FOR CONTRACT NO: 04-2285E4

INFORMATION HANDOUT

PERMITS

California Department of Fish and Game
Mitigation and Monitoring Plan for California Red Legged-Frogs
Biological Opinion and Amendment
State Water Resources Control Board
Mitigation and Monitoring Report for Impacts to Jurisdictional Water of the United States
US Army Corps of Engineer

MATERIAL INFORMATION

Final Foundation Report - Contra Loma UC
Final Foundation Report - Contra Loma UP
Final Foundation Report - G Street OC
Geotechnical Design and Materials Report
Limited Soil Investigation Report, 2610 Contra Loma Boulevard, Antioch, California

CAL-OSHA

Cal-OSHA M&T Unit Underground Classification

WATER SOURCE

Water Source Information

NON-STORMWATER

Non-Stormwater Information Package

MONITORING WELL

Information of Existing Monitoring Well and Conveyance Trench

FORMLINER

Photos of Formliner Samples and Test Panel Samples

PG&E

PG&E Standards - GS&S D-22, UO Standard S4110 and Attachment 1, S4450
Letter from PG&E dated May 13, 2011 and Standard Installation Details-
Natural Gas Pipeline in Box Girder Bridge

Route 04-CC-4-27.3/R29.0

FOR DEPARTMENT USE ONLY				
Date Received	Amount Received	Amount Due	Date Complete	Notification No.
	$	$		

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.

1. APPLICANT PROPOSING PROJECT

Name	Susan Miller		
Business/Agency	Contra Costa Transportation Authority		
Street Address	3478 Buskirk Avenue, Suite 100		
City, State, Zip	Pleasant Hill, CA 94523		
Telephone	(925) 256-4736	Fax	(925) 256-5580
Email	smiller@ccta.net		

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

Name	Booker Holton, TOVA Applied Science & Technology		
Street Address	20 East Altarinda Drive		
City, State, Zip	Orinda, CA 94563		
Telephone	(925) 254-1678	Fax	(925) 254-2693
Email	holton@tovascience.com		

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

Name	Laurie Lau, Caltrans		
Street Address	111 Grand Avenue		
City, State, Zip	Oakland, CA 94612		
Telephone	(510) 286-5568	Fax	(510) 286-5580
Email	laurie_lau@dot.ca.gov		

4. PROJECT NAME AND AGREEMENT TERM

A. Project Name		State Route (SR) 4 (East) Widening Project; Contra Loma - L Street & G Street Segment		
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*)	
2010	2014	06/01	10/15	1,000.00

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	SR 4 (East) Widening Project;Contra Loma - L Street & G Street Segment	$98,000,000.00	$4,000.00
2			
3			
4			
5			
		D. Base Fee *(if applicable)*	
		E. TOTAL FEE ENCLOSED	$4,000.00

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 project area consists of SR4 from just west of Contra Loma Boulevard Interchange to just east of the G Street Overcrossing in Antioch, California. This project is a phased component of the SR4 (East) Widening Project from just west of Loveridge Road to Route 160 (see attached Figure 1-Project Location Map). The project site is located in the West Antioch Creek Watershed (see attached Figure 2-West Antioch Creek & Contra Loma Interchange).

☐ *Continued on additional page(s)*

B. River, stream, or lake affected by the project.	West Antioch Creek
C. What water body is the river, stream, or lake tributary to?	San Joaquin 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	Contra Costa

F. USGS 7.5 Minute Quad Map Name	G. Township	H. Range	I. Section	J. ¼ Section
Antioch North	T.2.N	R.1.E		
Antioch South	T.2.N	R.1.E		

☐ *Continued on additional page(s)*

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

L. Assessor's Parcel Number(s)

74-353-126; 67-342-017; 71-021-03

☐ *Continued on additional page(s)*

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

Latitude/Longitude	*Latitude:*	37/59/59.59N	*Longitude:*	121/49/13.3W
	☑ 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.

The Contra Costa Transportation Authority (CCTA), in cooperation with the Federal Highway Administration (FHWA) and the California Department of Transportation (Caltrans), proposes to widen State Route 4 (SR4) and its interchanges and local roadways from just west of the Contra Loma Boulevard-L Street Interchange (PM 26.6) to just east of the G Street Overcrossing (PM 27.5). The project is a phased component of the widening of SR4 from just west of Loveridge Road to SR 160. The project would widen SR4 from its current four lanes to eight lanes, and widen the median that would not preclude future transit to reduce existing traffic congestion, improve traffic operations, improve air quality, and encourage high occupancy vehicle use to accommodate travel demand anticipated through the year 2030.

The Contra Loma - L Street & G Street Segments of the project will be implemented in two phases. The first phase of work for road widening near the Contra Loma-L Street Interchange requires the rerouting of a new (24 inch) PG&E natural gas pipeline across a channelized section of West Antioch Creek, approximately 720 feet northwest of the existing Contra Loma overcrossing. PG&E will relocate the existing 24" high pressure main, per CCTA and Caltrans request, from the south side of West Antioch Creek to the north side of the creek. The gas main will cross the creek channel and flood plain through a section of creek that is approximately 100' wide from top of bank to top of bank (see additional information in Attachment 10 (A)). One of three possible temporary water diversion structures would be considered for the creek crossing (see drawings Options 1 through 3). This first phase utility relocation is planned between a June - October 2010 construction period.

The second phase of work for the road widening project near Contra Loma-L Street Interchange is to construct roadway and drainage improvements along West Antioch Creek. This includes the project components described in Attachment 10 (A). See also attached drawings: (1) Construction Work Within Creek Areas, (2)Temporary Creek Diversion System (TD-1), (3) Downstream Cofferdam (TDD-1), (4) Upstream Cofferdam (TDD-2), and (5) Contour Grading Plans (G-1 and C-2).

☑ *Continued on additional page(s)*

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

Equipment expected to be used include backhoes, crawler, shovels, compaction equipment, and concrete application equipment.

☐ *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*) Drawings Identified - Item 10 above and Attachment 10 (A) ☐ 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.

Construction for the PG&E pipeline relocation would result in the removal of 5 trees in the floodplain and main channel. The pipeline alignment will be selected to minimize tree removal. The second phase road widening near Contra Loma-L Street Interchange for roadway and drainage improvements would result in an additional loss of 8 trees, and impacts to waters and wetlands in West Antioch Creek (see attached figures "Wetland Reverification", Sheets 8 and 9 of 15)

☐ *Continued on additional page(s)*

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

Vegetation Type	Temporary Impact	Permanent Impact
Non-native Grassland with scattered Freshwater Emergent Plants	Linear feet: _____ Total area: _____	Linear feet: 1003 Total area: 0.143 acres
	Linear feet: _____ Total area: _____	Linear feet: _____ Total area: _____

Tree Species	Number of Trees to be Removed	Trunk Diameter (range)
See Table 1- W.Antioch Ck.Impacted Trees	13	1" to 24" DBH

☑ *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

California red-legged frog (Rana aurora draytonii) is assumed to be present in Antioch Creek.

☐ *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 (1-1-05-F-0158), June 13, 2005; as amended April 15, 2008 (1-1-05-F-0158-2).

☐ *Continued on additional page(s)*

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

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

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 See Attachment 11(F)

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.

Work within West Antioch Creek shall be done during periods of no/low flow. When work in a low flow condition is unavoidable, the entire flow will be diverted around the construction area until work is complete. Normal flows will be restored as soon as work is completed at that location. A SWPPP will be developed and implemented as part of the proposed project. All exposed/disturbed areas and access locations within the creek zone left barren of vegetation as a result of the construction activities will be restored by seeding with a blend of native and non-native erosion control grass seeds.

☐ *Continued on additional page(s)*

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

All construction activities shall be restricted to the "dry season", to minimize take of dispersing California red-legged frog. A highly visible construction fence outlining environmentally sensitive areas will be installed as a first order of work and will remain until job completion. No work, storage, or other activities shall occur within the environmentally sensitive area. A Biological Monitor will be on site during installation of perimeter barriers and temporary fencing, and during any clearing and grubbing activities. When possible, landscape trees growing on the banks of drainages will be cut down, rather than bulldozed or pulled out.

(Please see the project's "Mitigation and Monitoring Plan for California Red-legged Frogs, September 2009").

☐ *Continued on additional page(s)*

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

Caltrans proposes the purchase of credits from an approved mitigation bank as compensation for the loss of CRLF habitat resulting from the entire SR 4 Widening Project, of which West Antioch Creek is a component. The impacted habitat will be mitigated off-site at a ratio of 3:1 for permanent impacts and 0.1:1 for temporary impacts (5.208 acres total).
An off-site compensatory mitigation area for trees impacted with the West Antioch Creek riparian corridor has been designated for nearby Kirker Creek in the City of Pittsburg. The implementation of the Kirker Creek Riparian Enhancement Project will provide compensatory mitigation at a 3:1 ratio. In addition, the project has developed a separate Mitigation and Monitoring Plan to address impacts to Wetlands and Other Waters of the U.S. and State.

☐ *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. USFWS Biological Opinion; NMFS Letter of Concurrence ☐ Applied ☑ Issued

B. USACE Individual Permit ☐ Applied ☑ Issued

C. SWQCB Clean Water Act 401 Water Quality Certification ☐ 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*): EA
☐ 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*)	2004092135		
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	Susan Miller (CCTA)	F. Telephone Number	(925) 256-4736

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

The project is part of a larger project on SR4 in eastern Contra Costa County. The overall larger project is the widening of SR4 from approximately 0.8 miles west of Loveridge Road to Route 160. This project is Phase 3 of the 4 phases of the overall project. The major improvements include widening SR4 from four to eight lanes, and widening its interchanges and all affected local roadways, providing a wide median for transit. The project design has been coordinated with Bay Area Rapid Transit (BART) in connection with a planned eBART transit extension in the median of SR4, which the environmental document was completed in April 2009.

☐ *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*) Booker Holton at (*insert telephone number*) (925) 254-1678 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

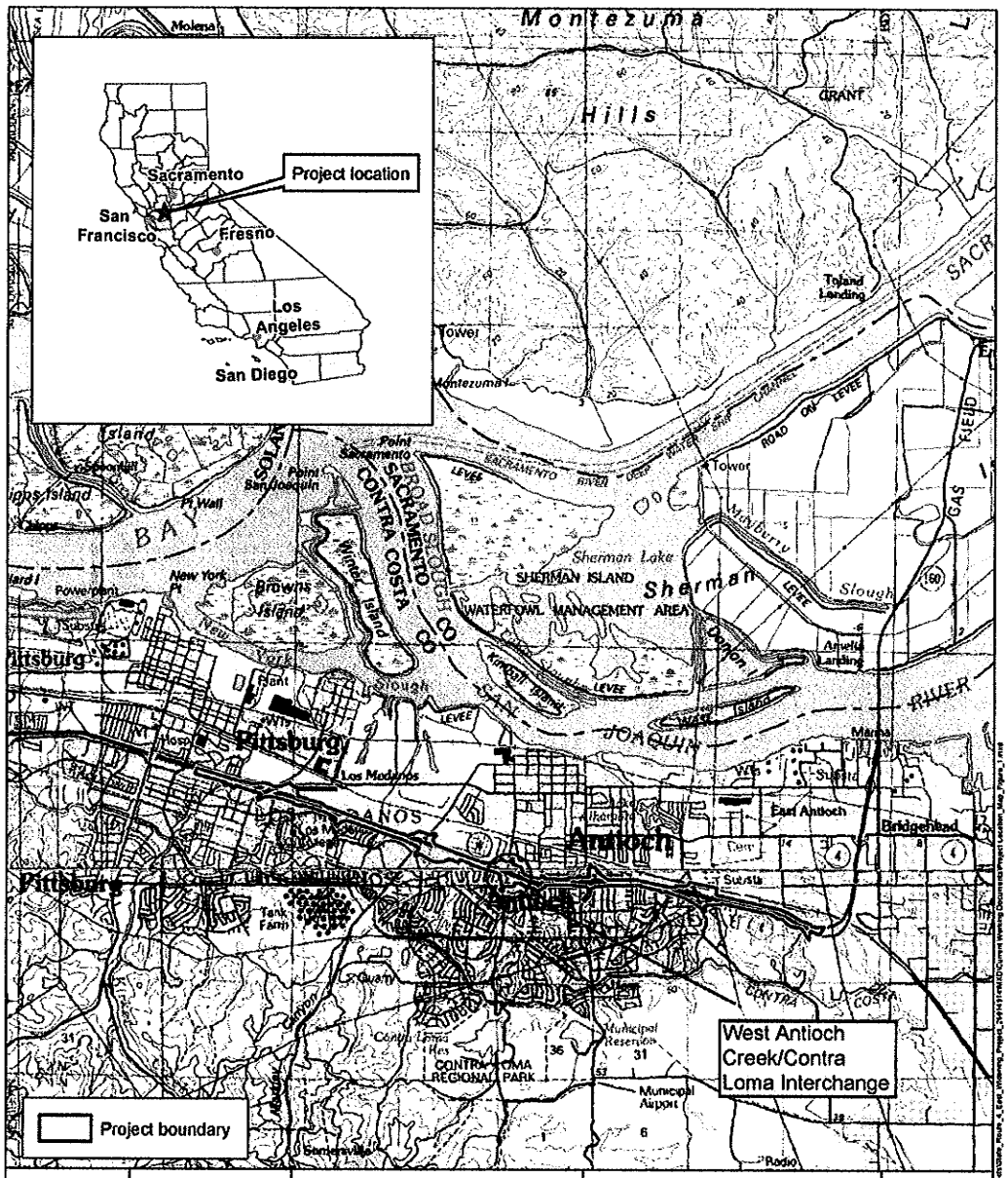
17. SIGNATURE

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

2/26/2010
Date

SUSAN H. MILLER
Print Name



N	Caltrans	State Route 4 (East) Widening Project Loveridge Road to State Route 160 0 1 2 Miles	Project Location Map	Figure 1

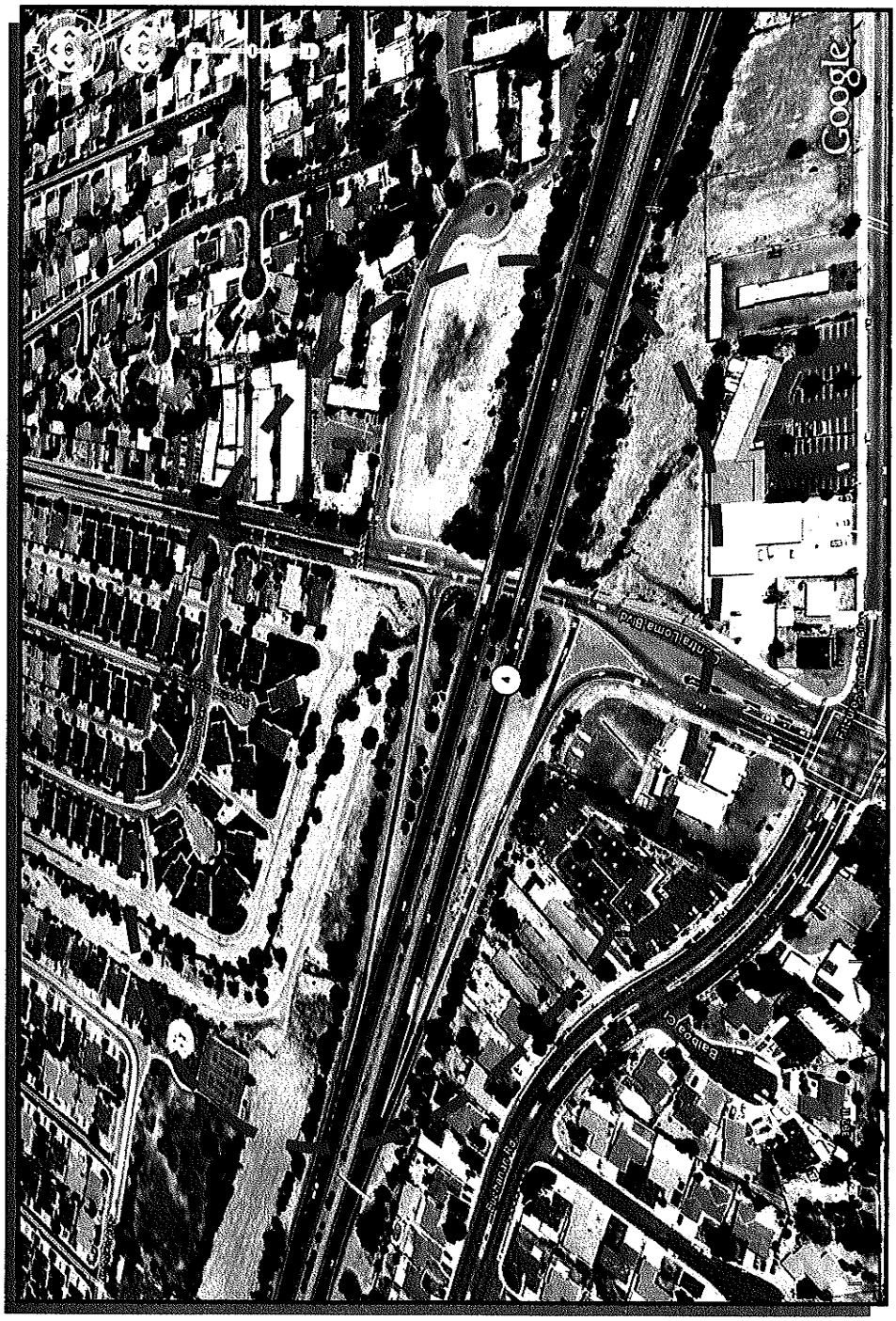
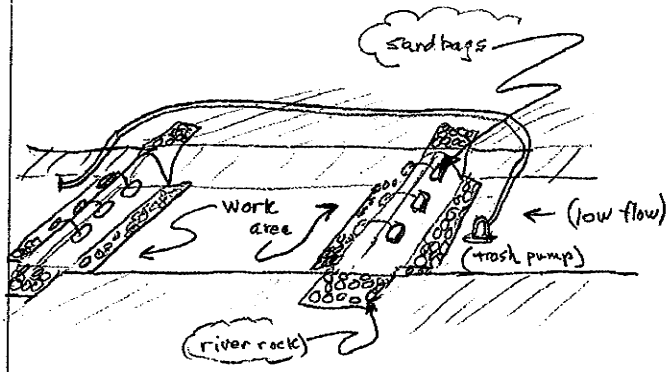


Figure 2 West Antioch Creek & Contra Loma Interchange Project Area

Harris & Associates
Program Managers
Construction Managers
Civil Engineers

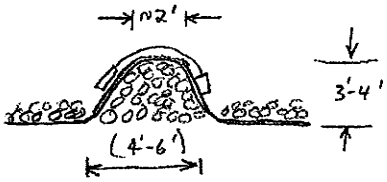
Project: Antioch Creek Sht. ___ of ___
Description: Temporary Dry Season Dams, upstream and downstream of gas line crossing
Proj. No. ___ By ___ Date ___ Chk'd By ___



Temporary Dams

Detail: River Rock, covered w/ impermeable plastic (visquine, e.g.), and stabilized with river rock at the toe, and sand bags on top

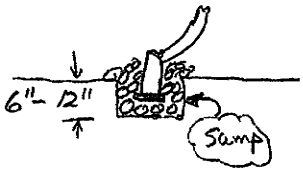
Typical Section:



Note: Place trash pump upstream of upstream dam, to discharge downstream of downstream dam.

Trash Pump Detail:

Place trash pump in a sump in the streambed, surrounded with river rock.



Option 1 – Temporary Construction Dry Season Dams at Proposed PG&E Gas Line Crossing

Design Drafting
62-3690

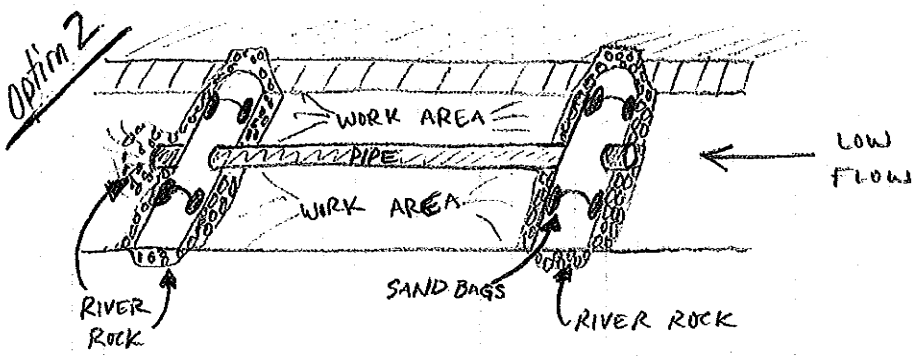
PACIFIC GAS AND ELECTRIC COMPANY

GENERAL COMPUTATION SHEET

SHEET NO. ____ OF ____ SHEETS
JOB FILE NO. ____
LOCATION ____

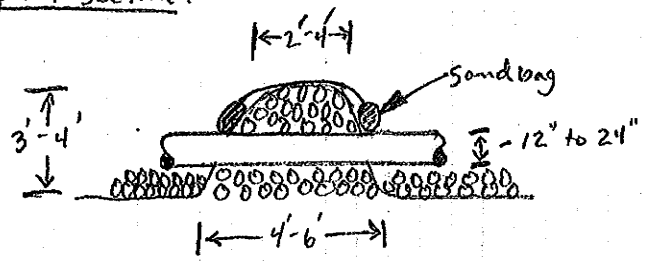
SUBJECT Antioch Creek
Temporary Dams for Gas Line Crossing

MADE BY ____ DATE ____ CHECKED BY ____ APPROVED BY ____



TEMPORARY DAMS: river rock covered with impermeable plastic (visqueen, etc.) and stabalized with river rock at the toe, and sand bags at top

Typical Section:



Option 2 – Temporary Construction Dry Season Dams at Proposed PG&E Gas Line Crossing

Design Drafting
62-3690

PACIFIC GAS AND ELECTRIC COMPANY

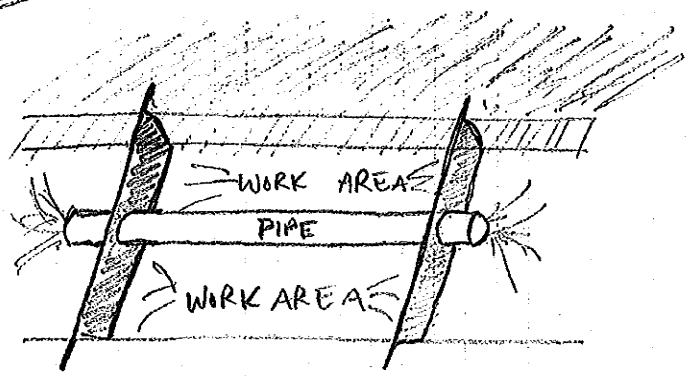
GENERAL COMPUTATION SHEET

SHEET NO. ____ OF ____ SHEETS
JOB FILE NO. ____
LOCATION ____

SUBJECT ____

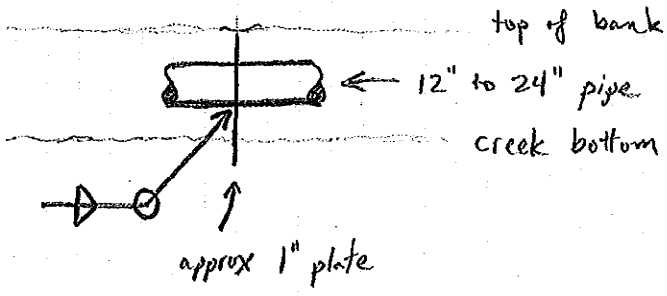
MADE BY ____ DATE ____ CHECKED BY ____ APPROVED BY ____

Option 3



Temporary Dams: steel plate welded to pipe and pushed into creek bed

Typical Section:



Option 3 – Temporary Construction Dry Season Dams at Proposed PG&E Gas Line Crossing

SR 4 (East) Widening Project
Contra Loma-L Street & G Street Segment

California Department of Fish and Game
1602 Lake or Streambed Alteration Agreement

Attachment 10 (A) – Project Description (Continued)

Implementation of the first phase PG&E gas pipeline relocation would require open trench pipeline construction. There is insufficient staging area for a directional bore beneath the creek channel. The creek channel is approximately 100 feet from edge of bank to edge of bank. The pipeline construction would be within a 60-foot wide, 100-foot long construction zone, with the pipeline installed approximately 5 feet below the creek bottom.

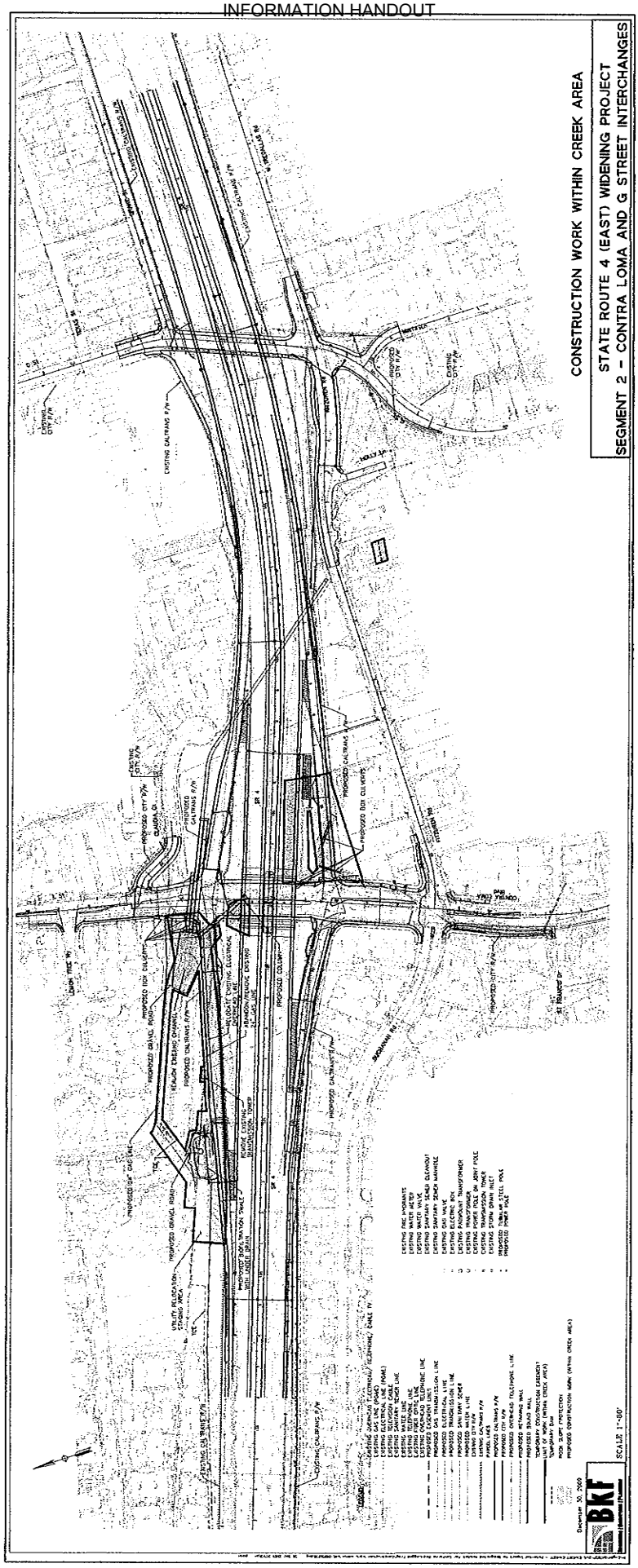
PG&E plans to build a temporary upstream gravel/sandbag/airbag dam to direct base flows through a diversion pipe around the construction site. The proposed "dry season" construction period, is scheduled for completion by October 15. During construction, a plastic diversion pipe will be installed through and approximately perpendicular to the PG&E trench line. Discharge flows will be through a downstream cofferdam wrapped with an impermeable polyethylene liner, and located approximately 15-20 feet from the trench crossing. PG&E will enter the work site using existing maintenance access roads on either bank, which are accessed from Sycamore Drive or "L" Street. Construction equipment and crew trucks will be kept to a minimum as there is not much working space. Equipment will likely include a large excavator that will remain on the banks and be able to reach into the floodplain and creek channel. Smaller excavators or backhoes may be used on the banks for termination points. Smaller equipment may also enter the floodplain from the banks to assist in installation and backfill of the pipeline.

The second phase of work for the road widening project near Contra Loma – L Street Interchange is the construction of roadway and drainage improvements along West Antioch Creek. This includes:

- Installation of an additional two 10'x8' box culverts from West Antioch Creek south of Fitzuren Road to West Antioch Creek just to the west of "L" Street
- Extension of the downstream end of a 10'x5' box culvert along Contra Loma Blvd/"L" Street which outfalls into West Antioch Creek
- Extension of the upstream end of a triple 5'x3 'box culvert along Contra Loma Blvd/"L" Street which extends into West Antioch Creek
- Installation of a single 5'x3' box culvert across the proposed eastbound onramp from Contra Loma Blvd. in West Antioch Creek
- Installation of 4'x 2' box culvert that outfalls to West Antioch Creek
- Installation of concrete headwalls and rock slope protection at the end of the drainage improvements

- Shifting and widening of the westbound onramp from "L" Street, the widening of "L" Street and Contra Loma Blvd. into West Antioch Creek
- Installation of the proposed eastbound onramp from Contra Loma Blvd. across West Antioch Creek
- Installation of a portion of concrete retaining wall along the proposed westbound onramp from L Street within West Antioch Creek
- Regrading and realignment of West Antioch Creek to the west of "L" Street due to the above improvements
- Temporary cofferdam and dewatering of West Antioch Creek to perform the above improvements
- Temporary access into West Antioch Creek to perform the subject improvements

This second phase implementation is planned for an April 2011 construction start, ending in October 2014 thru a period of one or two years. Because West Antioch Creek is defined by the U.S. Fish and Wildlife Service as California red-legged frog habitat, as conditioned by the Biological Opinion for the entire SR4 widening project, the construction period within the creek channel would be confined to the "dry season".


CONSTRUCTION WORK WITHIN CREEK AREA
STATE ROUTE 4 (EAST) WIDENING PROJECT
SEGMENT 2 - CONTRA LOMA AND G STREET INTERCHANGES
SCALE 1"=60'
BKF
December 30, 2009
EXISTING CALTRANS R/W
PROPOSED CALTRANS R/W
EXISTING CITY R/W
PROPOSED CITY R/W
PROPOSED BOX CULVERTS
PROPOSED GRAVEL ROAD
REMOVE EXISTING CHANNEL
PROPOSED CHANNEL
PROPOSED DIP CHANNEL
UTILITY RELOCATION STAGING AREA
RELOCATE EXISTING ELECTRICAL TRANSMISSION LINE
RELOCATE GAS LINE
REMOVE EXISTING TRANSMISSION TOWER
PROPOSED RIPRAP/WATER CHANNEL
BELL LADDER DRAIN
PROPOSED CULVERT
PROPOSED CALTRANS R/W
SR 4
SR 4
SCHAFFER RD
STEFFORD RD
VIA VERDE
EXISTING CALTRANS R/W
EXISTING CITY R/W
PROPOSED CITY R/W
EXISTING FIRE HYDRANTS
EXISTING WATER METER
EXISTING WATER VALVE
EXISTING SANITARY SEWER CLEANOUT
EXISTING SANITARY SEWER MANHOLE
EXISTING GAS VALVE
EXISTING ELECTRICAL BOX
EXISTING PADMOUNT TRANSFORMER
EXISTING TRANSFORMER
EXISTING UTILITY POLE
EXISTING TRANSMISSION TOWER
EXISTING STORM DRAIN INLET
PROPOSED TUBULAR STEEL POLE
PROPOSED TRAFFIC POLE
EXISTING CALTRANS R/W
EXISTING CITY R/W
PROPOSED CALTRANS R/W
PROPOSED CITY R/W
PROPOSED OVERHEAD TELEPHONE LINE
PROPOSED RETAINING WALL
PROPOSED SOUND WALL
TEMPORARY CONSTRUCTION EASEMENT
LIMIT OF WORK WITHIN CREEK AREA
ROW GRADING
ROCK SLOPE PROTECTION
PROPOSED CONSTRUCTION WORK WITHIN CREEK AREA

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	CC	4	26.6/27.5		

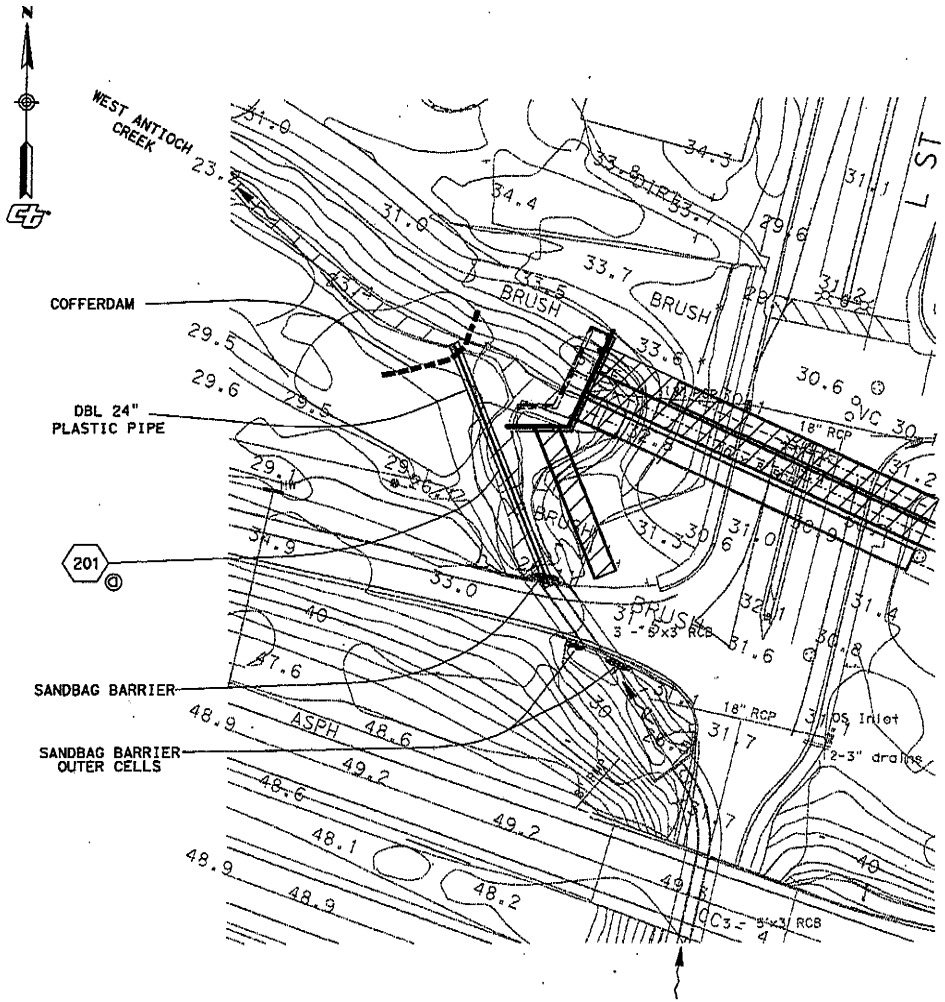
REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

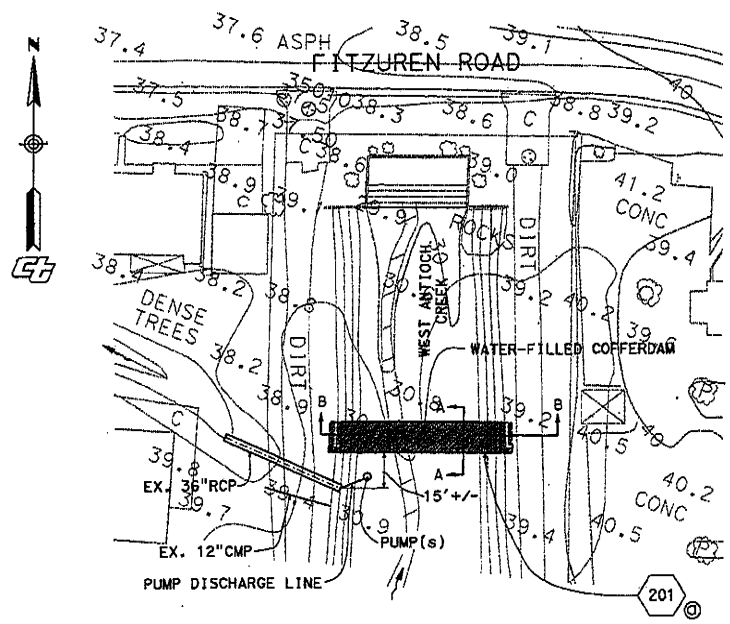
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF ELECTRONIC COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER J. F. PETERSON No. 42777 Exp. 3/31/10 CIVIL STATE OF CALIFORNIA

4-228511



DOWNSTREAM COFFERDAM PLAN
(FOR DETAILS SEE SHEET TDD-1)



UPSTREAM COFFERDAM PLAN
(FOR DETAILS SEE SHEET TDD-2)

INFORMATION HANDOUT

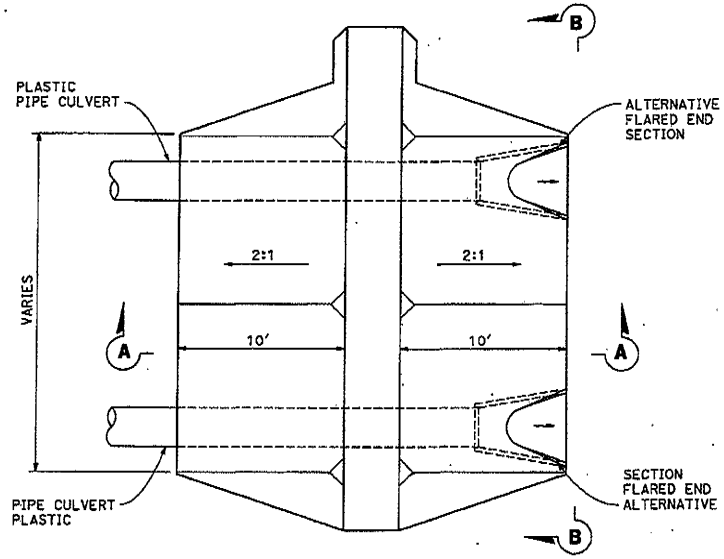
TEMPORARY CREEK DIVERSION SYSTEM

TEMPORARY DRAINAGE STAGE 1
NO SCALE **TD-1**

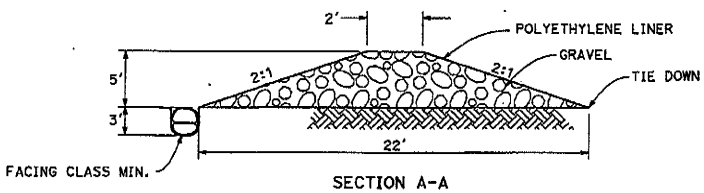
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans
FUNCTIONAL SUPERVISOR: JOSEPH PETERSON
CALCULATED-DESIGNED BY | CHECKED BY
BPN PARCEL
REVISED BY | DATE REVISED

LAST REVISED 00-00-00 | DATE PLOTTED => 01-DEC-2009 | TIME PLOTTED => 10:03

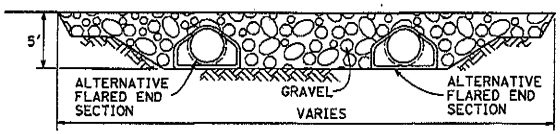
BORDER LAST REVISED 4/11/2008 | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | USERNAME => s136293 DGN FILE => TD-01.dgn | CU 04275 | EA 228511



PLAN



SECTION A-A

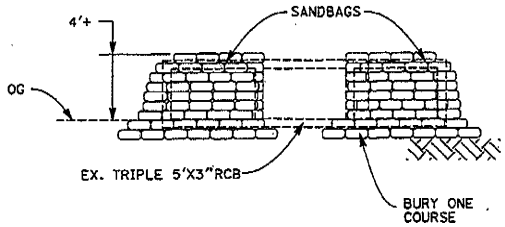


SECTION B-B

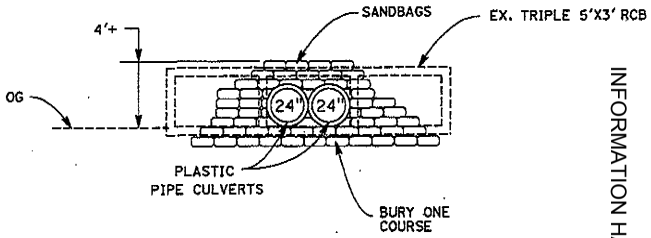
COFFERDAM DETAILS

NOTES

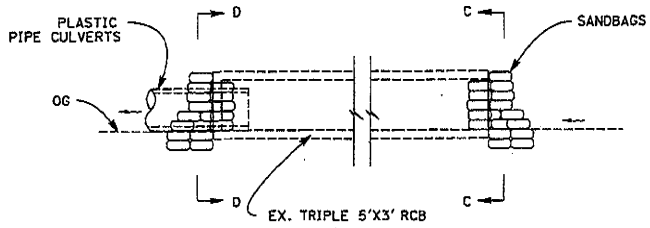
1. PLASTIC SHEET SHALL BE COMMERCIAL QUALITY POLYETHYLENE WITH A MINIMUM THICKNESS OF 10 MILS.
2. ALL PLASTIC SHEETING SHALL BE FREE OF CRACKS, OR OTHER DEFECTS ADVERSELY AFFECTING THE PROTECTIVE CHARACTERISTIC OF THE MATERIAL.
3. ALL JOINTS BETWEEN THE PLASTIC SHEET AND PIPE SHALL BE SEALED WITH COMMERCIAL QUALITY WATERPOOF TAPE.



SECTION C-C



SECTION D-D



SANDBAG BARRIER DETAILS

INFORMATION HANDOUT

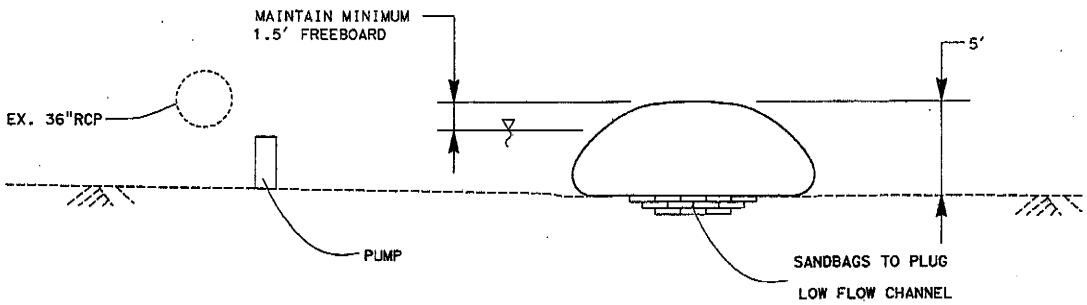
DOWNSTREAM COFFERDAM DETAILS

NO SCALE

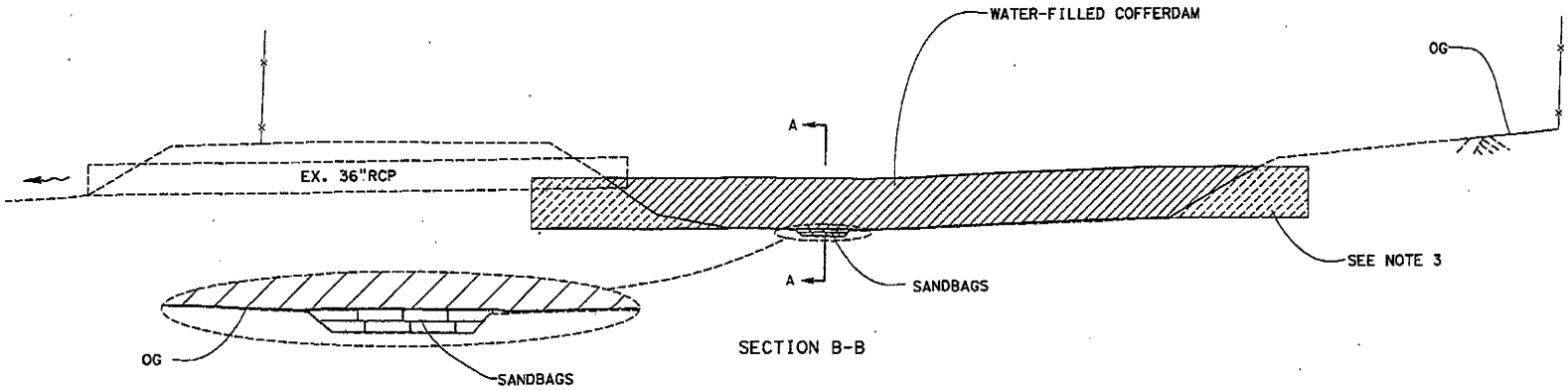
TDD-1

NOTES:

1. PUMP(s) TO BE SIZED BY CONTRACTOR TO PERFORM WORK INTENDED.
2. AVERAGE FLOW IN WEST ANTIOCH CREEK DURING RESTRICTED PERIOD IS 5.5 cfs.
3. ANCHOR WATER-FILLED COFFERDAM INTO CREEK SIDEBANKS TO PREVENT SEEPAGE.



SECTION A-A



SECTION B-B

UPSTREAM COFFERDAM DETAIL

NO SCALE

TDD-2

FOR ACCURATE RIGHT OF WAY AND ACCESS DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

1. CONTRACTOR TO VERIFY EXISTING GRADE ELEVATIONS PRIOR TO CONSTRUCTION.
2. FOR ABREVATIONS AND/OR LEGEND, SEE SHEET L-1.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	CC	4	26.6/27.5		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER N. V. BERNARDI No. 45407 Exp. 9/30/10 CIVIL STATE OF CALIFORNIA

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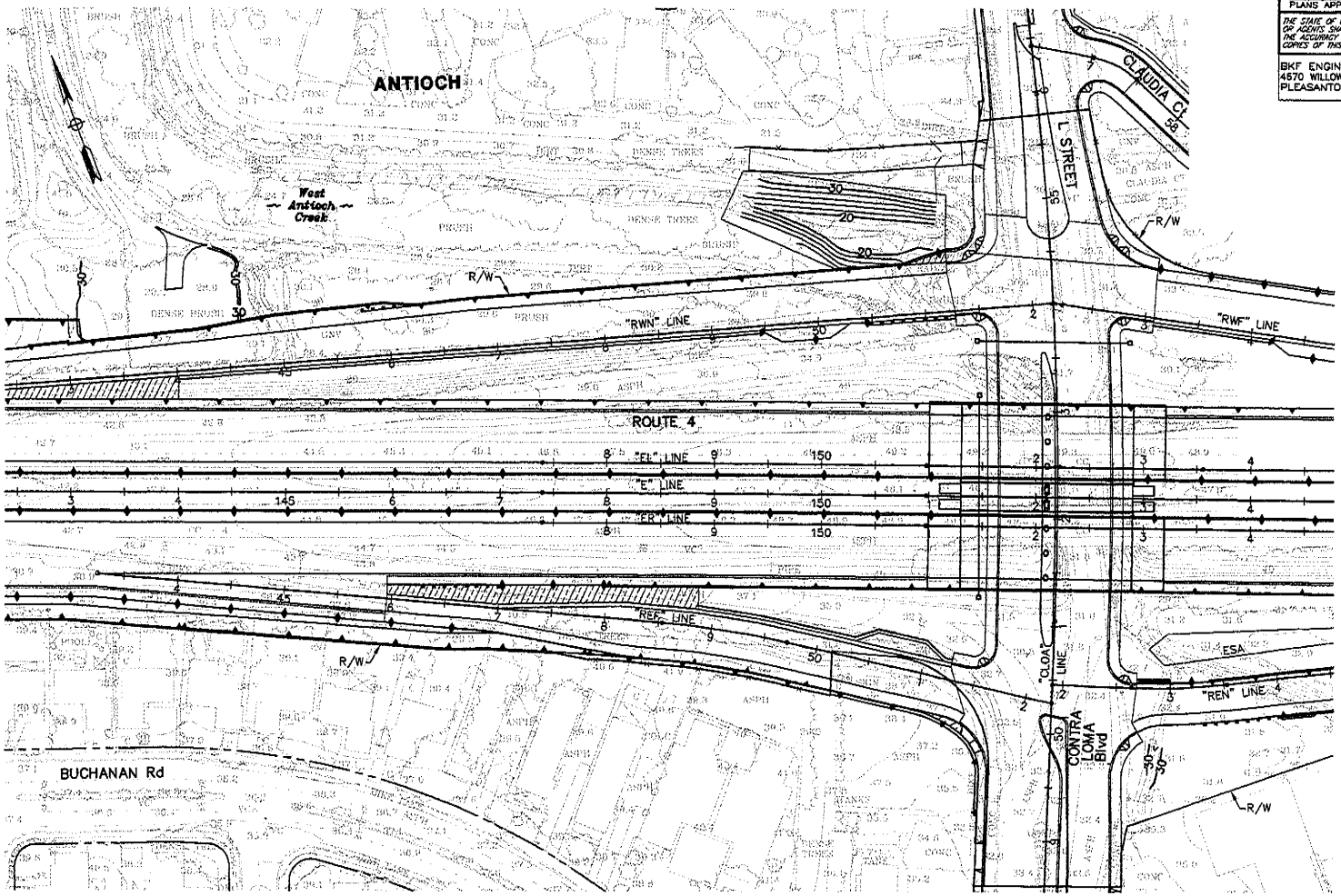
BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA. 94588

CCTA
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA. 94523



INFORMATION HANDOUT

CONTOUR GRADING

SCALE: 1" = 50'

G-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION	CONSULTANT FUNCTIONAL SUPERVISOR	CALCULATED-DESIGNED BY	REVISED BY
Caltrans	NATALINA V. BERNARDI	CHECKED BY	DATE REVISED

USE BORDER | DATE PLOTTED => Dec 14 2009 | 09-28-09 | TIME PLOTTED => 3:33 pm

BORDER LAST REVISED 4/11/2008 | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | USERNAME => $USER DGN FILE => $REQUEST | CU 04275 | EA 228511

FOR ACCURATE RIGHT OF WAY AND ACCESS DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

1. CONTRACTOR TO VERIFY EXISTING GRADE ELEVATIONS PRIOR TO CONSTRUCTION.
2. FOR ABREVATIONS AND/OR LEGEND, SEE SHEET L-1.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	CC	4	26.6/27.5		

REGISTERED CIVIL ENGINEER DATE

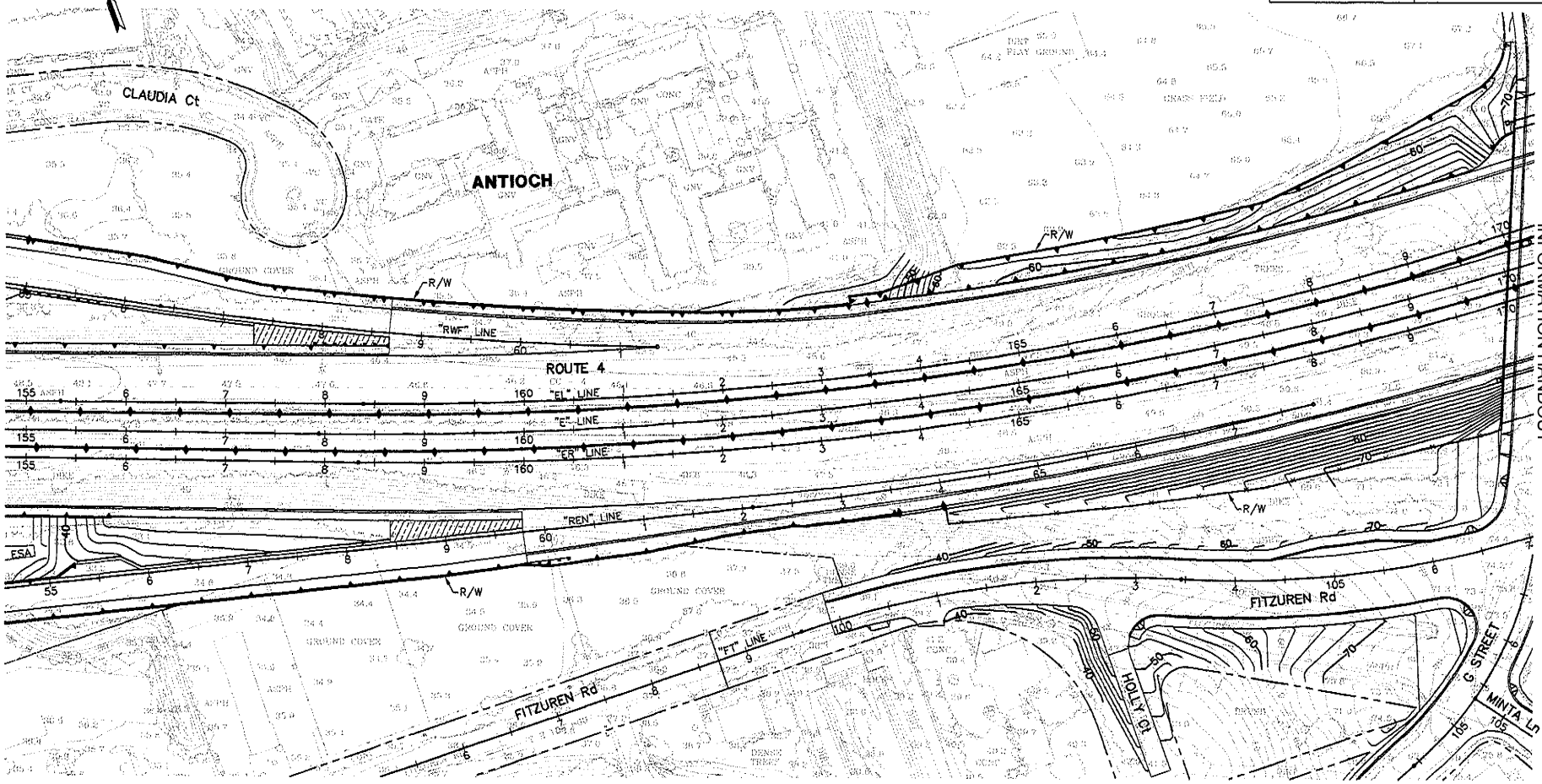
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER N. V. BERNARDI No. 45407 Exp. 9/30/10 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.

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA. 94588

CCTA
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA. 94523



CONTOUR GRADING

SCALE: 1" = 50'

G-2

STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI

CALCULATED-DESIGNED BY | CHECKED BY | REVISED BY | DATE REVISED

USE ORIGINAL | DATE PLOTTED => Dec 14 2009 | 09-28-09 | TIME PLOTTED => 3:33 pm

BORDER LAST REVISED 4/11/2008 | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | USERNAME => $USER | DGN FILE => $$$$USER | CU 04275 | EA 228511

US Army Corps of Engineers, San Francisco
Corps File Number: 2002 - 267465
Jurisdictional Delineation Maps

California Department of Transportation Project, PM 23.5 /29.6
State Route 4 East Widening Project, Contra Costa County CA
See Map Legend for Key Date January 5, 2008 Map 8

N

0 200 400 800
Feet

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Wetland Reverification

Sheet 8 of 15

November 2008

04-2285EA

INFORMATION HANDOUT

N

0 200 400 800

Feet

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Wetland Reverification

Sheet 9 of 15

November 2008

04-228SE4

INFORMATION HANDOUT

TABLE 1 – West Antioch Creek Impacted Trees

Tree Number	Species	Diameter (DBH) - Inches	Location	Impact	Comments
1	Chinese Elm	1	Creek Pipe Headwall	Removal	Staked Sapling
2	Willow	11,11, 10,10,8,8,7,6	South Bank of Creek - Adjacent to Proposed Retaining Wall	Removal or injury by contour grading	Multi-stemmed Clump
3	Black Walnut	8,8,5,5,3	South Bank of Creek - Adjacent to Proposed Retaining Wall	Removal or injury by contour grading	Multi-stemmed Specimen
4	Black Walnut	12,8,6	South Bank of Creek - Adjacent to Proposed PG&E Gas Pipeline Alignment	Open trench construction removal or injury	Multi-stemmed Specimen
5	Sycamore	8,6,3	South Bank of Creek - Adjacent to Proposed PG&E Gas Pipeline Alignment	Open trench construction removal or injury	Multi-stemmed Specimen
6	Black Walnut	3	South Bank of Creek - Adjacent to Proposed PG&E Gas Pipeline Alignment	Open trench construction removal or injury	—
7	Black Walnut	4,3	South Bank of Creek - Adjacent to Proposed PG&E Gas Pipeline Alignment	Open trench construction removal or injury	Multi-stemmed Specimen
8	Cottonwood	18,15	North Bank of Creek – Adjacent to Proposed PG&E Gas Pipeline Alignment	Open trench construction removal or injury	Multi-stemmed Specimen
9	Cottonwood	20	North Bank of Creek – In Area of Proposed Concrete Headwall/Box Culvert	Removal by contour grading	—
10	Cottonwood	24	North Bank of Creek – In Area of Proposed Concrete Headwall/Box Culvert	Removal by contour grading	—
11	Pepper Tree	5	North Bank of Creek – In Area of Proposed Concrete Headwall/Box Culvert	Removal by contour grading	Staked Specimen
12	Black Walnut	7, 10	South Bank of Creek In Area of Proposed Headwall/Box Culvert	Removal by contour grading	Multi-stemmed Specimen
13	Fan Palm	22	South Bank of Creek In Area of Proposed Headwall/Box Culvert	Removal by contour grading	—

SR 4 (East) Widening Project
Contra Loma-L Street & G Street Segment

California Department of Fish and Game
1602 Lake or Streambed Alteration Agreement Application

Attachment F. Hydrological Study Summary

West Antioch Creek

The upper reach of West Antioch Creek flows through unincorporated Contra Costa County before in enters the City of Antioch and eventually outlets into the Sacramento/San Joaquin River Delta.

Where it crosses State Route 4, West Antioch Creek's watershed is approximately 4350 acres. This area generates a Q_{100} flow of 2660 CFS. Contra Costa County Flood Control District (CCCFCD) has determined that triple 120-inch diameter pipes would be required to pass this flow beneath Route 4 during a 100-year storm.

The first bore of this crossing was installed by CCCFCD in 1996 and consists of a 120-inch Concrete Cast-in-Place Pipe transitioning to a 10' x 8' Reinforced Concrete Box at its outfall. The creek was re-aligned to its current configuration when this culvert was constructed.

The second bore will be constructed as part of this State Route 4 Freeway Widening Project and will also consist of a 120-inch Reinforced Concrete Pipe transitioning to a 10' x 8' Reinforced Concrete Box similar to the first bore.

The third bore will be constructed by the City of Antioch and CCCFCD in the future.

Temporary Creek Diversion System

A temporary creek diversion system consisting of cofferdams and pumps will be required to divert West Antioch Creek to its pre-1994 waterway in order to facilitate construction of the aforementioned second bore.

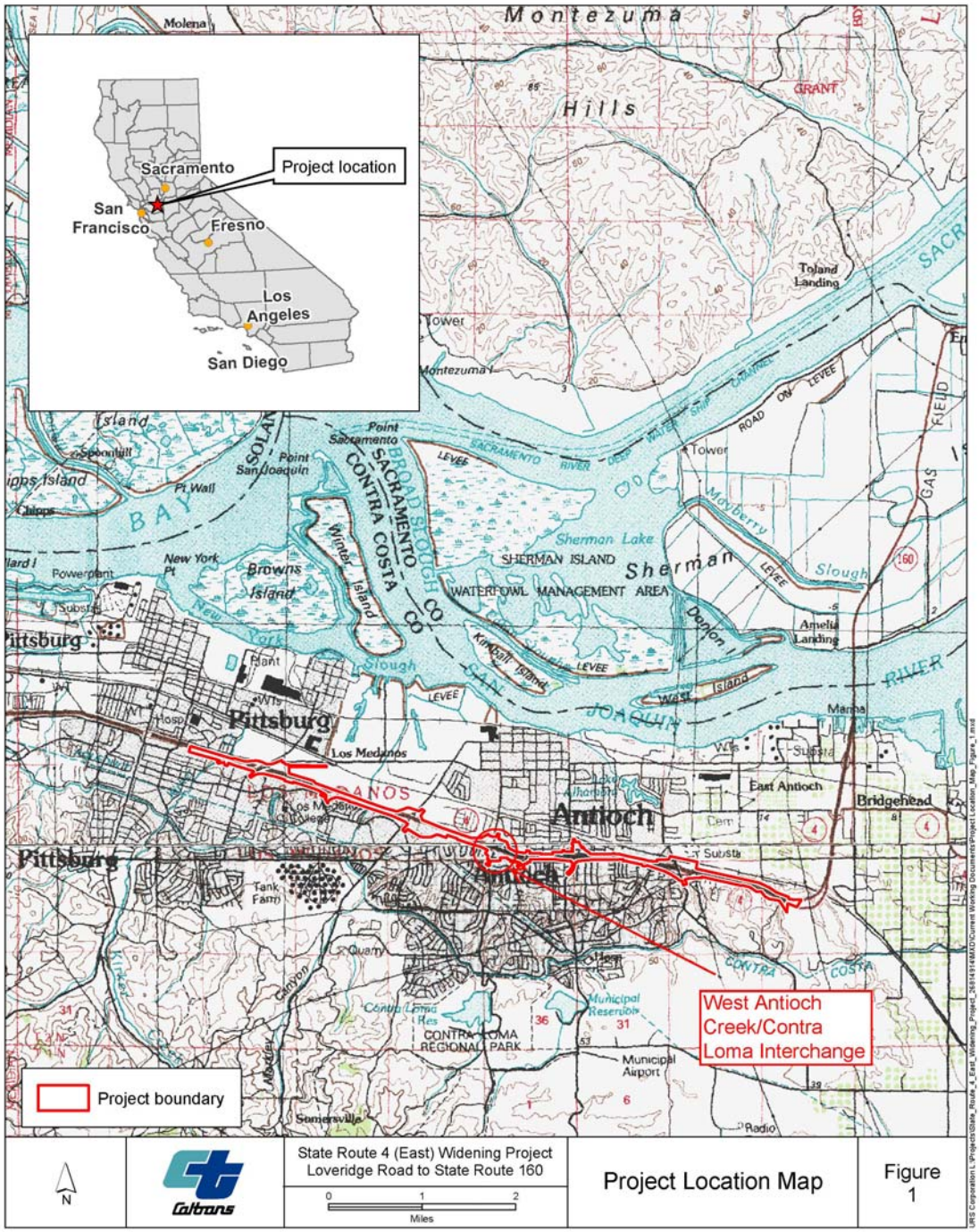
Work within West Antioch Creek will be restricted to the period between June 1st and October 31st. During this restricted period, both Antioch Municipal Reservoir and Contra Loma Reservoir will not be releasing flows to the creek. According to Contra Costa County's Community Development Department, the base flows within West Antioch Creek during the restricted period average 5.2 CFS. This base flow of 5.2 CFS will be the basis for determining the size of the diversion pumps and how often they will need to cycle.

A specification for the Temporary Creek Diversion System in addition to layout plans and details are attached for further clarification.

West Antioch Creek Flows vs Return Periods

Q_{100} = 2660 CFS, Q_{50} = 2400 CFS, Q_{25} = 1990 CFS, Q_{10} = 1620 CFS

Average base flow from June 1st until October 31st = 5.2 CFS


Project location
Sacramento
San Francisco
Fresno
Los Angeles
San Diego
Montezuma
Hills
Toland Landing
Sherman Island
Sherman Lake
Sherman
WATERFOWL MANAGEMENT AREA
Browns Island
Winter Island
Kimball Island
West Island
Amelia Landing
Pittsburg
Antioch
East Antioch
Bridgehead
Los Medanos
Tank Farm
Municipal Reservoir
CONTRA LOMA REGIONAL PARK
Municipal Airport
Somersville
West Antioch Creek/Contra Loma Interchange
Project boundary
N
Caltrans
State Route 4 (East) Widening Project
Loveridge Road to State Route 160
0 1 2
Miles
Project Location Map
Figure 1

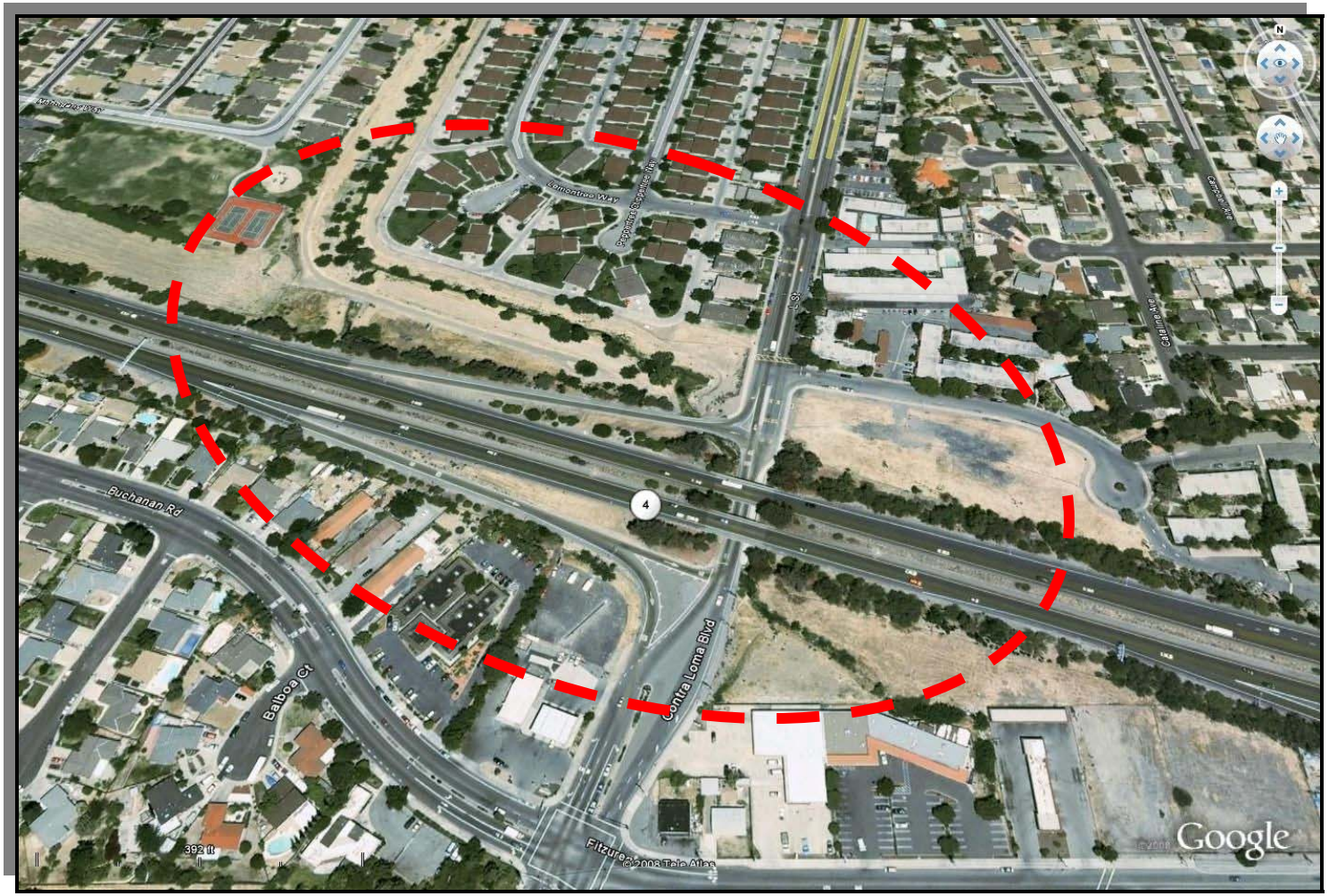
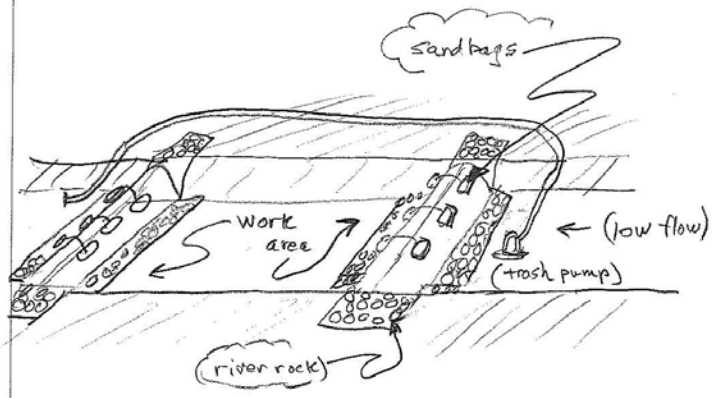


Figure 2 West Antioch Creek & Contra Loma Interchange Project Area

Harris & Associates
Program Managers
Construction Managers
Civil Engineers

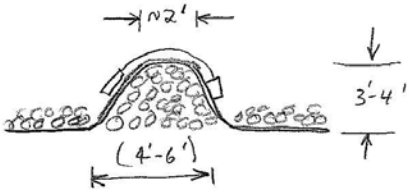
Project: Antioch Creek Sht. ____ of ____
Description: Temporary Dry Season Dams, upstream and downstream of gas line crossing
Proj. No. ____ By ____ Date ____ Chk'd By ____



Temporary Dams

Detail: River Rock, covered w/ impermeable plastic (visquine, e.g.), and stabilized with river rock at the toe, and sand bags on top

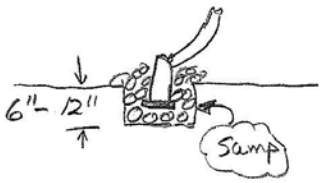
Typical Section:



Note: Place trash pump upstream of upstream dam, to discharge downstream of downstream dam.

Trash Pump Detail:

Place trash pump in a sump in the streambed, surrounded with river rock.



Option 1 – Temporary Construction Dry Season Dams at Proposed PG&E Gas Line Crossing

Design Drafting
62-3690

PACIFIC GAS AND ELECTRIC COMPANY

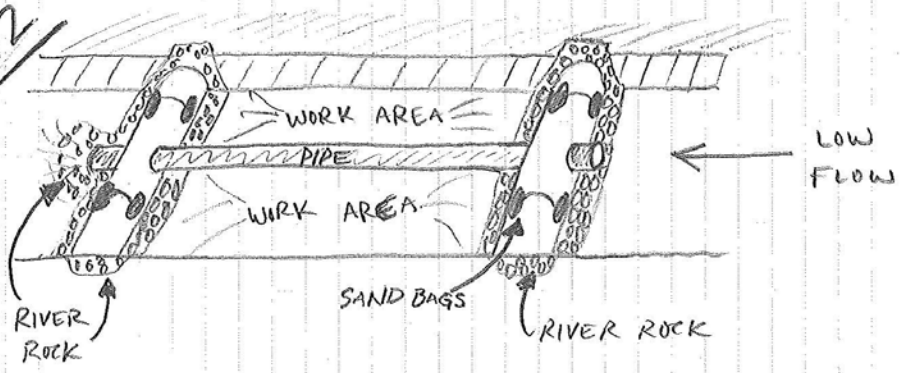
GENERAL COMPUTATION SHEET

SHEET NO. ____ OF ____ SHEETS
JOB FILE NO. ____
LOCATION ____

SUBJECT Antioch Creek
Temporary Dams for Gas Line Crossing

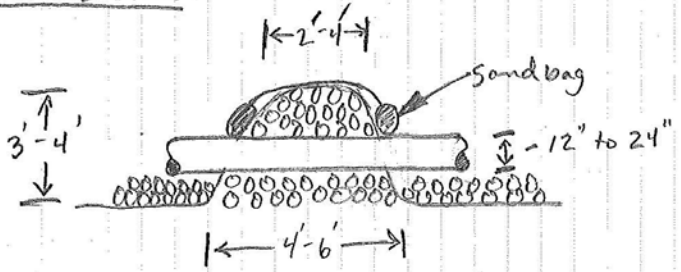
MADE BY ____ DATE ____ CHECKED BY ____ APPROVED BY ____

Option 2



TEMPORARY DAMS: river rock covered with impermeable plastic (visqueen, etc.) and stabalized with river rock at the toe, and sand bags at top

Typical Section:



Option 2 – Temporary Construction Dry Season Dams at Proposed PG&E Gas Line Crossing

Design Drafting
62-3690

PACIFIC GAS AND ELECTRIC COMPANY

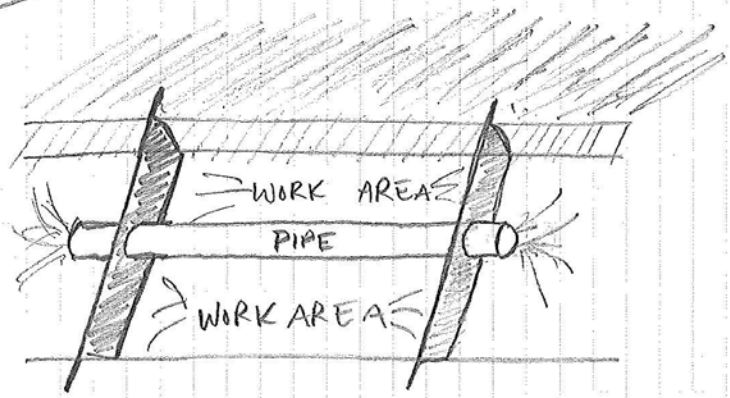
GENERAL COMPUTATION SHEET

SHEET NO. ____ OF ____ SHEETS
JOB FILE NO. ____
LOCATION ____

SUBJECT ____

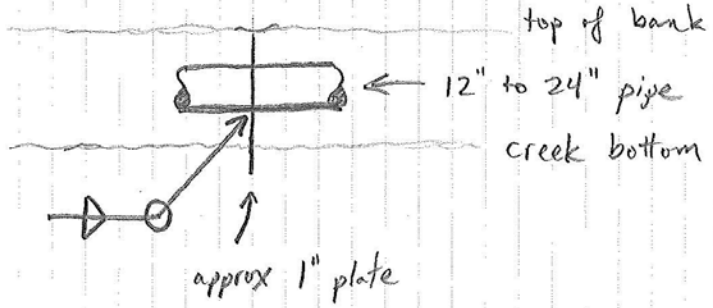
MADE BY ____ DATE ____ CHECKED BY ____ APPROVED BY ____

Option 3



Temporary Dams: steel plate welded to pipe and pushed into creek bed

Typical Section:



Option 3 – Temporary Construction Dry Season Dams at Proposed PG&E Gas Line Crossing

SR 4 (East) Widening Project
Contra Loma-L Street & G Street Segment

California Department of Fish and Game
1602 Lake or Streambed Alteration Agreement

Attachment 10 (A) – Project Description (Continued)

Implementation of the first phase PG&E gas pipeline relocation would require open trench pipeline construction. There is insufficient staging area for a directional bore beneath the creek channel. The creek channel is approximately 100 feet from edge of bank to edge of bank. The pipeline construction would be within a 60-foot wide, 100-foot long construction zone, with the pipeline installed approximately 5 feet below the creek bottom.

PG&E plans to build a temporary upstream gravel/sandbag/airbag dam to direct base flows through a diversion pipe around the construction site. The proposed "dry season" construction period, is scheduled for completion by October 15. During construction, a plastic diversion pipe will be installed through and approximately perpendicular to the PG&E trench line. Discharge flows will be through a downstream cofferdam wrapped with an impermeable polyethylene liner, and located approximately 15-20 feet from the trench crossing. PG&E will enter the work site using existing maintenance access roads on either bank, which are accessed from Sycamore Drive or "L" Street. Construction equipment and crew trucks will be kept to a minimum as there is not much working space. Equipment will likely include a large excavator that will remain on the banks and be able to reach into the floodplain and creek channel. Smaller excavators or backhoes may be used on the banks for termination points. Smaller equipment may also enter the floodplain from the banks to assist in installation and backfill of the pipeline.

The second phase of work for the road widening project near Contra Loma – L Street Interchange is the construction of roadway and drainage improvements along West Antioch Creek. This includes:

- Installation of an additional two 10'x8' box culverts from West Antioch Creek south of Fitzuren Road to West Antioch Creek just to the west of "L" Street
- Extension of the downstream end of a 10'x5' box culvert along Contra Loma Blvd/"L" Street which outfalls into West Antioch Creek
- Extension of the upstream end of a triple 5'x3 'box culvert along Contra Loma Blvd/"L" Street which extends into West Antioch Creek
- Installation of a single 5'x3' box culvert across the proposed eastbound onramp from Contra Loma Blvd. in West Antioch Creek
- Installation of 4'x 2' box culvert that outfalls to West Antioch Creek
- Installation of concrete headwalls and rock slope protection at the end of the drainage improvements

- Shifting and widening of the westbound onramp from “L” Street, the widening of “L” Street and Contra Loma Blvd. into West Antioch Creek

- Installation of the proposed eastbound onramp from Contra Loma Blvd. across West Antioch Creek

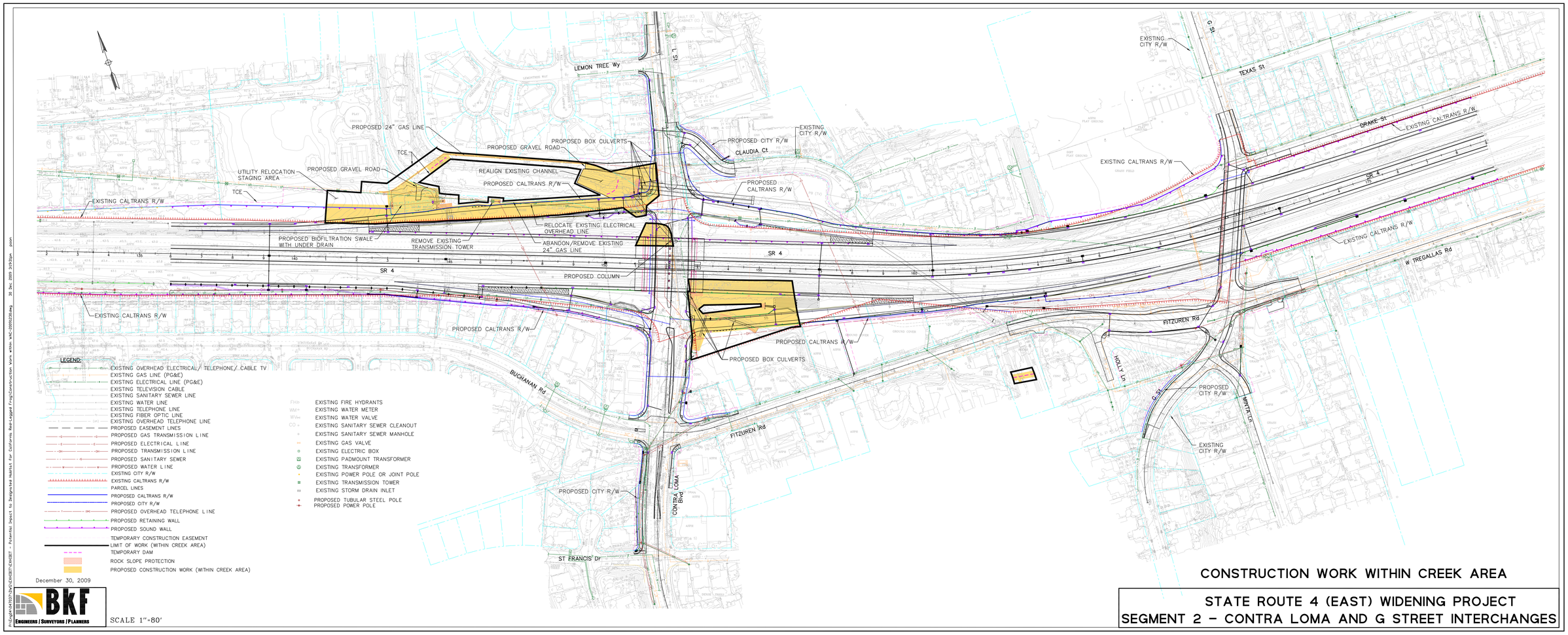
- Installation of a portion of concrete retaining wall along the proposed westbound onramp from L Street within West Antioch Creek

- Regrading and realignment of West Antioch Creek to the west of “L” Street due to the above improvements

- Temporary cofferdam and dewatering of West Antioch Creek to perform the above improvements

- Temporary access into West Antioch Creek to perform the subject improvements

This second phase implementation is planned for an April 2011 construction start, ending in October 2014 thru a period of one or two years. Because West Antioch Creek is defined by the U.S. Fish and Wildlife Service as California red-legged frog habitat, as conditioned by the Biological Opinion for the entire SR4 widening project, the construction period within the creek channel would be confined to the “dry season”.



December 30, 2009

BKF ENGINEERS / SURVEYORS / PLANNERS

SCALE 1"=80'

CONSTRUCTION WORK WITHIN CREEK AREA

STATE ROUTE 4 (EAST) WIDENING PROJECT
SEGMENT 2 – CONTRA LOMA AND G STREET INTERCHANGES

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	CC	4	26.6/27.5		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER J. F. PETERSON No. 42777 Exp. 3/31/10 CIVIL STATE OF CALIFORNIA

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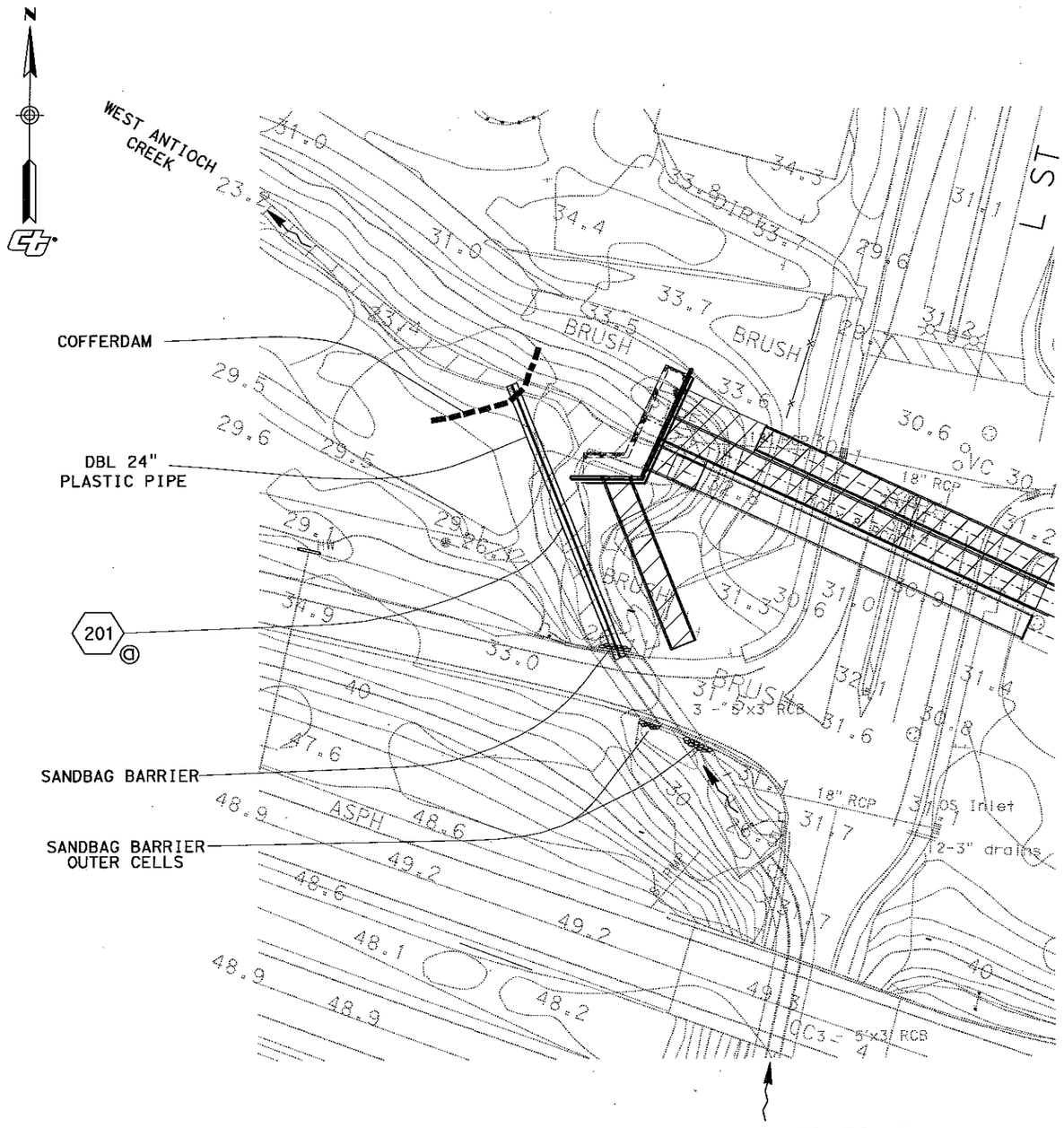
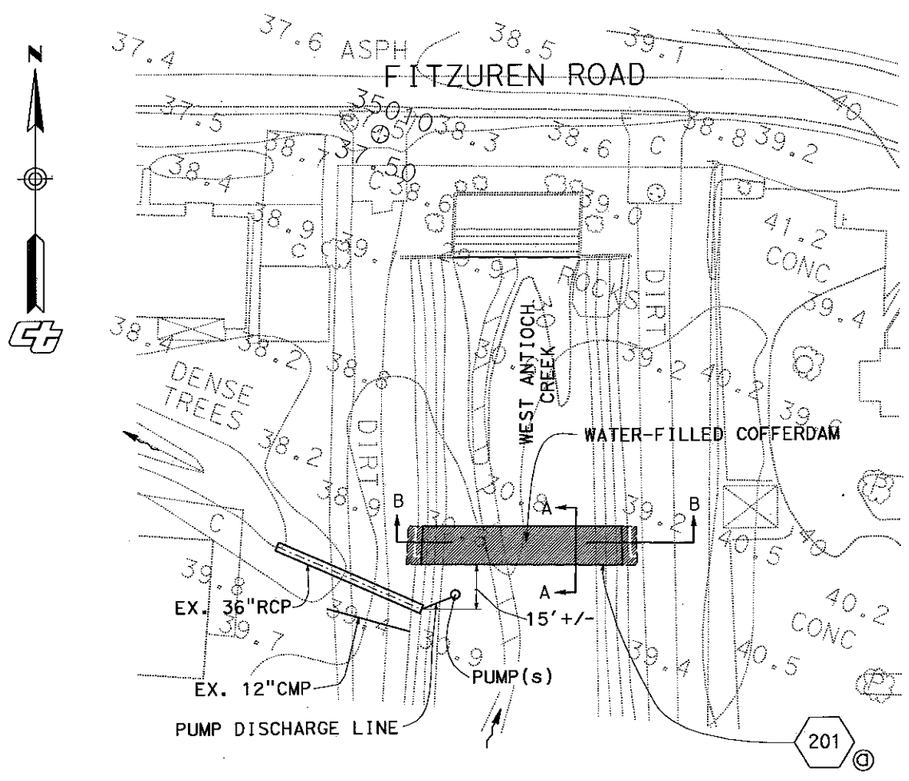
CONSTRUCT THIS STAGE



DOWNSTREAM COFFERDAM PLAN
(FOR DETAILS SEE SHEET TDD-1)



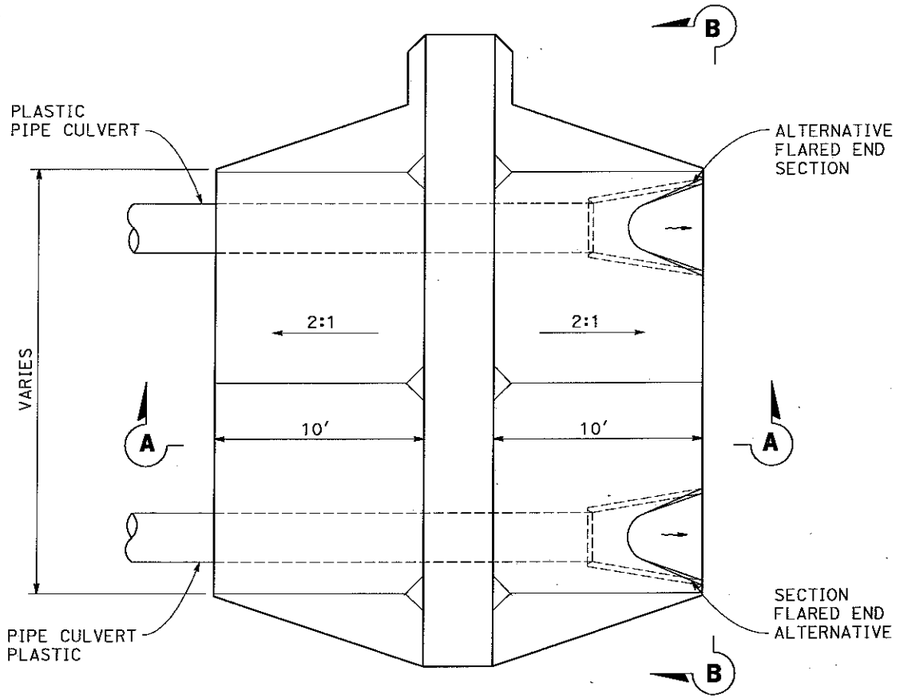
UPSTREAM COFFERDAM PLAN
(FOR DETAILS SEE SHEET TDD-2)

TEMPORARY CREEK DIVERSION SYSTEM

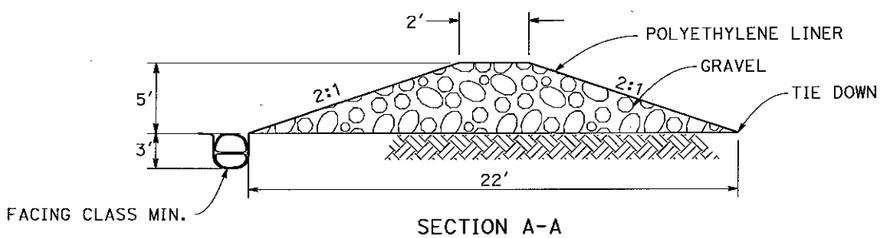
TEMPORARY DRAINAGE STAGE 1
NO SCALE **TD-1**

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans
FUNCTIONAL SUPERVISOR: JOSEPH PETERSON
CALCULATED-DESIGNED BY: BIPIN PATEL
CHECKED BY
REVISED BY
DATE REVISED

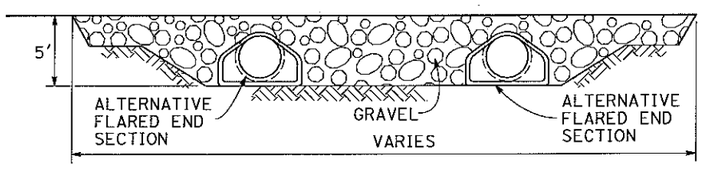
LAST REVISION 00-00-00
DATE PLOTTED => 01-DEC-2009
TIME PLOTTED => 10:03



PLAN



SECTION A-A

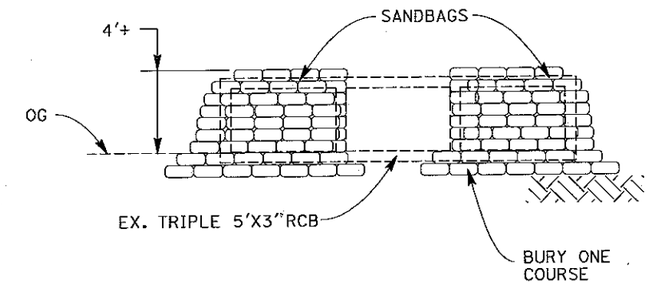


SECTION B-B

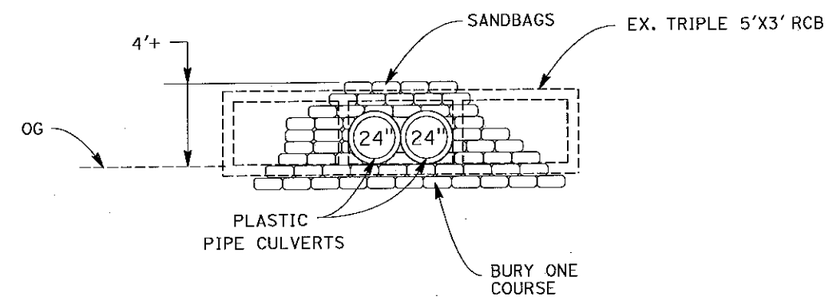
COFFERDAM DETAILS

NOTES

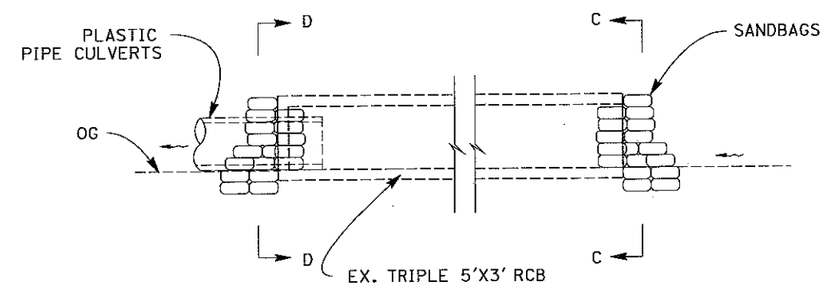
1. PLASTIC SHEET SHALL BE COMMERCIAL QUALITY POLYETHYLENE WITH A MINIMUM THICKNESS OF 10 MILS.
2. ALL PLASTIC SHEETING SHALL BE FREE OF CRACKS, OR OTHER DEFECTS ADVERSELY AFFECTING THE PROTECTIVE CHARACTERISTIC OF THE MATERIAL.
3. ALL JOINTS BETWEEN THE PLASTIC SHEET AND PIPE SHALL BE SEALED WITH COMMERCIAL QUALITY WATERPOOF TAPE.



SECTION C-C



SECTION D-D



SANDBAG BARRIER DETAILS

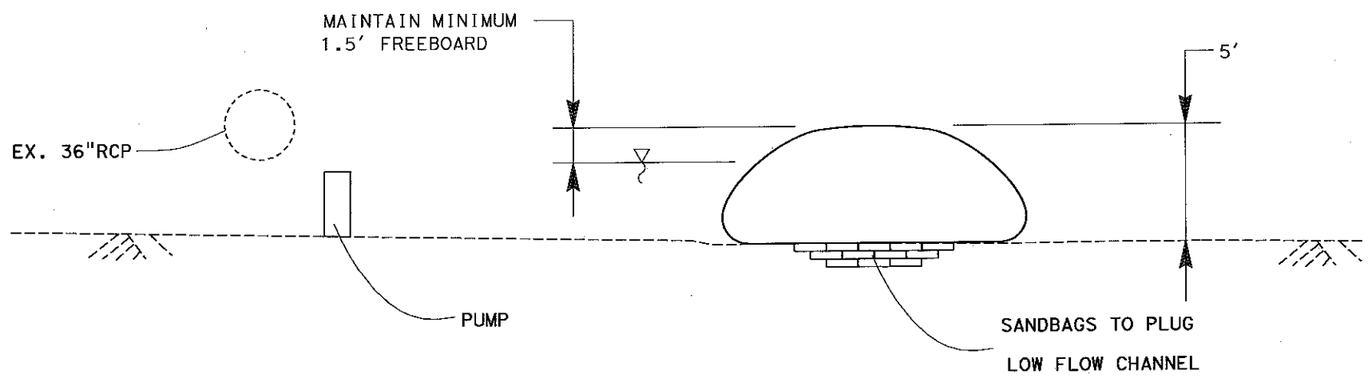
DOWNSTREAM COFFERDAM DETAILS

NO SCALE

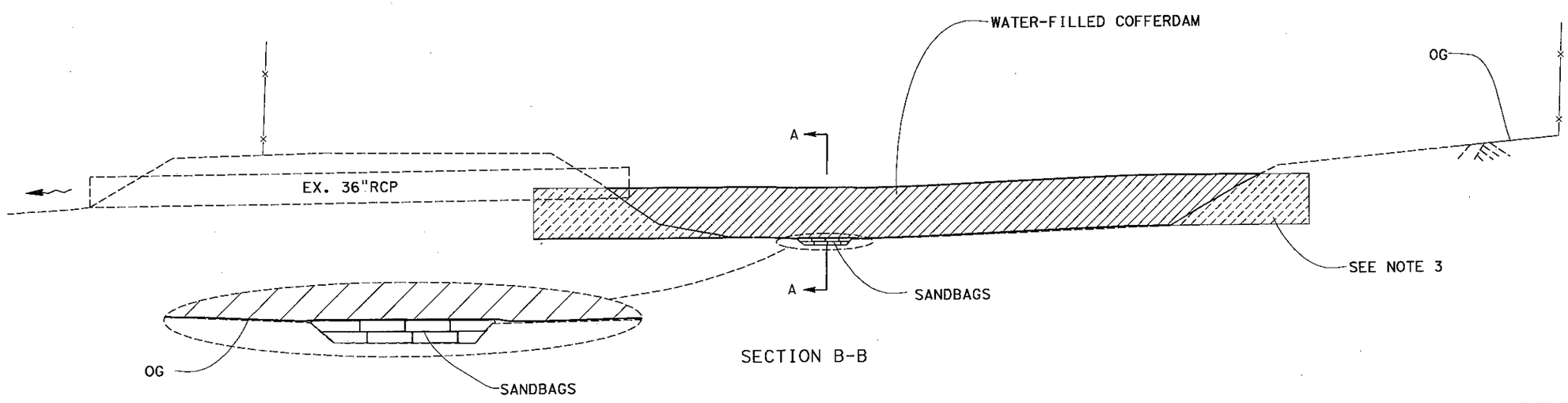
TDD-1

NOTES:

1. PUMP(s) TO BE SIZED BY CONTRACTOR TO PERFORM WORK INTENDED.
2. AVERAGE FLOW IN WEST ANTIOCH CREEK DURING RESTRICTED PERIOD IS 5.5 cfs.
3. ANCHOR WATER-FILLED COFFERDAM INTO CREEK SIDEBANKS TO PREVENT SEEPAGE.



SECTION A-A



SECTION B-B

UPSTREAM COFFERDAM DETAIL

NO SCALE

TDD-2

04-2285E4

INFORMATION HANDOUT

FOR ACCURATE RIGHT OF WAY AND ACCESS DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

1. CONTRACTOR TO VERIFY EXISTING GRADE ELEVATIONS PRIOR TO CONSTRUCTION.
2. FOR ABREVATIONS AND/OR LEGEND, SEE SHEET L-1.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	CC	4	26.6/27.5		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER N. V. BERNARDI No. 45407 Exp. 9/30/10 CIVIL STATE OF CALIFORNIA

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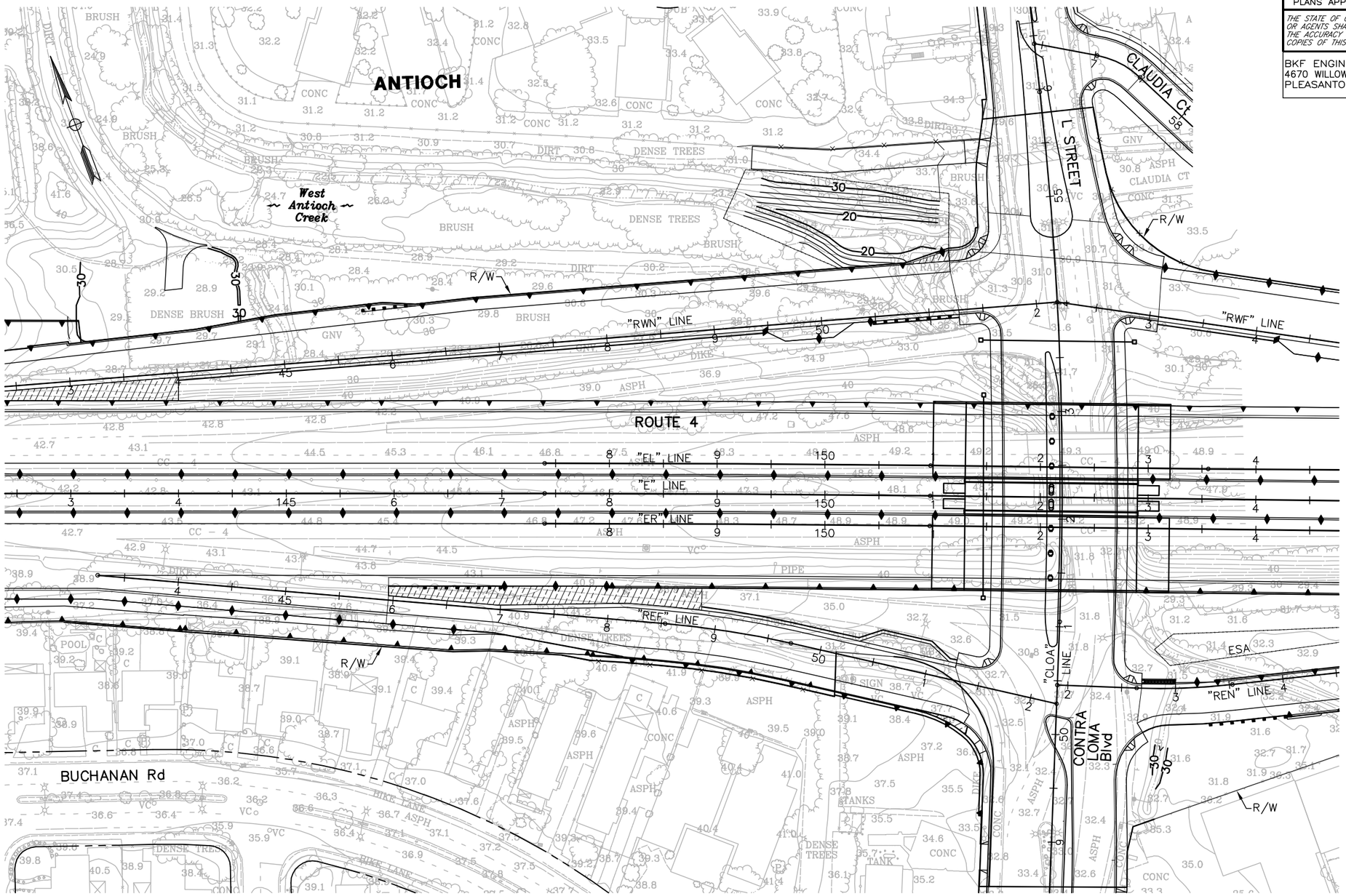
BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA. 94588

CCTA
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA. 94523



CONTOUR GRADING

SCALE: 1" = 50'

PAGE-39 **G-1**

REVISED BY | DATE REVISED | CALCULATED-DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION | DATE PLOTTED => Dec 14 2009 | 09-28-09 | TIME PLOTTED => 3:33 pm

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CU 04275

EA 228511

04-2285E4

INFORMATION HANDOUT

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2. FOR ABREVATIONS AND/OR LEGEND, SEE SHEET L-1.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	CC	4	26.6/27.5		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER N. V. BERNARDI No. 45407 Exp. 9/30/10 CIVIL STATE OF CALIFORNIA

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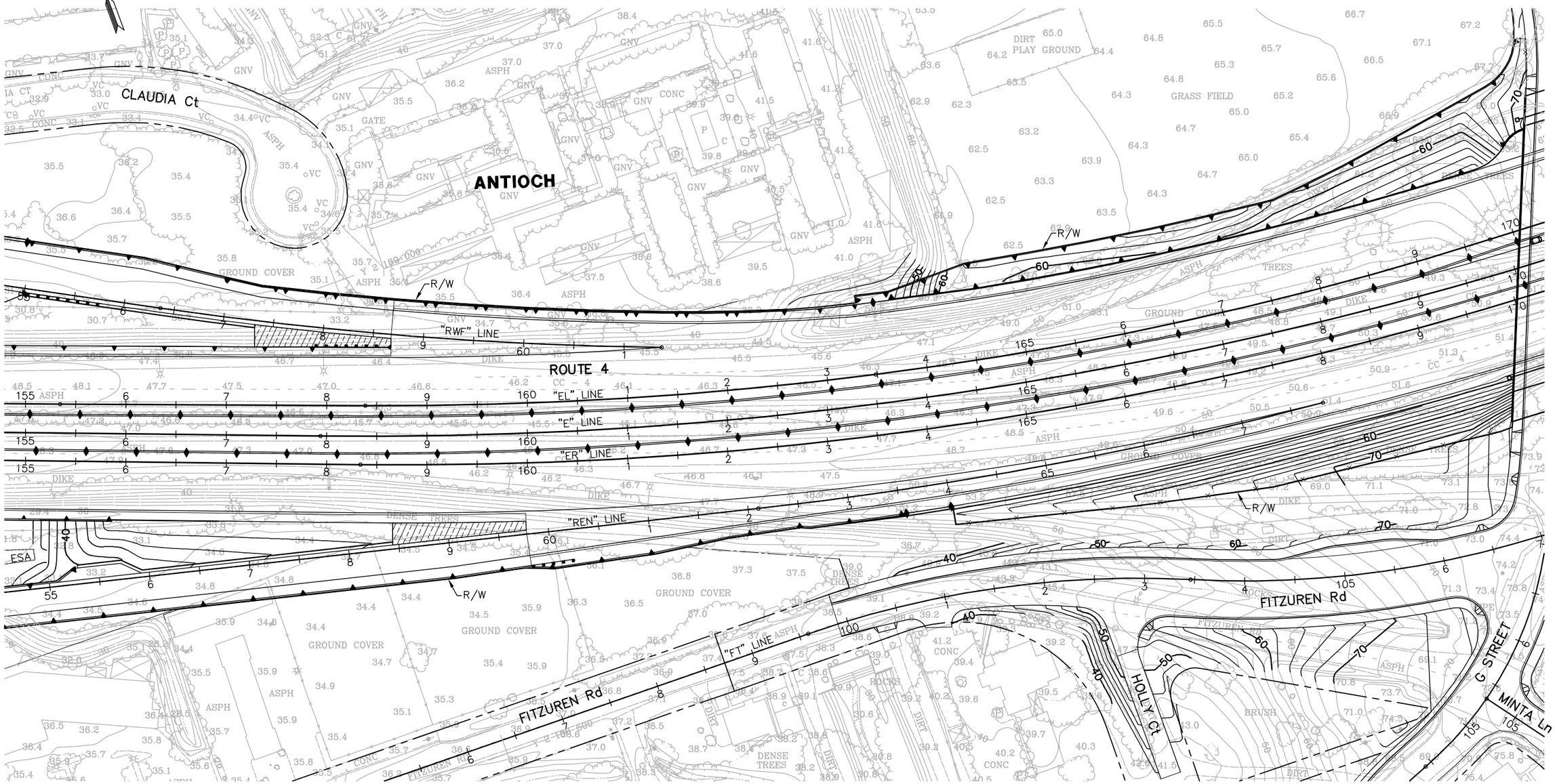
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA. 94588

CCTA
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA. 94523



CONTOUR GRADING

SCALE: 1" = 50'

PAGE-40 **G-2**

REVISED BY | DATE REVISED | CALCULATED-DESIGNED BY | CHECKED BY | CONSULTANT FUNCTIONAL SUPERVISOR: NATALINA V. BERNARDI

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION

Caltrans

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US Army Corps of Engineers, San Francisco
Corps File Number: 2002 - 26746S
Jurisdictional Delineation Maps

California Department of Transportation Project, PM 23.5 /29.6
State Route 4 East Widening Project, Contra Costa County CA
See Map Legend for Key Date January 5, 2008 Map 8

N

0 200 400 800

Feet

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Wetland Reverification

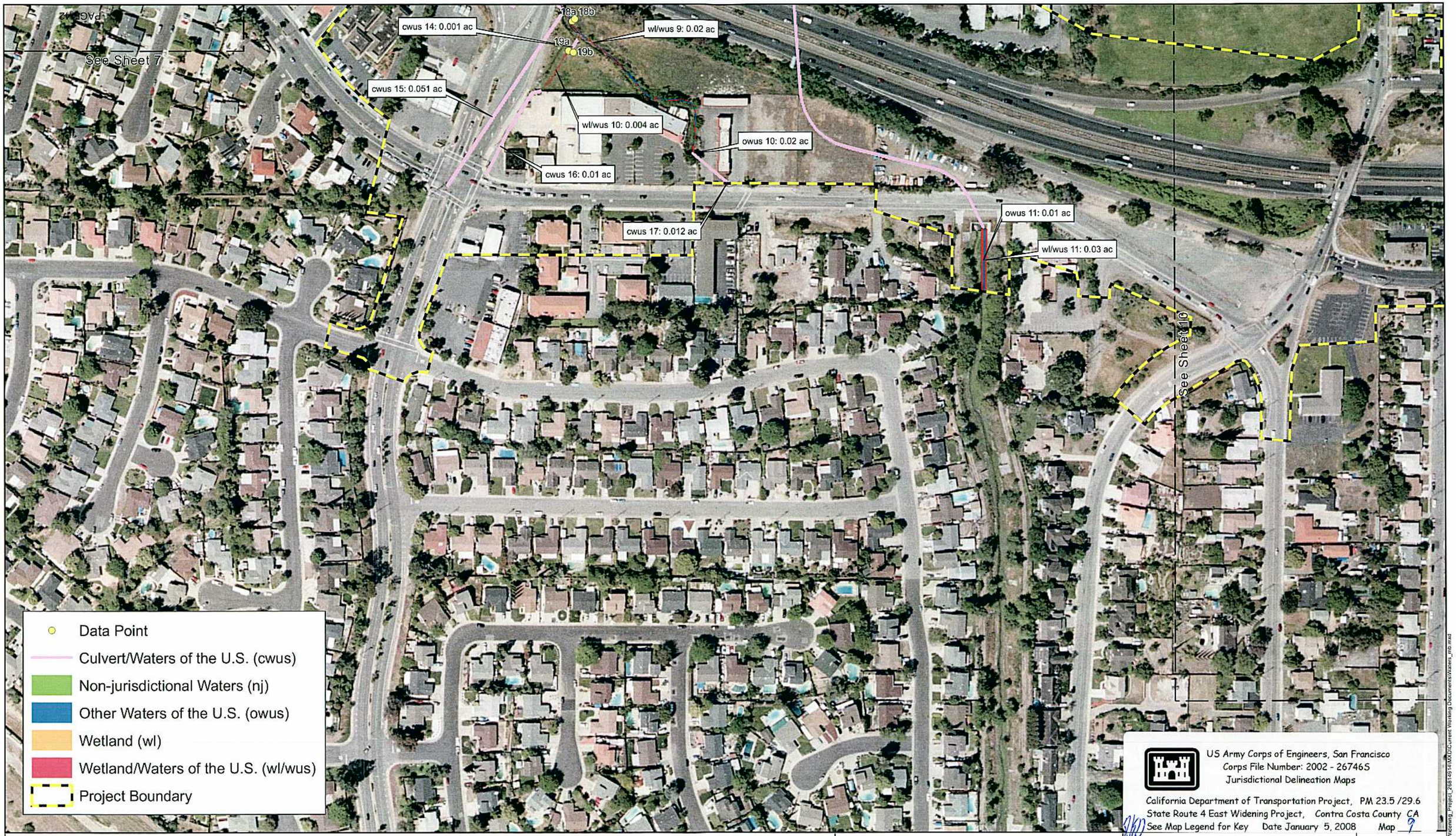
Sheet 8 of 15

November 2008

04-228654

INFORMATION HANDOUT

L:\Projects\State_Route_4_East_Widening_Project_26814914\XXX\Current Working Documents\Waters_wb.mxd



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Feet

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Wetland Reverification

Sheet 9 of 15

November 2008

INFORMATION HANDOUT

04-228564

TABLE 1 – West Antioch Creek Impacted Trees

Tree Number	Species	Diameter (DBH) - Inches	Location	Impact	Comments
1	Chinese Elm	1	Creek Pipe Headwall	Removal	Staked Sapling
2	Willow	11,11, 10,10,8,8,7,6	South Bank of Creek - Adjacent to Proposed Retaining Wall	Removal or injury by contour grading	Multi-stemmed Clump
3	Black Walnut	8,8,5,5,3	South Bank of Creek - Adjacent to Proposed Retaining Wall	Removal or injury by contour grading	Multi-stemmed Specimen
4	Black Walnut	12,8,6	South Bank of Creek - Adjacent to Proposed PG&E Gas Pipeline Alignment	Open trench construction removal or injury	Multi-stemmed Specimen
5	Sycamore	8,6,3	South Bank of Creek - Adjacent to Proposed PG&E Gas Pipeline Alignment	Open trench construction removal or injury	Multi-stemmed Specimen
6	Black Walnut	3	South Bank of Creek - Adjacent to Proposed PG&E Gas Pipeline Alignment	Open trench construction removal or injury	___
7	Black Walnut	4,3	South Bank of Creek - Adjacent to Proposed PG&E Gas Pipeline Alignment	Open trench construction removal or injury	Multi-stemmed Specimen
8	Cottonwood	18,15	North Bank of Creek – Adjacent to Proposed PG&E Gas Pipeline Alignment	Open trench construction removal or injury	Multi-stemmed Specimen
9	Cottonwood	20	North Bank of Creek – In Area of Proposed Concrete Headwall/Box Culvert	Removal by contour grading	___
10	Cottonwood	24	North Bank of Creek – In Area of Proposed Concrete Headwall/Box Culvert	Removal by contour grading	___
11	Pepper Tree	5	North Bank of Creek – In Area of Proposed Concrete Headwall/Box Culvert	Removal by contour grading	Staked Specimen
12	Black Walnut	7, 10	South Bank of Creek In Area of Proposed Headwall/Box Culvert	Removal by contour grading	Multi-stemmed Specimen
13	Fan Palm	22	South Bank of Creek In Area of Proposed Headwall/Box Culvert	Removal by contour grading	___

SR 4 (East) Widening Project
Contra Loma-L Street & G Street Segment

California Department of Fish and Game
1602 Lake or Streambed Alteration Agreement Application

Attachment F. Hydrological Study Summary

West Antioch Creek

The upper reach of West Antioch Creek flows through unincorporated Contra Costa County before in enters the City of Antioch and eventually outlets into the Sacramento/San Joaquin River Delta.

Where it crosses State Route 4, West Antioch Creek's watershed is approximately 4350 acres. This area generates a Q_{100} flow of 2660 CFS. Contra Costa County Flood Control District (CCCFCD) has determined that triple 120-inch diameter pipes would be required to pass this flow beneath Route 4 during a 100-year storm.

The first bore of this crossing was installed by CCCFCD in 1996 and consists of a 120-inch Concrete Cast-in-Place Pipe transitioning to a 10' x 8' Reinforced Concrete Box at its outfall. The creek was re-aligned to its current configuration when this culvert was constructed.

The second bore will be constructed as part of this State Route 4 Freeway Widening Project and will also consist of a 120-inch Reinforced Concrete Pipe transitioning to a 10' x 8' Reinforced Concrete Box similar to the first bore.

The third bore will be constructed by the City of Antioch and CCCFCD in the future.

Temporary Creek Diversion System

A temporary creek diversion system consisting of cofferdams and pumps will be required to divert West Antioch Creek to its pre-1994 waterway in order to facilitate construction of the aforementioned second bore.

Work within West Antioch Creek will be restricted to the period between June 1st and October 31st. During this restricted period, both Antioch Municipal Reservoir and Contra Loma Reservoir will not be releasing flows to the creek. According to Contra Costa County's Community Development Department, the base flows within West Antioch Creek during the restricted period average 5.2 CFS. This base flow of 5.2 CFS will be the basis for determining the size of the diversion pumps and how often they will need to cycle.

A specification for the Temporary Creek Diversion System in addition to layout plans and details are attached for further clarification.

West Antioch Creek Flows vs Return Periods

Q_{100} = 2660 CFS, Q_{50} = 2400 CFS, Q_{25} = 1990 CFS, Q_{10} = 1620 CFS

Average base flow from June 1st until October 31st = 5.2 CFS

State of California – The Natural Resources Agency **ARNOLD SCHWARZENEGGER**, *Governor*
DEPARTMENT OF FISH AND GAME
Bay Delta Region
Post Office Box 47
Yountville, California 94599
(707) 944-5520
www.dfg.ca.gov

June 8, 2010

Susan Miller
Contra Costa Transportation Authority
3478 Buskirk Avenue, Suite 100
Pleasant Hill, CA 94523

Subject: Final Lake or Streambed Alteration Agreement
Notification No. 1600-2010-0094-R3
State Route 4 Widening Project, West Antioch Creek

Dear Ms. Miller:

Enclosed is the final Streambed Alteration Agreement ("Agreement") for State Route 4 Widening Project ("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 8, 2010, based on information contained in the Negative Declaration 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 Melissa Escaron, Staff Environmental Scientist at (707) 339-0334 or mescaron@dfg.ca.gov.

