414
158.400	-0.239180	1494948.	-24463.3595	-0.0041480	5815.7907	82.6635	2488.4056
165.600	-0.262817	1323082.	-23858.6856	-0.0025172	5219.0330	85.3015	2336.8768
172.800	-0.275428	1154645.	-23239.6793	-0.0010834	4634.1840	86.6447	2264.9884
180.000	-0.278417	989834.	-22614.7130	0.0001577	4061.9242	86.9570	2248.7481
187.200	-0.273158	828789.	-21990.6060	0.0012101	3502.7389	86.4060	2277.5218
194.400	-0.260992	671601.	-21373.1708	0.0020784	2956.9485	85.1037	2347.7603
201.600	-0.243229	518322.	-20767.5382	0.0027670	2424.7277	83.1275	2460.7148
208.800	-0.221147	368963.	-20178.3649	0.0032805	1906.1201	80.5317	2621.9082
216.000	-0.195991	223502.	-19609.9750	0.0036233	1401.0474	77.3544	2841.7230
223.200	-0.168972	81883.1212	-19066.4580	0.0038001	909.3164	73.6226	3137.1100
230.400	-0.141270	-55980.2189	-18551.7318	0.0038150	819.3758	69.3569	3534.8600
237.600	-0.114035	-190206.	-18069.5655	0.0036726	1285.4379	64.5782	4077.3708
244.800	-0.088385	-320942.	-14396.9142	0.0033768	1739.3806	955.6027	77845.1119
252.000	-0.065410	-401898.	-7832.1486	0.0029585	2020.4791	867.9432	95539.4962
259.200	-0.045783	-437559.	-1973.6643	0.0024727	2144.3011	759.4135	119428.
266.400	-0.029803	-433523.	2761.9051	0.0019686	2130.2893	556.0224	134327.
273.600	-0.017436	-400339.	5979.8294	0.0014860	2015.0644	337.8454	139511.
280.800	-0.008405	-349340.	7804.1294	0.0010522	1837.9848	168.9045	144695.
288.000	-0.002285	-289323.	8583.3980	0.0006826	1629.5927	47.5590	149879.
295.200	0.001424	-226623.	8644.1824	0.0003840	1411.8865	-30.6744	155063.
302.400	0.003245	-165344.	8273.7741	0.0001572	1199.1115	-72.2168	160247.

309.600	0.003687	-107685.	7708.7946	-8.4767E-07	998.9050	-84.7220	165431.
316.800	0.003233	-54336.3695	7128.0356	-9.4610E-05	813.6679	-76.6000	170615.
324.000	0.002325	-4918.3011	5423.4958	-0.0001289	642.0774	-396.8833	1229083.
331.200	0.001376	23929.0255	2741.4424	-0.0001179	708.0869	-348.1315	1821124.
338.400	0.000627	34711.2662	458.4613	-8.3964E-05	745.5252	-286.0299	3283483.
345.600	0.000167	30639.6852	-1135.7777	-4.6145E-05	731.3878	-156.8143	6748920.
352.800	-3.73E-05	18415.8716	-1574.4994	-1.7756E-05	688.9440	34.9472	6748920.
360.000	-8.84E-05	7989.9066	-1150.4022	-2.4752E-06	652.7427	82.8576	6748920.
367.200	-7.29E-05	1853.2881	-606.0298	3.2211E-06	631.4350	68.3569	6748920.
374.400	-4.20E-05	-741.0970	-218.1778	3.8647E-06	627.5733	39.3797	6748920.
381.600	-1.73E-05	-1293.4805	-18.1215	2.6873E-06	629.4913	16.1915	6748920.
388.800	-3.31E-06	-1005.5291	51.3524	1.3569E-06	628.4914	3.1069	6748920.
396.000	2.27E-06	-555.7641	54.8932	4.5334E-07	626.9297	-2.1233	6748920.
403.200	3.21E-06	-215.6540	36.4053	6.9164E-09	625.7488	-3.0122	6748920.
410.400	2.36E-06	-31.5366	17.5813	-1.3613E-07	625.1095	-2.2167	6748920.
417.600	1.25E-06	37.6931	5.3723	-1.3257E-07	625.1309	-1.1747	6748920.
424.800	4.56E-07	45.9965	-0.3947547	-8.4139E-08	625.1597	-0.4272341	6748920.
432.000	4.16E-08	32.1177	-2.0733	-3.8934E-08	625.1115	-0.0390295	6748920.
439.200	-1.05E-07	16.1914	-1.8599	-1.0978E-08	625.0562	0.0982959	6748920.
446.400	-1.16E-07	5.3487	-1.1132	1.4876E-09	625.0186	0.1091461	6748920.
453.600	-8.34E-08	0.1600767	-0.4386483	4.6755E-09	625.0006	0.0782165	6748920.
460.800	-4.91E-08	-0.9739097	-0.0935794	4.2046E-09	625.0034	0.0176360	2585430.
468.000	-2.29E-08	-1.1929	-0.0004888	2.9506E-09	625.0041	0.0082225	2585430.
475.200	-6.62E-09	-0.9847725	0.0376756	1.6904E-09	625.0034	0.0023787	2585430.
482.400	1.44E-09	-0.6525778	0.0443733	7.4285E-10	625.0023	-0.0005183	2585430.
489.600	4.07E-09	-0.3467598	0.0372428	1.6453E-10	625.0012	-0.0014624	2585430.
496.800	3.81E-09	-0.1164951	0.0241946	-1.0356E-10	625.0004	-0.0021621	4083142.
504.000	2.58E-09	0.0017761	0.0111410	-1.6995E-10	625.0000	-0.0014639	4083142.

511.200	1.37E-09	0.0441556	0.0030837	-1.4337E-10	625.0002	-0.0007742	4083142.
518.400	5.17E-10	0.0463668	-0.0007589	-9.0981E-11	625.0002	-0.0002932	4083142.
525.600	5.51E-11	0.0333456	-0.0019267	-4.4851E-11	625.0001	-3.1236E-05	4083142.
532.800	-1.29E-10	0.0186802	-0.0017760	-1.4744E-11	625.0001	7.3104E-05	4083142.
540.000	-1.57E-10	0.0077904	-0.0011918	5.7500E-13	625.0000	8.9164E-05	4083142.
547.200	-1.21E-10	0.0015170	-0.0006246	5.9612E-12	625.0000	6.8408E-05	4083142.
554.400	-7.14E-11	-0.0012113	-0.0002326	6.1381E-12	625.0000	4.0483E-05	4083142.
561.600	-3.22E-11	-0.0018400	-2.1011E-05	4.3723E-12	625.0000	1.8283E-05	4083142.
568.800	-8.42E-12	-0.0015195	6.2006E-05	2.4282E-12	625.0000	4.7777E-06	4083142.
576.000	2.73E-12	-0.0009502	7.3639E-05	9.9891E-13	625.0000	-1.5463E-06	4083142.
583.200	5.96E-12	-0.0004604	5.5905E-05	1.8257E-13	625.0000	-3.3797E-06	4083142.
590.400	5.36E-12	-0.0001454	3.2804E-05	-1.6803E-13	625.0000	-3.0372E-06	4083142.
597.600	3.54E-12	1.2198E-05	1.4643E-05	-2.4513E-13	625.0000	-2.0075E-06	4083142.
604.800	1.83E-12	6.5750E-05	3.6888E-06	-2.0002E-13	625.0000	-1.0354E-06	4083142.
612.000	6.60E-13	6.5576E-05	-1.3852E-06	-1.2403E-13	625.0000	-3.7405E-07	4083142.
619.200	3.98E-14	4.5963E-05	-2.8131E-06	-5.9477E-14	625.0000	-2.2589E-08	4083142.
626.400	-1.97E-13	2.5144E-05	-2.4925E-06	-1.8327E-14	625.0000	1.1166E-07	4083142.
633.600	-2.24E-13	1.0095E-05	-1.6331E-06	2.0662E-15	625.0000	1.2707E-07	4083142.
640.800	-1.67E-13	1.6255E-06	-8.3438E-07	8.8489E-15	625.0000	9.4784E-08	4083142.
648.000	-9.67E-14	-1.9315E-06	-2.9584E-07	8.6718E-15	625.0000	5.4811E-08	4083142.
655.200	-4.23E-14	-2.6457E-06	-1.2233E-08	6.0230E-15	625.0000	2.3967E-08	4083142.
662.400	-9.92E-15	-2.1155E-06	9.4302E-08	3.2676E-15	625.0000	5.6261E-09	4083142.
669.600	4.79E-15	-1.2920E-06	1.0477E-07	1.2957E-15	625.0000	-2.7173E-09	4083142.
676.800	8.74E-15	-6.0844E-07	7.7154E-08	1.9587E-16	625.0000	-4.9547E-09	4083142.
684.000	7.61E-15	-1.8126E-07	4.3776E-08	-2.6113E-16	625.0000	-4.3168E-09	4083142.
691.200	4.98E-15	2.2280E-08	1.8076E-08	-3.5313E-16	625.0000	-2.8223E-09	4083142.
698.400	2.53E-15	7.9493E-08	2.7566E-09	-2.9423E-16	625.0000	-1.4330E-09	4083142.
705.600	7.40E-16	6.2356E-08	-3.9126E-09	-2.1214E-16	625.0000	-4.1949E-10	4083142.

```
 712.800 -5.28E-16  2.3427E-08 -4.3449E-09 -1.6250E-16    625.0000  2.9938E-10
4083142.
 720.000 -1.60E-15      0.0000      0.0000 -1.4894E-16    625.0000  9.0754E-10
2041571.
```

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 10:

```
Pile-head deflection             =     5.11821659 in
Computed slope at pile head      =    -0.05879768
Maximum bending moment           =       2950555. lbs-in
Maximum shear force              =    60000.00000 lbs
Depth of maximum bending moment  =    79.20000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             50
Number of zero deflection points =             11
```

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

```
Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad
```

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
1	V= 5000.000	M= 0.000	90000.0000	0.0227396	82956.2380	5000.0000
1	V= 10000.	M= 0.000	90000.0000	0.1105219	221406.	10000.0000
1	V= 15000.	M= 0.000	90000.0000	0.2618859	400324.	15000.0000
1	V= 20000.	M= 0.000	90000.0000	0.4811749	611220.	20000.0000
1	V= 25000.	M= 0.000	90000.0000	0.7612635	841803.	25000.0000
1	V= 30000.	M= 0.000	90000.0000	1.0918	1091494.	30000.0000
1	V= 35000.	M= 0.000	90000.0000	1.4531	1358008.	35000.0000
1	V= 40000.	M= 0.000	90000.0000	1.8874	1634317.	40000.0000
1	V= 50000.	M= 0.000	90000.0000	3.1890	2216014.	50000.0000
1	V= 60000.	M= 0.000	90000.0000	5.1182	2950555.	60000.0000

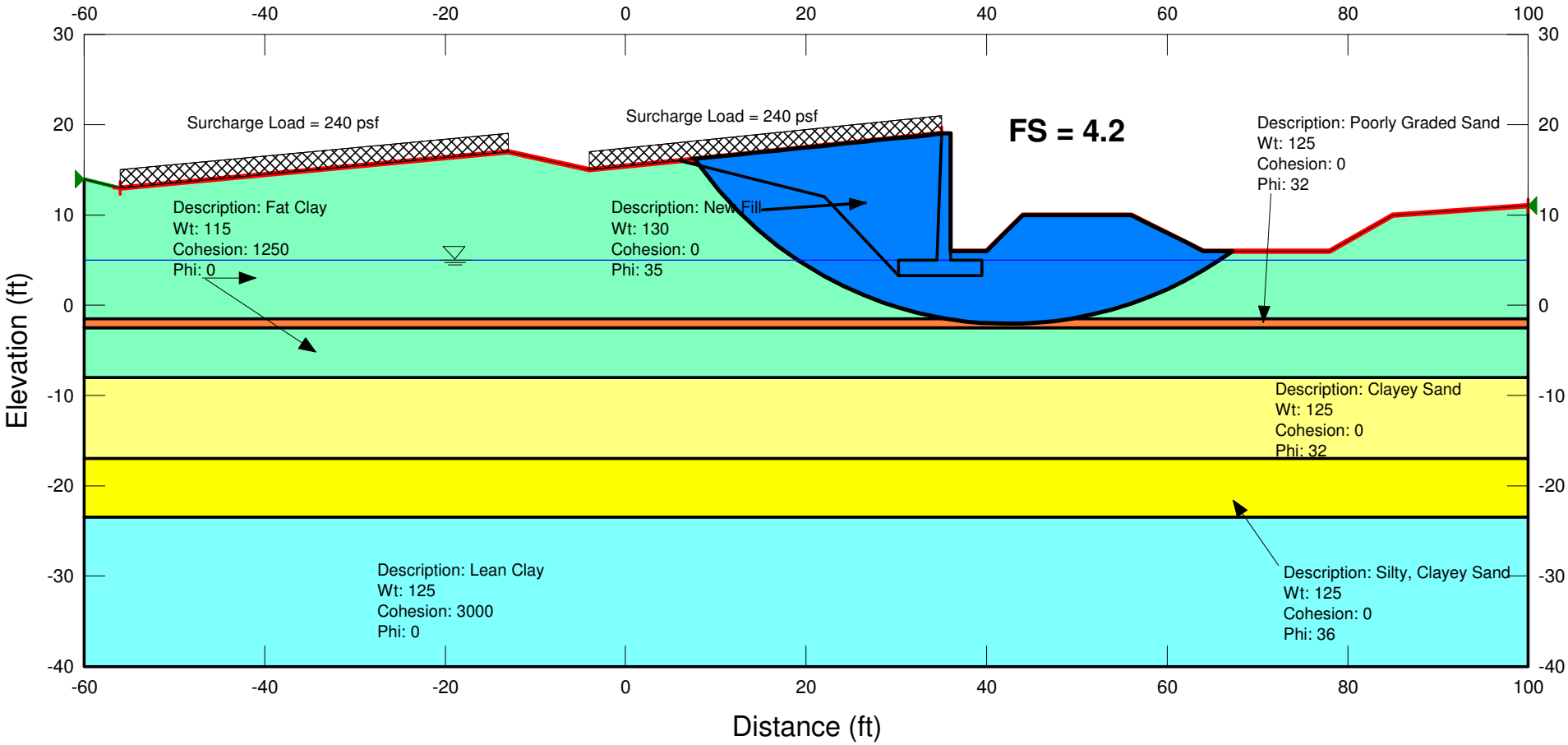
Pile-head Deflection vs. Pile Length

Boundary Condition Type 1, Shear and Moment

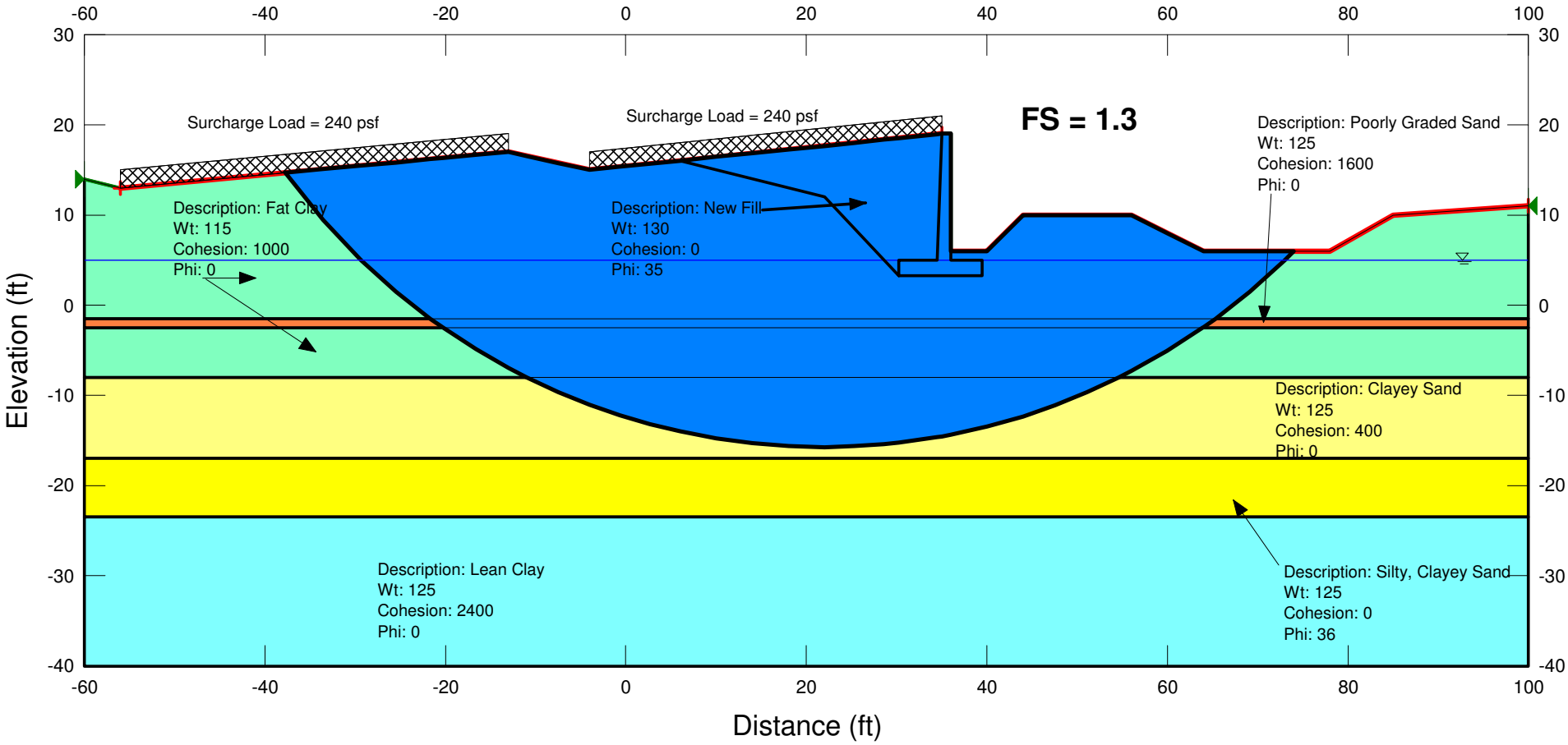
```
Shear      =          5000. lbs
Moment     =             0. in-lbs
Axial Load =         90000. lbs
```

Pile Length in	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
720.000	0.02273959	82956.23803	5000.00000
684.000	0.02313520	82716.27575	5000.00000
648.000	0.02268183	83316.75953	5000.00000
612.000	0.02307059	82332.05266	5000.00000
576.000	0.02274727	83235.58380	5000.00000
540.000	0.02307483	82800.20489	5000.00000
504.000	0.02286658	82939.84734	5000.00000
468.000	0.02279095	83219.69882	5000.00000
432.000	0.02280170	83169.36937	5000.00000
396.000	0.02290035	82860.90474	5000.00000

This analysis ended normally.



URS 100 W. San Fernando Street, Suite 200 San Jose, CA 95113 PHONE: (408) 297-9585 FAX: (408) 297-6962	PROJECT No 28645045	CALCULATED BY S. Manoharan	**U.S. 101 MSN B4** **Petaluma, CA** SLOPE STABILITY ANALYSIS STATIC CONDITION **RW 293 (R6-Sta.# 296+60)**	**FIGURE** **H1**
	Date February 4, 2010	CHECKED BY Stephen Huang		



URS
100 W. San Fernando Street, Suite 200
San Jose, CA 95113
PHONE: (408) 297-9585
FAX: (408) 297-6962

PROJECT No 28645045	CALCULATED BY S. Manoharan	U.S. 101 MSN B4	FIGURE
Date February 4, 2010	CHECKED BY Stephen Huang	Petaluma, CA SLOPE STABILITY ANALYSIS PSEUDO STATIC RW 293 (R6-Sta.# 296+60)	H2

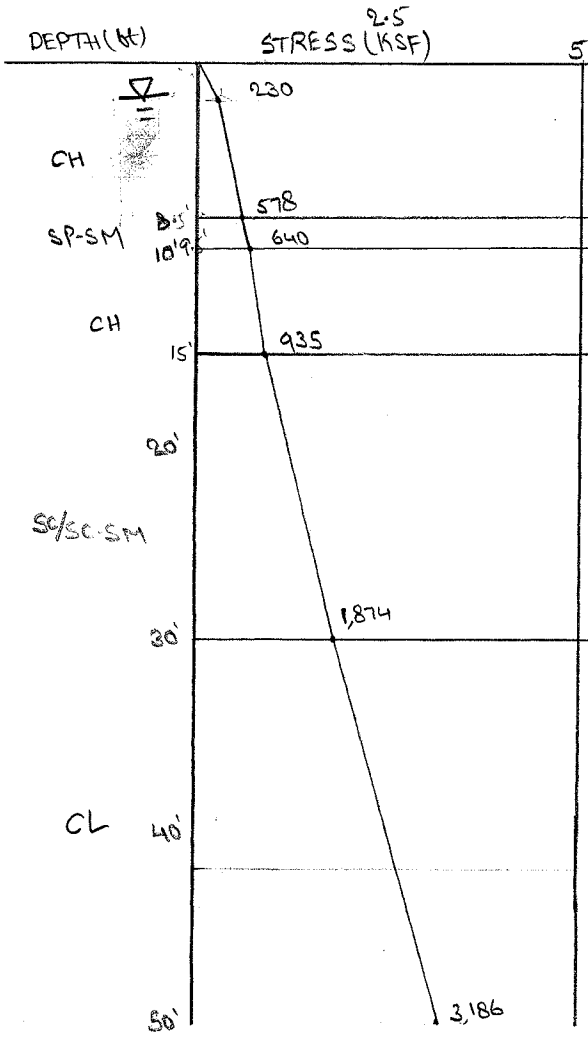
URS

Job 101 MSN - B4 - RETAINING WALL 993 | Project No. 28645045 | Page ____ of ____

Description CONSOLIDATION SETTLEMENT | Computed by MT | Sheet ____ of ____ | Date 02/04/09

Checked by SSH | Date 2/6/09

Reference



	γ' (PCF)	C_{CE}	$C_{\delta E}$	P_p (KSF)	E $\times 10^6$ (PSF)	μ	C_α	A	T_{ZERO}	
CH	115 53.6	0.16*	0.04*	10.0	0.1	0.5	–	1	–	$\frac{S_u}{\sigma_v}$ = 3 to 7
SP-SM	62.6	–	–		0.3	0.3	–	1	–	
CH	53.6	0.16	0.04	10.0	0.1	0.5	–	1	–	
SC/SC-SM	62.6	–	–	6.5	0.25	0.3	–	1	–	
CL	65.6	0.14	0.03	6.5	1.8	0.5	–	1	–	$\frac{S_u}{\sigma_v}$ = 0.5 to 1.2

$\frac{S_u}{\sigma_v} = m \cdot OCR^{\alpha}$ $\alpha = 0.8$ $m = 0.23$ $\left(\frac{S_u}{\sigma_v}\right)_{NC} = 0.23$) $3 = 0.23\,(OCR)^{0.8}$ $OCR \cong 25$ $P_p \cong 10{,}000$ PSF

$0.5 = 0.23(OCR)^{0.8}$ $OCR = 2.6$ $P_p \cong 6{,}500$ PSF

$E_s = 10(N+15)$ SP-SM @ 8.5'-9.5' $E_s = 10(18+15) = 330$ KSF

SC/SC-SM @ 15'-30.5' $E_s = 10(10+15) = 250$ KSF

* C_{CE} FROM R-09-014 (65') CON

```
6
7,5,115,.16,.04,10000,.1,.5,0,1,10
5,-1.5,53.6,.16,.04,10000,.1,.5,0,1,10
-1.5,-2.5,62.6,.000001,.0000001,6800,.3,.3,0,1,10
-2.5,-8,53.6,.16,.04,10000,.1,.5,0,1,10
-8,-23,62.6,0.000001,0.000001,7500,0.25,0.3,0,1,10
-23,-43,65.6,0.14,0.03,6500,1.8,0.5,0,1,10
20
0
4
25.5,50,0,7,17,100,455
17,50,0,10.5,34,100,650
22,50,0,15.5,24,100,260
29,50,0,17,10,100,260
```

SETTLEMENT POINT : .0, .0

SOIL LAYER	INITIAL STRESS (PSF)	VERTICAL STRESS INCREASE (PSF)	HORIZ. X STRESS INCREASE (PSF)	HORIZ. Y STRESS INCREASE (PSF)	SKEMPTON BJERRUM FACTOR	CONSOL. COMP. (IN.)	SECOND. COMP. 20. YR (IN.)	ELASTIC COMP. (IN.)	TOTAL COMP. (IN.)
1	115.0	173.8	178.1	171.7	1.000	.384	.000	.000	.384
2	404.2	182.9	169.0	168.1	1.000	.506	.000	.011	.517
3	609.7	190.9	154.8	162.0	1.000	.000	.000	.004	.004
4	788.4	197.1	139.4	154.8	1.000	.256	.000	.033	.289
5	1405.3	205.2	89.8	126.9	1.000	.000	.000	.101	.101
6	2530.8	185.1	38.7	82.6	1.000	.221	.000	.017	.237
						1.366	.000	.165	1.532

SETTLEMENT POINT : 34.0, .0

SOIL LAYER	INITIAL STRESS (PSF)	VERTICAL STRESS INCREASE (PSF)	HORIZ. X STRESS INCREASE (PSF)	HORIZ. Y STRESS INCREASE (PSF)	SKEMPTON BJERRUM FACTOR	CONSOL. COMP. (IN.)	SECOND. COMP. 20. YR (IN.)	ELASTIC COMP. (IN.)	TOTAL COMP. (IN.)
1	115.0	390.8	285.8	333.8	1.000	.618	.000	.019	.637
2	404.2	378.2	213.7	287.8	1.000	.895	.000	.099	.994
3	609.7	363.6	163.2	252.1	1.000	.000	.000	.010	.010
4	788.4	348.7	129.2	225.1	1.000	.420	.000	.113	.533
5	1405.3	297.1	64.8	159.6	1.000	.000	.000	.165	.165
6	2530.8	222.7	23.9	93.2	1.000	.264	.000	.022	.286
						2.196	.000	.429	2.625

SETTLEMENT POINT : 17.0, .0

SOIL LAYER	INITIAL STRESS (PSF)	VERTICAL STRESS INCREASE (PSF)	HORIZ. X STRESS INCREASE (PSF)	HORIZ. Y STRESS INCREASE (PSF)	SKEMPTON BJERRUM FACTOR	CONSOL. COMP. (IN.)	SECOND. COMP. 20. YR (IN.)	ELASTIC COMP. (IN.)	TOTAL COMP. (IN.)