Sincerely,

Scott Wilson
Environmental Program Manager
Bay Delta Region

cc: Melissa Escaron
Warden Jacobsen
Lieutenant Christensen

Conserving California's Wildlife Since 1870

CALIFORNIA DEPARTMENT OF FISH AND GAME
BAY DELTA REGION
POST OFFICE BOX 47
YOUNTVILLE, CALIFORNIA 94599
(707) 944-5520
WWW.DFG.CA.GOV

STREAMBED ALTERATION AGREEMENT
NOTIFICATION NO. 1600-2010-0094-3
West Antioch Creek

CALIFORNIA DEPARTMENT OF TRANSPORTATION
STATE ROUTE 4 WIDENING PROJECT

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

RECITALS

WHEREAS, pursuant to Fish and Game Code (FGC) section 1602, Permittee notified DFG on February 16, 2009 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 on State Route 4 just west of Contra Loma Boulevard to just east of the G Street Overcrossing in Antioch, California. Latitude: 37/59/59.59 N, Longitude: 121/49/13/3 W.

PROJECT DESCRIPTION

The Contra Costa Transportation Authority (CCTA), in cooperation with the California Department of Transportation (Caltrans) proposes to widen State Route 4 (SR 4) and its interchanges and local roadways from just west of the Contra Loma Boulevard-L Street Interchange to just east of the G Street Overcrossing. The project is a phased component of the widening of SR 4 from just west of Loveridge Road to SR 160.

The work will be conducted in 2 phases. The first phase of work requires the rerouting of a new 24-inch PG&E natural gas pipeline across a channelized section of West Antioch Creek, approximately 720 feet northwest of the existing Contra Loma overcrossing. The work will be done using open trench pipeline construction. PG&E will relocate the existing 24' high pressure main from the south side of West Antioch creek to the north side of the creek. The gas main will cross the creek channel and flood plain through a section of creek that is approximately 100' wide from top of bank to top of bank. The pipeline will be installed 5 feet below the creek bottom. A temporary water diversion structure, if needed, will be approved by DFG.

The second phase of work will construct roadway and drainage improvements along West Antioch Creek. These improvements include:

- Installation of two 10-foot by 8-foot box culverts from West Antioch Creek south of Fitzuren Road to West Antioch Creek jus to the west of L Street.
- Extension of the downstream end of a 10-foot by 5-foot box culvert along Contra Loma Blvd./L Street which outfalls into West Antioch Creek
- Extension of the upstream end of a triple 5-foot by 3-foot box culvert along Contra Loma Blvd./L Street which extends into West Antioch Creek
- Installation of a single 5-foot by 3-foot box culvert across the proposed eastbound onramp from Contra Loma Blvd. in West Antioch Creek
- Installation of 4-foot by 2-foot box culvert that outfalls to West Antioch Creek
- Installation of concrete headwalls and rock slope protection at the end of the drainage improvements
- Shifting and widening of the westbound onramp from L Street and widening of L Street and Contra Loma Blvd. into West Antioch Creek
- Installation of the proposed eastbound onramp from Contra Loma Blvd. across West Antioch Creek

- Installation of a portion of concrete retaining wall along the proposed westbound onramp from L Street within West Antioch Creek
- Regrading and realignment of West Antioch Creek to the west of L Street to accommodate improvements
- Temporary cofferdam and dewatering of West Antioch Creek to perform the above improvements
- Temporary access into West Antioch Creek to perform the subject improvements

PROJECT IMPACTS

Existing fish or wildlife resources the project could substantially adversely affect include: aquatic habitat including California red-legged (CRLF) frog habitat.

The adverse effects the project could have on the fish or wildlife resources identified above include: Potential for adverse impacts to aquatic and dispersal habitat for California red-legged frog resulting from decreased water quality, vegetation disturbance, soil disturbance, direct injury or mortality of individuals.

MEASURES TO PROTECT FISH AND WILDLIFE RESOURCES

1. Administrative Measures

Permittee (Caltrans and/or its Designee) 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 persons who will be working on the project at the project site on behalf of Permittee, including but not limited to Resident Engineers, 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 to verify compliance with the Agreement.

2. Avoidance and Minimization Measures

To avoid or minimize adverse impacts to fish and wildlife resources identified above, Permittee (Caltrans and/or its Designee) shall implement each measure listed below.

2.1 Permittee shall conduct all work according to the project description stated above as well as the plans submitted to DFG that are not in conflict with the above stated project description. Permittee shall notify the DFG of any modifications made to the plans submitted to DFG. Permittee will obtain final approval from DFG for stream diversions. Permittee shall allow 30 days for DFG review of diversion plans.

2.2 Permittee shall provide a Designated Onsite Biologist, approved by the Department, to monitor weather forecasts for rain events in coordination with the Department. The Designated Onsite Biologist and Caltrans Water Quality staff shall work together to ensure protection of aquatic resources before and during rain events. Storm Water Prevention Plan measures shall be monitored for proper installation and maintained to prevent sediment transport into the creek. The Resident Engineer shall make corrections suggested by the Designated Onsite Biologist to ensure compliance with this Agreement.

2.3 Permittee shall replace any trees removed within the West Antioch Creek riparian corridor at a minimum 3:1 ratio at Kirker Creek in the City of Pittsburg. Success criteria for the tree mitigation shall be included in a mitigation plan to be submitted to DFG for approval.

2.4 Permittee shall not work within any creek between October 15 and ~~June 15.~~ APRIL 15.

2.5 Permittee shall not use temporary or permanent erosions control devices containing plastic, including photo- or bio-degradable plastic netting.

2.6 Permittee shall conduct focused surveys for burrowing owls within 15 days prior to the beginning of work within West Antioch Creek. The project impact areas plus 250 feet shall be surveyed for suitable habitat, burrows, and owls. Surveys shall occur two hours before to 1 hour after sunset or from 1 hour before to 2 hours after sunrise. Occupied burrows within 250 feet of project areas shall not be disturbed during the nesting season, February 1 through August 31. After August 31, if occupied burrows are located within 160 feet of the project impact area, disturbance shall be kept to a minimum. If avoidance requirements cannot be met, on-site passive relocation should be implemented during the non-nesting season. If it is necessary to evict owls from burrows outside of the nesting season, then the Applicant will submit a mitigation plan for approval by DFG prior to burrow disturbance.

2.7 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 within 72 hours of said construction activities. If active nests are identified, a 50-foot no-work buffer for non-raptors and a 1000-foot no-work buffer for raptors shall be established. If active nests are found, Caltrans 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.

2.8 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 the giant garter snake, or any other state or federally listed species.

2.9 Permittee shall ensure that the Designated Onsite Biologist conducts a pre-construction survey for CRLF no more than 24 hours prior to the commencement of construction activities , including site preparation and grading. If construction activities stop for a period of two or more weeks, a new CRLF survey shall be completed no more than 24 hours prior to the re-initiation of these activities.

2.10 If any state or federal listed species, or state species of special concern, are observed during project surveys, Permittee shall submit California Natural Diversity Data Base (CNDDB) forms to the CNDDB for all preconstruction survey data within five working days

of the sightings, and provide DFG Region 3 with copies of the CNDDB forms and survey maps.

2.11 Permittee shall install, monitor and maintain high-visibility Environmentally Sensitive Area fencing, on a daily basis, to protect sensitive resources. Permittee shall remove as little vegetation as is necessary to conduct construction activities.

2.12 Permittee shall conduct an employee orientation program, presented by the Designated Onsite Biologist, for all persons who will work on-site during construction and landscape establishment activities.

2.13 Permittee shall have readily available, at all times, plastic sheeting or visquine and will cover exposed spoil piles and exposed areas to prevent these areas from losing loose soil into the stream. These covering materials shall be applied when it is evident rainy conditions threaten to erode loose soils into the stream.

2.14 Permittee shall not operate equipment or vehicles in water-covered portions of the stream, canals, ditches, or where wetland vegetation, riparian vegetation, or aquatic organisms may be destroyed, except as otherwise provided for in this Agreement and as necessary to complete authorized work.

2.15 Permittee shall locate staging and storage areas for equipment, materials, fuels, lubricants and solvents, outside of irrigation and agricultural ditches and canals. Stationary equipment such as motors, pumps, generators, compressors and welders, located within or adjacent to irrigation or agricultural ditches will be positioned over drip pans. Any equipment or vehicles driven and/or operated within or adjacent to the irrigation or agricultural ditches will be checked and maintained daily, to prevent leaks of materials that if introduced to water could be deleterious to aquatic life. Vehicles will be moved away from the canals and ditches prior to refueling and lubrication.

2.16 Permittee shall prevent raw cement/concrete or washings thereof, asphalt, straw, paint or other coating material, oil or other petroleum products, or any other substances related to project activities which could be hazardous to aquatic life, wildlife, or riparian habitat from contaminating the soil and/or entering the waters of the State. Permittee may be subject to a citation for placing materials where they may enter a irrigation or agricultural ditches.

2.17 Permittee shall not dump any litter or construction debris within the irrigation or agricultural ditches. All such debris and waste shall be picked up daily and properly disposed of at an appropriate site.

2.18 Any materials placed in seasonally dry portions of canals or ditches, that could be washed downstream or could be deleterious to aquatic life, wildlife, or riparian habitat shall be removed by Permittee prior to inundation by high flows.

3. Compensatory Measures

To compensate for adverse impacts to fish and wildlife resources identified above that cannot be avoided or minimized, Permittee (Caltrans and/or its Designee) shall implement each measure listed below.

3.1 Permittee shall purchase credits from a DFG approved mitigation bank for loss of CRLF habitat. Mitigation will be implemented at a 3:1 ratio for permanent impacts and a .1:1ratio for temporary impacts.

3.2 Permittee shall submit a plan to DFG for approval to mitigate for tree removal at Kirker Creek at a 3:1 ratio

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:

Susan Miller
Contra Costa Transportation Authority
3478 Buskirk Ave, Suite 100
Pleasant Hill, Ca 94523
smiller@ccta.net

To DFG:

Department of Fish and Game
Bay Delta Region
7329 Silverado Trail
Attn: Lake and Streambed Alteration Program – Melissa Escaron
Notification #1600-2010-0094-R3
mescaron@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, 2013, 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.

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 VIRGINIA STROHL REPRESENTING CALIFORNIA DEPARTMENT OF TRANSPORTATION

Susan Miller — June 3, 2010
Date

Contra Costa Transportation Authority

FOR DEPARTMENT OF FISH AND GAME

Scott Wilson — 6/8/10
Date

Environmental Program Manager

Prepared by: Melissa Escaron
Staff Environmental Scientist

NON-STORMWATER INFORMATION PACKAGE

For Construction on

STATE HIGHWAY
IN
CONTRA COSTA COUNTY

IN ANTIOCH
FROM 0.3 MILE WEST OF CONTRA LOMA BOULEVARD UNDERCROSSING
TO 0.2 MILE EAST OF G STREET OVERCROSSING

04-CC-R26.6/R27.5
(SEGMENT 2)
EA 2285E1

Publicly Owned Treatment Works (POTW) Facility Serving City of Antioch, California

Facility Name	Phone Number	Address of Facility & Website URL
Delta Diablo Sanitation District Wastewater Treatment Plant	**(925) 756-1940**	**2500 Pittsburg-Antioch Highway Antioch, CA 94509 http://www.ddsd.org/**

Appendix A

Project Location Map

JURISDICTIONAL DETERMINATION AND IDENTIFIED ARMY CORPS OF ENGINEERS SECTION 404 AUTHORIZATION

Introduction to this Application Packet

On July 10, 2002, the San Francisco District of the US Army Corps of Engineers (USACE) determined that the SR 4 Corridor Widening from 0.5 miles east of Railroad Avenue to State Route 160 in Antioch, CA fell under its jurisdiction. This jurisdictional delineation expired on July 10, 2007, five years after the date of the letter. A wetland reverification has been performed and provided to the Corps for review.

During the environmental investigation, the draft wetland report showed that the project would result in less than 0.5 acres of permanent impacts to wetlands and other jurisdictional waters. Because the impact didn't exceed the 0.5 acre threshold that triggers a Section 404 Individual permit, the environmental document identified that the project appears to meet the requirement for authorization under several existing Nationwide permits (NWP). However, the permittee opted to apply for a USACE San Francisco Regulatory Branch Section 404 Individual Permit due to the long expected duration of this project, currently estimated to be completed by 2017.

Section 1

Application

Appendix A

Project Location Map

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT
(33 CFR 325)

INFORMATION HANDOUT

OMB APPROVAL NO. 0710-003
Expires October 1996

Public reporting burden for this collection of information is estimated to average 5 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Service Directorate of Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302; and to the Office of Management and Budget, Paperwork Reduction Project (0710-0003), Washington, DC 20503. Please DO NOT RETURN your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY ACT STATEMENT

Authority: 33 USC 401, Section 10; 1413, Section 404. Principal Purpose: These laws require permits authorizing activities in, or affecting, navigable waters of the United States, the discharge of dredged or fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters. Routine Uses: Information provided on this form will be used in evaluating the application for a permit. Disclosure: Disclosure of requested information is voluntary. If information is not provided, however, the permit application cannot be processed nor can a permit be issued.

One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETED

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME Contra Costa Transportation Agency, ATTN: Susan Miller	8. AUTHORIZED AGENT'S NAME AND TITLE *(an agent is not required)* URS Corporation, ATTN: Jan Novak
6. APPLICANT'S ADDRESS 3478 Buskirk Avenue Suite 100 Pleasant Hill, CA 94523	9. AGENT'S ADDRESS 1333 Broadway, Suite 800 Oakland, CA 94612
7. APPLICANT'S PHONE NOS. W/AREA CODE a. Residence b. (925) 256-4736 b. Business	10. AGENT'S PHONE NOS. W/AREA CODE a. Residence b. (510) 874-1733 b. Business

11. STATEMENT OF AUTHORIZATION

I hereby authorize, URS Corporation to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

APPLICANT'S SIGNATURE DATE

NAME, LOCATION AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE *(see instructions)*

SR4 (East) Widening Project Loveridge Road to State Route 160

13. NAME OF WATERBODY, IF KNOWN *(if applicable)* KIRKER CREEK, LOS MEDANOS WASTEWAY, WEST ANTIOCH CREEK, OLD KIRKER CREEK,	14. PROJECT STREET ADDRESS *(if applicable)* N/A
15. LOCATION OF PROJECT Contra Costa (COUNTY) California (STATE)	

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN *(see instructions)*

Please see Attachment Block 16

17. DIRECTIONS TO THE SITE

From **1455 Market Street**
Head **northeast** on **Market St** toward **Polk St**
Turn **right** at **10th St**

Turn **right** at **Howard St**
Slight **left** at **S Van Ness Ave**
Merge onto **Central Fwy/US-101 S** via the ramp to **Oakland/San Jose/US-80**
Take the exit on the **left** onto **I-80 E** toward **Oakland/Bay Bridge**
Take the exit onto **I-580 E** toward **Downtown Oakland/Hayward-Stockton/CA-24**
Take the exit onto **CA-24 E** toward **Walnut Creek**
Take the exit onto **I-680 N** toward **Concord/Sacramento**
Take exit **50** to merge onto **CA-242 N** toward **Pittsburg/Concord**
Take the exit onto **CA-4 E** toward **Pittsburg/Stockton**
Arrive at **Loveridge Road** Interchange

18. Nature of Activity *(Description of project, include all features)*

Please see Attachment Block 18

19. Project Purpose *(Describe the reason or purpose of the project, see instructions)*

Please see Attachment Block 19

USE BLOCKS 20-22 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

Area will be filled to allow for the expansion of State Route 4 from a four (4) lane to an eight (8) lane highway, in order to accommodate present and future growth in Contra Costa County. The primary types of discharges will be roadway fill, culvert extensions and rock slope protection (RSP).

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards

1,008 yd.^{3} Roadway Fill
1,048 yd.^{3} RSP
569 yd.^{3} Concrete
4 yd.^{3} Concrete FES
640 yd.^{3} Concrete Box
150 yd.^{3} Grading
240 yd.^{3} Gravel (temporary fill)
12 yd.^{3} Sand Bags (temporary fill)
8 yd.^{3} Water Filled Cofferdam (temporary fill)

Please see Attachment Block 21 for specific locations and types of discharges.

22. Surface Area in Acres of Wetlands or Other Waters Filled *(see instructions)*

Wetland/Waters of the U.S. (Permanent Impacts): 0.091 acres

Wetland/Waters of the U.S. (Temporary Impacts): 0.048 acres

Other Waters of the US (Permanent Impacts): 0.089 acres

Other Waters of the U.S. (Temporary Impacts): 0.009 acres

Culvert Waters of the U.S. (Temporary Impacts): 0.140 acres

Please see Attachment Block 22 for specific locations and impacts.

23. Is Any Portion of the Work Already Complete? Yes ____ No _X_ IF YES, DESCRIBE THE COMPLETED WORK

24. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the waterbody (If more than can be entered here, please attach a supplemental list).

Please see Attachment Block 24

25. List of Other Certifications or Approvals/Denials Received from other Federal, State or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED

Please see Attachment Block 25

*Would include but is not restricted to zoning, building and flood plain permits

26. Application is hereby made for a permit or permits to authorize the work described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

SIGNATURE OF APPLICANT	DATE	SIGNATURE OF AGENT	DATE

The application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

*U.S.GPO: 1994-520-478/82018

BLOCK 16

The project site is shown on the Antioch North, California U.S. Geological Survey map:

Section: 19 Township: 02N Range: 02E

The project site is shown on the Antioch South, California U.S. Geological Survey map:

Section: 19, 25 Township: 02N Range: 01E

The project site is shown on the Antioch South, California U.S. Geological Survey map:

Section: 20, 28, 29, 30 Township: 02N Range: 02E

The project site is shown on the Honker Bay/ Antioch North, California U.S. Geological Survey map:

Section: Los Medanos Land Grant

The project site is located on SR4 from 1.33 kilometers (0.8 mile) west of Loveridge Road to approximately 1.24 kilometers (0.7 mile) east of Hillcrest Avenue.

BLOCK 18

The California Department of Transportation (Caltrans), in cooperation with the Federal Highway Administration (FHWA) and Contra Costa Transportation Authority (CCTA), proposes to widen State Route 4 (SR4), its interchanges, and affected local roadways from approximately 1.33 kilometers (0.8 mile) west of Loveridge Road to approximately 1.24 kilometers (0.7 mile) east of Hillcrest Avenue. The SR 4 corridor is currently facing severe problems which include traffic congestion and inefficient energy use, as well as deteriorating air quality and traffic safety. Correcting conditions on SR 4 is a necessary component of the overall program to improve transportation through Contra Costa County. The project will require reconstruction of all interchanges within the project limits and would include the addition of auxiliary lanes between interchanges to facilitate on and off traffic movements.

The proposed project will consist of the following actions:

- Widen SR4 from the existing four lanes to eight lanes. The widened freeway would consist of an HOV lane and three mixed-flow lanes in each direction.
- Preserve sufficient width in the SR 4 median through the Loveridge Road Interchange to accommodate the possibility of future public transit improvements.
- Eliminate partial interchange at G Street and reconstruct the overcrossing.
- Add auxiliary lanes on SR 4 between interchanges from the on-ramps to the off-ramps.
- Provide capability to create ramp metering facilities, including high occupancy vehicle (HOV) preferential lanes and California Highway Patrol (CHP) enforcement areas, where feasible.
- Widen Roosevelt Lane pedestrian undercrossing and the Cavallo Road undercrossing.
- Extend drainage facilities that cross SR4 in the project area.
- Reconstruct SR4 interchanges to accommodate the freeway widening at:
    - Loveridge Road
    - Somersville Road
    - Contra Loma Boulevard- L Street
    - Lone Tree Way –A Street
    - Hillcrest Avenue
- The proposed project would conform to improvements currently being constructed to the west of the project area as part of the Route 4/ Railroad Avenue Interchange Project (by others) as well as improvements proposed to the east of the project as part of the SR4 Bypass Project (by others).

- Caltrans is undertaking final design of the first segment of the project, Loveridge Road to Somersville Road. Considerations for the remainder of the SR4 East corridor from Somersville Road to the eastern project limit (1.6 kilometers east of Hillcrest) is based on project design plans.
- Existing drainage culverts (Kirker Creek, Old Kirker Creek, Los Medanos Waste Way, and West Antioch Creek) will be modified to accommodate the freeway widening:
  - Kirker Creek (Sheet 1) currently crosses SR4 in a 72” Reinforced Concrete Pipe combined with a twin 10’x8’ Reinforced Concrete Box (RCB). This project proposes to extend these culverts in-kind to accommodate the roadway widening. The system is capable of handling an ulitimate Q50 (2880 CFS) as determined by the Contra Costa Flood Control District.
  - The existing box culvert at Old Kirker Creek (Sheet 2) will be replaced to accommodate the freeway widening. It will be replaced with a double 12’ x 4’ Reinforced Concrete Box capable of passing a Q100 (1060 CFS) as determined by the Contra Costa Flood Control District. This design flow across Route 4 is currently restricted by inadequate downstream drainage facilities within the City of Pittsburg. The existing 36” sanitary sewer line that currently crosses Old Kirker Creek (just south of upstream end of the existing RCB) will also be relocated south of the existing crossing.
  - The Los Medanos Wasteway (Sheet 3) crosses SR 4 in an 8’x7’ RCB. The project proposes to extend this culvert in-kind to accommodate the roadway widening. The Contra Costa County Water District currently transports raw water through this channel, which is owned by the U.S. Bureau of Reclamation.
  - West Antioch Creek (Sheets 4 and 5) crosses SR 4 in a 120-inch diameter concrete pipe which eventually transitions to a 10" x 8' RCB at the downstream outfall. This project proposes to install an additional 120-inch concrete pipe which, when combined with the original culvert, can pass a Q100 (2100 CFS Undeveloped Condition) as determined by Contra Costa County Flood Control District. Improvements to the L Street/Contra Loma Interchange will require the partial removal of an existing triple 5' x 3' RCB and installation of a new 10' x 5' RCB on one of the laterals feeding the Creek. Another major lateral to West Antioch Creek slightly west of this interchange consists of a 42" and a 72" RCP which will need to be extended in-kind to accommodate the widening. Work within West Antioch Creek will also require the installation of temporary cofferdams both upstream and downstream of the work area. Base flows of West Antioch Creek will be diverted through an existing drainage by these cofferdams and re-enter West Antioch Creek downstream of the work area.

BLOCK 19

The purpose of the proposed State Route (SR) 4 (East) Widening Project – Loveridge Road to SR 160 project is to reduce existing congestion, improve traffic operations, encourage use of high occupancy vehicles (HOVs), and accommodate anticipated travel demand through the year 2030 by providing additional capacity and sufficient right-of-way to accommodate multi-modal transportation.

The project would widen SR 4 within the limits above from its current four lanes to an eight-lane facility. This project is part of Contra Costa Transportation Authority's overall plan to continue the widening of SR 4 further into the eastern portion of the county and is consistent with the Phase 1 Implementation Plan recommendation made in the SR 4 (east) Railroad Ave. to SR 160 Major Investment Study (MIS).

The SR 4 corridor is currently facing severe problems which include traffic congestion, inefficient energy use, deteriorating air quality, and deteriorating levels of traffic safety. Correcting conditions on SR 4 is a necessary component of the overall program to improve transportation through northern Contra Costa County.

The project will begin in 2009, and the estimated completion date is 2017.

BLOCK 21

The following describes the jurisdictional areas that will be filled, the acreage, type of fill, and the proposed discharge site(s).

Water Name/Description	**Map of area (impacts)**	**Impact Type* and Number**	**Total Area of Impact – Permanent (P) or Temporary (T) (Acres)**	**Fill**	**Fill Material (RSP = Rock Slope Protection) (FES = Flared End Section)**
Kirker Creek	Sheet 1	wl/wus 1 cwus 1 cwus 22 cwus 23 owus 1	0.048 (T) 0.011 (P) 0.010 (P) 0.019 (P) 0.005 (T)	Culvert Extension (temp. cofferdam)	216 yd.^{3} concrete 451 yd.^{3} RSP 40 yd.^{3} gravel (temp**) 1 yd.^{3} sand bags (temp**)
Old Kirker Creek	Sheet 2	wl/wus 2 wl/wus 3 owus 4 cwus 2	0.010 (P) 0.021 (P) 0.005 (P) 0.042 (P)	Culvert Extension (temp. cofferdam)	229 yd.^{3} concrete 73 yd.^{3} RSP 64 yd.^{3} gravel (temp**) 1 yd.^{3} sand bags (temp**)
Los Medanos Wasteway	Sheet 3	owus 5 owus 5 owus 6	0.011 (P) 0.004 (T) 0.007 (P)	Culvert Extension (temp. cofferdam)	124 yd.^{3} concrete 66 yd.^{3} gravel (temp**) 5 yd.^{3} sand bags (temp**)
West Antioch Creek Impacts:					
Extend existing 72” & 42” cross culverts underneath SR 4	Sheet 4	wl/wus 6 owus 8	0.011 (P) 0.004 (P)	Place RSP Culvert Extension	44 yd.^{3} RSP 300 yd.^{3} Roadway Fill
Small culvert crossing of “REN” Ramp. Southeast Quadrant of Contra Loma I/C	Sheet 5	wl/wus 10	0.002 (P)	Place 24” Pipe Place concrete flared end sections	28 yd.^{3} roadway fill 4 yd.^{3} concrete FES
Large culvert crossing of “REN” Ramp. Southeast quadrant of Contra Loma I/C	Sheet 5	wl/wus 9b owus 10b	0.007 (P) 0.007 (P)	Place 2 -36” Pipes Place RSP	380 yd.^{3} roadway fill 220 yd.^{3} RSP

Water Name/Description	**Map of area (impacts)**	**Impact Type* and Number**	**Total Area of Impact – Permanent (P) or Temporary (T) (Acres)**	**Fill**	**Fill Material (RSP = Rock Slope Protection) (FES = Flared End Section)**
Entrance to triple 5' x 3' RCB in Southeast Quadrant of Contra Loma I/C	Sheet 5	wl/wus 9a owus 10a	0.002 (P) 0.002 (P)	Culvert Extension Place RSP	90 yd.^{3} concrete box 55 yd.^{3} RSP
Open Channel immediately upstream of "RWN" on-ramp from L Street	Sheet 4	wl/wus 8 owus 9	0.005 (P) 0.004 (P)	Culvert Extension (temp. cofferdam)	150 yd.^{3} concrete box 70 yd.^{3} gravel (temp**) 150 yd.^{3} roadway fill
Existing triple 5' x 3' RCB under WB on-ramp from L Street	Sheet 4	cwus 11 cwus 12	0.044 (P) 0.014 (P)	Remove Culvert	115 yd.^{3} roadway fill
Small lateral tributary discharging to existing triple 5' x 3' RCB outfall	Sheet 4	wl/wus 7	0.003 (P)	Covered by proposed "RWN" ramp	35 yd.^{3} roadway fill
Outfall to West Antioch Creek adjacent to L Street at headwall	Sheet 4	wl/wus 5b owus 7b	0.013 (P) 0.031 (P)	Culvert Extension (temp. cofferdam) Headwall & RSP Widen Channel	400 yd.^{3} concrete box 5 yd.^{3} sand bags (temp**) 400 yd.^{3} RSP 150 yd.^{3} grading
Utility relocation north of existing 72" & 42" cross culverts underneath SR 4	Sheet 4	wl/wus 5a owus 7a	0.008 (P) 0.015 (P)	Utility Relocation	Trenching and Grading
Entrance to culvert south of Fitzuren Rd.	Sheet 5	wl/wus 11 owus 11	0.009 (P) 0.003 (P)	Temp. Cofferdam	8 yd.^{3} water filled cofferdam (temp**)

Water Name/Description	Map of area (impacts)	Impact Type* and Number	Total Area of Impact – Permanent (P) or Temporary (T) (Acres)	Fill	Fill Material (RSP = Rock Slope Protection) (FES = Flared End Section)
TOTAL		**WL/WUS** **OWUS** **CWUS**	**0.091 (P)** **0.048 (T)** **0.089 (P)** **0.009 (T)** **0.140 (T)**		**1,008 yd.^{3} Roadway Fill** **1,048 yd.^{3} RSP** **569 yd.^{3} Concrete** **4 yd.^{3} Concrete FES** **640 yd.^{3} Concrete Box** **150 yd.^{3} Grading** **240 yd.^{3}Gravel (temp**)** **12 yd.^{3} Sand Bags (temp**)** **8 yd.^{3} Water Filled Cofferdam (temp**)**

***wl/wus = Wetland/Waters of the U.S.**
owus = Other Waters of the U.S.
cwus = Culvert Waters of the U.S.

temp = temporary fills for water diversion**

BLOCK 22

The following describes the jurisdictional areas that will be filled, the acreage, type of fill, and the proposed fill method

Water Name/Description	Plan View location (Illus. 2)	Impact Type* and Number	Total Area of Impact – Permanent (P) or Temporary (T) (Acres)	Fill Type	Fill Method
Kirker Creek	Sheet 1	wl/wus 1 cwus 1 cwus 22 cwus 23 owus 1	0.048 (T) 0.011 (P) 0.010 (P) 0.019 (P) 0.005 (T)	Culvert Extension (temp. cofferdam)	Poured Concrete Excavator Excavator
Old Kirker Creek	Sheet 2	wl/wus 2 wl/wus 3 owus 4 cwus 2	0.010 (P) 0.021 (P) 0.005 (P) 0.042 (P)	Culvert Extension (temp. cofferdam)	Poured Concrete Excavator
Los Medanos Wasteway	Sheet 3	owus 5 owus 5 owus 6	0.011 (P) 0.004 (T) 0.007 (P)	Culvert Extension (temp. cofferdam)	Poured Concrete
West Antioch Creek Impacts:					
Station "E" 145+00 Extend existing 72" & 42" cross culverts	Sheet 4	wl/wus 6 owus 8	0.011 (P) 0.004 (P)	Culvert Extension Place RSP	Excavator Excavator
Small culvert crossing of "REN" Ramp. Southeast Quadrant of Contra Loma I/C	Sheet 5	wl/wus 10	0.002 (P)	Place 24" Pipe Place concrete flared end sections	Excavator Excavator
Large culvert crossing of "REN" Ramp. Southeast quadrant of Contra Loma I/C	Sheet 5	wl/wus 9b owus 10b	0.007 (P) 0.007 (P)	Place 2 -36" Pipes Place RSP	Excavator Excavator

Water Name/Description	**Plan View location (Illus. 2)**	**Impact Type* and Number**	**Total Area of Impact – Permanent (P) or Temporary (T) (Acres)**	**Fill Type**	**Fill Method**
Entrance to triple 5' x 3' RCB in Southeast Quadrant of Contra Loma I/C	Sheet 5	wl/wus 9a owus 10a	0.002 (P) 0.002 (P)	Culvert Extension Place RSP	Preformed Concrete Excavator
Open Channel immediately upstream of "RWN" on-ramp from L Street.	Sheet 4	wl/wus 8 owus 9	0.005 (P) 0.004 (P)	Culvert Extension (temp. cofferdam)	Preformed Concrete Excavator
Existing triple 5' x 3' RCB under WB on-ramp from L Street	Sheet 4	cwus 11 cwus 12	0.044 (P) 0.014 (P)	Remove Culvert	Excavator
Small lateral tributary discharging to existing triple 5' x 3' RCB outfall.	Sheet 4	wl/wus 7	0.003 (P)	Covered by proposed "RWN" ramp	Excavator
Outfall to West Antioch Creek adjacent to L Street at headwall	Sheet 4	wl/wus 5b owus 7b	0.013 (P) 0.031 (P)	Culvert Extension (temp. cofferdam) Headwall & RSP Widen Channel	Preformed Concrete Excavator Grading
Utility relocation north of existing 72" & 42" cross culverts underneath SR 4	Sheet 4	wl/wus 5a owus 7a	0.008 (P) 0.015 (P)	Utility Relocation	Trenching and Grading
Entrance to culvert south of Fitzuren Rd.	Sheet 5	wl/wus 11 owus 11	0.009 (P) 0.003 (P)	Temporary Cofferdam	Construction
TOTAL		**WL/WUS** **OWUS** **CWUS**	**0.091 (P)** **0.048 (T)** **0.089 (P)** **0.009 (T)** **0.140 (T)**		

Water Name/Description	Plan View location (Illus. 2)	Impact Type* and Number	Total Area of Impact – Permanent (P) or Temporary (T) (Acres)	Fill Type	Fill Method
*wl/wus = Wetland/Waters of the U.S. owus = Other Waters of the U.S. cwus = Culvert Waters of the U.S.					

BLOCK 24

Property Owners: Street Address:

APN	Site	Owner	Owner Notification
074-411-007	Park	City of Antioch Public Works	P.O. Box 5007, Antioch, CA 94531
074-353-127	vacant	City of Antioch Public Works	P.O. Box 5007, Antioch, CA 94531
074-353-126	vacant	City of Antioch Public Works	P.O. Box 5007, Antioch, CA 94531
074-353-125	vacant	City of Antioch Public Works	P.O. Box 5007, Antioch, CA 94531
067-342-004	992-1008 Fitzuren Rd., Antioch, CA 94509	Skyland Properties	1004 Fitzuren Rd., Antioch, CA 94509
067-342-012	924 Fitzuren Rd., Antioch	Eileen Davis	1120 Bond Ct., Antioch, CA 94509
071-021-003	Fitzuren Rd.,	City of Antioch Public Works	P.O. Box 5007, Antioch, CA 94531
071-021-013	909 Fitzuren Rd., Antioch, CA 94509	Poonam Chillappagari	909 Fitzuren Rd., Antioch, CA 94509
071-021-018	Fitzuren Rd.,	City of Antioch Public Works	P.O. Box 5007, Antioch, CA 94531
071-021-022	911 Fitzuren Rd., Antioch	Frank Davi/Charles Johnson	P.O. Box 1171, Antioch, CA 94509
071-021-023	909 Fitzuren Rd., Antioch, CA 94509	Llyod Harris IV	909 Fitzuren Rd., Antioch, CA 94509
071-021-024	915 Fitzuren Rd., Antioch	Frank Davi/Charles Johnson	P.O. Box 1171, Antioch, CA 94509

APN	Site	Owner	Owner Notification
068-351-003	2812 Harbour Drive, Antioch, 94509	Church of Christ of Antioch	1020 E Tregallas, Antioch, CA 94509
068-351-002	Harbour Drive, Antioch, 94509	Church of Christ of Antioch	1020 E Tregallas, Antioch, CA 94509
068-351-001	Harbour Drive, Antioch, 94509	Church of Christ of Antioch	1020 E Tregallas, Antioch, CA 94509
068-252-045	2709 Windsor Drive, Antioch, 94509	First Missionary Baptist Church	640 E Tregallas, Antioch, CA 94509
068-252-041	2721 Windsor Drive, Antioch, 94509	First Missionary Baptist Church	640 E Tregallas, Antioch, CA 94509
068-352-001	1105 Ames Ct., Antioch, 94509	Margaret Aragon	1105 Ames Ct., Antioch, 94509
068-352-002	1109 Ames Ct., Antioch, 94509	Jack P. Leardini TRE	27 Rolph Park Ave., Crockett, CA 94525
068-352-003	1113 Ames Ct., Antioch, 94509	Ramon & Teresa Ramirez	1113 Ames Ct., Antioch, 94509
068-352-004	1117 Ames Ct., Antioch, 94509	Abraham Y. Dabis	1117 Ames Ct., Antioch, 94509
068-352-005	1116 Ames Ct., Antioch, 94509	Troy & Monica Coray	1116 Ames Ct., Antioch, 94509
068-352-006	1112 Ames Ct., Antioch, 94509	Helen P Platt	1112 Ames Ct., Antioch, 94509
068-352-007	1108 Ames Ct., Antioch, 94509	Donald & Sandra Harrison	1108 Ames Ct., Antioch, 94509
068-352-008	1104 Ames Ct., Antioch, 94509	Marion Jones	2782 Manzanita Way, Hemet, CA 92545
068-352-009	1100 Ames Ct., Antioch, 94509	Neil & Rose Ann Jortner	1100 Ames Ct., Antioch, 94509

APN	Site	Owner	Owner Notification
068-100-032	917 Sunset Dr., Antioch, 94509	Lewis & Leslie Mathews	1661 Ramona Way, Alamo, CA 94507
068-300-017	Sunset Dr.	David & Thea Shupe, Shannon & Ann Creson	2200 Wymore Way, Antioch, CA 94509
052-014-005	Sunset Dr.	Ennco & Rose Cinquini, David & Mary Brink	224 Cobblestone Dr., Antioch, CA 94509
052-014-006	1305 Sunset Dr., Antioch, CA 94509	Robert & Marie Lister	1305 Sunset Dr., Antioch, CA 94509
052-014-007	Hillcrest Ave	Ennco & Rose Cinquini, David & Mary Brink	224 Cobblestone Dr., Antioch, CA 94509
052-052-018	No address	FKP Inc.	1955 Lake Park Dr., #250, Smyrna, GA 30080
052-150-008	State Highway 4	City of Antioch Public Works	P.O. Box 5007, Antioch, CA 94531
88-540-15 88-540-09	2153 Martin Way Pittsburg (vacant land)	Albert D Seeno Construction Co	P O Box 4113 Concord CA 94524
88-240-38	vacant land	City of Pittsburg	
88-240-57	2100 2104 2106 Loveridge Pittsburg (commercial improved)	Pittsburg Storage Partners	P O Box 25025 Glendale CA 91201
88-152-28	2025 Leland E Pittsburg (vacant land)	A-S Pipelines Co Inc.	2025 Leland Pittsburg CA 94565
88-152-30	Commerce Pittsburg (vacant land)	Albert D Seeno Construction	P O Box 4113 Concord CA 94524
Contra Costa Canal	Drainage channel	U. S. Bureau of Reclamation	
74-122-23	3600 3698 Delta Fair Antioch (commercial improved)	Delta Square Associates	P.O. Box 177 Lafayette CA 94549

APN	Site	Owner	Owner Notification
74-460-29	Century Blvd Pittsburg (vacant land)	Century Plaza Dev Corp.	4021 Port Chicago Hwy Concord CA 94520
Contra Costa Canal	Drainage channel	U. S. Bureau of Reclamation	
74-090-21	Century CT Pittsburg (commercial improved)	Century Plaza Dev Corp/Mazzei Hyundai	4021 Port Chicago Hwy Concord CA 94520
74-112-07	3900 Belle Antioch (single family improved)	Pawlowski Anna E	4356 Whitehaven Baton Rouge CA 70808

BLOCK 25

The following table summarizes the permits and approvals that are anticipated to be needed from other agencies, and their status.

Agency	Permit or Approval	Status
Regional Water Quality Control Board	§401 Water Quality Certification	Pending
California Department of Fish and Game	California Fish and Game Code §1602	Pending
US Fish and Wildlife Service	BO	BO issued (1-1-05-F-0158) on 6/13/05 (included in Appendix A)

Appendix A

Project Location Map

Appendix B

Plan View and Cross-Sectional Map

DD-20 Key Map

DD-21 – DD-24 Kirker Creek RCB Extension

DD-25 – DD-30 Old Kirker Creek RCB Replacement

DD-31 – DD-32 Old Kirker Creek Headwall Replacement

DD-33 – DD-35 Los Medanos Wasteway RCB Extension

Appendix C

USFWS Biological Opinion

Issued 06/13/2005

Appendix D

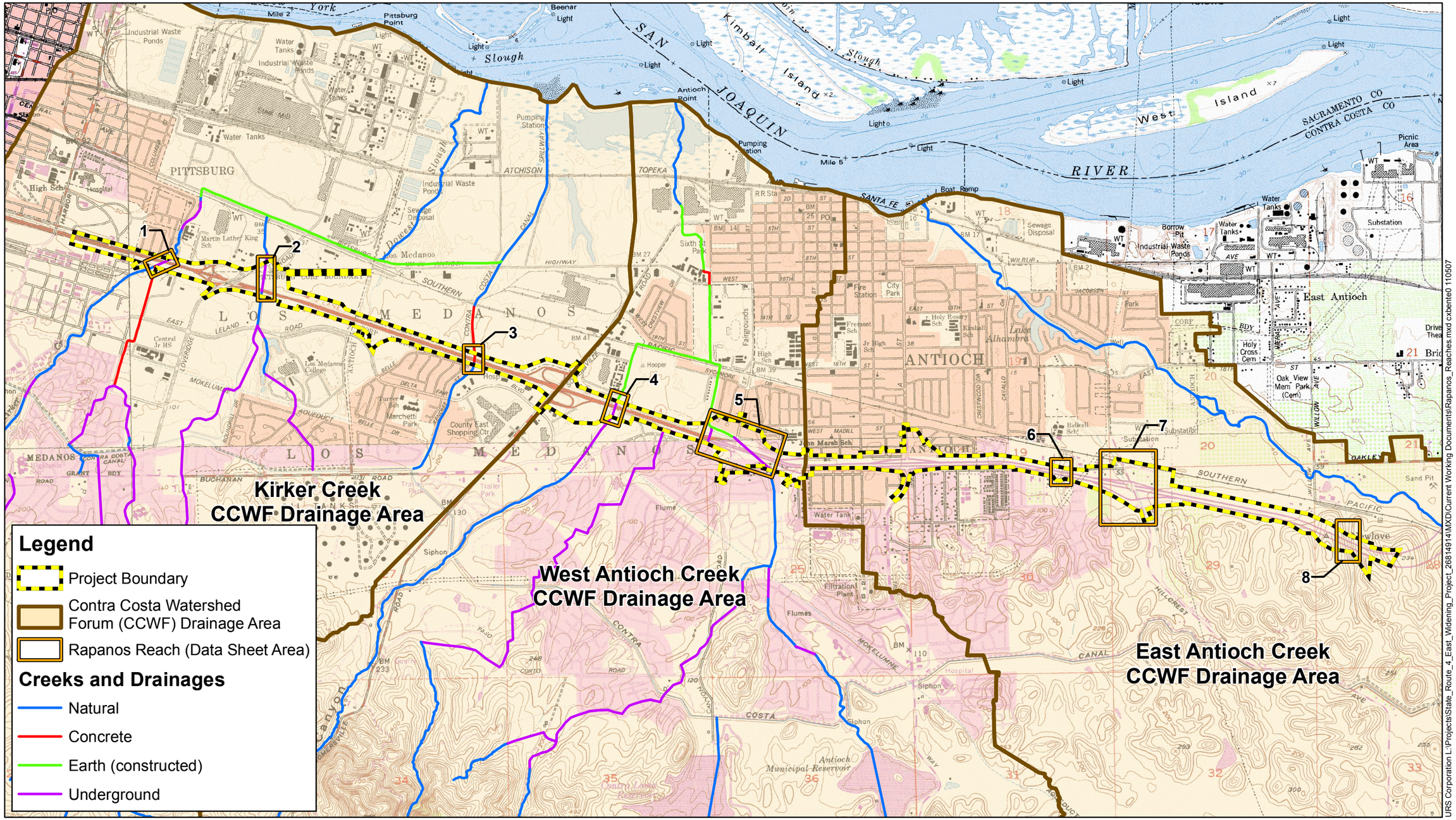
NOAA Letter of Concurrence

Issued June 1, 2004

Appendix E

Impacts to Jurisdictional Waters

(Rapanos Reach 1 – 5)



Source: Contra Costa County Community Development Department, Contra Costa Watershed Forum (CCWF)

1:30,000 1 inch equals 2,500 feet

0 1,250 2,500 5,000 7,500 10,000 12,500 15,000 Feet

URS	State Route 4 (East) Widening Project Loveridge Road to State Route 160 26814914	Drainage Areas and Rapanos Reaches	Figure C-1

Appendix F

Mitigation and Monitoring Plan for Wetlands and Other Waters of the U.S.

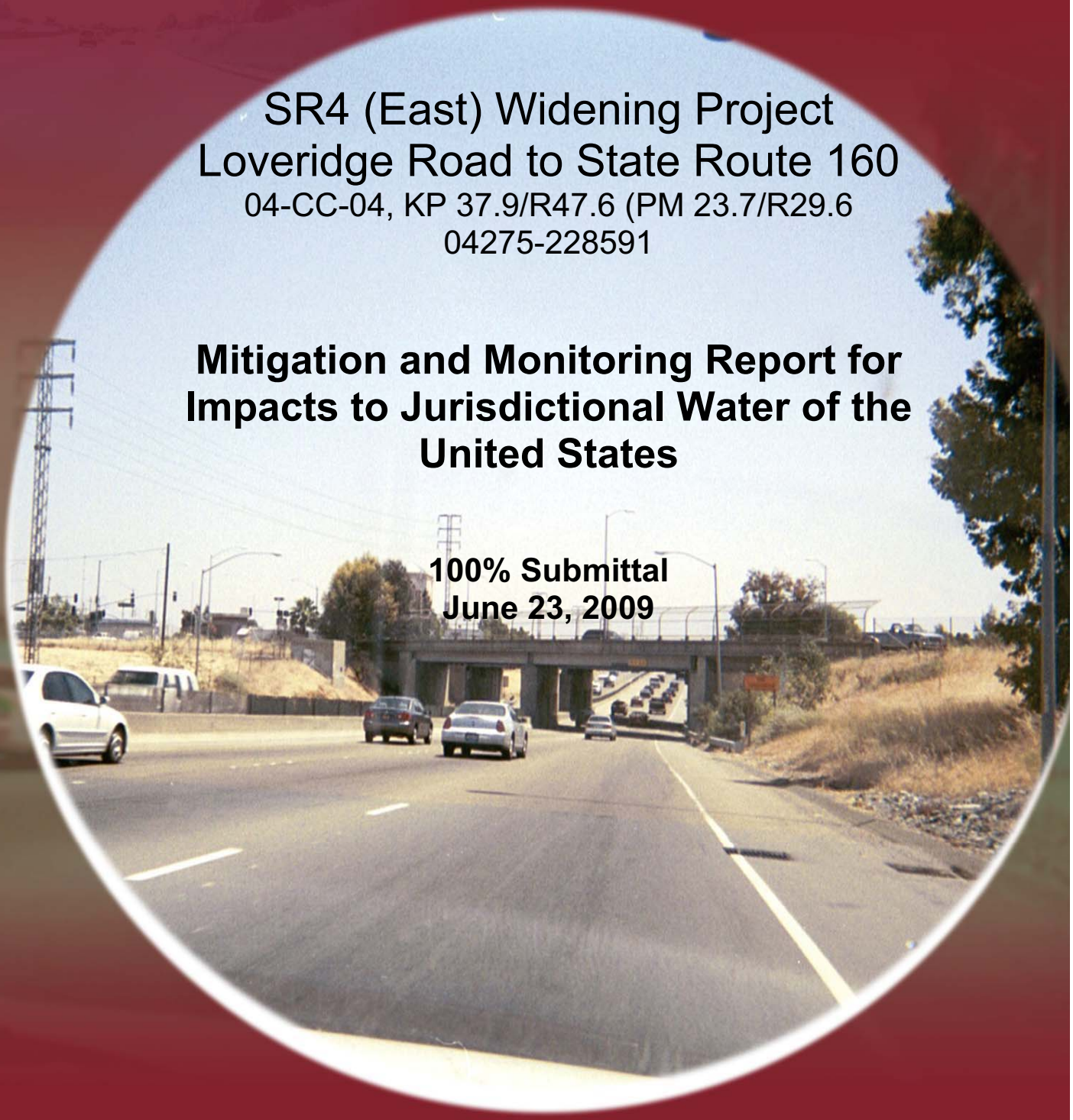
CONTRA COSTA TRANSPORTATION AUTHORITY

California Department of Transportation

Caltrans

SR4 (East) Widening Project
Loveridge Road to State Route 160

04-CC-04, KP 37.9/R47.6 (PM 23.7/R29.6
04275-228591



Mitigation and Monitoring Report for Impacts to Jurisdictional Water of the United States

100% Submittal
June 23, 2009

URS

TABLE OF CONTENTS

1. Section 1 Introduction 1-1

2. Section 2 Project Background 2-1

2.1 PROJECT DESCRIPTION 2-1
2.2 PROJECT AREA 2-2

3. Section 3 Environmental Setting 3-1

3.1 DESCRIPTION OF BIOLOGICAL COMMUNITIES 3-1
3.1.1 Freshwater Emergent Wetland 3-1
3.1.2 Non-Native Grassland 3-1
3.1.3 Ruderal/Disturbed and Croplands 3-1
3.1.4 Windrow 3-1

4. Section 4 Impacts 4-1

4.1 SUMMARY OF IMPACTS TO WETLANDS AND OTHER WATERS OF THE U.S. 4-1
4.1.1 Wetland Regulations 4-1
4.1.2 Affected Environment 4-1

5. Section 5 Avoidance and Minimization 5-1

5.1 WETLANDS AND OTHER WATERS OF THE U.S. and the state 5-1

6. Section 6 Mitigation Goals 6-1

6.1 Wetland Mitigation Goals 6-1
6.1.1 Avoidance and Minimization of Impacts to Wetlands and OWUS 6-1
6.1.2 Provide Compensation for Permanent Impacts to Jurisdictional Waters 6-1

7. Section 7 Proposed Off–Site Mitigation 7-1

7.1 SELECTION OF OFF-SITE MITIGATION 7-1
7.2 Proposed Off-Site Mitigation For Jurisdictional Waters 7-2

8. Section 8 Mitigation Implementation 8-1

8.1 PRESERVATION OF HABITAT AT ELSIE N. GRIDLEY MITIGATION BANK 8-1

9. Section 9 Monitoring 9-1

9.1 Off-Site Mitigation Monitoring 9-1

TABLE OF CONTENTS

10. Section 10 Contingency Plan 10-1

10.1 Jurisdictional Waters Contingency plans 10-1
10.1.1 Wildlands, Inc. Holland Tract Preserve 10-1

11. Section 11 References 11-1

Tables

4-1 Temporary Impacts to Wetlands and Other Waters of the U.S. from Proposed SR4 Widening Project

4-2 Permanent Impacts to Wetlands and Other Waters of the U.S. from Proposed SR4 Widening Project

8-1 Summary of Mitigation Opportunities Considered in Contra Costa County for the Proposed SR4 Widening Project

10-1 Performance Criteria for On-Site Wetland Restoration

Figures

1 Project Location Area Map

2 Elsie N. Gridley Mitigation Bank Service Area

3 Holland Tract Preserve Future Mitigation Bank Location

Sheets

1-5 Impacts to Jurisdictional Waters

Appendix A

Impacts to Jurisdictional Features

Appendix B

Drainage Plans for Kirker Creek

TABLE OF CONTENTS

Acronyms and Abbreviations

Caltrans	California Department of Transportation
CCTA	Contra Costa Transportation Authority
CHP	California Highway Patrol
CRLF	California Red-Legged Frog
CWUS	Culvert waters of the U.S.
ESA fencing	Environmentally Sensitive Area fencing
FHWA	Federal Highway Administration
HOV	High Occupancy Vehicle
Km	Kilometers
OWUS	Other waters of the U.S.
OWUS	Other Waters of the U.S.
SR4	State Route 4
USACE	U.S. Army Corps of Engineers
WL	Wetlands
WL/WUS	Wetland Waters
WS	Waters of the State (California)
WUS	Waters of the United States

SECTIONONE Introduction

This document describes the proposed off-site mitigation for impacts to jurisdictional wetlands and other waters of the U.S. from potential impacts of the proposed State Route 4 Widening Project. The purpose of the proposed project is to reduce existing congestion, improve traffic operations, encourage high occupancy vehicle (HOV) use, and accommodate anticipated travel demand through the year 2030 by providing sufficient right-of-way to accommodate multi-modal transportation.

The project is estimated to permanently impact 0.139 acre of wetlands/waters (WL/WUS), 0.089 acre of other waters of the U.S. (OWUS) and 0.008 acre of waters of the state (WS). In addition, there will be temporary impacts to 0.009 acre of OWUS, as well as to 0.140 acre of culvert waters of the U.S. (CWUS). This mitigation report provides the project background as well as compensation possibilities that are appropriate for the losses of jurisdictional WL/WUS, OWUS, and WS.

2.1 PROJECT DESCRIPTION

The California Department of Transportation (Caltrans), in cooperation with the Federal Highway Administration (FHWA) and Contra Costa Transportation Authority (CCTA), proposes to widen State Route 4 (SR4), its interchanges, and affected local roadways from approximately 0.84 mile west of Loveridge Road to approximately 0.70 mile east of Hillcrest Avenue. The SR4 corridor is currently facing severe problems which include traffic congestion and inefficient energy use, as well as deteriorating air quality and traffic safety. Correcting conditions on SR4 is a necessary component of the overall program to improve transportation through Contra Costa County. The project will require reconstruction of all interchanges within the project limits and would include the addition of auxiliary lanes between interchanges to facilitate on and off traffic movements.

The proposed project will consist of the following actions:

- Widen SR4 from the existing four lanes to eight lanes. The widened freeway would consist of an HOV lane and three mixed-flow lanes in each direction.
- Preserve sufficient width in the SR4 median through the Loveridge Road Interchange to accommodate the possibility of future public transit improvements.
- Eliminate partial interchange at G Street and reconstruct the overcrossing.
- Add auxiliary lanes on SR4 between interchanges from the on-ramps to the off-ramps.
- Provide capability to create ramp metering facilities, including high occupancy vehicle (HOV) preferential lanes and California Highway Patrol (CHP) enforcement areas, where feasible.
- Widen Roosevelt Lane pedestrian undercrossing and the Cavallo Road undercrossing.
- Extend drainage facilities that cross SR4 in the project area.
- Reconstruct SR4 interchanges to accommodate the freeway widening at:
    - Loveridge Road
    - Somersville Road
    - Contra Loma Boulevard- L Street
    - Lone Tree Way –A Street
    - Hillcrest Avenue

The proposed project would conform to improvements currently being constructed to the west of the project area as part of the Route 4/ Railroad Avenue Interchange Project (by others) as well as improvements proposed to the east of the project as part of the SR4 Bypass Project (by others).

Caltrans is undertaking final design of the first segment of the project, Loveridge Road to Somersville Road. Considerations for the remainder of the SR4 East corridor from Somersville Road to the eastern project limit (0.70 mile east of Hillcrest Avenue) is based on project design plans.

2.2 PROJECT AREA

The project area is defined as the area that may be disturbed during project construction, located on the Route 4 corridor in Contra Costa County, 0.84 mile west of Loveridge Road (PM 23.7) to approximately 0.7 mile east of Hillcrest Avenue (PM 29.7). The SR4 project area is slightly more than 6.1 miles in length (9.8 kilometers). The project area extends slightly beyond the anticipated 8-lane area of the proposed highway, to accommodate for construction equipment. The proposed project location is depicted in Figure 1.

N

Caltrans

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

0 0.5 1 1.5 2 Miles

Project Location Map

Figure 1

URS Corporation L:\Projects\State_Route_4_East_Widening_Project_26814914\WXD\Current Working Documents\Project Location_Map_Figure_1.mxd

3.1 DESCRIPTION OF BIOLOGICAL COMMUNITIES

The project corridor includes the SR4 roadway from approximately 1.33 kilometers (km) west of Loveridge Road to East Antioch in Contra Costa County. The project corridor encompasses approximately 6.1 miles (9.8 km) of highway and ranges in elevation from 12 feet (3.66 meters) to 35 feet (10.67 meters) above sea level. Current land use in the project area is primarily commercial, but also includes residential developments and some open agricultural fields.

The project corridor traverses four vegetation communities and a number of jurisdictional waters. Biological communities identified within the project corridor include freshwater emergent wetland, non-native grassland, ruderal/disturbed, and windrow. A brief description of each community and its associated wildlife assemblage is provided below.

3.1.1 Freshwater Emergent Wetland

Freshwater marshes are found throughout California and are among the most productive wildlife habitats within the state. These marshes are found in various land depressions or at the edges of rivers and lakes. They provide food, cover, and water for more than 160 species of birds, and a variety of mammals, reptiles, and amphibians. California Red Legged Frogs (*Rana aurora draytonii*) are among the species that could utilize these freshwater communities in the greater project area.

3.1.2 Non-Native Grassland

This community, primarily composed of non-native grasslands, occurs intermittently along SR4. It is typically found on fine-textured, usually clay soils, which may range from moist, possibly even waterlogged, during the rainy season to very dry during the dry season. Grasslands provide foraging and nesting habitat for a wide variety of wildlife species including raptors, small mammals, amphibians and reptiles.

3.1.3 Ruderal/Disturbed and Croplands

This community type encompasses urban development, highly disturbed vegetation communities, highly eroded/disturbed areas, and erosion control areas, and active or fallow croplands. The ruderal areas observed in the SR4 corridor occur intermittently and have a high incidence of exotic plant invasion. This is the most common community type found within this highly developed urban environment.

3.1.4 Windrow

Windrows occur in SR4 intermittently along the road, both within and adjacent to the project right-of-way. This community consists of various tree species that have been planted for ornamental or commercial purposes. Windrows may provide roost, perches, and nest sites for various bird species, particularly raptors. Its litter layer may provide cover for small vertebrate species.

4.1 SUMMARY OF IMPACTS TO WETLANDS AND OTHER WATERS OF THE U.S.

There are eight jurisdictional drainages found within the project corridor. These are primarily stream channels that cross underneath State Route 4. Because the project involves the widening of an existing roadway, opportunities to avoid wetlands that run along or cross the roadway are limited. Still, only four of these drainages are impacted by the SR4 widening project.

4.1.1 Wetland Regulations

As established in Section 404 of the Clean Water Act (33 U.S.C. 1344), the U.S. Army Corps of Engineers (USACE) has final authority over the identification of wetlands and other waters of the U.S. in the project vicinity, including their jurisdiction, determination of areas affected by the project, and the type of permits and conditions required. A "no net loss" of wetland acreage or value policy is established within both the state and federal executive branches.

The project area was originally delineated and approved by USACE in 2002. A wetland re-verification of the study area has been completed and was submitted to USACE on January 29, 2008, along with this mitigation report.

4.1.2 Affected Environment

Habitat values and functions of the wetland sites in the SR4 corridor are of low quality and limited value due to several factors such as fragmentation, small size, isolation from other wetland areas, and lack of ecotones or riparian vegetation. Plant and animal species observed in the project area are recorded as generalist species that inhabit a broad spectrum of habitats.

Based on the URS reverification of the existing wetland delineation, the sum of 2.216 acres of wetland and other waters of the U.S. (including 1.599 acres of CWUS) were delineated at the following locations along the project corridor:

- Kirker Creek
- Old Kirker Creek
- An unnamed drainage channel (tributary to Kirker Creek) located west of Loveridge Road and north of SR4.
- Los Medanos Wasteway
- West Antioch Creek

The project will permanently affect 0.236 acre of WL/WUS, OWUS, and WS. In addition, 0.009 acre of OWUS and 0.140 acre of CWUS will be temporarily impacted by the proposed project. A summary of permanent (construction phase) impacts are presented in Table 4-1, a detailed breakdown of impacts and mitigation is provided in Appendix A. These values were acquired from the Wetland Reverification for State Route 4 (East) Widening Project: Loveridge Road to State Route 160 (URS, 2007). This reverification was verified by USACE on January 5, 2009 (File Number: 2002-26746S) Impacts to wetlands and other jurisdictional waters are shown in Sheets 1-5.

N

0 200 400 800

Feet

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Impacts to Jurisdictional Waters (Rapanos Reach 4)

Sheet 4 of 5

December 2008

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Feet

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Impacts to
Jurisdictional Waters
(Rapanos Reach 3)

Sheet 3
of 5

December
2008

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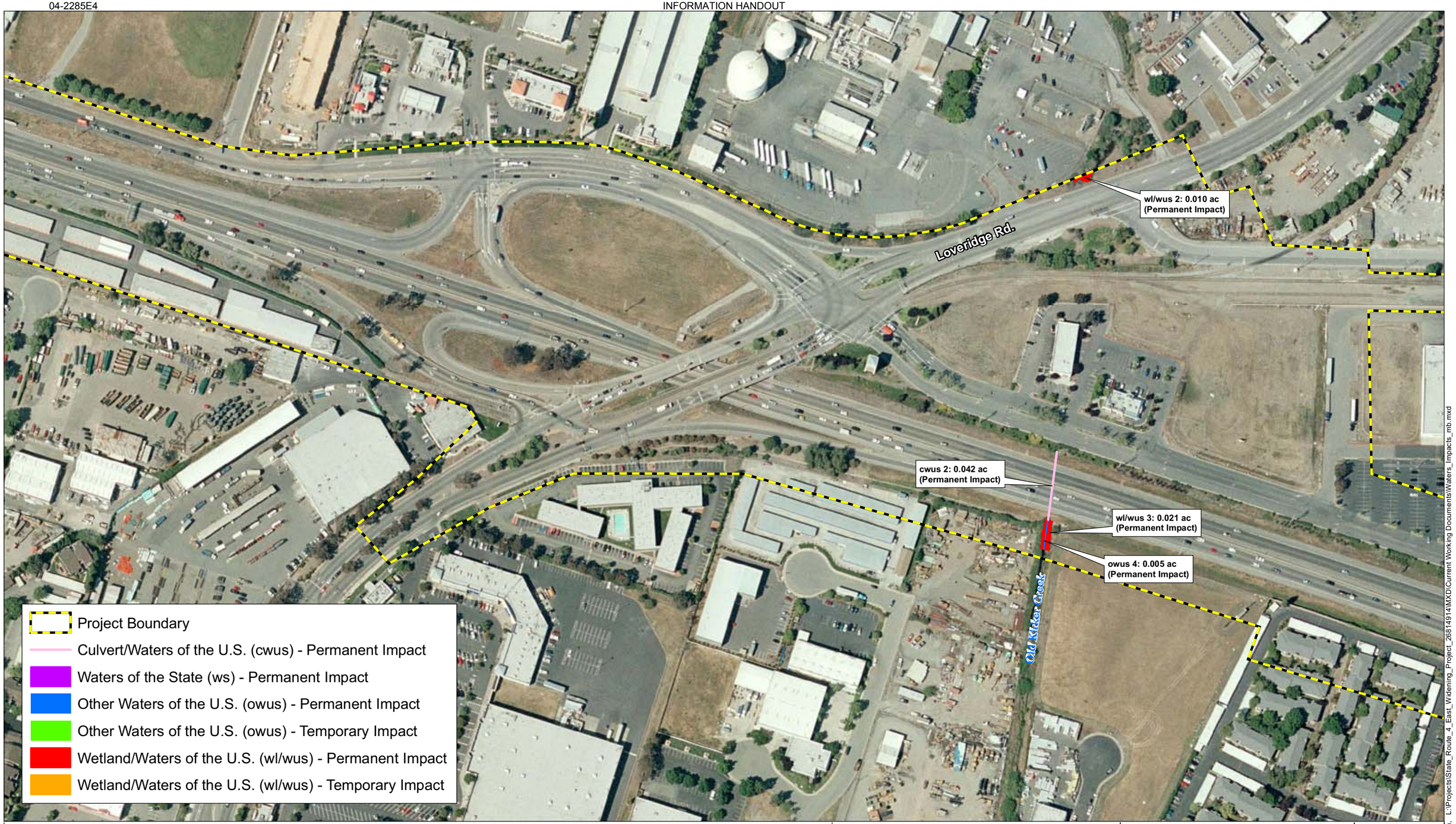

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Feet

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Impacts to
Jurisdictional Waters
(Rapanos Reach 2)

Sheet 2
of 5

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2008

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Feet

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Impacts to
Jurisdictional Waters
(Rapanos Reach 1)

Sheet 1
of 5

December
2008

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Feet

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Impacts to
Jurisdictional Waters
(Rapanos Reach 5)

Sheet 5
of 5

December
2008

URS Corporation, J. Owen, L:\Projects\State_Route_4_East_Widening_Project_26814914\MXD\Current Working Documents\Waters_Impacts_mb.mxd

The project will temporarily impact 0.005 acre of other waters of the U.S. (OWUS 1) within Kirker Creek (Sheet 1), and 0.004 acre (OWUS 5) within the Los Medanos Wasteway (Sheet 3). These impacts will be caused by the restructuring of these engineered sections of the channels as a result of road widening. OWUS 1 will be slightly widened, and the concrete lined channel will be replaced with a rock-slope protection (RSP) lined channel, as shown in the Kirker Creek Drainage Plans (Appendix B). OWUS 5 will be temporarily impacted due to relocation of the existing culvert outfall apron as the roadway is widened. OWUS 5 is an unvegetated sandy channel that will be regraded to its original shape following construction. There will be no impacts to wetland vegetation as a result of either of these two temporary impacts. As a result, no mitigation, beyond regrading, will be necessary for these impacts. No other temporary impacts occur as a result of this project.

Table 4-1 Permanent Impacts to Wetlands and Other Waters of the U.S. and the State from Proposed SR4 Widening Project

Affected Features	Permanently Affected by Project (Acres)	Suggested Mitigation Ratio	Proposed Offsite Mitigation (Acres)
Kirker Creek, Old Kirker Creek, and Los Medanos Wasteway			
Wetland/ Waters of the U.S.	0.079	4:1	0.316
Other Waters of the U.S.	0.023	4:1	0.092
Waters of the State	0.008	4:1	0.032
West Antioch Creek			
Wetlands/ Waters of the U.S.	0.060	4:1	0.240
Other Waters of the U.S.	0.066	4:1	0.264
Waters of the State	NA	4:1	
Total	**0.236**		**0.944**

5.1 WETLANDS AND OTHER WATERS OF THE U.S. AND THE STATE

Impacts to wetland/waters, other waters of the U.S, culvert waters of the U.S., and waters of the State will be avoided and minimized during construction through the following on-site measures.

Water Quality Impact Avoidance Measures

Contractors will be required to implement a SWPPP as part of the NPDES General Construction Activity Storm Water Permit. Measures in the plan would include:

- Excessive siltation and sedimentation will be avoided by not working during the rainy season (October 16 – May 31 at the Contra Loma Interchange (West Antioch Creek); October 16 – March 31 at all other locations);
- Conducting all construction work according to site-specific construction plans that minimize the potential for sediment input to the aquatic system. Erosion control procedures will be implemented to prevent discharge of soil and backfill material into adjacent sensitive habitats, waterways, or wetlands. These measures will include:
  - silt fences;
  - biodegradable soil stabilization blankets;
  - mulching;
  - vegetated upland buffers;
  - hydroseeding with tackifiers; and
  - seeding with native species.

  All non-cultivated bare ground will be treated with appropriate erosion control measures according to the SWPPP;
- Minimizing the areas to be cleared, graded, and recontoured;
- Grading and shaping of disturbed areas to restore natural topography;
- Avoiding riparian and wetland vegetation outside the construction zone by installing Environmentally Sensitive Area fencing (ESA fencing);
- Covering bare areas with mulch and revegetating all cleared areas using native species;
- Providing areas located outside the OHWM for staging, refueling, and storing equipment, materials, fuels, lubricants, solvents, and other possible contaminants;
- Preventing raw cement, concrete or concrete washings, asphalt, paint or other coating material, oil or other petroleum products, or any other substances that could be hazardous to aquatic life from contaminating the soil or entering watercourses;
- Establishing a spill prevention and countermeasure plan before project construction that includes strict onsite handling rules to keep construction and maintenance materials out of drainages and waterways. This includes cleaning up all spills immediately according to the spill prevention and countermeasure plan; and
- Avoiding operation of equipment in flowing water.

Stream Diversion Limits

Caltrans proposes to implement the following stream diversion measures, in order to avoid impacts to stream channels during construction work:

- Temporary creek diversion systems will be established for all creek channels affected by the project. These creek channels are Kirker Creek, Old Kirker Creek, Los Medanos Wasteway, and West Antioch Creek (Contra Loma Interchange).
- A possible option that is being investigated at Contra Loma Interchange is to establish 2 separate temporary water diversion systems at West Antioch Creek. For the first system, a cofferdam will need to be placed upstream of the open 120-inch reinforced concrete pipe (RCP), underneath Fitzuren Road, southwest of the G Street interchange. Base flows traveling down West Antioch Creek toward the freeway would collect behind this cofferdam and eventually drain westerly along their historic path and eventually enter the upstream end of the triple 5 x 3 foot reinforced concrete box (RCB) at Contra Loma Boulevard. The triple 5 x 3 foot RCB outfalls into the open channel portion of West Antioch Creek further downstream. The second temporary water diversion system would have to be applied upstream of the triple 5 x 3 foot RCB while it is being replaced at its downstream end. A City of Antioch 6 x 3 foot RCB empties into this system which means there will be a significant base flow to contend with during the summer months. A water-filled cofferdam would be temporarily installed at this location to deal with these base flows.
- Corrugated steel pipe (CSP), sized at about 48 inches in diameter for dry-season flows, will be utilized wherever pipe is necessary. Clean gravel and filter fabric would also be installed. The cofferdams, filter fabric, and corrugated steel pipe will be removed from the creek bed after completion of the project.
- These creek diversion systems are only to be used between April 1st and October 15th for the Kirker Creek, Old Kirker Creek, and Los Medanos Wasteway creek diversion systems, and between June 1st and October 15th for the West Antioch Creek diversion system.
- Caltrans will ensure that a biologist is on site prior to dewatering to ensure no sensitive aquatic species are stranded.
- A gravel cofferdam wrapped with an impermeable plastic liner will be placed upstream of the work area to direct base flows through an appropriately sized diversion pipe. The diversion pipe will extend through the Contractor's work area and outlet through a sandbag dam at the downstream end.
- Once the temporary creek diversion systems are no longer required, the CSP, the sandbags, the gravel dam, and the impermeable plastic liner will all be removed and the creek returned to its natural condition.
- Constructing sediment catch basins across stream channels immediately below the project site will be implemented when performing in-channel construction to prevent silt- and

sediment-laden water from entering the main stream flow. Accumulated sediments will be periodically removed from the catch basins.

Revegetation of Upland Areas

Upland plant communities will be temporarily affected by construction. Revegetation of upland area in the vicinity of aquatic features will reduce erosion and sedimentation into receiving bodies. Non-native grassland and ruderal plant communities will be replaced with native plant species. Revegetation of the temporarily impacted areas outside of wetland habitats will be conducted with a commercially available native seed mix. To minimize erosion, seeding and planting activities will be completed by the end of December of the final construction year for each respective construction segment.

Caltrans proposes to implement off-site mitigation for permanent impacts to jurisdictional waters. This section describes the long-term goals of the proposed mitigation. These goals include the types of habitats to be restored, enhanced, or compensated.

6.1 WETLAND MITIGATION GOALS

The proposed wetland mitigation plan has two primary goals:

- Avoidance and minimization of impacts to wetlands and other jurisdictional waters; and
- Provide compensation for permanent losses of wetlands and other waters.

Specific goals related to performance of the wetland mitigation are referenced in the performance criteria associated with the off-site mitigation proposal.

6.1.1 Avoidance and Minimization of Impacts to Wetlands and OWUS

Whenever possible, impacts to jurisdictional waters will be avoided. The avoidance and minimization techniques described in Section 5 (Avoidance and Minimization) reduce negative impacts to WL/WUS and OWUS. This goal serves to reduce the amount of on-site restoration and off-site mitigation required.

6.1.2 Provide Compensation for Permanent Impacts to Jurisdictional Waters

Caltrans proposes to provide off-site compensation for the permanent loss of WL/WUS (0.139 acre of permanent impacts) as well as the permanent loss of OWUS (0.089 acre of permanent impacts). The goal of the proposed mitigation is to provide compensation for the loss of jurisdictional waters that will be appropriate ecologically (same wetland and/or ecosystem type) and geographically (in proximity to the project). As wetlands will be provided as compensation for impacts to OWUS, a mitigation ratio of 4:1 is proposed to compensate for out of kind replacement of jurisdictional aquatic features. Providing high-quality wetland compensation for the loss of low-quality OWUS areas is expected to satisfy mitigation requirements. Based on mitigation ratios provided in Table 4-1, 0.944 acre of jurisdictional waters will be obtained to complete off-site mitigation. The off-site mitigation will occur at the mitigation bank identified in Section 8 (Proposed Off-Site Mitigation).

7.1 SELECTION OF OFF-SITE MITIGATION

Locations for off-site mitigation were evaluated to acquire the most suitable habitat replacement based on the following criteria:

- Compatibility with target wetland types (freshwater emergent)
- Compatibility with sensitive species target habitat as well as habitat values
- Lands or projects available for enhancement, restoration, and/or creation of wetland or sensitive species habitat in close proximity to proposed project site, within Contra Costa County

All possible mitigation or conservation banks, as well as sites for habitat enhancement and/or creation, in the Contra Costa County region were investigated as possible mitigation opportunities for this project. Potential sites were found in listings from the USFWS and CDFG websites, web searches, and other potential sources. Table 7-1 presents the organizations and projects identified and contacted as potential options for the off-site mitigation project, as well as a description of their mitigation potential.

Table 7-1 Summary of Mitigation Opportunities Considered for the Proposed SR4 Widening Project

Site/Organization	Species/Habitat	Acres/Credits Available	Location	Description/Project Status
Elsie N. Gridley Mitigation Bank	WL	Yes	Contra Costa County	Several restoration projects available for wetlands.
Wildlands Inc. Holland Tract Preserve	WL	No*	Contra Costa County	Located 3 miles east of project site, potential for restoration and creation of freshwater marsh. Mitigation bank not yet operational.
Muir Heritage Land Trust	CRLF, WL	No*	Contra Costa County	Several potential projects available for restoration, protection and preservation purposes. Nothing concrete specified.
Life Garden	WL	No*	Contra Costa County	Iron Horse Corridor in Walnut Creek Watershed. Project is not currently established.
Nature Conservancy	WL	No*	California	No current projects available for mitigation or easements.
American Land Trust	WL	No*	Contra Costa County	Awaiting approval for land use as mitigation bank
French Camp	WL	No*	Contra Costa County	Not yet approved by USACE to sell mitigation credits
San Joaquin Valley Mitigation Bank	WL	No*	San Joaquin County	No current projects available for mitigation

Table 7-1 Summary of Mitigation Opportunities Considered for the Proposed SR4 Widening Project

Site/Organization	Species/Habitat	Acres/Credits Available	Location	Description/Project Status
California State Parks, Cowell Ranch	WL, CRLF	No*	Contra Costa County	No current projects available for mitigation
Trust for Public Lands	WL	No*	Contra Costa County	No current projects available for mitigation
TARC, Trails for Richmond	WL	No*	Contra Costa County	No current projects available for mitigation
Bryte Ranch Mitigation Bank	WL	No*	El Dorado, Placer, Sacramento Counties	No current projects available for mitigation near Contra Costa County
East Bay Regional Parks	WL, CRLF	No*	Contra Costa County	An HCP covers the restoration of a riparian channel near CRLF habitat.

CRLF = California Red-Legged Frogs
USFWS = US Fish and Wildlife Service
USACE = US Army Corps of Engineers
WL = Wetlands
HCP = Habitat Conservation Plan

*Denotes organizations which do not currently have available programs (As of Nov. 2007), but may become open in the future.

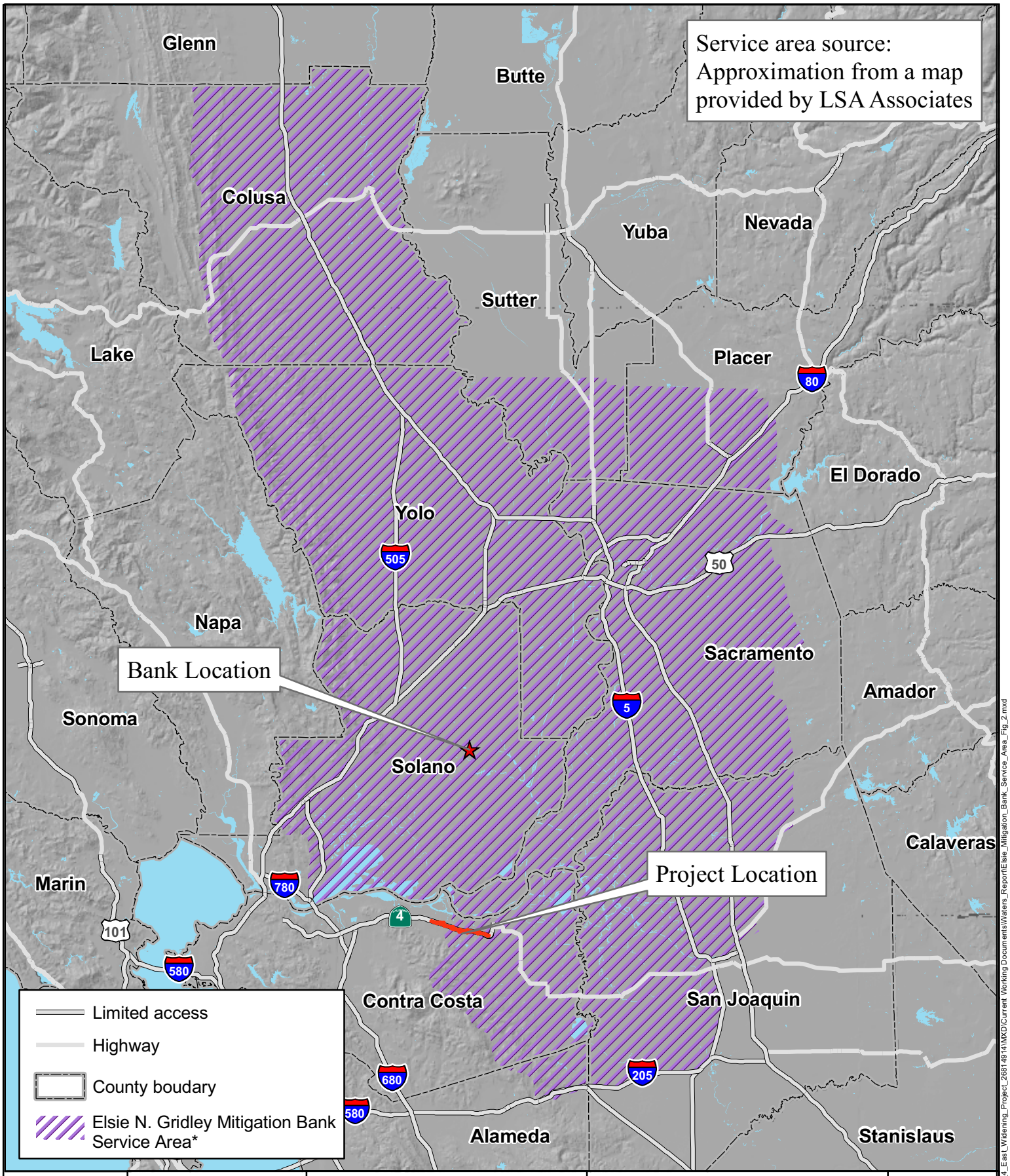
7.2 PROPOSED OFF-SITE MITIGATION FOR JURISDICTIONAL WATERS

Mitigation will take effect for both permanently and temporarily impacted jurisdictional waters following USACE 2002 no-net-loss guidelines. Although most jurisdictional waters onsite constitute poor habitat quality, wetlands will be mitigated at the ratios presented in Table 4-1 and discussed above in Section 6.1.2. Following these recommendations, Caltrans will purchase wetland credits equivalent to 0.944 acres.

7.2.1 Elsie N. Gridley Mitigation Bank

The Elsie N. Gridley Mitigation Bank (EGMB) is approved by USACE to sell wetlands and vernal pools for recreation, restoration, and preservation credits. This particular bank service area extends into eastern Contra Costa County, in close proximity to the SR4 project area. The purchase of mitigation credits at the Elsie N. Gridley Mitigation Bank would offer the best fit for project mitigation, since these are the best available high quality wetlands in the SR4 proximity.

The established habitat presented at EGMB offers the best potential mitigation within the Bay Area. The Elsie N. Gridley Bank has several projects, and serves the area in east Contra Costa County, as is outlined in Figure 2.



N

Caltrans

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

0 5 10 15 20 Miles

Elsie N Gridley Mitigation Bank Service Area

Figure 2

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8.1 PRESERVATION OF HABITAT AT ELSIE N. GRIDLEY MITIGATION BANK

Wetland preservation credits will be purchased at the Elsie N. Gridley Mitigation Bank (EGMB) to compensate for the project's permanent impacts to wetlands and other waters of the U.S. Documentation to USACE will need to be provided stating the correct number of credits allocated to the EGMB before the start of construction, scheduled for May 2009.

9.1 OFF-SITE MITIGATION MONITORING

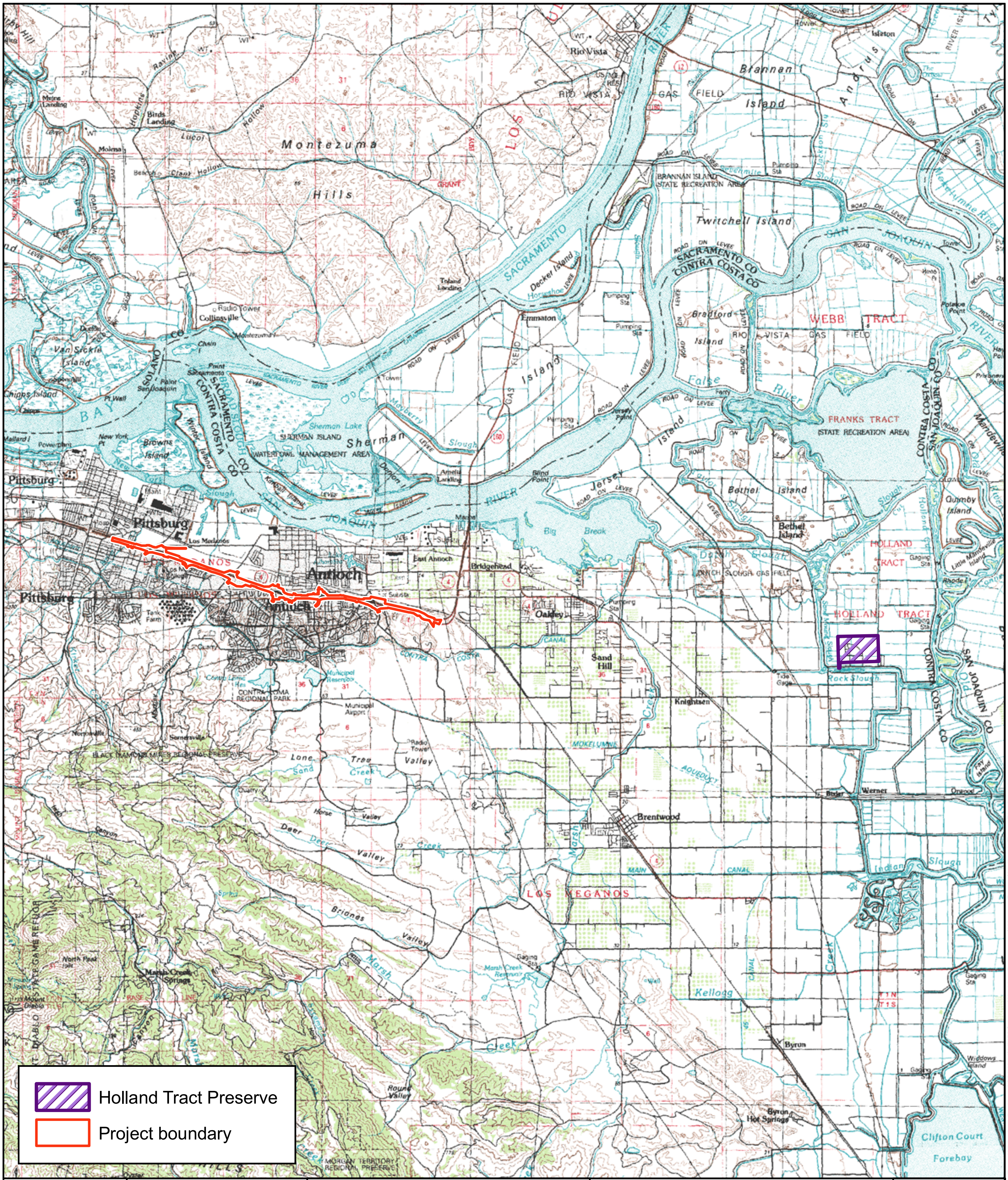
Purchased Mitigation Bank Credits and Conservation Easements

Prior to initiation of ground disturbing activities on the SR4 project, Caltrans shall provide evidence to USACE, CDFG, and RWQCB that the appropriate number of credits for jurisdictional waters have been dedicated at EGMB. All monitoring and performance standards shall be the responsibility of the mitigation bank, species fund, or conservation easement managers.

10.1 JURISDICTIONAL WATERS CONTINGENCY PLANS

10.1.1 Wildlands, Inc. Holland Tract Preserve

If it is not possible to purchase credits from the Elsie N. Gridley Mitigation Bank before the initial start of construction, credits will be pursued at Wildlands Inc. Holland Tract Preserve. Wildlands Inc. has recently purchased approximately 263 acres of land, known as the Holland Tract, located in East Contra Costa County near Oakley, about 16 miles east of the SR4 project. The preserve is bordered by sloughs and rivers feeding the Sacramento-San Joaquin Delta. The preserve plans on establishing or enhancing 107.5 acres of wetlands and open water habitat. These wetland environments will include both freshwater and tidally influenced wetlands. Although the Holland Tract Preserve is an excellent opportunity for SR4 mitigation purposes, as it provides credits for wetland habitat restoration and creation, this project is in the planning stages. The project site is outlined in Figure 3.



N

Caltrans

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

0 1 2 4 Miles

Wildlands Inc.
Holland Tract Preserve

Figure 3

L:\Projects\State_Route_4_East_Widening_Project_26814914\MXD\Current Working Documents\Waters_Report\Holland_Trust_Fig_3.mxd

California Department of Transportation (Caltrans) and Federal Highway Administration (FHWA). 2005. Initial Study/ Negative Declaration/Final Environmental Assessment. State Route 4 (East) Widening Project: Loveridge Road to State Route 160. August 2005.

Parsons. 2004. State Route 4 (East) Widening Project: Loveridge Road to State Route 160 – Natural Environment Study/ Biological Assessment. Prepared for Contra Costa Transportation Authority, State of California Department of Transportation and U.S. Department of Transportation Federal Highway Administration. May 2004.

Parsons. 2005. State Route 4 (East) Widening Project: Loveridge Road to State Route 160 – Addendum to the Natural Environment Study/ Biological Assessment. Prepared for Contra Costa Transportation Authority, State of California Department of Transportation and U.S. Department of Transportation Federal Highway Administration. June 2005.

URS Corporation. 2006. San Antonio Pipeline Relocation Project- Off-Site Compensatory Mitigation Plan for Federally Listed Species & Wetlands. Prepared for Chevron Pipe Line Company. September 2006.

URS Corporation. 2007. Greenwood Bridge Replacement- Conceptual Mitigation Plan. Prepared for Caltrans. May 2007.

URS Corporation. 2007. Wetland Reverification for SR4 (East) Widening Project Loveridge Road to Somersville Road - 04-CC-04, KP 37.9/41.3 (PM 23.7/25.8). Prepared for Caltrans/Contra Costa Transportation Authority. December 2007.

U.S. Army Corps of Engineers. 2002. Regulatory Guidance Letter No. 02, December 24,2004. Guidance Compensatory Mitigation Projects for Aquatic Resource Impacts Under the Corps Regulatory Program Pursuant to Section 407 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899.

Appendix A
Impacts to Jurisdictional Features

Appendix A: Impacts to Jurisdictional Features

Feature Name	Impact Sheet	Segment	Impact Type	Feature Type	Impact Acres	Linear Feet Impact	Mitigation Ratio
owus 1	1	Loveridge-Somersville	Temporary	Other Waters of the U.S.	0.005	82	NA
owus 4	**2**	**Loveridge-Somersville**	**Permanent**	**Other Waters of the U.S.**	**0.005**	**66**	**4:1**
owus 5	**3**	**Loveridge-Somersville**	**Permanent**	**Other Waters of the U.S.**	**0.011**	**51.3**	**4:1**
owus 5	3	Loveridge-Somersville	Temporary	Other Waters of the U.S.	0.004	10	NA
owus 6	**3**	**Loveridge-Somersville**	**Permanent**	**Other Waters of the U.S.**	**0.007**	**13.5**	**4:1**
		Loveridge-Somersville	**Total Temporary OWUS**		**0.009**		
		Loveridge-Somersville	**Total Permanent OWUS**		**0.023**		
owus 10a	**5**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.002**	**20**	**4:1**
owus 10b	**5**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.007**	**100**	**4:1**
owus 11	**5**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.003**	**10**	**4:1**
owus 7a	**4**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.015**	**85**	**4:1**
owus 7b	**4**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.031**	**295**	**4:1**
owus 8	**4**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.004**	**44**	**4:1**
owus 9	**4**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.004**	**80**	**4:1**
		Somersville- Route 160	**Total Permanent OWUS**		**0.066**		
ws 1	**1**	**Loveridge-Somersville**	**Permanent**	**Waters of the State**	**0.008**	**698**	**4:1**
		Loveridge-Somersville	**Total Permanent WS**		**0.008**		
wl/wus 1	**1**	**Loveridge-Somersville**	**Permanent**	**Wetland/Waters of the U.S.**	**0.048**	**98**	**4:1**
wl/wus 2	**2**	**Loveridge-Somersville**	**Permanent**	**Wetland/Waters of the U.S.**	**0.010**	**10**	**4:1**
wl/wus 3	**2**	**Loveridge-Somersville**	**Permanent**	**Wetland/Waters of the U.S.**	**0.021**	**66**	**4:1**
		Loveridge-Somersville	**Total Permanent WL/WUS**		**0.079**		

Appendix A: Impacts to Jurisdictional Features (continued)

Feature Name	Impact Sheet	Segment	Impact Type	Feature Type	Impact Acres	Linear Feet Impact	Mitigation Ratio
wl/wus 10	5	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.002	20	4:1
wl/wus 11	5	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.009	40	4:1
wl/wus 5a	4	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.008	65	4:1
wl/wus 5b	4	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.013	90	4:1
wl/wus 6	4	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.011	44	4:1
wl/wus 7	4	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.003	24	4:1
wl/wus 8	4	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.005	72	4:1
wl/wus 9a	5	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.002	20	4:1
wl/wus 9b	5	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.007	30	4:1
		Somersville- Route 160	Total Permanent WL/WUS		0.060		

	Temporary Impacts	Permanent Impacts	Total Impacts
Total ws	0.000	0.008	0.008
Total owus	0.009	0.089	0.098
Total wl/wus	0.000	0.139	0.139
Grand Total	0.009	0.236	0.245

Appendix B
Drainage Plans

04-228554

INFORMATION HANDOUT

NOTES:

FOR LEGEND, NOTES AND ABBREVIATIONS SEE SHEET D-1.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER J.E. Peterson No. 42777 Exp. 3-31-08 CIVIL STATE OF CALIFORNIA

CONTRA COSTA
TRANSPORTATION AUTHORITY
3478 Buskirk Ave. Suite 100
Pleasant Hill, CA 94523

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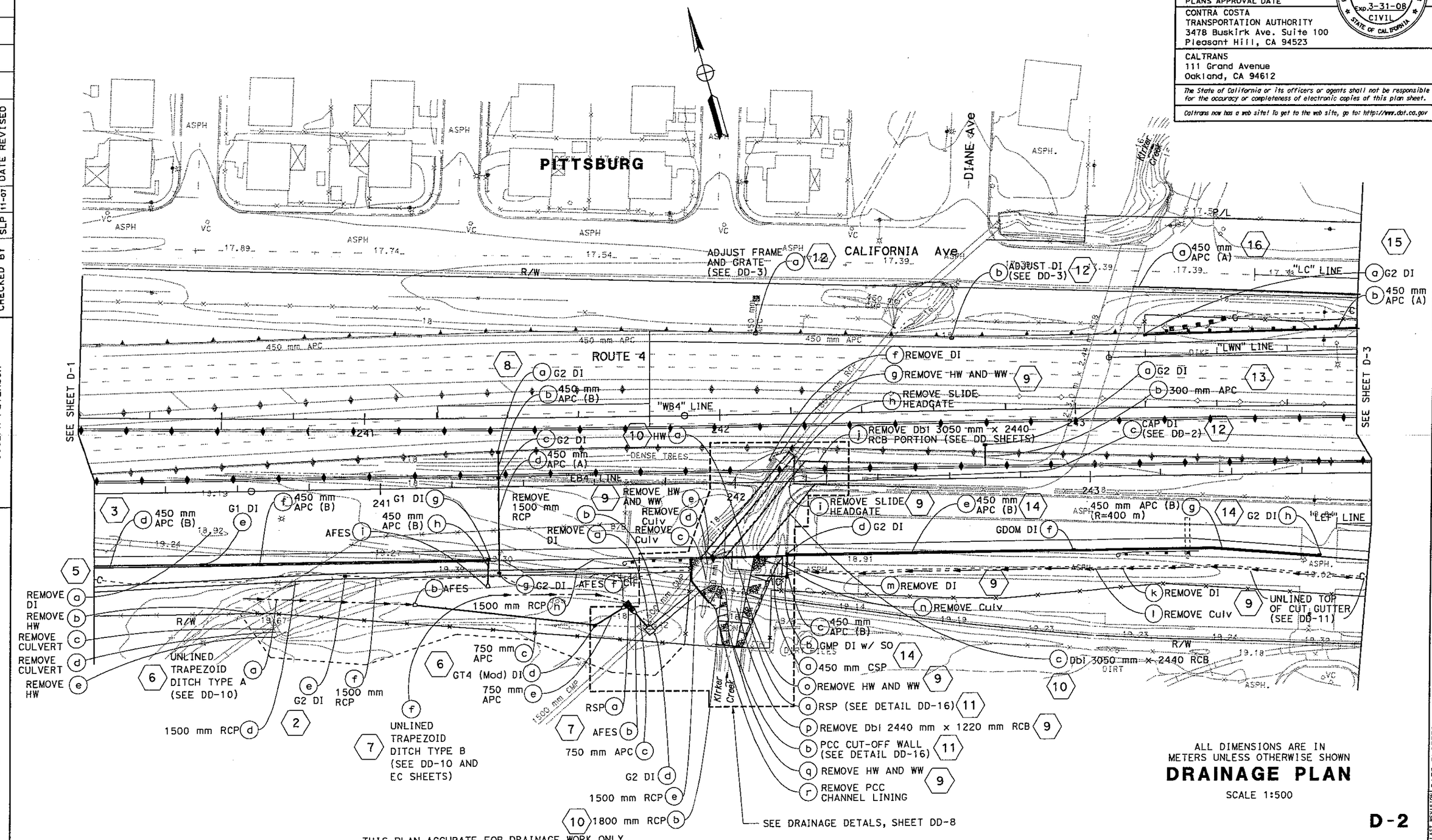

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DRAINAGE PLAN

SCALE 1:500

D-2

THIS PLAN ACCURATE FOR DRAINAGE WORK ONLY.

REVISED BY	DATE REVISED
KMR	11-07
SLP	11-07

CALCULATED/DESIGNED BY — CHECKED BY

DESIGN OVERSIGHT — JOSEPH PETERSON

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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Joseph E. Peterson
REGISTERED CIVIL ENGINEER DATE

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J.E. Peterson
No. 42777
Exp. 3-31-08
CIVIL
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PLANS APPROVAL DATE

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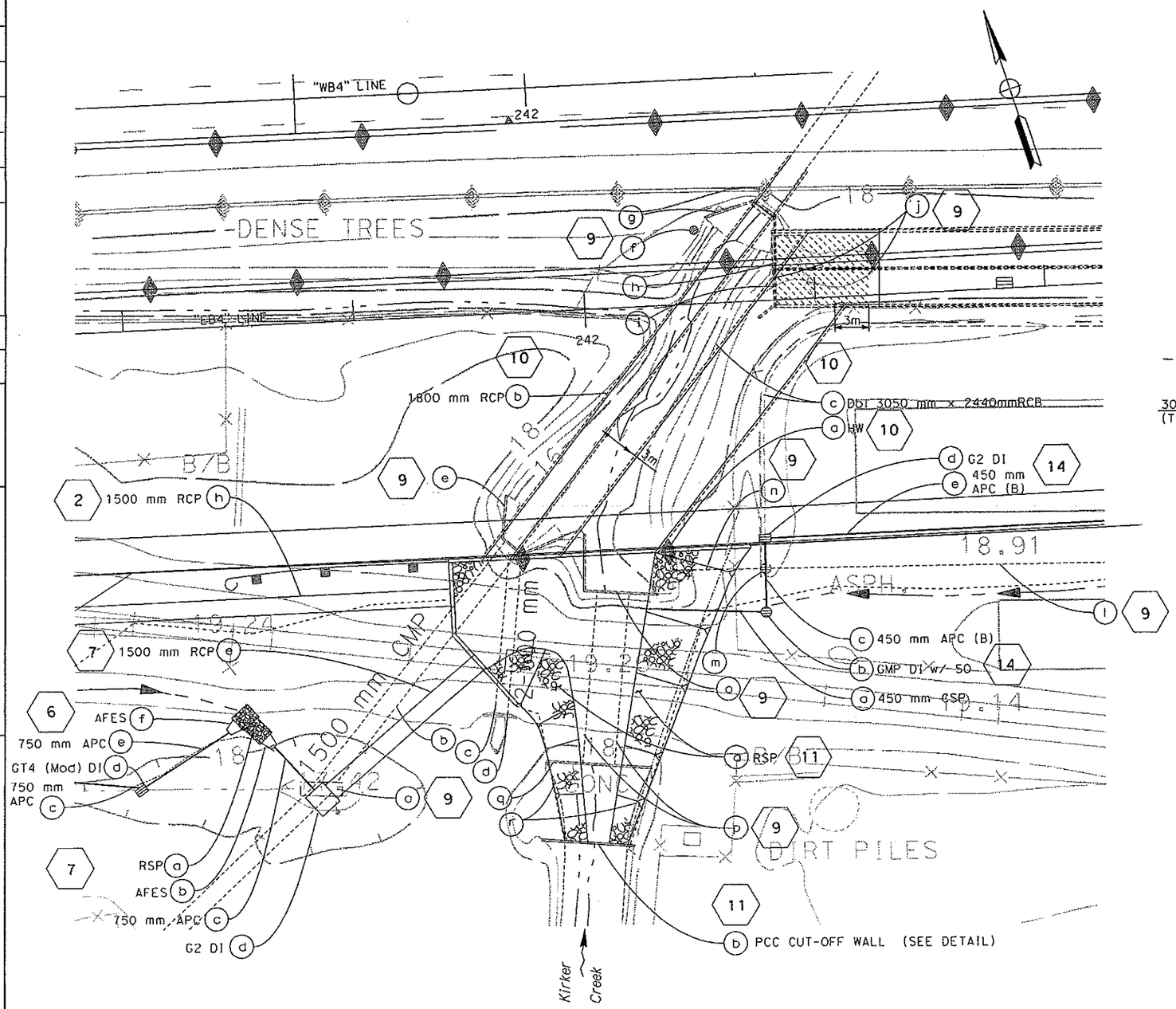

KIRKER CREEK MODIFICATION

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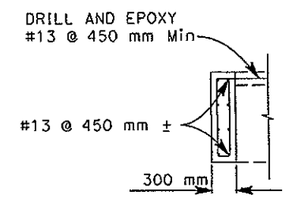
NOTE: FOR ADDITIONAL INFORMATION SEE DD-21



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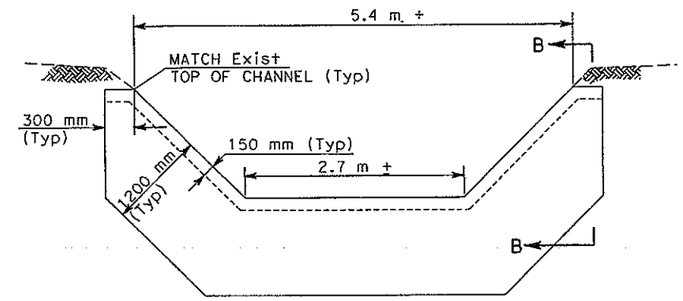

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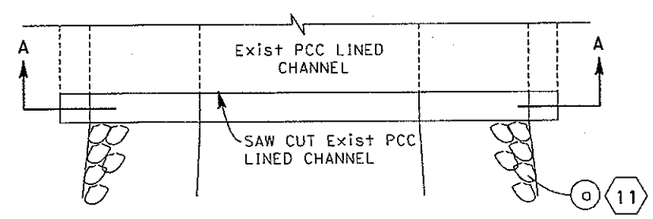

PCC CHANNEL CUT-OFF WALL

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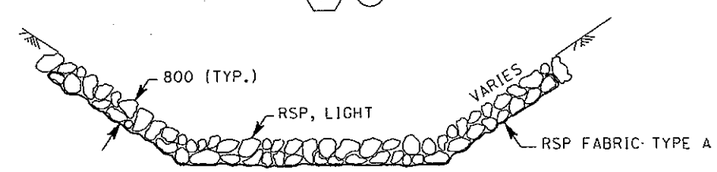

RSP DETAIL

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DRAINAGE DETAILS

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DD-16

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INFORMATION HANDOUT

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
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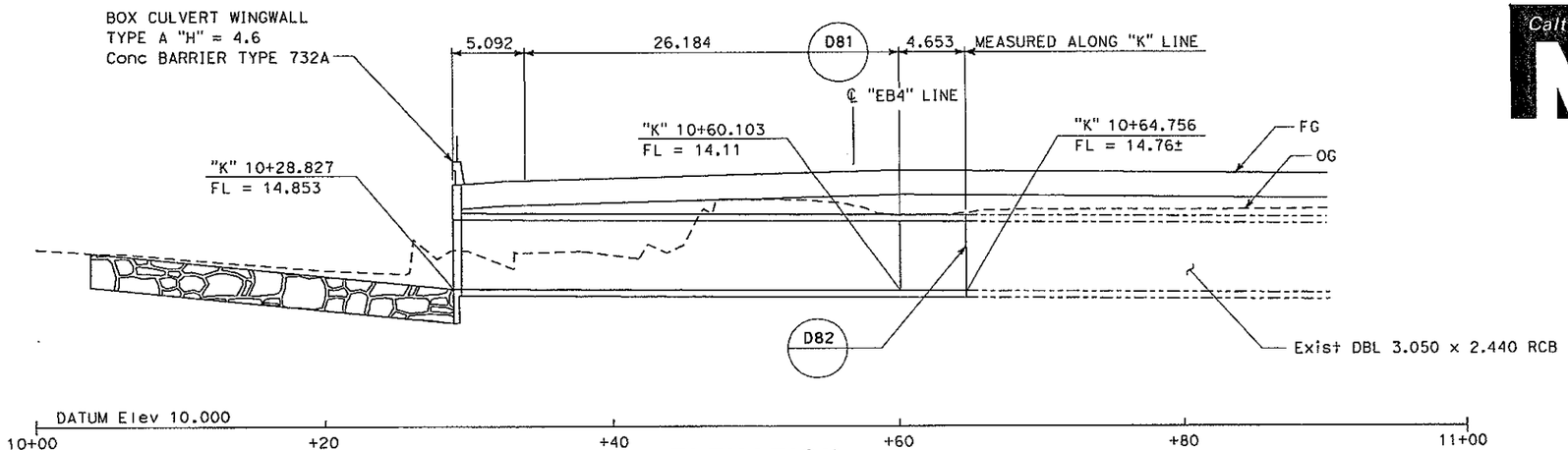

ELEVATION

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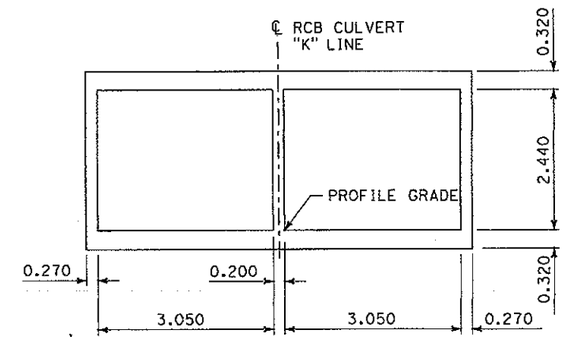
Vert 1:100



TYPICAL SECTION (D81)

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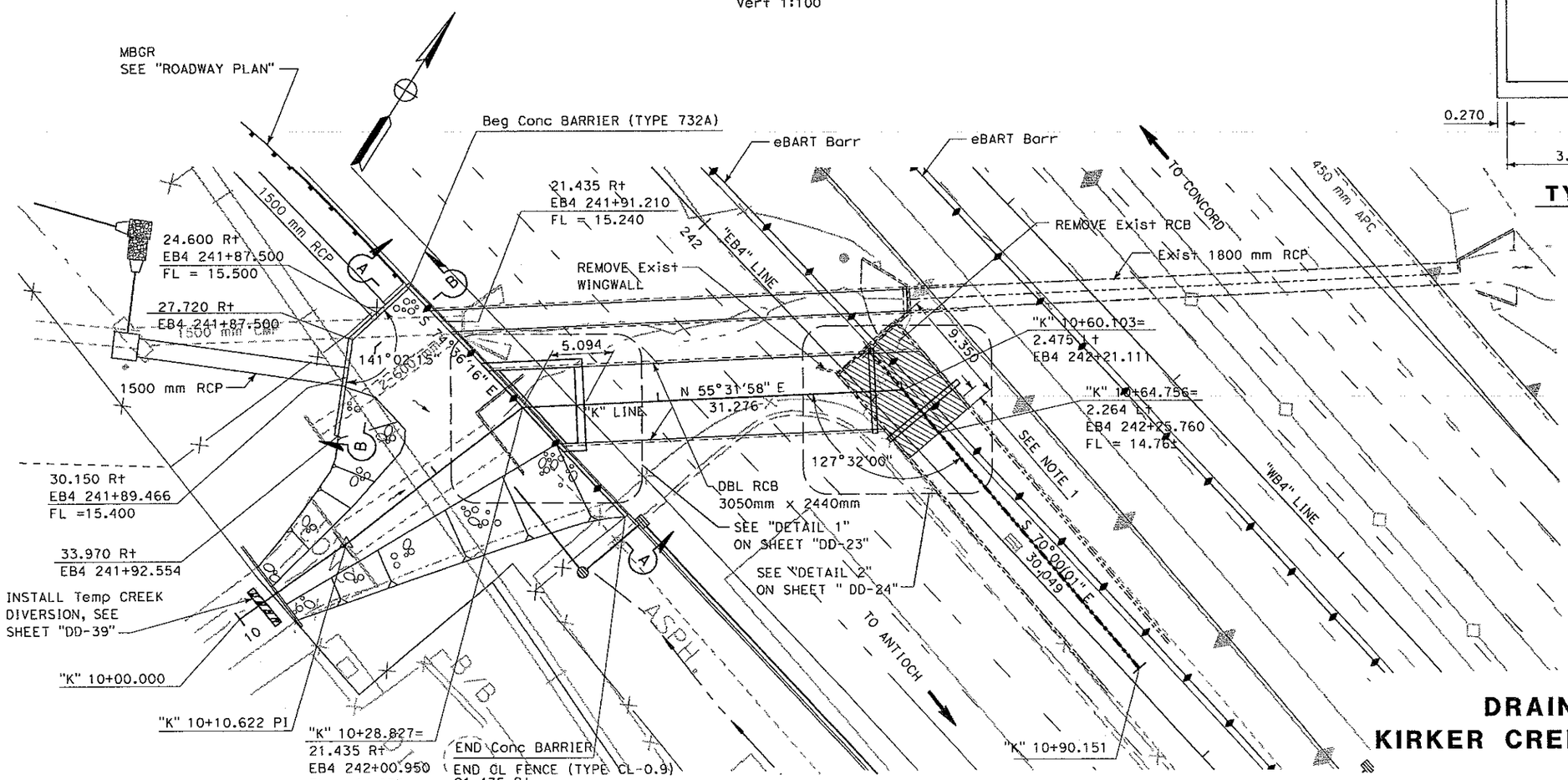

PLAN

1:200

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NOTES:

1. SEE (D82) FOR RCB EXTENSION DETAILS.
2. SEE "DD-22" SHEET FOR SECTION A-A AND SECTION B-B.
3. SEE "DD-23" SHEET FOR "DETAIL 1".
4. SEE "DD-24" SHEET FOR "DETAIL 2".
5. FOR REINFORCEMENT DETAILS SEE Std PLANS D81, BOX 3.050 x 2.440 WITH 6 m Max COVER

LEGEND:

REMOVE RCB (PARTIAL)

INDICATES EXISTING STRUCTURE

DRAINAGE DETAILS
KIRKER CREEK RCB EXTENSION

SCALE AS SHOWN

DD-21

REVISED BY	DATE REVISED
PH	03/05
AM	03/05

CALCULATED/DESIGNED BY
CHECKED BY

DESIGN OVERSIGHT
JOSEPH PETERSON

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
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EA 228591

Appendix G

Stream Diversion Plans

Stream Diversion Plans

- Temporary creek diversion systems will be established for all creek channels affected by the project. These creek channels are Kirker Creek, Old Kirker Creek, Los Medanos Wasteway, and West Antioch Creek (Contra Loma Interchange).
- These creek diversion systems are only to be used between April 1st and October 15th for the Kirker Creek, Old Kirker Creek, and Los Medanos Wasteway creek diversion systems, and between June 1st and October 15th for the West Antioch Creek diversion system.
- An upstream gravel dam is used to direct the base flows during the dry season through an appropriately sized diversion pipe (The pipe diameter varies from 700 – 900 mm, depending on the location). This plastic diversion pipe passes through the Contractor's work area and discharges flows through a downstream sandbag cofferdam wrapped with an impermeable polyethylene liner. The pipe will discharge 15-20 feet upstream from the construction area. Only clean gravel, sandbags, and filter fabric will be used.
- A possible option that is being investigated at Contra Loma Interchange is to establish 2 separate temporary water diversion systems at West Antioch Creek. For the first system, a cofferdam will need to be placed upstream of the open 120-inch reinforced concrete pipe (RCP), underneath Fitzuren Road, southwest of the G Street interchange. Base flows traveling down West Antioch Creek toward the freeway would collect behind this cofferdam and eventually drain westerly along their historic path and eventually enter the upstream end of the triple 5 x 3 foot reinforced concrete box (RCB) at Contra Loma Boulevard. The triple 5 x 3 foot RCB outfalls into the open channel portion of West Antioch Creek further downstream. The second temporary water diversion system would have to be applied upstream of the triple 5 x 3 foot RCB while it is being replaced at its downstream end. A City of Antioch 6 x 3 foot RCB empties into this system which means there will be a significant base flow to contend with during the summer months. A water-filled cofferdam would be temporarily installed at this location to deal with these base flows.
- The construction of sediment catch basins across stream channels immediately below the project site when performing in-channel construction to prevent silt- and sediment-laden water from entering the main streamflow (accumulated sediments would be periodically removed from the catch basin).
- Caltrans will ensure that a biologist is on site prior to dewatering to ensure no sensitive aquatic species are stranded.
- Once the temporary creek diversion systems are no longer required, the plastic pipe, the sandbags, the gravel dam, and the impermeable plastic liner will all be removed and the creek returned to its natural condition.
- The following figures are some representative plans of the proposed water diversion systems.

GEOTECHNICAL DESIGN & MATERIALS REPORT
(FINAL)
CONTRA LOMA AND G STREET INTERCHANGES
STATE ROUTE 4 (EAST) WIDENING PROJECT - SEGMENT 2
ANTIOCH, CONTRA COSTA COUNTY, CALIFORNIA
04-CC-4-26.6/R27.5 EA 2285E1

For

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Pleasanton, CA 94588

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December 2010 Job No. 206118.GDR

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Practicing in the Geosciences

Geotechnical ■
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Materials Testing ■
Construction Inspection ■

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4670 Willow Road, Suite 250
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Job No.: 206118.GDR
December 1, 2010

Attn: Ms. Natalina Bernardi

Sub: GEOTECHNICAL DESIGN & MATERIALS REPORT (FINAL)
Contra Loma and G Street Interchanges, State Route Widening Project – Segment 2,
Antioch, Contra Costa County, California
04-CC-4-R26.6/R27.5 EA 2285E1

Dear Ms. Bernardi:

Transmitted herewith is the Final Geotechnical Design & Materials Report for the subject project. The report was prepared in accordance with the scope of work outlined in our proposal. The report is for submittal to Caltrans for their review and approval.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning our findings or conclusions, please feel free to contact this office.

Very truly yours,
PARIKH CONSULTANTS, INC.

Gary Parikh, P.E., G.E., 666
Project Manager

Attachment: Final Geotechnical Design & Materials Report (12 copies bound)

"Approved as to impact on State facilities and conformance with applicable State standards and practices, and the technical oversight were performed as described in the California Department of Transportation A&E Consultant Services Manual."

Caltrans_____

Title_____

Date_____

Caltrans_____

Title_____

Date_____

TABLE OF CONTENTS **Page**

Title Page 1
Letter of Transmittal 2
Legal Protection of Design Immunity for State 3
Table of Contents 4
List of Tables 6
List of Plates 6
Appendices 6

1. Introduction 8
2. Existing Facilities and Proposed Improvements 9
3. Pertinent Reports and Investigations 12
4. Physical Setting 12
4.1 Climate 12
4.2 Topography 13
4.3 Surface Drainage 13
4.4 Man-Made and Natural Features of Engineering and Construction Significance 14
4.5 Regional Geology and Seismicity 14
5. Exploration 14
5.1 Drilling, Sampling and Cone Penetrometer Testing (CPT) 14
5.2 Geologic Mapping 19
5.3 Geophysical Studies 19
5.4 Instrumentation 19
5.5 Exploration Notes 20
6. Geotechnical Testing 20
6.1 In-Situ Testing 20
6.2 Laboratory Testing 20
7. Geotechnical Conditions 21
7.1 Site Geology 21
7.1.1 Lithology 22
7.1.2 Structure 22
7.1.3 Existing Slope Stability 22
7.2 Subsurface Soil Conditions 23
7.3 Water 24
7.3.1 Surface Water 24
7.3.1.1 Scour 24
7.3.1.2 Erosion 25
7.3.2 Groundwater 25
7.4 Project Site Seismicity 26
7.4.1 Ground Motions 26
7.4.2 Ground Rupture 27
8. Geotechnical Analyses and Design 28
8.1 Seismic Analysis 28
8.1.1 Parameter Selection 28

8.1.2 Analysis....28
8.1.3 Liquefaction Potential....28
8.2 Cuts and Excavations....30
8.2.1 Stability....30
8.2.2 Rippability....31
8.2.3 Grading Factor....31
8.3 Embankments....31
8.3.1 Evaluation of Embankment Settlements....31
8.3.2 Evaluation of Embankment Stability....33
8.4 Earth Retaining Systems....33
8.5 Culverts....46
8.5.1 Corrosion Investigation....46
8.5.2 Bore and Jack Culvert....49
8.6 Minor Structure Foundations....52
8.6.1 Soundwall....52
8.6.1.1 Subsurface Soil Conditions....54
8.6.1.2 Foundation Recommendations....54
8.6.1.3 Design and Construction Considerations for the CIDH Piles....54
8.6.2 Overhead Sign Structures....55
8.6.2.1 Subsurface Soil Conditions....56
8.6.2.2 Pile Capacity Analyses....56
8.6.3 Other Minor Structure....57
9. Structural Pavement....57
10. Material Sources....66
11. Material Disposal....66
12. Construction Considerations....66
12.1 Construction Advisories....66
12.2 Construction Considerations that Influence Specifications....67
12.3 Construction Monitoring and Instrumentation....67
12.4 Hazardous Waste Considerations....67
12.5 Differing Site Conditions....67
13. Recommendations and Specifications....68
13.1 Summary of Recommendations....68
13.2 Recommended Materials Specifications....69
13.2.1 Standard Specifications....69
13.2.2 Special Provisions....69
14. Investigation Limitations....71

References

LIST OF TABLES

Table

1A Summary of Borings (For Pavement Design and Roadway)
1B Summary of Borings (Ramps and Embankments)
1C Summary of Borings (Retaining Walls and Soundwalls)
1D Summary of Borings (for Contra Loma Blvd. Undercrossing)
1E Summary of Borings (For G Street Overcrossing)
1F Summary of Cone Penetrometer Testing (CPT)
2 Summary of Groundwater Elevations
3 Seismic Sources
4 Potential Liquefaction Locations and Depths
5 Summary of Proposed Construction and Maximum Fill Thickness
6 Summary of Proposed Retaining Walls
7 Summary of Corrosion Test Results
8 Recommended Minimum Thickness and Protective Measures for Culverts
9 Summary of Proposed Soundwalls
10 Summary of Overhead Sign Structures
11 Summary of R-Value Test Results
12 As-Built Pavement Sections
13A Recommended Pavement Sections for Mainline
13B Recommended Pavement Sections for Contra Loma Blvd. and L Street
13C Recommended Pavement Sections for On and Off Ramps, Temporary Detours during Construction, G Street, Fitzuren Road and Claudia Ct.
14 Sources of Imported Borrow

LIST OF PLATES

Project Location Map ..... Plate 1
Site Plan ..... Plates 2A through 2F
Geologic Map ..... Plate 3
Fault Map ..... Plate 4
Lateral Earth Pressure Diagram for Shoring Design ..... Plate 5

APPENDICES

Appendix A

Log of Test Borings ..... Plates A-1 through A-13
As-Built Log of Test Boring ..... Plates A-14 and A-15
Summary of R-Value Borings ..... Plate A-16
CPT Results ..... Plates A-17 and A-18

Appendix B

Laboratory Tests ..... Plate B-1
Plasticity Chart ..... Plates B-2A through B-2E
Grain Size Distribution Curves ..... Plates B-3A through B-3J
Corrosion Tests ..... Plates B-4A through B-4R
R-Value Tests ..... Plates B-5A through B-5N
Expansion Index ..... Plates 6-A and 6-B
Direct Shear ..... Plates 7-A through 7-E
Unconsolidated Undrained (UU) Triaxial Test ..... Plate 8
Consolidation Test ..... Plates 9-A through 9-E

Appendix C

Liquefaction Analyses – CPT
Liquefaction Analyses – SPT
Slope Stability for Cut Slopes
SHAFT Runs for Retaining - Wall No. 6
LPILE Runs for Retaining - Wall No. 6
Soldier Pile-Lagging Calculations – Wall No. 13
"Culvert 4" Results
Structural Pavement Design

Appendix D

Existing Pavement Sections (13 sheets)

Appendix E

Caltrans Comments and Responses on 65 percent Submittal
Caltrans Comments and Responses on 95 percent Submittal
Caltrans Comments and Responses on 100 percent Submittal
Caltrans Comments and Responses on October 2010 Report

GEOTECHNICAL DESIGN & MATERIALS REPORT
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STATE ROUTE 4 (EAST) WIDENING PROJECT – SEGMENT 2
ANTIOCH, CONTRA COSTA COUNTY, CALIFORNIA
04-CC-4-R26.6/R27.5 EA 2285E1

1. INTRODUCTION

This report presents the results of our geotechnical engineering investigation for the proposed "Contra Loma and G Street Interchanges" in Antioch, California, hereinafter referred to as "PROJECT". The work was performed in general accordance with the scope of work outlined in our proposal to BKF Engineers (Designer). The general location of the project site and its vicinity are shown in the Project Location Map, Plate 1.