1	115.0	561.9	376.0	464.4	1.000	.739	.000	.034	.773
2	404.2	538.4	245.5	383.6	1.000	1.147	.000	.175	1.322
3	609.7	506.2	164.7	323.9	1.000	.000	.000	.014	.014
4	788.4	473.4	116.7	280.8	1.000	.539	.000	.181	.720
5	1405.3	371.4	43.3	185.6	1.000	.000	.000	.218	.218
6	2530.8	252.9	11.8	101.6	1.000	.298	.000	.026	.324
						2.723	.000	.648	3.372

SETTLEMENT POINT : 17.0, 50.0

SOIL LAYER	INITIAL STRESS (PSF)	VERTICAL STRESS INCREASE (PSF)	HORIZ. X STRESS INCREASE (PSF)	HORIZ. Y STRESS INCREASE (PSF)	SKEMPTON BJERRUM FACTOR	CONSOL. COMP. (IN.)	SECOND. COMP. 20. YR (IN.)	ELASTIC COMP. (IN.)	TOTAL COMP. (IN.)
1	115.0	1123.4	751.4	903.2	1.000	.991	.000	.071	1.062
2	404.2	1075.5	490.0	721.8	1.000	1.758	.000	.366	2.125
3	609.7	1009.6	328.1	587.0	1.000	.000	.000	.029	.029
4	788.4	941.8	231.7	489.5	1.000	.901	.000	.384	1.285
5	1405.3	726.8	84.5	277.3	1.000	.000	.000	.445	.445
6	2530.8	465.5	21.7	110.7	1.000	.528	.000	.053	.581
						4.178	.000	1.349	5.527

SETTLEMENT POINT : 34.0, 50.0

SOIL LAYER	INITIAL STRESS (PSF)	VERTICAL STRESS INCREASE (PSF)	HORIZ. X STRESS INCREASE (PSF)	HORIZ. Y STRESS INCREASE (PSF)	SKEMPTON BJERRUM FACTOR	CONSOL. COMP. (IN.)	SECOND. COMP. 20. YR (IN.)	ELASTIC COMP. (IN.)	TOTAL COMP. (IN.)
1	115.0	781.2	570.3	644.1	1.000	.856	.000	.042	.898
2	404.2	755.1	425.1	533.7	1.000	1.428	.000	.215	1.643
3	609.7	724.6	323.3	448.1	1.000	.000	.000	.020	.020
4	788.4	692.7	254.8	383.5	1.000	.723	.000	.247	.969
5	1405.3	579.4	124.7	232.0	1.000	.000	.000	.340	.340
6	2530.8	407.6	43.0	99.1	1.000	.467	.000	.045	.512
						3.474	.000	.908	4.382

SETTLEMENT POINT : .0, 17.0

SOIL LAYER	INITIAL STRESS (PSF)	VERTICAL STRESS INCREASE (PSF)	HORIZ. X STRESS INCREASE (PSF)	HORIZ. Y STRESS INCREASE (PSF)	SKEMPTON BJERRUM FACTOR	CONSOL. COMP. (IN.)	SECOND. COMP. 20. YR (IN.)	ELASTIC COMP. (IN.)	TOTAL COMP. (IN.)
1	115.0	344.8	337.8	286.4	1.000	.578	.000	.008	.586
2	404.2	354.8	308.2	243.3	1.000	.854	.000	.062	.915
3	609.7	359.1	273.7	211.9	1.000	.000	.000	.009	.009
4	788.4	359.5	240.5	189.2	1.000	.431	.000	.095	.526
5	1405.3	341.3	144.4	134.9	1.000	.000	.000	.185	.185
6	2530.8	273.5	56.4	77.3	1.000	.321	.000	.028	.348
						---	---	---	---
						2.183	.000	.387	2.570

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	6-8-09	6-8-09	2278777.0 ft / 5953668.1 ft	A-09-101
DRILLING CONTRACTOR: WDC Exploration & Wells			BOREHOLE LOCATION (Offset, Station, Line): ' Lt Sta	SURFACE ELEVATION: 7 ft
DRILLING METHOD: Hollow-Stem Auger			DRILL RIG: CME 75 Crawler	BOREHOLE DIAMETER: 8-inch
SAMPLER TYPE(S) AND SIZE(S) (ID): Modified CA (1.96"), SPT (1.44")			SPT HAMMER TYPE: Auto Hammer 140lb/30in	HAMMER EFFICIENCY, ERi
BOREHOLE BACKFILL AND COMPLETION: Cement			GROUNDWATER READINGS: DURING DRILLING 10 ft; AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 51.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	Fat CLAY (CH); stiff; dark brown; moist.												
	1													
5.00	2		X	1	3 3 3	6	50		34	86	UC = 0.63			γ_m = 115 c = 1260 $\frac{S_u}{\sigma'_v}$ = 7
	3													
3.00	4		X	2	0 0 1	1	60							Weight of rods for first 12 inches; no liners in sampler
	5	At EL. 2.5 ft, becomes brown; trace fine GRAVEL.	X	3	1 5 6	11	65		32	88	UC = 0.66			γ_m = 116 c = 1320 $\frac{S_u}{\sigma'_v}$ = 3
1.00	6													
	7													
-1.00	8													
	9	Poorly graded SAND with SILT (SP-SM); medium dense; grayish brown; wet.	X	4	5 11 8	19	80							
-3.00	10	Fat CLAY (CH); stiff; light brown; moist.												
	11													
-5.00	12													
	13													
-7.00	14													
	15	CLAYEY SAND (SC); loose; dark grayish brown; wet.	X	5	2 3 7	10	80		20	104				+#4=5% -#200=17% PA γ_m = 125
-9.00	16													
	17													
-11.00	18													
	19													
-13.00	20	At EL. -13.0 ft, becomes very loose.	X	6	1 2 1	3	40							
	21													
-15.00	22	At EL. -15.0 ft, contains thin Lean Clay (CL) seams; medium stiff; gray.												
	23													
-17.00	24	SILTY, CLAYEY SAND (SC-SM); dense; gray; moist.												
	25													

(continued)

DRAFT

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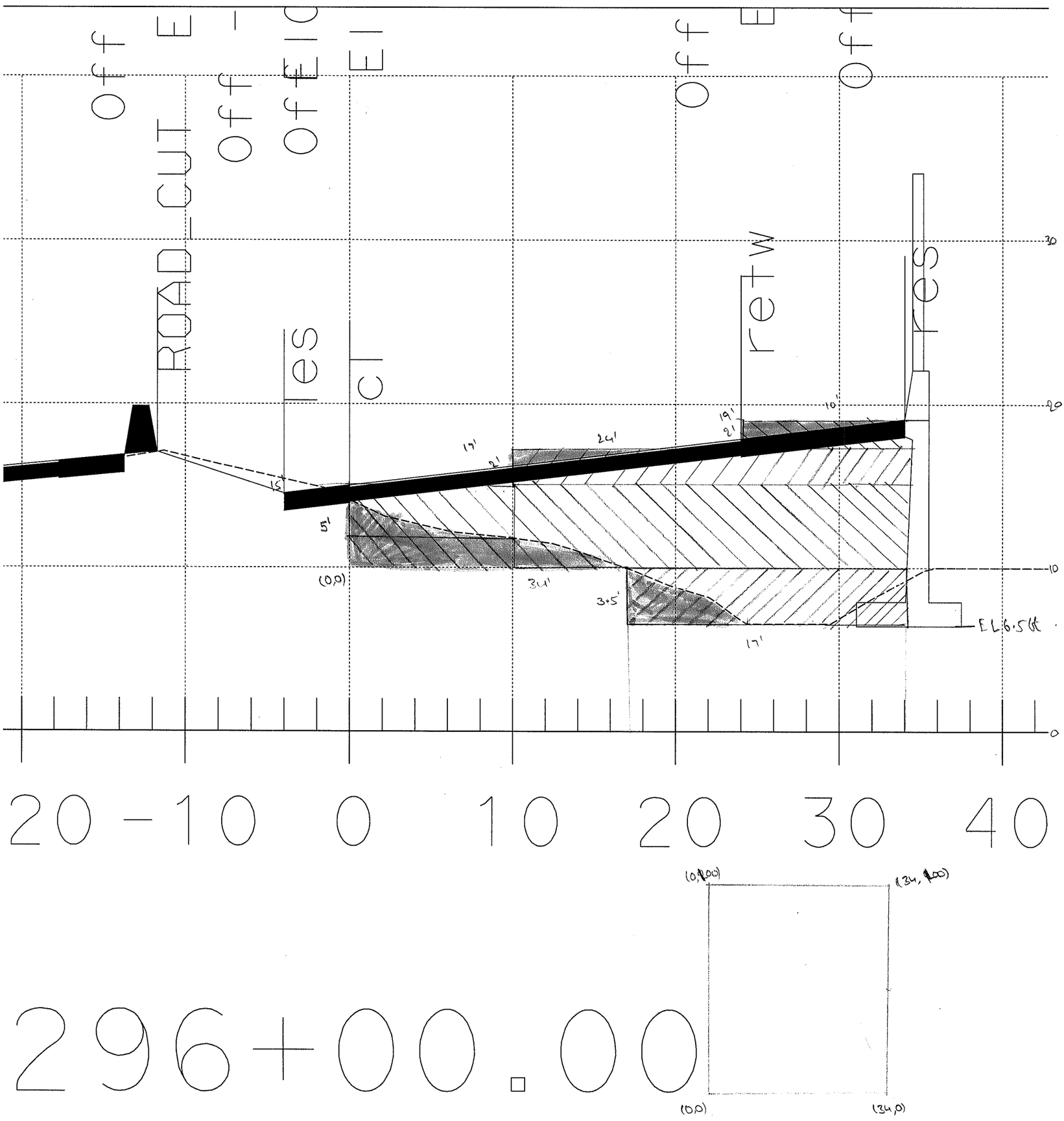
San Jose Office
55 S. Market St, Ste 1500
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				A-09-101
DIST. 04	COUNTY Sonoma	ROUTE 101	POSTMILE 0.9/2.9	EA 04-28645045
PROJECT OR BRIDGE NAME: Retaining Wall 293				
BRIDGE NUMBER	PREPARED BY L.Phillips	DATE 6-11-09	SHEET 1 of 2	

URS BORING RECORD 200802 28645045-MSNB4PETALUMARIVER.GPJ SNJ_CT.GLB 8/25/09



./ramps_B4Xsections.dgn 10/20/2009 4:00:12 PM

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25	SILTY, CLAYEY SAND (SC-SM) *(continued)*.	X	7	24 19 20	39	65		19	105				$\gamma_m = 125$
-19.00	26													
	27													
-21.00	28													
	29													
-23.00	30		X	8	4 6 9	15	60							
	31	Lean CLAY (CL); very stiff; bluish gray; moist.												
-25.00	32													
	33													
-27.00	34													
	35		X	9	4 6 7	13	100		21	106	UC = 1.49			$\gamma_m = 128$ $c = 2980$ $\frac{S_u}{\sigma_v} = 1.25$
-29.00	36													
	37													
-31.00	38													
	39													
-33.00	40		X	10	8 14 14	28	65		24	102	UC = 1.63			$\gamma_m = 126$ $c = 3260$ $\frac{S_u}{\sigma_v} = 1.2$
	41													
-35.00	42	GRAVELLY lean CLAY (CL); medium stiff; gray; moist to wet.												Hard drilling from 42 to 45 feet
	43													
-37.00	44													
	45	Lean CLAY (CL); very stiff; dark bluish gray mottled with brown; moist.	X	11	3 7 10	17	100							
-39.00	46													
	47													
-41.00	48													
	49													
-43.00	50	At EL. -43.0 ft, becomes medium stiff; brown.	X	12	0 7 13	20	100		21	105	UC = 0.94			$\gamma_m = 127$ $c = 1880$ $\frac{S_u}{\sigma_v} = 0.53$
	51	At EL. -43.5 ft, becomes stiff; dark bluish gray.												
-45.00	52	Bottom of Borehole at 51.5 ft.												
	53													
-47.00	54													
	55													

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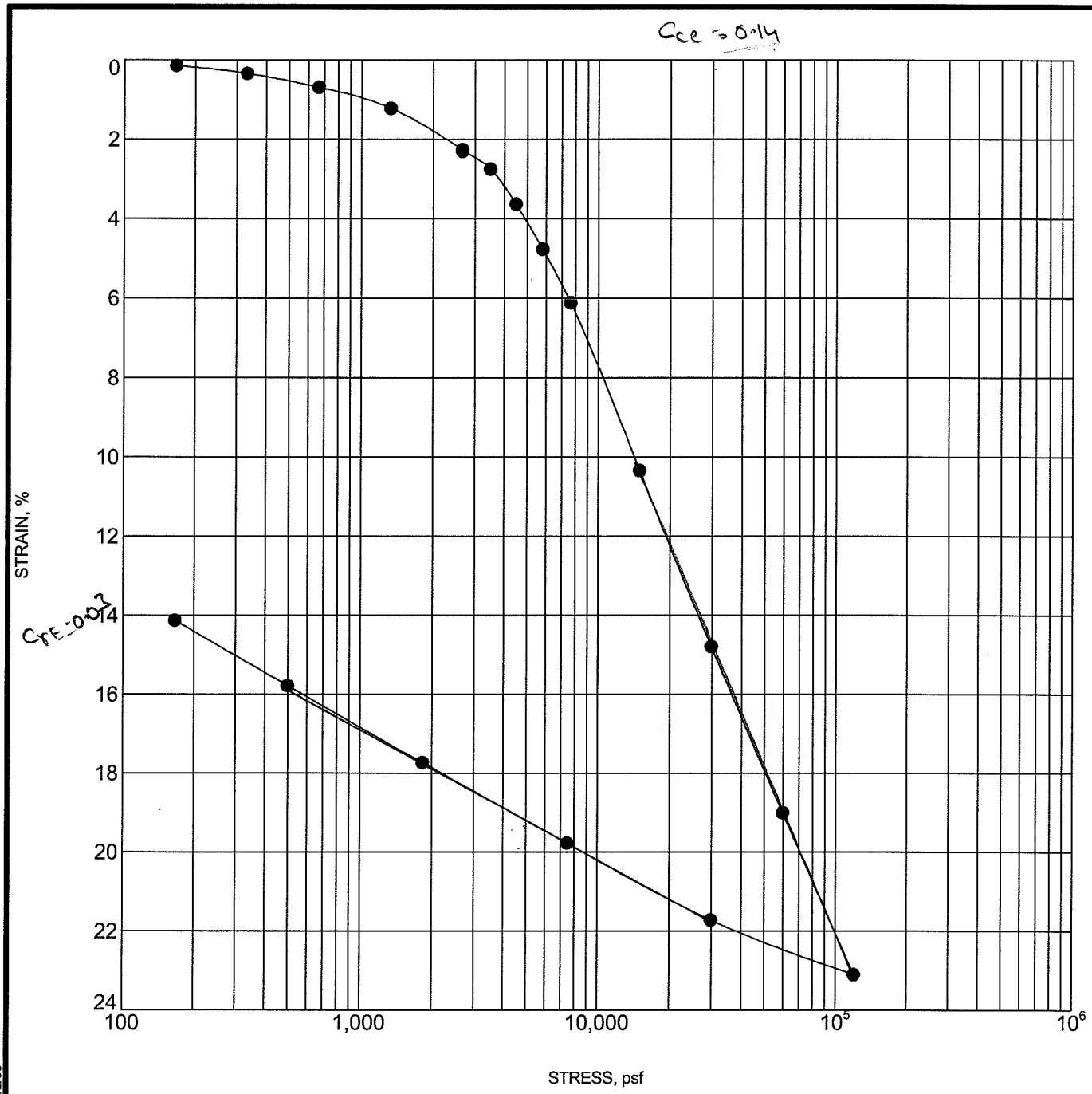
URS BORING RECORD 200802 28645045-MSNB4PETALUMARIVER.GPJ SNJ_CT.GLB 8/25/09