This report addresses geotechnical design recommendations for embankments, retaining walls, soundwalls, corrosion recommendations for the culvert design, overhead sign structures, and structural pavement sections. Separate foundation investigation reports have been prepared for the two bridge structures within the corridor. The investigation included review of readily available soils and geologic literature pertaining to the site including as-built information and "Log of Test Borings" (LOTB), site reconnaissance, drilling exploratory soil borings, obtaining representative soil samples and logging soil materials encountered in exploratory borings, cone penetrometer testing (CPT), laboratory testing of the representative soil samples, performing engineering analyses, and preparation of this report.

The purpose of this report is to document subsurface geotechnical conditions, provide analyses of anticipated site conditions as they pertain to the project described herein, and to recommend design and construction criteria for the roadway portions of the project. This report also establishes a geotechnical baseline to be used in assessing the existence and scope of changed site conditions, if any.

The report is intended for use by the project roadway design engineer, construction personnel, bidders and contractors for information and reference purposes only and should not be construed as project specifications.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the subsurface soil conditions during construction nor

is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain a properly constructed project. We, therefore, recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction.

2. EXISTING FACILITIES AND PROPOSED IMPROVEMENTS

The proposed "Contra Loma and G Street Interchanges" project is a segment (Segment 2) of the State Route 4 (SR4) Widening project between Loveridge Road and State Route 160. The project site is located in Antioch, California along State Route 4 from Sta. 136+00 to Sta. 179+00 along the "E" line. Currently, State Route 4 is a 4-lane median divided freeway.

The following bridge structures exist along SR4 within the project limits:

Contra Loma Boulevard Undercrossing (Bridge No. 28-98)
G Street Overcrossing (Bridge No. 28-97)

The existing Contra Loma Boulevard Undercrossing (Bridge No. 28-98) consists of two parallel prestressed concrete girder bridges constructed in 1951. Per the As-Built drawings, both bridges (known at the time as Stewartville Road Bridge) are three-span structures, approximately 90 feet long and 37 feet wide. The bridge abutments at the two ends are supported on precast prestressed concrete piles. The bents are supported on concrete frames. The bottom members of the frames are embedded and serve as spread footing foundations for the internal bents. The existing bridge abutments are built on approximately 20 feet of fill.

The existing G Street Overcrossing (Bridge No. 28-97) was also constructed in 1951. Per the As-Built drawings, the overcrossing (originally "H" Street Overcrossing) consists of a 94-ft long two-span concrete bridge; the bent rests on two columns. The bridge abutments and the two columns at the bent appear to be supported on shallow spread footing

foundations. The deck of the overcrossing is roughly at the same elevation as the adjacent grade. SR4 passes under the bridge through a cut, approximately 20 feet deep.

The project consists of new interchanges at Contra Loma Boulevard/L Street and at G Street. These include: widening of State Route 4, demolition of the existing bridges (Bridge Nos. 28-98 L/R and 28-97); construction of new bridges (Contra Loma Boulevard Undercrossing (Bridge No. 28-399 L/R) and G Street Overcrossing (Bridge No. 28-400)) to replace the existing bridges; widening of stretches of Contra Loma Boulevard, L Street, G Street, Fitzuren Road and Claudia Ct.; construction of retaining walls and sound walls and the construction of associated entrance and exit ramps.

In summary:

- State Route 4 will be widened from 4 lanes to 6 lanes: from Sta.130+50 to Sta. 179+00. It will also include standard median and shoulders.
- Contra Loma Boulevard/L Street will be widened from north of St. Francis Drive to approximately 180 feet north of Lemon Tree Way.
- G Street will be widened from 250 feet south of Fitzuren Road to approximately 150 feet north of Drake Street.
- Portions of Fitzuren Road and Claudia Ct. will be widened.
- New entrance and exit ramps will be constructed for the Contra Loma Boulevard/L Street Interchange for both directions of State Route 4.
- The existing bridges at Contra Loma Boulevard Undercrossing and G Street Overcrossing will be demolished and replaced by new bridges.

The proposed project will generally include the following structures:

Bridge Structures

- Contra Loma Boulevard Undercrossing (Bridge No. 28-399 R/L)
- G Street Overcrossing (Bridge No. 28-400)

Retaining Walls

Retaining Wall No. 1	North side of On-Ramp to westbound State Route 4 from L Street
Retaining Wall No. 2	South side of eastbound State Route 4, west of Contra Loma Boulevard
Retaining Wall Nos. 3A & 3B	South side of Off-Ramp from eastbound State Route 4 to Contra Loma Boulevard
Retaining Wall No. 4	North side of On-ramp to eastbound State Route 4 from Contra Loma Boulevard
Retaining Wall No. 5	Not Used
Retaining Wall No. 6	South side of eastbound State Route 4, east of Contra Loma Boulevard
Retaining Wall No. 7	North side of On-ramp to eastbound State Route 4 from Contra Loma Boulevard
Retaining Wall No. 8	Not Used
Retaining Wall Nos. 9A, 9B & 9C	North side of Off-ramp from westbound State Route 4 to Contra Loma Boulevard
Retaining Wall No. 11	North side of On-Ramp to westbound State Route 4 from G Street (Soil Nail Wall)
Retaining Wall No. 12	South of eastbound State Route 4, starting from east of G Street
Retaining Wall No. 13	West side of Contra Loma Blvd. between St. Francis Drive and Buchanan Road

Overhead Sign Structures

- Four standard overhead signs are planned.

Soundwalls

- Ten soundwalls are proposed.

Based on the plan, the project will require fill for the widening of State Route 4 between Sta. 142+38 and 161+40 on the westbound direction and between Sta. 142+35 and 167+83 on the eastbound direction. Fill will also be required for the entire on- and off-ramps for Contra Loma Boulevard/L Street for both eastbound and westbound directions and for the approach embankments of the proposed new bridge structures. Cuts will be required for the widening of State Route 4 between Sta. 130+50 and 136+59 and between 161+40 and 179+00 in the westbound direction; and between Sta. 130+50 and 143+25 and between 167+83 and 179+00 in the eastbound direction. The roadway work will also include cuts for the widening of Contra Loma Boulevard below the bridge. Most cuts and fills will be retained by retaining walls. When not retained by retaining walls, the proposed side slopes will have a gradient of 2(H): 1(V) to 4(H): 1(V) or flatter.

As part of the overall program, eBART structures and associated retaining walls are also planned in the median of the highway. These structures are not in the scope of work for the subject project/contract. These are addressed separately under a different scope and contract.

Our recommendations presented in this report are based on the above information. Any major deviation should be reported to our office for consideration.

3. PERTINENT REPORTS AND INVESTIGATIONS

In addition to the field explorations, we referred to the following available as-built information:

- As-built LOTB (Caltrans, 1951) (Br. No. 28-97)
- As-built LOTB (Caltrans, 1951) (Br. No. 28-98)
- As-Built Plans (Caltrans, 51) (Br. No. 28-97)
- As-Built Plans (Caltrans, 51) (Br. No. 28-98)
- As-Built Pavement Sections for State Route 4, Contra Loma Blvd./L Street, G Street, Fitzuren Road and Claudia Ct.

4. PHYSICAL SETTING

4.1 Climate

The project area is characterized by moderate climatic conditions. This consists of mild winters, warm summers, small daily and seasonal temperature ranges and low to mild humidity. Extremes of temperature range from 92°F to 48°F in July/August and 50°F to 37°F in January.

Based on statistics of National Weather Services, average rainfall precipitation is about 13 inches in the Antioch area and is principally during the months of

November through March. January usually has the most precipitation accumulation with 2.73 inches average precipitation.

4.2 Topography

The project is located along the base of the north flank of Mount Diablo to the south and Suisun Bay to the north. The terrain adjacent to the alignment indicates two areas of high ground at the western and eastern ends, with a lower area in between.

At the northern side, the adjacent terrain elevations fall from 59.5-ft to 28.4-ft between Sta. 130+00 to Sta. 143+00 and then rise gently from 28.4-ft to 41.6-ft between Sta. 143 +00 to Sta. 164+00. Beyond Sta. 164+00 and up to the eastern end of the project, the elevations range from 62.5-ft to 66.8-ft.

At the southern side, the adjacent terrain elevations fall from 62.5-ft to 31.2-ft between Sta. 130+00 to Sta. 153+00 and then rise gently from 31.2-ft to 36.7-ft between Sta. 153+00 to Sta. 164+00. Beyond Sta. 167+50 and up to the eastern end of the project, elevation ranges between 68.8-ft to73.0-ft.

The elevations of the 'top of pavement' along SR4 range from approximately 43.0-ft at the western end to approximately 57.0-ft at the eastern end.

4.3 Surface Drainage

The West Antioch Creek crosses the alignment under the Contra Loma Boulevard Undercrossing. In the area of the crossing, the water of the creek flows through a 'group' of three buried 5' x 3' reinforced concrete boxes (RCBs). As part of the project, a portion of the three-box RCB alignment will be removed and replaced by a new RCB.

4.4 Man-Made and Natural Features of Engineering and Construction Significance

Other than the existing Contra Loma Boulevard/L Street Interchange, the G Street Interchange, and the West Antioch Creek, there are no man-made or natural features of engineering and construction significance within the project site.

4.5 Regional Geology and Seismicity

The regional structure of the area is similar to other portions of the Northern California Coast Ranges, consisting of a complex series of northwest-trending synclines and anticlines with a number of northwest-trending faults.

In the general project area, the geologic unit comprises primarily of alluvial soils deposited primarily during the Pleistocene period. A small zone of Holocene alluvial soil is indicated near the eastern end of the project site. A geologic map of the project site is presented on Plate 3.

Faults in the vicinity of the site with a moderate to high surface potential include the Vaca Fault Zone, Great Valley Fault and Greenville Fault. Significant earthquakes, which have occurred in this area, are generally associated with crustal movements along well-defined active fault zones. A Fault Map, showing the site location relative to the major active faults in the vicinity, is presented on Plate 4.

5. EXPLORATION

5.1 Drilling, Sampling and Cone Penetrometer Testing (CPT)

Based on the Geometric Approval Drawings, discussions with the designer, and readily available geotechnical data in the area, a total of fifty borings were initially drilled for the PROJECT. All the borings were drilled between September

and December, 2006. Four additional borings were drilled in September, 2010 in response to needs for additional information resulting from subsequent design modifications. In addition to the borings, two CPTs were performed on October 26-27, 2007.

- Four "deep" borings were drilled: two borings were drilled near the abutments of the proposed new Contra Loma Boulevard Undercrossing and two were drilled near the abutments of the proposed new G Street Overcrossing. These borings were drilled to the depth of approximately 100 feet below the existing ground surface.
- Twenty one borings were initially drilled to depths of approximately 30 feet below ground surface borings for the design of new retaining walls and soundwalls. Four additional borings were added later for design of retaining walls: two to approximately 30-ft depth, below ground surface and one each to 50-ft and 60-ft depth.
- Six borings were drilled generally to depths of approximately 30 feet. Below ground surface for the design of the new ramps and embankments.
- Twenty borings were drilled to the depths of approximately 5 feet to collect bulk samples for the pavement design.

The approximate locations of these borings are shown on the attached Site Plans (Plates 2A through 2E). The as-built LOTB of the existing Contra Loma Blvd. Undercrossing (Bridge No. 28-98R/L) and G Street Overcrossing (Bridge No. 28-97) are also included in the report.

Shallow (5-ft deep) borings drilled generally for pavement design were drilled with a jeep mounted rig, using a 6-in diameter solid stem auger. Most of the other borings were drilled with truck-mounted drill rig using 8-inch diameter hollow stem auger. Several borings, where the boring locations presented access difficulties, were drilled using a portable drill rig using a 3.5-inch diameter solid stem auger. The borings were drilled under the technical supervision of our engineer, who classified and continuously logged the soils encountered during

drilling and supervised the collection of soil samples at various depths for visual examination and laboratory testing. The soil samples were obtained during drilling by driving generally a 2.5-inch Inside Diameter (I.D.) Modified California sampler. On some occasions a 1.4-inch I.D. Standard Penetration Test sampler was used. The sampler was driven into the subsurface soils under the impact of a 140-lb hammer falling through 30 inches. The blow counts required to drive the sampler for the last 12 inches are presented on the LOTB in Appendix A. After visual examination, the collected samples were sealed and transported to our laboratory for further evaluation and testing. The boring locations, stations, and relevant information are summarized in Tables 1A through 1E below.

The descriptions of the soil materials encountered in the exploratory borings and relevant boring information are presented in the LOTB presented in Appendix A. The laboratory test methods and results are presented in Appendix B. The logs presented in Appendix A were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the LOTB.

In addition to the borings, two cone penetrometer tests (CPT) were performed adjacent to the bridge borings on October 26-27, 2007. The CPT locations are presented in Table 1F. CPT work was performed by Gregg Drilling & In Situ, Inc. using a truck mounted CPT rig. The CPTs were conducted using a 60-degree cone attached to a 1.7-inch diameter rod pushed into the subsurface. The soil resistance exerted to the tip and side of the cone were recorded and correlated to soil type, classification and strength characteristics. Groundwater level was estimated from pore pressure dissipation measurements during CPT operation. Detailed information from the CPT investigation is presented in Appendix A.

TABLE 1A: SUMMARY OF BORINGS (PAVEMENT DESIGN AND ROADWAY)

Boring No.	Station (ft.)	Offset from "E" line (ft.)	Approx. Ground Elev. (ft)	Boring Depth (ft)	Description	Lab Tests
R-22	137+52	38.8 Rt.	43.8	0-5'	SANDY CLAY (SC), yellowish brown, moist	R=39
R-23	137+55	38.4 Rt.	41.8	0-5'	SANDY LEAN CLAY (CL), yellowish brown, dry	--
R-24	141+67	0 C.L.	41.0	0-5'	SANDY CLAY (SC), yellowish brown, moist	R=40
R-25A	142+31	91 Lt.	32.0	0-5'	SANDY CLAY (SC), brown, moist	R=10
R-25	143+41	66.5 Lt.	42.8	0-5'	LEAN CLAY (CL), brown, moist	R=12 EI=70
R-26	147+48	55 Rt.	45.0	0-5'	SANDY CLAY (SC), yellowish brown, moist	R=31
R-27	148+80	51.5 Lt.	48.0	0-5'	SILTY SAND WITH CLAY (SM), light brown, moist	R=27
R-28	150+45	60 Rt.	44.0	0-5'	LEAN CLAY (CL), yellowish brown, moist	--
R-29	152+42	42.5 Lt.	30.3	0-5'	SILTY SAND (SM), yellowish brown, dry	--
R-31	154+76	139.5 Lt.	48.6	0-5'	LEAN CLAY (CL), grayish brown, dry	--
R-32	156+53	139.5 Lt.	34.0	0-5'	SANDY LEAN CLAY (CL), grayish brown, moist	R=36
R-33	156+74	12 Lt.	46.4	0-5'	SANDY CLAY (SC), yellowish brown, dry	R=20
R-34	160+26	54 Rt.	46.3	0-5'	CLAYEY SAND (SC), grayish brown, moist	R=51
R-35	162+65	58 Lt.	45.6	0-5'	SANDY LEAN CLAY (CL), grayish brown, moist	R=37
R-36	165+57	251.4 Rt.	49.0	0-5'	LEAN CLAY (CL), brown, moist	R=12
R-37A	164+15	12 Lt.	47.4	0-5'	SANDY HEAVY CLAY, brown, moist	R=14
R-37	166+35	16.5 Rt.	49.3	0-5'	LEAN CLAY (CL), yellowish brown, moist	R=14 EI=74
R-38	167+02	294.8 Rt.	72.8	0-5'	LEAN CLAY (CL), brown, moist	R<5
R-39	169+11	196 Lt.	67.1	0-5'	LEAN CLAY (CL), brown, moist	R<5
R-40	171+83	O C.L.	54.4	0-5'	SILTY SAND (SM), yellowish gray, moist	R=35
Note : All Borings drilled with 6" Solid Stem Auger						

TABLE 1B: SUMMARY OF BORINGS (RAMPS AND EMBANKMENTS)

Boring No.	Station (ft)	Offset from "E" line (ft.)	Boring Depth (ft)	Approx. Ground Elev. (ft)	Approx. Groundwater Elev. (ft)
C-118	144+50	140.0 Lt.	30.0	29.5	1.0
C-119	145+60	139.0 Rt.	30.0	39.4	-
E-121	148+00	79 Lt.	30.0	40.0	-
E-122	150+15	173 Rt.	30.0	29.2	10.7
E-126	153+02	209.0 Lt.	30.0	33.5	15.5
E-130	159+46	127.6 Rt.	30.0	34.5	-

TABLE 1C: SUMMARY OF BORINGS (RETAINING WALLS AND SOUNDWALLS)

Boring No.	Station (ft)	Offset from "E" line (ft.)	Boring Depth (ft)	Approx. Ground Elev. (ft)	Approx. Groundwater Elev. (ft)
RW-110	131+82	120 Rt.	30.0	62.6	-
RW/SW-111	131+92	89.8 Lt.	30.0	58.5	-
SW-112	134+59	131 Rt.	30.0	59.0	-
RW/SW-113	134+77	104.9 Lt.	30.0	57.7	-
SW-114	138+82	103.3 Rt.	30.0	41.5	-
SW-115	138+25	99.0 Lt.	30.0	54.6	-
RW/SW-116	140+13	105.8 Rt.	30.0	37.5	13.0
SW-117	141+62	69.8 Lt.	30.0	41.2	16.2
RW-120	148+65	101.2 Rt.	30.0	41.5	19.0
RW-123	150+82	188.0 Rt.	30.0	38.3	19.8
RW-127	156+29	156.6 Rt.	30.0	34.8	12.8
SW-128	155+45	107.4 Lt.	30.0	30.6	-
SW-129	157+21	68.3 Rt.	30.0	32.0	-
SW-131	158+12	115.2 Lt.	30.0	33.2	-
SW-132	162+22	102.2 Lt	30.0	38.2	-
SW-133	163+42	105.4 Rt.	30.0	51.1	-
SW-134	167+79	96.0 Lt.	30.0	51.0	-
SW-135	165+47	97.0 Lt.	30.0	63.0	-
RW/SW-136	169+38	163.0 Lt.	30.0	65.0	-
RW/SW-139	172+32	123 .0 Rt.	30.0	68.0	-
RW/SW-140	174+52	145.6 Lt.	30.0	65.5	-
A-10-252	154+63	58.0 Rt.	50.0	30.0	1.5
A-10-253	160+26	102.0 Rt.	60.0	36.1	7.1
A-10-254	44+79(1)	58.0 Lt.(1).	30.0	36.0	11.0
A-10-255	44+32(1)	73.0 Lt.(1)	30.0	48.0	21.0

(1) Station and offset with respect to "CLOA" Line

TABLE 1D: SUMMARY OF BORINGS (FOR CONTRA LOMA BLVD UNDERCROSSING)

Boring No.	Station (ft)	Offset from "E" line (ft.)	Boring Depth (ft)	Approx. Ground Elev. (ft)	Approx. Groundwater Elev. (ft)
CLO-124	150+79	0 C.L.	100.0	48.1	8.6
CLO-125	153+58	0 C.L.	100.0	48.3	5.3

TABLE 1E: SUMMARY OF BORINGS (FOR G STREET OVERCROSSING)

Boring No.	Station (ft)	Offset from "E" line (ft.)	Boring Depth (ft)	Approx. Ground Elev. (ft)	Approx. Groundwater Elev. (ft)
GST-137	170+18	117.2 Rt.	100.0	62.0	8.0
GST-138	170+46	130.0 Lt.	100.0	62.0	3.3

TABLE 1F: SUMMARY OF CONE PENETROMETER TESTING (CPT)

Boring No.	Station (ft)	Offset from "E" line (ft.)	Boring Depth (ft)	Approx. Ground Elev. (ft)	Approx. Groundwater Elev. (ft)
CLO-125-CPT	153+35	0 C.L.	100.0	70.0	-
GST-138-CPT	170+37	125.0 Lt.	100.0	65.2	-

5.2 Geologic Mapping

The project site consists primarily of older alluvial deposits and embankment. The subject was considered and was determined to be not significant for the project.

5.3 Geophysical Studies

The subject was considered and was determined to be not applicable to the project.

5.4 Instrumentation

The subject was considered and was determined to be not applicable to the project.

5.5 Exploration Notes

Fill material generally consisting of sandy lean clay to lean clay was typically encountered in the shallow borings up to 5-ft depth and in the borings within the depths of embankment. The other exploratory borings encountered alluvial deposits, predominantly consisting of stiff to hard lean clay interbedded occasionally with layers of medium dense to dense silty and clayey sand. Very dense sands were encountered below the stiff alluvial clays in the deep borings drilled for the Contra Loma Boulevard Undercrossing.

6. GEOTECHNICAL TESTING

6.1 In-Situ Testing

In-situ testing consisted of recording blow counts during sampling in the field. The soil samples were obtained during drilling by driving a 2.5-inch I.D. Modified California sampler or a 1.4-inch I.D. Standard Penetration Test Sampler into the subsurface soils under the impact of a 140-lb hammer falling through 30 inches. Based on our previous experience, when correlating standard penetration data in similar soils, the blow counts for the Modified California Sampler can be taken as roughly 1.6 times that for the Standard Penetration Test Sampler in similar soils. The field blow counts (SPT-N values) typically ranged from 4 to more than 50 (practical refusal). From the average SPT-N values for various soil materials encountered in the field exploration, the subsoils are generally stiff to hard for the clay and medium dense to dense for the sandy soils. Loose sand was encountered in some of the borings, which is described in Section 7.2 "Subsurface Soil Conditions".

6.2 Laboratory Testing

Laboratory tests performed for the study include the following: Laboratory determination of Moisture-Density (California Test Method T226), Atterberg

Limits (California Test Method T204), Grain Size Analysis (California Test Method T203), Unconfined Compression Test (California Test Method T221), Unconsolidated Undrained Triaxial Test, Consolidation Test, Direct Shear Tests, R-value Test (California Test Method T301) and Corrosion Test (California Test Method T 643). The laboratory test results are contained in Appendix B.

In general, the average natural moisture content of the soils is on the order of 10% to 30%. Laboratory data of moisture contents, total density, grain size distribution, Atterberg Limits and unconfined compression strengths are presented on the Log of Test Borings.

7. GEOTECHNICAL CONDITIONS

7.1 Site Geology

General geologic features pertaining to the site were evaluated with reference to the "Geologic Map of Quaternary Geology of Contra Costa County and Surrounding Areas, CA: Derived from Digital Database open-file 97-98" by E.J. Helley and R.W. Graymer 1997; Scale 1:100000. Based on the map, the site consists primarily of Pleistocene alluvial deposits (Qpaf), with a small zone of Holocene alluvial deposits (Qhaf) near the middle of the site. A geologic map of the general project area is shown on Plate 3. Description of the main geologic units is as follows:

Qpaf (Alluvial Fans and Fluvial Deposits (Pleistocene)) – Brown dense gravely and clayey sand or clayey gravel that fines upward to sandy clay. These deposits display various sorting and are located in most stream channels in the county. All Qpaf deposits can be related to modern stream courses. They are distinguished from younger alluvial fans and fluvial deposits by higher topographic position, greater degree of dissection, and stronger soil profile development. They are less permeable than Holocene deposits, and locally contain fresh water mollusks and extinct late Pleistocene vertebrate fossils. They are overlain by Holocene deposits on lower parts of the alluvial plain, and incised by channels that are partly filled with

Holocene alluvium on higher parts of the alluvial plain. Maximum thickness is unknown but at least 150 feet (50m).

Qhaf (Alluvial Fan and Fluvial Deposits (Holocene)) - Alluvial fan deposits are brown or tan, medium dense to dense, gravely sand or sandy gravel that generally grades upward to sandy or silty clay. Near the distal fan edges, the fluvial deposits are typically brown, never reddish, medium dense sand that fines upward to sandy or silty clay. The best developed Holocene alluvial fans in Contra Costa County are on the Richmond Bay Plain and the fans of Sand and Deer Creeks in the Brentwood area. All other alluvial fans and fluvial deposits are confined to narrow valley floors. Several Holocene fans along the south shore of the Carquinez Strait have bulbous surface morphology, are short, overlap older Pleistocene surfaces, and may be debris flows.

7.1.1 Lithology

The project site consists of mainly Pleistocene Alluvial Fans and Fluvial Deposits. The subject was considered and was determined to be not applicable for the project.

7.1.2 Structure

The fault that is closest to the project site is the Vaca Fault Zone, which is a right-lateral strike-slip fault.

7.1.3 Existing Slope Stability

There are no significant natural or artificial slopes at the project site.

7.2 Subsurface Soil Conditions

Based on the boring data and as-built LOTBs, the subsurface soil conditions at the project site indicate predominantly stiff to hard lean clays and sandy clays. Presence of occasional layers of clayey or silty sand, generally medium dense to dense, are noted, generally interbedded with the clay soils. There was no evidence of the presence of soft clays in any of the borings. and medium stiff clays were encountered in only three isolated samples. Other pertinent information includes:

a) Presence of potentially liquefiable soils (loose to medium dense sands below or near measured groundwater) within a 30-ft depth in three borings: RW-123, RW-127 and A-10-252. Liquefaction was initially indicated in the deep bridge borings; this conclusion was later revised, based on results from adjacent CPT soundings. Liquefaction is discussed further in Section 8.1.3.
b) Presence of loose clayey and silty sands in isolated samples in five borings: Boring A-10-254 at the surface; Boring SW-133 at 15-ft depth; Boring A-10-252 at 20-ft depth; and Borings RW-127 and RW-130 at around 25-ft depth.
c) Presence of fat clay at seven isolated locations:
   - a 12-ft thick layer at the surface in Boring A-10-252
   - a 10-ft thick layer at a depth of 52 feet in Boring GST-137
   - a 10-ft thick layer at a depth of 23 feet in Boring CLO-124
   - 5-ft layers at a depth of: 5.5 feet in Boring SW-140; 4 feet in Boring E-122; 14.5 feet in Boring RW-110; and 15 feet in RW-116
d) Presence of a 15-ft thick medium stiff clay layer in Boring A-10-253 at a depth of 28 feet.
e) Presence of hard clays was within a 30-ft depth in 22 borings. Hard clays were encountered within 10 feet of the ground surface in ten borings.
f) Presence of very dense sands 20 to 25 below ground surface in one shallow (e.g. less than 30-ft deep) boring: SW-140.

Groundwater was encountered in all the four deep borings and in eight of the 30-ft borings. The groundwater elevation in the four deep borings ranged from 3.3 feet (at GST-138) to 8.6 feet (at CLO-124) and ranged between 1.0 foot (at C-118) and 21.0 feet (at A-10-255) in the 30-ft to 60-ft deep borings. Groundwater conditions at the project site are described in Section 7.3.2.

Detailed descriptions of the materials encountered in the exploratory borings are presented in the LOTB in Appendix A. It should be noted that these descriptions and related information depict subsurface conditions only at the locations indicated and on the particular date noted on the LOTB. Because of the variability from place to place within soil/rock in general, subsurface conditions at other locations may differ from conditions occurring at the locations explored. The abrupt stratum changes shown on the logs may be gradational, and relatively minor changes in soil types within a stratum may not be noted due to inherent limitations in the field investigations. Also, the passage of time may result in a change in the soil conditions at the locations due to environmental changes.

7.3 Water

7.3.1 Surface Water

The terrain at the project site gently slopes towards the north, and the surface water /drainage sheet flows towards the north.

7.3.1.1 Scour

The West Antioch Creek crosses the alignment in the region of the Contra Loma Boulevard Undercrossing. The water in the creek flows from southeast to northwest. The flow is contained in reinforced concrete boxes in the area of the structures. A headwall will be constructed at the northwest end, just east of a proposed retaining wall (Retaining Wall No. 1), with riprap in front of the

headwall. Beyond this point the Antioch creek will flow in an open channel. A length of approximately 170 feet of the channel from the riprap will be regraded to have 2H: 1V side slopes.

For approximately 70 feet from the headwall, the creek runs roughly parallel to the retaining wall – the bottom of the creek being approximately 15 feet from the wall alignment. We recommend appropriate design measures be considered to protect the slope in this segment from scour by using rip rap or other means.

7.3.1.2 Erosion

The existing slopes have established landscaping to help control erosion. The subject was considered and was determined to be not applicable for the project. It is recommended that construction of the proposed project be undertaken during the dry season.

7.3.2 Groundwater

Groundwater was encountered during drilling. The boring numbers, station and offset, approximate ground elevations and approximate groundwater elevations are summarized in Table 2. Groundwater was encountered between Elev. 1.0 and 19.8 feet (between 18.0 feet and 62.0 feet below ground surface) during field exploration.

TABLE 2: SUMMARY OF GROUNDWATER ELEVATIONS

Boring No.	Station (ft)	Offset from "E" line (ft.)	Boring Depth (ft)	Approx. Ground Elev. (ft)	Approx. Groundwater Depth (ft)	Approx. Groundwater Elev. (ft)
RW/SW-116	142+13	105.8 Rt.	30.0	37.5	24.5	13.0
SW-117	141+62	69.8 Lt.	30.0	41.2	25.0	16.2
C-118	144+50	140.0 Lt	30.0	29.5	29.0	1.0
RW-120	148+65	101.2 Rt.	30.0	41.5	22.5	19.0
E-122	105+15	173.0 Lt.	30.0	29.2	18.5	10.7
RW-123	150+82	188.0 Rt.	30.0	38.3	18.5	19.8
CLO-124	150+79	0 C.L.	100.0	48.1	39.5	8.6
CLO-125	153+58	0 C.L.	100.0	48.3	43.0	5.3
E-126	153+02	209.0 Lt.	30.0	33.5	18.0	15.5
A-10-252	154+63	58.0 Rt.	50.0	30.0	28.5	1.5
RW-127	156+29	156.6 Rt.	30.0	34.8	22.0	12.8
A-10-253	160+26	102.0 Rt.	60.0	36.1	29.0	7.1
GST-137	170+18	117.2 Rt.	100.0	70.0	62.0	8.0
GST-138	170+46	130.0 Lt.	100.0	65.3	62.0	3.3
A-10-254	44+79(1)	58.0 Lt.(1).	30.0	36.0	23.0	13.0
A-10-255	44+32(1)	73.0 Lt.(1)	30.0	48.0	27.0	21.0
(1) Station and offset with respect to "CLOA" Line						

It is anticipated that groundwater level will vary with the passage of time due to seasonal groundwater fluctuations, surface and subsurface flow, ground surface run-off and other environmental factors.

7.4 Project Site Seismicity

7.4.1 Ground Motions

The project is located in a seismically active part of Northern California. Many faults exist in the area, which are capable of producing earthquakes which may cause strong ground shaking at the site.

Applicable major faults in the vicinity of the project site were identified and their associated maximum earthquake magnitudes were established using the Caltrans 2007 Deterministic PGA Map and the associated Data Base. The documents have been finalized by Caltrans, and released for use in design in September, 2009. The moment magnitudes noted in the table represent the largest earthquakes that could occur on the given fault based on the current understanding of the regional tectonic structure. A fault map of the project vicinity is shown on Plate 4.

TABLE 3: SEISMIC SOURCES

Fault	Fault No.(1)	Fault Type	Distance from Site (miles)	Maximum Moment Magnitude
Vaca Fault Zone	14	RLSS(2)	5.5	6.9
Great Valley Fault 5	24	Reverse Fault	7.4	6.5
Greenville Fault Zone (Clayton Section)	351	RLSS	5.9	6.6
Concord Fault Zone (Ygnacio Valley Section)	341	RLSS	10.4	6.6

(1) Number of the Fault in the Data Base associated with the Caltrans 2007 Deterministic PGA Map
(2) RLSS – Right Lateral Strike Slip Fault

Based on the Caltrans 2007 Deterministic PGA Map, the controlling fault is the Vaca Fault Zone (Fault No. 14 in the map), which is associated with a Maximum Moment Magnitude (Mmax) of 6.9. Peak bedrock acceleration (PBA) of 0.47g is anticipated at the site.

7.4.2 Ground Rupture

Since no active faults pass through the site, the potential for fault rupture is low.

8. GEOTECHNICAL ANALYSES AND DESIGN

8.1 Seismic Analysis

8.1.1 Parameter Selection

The value of PGA for the project sites for the two structure locations within the project limits (Contra Loma Undercrossing and G Street Overcrossing) were calculated from the distances to the applicable faults in the project vicinity using the Caltrans 2007 Deterministic PGA Map and the attenuation relation by Sadigh et al. (1997). The computed PGA value was increased by 20%, also per Sadigh (1997), to account for the reverse fault effect, wherever applicable.

Design ARS curves were computed for the bridges per Caltrans SDC 1.4, which are presented in the applicable Foundation Reports.

8.1.2 Analysis

Majority of the proposed cuts and fills are supported by retaining walls. For the minor slopes, the maximum slope heights, relatively flat slopes, the competent subsurface soils and the low groundwater table suggest that the slopes will be stable under seismic loads. Therefore, analyses to assess the stability of the slopes in the project site were not deemed necessary and were not performed.

8.1.3 Liquefaction Potential

Liquefaction is a phenomenon in which saturated soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged, cohesionless sands and silts of low relative density are the type of soils

which usually are susceptible to liquefaction - the susceptibility increases with decreasing relative density (reflected by the number of blows to drive a sampler), and decreasing fines content. Accepted procedures for the assessment for liquefaction potential for cohesionless soils have evolved over the years through research and field observations (Youd et al, 2001). Recent research and field observations have shown that clays of low plasticity are also potentially liquefiable, based on the moisture content and plasticity characteristics of the clay. Procedures for the assessment of liquefaction potential for clay soils have also been established and have received general acceptance. (Bray et. al., 2004).

Based on the analyses, potentially liquefiable layers of loose to medium dense sands were identified at the following locations and depths:

TABLE 4: POTENTIAL LIQUEFACTION LOCATIONS AND DEPTHS

Boring No.	Depth (ft)	Soil Description	Comments
RW-123	28.5 - 30	Medium Dense Silty Sand	At bottom of boring
RW-127	23.5 - 28.5	Loose Silty Sand	
	28.5 - 30	Loose Clayey Sand	At bottom of boring
A-10-252	17.5 – 27.5	Loose to medium dense clayey sand	Groundwater encountered during drilling at 28.5-ft depth Also, see discussion below.
CLO-125	50 - 65	Medium Dense Sand	No liquefaction per adjacent CPT
GST-138	75 - 85	Medium Dense Poorly Graded Sand	No liquefaction per adjacent CPT

Laboratory tests on clayey sand samples at depths between 17.5 and 27.5 indicated plasticity index (PI values of) 21 and 17. Based on the PI values, the clayey sands are judged to be potentially non-liquefiable.

As may be noted from the above table, potential for liquefaction is very localized.

8.2 Cuts and Excavations

Based on the plans, majority of the significant proposed cuts are supported by retaining walls. Cut slopes within the project are 2H : 1V or flatter; majority of the slopes are 4H : 1V or flatter. The most significant slopes (2H : 1V or flatter) are:

- North of the westbound SR4 travel way, between Sta. 132+50 and Sta. 136+00
- North of the westbound SR4 travel way, between Sta. 171+50 and Sta. 176+00

8.2.1 Stability

According to the designer, the maximum height of the cut between Sta. 132+50 and Sta. 136+00 is estimated to be about 17 feet (near Sta. 134+00) with a slope slightly flatter than 2:1. With reference to boring RW/SW-113, which was drilled in the vicinity of the "cut slope", the subsurface soil conditions generally consist predominantly of hard lean clays with a layer of very stiff clay in the top 5 feet. Groundwater was not encountered in the boring during drilling in September, 2006.

The maximum height of the cut between Sta. 171+50 and Sta. 176+00 is estimated to be about 17 feet (near Sta. 172+00) with a slope slightly flatter than 2:1. With reference to boring SW-140, which was drilled in the vicinity of the "cut slope", the subsurface soil conditions generally consist of very stiff lean clays in the top 14 feet, underlain by hard clays and very dense sands. Groundwater was not encountered in the boring during drilling in September, 2006.

Slope stability analyses were performed for the slope between Sta. 171+50 and Sta. 176+00. The results (presented in Appendix D) indicate factors of

safety of 4.4 for long term and 10.4 for short term conditions. The factors of safety were found to be acceptable. The factors of safety for the slope between Sta. 132+50 and Sta. 136+00 is also considered acceptable, since the soil conditions at this location are relatively stronger than the previous location.

8.2.2 Rippability

The proposed cuts are anticipated to be in native soils. Based on the investigation, rippability does not appear to be a concern for construction.

8.2.3 Grading Factor

Source of the fill may include the fill generated from the cuts planned for the project. Fill may also be imported from outside borrow sources. The source of borrow is unknown at the time of report preparation. Based on previous experience, for preliminary estimate, a grading factor of 0.9 may be assumed for import materials.

8.3 Embankments

8.3.1 Evaluation of Embankment Settlements

Major portion of the project will involve placement of embankment fill. Thickness of fill along the State Route 4 alignment is generally around 4 feet, or less. Additional embankment fill will be required for approach embankments and entrance and exit ramps. Embankment fill will also be required in some locations for widening of State Route 4. The approximate maximum fill thicknesses at the approach embankments and ramps and for the widening are summarized in Table 5 below for significant fills (greater than 10 feet).

TABLE 5: SUMMARY OF PROPOSED CONSTRUCTION AND MAXIMUM FILL THICKNESS

Proposed Construction	Approx. Max Fill Thickness (ft)	Relevant Boring(s)
Westbound SR4 Widening from Sta. 142+50 to Sta. 160+50	13 ft @ Sta. 153+50	SW-117, E-121, , SW-128, SW-131
Eastbound SR4 Widening from Sta. 147+50 to Sta. 160+00	20 ft @ Sta. 154+50	C-119, RW-120, SW-129
Westbound On-Ramp	16 ft @ Sta. 45+00 ("RWN" Line)	C-118, E-122
Eastbound On-Ramp	16 ft @ Sta. 59+00 ("REN" Line)	RW-127, SW-133
Westbound Off-ramp	12 ft @ Sta. 59+50 ("RWF" Line)	E-126, SW-131, SW-132

Subsurface Soil Conditions

The boring data indicates that the subsurface soil conditions underneath the proposed fill embankments within the project limits generally consist of very stiff to hard clays with pockets/lenses/layers of medium dense to dense sands. No distinct layers of soft clay (e.g. Bay Mud) were encountered. Groundwater was encountered in seven borings (SW-117, C-118, RW-120, E-122, RW-123, E-126, and RW-127) at depths ranging from 18 to 28.5 feet below ground surface at the time of drilling.

Evaluations

The competent subsurface conditions coupled with the relatively deep (18 feet) groundwater table, preclude the potential occurrence of significant consolidation settlements for the embankments (maximum height of 20 feet). Therefore, significant potential consolidation settlements from the embankments are not expected.

Waiting Periods

Since relatively minor settlements are expected, based on our previous Caltrans project experience, the standard "30-day waiting period" is generally a normal construction practice prior to the foundation construction of the abutments. The waiting period serves as a contingency

for the estimated consolidation settlement within the over-consolidated range.

Differential Settlement
Since total settlements are not significant, differential settlements are also expected to be not significant.

8.3.2 Evaluation of Embankment Stability

New embankment fill will be required at the locations as described in Section 8.3.1 above. The maximum height of embankment at locations where retaining walls are not present will be on the order of 10 feet. The gradient of the slope is 4(H): 1(V) or flatter. The underlying soils are stiff to hard clays and medium dense to dense sands. Groundwater was encountered at no less than 18 feet below ground surface. A minimum factor of safety of 1.5 for static and 1.1 for pseudo-static condition is required. It was judged that under the above relatively flat slope conditions, potential for slope instability was minimal. Therefore, analyses to assess the stability of the slopes in the project site were not deemed necessary and were not performed.

8.4 Earth Retaining Systems

It is our understanding that due to right-of-way and other geometric constraints, the project will require construction of thirteen retaining walls. Information of approximate wall locations, type of walls, design loading cases, and maximum wall heights was provided by the designer and is summarized in Table 6.

TABLE 6: SUMMARY OF PROPOSED RETAINING WALLS

Wall No.	Wall Type	Location (Along approx. Sta.)	Wall Height (ft)	Total Length (ft)	Relevant Soil Borings
1	1	"RWN" Line 42+64 to 50+82	6-18	821	C-118, E-122
2	1	"ER" Line 148+00 to 151+23	8-12	322	C-119, RW-120, RW-123
3A	7SW	"REF" Line 47+87 to 50+00	8-10	209	RW-120, RW-123
3B	7	"REF" Line 50+00 to "CLOA" Line 49+22	8-12	230	RW-120, RW-123
4	1	"REN" Line 53+37 to 55+27	8-12	193	RW-127, A-10-252
6	1(1)	"ER" Line 152+97 to 155+87	8-24	290	A-10-252, SW-129
7	1(2)	"REN" Line 54+00 to 63+53	6-18	955	RW-127, E-130, SW-133, A-10-253
9A	1	"RWF" Line 54+98 to 56+87	6-10	189	E-126, SW-128, SW-131
9B & 9C	1SWB(3)	"RWF" Line 56+87 to "EL" 162+67	8-14	571	SW-128, SW-131, SW-132
11	Soil Nail Wall	"EL" Line 164+07 to 170+20	8-20	605	SW-135, SW-136, GST-138
12	1	"ER" Line 170+60 to 180+10	6-22	952	RW/SW-139, RW/SW-141, RW/SW-143,
13	7(4) (Modified)	"CLOA" Line 42+89 to 46+14	6-14	326	A-10-254, A-10-255

(1) Major portion of the wall is on piles
(2) Wall No. 7B ("REN" Line: 58.50) And Wall No. 7D ("REN" Line: 61.25 to 62.00) will be on piles)
(3) Wall No. 9B ("RWF Line: 56+87 to 58+60) will be on piles
(4) A small portion of the wall (between Sta. 44+76 and 45+36 will be a Soldier Pile and Lagging wall)

Per the tables above, the proposed walls are all reinforced concrete walls (Type 1, or Type 7) except for Wall No. 11, which is a Soil Nail wall.

For concrete walls, Caltrans Standard reinforced concrete walls conforming to the Caltrans design requirements and guidelines should be used wherever feasible. Where not feasible and design modifications are required, the walls should be designed using the following recommended design parameters:

<u>Active Earth Pressure (equivalent fluid pressure)</u>
Note: The active earth pressure acts parallel to the backslope
Horizontal Backslope: 36 pcf

4(horizontal) : 1(vertical) Backslope: 39 pcf (horizontal component = 38 pcf)
2(horizontal) : 1(vertical) Backslope: 52 pcf (horizontal component = 46 pcf)

Passive Earth Pressure (equivalent fluid pressure): 300 pcf

Friction Coefficient at the base of the Retaining Wall: 0.35

For the soil nail wall (Wall No. 11), Caltrans specifications for soil nail construction are recommended. The strength of the soil nails shall be verified during construction using proof tests on nails. Appropriate drainage shall be provided behind the soil nail walls. The facing should be reinforced and shotcreted expeditiously. The contractor should make his own interpretation regarding constructability of the nails. Proper quality control by the contractor and appropriate inspections and testing should be implemented.

Individual walls are discussed in detail below.

Retaining Wall No. 1

Retaining Wall No. 1 is a fill wall, approximately 821 feet long, located on the northern side of the on-ramp to westbound travel way of Highway 4 from Contra Loma Blvd., between Sta. 42+64 and 50+82 (Control Line RWN). Retaining wall heights range between 6 and 18 feet, with a concrete barrier (Type 732A) on top of the wall. The wall alignment is outside the present ROW line. However, it is our understanding that additional easement/ROW will be acquired to accommodate the wall. Based on the relevant soil borings, the soil conditions in this section near the surface indicate predominantly very stiff clays with occasional layers of medium dense silty sands. Groundwater was encountered at depths ranging from 18.0 to 28.5 feet below ground surface (elevations 1.0 to 11.0). A Type 1 wall on spread footing is reasonable since the required toe pressure for a 18-ft high wall (4.0 ksf) per Caltrans Standard Plans is less than the recommended allowable bearing pressure of 4.2 ksf (ultimate bearing pressure of 12.5 ksf).

Retaining Wall No. 2

Retaining Wall No. 2 is a fill wall, approximately 322 feet long, on the south side of eastbound State Route 4, immediately east of the Contra Loma Boulevard Undercrossing, between Sta. 148+00 and 151+23 (Control Line ER). The wall heights range between 8 and 12 feet, with a concrete barrier (Type 732A) on top of the wall for the entire alignment. Based on the relevant soil borings, the soil conditions in this section near the surface indicate predominantly stiff to very stiff clays. Groundwater was encountered at depths ranging from 18.6 to 22.5 feet below ground surface (elevations 19.0 to 19.7). A Type 1 wall on spread footing is reasonable since the required toe pressure for a 12-ft high wall (2.8 ksf) per Caltrans Standard Plans is less than the recommended allowable bearing pressure of 3.3 ksf (ultimate bearing pressure of 10.0 ksf). A minor potential for liquefaction under MCE is noted in boring RW-123 near the eastern end of the wall, below elevation 19.7 (e.g. approximately 20 feet below the bottom of footing for the retaining wall). The liquefying layer appears localized. We are of the opinion that considering all these factors, potential for damage from liquefaction is low.

Retaining Wall No. 3A & 3B

Retaining Wall Nos. 3A and 3B are cut walls located on the southern side of the off-ramp to Contra Loma from Highway 4 eastbound travel way between Sta. 47+87 and Sta. 50+00 (Control Line REF)and between Sta. 50+00 (Control Line REF) and 49+22 (Control Line CLOA), respectively. There is a concrete barrier (Type 60D) on the side of the walls. The wall alignments are outside the present ROW line. However, it is our understanding that additional easement/ROW will be acquired to accommodate the wall. Per the relevant soil borings, the soil conditions in this section at the proposed foundation levels indicate predominantly very stiff clays. Groundwater was encountered at depths of 18.6 to 22.5 feet below ground surface (elevations 19.0 to 19.7). A minor potential for liquefaction under MCE is noted in boring RW-123 near the eastern end of the wall, below elevation 19.7 (e.g. approximately 6 feet below the bottom of footing for the

retaining wall). The liquefying layer appears localized. If the soil does liquefy, it can cause some settlement in the wall. However the mitigation for such conditions may outweigh the required foundation design

Retaining Wall 3A is approximately 209 feet long. Wall heights range from 8 to 10 feet, with a soundwall on top of the wall for the entire alignment. The acquired additional easement/ROW is insufficient for a Type 1SW wall and thus, a Type 7SW wall is planned. A Type 7SW wall on spread footings is reasonable, since the minimum required ultimate bearing capacity (4.25 ksf) per Caltrans Standard Plans is less than the recommended ultimate bearing pressure of 12.5 ksf.

Retaining Wall 3B is approximately 230 feet long with a major portion of the wall height of 12 feet for the entire alignment. As for Wall No. 3A, the acquired additional easement/ROW is insufficient for a Type 1 wall and thus, a Type 7 wall is planned. A Type 7B wall on spread footings is reasonable, since the minimum required allowable bearing capacity (2 ksf) per Caltrans Standard Plans is less than the recommended allowable bearing pressure of 4.2 ksf (ultimate bearing pressure of 12.5 ksf).

Retaining Wall No. 4

Retaining Wall No.4 is a fill wall, approximately 193 feet long, located on the northern side of the on-ramp from Contra Loma to the eastbound travel way of State Route 4 between Sta. 53+37 and 55+27 (Control Line REN). The retaining wall heights range from 8 to 12 feet. The entire wall alignment is within the present ROW line. A box culvert for the West Antioch Creek crosses the wall alignment approximately 32.5 feet to 50.0 feet from the western end. There is no site specific soils information as the access to the location is within private property. However, based on the nearest borings, an allowable bearing capacity of 3.3 ksf (ultimate of 10.0 ksf) is recommended. The recommended capacity is representative of stiff to very stiff clays. Therefore, a standard Type 1 wall on spread footing is reasonable since the required toe pressure for a 12-ft high wall (2.8 ksf) per Caltrans Standard Plans is equal to the recommended allowable

bearing pressure. The footing is depressed in the region of the box culvert to include the culvert.

Retaining Wall No. 6

Retaining Wall No. 6 is a fill wall, 290 feet long, located along the southern side of eastbound travel way between Sta. 152+97 and Sta.155+87 (Control Line ER). The retaining wall heights range from 8 to 24 feet with a concrete barrier (Type 732A) on top of the wall for the entire alignment. The entire wall alignment is within the present ROW line.

A 50-ft boring drilled near the midpoint of the wall alignment (Boring A-10-252) indicates a 12-ft layer of very stiff highly plastic clays, underlain predominantly by stiff lean clays. A 10-ft layer of loose to medium dense clayey sand is indicated at a depth of 17 to 27 feet. Atterberg limit tests on samples of the clayey sands indicated plasticity indices of 17 and 21. The clayey sands were thus judged to be potentially non-liquefiable. An allowable bearing pressure of 3.3 ksf (ultimate bearing pressure of 10 ksf) is recommended. The recommended bearing pressure reflects the effect of the lower shear strengths of the soils underlying the very stiff clay layer near the surface.

The allowable bearing pressure is less than the required toe pressures for walls higher than 14 feet per Caltrans Standard Plans for a Type 1 pile on spread footing. Therefore it is recommended that the retaining wall be founded on piles. Caltrans Standard Class 200 Alt. 'X' (14-in square) precast, prestressed concrete piles are recommended.

The required pile penetrations were computed based on the design load and other pertinent information provided by the designer. The APILE computer program was used in the computations; the results are presented in Appendix C. A Pile Data Table is presented below.

PILE DATA TABLE – Retaining Wall No. 6

Location	Pile Type	Design Load (kips)	Nominal Resistance (kips)		Finish Grade (ft)(2)	Bottom of Footing Elev. (ft)(3)	Design Tip Elev. (ft)(1)	Specified Tip Elev. (ft)
			Compression	Tension				
Retaining Wall No. 6	Class 200 Alt. 'X'	136	272	0	30.0	25.5	-15.0(a) 8.0(c)	-15.0

Notes:
1. Design Tip Elevation is controlled by the following demands: (a) Compression; (b) Tension, (c) Lateral Loads.
2. Finish Grade at approximately 2 ft above top of footing @ Elev. 27.96.
3. Bottom of footing approximately 2'6" below top of footing @ Elev. 27.96.

At locations where the wall is on spread footing, to mitigate the adverse effects of the fat clay layer at the surface, it is recommended that two feet of soil below the wall footing be excavated and replaced by aggregate base material or lean concrete.

Retaining Wall No. 7

Retaining Wall No.7 is a fill wall, approximately 955 feet long, located on the southern side of the on-ramp from Contra Loma to the eastbound travel way of State Route 4 between Sta. 54+00 and 63+53 (Control Line REN). Retaining wall heights range between 6 and 18 feet, with a concrete barrier (Type 732A) on top of the wall for the entire alignment. A part of the wall alignment is essentially on the present ROW line. However, it is our understanding that additional easement/ROW will be acquired to accommodate the wall. Per the relevant soil borings, the soil conditions in this section near the surface indicate predominantly very stiff clays. A standard Type 1 wall on spread footing is reasonable since the required toe pressure for a 18-ft high wall (4.0 ksf) per Caltrans Standard Plans is less than the recommended allowable bearing pressure of 4.2 ksf (ultimate bearing pressure of 12.5 ksf).

Loose clayey and silty sands were encountered at a depth of 25 feet below ground surface (Elevation 10.0) in two of the three relevant borings (RW-127 and E-130). Groundwater was encountered at depth of 22.0 feet below ground surface

(elevation 12.8) in boring RW-127 near the western end of the wall. A significant potential for liquefaction is noted during a MCE in the loose sandy soils 25 feet below ground surface (e.g. at least 14 feet below the bottom of footing). The liquefying layer appears localized. We are of the opinion that considering all these factors, potential for damage from liquefaction is low.

A box culvert for the West Antioch Creek crosses the wall alignment approximately 46.5 feet to 61.0 feet from the western end. The footing is depressed in the region of the box culvert to include the culvert.

Two 10-ft diameter reinforced concrete pipes (RCP) planned (to be constructed by others) cross the retaining wall alignment. To avoid loading on the pipes, it is proposed that portions of the retaining wall over the pipes be Type 1 wall, founded on 24-in diameter CIDH piles, instead of the spread footings to span over the pipes. The required pile penetrations were computed based on the design load and other pertinent information provided by the designer. The SHAFT computer program was used in the computations; the results are presented in Appendix C. A Pile Data Table is presented below.

PILE DATA TABLE – Retaining Wall No. 7

Location	Pile Type	Design Load (kips)	Nominal Resistance (kips)		Finish Grade (ft)(2)	Top of Pile Elev. (ft)(3)	Design Tip Elev. (ft)(1)	Specified Tip Elev. (ft)
			Compression	Tension				
Retaining Wall No. 7B	24-in. dia. CIDH Pile	179	358	0	33.9	32.5	-21.0(a) 13.40(c)	-21.0
Retaining Wall No. 7D	24-in. dia. CIDH Pile	182	364	0	36.5	33.7	-21.0(a) 13.70(c)	-21.0

Notes:
1. Design Tip Elevation is controlled by the following demands: (a) Compression; (b) Tension, (c) Lateral Loads.

Retaining Wall Nos. 9A, 9B & 9C

Retaining Wall No. 9 is a fill wall located on the northern side of the off-ramp to Contra Loma Boulevard from the westbound travel way of State Route 4, continuing on the northern side of westbound travel way of State Route 4 (between Sta. 54+98 (Control Line RWF) and 162+67 (Control Line EL)). For design purposes, the wall may be subdivided into two parts as discussed below:

Wall No. 9A (54+98 to 56+87): Wall No. 9A is 189 feet long. The retaining wall heights in this section range from 6 to 10 feet, with a concrete barrier (Type 736A) on top of the wall. The entire wall alignment is outside the present ROW. However, it is our understanding that additional easement/ROW will be acquired to accommodate the wall. The surficial soils along the alignment are predominantly very stiff to hard clays. Groundwater was not encountered during drilling in any of the relevant borings. A Type 1 wall on spread footing is reasonable since the required toe pressure for a 10-ft high wall (2.5 ksf) per Caltrans Standard Plans is less than the recommended allowable bearing pressure of 4.2 ksf (ultimate bearing pressure of 12.5 ksf).

Wall No. 9B & 9C (56+87 (RWF) to 162+67 (EL): Wall No. 9B is approximately 571 feet long. The retaining wall heights range from 8 to14 feet, with a traffic barrier and soundwall on top of the wall for the entire alignment. The entire wall alignment is outside the present ROW. However, it is our understanding that additional easement/ROW will be acquired to accommodate the wall. The surficial soils along the alignment are predominantly very stiff to hard clays. Groundwater was not encountered during drilling. A Type 1SWB wall on spread footing is reasonable since the required ultimate bearing pressure for a 12-ft high wall with a soundwall on top (7.3 ksf) per Caltrans Standard Plans is less than the recommended ultimate bearing pressure of 12.5 ksf.

Two 10-ft diameter reinforced concrete pipes (RCP) planned (to be constructed by others) cross the retaining wall alignment. To avoid loading on the pipes, it is proposed that portions of the retaining wall over the pipes be Type 1 wall,

founded on 24-in diameter CIDH piles, instead of the spread footings to span over the pipes. The required pile penetrations were computed based on the design load and other pertinent information provided by the designer. The SHAFT computer program was used in the computations; the results are presented in Appendix C. A Pile Data Table is presented below.

PILE DATA TABLE – Retaining Wall No. 9

Location	Pile Type	Design Load (kips)	Nominal Resistance (kips)		Finish Grade (ft)	Top of Pile Elev. (ft)	Design Tip Elev. (ft)(1)	Specified Tip Elev. (ft)
			Compression	Tension				
Retaining Wall No. 9B	24-in. dia. CIDH Pile	156	312	0	33.9	32.7	3.0(a) 8.70(c)	3.0

Notes:
1. Design Tip Elevation is controlled by the following demands: (a) Compression; (b) Tension, (c) Lateral Loads.

Retaining Wall No. 11 Retaining Wall No. 11, is a cut wall, approximately 605 feet long on the southern side of the on-ramp from G Street to the westbound travel way of State Route 4 between Sta. 164+07 and 170+20 (Control Line EL),. The eastern end of the wall ends near Drake Street/G Street intersection. The retaining heights range from 8 to 20 feet. It is our understanding that the entire wall alignment is within the present ROW.

Wall No. 11 will be designed as a soil nail wall. The soil conditions along the alignment are expected to be predominantly very stiff to hard clays for the cut face for the major portion of the proposed cut. Near the eastern end, the soils of the proposed cut are expected to be predominantly medium dense to dense clayey and silty sands. Groundwater was encountered during drilling at a depth of over 60 feet. The ground above the soil nail wall rises at 4H:1V gradient to an additional height of 6.5 feet.

For design of soil nail wall, the following geotechnical parameters are recommended:

founded on 24-in diameter CIDH piles, instead of the spread footings to span over the pipes. The required pile penetrations were computed based on the design load and other pertinent information provided by the designer. The SHAFT computer program was used in the computations; the results are presented in Appendix C. A Pile Data Table is presented below.

PILE DATA TABLE – Retaining Wall No. 9

Location	Pile Type	Design Load (kips)	Nominal Resistance (kips)		Finish Grade (ft)(2)	Top of Pile Elev. (ft)(3)	Design Tip Elev. (ft)(1)	Specified Tip Elev. (ft)
			Compression	Tension				
Retaining Wall No. 9B	24-in. dia. CIDH Pile	156	312	0	33.9	32.7	3.0(a) 8.70(c)	3..0

Notes:
1. Design Tip Elevation is controlled by the following demands: (a) Compression; (b) Tension, (c) Lateral Loads.

Retaining Wall No. 11 Retaining Wall No. 11, is a cut wall, approximately 605 feet long on the southern side of the on-ramp from G Street to the westbound travel way of State Route 4 between Sta. 164+07 and 170+20 (Control Line EL),. The eastern end of the wall ends near Drake Street/G Street intersection. The retaining heights range from 8 to 20 feet. It is our understanding that the entire wall alignment is within the present ROW.

Wall No. 11 will be designed as a soil nail wall. The soil conditions along the alignment are expected to be predominantly very stiff to hard clays for the cut face for the major portion of the proposed cut. Near the eastern end, the soils of the proposed cut are expected to be predominantly medium dense to dense clayey and silty sands. Groundwater was encountered during drilling at a depth of over 60 feet. The ground above the soil nail wall rises at 4H:1V gradient to an additional height of 6.5 feet.

For design of soil nail wall, the following geotechnical parameters are recommended:

- Soil Unit Weight = 125 pcf
- Above El. 50: Friction Angle = 25 degrees; Cohesion = 250 psf
- Below El. 50: Friction Angle = 28 degrees; Cohesion = 500 psf

Calculations for the soil nail wall are presented in Appendix C.

A new soundwall (Soundwall No.10B) is proposed at least 16 feet away from the retaining wall backface. It is our understanding that the designer has verified that soundwall piles should have minimal effect on the wall design.

Retaining Wall No. 12

Retaining Wall No. 12 is a cut wall, approximately 852 feet long along the southern side of State Route 4 eastbound travel way, starting from the eastern edge of G Street, between Sta. 170+60 and 180+10 (Control Line ER). Wall heights range from 22 feet at the western end to 6 feet at the eastern end. The ground above the wall rises at 2H:1V gradient to an additional height of 8.7 feet where a soundwall is planned. The soundwall is anticipated to be approximately 24.5 feet away from the back of the wall. Therefore, the soundwall piles are unlikely to impact the retaining wall design. The entire wall alignment is within the present ROW line.

A Type 1 retaining wall is planned for this location. The soil conditions in this section indicate predominantly hard clays at the proposed foundation elevation. Groundwater was not encountered during drilling. An allowable bearing pressure of 5 ksf (ultimate bearing capacity of 15 ksf) is recommended. A Type 1 retaining wall on spread footing is reasonable, since the required toe pressure for a 22-ft high Type 1 wall is 4.6 ksf, e.g. less than the recommended allowable bearing pressure.

Retaining Wall No. 13

Retaining Wall No. 13 is a cut wall, approximately 326 feet long, located on the western side of Contra Loma Boulevard, between Buchanan Road and St. Francis

Drive. Wall heights range from 6 to 14 feet. The ground rises behind the wall at slopes up to 2 (horizontal): 1(vertical).

A Type 7 wall is proposed due to right-of-way constraints for most of the alignment. However, two utility boxes will be present in front of the wall: the faces of the utility boxes are 3.5 feet from the wall alignment. A Type 7 wall could not be accommodated at the location. Therefore, a Soldier Pile and Lagging wall is proposed for a small segment of the wall. Thus, the wall is in 3 segments:

Wall No. 13A: Sta. 42+95 to Sta. 44+76	(Type 7 Wall)
Wall No. 13B: Sta. 44+76 to Sta. 45+36	(Soldier Pile and Lagging Wall)
Wall No. 13C: Sta. 45+36 to Sta. 46+12	(Type 7 Wall)

Passive pressures from the soldier piles will exert pressures on the utility boxes. The box walls will have to be designed for these pressures. The boxes may experience some lateral movement due to these pressures. It is our understanding that the utility boxes will be constructed after the wall has been completed.

Two soil borings (Boring Nos. A-10-254 and A-10-255) were drilled at the wall location: one from the top of the slope and the other from the road level immediately below the slope. Stiff clays were generally encountered in both borings; a significant exception was a 10-ft layer of dense sand and hard clay encountered on the surface of the boring from the road level. Stiffer soils near the road surface (top of excavation) would result in higher stresses being imparted by the wall on the utility boxes. It is therefore recommended that the soil between the soldier pile and the faces of the utility boxes be excavated to the bottoms of the boxes and removed, and replaced with compacted clay.

The Type 7 walls (Wall Nos. 13A and 13C)) should be specially designed using the following parameters:

- Unit Weight = 120 pcf

- Equivalent Fluid Pressure (active) = 49 pcf (2 : 1 backslope)
- Equivalent Fluid Pressure (passive) = 350 pcf
- Friction at the bottom of the footing = 0.35
- Allowable Bearing Pressure = 4300 psf

The Soldier Pile and Lagging wall (Wall No. 13B) should be designed using the PYWALL program, using thee following parameters:

Above the Excavation Line

- Soil Type: Sand
- Unit Weight: 0.0723 pci; Friction Angle: 35 degrees; k = 60 pci
- Slope of Backfill: 26.6 degrees (2:1 backslope)
- Width of Active Earth Pressure = Center to center spacing of soldier piles

Below the Excavation Line

Above El.20.0 (Stiff Clay – Shear Strength = 1500 psf)

- Soil Type: Stiff Clay w/o Free Water
- Unit Weight: .0694 pci; Shear Strength: 10.42 psi; e_{50}: 0.007; k = 500 pci

(This includes compacted clay fill above El. 26.0 and native material below that depth)

Below El. 20.0 (Stiff Clay below water table – Shear Strength = 1500 psf)

- Soil Type: Stiff Clay w/o Free Water
- Unit Weight: .0347 pci; Shear Strength: 10.42 psi; e_{50}: 0.007; k = 500 pci
- Width of for Generating p-y Soil Resistance = width/diameter of soldier pile
- Group reduction factors for p-y (e.g. p-multiplier):
    - 0.81 for center-to-center spacing of 2.0
    - 0.93 for center-to-center spacing of 3.0
    - 1.0 for center-to-center spacing of 3.7

  The y-multiplier should be taken as 1.0 and the group reduction factors should be interpolated for intermediate values of center-to-center pile spacing

Calculations for Soldier Pile and Lagging Wall (PYWALL Analyses) are presented in Appendix C.

8.5 Culverts

The drainage plans provided by the designer indicates several new Alternative Pipe Culverts (APC) with diameters ranging from 12 to 24 inches. It is our understanding that small diameter culverts (24 inches and under) can be designed and constructed using Standard Plans and Specifications, and no specific geotechnical investigation is required per Caltrans guidelines.

8.5.1 Corrosion Investigation

The corrosion investigation for this project was performed in general accordance with the provisions of California Test Method 643. Representative native soil samples at the anticipated pipe subgrade were obtained for corrosion tests. A summary of the corrosion test results is presented in Table 7. Based on the results obtained, corrosion analyses were carried out using Caltrans CULVERT 4 program. The analysis results and design for culverts are presented in Table 7.

TABLE 7: SUMMARY OF CORROSION TEST RESULTS

Boring	Station and Offset from "E" line (ft.)	Depth (ft)	pH	Resistivity (ohms-cm)	Sulfate (ppm)	Chloride (ppm)
RW/SW-111	"E" 130+71, 34.5 Lt.	16	7.61	2360	37.1	13.3
RW/SW-116	"E" 140+13, 105.8 Rt.	20	7.47	280	2573.4	456.7
C-118	"E" 144+50, 139.0 Rt.	2	7.72	1210	51.3	7.6
SW-121	"E" 148+00, 79.0 Lt.	3	7.98	1230	41.0	16.4
E-122	"E" 150+15, 173.0 Rt.	3	7.74	1230	21.5	12.1
RW-123	"E" 150+82, 188.0 Rt.	10	7.63	1180	13.2	15.2
CLO-124	"E" 150+79, 0 C.L.	8.5	7.96	780	108.2	22.1
RW-127	"E" 156+29, 156.6 Rt.	4.5	7.56	990	29.1	15.6
SW-129	"E" 157+21, 68.3 Lt.	6.0	7.89	1150	55.2	16.3
E-130	"E" 159+46, 127.6 Rt.	4.5	7.18	1050	28.5	14.3

SW-131	"E" 158+12, 115.2 Lt.	10	7.71	380	561.6	254.9
SW-132	"E" 162+22, 102.2 Lt.	6	7.05	1180	22.9	15.2
SW-134	"E" 167+87, 96.0 Lt.	4.5	7.61	1050	37.8	8.3
RW/SW-136	"E" 169+35, 155.7 Lt.	9.5	7.61	800	32.7	57.8
GST-138	"E" 170+46, 130.0 Lt.	4	7.61	430	230.0	380.6
RW/SW-139	"E" 172+32, 123.0 Rt.	11	7.71	1470	42.1	27.7
RW/SW-140	"E" 174+52, 145.6 Lt.	9.5	7.87	430	248.9	244.5

Corrosion test results indicate that the soils at the site are generally corrosive. Based on CULVERT 4 analysis (see Table 8) using corrosion information from the borings, standard reinforced concrete pipe design is suitable with Type IP (MS) modified cement or Type II Modified cement, minimum required as per Caltrans Bridge Design Specifications (Section 8.22).

04-2285E4

TABLE 8: RECOMMENDED MINIMUM THICKNESS AND PROTECTIVE MEASURES FOR CULVERTS
CONTRA LOMA AND G STREET INTERCHANGES

								Alternative Design (also see note below)		
Location		**Culvert Type**		**Corrugated Steel (Gal.) (gage)**			**Reinforced Concrete**	**Corrugated Aluminum (gage)**	**Corrugated Aluminized Steel (Type 2, gage)**	**Steel Pipe (Gal., gage)**
		Est. Service Life (yr.)		25	50	50		50	50	50
Station & Offset	Boring No.(3)	Resistivity (ohm-cm)	pH	Galv. (2 oz./sq. ft))		Bit.Coat. (Soil Sides)				Galv. + Polymer (90° Invert)
"E Line" 130+81; 85.6 Lt	RW/SW-111 (16 ft)	2360	7.6	18	14	18	See note (2)	16	16	18
"E Line" 142+16; 105.0 Rt	RW/SW-116 (20 ft)	280	7.5	12	8	12	See note (2)	No	No	18
"E Line" 144+50; 0.0 Lt	C-118 (2.0 ft)	1210	7.7	18	12	18	See note (2)	No	No	18
"E Line" 148+25; 0.0 Lt	E-121 (3.0 ft)	1230	8.0	18	12	18	See note (2)	No	No	18
"E Line" 151+00; 0.0 Lt	RW-123 (10.0 ft)	1180	7.6	18	12	18	See note (2)	No	No	18
"E Line" 151+00; 0.0 Lt	CLO-124 (8.5 ft)	780	8.0	16	10	16	See note (2**)	No	No	18
"E Line" 156+25; 0.0 Lt	RW-127 (4.5 ft)	990	7.6	16	12	16	See note (2**)	No	No	18
"E Line" 157+25; 0.0 Lt	SW-129 (6.0 ft)	1150	7.9	18	12	18	See note (2)	No	No	18
"E Line" 159+50; 0.0 Lt	E-130 (4.5 ft)	1050	7.2	16	10	16	See note (2)	No	No	18
"E Line" 158+00; 0.0 Lt	SW-131 (10.0 ft)	380	7.7	14	8	14	See note (2**)	No	No	18
"E Line" 162+25; 18.0 Lt	SW-132 (6.0 ft)	1180	7.1	14	10	14	See note (2)	No	No	18
"E Line" 167+00; 0.0 Lt	SW-134 (4.5 ft)	1050	7.6	18	12	18	See note (2)	No	No	18
"E Line" 169+50; 0.0 Lt	RW/SW-136 (9.5 ft)	800	7.6	16	12	16	See note (2**)	No	No	18
"E Line" 170+25; 0.0 Lt	GST-138 (4.0 ft)	430	7.6	14	8	14	See note (2**)	No	No	18
"E Line" 172+50; 0.0 Lt	RW/SW-139 (11.0	1470	7.7	18	12	18	See note (2)	No	No	18
"E Line" 174+50; 0.0 Lt	RW/SW-140 (9.5 ft)	430	7.7	14	10	14	See note (2**)	No	No	18

Note (1): Thermoplastic pipe can be used as an alternative and should not have any corrosion concerns. However, the types of thermoplastic pipe that can be used will depend on the height of fill, available sizes and manufacturer's specifications.
Note (2): Standard reinforced concrete pipe design is suitable with Type IP (MS) modified cement or Type II modified cement, minimum required by Caltrans Std. Specs 90-1.01 (** - Sulfate Resistant Concrete and RCP)
Note (3): The numbers in the parentheses indicate sample depths
Note (4): The results of analyses from the program "Culvert 4" are presented in Appendix C.

INFORMATION HANDOUT

The results in Table 8 indicate that:

- For corrugated steel pipes (Galv. 57g), the recommended pipe thickness for a 25-yr design life is 16 gage between Sta. 130+50 and Sta. 157+50; and 14 gage between. Sta. 157+50 and Sta. 179+00.
- For corrugated steel pipes (Galv. 57g), the recommended pipe thickness for a 50-yr design life is 8 gage for the entire alignment between Sta. 130+50 and Sta. 179+00.
- For corrugated steel pipes (bitumen coated – soil sides), the recommended pipe thickness for a 50-yr design life is 16 gage between Sta. 130+50 and Sta. 157+50; and 14 gage between. Sta. 157+50 and Sta. 179+00.
- For steel pipes (galvanized + polymer, 90 deg. invert), the recommended pipe thickness for a 50-yr design life is 18 gage for all locations.
- For reinforced concrete pipes, for all locations, sulfate resistant Type IP (MS) modified cement or Type II Modified cement, minimum required as per Caltrans Bridge Design Specifications (Section 8.22) is recommended.
- Corrugated aluminum or corrugated aluminized steel pipes are not recommended at any location.

Thermoplastic pipe may be used as an alternative and should not have any corrosion concerns. However, the types of thermoplastic pipe that can be used will depend on the height of fill, available sizes and manufacturer's specifications.

8.5.2 Bore-and-Jack Culvert

Based on the Drainage Plans provided by the designer, there are four bore-and-jack culverts crossing State Route 4 within the limits of the project alignment. The locations, sizes and culvert type are tabulated below.

No.	Type	Size	Length	From Sta.	To Sta.
1	RCP	24-in.	49.0 ft.	49.25 Rt. E 139+79.81	0.0 Lt. E 139+79.81
2	RCP	24-in.	52.5 ft.	0.0 Lt. E 139+79.81	65.41 Lt. E 139+79.81
3	RCP	18-in.	59.8 ft.	58.00 Lt. EL 157+00.00	1.74 Rt. EL 156+95.84
4	RCP	120-in.	892.2 ft.	75.64 Lt. RWN 54+68.37	42.23 Lt. FT 99+58.00

Minimum Soil Cover

In general, a minimum soil cover of 2 times the diameter of the RCP is recommended below the subgrade throughout the length of the RCP during the construction of the bore-and-jack culvert.

Lateral Design

It is anticipated that the shoring system such as sheet piles will be used for the proposed jacking and receiving pits. Lateral earth pressures for internally braced sheet pile system are presented on "Lateral Pressure Diagram for Shoring Design", Plate 5. Additional lateral load resulting from adjacent street traffic and construction operation should be included for design. The lateral load may be assumed at 40% of the total surcharge load.

Shoring design may require the sheet piles to be relatively deep. An equivalent fluid density 320 pcf may be used in calculating passive resistance below the base of excavation. A minimum factor of safety of 1.5 is recommended. The contractor shall provide their own design-build system for the shoring work. It is the contractor's responsibility to select the type of shoring system and design the performance of the system. The pressure exerted by the reaction block on the surrounding soil should not exceed a horizontal bearing capacity of 3500 psf. The reaction block should be properly designed to distribute the jacking thrust to the jacking pit shoring system.

Construction Dewatering

Groundwater was not encountered in the nearest borings for Culvert Nos. 1 and 2 (Borings SW-114 and SW-115) or Culvert No. 3 (Borings SW-128, SW-129 and SW-131) within the drilled depth of 30 feet. Groundwater is therefore not expected to be encountered during construction for Culvert Nos. 1, 2 and 3. Groundwater was also not encountered in the nearest borings for the 120-in. Culvert No 4 (Borings E-130, SW-131, SW-132, SW-133). However, since the culvert invert may be greater than 30 feet below ground surface; pertinent information regarding potential occurrence of groundwater is not available for Culvert No. 4.

Additionally, groundwater levels may change with the passage of time. Therefore, the contractor should satisfy themselves with the prevailing conditions and obtain additional information if needed to design dewatering method, if required. Developing and implementing an effective dewatering program should be the contractor's responsibility. The dewatering system should prevent pumping soil fines with the discharge water. If soil fines are pumped, failure of shoring, partial instability of excavation bottom resulting in intolerable settlement of existing structure/utilities, and unsafe working conditions may occur.

Working Platform

As per the borings, the subsoils at the excavation bottom are anticipated to be clayey. If groundwater is present in close proximity of the subgrade, equipment and personnel may lose mobility in the clayey soil. If mobility and support become difficult, it may be necessary to stabilize the subgrade soil. Stabilization can be accomplished by constructing a working platform, which may consist of minimum 12 inches of ¾-inche crushed rock wrapped around by a layer of high strength geofabric (such as subgrade enhancement fabric). The contractor may choose to use other measures such as placing timber material or other construction techniques.

Grading

It is anticipated that earthwork will consist of excavating and backfilling the pits. The areas between the bottom of the excavation 12 inches (minimum) above the pipeline should be backfilled with suitable bedding material (minimum 90% relative compaction per the project specification). Above the bedding material and up to 2 feet (minimum) below the pavement subgrade, native material at a minimum 90% relative compaction may be used for the backfill. This backfill should be placed and compacted at or above the optimum moisture content to reduce settlement resulting from potential hydro-compaction in the future. Select backfill should be used within 610 mm (minimum) below the pavement subgrade. The selected backfill should be relatively non-expansive granular material having a plasticity index less than 15 and a minimum R-Value of 15 and should be compacted to a minimum 95% relative compaction per the project specifications. Pavement restoration should be in accordance with the Caltrans standards or restored to match the adjacent existing pavement section.

8.6 Minor Structure Foundations

8.6.1 Soundwall

Based on the "Retaining Wall Plan" and "Soundwall Plan" provided by BKF Engineers (plan), ten soundwalls are planned. The locations and other details are presented below.

TABLE 9: SUMMARY OF PROPOSED SOUNDWALLS

Wall No.	Location	Total Length (ft)	Height (ft)	Relevant Borings	Remarks
2[1]	Begin: "E" Line 136+00, 132.63 Rt. (offset) End: "REF" Line 44+08, 44.24 (offset)	804	14-16	SW-114 RW/SW-116	On 16-in CIDH piles
5[2]	Begin: "REF" Line 44+08, 43.74 Rt. (offset) End: "REF" Line47+87, 34.88 Rt. (offset)	379	14.33-16.33	RW/SW-116 C-119	On Concrete barrier on 16-in CIDH piles
6[2]	Begin: "REF" Line 47+87, 35.7 Rt (offset) End: "REF" Line 50+00, 35.83 Rt (offset)	209	10	RW-120 RW-123	On Retaining wall No. 3A
7[3]	Begin: "E" Line 142+38, 86.0 Lt (offset) End: "E" Line 157+88, 58.0 Lt (offset)	1551	12.33 to 13.67	SW-117, E-121, SW-128, SW-131	On concrete barrier on On 16-in CIDH pile
8[4]	Begin: "RWF" Line 56+87, 40.22 Lt. (offset) End: "EL" Line 162+67, 74.58 Lt. (offset)	571	10.33 to 12.33	SW-131, SW-132	On concrete barrier on Retaining Wall No. 9B
9[4]	Begin: "EL" Line 162+67, 73.08 Rt. (offset) End: "EL" Line 163+39, 71.6 Lt. (offset)	70	12.33	SW-132	On Concrete barrier on 16-in CIDH piles
10A &10B[5]	Begin: "EL" Line 163+39, 73.1 Lt. (offset) End: "EL" Line 170+20, 182.81 Lt.	78 612	6-14 10-12	SW-135, RW/SW-136	On 16-in CIDH Piles
11[6]	Begin: "E" Line 171+43, 146.43 Lt. (offset) End: "E" Line 179+00, 146.83 Lt. (offset)	758	10	SW-140 RW/SW-142	On 16-in CIDH Piles
12[7]	Begin: "ER" Line 170+55, 98.85 Rt. (offset) End: "E" Line 179+00, 131.29 Rt. (offset)	870	10	RW/SW-139 RW/SW-141	On 16-in CIDH Piles

Notes:
1. On south side of Eastbound State Route 4
2. On south side of off-ramp from eastbound State Route 4 to Contra Loma Boulevard
3. On north side of Westbound State Route 4
4. On north side of Westbound Off-ramp to Contra Loma Boulevard
5. On north side of Westbound On-Ramp from G Street to State Route 4
6. On north side of Westbound State Route 4, east of G Street
7. On south side of Eastbound State Route 4, east of G Street

8.6.1.1 Subsurface Soil Conditions

Existing borings along the soundwall alignments indicate predominantly stiff to hard lean clays with occasional layers of medium dense to dense sands. Groundwater was encountered at 18 feet below ground surface.

8.6.1.2 Foundation Recommendations

Foundations for soundwalls are discussed below:

1. Foundations for soundwalls located on top of retaining walls should be as recommended in the earlier section on Retaining Walls (Section 8.4).
2. For foundations for soundwalls at grade or on concrete traffic barriers, it is recommended to use Caltrans standard soundwall supported on Cast-in-drilled-hole (CIDH) piles. Details for design and construction for the CIDH piles are presented in the following section.

8.6.1.3 Design and Construction Considerations for the CIDH Piles

According to Caltrans Bridge Design Aids, pile foundation for sound wall may be designed by Sheet Piling Procedure or by using a variation of the simplified and approximate method outlined in the Uniform Building Code (1997) Section 1806.8. For lateral design, Caltrans standard design can be used for this project. Based on the Caltrans "Standard Drawing – Soundwall – Masonry Block on Pile Cap Detail No. 2", and an assumed angle of shearing resistance of 35°. The maximum slope gradient of the sloping ground is 1V: 2H. It is anticipated that the soundwall foundation

will be in relatively competent native soils. The criteria for level ground condition are described in Caltrans Memo to Designer (22-1, Section IV).

Caltrans standard specification for "Cast-in-Place Concrete Piling" should be used for the construction of CIDH piles. Due to presence of sand and gravel layers, raveling or caving is expected, which may require additional drilling and cleaning effort and may increase the concrete volume for the piles. Groundwater should also be expected in these layers or as perched conditions. Relatively difficult drilling conditions may be encountered for drilling into the hard clays and the dense sand layers. It is prudent to make the contractor aware of these conditions so that appropriate steps can be taken to comply with the standards and to maintain the integrity of the CIDH piles. The use of temporary steel casing should be anticipated at all times to maintain the integrity of the piles. All pile excavations should be observed by the Geotechnical Engineer prior to the placement of reinforcement and concrete so that if conditions differ from those anticipated, appropriate recommendations can be made.

8.6.2 Overhead Sign Structures

It is proposed to construct four overhead sign structures at grade along State Route 4. The overhead sign structures will be Caltrans Standard "Overhead Signs-Truss Single Post Type VIII". The overhead sign structures will be along both eastbound and westbound directions of State Route 4. The sign structures will be 20 to 22 feet above grade. The recommended foundation system will consist of a 5-ft diameter "Cast-in-drilled-hole" (CIDH) pile, which is used in the Caltrans standard design.

8.6.2.1 Subsurface Soil Conditions

Based on the boring data, the subsurface soil conditions at the four overhead sign structure locations are summarized in the table below.

TABLE 10: SUMMARY OF OVERHEAD SIGN STRUCTURES

Sign	Location		Post Type	Relevant Boring	Subsurface Soil Conditions
	Station	Direction			
A	142+64 ("E" line)	Eastbound	VIII	RW/SW-116	Very stiff lean clay to 5-ft depth, underlain by medium dense silty to 15-ft depth, underlain by very stiff clay to 30-ft depth. Groundwater encountered at 24-ft depth at the time of drilling
B	153+67 ("E" line)	Westbound	VIII	CLO-125	Medium dense silty sand to 10-ft depth, underlain by stiff sandy lean clay to 20-ft depth, underlain by stiff to very stiff fat clay.
C	145+11 ("E" line)	Westbound	VIII	C-118	Stiff lean clays to 5-ft depth, underlain by very stiff clays to 15-ft depth, underlain by hard clays. Groundwater encountered at 28.5-ft depth at the time of drilling
E	163+55 ("E" line)	Westbound		SW-132	Very stiff to hard clays to 30-ft depth
Note: Groundwater not encountered within 30-ft depth, unless mentioned otherwise.					

8.6.2.2 Pile Capacity Analyses

The piles for the overhead sign structures are subject to vertical loads, lateral loads, bending moments and torsional moments. According to Caltrans Standard Plan (2006 Standard Plan S8), the recommended pile diameter is 5 feet and the recommended pile length is 25 feet for Post Type VIII. Based on the laboratory test results, the existing subsurface soil conditions generally meet the requirements as specified in the Caltrans Standard Plans.

Vertical loads are generally small and vertical capacities developed from the frictional resistance should be acceptable. Specific loads were not provided by the designer. Therefore, definitive analyses for lateral loads were not performed. However, as noted in Table

10, the soils are generally stiff to very stiff clays. Standard design for the piles is therefore judged to be adequate.

8.6.3 Other Minor Structures

According to the designer, the other minor structures for this project include the traffic signal systems and minor drainage structures. The foundation design of these minor structures should be according to the Caltrans Standard Plans. Based on the borings, the subsurface soil conditions at the proposed traffic signal systems generally consist of stiff to hard lean clays with pockets/lenses/layers of medium dense to dense sands. The native soil on site should provide adequate design capacity for these structures.

9. STRUCTURAL PAVEMENT

R-value tests were conducted on representative samples collected at subgrade level. The test results are summarized in Table 11.

TABLE 11: SUMMARY OF R-VALUE TEST RESULTS

Boring No.	Station	Offset From Center Line	Boring Depth	Profile		R Value	Soil Type	Remarks
				a	b			
R-22	137+52	38.8' (R)	0-5'	F (1.0 ft.)	C (2.0 ft.)	39	Sandy Clay	
R-24	141+67	0' (C.L)	0-5'	F (1.0 ft.)	C (2.0 ft.)	40	Sandy Clay	
R-25A	142+31	91' (L)	0-5'	F (6.0 ft.)	F (3.0 ft.)	10	Sandy Clay	Engineered fill required
R-25	143+41	66.5'(L)	0-5'	F	F	12	Clay	Engineered fill required; EI = 70
R-26	147+48	55' (R)	0-5'	F (6.0 ft.)	F (3.0 ft.)	31	Sandy Clay	Engineered fill required
R-27	148+80	51.5' (L)	0-5'	F (3.0 ft.)	C/F(0.0 ft)	27	Silty sands with clay	
R-32	156+53	139.5'(L)	0-5'	F (3.0 ft.)	C/F (0.0 ft)	36	Sandy Clay	
R-33	156+74	12' (L)	0-5'	F (1.5 ft.)	C (1.5 ft.)	20	Sandy Clay	
R-34	160+26	54'(R)	0-5'			51	Clayey Sand	
R-35	162+65	58' (L)	0-5'	F (1.0 ft.)	C (2.0 ft.)	37	Sandy Clay	
R-36	165+57	251.4' (R)	0-5'	F (1.0 ft.)	C (2.0 ft.)	12	Clay	Fitzuren Road
R-37A	164+15	12' (L)	0-5'	F (1.0 ft.)	C (2.0 ft.)	14	Heavy Clay	
R-37	166+35	16.5 (R)	0-5'	F (1.0 ft.)	C (2.0 ft.)	6	Clay	EI=74
R-38	167+02	294.8' (R)	0-5'	F (1.0 ft.)	C (2.0 ft.)	<5	Clay	City Street
R-39	169+11	196 (L)	0-5'			<5	Clay	City Street
R-40	171+83	0 C.L.	0-5'	F (0.5 ft.)	C (2.5 ft.)	35	Silty Sand	

Stationing is referenced to the plan, 08/02/2007 (English)
Potential Expansion: Medium (Expansion Index, EI = 51 to 90), ASTM D – 4829
a: New roadway level (reference made with existing roadway level)
b: New grading plane (reference made with existing roadway level)
F: Fill
C: Cut
Note: Sta. 166+00 to Sta. 174+00 – remove and replace with 2.5 feet of import fill (R=15)

As-built Pavement Sections

The following are the as-built pavement sections based on the "Typical Cross Sections" of the plan provided by the designer:

TABLE 12: AS-BUILT PAVEMENT SECTIONS

Location	Segment	Pavement Section
State Route 4 (Eastbound and Westbound) "E" 136+00 to 179+00	Outer Lane	0.15-ft RAC (Type G) 1.30-ft AC (Type A)
	Inside Lanes	0.15-ft RAC (Type G) 0.50-ft AC (Type A) 0.85-ft CTB
	Outside Shoulder - Westbound	0.15-ft RAC (Type G) 0.25-ft AC (Type B) 0.60-ft AB (Class 2)
	Outside Shoulder - Eastbound	0.15-ft RAC (Type G) 0.25-ft AC (Type B) 0.60-ft CTB
Contra Loma Boulevard	St. Francis Drive to Buchanan Road	0.67-ft AC 0.35-ft CTB 0.75-ft AS
	Buchanan Road to south of SR4	0.25-ftAC 0.67-ft AB 0.83-ft AS
	South of SR4 to north of SR4	0.38-ftAC 0.50-ft AB 0.50-ft AS
L Street		0.25-ftAC 0.67-ft AB 0.92-ft AS
G Street		0.25-ftAC 0.58-ft AB 0.92-ft AS

The existing pavement sections of State Route 4 – Segment 2 and relevant portions of Contra Loma Blvd/L Street, G Street, Fitzuren Road and Claudia Ct. are presented in Appendix D. It should be noted that the above table and the sections do not account for any overlays that may have been placed.

Findings, Design Approach and Recommendations:

- Based on the R-value tests results, the R-values of the subsurface soils at the project site are typically between <5 and 51, as indicated in the Table 11. The higher R-values are generally for sandier soils.

- According to the designer, the structural pavement design will be required for the travel lanes and shoulders along State Route 4 from Sta. 136+00 to Sta. 179+00; along the new on-ramps and off-ramps with Contra Loma Boulevard and L Street.
- Structural pavement design will also be required for widening of Contra Loma Blvd./L Street from north of Francis Drive to 180 feet north of Lemon Tree Way; widening of G Street from 250 feet south of Fitzuren Road to approximately 150 feet north of Drake Street; and widening of small portions of Fitzuren Road and Claudia Ct.
- Fill material to be placed within 2.5 feet of the grading plane should have a minimum R-value of 15.
- The R value for the subgrade along Contra Loma Blvd./L Street, G Street, Fitzuren Road and Claudia Ct. are assumed as 5.
- The On- and Off-ramps are almost entirely on fill; an R-value of 15 is assumed for the fill.
- The recommended minimum R-value for Class 3 Aggregate Base (AB) is 78 and for Class 4 Aggregate Subbase (AS) it is 50.

Recommended Structural Pavement Sections

The Traffic Indices and the recommended typical structural pavement sections for 40-year design of the State Route 4, the entrance and exit ramps to and Contra Loma Blvd./L Street, and the portions of roads to be widened are presented in Table 13. The calculations for the proposed pavement sections are contained in Appendix C.

Based on the field investigations and the laboratory test data, the in-place soil at some locations has relatively low R-value (5). These low R values occur primarily in sample locations outside the Mainline, in ramps and local street locations. The values along the Mainline are generally 15 or greater, except a few isolated locations. A significant portion of the project will require embankment fill and therefore the pavement section is expected to be on borrow material. The borrow material is assumed to have an R-value of 15 in the design. The section at Sta. 143+00 has clay (R = 10 and 12); however, it is

proposed to be on borrow fill. A limited portion of the project near the end is expected to be at-grade or in some cut. At these locations, where the pavement will conform to the existing grade, there will be a need for over- excavation and rebuilding of the roadway prism. This should be built with borrow material or onsite local barrow (R-15). This includes the section between Sta. 166+00 and Sta. 174+00 (R= 6 and 14). Therefore, this section will require removal of top 2.5 feet of the existing clayey soil and replacement with borrow material (R=15). The Mainline of State Route 4 is based on this design assumption.

The pavement section for the ramps has assumed the same 'R-value of 15' material from borrow sources. There are also median shoulders and outside shoulders. These are also designed using the R-value of 15.

Traffic Indices have been approved by Caltrans for the corridor. Based on the available data, the TI-values range from 12.5 for the median lane and 14.5 for the outside lane. For ease of construction, and to allow for offsetting of LCB joints from that of lane line joints, outside lane TI have been used in design of both inside and outside lane structural sections.

The ramps are to be designed for a TI value of 10. A TI value of 10 has also been suggested by the designer for design of the pavement sections for temporary detours during construction.

Pavement design for the project has been evaluated based on Life Cycle Cost Analyses (LCCA) and the review and approval by Caltrans. Several meetings have been held in reference to the pavement design and selections of the options with the Materials Department. In addition the LCCA was conducted with the assistance of the HQ.

The width of the shoulders and the decision of using PCC shoulders or HMA shoulders (hybrid design) have been made subsequent to the meeting with Caltrans. It should be noted that the PCC section is based on the assumption that there is lateral confinement

from the adjacent lane of a minimum 2' wide PCC shoulder. The three options for shoulder section include PCC, HMA and 2 feet of PCC plus HMA (hybrid section).

The LCCA analyses required that the pavement section be considered with two primary options; Hot Mix Asphalt and JPCP section. The concrete section is based on HDM tables for Inland Valley Type II Subgrade Soil conditions. The summary of pavement sections have been reviewed and concurred with the Materials Department (District 4). The following Tables provide the details of the mainline pavement design, the ramps, and the widening of Contra Loma Blvd./L Street, G Street, Fitzuren Road and Claudia Ct.

TABLE 13A: RECOMMENDED PAVEMENT SECTIONS FOR MAINLINE

Contra Loma and G Street Interchanges [R-Value: 15 (Import Fill) (2)																
Lane	TI	Flexible Pavement Section (ft.)										Rigid Pavement Section (ft.)				
		Option -1 (Full Depth)(3)				Option -2 (HMA-A/LCB/AS)						Options - 3 (JPCP/LCB/AS(1))				
		RHMA-O	RHMA-G	HMA-A	Total	RHMA-O	RHMA-G	HMA-A	LCB	AS	Total	JPCP	LCB(4)	HMA-A(4)	AS(1)	Total
Outside	14.5	0.10	0.20	1.70	**2.00**	0.10	0.20	0.55	0.70	1.45	**3.00**	1.00	0.35	0.25	0.70	**2.05/1.95**
Median	14.5	0.10	0.20	1.70	**2.00**	0.10	0.20	0.55	0.70	1.45	**3.00**	1.00	0.35	0.25	0.70	**2.05/1.95**
Outside Shoulder	14.5					0.10	0.20	0.55	0.70	1.45	**3.00**					
Median Shoulder	14.5					0.10	0.20	0.55	0.70	1.45	**3.00**	1.00	0.35	0.25	0.70	**2.05/1.95**
Outside Shoulder		Hybrid Shoulder Using 14' JPCP outside lane and 8' HMA shoulder										HMA 0.70 – 1.00	0.35	0.25	0.70	**1.90-2.20**

(1) Aggregate Subbase (Class 4, min R value=50)
(2) Majority of the segment is expected to be in fill. R-value recommended is 15 for import and for overexcavation and replacement.
(3) Full depth HMA should only be used for narrow widening, i.e. areas inaccessible to conventional equipment.
(4) Either LCB or HMA-A should be used (not both). LCB and HMA-A thicknesses have been modified per Caltrans PPB 09-01 (Rigid Pavement Base Design) dated August 27, 2009). HMA-A, if used, the AS should be prime coated, prior to placement of HMA-A.

Notes: **TI:** Traffic Index (Outside lane TI has been used for both inside and outside structural section for ease of construction and to allow for offsetting of LCB joints from that of lane line joints)
HMA-A: Hot Mix Asphalt (Type A); **RHMA-G:** Rubberized Hot Mix Asphalt – Gap Graded
FDHMA-A: Full Depth Hot Mix Asphalt (Type A); **RHMA-O:** Rubberized Open Graded Hot Mix Asphalt
LCB: Lean Concrete Base; **AB:** Aggregate Base (Class 3, R-Value = 78); **AS:** Aggregate Subbase (Class 4, R-Value=50)
Flexible Pavement: Gravel Equivalent Calculation (Table 633.1, Highway Design Manual, July 2008)
Rigid Pavement Thickness: Table 623.1G; Inland Valley Type II Subgrade; Lateral Support (Highway Design Manual, June 2008)

TABLE 13B: RECOMMENDED PAVEMENT SECTIONS FOR CONTRA LOMA BLVD. AND L STREET

Lane	R-Value	TI	Flexible Pavement Section (ft.)									
			Option -1 (Full Depth)*		Option -2 (HMA-A/LCB/AS)				Option -3 (HMA-A/AB/AS)			
			HMA-A	Total	HMA-A	LCB	AS	Total	HMA-A	AB	AS	Total
Contra Loma Blvd./L Street	5	12.0	1.60	**1.60**	0.60	0.70	1.30	**2.60**	0.65	1.05	1.35	**3.05**

Note:

TI: Traffic Index
FDHMA-A: Full Depth Hot Mix Asphalt (Type A)
HMA-A: Hot Mix Asphalt (Type A)
LCB: Lean Concrete Base
AB: Aggregate Base (Class 3, R-Value = 78)
AS: Aggregate Subbase (Class 4, R-Value=50)
Flexible Pavement: Gravel Equivalent Calculation (Table 633.1, Highway Design Manual, July 2008)

- Full depth HMA should only be used for narrow widening, i.e. areas inaccessible to conventional equipment

TABLE 13C: RECOMMENDED PAVEMENT SECTIONS FOR ON AND OFF RAMPS, TEMPORARY DETOURS DURING CONSTRUCTION, G STREET, FITZUREN ROAD AND CLAUDIA CT.

Lane	R-Value	TI	Flexible Pavement Section (ft.)**								
			Option -1 (Full Depth)		Option -2 (HMA-A/AB)			Option -3 (HMA-A/AB/AS)			
			HMA-A	Total	HMA-A	AB	Total	HMA-A	AB	AS	Total
On and Off Ramps	15*	10.0	1.20	**1.20**	--	--	--	0.50	0.85	0.90	**2.25**
Temporary Detours during Construction	15*	10.0	1.20	**1.20**	--	--	--	0.50	0.85	0.90	**2.25**
G Street	5	8.0	1.05	**1.05**	0.40	1.50	**1.90**	0.40	0.65	0.95	**2.00**
Fitzuren Road		8.0	1.05	**1.05**	0.40	1.50	**1.90**	0.40	0.65	0.95	**2.00**
Claudia Ct.		5.0	0.65	**0.65**	0.25	0.80	**1.05**	0.25	0.35	0.50	**1.10**

Notes:

TI: Traffic Index
FDHMA-A: Full Depth Hot Mix Asphalt (Type A)
HMA-A: Hot Mix Asphalt (Type A)
AB: Aggregate Base (Class 3, R-Value = 78)
AS: Aggregate Subbase (Class 4, R-Value=50)
Subgrade Type: Inland Valley, Type II Subgrade Soil
Flexible Pavement: Gravel Equivalent Calculation (Table 633.1, Highway Design Manual, July 2008)
*** Pavement on Fill Material (R = 15)**
** Full depth HMA should only be used for narrow widening, i.e. areas inaccessible to conventional equipment

10. MATERIAL SOURCES

There are several commercial sources of asphalt, concrete, and aggregate products in the area. Table 14 lists available commercial suppliers in the area.

TABLE 14: SOURCES OF IMPORTED BORROW

Source	Location	Approx. Haul Distance (one way, miles)
Antioch Rock & Ready Mix	3600 Wilbur Ave., Antioch	5
NAV-Land	2665 Pittsburg-Antioch Hwy, Antioch	1.5
Mega-Sand Incorporated	110 L Street #2, Antioch	1.5
Mex-Cal Incorporated	4826 Belle Drive, Antioch	2
RMC Pacific Materials	1544 Stanley Blvd., Pleasanton	40

11. MATERIAL DISPOSAL

Majority of the project will require imported borrow material for the project. Disposal of ADL contaminated material (if any) is beyond the scope of this report.

12. CONSTRUCTION CONSIDERATIONS

12.1 Construction Advisories

Majority of the project will need fill material for the proposed new interchange. The site is the existing State Route 4. Therefore traffic control and construction staging is required to maintain traffic flow during construction. There are numerous utility lines at the site. The contractor should verify the utility lines, be aware of the existing conditions and plan the construction activities accordingly.

The borings encountered clayey/sandy materials near the existing ground surface. Localized subgrade pumping may be encountered during earthwork construction depending on the weather, subsurface moisture, and surface drainage conditions. Equipment mobility may also be difficult if the subgrade is wet. In such a case, the subgrade soils may require reworking, aeration, or over-excavation and replacing with dry granular fill to facilitate earthwork construction.

12.2 Construction Considerations that Influence Specifications

The contractor should verify the existing utility line conditions, and these locations should not be used for stockpiling of borrow materials. Any utility conflicts with proposed construction should also be reviewed prior to construction.

12.3 Construction Monitoring and Instrumentation

The construction subject of monitoring and instrumentation was considered and was determined to be not significant for the project.

12.4 Hazardous Waste Considerations

The project environmental study report should be referred to for further details at the sites within the project.

12.5 Differing Site Conditions

The soil conditions described in this report are based on available boring data. It should be noted that these borings depict subsurface conditions only at the locations drilled. Because of the variability from place to place within soils in general, and the nature of geologic depositions, subsurface soil conditions could change between the explored locations.

Early communication should be made between the Resident Engineer, the Contractor and the Geotechnical Engineer as soon as conditions that differ from those established in this report are recognized by any of the parties. Additional recommendations could be provided if such conditions arise.

13. RECOMMENDATIONS AND SPECIFICATIONS

13.1 Summary of Recommendations

If the designer has questions or concerns regarding any of these recommendations, or, if conditions are found to be different during construction, the Geotechnical Engineer who prepared this report should be contacted. Additional fieldwork, analysis or changes in recommendations may be required. These services may be provided under a separate authorization, as necessary. A concise summary of the geotechnical recommendations is presented below:

- Design peak bedrock acceleration (PBA) = 0.47 g.
- The boring data indicates that the subsoils generally consist of stiff to hard clay with occasional layers of medium dense to very dense sand. Groundwater was encountered between Elev. 1.0 feet and 21.0 feet during drilling. The impact of liquefaction potential to this new interchange project is considered relatively low. (Ref.: Section 8.1.3)
- Settlement due to the placement of embankment fill is expected to be insignificant
- Pavement Sections for the new interchange (Ref: Section 9):
  The structural pavement sections for the project include HMA and PCC sections for the mainline, HMA for the on-off-ramps from the State Route 4, temporary detours during constructions and for the widening of Contra Loma Blvd./L Street, G Street, Fitzuren Road and Claudia Ct. These are detailed in Tables 13A, 13B and 13C above.

13.2 Recommended Materials Specifications

13.2.1 Standard Specifications

Unless otherwise stated in the special provisions, all materials specifications should conform to Caltrans Standard Specifications, May 2006 edition, including but not limited to the following: Earthwork, Structure Backfill, Pervious Backfill Material, Reinforcing Geofabric, Thermoplastic Pipes, Asphalt Concrete, Aggregate Base, Aggregate Subbase and Cement Treated Base, etc.

13.2.2 Special Provisions

Imported Borrow:
Imported material should be in accordance with the specifications set forth in Caltrans Section 19. In particular, for new embankment/roadway construction, the material placed within 2.5 feet of the grading plane should meet the following requirements:

1. Free of organic or other deleterious materials.
2. An R-value of no less than 15.

Aggregate Base:
Aggregate Base (Class 3) shall conform to the provisions in Section 26 of the Standard Specifications and to the Special Provisions. It shall also be clean and free from organic matter and other deleterious substances. The percentage composition by weight of Class 3 aggregate base shall conform to the following grading as determined by California Test Method No. 202.

Gradation Requirement (Percent Passing ¾ in. Maximum)

Sieve Sizes	Operating Range	Contract Compliance
1 in.	100	100
3/4 in.	90 – 100	87 – 100
No. 4	35 – 60	30 – 65
No. 30	10 – 30	5 – 35
No. 200	2 – 11	0 – 14

Gradation Requirement (Percent Passing 1-1/2 in. Maximum)

Sieve Sizes	Operating Range	Contract Compliance
2 in.	100	100
1-1/2 in.	90 – 100	87 – 100
1 in.	------	------
3/4 in.	50 – 85	45 – 90
No. 4	25 – 45	20 – 50
No. 30	10 – 25	6 – 29
No. 200	2 – 11	0 – 14

Aggregate Base (Class 3) shall also conform to the quality requirements given on the following table:

Quality Requirements

California Test Method	Operating Range	Contract Compliance
Sand Equivalent (217)	25 min	22 Min.
Resistance (R-value) (301)	-	78 Min.
Durability Index	-	35 Min.

Aggregate Subbase: Aggregate Subbase (Class 4) shall conform to the provisions in Section 25 of the Standard Specifications and to these Special Provisions.

Aggregate Subbase (Class 4) shall be clean and free from organic matter and other deleterious substances. The percentage composition by weight of Class 4 aggregate subbase shall conform to the following grading as determined by California Test Method No. 202.

Gradation Requirement (Percent Passing)

Sieve Sizes	Operating Range	Contract Compliance
2-1/2 in.	100	100
No. 4	30 - 65	25 - 70
No. 200	0 - 15	0 – 18

Aggregate Subbase (Class 4) shall also conform to the quality requirements given on the following table:

Quality Requirements

California Test Method	Operating Range	Contract Compliance
Sand Equivalent (217)	21 Min.	18 Min.
Resistance (R-value) (301)	-	50 Min.

14. INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our field exploration and the assumption that the soil conditions do not deviate from observed conditions. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; differing soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed "Contra Loma and G Street Interchanges" project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or

undesirable conditions are encountered during construction, our findings and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the soil conditions can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
PARIKH CONSULTANTS, INC.

Partha Sircar, P.E C54619
Senior Engineer

Gary Parikh, G.E. 666
Project Manager

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-11
GEOTECHNICAL
STATE OF CALIFORNIA

S:\Ongoing Projects\206118\GDMR\Report

REFERENCES

1. California Department of Transportation, May 2006, Standard Plans.

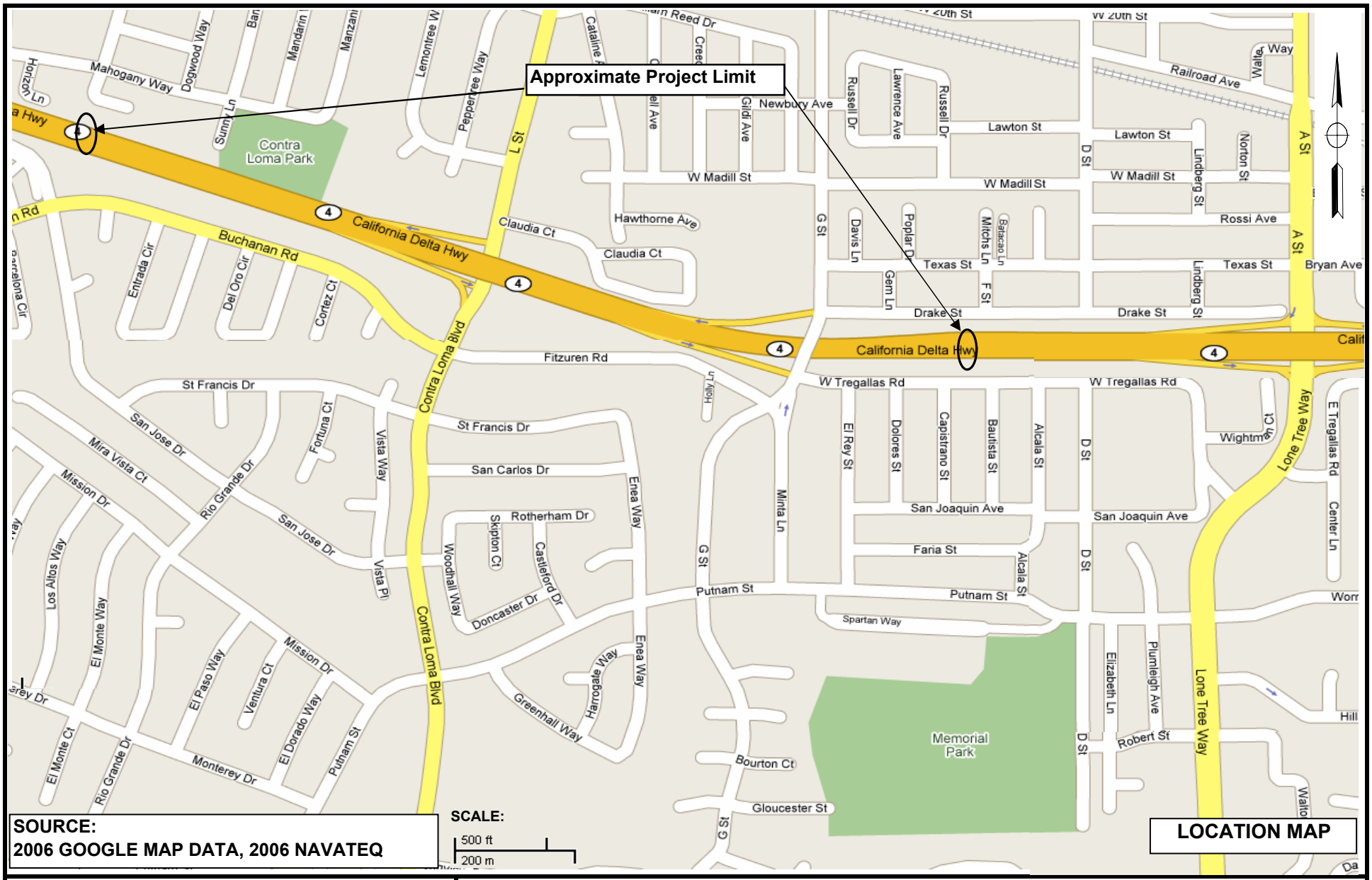
2. California Department of Transportation, May 2006, Standard Specifications, Sections 1 through 95.

3. California Department of Transportation, Highway Design Manual, June 2006

4. California Department of Transportation, "in-Progress" Seismic Hazard Map

5. E. J. Helley and R.W. Graymer., 1997, "Geologic Map of Quaternary Geology of Alameda County and Surrounding Area, CA" Derived from Digital Database open-file 97-97, Scale 1: 100, 000.

6. Youd, T.L. and Idriss, I.M., Co-Chairs, 2001, Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils, ASCE, Journal of Geotechnical and Geoenvironmental Engineering, V. 127, No. 4, p 297-313.