URS

San Jose Office

55 S. Market St, Ste 1500
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				**A-09-101**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Retaining Wall 293**				
BRIDGE NUMBER	PREPARED BY **L.Phillips**	DATE **6-11-09**	SHEET **2 of 2**	

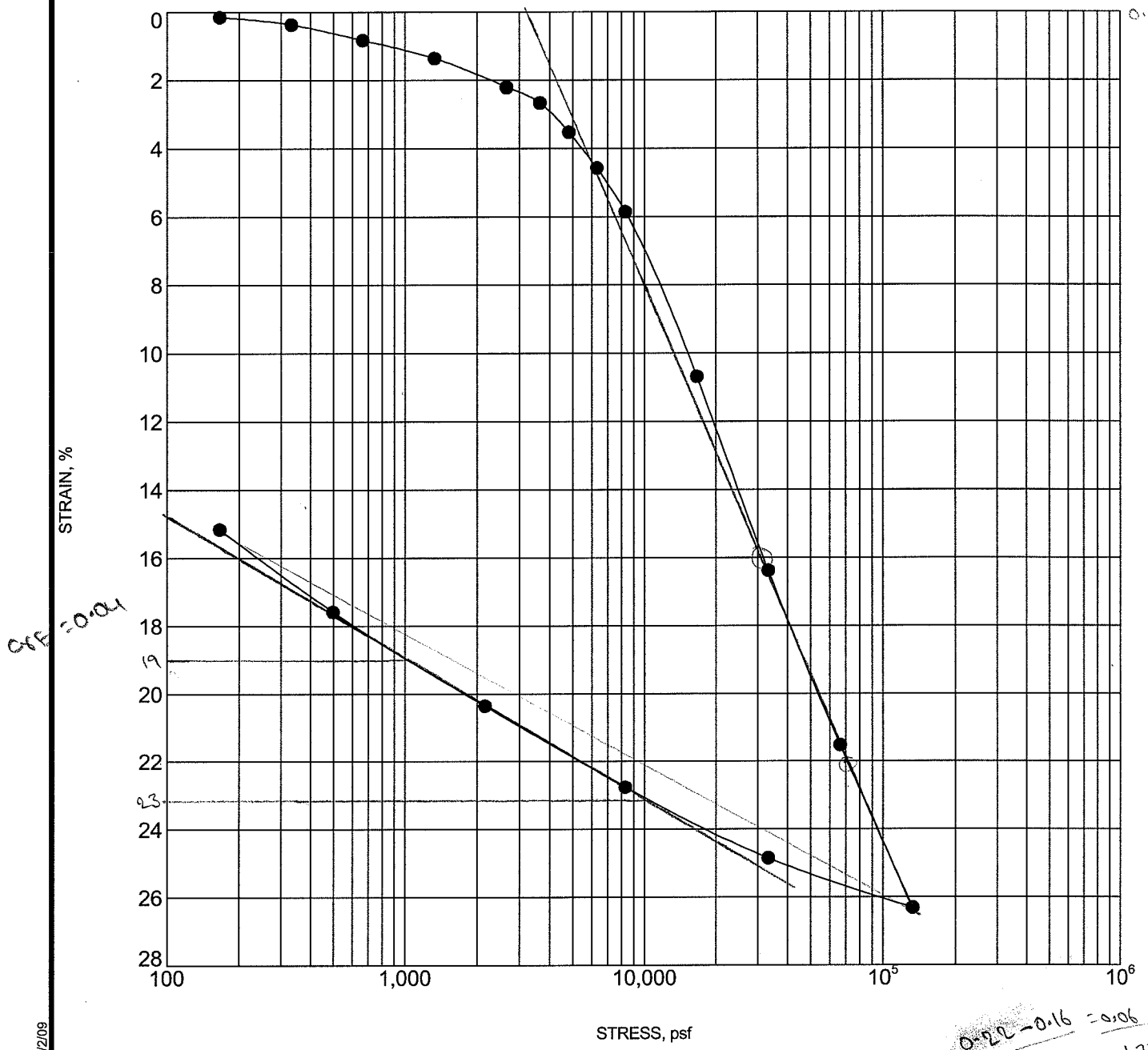


Specimen Identification			Classification	γ_d	MC%
●	**R-09-015**	**25.0**	**Lean CLAY**	**101**	**25**

CONSOLIDATION TEST

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

US EM CONSOL STRAIN 28645040 MSNB4PETRIVER.GPJ SNJ CT.GLB 12/2/09

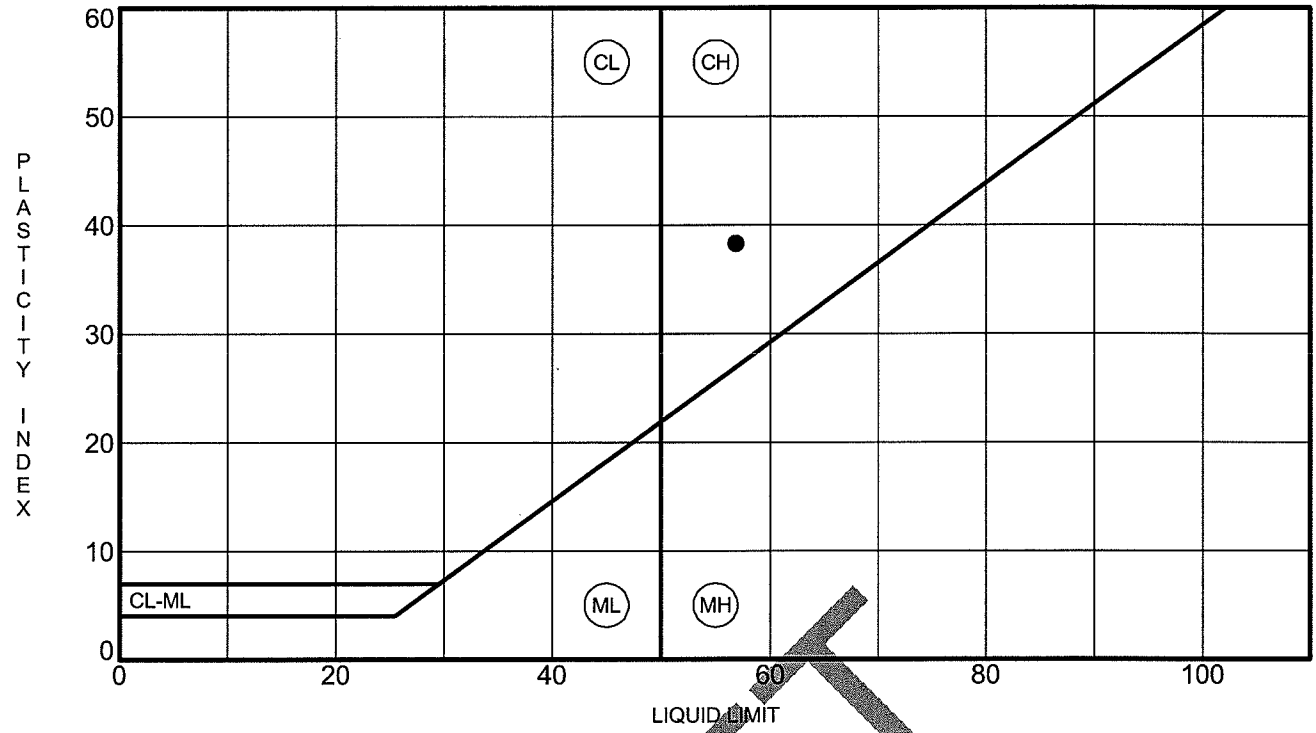


Specimen Identification			Classification	γ_d	MC%
●	R-09-014	30.0	Lean CLAY	101	27

CONSOLIDATION TEST

Project Name: U.S. 101 MSN B4, Petaluma
Location: Sonoma 101 0.9/2.9
Number: 28645045

US EM CONSOL STRAIN 28645040 MSNB4PETRIVER.GPJ SNJ CT.GLB 12/2/09



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**A-09-103**	**15.0**	**57**	**19**	**38**		**Fat CLAY (CH)**

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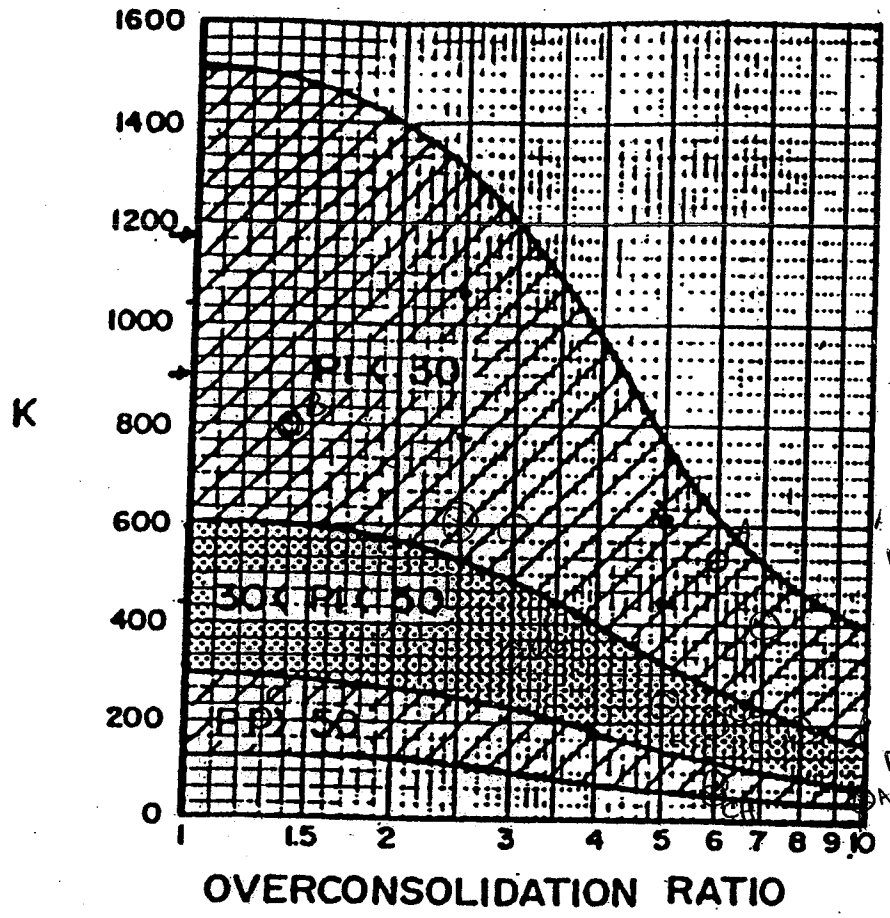
San Jose, CA 95113

ATTERBERG LIMITS' RESULTS

Project Name: MSN B4, Petaluma River
Location: Sonoma 101 0.9/2.9
Number: 28645045