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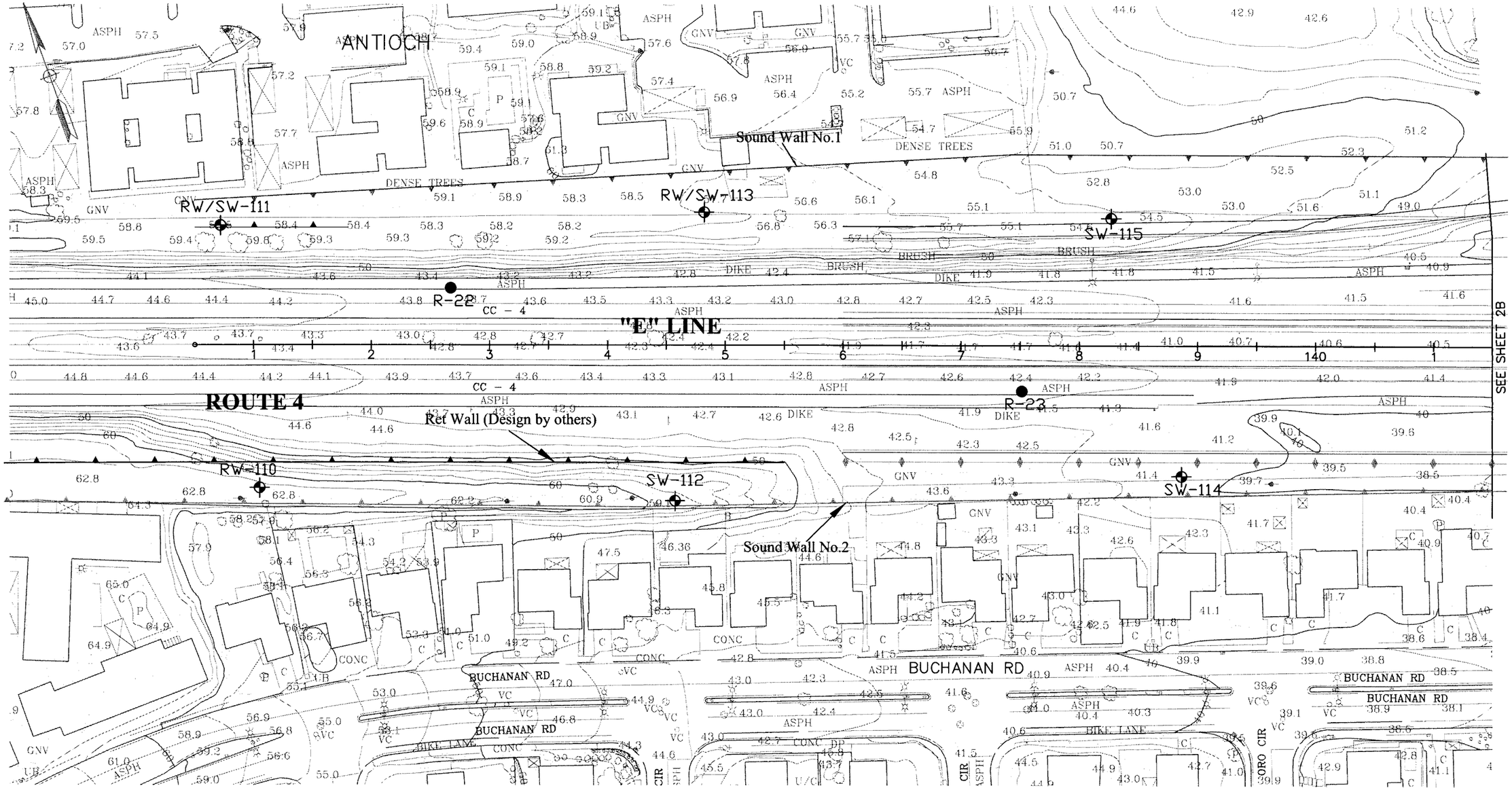
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

CONTRA LOMA AND G STREET INTERCHANGES
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.: 206118.GDR	PLATE NO.: 1



LEGEND

RW/SW-111 — Approx. Boring Location

R-22 — Approx. R-Value Boring Location

SCALE 1 inch = 100 feet

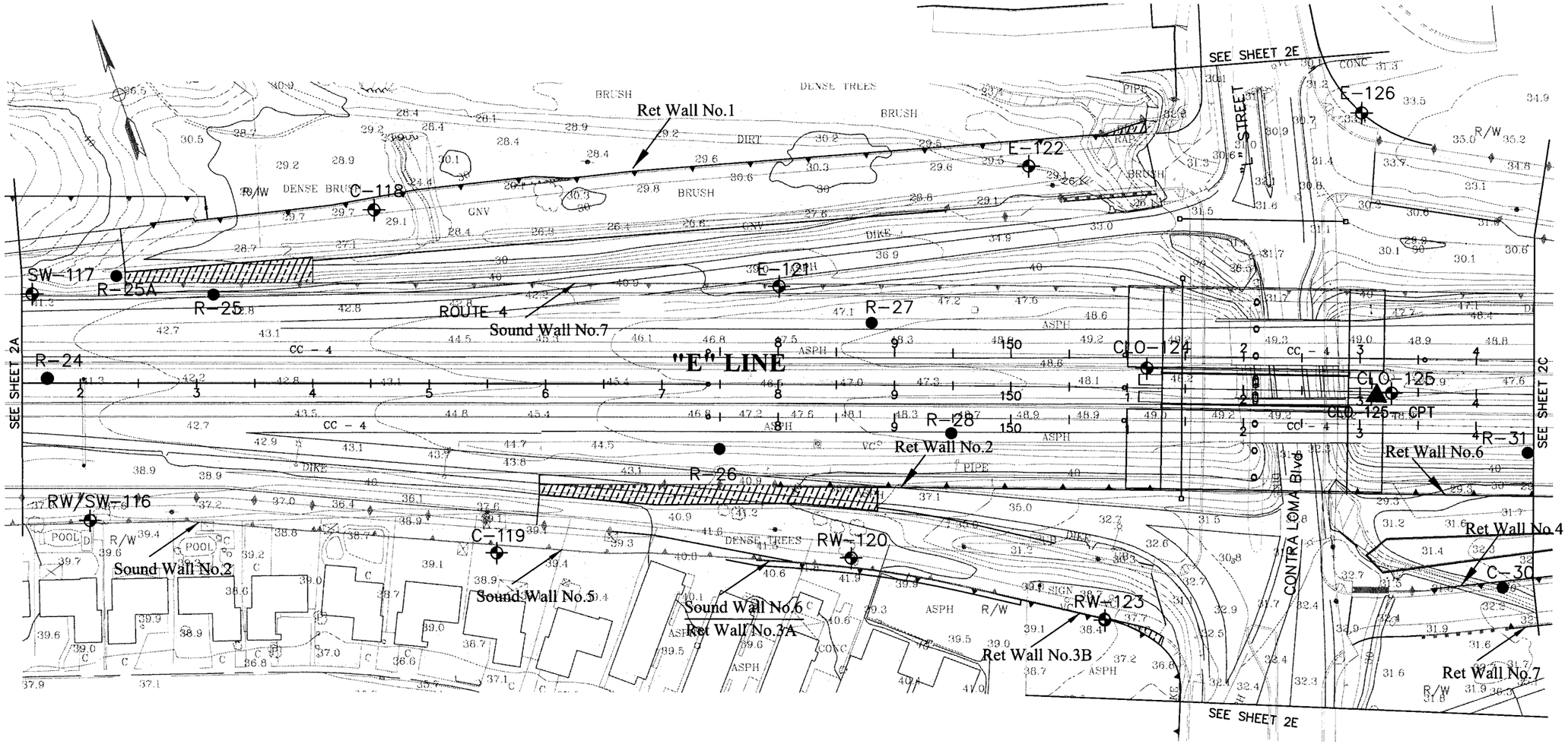
Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers / Surveyors / Planners

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

CONTRA LOMA AND G STREET INTERCHANGES
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.: 206118.GDR | PLATE NO. 2A



LEGEND

RW/SW-116 — Approx. Boring Location

R-25 — Approx. R-Value Boring Location

CLD-125-CPT — Approx. CPT Location

SCALE 1 inch = 100 feet

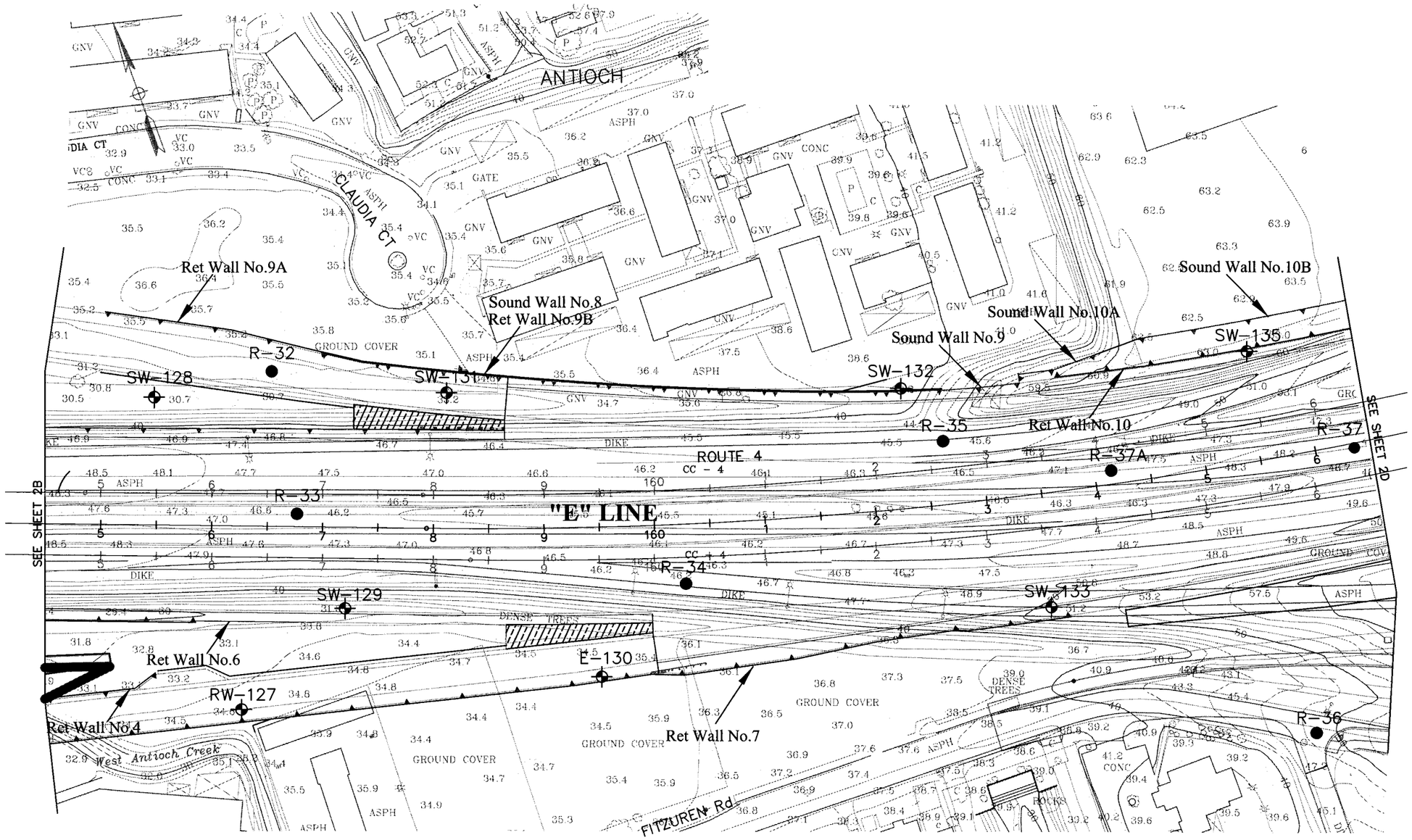
Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers / Surveyors / Planners

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

CONTRA LOMA AND G STREET INTERCHANGES
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.: 206118.GDR | PLATE NO: 2B



SITE PLAN

LEGEND

SW-129 — Approx. Boring Location

R-33 — Approx. R-Value Boring Location

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers / Surveyors / Planners

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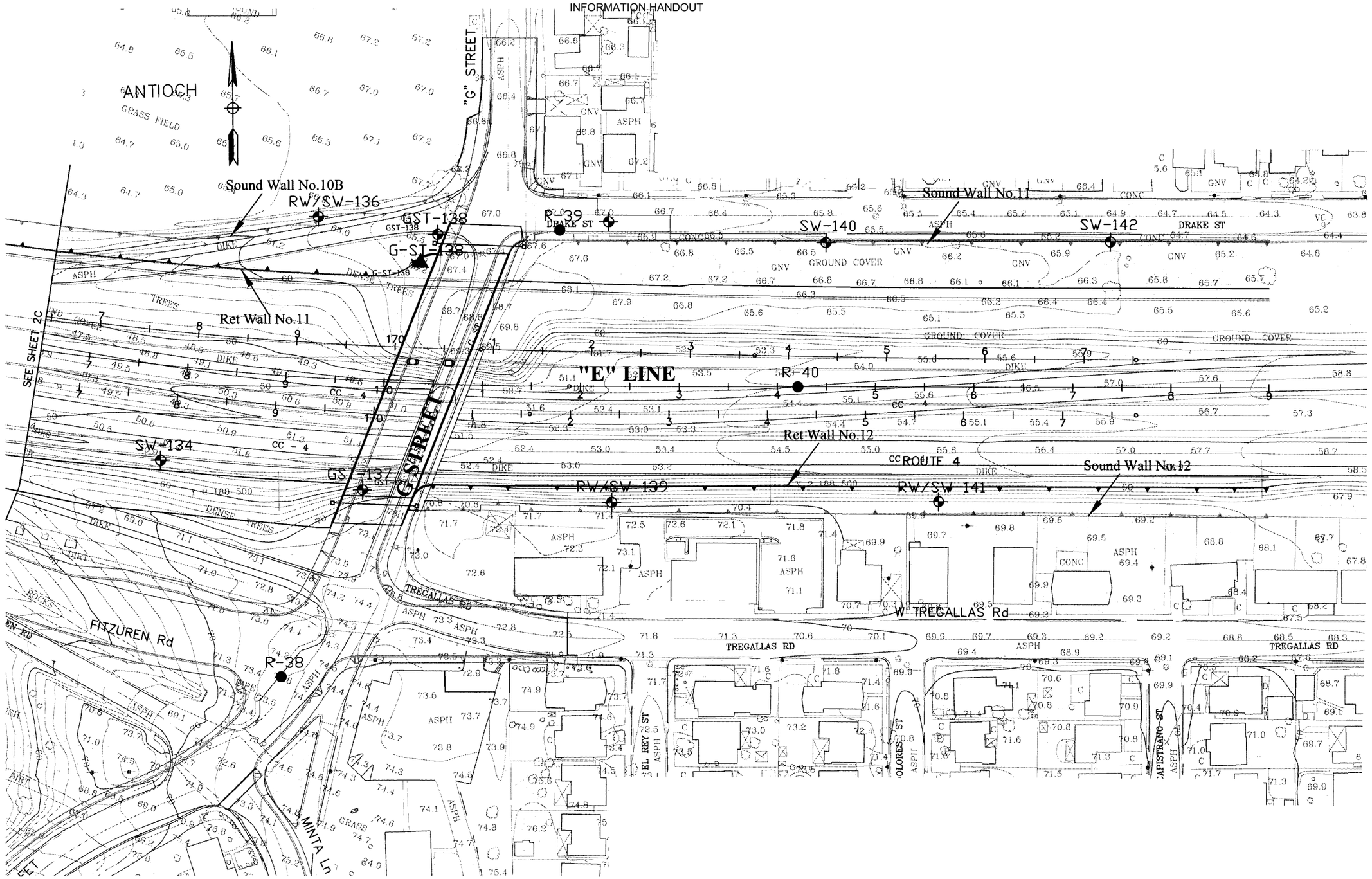
CONTRA LOMA AND G STREET INTERCHANGES
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.:206118.GDR

PLATE NO: 2C



LEGEND

SW-134 — Approx. Boring Location

R-38 — Approx. R-Value Boring Location

G-ST-138 — Approx. CPT Location

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers / Surveyors / Planners

SITE PLAN

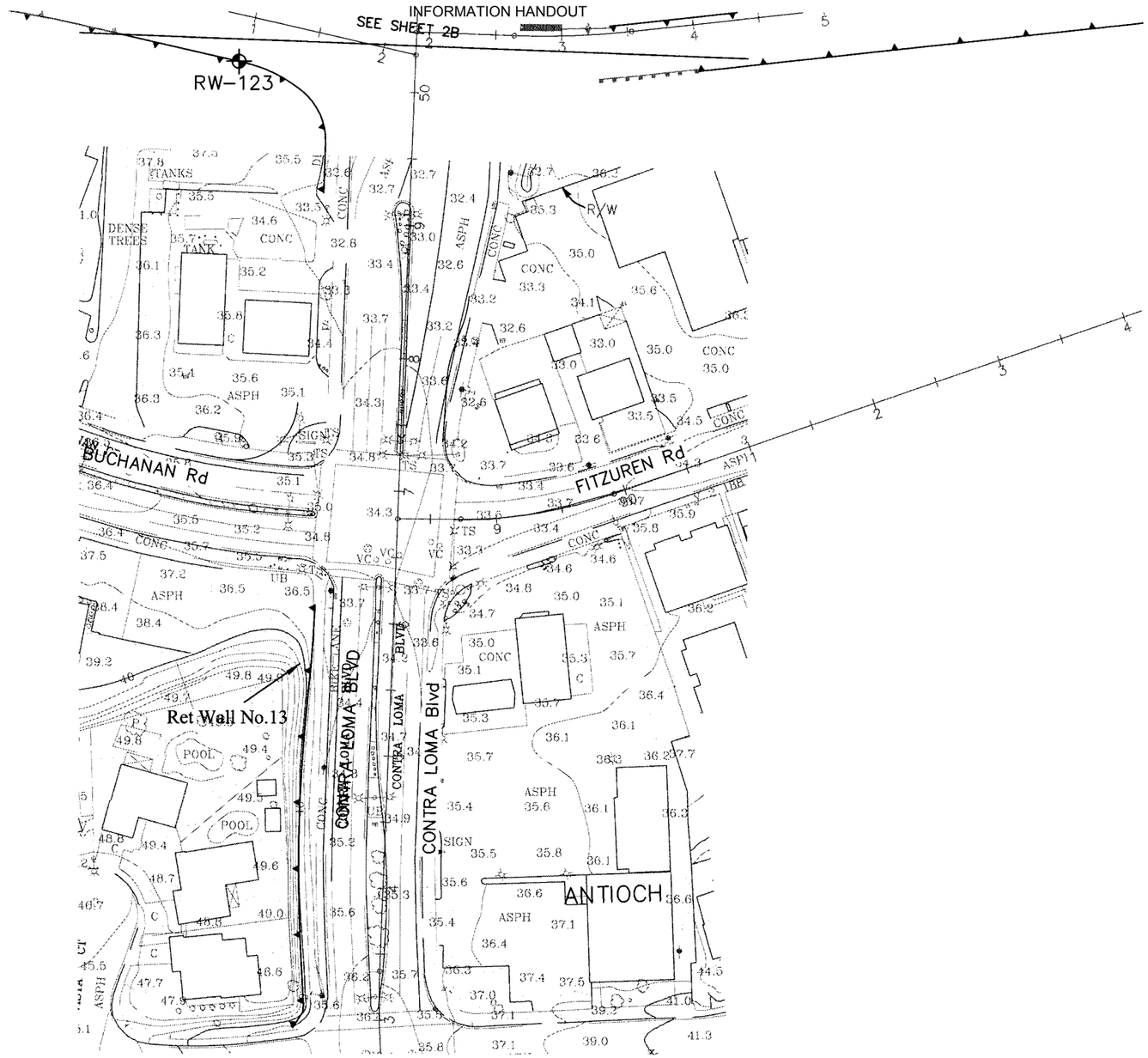
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

CONTRA LOMA AND G STREET INTERCHANGES
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.:206118.GDR

PLATE NO: 2D

INFORMATION HANDOUT



SITE PLAN

LEGEND

RW-123 Approx. Boring Location

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers / Surveyors / Planners

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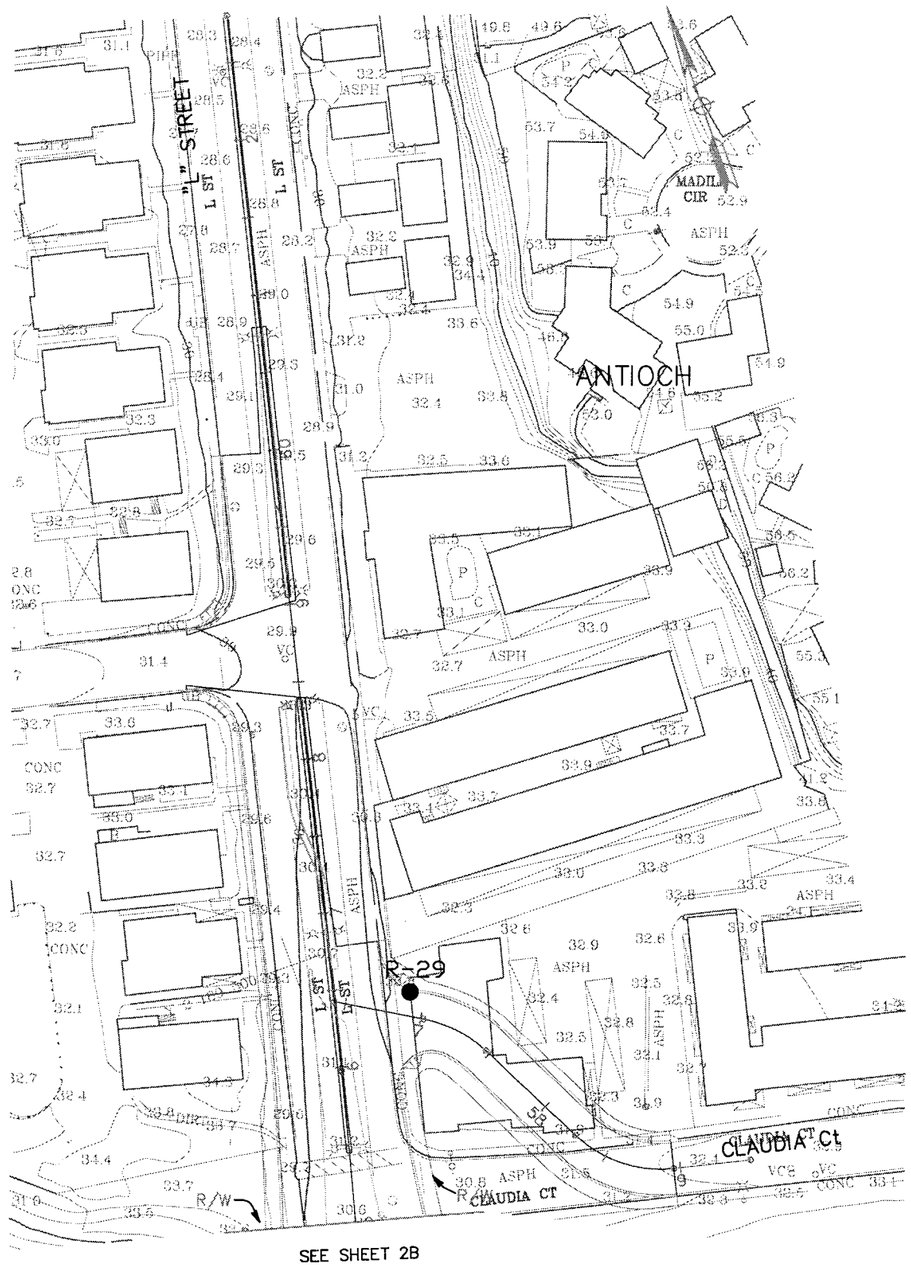
MATERIALS ENGINEERING

CONTRA LOMA AND G STREET INTERCHANGES
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.:206118.GDR | PLATE NO: 2E



SEE SHEET 2B

SITE PLAN

LEGEND

R–29 Approx. R-Value Boring Location

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by BKF Engineers / Surveyors / Planners

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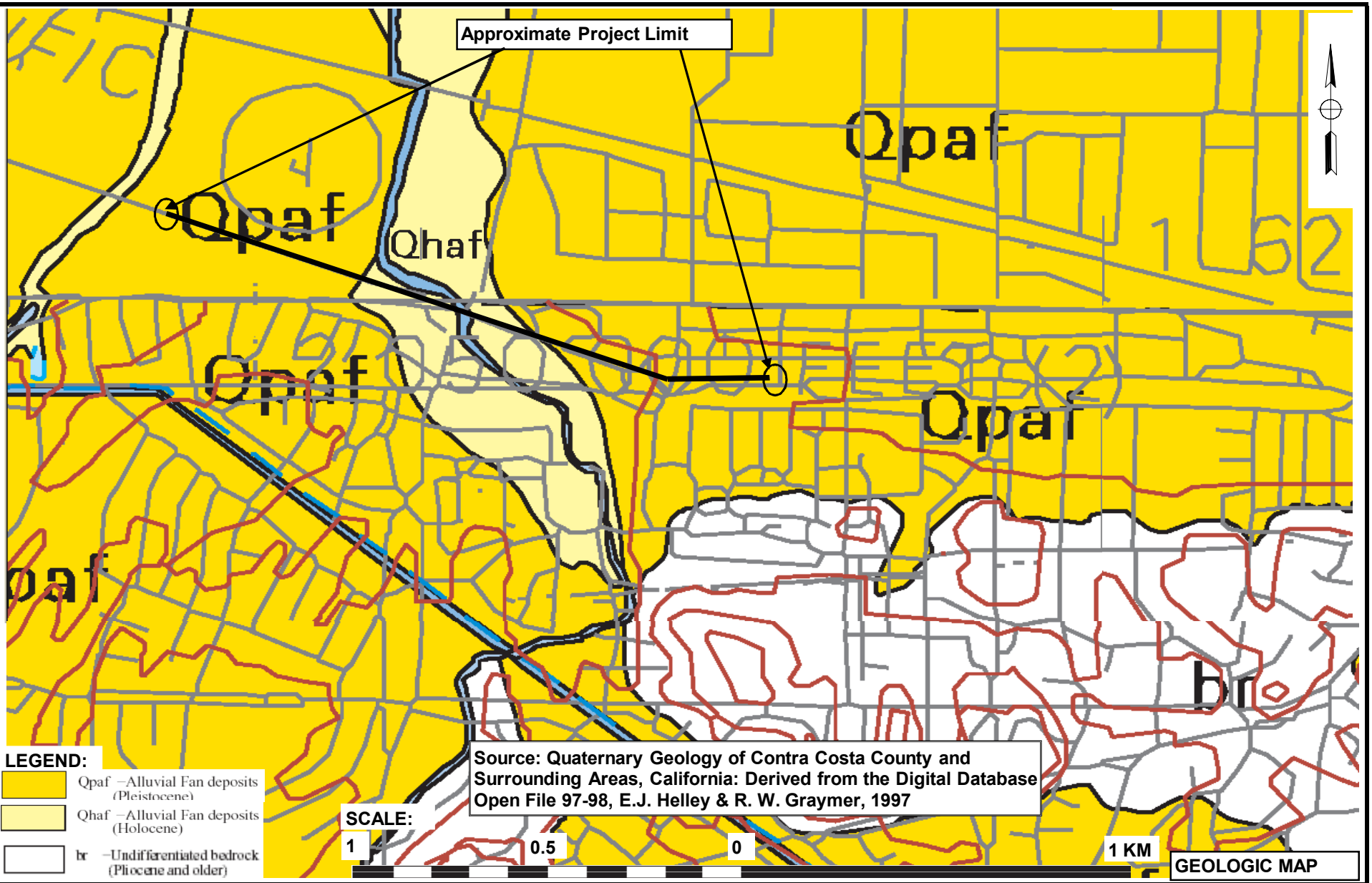
CONTRA LOMA AND G STREET INTERCHANGES
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.:206118.GDR | PLATE NO.:2F



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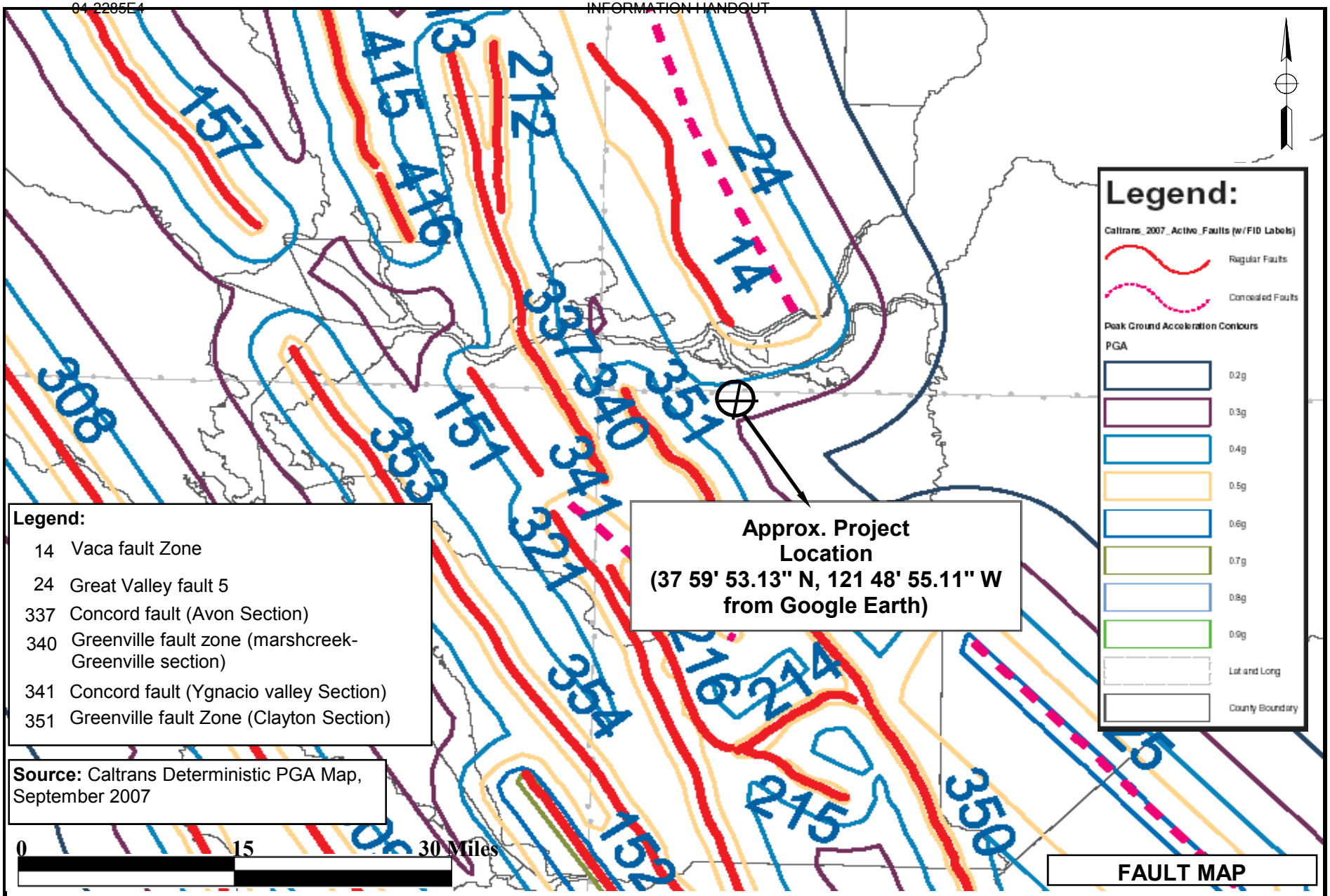
MATERIALS TESTING

CONTRA LOMA AND G STREET INTERCHANGES
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.: 206118.GDR	PLATE NO.: 3



Legend:

14	Vaca fault Zone
24	Great Valley fault 5
337	Concord fault (Avon Section)
340	Greenville fault zone (marshcreek-Greenville section)
341	Concord fault (Ygnacio valley Section)
351	Greenville fault Zone (Clayton Section)

Source: Caltrans Deterministic PGA Map, September 2007

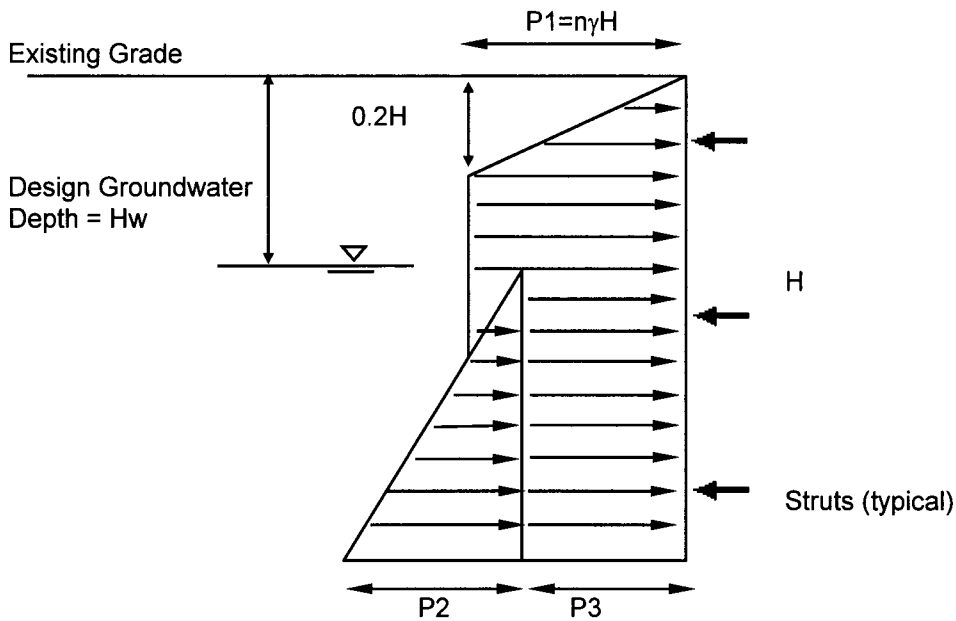
FAULT MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

CONTRA LOMA AND G STREET INTERCHANGES
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.: 206118.GDR | **PLATE NO.: 4**

LATERAL EARTH PRESSURE DIAGRAM FOR SHORING DESIGN



H = Excavation Depth in feet

P1 = nγH = 0.3(125)H = 37.5H psf

P2 = 62.4 (H-Hw) psf

P3 = n(γHw + γ'(H - Hw)) psf

γ = 125 pcf (Total Unit Weight)

γ' = 65 pcf (Buoyant Unit Weight)

1. The pressure diagram is based on average soil and groundwater conditions.
2. Lateral earth pressure should be checked where conditions are different.
3. All relevant surcharge loads including construction operation should be added for designing the shoring system.

LATERAL EARTH PRESSURE DIAGRAM FOR SHORING DESIGN

PARIKH

Practicing in the Geosciences

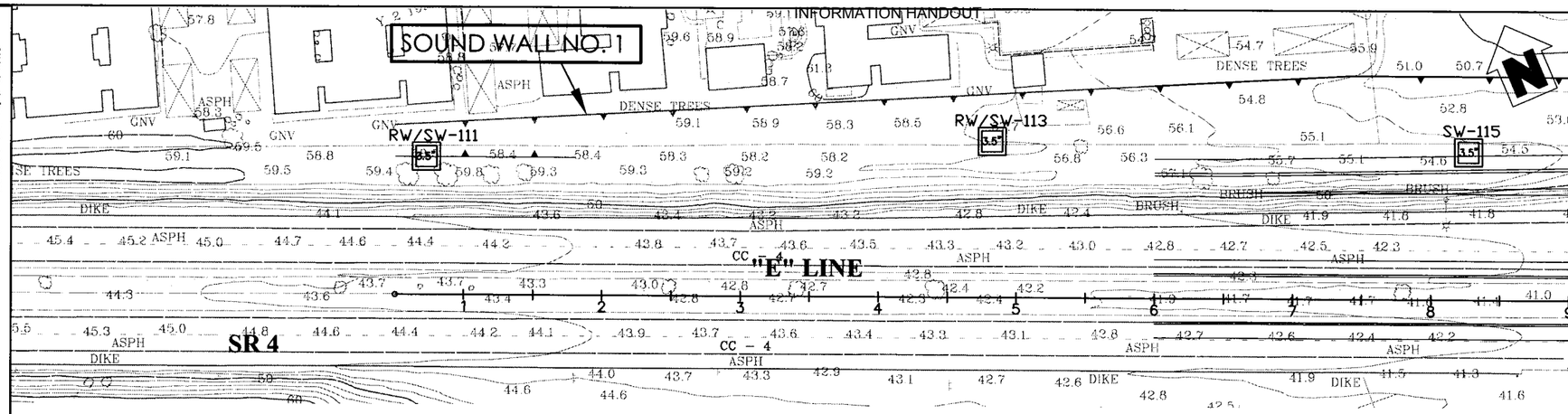
CONTRA LOMA AND G STREET INTERCHANGES
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.: 206118.GDR	PLATE NO. 5

APPENDIX A

04-2285E4

INFORMATION HANDOUT



PLAN
1"=50'

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4	26.5/27.5		

REGISTERED ENGINEER-GEOTECHNICAL

PLANS APPROVAL DATE

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PLEASANT HILL, CA 94523

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

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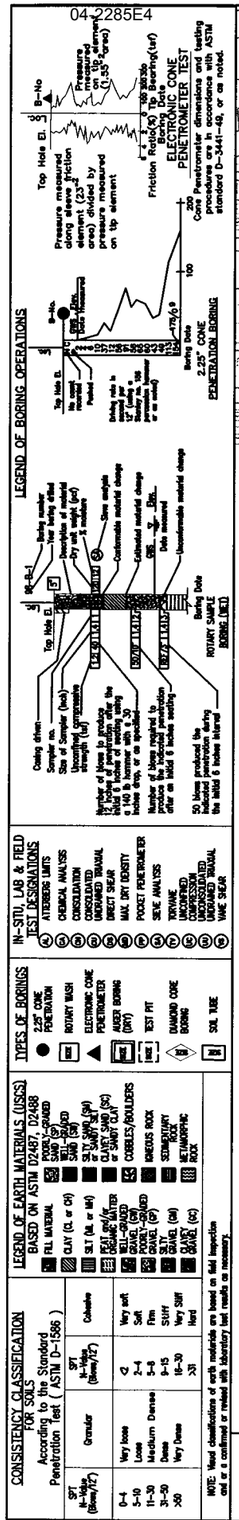
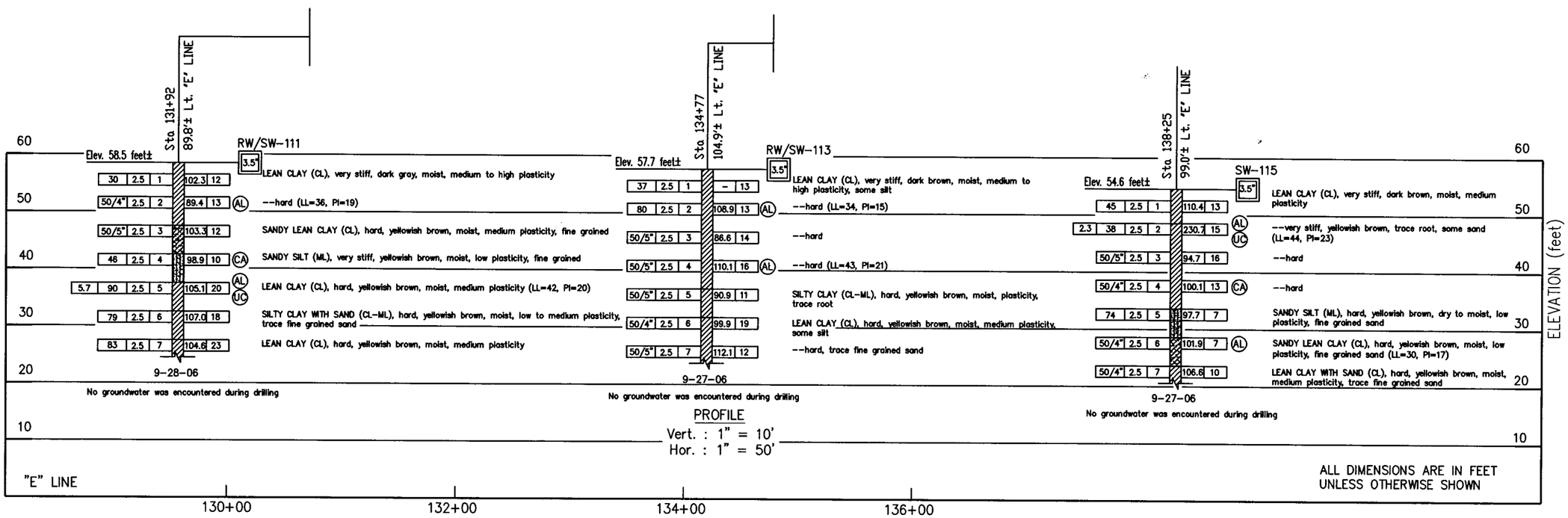
Note:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)





DESIGN OVERSIGHT	DRAWN By: D. GOUTHIER	Field investigation by: L.S. BHANGOO	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR PROJECT ENGINEER	STRUCTURE NO. / POST MILES (PM)
SIGN OFF DATE	CHECKED By: P. SIRCAR				

CONTRA LOMA AND G STREET INTERCHANGES

LOG OF TEST BORINGS

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 4 5

CU 04275
EA 2285E1

DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES (PRELIMINARY STAGE ONLY) ~~09/21/09~~ 03/08/10

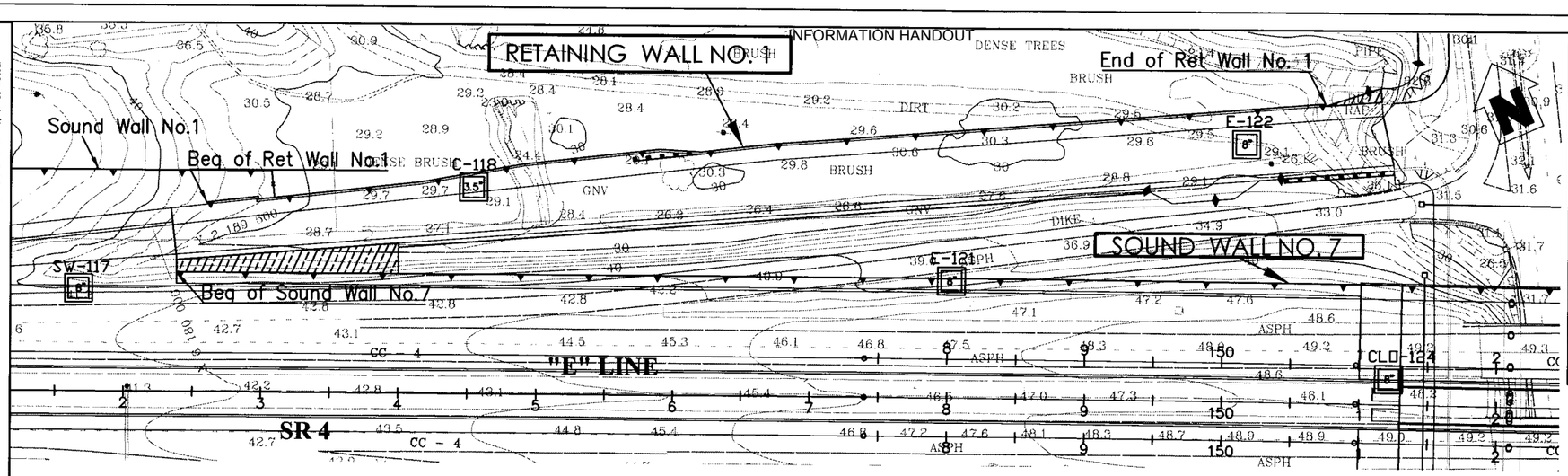
SHEET OF

PAGE 210

PLATE A-1

04-2285E4

INFORMATION HANDOUT



PLAN
1"=50'

Note:
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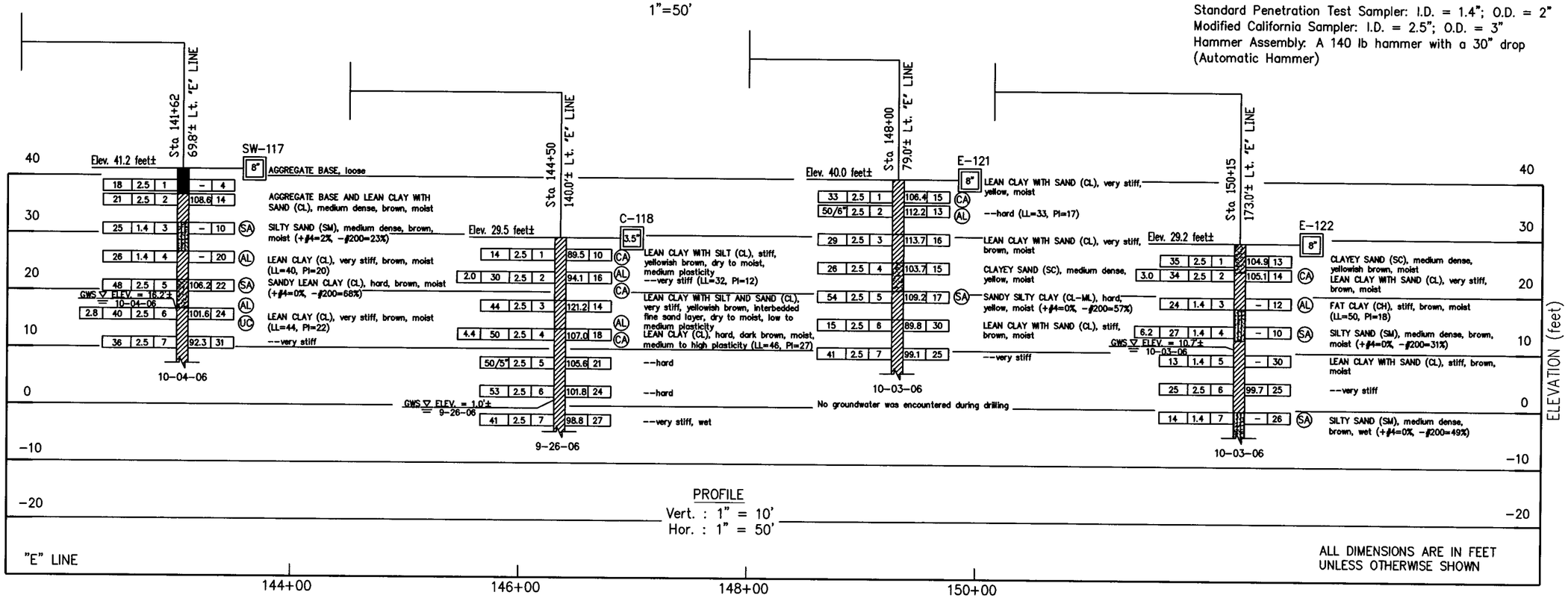
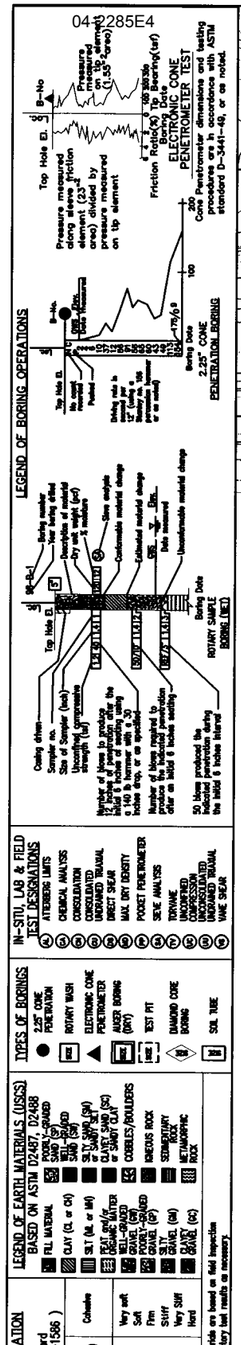
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

Note: See Plate A-12 for log of test boring of CLO-124



DISTRICT	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4	26.5/27.5		

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PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. G.E. 666 Exp. 12/31/11 GEOTECHNICAL STATE OF CALIFORNIA

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PLEASANTON, CA 94588

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SIGN OFF DATE

DRAWN By: D. GOUTHIER

CHECKED By: P. SIRCAR

Field Investigation by: L.S. BHANGOO

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

P. SIRCAR
PROJECT ENGINEER

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 4 5

CU 04275
EA 2285E1

STRUCTURE NO.

POST MILES (PM)

DISREGARD PRINTS BEARING EARLIER REVISION DATES

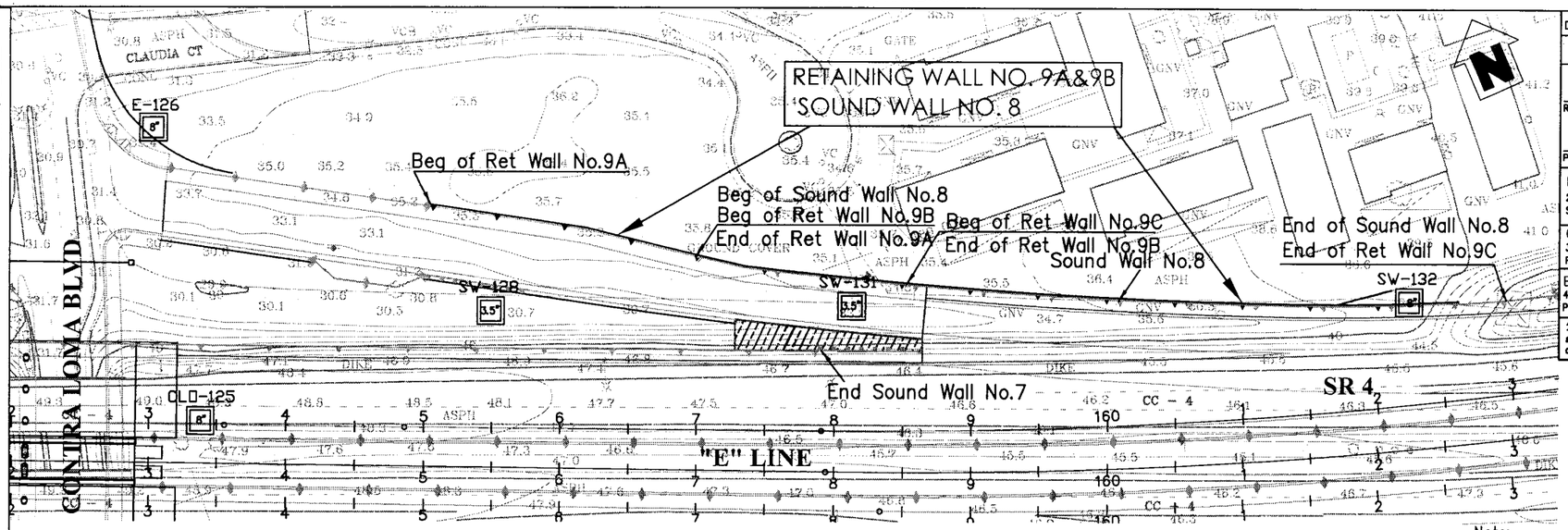
REVISION DATES (PRELIMINARY STAGE ONLY) 09/21/09 03/08-10

CONTRA LOMA AND G STREET INTERCHANGES

LOG OF TEST BORINGS

PAGE SHEET OF

PLATE A-2



PLAN
1"=50'

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4	26.5/27.5		

REGISTERED ENGINEER-GEOTECHNICAL

PLANS APPROVAL DATE

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Note:
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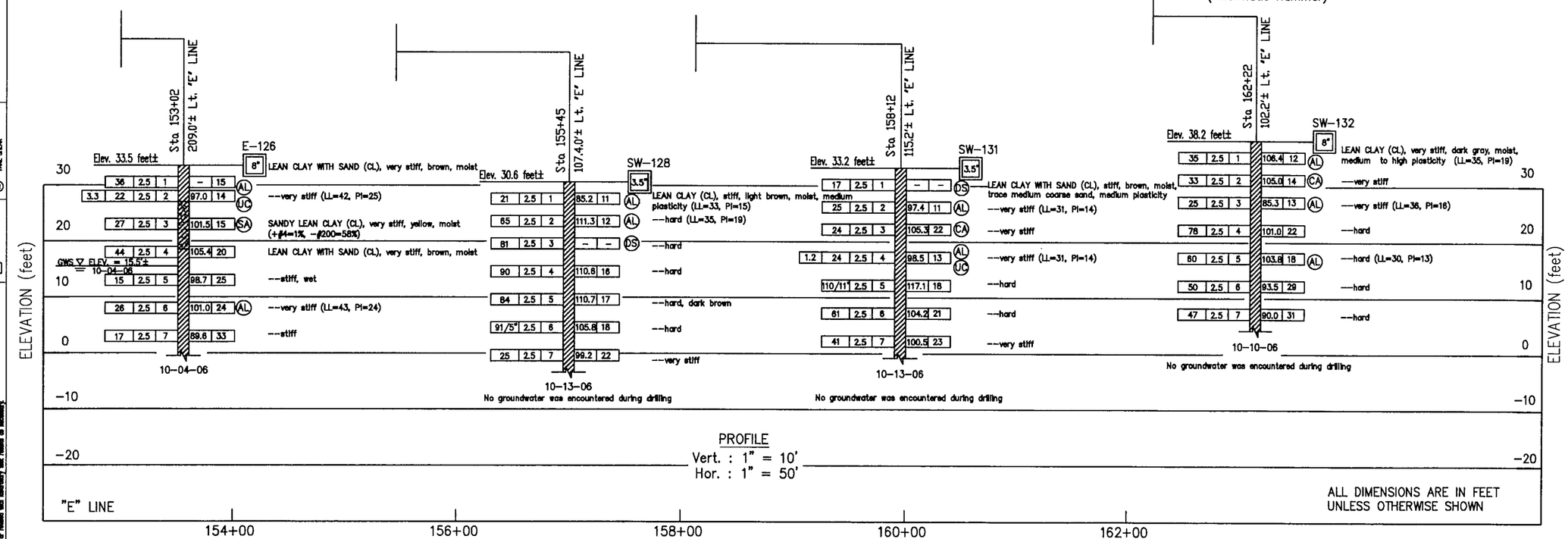
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

DESIGN OVERSIGHT	DRAWN By: D. GOUTHIER	Field investigation by: L.S. BHANGOO	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
SIGN OFF DATE	CHECKED By: P. SIRCAR		P. SIRCAR PROJECT ENGINEER

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 4 5

CU 04275
EA 2285E1

STRUCTURE NO.

POST MILES (PM)

CONTRA LOMA AND G STREET INTERCHANGES

LOG OF TEST BORINGS

DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES (PRELIMINARY STAGE ONLY) 09/21/09 03/08/10 | SHEET | OF

INFORMATION HANDOUT

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4	26.5/27.5		

REGISTERED ENGINEER-GEOTECHNICAL

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. G.E. 666 Exp. 12/31/11 GEOTECHNICAL STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
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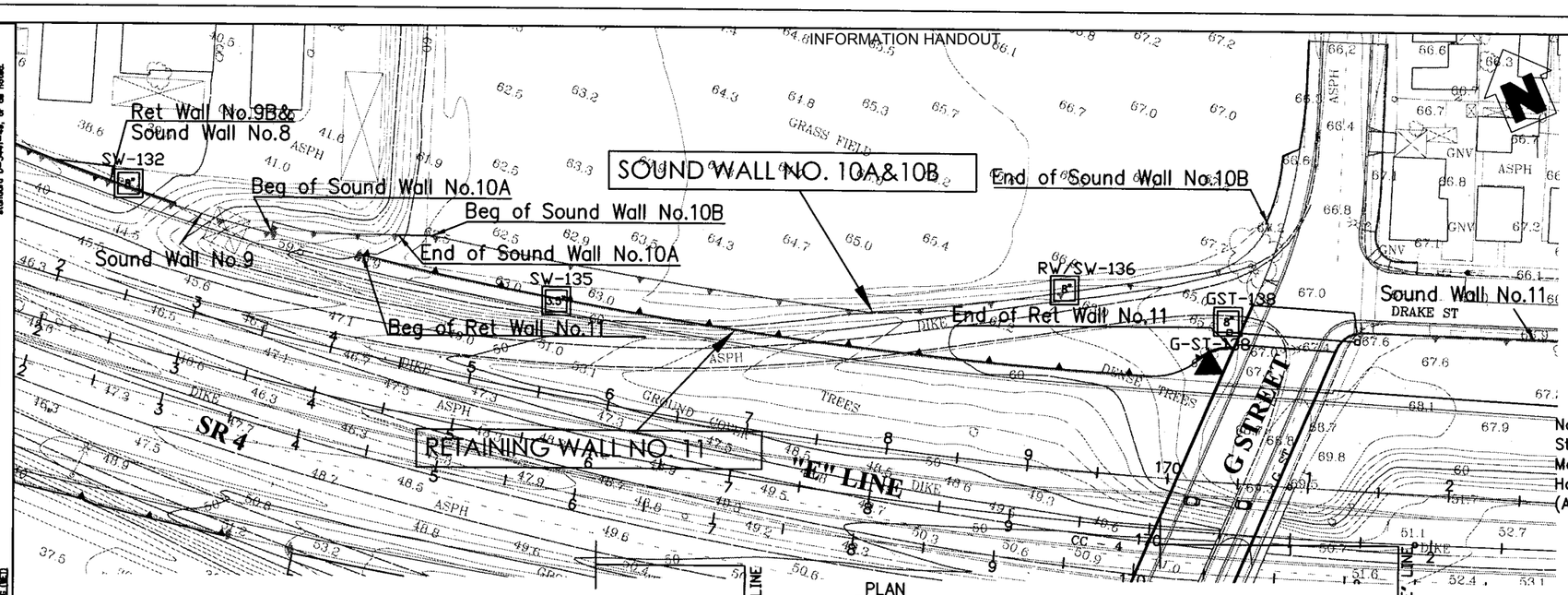
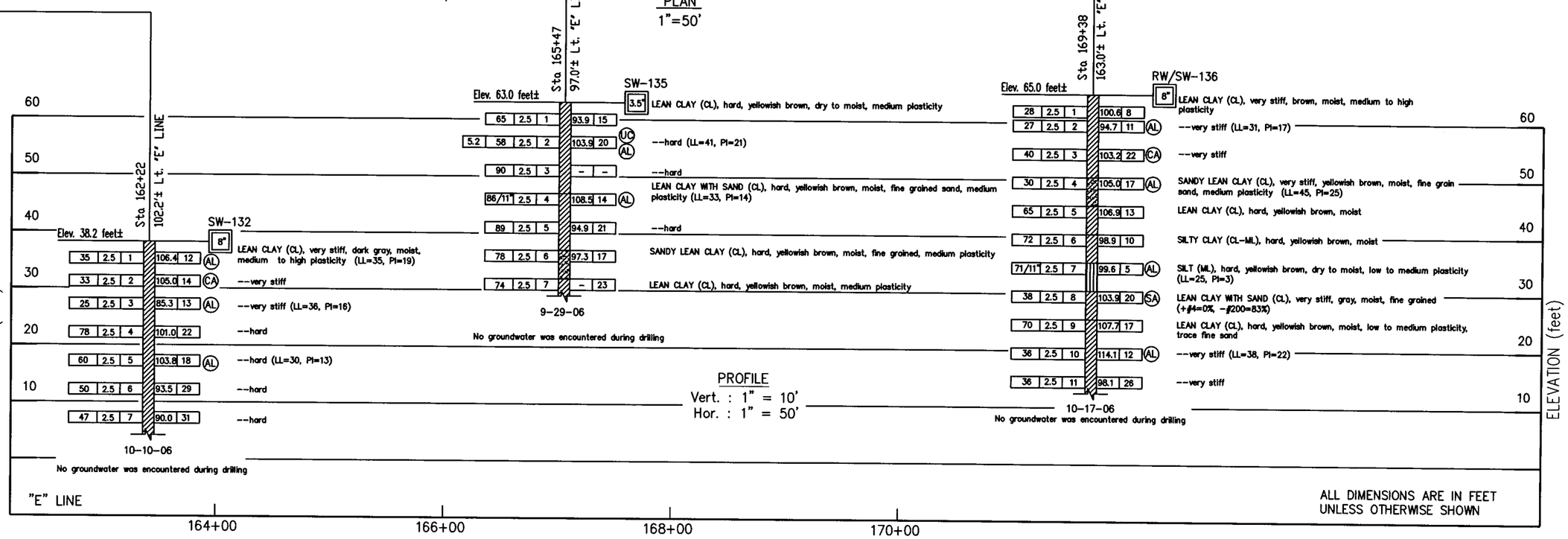
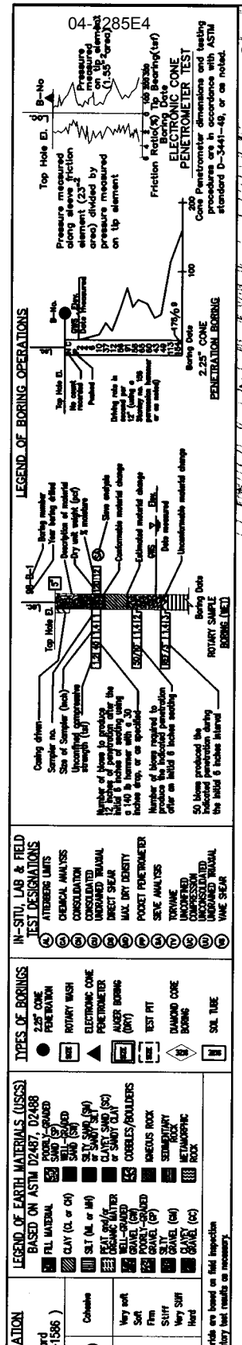


PLAN
1"=50'

Note:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)



Note: See Plate A-13 for log of test boring of GST-138 and G-ST-138



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SIGN OFF DATE	CHECKED By: P. SIRCAR		P. SIRCAR PROJECT ENGINEER

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 4 5

CU 04275
EA 2285E1

STRUCTURE NO.
POST MILES (PM)

CONTRA LOMA AND G STREET INTERCHANGES

LOG OF TEST BORINGS

DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES (PRELIMINARY STAGE ONLY) 09/21/09 03/08/10

PLATE A-4

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4	26.5/27.5		

REGISTERED ENGINEER-GEOTECHNICAL

PLANS APPROVAL DATE

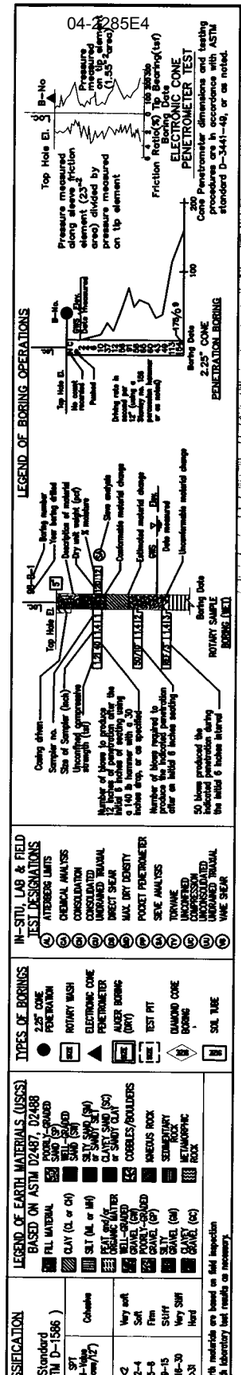
REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. GE 666 Exp. 12/31/11 GEOTECHNICAL STATE OF CALIFORNIA

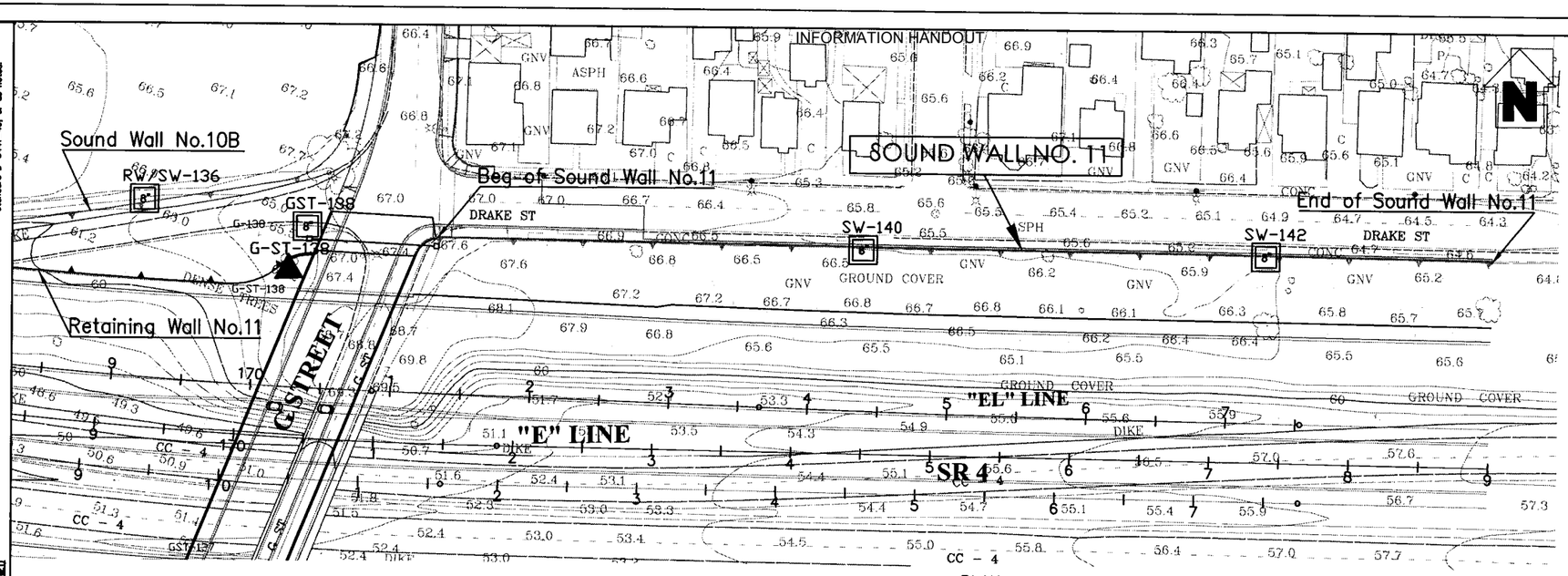
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE CA 95131

CCTA
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

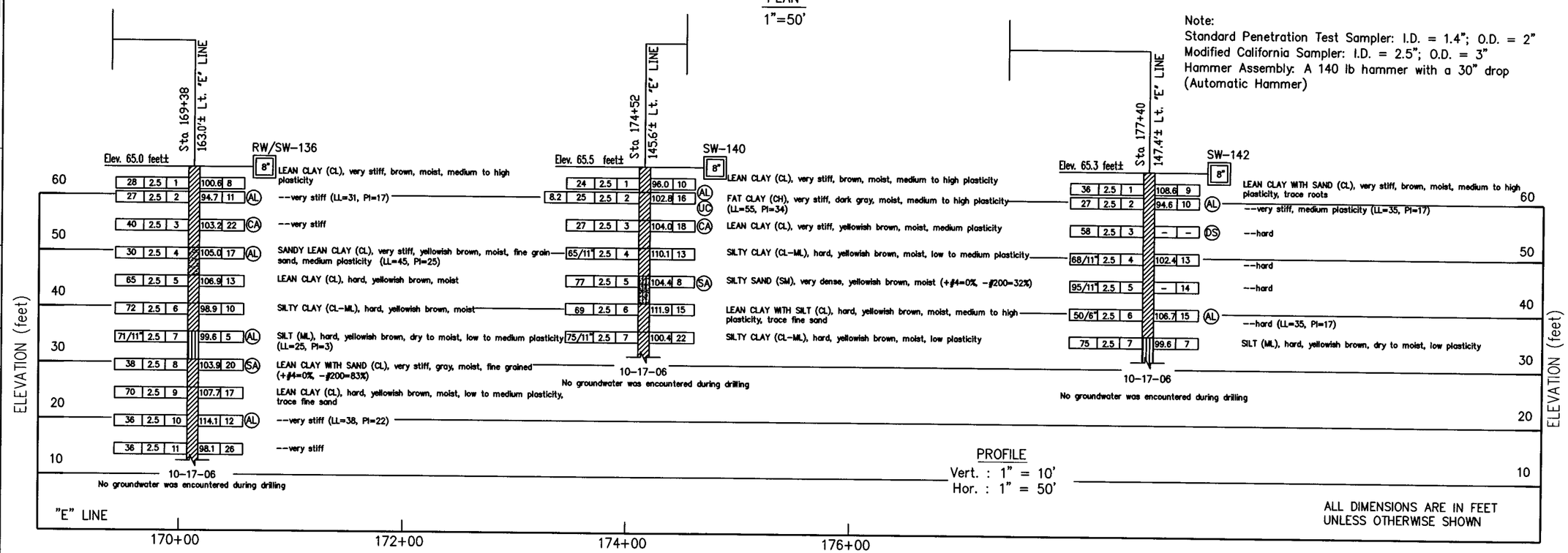
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.





PLAN
1"=50'

Note:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

Note: See Plate A-13 for log of test boring of GST-138 and G-ST-138

DESIGN OVERSIGHT	DRAWN By: D. GOUTHIER	Field Investigation by: L.S. BHANGOO	P. SIRCAR PROJECT ENGINEER
SIGN OFF DATE	CHECKED By: P. SIRCAR		

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 4 5

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

CU 04275
EA 2285E1

STRUCTURE NO.

POST MILES (PM)

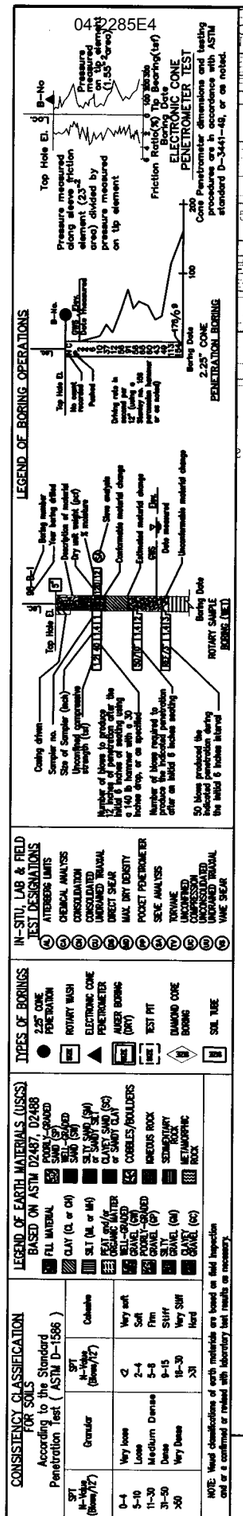
CONTRA LOMA AND G STREET INTERCHANGES

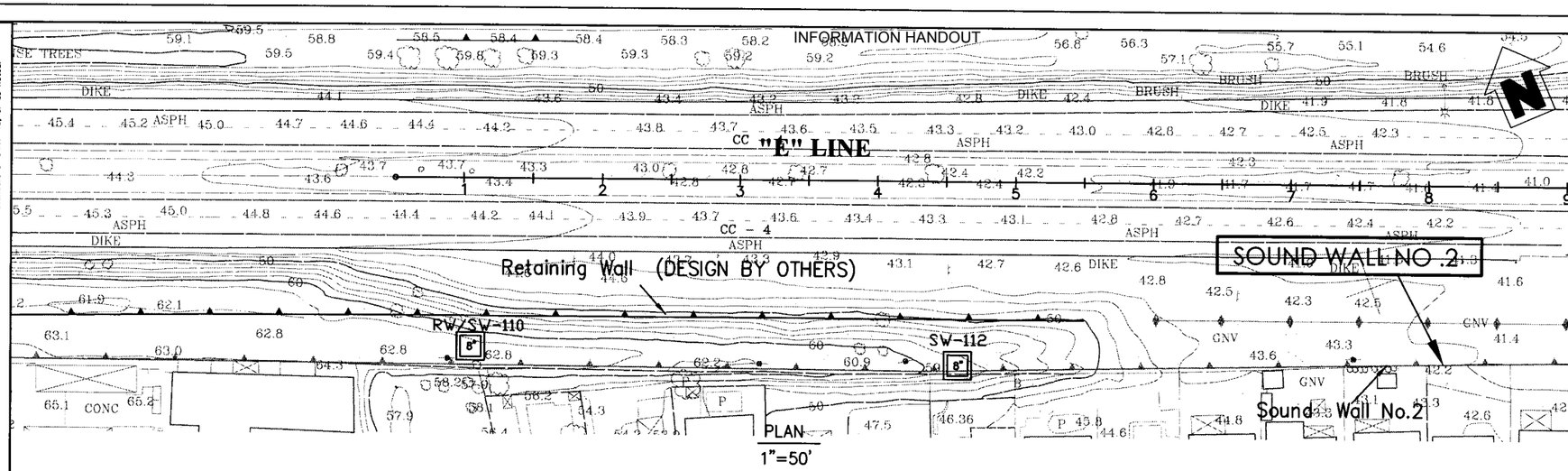
LOG OF TEST BORINGS

DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES (PRELIMINARY STAGE ONLY) 09/21/09 03/08/10 SHEET OF

PLATE A-5

0422285E4





DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4	26.5/27.5		

REGISTERED ENGINEER-GEOTECHNICAL

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. GE 666 Exp. 12/31/11 GEOTECHNICAL STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE CA 95131

CCTA
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

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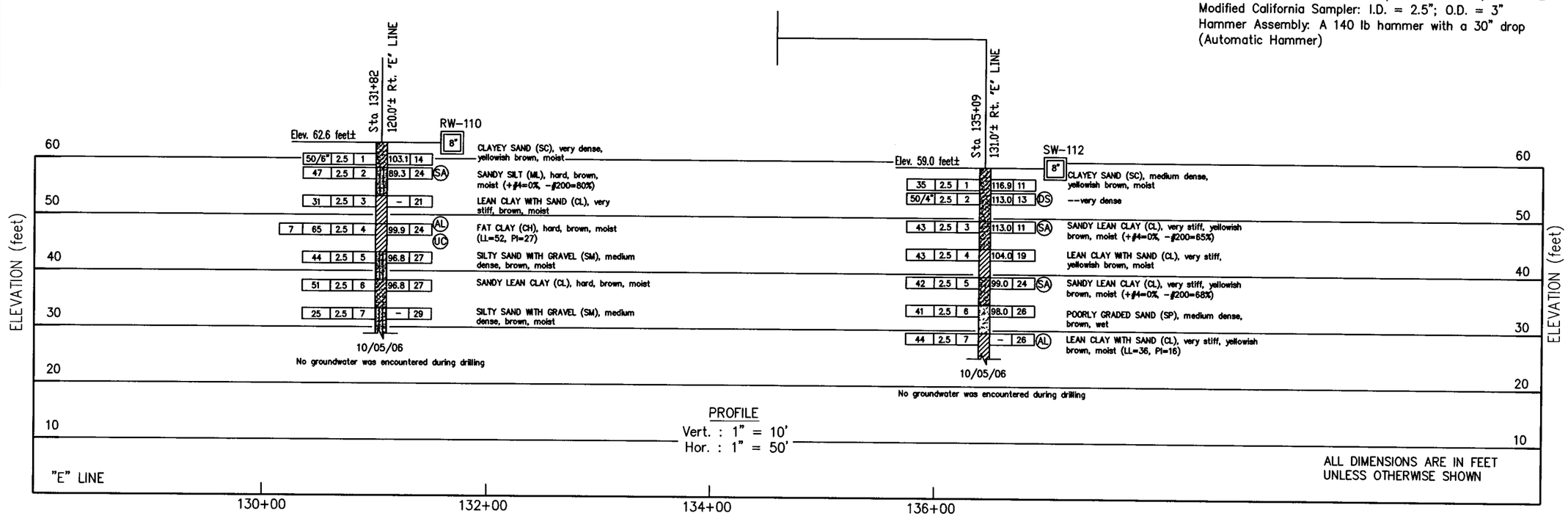
Note:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)



ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN By: O. GOUTHIER

CHECKED By: P. SIRCAR

Field Investigation by: L.S. BHANGOO

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

P. SIRCAR
PROJECT ENGINEER

STRUCTURE NO.

POST MILES (PM)

CONTRA LOMA AND G STREET INTERCHANGES

LOG OF TEST BORINGS

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 4 5

CU 04275
EA 2285E1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 09/21/09 03/08/10

PAGE SHEETS OF

PLATE A-6

04-2285E4

INFORMATION HANDOUT

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4	26.5/27.5		

REGISTERED ENGINEER-GEOTECHNICAL

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. G.E. 666 Exp. 12/31/11 GEOTECHNICAL STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE CA 95131

CCTA
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

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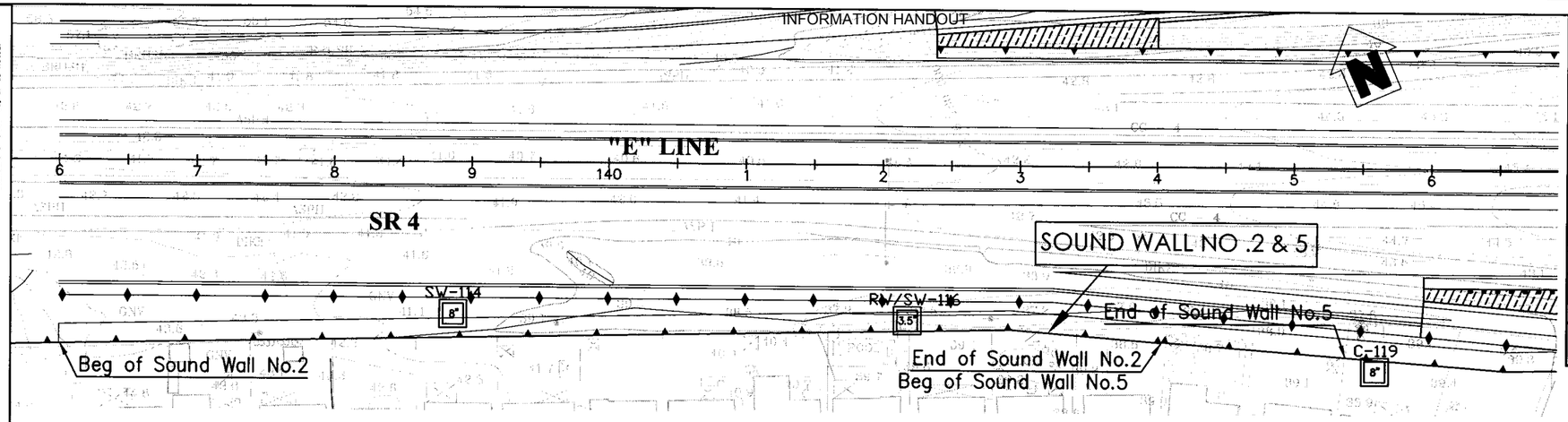

PLAN
1"=50'

Note:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
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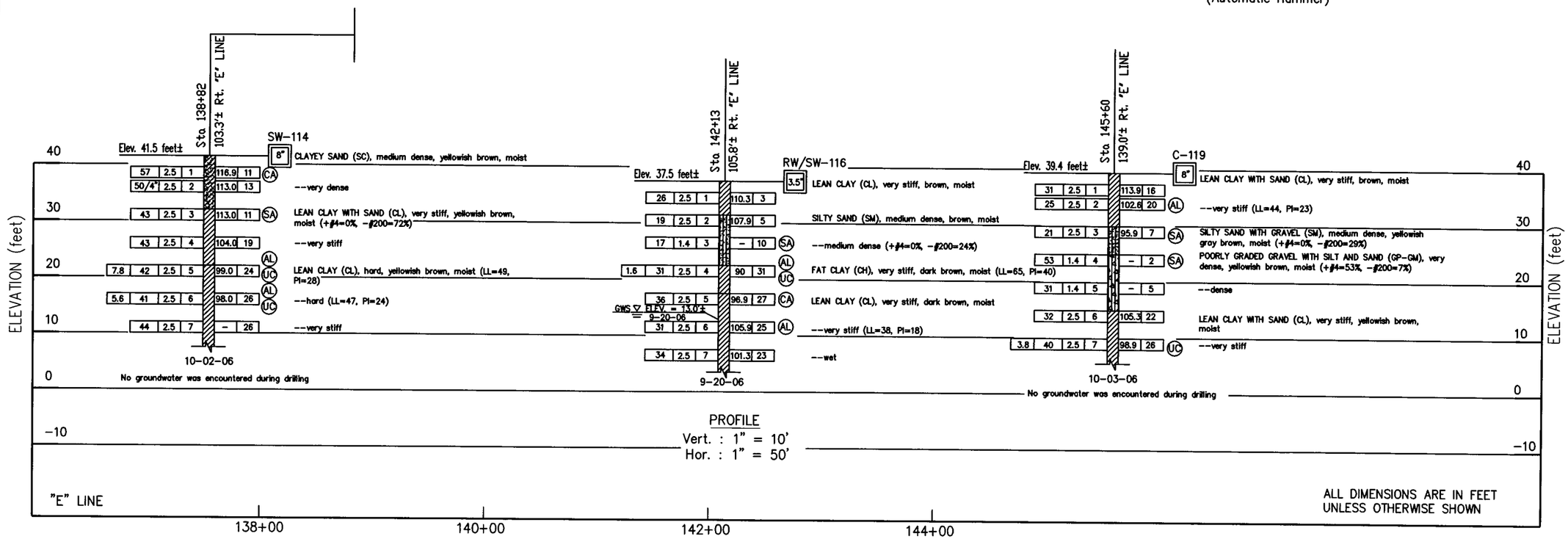
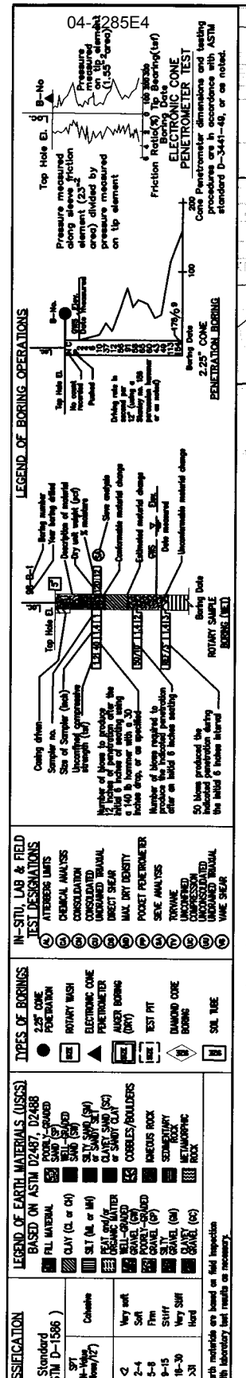


PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN



DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN By: D. GOUTHIER

CHECKED By: P. SIRCAR

Field Investigation by: L.S. BHANGOO

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

P. SIRCAR
PROJECT ENGINEER

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 4 5

CU 04275
EA 2285E1

STRUCTURE NO.

POST MILES (PM)

CONTRA LOMA AND G STREET INTERCHANGES

LOG OF TEST BORINGS

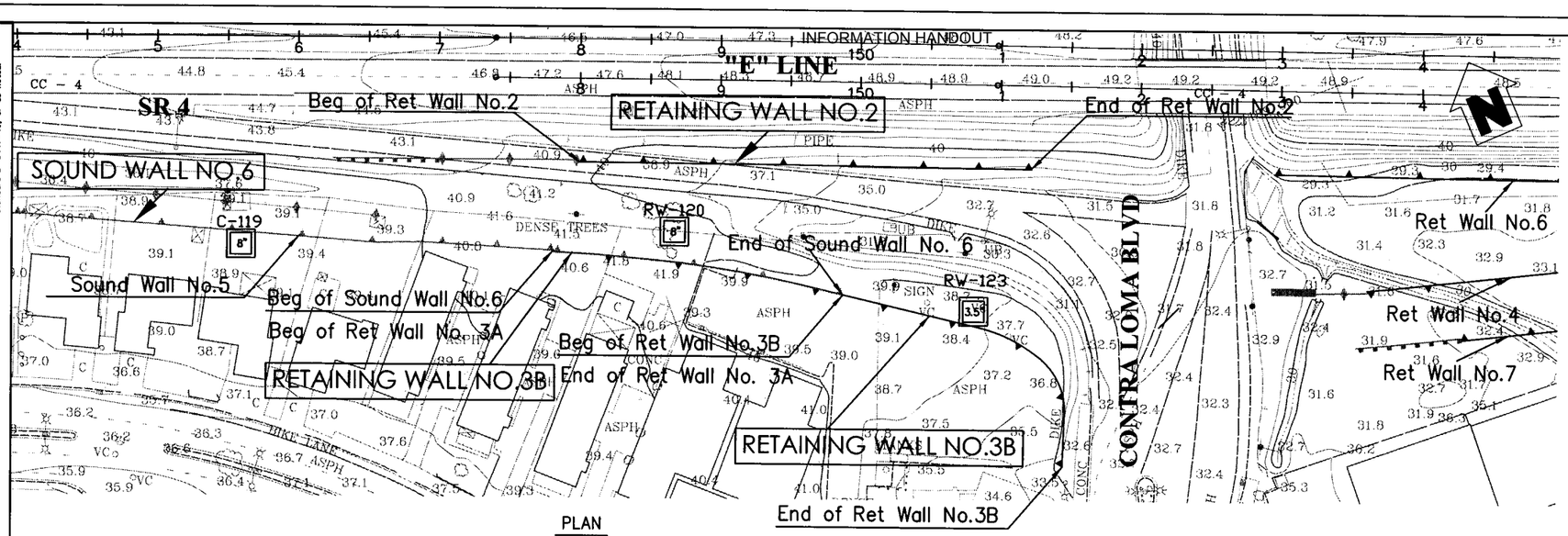
DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 09/21/09 03/08/10

PAGE SHEET OF

PLATE A-7

04-2285E4



PLAN
1"=50'

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4	26.5/27.5		

REGISTERED ENGINEER-GEOTECHNICAL

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. GE 666 Exp. 12/31/11 GEOTECHNICAL STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
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PLEASANT HILL, CA 94523

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

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Note:
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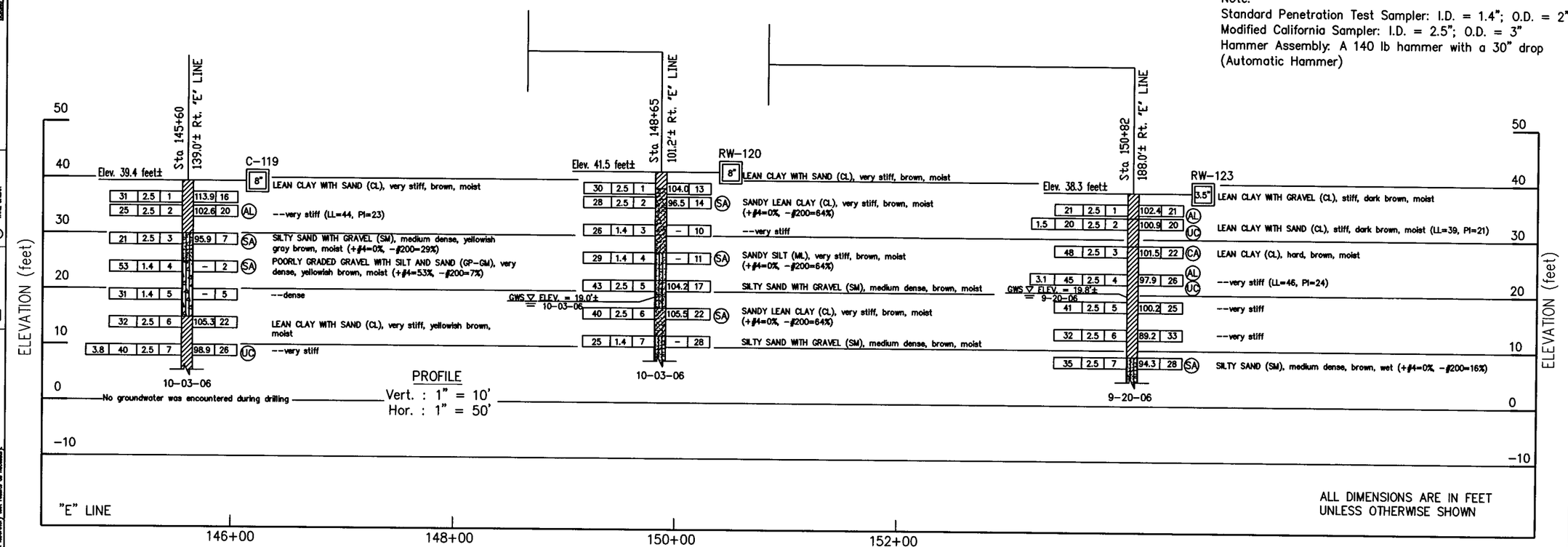


ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

LEGEND OF BORING OPERATIONS

IN-SITU, LAB & FIELD TEST DESIGNATIONS

TYPES OF BORINGS

LEGEND OF EARTH MATERIALS (USCS) BASED ON ASTM D2487, D2488

CONSISTENCY CLASSIFICATION FOR SOILS According to the Standard Penetration Test (ASTM D-1586)

NOTE: Visual classifications of earth materials are based on field inspection and or a combined or revised with laboratory test results as necessary.

DESIGN OVERSIGHT		DRAWN By: D. GOUTHIER	Field Investigation by: L.S. BHANGOO	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	STRUCTURE NO.
SIGN OFF DATE		CHECKED By: P. SIRCAR		P. SIRCAR PROJECT ENGINEER	POST MILES (PM)
			ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 4 5	CU 04275 EA 2285E1	DISREGARD PRINTS BEARING EARLIER REVISION DATES →

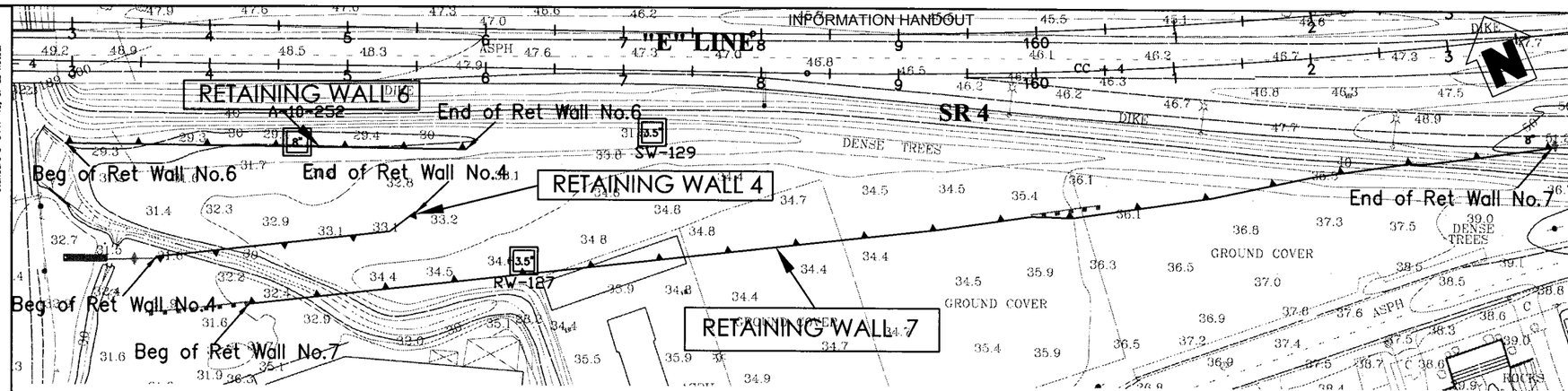
CONTRA LOMA AND G STREET INTERCHANGES

LOG OF TEST BORINGS

REVISION DATES (PRELIMINARY STAGE ONLY) 09/21/09 03/08/10 SHEET OF

PLATE A-8

04-2285E4



DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4	26.5/27.5		

REGISTERED ENGINEER-GEOTECHNICAL

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. GE 666 Exp. 12/31/11 GEOTECHNICAL STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE CA 95131

CCTA
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

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PLAN
1"=50'

Note:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
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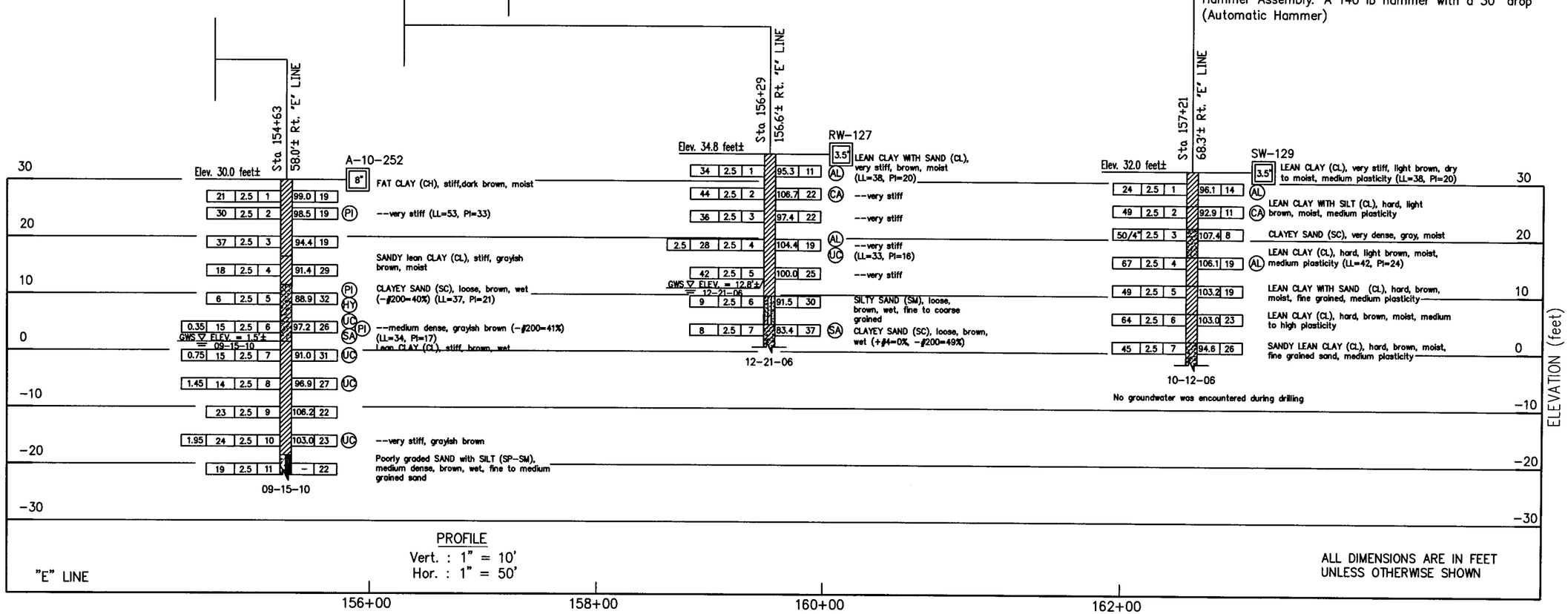


PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

LEGEND OF BORING OPERATIONS

IN-SITU, LAB & FIELD TEST DESIGNATIONS

TYPES OF BORINGS

LEGEND OF EARTH MATERIALS (USCS) BASED ON ASTM D2487, D2488

CONSISTENCY CLASSIFICATION FOR SOILS According to the Standard Penetration Test (ASTM D-1586)

NOTE: Visual classifications of earth materials are based on field inspection and or a combined or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN By: D. GOUTHIER	Field Investigation by: L.S. BHANGOO	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
SIGN OFF DATE	CHECKED By: P. SIRCAR		P. SIRCAR PROJECT ENGINEER

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 4 5

CU 04275
EA 2285E1

STRUCTURE NO.
POST MILES (PM)

CONTRA LOMA AND G STREET INTERCHANGES

LOG OF TEST BORINGS

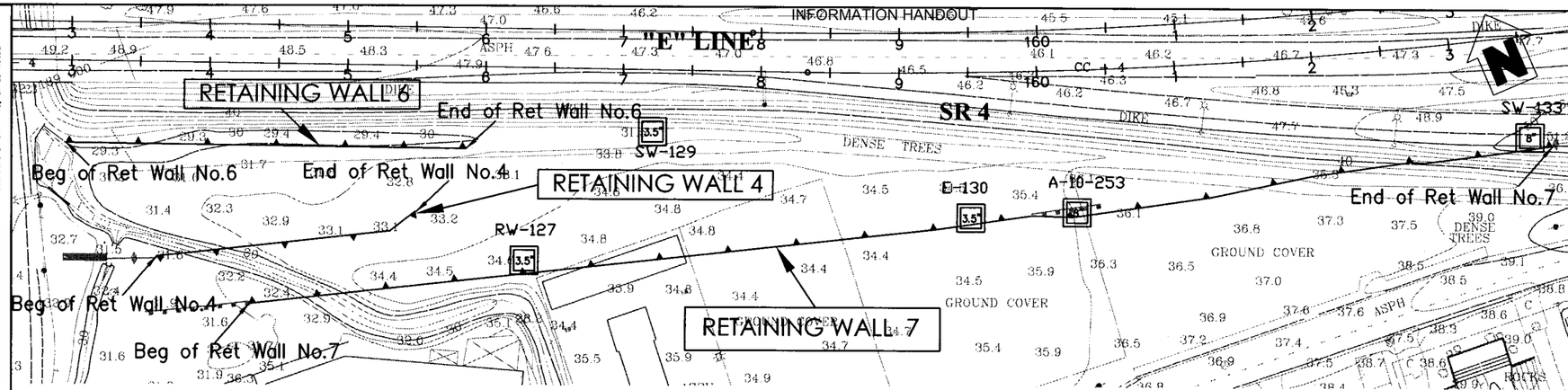
DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 09/21/09 03/08/10

PAGE 6 OF 6

S:\ACAD\206118.GDR\LOTB\Eastbound\LOTB-Plate 6-8-9-10-11 (LT).dwg, RW4-RW6-RW7(Plate-9), 11/30/2010 12:54:10 PM, \\PARIKH-DC\HP LaserJet 5200 PCL 6

04-2285E4



PLAN
1"=50'

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4	26.5/27.5		

REGISTERED ENGINEER-GEOTECHNICAL

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. GE. 666 Exp. 12/31/11 GEOTECHNICAL STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE CA 95131

CCTA
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

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Note:
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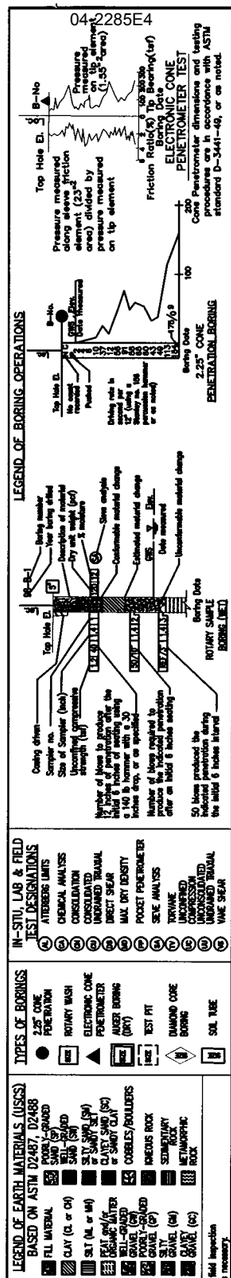

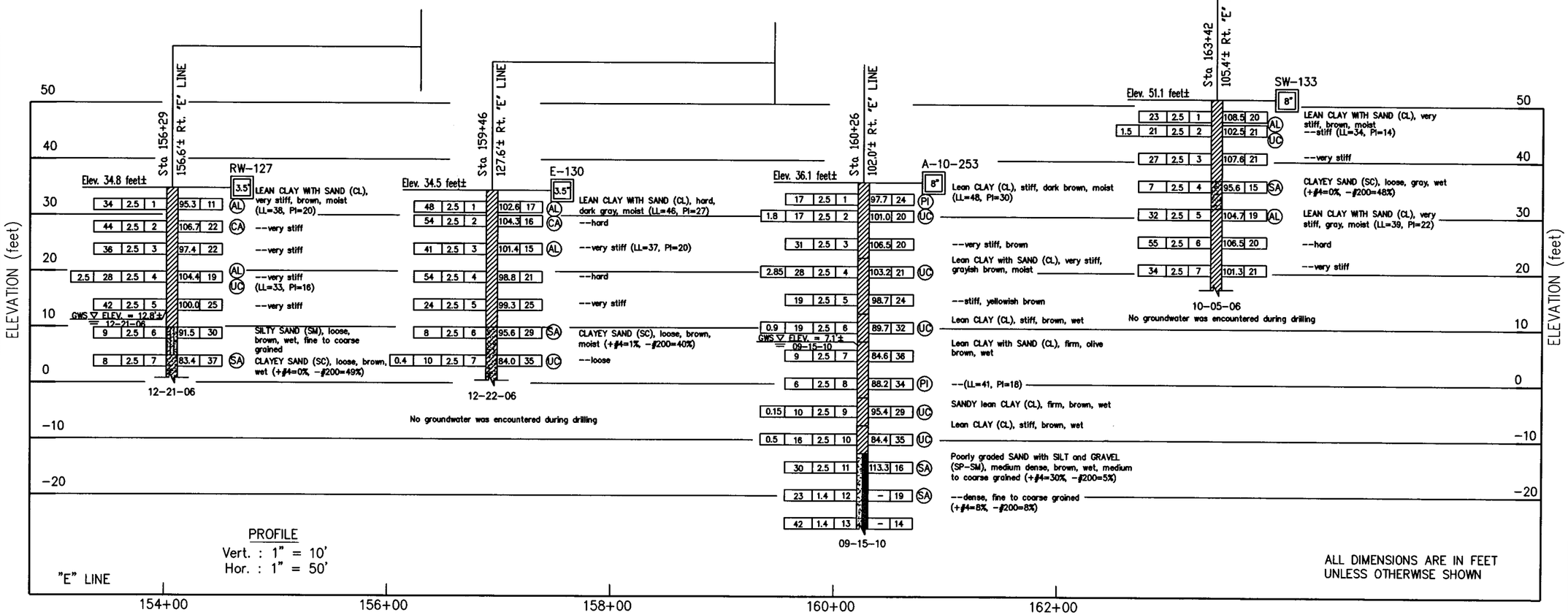

PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

DESIGN OVERSIGHT
SIGN OFF DATE

DRAWN By: D. GOUTHIER
CHECKED By: P. SIRCAR

Field Investigation by: L.S. BHANGOO

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

P. SIRCAR
PROJECT ENGINEER

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 4 5

CU 04275
EA 2285E1

STRUCTURE NO.
POST MILES (PM)

CONTRA LOMA AND G STREET INTERCHANGES

LOG OF TEST BORINGS

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 09/21/09 03/08/10

PAGE SHEET OF

PLATE A-10

04-2285E4

INFORMATION HANDOUT

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4	26.5/27.5		

REGISTERED ENGINEER-GEOTECHNICAL

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. GE 666 Exp. 12/31/11 GEOTECHNICAL STATE OF CALIFORNIA

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2360 QUME DRIVE, SUITE A
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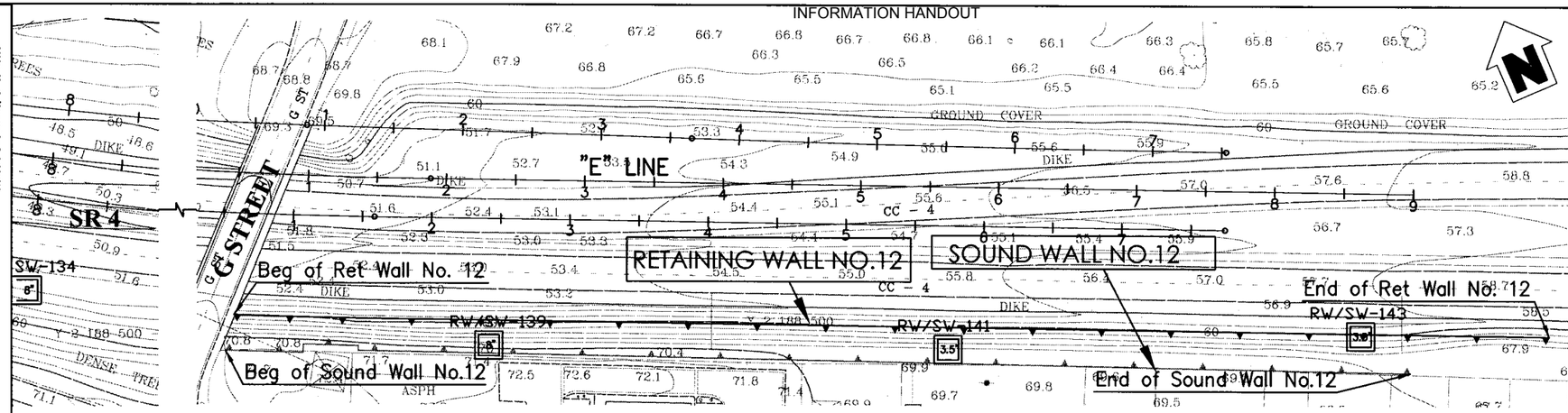

PLAN
1"=50'

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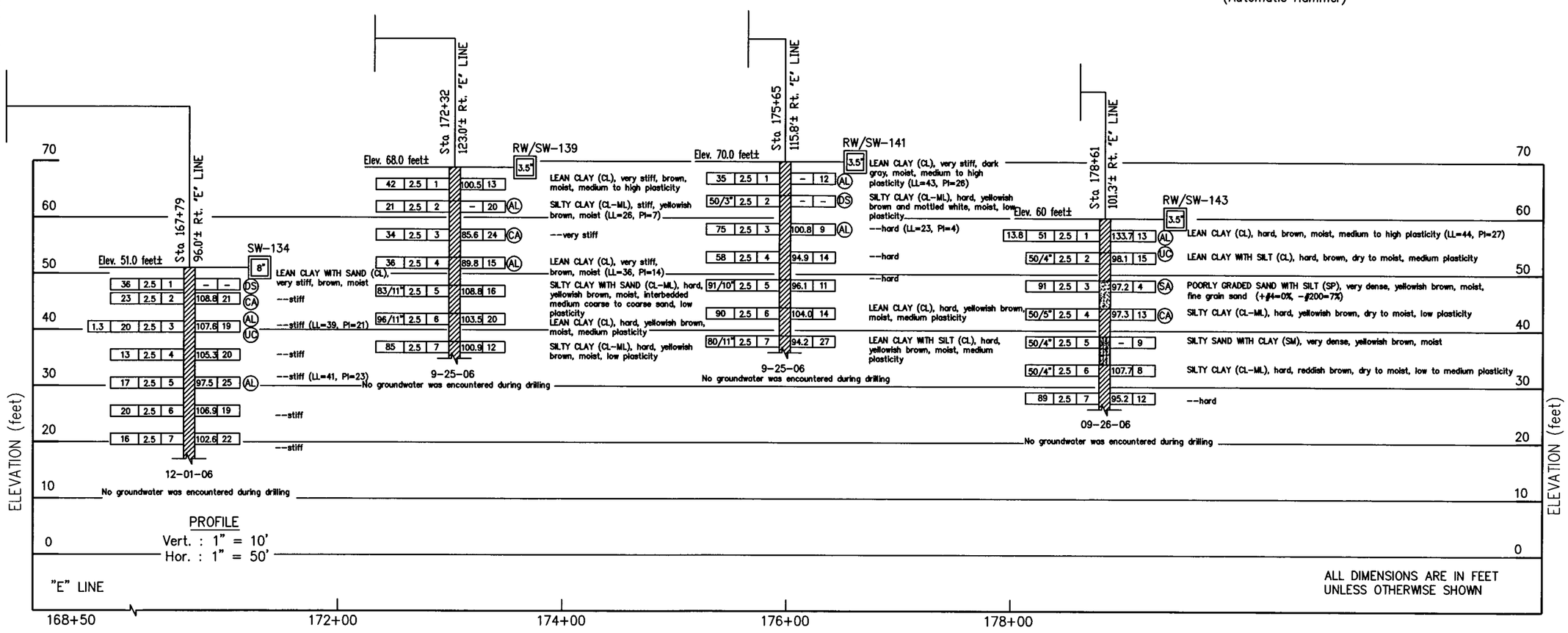


PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

LEGEND OF BORING OPERATIONS

IN-SITU, LAB & FIELD TEST DESIGNATIONS

TYPES OF BORINGS

LEGEND OF EARTH MATERIALS (USCS) BASED ON ASTM D2487, D2488

CONSISTENCY CLASSIFICATION FOR SOILS According to the Standard Penetration Test (ASTM D-1586)

NOTE: Visual classifications of earth materials are based on field inspection and or a confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN By: D. GOUTHIER

CHECKED By: P. SIRCAR

Field Investigation by: L.S. BHANGOO

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

P. SIRCAR
PROJECT ENGINEER

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 4 5

CU 04275
EA 2285E1

STRUCTURE NO.

POST MILES (PM)

CONTRA LOMA AND G STREET INTERCHANGES

LOG OF TEST BORINGS

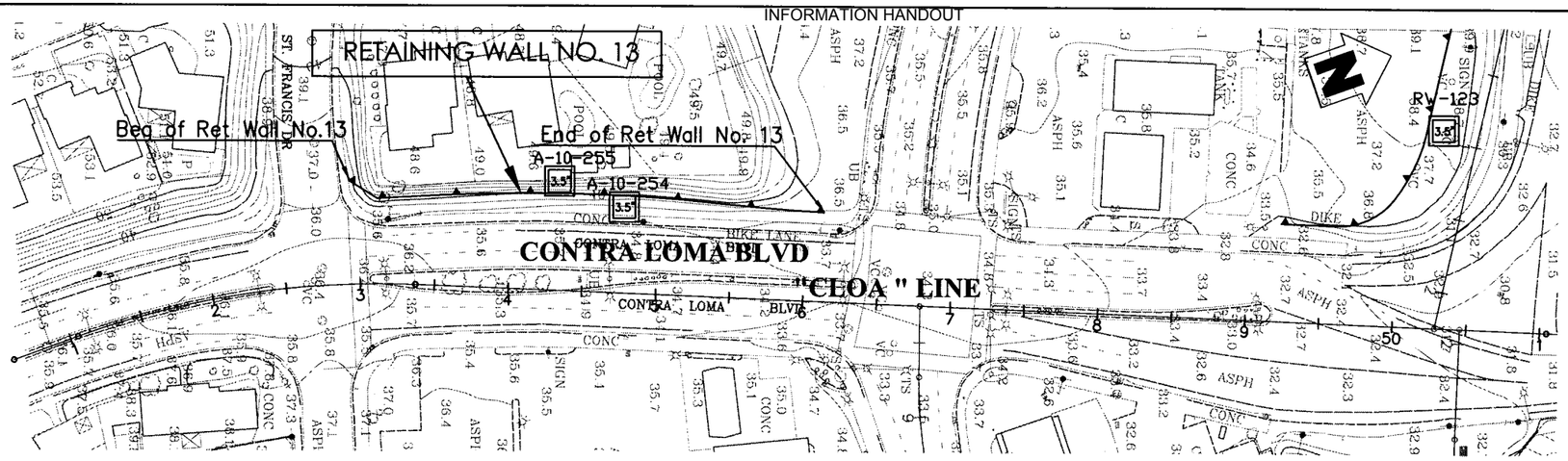
DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 09/21/09 03/08/10

PLATE A-11

04-2285E4

INFORMATION HANDOUT



PLAN
1"=50'

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4	26.5/27.5		

REGISTERED ENGINEER-GEOTECHNICAL

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. GE 666 Exp. 12/31/11 GEOTECHNICAL STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
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PLEASANTON, CA 94588

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Note:
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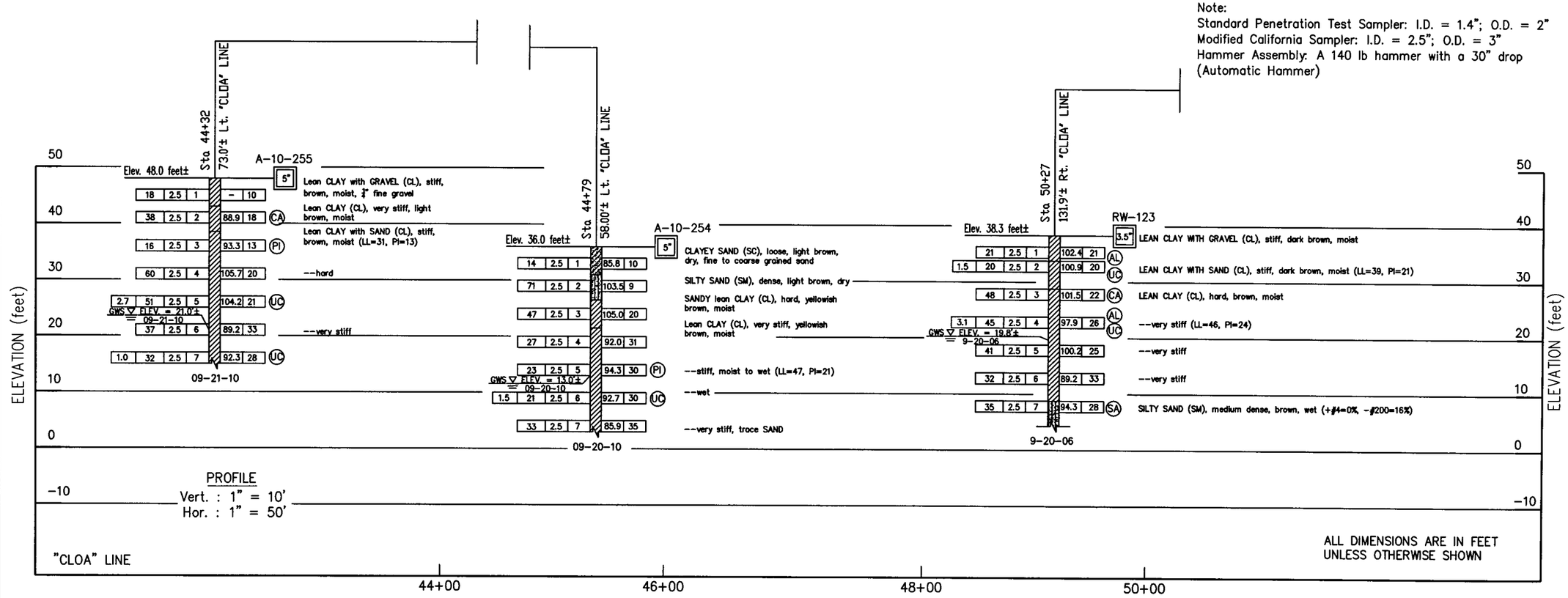

PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

LEGEND OF BORING OPERATIONS

IN-SITU, LAB & FIELD TEST DESIGNATIONS

TYPES OF BORINGS

LEGEND OF EARTH MATERIALS (USCS) BASED ON ASTM D2487, D2488

CONSISTENCY CLASSIFICATION FOR SOILS According to the Standard Penetration Test (ASTM D-1586)

NOTE: Visual classification of earth materials are based on field inspection and are continued or revised with laboratory test results as necessary.

DESIGN OVERSIGHT		DRAWN By: D. GOUTHIER	Field Investigation by: L.S. BHANGOO	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR PROJECT ENGINEER
SIGN OFF DATE		CHECKED By: P. SIRCAR			

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 4 5

CU 04275
EA 2285E1

STRUCTURE NO.
POST MILES (PM)

CONTRA LOMA AND G STREET INTERCHANGES

LOG OF TEST BORINGS

DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES (PRELIMINARY STAGE ONLY) 09/21/09 03/08/10

SHEET 1 OF

PLATE A-12

04-2285E4

INFORMATION HANDOUT

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4	26.5/27.5		

REGISTERED ENGINEER–GEOTECHNICAL

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. GE 666 Exp. 12/31/11 GEOTECHNICAL STATE OF CALIFORNIA

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PLEASANTON, CA 94588

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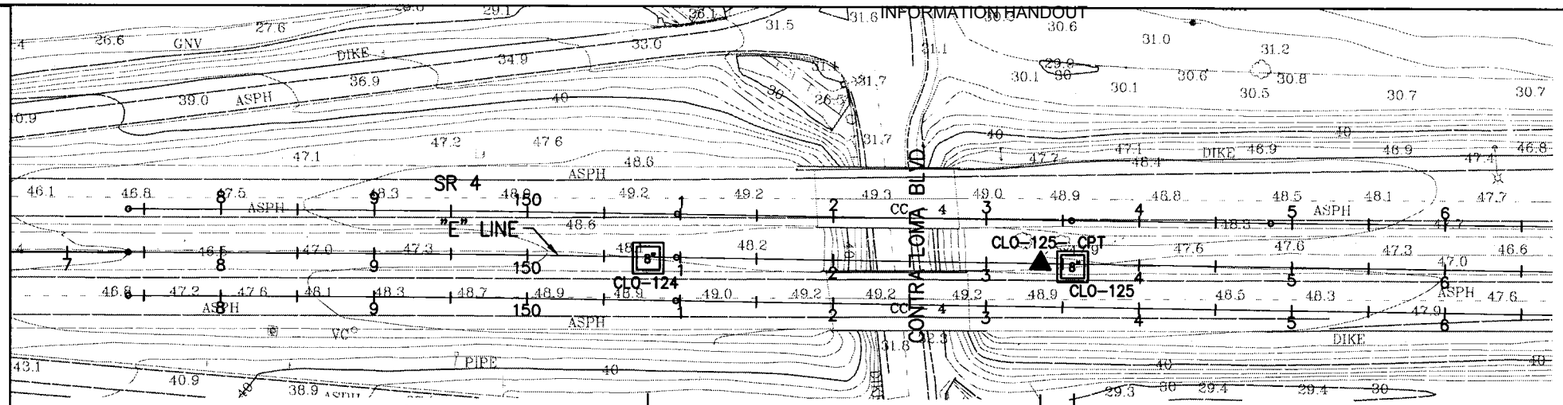
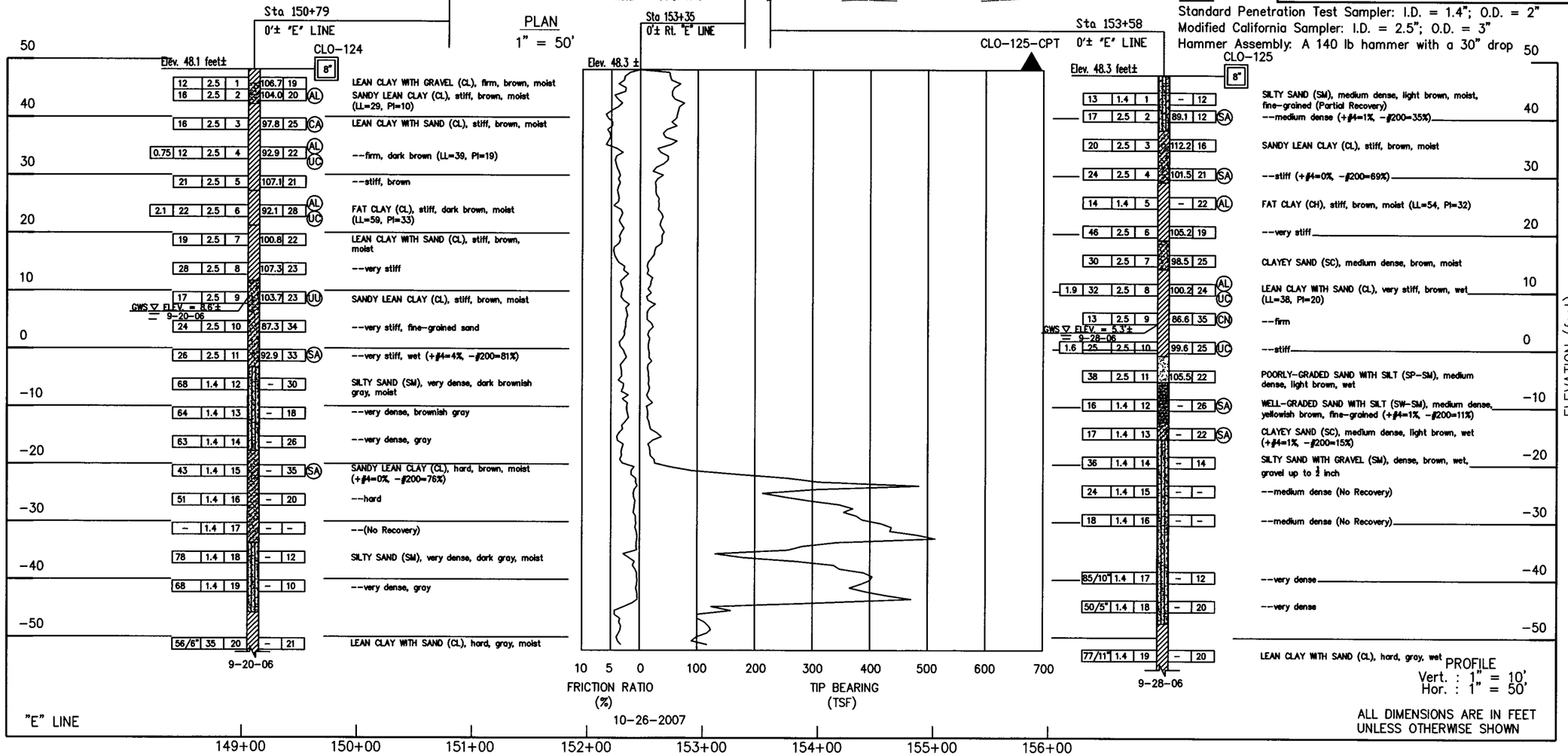


PLAN
1" = 50'

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

LEGEND OF BORING OPERATIONS

IN-SITU LAB & FIELD TEST DESIGNATIONS

TYPES OF BORINGS

LEGEND OF EARTH MATERIALS (USCS) BASED ON ASTM D2487, D2488

CONSISTENCY CLASSIFICATION FOR SOILS According to the Standard Penetration Test (ASTM D-1586)

DESIGN OVERSIGHT	DRAWN By: D. GOUTHIER	Field Investigation by: L.S. BHANGOO	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
SIGN OFF DATE	CHECKED By: P. SIRCAR		P. SIRCAR PROJECT ENGINEER

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 4 5

CU 04275
EA 2285E1

STRUCTURE NO.
POST MILES (PM)

CONTRA LOMA AND G STREET INTERCHANGES

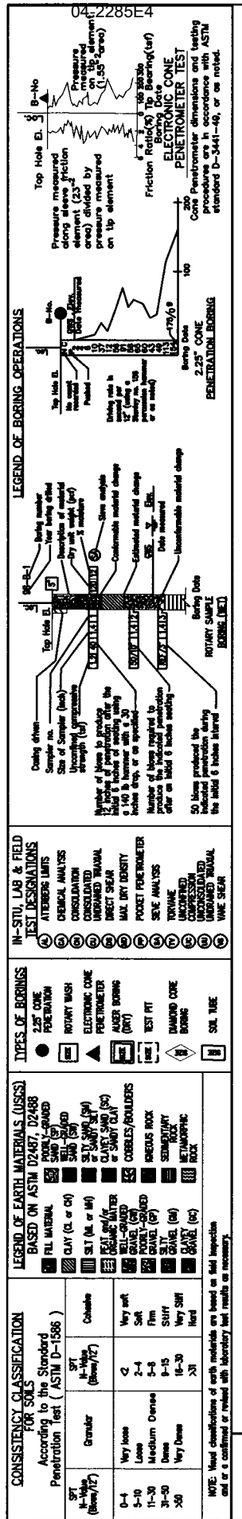
LOG OF TEST BORINGS

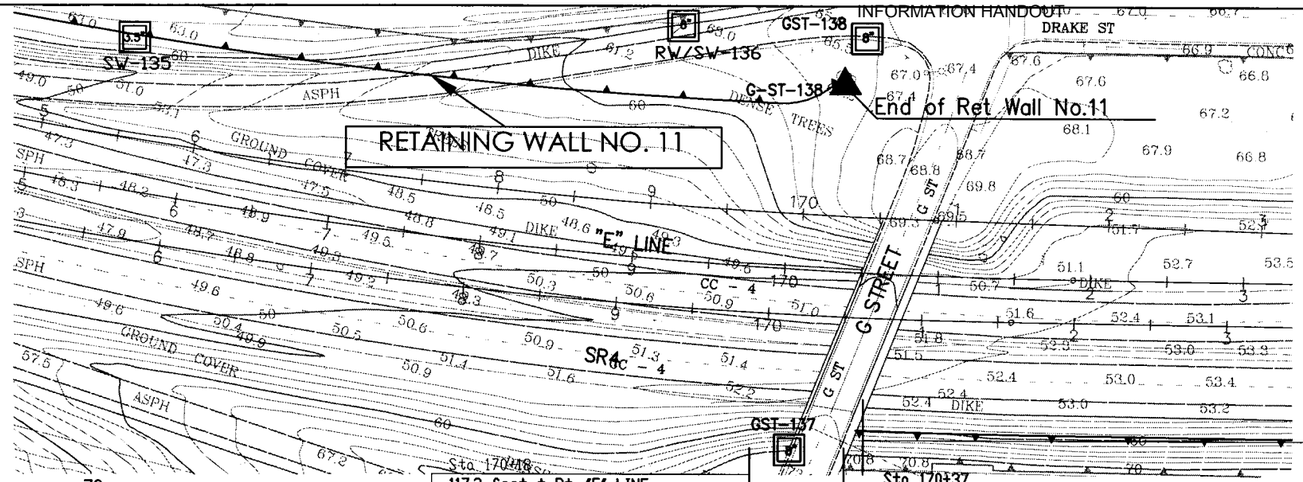
DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES (PRELIMINARY STAGE ONLY) 09/21/09 03/08/10

SHEET OF

PLATE A-13

04-2285E4





PLAN
1"= 50'

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4	26.5/27.5		

REGISTERED ENGINEER-GEOTECHNICAL

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. GE 666 Exp. 12/31/11 GEOTECHNICAL STATE OF CALIFORNIA

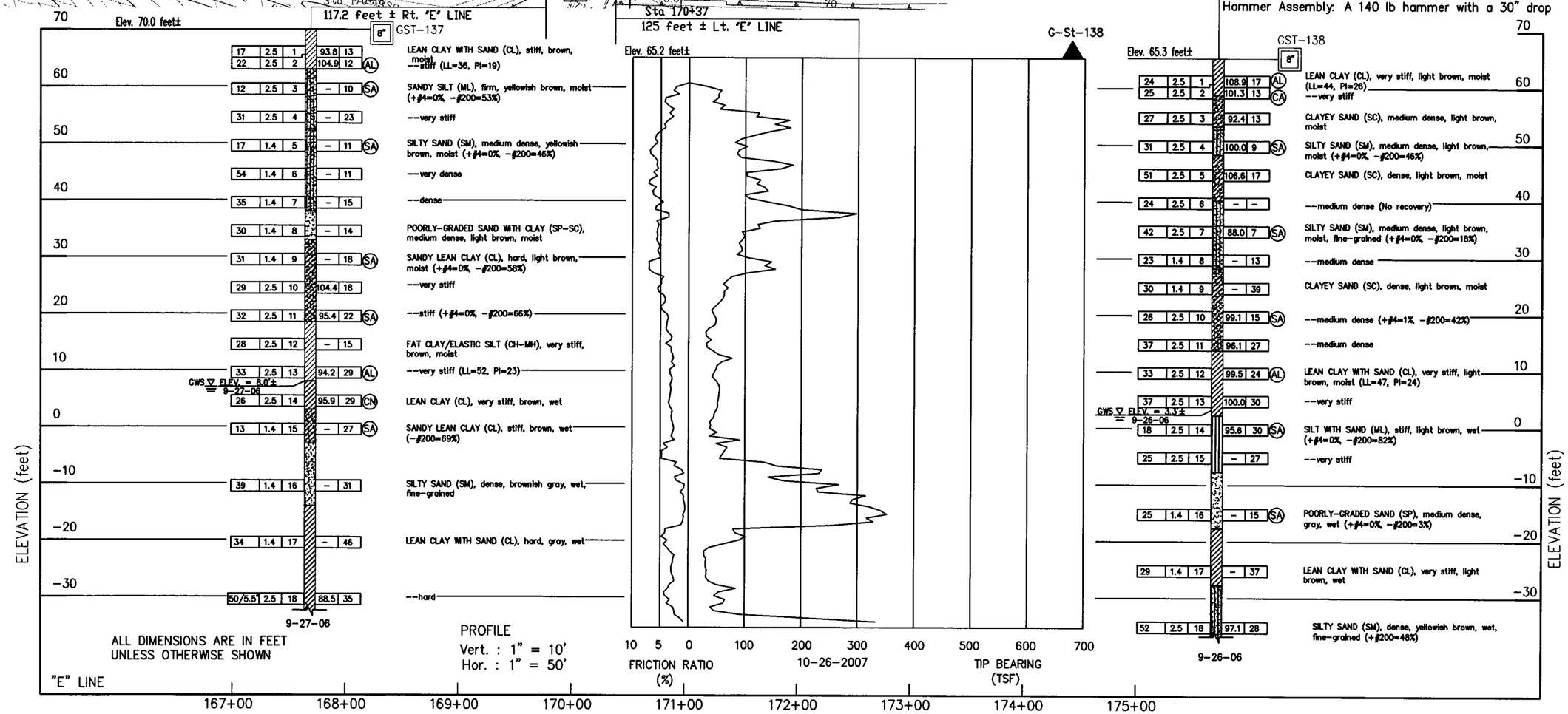
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE CA 95131

CCTA
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

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:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop



DESIGN OVERSIGHT	DRAWN By: D. GOUTHIER	Field investigation by: L.S. BHANGOO	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR PROJECT ENGINEER
SIGN OFF DATE	CHECKED By: P. SIRCAR	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 4 5		CU 04275 EA 2285E1

STRUCTURE NO.

POST MILES (PM)

CONTRA LOMA AND G STREET INTERCHANGES

LOG OF TEST BORINGS

DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES (PRELIMINARY STAGE ONLY) ~~09/21/09~~ 03/08/10 SHEET OF

PLATE A-14

04-2285E4

INFORMATION HANDOUT

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	CC	4	26.5/27.5	–	–

REGISTERED CIVIL ENGINEER — DATE

G STREET UNDERCROSSING
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: 04257
EA: 2285E1

BRIDGE No.

Sheet 15 of

REGISTERED PROFESSIONAL ENGINEER
GARY FARIKU
No. GE 666
Exp. 12/31/11
GEOTECHNICAL
STATE OF CALIFORNIA

Revisions made to this Log of Test Borings from the original 1951 Log of Test Borings are the addition of the following table and notes:

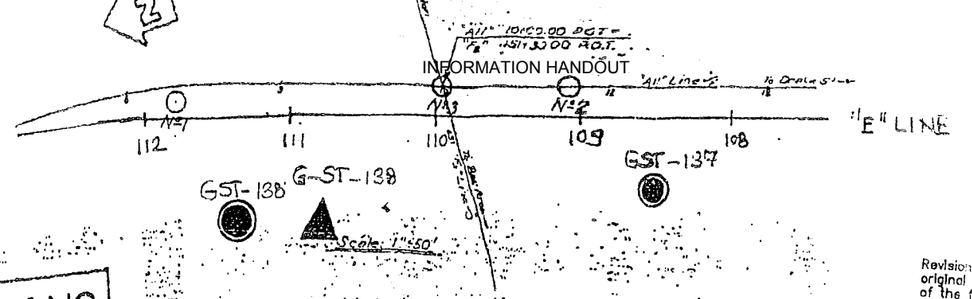
Boring	Station	Offset from 'E' LINE
No.1	109+10	50 ft Lt
No.2	108+90	100 ft Lt
No.3	111+75	100 ft Lt

'E' Line parallels to 'AH' Lines.

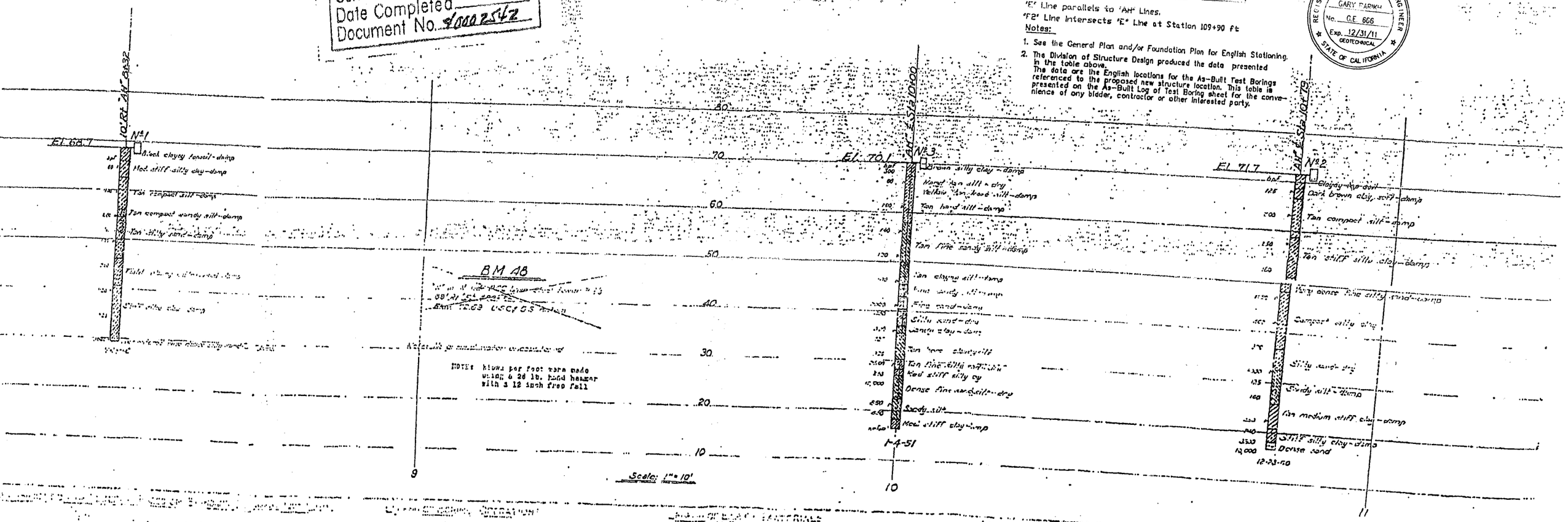
'F2' Line intersects 'E' Line at Station 109+90 ft

Notes:

1. See the General Plan and/or Foundation Plan for English Stationing.
2. The Division of Structure Design produced the data presented in the table above. The data are the English 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.



AS BUILT PLANS
Contract No. 52-0472 27
Date Completed
Document No. 4000254 2

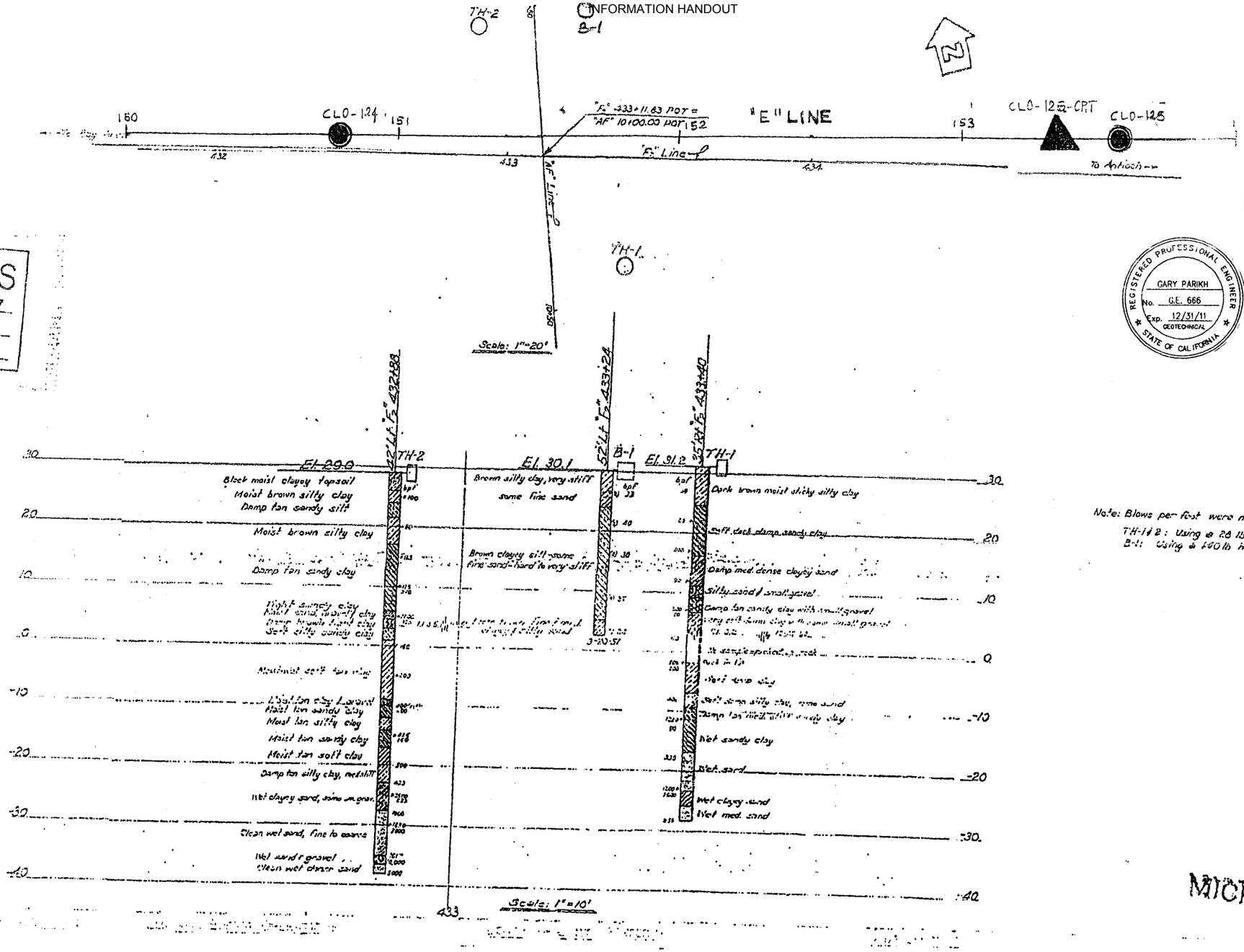


MICROFILMED

"4" STREET OVERCROSSING

INFORMATION HANDOUT

AS BUILT PLANS
Contract No. 52-0476C2
Date Completed
Document No. 4000254Z



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	CC	4	26.5/27.5		

REGISTERED CIVIL ENGINEER — DATE

CONTRA LOMA BOULEVARD UNDERCROSSING

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: 04257
EA: 2285E1

BRIDGE No.

Sheet 16 of

REGISTERED PROFESSIONAL ENGINEER
GARY PARIKH
No. G.E. 666
Exp. 12/31/11
GEOTECHNICAL
STATE OF CALIFORNIA

[illegible] made to this Log of Test Borings from the [illegible] 1951. Log of Test Borings are the [illegible] of the following table and notes.

Boring	Station	Offset from "E" LINE
TH-1	151+28	19.5 ft Rt
B-1	151+84	21 ft Rt
TH-2	151+82	22 ft Lt

"E" Line parallels to 'AH' Lines.

"F2" Line intersects "E" Line at Station 109+90 ft

Notes:

1. See the General Plan and/or Foundation Plan for English Stationing.
2. The Division of Structure Design produced the data presented in the table above. The data are the English 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: Blows per foot were made in the following manner;
TH-1 & 2: Using a 28 lb hand hammer with a 12" free fall.
B-1: Using a 140 lb hammer with a 30" free fall.

MICROFILMED

(SEGMENT 2- CONTRA LOMA AND G STREET INTERCHANGES)

SUMMARY OF R-VALUE BORINGS

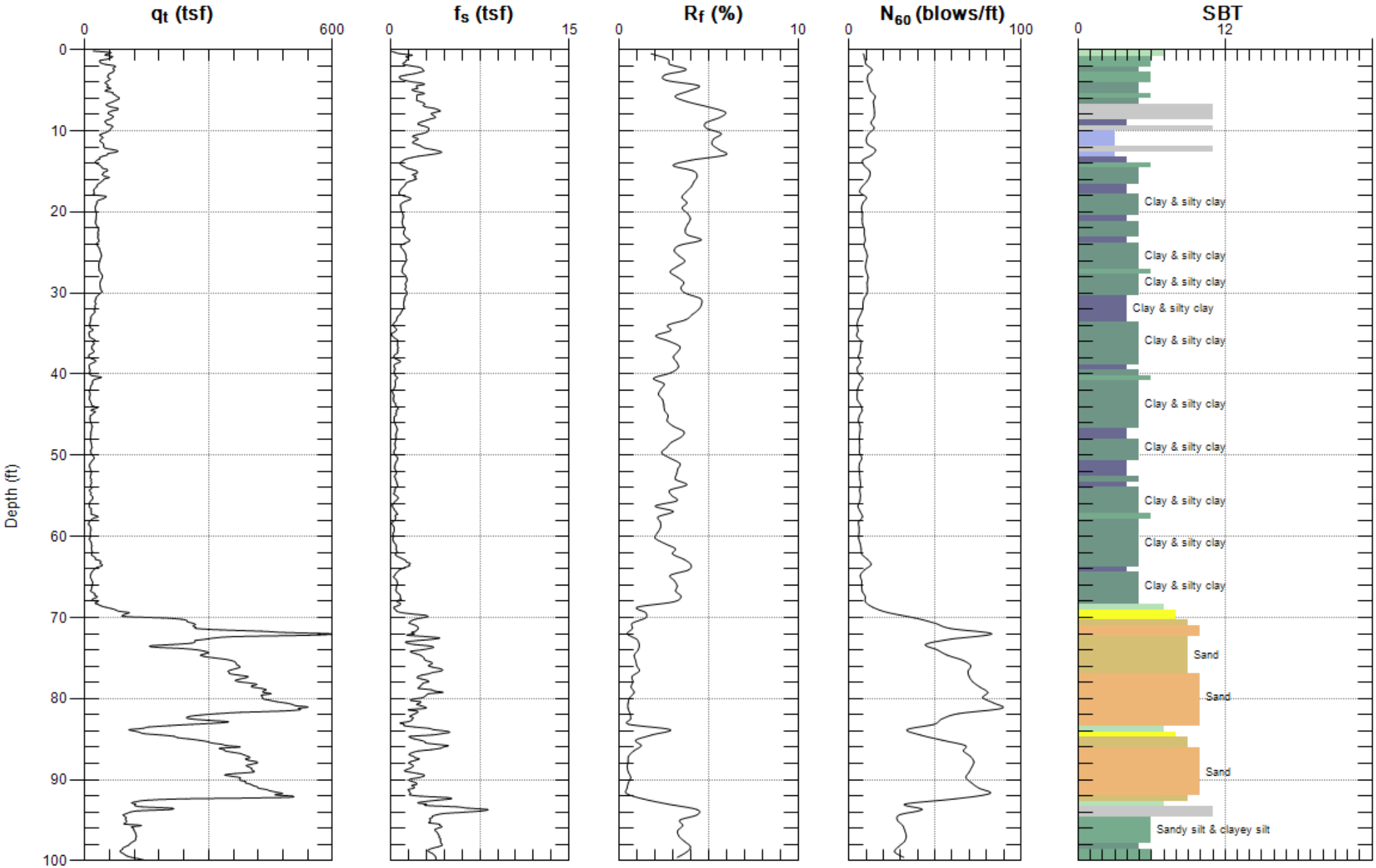
Boring No.	Station (ft.)	Offset (ft.) From "E" line	Approx. Ground Elev. (ft)	Boring Depth (ft)	Description	Date drilled
R-22	137+52	38.8 Rt.	43.8	0-5'	SANDY CLAY (SC), yellowish brown, moist	6/23/06
R-23	137+55	38.4 Rt.	41.8	0-5'	SANDY LEAN CLAY (CL), yellowish brown, dry	6/23/06
R-24	141+67	0 C.L.	41.0	0-5'	SANDY CLAY (SC), yellowish brown, moist	6/21/06
R-25A	142+31	91 Lt.	32.0	0-5'	SANDY CLAY (SC), brown, moist	8/15/06
R-25	143+41	66.5 Lt.	42.8	0-5'	LEAN CLAY (CL), brown, moist	6/21/06
R-26	147+48	55 Rt.	45.0	0-5'	SANDY CLAY (SC), yellowish brown, moist	6/23/06
R-27	148+80	51.5 Lt.	48.0	0-5'	SILTY SAND WITH CLAY (SM), light brown, moist	6/23/06
R-28	150+45	60 Rt.	44.0	0-5'	LEAN CLAY (CL), yellowish brown, moist	6/23/06
R-29	152+42	42.5 Lt.	30.3	0-5'	SILTY SAND (SM), yellowish brown, dry	6/23/06
C-30	154+24	165.5 Rt.	34.0	0-5'	LEAN CLAY (CL), brown, dry	6/23/06
R-31	154+76	139.5 Lt.	48.6	0-5'	LEAN CLAY (CL), grayish brown, dry	6/21/06
R-32	156+53	139.5 Lt.	34.0	0-5'	SANDY LEAN CLAY (CL), grayish brown, moist	6/23/06
R-33	156+74	12 Lt.	46.4	0-5'	SILTY SAND (SM), yellowish brown, dry	6/23/06
R-34	160+26	54 Rt.	46.3	0-5'	CLAYEY SAND (SC), grayish brown, moist	R=51
R-35	162+65	58 Lt.	45.6	0-5'	SANDY LEAN CLAY (CL), grayish brown, moist	6/23/06
R-36	165+57	251.4 Rt.	49.0	0-5'	LEAN CLAY (CL), brown, moist	8/15/06
R-37A	164+15	12 Lt.	47.4	0-5'	SANDY HEAVY CLAY, brown, moist	R=14
R-37	166+35	16.5 Rt.	49.3	0-5'	LEAN CLAY (CL), yellowish brown, moist	6/23/06
R-38	169+16	303.0 Rt.	72.8	0-5'	LEAN CLAY (CL), brown, moist	8/15/06
R-39	171+78	161.0 Lt.	67.1	0-5'	LEAN CLAY (CL), brown, moist	8/15/06
R-40	174+21	O C.L.	54.4	0-5'	SILTY SAND (SM), yellowish gray, moist	6/21/06
Note : All Borings drilled with 6" Solid Stem Auger						

Plate-A-16

PARIKH CONSULTANTS

Site: HWY 4 EAST
Sounding: CLO-125

Engineer: D.WANG
Date: 10/26/2007 12:31



Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

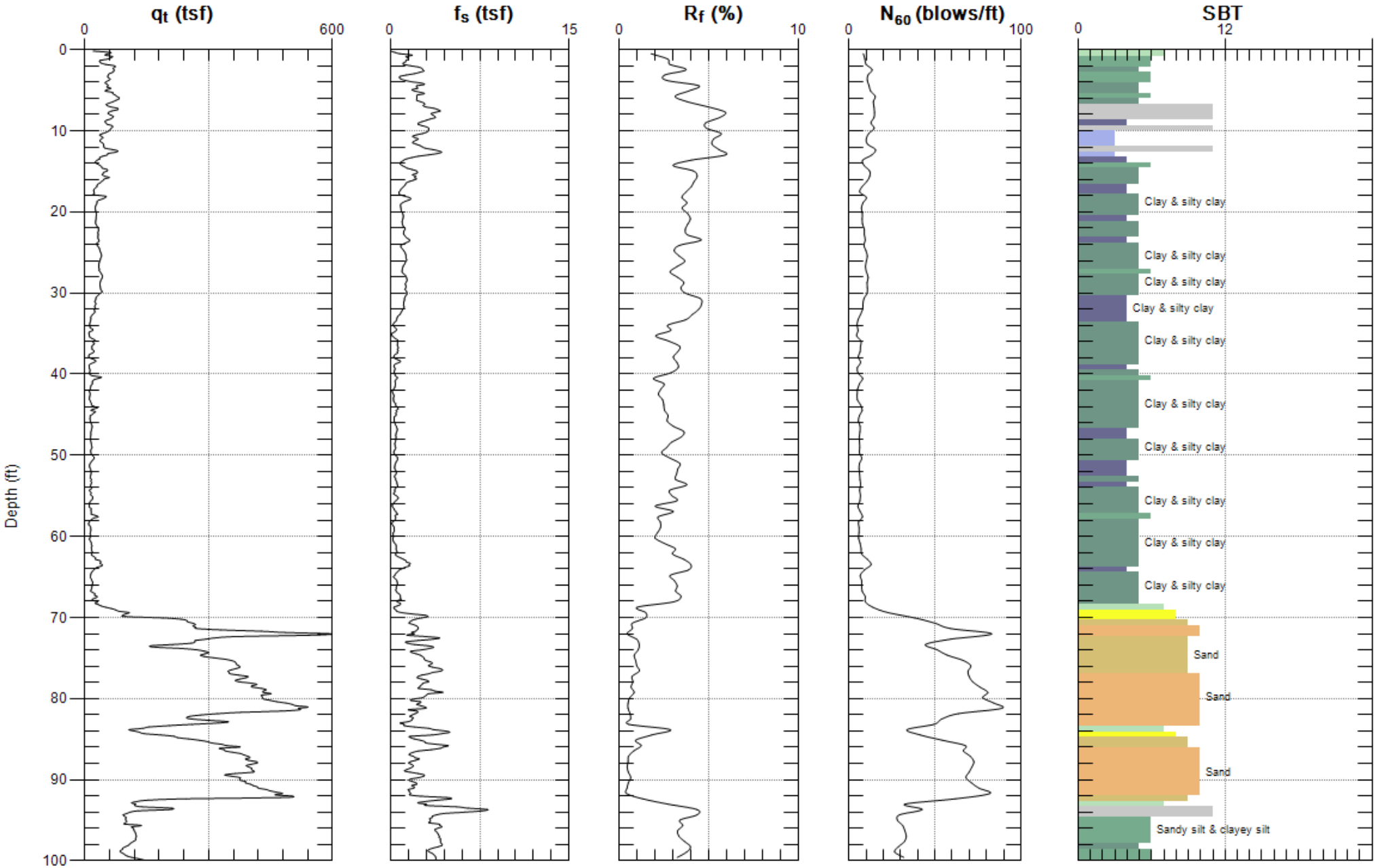
Plate A-17-1

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: HWY 4 EAST
Sounding: CLO-125

Engineer: D.WANG
Date: 10/26/2007 12:31



Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

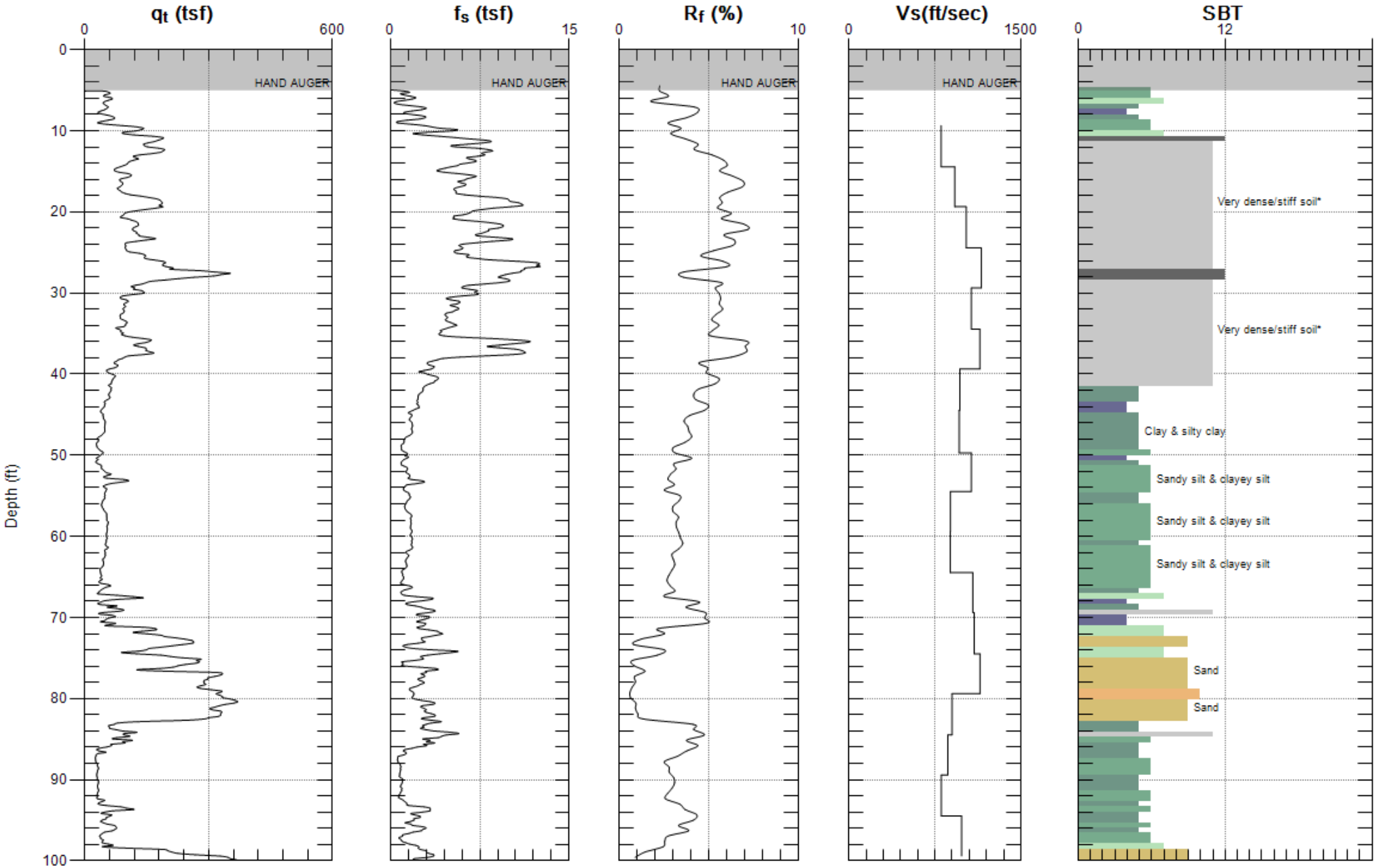
Plate A-17-2

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: HWY 4 EAST **Engineer: D.WANG**

Sounding: G-St-138 **Date: 10/26/2007 09:40**



Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

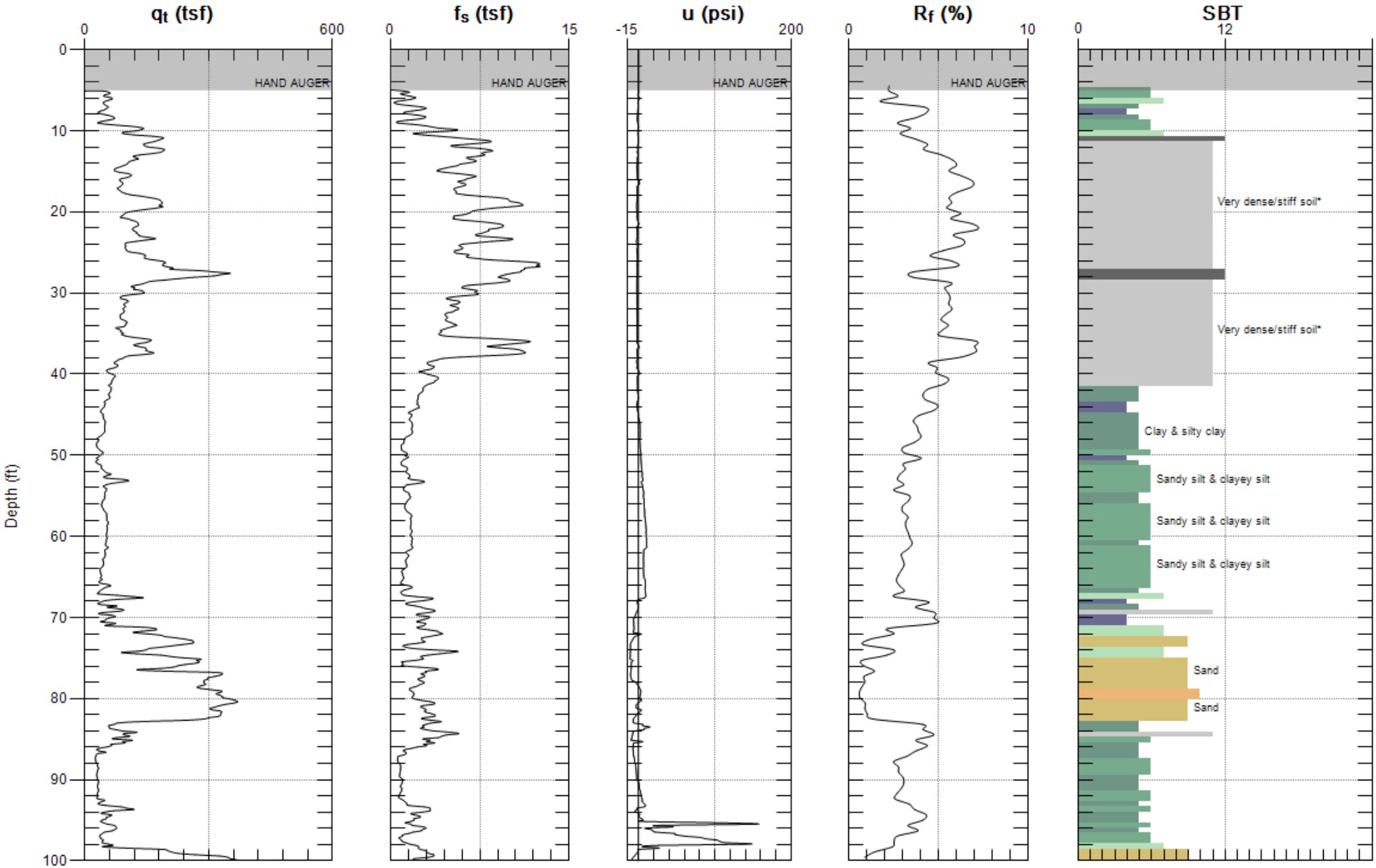
Plate A-18-1

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: HWY 4 EAST **Engineer: D.WANG**

Sounding: G-St-138 **Date: 10/26/2007 09:40**



Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

Plate A-18-2

SBT: Soil Behavior Type (Robertson 1990)

APPENDIX B

APPENDIX B

LABORATORY TESTS

Classification Tests
The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented on "Log of Test Borings", Appendix A.

Moisture-Density
The natural moisture contents and dry unit weights were determined for selected undisturbed samples of the soils in general accordance with ASTM Test Method D 2216-92. This information was used to classify and correlate the soils. The results are presented at the appropriate depths on the "Log of Test Borings", Appendix A.

Atterberg Limits
The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the effective strength characteristics and expansion potential with variations in moisture content. The Atterberg Limits were determined in general accordance with ASTM Test Method D 4318-93. The results of these tests are presented on Plates B-2A thru B-2E, "Plasticity Chart".

Grain Size Classification
Grain size classification tests (ASTM Test Method D422-63) were performed on selected samples of granular soil to aid in the classification. The results are presented on Plates B-3A thru B-3J, "Grain Size Distribution Curves".

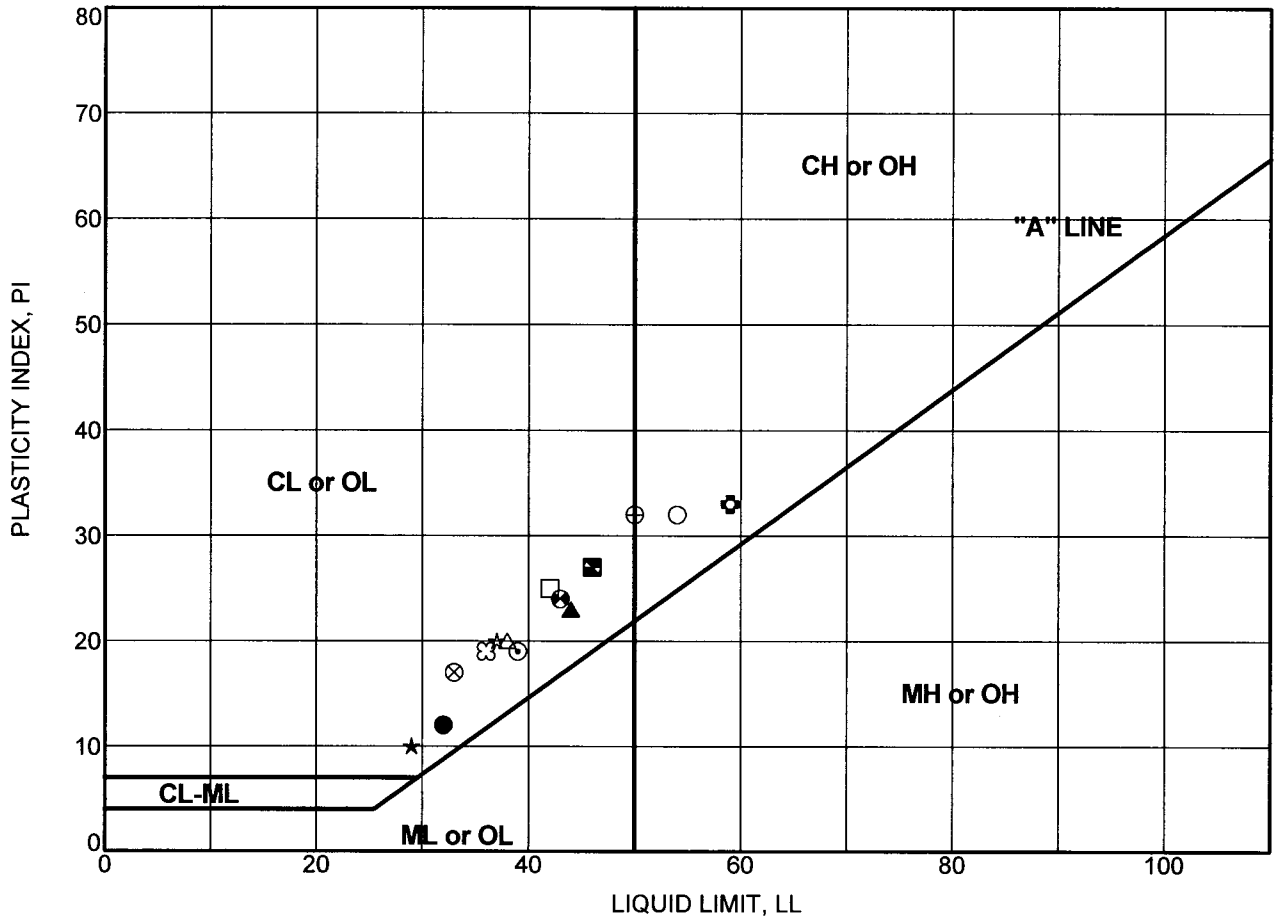
Unconfined Compression Tests
Strength tests were performed on selected undisturbed samples using unconfined compression machine. Unconfined compression tests were performed in general accordance with ASTM Test Method D 2166-91. The results are presented on "Log of Test Borings"

Corrosion Tests
Corrosion tests were performed on selected samples to determine the corrosion potential of the soils. The pH and minimum resistively tests were performed according to California Test Method 643, 417 and 422. The tests were performed by Sunland Analytical. The test results are presented on Plates B-4A thru B-4R.

R-value Tests
R-value tests were performed on representative bulk samples for pavement design. The tests were performed according to California Test Method 301. The test results are presented on Plates B-5A thru B-5N.

Expansion Index
Expansion Index tests were performed on representative bulk samples to determine an indication of swelling potential of a compacted soil. The tests were performed according to ASTM Test Method D-4829. The test results are presented on Plates B-6A and B-6B.

Direct Shear Tests
Direct Shear tests were performed on selected undisturbed sample to determine the shear strength of a soil material in direct shear. The tests were performed according to ASTM Test Method D 3080 by Cooper. The test results are presented on Plate B-7A and B-7E.



PLASTICITY CHART

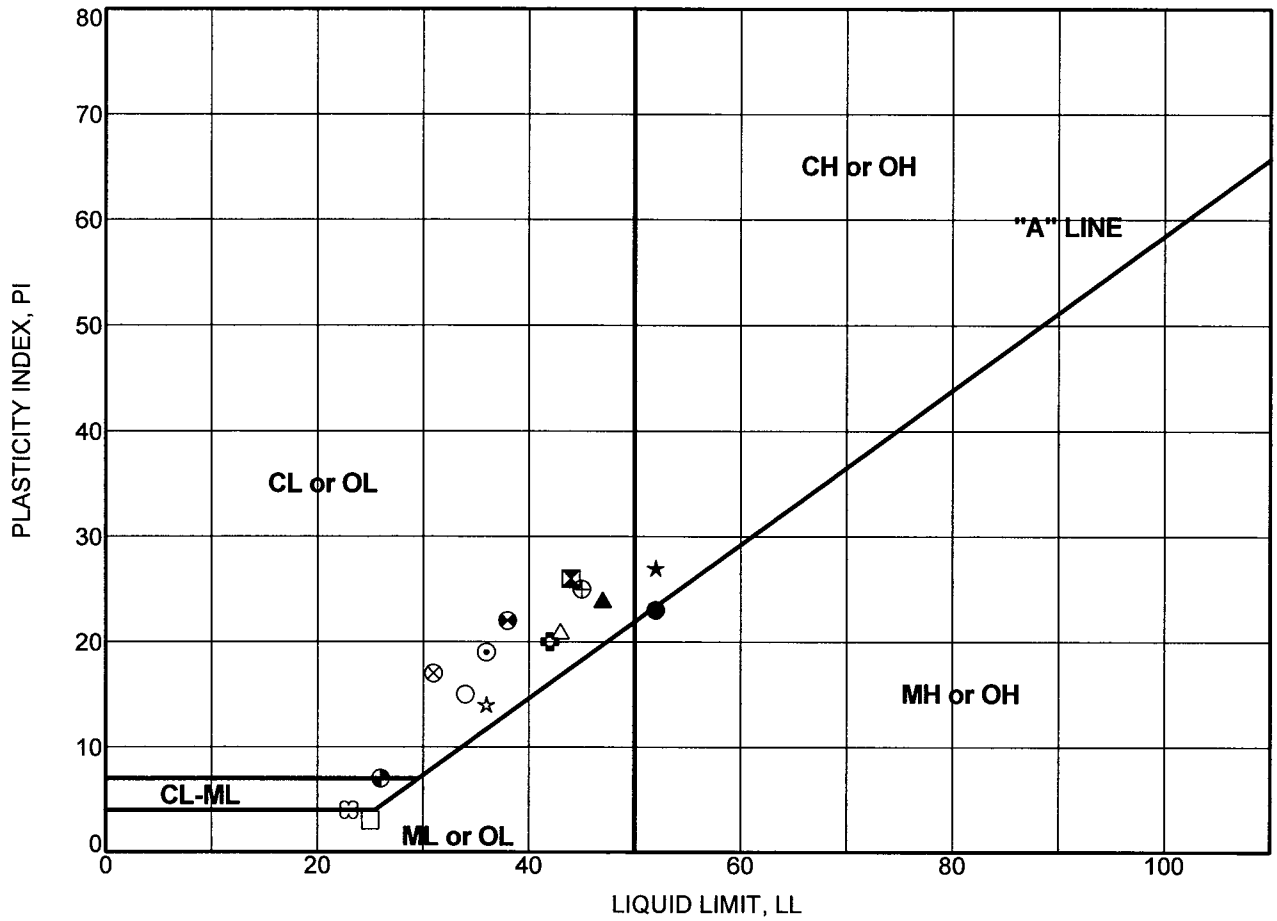
Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
C-118	MC-2	6.0	●	16	32	20	12	LEAN CLAY (CL)
C-118	MC-4	16.0	⊠	18	46	19	27	LEAN CLAY (CL)
C-119	MC-2	4.5	▲	20	44	21	23	LEAN CLAY (CL)
CLO-124	MC-2	3.5	★	20	29	19	10	SANDY LEAN CLAY (CL)
CLO-124	MC-4	13.5	⊙	22	39	20	19	LEAN CLAY WITH SAND (CL)
CLO-124	MC-6	23.5	✿	28	59	26	33	FAT CLAY (CH)
CLO-125	SPT-5	21.0	○	22	54	22	32	FAT CLAY (CH)
CLO-125	MC-8	36.0	△	24	38	18	20	LEAN CLAY WITH SAND (CL)
E-121	MC-2	4.5	⊗	13	33	16	17	LEAN CLAY (CL)
E-122	SPT-3	9.5	⊕	12	50	18	32	FAT CLAY (CH)
E-126	MC-2	4.5	□	14	42	17	25	LEAN CLAY (CL)
E-126	MC-6	24.5	⊗	24	43	19	24	LEAN CLAY (CL)
E-130	MC-1	2.0	◕	17	46	19	27	LEAN CLAY (CL)
E-130	MC-3	9.5	☆	15	37	17	20	LEAN CLAY (CL)
GST-137	MC-2	4.5	✿	12	36	17	19	LEAN CLAY WITH SAND (CL)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

CONTRA LOMA AND G STREET INTERCHANGE
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO: 206118.GDR

PLATE NO: B-2A



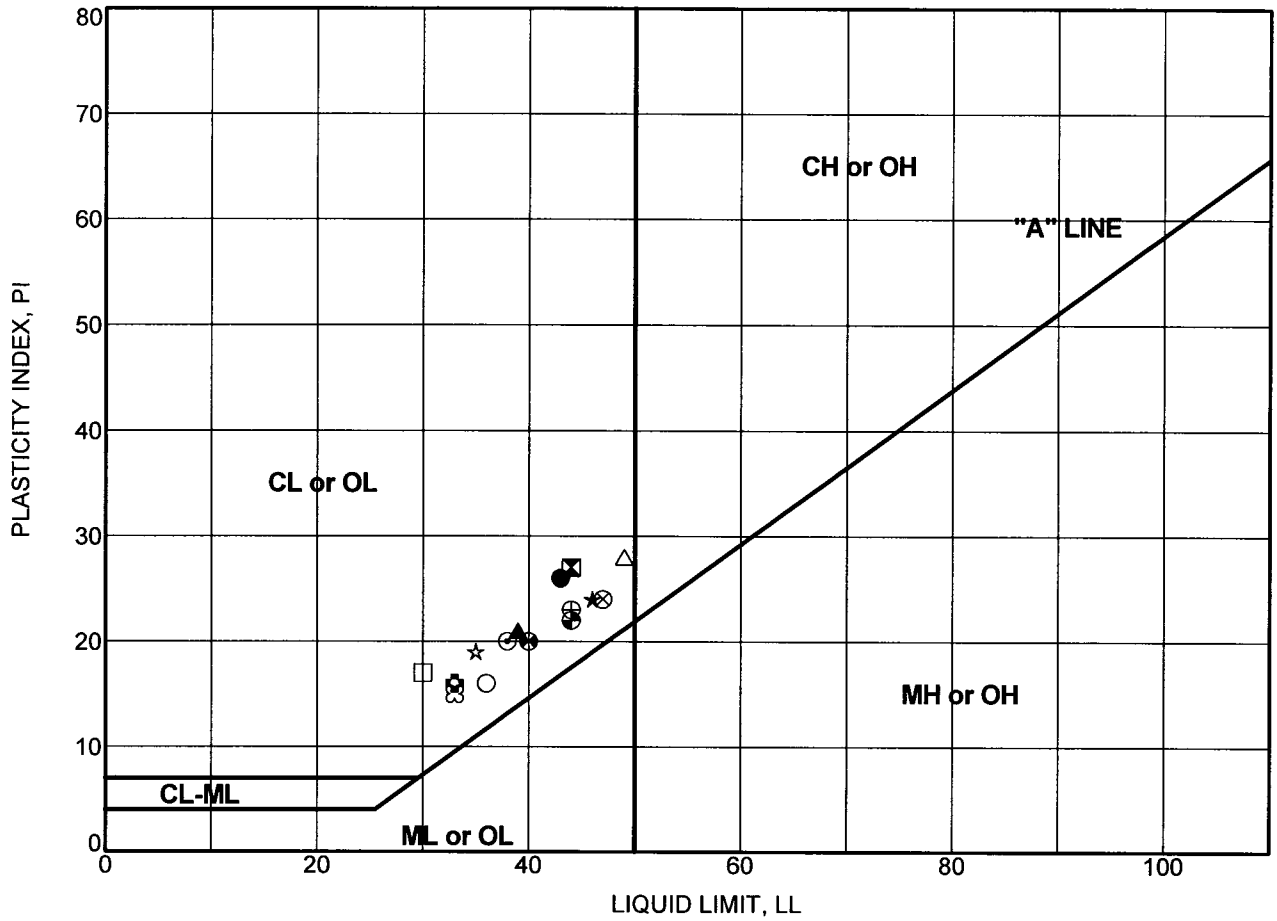
PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
GST-137	MC-13	59.5	●	29	52	29	23	FAT CLAY / ELASTIC SILT (CH-MH)
GST-138	MC-1	3.0	⊠	17	44	18	26	LEAN CLAY (CL)
GST-138	MC-12	54.5	▲	24	47	23	24	LEAN CLAY WITH SAND (CL)
RW/SW-110	MC-4	14.5	★	24	52	25	27	FAT CLAY (CH)
RW/SW-111	MC-2	6.0	⊙	13	36	17	19	LEAN CLAY (CL)
RW/SW-111	MC-5	21.0	✿	20	42	22	20	LEAN CLAY (CL)
RW/SW-113	MC-2	6.0	○	13	34	19	15	LEAN CLAY (CL)
RW/SW-113	MC-4	16.0	△	16	43	22	21	LEAN CLAY (CL)
RW/SW-136	MC-2	4.5	⊗	11	31	14	17	LEAN CLAY (CL)
RW/SW-136	MC-4	14.5	⊕	17	45	20	25	LEAN CLAY (CL)
RW/SW-136	MC-7	29.5	□	5	25	22	3	SILT (ML)
RW/SW-136	MC-10	44.5	⊗	12	38	16	22	LEAN CLAY WITH SAND (CL)
RW/SW-139	MC-2	6.0	◕	20	26	19	7	LEAN CLAY (CL)
RW/SW-139	MC-4	16.0	☆	15	36	22	14	LEAN CLAY (CL)
RW/SW-141	MC-1	2.0	☒	12	23	19	4	SILTY CLAY (CL-ML)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

CONTRA LOMA AND G STREET INTERCHANGE
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO: 206118.GDR | PLATE NO: B-2B



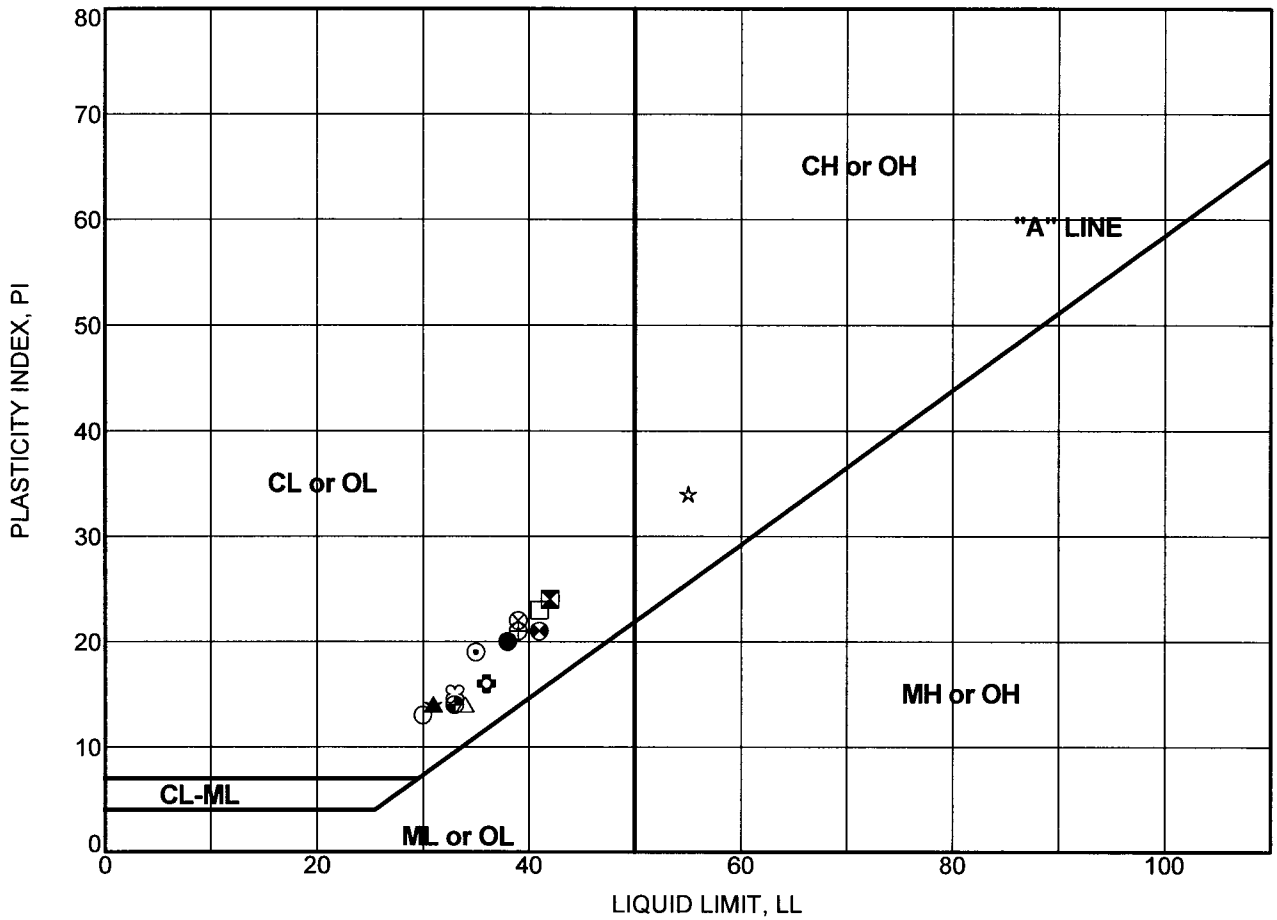
PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
RW/SW-141	MC-3	11.0	●	9	43	17	26	LEAN CLAY (CL)
RW/SW-143	MC-1	2.0	⊠	13	44	17	27	LEAN CLAY (CL)
RW-123	MC-2	6.0	▲	20	39	18	21	LEAN CLAY (CL)
RW-123	MC-4	15.0	★	26	46	22	24	LEAN CLAY (CL)
RW-127	MC-1	2.0	⊙	11	38	18	20	LEAN CLAY (CL)
RW-127	MC-4	14.5	✿	19	33	17	16	LEAN CLAY (CL)
SW-112	SPT-7	29.5	○	28	36	20	16	LEAN CLAY (CL)
SW-114	MC-5	19.5	△	24	49	21	28	LEAN CLAY (CL)
SW-114	MC-6	24.5	⊗	26	47	23	24	LEAN CLAY (CL)
SW-115	MC-2	6.0	⊕	15	44	21	23	LEAN CLAY (CL)
SW-115	MC-7	31.0	□	10	30	13	17	LEAN CLAY (CL)
SW-117	SPT-4	14.5	⊗	20	40	20	20	LEAN CLAY (CL)
SW-117	MC-6	24.5	◕	24	44	22	22	LEAN CLAY (CL)
SW-128	MC-1	2.0	☆	11	35	16	19	LEAN CLAY (CL)
SW-128	MC-2	6.0	✿	12	33	18	15	LEAN CLAY (CL)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

CONTRA LOMA AND G STREET INTERCHANGE
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO: 206118.GDR | PLATE NO: B-2C



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
SW-129	MC-1	2.0	●	14	38	18	20	LEAN CLAY (CL)
SW-129	MC-4	15.0	⊠	19	42	18	24	LEAN CLAY (CL)
SW-131	MC-2	6.0	▲	11	31	17	14	LEAN CLAY (CL)
SW-131	MC-4	15.0	★	13	31	17	14	LEAN CLAY (CL)
SW-132	MC-1	2.0	⊙	12	35	16	19	LEAN CLAY (CL)
SW-132	MC-3	10.0	✿	13	36	20	16	LEAN CLAY (CL)
SW-132	MC-5	20.0	○	18	30	17	13	LEAN CLAY (CL)
SW-133	MC-3	4.5	△	21	34	20	14	LEAN CLAY (CL)
SW-133	MC-5	19.5	⊗	19	39	17	22	LEAN CLAY (CL)
SW-134	MC-3	9.5	⊕	20	39	18	21	LEAN CLAY (CL)
SW-134	MC-5	19.5	□	25	41	18	23	LEAN CLAY (CL)
SW-135	MC-2	6.0	⊛	20	41	20	21	LEAN CLAY (CL)
SW-135	MC-4	16.0	◕	14	33	19	14	LEAN CLAY (CL)
SW-140	MC-2	4.5	☆	16	55	21	34	FAT CLAY (CH)
SW-142	MC-2	4.5	⌘	10	33	18	15	LEAN CLAY (CL)

PARIKH CONSULTANTS, INC.
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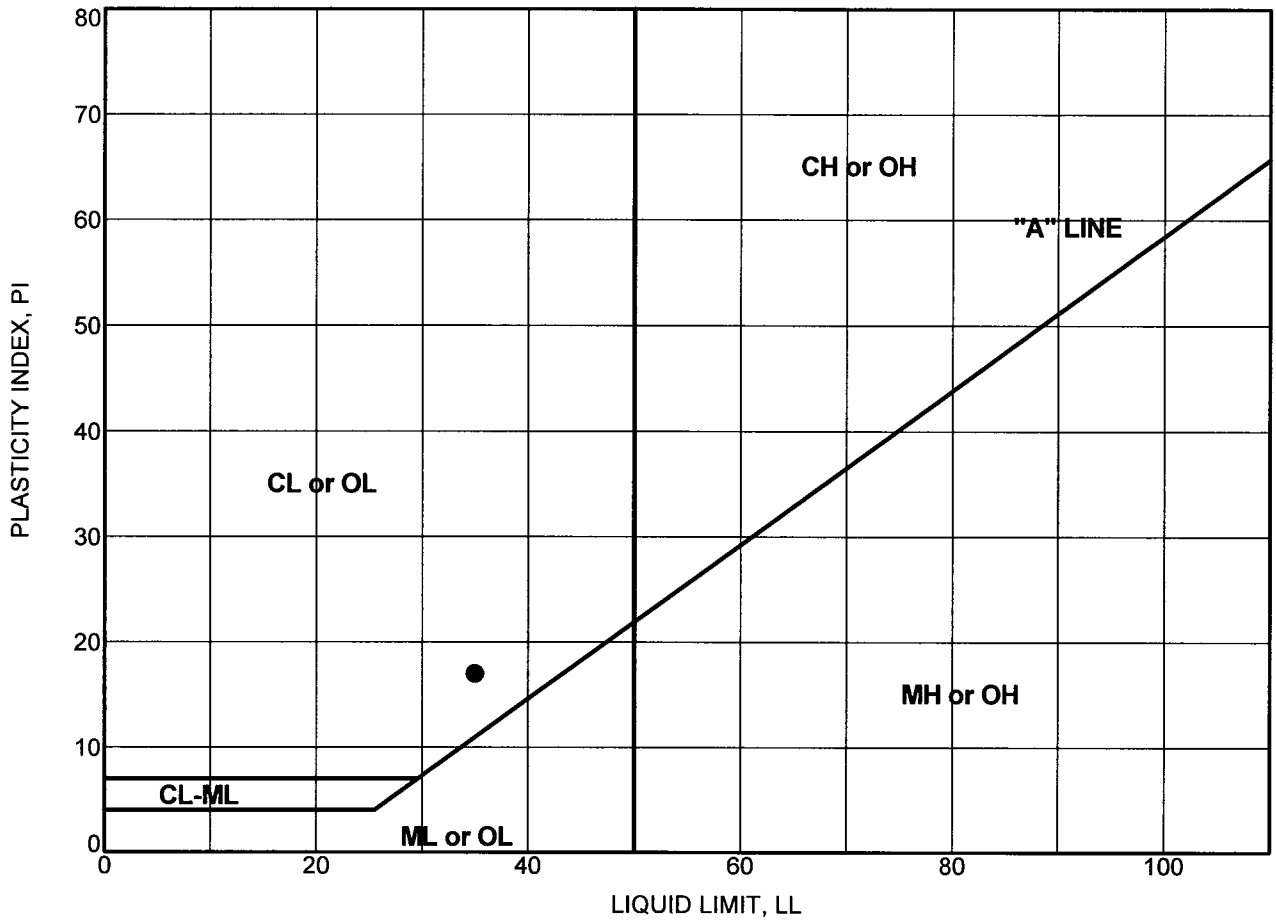
MATERIALS ENGINEERING

CONTRA LOMA AND G STREET INTERCHANGE
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO: 206118.GDR | PLATE NO: B-2D



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
SW-142	MC-6	24.5	●	15	35	18	17	LEAN CLAY (CL)

PARIKH CONSULTANTS, INC.
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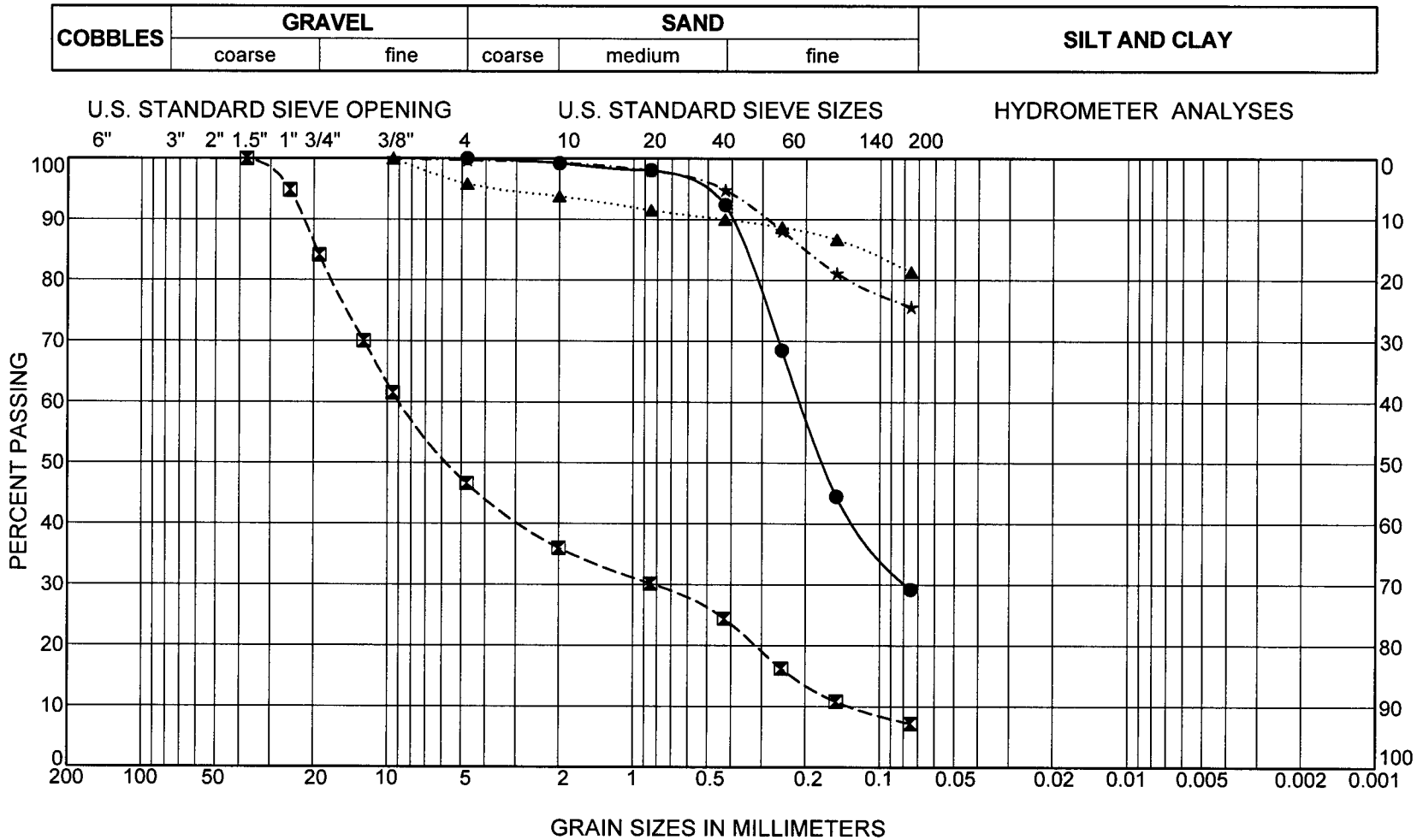
MATERIALS ENGINEERING

CONTRA LOMA AND G STREET INTERCHANGE
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO: 206118.GDR

PLATE NO: B-2E

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
C-119	MC-3	9.5	●			SILTY SAND (SM)
C-119	SPT-4	14.5	⊠			POORLY-GRADED GRAVEL WITH SILT AND SAND (GP-GM)
CLO-124	MC-11	48.5	▲			SANDY LEAN CLAY (CL)
CLO-124	SPT-15	68.5	★			SANDY LEAN CLAY (CL)

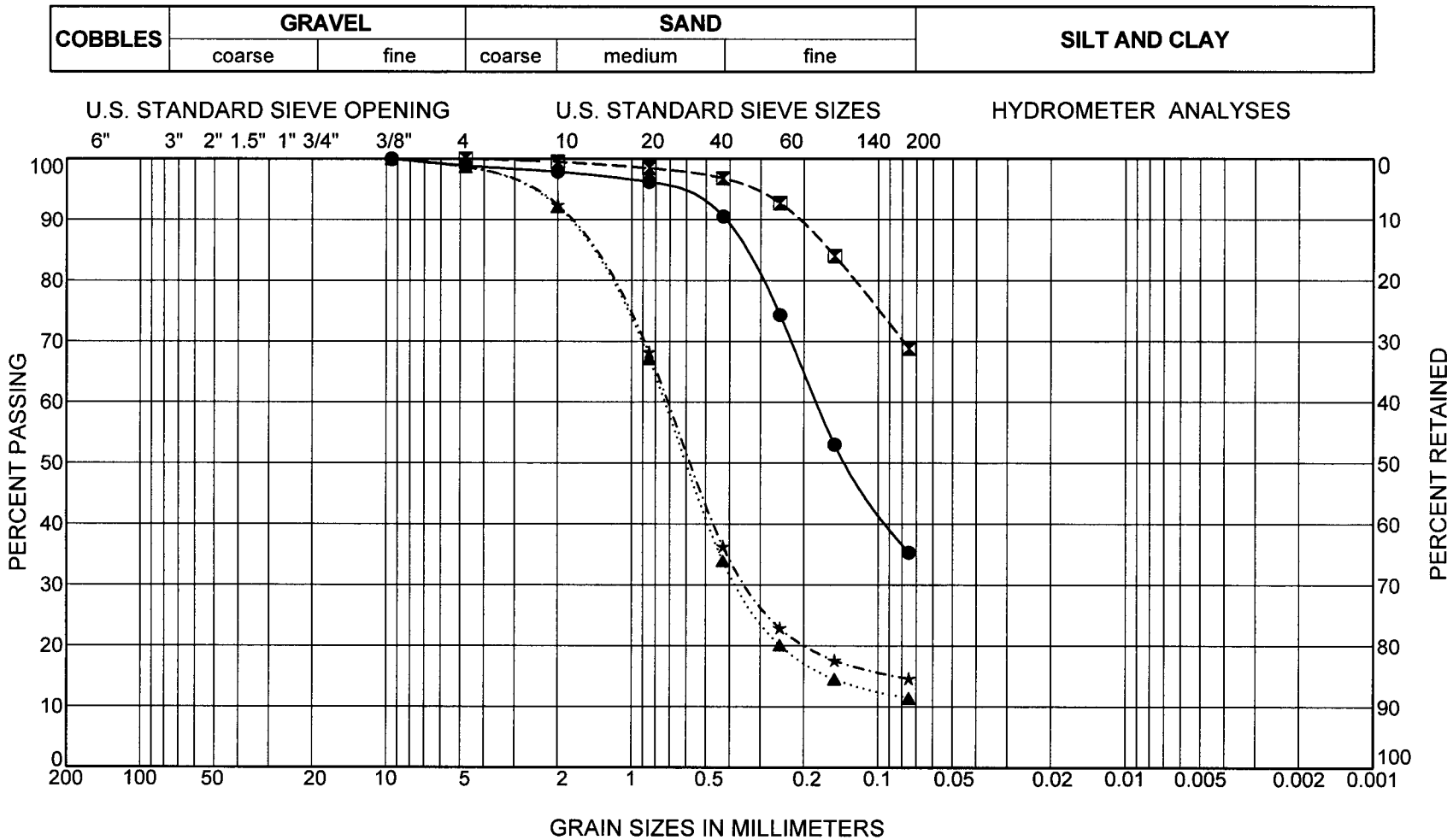
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

JOB NO: 206118.GDR

CONTRA LOMA AND G STREET INTERCHANGE
CONTRA COSTA COUNTY, CALIFORNIA

PLATE NO: B-3A

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
CLO-125	MC-2	6.0	●			SILTY SAND (SM)
CLO-125	MC-4	16.0	⊠			SANDY LEAN CLAY (CL)
CLO-125	SPT-12	56.0	▲			WELL-GRADED SAND WITH SILT (SW-SM)
CLO-125	SPT-13	60.0	★			CLAYEY SAND (SC)

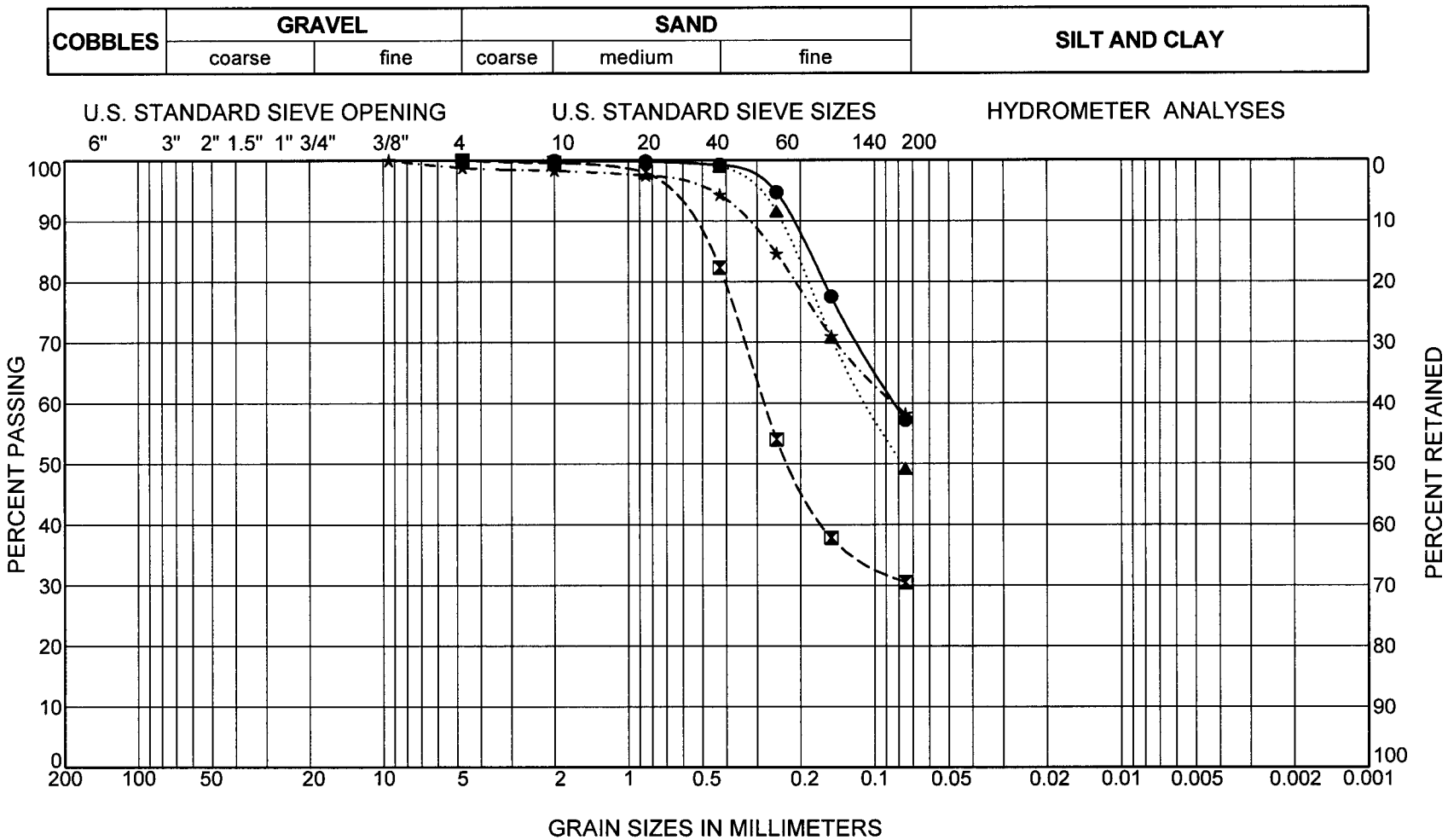
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

CONTRA LOMA AND G STREET INTERCHANGE
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO: 206118.GDR

PLATE NO: B-3B

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
E-121	MC-5	19.5	●			SANDY SILTY CLAY (CL)
E-122	SPT-4	14.5	⊠			SILTY SAND (SM)
E-122	SPT-7	29.5	▲			SILTY SAND (SM)
E-126	MC-3	9.5	★			SANDY LEAN CLAY (CL)

PARIKH CONSULTANTS, INC.
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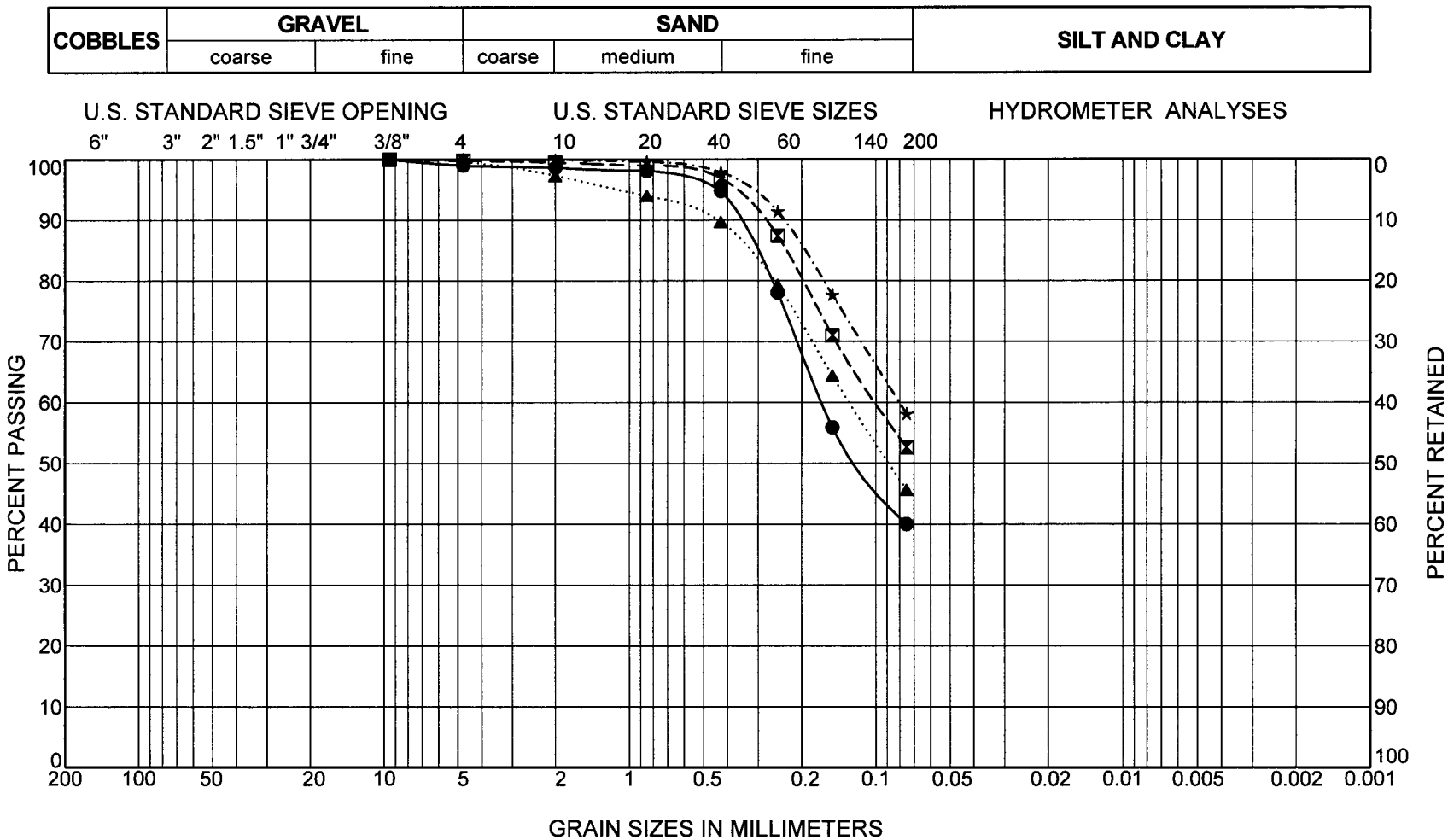
MATERIALS ENGINEERING

CONTRA LOMA AND G STREET INTERCHANGE
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO: 206118.GDR

PLATE NO: B-3C

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
E-130	MC-6	24.5	●			CLAYEY SAND (SC)
GST-137	MC-3	9.5	⊠			SANDY SILT (ML)
GST-137	SPT-5	19.5	▲			SILTY SAND (SM)
GST-137	SPT-9	39.5	★			SANDY LEAN CLAY (CL)

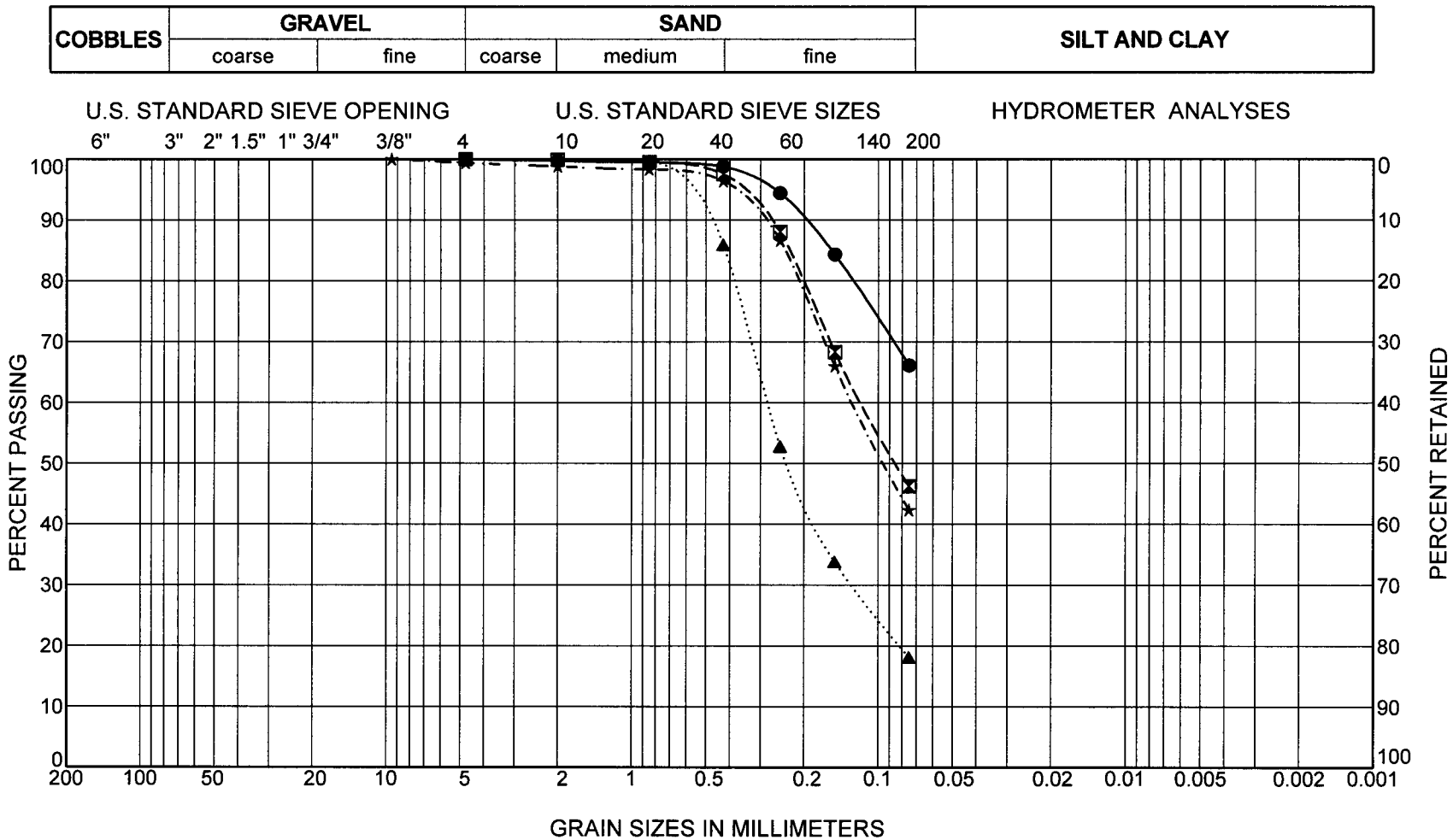
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

JOB NO: 206118.GDR

CONTRA LOMA AND G STREET INTERCHANGE
CONTRA COSTA COUNTY, CALIFORNIA

PLATE NO: B-3D

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
GST-137	MC-11	49.5	●			SANDY LEAN CLAY (CL)
GST-138	MC-4	14.5	⊠			SILTY SAND (SM)
GST-138	MC-7	29.5	▲			SILTY SAND (SM)
GST-138	MC-10	44.5	★			CLAYEY SAND (SC)

PARIKH CONSULTANTS, INC.
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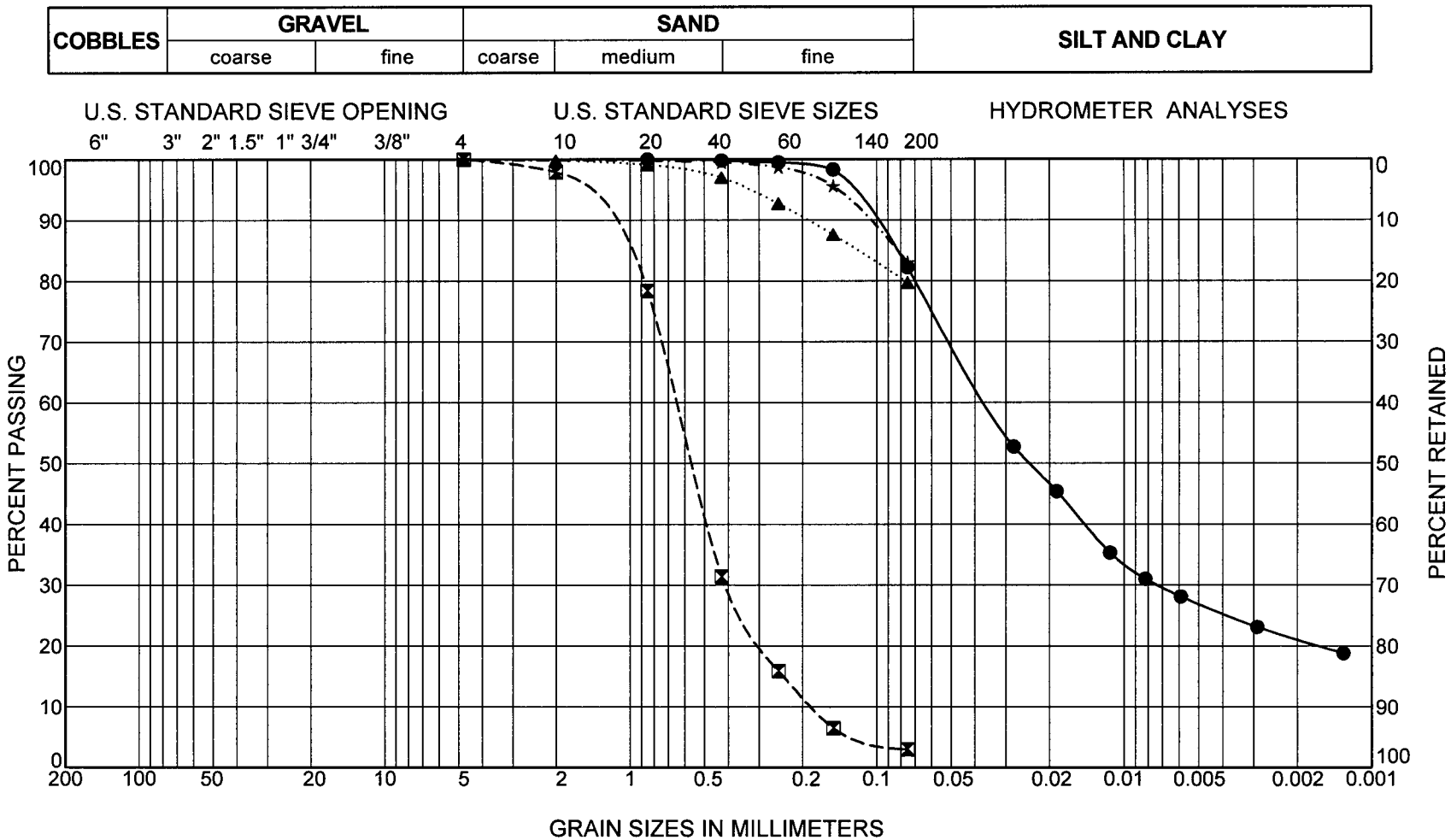
MATERIALS ENGINEERING

JOB NO: 206118.GDR

CONTRA LOMA AND G STREET INTERCHANGE
CONTRA COSTA COUNTY, CALIFORNIA

PLATE NO: B-3E

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
GST-138	MC-14	64.5	●			SILT WITH SAND (ML)
GST-138	SPT-16	79.0	⊠			POORLY-GRADED SAND (SP)
RW/SW-110	MC-2	4.5	▲			SANDY SILT (ML)
RW/SW-136	MC-8	34.5	★			LEAN CLAY (CL)

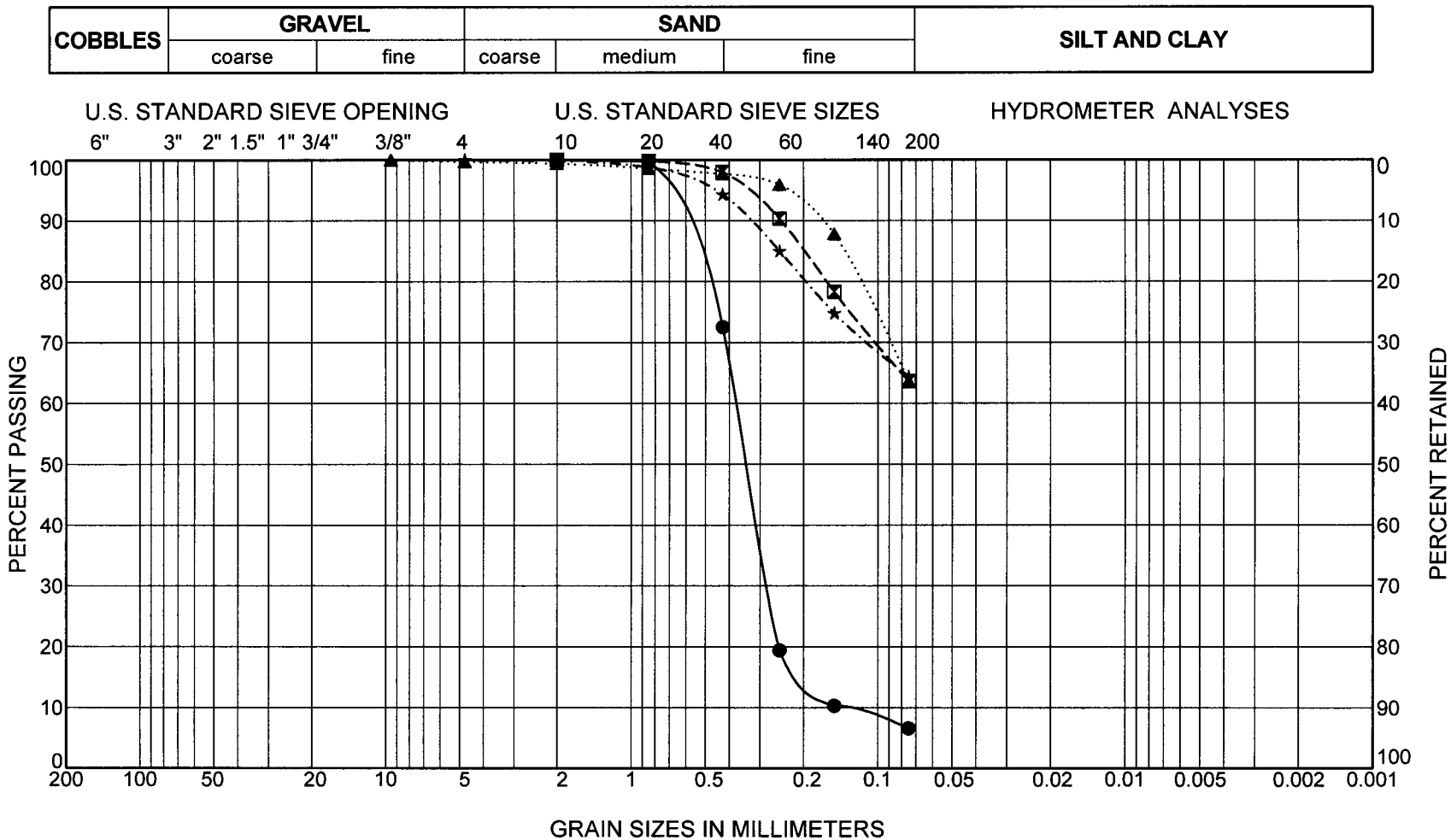
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

JOB NO: 206118.GDR

CONTRA LOMA AND G STREET INTERCHANGE
CONTRA COSTA COUNTY, CALIFORNIA

PLATE NO: B-3F

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
RW/SW-143	MC-3	11.0	●			POORLY-GRADED SAND WITH SILT (SP-SM)
RW-120	MC-2	4.5	⊠			SANDY CLAY (CL)
RW-120	MC-4	14.5	▲			SANDY SILT (ML)
RW-120	MC-6	24.5	★			SANDY LEAN CLAY (CL)

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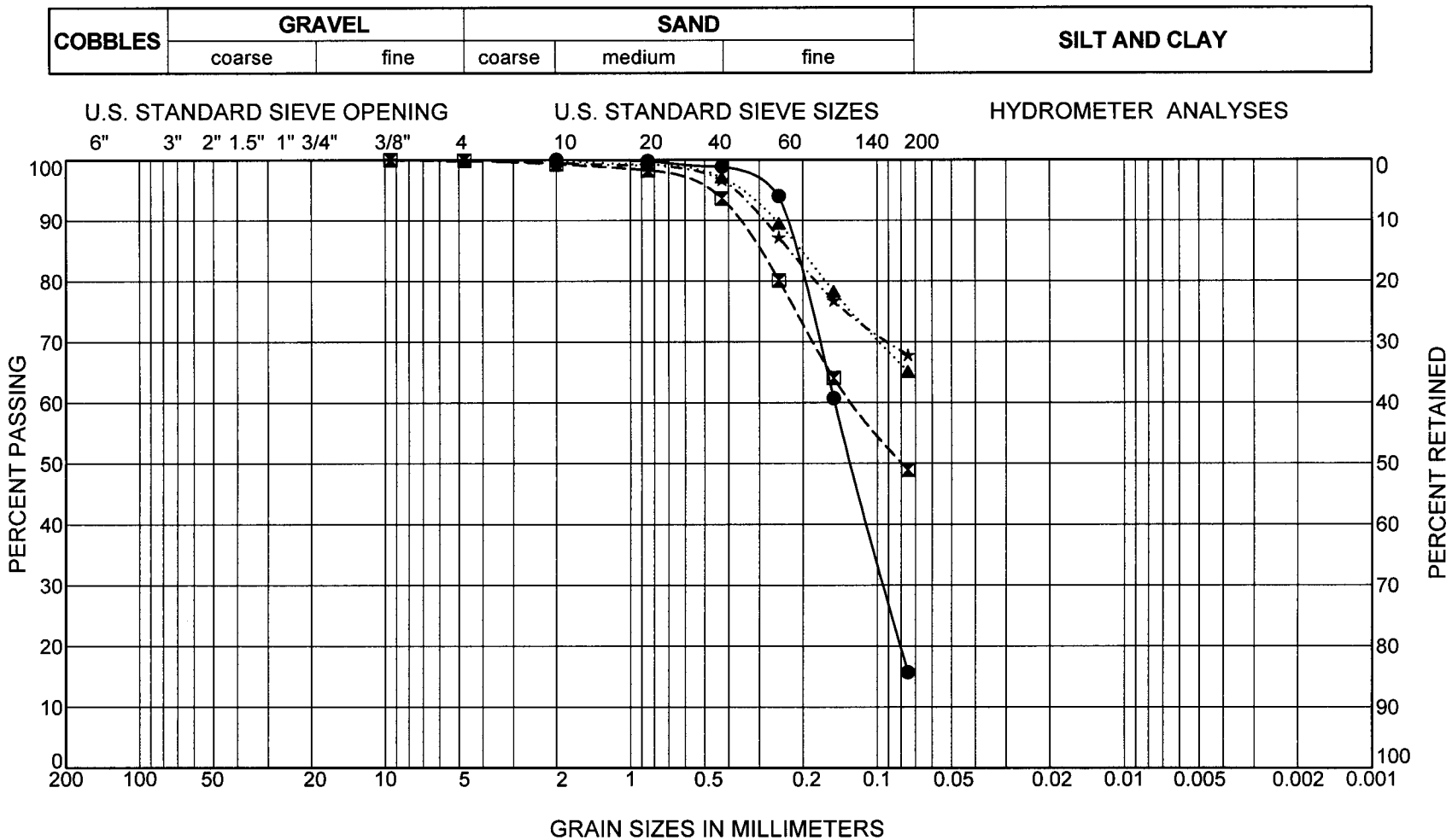
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

JOB NO: 206118.GDR

CONTRA LOMA AND G STREET INTERCHANGE
CONTRA COSTA COUNTY, CALIFORNIA

PLATE NO: B-3G

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
RW-123	MC-7	30.0	●			SILTY SAND (SM)
RW-127	MC-6	24.5	⊠			CLAYEY SAND (SC)
SW-112	SPT-3	9.5	▲			SANDY LEAN CLAY (CL)
SW-112	SPT-5	19.5	★			SANDY LEAN CLAY (CL)

PARIKH CONSULTANTS, INC.
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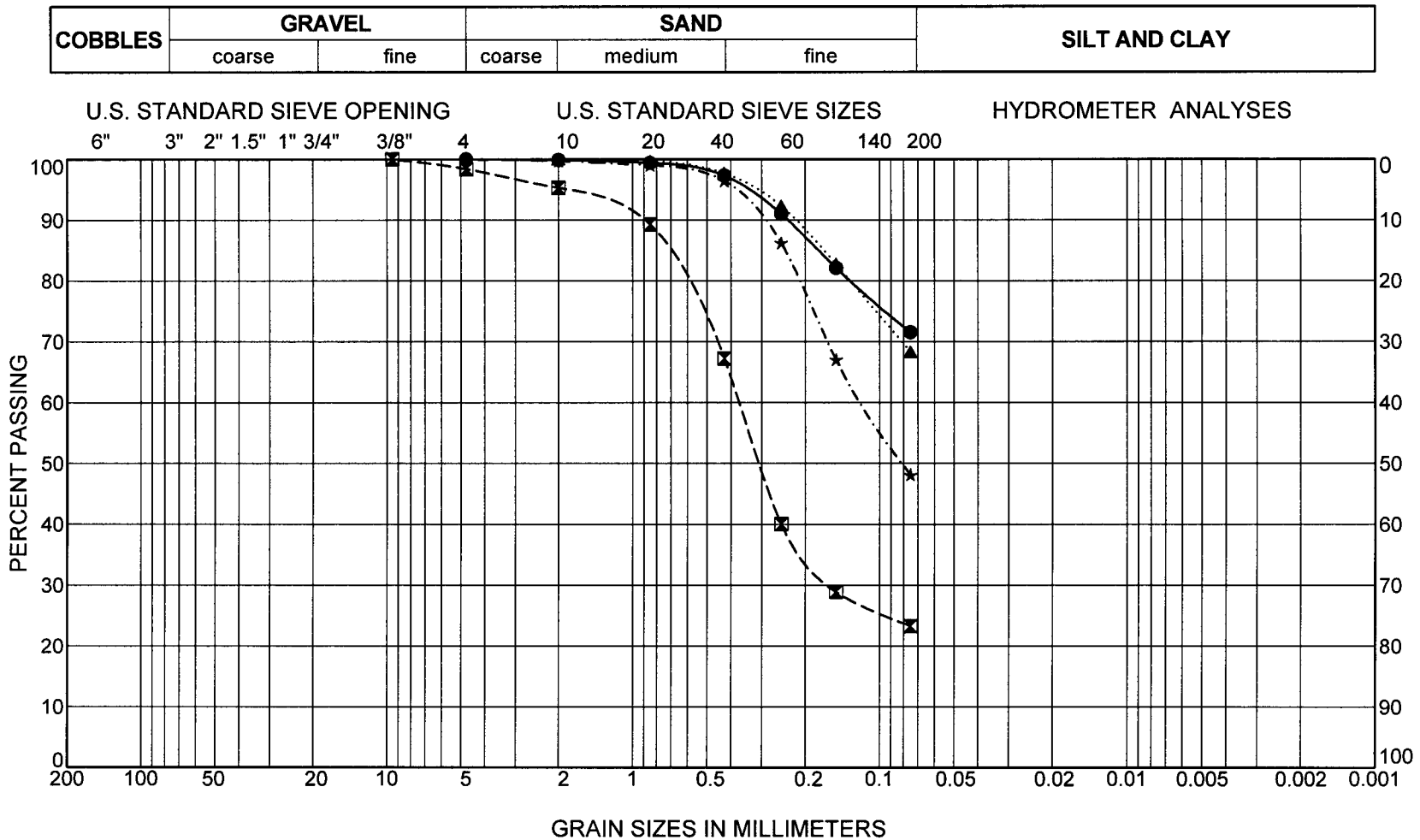
MATERIALS ENGINEERING

JOB NO: 206118.GDR

CONTRA LOMA AND G STREET INTERCHANGE
CONTRA COSTA COUNTY, CALIFORNIA

PLATE NO: B-3H

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
SW-114	MC-3	9.5	●			LEAN CLAY WITH SAND (CL)
SW-117	SPT-3	9.5	⊠			SILTY SAND (SM)
SW-117	MC-5	19.5	▲			SANDY LEAN CLAY (CL)
SW-133	MC-4	14.5	★			CLAYEY SAND (SC)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

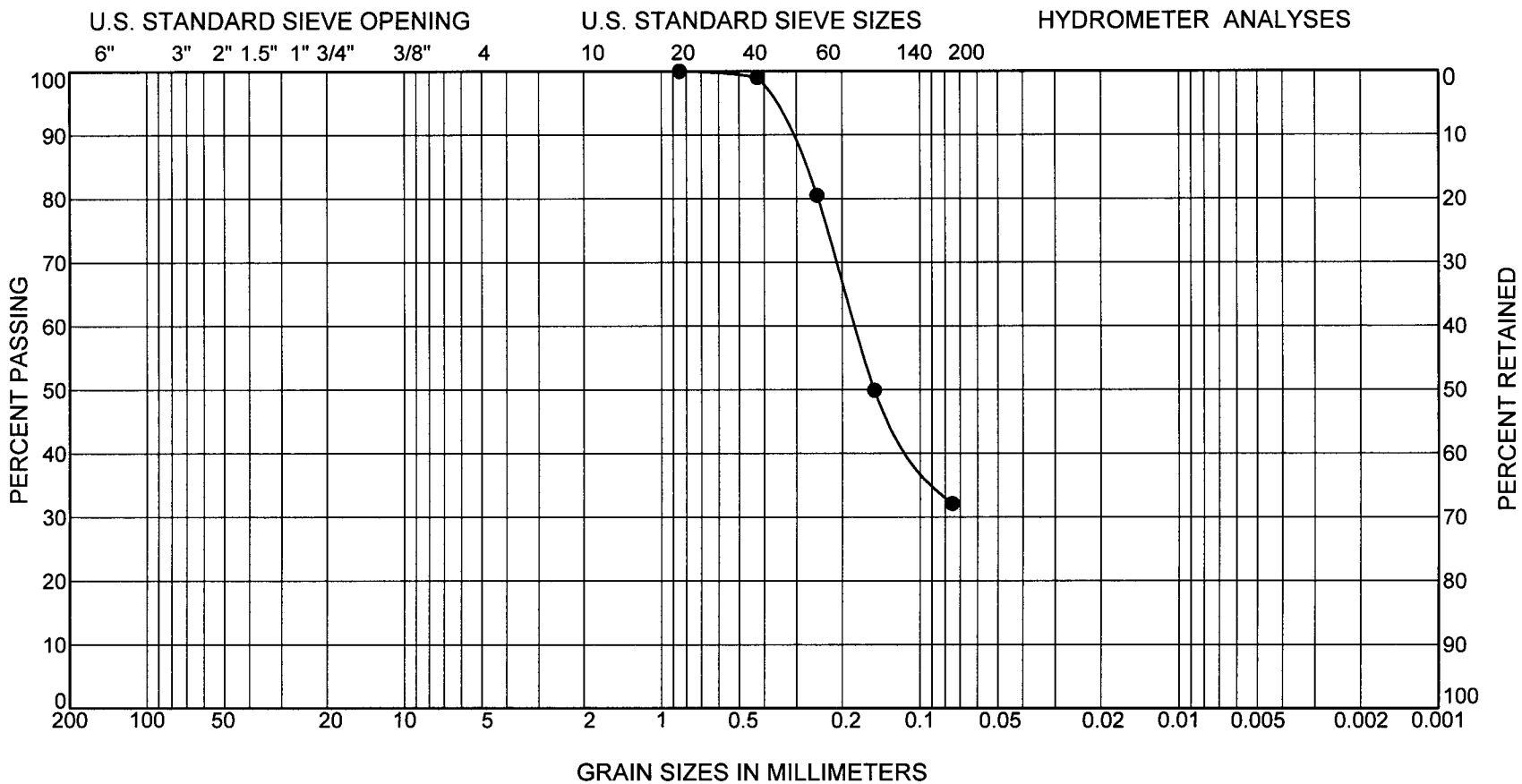
CONTRA LOMA AND G STREET INTERCHANGE
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO: 206118.GDR

PLATE NO: B-3I

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
SW-140	MC-5	19.5	●			SILTY SAND (SM)

PARIKH CONSULTANTS, INC.
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MATERIALS ENGINEERING

JOB NO: 206118.GDR

CONTRA LOMA AND G STREET INTERCHANGE
CONTRA COSTA COUNTY, CALIFORNIA

PLATE NO: B-3J

INFORMATION HANDOUT

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/17/2007
Date Submitted 01/12/2007

To: 'rav Dayah
'arikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118.GDR/RTE4 EAST Site ID : RW/SW111#4 @ 16.
Thank you for your business.

* For future reference to this analysis please use SUN # 49661-99008.

EVALUATION FOR SOIL CORROSION

Soil pH	7.61		
Minimum Resistivity	2.36 ohm-cm (x1000)		
Chloride	13.3 ppm	00.00133	%
Sulfate	37.1 ppm	00.00371	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Plate No. B-4A

04-2285E4

Sunland Analytical

INFORMATION HANDOUT

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/17/2007
Date Submitted 01/12/2007

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118.GDR/RTE4 EAST Site ID : SW/RW116#5 @ 20.
Thank you for your business.

* For future reference to this analysis please use SUN # 49661-99007.

EVALUATION FOR SOIL CORROSION

Soil pH	7.47		
Minimum Resistivity	0.28	ohm-cm (x1000)	
Chloride	456.7 ppm	00.04567	%
Sulfate	2573.4 ppm	00.25734	%

METHODS
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

04-2285E4

Sunland Analytical

INFORMATION HANDOUT

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/17/2007
Date Submitted 01/12/2007

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118.GDR/RTE4 EAST Site ID : C118#1 @ 2'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49661-99006.

EVALUATION FOR SOIL CORROSION

Soil pH	7.72		
Minimum Resistivity	1.21 ohm-cm (x1000)		
Chloride	7.6 ppm	00.00076	%
Sulfate	51.3 ppm	00.00513	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Plate No. B-4C

04-2285E4

Sunland Analytical

INFORMATION HANDOUT

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/17/2007
Date Submitted 01/12/2007

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118.GDR/RTE4 EAST Site ID : SW121#1 @ 3'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49661-99009.

EVALUATION FOR SOIL CORROSION

Soil pH	7.98		
Minimum Resistivity	1.23	ohm-cm (x1000)	
Chloride	16.4 ppm	00.00164	%
Sulfate	41.0 ppm	00.00410	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Plate No. B-4D

04-2285E4

Sunland Analytical

INFORMATION HANDOUT

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/09/2007
Date Submitted 02/06/2007

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118GDR RTE4 EAST Site ID : E122 #1 @3'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49834-99333.

EVALUATION FOR SOIL CORROSION

Soil pH	7.74		
Minimum Resistivity	1.23	ohm-cm (x1000)	
Chloride	12.1 ppm	00.00121	%
Sulfate	21.5 ppm	00.00215	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Plate No. B-4E

04-2285E4

Sunland Analytical

INFORMATION HANDOUT

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/31/2007
Date Submitted 01/25/2007

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118.GDR/RTE4 EAST Site ID : RW123#3 @ 10'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49731-99160.

EVALUATION FOR SOIL CORROSION

Soil pH	7.63		
Minimum Resistivity	1.18	ohm-cm (x1000)	
Chloride	15.2 ppm	00.00152	%
Sulfate	13.2 ppm	00.00132	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Plate No. B-4F

04-2285E4

Sunland Analytical

INFORMATION HANDOUT

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/31/2007
Date Submitted 01/25/2007

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118.GDR/RTE4 EAST Site ID : RW127#2 @ 4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49731-99164.

EVALUATION FOR SOIL CORROSION

Soil pH	7.56		
Minimum Resistivity	0.99	ohm-cm (x1000)	
Chloride	15.6 ppm	00.00156	%
Sulfate	29.1 ppm	00.00291	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

04-2285E4

Sunland Analytical

INFORMATION HANDOUT

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/31/2007
Date Submitted 01/25/2007

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118.GDR/RTE4 EAST Site ID : SW129#2 @ 6'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49731-99162.

EVALUATION FOR SOIL CORROSION

Soil pH	7.89	
Minimum Resistivity	1.15 ohm-cm (x1000)	
Chloride	16.3 ppm	00.00163 %
Sulfate	55.2 ppm	00.00552 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

04-2285E4

Sunland Analytical

INFORMATION HANDOUT

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/31/2007
Date Submitted 01/25/2007

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118.GDR/RTE4 EAST Site ID : SW130#2 @ 4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49731-99166.

EVALUATION FOR SOIL CORROSION

Soil pH	7.18		
Minimum Resistivity	1.05 ohm-cm (x1000)		
Chloride	14.3 ppm	00.00143	%
Sulfate	28.5 ppm	00.00285	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

04-2285E4

Sunland Analytical

INFORMATION HANDOUT

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/31/2007
Date Submitted 01/25/2007

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118.GDR/RTE4 EAST Site ID : SW131#3 @ 10'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49731-99165.

EVALUATION FOR SOIL CORROSION

Soil pH	7.71	
Minimum Resistivity	0.38 ohm-cm (x1000)	
Chloride	254.9 ppm	00.02549 %
Sulfate	561.6 ppm	00.05616 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Plate No. B-4J

04-2285E4

Sunland Analytical

INFORMATION HANDOUT

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/31/2007
Date Submitted 01/25/2007

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118.GDR/RTE4 EAST Site ID : SW132#2 @ 6'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49731-99163.

EVALUATION FOR SOIL CORROSION

Soil pH	7.05		
Minimum Resistivity	1.18	ohm-cm (x1000)	
Chloride	15.2 ppm	00.00152	%
Sulfate	22.9 ppm	00.00229	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Plate No. B-4K

04-2285E4

Sunland Analytical

INFORMATION HANDOUT

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/31/2007
Date Submitted 01/25/2007

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118.GDR/RTE4 EAST Site ID : SW134#2 @ 4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49731-99159.

EVALUATION FOR SOIL CORROSION

Soil pH	7.61		
Minimum Resistivity	1.05	ohm-cm (x1000)	
Chloride	8.3 ppm	00.00083	%
Sulfate	37.8 ppm	00.00378	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Plate No. B-4L

04-2285E4

Sunland Analytical

INFORMATION HANDOUT

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/31/2007
Date Submitted 01/25/2007

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118.GDR/RTE4 EAST Site ID : RW/SW136#3 @9.5.
Thank you for your business.

* For future reference to this analysis please use SUN # 49731-99161.

EVALUATION FOR SOIL CORROSION

Soil pH	7.61		
Minimum Resistivity	0.80	ohm-cm (x1000)	
Chloride	57.8 ppm	00.00578	%
Sulfate	32.7 ppm	00.00327	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

04-2285E4

Sunland Analytical

INFORMATION HANDOUT

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/09/2007
Date Submitted 02/06/2007

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118GDR RTE4 EAST Site ID : RW/SW139#3@11'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49834-99330.

EVALUATION FOR SOIL CORROSION

Soil pH	7.71		
Minimum Resistivity	1.47	ohm-cm (x1000)	
Chloride	27.7 ppm	00.00277	%
Sulfate	42.1 ppm	00.00421	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Plate No. B-4N

04-2285E4

Sunland Analytical

INFORMATION HANDOUT

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/16/2007
Date Submitted 02/12/2007

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118.GDR\RTE. 4 Site ID : SW140#3 @ 9.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49869-99408.

EVALUATION FOR SOIL CORROSION

Soil pH	7.87		
Minimum Resistivity	0.43	ohm-cm (x1000)	
Chloride	244.5 ppm	00.02445	%
Sulfate	248.9 ppm	00.02489	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Plate No. B-4O

04-2285E4

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 11/17/2006
Date Submitted 11/14/2006

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118.G ST. Site ID : GST138#2@4.
Thank you for your business.

* For future reference to this analysis please use SUN # 49345-98396.

EVALUATION FOR SOIL CORROSION

Soil pH	7.61		
Minimum Resistivity	0.43	ohm-cm (x1000)	
Chloride	380.6 ppm	00.03806	%
Sulfate	230.0 ppm	00.02300	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Plate No. B-4P

04-2285E4

INFORMATION HANDOUT

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 11/15/2006
Date Submitted 11/08/2006

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118 CLO/CONTRA LO Site ID : CLO-124#3@8-1/2.
Thank you for your business.

* For future reference to this analysis please use SUN # 49312-98317.