CH @ 0'-85'
E=KSu = (70) (1250) = 87500
=0.09x10^6 PSF ≅ 0.1 KSF

CL @ 30'-50'
E=KSu = (600) (3000) = 1800000
=1.8x10^6 PSF

$E_u = KS_u$

E_u = UNDRAINED MODULUS OF CLAY

K = FACTOR FROM CHART ABOVE

S_u = UNDRAINED SHEAR STRENGTH OF CLAY

Fig. 2 CHART FOR ESTIMATING UNDRAINED MODULUS OF CLAY

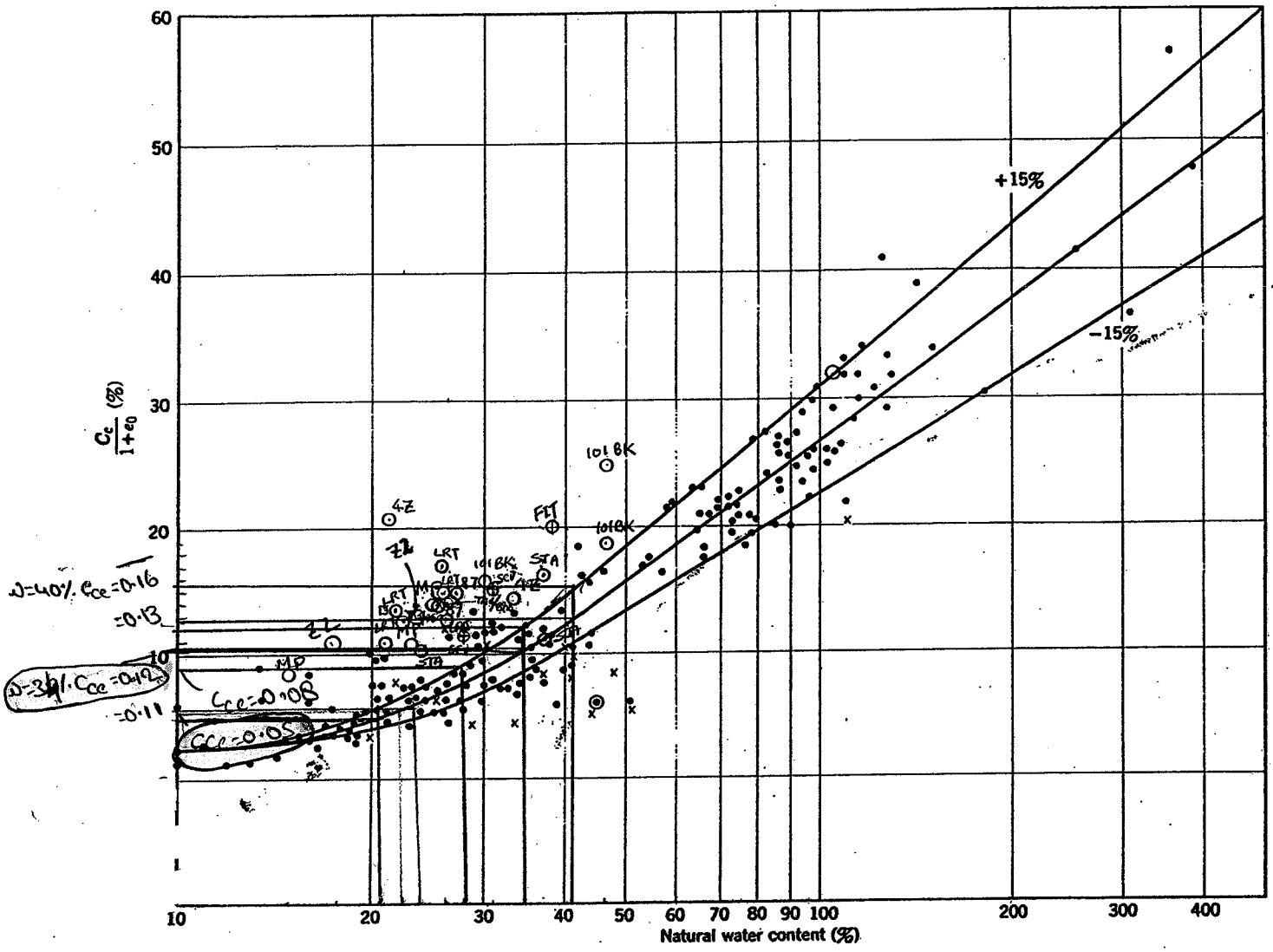


Fig. 22.1(c)

(After Lamb and Whitman, 1969)

SAN JOSE LOCAL PROJECTS

O FIT 16755V FIDELITY TITLE OFFICE BUILDING

O SJA 16171V S.J. AIRPORT

O 4Z 8715027R 4TH/ZANKER

O MP 8815006R MILPITAS PIPELINE

O LRT 8815012R ROUTE 85 / LRT TUNNEL

O 87 ROUTE 87 BRIDGE (NORTH BOUND)
8810100R

O 101 BK HWY 101 / BROKAW RD
8810188R

O TAS/880 TASMAN DR. / I-880

O SCV 91C0204R SANTA CLARA CONDUIT VAULT

O ZZ 90C0428R MILPITAS ZONE 2 TANK

OSFP Review Comment & Response Form

General Project Information	Review Phase		Reviewer Information
Dist: 04 EA: 2640C1 **Project Name: Petaluma River Bridge** **OSFP Liaison: Tracy Bertram** **Phone: 916-227-8379** **e-mail: TracyBertram/HQ/Caltrans/CAGov**	☐ PSR/PDS (Review No.) ☐ APS/PSR (Review No.) ☐ APS/PR (Review No.) ☐ Type Selection	☐ 65% PS&E Unchecked Details ☐ PS&E (Review No.) ☐ Construction Support ☐ Other:FR	**Reviewer Name: M.Zabolzadeh/R.Nashed** **Functional Unit: GDW-GS** **Phone Number: ((510)2864831** **e-mail: Mohammadzabolzadeh@dot.ca.gov** **Date of Review: 5/25/2010**
	Structure Information (Use when necessary to document comments by individual structure) **Structure Name: Retaining Wall 293** **Br No: _____**		

Consultant Information (to be filled in by Consultant)

Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
1	FR	N/A	FR prepared by URS Corporation dated 4/19/2010.		
2	FR	Section 2.1	The statement "All retaining walls are planned to be standard Caltrans Type I" should be revised to "All retaining walls are planned to be standard Caltrans Type I on spread footing foundation".	Will revise.	
3	FR	Section 3.1.1	The second paragraphs "The north abutment of the Petaluma….the south abutment of the Petaluma River Bridge" should be moved under **"Local Geology" section"**	Will modify.	
4	FR	Section 3.1.1	The statement "the northern abutment of U.S. 101/SR 116 bridge" should replace "The north abutment of the Petaluma River Bridge and both abutments of SR 116 bridges" statement. This is more specific to the job under study.	Will revise.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

5	FR	Section 3.1.1	The last sentence in the second paragraph "**Regional Tectonic Setting and seismicity"** should be moved as a heading of the following section of the text.	Will revise.	
6	FR	Section 3.1.3	The borings list should be omitted from this sector, since it is repeated properly under "Field Exploration" section.	Will modify.	
7	FR	Section 3.2.2	Should be limited only to the exploration work done for the retaining wall 293, not to the whole B4 segment project.	Will modify.	
8	FR	Appendix	Settlement calculations should be attached.	Will add calculations.	
9	FR	N/A	C3- Not approved. Resubmitted to GS is required.		
10					
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P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

U.S. 101 Marin-Sonoma Narrows Contract C3
Sonoma County, California
04120003311 (04-2640K1)
April 2012

Storm Water Information Handout

Prepared for:

Prepared by:

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Appendices

Appendix A Notice of Intent (NOI)
Appendix B Conceptual Sampling Plan

Disclaimer

A “Disclaimer” is required specifying that the information provided in the Storm Water Information Handout is just a guideline and is to be used for information purposes only and should not be considered a sole source document to adhere to the requirements of the National Pollutant Discharge Elimination System (NPDES) Construction General Permit (CGP), Number CAS000002, effective on July 1, 2010. The Contractor is required to provide water quality monitoring, sampling and implement best management practices (BMPs) based on standard industry operations, field conditions and conditions encountered based on the Contractor’s means and methods. The information in this handout is not to be construed in any way as a waiver of the provisions in the CGP. Bidders and contractors are cautioned to make independent investigations and examinations as they deem necessary to satisfy the conditions encountered in performance of work, with respect to the following: sampling and monitoring locations, distribution of watershed areas for sizing of BMPs, and selection of BMPs in order to conform to the requirement of the contract documents and the CGP.

1 OVERVIEW

1.1 Intent of this Document

The objectives of this Water Quality Information Handout are: to summarize general water quality information of the Project; to summarize updated requirements per the Construction General Permit (CGP), which became effective on July 1, 2010; to aid in developing the Storm Water Pollution Prevention Plan (SWPPP) of the project; and to highlight information necessary to file Permit Registration Documents (PRDs) to the State Water Resources Control Board via the Stormwater Multi Application Reporting and Tracking System (SMARTS) and file the Notice of Intent (NOI) at the start of construction.

1.2 Summary of New Requirements

The "National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities" (NPDES Number CAS000002), or CGP, regulates discharges from construction activities within the Project area.

The CGP is based on a risk level (RL) permitting approach. The RL is calculated by 1) project sediment risk and 2) receiving water risk. See the risk assessment calculations in Section 3.1 of this document for details.

A risk assessment was done for the **U.S. 101 Marin-Sonoma Narrows Contract C3 (EA 04-2640K1)**, and the Project was determined to be **RL 2.**

RL 2 projects are subject to best management practice (BMP) implementation and visual monitoring requirements, plus additional monitoring and sampling requirements. RL 2 projects are subject to Numeric Action Levels (NALs) for pH and turbidity. Detailed guidance to comply with RL 2 requirements are provided in "Water Pollution Control" of the Contract Special Provisions and the CGP.

All projects are required to upload stormwater data into SMARTS, such as NOIs, SWPPPs, annual reports, and monitoring data, as applicable.

2 GENERAL PROJECT INFORMATION

2.1 Location

The Project is located in the city of Petaluma in Sonoma County (see Figure 1).

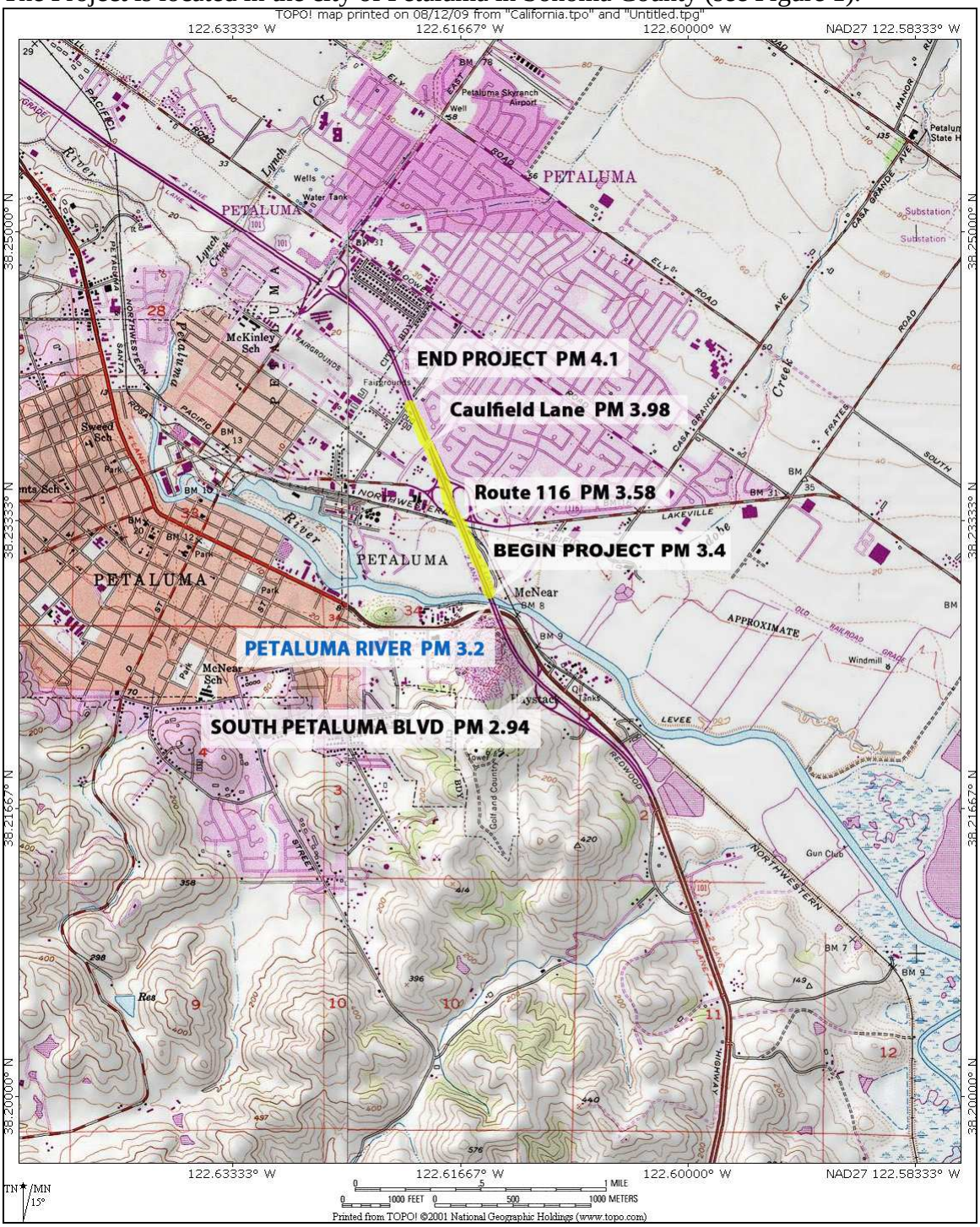


Figure 1. Vicinity Map

2.2 Major Engineering Features

Contract C3 of the Marin Sonoma Narrows (MSN) High Occupancy Vehicle (HOV) Lane Widening Project is one segment of the overall MSN Project that proposes to add HOV facilities to United States Highway (U.S.) 101 from State Route (SR) 37 in Novato to north of Corona Road Overcrossing in Petaluma. The MSN C3 Project consists of the following improvements to U.S. 101 from north of the Petaluma River Bridge to north of Caulfield Lane:

- Replace the existing four span northbound (NB) U.S. 101/SR 116 Separation and Overhead (SOH) built in 1955 with a new four span structure.
- Widen the recently constructed southbound (SB) U.S. 101/SR 116 SOH completed in 2007 by approximately 24 feet along the eastern edge of the deck.
- Reconstruct the NB on-ramp and off-ramp at the SR 116 interchange.
- Construct a retaining wall and sound wall along the NB on-ramp at the SR 116 interchange.
- Reconstruct and widen U.S. 101 to meet current freeway design standards and accommodate future HOV lanes.