EVALUATION FOR SOIL CORROSION

Soil pH	7.96		
Minimum Resistivity	0.78	ohm-cm (x1000)	
Chloride	22.1 ppm	00.00221	%
Sulfate	108.2 ppm	00.01082	%

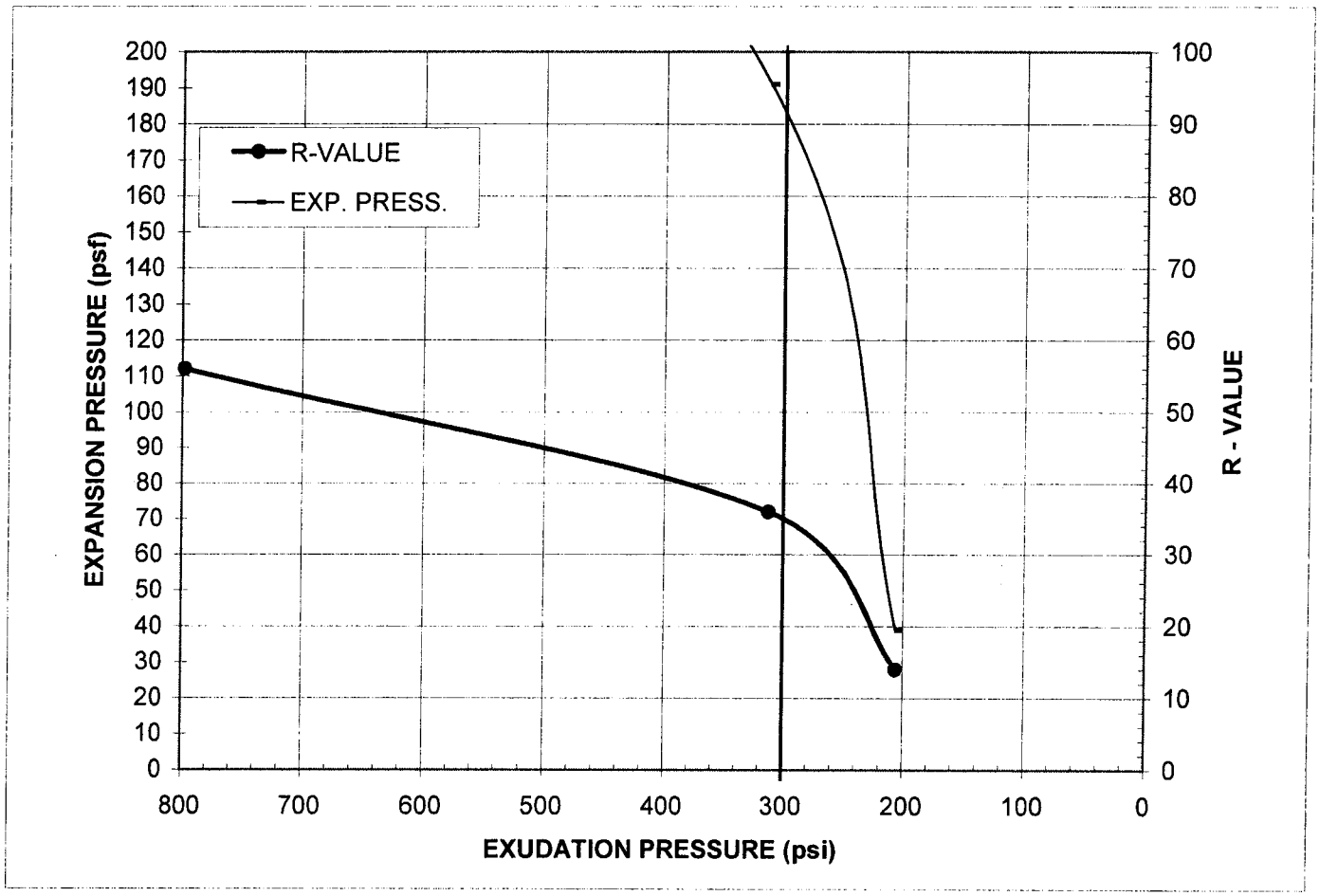
METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Plate No. B-4R

R-VALUE REPORT

04-2285E4 Parikh Consultants, Inc. INFORMATION HANDOUT ASTM D2844 or CTM 301 (408) 945-1011

Project Name:	Route 4 East			Date:	7/18/06
Client:	BKF			Project #:	206118.GDR
Sample #:	R40	Depth:	0' - 5'	Lab #:	M590
Location / Source:		Native		Sample Date:	
Material :	Silty sands, yellowish gray			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	206	312	798
Expansion Pressure, psf	39	191	403
R-Value	14	36	56
Moisture Content at Test, %	18.8	16.5	15.0
Dry Density at Test, pcf	106.3	110.3	114.6

R-Value @ 300 psi Exudation Pressure = 35

Expansion Pressure @300 psi Exudation, psf = **184**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

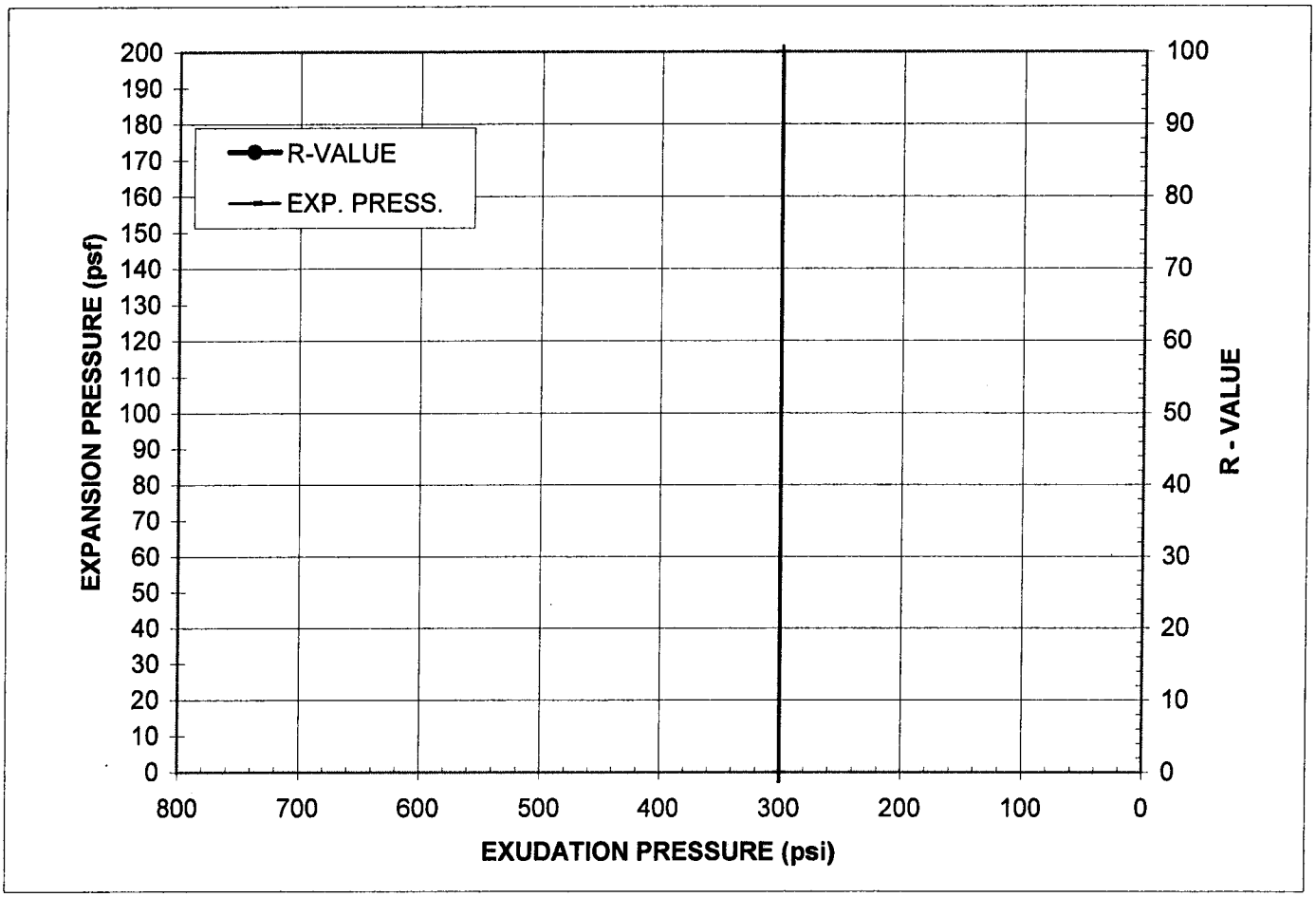
RVALUE with calcs pdp

Plate No. B-5A

R-VALUE REPORT

04-2285E4 Parikh Consultants, Inc. INFORMATION HANDOUT ASTM D2844 or CTM 301 (408) 945-1011

Project Name:	Route 4 East			Date:	9/27/06
Client:	TYLIN			Project #:	206118.GDR
Sample #:	R39	Depth:	0' - 5'	Lab #:	M590
Location / Source:		Native		Sample Date:	
Material :	Clay, brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi			
Expansion Pressure, psf			
R-Value			
Moisture Content at Test, %			
Dry Density at Test, pcf			

R-Value @ 300 psi Exudation Pressure = <5	Expansion Pressure @300 psi Exudation, psf =
Minimum R-Value Requirement:	

Comments: Test sample extruded from under the mold and around the follower ram during Exudation Test.
Test terminated - R-Valve = < 5

Report By: Prav Dayah

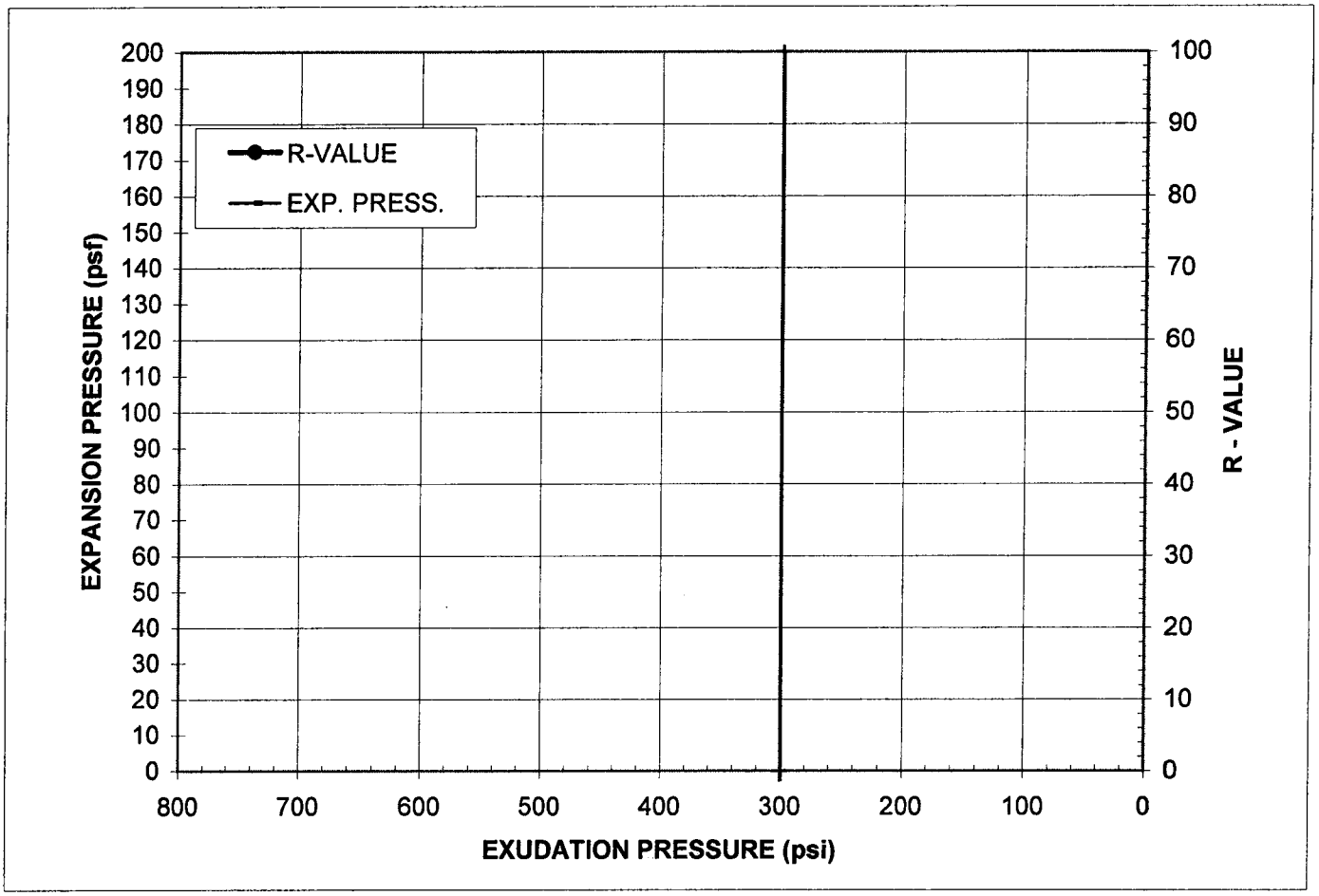
RVALUE with calcs pdp

Plate No. B-5B

R-VALUE REPORT

04-2285E4 Parikh Consultants, Inc. INFORMATION HANDOUT ASTM D2844 or CTM 301 (408) 945-1011

Project Name:	Route 4 East			Date:	9/27/06
Client:	TYLIN			Project #:	206118.GDR
Sample #:	R38	Depth:	0' - 5'	Lab #:	M590
Location / Source:		Native		Sample Date:	
Material :	Clay, brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi			
Expansion Pressure, psf			
R-Value			
Moisture Content at Test, %			
Dry Density at Test, pcf			

R-Value @ 300 psi Exudation Pressure = **<5**

Expansion Pressure @300 psi Exudation, psf =

Minimum R-Value Requirement:

Comments: Test sample extruded from under the mold and around the follower ram during Exudation Test.
Test terminated - R-Valve = < 5

Report By: Prav Dayah

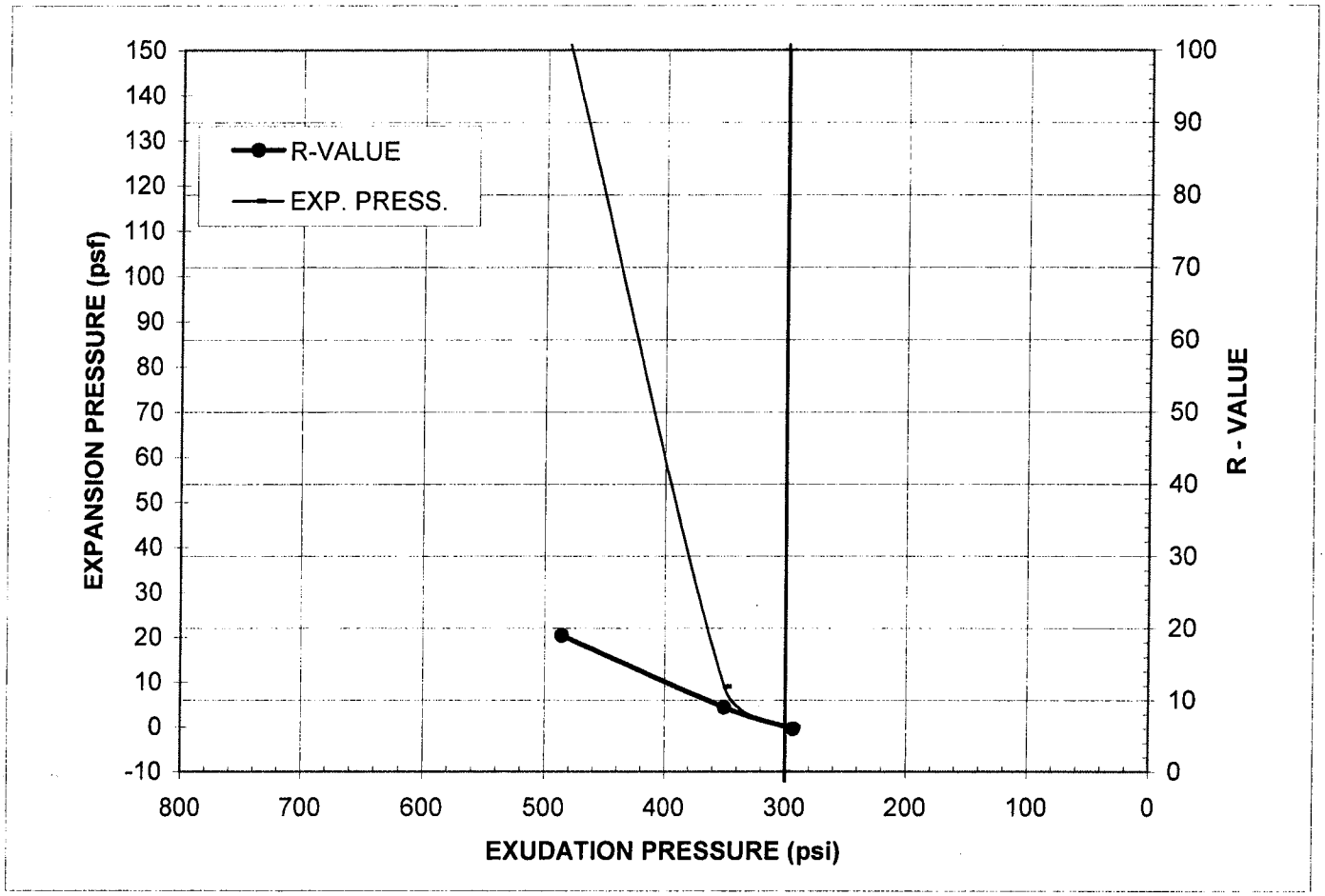
RVALUE with calcs pdp

Plate No. B-5C

R-VALUE REPORT

04-2285E4 Parikh Consultants, Inc. INFORMATION HANDOUT ASTM D2844 or CTM 301 (408) 945-1011

Project Name: Route 4 East		Date:	7/18/06
Client: BKF		Project #:	206118.GDR
Sample #: R37	Depth: 0' - 5'	Lab #:	M590
Location / Source:	Native	Sample Date:	
Material : Clay, grayish brown		Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	293	350	486
Expansion Pressure, psf	0	9	156
R-Value	6	9	19
Moisture Content at Test, %	23.6	22.6	20.7
Dry Density at Test, pcf	98.1	100.1	105.7

R-Value @ 300 psi Exudation Pressure = 6

Expansion Pressure @300 psi Exudation, psf = **0**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

RVALUE with calcs pdp

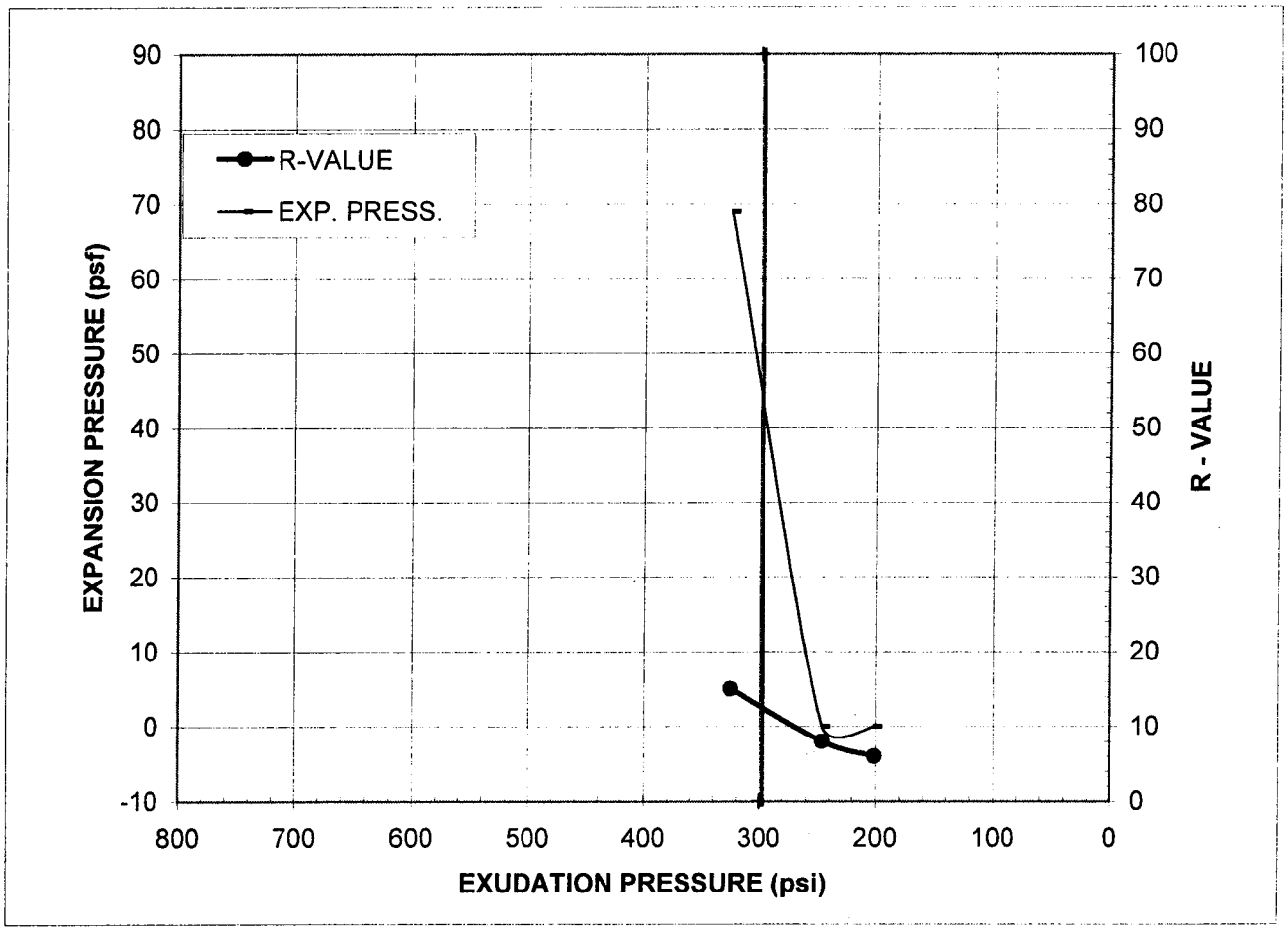
Plate No. B-5D

INFORMATION HANDOUT

R-VALUE REPORT

Parikh Consultants, Inc. **ASTM D2844 or CTM 301** (408) 945-1011

Project Name:	Highway 4 East			Date:	5/20/08
Client:	T Y Lin			Project #:	206117.GDR
Sample #:	R-37A	Depth:	0'-5'	Lab #:	M707
Location / Source:		Native / Onsite		Sample Date:	
Material :	Sandy heavy clay, brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	201	246	325
Expansion Pressure, psf	0	0	69
R-Value	6	8	15
Moisture Content at Test, %	24.0	22.2	20.5
Dry Density at Test, pcf	98.2	101.3	105.6

R-Value @ 300 psi Exudation Pressure = 14

Expansion Pressure @300 psi Exudation, psf = **44**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

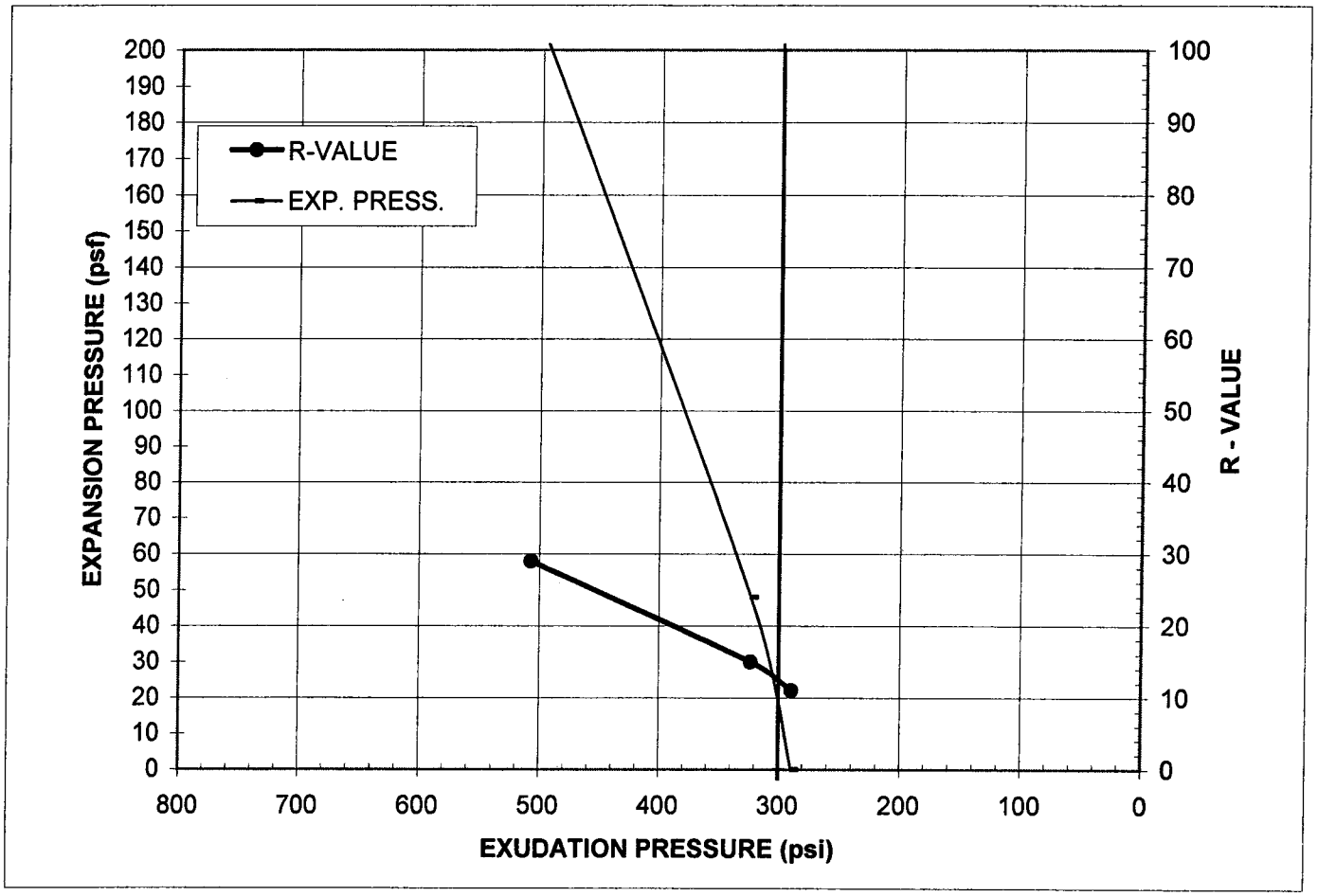
RVALUE with calcs pdp

Plate No. B-5E

R-VALUE REPORT

04-2285E4
Parikh Consultants, Inc.
INFORMATION HANDOUT
ASTM D2844 or CTM 301
(408) 945-1011

Project Name:	Route 4 East	Date:	9/27/06
Client:	TYLIN	Project #:	206118.GDR
Sample #:	R36	Depth:	0' - 5'
Lab #:	M590		
Location / Source:	Native	Sample Date:	
Material :	Clay, brown	Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	289	323	507
Expansion Pressure, psf	0	48	212
R-Value	11	15	29
Moisture Content at Test, %	20.4	18.5	16.5
Dry Density at Test, pcf	107.9	109.1	113.7

R-Value @ 300 psi Exudation Pressure = 12

Expansion Pressure @300 psi Exudation, psf = **20**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

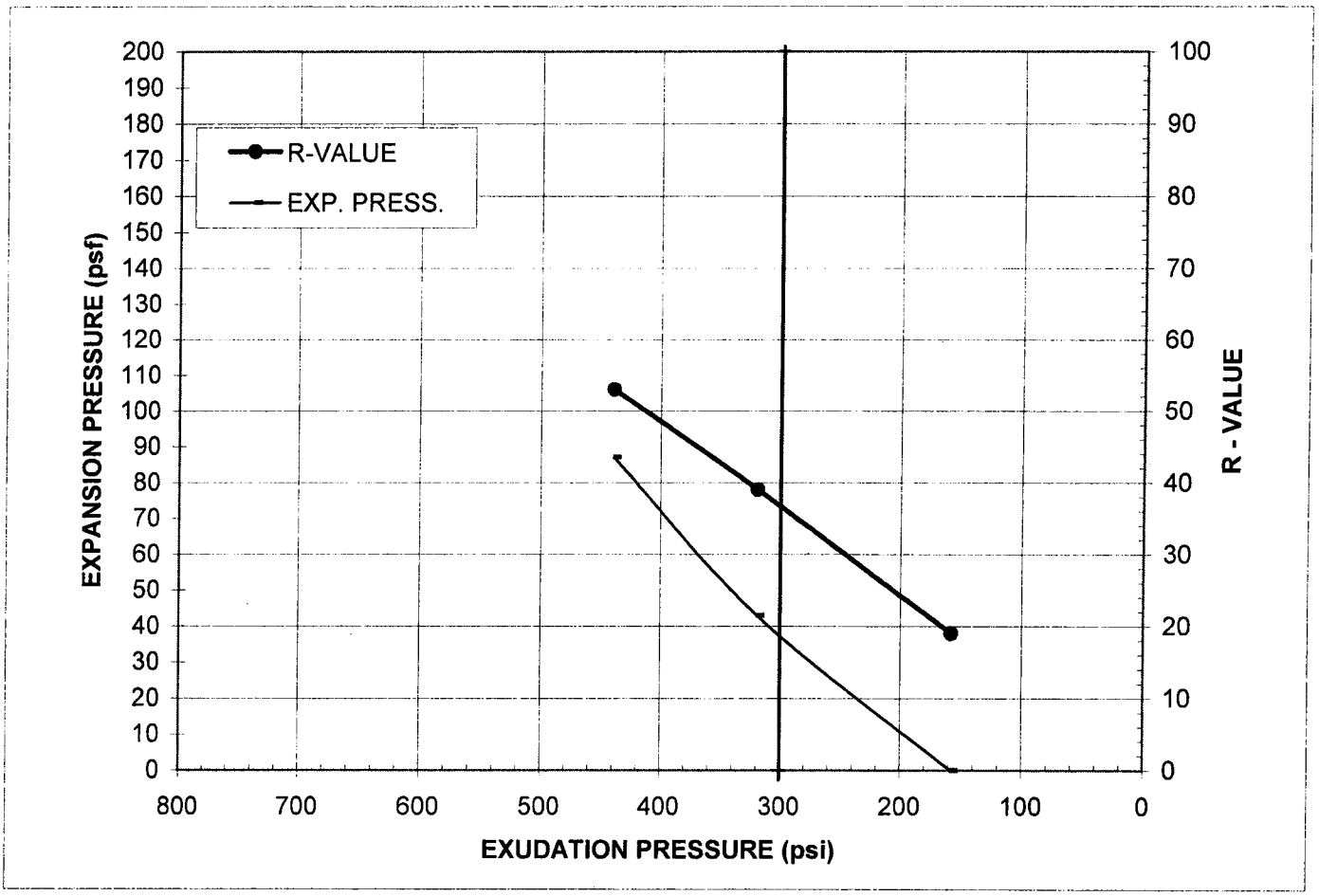
RVALUE with calcs pdp

Plate No. B-5F

R-VALUE REPORT

04-2285E4 Parikh Consultants, Inc. INFORMATION HANDOUT ASTM D2844 or CTM 301 (408) 945-1011

Project Name:	Route 4 East			Date:	7/18/06
Client:	BKF			Project #:	206118.GDR
Sample #:	R35	Depth:	0' - 5'	Lab #:	M590
Location / Source:		Native		Sample Date:	
Material :	Sandy clay, yellowish brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	158	319	439
Expansion Pressure, psf	0	43	87
R-Value	19	39	53
Moisture Content at Test, %	16.6	15.3	13.4
Dry Density at Test, pcf	111.4	114.2	116.3

R-Value @ 300 psi Exudation Pressure = 37

Expansion Pressure @300 psi Exudation, psf = **38**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

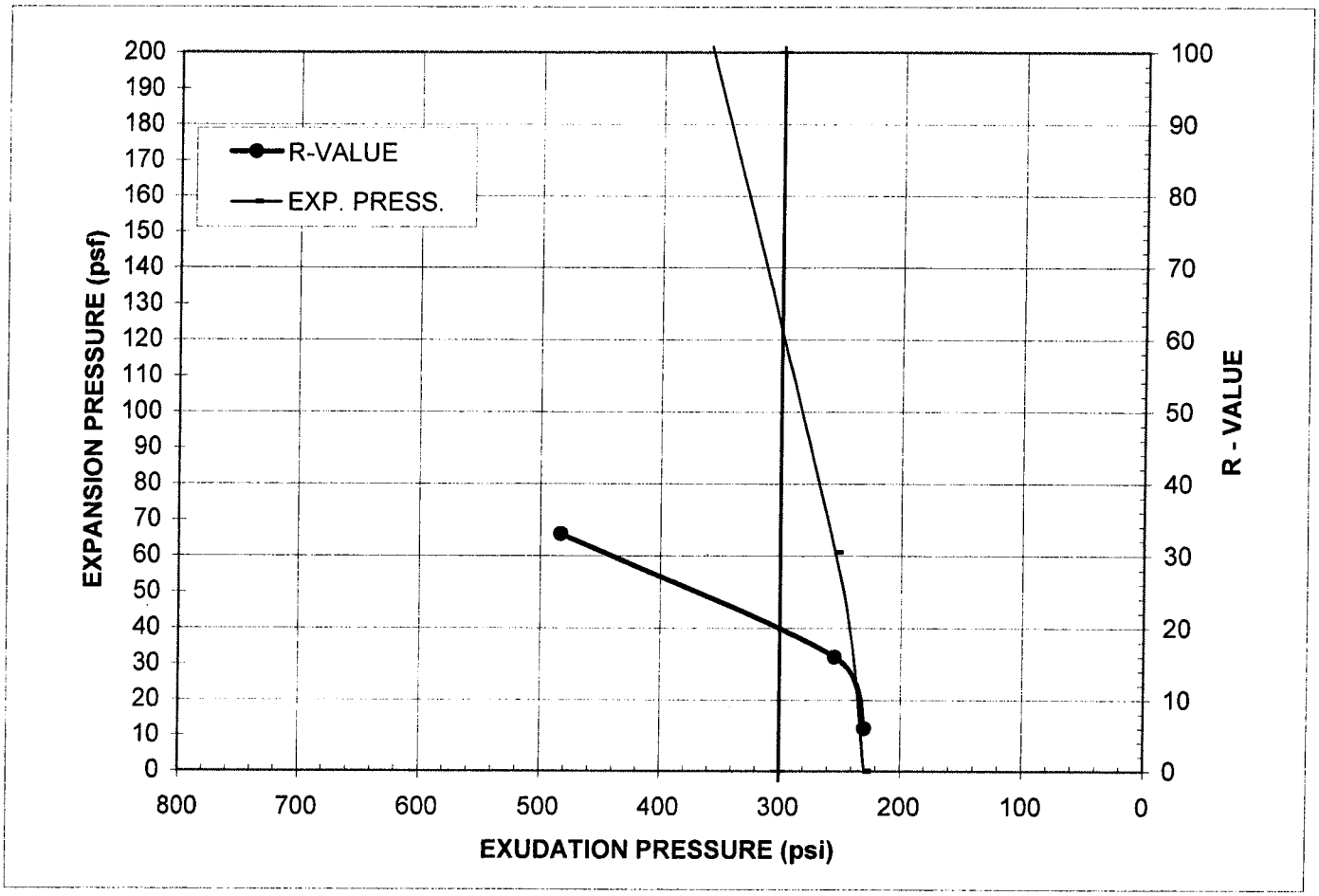
RVALUE with calcs pdp

Plate No. B-5G

R-VALUE REPORT

04-2285E4 Parikh Consultants, Inc. ASTM D2844 or CTM 301 INFORMATION HANDOUT (408) 945-1011

Project Name:	Route 4 East			Date:	7/18/06
Client:	BKF			Project #:	206118.GDR
Sample #:	R33	Depth:	0' - 5'	Lab #:	M590
Location / Source:		Native		Sample Date:	
Material :	Sandy clay, yellowish brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	229	254	483
Expansion Pressure, psf	0	61	360
R-Value	6	16	33
Moisture Content at Test, %	22.4	20.4	18.0
Dry Density at Test, pcf	100.3	104.2	107.4

R-Value @ 300 psi Exudation Pressure = 20

Expansion Pressure @300 psi Exudation, psf = **124**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

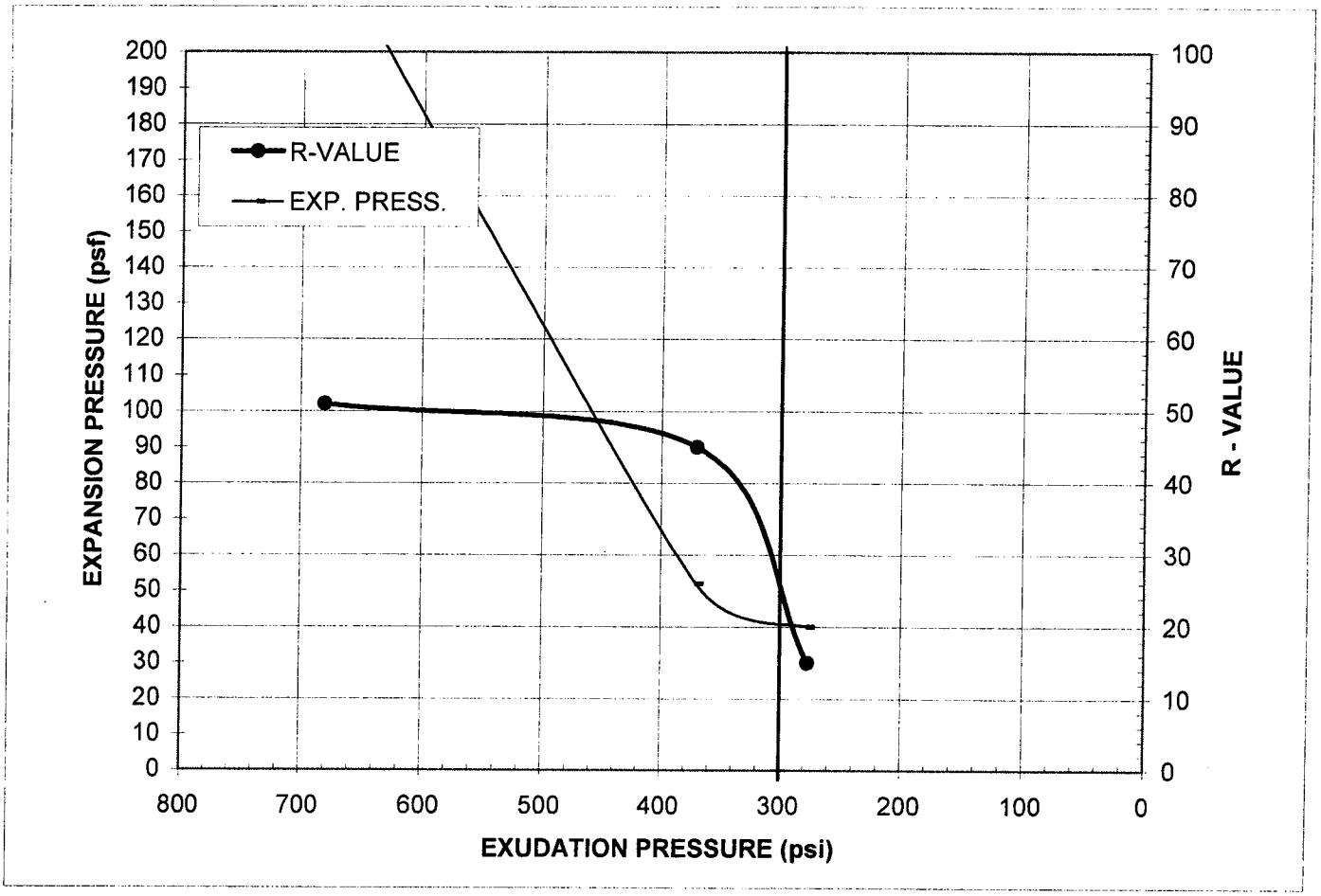
RVALUE with calcs pdp

Plate No. B-5H

R-VALUE REPORT

04-2285E4 Parikh Consultants, Inc. INFORMATION HANDOUT ASTM D2844 or CTM 301 (408) 945-1011

Project Name:	Route 4 East	Date:	7/18/06
Client:	BKF	Project #:	206118.GDR
Sample #: R27	Depth: 0' - 5'	Lab #:	M590
Location / Source:	Native	Sample Date:	
Material :	Silty sands with clay, light brown	Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	277	370	680
Expansion Pressure, psf	40	52	229
R-Value	15	45	51
Moisture Content at Test, %	16.7	17.8	16.9
Dry Density at Test, pcf	107.7	109.8	114.4

R-Value @ 300 psi Exudation Pressure = 27

Expansion Pressure @300 psi Exudation, psf = **40**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

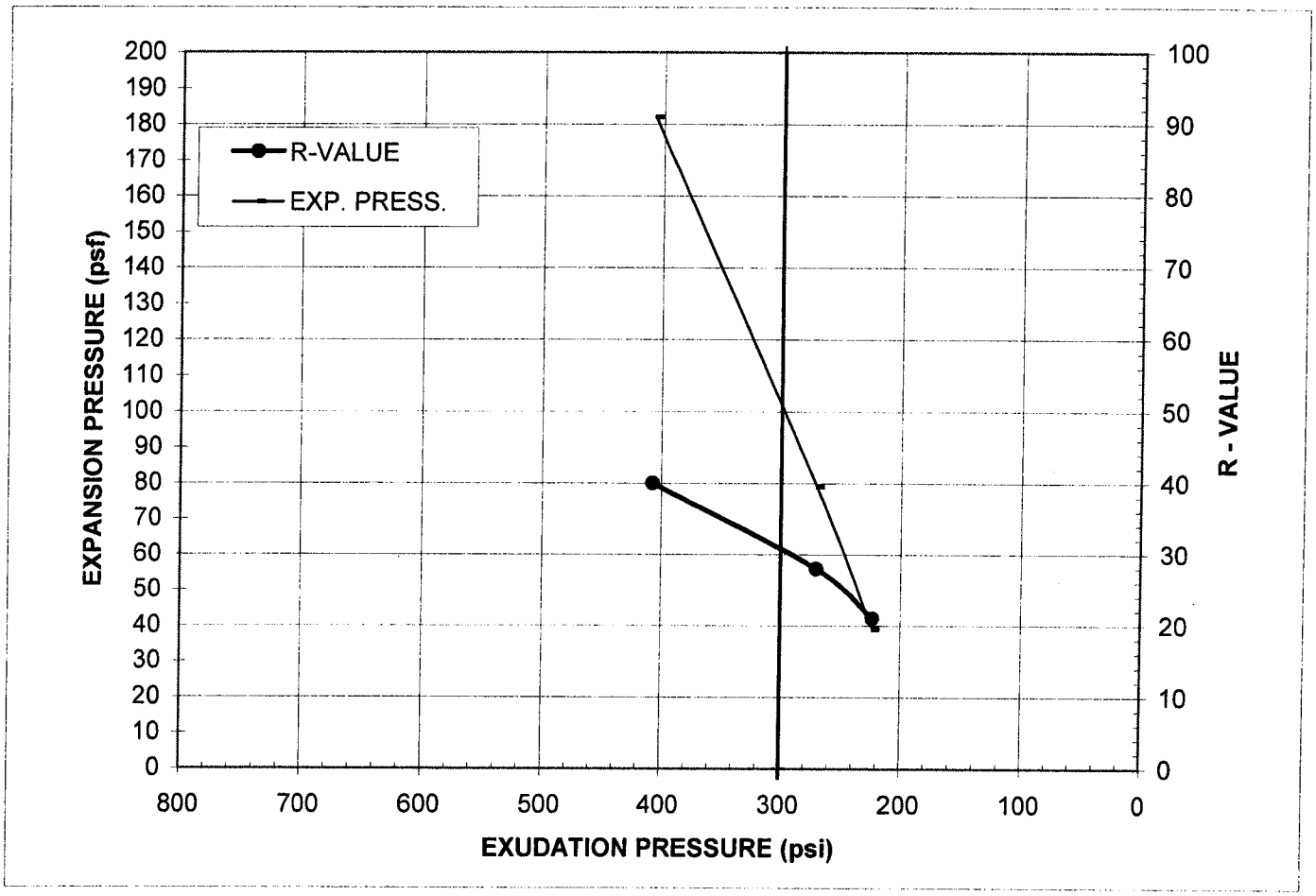
RVALUE with calcs pdp

Plate No. B-5I

R-VALUE REPORT

04-2285E4 Parikh Consultants, Inc. ASTM D2844 or CTM 301 INFORMATION HANDOUT (408) 945-1011

Project Name:	Route 4 East			Date:	7/18/06
Client:	BKF			Project #:	206118.GDR
Sample #:	R26	Depth:	0' - 5'	Lab #:	M590
Location / Source:		Native		Sample Date:	
Material :	Sandy clay,brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	223	270	407
Expansion Pressure, psf	39	79	182
R-Value	21	28	40
Moisture Content at Test, %	17.9	17.2	15.6
Dry Density at Test, pcf	109.4	109.9	113.5

R-Value @ 300 psi Exudation Pressure = 31

Expansion Pressure @300 psi Exudation, psf = **100**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

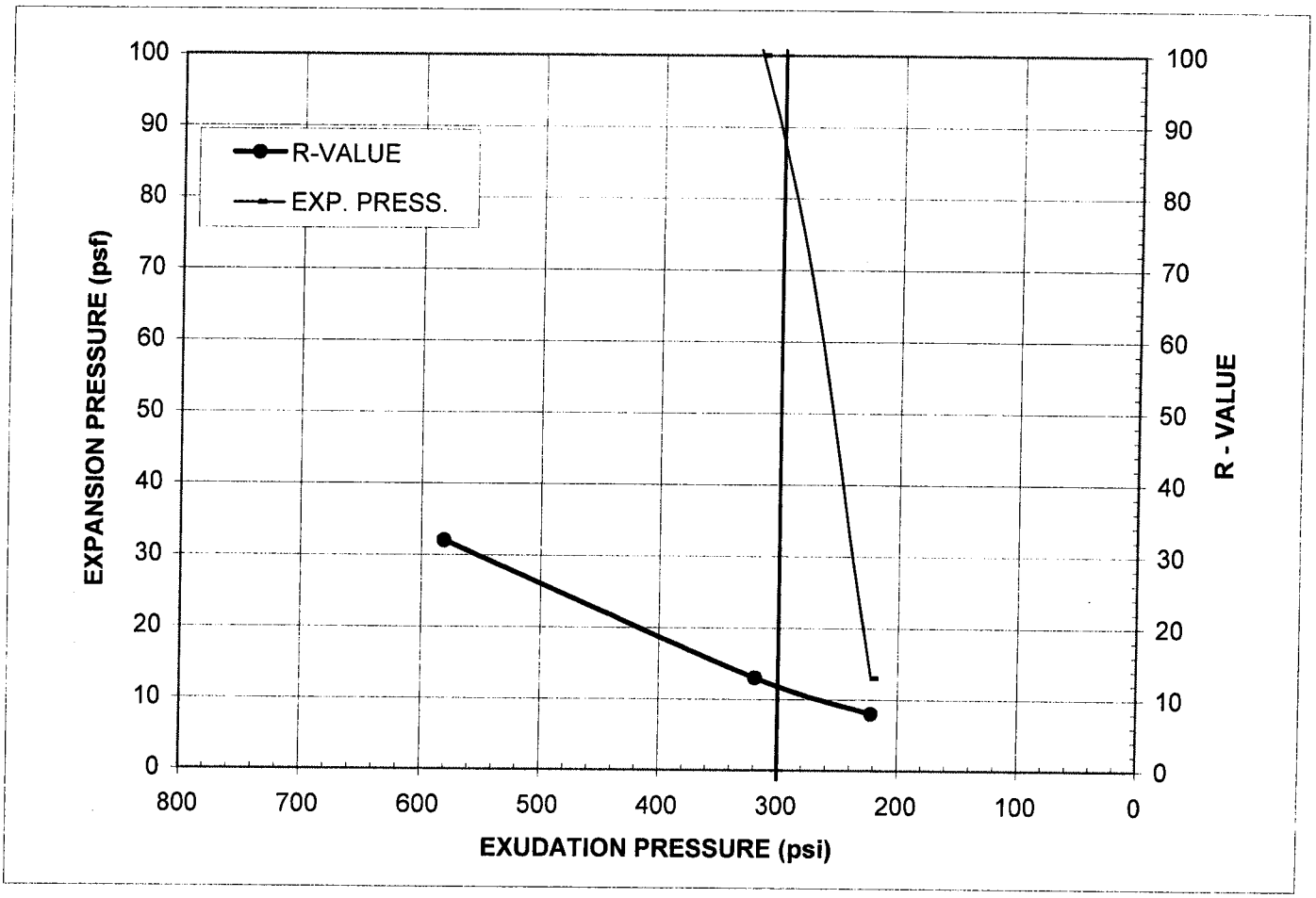
RVALUE with calcs pdp

Plate No. B-5J

R-VALUE REPORT

04-2285E4 Parikh Consultants, Inc. INFORMATION HANDOUT ASTM D2844 or CTM 301 (408) 945-1011

Project Name:	Route 4 East			Date:	7/18/06
Client:	BKF			Project #:	206118.GDR
Sample #:	R25	Depth:	0' - 5'	Lab #:	M590
Location / Source:		Native		Sample Date:	
Material :	Clay, brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	222	319	581
Expansion Pressure, psf	13	100	226
R-Value	8	13	32
Moisture Content at Test, %	21.0	19.1	17.2
Dry Density at Test, pcf	102.0	106.8	112.5

R-Value @ 300 psi Exudation Pressure = 12

Expansion Pressure @300 psi Exudation, psf = **90**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

RVALUE with calcs pdp

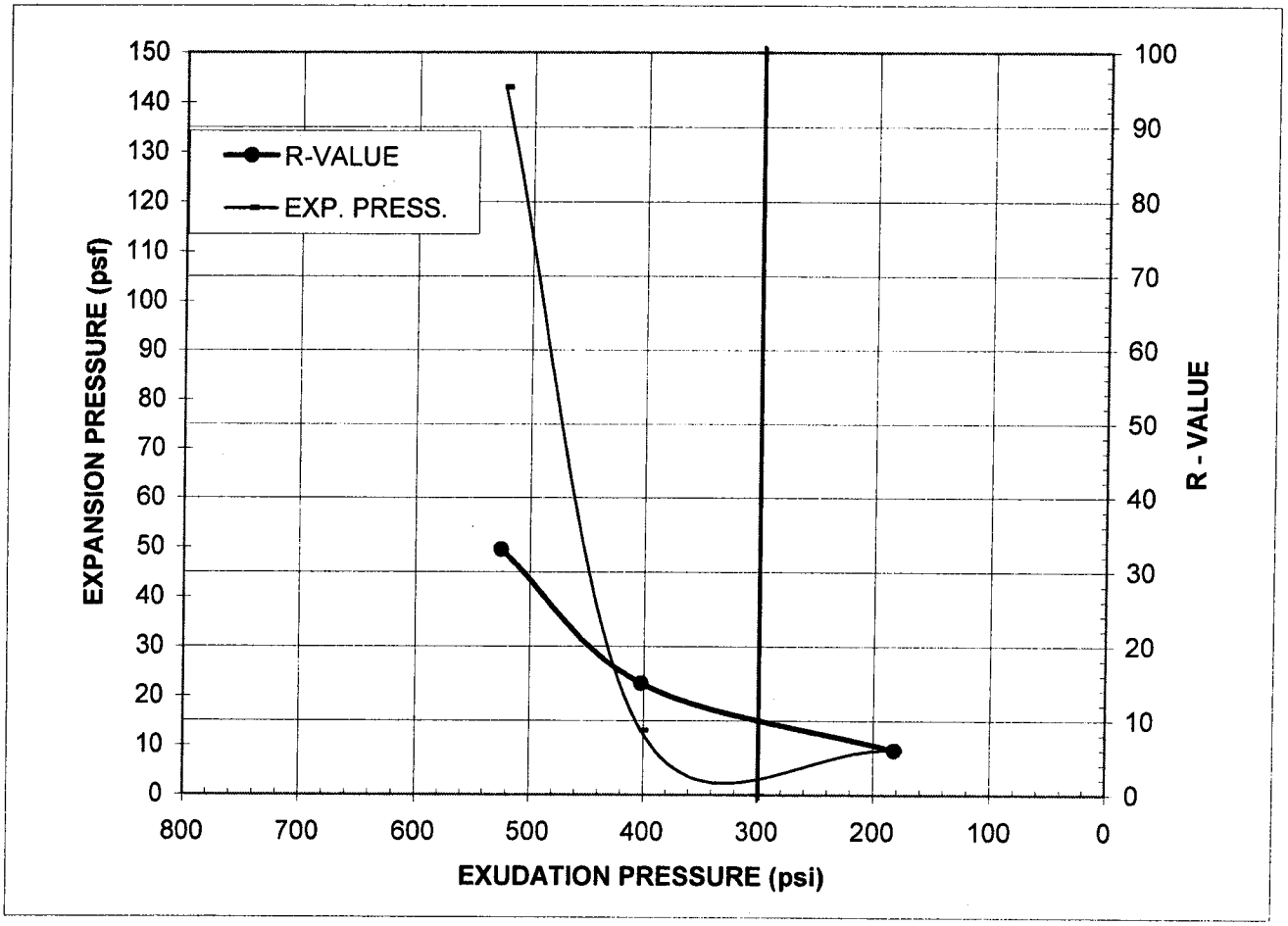
Plate No. B-5K

04-2285E4

R-VALUE REPORT

Parikh Consultants, Inc. ASTM D2844 or CTM 301 (408) 945-1011

Project Name:	Highway 4 East	Date:	5/19/08
Client:	BKF	Project #:	206118.GDR
Sample #: R-25A	Depth: 0'-5'	Lab #:	M708
Location / Source:	Native / Onsite	Sample Date:	
Material :	Sandy clay, brown	Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	182	402	525
Expansion Pressure, psf	9	13	143
R-Value	6	15	33
Moisture Content at Test, %	19.8	17.5	15.6
Dry Density at Test, pcf	105.8	111.2	115.6

R-Value @ 300 psi Exudation Pressure = 10

Expansion Pressure @300 psi Exudation, psf = **4**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

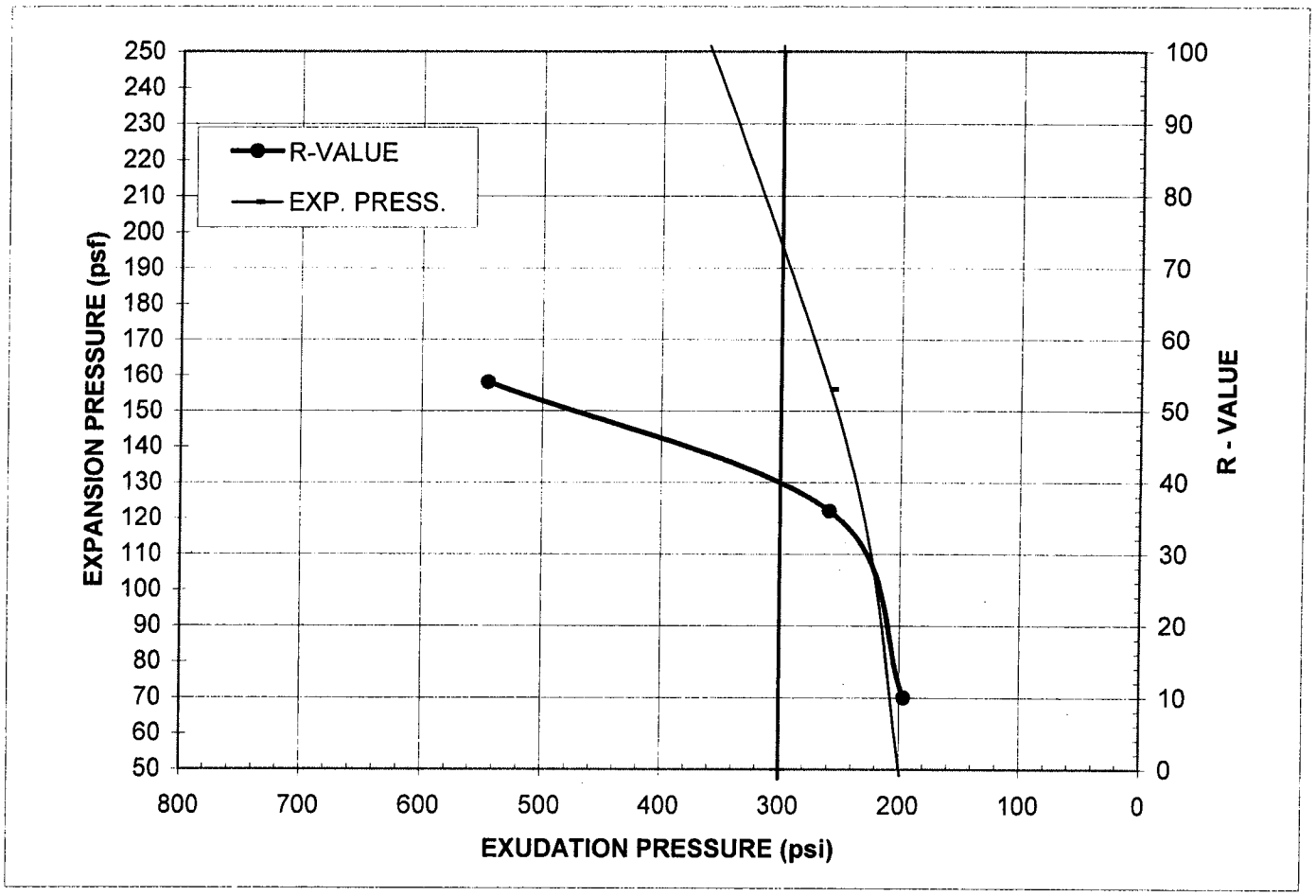
RVALUE with calcs pdp

Plate No. B-5L

R-VALUE REPORT

04-2285E4 Parikh Consultants, Inc. INFORMATION HANDOUT ASTM D2844 or CTM 301 (408) 945-1011

Project Name:	Route 4 East	Date:	7/18/06
Client:	BKF	Project #:	206118.GDR
Sample #:	R24 Depth: 0' - 5'	Lab #:	M590
Location / Source:	Native	Sample Date:	
Material :	Sandy clay, yellowish brown	Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	196	259	545
Expansion Pressure, psf	43	156	411
R-Value	10	36	54
Moisture Content at Test, %	20.7	18.8	16.8
Dry Density at Test, pcf	104.8	109.1	111.8

R-Value @ 300 psi Exudation Pressure = 40

Expansion Pressure @300 psi Exudation, psf = **195**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

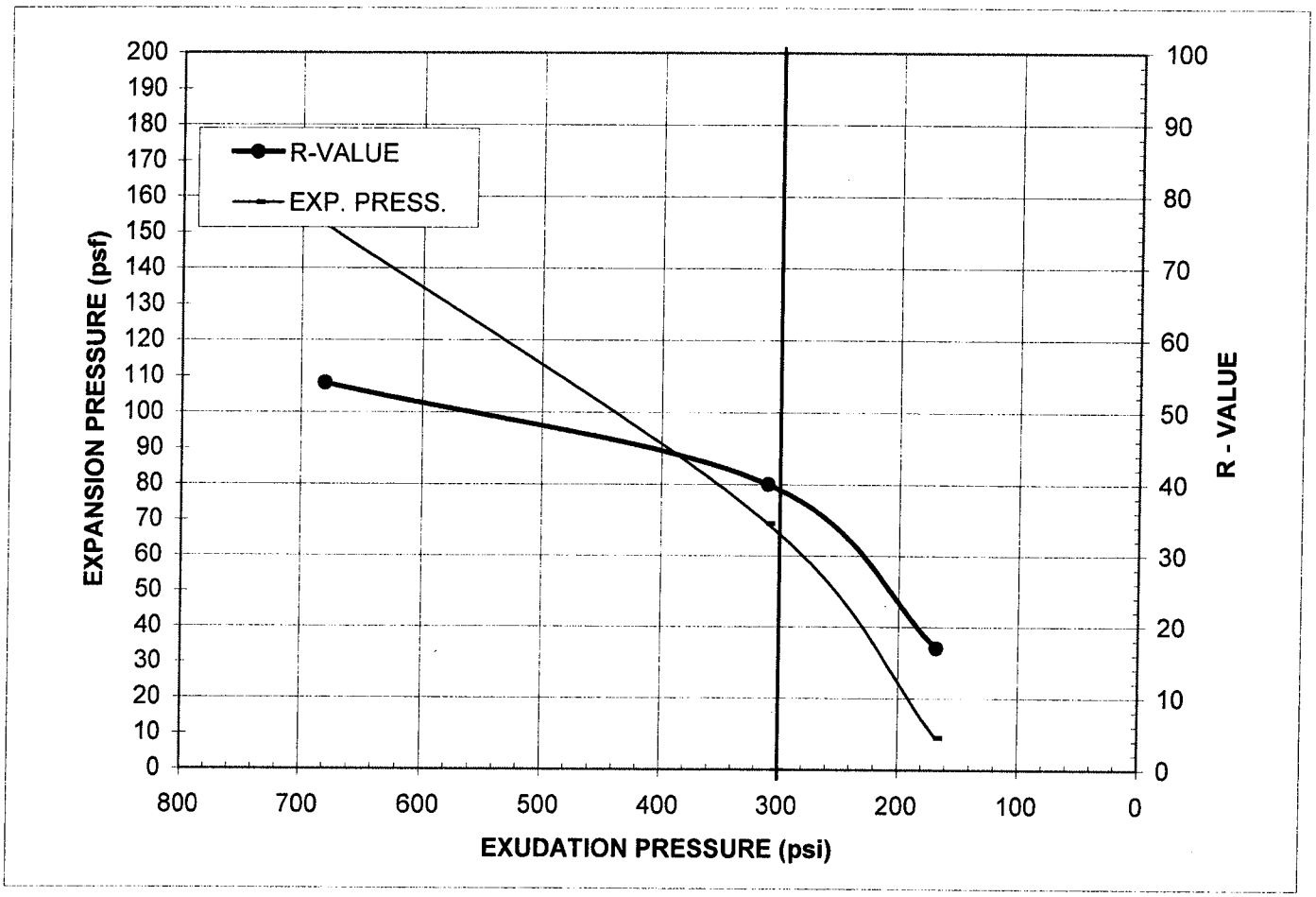
RVALUE with calcs pdp

Plate No. B-5M

R-VALUE REPORT

04-2385R4 Parikh Consultants, Inc. ASTM D2844 or CTM 301 INFORMATION HANDOUT (408) 945-1011

Project Name:	Route 4 East			Date:	7/18/06
Client:	BKF			Project #:	206118.GDR
Sample #:	R22	Depth:	0' - 5'	Lab #:	M590
Location / Source:		Native		Sample Date:	
Material :	Sandy clay, yellowish brown			Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	168	310	680
Expansion Pressure, psf	9	69	152
R-Value	17	40	54
Moisture Content at Test, %	17.9	16.0	14.1
Dry Density at Test, pcf	108.8	112.2	114.8

R-Value @ 300 psi Exudation Pressure = 39

Expansion Pressure @300 psi Exudation, psf = **68**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

RVALUE with calcs pdp

Plate No. B-5N

04-2285E4

LABORATORY TEST REPORT

INFORMATION HANDOUT

(408)-945-1011

Parikh Consultants, Inc.

PROJECT NAME:	Route 4 East	PROJECT #:	206118.GDR
SAMPLE #:	R37 DEPTH: 0'-5'	LAB #:	M590
SOURCE:	Native / Antioch	DATE:	8/15/2006
MATERIAL DESCRIPTION	Clay, grayish brown		

EXPANSION INDEX - ASTM D-4829

					Specification
Expansion Index			74		
Corrected Expansion Index			76		
Expansion Potential			Medium		
Saturation %	Initial:	53	Final:	93	
Moisture Contenet%	Initial:	12	Final:	24.2	
Dry Density, pcf	Initial:	104.6	Final:	98.9	

SAND EQUIVALENT CTM 217

		Specifications
SE		

Sieve Analysis CTM 202

Sieve Size	Percent Passing	Project Specification
6"		
3"		
1-1/2"		
1"		
3/4"		
3/8"		
No. 4		
No. 30		
No. 50		
No. 100		
No. 200		

Comments:

Reported by : Prav Dayah

PARIKH CONSULTANT'S INC.

6/14/2005

Plate No. B-6A

04-2285E4

LABORATORY TEST REPORT

INFORMATION HANDOUT

(408)-945-1011

Parikh Consultants, Inc.

PROJECT NAME:	Route 4 East	PROJECT #:	206118.GDR
SAMPLE #:	R25 DEPTH: 0'-5'	LAB #:	M590
SOURCE:	Native / Antioch	DATE:	8/14/2006
MATERIAL DESCRIPTION	Clay, brown		

EXPANSION INDEX - ASTM D-4829

					Specification
Expansion Index			70		
Corrected Expansion Index			77		
Expansion Potential			Medium		
Saturation %	Initial:	59	Final:	94	
Moisture Contenet%	Initial:	12.6	Final:	23.7	
Dry Density, pcf	Initial:	106.9	Final:	100.2	

SAND EQUIVALENT CTM 217

		Specifications
SE		

Sieve Analysis CTM 202

Sieve Size	Percent Passing	Project Specification
6"		
3"		
1-1/2"		
1"		
3/4"		
3/8"		
No. 4		
No. 30		
No. 50		
No. 100		
No. 200		

Comments:

Reported by : Prav Dayah

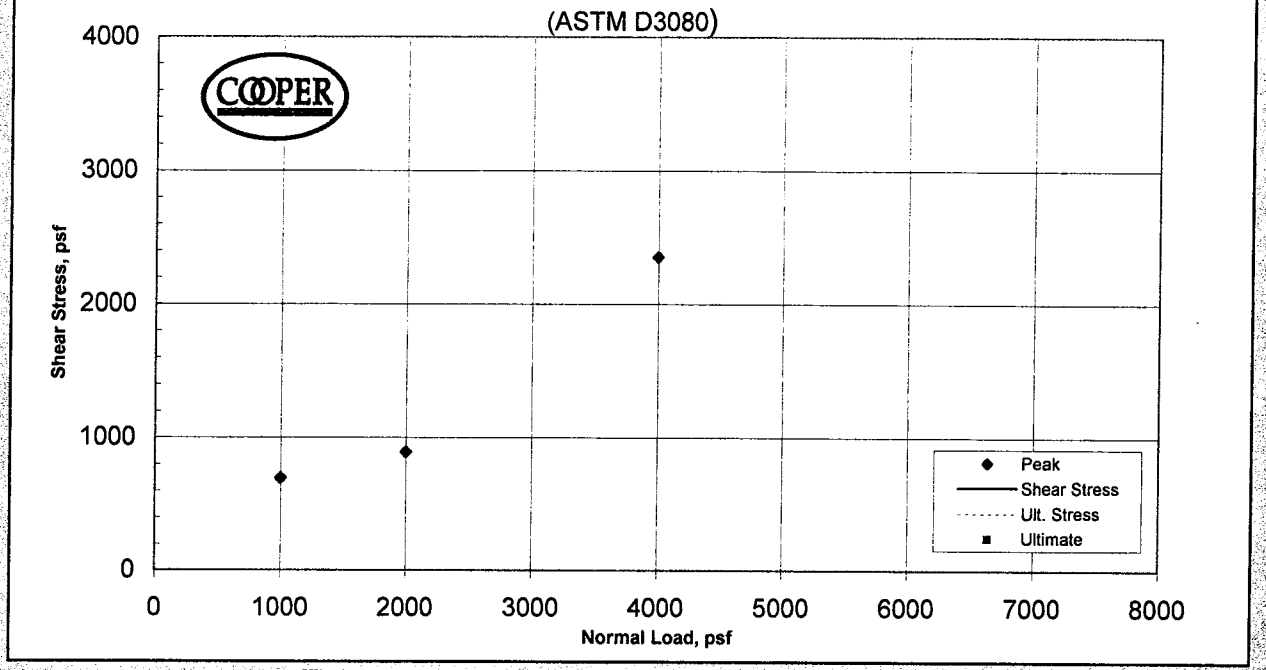
PARIKH CONSULTANTS INC.

6/14/2005

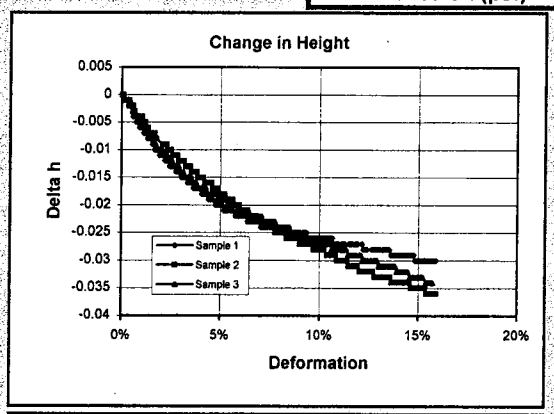
Plate No. B-6B

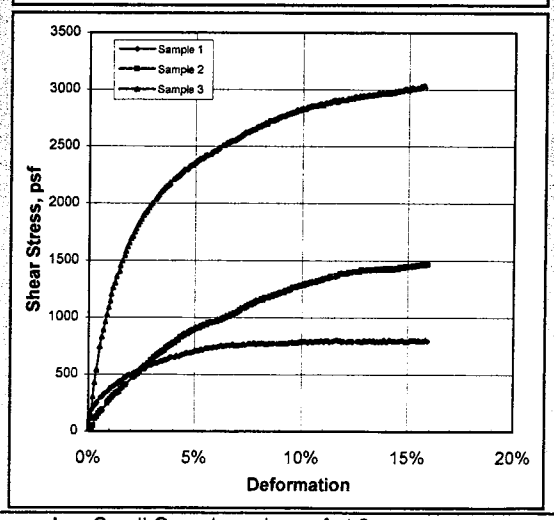
Direct Shear

(ASTM D3080)



P. Phi (degrees)		Ult. phi (degrees)	
P. Cohesion (psf)		Ult.Cohesion (psf)	





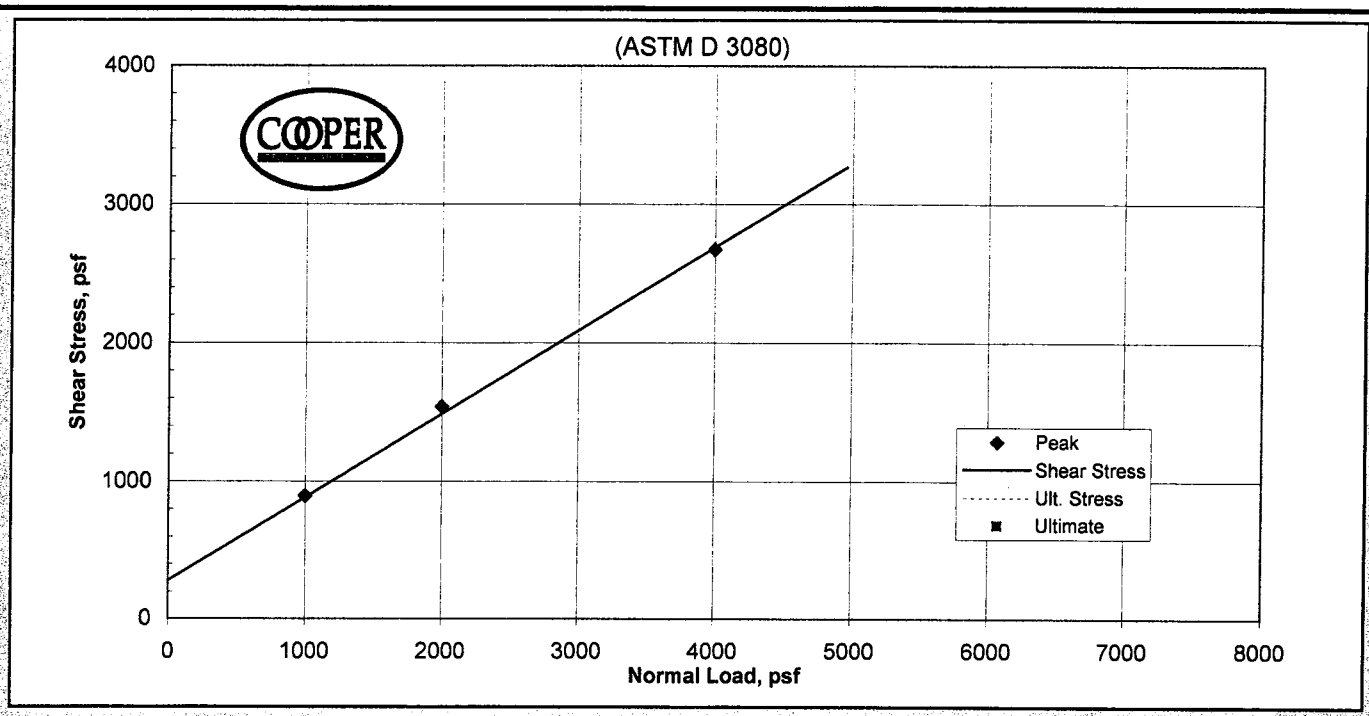
	Sample Data: Initial			
	1	2	3	4
Moisture	14.3%	15.3%	14.5%	
Dry Density, pcf	94.5	96.4	102.5	
Void Ratio	0.82	0.78	0.67	
Saturation	48.3%	53.7%	59.1%	
Diameter, in.	2.43	2.43	2.43	
Height, in.	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture	27.5%	25.9%	22.0%	
Dry Density, pcf	96.5	99.4	105.2	
Void Ratio	0.78	0.73	0.63	
Saturation	97.3%	98.1%	95.6%	
Diameter, in.	2.43	2.43	2.43	
Height, in.	0.98	0.97	0.97	
Normal Stress, psf	1000	2000	4000	
Shear Stress, psf	696	891	2354	
Strengths picked at	5%	5%	5%	
Ult. Stress, psf	-	-	-	
Rate in/min.	0.0002	0.0002	0.0002	

CTL #	157-239	Date:	2/1/2007	
Client:	Parikh Consultants Inc.			
Project Name:	Route 4-East			
Project Number:	206118.GDR		Reduced by:	MJ
Sample #	Boring	Sample	Depth, ft.	
1	131	1	2	
2	131	1	2	
3	131	1	2	
4				

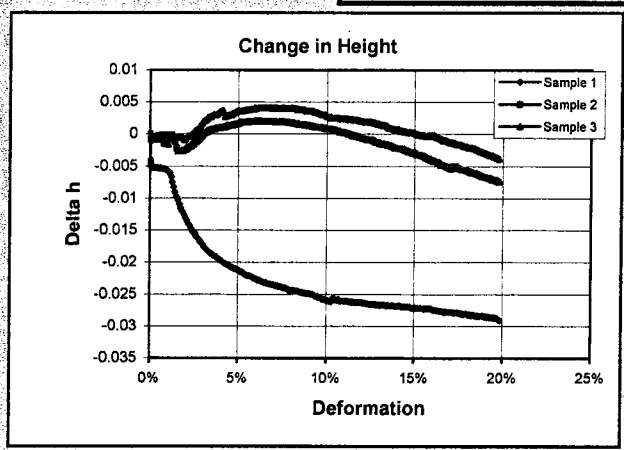
Visual Soil Classification	
1	Brn. Sa CLAY/Clayey SA. Tr. Grav.
2	Brn. Sa CLAY/Clayey SA. Tr. Grav.
3	Brn. Sa CLAY/Clayey SA. Tr. Grav.
4	

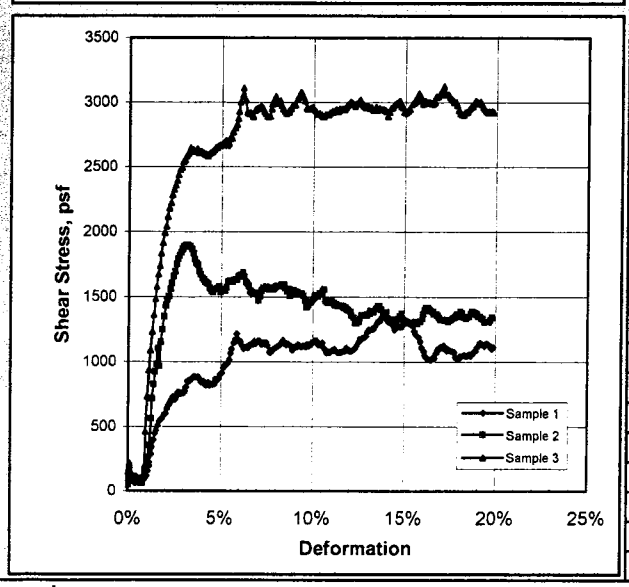
Remarks: Small Gravel on plane of pt 3

Direct Shear



P. Phi (degrees)	31.1	Ult. phi (degrees)	
P. Cohesion (psf)	280	Ult.Cohesion (psf)	





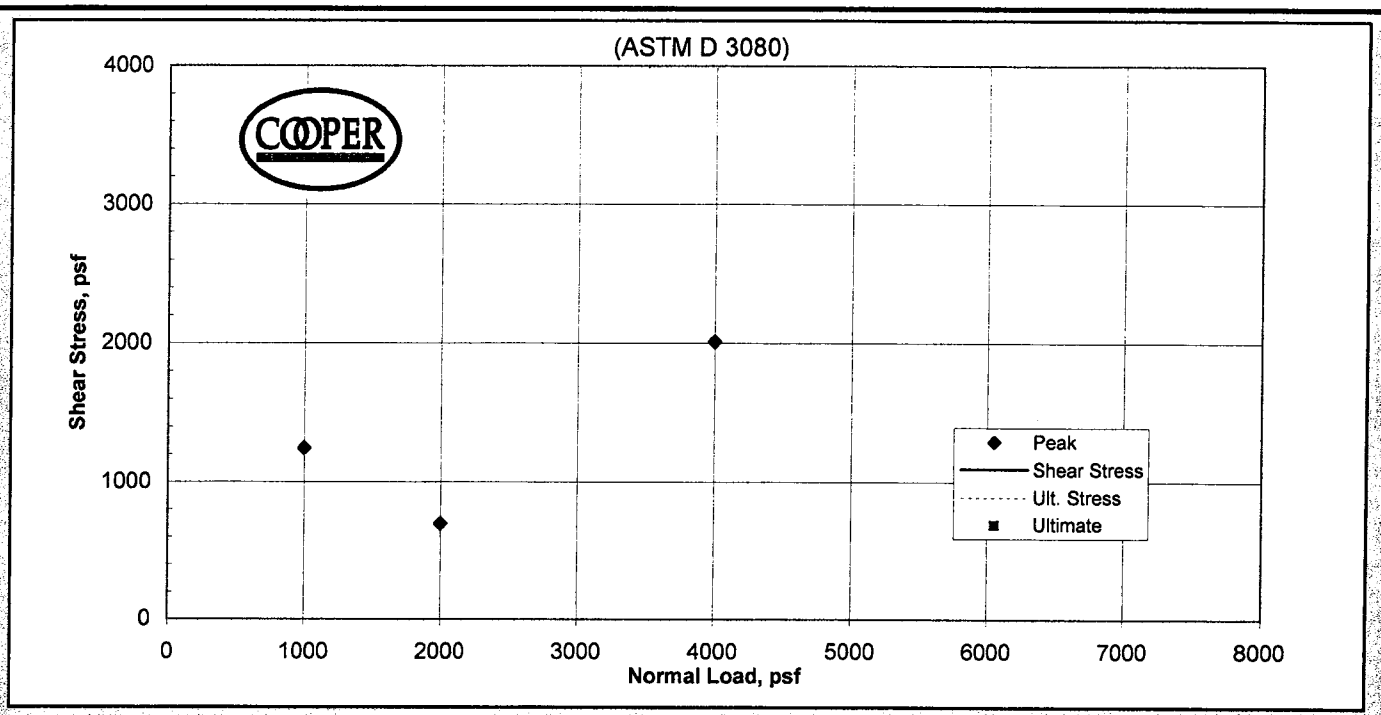
Sample Data: Initial				
Initial	1	2	3	4
Moisture	15.9%	18.5%	15.7%	
Dry Density, pcf	98.2	107.5	109.6	
Void Ratio	0.7489	0.5966	0.5966	
Saturation	58.4%	85.2%	73.9%	
Diameter, in.	2.43	2.43	2.43	
Height, in.	1.00	1.00	1.00	
Sample Data: At Test				
Moisture	23.1%	21.6%	19.1%	
Dry Density, pcf	99.1	107.5	110.7	
Void Ratio	0.7327	0.5976	0.5806	
Saturation	86.7%	99.5%	92.3%	
Diameter, in.	2.43	2.43	2.43	
Height, in.	0.99	1.00	0.99	
Normal Stress, psf	1000	2000	4000	
Shear Stress, psf	894	1537	2673	
Deformation	5%	5%	5%	
Ultimate Stress, psf	0	0	0	
Rate in/min.	0.0002	0.0002	0.0002	

CTL #	157-240	Date:	2/21/2007	
Client:	Parikh Consultants Inc.			
Project Name:	Route 4-East			
Project Number:	206118GDR		Reduced by:	MD
Sample #	Boring	Sample	Depth, ft.	
1	SW-134	1	2	
2				
3				
4				
Visual Soil Classification				
1	Brown Clayey SAND near Sandy CLAY			
2	Brown Clayey SAND near Sandy CLAY			
3	Brown Clayey SAND near Sandy CLAY			
4				

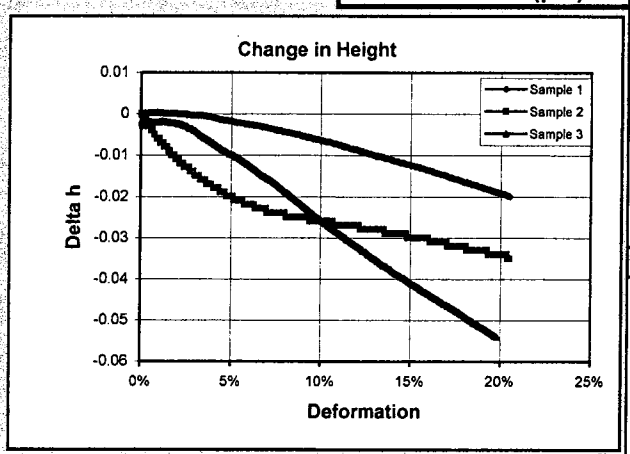
Remarks:

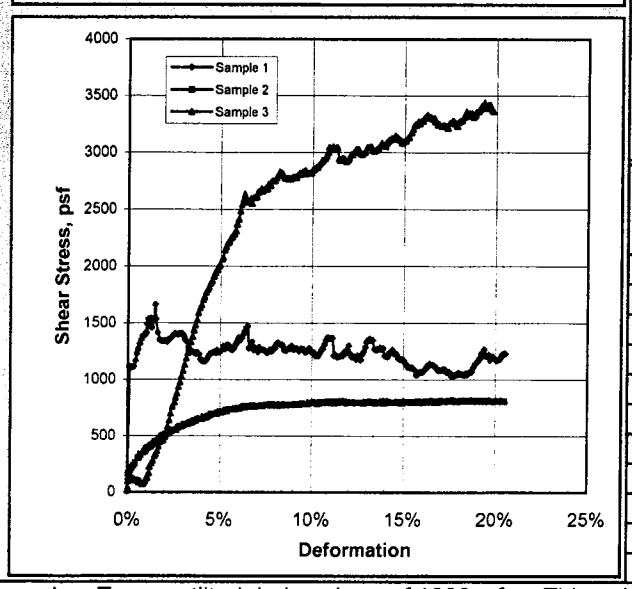
04-2285E4

Direct Shear



P. Phi (degrees)		Ult. phi (degrees)	
P. Cohesion (psf)		Ult.Cohesion (psf)	





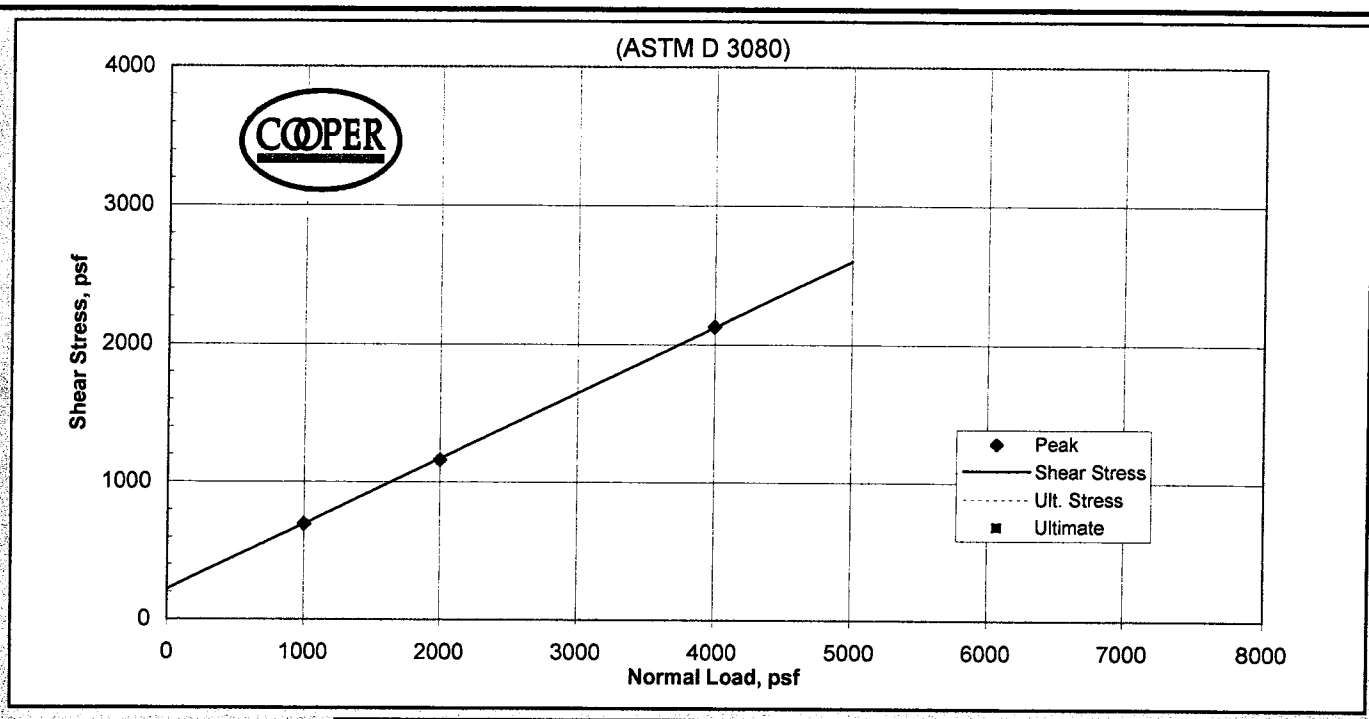
Sample Data: Initial				
Initial	1	2	3	4
Moisture	24.3%	26.5%	21.7%	
Dry Density, pcf	98.4	97.9	101.6	
Void Ratio	0.7445	0.7533	0.7533	
Saturation	89.7%	96.8%	82.4%	
Diameter, in.	2.43	2.43	2.43	
Height, in.	1.00	1.00	1.00	
Sample Data: At Test				
Moisture	28.4%	26.8%	25.5%	
Dry Density, pcf	96.3	98.0	102.4	
Void Ratio	0.7822	0.7531	0.7396	
Saturation	99.8%	98.0%	98.3%	
Diameter, in.	2.43	2.43	2.43	
Height, in.	1.02	1.00	0.99	
Normal Stress, psf	1000	2000	4000	
Shear Stress, psf	1242	696	2012	
Deformation	5%	5%	5%	
Ultimate Stress, psf	0	0	0	
Rate in/min.	0.0002	0.0002	0.0002	

CTL #	157-241	Date:	4/23/2007	
Client:	Parikh Consultants Inc.			
Project Name:	Rte. 4 East			
Project Number:	206118GDR		Reduced by:	MD
Sample #	Boring	Sample	Depth, ft.	
1	SW 135	3	11	
2	SW 135	3	11	
3	SW 135	3	11	
4				
Visual Soil Classification				
1	Brown sandy CLAY			
2	Brown sandy CLAY			
3	Brown sandy CLAY			
4				

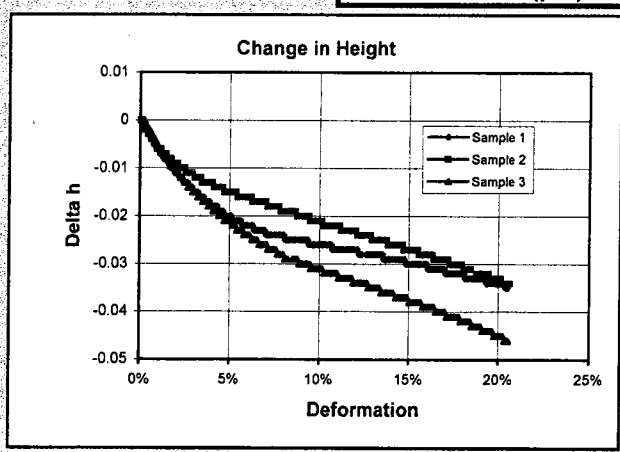
Remarks: Top cap tilted during shear of 1000psf pt. This point is suspect. No additional material remaining for testing.

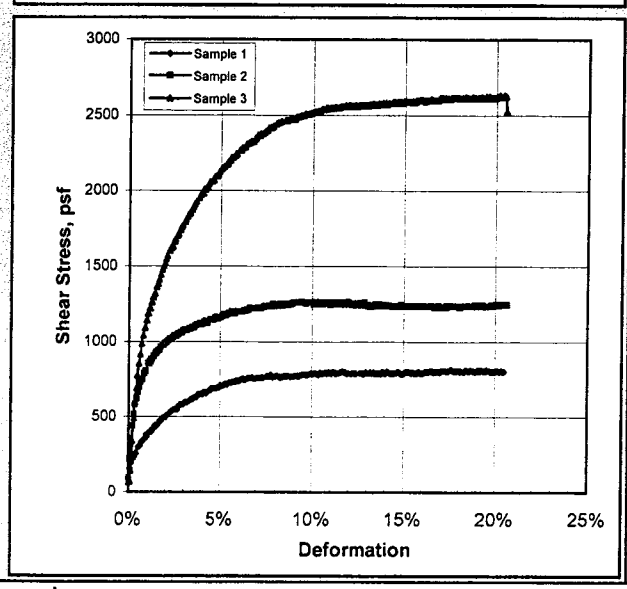
Plate No. B-7C

Direct Shear



P. Phi (degrees)	25.5	Ult. phi (degrees)	
P. Cohesion (psf)	220	Ult.Cohesion (psf)	





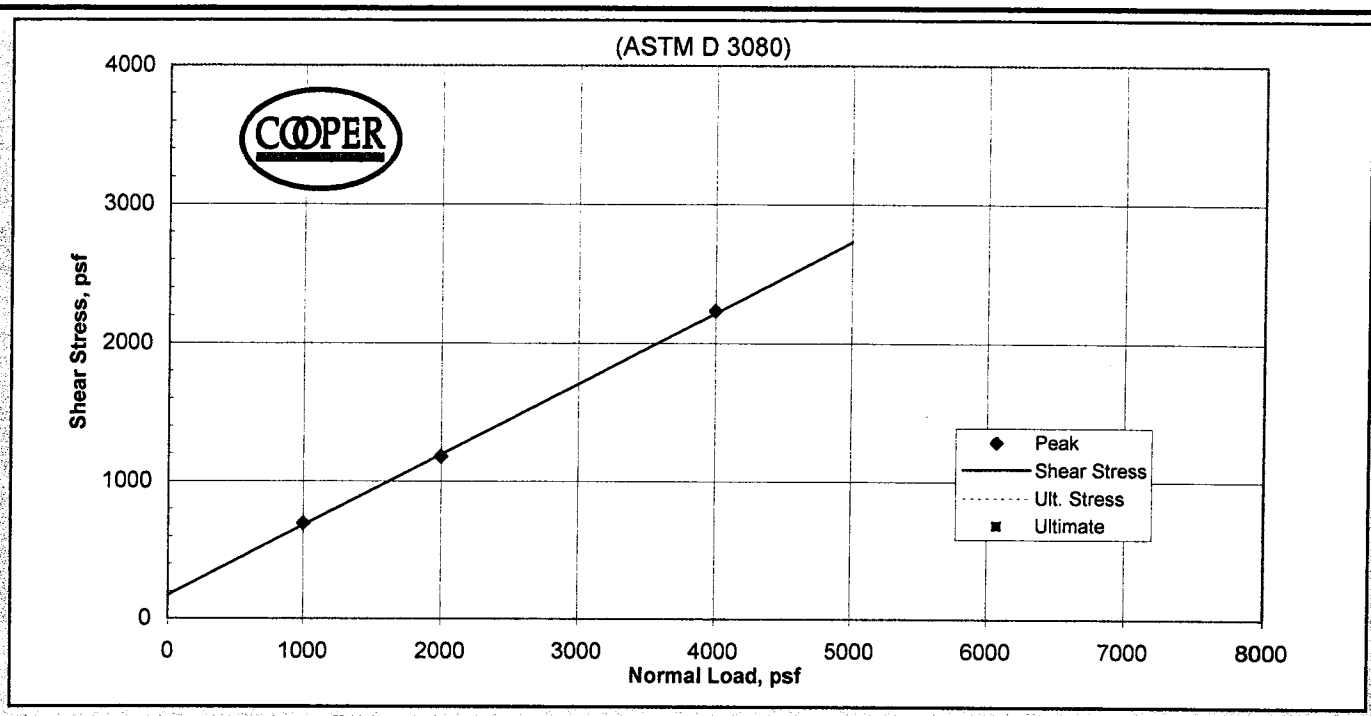
Sample Data: Initial				
Initial	1	2	3	4
Moisture	16.4%	17.0%	15.1%	
Dry Density, pcf	89.0	88.0	89.4	
Void Ratio	0.9280	0.9514	0.9514	
Saturation	48.7%	49.1%	44.3%	
Diameter, in.	2.43	2.43	2.43	
Height, in.	1.00	1.00	1.00	
Sample Data: At Test				
Moisture	32.3%	32.0%	25.6%	
Dry Density, pcf	90.5	91.0	98.3	
Void Ratio	0.8960	0.8858	0.7744	
Saturation	99.1%	99.4%	92.2%	
Diameter, in.	2.43	2.43	2.43	
Height, in.	0.98	0.97	0.91	
Normal Stress, psf	1000	2000	4000	
Shear Stress, psf	696	1161	2127	
Deformation	5%	5%	5%	
Ultimate Stress, psf	0	0	0	
Rate in/min.	0.0002	0.0002	0.0002	

CTL #	157-241	Date:	4/16/2007	
Client:	Parikh Consultants Inc			
Project Name:	RTE. 4 East			
Project Number:	206118GDR		Reduced by:	MD
Sample #	Boring	Sample	Depth, ft.	
1	RW/SW141	2	6	
2	RW/SW141	2	6	
3	RW/SW141	2	6	
4				
Visual Soil Classification				
1	Yel-Brn Sandy CLAY			
2	Yel-Brn Sandy CLAY			
3	Yel-Brn Sandy CLAY			
4				

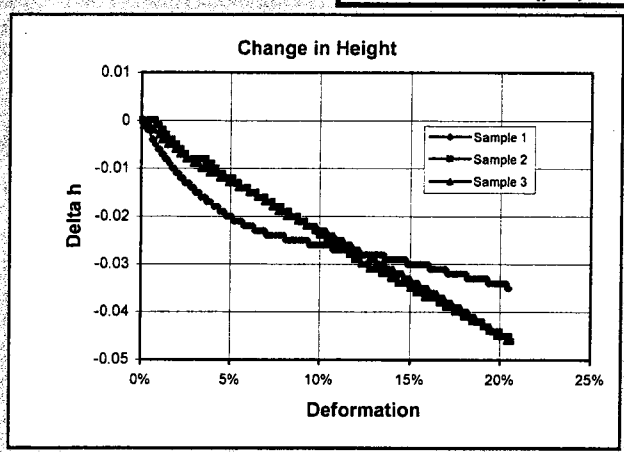
Remarks:

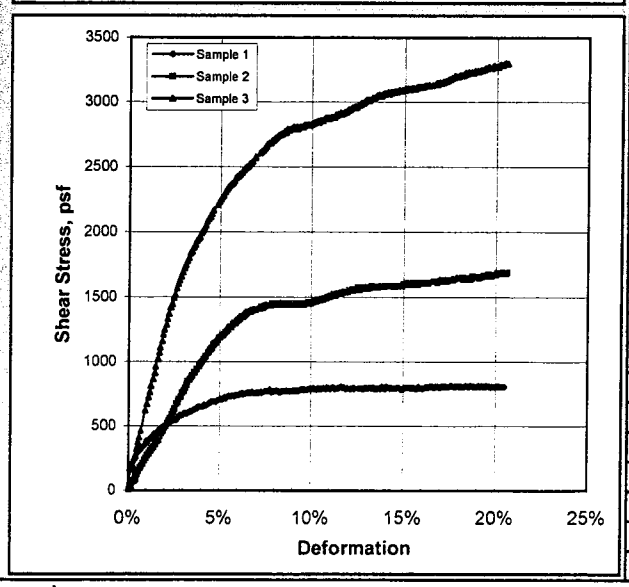
Plate No. D-7D

Direct Shear



P. Phi (degrees)	27.1	Ult. phi (degrees)	
P. Cohesion (psf)	170	Ult.Cohesion (psf)	





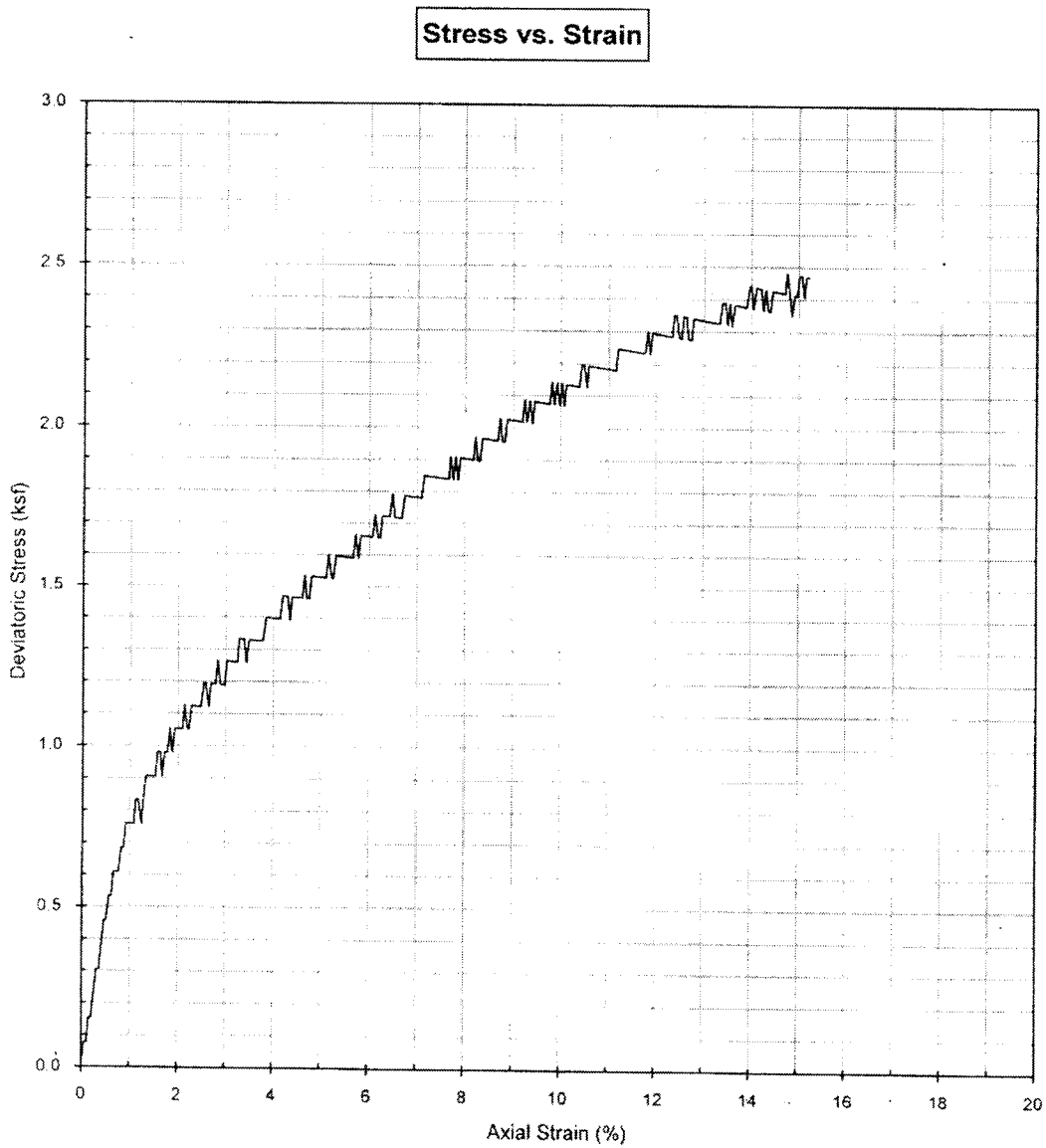
Sample Data: Initial				
Initial	1	2	3	4
Moisture	19.0%	13.2%	19.2%	
Dry Density, pcf	87.1	95.6	103.3	
Void Ratio	0.9717	0.7955	0.7955	
Saturation	53.7%	45.7%	71.6%	
Diameter, in.	2.43	2.43	2.43	
Height, in.	1.00	1.00	1.00	
Sample Data: At Test				
Moisture	34.7%	24.7%	25.9%	
Dry Density, pcf	87.5	96.3	104.3	
Void Ratio	0.9628	0.7820	0.7777	
Saturation	99.2%	87.0%	98.7%	
Diameter, in.	2.43	2.43	2.43	
Height, in.	1.00	0.99	0.99	
Normal Stress, psf	1000	2000	4000	
Shear Stress, psf	696	1180	2232	
Deformation	5%	5%	5%	
Ultimate Stress, psf	0	0	0	
Rate in/min.	0.0002	0.0002	0.0002	

CTL #	157-241	Date:		
Client:	Parikh Consultants inc.			
Project Name:	Rte.-4 Wast			
Project Number:	206118.GDR		Reduced by:	MD
Sample #	Boring	Sample	Depth, ft.	
1	SW 142	3	9.5	
2	SW 142	3	9.5	
3	SW 142	3	9.5	
4				
Visual Soil Classification				
1	Brown Sandy CLAY			
2	Brown Sandy CLAY			
3	Brown Sandy CLAY			
4				

Remarks:

Plate No. B-7E

UNCONSOLIDATED UNDRAINED COMPRESSION TEST



Boring No.	CLO 124
Sample No.	9
Elev. or Depth (ft)	38.5
Soil Description	Sandy lean clay, yellowish brown

Height of Sample (inch)	5
Initial Diameter (inch)	2.416
% Moisture	23
Dry Density (pcf)	103.7
Cell Pressure (ksf)	4.896
Maximum Strength (ksf)	2.48
Strain @ Failure (%)	15.0

Date: 10/26/2006

File Name: clo124-9

04-2285E4

INFORMATION HANDOUT

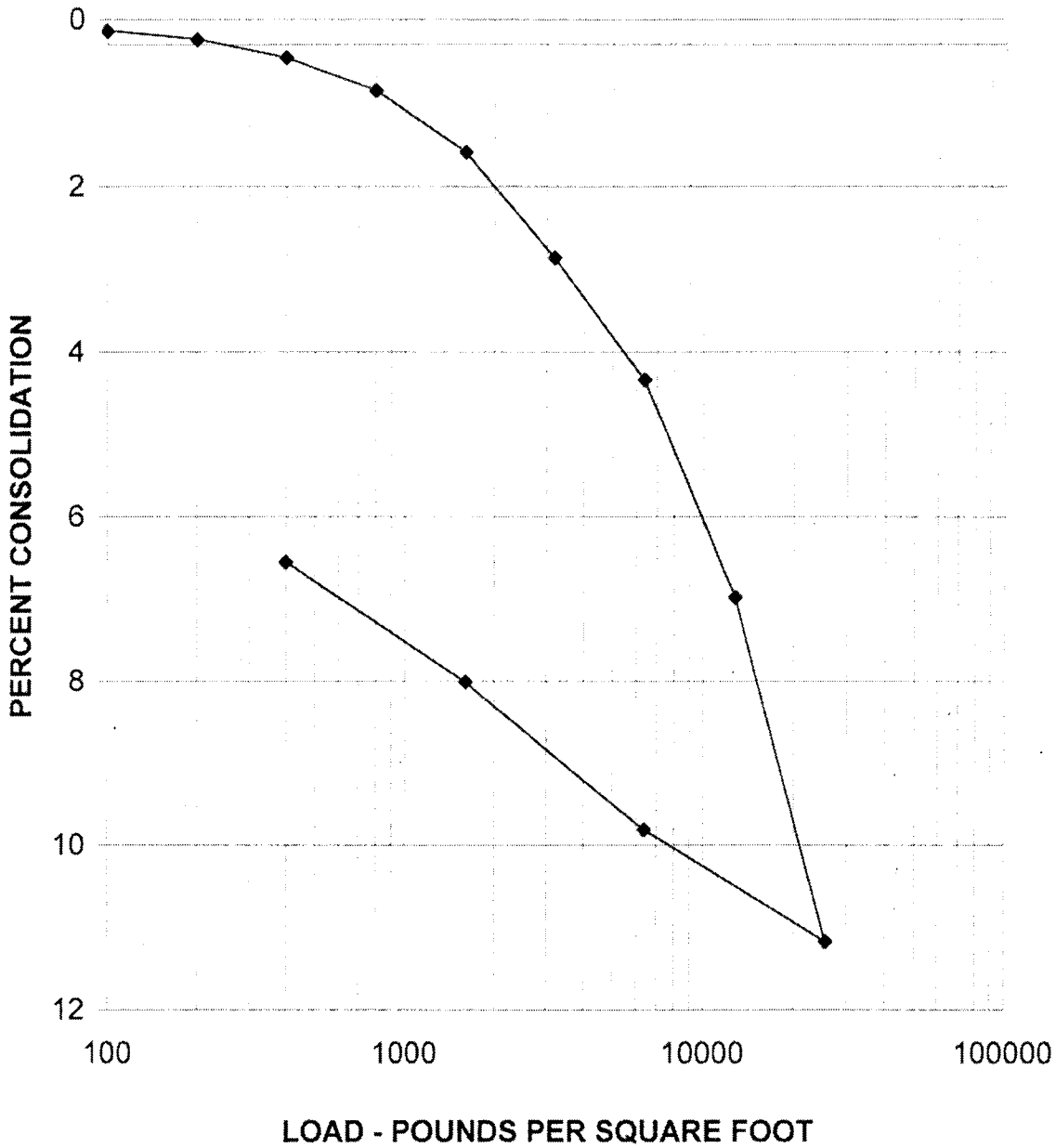
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

CONTRA LOMA BLVD / L STREET BRIDGE

JOB NO.: 206118.CLO

INFORMATION HANDOUT

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	28.5	95.9	1.0000	2.416
FINAL	26.0	102.7	0.9345	2.416

BORING NO.	GST 137	SAMPLE NO.	14	ELEV. OR DEPTH	64.5'
DESCRIPTION	Lean clay, yellowish brown				

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

G Street Bridge
CCTA / BKF

DATE	JOB NO:
11/14/06	206118.GST

Reported by: Prav Dayah

CONSOLIDATION TEST - TIME CURVE

JOB #: 206118.GST

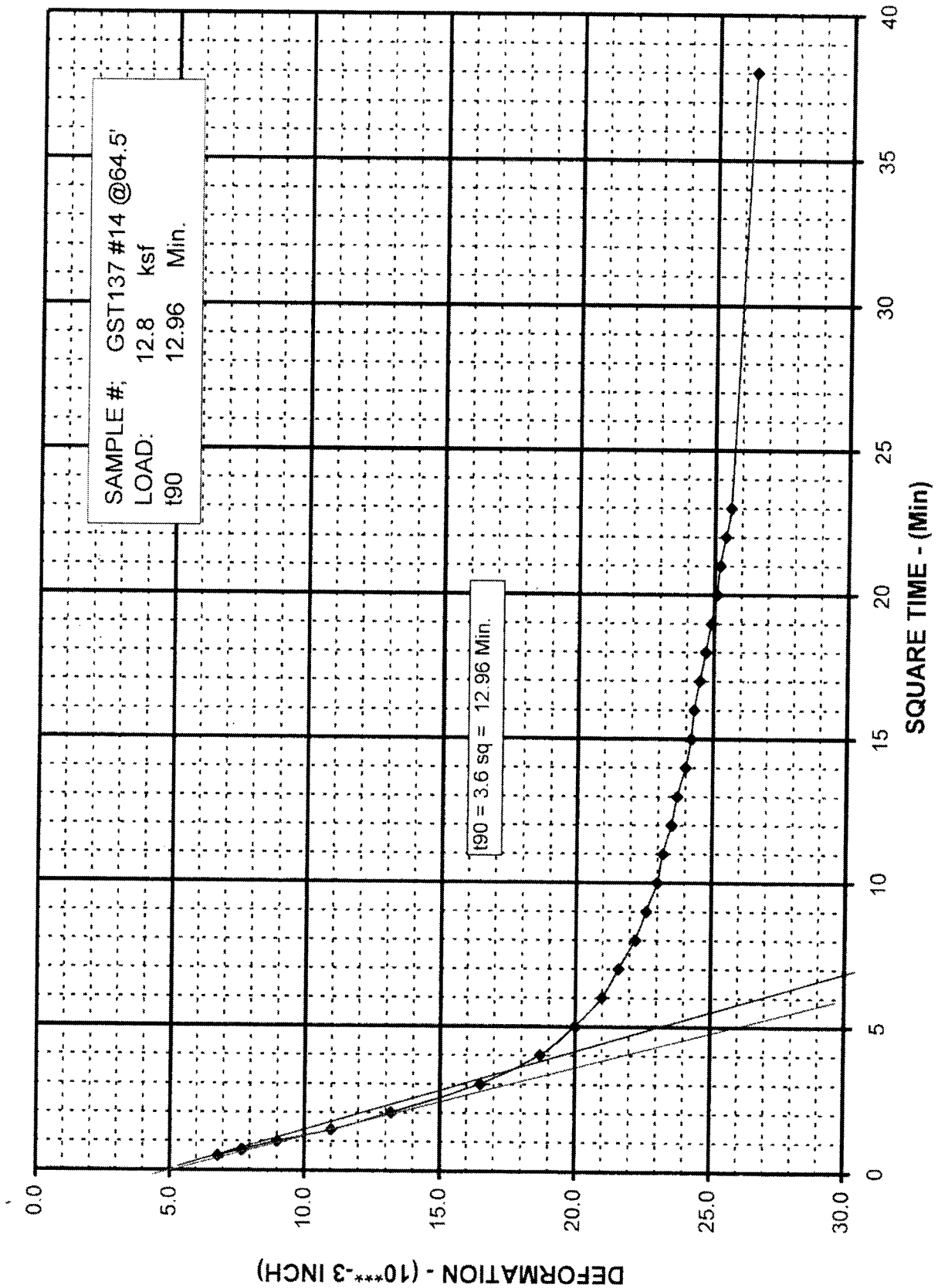
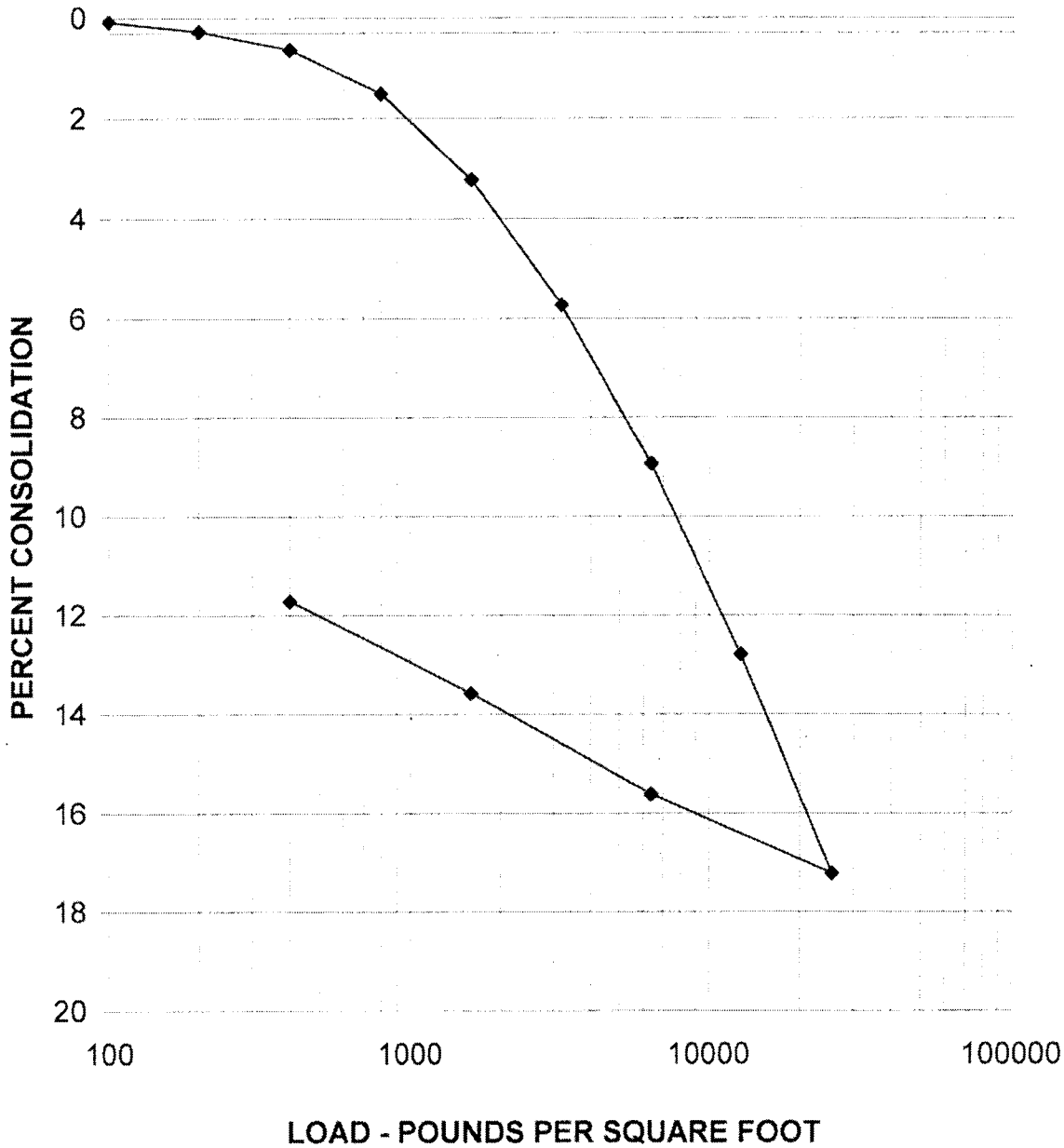


Plate B-9B

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	34.8	86.6	1.0000	2.416
FINAL	29.0	98.1	0.8829	2.416

BORING NO.	CLO 125	SAMPLE NO.	9	ELEV. OR DEPTH	41'
DESCRIPTION	Lean clay, yellowish brown				

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

Contra Loma Blvd / L Street Bridge
CCTA / BKF

DATE	JOB NO:
11/02/06	206118.CLO

Reported by: Prav Dayah

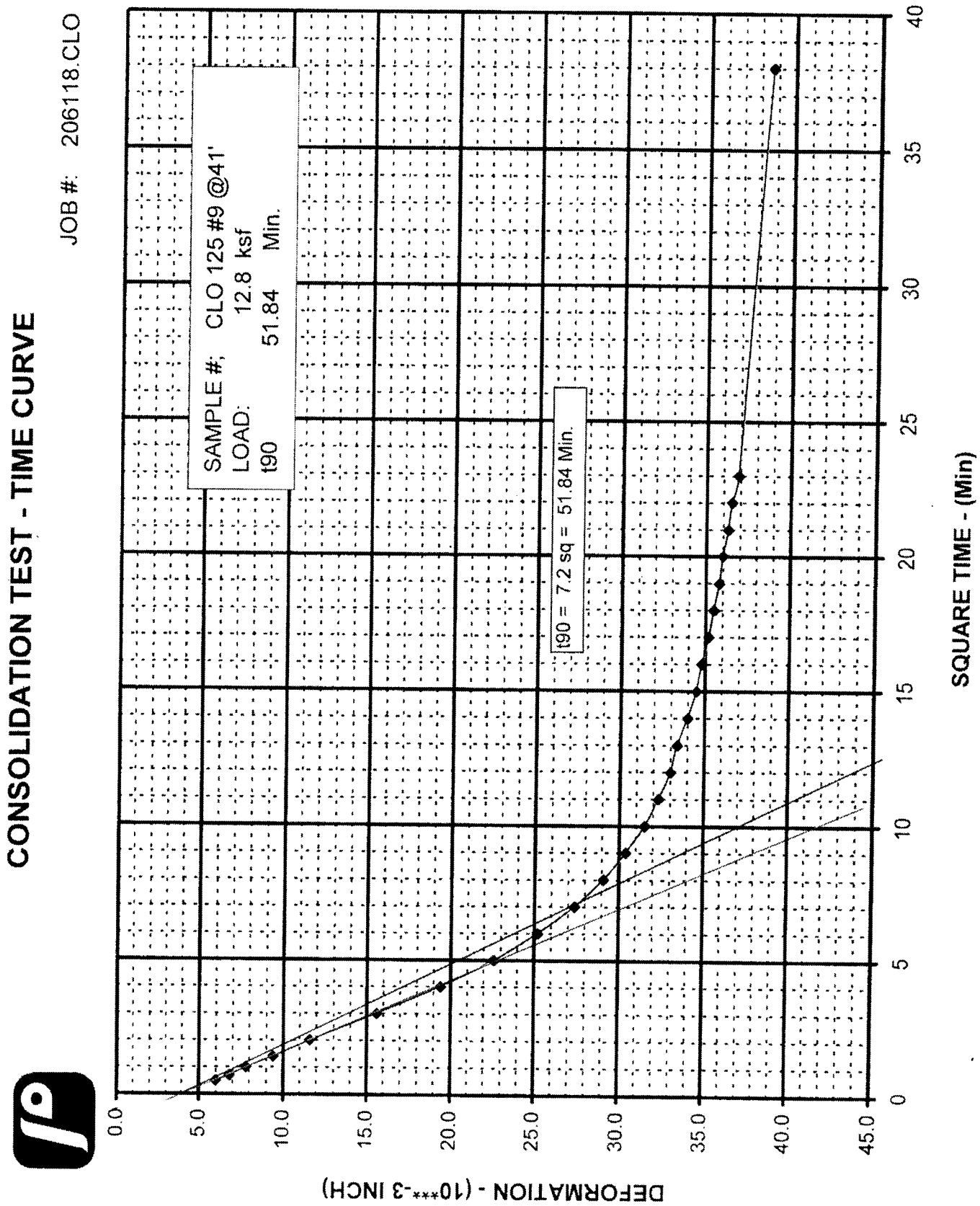

CONSOLIDATION TEST - TIME CURVE
JOB #: 206118.CLO
SAMPLE #; CLO 125 #9 @41'
LOAD: 12.8 ksf
t90 51.84 Min.
t90 = 7.2 sq = 51.84 Min.
DEFORMATION - (10***-3 INCH)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
0
5
10
15
20
25
30
35
40
SQUARE TIME - (Min)