The NB U.S. 101/SR 116 SOH replacement structure will be constructed east of the existing bridge and carry four lanes of northbound traffic. The width of the new structure ranges from 59 to 80.7 feet and has a length of 562 feet. The structure is a four-span structure consisting of a cast-in-place reinforced concrete deck on reinforced concrete pier walls to match the new widened bridge. Two retaining walls are proposed at each abutment spanning across the median between the NB replacement structure and the SB widening structure.

As part of the proposed highway widening, the SB U.S. 101/SR 116 structure will be widened by 24 feet along the eastern edge of the deck. The bridge carries southbound U.S. 101 traffic over the existing Sonoma Marin Area Rail Transit (SMART) railroad tracks as well as SR 116, at an approximately 39 degree skew. The overall length of the bridge is approximately 562 feet with a width of 83 feet. The existing structure is a five-span structure consisting of a cast-in-place prestressed concrete box girder supported on single-column bents and seat type abutments.

2.3 Receiving Water Bodies

The Project is within the jurisdiction of the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB).

The Project site is located within Hydrologic Sub-Area 206.30, which is described as being within the San Pablo Hydrologic Unit and the Petaluma River Hydrologic Area.

The direct receiving water body for this Project is the Petaluma River, which crosses US 101 south of the Project limits at Post Mile (PM) 3.2. Petaluma River continues to flow southeast after crossing US 101 and empties into San Pablo Bay approximately 9 miles from the Project area.

Beneficial uses for Petaluma River include:

- Cold freshwater habitat (COLD)
- Estuarine habitat (EST)
- Migration of aquatic organisms (MIGR)
- Preservation of rare and endangered species (RARE)
- Spawning, reproduction, and/or early development (SPWN)
- Warm freshwater habitat (WARM)
- Wildlife habitat (WILD)
- Water contact recreation (REC-1)
- Non-contact water recreation (REC-2)
- Navigation (NAV)

Petaluma River is listed on the 303(d) List; Table 1 displays the pollutants, pollutant sources and proposed or United States Environmental Protection Agency approved total maximum daily load (TMDL) completion date for the listed pollutant.

Table 1. Petaluma River 303(d) List Summary

Pollutant	Source	Proposed or US EPA Approved TMDL Completion Date
Diazinon	Urban Runoff/Storm Sewers	2019
Nutrients	Construction/Land Development Urban Runoff/Storm Sewers	2019
Pathogens	Construction/Land Development Urban Runoff/Storm Sewers	2019
Sedimentation/Siltation	Construction/Land Development Urban Runoff/Storm Sewers	2019
Trash	Illegal dumping Urban Runoff/Storm Sewers	2021

2.4 Climate and Rainfall

A National Oceanic and Atmospheric Administration (NOAA) weather station located in Petaluma, approximately 3 miles northwest of the Project site was used to obtain precipitation data (see Figure 2). The compliance storm event was determined from NOAA's online Atlas 14, Volume 6, Version 2 (http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ca).

Rainy days per year (assumed equal to precipitation 0.10 inches or greater): 44.8 days

Qualifying rain events per year (precipitation 0.5 inches or greater): 17.5 days

Compliance Storm Event (rainfall total for the 5 year, 24 hour storm) 3.27 inches

2.5 Soils and Geology

A soil map for the Project was obtained from the United States Department of Agriculture Natural Resources Conservation Service "Web Soil Survey" is shown in Figure 3. The table

shown in Figure 3 lists the soil types and the soil erodibility factor (K) by soil type. Based on this figure, the soils within the Project are classified as Clear Lake Clay (CeA) with a K of 0.24.

2.6 Hazardous Waste

The hazardous waste studies for this Project are presented in the *Site Investigation Report-Route-101 Marin/Sonoma-Narrows HOV Widening Project Contract B4: Petaluma River Bridge* URS Project No. 28645045, February 2011.

2.7 Existing (Pre-Construction) Control Practices

There are no identified existing treatment BMPs within the Project limits. A proposed biofiltration swale is located between the SMART railroad tracks and the U.S. 101 fill slope; the swale extends from "A" Line Station 187+83 to Station 190+35. This swale is shown on both the design plans for this Project and on the MSN B2 Contract (EA 04-2640U1) design plans. This biofiltration swale will be constructed based on whichever contract first works in that area. Currently, the MSN B2 Contract is scheduled to start construction before this Project; however, current proposed design level staging suggest that construction for this Project will begin work in this area prior to MSN B2. Once the swale is constructed and established, the swale will be protected in place with ESA fencing to identify the swale as outside the limits of any additional soil disturbance.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data,
and Information Service

Climatography of the United States No. 20 1971-2000

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801
www.ncdc.noaa.gov

Station: PETALUMA FIRE STA 2, CA

COOP ID: 046826

Climate Division: CA 1 **NWS Call Sign:** **Elevation: 31 Feet** **Lat: 38°16N** **Lon: 122°39W**

Precipitation (inches)

	Precipitation Totals									Mean Number of Days (3)				Precipitation Probabilities (1) Probability that the monthly/annual precipitation will be equal to or less than the indicated amount										
	Means/ Medians(1)		Extremes							Daily Precipitation				Monthly/Annual Precipitation vs Probability Levels These values were determined from the incomplete gamma distribution										
Month	Mean	Median	Highest Daily(2)	Year	Day	Highest Monthly(1)	Year	Lowest Monthly(1)	Year	>= 0.01	>= 0.10	>= 0.50	>= 1.00	.05	.10	.20	.30	.40	.50	.60	.70	.80	.90	.95
Jan	5.41	5.01	4.06	1979	10	16.31	1995	.32	1976	11.8	8.1	3.7	1.6	.47	.84	1.56	2.31	3.13	4.07	5.18	6.58	8.51	11.74	14.90
Feb	5.31	4.39	3.28	1998	3	19.59	1998	.31	1971	10.8	7.9	3.6	1.5	.42	.77	1.46	2.19	3.00	3.93	5.05	6.45	8.40	11.67	14.90
Mar	3.85	3.05	3.69	1995	9	15.04	1983	.08	1988	11.0	7.2	2.5	.9	.27	.51	1.00	1.52	2.11	2.80	3.62	4.67	6.12	8.58	11.02
Apr	1.40	1.16	1.85	1953	27	4.59	1983	.06	1977	6.0	3.6	.8	.1	.08	.17	.34	.53	.74	.99	1.30	1.69	2.24	3.16	4.09
May	.62	.26	1.78	1996	16	3.74	1998	.00+	1992	3.4	1.6	.3	@	.00	.00	.00	.04	.14	.27	.46	.71	1.08	1.74	2.42
Jun	.15	.01	1.75	1967	2	1.12	1992	.00+	1996	1.1	.4	.1	.0	.00	.00	.00	.00	.00	.02	.05	.12	.24	.47	.74
Jul	.05	.00	.91	1974	8	.95	1974	.00+	2000	.3	.1	@	.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.12	.30
Aug	.08	.00	1.00	1997	20	1.04	1997	.00+	1999	.4	.2	@	@	.00	.00	.00	.00	.00	.00	.00	.00	.02	.21	.44
Sep	.29	.10	1.85	1959	18	1.77	1989	.00+	1995	2.0	.7	.2	.0	.00	.00	.00	.00	.03	.10	.18	.31	.50	.85	1.21
Oct	1.37	.96	2.94	1962	13	4.64	1975	.00+	1995	4.4	2.3	1.2	.4	.00	.12	.35	.57	.79	1.05	1.34	1.71	2.21	3.03	3.84
Nov	3.52	2.99	3.78	1970	28	9.70	1973	.26	1986	9.6	6.3	2.6	.8	.24	.46	.91	1.39	1.93	2.56	3.31	4.27	5.60	7.85	10.08
Dec	3.80	3.13	3.80	1995	12	10.82	1996	.00	1989	9.7	6.4	2.5	.8	.28	.68	1.29	1.85	2.43	3.07	3.80	4.69	5.90	7.86	9.75
Ann	25.85	23.57	4.06	Jan 1979	10	19.59	Feb 1998	.00+	Jul 2000	70.5	44.8	17.5	6.1	11.21	13.53	16.78	19.43	21.91	24.41	27.10	30.19	34.08	40.01	45.37

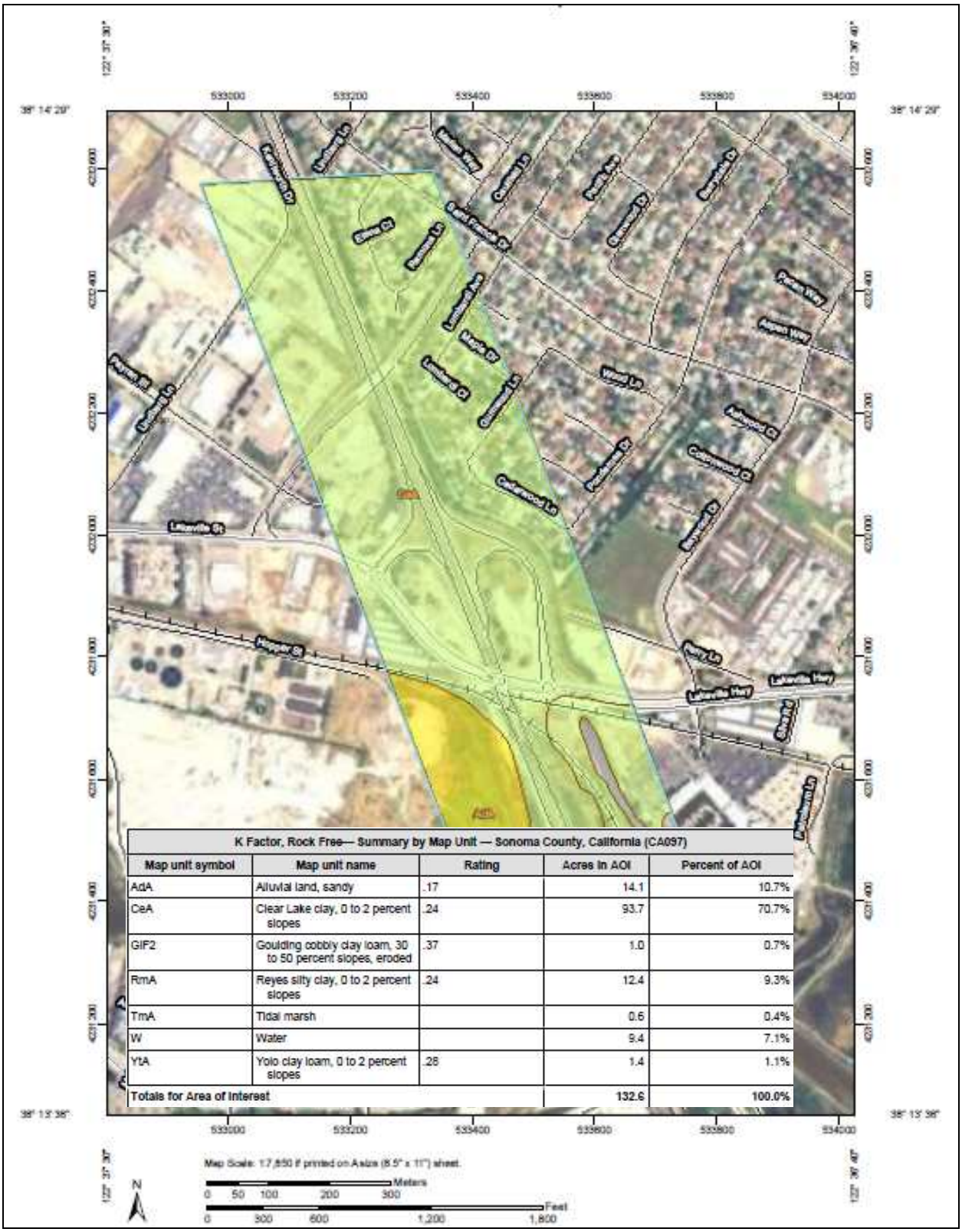
+ Also occurred on an earlier date(s)
# Denotes amounts of a trace
@ Denotes mean number of days greater than 0 but less than .05
** Statistics not computed because less than six years out of thirty had measurable precipitation

(1) From the 1971-2000 Monthly Normals
(2) Derived from station's available digital record: 1948-2001
(3) Derived from 1971-2000 serially complete daily data

Complete documentation available from:
www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

169-B

Figure 2. Rainfall Data



K Factor, Rock Free— Summary by Map Unit — Sonoma County, California (CA097)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AdA	Alluvial land, sandy	.17	14.1	10.7%
CeA	Clear Lake clay, 0 to 2 percent slopes	.24	93.7	70.7%
GIF2	Goulding cobbly clay loam, 30 to 50 percent slopes, eroded	.37	1.0	0.7%
RmA	Reyes silty clay, 0 to 2 percent slopes	.24	12.4	9.3%
TmA	Tidal marsh		0.6	0.4%
W	Water		9.4	7.1%
YtA	Yolo clay loam, 0 to 2 percent slopes	.28	1.4	1.1%
Totals for Area of Interest			132.6	100.0%

Figure 3. Soil Map

Note: 1. AOI – Area of Interest

3 CONSTRUCTION GENERAL PERMIT

To minimize the potential effects of construction runoff on the quality of the receiving water bodies, any construction activity affecting one acre or more must obtain coverage under the CGP. Permit applicants are required to prepare a SWPPP and implement BMPs to reduce construction effects on receiving water quality.

3.1 Risk Assessment

The CGP requirements include a risk assessment to determine the Project's impact risk to receiving water bodies. The risk assessment uses measurements of the Project's potential sediment risk and the sensitivity of the receiving water bodies to sediment to determine the risk level of the Project. This Project has a **Low Site Sediment Risk Factor** and a **High Receiving Water Risk Factor**; the combined risk is **Level 2**. The risk factors are detailed in the following sections.

3.1.1 Sediment Risk

The sediment risk is based on the following equation from the CGP "Fact Sheet" (Section J.1.a pg. 28):

Equation 1. Sediment Risk Equation

$$A = (R)(K)(LS)(C)(P)$$

Where:

A = Rate of sheet and rill erosion (tons per acre)
R = Runoff erosivity factor
K = Soil erodibility factor
LS = Length-slope
C = Cover = 1.0 (bare ground conditions; set value per CGP)
P = Management operations and support practices = 1.0 (bare ground conditions; set value per CGP)

The R factor of **92.95** was determined using the U.S. Environmental Protection Agency (EPA) "Stormwater Phase II Final Rule Construction Rainfall Erosivity Waiver" Fact Sheet 3.1 because the U.S. EPA "Rainfall Erosivity Factor Calculator for Small Construction Sites" is currently off-line.

The K factor of **0.24** was determined from Figure 3.

The LS factor of **0.54** was determined by examining electronic cross sections of the existing grade (see Table 2).

Based on these factors, the rate of sheet and rill erosion (A) is **12.05** tons per acre. Because this value is less than 15, the Project is classified as having a low sediment risk.

Risk Assessment R-Factor Calculation

The R value is determined from the construction Project in Petaluma with the duration from September 2012 to September 2014.

Erosivity Index Zone Map:

The Project is in EI distribution zone 20.

Erosivity Index Tables

EI percentage Sept. 1 to Dec. 31

92.4% - 57.4% = 35.0%

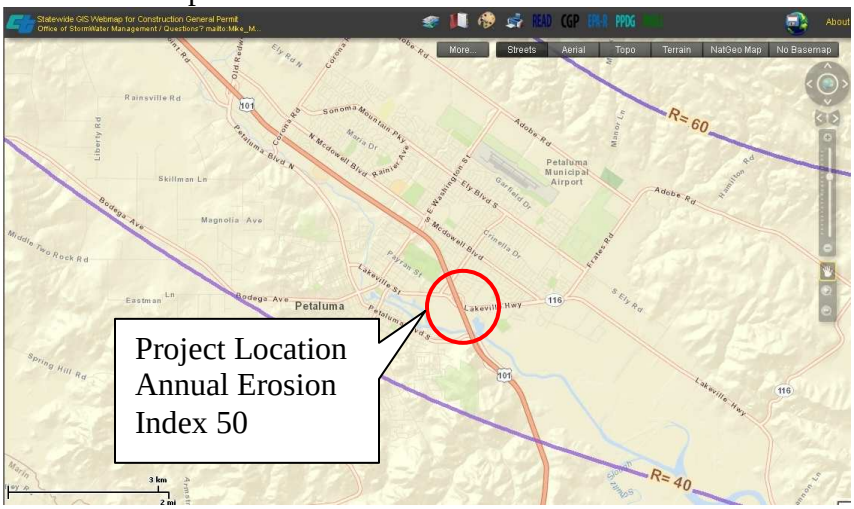
EI percentage Jan.1 to Dec. 31

92.4% - 0.0% = 92.4%

EI percentage Jan.1 to Sept. 30

58.5% - 0.0% = 58.5%

Isoerodent Map of California



R-value for Project = 50 x (35.0% + 92.4% + 58.5%) = 92.95

R-value for complete project duration = 92.95

Figure 4. R Factor

Table 2. LS Factor

Site Specific Analysis of LS Factor
Project 04120003311 (04-2640K1)

Number of X-Sections = 3

Alignment		Number of	Slope Segment 1				Slope Segment 2				Slope Segment 3				Slope Segment 4				Slope Segment 5				Weighted Average for All segments	
Station	Line	Segments	Length (ft)	Rise (ft)	Steepness (%)	LS	Length (ft)	Rise (ft)	Steepness (%)	LS	Length (ft)	Rise (ft)	Steepness (%)	LS	Length (ft)	Rise (ft)	Steepness (%)	LS	Length (ft)	Rise (ft)	Steepness (%)	LS	Total Slope Length (ft)	Weighted LS
180+00	A	4	13.400	5.816	43.40	1.57	50.610	1.771	3.50	0.34	45.700	1.965	4.30	0.38	10.060	3.521	35.00	1.09	0.000	0.000	N/A	0.00	119.770	0.56
200+00	A	5	35.190	0.070	0.20	0.05	7.900	1.943	24.60	0.73	21.630	1.557	7.20	0.37	48.530	1.504	3.10	0.30	19.340	4.912	25.40	1.29	132.590	0.42
210+00	A	4	15.210	1.460	9.60	0.39	42.570	0.894	2.10	0.20	22.290	6.197	27.80	1.57	17.430	2.684	15.40	0.72	0.000	0.000	N/A	0.00	97.500	0.64

Area Weighted LS = **0.54**
(Composite Weigthed LS / Number of X-Sections)

	A	B	C
1	**Sediment Risk Factor Worksheet**		**Entry**
2	**A) R Factor**		
3	Analyses of data indicated that when factors other than rainfall are held constant, soil loss is directly proportional to a rainfall factor composed of total storm kinetic energy (E) times the maximum 30-min intensity (I30) (Wischmeier and Smith, 1958). The numerical value of R is the average annual sum of EI30 for storm events during a rainfall record of at least 22 years. "Isoerodent" maps were developed based on R values calculated for more than 1000 locations in the Western U.S. Refer to the link below to determine the R factor for the project site.		
4	http://cfpub.epa.gov/npdes/stormwater/LEW/lewCalculator.cfm		
5	**R Factor Value**		92.95
6	**B) K Factor (weighted average, by area, for all site soils)**		
7	The soil-erodibility factor K represents: (1) susceptibility of soil or surface material to erosion, (2) transportability of the sediment, and (3) the amount and rate of runoff given a particular rainfall input, as measured under a standard condition. Fine-textured soils that are high in clay have low K values (about 0.05 to 0.15) because the particles are resistant to detachment. Coarse-textured soils, such as sandy soils, also have low K values (about 0.05 to 0.2) because of high infiltration resulting in low runoff even though these particles are easily detached. Medium-textured soils, such as a silt loam, have moderate K values (about 0.25 to 0.45) because they are moderately susceptible to particle detachment and they produce runoff at moderate rates. Soils having a high silt content are especially susceptible to erosion and have high K values, which can exceed 0.45 and can be as large as 0.65. Silt-size particles are easily detached and tend to crust, producing high rates and large volumes of runoff. Use Site-specific data must be submitted.		
8	Site-specific K factor guidance		
9	**K Factor Value**		0.24
10	**C) LS Factor (weighted average, by area, for all slopes)**		
11	The effect of topography on erosion is accounted for by the LS factor, which combines the effects of a hillslope-length factor, L, and a hillslope-gradient factor, S. Generally speaking, as hillslope length and/or hillslope gradient increase, soil loss increases. As hillslope length increases, total soil loss and soil loss per unit area increase due to the progressive accumulation of runoff in the downslope direction. As the hillslope gradient increases, the velocity and erosivity of runoff increases. Use the LS table located in separate tab of this spreadsheet to determine LS factors. Estimate the weighted LS for the site prior to construction.		
12	LS Table		
13	**LS Factor Value**		0.54
14			
15	**Watershed Erosion Estimate (=RxKxLS) in tons/acre**	12.05	
16	**Site Sediment Risk Factor**	**Low**	
17	Low Sediment Risk: < 15 tons/acre		
18	Medium Sediment Risk: >=15 and <75 tons/acre		
19	High Sediment Risk: >= 75 tons/acre		
20			

Figure 5. Sediment Risk Assessment

3.1.2 Receiving Water Body Risk

Because the receiving water body, Petaluma River, is a 303(d) listed impaired water body for sediment and has the beneficial uses of SPWN, COLD, and MIGR, the receiving water body risk for this Project is high (Figure 6).

Receiving Water (RW) Risk Factor Worksheet	**Entry**	**Score**
A. Watershed Characteristics	**yes/no**	
A.1. Does the disturbed area discharge (either directly or indirectly) to a **303(d)-listed waterbody impaired by sediment**? For help with impaired waterbodies please check the attached worksheet or visit the link below: 2006 Approved Sediment-impared WBs Worksheet http://www.waterboards.ca.gov/water_issues/programs/tmdl/303d_lists2006_epa.shtml **OR** A.2. Does the disturbed area discharge to a waterbody with designated beneficial uses of SPAWN & COLD & MIGRATORY? http://www.ice.ucdavis.edu/geowbs/asp/wbguse.asp	**Yes**	**High**

Figure 6. Receiving Water Body Risk Assessment

Figure 7 shows the combined RL matrix for the sediment and receiving water risks.

Combined Risk Level Matrix

Receiving Water Risk	Sediment Risk: Low	Sediment Risk: Medium	Sediment Risk: High
Low	Level 1	Level 2	
High	Level 2		Level 3

Project Sediment Risk: Low
Project RW Risk: High
Project Combined Risk: Level 2

Figure 7. Combined RL Matrix

3.2 Notice of Termination (NOT)

The CGP provides requirements for completion and approval of the NOT. The NOT requirements are presented in Section II.D of the CGP "Order." These requirements include demonstrating through photos, computational proof or other "custom methods," to be developed by Caltrans.

While these methods of demonstrating compliance are at the option of Caltrans, should the RWQCB determine that the visual photos do not adequately show compliance, further

computational efforts may be required. This computational proof is obtained through the use of the Revised Universal Soil Loss Equation 2 (RUSLE2) program.

3.3 Caltrans Forms

The Caltrans Division of Construction has developed forms to comply with the CGP. These forms are available at: http://www.dot.ca.gov/hq/construc/forms.htm.

4 RUN-ON DISCHARGES

There are no run-on discharges anticipated from the off-site areas around this Project.

5 PERMIT REGISTRATION DOCUMENTS

To obtain permit coverage under the CGP, all dischargers must electronically file PRDs, NOTs, changes of information, sampling and monitoring information, annual reporting, and other compliance documents required by the CGP through the SWRCB's SMARTS. The Contractor will have to coordinate these submittals with Caltrans within the timeframe allotted in the contract special provisions and as specified in the CGP. SMARTS is found under the following website:

https://smarts.waterboards.ca.gov/smarts/faces/SwSmartsLogin.jsp

PRDs include the following information:

1. **Notice of Intent**

2. **Site Map(s) Includes:**
    a. The project's surrounding area (vicinity)
    b. Site layout
    c. Construction site boundaries
    d. Drainage areas
    e. Discharge locations
    f. Sampling locations
    g. Areas of soil disturbance (temporary or permanent)
    h. Active areas of soil disturbance (cut or fill)
    i. Locations of all runoff BMPs
    j. Locations of all erosion control BMPs
    k. Locations of all sediment control BMPs
    l. Locations of sensitive habitats, watercourses, or other features which are not to be disturbed
    m. Locations of all post-construction BMPs
    n. Locations of storage areas for waste, vehicles, service, loading/unloading of materials, access (entrance/exits) points to construction site, fueling and water storage, water transfer for dust control and compaction practices

3. **SWPPP**

4. **Risk Assessment**
    a. The Standard Risk Assessment includes utilization of the following:
        i. Receiving water risk documentation
        ii. Sediment sensitive water bodies list
        iii. EPA Rainfall Erosivity Factor Calculator Website (if website is active)
        iv. Sediment risk documentation

5.1 General Information Included

The following is a list of information included in this Storm Water Information Handout that can be used for the PRDs:

- Draft NOI
- Vicinity Map
- Risk Assessment

5.2 Storm Water Pollution Prevention Plan

The Contractor for the Project is required to prepare a SWPPP because the Project involves disturbing more than 1 acre of soil. The SWPPP must include the following information:

- Active areas of cut and fill
- Areas of soil disturbance (temporary and permanent)
- Locations of storage areas for waste, vehicles, access, etc.
- Locations of all runoff BMPs
- Locations of all erosion control BMPs
- Locations of all sediment control BMPs

The SWPPP should be submitted with the PRDs and will be forthcoming from the Contractor.

5.3 Notice of Intent (NOI)

Caltrans will be responsible for submitting the NOI to SMARTS. The Contractor should provide Caltrans with the information necessary to complete the NOI. The NOI must be submitted once the Contractor submits the SWPPP. A draft of the NOI is included in Appendix A.

5.4 Site Maps

Registration requirements can be met by the inclusion of the following plans, which can be found in the appendices.