Plate B-9D

CONSOLIDATION TEST - TIME CURVE

JOB #: 206118.CLO

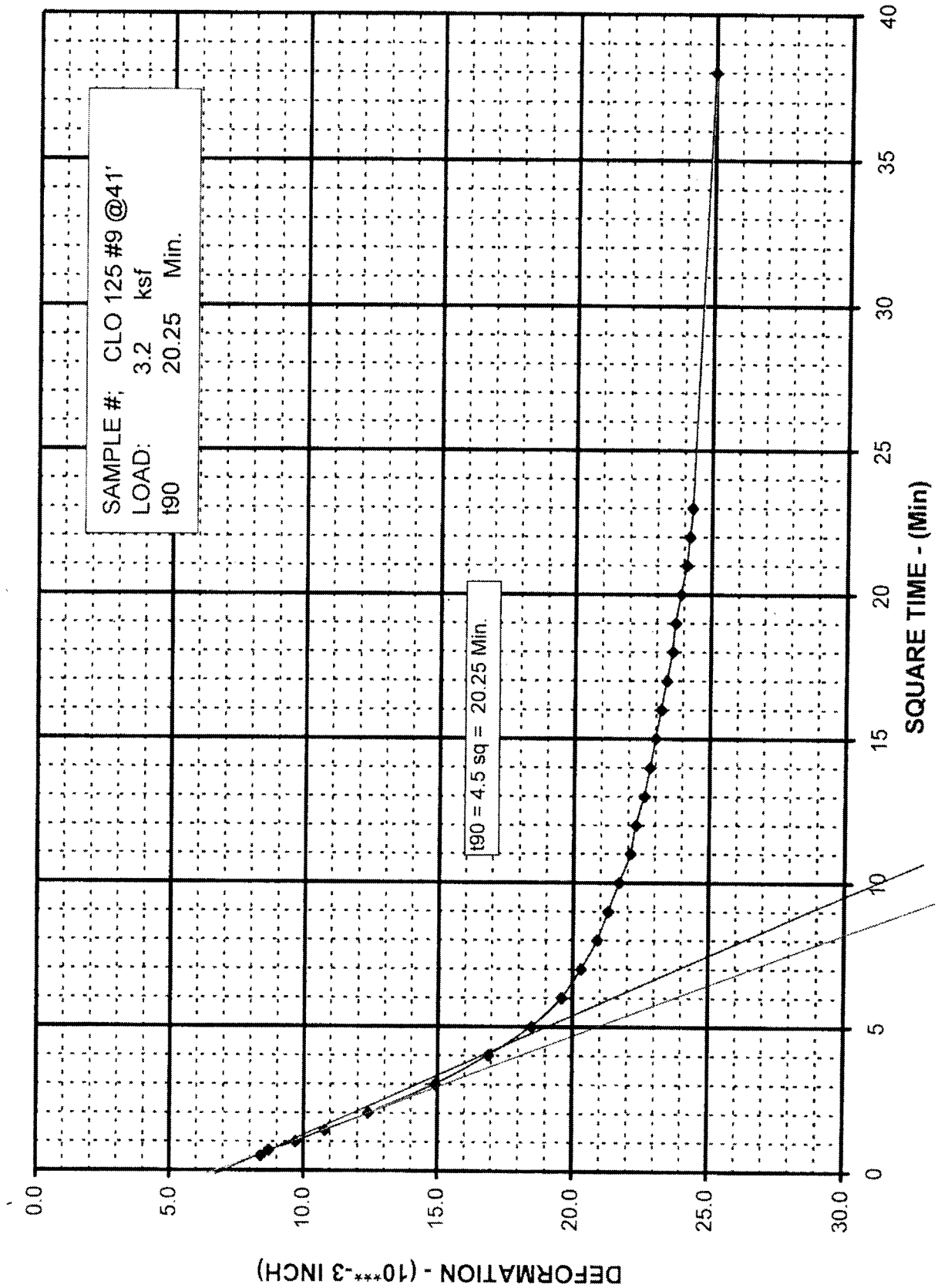


Plate B-9E

APPENDIX C

LIQUEFACTION ANALYSES - CPT

INFORMATION HANDOUT

LIQUEFACTION POTENTIAL ANALYSIS (per Youd & Idriss, 2001)

PROJECT NAME **ROUTE 4**
PROJECT NO. **206118.CLO**
CPT NO. **CLO-125 (CONTRA LOMA)**

FAULT INFO
COAST RANGE - SIERRAN BLOCK BOUNDARY ZONE (CSB)
a_{max} (g)= 0.7

FAULT M_w = 7
MSF = 1.19

Depth (ft)		Soil Behavior Type	CPT RESULT INPUT qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	CSR γ_d	CSR	$CRR_{7.5}$ Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	F.S.=(CRR 7.5/CSR)*MSF*Kσ*Kα Kσ	Kα	F.S.
0.492	7	Silty Sand to Sandy Silt	50.956	0.897	0.029		0.029	1.48	1.7	1.00	0.455	1.480	1.70	86.63	1.000	86.625	0.14	1.00	1	
1.148	6	Sandy Silt to Clayey Silt	51.959	1.398	0.067		0.067	1.75	1.7	1.00	0.455	1.750	1.70	88.33	1.072	94.655	0.16	1.00	1	
1.804	6	Sandy Silt to Clayey Silt	54.304	1.525	0.104		0.104	1.83	1.68712	1.00	0.454	1.830	1.69	91.62	1.129	103.452	0.18	1.00	1	
2.461	5	Clayey Silt to Silty Clay	70.023	2.605	0.142		0.142	1.95	1.63934	1.00	0.453	1.950	1.64	114.79	1.240	142.326	0.35	1.00	1	
3.117	6	Sandy Silt to Clayey Silt	59.138	1.491	0.179		0.179	1.88	1.59536	0.99	0.453	1.880	1.60	94.35	1.171	110.439	0.21	1.00	1	
3.773	6	Sandy Silt to Clayey Silt	55.602	1.457	0.217		0.217	1.95	1.55258	0.99	0.452	1.950	1.55	86.33	1.240	107.033	0.19	1.00	1	
4.429	5	Clayey Silt to Silty Clay	55.346	2.444	0.255		0.255	2.18	1.51203	0.99	0.451	2.180	1.51	83.68	1.619	135.499	0.31	1.00	1	
5.085	5	Clayey Silt to Silty Clay	60.381	2.327	0.292		0.292	2.15	1.47453	0.99	0.450	2.150	1.47	89.03	1.553	138.251	0.33	1.00	1	
5.741	6	Sandy Silt to Clayey Silt	76.707	2.379	0.33		0.33	2.04	1.43791	0.99	0.450	2.040	1.44	110.30	1.356	149.551	0.39	1.00	1	
6.398	5	Clayey Silt to Silty Clay	67.772	2.545	0.367		0.367	2.16	1.40396	0.99	0.449	2.160	1.40	95.15	1.574	149.789	0.39	1.00	1	
7.054	11	Sitff Fine-Grained	65.779	3.263	0.41		0.41	2.3	1.36646	0.99	0.448	2.300	1.37	89.88	1.949	175.161		1.00	1	
7.71	11	Sitff Fine-Grained	64.213	3.796	0.453		0.453	2.39	1.33091	0.98	0.448	2.390	1.33	85.46	2.272	194.171		1.00	1	
8.366	11	Sitff Fine-Grained	62.821	3.501	0.496		0.496	2.4	1.29717	0.98	0.447	2.400	1.30	81.49	2.312	188.434		1.00	1	
9.022	4	Silty Clay to Clay	54.816	2.631	0.533		0.533	2.4	1.26947	0.98	0.446	2.400	1.27	69.59	2.312	160.912		1.00	1	
9.678	11	Sitff Fine-Grained	63.562	3.079	0.576		0.576	2.39	1.23874	0.98	0.446	2.390	1.24	78.74	2.272	178.891		1.00	1	
10.335	3	Clay	46.043	2.609	0.613		0.613	2.55	1.21346	0.98	0.445	2.550	1.21	55.87	3.034	169.526		1.00	1	
10.991	3	Clay	39.783	2.089	0.649		0.649	2.58	1.18983	0.98	0.445	2.580	1.19	47.34	3.206	151.778	0.41	1.00	1	
11.647	3	Clay	43.598	2.251	0.686		0.686	2.56	1.16649	0.98	0.444	2.560	1.17	50.86	3.091	157.175	0.44	1.00	1	
12.303	11	Sitff Fine-Grained	63.495	3.515	0.729		0.729	2.5	1.14049	0.97	0.443	2.500	1.14	72.42	2.768	200.477		1.00	1	
12.959	3	Clay	53.034	3.139	0.765		0.765	2.58	1.11959	0.97	0.443	2.580	1.12	59.38	3.206	190.388		1.00	1	
13.615	4	Silty Clay to Clay	30.698	1.229	0.803		0.803	2.64	1.09835	0.97	0.442							1.00	1	
14.272	6	Sandy Silt to Clayey Silt	35.605	1.067	0.84		0.84	2.52	1.07843	0.97	0.441	2.520	1.08	38.40	2.872	110.263	0.20	1.00	1	
14.928	5	Clayey Silt to Silty Clay	48.344	1.989	0.878		0.878	2.53	1.05871	0.97	0.441	2.530	1.06	51.18	2.925	149.696	0.39	1.00	1	
15.584	5	Clayey Silt to Silty Clay	48.344	2.096	0.916		0.916	2.56	1.0397	0.97	0.440	2.560	1.04	50.26	3.091	155.341	0.43	1.00	1	
16.24	5	Clayey Silt to Silty Clay	40.501	1.687	0.953		0.953	2.62	1.02183	0.97	0.439							1.00	1	
16.896	4	Silty Clay to Clay	27.534	1.104	0.991		0.991	2.75	1.00411	0.96	0.439							1.00	1	
17.552	4	Silty Clay to Clay	22.058	0.816	1.028		1.028	2.82	0.98743	0.96	0.438							0.99	1	
18.209	5	Clayey Silt to Silty Clay	39.872	1.39	1.066		1.066	2.6	0.97087	0.96	0.437							0.99	1	
18.865	5	Clayey Silt to Silty Clay	29.789	1.12	1.104		1.104	2.74	0.95486	0.96	0.437							0.98	1	
19.521	5	Clayey Silt to Silty Clay	25.89	0.903	1.141		1.141	2.78	0.93977	0.96	0.436							0.97	1	
20.177	5	Clayey Silt to Silty Clay	27.394	1.037	1.179		1.179	2.79	0.92476	0.96	0.435							0.97	1	
20.833	4	Silty Clay to Clay	27.032	1.069	1.216		1.216	2.82	0.9106	0.95	0.434							0.96	1	
21.49	5	Clayey Silt to Silty Clay	27.617	1.051	1.254		1.254	2.82	0.8965	0.95	0.434							0.96	1	
22.146	5	Clayey Silt to Silty Clay	32.268	1.185	1.292		1.292	2.76	0.88283	0.95	0.433							0.95	1	
22.802	5	Clayey Silt to Silty Clay	32.04	1.207	1.329		1.329	2.78	0.86991	0.95	0.432							0.94	1	
23.458	4	Silty Clay to Clay	32.647	1.486	1.367		1.367	2.84	0.85703	0.95	0.431							0.94	1	
24.114	5	Clayey Silt to Silty Clay	31.099	1.041	1.404		1.404	2.78	0.84485	0.94	0.430							0.93	1	
24.77	5	Clayey Silt to Silty Clay	36.925	1.129	1.442		1.442	2.7	0.8327	0.94	0.429							0.93	1	
25.427	5	Clayey Silt to Silty Clay	39.498	1.318	1.479		1.479	2.71	0.8212	0.94	0.428							0.92	1	
26.083	5	Clayey Silt to Silty Clay	36.034	1.314	1.517		1.517	2.78	0.80972	0.94	0.427							0.92	1	
26.739	5	Clayey Silt to Silty Clay	34.296	1.1	1.555		1.555	2.77	0.79855	0.94	0.426							0.92	1	
27.395	6	Sandy Silt to Clayey Silt	37.593	1.063	1.592		1.592	2.71	0.78797	0.93	0.424							0.91	1	
28.051	5	Clayey Silt to Silty Clay	41.353	1.343	1.63		1.63	2.72	0.77739	0.93	0.423							0.91	1	
28.707	5	Clayey Silt to Silty Clay	37.454	1.346	1.667		1.667	2.79	0.76735	0.93	0.422							0.90	1	
29.364	5	Clayey Silt to Silty Clay	38.2	1.308	1.705		1.705	2.78	0.75731	0.92	0.420							0.90	1	
30.02	5	Clayey Silt to Silty Clay	37.042	1.363	1.743		1.743	2.82	0.74754	0.92	0.419							0.89	1	
30.676	4	Silty Clay to Clay	27.127	1.223	1.78		1.78	3	0.73826	0.92	0.417							0.89	1	
31.332	4	Silty Clay to Clay	25.133	1.149	1.818		1.818	3.04	0.72896	0.91	0.416							0.89	1	
31.988	4	Silty Clay to Clay	24.186	1.068	1.855		1.855	3.05	0.72013	0.91	0.414							0.88	1	
32.644	4	Silty Clay to Clay	19.323	0.783	1.893		1.893	3.13	0.71128	0.91	0.412							0.88	1	
33.301	4	Silty Clay to Clay	13.976	0.514	1.931		1.931	3.25	0.70265	0.90	0.410							0.88	1	
33.957	5	Clayey Silt to Silty Clay	12.322	0.332	1.968		1.968	3.25	0.69444	0.90	0.408							0.87	1	
34.613	5	Clayey Silt to Silty Clay	14.505	0.413	2.006		2.006	3.19	0.68621	0.89	0.406							0.87	1	
35.269	5	Clayey Silt to Silty Clay	12.192	0.246	2.043		2.043	3.2	0.67838	0.89	0.404							0.87	1	
35.925	5	Clayey Silt to Silty Clay	21.713	0.598	2.081		2.081	3.02	0.67053	0.88	0.402							0.86	1	
36.581	5	Clayey Silt to Silty Clay	19.067	0.638	2.119		2.119	3.14	0.66285	0.88	0.400							0.86	1	
37.238	5	Clayey Silt to Silty Clay	18.315	0.59	2.156		2.156	3.15	0.65554	0.87	0.398							0.86	1	
37.894	5	Clayey Silt to Silty Clay	14.093	0.42	2.194		2.194	3.26	0.6482	0.87	0.395							0.85	1	
38.55	5	Clayey Silt to Silty Clay	19.607	0.624	2.231		2.231	3.13	0.64121	0.86	0.393							0.85	1	
39.206	4	Silty Clay to Clay	11.419	0.37	2.269		2.269	3.4	0.63419	0.86	0.390							0.85	1	
39.862	5	Clayey Silt to Silty Clay	13.519	0.379	2.307		2.307	3.29	0.62732	0.85	0.388							0.85	1	
40.518	6	Sandy Silt to Clayey Silt	26.614	0.502	2.344		2.344	2.9	0.62077	0.85	0.385							0.84	1	
41.175	5	Clayey Silt to Silty Clay	17.084	0.426	2.382		2.382	3.16	0.61418	0.84	0.382							0.84	1	
41.831	5	Clayey Silt to Silty Clay	12.617	0.295	2.419		2.419	3.3	0.6079	0.83	0.380							0.84	1	
42.487	5	Clayey Silt to Silty Clay	11.965	0.264	2.457		2.457	3.32	0.60159	0.83	0.377							0.84	1	
43.143	5	Clayey Silt to Silty Clay	12.104	0.297	2.495		2.495	3.34	0.5954	0.82	0.374							0.83	1	
43.799	5	Clayey Silt to Silty Clay	19.674	0.49	2.532		2.532	3.12	0.5895	0.82	0.371							0.83	1	
44.455	5	Clayey Silt to Silty Clay	23.016	0.576	2.57		2.57	3.07	0.58355	0.81	0.368							0.83	1	
45.112	5	Clayey Silt to Silty Clay	15.898	0.429	2.607		2.607	3.26	0.57788	0.80	0.365							0.83	1	
45.768	5	Clayey Silt to Silty Clay	13.653	0.363	2.645		2.645	3.34	0.57217	0.80	0.362							0.82	1	
46.424	5	Clayey Silt to Silty Clay	17.017	0.511	2.682		2.682	3.26	0.56672	0.79	0.359							0.82	1	
47.08	4	Silty Clay to Clay	15.368	0.553	2.72		2.72	3.36	0.56122	0.78	0.356							0.82	1	
47.736	4	Silty Clay to Clay	14.143	0.487	2.758		2.758	3.4	0.55584	0.78	0.353							0.82	1	
48.392	5	Clayey Silt to Silty Clay	14.989	0.435	2.795		2.795	3.34	0.55069	0.77	0.350							0.81	1	
49.049	5	Clayey Silt to Silty Clay	16.198	0.428	2.833		2.833	3.28	0.5455	0.76	0.347							0.81	1	
49.705	5	Clayey Silt to Silty Clay	15.647	0.369	2.87		2.87	3.28	0.54054	0.76	0.344							0.81	1	
50.361	5	Clayey Silt to Silty Clay	20.37	0.58	2.908		2.908	3.2	0.53554	0.75	0.341							0.81	1	
51.017	4	Silty Clay to Clay	13.725	0.465	2.946		2.946	3.44	0.53063	0.74	0.338							0.81	1	
51.673	4	Silty Clay to Clay	13.274	0.435	2.983		2.983	3.46	0.52594	0.74	0.335							0.80	1	
52.329	4	Silty Clay to Clay	14.444	0.463	3.021		3.021	3.42	0.5212	0.73	0.332							0.80	1	
52.986	5	Clayey Silt to Silty Clay	14.873	0.47	3.058		3.058	3.4	0.51667	0.72	0.329							0.80	1	
53.642	4	Silty Clay to Clay	15.418	0.582	3.096		3.096	3.43	0.5121	0.72	0.326							0.80	1	
54.298	5	Clayey Silt to Silty Clay	14.343	0.408	3.134		3.134	3.41	0.50761	0.71	0.323							0.80	1	
54.954	5	Clayey Silt to Silty Clay	16.438	0.486	3.171		3.171	3.35	0.50332	0.70	0.320							0.79	1	
55.61	5	Clayey Silt to Silty Clay	14.683	0.48	3.209		3.209	3.43	0.49898	0.70	0.317							0.79	1	
56.266	5	Clayey Silt to Silty Clay	11.492	0.238	3.246		3.246	3.46	0.49483	0.69	0.315							0.79	1	
56.923	5	Clayey Silt to Silty Clay	15.079	0.465	3.284		3.284	3.41	0.49063	0.69	0.312							0.79	1	
57.579	6	Sandy Silt to Clayey Silt	22.225	0.483	3.322		3.322	3.16	0.48651	0.68	0.309							0.79	1	
58.235	5	Clayey Silt to Silty Clay	11.709	0.268	3.359		3.359	3.53	0.48256	0.67	0.307							0.78	1	
58.891	5	Clayey Silt to Silty Clay	13.057	0.301	3.397		3.397	3.46	0.47857	0.67	0.304							0.78	1	
59.547	5	Clayey Silt to Silty Clay	13.664	0.294	3.434		3.434	3.42	0.47475	0.66	0.302							0.78	1	
60.203	5	Clayey Silt to Silty Clay	12.6	0.255	3.472		3.472	3.46	0.47089	0.66	0.299							0.78	1	
60.86	5	Clayey Silt to Silty Clay	15.251	0.391	3.51		3.51	3.4	0.46709	0.65	0.297							0.78	1	
61.516	5	Clayey Silt to Silty Clay	16.449	0.526	3.547	0.006	3.541	3.42	0.46404	0.65	0.295							0.78	1	
62.172	5	Clayey Silt to Silty Clay	18.031	0.546	3.585	0.027	3.558	3.36	0.46238	0.64	0.294							0.78	1	
62.828	5	Clayey Silt to Silty Clay	29.689	1.077	3.622	0.047	3.575	3.18	0.46073	0.64	0.294							0.78	1	
63.484	5	Clayey Silt to Silty Clay	37.476	1.5	3.66	0.068	3.592	3.11	0.4591	0.63	0.293							0.77	1	
64.14	4	Silty Clay to Clay	22.058	0.852	3.698	0.088	3.609	3.34	0.45748	0.63	0.293							0.77	1	
64.797	5	Clayey Silt to Silty Clay	14.215	0.406	3.735	0.109	3.627	3.5	0.45577	0.62	0.292							0.77	1	

INFORMATION HANDOUT

LIQUEFACTION POTENTIAL ANALYSIS (per Youd & Idriss, 2001)

PROJECT NAME **ROUTE 4**
PROJECT NO. **206118.CLO**
CPT NO. **CLO-125 (CONTRA LOMA)**

FAULT INFO
COAST RANGE - SIERRAN BLOCK BOUNDARY ZONE (CSB)
a_{max} (g)= 0.7

FAULT M_w = 7
MSF = 1.19

		CPT RESULT INPUT								CSR		CRR 7.5						F.S.=(CRR 7.5/CSR)*MSF*Kσ*Kα		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
65.453	5	Clayey Silt to Silty Clay	16.989	0.526	3.773	0.129	3.644	3.42	0.45417	0.62	0.292							0.77	1	
66.109	5	Clayey Silt to Silty Clay	17.307	0.567	3.81	0.15	3.661	3.43	0.45258	0.61	0.291							0.77	1	
66.765	5	Clayey Silt to Silty Clay	17.925	0.571	3.848	0.17	3.678	3.4	0.451	0.61	0.291							0.77	1	
67.421	5	Clayey Silt to Silty Clay	24.531	0.849	3.885	0.19	3.695	3.28	0.44944	0.61	0.290							0.77	1	
68.077	5	Clayey Silt to Silty Clay	25.679	0.771	3.923	0.211	3.712	3.23	0.44788	0.60	0.290							0.77	1	
68.734	7	Silty Sand to Sandy Silt	52.588	0.52	3.962	0.231	3.73	2.67	0.44625	0.60	0.289							0.77	1	
69.39	8	Sand to Silty Sand	91.658	1.337	4.001	0.252	3.749	2.53	0.44453	0.60	0.289	2.530	0.44	40.75	2.925	119.170	0.24	0.77	1	0.82
70.046	8	Sand to Silty Sand	172.208	2.523	4.041	0.272	3.769	2.29	0.44275	0.59	0.289	2.290	0.44	76.24	1.917	146.164	0.37	0.75	1	1.28
70.702	9	Sand	257.71	1.835	4.082	0.293	3.789	1.97	0.44097	0.59	0.288	1.970	0.44	113.64	1.263	143.499	0.35	0.68	1	1.23
71.358	10	Gravelly Sand to Sand	311.802	2.256	4.124	0.313	3.81	1.9	0.43912	0.58	0.288	1.900	0.44	136.92	1.189	162.775		0.66	1	
72.014	10	Gravelly Sand to Sand	484.946	2.075	4.165	0.334	3.832	1.62	0.4372	0.58	0.288	1.620	0.44	212.02	1.000	212.019		0.58	1	
72.671	9	Sand	302.751	2.887	4.206	0.354	3.852	1.99	0.43547	0.58	0.287	1.990	0.44	131.84	1.287	169.698		0.66	1	
73.327	9	Sand	213.595	2.341	4.247	0.375	3.872	2.15	0.43375	0.58	0.287	2.150	0.43	92.65	1.553	143.862	0.36	0.72	1	1.24
73.983	9	Sand	253.661	2.631	4.288	0.395	3.892	2.08	0.43205	0.57	0.287	2.080	0.43	109.59	1.420	155.585	0.43	0.69	1	1.50
74.639	9	Sand	294.936	2.412	4.328	0.416	3.913	1.96	0.43028	0.57	0.286	1.960	0.43	126.90	1.251	158.770	0.45	0.66	1	1.58
75.295	9	Sand	347.084	3.121	4.369	0.436	3.933	1.93	0.4286	0.57	0.286	1.930	0.43	148.76	1.218	181.259		0.64	1	
75.951	9	Sand	370.2	3.555	4.41	0.457	3.953	1.93	0.42694	0.56	0.286	1.930	0.43	158.05	1.218	192.580		0.63	1	
76.608	9	Sand	354.314	3.907	4.45	0.477	3.973	1.98	0.42529	0.56	0.286	1.980	0.43	150.68	1.275	192.083		0.64	1	
77.264	10	Gravelly Sand to Sand	376.951	2.637	4.492	0.498	3.995	1.84	0.42348	0.56	0.286	1.840	0.42	159.63	1.137	181.508		0.62	1	
77.92	10	Gravelly Sand to Sand	386.694	2.883	4.534	0.518	4.016	1.85	0.42178	0.56	0.286	1.850	0.42	163.10	1.145	186.762		0.61	1	
78.576	10	Gravelly Sand to Sand	419.006	2.7	4.576	0.539	4.037	1.79	0.42009	0.55	0.285	1.790	0.42	176.02	1.099	193.523		0.60	1	
79.232	10	Gravelly Sand to Sand	437.015	3.58	4.618	0.559	4.059	1.84	0.41833	0.55	0.285	1.840	0.42	182.82	1.137	207.868		0.60	1	
79.888	10	Gravelly Sand to Sand	434.241	2.473	4.659	0.579	4.08	1.75	0.41667	0.55	0.285	1.750	0.42	180.93	1.072	193.888		0.59	1	
80.545	10	Gravelly Sand to Sand	483.153	2.306	4.701	0.6	4.101	1.67	0.41502	0.55	0.285	1.670	0.42	200.52	1.017	204.000		0.57	1	
81.201	10	Gravelly Sand to Sand	513.315	2.439	4.743	0.62	4.122	1.65	0.41338	0.54	0.285	1.650	0.41	212.19	1.003	212.901		0.57	1	
81.857	10	Gravelly Sand to Sand	342.127	2.024	4.785	0.641	4.144	1.85	0.41168	0.54	0.285	1.850	0.41	140.85	1.145	161.280		0.63	1	
82.513	10	Gravelly Sand to Sand	281.484	1.749	4.826	0.661	4.165	1.94	0.41007	0.54	0.285	1.940	0.41	115.43	1.229	141.858	0.35	0.66	1	1.21
83.169	10	Gravelly Sand to Sand	258.073	1.351	4.868	0.682	4.186	1.94	0.40847	0.54	0.285	1.940	0.41	105.41	1.229	129.553	0.28	0.67	1	0.99
83.825	7	Silty Sand to Sandy Silt	131.379	3.711	4.907	0.702	4.204	2.61	0.40711	0.54	0.285							0.75	1	
84.482	8	Sand to Silty Sand	180.647	3.255	4.946	0.723	4.224	2.38	0.4056	0.53	0.284	2.380	0.41	73.27	2.233	163.584		0.74	1	
85.138	9	Sand	272.059	2.447	4.987	0.743	4.244	2.05	0.40411	0.53	0.284	2.050	0.40	109.94	1.371	150.738	0.40	0.67	1	1.40
85.794	9	Sand	337.436	4.078	5.028	0.764	4.264	2.05	0.40264	0.53	0.284	2.050	0.40	135.86	1.371	186.276		0.64	1	
86.45	10	Gravelly Sand to Sand	348.143	2.735	5.07	0.784	4.285	1.93	0.40109	0.53	0.284	1.930	0.40	139.64	1.218	170.144		0.63	1	
87.106	10	Gravelly Sand to Sand	389.501	1.945	5.111	0.805	4.307	1.78	0.39949	0.53	0.284	1.780	0.40	155.60	1.092	169.971		0.60	1	
87.762	10	Gravelly Sand to Sand	404.251	1.928	5.153	0.825	4.328	1.76	0.39797	0.52	0.284	1.760	0.40	160.88	1.078	173.501		0.59	1	
88.419	10	Gravelly Sand to Sand	400.006	1.736	5.195	0.846	4.349	1.74	0.39647	0.52	0.284	1.740	0.40	158.59	1.065	168.868		0.59	1	
89.075	10	Gravelly Sand to Sand	384.694	1.899	5.237	0.866	4.371	1.79	0.3949	0.52	0.284	1.790	0.39	151.92	1.099	167.023		0.60	1	
89.731	10	Gravelly Sand to Sand	364.686	2.281	5.279	0.887	4.392	1.86	0.39342	0.52	0.284	1.860	0.39	143.47	1.153	165.475		0.61	1	
90.387	10	Gravelly Sand to Sand	392.715	1.934	5.32	0.907	4.413	1.78	0.39195	0.52	0.284	1.780	0.39	153.92	1.092	168.138		0.60	1	
91.043	10	Gravelly Sand to Sand	427.083	1.785	5.362	0.928	4.435	1.72	0.39042	0.52	0.284	1.720	0.39	166.74	1.051	175.299		0.58	1	
91.699	10	Gravelly Sand to Sand	471.394	1.838	5.404	0.948	4.456	1.66	0.38897	0.52	0.284	1.660	0.39	183.36	1.010	185.265		0.56	1	
92.356	9	Sand	300.74	3.872	5.445	0.968	4.476	2.12	0.3876	0.51	0.284	2.120	0.39	116.57	1.492	173.935		0.66	1	
93.012	7	Silty Sand to Sandy Silt	124.689	3.373	5.483	0.989	4.494	2.64	0.38637	0.51	0.284							0.74	1	
93.668	11	Sitff Fine-Grained	158.706	6.835	5.526	1.009	4.517	2.69	0.38482	0.51	0.284							0.74	1	
94.324	11	Sitff Fine-Grained	100.369	4.35	5.569	1.03	4.539	2.86	0.38334	0.51	0.284							0.74	1	
94.98	6	Sandy Silt to Clayey Silt	99.74	3.362	5.606	1.05	4.556	2.79	0.38221	0.51	0.285							0.74	1	
95.636	6	Sandy Silt to Clayey Silt	112.496	3.976	5.644	1.071	4.573	2.76	0.38108	0.51	0.285							0.74	1	
96.293	6	Sandy Silt to Clayey Silt	119.871	3.891	5.682	1.091	4.59	2.71	0.37997	0.51	0.285							0.74	1	
96.949	6	Sandy Silt to Clayey Silt	123.514	4.095	5.719	1.112	4.607	2.71	0.37885	0.50	0.285							0.74	1	
97.605	6	Sandy Silt to Clayey Silt	116.813	4.243	5.757	1.132	4.625	2.76	0.37768	0.50	0.285							0.74	1	
98.261	5	Clayey Silt to Silty Clay	98.843	3.918	5.794	1.153	4.642	2.85	0.37658	0.50	0.285							0.74	1	
98.917	6	Sandy Silt to Clayey Silt	90.393	3.383	5.832	1.173	4.659	2.86	0.37549	0.50	0.285							0.74	1	
99.573	6	Sandy Silt to Clayey Silt	117.052	3.784	5.87	1.194	4.676	2.73	0.3744	0.50	0.285							0.73	1	

INFORMATION HANDOUT

LIQUEFACTION POTENTIAL ANALYSIS (per Youd & Idriss, 2001)

PROJECT NAME **ROUTE 4**
PROJECT NO. **206118.CLO**
CPT NO. **GST-138 (G ST.)**

FAULT INFO
COAST RANGE - SIERRAN BLOCK BOUNDARY ZONE (CSB)
a_{max} (g)= 0.76

FAULT M_w = 7
MSF = 1.19

			CPT RESULT INPUT							CSR		CRR 7.5						F.S.=(CRR 7.5/CSR)*MSF*Kσ*Kα		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
0.492									1.7	1.00	#VALUE!							#VALUE!	1	
1.148									1.7	1.00	#VALUE!							#VALUE!	1	
1.804									1.7	1.00	#VALUE!							#VALUE!	1	
2.461									1.7	1.00	#VALUE!							#VALUE!	1	
3.117									1.7	0.99	#VALUE!							#VALUE!	1	
3.773									1.7	0.99	#VALUE!							#VALUE!	1	
4.429									1.7	0.99	#VALUE!							#VALUE!	1	
5.085	6	Sandy Silt to Clayey Silt	32.786	0.735	0.291		0.291	2.12	1.47552	0.99	0.489	2.120	1.48	48.38	1.492	72.185	0.11	1.00	1	
5.741	6	Sandy Silt to Clayey Silt	57.167	1.562	0.329		0.329	2.07	1.43885	0.99	0.488	2.070	1.44	82.25	1.403	115.397	0.22	1.00	1	
6.398	7	Silty Sand to Sandy Silt	52.549	0.93	0.368		0.368	1.97	1.40306	0.99	0.488	1.970	1.40	73.73	1.263	93.100	0.16	1.00	1	
7.054	5	Clayey Silt to Silty Clay	51.741	2.152	0.405		0.405	2.29	1.37072	0.99	0.487	2.290	1.37	70.92	1.917	135.961	0.31	1.00	1	
7.71	4	Silty Clay to Clay	41.938	1.825	0.443		0.443	2.39	1.33901	0.98	0.486	2.390	1.34	56.16	2.272	127.586	0.27	1.00	1	
8.366	5	Clayey Silt to Silty Clay	63.433	2.38	0.48		0.48	2.25	1.30952	0.98	0.485	2.250	1.31	83.07	1.798	149.376	0.39	1.00	1	
9.022	6	Sandy Silt to Clayey Silt	54.543	1.479	0.518		0.518	2.2	1.28056	0.98	0.485	2.200	1.28	69.85	1.667	116.416	0.23	1.00	1	
9.678	6	Sandy Silt to Clayey Silt	124.338	4.269	0.556		0.556	2.09	1.25285	0.98	0.484	2.090	1.25	155.78	1.437	223.839		1.00	1	
10.335	7	Silty Sand to Sandy Silt	119.085	3.411	0.594		0.594	2.05	1.22631	0.98	0.483	2.050	1.23	146.04	1.371	200.222		1.00	1	
10.991	12	Sand to Clayey Sand	177.845	6.54	0.634		0.634	2.06	1.19956	0.98	0.483	2.060	1.20	213.34	1.387	295.839		1.00	1	
11.647	11	Stiff Fine-Grained	152.283	6.666	0.677		0.677	2.17	1.17208	0.98	0.482	2.170	1.17	178.49	1.596	284.935		1.00	1	
12.303	11	Stiff Fine-Grained	179.566	7.491	0.72		0.72	2.13	1.14583	0.97	0.481	2.130	1.15	205.75	1.512	311.047		1.00	1	
12.959	11	Stiff Fine-Grained	144.635	7.452	0.762		0.762	2.27	1.1213	0.97	0.481	2.270	1.12	162.18	1.856	301.020		1.00	1	
13.615	11	Stiff Fine-Grained	116.924	6.784	0.805		0.805	2.38	1.09726	0.97	0.480	2.380	1.10	128.30	2.233	286.430		1.00	1	
14.272	11	Stiff Fine-Grained	92.744	5.564	0.848		0.848	2.46	1.07422	0.97	0.479	2.460	1.07	99.63	2.574	256.468		1.00	1	
14.928	11	Stiff Fine-Grained	81.464	4.552	0.891		0.891	2.49	1.05213	0.97	0.479	2.490	1.05	85.71	2.718	232.994		1.00	1	
15.584	11	Stiff Fine-Grained	103.45	6.534	0.934		0.934	2.48	1.03093	0.97	0.478	2.480	1.03	106.65	2.669	284.684		1.00	1	
16.24	11	Stiff Fine-Grained	88.638	6.121	0.976		0.976	2.56	1.01103	0.97	0.477	2.560	1.01	89.62	3.091	276.962		1.00	1	
16.896	11	Stiff Fine-Grained	85.224	5.837	1.019		1.019	2.58	0.99144	0.96	0.476	2.580	0.99	84.49	3.206	270.927		1.00	1	
17.552	11	Stiff Fine-Grained	93.072	5.63	1.062		1.062	2.52	0.97259	0.96	0.476	2.520	0.97	90.52	2.872	259.942		0.99	1	
18.209	11	Stiff Fine-Grained	151.464	8.462	1.105		1.105	2.38	0.95445	0.96	0.475	2.380	0.95	144.56	2.233	322.751		0.98	1	
18.865	11	Stiff Fine-Grained	184.284	10.563	1.148		1.148	2.35	0.93697	0.96	0.474	2.350	0.94	172.67	2.120	365.996		0.97	1	
19.521	11	Stiff Fine-Grained	163.039	8.924	1.19		1.19	2.37	0.9205	0.96	0.473	2.370	0.92	150.08	2.194	329.277		0.97	1	
20.177	11	Stiff Fine-Grained	102.096	6.361	1.233		1.233	2.55	0.90423	0.96	0.472	2.550	0.90	92.32	3.034	280.116		0.96	1	
20.833	11	Stiff Fine-Grained	103.232	5.874	1.276		1.276	2.53	0.88853	0.95	0.472	2.530	0.89	91.72	2.925	268.274		0.95	1	
21.49	11	Stiff Fine-Grained	126.759	8.766	1.319		1.319	2.55	0.87336	0.95	0.471	2.550	0.87	110.71	3.034	335.909		0.95	1	
22.146	11	Stiff Fine-Grained	120.065	8.59	1.362		1.362	2.58	0.8587	0.95	0.470	2.580	0.86	103.10	3.206	330.586		0.94	1	
22.802	11	Stiff Fine-Grained	134.13	7.825	1.405		1.405	2.49	0.84453	0.95	0.469	2.490	0.84	113.28	2.718	307.930		0.93	1	
23.458	11	Stiff Fine-Grained	140.514	8.992	1.447		1.447	2.52	0.83113	0.95	0.468	2.520	0.83	116.79	2.872	335.363		0.93	1	
24.114	11	Stiff Fine-Grained	99.01	6.252	1.49		1.49	2.62	0.81784	0.94	0.467							0.92	1	
24.77	11	Stiff Fine-Grained	108.34	5.691	1.533		1.533	2.54	0.80498	0.94	0.466	2.540	0.80	87.21	2.979	259.799		0.92	1	
25.427	11	Stiff Fine-Grained	143.193	6.496	1.576		1.576	2.42	0.79251	0.94	0.465	2.420	0.79	113.48	2.396	271.886		0.91	1	
26.083	11	Stiff Fine-Grained	178.129	10.271	1.619		1.619	2.45	0.78042	0.94	0.463	2.450	0.78	139.02	2.528	351.460		0.91	1	
26.739	11	Stiff Fine-Grained	199.819	11.969	1.661		1.661	2.44	0.76896	0.94	0.462	2.440	0.77	153.65	2.483	381.542		0.90	1	
27.395	12	Sand to Clayey Sand	296.963	10.601	1.701		1.701	2.16	0.75836	0.93	0.461	2.160	0.76	225.20	1.574	354.531		0.82	1	
28.051	12	Sand to Clayey Sand	266.283	9.52	1.741		1.741	2.19	0.74804	0.93	0.459	2.190	0.75	199.19	1.643	327.197		0.82	1	
28.707	11	Stiff Fine-Grained	153.809	8.734	1.784		1.784	2.51	0.73727	0.93	0.458	2.510	0.74	113.40	2.820	319.727		0.89	1	
29.364	11	Stiff Fine-Grained	122.421	6.533	1.826		1.826	2.56	0.72703	0.92	0.456	2.560	0.73	89.00	3.091	275.072		0.89	1	
30.02	11	Stiff Fine-Grained	126.365	7.007	1.869		1.869	2.57	0.71685	0.92	0.455	2.570	0.72	90.58	3.148	285.156		0.88	1	
30.676	11	Stiff Fine-Grained	94.504	5.331	1.912		1.912	2.67	0.70694	0.92	0.453							0.88	1	
31.332	11	Stiff Fine-Grained	99.233	5.516	1.955		1.955	2.65	0.69731	0.91	0.451							0.87	1	
31.988	11	Stiff Fine-Grained	95.373	5.479	1.998		1.998	2.68	0.68793	0.91	0.449							0.87	1	
32.644	11	Stiff Fine-Grained	89.201	4.798	2.041		2.041	2.69	0.6788	0.91	0.448							0.87	1	
33.301	11	Stiff Fine-Grained	93.412	4.798	2.083		2.083	2.67	0.67012	0.90	0.446							0.86	1	
33.957	11	Stiff Fine-Grained	94.236	5.218	2.126		2.126	2.69	0.66146	0.90	0.443							0.86	1	
34.613	11	Stiff Fine-Grained	85.096	4.416	2.169		2.169	2.71	0.65301	0.89	0.441							0.86	1	
35.269	11	Stiff Fine-Grained	107.154	5.444	2.212		2.212	2.64	0.64478	0.89	0.439							0.85	1	
35.925	11	Stiff Fine-Grained	147.147	10.434	2.255		2.255	2.66	0.63676	0.88	0.437							0.85	1	
36.581	11	Stiff Fine-Grained	134.436	9.428	2.297		2.297	2.69	0.62911	0.88	0.434							0.85	1	
37.238	11	Stiff Fine-Grained	153.648	10.872	2.34		2.34	2.66	0.62147	0.87	0.432							0.84	1	
37.894	11	Stiff Fine-Grained	104.569	6.539	2.383		2.383	2.74	0.61401	0.87	0.429							0.84	1	
38.55	11	Stiff Fine-Grained	76.618	3.414	2.426		2.426	2.74	0.60673	0.86	0.427							0.84	1	
39.206	11	Stiff Fine-Grained	68.725	3.381	2.469		2.469	2.81	0.59962	0.86	0.424							0.83	1	
39.862	11	Stiff Fine-Grained	61.517	2.989	2.511		2.511	2.85	0.59283	0.85	0.421							0.83	1	
40.518	11	Stiff Fine-Grained	69.828	3.865	2.554		2.554	2.85	0.58604	0.85	0.418							0.83	1	
41.175	11	Stiff Fine-Grained	62.564	3.332	2.597		2.597	2.88	0.5794	0.84	0.415							0.83	1	
41.831	5	Clayey Silt to Silty Clay	62.81	2.776	2.635		2.635	2.83	0.57366	0.83	0.412							0.82	1	
42.487	5	Clayey Silt to Silty Clay	59.785	2.473	2.672		2.672	2.83	0.56818	0.83	0.409							0.82	1	
43.143	5	Clayey Silt to Silty Clay	54.376	2.314	2.71		2.71	2.88	0.56266	0.82	0.406							0.82	1	
43.799	4	Silty Clay to Clay	47.519	2.351	2.747		2.747	2.98	0.55739	0.82	0.403							0.82	1	
44.455	4	Silty Clay to Clay	40.93	1.937	2.785		2.785	3.03	0.55207	0.81	0.400							0.81	1	
45.112	5	Clayey Silt to Silty Clay	43.871	1.708	2.823		2.823	2.95	0.54686	0.80	0.396							0.81	1	
45.768	5	Clayey Silt to Silty Clay	47.948	1.727	2.86		2.86	2.9	0.54187	0.80	0.393							0.81	1	
46.424	5	Clayey Silt to Silty Clay	48.455	1.842	2.898		2.898	2.92	0.53685	0.79	0.390							0.81	1	
47.08	5	Clayey Silt to Silty Clay	46.979	1.826	2.935		2.935	2.94	0.53204	0.78	0.387							0.81	1	
47.736	5	Clayey Silt to Silty Clay	35.655	1.436	2.973		2.973	3.06	0.5272	0.78	0.383							0.80	1	
48.392	5	Clayey Silt to Silty Clay	30.358	1.111	3.011		3.011	3.11	0.52244	0.77	0.380							0.80	1	
49.049	5	Clayey Silt to Silty Clay	31.678	0.951	3.048		3.048	3.04	0.51789	0.76	0.377							0.80	1	
49.705	6	Sandy Silt to Clayey Silt	40.345	1.246	3.086		3.086	2.96	0.5133	0.76	0.373							0.80	1	
50.361	4	Silty Clay to Clay	31.6	1.276	3.123		3.123	3.13	0.50891	0.75	0.370							0.80	1	
51.017	5	Clayey Silt to Silty Clay	32.992	1.009	3.161		3.161	3.05	0.50447	0.74	0.367							0.79	1	
51.673	6	Sandy Silt to Clayey Silt	43.186	1.361	3.199		3.199	2.95	0.50011	0.74	0.363							0.79	1	
52.329	6	Sandy Silt to Clayey Silt	53.067	1.513	3.236		3.236	2.85	0.49594	0.73	0.360							0.79	1	
52.986	6	Sandy Silt to Clayey Silt	77.509	2.102	3.274		3.274	2.7	0.49173	0.72	0.357							0.79	1	
53.642	6	Sandy Silt to Clayey Silt	58.922	1.803	3.311		3.311	2.83	0.4877	0.72	0.354							0.79	1	
54.298	6	Sandy Silt to Clayey Silt	50.154	1.256	3.349		3.349	2.85	0.48362	0.71	0.351							0.79	1	
54.954	5	Clayey Silt to Silty Clay	48.338	1.627	3.387	0.007	3.379	2.94	0.48045	0.70	0.348							0.78	1	
55.61	5	Clayey Silt to Silty Clay	44.467	1.48	3.424	0.028	3.396	2.97	0.47868	0.70	0.347							0.78	1	
56.266	6	Sandy Silt to Clayey Silt	41.815	1.255	3.462	0.048	3.413	2.98	0.47691	0.69	0.347							0.78	1	
56.923	6	Sandy Silt to Clayey Silt	48.739	1.458	3.499	0.069	3.43	2.92	0.47516	0.69	0.346							0.78	1	
57.579	6	Sandy Silt to Clayey Silt	53.078	1.751	3.537	0.089	3.448	2.91	0.47332	0.68	0.344							0.78	1	
58.235	6	Sandy Silt to Clayey Silt	55.017	1.742	3.575	0.11	3.465	2.89	0.4716	0.67	0.344							0.78	1	
58.891	6	Sandy Silt to Clayey Silt	54.393	1.732	3.612	0.13	3.482	2.9	0.46988	0.67	0.343							0.78	1	
59.547	6	Sandy Silt to Clayey Silt	53.257	1.769	3.65	0.151	3.499	2.92	0.46818	0.66	0.342							0.78	1	
60.203	6	Sandy Silt to Clayey Silt	52.816	1.803	3.687	0.171	3.516	2.93	0.4665	0.66	0.341							0.78	1	
60.86	5	Clayey Silt to Silty Clay	51.068	1.81	3.725	0.192	3.533	2.95	0.46482	0.65	0.340							0.78	1	
61.516	6	Sandy Silt to Clayey Silt	51.725	1.715	3.763	0.212	3.55	2.93	0.46316	0.65	0.339							0.78	1	
62.172	6	Sandy Silt to Clayey Silt	49.146	1.443	3.8	0.233	3.567	2.93	0.46151	0.64	0.338							0.78	1	
62.828	6	Sandy Silt to Clayey Silt	45.631	1.374	3.838	0.253	3.585	2.96	0.45977	0.64	0.337							0.77	1	
63.484	6	Sandy Silt to Clayey Silt	44.222	1.364	3.875	0.274	3.602	2.99	0.45814	0.63	0.336							0.77	1	
64.14	6	Sandy Silt to Clayey Silt	38.251	1.124	3.913	0.294	3.619	3.04	0.45653	0.63	0.335							0.77	1	
64.797	6	Sandy Silt to Clayey Silt	38.924	1.071	3.95	0.315	3.636	3.01	0.45492	0.62	0.335							0.77	1	

INFORMATION HANDOUT

LIQUEFACTION POTENTIAL ANALYSIS (per Youd & Idriss, 2001)

PROJECT NAME **ROUTE 4**
PROJECT NO. **206118.CLO**
CPT NO. **GST-138 (G ST.)**

FAULT INFO
COAST RANGE - SIERRAN BLOCK BOUNDARY ZONE (CSB)
a_{max} (g)= 0.76

FAULT M_w = 7
MSF = 1.19

			CPT RESULT INPUT							CSR		CRR 7.5						F.S.=(CRR 7.5/CSR)*MSF*Kσ*Kα		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
65.453	6	Sandy Silt to Clayey Silt	38.027	1.012	3.988	0.335	3.653	3.02	0.45333	0.62	0.334							0.77	1	
66.109	6	Sandy Silt to Clayey Silt	50.739	1.44	4.026	0.356	3.67	2.92	0.45175	0.61	0.333							0.77	1	
66.765	5	Clayey Silt to Silty Clay	37.075	1.144	4.063	0.376	3.687	3.07	0.45017	0.61	0.332							0.77	1	
67.421	7	Silty Sand to Sandy Silt	90.794	2.272	4.102	0.396	3.705	2.66	0.44852	0.61	0.332							0.77	1	
68.077	4	Silty Clay to Clay	49.084	2.182	4.14	0.417	3.723	3.06	0.44688	0.60	0.331							0.77	1	
68.734	5	Clayey Silt to Silty Clay	68.658	2.549	4.177	0.437	3.74	2.88	0.44534	0.60	0.330							0.77	1	
69.39	11	Sitff Fine-Grained	63.784	3.05	4.22	0.458	3.762	2.98	0.44337	0.60	0.330							0.77	1	
70.046	4	Silty Clay to Clay	59.623	2.825	4.258	0.478	3.779	3.01	0.44186	0.59	0.329							0.77	1	
70.702	4	Silty Clay to Clay	55.184	2.672	4.295	0.499	3.796	3.04	0.44035	0.59	0.329							0.77	1	
71.358	7	Silty Sand to Sandy Silt	134.888	2.931	4.334	0.519	3.814	2.49	0.43877	0.58	0.328	2.490	0.44	59.19	2.718	160.888		0.77	1	
72.014	7	Silty Sand to Sandy Silt	157.213	3.922	4.372	0.54	3.833	2.48	0.43712	0.58	0.328	2.480	0.44	68.72	2.669	183.438		0.76	1	
72.671	9	Sand	236.187	2.846	4.413	0.56	3.853	2.14	0.43538	0.58	0.327	2.140	0.44	102.83	1.532	157.535	0.44	0.70	1	1.36
73.327	9	Sand	231.937	1.821	4.454	0.581	3.873	2.04	0.43367	0.58	0.327	2.040	0.43	100.58	1.356	136.380	0.32	0.70	1	0.97
73.983	7	Silty Sand to Sandy Silt	141.728	3.521	4.492	0.601	3.891	2.52	0.43214	0.57	0.326	2.520	0.43	61.25	2.872	175.874		0.76	1	
74.639	7	Silty Sand to Sandy Silt	168.927	3.554	4.531	0.622	3.909	2.41	0.43061	0.57	0.326	2.410	0.43	72.74	2.354	171.209		0.76	1	
75.295	9	Sand	267.542	1.923	4.572	0.642	3.93	1.97	0.42885	0.57	0.326	1.970	0.43	114.74	1.263	144.879	0.36	0.68	1	1.11
75.951	9	Sand	227.414	1.891	4.613	0.663	3.95	2.07	0.42718	0.56	0.325	2.070	0.43	97.15	1.403	136.291	0.32	0.70	1	0.97
76.608	9	Sand	230.689	3.281	4.653	0.683	3.97	2.2	0.42553	0.56	0.325	2.200	0.43	98.17	1.667	163.619		0.71	1	
77.264	9	Sand	314.888	2.647	4.694	0.704	3.99	1.95	0.42389	0.56	0.324	1.950	0.42	133.48	1.240	165.495		0.65	1	
77.92	9	Sand	291.775	2.587	4.735	0.724	4.011	2	0.42218	0.56	0.324	2.000	0.42	123.18	1.300	160.137		0.66	1	
78.576	9	Sand	286.759	2.024	4.775	0.744	4.031	1.95	0.42057	0.55	0.324	1.950	0.42	120.60	1.240	149.530	0.39	0.66	1	1.21
79.232	10	Gravelly Sand to Sand	322.09	1.865	4.817	0.765	4.052	1.86	0.41889	0.55	0.324	1.860	0.42	134.92	1.153	155.609	0.43	0.64	1	1.33
79.888	10	Gravelly Sand to Sand	341.842	2.076	4.859	0.785	4.074	1.85	0.41714	0.55	0.323	1.850	0.42	142.60	1.145	163.284		0.63	1	
80.545	9	Sand	352.687	3.204	4.9	0.806	4.094	1.94	0.41556	0.55	0.323	1.940	0.42	146.56	1.229	180.126		0.63	1	
81.201	9	Sand	316.242	2.807	4.94	0.826	4.114	1.98	0.414	0.54	0.323	1.980	0.41	130.92	1.275	166.894		0.65	1	
81.857	9	Sand	328.357	3.357	4.981	0.847	4.134	2	0.41245	0.54	0.323	2.000	0.41	135.43	1.300	176.059		0.64	1	
82.513	9	Sand	256.407	3.401	5.022	0.867	4.155	2.16	0.41083	0.54	0.322	2.160	0.41	105.34	1.574	165.833		0.69	1	
83.169	5	Clayey Silt to Silty Clay	79.598	3.263	5.06	0.888	4.172	2.9	0.40953	0.54	0.322							0.75	1	
83.825	5	Clayey Silt to Silty Clay	82.934	3.436	5.097	0.908	4.189	2.88	0.40824	0.54	0.322							0.75	1	
84.482	11	Sitff Fine-Grained	100.937	4.766	5.14	0.929	4.211	2.85	0.40658	0.53	0.322							0.75	1	
85.138	6	Sandy Silt to Clayey Silt	90.27	3.371	5.178	0.949	4.228	2.83	0.40531	0.53	0.322							0.75	1	
85.794	5	Clayey Silt to Silty Clay	62.976	2.75	5.215	0.97	4.245	3.01	0.40404	0.53	0.322							0.75	1	
86.45	5	Clayey Silt to Silty Clay	36.724	1.37	5.253	0.99	4.263	3.2	0.40271	0.53	0.322							0.75	1	
87.106	5	Clayey Silt to Silty Clay	27.734	0.894	5.29	1.011	4.28	3.3	0.40146	0.53	0.322							0.75	1	
87.762	6	Sandy Silt to Clayey Silt	27.689	0.69	5.328	1.031	4.297	3.24	0.40022	0.52	0.321							0.75	1	
88.419	6	Sandy Silt to Clayey Silt	31.75	0.874	5.365	1.052	4.314	3.2	0.39898	0.52	0.321							0.75	1	
89.075	6	Sandy Silt to Clayey Silt	30.396	0.841	5.403	1.072	4.331	3.22	0.39776	0.52	0.321							0.75	1	
89.731	5	Clayey Silt to Silty Clay	30.196	0.91	5.441	1.093	4.348	3.25	0.39654	0.52	0.321							0.75	1	
90.387	5	Clayey Silt to Silty Clay	32.223	0.989	5.478	1.113	4.365	3.22	0.39533	0.52	0.321							0.74	1	
91.043	5	Clayey Silt to Silty Clay	32.006	0.939	5.516	1.133	4.382	3.22	0.39412	0.52	0.321							0.74	1	
91.699	6	Sandy Silt to Clayey Silt	31.293	0.841	5.553	1.154	4.4	3.21	0.39286	0.52	0.321							0.74	1	
92.356	6	Sandy Silt to Clayey Silt	36.189	0.93	5.591	1.174	4.417	3.13	0.39167	0.51	0.321							0.74	1	
93.012	5	Clayey Silt to Silty Clay	49.463	1.666	5.629	1.195	4.434	3.06	0.39049	0.51	0.321							0.74	1	
93.668	6	Sandy Silt to Clayey Silt	84.65	3.101	5.666	1.215	4.451	2.87	0.38931	0.51	0.321							0.74	1	
94.324	5	Clayey Silt to Silty Clay	53.04	2.285	5.704	1.236	4.468	3.1	0.38814	0.51	0.321							0.74	1	
94.98	5	Clayey Silt to Silty Clay	45.509	1.894	5.741	1.256	4.485	3.15	0.38698	0.51	0.321							0.74	1	
95.636	6	Sandy Silt to Clayey Silt	63.829	2.134	5.779	1.277	4.502	2.95	0.38583	0.51	0.321							0.74	1	
96.293	5	Clayey Silt to Silty Clay	61.311	2.371	5.817	1.297	4.519	3.01	0.38468	0.51	0.321							0.74	1	
96.949	6	Sandy Silt to Clayey Silt	37.883	1.05	5.854	1.318	4.536	3.13	0.38354	0.50	0.321							0.74	1	
97.605	6	Sandy Silt to Clayey Silt	43.631	1.138	5.892	1.338	4.554	3.04	0.38234	0.50	0.321							0.74	1	
98.261	7	Silty Sand to Sandy Silt	90.643	2.214	5.93	1.359	4.572	2.74	0.38115	0.50	0.321							0.74	1	
98.917	9	Sand	218.802	3.098	5.971	1.379	4.592	2.27	0.37983	0.50	0.322	2.270	0.38	83.11	1.856	154.256	0.42	0.70	1	1.31
99.573	9	Sand	332.908	2.889	6.012	1.4	4.612	2	0.37853	0.50	0.322	2.000	0.38	126.01	1.300	163.819		0.63	1	

LIQUEFACTION ANALYSES - SPT

LIQUEFACTION POTENTIAL ANALYSIS

PROJECT NAME **SR4 - Segment 2**
PROJECT NO. **206118.GDR**
BORING NO. **RW-120**

BOREHOLE DIA (in)= 8
GW DEPTH (ft)= 22.5

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

(Lower-Level Design Basis EQ)

HAMMER ENERGY = 60% *(Pithcer Freste Rig-auto hammer = 75%)*
(Pithcer Failing Rig-auto hammer = 68%)
(Pithcer Failing Rig-rope & pulley = 60%)

FAULT INFO
CSRB
a_{max} *(g)=* 0.47
FAULT M_w = 7.5

MSF = 1.00

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*											*F.S.=($CRR_{7.5}$/CSR)*MSF*Kσ*Kα*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sampler Type	σ_v (psf)	σ_v' (psf)	γ_d	CSR	SPT-$N_{eq.}$	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	2	2	30	MC	250	250	1.00		20	1.0	0.75	1.0	1.15	16.8	1.66	27.9				1.00	1	
2	4	2	28	MC	500	500	0.99		18	1.0	0.75	1.0	1.15	15.7	1.52	23.8				1.00	1	
3	9	2	26	SPT	1125	1125	0.98		26	1.0	0.75	1.2	1.15	26.9	1.25	33.6				1.00	1	
4	14	1	29	SPT	1750	1750	0.97	0.30	29	1.0	0.85	1.2	1.15	34.0	1.06	36.1		36.1		1.00	1	
5	19	1	43	MC	2375	2375	0.96	0.29	28	1.0	0.85	1.0	1.15	27.3	0.92	25.2		25.2	0.30	0.93	1	
6	24	2	40	MC	3000	2906	0.95		26	1.0	0.95	1.0	1.15	28.4	0.83	23.6				0.86	1	
7	29	1	25	SPT	3625	3219	0.93	0.32	25	1.0	0.95	1.2	1.15	32.8	0.78	25.7	15%	29.4	0.43	0.83	1	1.12

1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\,(N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC ≤ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC ≥ 35% $\alpha = 5.0$, $\beta = 1.2$

Reference: Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

INFORMATION HANDOUT

LIQUEFACTION POTENTIAL ANALYSIS

PROJECT NAME **SR4 - Segment 2**
PROJECT NO. **206118.GDR**
BORING NO. **RW-123**

BOREHOLE DIA (in)= 3.5
GW DEPTH (ft)= 18.6

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 60% *(Pithcer Freste Rig-auto hammer = 75%)*
(Pithcer Failing Rig-auto hammer = 68%)
(Pithcer Failing Rig-rope & pulley = 60%)

FAULT INFO
CSRB (Lower-Level Design Basis EQ)
a_{max} *(g)=* 0.47
FAULT M_w = 7.5
MSF = 1.00

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*												*F.S.=($CRR_{7.5}$/CSR)*MSF*Kσ*Kα*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sampler Type	σ_v (psf)	σ_v' (psf)	γ_d	CSR	SPT-$N_{eq.}$	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	2	2	21	MC	250	250	1.00		14	1.0	0.75	1.0	1.00	10.2	1.66	17.0				1.00	1	
2	4	2	20	MC	500	500	0.99		13	1.0	0.75	1.0	1.00	9.8	1.52	14.8				1.00	1	
3	9	2	48	MC	1125	1125	0.98		31	1.0	0.75	1.0	1.00	23.4	1.25	29.2				1.00	1	
4	14	2	45	MC	1750	1750	0.97		29	1.0	0.85	1.0	1.00	24.9	1.06	26.4				1.00	1	
5	19	2	41	MC	2375	2350	0.96		27	1.0	0.85	1.0	1.00	22.7	0.93	21.0				0.94	1	
6	24	2	32	MC	3000	2663	0.95		21	1.0	0.95	1.0	1.00	19.8	0.87	17.2				0.90	1	
7	29	1	35	MC	3625	2975	0.93	0.34	23	1.0	0.95	1.0	1.00	21.6	0.82	17.7	16%	21.4	0.23	0.86	1	0.58

1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\,(N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$

Reference: Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

INFORMATION HANDOUT

LIQUEFACTION POTENTIAL ANALYSIS

PROJECT NAME **SR4 - Segment 2**
PROJECT NO. **206118.GDR**
BORING NO. **RW-127**

BOREHOLE DIA (in)= 3.5
GW DEPTH (ft)= 22

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 60% *(Pithcer Freste Rig-auto hammer = 75%)*
(Pithcer Failing Rig-auto hammer = 68%)
(Pithcer Failing Rig-rope & pulley = 60%)

FAULT INFO
CSRB (Lower-Level Design Basis EQ)
a_{max} *(g)=* 0.47
FAULT M_w = 7.5
MSF = 1.00

Sample No	Depth (ft)	Soil Type	Blow Count	Sampler Type	σ_v (psf)	σ_v' (psf)	γ_d	CSR	SPT-N_{eq}	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	$K\sigma$	$K\alpha$	F.S.
					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*											*F.S.=($CRR_{7.5}$/CSR)*MSF*$K\sigma$*$K\alpha$*		
1	2	2	34	MC	250	250	1.00		22	1.0	0.75	1.0	1.00	16.6	1.66	27.5				1.00	1	
2	4	2	44	MC	500	500	0.99		29	1.0	0.75	1.0	1.00	21.5	1.52	32.5				1.00	1	
3	9	2	36	MC	1125	1125	0.98		23	1.0	0.75	1.0	1.00	17.6	1.25	21.9				1.00	1	
4	14	2	28	MC	1750	1750	0.97		18	1.0	0.85	1.0	1.00	15.5	1.06	16.4				1.00	1	
5	19	2	42	MC	2375	2375	0.96		27	1.0	0.85	1.0	1.00	23.2	0.92	21.4				0.93	1	
6	24	1	9	MC	3000	2875	0.95	0.30	6	1.0	0.95	1.0	1.00	5.6	0.83	4.6		4.6	0.07	0.92	1	0.21
7	29	1	8	MC	3625	3188	0.93	0.32	5	1.0	0.95	1.0	1.00	4.9	0.79	3.9	16%	6.9	0.09	0.90	1	0.24

1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\,(N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for $FC \leq 5\%$ $\alpha = 0$, $\beta = 1.0$
   for $5\% < FC < 35\%$ $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for $FC \geq 35\%$ $\alpha = 5.0$, $\beta = 1.2$

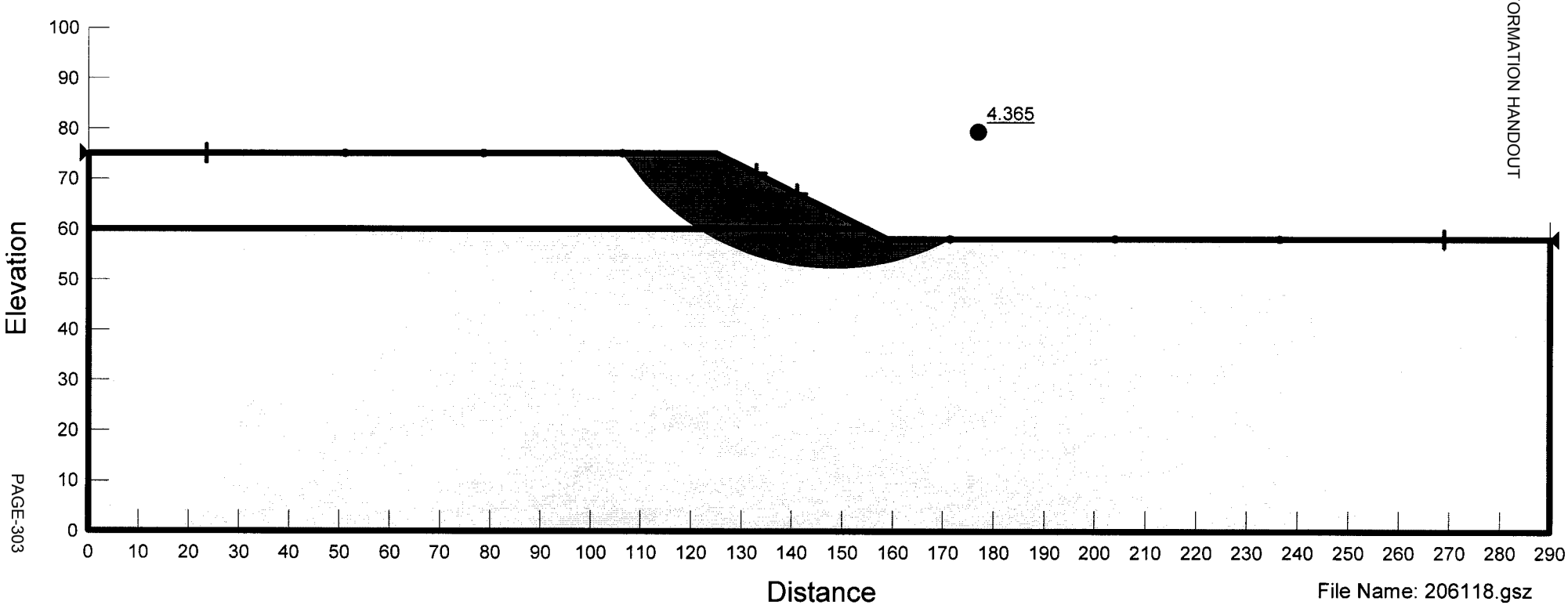
Reference: Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

SLOPE STABILITY FOR CUT SLOPES

SR 4, SEGMENT 2
(LONG-TERM)

Name: CLAY (1)	Unit Weight: 125 pcf	Cohesion: 400 psf	Phi: 28 °	Phi-B: 0 °
Name: CLAY (2)	Unit Weight: 125 pcf	Cohesion: 800 psf	Phi: 30 °	Phi-B: 0 °

2 (Horizontal) : 1 (Vertical) Slope
Height of Slope = 17.0 ft
(Based on Boring SW-140)



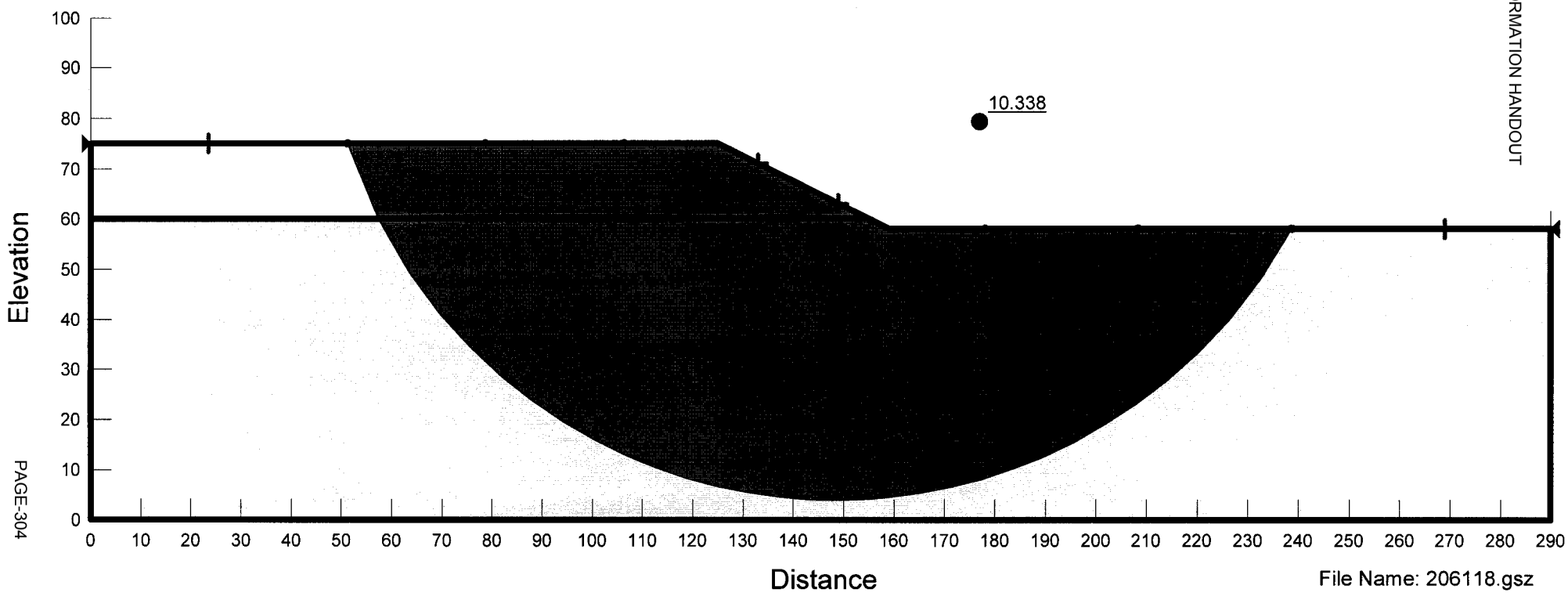
File Name: 206118.gsz
4/7/2009 11:55:56 AM

04-2285E4
INFORMATION HANDOUT

SR 4, SEGMENT 2
(SHORT-TERM)

Name: Su=2500 psf Unit Weight: 125 pcf Cohesion: 2500 psf
Name: Su=4000 psf Unit Weight: 125 pcf Cohesion: 4000 psf

2(Horizontal): 1(Vertical) Slope
Height of Slope = 17.0 ft
(Based on Boring SW-140)



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4/7/2009 11:52:10 AM

LPILE RUN
Retaining Wall No. 6

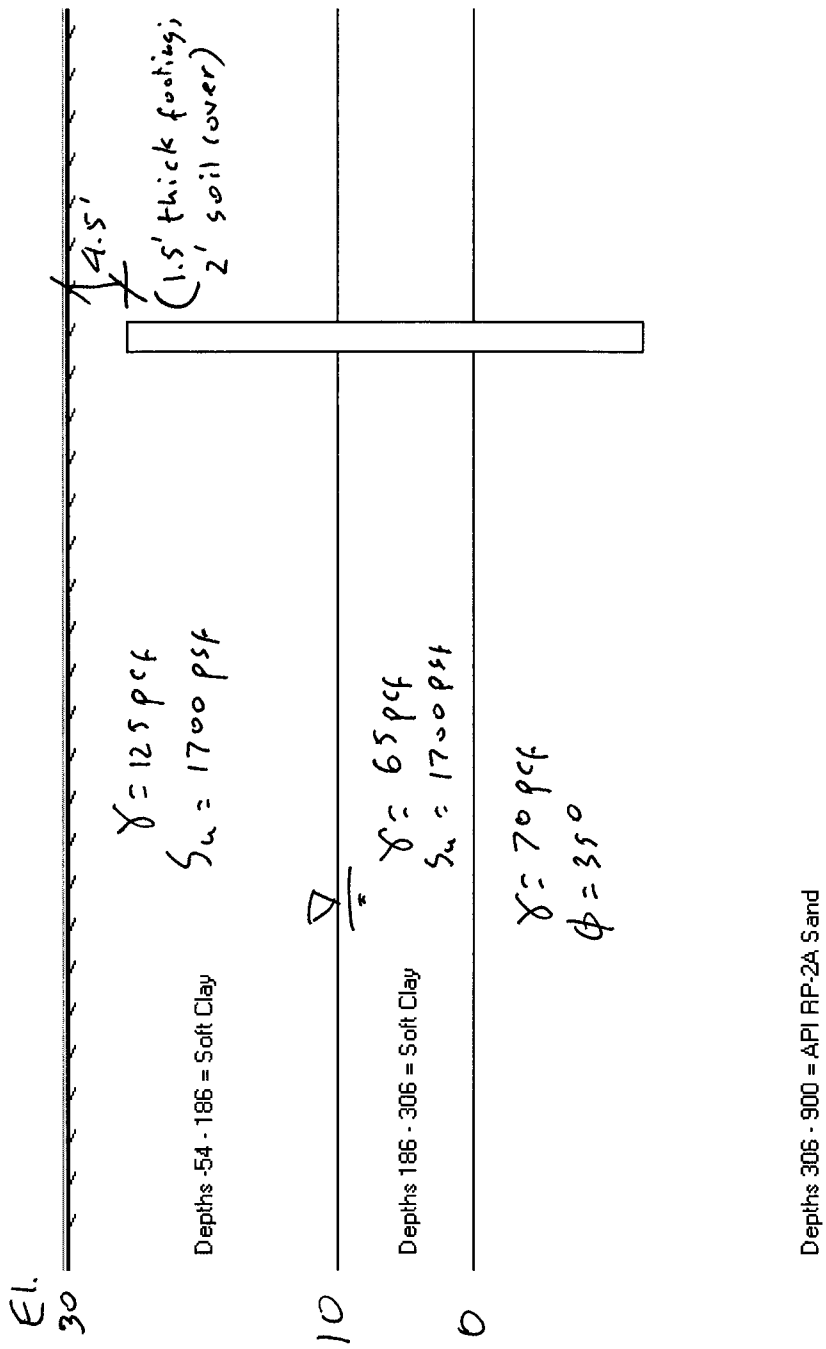
Retaining Wall No. 6
(Soil Profile based on boring CLO-125)

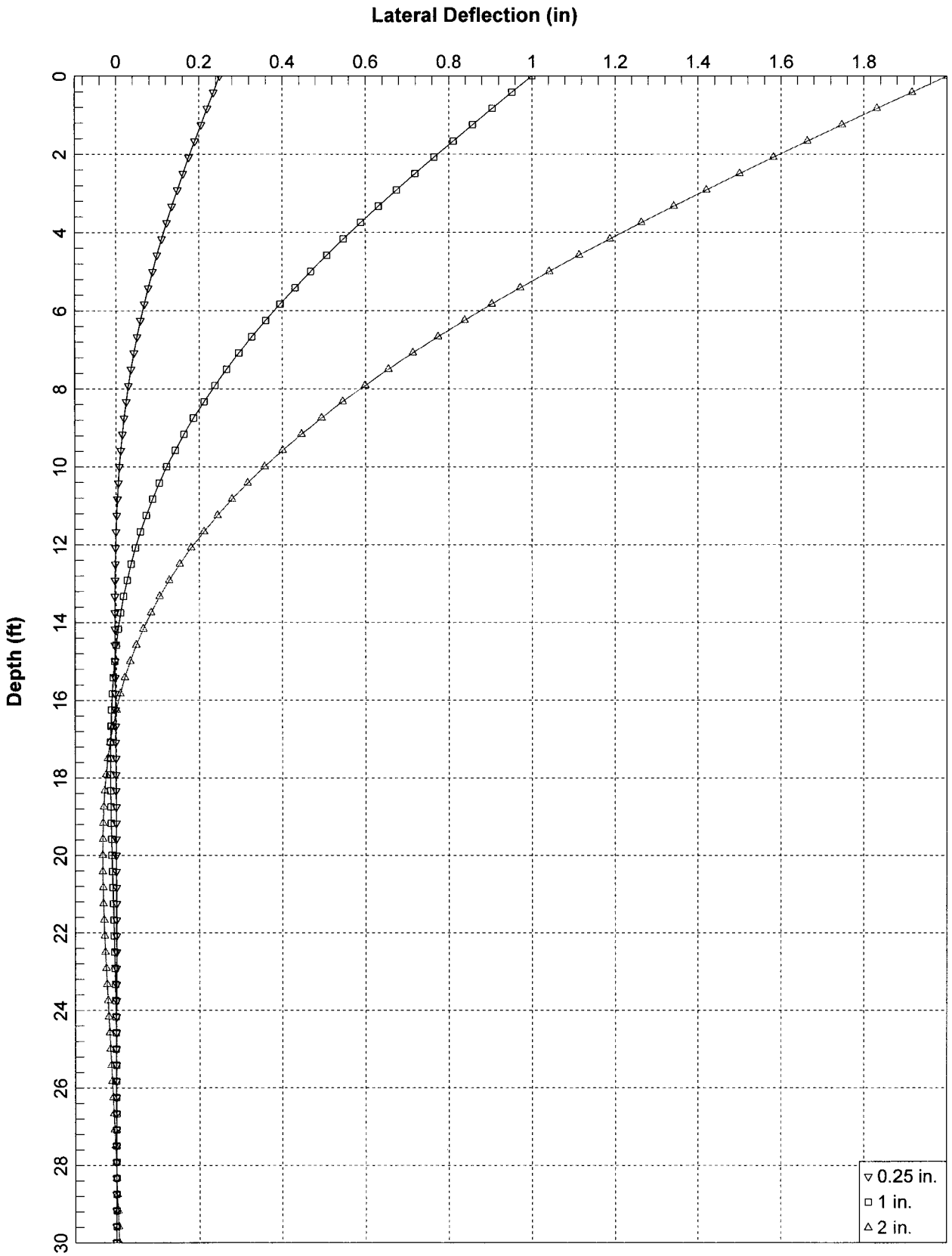
24-in. Dia. CIDH Pile

$A = 452.9\ in^2$

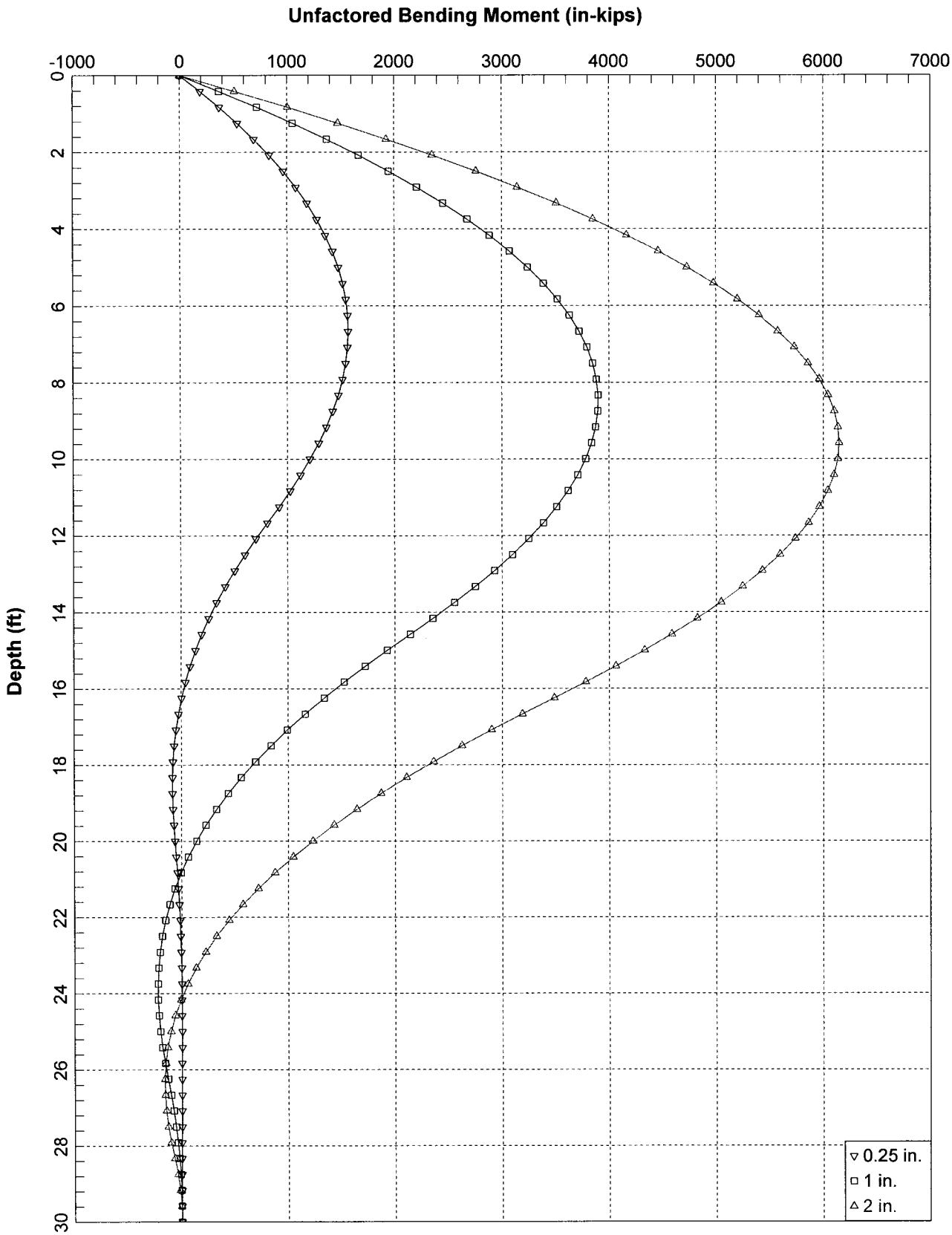
$I = 16286\ in^4$

$E = 3{,}600{,}000\ lb/in^2$





SR4 Contra Loma & G Street Interchanges - Retaining Wall No. 6 - 24-in. CIDH PIle



SR4 Contra Loma & G Street Interchanges - Retaining Wall No. 6 - 24-in. CIDH PIle

LPILE Plus for Windows, Version 5.0 (5.0.21)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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Gary Parikh
Parikh Consultants

Path to file locations: S:\Ongoing Projects\2006\206118 BKF\Retaining Walls and Sound Walls\LPILE\
Name of input data file: Ret WAll #6 - 24 in CIDH - CLO-125 -Free Head.lpd
Name of output file: Ret WAll #6 - 24 in CIDH - CLO-125 -Free Head.lpo
Name of plot output file: Ret WAll #6 - 24 in CIDH - CLO-125 -Free Head.lpp
Name of runtime file: Ret WAll #6 - 24 in CIDH - CLO-125 -Free Head.lpr

Time and Date of Analysis

Date: April 6, 2009 Time: 17:14:52

Problem Title

Retaining Wall #6 - 24-in Diameter CIDH PIle - CLO-125

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 uses p-y multiplers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- 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 = 76
- 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 = 456.00 in
Depth of ground surface below top of pile = -54.00 in
Slope angle of ground surface = .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	24.00000000	16286.0000	452.4000	3600000.
2	456.0000	24.00000000	16286.0000	452.4000	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970
Distance from top of pile to top of layer = -54.000 in
Distance from top of pile to bottom of layer = 186.000 in

Layer 2 is soft clay, p-y criteria by Matlock, 1970
Distance from top of pile to top of layer = 186.000 in
Distance from top of pile to bottom of layer = 306.000 in

Layer 3 is sand, p-y criteria by API RP-2A, 1987
Distance from top of pile to top of layer = 306.000 in
Distance from top of pile to bottom of layer = 900.000 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

(Depth of lowest layer extends 444.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Distribution of effective unit weight of soil with depth
is defined using 6 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-54.00	.07230
2	186.00	.07230
3	186.00	.03760
4	306.00	.03760
5	306.00	.04050
6	900.00	.04050

Shear Strength of Soils

Distribution of shear strength parameters with depth
defined using 6 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-54.000	11.81000	.00	.00700	.0
2	186.000	11.81000	.00	.00700	.0
3	186.000	11.81000	.00	.00700	.0
4	306.000	11.81000	.00	.00700	.0
5	306.000	.00000	35.00	------	------
6	900.000	.00000	35.00	------	------

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.

p-y Modification Factors

Distribution of p-y multipliers with depth defined using 2 points

Point No.	Depth X in	p-mult	y-mult
1	.000	.6500	1.0000
2	360.000	.6500	1.0000

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 = 3

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)

Deflection at pile head = .250 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = 400000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 1.000 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = 400000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 2.000 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = 400000.000 lbs

**** WARNING ****

An unreasonable input value for shear strength has been specified for a soil defined using the soft clay criteria. The input value is greater than 8.68 psi (1250 psf). You should check your input data for correctness.

Computed Values of Load Distribution and Deflection for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .250000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = 400000.000 lbs

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
0.000	.250000	0.0000	29270.3331	-.0027569	884.1733	-345.2598
6.000	.233458	176024.	27185.3918	-.0027479	1013.8729	-349.7206
12.000	.217025	339415.	25076.4200	-.0027215	1134.2640	-353.2700
18.000	.200800	490004.	22948.9477	-.0026791	1245.2228	-355.8874
24.000	.184876	627662.	20808.6265	-.0026219	1346.6528	-357.5530
30.000	.169337	752293.	18661.2238	-.0025513	1438.4848	-358.2479
36.000	.154260	863843.	16512.6190	-.0024686	1520.6778	-357.9537
42.000	.139714	962294.	14368.8004	-.0023752	1593.2195	-356.6525
48.000	.125758	1047669.	12235.8628	-.0022723	1656.1264	-354.3267
54.000	.112446	1120031.	10120.0077	-.0021614	1709.4450	-350.9584
60.000	.099821	1179484.	8027.5451	-.0020437	1753.2514	-346.5292
66.000	.087921	1226172.	5964.8987	-.0019206	1787.6524	-341.0196
72.000	.076774	1260282.	3938.6152	-.0017934	1812.7857	-334.4082
78.000	.066400	1282044.	1955.3797	-.0016633	1828.8204	-326.6703
84.000	.056814	1291730.	22.0397	-.0015316	1835.9579	-317.7763
90.000	.048021	1289660.	-1854.3571	-.0013995	1834.4323	-307.6893
96.000	.040019	1276196.	-3666.5066	-.0012683	1824.5116	-296.3606
102.000	.032802	1251749.	-5406.7595	-.0011389	1806.4987	-283.7238
108.000	.026353	1216781.	-7066.9826	-.0010126	1780.7333	-269.6839
114.000	.020651	1171806.	-8638.3319	-.0008904	1747.5941	-254.0991
120.000	.015668	1117395.	-10110.8667	-.0007732	1707.5027	-236.7458
126.000	.011372	1054187.	-11472.8485	-.0006621	1660.9291	-217.2481
132.000	.007723	982899.	-12709.3379	-.0005579	1608.4021	-194.9150

Ret WAll #6 - 24 in CIDH - CLO-125 -Free Head.lpo

138.000	.004677	904353.	-13798.9295	-.0004613	1550.5269	-168.2822
144.000	.002187	819526.	-14703.6647	-.0003731	1488.0242	-133.2962
150.000	.000200	729700.	-15260.9507	-.0002938	1421.8374	-52.4658
156.000	-.001339	637805.	-15066.9045	-.0002239	1354.1268	117.1478
162.000	-.002486	549971.	-14274.9730	-.0001631	1289.4083	146.8294
168.000	-.003296	467288.	-13341.5842	-.0001110	1228.4850	164.3002
174.000	-.003819	390405.	-12330.0126	-6.7141E-05	1171.8354	172.8903
180.000	-.004102	319650.	-11280.1337	-3.0809E-05	1119.7011	177.0693
186.000	-.004188	255192.	-10213.9912	-1.3949E-06	1072.2059	178.3116
192.000	-.004118	197089.	-9147.1205	2.1748E-05	1029.3944	177.3120
198.000	-.003927	145322.	-8091.6134	3.9268E-05	991.2506	174.5237
204.000	-.003647	99801.4509	-7057.2506	5.1811E-05	957.7099	170.2639
210.000	-.003306	60386.0955	-6052.1589	6.0008E-05	928.6675	164.7666
216.000	-.002927	26887.5070	-5083.2282	6.4473E-05	903.9848	158.2103
222.000	-.002532	-922.1145	-4156.3950	6.5802E-05	884.8527	150.7341
228.000	-.002137	-23305.0821	-3276.8533	6.4562E-05	901.3452	142.4465
234.000	-.001757	-40554.2525	-2449.2270	6.1295E-05	914.0549	133.4290
240.000	-.001402	-52990.0200	-1677.7353	5.6508E-05	923.2179	123.7349
246.000	-.001079	-60958.3153	-966.3859	5.0678E-05	929.0892	113.3816
252.000	-.000794	-64829.9025	-319.2547	4.4241E-05	931.9419	102.3288
258.000	-.000548	-65001.7291	259.0146	3.7598E-05	932.0685	90.4276
264.000	-.000343	-61902.1971	815.8394	3.1104E-05	929.7846	95.1807
270.000	-.000175	-55360.9576	1247.2179	2.5104E-05	924.9649	48.6122
276.000	-4.13E-05	-47056.0819	1427.5174	1.9864E-05	918.8456	11.4876
282.000	6.34E-05	-38326.0937	1409.1513	1.5495E-05	912.4131	-17.6097
288.000	.000145	-30220.6412	1235.8150	1.1987E-05	906.4407	-40.1691
294.000	.000207	-23553.8524	942.5884	9.2357E-06	901.5285	-57.5731
300.000	.000255	-18953.9119	556.9913	7.0606E-06	898.1391	-70.9592
306.000	.000292	-16903.8482	336.5219	5.2258E-06	896.6285	-2.5305
312.000	.000318	-14940.7324	320.4350	3.5963E-06	895.1821	-2.8318
318.000	.000335	-13075.8908	302.7554	2.1628E-06	893.8080	-3.0614
324.000	.000344	-11318.0493	283.8996	9.1457E-07	892.5128	-3.2238
330.000	.000346	-9673.4855	264.2571	-1.5954E-07	891.3010	-3.3237
336.000	.000342	-8146.1978	244.1881	-1.0714E-06	890.1757	-3.3660
342.000	.000333	-6738.0859	224.0216	-1.8330E-06	889.1381	-3.3562
348.000	.000320	-5449.1406	204.0547	-2.4566E-06	888.1884	-3.2995
354.000	.000304	-4277.6380	184.5520	-2.9543E-06	887.3252	-3.2014
360.000	.000285	-3220.3357	165.7456	-3.3379E-06	886.5461	-3.0674
366.000	.000264	-2272.6682	143.1466	-3.6190E-06	885.8479	-4.4656
372.000	.000241	-1485.2055	117.2307	-3.8113E-06	885.2676	-4.1730
378.000	.000218	-847.6050	93.1676	-3.9307E-06	884.7978	-3.8481
384.000	.000194	-348.3267	71.1325	-3.9919E-06	884.4300	-3.4970
390.000	.000170	25.1456	51.2671	-4.0084E-06	884.1918	-3.1248
396.000	.000146	286.1183	33.6858	-3.9925E-06	884.3841	-2.7356
402.000	.000122	448.5387	18.4816	-3.9549E-06	884.5038	-2.3324
408.000	9.86E-05	526.8808	5.7319	-3.9050E-06	884.5615	-1.9175
414.000	7.53E-05	536.0649	-4.4962	-3.8506E-06	884.5683	-1.4919
420.000	5.24E-05	491.4090	-12.1406	-3.7980E-06	884.5354	-1.0562
426.000	2.97E-05	408.6084	-17.1399	-3.7519E-06	884.4744	-.6102267
432.000	7.33E-06	303.7392	-19.4301	-3.7155E-06	884.3971	-.1531747
438.000	-1.49E-05	193.2812	-18.9416	-3.6901E-06	884.3157	.3160313
444.000	-3.69E-05	94.1529	-15.5975	-3.6754E-06	884.2427	.7986559
450.000	-5.90E-05	23.7530	-9.3138	-3.6693E-06	884.1908	1.2959
456.000	-8.10E-05	0.0000	0.0000	-3.6681E-06	884.1733	1.8087

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

```
Pile-head deflection          =      .25000000 in
Computed slope at pile head   =     -.00275692
```

Ret WAll #6 - 24 in CIDH - CLO-125 -Free Head.lpo

```
Maximum bending moment          =      1291730. lbs-in
Maximum shear force             =     29270.33310 lbs
Depth of maximum bending moment =     84.00000000 in
Depth of maximum shear force    =       0.00000 in
Number of iterations            =            13
Number of zero deflection points =            3
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = 1.000000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = 400000.000 lbs

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
0.000	1.000000	0.0000	59542.7676	-.0089124	884.1733	-548.0658
6.000	.946526	368781.	56225.6193	-.0088935	1155.9021	-557.6502
12.000	.893277	717396.	52854.2174	-.0088380	1412.7719	-566.1504
18.000	.840470	1045454.	49435.1424	-.0087478	1654.4944	-573.5413
24.000	.788304	1352607.	45975.1224	-.0086251	1880.8139	-579.7987
30.000	.736969	1638556.	42481.0278	-.0084720	2091.5090	-584.8995
36.000	.686640	1903045.	38959.8665	-.0082908	2286.3927	-588.8210
42.000	.637480	2145870.	35418.7797	-.0080836	2465.3129	-591.5413
48.000	.589637	2366872.	31865.0387	-.0078527	2628.1537	-593.0390
54.000	.543247	2565943.	28306.0422	-.0076003	2774.8353	-593.2931
60.000	.498433	2743026.	24749.3147	-.0073286	2905.3149	-592.2827
66.000	.455304	2898113.	21202.5068	-.0070400	3019.5872	-589.9866
72.000	.413954	3031248.	17673.3959	-.0067366	3117.6853	-586.3836
78.000	.374465	3142529.	14169.8906	-.0064207	3199.6804	-581.4514
84.000	.336905	3232106.	10700.0369	-.0060945	3265.6833	-575.1665
90.000	.301331	3300183.	7272.0280	-.0057603	3315.8445	-567.5032
96.000	.267782	3347020.	3894.2200	-.0054201	3350.3549	-558.4328
102.000	.236289	3372930.	575.1539	-.0050763	3369.4468	-547.9225
108.000	.206867	3378287.	-2676.4133	-.0047308	3373.3941	-535.9332
114.000	.179519	3363521.	-5851.4635	-.0043859	3362.5139	-522.4169
120.000	.154237	3329122.	-8940.6532	-.0040434	3337.1675	-507.3131
126.000	.130998	3275642.	-11934.2215	-.0037054	3297.7618	-490.5430
132.000	.109771	3203698.	-14821.8540	-.0033739	3244.7511	-472.0011
138.000	.090512	3113974.	-17592.4796	-.0030506	3178.6404	-451.5408
144.000	.073164	3007231.	-20233.9566	-.0027374	3099.9887	-428.9516
150.000	.057662	2884306.	-22732.5665	-.0024360	3009.4145	-403.9184
156.000	.043932	2746133.	-25072.1544	-.0021479	2907.6040	-375.9442
162.000	.031888	2593750.	-27232.5482	-.0018746	2795.3242	-344.1871
168.000	.021437	2428340.	-29186.3025	-.0016177	2673.4453	-307.0644
174.000	.012476	2251279.	-30878.1172	-.0013782	2542.9817	-256.8739
180.000	.004898	2064418.	-32213.3911	-.0011574	2405.2969	-188.2175
186.000	-.001412	1870274.	-32406.8290	-.0009560	2262.2458	123.7382
192.000	-.006574	1680125.	-31413.9448	-.0007744	2122.1386	207.2233
198.000	-.010705	1497024.	-30060.6770	-.0006118	1987.2241	243.8660
204.000	-.013916	1322334.	-28530.5272	-.0004675	1858.5074	266.1839
210.000	-.016315	1156902.	-26889.8900	-.0003407	1736.6122	280.6951
216.000	-.018004	1001290.	-25177.5802	-.0002302	1621.9532	290.0748
222.000	-.019078	855876.	-23420.1392	-.0001352	1514.8076	295.7388
228.000	-.019627	720898.	-21637.2699	-5.4535E-05	1415.3518	298.5509
234.000	-.019732	596490.	-19844.3475	1.2874E-05	1323.6848	299.0899

Ret WAll #6 - 24 in CIDH - CLO-125 -Free Head.lpo

240.000	-.019472	482704.	-18053.7666	6.8095E-05	1239.8435	297.7704
246.000	-.018915	379518.	-16275.7374	.0001122	1163.8135	294.9060
252.000	-.018125	286856.	-14518.7888	.0001463	1095.5374	290.7435
258.000	-.017160	204591.	-12790.1052	.0001715	1034.9216	285.4843
264.000	-.016068	132552.	-11095.7596	.0001887	981.8415	279.2975
270.000	-.014895	70535.6326	-9440.8816	.0001991	936.1460	272.3284
276.000	-.013679	18305.7513	-7829.7846	.0002036	897.6615	264.7039
282.000	-.012451	-24399.2850	-6266.0658	.0002033	902.1514	256.5357
288.000	-.011239	-57863.0445	-4752.6943	.0001991	926.8085	247.9215
294.000	-.010062	-82387.4181	-3292.0953	.0001919	944.8788	238.9448
300.000	-.008935	-98289.5426	-1886.2444	.0001827	956.5959	229.6721
306.000	-.007869	-105899.	-992.6162	.0001723	962.2030	68.2039
312.000	-.006868	-111028.	-604.5970	.0001612	965.9818	61.1358
318.000	-.005935	-113928.	-258.5245	.0001496	968.1188	54.2217
324.000	-.005073	-114848.	46.7194	.0001379	968.7969	47.5262
330.000	-.004280	-114030.	312.6101	.0001262	968.1936	41.1040
336.000	-.003558	-111703.	540.9208	.0001147	966.4793	34.9996
342.000	-.002904	-108089.	733.6630	.0001034	963.8164	29.2478
348.000	-.002317	-103395.	893.0284	9.2609E-05	960.3581	23.8740
354.000	-.001793	-97817.1040	1021.3335	8.2314E-05	956.2478	18.8944
360.000	-.001329	-91534.5451	1120.9663	7.2625E-05	951.6186	14.3166
366.000	-.000921	-84714.1068	1210.7180	6.3606E-05	946.5931	15.6006
372.000	-.000566	-77311.2394	1286.8653	5.5316E-05	941.1385	9.7818
378.000	-.000257	-69537.2384	1329.8458	4.7802E-05	935.4104	4.5450
384.000	8.02E-06	-61582.5380	1343.0474	4.1092E-05	929.5491	-.1444811
390.000	.000236	-53617.9136	1329.6230	3.5198E-05	923.6805	-4.3303
396.000	.000430	-45796.0112	1292.4424	3.0111E-05	917.9171	-8.0632
402.000	.000597	-38253.1376	1234.0543	2.5810E-05	912.3593	-11.3994
408.000	.000740	-31111.2489	1156.6600	2.2261E-05	907.0970	-14.3987
414.000	.000864	-24480.0706	1062.0969	1.9416E-05	902.2109	-17.1224
420.000	.000973	-18459.2855	951.8333	1.7219E-05	897.7746	-19.6322
426.000	.001071	-13140.7240	826.9739	1.5602E-05	893.8558	-21.9876
432.000	.001160	-8610.4901	688.2765	1.4489E-05	890.5178	-24.2448
438.000	.001245	-4950.9555	536.1794	1.3795E-05	887.8213	-26.4542
444.000	.001326	-2242.5549	370.8415	1.3427E-05	885.8257	-28.6585
450.000	.001406	-565.3085	192.1931	1.3284E-05	884.5898	-30.8910
456.000	.001485	0.0000	0.0000	1.3255E-05	884.1733	-33.1733

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 2:

```
Pile-head deflection            =     1.00000000 in
Computed slope at pile head     =     -.00891241
Maximum bending moment          =      3378287. lbs-in
Maximum shear force             =     59542.76760 lbs
Depth of maximum bending moment =      108.00000 in
Depth of maximum shear force    =        0.00000 in
Number of iterations            =             17
Number of zero deflection points =             2
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = 2.000000 in

Ret WAll #6 - 24 in CIDH - CLO-125 -Free Head.lpo

Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = 400000.000 lbs

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
0.000	2.000	0.0000	84828.0975	-.0160483	884.1733	-690.5197
6.000	1.904	535055.	80644.8042	-.0160209	1278.4176	-703.9114
12.000	1.808	1044638.	76384.7278	-.0159401	1653.8932	-716.1141
18.000	1.712	1528185.	72055.0835	-.0158085	2010.1842	-727.1007
24.000	1.618	1985180.	67663.2473	-.0156287	2346.9117	-736.8447
30.000	1.525	2415161.	63216.7505	-.0154035	2663.7345	-745.3209
36.000	1.433	2817718.	58723.2750	-.0151358	2960.3500	-752.5043
42.000	1.343	3192492.	54190.6495	-.0148282	3236.4947	-758.3709
48.000	1.255	3539181.	49626.8453	-.0144838	3491.9452	-762.8972
54.000	1.169	3857537.	45039.9738	-.0141053	3726.5188	-766.0600
60.000	1.086	4147366.	40438.2841	-.0136957	3940.0738	-767.8366
66.000	1.005	4408535.	35830.1619	-.0132579	4132.5108	-768.2042
72.000	.926907	4640966.	31224.1291	-.0127949	4303.7727	-767.1401
78.000	.851563	4844640.	26628.8455	-.0123095	4453.8456	-764.6211
84.000	.779193	5019598.	22053.1115	-.0118048	4582.7596	-760.6235
90.000	.709906	5165940.	17505.8740	-.0112836	4690.5889	-755.1223
96.000	.643790	5283830.	12996.2347	-.0107489	4777.4531	-748.0908
102.000	.580919	5373490.	8533.4619	-.0102036	4843.5174	-739.5001
108.000	.521348	5435208.	4127.0085	-.0096505	4888.9933	-729.3177
114.000	.465113	5469336.	-213.4646	-.0090925	4914.1398	-717.5067
120.000	.412237	5476291.	-4478.0549	-.0085324	4919.2641	-704.0234
126.000	.362724	5456555.	-8656.5725	-.0079730	4904.7225	-688.8158
132.000	.316561	5410682.	-12738.4771	-.0074170	4870.9219	-671.8191
138.000	.273720	5339295.	-16712.7897	-.0068669	4818.3217	-652.9517
144.000	.234158	5243090.	-20567.9675	-.0063254	4747.4350	-632.1075
150.000	.197816	5122841.	-24291.7245	-.0057950	4658.8323	-609.1448
156.000	.164618	4979405.	-27870.7672	-.0052781	4553.1444	-583.8694
162.000	.134479	4813727.	-31290.3924	-.0047770	4431.0678	-556.0057
168.000	.107295	4626850.	-34533.8512	-.0042939	4293.3715	-525.1473
174.000	.082952	4419932.	-37557.8211	-.0038310	4140.9078	-482.8427
180.000	.061323	4194545.	-40316.1385	-.0033902	3974.8365	-436.5964
186.000	.042269	3952411.	-42782.9764	-.0029733	3796.4250	-385.6829
192.000	.025642	3695421.	-44919.5833	-.0025820	3607.0676	-326.5194
198.000	.011285	3425770.	-46644.4154	-.0022176	3408.3803	-248.4246
204.000	-.000969	3146333.	-47062.6729	-.0018813	3202.4833	109.0054
210.000	-.011291	2870048.	-45990.8878	-.0015735	2998.9084	248.2563
216.000	-.019851	2601995.	-44347.0684	-.0012935	2801.3993	299.6836
222.000	-.026813	2344092.	-42454.1363	-.0010404	2611.3686	331.2938
228.000	-.032336	2097540.	-40402.3136	-.0008131	2429.7016	352.6472
234.000	-.036571	1863167.	-38242.1053	-.0006105	2257.0093	367.4223
240.000	-.039662	1641565.	-36007.3393	-.0004311	2093.7260	377.4997
246.000	-.041745	1433149.	-33722.8424	-.0002738	1940.1591	383.9992
252.000	-.042948	1238205.	-31407.8782	-.0001371	1796.5187	387.6555
258.000	-.043390	1056912.	-29077.9573	-1.9689E-05	1662.9372	388.9848
264.000	-.043184	889364.	-26745.8964	7.9900E-05	1539.4825	388.3688
270.000	-.042432	735578.	-24422.4859	.0001630	1426.1687	386.1013
276.000	-.041227	595511.	-22116.9365	.0002312	1322.9634	382.4151
282.000	-.039658	469065.	-19837.1923	.0002856	1229.7943	377.4996
288.000	-.037800	356094.	-17590.1598	.0003279	1146.5538	371.5112
294.000	-.035723	256410.	-15381.8837	.0003592	1073.1035	364.5808
300.000	-.033490	169787.	-13217.6872	.0003810	1009.2775	356.8180
306.000	-.031151	95968.6614	-11337.7935	.0003946	954.8858	269.8133
312.000	-.028754	31839.7174	-9760.9308	.0004011	907.6337	255.8076
318.000	-.026338	-23087.9730	-8272.0235	.0004016	901.1852	240.4948
324.000	-.023935	-69352.1790	-6878.0068	.0003969	935.2740	224.1774
330.000	-.021576	-107529.	-5584.0586	.0003878	963.4038	207.1387
336.000	-.019282	-138222.	-4393.7231	.0003752	986.0196	189.6398

Ret WAll #6 - 24 in CIDH - CLO-125 -Free Head.lpo

342.000	-.017073	-162055.	-3309.0500	.0003599	1003.5800	171.9179
348.000	-.014963	-179658.	-2330.7444	.0003424	1016.5508	154.1840
354.000	-.012964	-191667.	-1458.3245	.0003234	1025.3992	136.6227
360.000	-.011083	-198710.	-690.2818	.0003034	1030.5889	119.3915
366.000	-.009323	-201407.	141.5295	.0002829	1032.5757	157.8789
372.000	-.007688	-198370.	1014.0124	.0002625	1030.3382	132.9488
378.000	-.006174	-190499.	1739.8287	.0002426	1024.5382	108.9900
384.000	-.004777	-178657.	2324.9414	.0002237	1015.8127	86.0476
390.000	-.003489	-163673.	2775.4274	.0002062	1004.7723	64.1144
396.000	-.002303	-146341.	3097.1816	.0001903	992.0017	43.1370
402.000	-.001206	-127420.	3295.6542	.0001763	978.0603	23.0206
408.000	-.000187	-107639.	3375.6256	.0001643	963.4852	3.6365
414.000	.000766	-87701.2964	3341.0207	.0001543	948.7942	-15.1715
420.000	.001664	-68287.7565	3194.7697	.0001463	934.4897	-33.5788
426.000	.002521	-50066.2830	2938.7164	.0001402	921.0636	-51.7722
432.000	.003347	-33696.3138	2573.5793	.0001360	909.0017	-69.9401
438.000	.004153	-19835.9134	2098.9700	.0001332	898.7890	-88.2629
444.000	.004946	-9148.1067	1513.4745	.0001317	890.9139	-106.9022
450.000	.005733	-2306.5335	814.8007	.0001311	885.8728	-125.9891
456.000	.006520	0.0000	0.0000	.0001310	884.1733	-145.6112

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

```
Pile-head deflection              =     2.00000000 in
Computed slope at pile head       =     -.01604832
Maximum bending moment            =       5476291. lbs-in
Maximum shear force               =    84828.09746 lbs
Depth of maximum bending moment   =      120.00000 in
Depth of maximum shear force      =        0.00000 in
Number of iterations              =             19
Number of zero deflection points  =              2
```

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= .250000 M=	0.000	400000.	.2500000	1291730.	29270.3331
4	y= 1.000000 M=	0.000	400000.	1.0000000	3378287.	59542.7676
4	y= 2.000 M=	0.000	400000.	2.0000	5476291.	84828.0975

SHAFT RUN
Retaining Wall No. 6

SHAFT Runs SR Bypass – Contra Loma Blvd. Undercrossing
Pile capacities computed using SHAFT program – Output follows

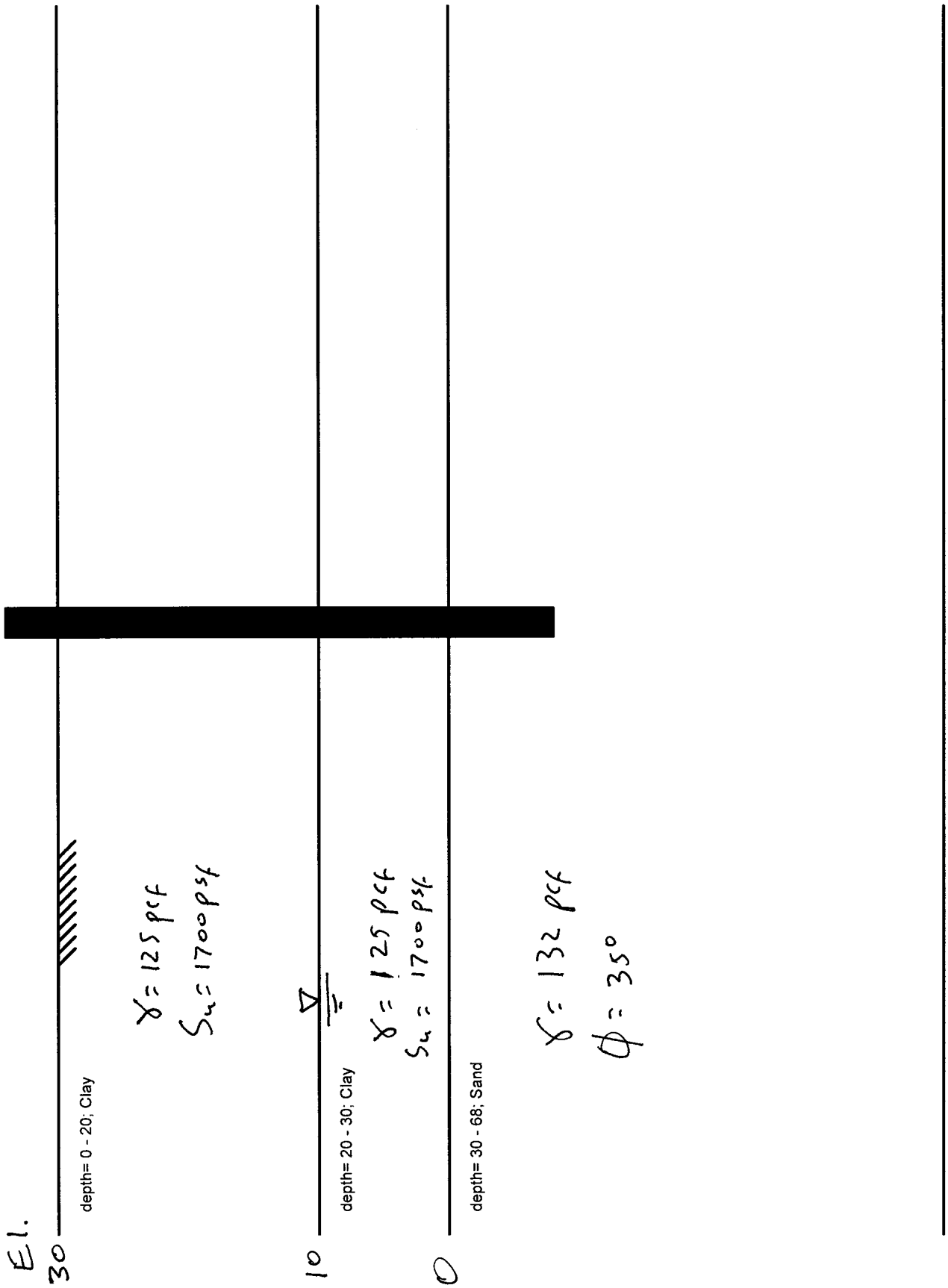
Retaining Wall No. 6 (based on boring CLO-125)
24-in CIDH Pile

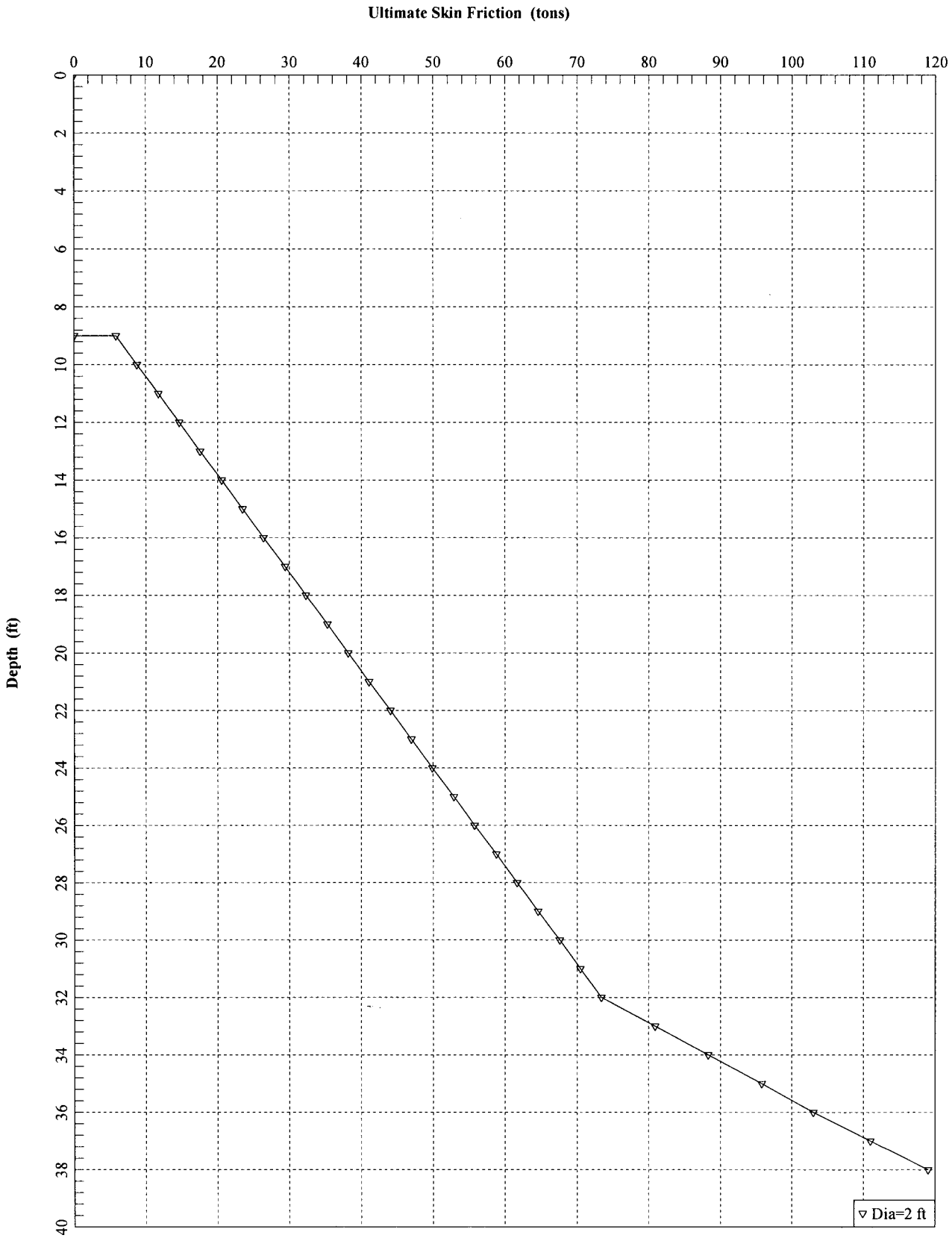
Note: Neglected End Bearing for Pile Capacity

Ground Surface Elevation 30.0 (approx.)