- Conceptual Sampling Plan –recommended and for reference only (Appendix B)
    - Subject to changes by the Contractor and approved by the Resident Engineer

Appendix A Notice of Intent (NOI)

Attachment 2

State Water Resources Control Board

NOTICE OF INTENT

TO COMPLY WITH THE TERMS OF THE
GENERAL PERMIT TO DISCHARGE STORM WATER
ASSOCIATED WITH CONSTRUCTION ACTIVITY (WQ ORDER No. 99-08-DWQ)

I. NOI STATUS (SEE INSTRUCTIONS)

MARK ONLY ONE ITEM 1. [X] New Construction 2. [ ] Change of Information for WDID#

II. PROPERTY OWNER

Name	Contact Person		
California Department of Transportation District 4	Bijan Sartipi		
Mailing Address	Title		
111 Grand Avenue	District Director		
City	State	Zip	Phone
Oakland	CA	94612	(510) 286-5900

Owner Type (*check one*) 1.[ ] Private Individual 2.[ ]Business 3.[ ]Municipal 4.[X]State 5.[ ]Federal 6.[ ]Other

III. DEVELOPER/CONTRACTOR INFORMATION

Developer/Contractor	Contact Person		
Mailing Address	Title		
City	State	Zip	Phone

IV. CONSTRUCTION PROJECT INFORMATION

Site/Project Name	Site Contact Person		
EA 04-2640K1 Son 101 MSN Contract C3	CALTRANS RESIDENT ENGINEER		
Physical Address/Location	Latitude	Longitude	County
US 101 From North of Petaluma River Bridge to Caufield Ln	38.2352 °	-122.6188 °	Sonoma
City (or nearest City)	Zip	Site Phone Number	Emergency Phone Number
Petaluma	94952		

A. Total size of construction site area: 40.5 Acres

B. Total area to be disturbed: 16.39 Acres (% of total 40)

C. Percent of site imperviousness (including rooftops):
Before Construction: 11 %
After Construction: 21 %

D. Tract Number(s): _____, _____

E. Mile Post Marker: 3.4/4.1

F. Is the construction site part of a larger common plan of development or sale?
[X] YES [ ] NO

G. Name of plan or development: MARIN SONOMA NARROWS

H. Construction commencement date: 09/01/12

I. % of site to be mass graded: _____

J. Projected construction dates:
Complete grading: 09/30/14 Complete project: 09/30/14

K. Type of Construction (Check all that apply):

1. [ ] Residential 2. [ ] Commercial 3. [ ] Industrial 4. [ ] Reconstruction 5. [X] Transportation

6. [ ] Utility Description: _____ 7. [ ] Other (Please List): _____

V. BILLING INFORMATION

SEND BILL TO:	Name	Contact Person	
[X] OWNER (as in II. above)			
[ ] DEVELOPER (as in III. above)	Mailing Address	Phone/Fax	
[ ] OTHER (enter information at right)	City	State	Zip

VI. REGULATORY STATUS

A. Has a local agency approved a required erosion/sediment control plan? ☒ YES ☐ NO

Does the erosion/sediment control plan address construction activities such as infrastructure and structures? ☒ YES ☐ NO

Name of local agency: California Department of Transportation Phone: _____

B. Is this project or any part thereof, subject to conditions imposed under a CWA Section 404 permit of 401 Water Quality Certification? ☒ YES ☐ No

If yes, provide details: 401 Certification issued by SFBRWQCB; 404 Permit issued by USACOE

VII. RECEIVING WATER INFORMATION

A. Does the storm water runoff from the construction site discharge to (Check all that apply):

1. ☐ **Indirectly to waters of the U.S.**
2. ☐ **Storm drain system - Enter owner's name:**_____
3. ☒ **Directly to waters of U.S. (e.g. , river, lake, creek, stream, bay, ocean, etc.)**

B. Name of receiving water: (river, lake, creek, stream, bay, ocean): Petaluma River

VIII. IMPLEMENTATION OF NPDES PERMIT REQUIREMENTS

A. STORM WATER POLLUTION PREVENTION PLAN (SWPPP) (check one)

☐ A SWPPP has been prepared for this facility and is available for review: Date Prepared: ____/____/____ Date Amended: ____/____/____

☐ A SWPPP will be prepared and ready for review by (enter date): ____/____/____

☐ A tentative schedule has been included in the SWPPP for activities such as grading, street construction, home construction, etc.

B. MONITORING PROGRAM

☒ A monitoring and maintenance schedule has been developed that includes inspection of the construction BMPs before anticipated storm events and after actual storm events and is available for review.

If checked above: A qualified person has been assigned responsibility for pre-storm and post-storm BMP inspections to identify effectiveness and necessary repairs or design changes ☐ YES ☐ NO

Name: _____ Phone: _____

C. PERMIT COMPLIANCE RESPONSIBILITY

A qualified person has been assigned responsibility to ensure full compliance with the Permit, and to implement all elements of the Storm Water Pollution Prevention Plan including:

1. Preparing an annual compliance evaluation ☐ YES ☐ NO

   Name: _____ Phone: _____

2. Eliminating all unauthorized discharges ☐ YES ☐ NO

IX. VICINITY MAP AND FEE (must show site location in relation to nearest named streets, intersections, etc.)

Have you included a vicinity map with this submittal? ☒ YES ☐ NO

Have you included payment of the annual fee with this submittal? ☐ YES ☐ NO

X. CERTIFICATIONS

"I certify under penalty of law that this document and all attachments were prepared under my direction and supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment. In addition, I certify that I have read the entire General Permit, including all attachments, and agree to comply with and be bound by all of the provisions, requirements, and prohibitions of the permit, including the development and implementation of a Storm Water Pollution Prevention Plan and a Monitoring Program Plan will be complied with."

Printed Name: _____

Signature: _____ **Date:** _____

Title: _____

Appendix B Conceptual Sampling Plan

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	3.4/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

WRECO
1243 ALPINE ROAD
SUITE 108
WALNUT CREEK, CA 94596

SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401

NOTES:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

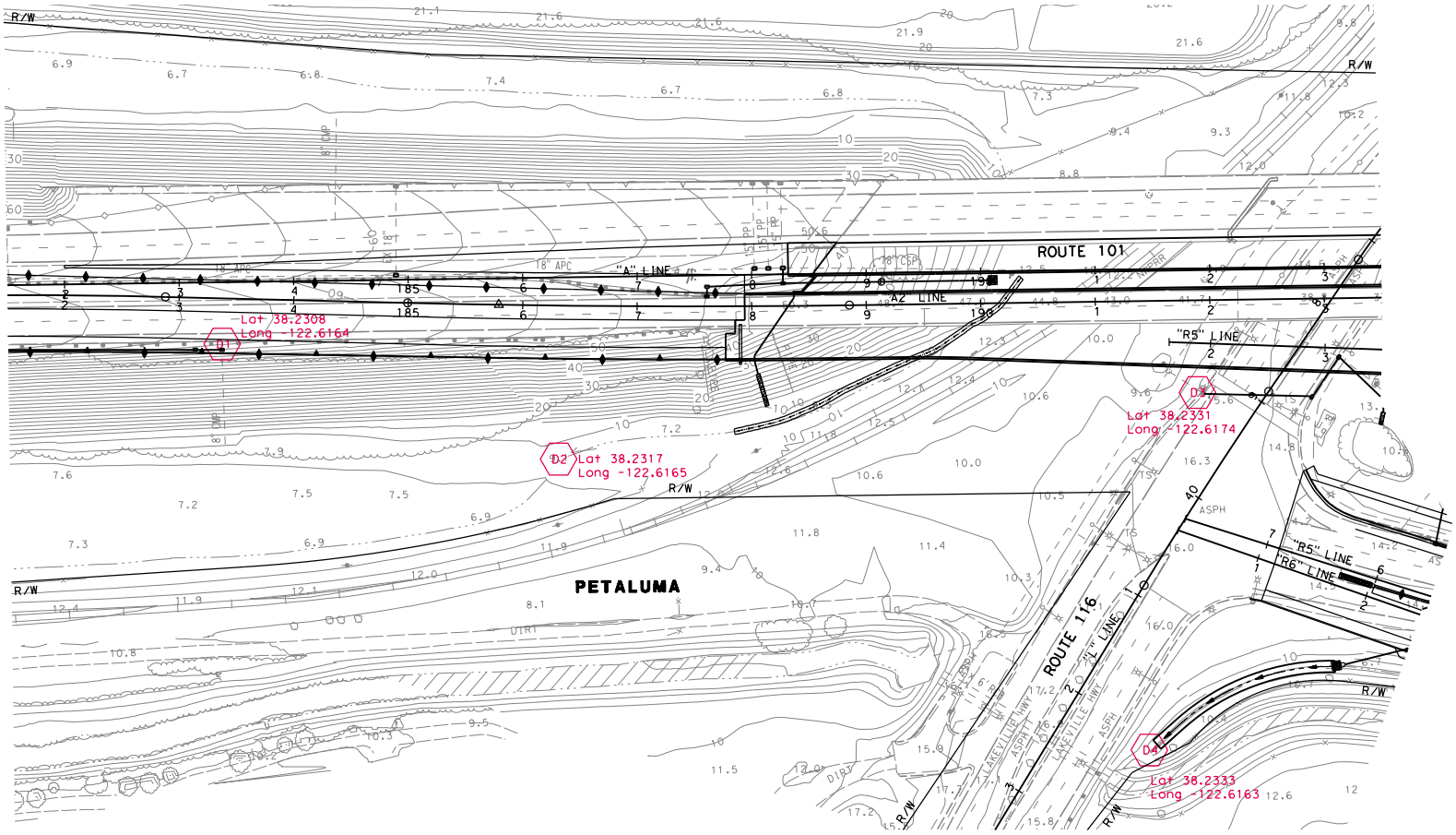
LEGEND:

D/S DISCHARGE AND SAMPLING LOCATION AND No.

ABBREVIATIONS:

D DISCHARGE AND SAMPLING LOCATION

S ADDITIONAL RECOMMENDED SAMPLING LOCATION



CONCEPTUAL SAMPLING PLAN

SCALE: 1" = 50'

CSP-1

THIS PLAN ACCURATE FOR SAMPLING LOCATIONS ONLY

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR

CALCULATED-DESIGNED BY

CHECKED BY

REVISED BY

DATE REVISED

LAST REVISION 00-00-00

DATE PLOTTED => 4/5/2012
TIME PLOTTED => 11:59:49 AM

BORDER LAST REVISED 7/2/2010

USERNAME => andrew_chin
DGN FILE => ...\Dwg\sampling\CSP-02.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0714

PROJECT NUMBER & PHASE 04120003311

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	3.4/4.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

WRECO
1243 ALPINE ROAD
SUITE 108
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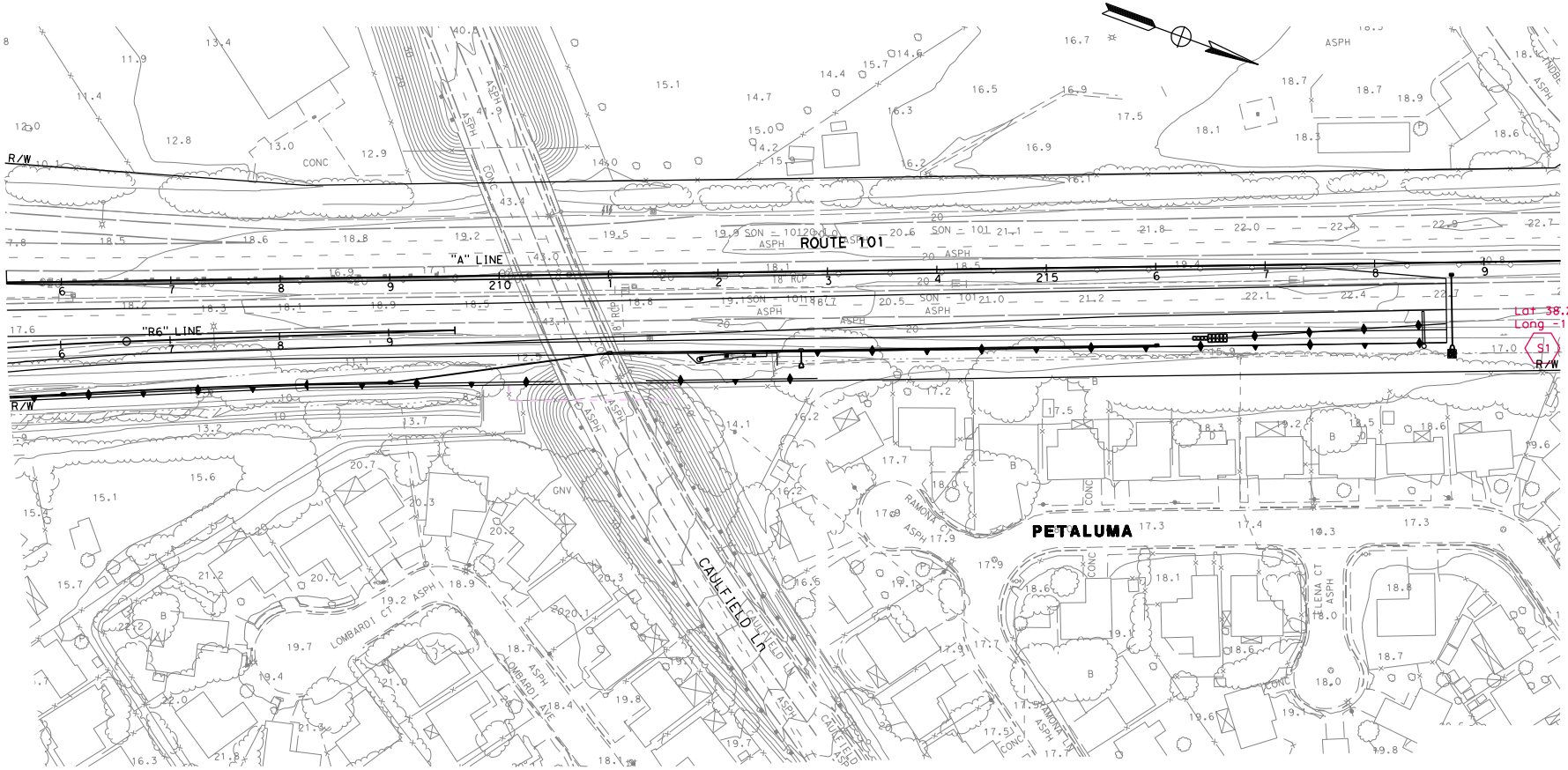
SUITE 206
SANTA ROSA, CA 95401

NOTES:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.



CONCEPTUAL SAMPLING PLAN

SCALE: 1" = 50'

CSP-2

THIS PLAN ACCURATE FOR SAMPLING LOCATIONS ONLY

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

REVISED BY	DATE REVISED
-	-
-	-

CALCULATED-DESIGNED BY	CHECKED BY
-	-

CONSULTANT FUNCTIONAL SUPERVISOR: -

LAST REVISION 00-00-00 | DATE PLOTTED => 4/5/2012 | TIME PLOTTED => 12:06:03 PM

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