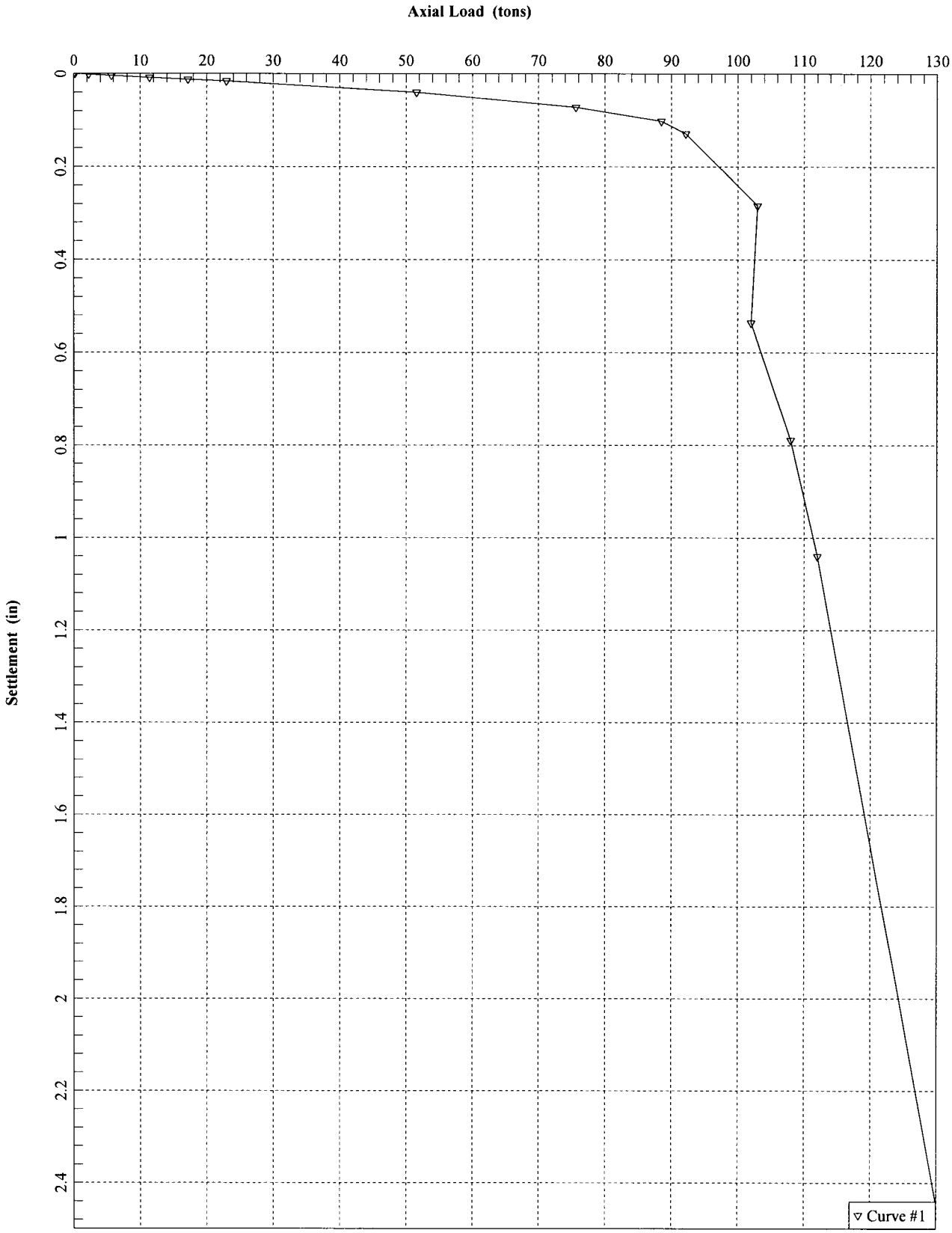
Nominal Compression Load = 228 kips = 114 tons
Reqd. Shaft Length per SHAFT output = 38.0 ft
Recommended Penetration = 38.0 feet
Reqd. Tip Elevation = 30.0-38.0 = -8.0

Retaining Wall No. 6
(Soil Profile based on boring CLO-125)





SR4 Contra Loma & G Street Interchanges - Retaining Wall NO. 6 - 24-in. CIDH PIle



SR4 Contra Loma & G Street Interchanges - Retaining Wall No. 6 - 24-in. CIDH PIle

```
                    Retaining WAll No. 6-A.sfo
VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

   Highway 4 -REtaining WAll No. 6 - 24 in CIDH

   PROPOSED DEPTH =      38.0 FT
   ----------------

   NUMBER OF LAYERS =    3
   ------------------

   WATER TABLE DEPTH =      19.0 FT.
   -------------------

   FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 2.50
   --------------------------------------------------------
   FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
   --------------------------------------------------------

   SOIL INFORMATION
   ----------------

   LAYER NO 1----CLAY

     AT THE TOP

     STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
     END BEARING COEFFICIENT-Nc                         = 0.900E+01
     UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
     INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
     BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
     SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
     MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
     DEPTH, FT                                          = 0.000E+00

     AT THE BOTTOM

     STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
     END BEARING COEFFICIENT-Nc                         = 0.900E+01
     UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
     INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
     BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
     SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
     MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
     DEPTH, FT                                          = 0.200E+02

   LAYER NO 2----CLAY

     AT THE TOP

     STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
     END BEARING COEFFICIENT-Nc                         = 0.900E+01
     UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
     INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
     BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
```

Retaining WAll No. 6-A.sfo

```
     SOIL UNIT WEIGHT, LB/CU FT                         = 0.128E+03
     MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
     DEPTH, FT                                          = 0.200E+02

     AT THE BOTTOM

     STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
     END BEARING COEFFICIENT-Nc                         = 0.900E+01
     UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
     INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
     BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
     SOIL UNIT WEIGHT, LB/CU FT                         = 0.128E+03
     MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
     DEPTH, FT                                          = 0.300E+02

   LAYER NO 3----SAND

     AT THE TOP

     SKIN FRICTION COEFFICIENT- BETA                    = 0.761E+00
     UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
     INTERNAL FRICTION ANGLE, DEG.                      = 0.350E+02
     BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
     SOIL UNIT WEIGHT, LB/CU FT                         = 0.132E+03
     MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.400E+04
     DEPTH, FT                                          = 0.300E+02

     AT THE BOTTOM

     SKIN FRICTION COEFFICIENT- BETA                    = 0.387E+00
     UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
     INTERNAL FRICTION ANGLE, DEG.                      = 0.350E+02
     BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
     SOIL UNIT WEIGHT, LB/CU FT                         = 0.132E+03
     MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.400E+04
     DEPTH, FT                                          = 0.680E+02

   DRILLED SHAFT INFORMATION
   -------------------------

    DIAMETER OF STEM          =    2.000  FT.
    DIAMETER OF BASE          =    2.000  FT.
    END OF STEM TO BASE       =    0.000  FT.
    ANGLE OF BELL             =    0.000  DEG.
    IGNORED TOP PORTION       =    5.000  FT.
    IGNORED BOTTOM PORTION    =    2.000  FT.
    AREA OF ONE PERCENT STEEL =    4.524  SQ.IN.
    ELASTIC MODULUS, Ec       = 0.360E+07 LB/SQ IN
    VOLUME OF UNDERREAM       =    0.000  CU.YDS.

   PREDICTED RESULTS
   -----------------

   QS     = ULTIMATE SIDE RESISTANCE;
   QB     = ULTIMATE BASE RESISTANCE;
```

Retaining WAll No. 6-A.sfo

WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
8.0	0.93	2.94	24.04	26.97	10.95	9.19	28.97
9.0	1.05	5.88	24.04	29.91	13.89	10.36	28.56
10.0	1.16	8.81	24.04	32.85	16.83	11.54	28.23
11.0	1.28	11.75	24.04	35.79	19.76	12.71	27.96
12.0	1.40	14.69	24.04	38.73	22.70	13.89	27.73
13.0	1.51	17.63	24.04	41.66	25.64	15.06	27.54
14.0	1.63	20.56	24.04	44.60	28.58	16.24	27.38
15.0	1.75	23.50	24.04	47.54	31.51	17.41	27.23
16.0	1.86	26.44	24.04	50.48	34.45	18.59	27.11
17.0	1.98	29.38	24.04	53.41	37.39	19.76	27.00
18.0	2.09	32.32	24.04	56.35	40.33	20.94	26.90
19.0	2.21	35.25	24.04	59.29	43.27	22.11	26.82
20.0	2.33	38.19	24.04	62.23	46.20	23.29	26.74
21.0	2.44	41.13	24.04	65.17	49.14	24.46	26.67
22.0	2.56	44.07	24.04	68.10	52.08	25.64	26.60
23.0	2.68	47.00	24.04	71.04	55.02	26.81	26.54
24.0	2.79	49.94	24.04	73.98	57.95	27.99	26.49
25.0	2.91	52.88	24.04	76.92	60.89	29.16	26.44
26.0	3.03	55.82	24.04	79.85	63.83	30.34	26.39
27.0	3.14	58.76	26.67	85.43	67.65	32.39	27.19
28.0	3.26	61.69	29.84	91.53	71.64	34.62	28.09
29.0	3.37	64.63	31.42	96.05	75.10	36.33	28.46
30.0	3.49	67.57	31.42	98.99	78.04	37.50	28.35
31.0	3.61	70.51	31.42	101.93	80.98	38.68	28.25
32.0	3.72	73.44	31.42	104.86	83.92	39.85	28.16
33.0	3.84	80.87	31.42	112.29	91.34	42.82	29.24
34.0	3.96	88.34	31.42	119.76	98.81	45.81	30.27
35.0	4.07	95.84	31.42	127.26	106.32	48.81	31.25
36.0	4.19	103.38	31.42	134.80	113.86	51.83	32.18
37.0	4.31	110.96	31.42	142.38	121.43	54.86	33.07
38.0	4.42	118.56	31.42	149.98	129.03	57.90	33.92

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.2288E+00	0.1636E-03	0.4582E-02	0.1000E-03
0.2288E+01	0.1636E-02	0.4582E-01	0.1000E-02
0.5721E+01	0.4091E-02	0.1146E+00	0.2500E-02
0.1145E+02	0.8182E-02	0.2291E+00	0.5000E-02
0.1724E+02	0.1228E-01	0.3437E+00	0.7500E-02
0.2302E+02	0.1638E-01	0.4582E+00	0.1000E-01
0.5163E+02	0.3987E-01	0.1146E+01	0.2500E-01
0.7564E+02	0.7242E-01	0.2291E+01	0.5000E-01
0.8849E+02	0.1020E+00	0.3437E+01	0.7500E-01
0.9216E+02	0.1286E+00	0.4582E+01	0.1000E+00
0.1029E+03	0.2842E+00	0.1121E+02	0.2500E+00
0.1022E+03	0.5361E+00	0.1808E+02	0.5000E+00
0.1076E+03	0.7891E+00	0.2353E+02	0.7500E+00
0.1125E+03	0.1042E+01	0.2836E+02	0.1000E+01
0.1298E+03	0.2452E+01	0.4587E+02	0.2400E+01

“CULVERT 4” RESULTS

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...Highway 4 East

PROJECT ACCOUNT NO.206118.GDR

SAMPLE LOCATION....RW/SW 111 # 4 @ 16

TEST SAMPLE NO.....4

OPERATOR.....Ganga

TEST DATE.....01/17/2007

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.6 , WATER pH = 0.0 , SOIL pH = 7.6

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 2360 , WATER = 0 , SOIL = 2360

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ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	35	43	50	60	85
16 0.064	46	54	61	71	96
14 0.079	56	64	71	81	106
12 0.109	78	86	93	103	128
10 0.138	99	107	114	124	149
08 0.168	120	128	135	145	170

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
IF ABRASIVE CONDITIONS DO NOT EXIST
SITE CONDITIONS MEET CORROSION REQUIREMENTS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
SITE CONDITIONS MEET CORROSION REQUIREMENTS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...Highway 4 East

PROJECT ACCOUNT NO.206118.GDR

SAMPLE LOCATION....RW/SW 116 # 5 @ 20

TEST SAMPLE NO.....5

OPERATOR.....Ganga

TEST DATE.....01/17/2007

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.5 , WATER pH = 0.0 , SOIL pH = 7.5

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 280 , WATER = 0 , SOIL = 280

CHLORIDES, PPM... 456.7 , SULFATES, PPM... 2573.4

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ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	14	22	29	39	64
16 0.064	19	27	34	44	69
14 0.079	23	31	38	48	73
12 0.109	32	40	47	57	82
10 0.138	41	49	56	66	91
08 0.168	50	58	65	75	100

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

FOR SULFATE RESISTANT CONCRETE AND RCP
TYPE II MODIFIED CEMENT OR TYPE V CEMENT
7 sk/cy WITH 25% MINERAL ADMIXTURE REPLACEMENT (BY WEIGHT)
AND A MAXIMUM WATER-TO-CEMENTITIOUS RATIO OF 0.40

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...Highway 4 East

PROJECT ACCOUNT NO.206118.GDR

SAMPLE LOCATION....C-118 # 1 @ 2 ft

TEST SAMPLE NO.....1

OPERATOR.....Ganga

TEST DATE.....01/17/2007

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.7 , WATER pH = 0.0 , SOIL pH = 7.7

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1210 , WATER = 0 , SOIL = 1210

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ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	26	34	41	51	76
16 0.064	35	43	50	60	85
14 0.079	43	51	58	68	93
12 0.109	59	67	74	84	109
10 0.138	75	83	90	100	125
08 0.168	91	99	106	116	141

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...Highway 4 East

PROJECT ACCOUNT NO.206118.GDR

SAMPLE LOCATION....SW-121 #1 @ 3 ft

TEST SAMPLE NO.....1

OPERATOR.....Ganga

TEST DATE.....01/17/2007

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 8.0 , WATER pH = 0.0 , SOIL pH = 8.0

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1230 , WATER = 0 , SOIL = 1230

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	27	35	42	52	77
16 0.064	35	43	50	60	85
14 0.079	43	51	58	68	93
12 0.109	59	67	74	84	109
10 0.138	76	84	91	101	126
08 0.168	92	100	107	117	142

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...Highway 4 East

PROJECT ACCOUNT NO.206118.GDR

SAMPLE LOCATION....E-122 # 1 @ 3 ft

TEST SAMPLE NO.....1

OPERATOR.....Ganga

TEST DATE.....02/09/2007

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.7 , WATER pH = 0.0 , SOIL pH = 7.7

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1230 , WATER = 0 , SOIL = 1230

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	27	35	42	52	77
16 0.064	35	43	50	60	85
14 0.079	43	51	58	68	93
12 0.109	59	67	74	84	109
10 0.138	76	84	91	101	126
08 0.168	92	100	107	117	142

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...Highway 4 East

PROJECT ACCOUNT NO.206118.GDR

SAMPLE LOCATION....RW-123 # 3 @ 10 ft

TEST SAMPLE NO.....3

OPERATOR.....Ganga

TEST DATE.....01/31/2007

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.6 , WATER pH = 0.0 , SOIL pH = 7.6

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1180 , WATER = 0 , SOIL = 1180

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ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage	& in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18	0.052	26	34	41	51	76
16	0.064	34	42	49	59	84
14	0.079	42	50	57	67	92
12	0.109	58	66	73	83	108
10	0.138	74	82	89	99	124
08	0.168	90	98	105	115	140

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...Highway 4 East

PROJECT ACCOUNT NO.206118.GDR

SAMPLE LOCATION....RW-127 # 2 @ 4.5 ft

TEST SAMPLE NO.....2

OPERATOR.....Ganga

TEST DATE.....01/31/2007

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.6 , WATER pH = 0.0 , SOIL pH = 7.6

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 990 , WATER = 0 , SOIL = 990

CHLORIDES, PPM... 15.6 , SULFATES, PPM... 29.1

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	24	32	39	49	74
16 0.064	32	40	47	57	82
14 0.079	39	47	54	64	89
12 0.109	54	62	69	79	104
10 0.138	69	77	84	94	119
08 0.168	84	92	99	109	134

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

FOR SULFATE RESISTANT CONCRETE AND RCP
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...Highway 4 East

PROJECT ACCOUNT NO.206118.GDR

SAMPLE LOCATION....SW-129 # 2 @6 ft

TEST SAMPLE NO.....2

OPERATOR.....Ganga

TEST DATE.....01/31/2007

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.9 , WATER pH = 0.0 , SOIL pH = 7.9

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1150 , WATER = 0 , SOIL = 1150

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	26	34	41	51	76
16 0.064	34	42	49	59	84
14 0.079	42	50	57	67	92
12 0.109	58	66	73	83	108
10 0.138	74	82	89	99	124
08 0.168	89	97	104	114	139

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...Highway 4 East

PROJECT ACCOUNT NO.206118.GDR

SAMPLE LOCATION....SW-130 # 2 @ 4.5 ft

TEST SAMPLE NO.....2

OPERATOR.....Ganga

TEST DATE.....01/31/2007

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.2 , WATER pH = 0.0 , SOIL pH = 7.2

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1050 , WATER = 0 , SOIL = 1050

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	21	29	36	46	71
16 0.064	28	36	43	53	78
14 0.079	34	42	49	59	84
12 0.109	47	55	62	72	97
10 0.138	60	68	75	85	110
08 0.168	73	81	88	98	123

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...Highway 4 East

PROJECT ACCOUNT NO.206118.GDR

SAMPLE LOCATION....SW-131 # 3 @10 ft

TEST SAMPLE NO.....3

OPERATOR.....Ganga

TEST DATE.....01/31/2007

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.7 , WATER pH = 0.0 , SOIL pH = 7.7

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 380 , WATER = 0 , SOIL = 380

CHLORIDES, PPM... 254.9 , SULFATES, PPM... 561.6

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage	& in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18	0.052	16	24	31	41	66
16	0.064	21	29	36	46	71
14	0.079	26	34	41	51	76
12	0.109	36	44	51	61	86
10	0.138	47	55	62	72	97
08	0.168	57	65	72	82	107

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

FOR SULFATE RESISTANT CONCRETE AND RCP
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...Highway 4 East

PROJECT ACCOUNT NO.206118.GDR

SAMPLE LOCATION....SW-132 # 2 @6 ft

TEST SAMPLE NO.....2

OPERATOR.....Ganga

TEST DATE.....01/31/2007

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.1 , WATER pH = 0.0 , SOIL pH = 7.1

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1180 , WATER = 0 , SOIL = 1180

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	19	27	34	44	69
16 0.064	24	32	39	49	74
14 0.079	30	38	45	55	80
12 0.109	42	50	57	67	92
10 0.138	53	61	68	78	103
08 0.168	65	73	80	90	115

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...Highway 4 East

PROJECT ACCOUNT NO.206118.GDR

SAMPLE LOCATION....SW-134 #2 @4.5 ft

TEST SAMPLE NO.....2

OPERATOR.....Ganga

TEST DATE.....01/31/2007

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.6 , WATER pH = 0.0 , SOIL pH = 7.6

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1050 , WATER = 0 , SOIL = 1050

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	25	33	40	50	75
16 0.064	33	41	48	58	83
14 0.079	40	48	55	65	90
12 0.109	56	64	71	81	106
10 0.138	71	79	86	96	121
08 0.168	86	94	101	111	136

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...Highway 4 East

PROJECT ACCOUNT NO.206118.GDR

SAMPLE LOCATION....RW/SW-136 # 3 @ 9.5 ft

TEST SAMPLE NO.....3

OPERATOR.....Ganga

TEST DATE.....01/31/2007

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.6 , WATER pH = 0.0 , SOIL pH = 7.6

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 800 , WATER = 0 , SOIL = 800

CHLORIDES, PPM... 57.8 , SULFATES, PPM... 32.7

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ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	22	30	37	47	72
16 0.064	29	37	44	54	79
14 0.079	36	44	51	61	86
12 0.109	50	58	65	75	100
10 0.138	63	71	78	88	113
08 0.168	77	85	92	102	127

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

FOR SULFATE RESISTANT CONCRETE AND RCP
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...Highway 4 East

PROJECT ACCOUNT NO.206118.GDR

SAMPLE LOCATION....RW/SW-139 # 3 @ 11 ft

TEST SAMPLE NO.....3

OPERATOR.....Ganga

TEST DATE.....02/09/2007

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.7 , WATER pH = 0.0 , SOIL pH = 7.7

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1470 , WATER = 0 , SOIL = 1470

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ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	29	37	44	54	79
16 0.064	38	46	53	63	88
14 0.079	46	54	61	71	96
12 0.109	64	72	79	89	114
10 0.138	81	89	96	106	131
08 0.168	99	107	114	124	149

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...Highway 4 East

PROJECT ACCOUNT NO.206118.GDR

SAMPLE LOCATION....SW-140 #3 @ 9.5 ft

TEST SAMPLE NO.....3

OPERATOR.....Ganga

TEST DATE.....02/16/2007

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.9 , WATER pH = 0.0 , SOIL pH = 7.9

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 430 , WATER = 0 , SOIL = 430

CHLORIDES, PPM... 244.5 , SULFATES, PPM... 248.9

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ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	17	25	32	42	67
16 0.064	22	30	37	47	72
14 0.079	28	36	43	53	78
12 0.109	38	46	53	63	88
10 0.138	49	57	64	74	99
08 0.168	60	68	75	85	110

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

FOR SULFATE RESISTANT CONCRETE AND RCP
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...SR4 EAST

PROJECT ACCOUNT NO.206118.GST

SAMPLE LOCATION....GST138#@4 FT

TEST SAMPLE NO.....2

OPERATOR.....O.GOUTHIER

TEST DATE.....11/17/2006

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.6 , WATER pH = 0.0 , SOIL pH = 7.6

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 430 , WATER = 0 , SOIL = 430

CHLORIDES, PPM... 380.6 , SULFATES, PPM... 230

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ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage	& mm	GALV. 57 g	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18	1.3	17	25	32	42	67
16	1.6	22	30	37	47	72
14	2.0	28	36	43	53	78
12	2.8	38	46	53	63	88
10	3.5	49	57	64	74	99
8	4.3	60	68	75	85	110

FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

FOR SULFATE RESISTANT CONCRETE AND RCP
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...SR4 EAST

PROJECT ACCOUNT NO.206118.CLO

SAMPLE LOCATION....CLO-124#3@8.5 FT

TEST SAMPLE NO.....3

OPERATOR.....O.GOUTHIER

TEST DATE.....11/15/2006

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 8.0 , WATER pH = 0.0 , SOIL pH = 8.0
MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 780 , WATER = 0 , SOIL = 780
CHLORIDES, PPM... 22.1 , SULFATES, PPM... 108.2

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ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & mm	GALV. 57 g	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 1.3	22	30	37	47	72
16 1.6	29	37	44	54	79
14 2.0	36	44	51	61	86
12 2.8	49	57	64	74	99
10 3.5	63	71	78	88	113
8 4.3	76	84	91	101	126

FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

FOR SULFATE RESISTANT CONCRETE AND RCP
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

STRUCTURAL PAVEMENT DESIGN

Project: Rte 4 East-Somersville Interchange, Contra Costa County
Job No: 206118.GDR
Somersville Road to A Street - Phase 1, (Ultimate)

R-value (Soil) = 15
R-value (AS) = 50 (Class 4)

	TI =	12.5	14.5	9.00
	Total GE req (ft) =	3.40	3.94	2.45
Full Depth AC:				
	Add SF (ft) =	0.10	0.10	0.10
	GE req(AC) + SF (ft) =	3.50	4.04	2.55
(table 633.1)	**t(AC) (ft) =**	**1.60**	**1.85**	**1.10**
Depth (AC & LCB):				
	GE req(AC+LCB) (ft) =	3.40	3.94	2.45
	40% of GE req (AC+LCB) (ft) =	1.36	1.58	0.98
	Add SF (ft) =	0.20	0.20	0.20
	GE req(AC) + SF (ft) =	1.56	1.78	1.18
(table 633.1)	**t(AC) (ft) =**	**0.85**	**1.00**	**0.60**
(table 633.1)	GE t(AC) (ft) =	1.56	1.81	1.180
	GE req(LCB) (ft) =	1.84	2.13	1.27
(table 633.1)	**t(LCB) (ft) =**	**1.00**	**1.15**	**0.70**
Depth (AC, LCB & AS):				
	GE req(AC+LCB) (ft) =	2.00	2.32	1.44
	40% of GE req (AC+LCB) (ft) =	0.80	0.93	0.58
	Add SF (ft) =	0.20	0.20	0.20
	GE req(AC) + SF (ft) =	1.00	1.13	0.78
(table 633.1)	**t(AC) (ft) =**	**0.65**	**0.75**	**0.45**
(table 633.1)	GE t(AC) (ft) =	1.09	1.23	0.85
	GE req(LCB) (ft) =	0.91	1.09	0.59
	Add SF (ft) =	0.20	0.20	0.20
	GE req(LCB) + SF (ft) =	1.11	1.29	0.79
(table 633.1)	**t(LCB) (ft) =**	**0.60**	**0.70**	**0,45**
	GE t(LCB) (ft) =	1.14	1.33	0.86
	GE t (AC+LCB) (ft) =	2.23	2.56	1.71
	GE req(AS) (ft) =	1.17	1.38	0.74
(table 633.1)	**t(AS) (ft) =**	**1.20**	**1.40**	**0.75**

Note: User must input all values in yellow and then reference chapter 600 to get the final values in gray
For full depth of AC section, 0.1 ft satety factor is taken whereas for AC with AB and AS, 0.2 ft factor of safery is added.

Project: Rte 4 East-Contra Loma and G Street Interchanges
Job No: 206118.GDR
Contra Loma Blvd. & L Street

R-value (Soil) = 5
R-value (AS) = 50 (Class 4)

TI =	12.0	11.0	
Total GE req (ft) =	3.65	3.34	
Full Depth AC:			
Add SF (ft) =	0.10	0.10	
GE req(AC) + SF (ft) =	3.75	3.44	
(table 633.1) **t(AC) (ft)** =	**1.60**	**1.45**	
Depth (AC & LCB):			
GE req(AC+LCB) (ft) =	3.65	3.34	
40% of GE req (AC+LCB) (ft) =	1.46	1.34	
Add SF (ft) =	0.20	0.20	
GE req(AC) + SF (ft) =	1.66	1.54	
(table 633.1) **t(AC) (ft)** =	**0.90**	**0.80**	
(table 633.1) GE t(AC) (ft) =	1.76	1.57	
GE req(LCB) (ft) =	1.89	1.77	
(table 633.1) **t(LCB) (ft)** =	**1.00**	**0.95**	
Depth (AC, LCB & AS):			
GE req(AC+LCB) (ft) =	1.92	1.76	
40% of GE req (AC+LCB) (ft) =	0.77	0.70	
Add SF (ft) =	0.20	0.20	
GE req(AC) + SF (ft) =	0.97	0.90	
(table 633.1) **t(AC) (ft)** =	**0.60**	**0.55**	
(table 633.1) GE t(AC) (mm) =	1.02	0.95	
GE req(LCB) (mm) =	0.90	0.81	
Add SF (mm) =	0.2	0.2	
GE req(LCB) + SF (mm) =	1.10	1.01	
(table 633.1) **t(LCB) (mm)** =	**0.70**	**0.60**	
GE t(LCB) (mm) =	1.33	1.14	
GE t (AC+LCB) (mm) =	2.35	2.09	
GE req(AS) (mm) =	1.30	1.25	
(table 633.1) **t(AS) (mm)** =	**1.30**	**1.25**	

Note: User must input all values in yellow and then reference chapter 600 to get the final values in gray
For full depth of AC section, 0.1 ft satety factor is taken whereas for AC with AB and As 0.20 ft factor of safery is added.

Project: Rte 4 East - Contra Loma & G Street Interchanges
Job No.: 206118.GDR
Flexible pavement Design - On and Off Ramps

R-value (soil) = 15
R-value (AB) = 78 (Class 2)
R-value (AS) = 50 (Class 2)

	TI =	10.00	
	Total GE req =	2.72	
Full Depth AC:	Add SF =	0.10	
	GE req(HMA-A) + SF =	2.82	
(table 633.1)	**t(HMA-A)=**	**1.20**	

Depth (AC & AB):	GE req(HMA-A) =	0.70	
	Add SF =	0.20	
	GE req(HMA-A) + SF =	0.90	
(table 633.1)	**t(HMA-A)=**	**0.50**	
(table 633.1)	GE t(HMA-A)=	0.90	
	GE req(AB) =	1.82	
(table 633.1)	**t(AB)=**	**1.65**	
		2.15	

Depth (AC, AB& AS):	GE req(HMA-A) =	0.70	
	Add SF =	0.20	
	GE req(HMA-A) + SF =	0.90	
(table 633.1)	**t(HMA-A)=**	**0.50**	
(table 633.1)	GE t(HMA-A)=	0.90	
	GE req(HMA-A+AB) =	1.60	
	GE req(AB) =	0.70	
	Add SF =	0.20	
	GE req(AB) + SF =	0.90	
(table 633.1)	**t(AB)=**	**0.85**	
	GE t(AB)=	0.94	
	GE t (HMA-A+AB)	1.84	
	GE req(AS) =	0.90	
(table 633.1)	**t(AS)=**	**0.90**	
		2.25	

Note: User must input all values in yellow and then reference chapter 600 to get the final values in gray
For full depth of HMA-A section, 0.1 ft satety factor is taken whereas for HMA-A with AB and HMA-A with AB & AS sections, 0.20 ft factor of safery is added.

0.45

Job No.: 206118.GDR

Flexible pavement Design - G Street and Fitzuren Road

R-value (soil) = 5
R-value (AB) = 78 (Class 2)
R-value (AS) = 50 (Class 2)

	TI =	8.00	
	Total GE req =	2.43	
Full Depth AC:	Add SF =	0.10	
	GE req(HMA-A) + SF =	2.53	
(table 633.1)	**t(HMA-A)=**	**1.05**	

Depth (AC & AB):	GE req(HMA-A) =	0.56	
	Add SF =	0.20	
	GE req(HMA-A) + SF =	0.76	
(table 633.1)	**t(HMA-A)=**	**0.40**	
(table 633.1)	GE t(HMA-A)=	0.80	
	GE req(AB) =	1.63	
(table 633.1)	**t(AB)=**	**1.50**	
		1.90	

Depth (AC, AB& AS):	GE req(HMA-A) =	0.56	
	Add SF =	0.20	
	GE req(HMA-A) + SF =	0.76	
(table 633.1)	**t(HMA-A)=**	**0.40**	
(table 633.1)	GE t(HMA-A)=	0.80	
	GE req(HMA-A+AB) =	1.28	
	GE req(AB) =	0.48	
	Add SF =	0.20	
	GE req(AB) + SF =	0.68	o
(table 633.1)	**t(AB)=**	**0.65**	
	GE t(AB)=	0.72	
	GE t (HMA-A+AB)	1.52	
	GE req(AS) =	0.91	
(table 633.1)	**t(AS)=**	**0.95**	
		2.00	

Note: User must input all values in yellow and then reference chapter 600 to get the final values in gray

For full depth of HMA-A section, 0.1 ft satety factor is taken whereas for HMA-A with AB and HMA-A with AB & AS sections, 0.20 ft factor of safery is added.

Project: Rte 4 East - Contra Loma & G Street Interchanges
Job No.: 206118.GDR
Flexible pavement Design - Claudia Ct.

R-value (soil) = 5
R-value (AB) = 78 (Class 2)
R-value (AS) = 50 (Class 2)

	TI =	5.00	
	Total GE req =	1.52	
Full Depth AC:	Add SF =	0.10	
	GE req(HMA-A) + SF =	1.62	
(table 633.1)	**t(HMA-A)=**	**0.65**	

Depth (AC & AB):	GE req(HMA-A) =	0.35	
	Add SF =	0.20	
	GE req(HMA-A) + SF =	0.55	
(table 633.1)	**t(HMA-A)=**	**0.25**	
(table 633.1)	GE t(HMA-A)=	0.63	
	GE req(AB) =	0.89	
(table 633.1)	**t(AB)=**	**0.85**	
		1.10	

Depth (AC, AB& AS):	GE req(HMA-A) =	0.35	
	Add SF =	0.20	
	GE req(HMA-A) + SF =	0.55	
(table 633.1)	**t(HMA-A)=**	**0.25**	
(table 633.1)	GE t(HMA-A)=	0.63	
	GE req(HMA-A+AB) =	0.80	
	GE req(AB) =	0.17	
	Add SF =	0.20	
	GE req(AB) + SF =	0.37	o
(table 633.1)	**t(AB)=**	**0.35**	
	GE t(AB)=	0.39	
	GE t (HMA-A+AB)	1.02	
	GE req(AS) =	0.50	
(table 633.1)	**t(AS)=**	**0.50**	
		1.10	

Note: User must input all values in yellow and then reference chapter 600 to get the final values in gray
For full depth of HMA-A section, 0.1 ft satety factor is taken whereas for HMA-A with AB and HMA-A with AB & AS sections, 0.20 ft factor of safery is added.

Project: Rte 4 East - Contra Loma & G Street Interchanges
Job No.: 206118.GDR
Flexible pavement Design - Contra Loma & L Street

R-value (soil) = 5
R-value (AB) = 78 (Class 2)
R-value (AS) = 50 (Class 2)

	TI =	12.00	11.00
	Total GE req =	3.65	3.34
Full Depth AC:	Add SF =	0.10	0.10
	GE req(HMA-A) + SF =	3.75	3.44
(table 633.1)	**t(HMA-A)=**	**1.60**	**1.45**

Depth (AC & AB):	GE req(HMA-A) =	0.84	0.77
	Add SF =	0.20	0.20
	GE req(HMA-A) + SF =	1.04	0.97
(table 633.1)	**t(HMA-A)=**	**0.60**	**0.55**
(table 633.1)	GE t(HMA-A)=	1.02	0.95
	GE req(AB) =	2.63	2.39
(table 633.1)	**t(AB)=**	**2.40**	**2.20**
		3.00	**2.75**

Depth (AC, AB& AS):	GE req(HMA-A) =	0.84	0.77
	Add SF =	0.20	0.20
	GE req(HMA-A) + SF =	1.04	0.97
(table 633.1)	**t(HMA-A)=**	**0.65**	**0.55**
(table 633.1)	GE t(HMA-A)=	1.14	0.95
	GE req(HMA-A+AB) =	1.92	1.76
	GE req(AB) =	0.78	0.81
	Add SF =	0.20	0.20
	GE req(AB) + SF =	0.98	1.01 o
(table 633.1)	**t(AB)=**	**1.05**	**1.00**
	GE t(AB)=	1.16	1.10
	GE t (HMA-A+AB)	2.30	2.05
	GE req(AS) =	1.35	1.29
(table 633.1)	**t(AS)=**	**1.35**	**1.30**
		3.05	**2.85**

Note: User must input all values in yellow and then reference chapter 600 to get the final values in gray
For full depth of HMA-A section, 0.1 ft satety factor is taken whereas for HMA-A with AB and HMA-A with AB & AS sections, 0.20 ft factor of safery is added.

RECOMMENDED PAVEMENT SECTIONS FOR ON AND OFF RAMPS, G STREET, FITZUREN ROAD AND CLAUDIA CT.

Lane	R-Value	TI	Flexible Pavement Section (ft.)											
			Option -1 (Full Depth)			Option -2 (HMA-A/AB)				Option -3 (HMA-A/AB/AS)				
			OG	HMA-A	Total	OG	HMA-A	AB	Total	OG	HMA-A	AB	AS	Total
On and Off Ramps	15*	10.0	--	1.20	**1.30**	--	--	--	--	--	0.50	0.85	0.90	**2.25**
G Street	5	8.0	--	1.05	**1.05**	--	0.40	1.50	**1.90**	--	0.40	0.65	0.95	**2.00**
Fitzuren Road		8.0	--	1.05	**1.05**	--	0.40	1.50	**1.90**	--	0.40	0.65	0.95	**2.00**
Claudia Ct.		5.0	--	0.65	**0.65**	--	0.25	0.80	**1.05**	--	0.25	0.35	0.50	**1.10**

Notes: A subgrade enhancement fabric should be placed on top of the subgrade per Caltrans Highway Design Manual dated July, 2008, since the subgrade R-value is less than 20

TI: Traffic Index
FDHMA-A: Full Depth Asphalt Concrete (Type A)
HMA-A: Asphalt Concrete (Type A)
OG: Open Graded Asphalt Concrete (Optional)
AB: Aggregate Base (Class 3, R-Value = 78)
AS: Aggregate Subbase (Class 4, R-Value=50)
Subgrade Type: Inland Valley, Type II Subgrade Soil
Flexible Pavement: Gravel Equivalent Calculation (Table 633.1, Highway Design Manual, July 2008)
*** Pavement on Fill Material (R = 15)**

RECOMMENDED PAVEMENT SECTIONS FOR CONTRA LOMA BLVD. AND A STREET

Lane	R-Value	TI	Flexible Pavement Section (ft.)												
			Option -1 (Full Depth)			Option -2 (HMA-A/LCB/AS)					Option -3 (HMA-A/AB/AS)				
			OG	HMA-A	Total	OG	HMA-A	LCB	AS	Total	OG	HMA-A	AB	AS	Total
Contra Loma Blvd./A Street	5	12.0	0.10	1.60	**1.70**	0.10	0.60	0.70	1.30	**2.70**	0.10	0.65	1.05	1.35	**3.15**
		11.0	0.10	1.45	**1.55**	0.10	0.55	0.60	1.25	**2.50**	0.10	0.55	1.00	1.30	**2.95**

Note: A subgrade enhancement fabric should be placed on top of the subgrade per Caltrans Highway Design Manual dated July, 2008, since the subgrade R-value is less than 20

TI: Traffic Index
FDHMA-A: Full Depth Asphalt Concrete (Type A)
HMA-A: Asphalt Concrete (Type A)
OG: Open Graded Asphalt Concrete (Optional)
LCB: Lean Concrete Base
AB: Aggregate Base (Class 3, R-Value = 78)
AS: Aggregate Subbase (Class 4, R-Value=50)
Flexible Pavement: Gravel Equivalent Calculation (Table 633.1, Highway Design Manual, July 2008)

APPENDIX D

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	CC	4	26.6/27.5	228	444

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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CCTA
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PLEASANT HILL, CA. 94523

NOTES:

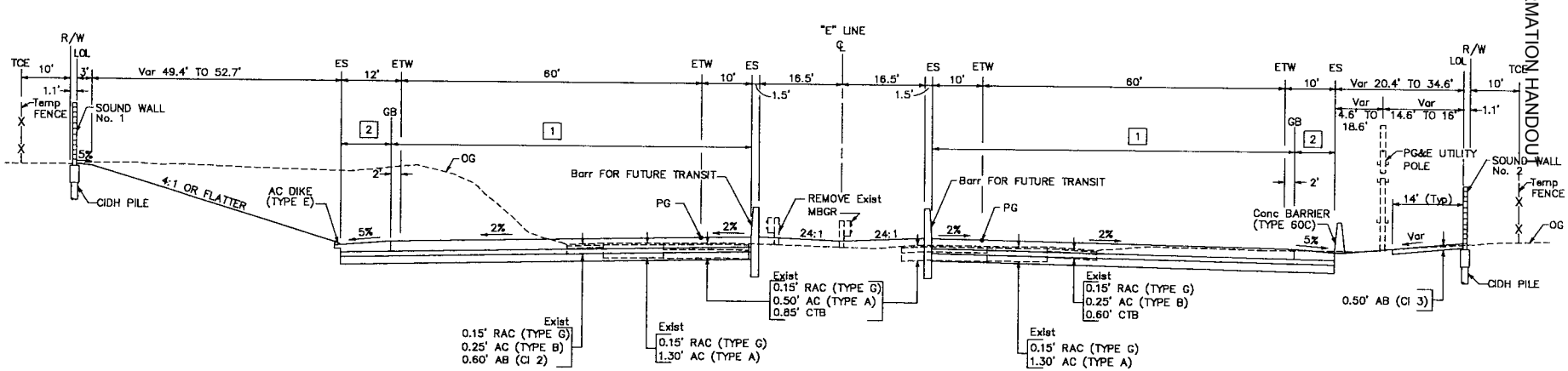
1. DIMENSIONS OF THE PAVEMENT STRUCTURES (STRUCTURAL SECTIONS) ARE SUBJECT TO TOLERANCES SPECIFIED IN THE STANDARD SPECIFICATIONS.
2. SUPERELEVATION AS SHOWN OR AS DIRECTED BY THE ENGINEER.
3. SLOPE ROUNDING WILL BE REQUIRED ON ALL SIDE SLOPES UNLESS OTHERWISE NOTED.
4. WHENEVER FILL SLOPE IS STEEPER THAN 4:1, SUBBASE MATERIAL SHALL BE EXTENDED TO THE FILL SLOPE.
5. FOR BARRIER FOR FUTURE TRANSIT, SEE CONSTRUCTION DETAIL SHEETS C-20 TO C-24.
6. FOR LIMITS AND TYPES OF DIKE, LIMITS OF CL FENCE, AND LIMITS OF MBGR, SEE LAYOUT SHEETS AND CONSTRUCTION DETAIL SHEETS.
7. FOR LIMITS AND TYPES OF CURB, GUTTER AND SIDEWALK, SEE LAYOUT SHEETS AND CONSTRUCTION DETAIL SHEETS.
8. FOR LIMITS AND LOCATIONS OF SOUND WALLS AND RETAINING WALLS, SEE STRUCTURE PLANS.
9. FOR LIMITS AND DETAILS OF DITCH, SEE DRAINAGE SHEETS.
10. FOR LIMITS OF CONTOUR GRADING, SEE GRADING SHEETS.
11. FOR LIMITS OF OVEREXCAVATION, SEE SHEET X-13.
12. EXTEND 0.17' OF THE TOP LAYER OF HMA (TYPE A) PLACED ON THE Shld UNDER DIKES WITH NO JOINT AT THE ES. SEE Std PLANS A87B FOR DETAIL.

ABBREVIATIONS:

ACSG	ASPHALT CONCRETE SIDE GUTTER
Barr	BARRIER
BOW	BACK OF WALK
C&G	CURB AND GUTTER
COA	CITY OF ANTIOCH
FOB	FACE OF BARRIER
FOC	FACE OF CURB
GB	GRADE BREAK
LG	LIP OF GUTTER
PG&E	PACIFIC GAS & ELECTRIC COMPANY
RAC	RUBBERIZED ASPHALT CONCRETE

TYPICAL STRUCTURAL SECTIONS

1. 1.00' JPCP
   0.50' LCB
   0.70' AS (Cl 4)
2. Var 0.70' TO 1.00' HMA (TYPE A)
   0.50' LCB
   0.70' AS (Cl 4)
3. 0.50' HMA (TYPE A)
   0.85' AB (Cl 3)
   0.90' AS (Cl 4)
4. 1.60' DEEP LIFT HMA (TYPE A)
5. 0.40' HMA (TYPE A)
   0.65' AB (Cl 3)
   0.95' AS (Cl 4)
6. 0.25' HMA (TYPE A)
   0.35' AB (Cl 3)
   0.50' AS (Cl 4)
7. 0.67' PCC (Cl A)
   0.50' AB (Cl 3)
8. 0.50' HMA (TYPE A)
   Var PCC (Cl A)
9. 0.67' & Var PCC (Cl A)
10. 0.60' HMA (TYPE A)
    0.70' LCB
    1.30' AS (Cl 4)
11. 1.05' DEEP LIFT HMA (TYPE A)
12. 0.50' MINOR CONCRETE (TEXTURED PAVING)
    0.5' AB (Cl 2)



ROUTE 4

WESTBOUND
STA "E" 136+00.00 TO 136+59.18

EASTBOUND
STA "E" 136+00.00 TO 143+24.97

TYPICAL CROSS SECTIONS

NO SCALE

X-1

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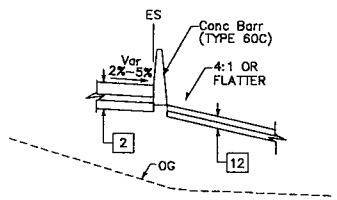
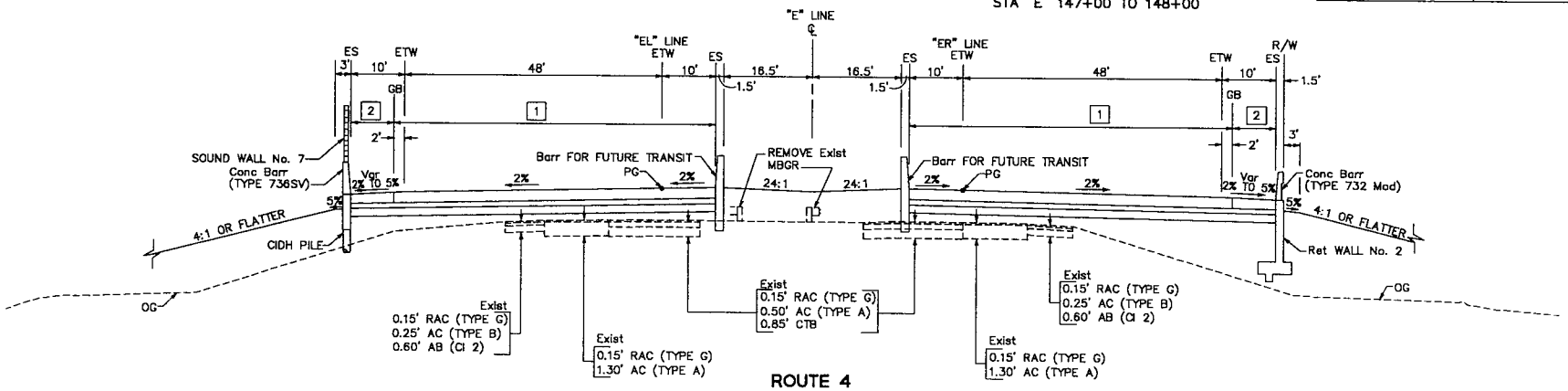


EASTBOUND
STA "E" 147+00 TO 148+00



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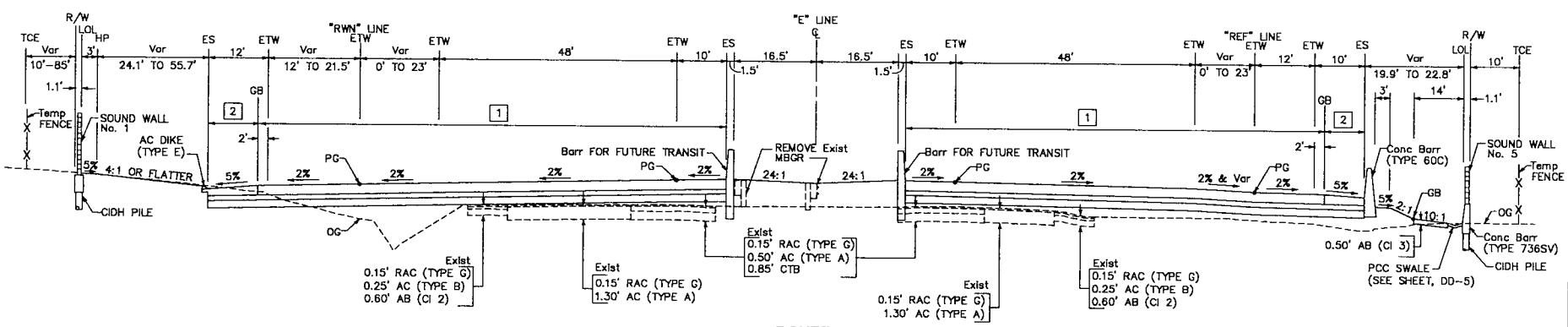
ROUTE 4

EASTBOUND
STA "E" 145+94.97 TO 150+00.08



ROUTE 4

WESTBOUND
STA "E" 136+59.18 TO 142+38.41

EASTBOUND
STA "E" 143+24.97 TO 145+94.97

FOR NOTES AND ABBREVIATIONS, SEE SHEET X-1.

TYPICAL CROSS SECTIONS

NO SCALE

X-2

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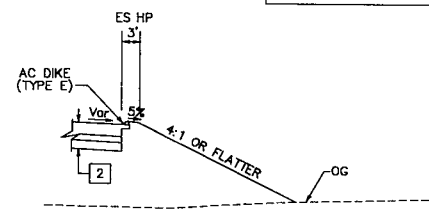
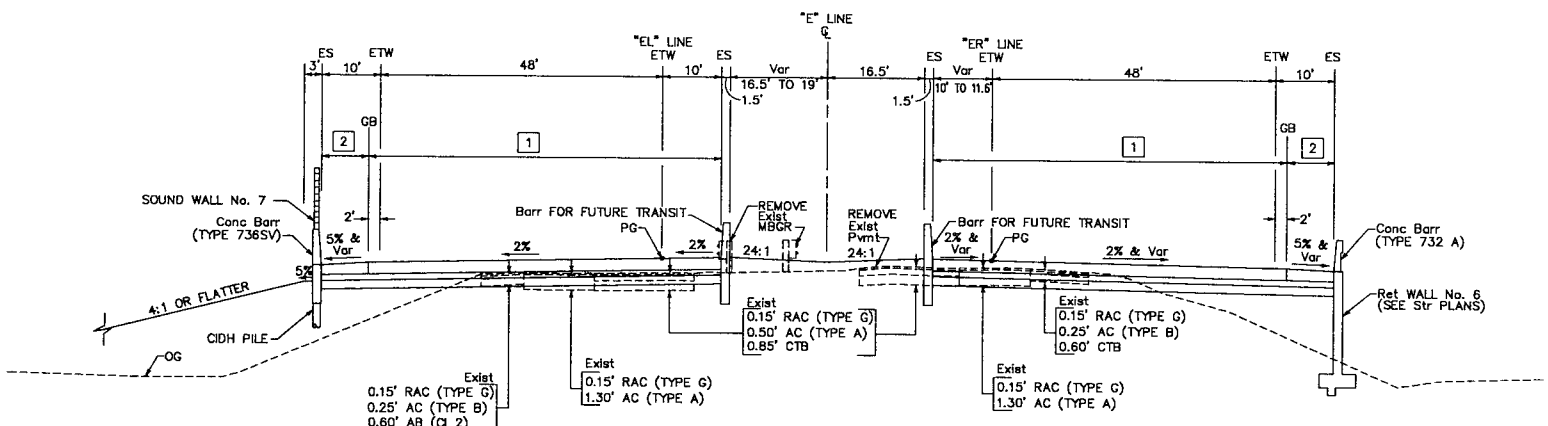


EASTBOUND
STA "E" 155+86.82 TO 159+95.31



ROUTE 4

WESTBOUND
STA "E" 153+20.08 TO 158+64.63

EASTBOUND
STA "E" 153+20.08 TO 159+95.31

INFORMATION HANDOUT

TYPICAL CROSS SECTIONS

NO SCALE

X-3

FOR NOTES AND ABBREVIATIONS, SEE SHEET X-1.

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04	CC	4	26.6/27.5		

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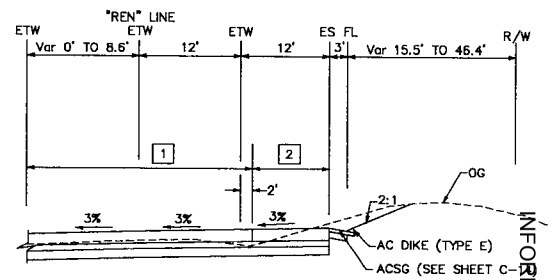

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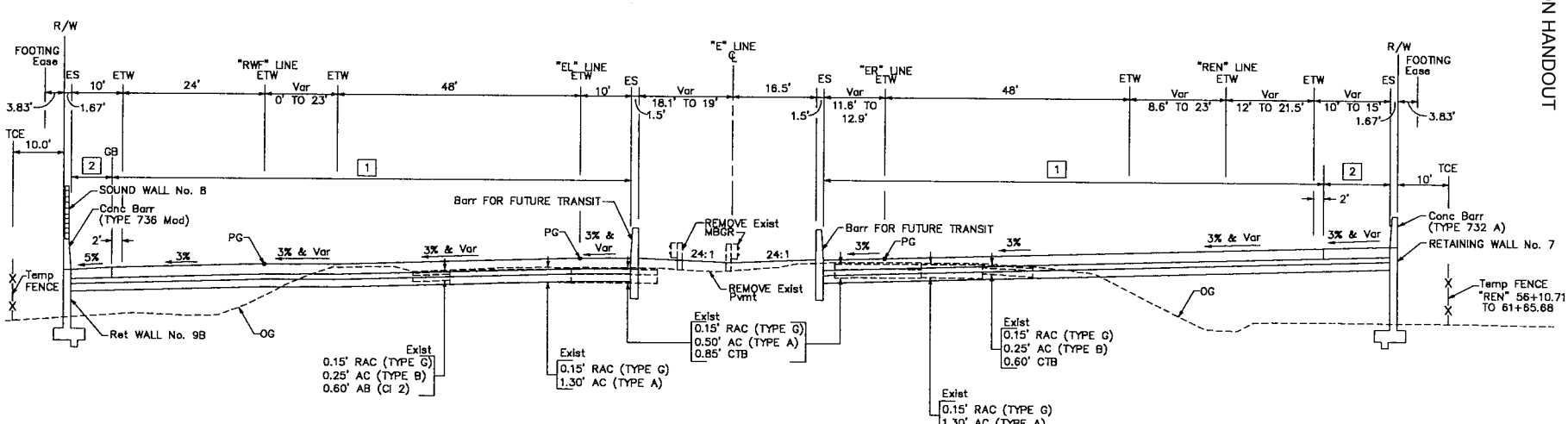

ROUTE 4

WESTBOUND
STA "E" 158+64.63 TO 161+39.96

EASTBOUND
STA "E" 159+95.31 TO 167+82.89
(SEE NOTE 11)

FOR NOTES AND ABBREVIATIONS, SEE SHEET X-1.

TYPICAL CROSS SECTIONS

NO SCALE

X-4

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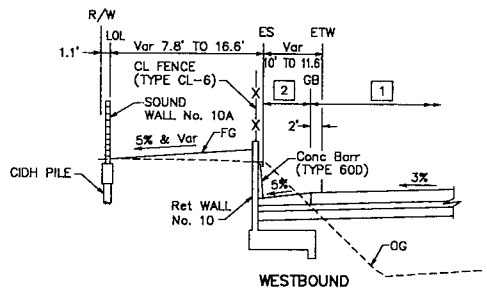

WESTBOUND
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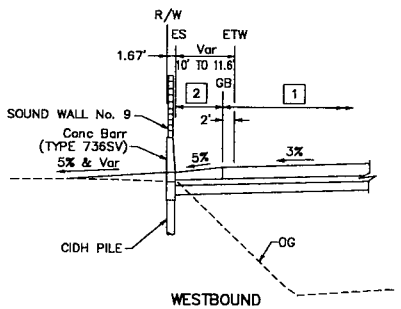

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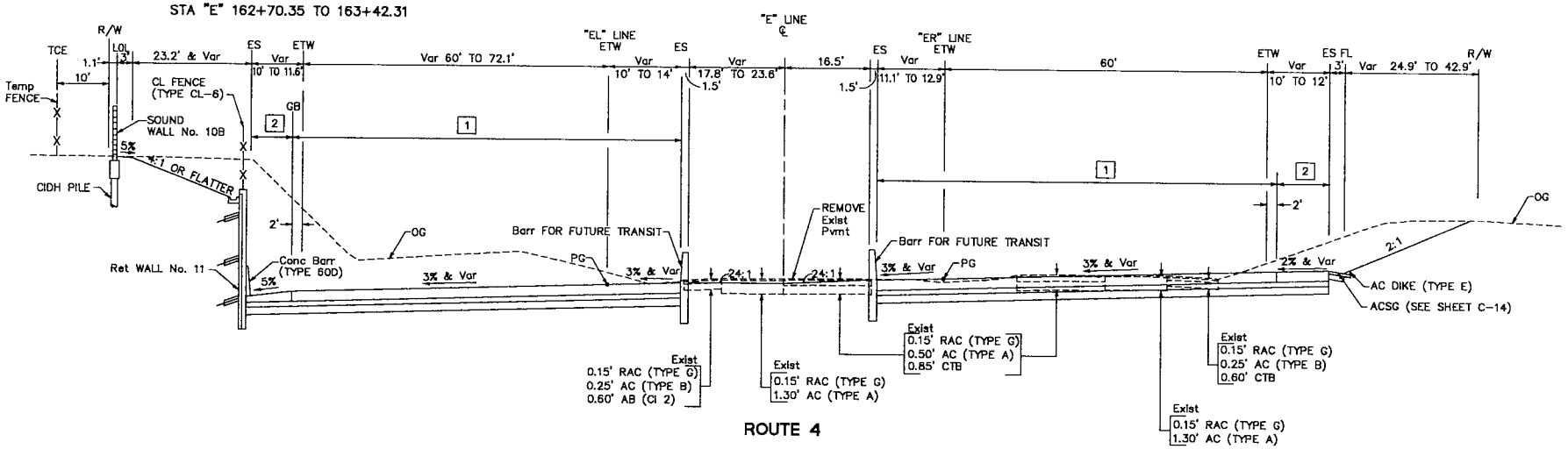

ROUTE 4

WESTBOUND
STA "E" 161+39.96 TO 169+90.04
(SEE NOTE 11)

EASTBOUND
STA "E" 167+82.98 TO 170+51.16
(SEE NOTE 11)

TYPICAL CROSS SECTIONS

NO SCALE

X-5

FOR NOTES AND ABBREVIATIONS, SEE SHEET X-1.

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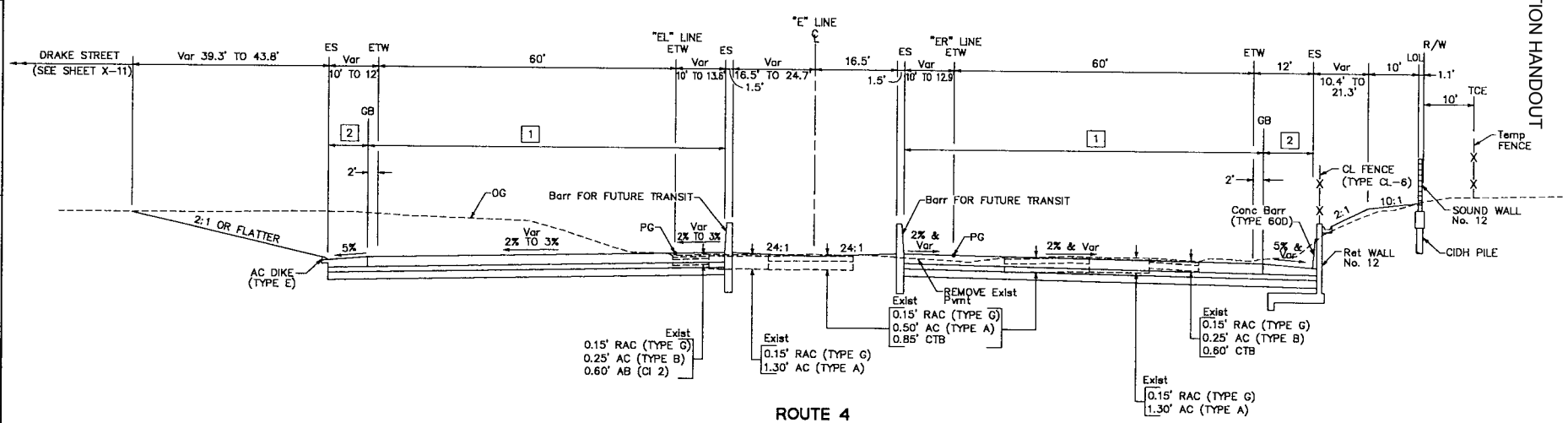

ROUTE 4

WESTBOUND
STA "E" 169+90.04 TO 179+00.00
(SEE NOTE 11)

EASTBOUND
STA "E" 170+51.16 TO 178+50.00
(SEE NOTE 11)

TYPICAL CROSS SECTIONS

NO SCALE

X-6

FOR NOTES AND ABBREVIATIONS, SEE SHEET X-1.

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	CC	4	26.6/27.5	228	

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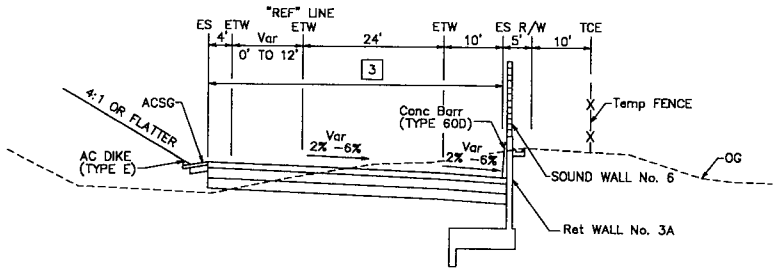
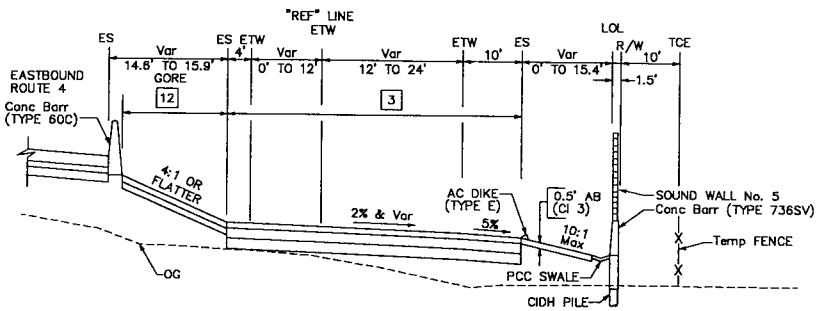


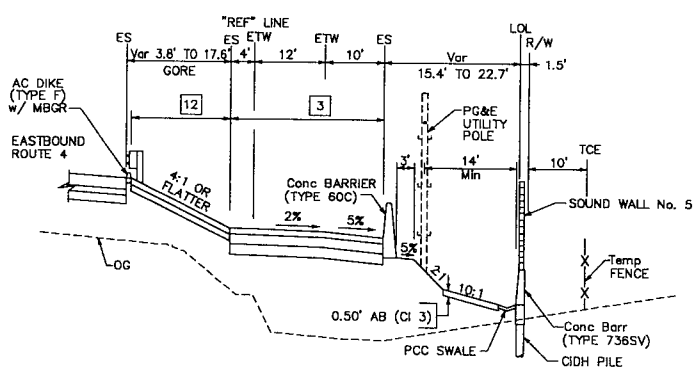
EASTBOUND ROUTE 4 CONTRA LOMA Blvd OFF-RAMP

STA "REF" 48+17.50 TO 51+25.79



EASTBOUND ROUTE 4 CONTRA LOMA Blvd OFF-RAMP

STA "REF" 46+97.50 TO 48+17.50



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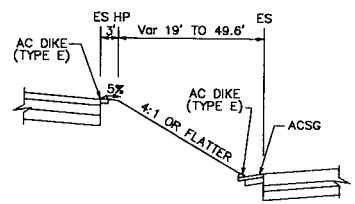
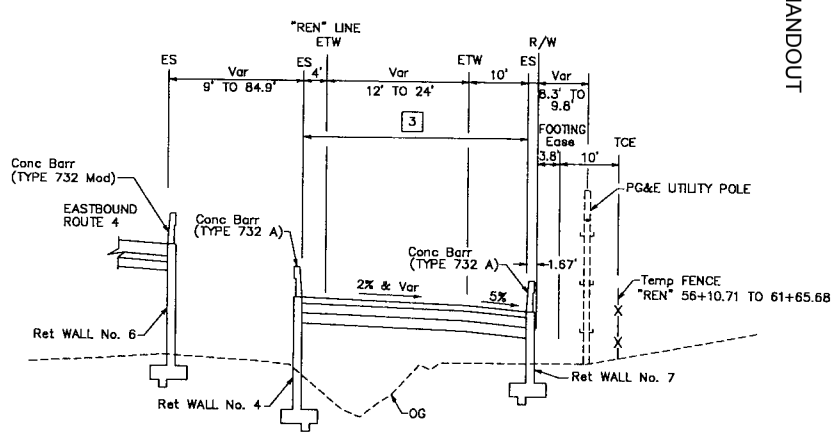


EASTBOUND ROUTE 4 CONTRA LOMA Blvd ON-RAMP

STA "REN" 55+92.50 TO 58+43.94

(SEE BELOW FOR DIMENSIONS NOT SHOWN)



EASTBOUND ROUTE 4 CONTRA LOMA Blvd ON-RAMP

STA "REN" 53+00.00 TO 59+77.89

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X-7

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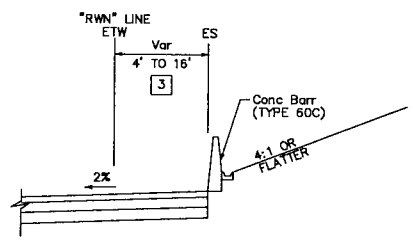

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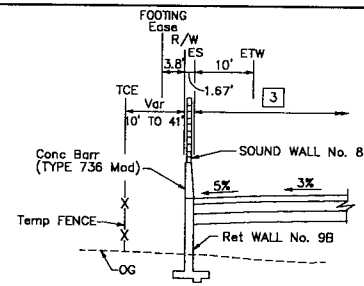
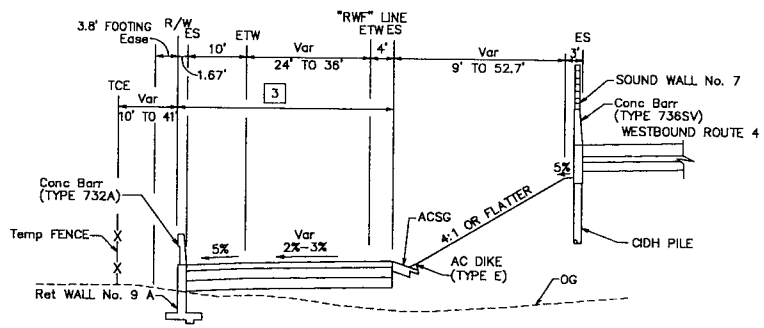


WESTBOUND ROUTE 4 CONTRA LOMA Blvd OFF-RAMP
STA "RWF" 56+97.01 TO 58+67.77



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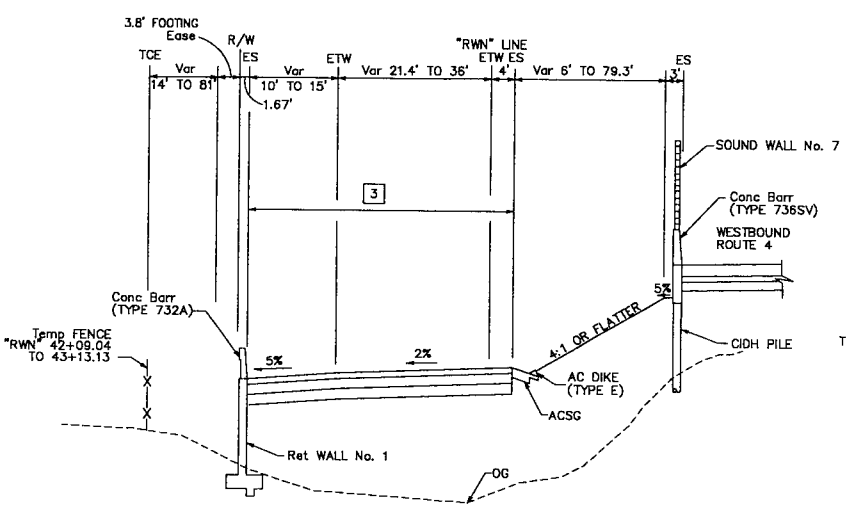

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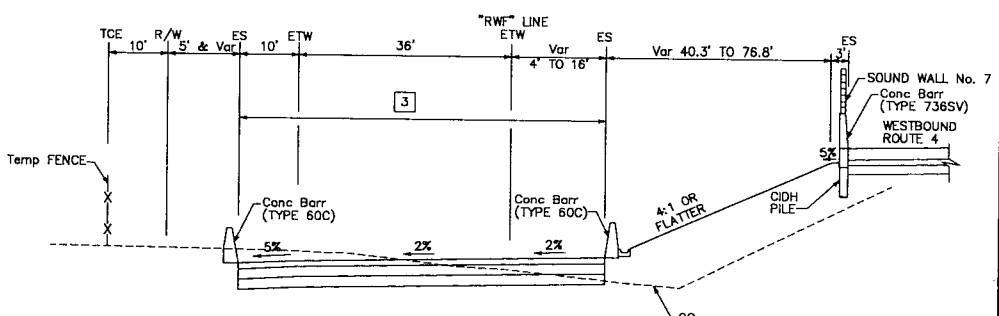
STA "RWN" 42+37.48 TO 51+22.66



WESTBOUND ROUTE 4 CONTRA LOMA Blvd OFF-RAMP
STA "RWF" 53+05.26 TO 54+97.86

INFORMATION HANDOUT

TYPICAL CROSS SECTIONS

NO SCALE

X-8

FOR NOTES AND ABBREVIATIONS, SEE SHEET X-1.

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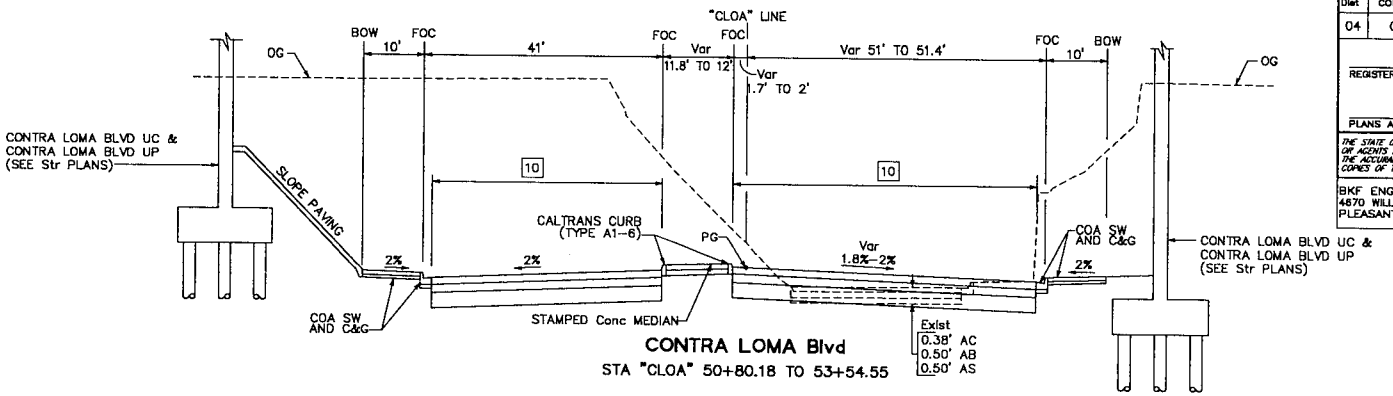

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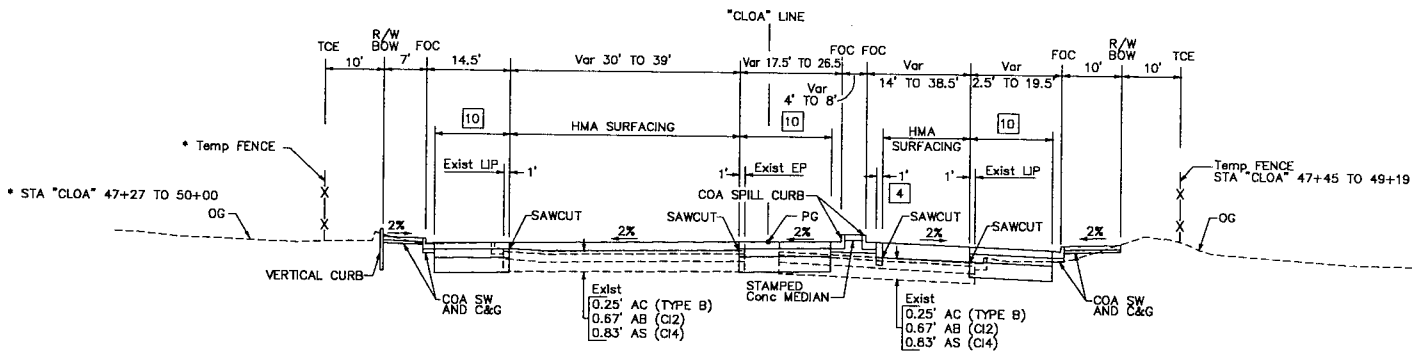
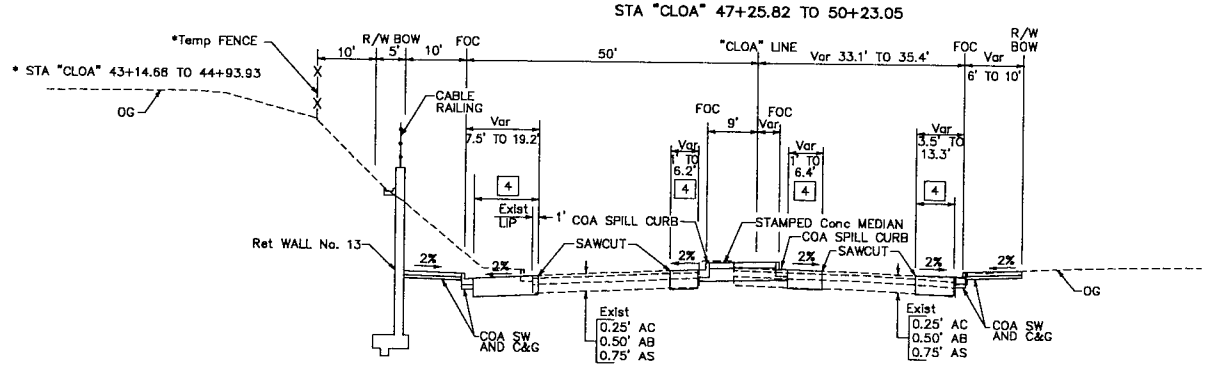


CONTRA LOMA Blvd
STA "CLOA" 47+25.82 TO 50+23.05



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STA "CLOA" 42+89.15 TO 46+47.82

CONTRA LOMA Blvd
STA "CLOA" 43+99.21 TO 46+40.53

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TYPICAL CROSS SECTIONS
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X-9

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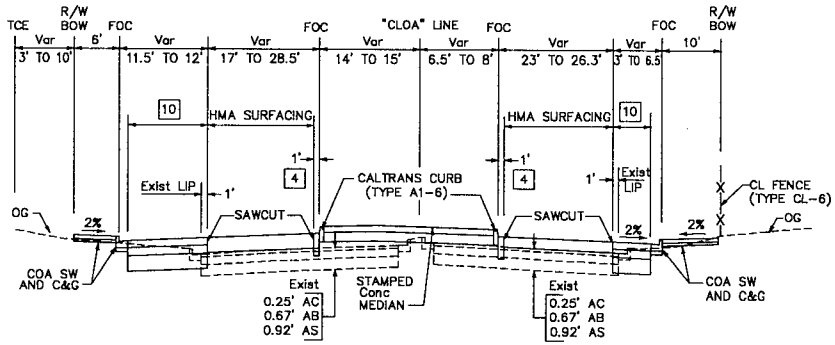

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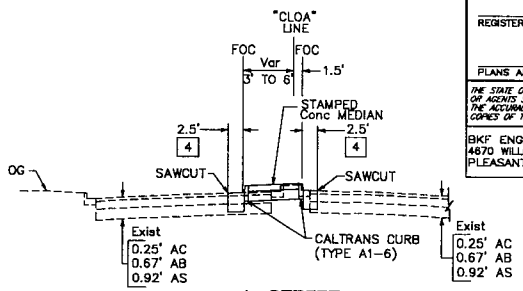

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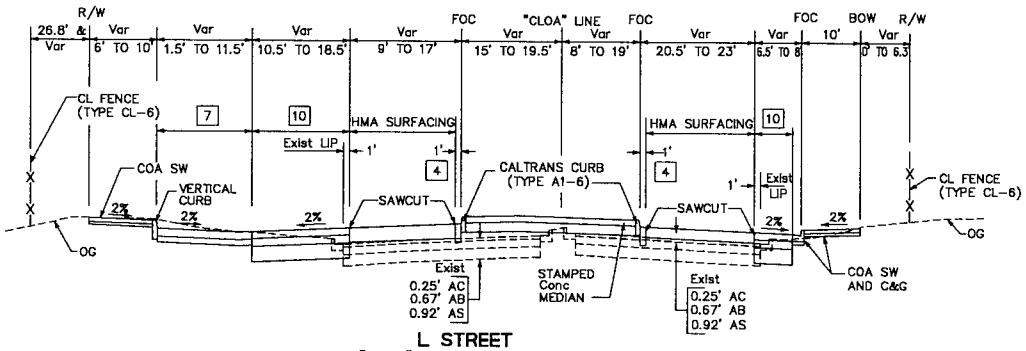

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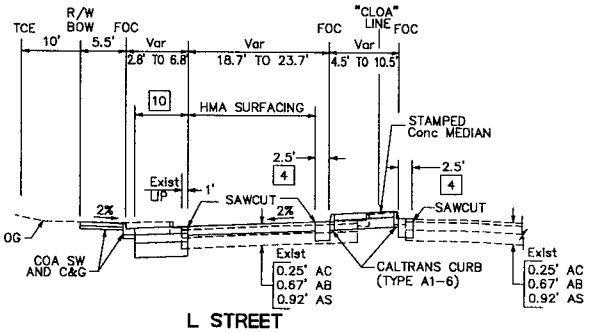

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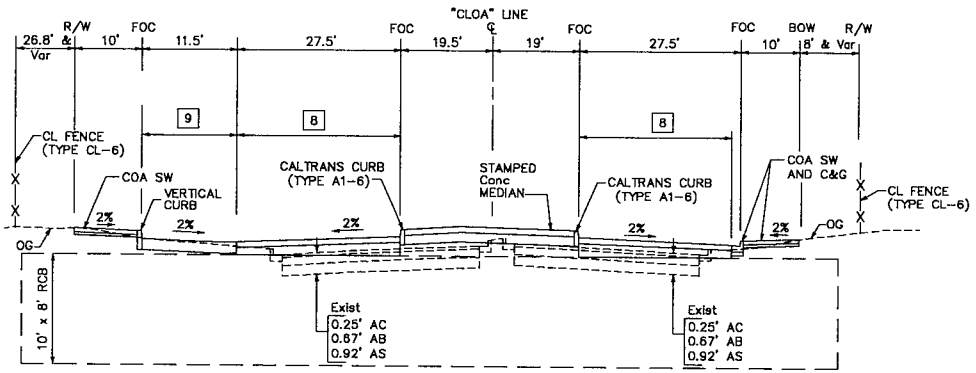

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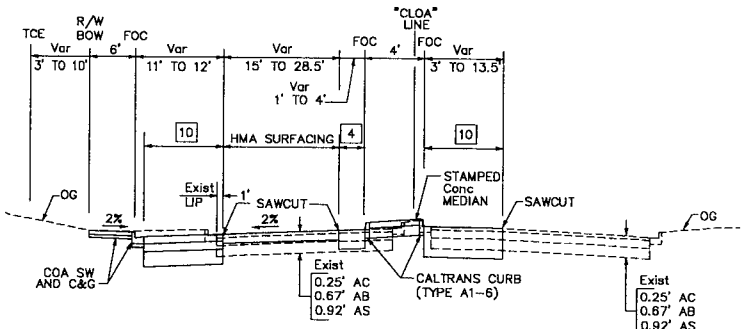

L STREET
STA "CLOA" 56+77.74 TO 58+51.58

INFORMATION HANDOUT

TYPICAL CROSS SECTIONS

NO SCALE

X-10

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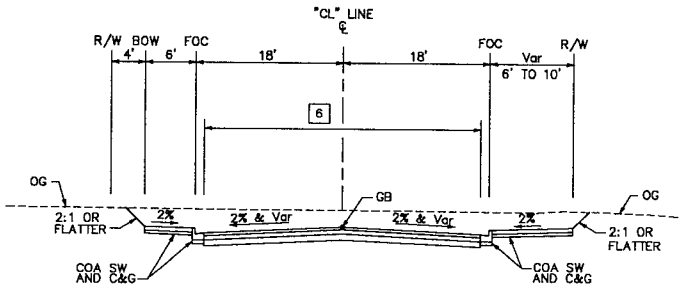

CLAUDIA Ct

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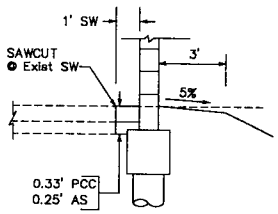
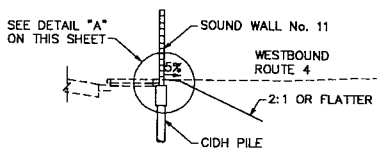


DETAIL "A"



DRAKE STREET

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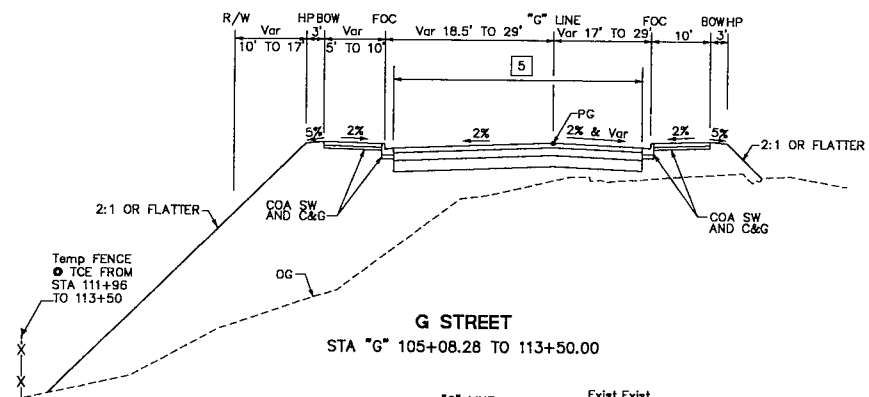

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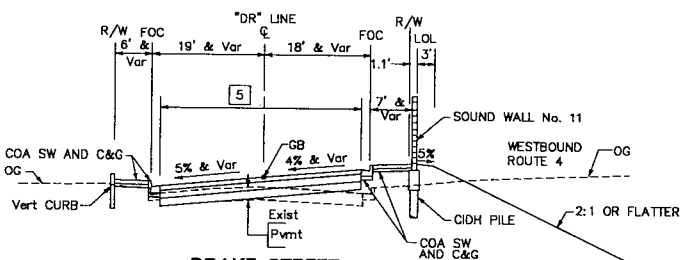

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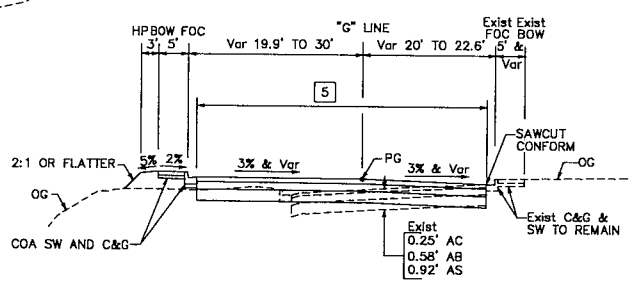

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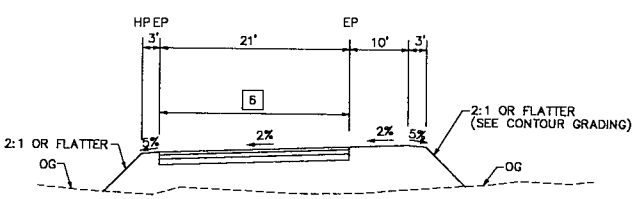

HOLLY Ct

TYPICAL CROSS SECTIONS

NO SCALE

X-11

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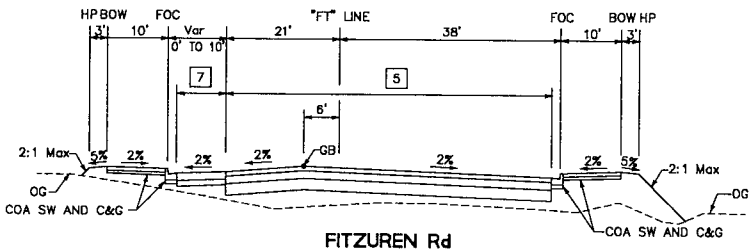

FITZUREN Rd

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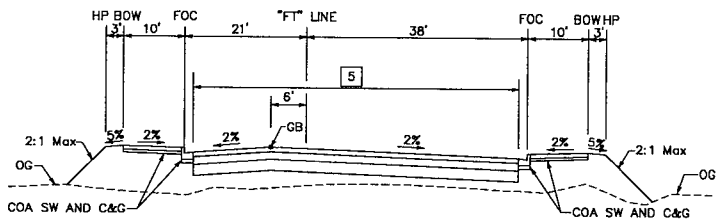

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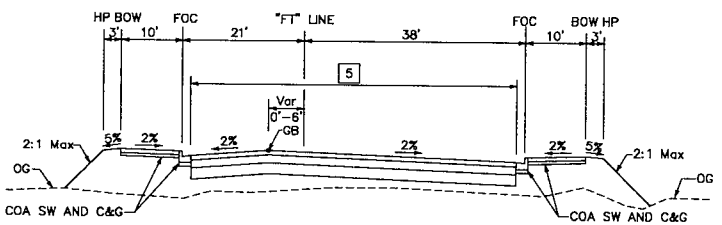

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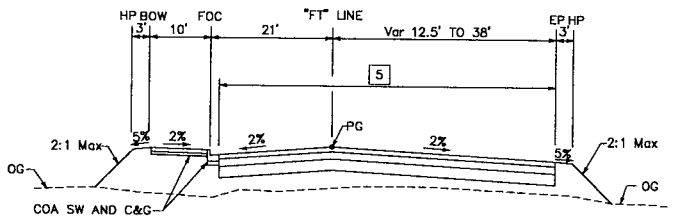

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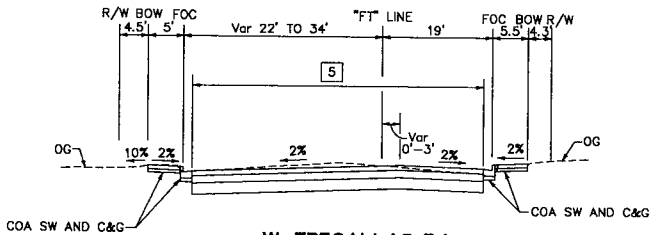

W. TREGALLAS Rd

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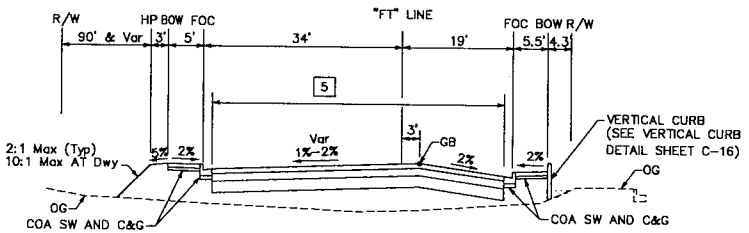

W. TREGALLAS Rd

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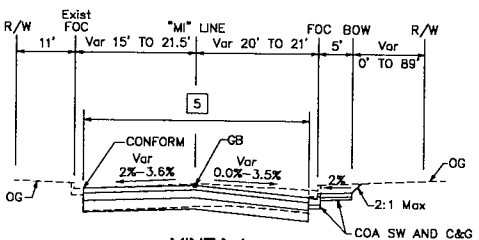

MINTA Ln

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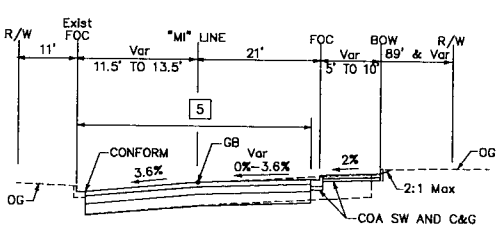

MINTA Ln

STA "MI" 104+60.00 TO 104+94.87

TYPICAL CROSS SECTIONS

NO SCALE

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X-12

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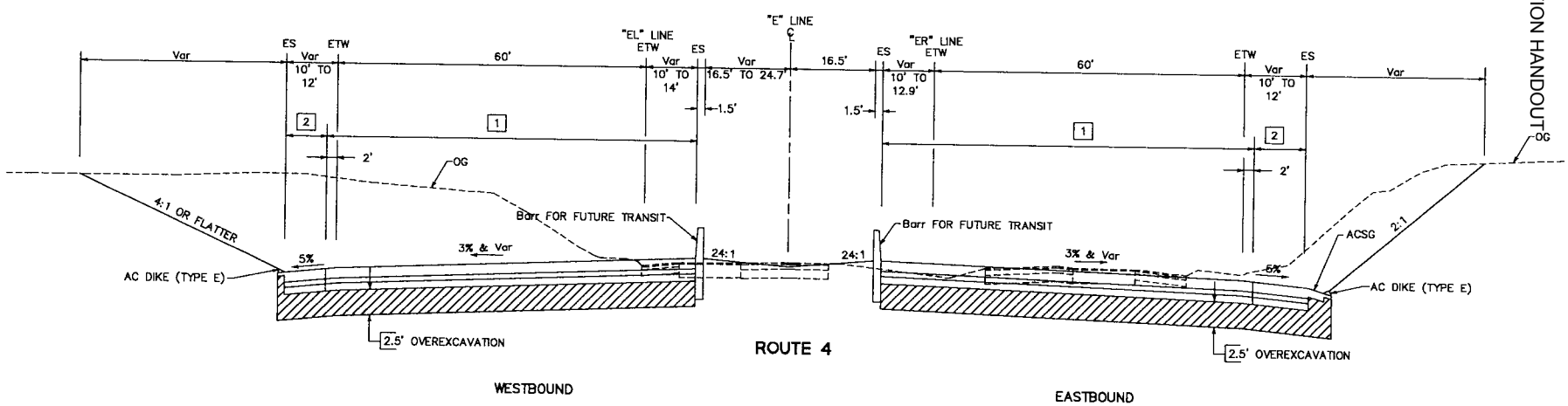

ROUTE 4

STA "E" 166+00.00 TO 174+00.00

LIMITS OF OVEREXCAVATION

TYPICAL CROSS SECTIONS

NO SCALE

X-13

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FINAL FOUNDATION REPORT
CONTRA LOMA BOULEVARD
UNDERCROSSING (REPLACE)
AT STATE ROUTE 4
(BRIDGE NO. 28-0399 L/R)
CONTRA CONSTA COUNTY, CALIFORNIA
EA 2285E1

For

BKF Engineers
4670 Willow Road, Suite 250
Pleasanton, CA 94588

PARIKH CONSULTANTS, INC.
1243 Alpine Road, Suite 110
Walnut Creek, California
(925) 933-6336

October, 2010 Job No. 206118.CLM

TABLE OF CONTENTS

PAGE

INTRODUCTION **1**

PROPOSED CONSTRUCTION **1**

PURPOSE AND SCOPE **2**

SITE CONDITIONS **2**

FIELD EXPLORATION AND LABORATORY TESTING **3**

Soil Borings *3*
Cone Penetration Testing (CPT) *4*
Laboratory Testing *4*
Boring and CPT Logs *4*

SUBSURFACE CONDITIONS **4**

GEOLOGY **5**

EARTHQUAKE CONSIDERATIONS **6**

SEISMIC SOURCES 6
SEISMIC HAZARDS/LIQUEFACTION IMPACT 7

FINDINGS AND RECOMMENDATIONS **8**

GENERAL 8
FOUNDATIONS 8
LATERAL PILE CAPACITY 13
LATERAL EARTH PRESSURES 14
SEISMIC DESIGN CRITERIA 15
GRADING 17
CORROSION 18
PLAN REVIEW 18
CONSTRUCTION OBSERVATION 18

INVESTIGATION LIMITATIONS **19**

PROJECT LOCATION MAP ..... Plate 1
GEOLOGIC MAP ..... Plate 2
FAULT MAP ..... Plate 3
ARS DESIGN CURVE ..... Plate 4

Appendix A Log of Test Borings & As-Built Log of Test Borings
Appendix B Laboratory Test Data
Appendix C CPT Data
Appendix D Calculations
Appendix E Caltrans Comments & Responses

FINAL FOUNDATION REPORT
CONTRA LOMA BOULEVARD UNDERCROSSING (REPLACE)
AT STATE ROUTE 4
(BRIDGE NO. 28-0399L/R)
CONTRA COSTA COUNTY, CALIFORNIA
EA 2285E1

INTRODUCTION

This report presents the results of our geotechnical engineering investigation for the proposed bridge replacement for the Contra Loma Boulevard Undercrossing at Route 4 in Antioch, Contra Costa County, California. Our work was performed generally in accordance with the scope of work as per our agreement. The general location of the site and its vicinity are shown on the Project Location Map, Plate 1.

The geotechnical recommendations presented in this report are intended for design input and are not intended to use as specifications. These recommendations should not be used for direct bidding purposes.

PROPOSED CONSTRUCTION

The proposed project consists of the demolition of the existing bridges and replacement by two parallel, essentially identical new bridges. The bridges will separated by 36 feet. The new bridges would accommodate four 12-foot lanes in each direction with 10-foot shoulders. The bridges will be continuous two-span structures, with equal 80-foot spans, and a total length of 160 feet. The proposed deck will consist of precast prestressed concrete voided slab with a composite cast-in-place concrete deck. The superstructure will be supported on a three column bent, a short seat abutment (Abutment 1) and a tall seat abutment (Abutment 3). The columns in the bent will be 4-ft by 6-ft octagonal flared columns, each supported on a 78-inch cast-in-drilled-hole (CIDH) pile. The abutments and the Abutment 3 wingwalls will be supported on 14-inch square Caltrans Standard Class 200 Alt. 'X' precast prestressed concrete piles.

There are plans for the construction of an eBART structure in the space between the two bridges.

PURPOSE AND SCOPE

The purpose of this investigation was to evaluate the general soil conditions at the project site, to evaluate their engineering properties, and to provide recommendations for foundation support of the proposed project.

The scope of work performed for this investigation included a review of the readily available soils and geologic literature, obtaining representative soil samples and logging soil materials encountered in two drilled borings and one cone penetrometer test (CPT), laboratory testing of the collected samples, engineering analysis of the field and laboratory data, and preparation of this report. The basis for this investigation is the preliminary plans provided to us by BKF Engineers. We have presented the descriptive log of the boreholes in Appendix A.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain a properly constructed project. We, therefore, recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction.

Our recommendations in this report are based on the above information. Any major deviation should be reported to this office for consideration.

SITE CONDITIONS

The project is located on State Route 4 across Contra Loma Boulevard-A Street in Antioch, Contra Costa County. The existing crossing consists of two parallel prestressed concrete bridges constructed in 1951. Per the As-Built drawings, both bridges (known at the time as Stewartville Bridge are three-span structures, approximately 90 feet long and 37 feet wide. The bridge abutments at the two ends are supported on precast prestressed concrete piles. The bents are supported on concrete frames. The bottom members of the frames are embedded and serve as

spread footing foundations for the internal bents. The present bridge is built on approximately 20 feet of fill.

The top surfaces of the existing bridges are at approximately Elev. 50 feet. The top of pavement in Contra Loma Boulevard-A Street below the bridges is approximately at Elev 30 feet. Approach fill on both ends of the bridge rises from approximately Elev. 30 feet to Elev. 50 feet.

FIELD EXPLORATION AND LABORATORY TESTING

Initially, based on the plans, discussions with design engineer, and readily available data of the proposed project, two (2) exploratory borings were drilled. Subsequently, a cone penetrometer test (CPT) was added, adjacent to one of the borings to reevaluate the liquefaction potential (see section on liquefaction). The boring and CPT locations are shown on the plan portion of the Log of Test Borings in Appendix A.

Soil Borings

The borings were drilled on September 20 and 28, 2006, from the top of the road embankments adjacent to the existing bridge abutments. They were advanced with a truck-mounted drill rig, using hollow stem auger drilling method. Both the borings were drilled to depths of 100 feet below the existing ground surface.

Selected samples were obtained at various depths generally from 3.0-inch O.D. & 2.5 inches I.D. (Modified California) samplers above a depth of 50 feet below ground surface and from 2.0-inch O.D. & 1.4-inch I.D. (Standard Penetration Test) samplers at depths greater than 50 feet. The samplers were driven in subsurface soils under the impact of a 140-lb hammer having a free fall of 30 inches. The blow counts are presented on the "Log of Test Borings". (When correlating standard penetration data in similar soils, the blow counts for the Modified California Sampler can be taken as roughly 1.6 times that for the Standard Penetration Test in similar soils). The samples were sealed and transported to our laboratory for further evaluation and testing. The field investigation was conducted under the supervision of our field engineer who logged the test borings and prepared the samples for subsequent laboratory testing and evaluation.

Cone Penetration Testing (CPT)

CPT work was performed by Gregg Drilling & In Situ, Inc. on October 26, 2007 using a truck mounted CPT rig. The CPTs were conducted using a 60-degree cone attached to a 1.7-inch diameter rod pushed into the subsurface. The soil resistance exerted to the tip and side of the cone were recorded and correlated to soil type, classification and strength characteristics. Groundwater level was estimated from pore pressure dissipation measurements during CPT operation. Detailed information from the CPT investigation is presented in Appendix C.

Laboratory Testing

Laboratory tests were performed on selected samples obtained during field exploration to determine the physical and engineering properties of the subsoils. Laboratory data of moisture contents, total density, grain size distribution, Atterberg Limits and unconfined compression strengths are presented on the Log of Test Borings. Other tests performed include an Unconsolidated Undrained (UU) triaxial test on a sample from boring CLO-124 and a consolidation test on a sample from boring CLO-125. A detailed description of laboratory testing performed is presented in Appendix B. Appendix B also includes Plasticity Charts for Atterberg Limits, grain size distribution curves, stress-strain curve for the UU test and the load-deformation curve for the consolidation test.

Boring and CPT Logs

The log of test borings (LOTB) sheets, consistent with current Caltrans guidelines, are presented in Appendix A. They were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs. The abrupt stratum changes shown on these logs may be gradual and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations. CPT logs are also presented on the LOTB sheets at appropriate locations.

SUBSURFACE CONDITIONS

Boring CLO-124 on the western side indicated predominantly stiff lean clays to a depth of

approximately 55 feet. Alternate layers of very dense silty sands and hard clays were encountered below 55 -ft de pth. In Boring C LO-125 on t he e astern s ide, m edium de nse s ilty s and w as encountered to a depth of approximately 15 feet, underlain by stiff clays and medium dense clayey sand layers to a depth of approximately 50 feet. Medium dense sandy soils occurred below 50-ft depth to a depth of approximately 85 feet, underlain by layers of very dense silty sand and hard clay. In addition to the new borings, we reviewed two borings in the LOTB sheet from the As-built drawings for the existing undercrossing, which are also presented in Appendix A. The borings, drilled in 1961, also show essentially similar soil conditions, e.g. predominantly silty and sandy clays.

During field exploration in September 2006, the water levels in the borings were approximately at Elev. 8.6 feet at the western end and Elev. 5.3 feet at the eastern end. However, the groundwater may vary with the passage of time due to seasonal groundwater fluctuation, surface and subsurface flows, ground surface run-off and other factors that may not be present at the time of investigation.

GEOLOGY

General geologic features pertaining to the site were evaluated with reference to the "Geologic Map of Quaternary Geology of Contra Costa County and Surrounding Areas, CA: Derived from Digital Database open-file 97-98" by E.J. Helley and R.W. Graymer 1997; Scale 1:100000. Based on the map, the site is located at the boundary of areas covered by Holocene alluvial fan and fluvial deposits (Qhaf) and Pleistocene alluvial fan and fluvial deposits (Qpaf). A geologic map of the general project area is shown on Plate 2. Description of the main geologic units is as follows:

> *Qhaf (Alluvial Fans and Fluvial Deposits (Holocene)) – Alluvial fan deposits are brown or tan, medium dense to dense, gravely sand or sandy grave that generally grades upward to sandy or silty clay. Near the distal fan edges, the fluvial deposits are typically brown, never reddish, medium dense sand that fines upward to sandy or silty clay. The best developed Holocene alluvial fans in Contra Costa County are on the Richmond Bay Plain and the fans of Sand and Deer Creeks in the Brentwood Area. All other alluvial fans and fluvial deposits are confined to narrow valley floors. Several Holocene fans along the south shore of the Carquinez Strait have bulbous surface morphology, are short, overlap older Pleistocene*

surfaces, and may be debris flows.

Qpaf (Alluvial Fans and Fluvial Deposits (Pleistocene)) – Brown dense gravely and clayey sand or clayey gravel that fines upward to sandy clay. These deposits display various sorting and are located in most stream channels in the county. All Qpaf deposits can be related to modern stream courses. They are distinguished from younger alluvial fans and fluvial deposits by higher topographic position, greater degree of dissection, and stronger soil profile development. They are less permeable than Holocene deposits, and locally contain fresh water mollusks and extinct late Pleistocene vertebrate fossils. They are overlain by Holocene deposits on lower parts of the alluvial plain, and incised by channels that are partly filled with Holocene alluvium on higher parts of the alluvial plain. Maximum thickness is unknown but at least 50m (150 feet).

EARTHQUAKE CONSIDERATIONS

Seismic Sources

The project is located in a seismically active part of Northern California. Many faults exist in the area, which are capable of producing earthquakes which may cause strong ground shaking at the site.

Applicable major faults in the vicinity of the project site were identified and their associated maximum earthquake magnitudes were established using the Caltrans 2007 Deterministic PGA Map and the associated Data Base. The documents were supplied to us by Caltrans, with the understanding that the fault locations in the map and the associated magnitudes in the Data Base have essentially been finalized and are appropriate for design purposes. The moment magnitudes noted in the table represent the largest earthquakes that could occur on the given fault based on the current understanding of the regional tectonic structure. A fault map of the project vicinity is shown on Plate 3.

Fault	Fault No.(1)	Fault Type	Distance from Site (miles)	Maximum Moment Magnitude
Vaca Fault Zone	14	RLSS(2)	5.5	6.9
Great Valley Fault 5	24	Reverse Fault	6.7	6.5
Greenville Fault Zone (Clayton Section)	351	RLSS	6.8	6.6
Concord Fault Zone (Ygnacio Valley Section)	341	RLSS	10.4	6.6

(1) Number of the Fault in the Data Base associated with the Caltrans 2007 Deterministic PGA Map
(2) RLSS – Right Lateral Strike Slip Fault

Based on the Caltrans 2007 Deterministic PGA Map and the attenuation relationship by Sadigh et al. (1997), the controlling fault is the Vaca Fault Zone (Fault No. 14 in the map), which is associated with a Maximum Moment Magnitude (Mmax) of 6.9. A peak bedrock acceleration (PBA) of 0.46g is anticipated at the site.

Seismic Hazards/Liquefaction Impact

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction. Since no active faults pass through the site, the potential for fault rupture is relatively low. Based on available geological and seismic information, the possibility of the site to experience strong ground shaking may be considered significant.

Liquefaction is a phenomenon in which saturated soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged, cohesionless sands and silts of low relative density are the type of soils which usually are susceptible to liquefaction - the susceptibility increases with decreasing relative density (reflected by the number of blows to drive a sampler), and decreasing fines content. Accepted procedures for the assessment of liquefaction potential for cohesionless soils have evolved over the years through research and field observations (Youd et al, 2001). Recent research and field observations have shown that clays of low plasticity are also potentially liquefiable, based on the moisture content and plasticity characteristics of the clay. Procedures for the assessment of liquefaction potential for clay soils have also been established and have received

general acceptance (Bray et. al., 2004).

Initial analyses based on the blow counts by the drive sampler indicated the presence of potentially liquefiable medium dense sand layers below 50-ft depth in boring CLO-125. It is generally accepted that when hollow stem auger drilling techniques are used, the measured blow counts and the associated liquefaction analyses are less reliable. Thus, a cone penetration test (CPT) was subsequently performed 23 feet west of boring CLO-125 to confirm/negate the finding. Based on the CPT results the potential for liquefaction was found to be low.

FINDINGS AND RECOMMENDATIONS

General

Based on the findings of the investigation, it is our opinion that the site is feasible for the planned bridge structures provided the recommendations presented in this report are incorporated into the final design and construction.

This report was prepared specifically for the proposed bridge structure according to the plans provided to us. Normal construction procedures were assumed throughout our analysis and represent one of the bases of recommendations presented herein. Our design criteria have been based upon the materials encountered at the site. Therefore, we should be notified in the event that these conditions are changed, so as to modify or amend our recommendations.

Foundations

For the proposed structure, 14-inch square Caltrans Standard Class 200 Alt. ‘X’ precast prestressed concrete piles are recommended for foundation support at the two abutment locations and the Abutment 3 wingwall and 78-inch CIDH piles are recommended for the column foundations for Bent 2.

Pile Design

Pertinent foundation design information was provided by Biggs Cordosa (Structural Engineers for the project), which are presented in the following tables (Foundation Design Data and Foundation Design Loads).

FOUNDATION DESIGN DATA – Left and Right Bridges

Support No	Design Method	Pile Type	Finish Grade Elev. (ft)	Pile Cut-off Elev. (ft)	Pile Cap Size (ft)		Permissible Settlement (inch)	No. of Piles per Support
					B(1)	L(2)		
Abutment 1	WSD	Class 200 'Alt. X'	44.50	40.5	8	72.83	1.0	19
Bent 2	LRFD	78-in CIDH	32.30	30.30	N/A	N/A	1.0	1
Abutment 3	WSD	Class 200 'Alt. X'	32.00	27.50	12	72.83	1.0	34
Abutment 3 Wingwall	WSD	Class 200 'Alt. X'	38.30	31.50	Varies		1.0	7

Notes: (1) B = Width (2) L = Length

FOUNDATION DESIGN LOADS – Left and Right Bridges

Support No.	Service-I Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Limit State (Controlling Group, kips)			
	Total Load		Permanent Loads	Compression		Tension		Compression		Tension	
	Per Supp.	Per Pile	Per Support	Per Supp.	Max. Per Pile	Per Supp.	Max. Per Pile	Per Supp.	Max. Per Pile	Per Supp.	Max. Per Pile
Abutment 1	2130	130	1800	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bent 2	1420	1420	1060	2060	2060	0	0	1280	1280	0	0
Abutment 3	3440	130	3120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Abutment 3 Wingwall	810	90	420	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes: Total Load for Service-I Limit State = DL + LL (HL93) + Earth
Strength Limit State = Assumes LRFD at Bent 2 using 1.25DC + 1.50DW + 1.35LL (P15).
Extreme Limit State = DL + Seismic

Consistent with the current Caltrans requirements, Working Stress Design (WSD) was used for the abutment foundations and Load Resistance Factor Design (LRFD) was used for the foundations for Bent 2 for the two bridges.

The abutment foundations were evaluated for the foundation design data and loading conditions using Caltrans November 2003 Bridge Design Specifications for foundations, using Working Stress Design (WSD) methods. The Bent 2 foundations were evaluated for the foundation design data and loading conditions using AASHTO LRFD Bridge Design Specifications – 3rd Edition, with Interims Through 2006 and current Caltrans Memo To Designer 3-1 (Attachment 1). The actual load demands on the piles, based upon WSD and LRFD are presented in the table below for the two bridges.

LOAD DEMANDS – Left and Right Bridges

Support No.	Design Method	Service Loads (kips)		Required Nominal Resistance (kips)				Required Nominal Resistance (kips)	
				Strength Limit		Extreme Limit			
		Comp.	Tens.	Comp. (ϕ=0.7)	Tens. (ϕ=0.7)	Comp. (ϕ=1.0)	Tens. (ϕ=1.0)	Comp.	Tens.
Abutment 1	WSD	130	0	N/A	N/A	N/A	N/A	260	0
Bent 2	LRFD	1420	0	2950	0	1280	0	2950	0
Abutment 3	WSD	130	0	N/A	N/A	N/A	N/A	260	0
Abutment 3 Wingwall	WSD	90	0	N/A	N/A	N/A	N/A	180	0

Estimation of the pile capacities was made using the site-specific subsurface conditions for the loads computed above and other pertinent information provided by the Structural Engineer. Estimation of the pile capacities was made for each support location using the site-specific subsurface conditions. The top of pile (bottom of footing) elevations were based on the information provided by the designer.

The computer program APILE developed by Ensoft, Inc. was used for the computations for the precast prestressed concrete piles. The program computes pile capacities for driven piles using four different methods: FHWA Method; US Corps of Engineers Method; Lambda Method; and API-RP2A Method from the American Petroleum Institute. The API-RP2A Method was chosen as the basis for the recommended pile tip elevations, since this method was judged to be the most appropriate for predominantly clay soils. The computer program SHAFT developed by Ensoft, Inc. was used for the computations for the CIDH piles at Bent 2. The program computes capacities for drilled shafts (CIDH piles) based on procedures proposed by O'Neil and Reese (1999). The procedures utilize an α factor (α=0.55) for "Clay" and a β factor for "Sand" where β is a function

of depths below ground surface and independent of soil friction angle The SHAFT program also computes the pile settlement and associated mobilization of shaft and end-bearing resistance, consistent with the O'Neil and Reese (1999) procedures. This feature is particularly useful for large diameter (78-inch) piles for Bent 2.

The pile data table is presented below. Pile capacity computations (APILE and SHAFT output) are presented in Appendix D. End bearing was neglected in the estimation of axial pile capacities for the 24-inch diameter abutment piles. For the 72-inch diameter piles, consideration was given to the pile head settlement under the nominal load to approximately 5 percent of the pile diameter.

PILE DATA TABLE – Left and Right Bridges

Location	Pile Type	Nominal Resistance (kips)		Finish Grade (ft)	Cut-off Elev. (ft)	Design Tip Elev. (ft)(1)	Specified Tip Elev. (ft)
		Compression	Tension				
Abutment 1(2)	Class 200 'Alt. X'	260	0	44.50	40.50.	-9.5(a) 18.0 (c)	-9.5
Bent 2	78-in CIDH	2950	0	32.30	30.30	-35.0(a) - 25.0(c)	-35.0
Abutment 3 Left Bridge	Class 200 'Alt. X'	260	0	32.00	27.50	-19.0(a) 5.0 (c)	-19.0
Abutment 3 Right Bridge(3)	Class 200 'Alt. X'	260	0	32.00	27.50	-21.0(a) 5.0 (c)	-21.0
Abutment 3 Wingwall	Class 200 'Alt. X'	180	0	38.16	31.50	-1.0(a) 9.0 (c)	-1.0

Notes:
1. Design Tip Elevation is controlled by the following demands: (a) Compression; (b) Tension, (c) Lateral Loads.
2. Piles in Abutment 1 assumed to be predrilled through the embankment to Elev. 32.0 feet
3. Piles in Abutment 3 for right bridge will be predrilled to Elev. 21.0 ft. due to an existing 15" SS utility.

Installation of Precast Prestressed Concrete Piles

An adequate hammer should be chosen for driving the 14-inch square precast prestressed concrete piles. It is highly recommended that prior to start of production pile driving, a pile drivability analysis be performed to assess the adequacy of the hammer and to establish a field pile driving criterion. In the event the piles do not attain the required bearing value at the end of driving, the piles should be allowed to stand for a "set period" of at least 24 hours without driving. After the required "set period", at least two piles in the footing should be redriven to determine if the bearing value has been attained. If it is determined that the bearing value has been attained, then the

remaining piles should be considered satisfactory. In the event unanticipated driving conditions are encountered, the Resident Engineer should consult the Geotechnical Engineer for further course of action.

Piles at Abutment 3 of the right bridge should be predrilled to Elev. 21.0 feet due to the presence of an existing utility line. The Resident Engineer may allow to predrill through the embankment at Abutment 1. Predrilling through the abutment should be limited to Elev. 32.0 feet. The predrilled holes should have a diameter of not less than the greatest dimension of the pile cross-section plus 6 inches, consistent with the Caltrans Standard Specifications. After driving the pile, the annular space around the pile should be filled with pea gravel to ground surface.

CIDH Pile Installation

Caltrans standard specifications and standard special provisions (SSP) for "Cast-in-Place Concrete Piling" should be used for the construction of CIDH piles. It is possible that groundwater may be encountered during construction and "dry" condition as per the standard specifications Section 49-4 could not be maintained.

Vertical inspection pipes for acceptance testing should be provided in all CIDH piles that are 24 inches in diameter or larger, except when the holes are dry or when the holes are dewatered without the use of temporary casing to control groundwater. The acceptance test should include Gamma- Gamma Logging and may also include cross-hole sonic logging. Gamma-Gamma Logging should be performed in accordance with California Test 233 Standard (CT233) to check the homogeneity of CIDH piles. Details of the acceptance testing and Gamma-Gamma Logging are contained in Caltrans SSP and CT233.

It is prudent to make the contractor aware of these conditions so that he takes appropriate steps to comply with the standards and maintain the integrity of the CIDH piles. The use of temporary steel casing should be anticipated at all times to maintain the integrity of the piles. It is also recommended that the specifications set certain criteria for qualifications and previous work experience requirements to pre-qualify the potential contractors. The intent is to help select qualified contractors to reduce construction issues.

All piles excavations should be observed by the geotechnical engineer or regulatory agency prior to the placement of reinforcement and concrete so that if conditions differ from those anticipated, appropriate recommendations can be made.

Lateral Pile Capacity

Analyses for lateral load behavior of the piles may be performed using the LPILE computer program. Geotechnical parameters for the development of p-y curves for the LPILE program are presented in the tables below. The parameters are based on field borings, CPT and lab testing data. The elevation information is based on the topographic data provided to us. It is recommended to use a p-multiplier of 0.6 (60% effective) and a y-multiplier of 1.0 to consider group effect for piles spaced at minimum 3 times the maximum dimension.

Geotechnical Parameters For LPILE Analysis

Abutment 1

Elevation (ft.)	Generalized Soil Profile	LPILE Soil Type	Probable Soil Strength	K (pci)	e_{50} (in/in)	Effect Unit Weight (pci)
49 to 33	Medium Stiff Lean Clay	1, Soft Clay	Su = 5.21	100	.010	.0694
33 to 10	Stiff Lean Clay	3, STIFF CLAY w/o water	Su = 11.81 psi	500	.007	.0723
10 to -8	Stiff Sandy Lean Clay	3, STIFF CLAY w/o water	Su = 11.81 psi	500	.007	.0376
-8 to -18	Very Dense Silty Sand	8, SAND (API)	ϕ= 40°	150	--	.0405
-18 to -33	Hard Lean Clay	3, STIFF CLAY w/o water	S_u = 31.25 psi	2000	.004	.0405
-33 to -45	Very Dense Silty Sand	8, SAND (API)	ϕ = 40°	150	--	.0405
Ground Surface @ El +49		Groundwater Table @ El +10				

Abutment 3

Elevation (ft.)	Generalized Soil Profile	LPILE Soil Type	Probable Soil Strength	K (pci)	e_{50} (in/in)	Effect Unit Weight (pci)
49 to 33	Loose to Medium Dense Silty Sand	8, SAND (API)	$\phi = 32°$	60	--	.0723
33 to 10	Stiff Lean Clay	3, STIFF CLAY w/o water	Su = 11.81 psi	500	.007	.0723
10 to 0	Stiff Lean Clay	3, STIFF CLAY w/o water	Su = 11.81 psi	500	.007	.0376
0 to -35	Medium Dense Sand	8, SAND (API)	$\phi = 35°$	60	--	.0405
-35 to -45	Very Dense Sand	8, SAND (API)	$\phi = 40°$	150	--	.0405
Ground Surface @ El +49		Groundwater Table @ El +10				

For lateral pile analyses at Bent 2, LPILE analyses were performed for both soil conditions and the more conservative results as appropriate should be used for design.

The parameters reported above are based on standard pile sizes. For piles larger than 2 feet in diameter, such as for the 6.5-ft diameter CIDH piles at the Bent 2 location, the K values should be scaled up and the e_{50} values should be scaled down by a factor of (pile size/2')$^{0.5}$.

Lateral Earth Pressures

Abutment retaining walls and wing walls should be designed to resist the following Applied Lateral Earth Pressures and live load. These values assume no hydrostatic pore pressure buildup behind the wall and are based on well-drained backfill behind the walls supported in native soil.

Applied Lateral Earth Pressure

Active Condition	36 pcf Equivalent Fluid Pressure (EFP) for engineered fill
At-Rest Condition	55 pcf Equivalent Fluid Pressure (EFP) for engineered fill
Passive Resistance	For seismic design, use 375 pcf Equivalent Fluid Pressure (EFP), engaging the total height of the wall. Alternatively, the wall may be designed for a uniform pressure of 5

ksf (ultimate) acting over twice the height of the abutment backwall.
In either case, the displacement of the wall should be evaluated using the table below to assure that the wall displacement is acceptable:

Wall Deflection/Wall Height	Pmob/Pult
0.005	0.55
0.010	0.70
0.015	0.82
0.020	0.90
0.025	0.97
0.030 and greater	1.00

Intermediate values may be interpolated.

Cantilever walls which are free to rotate at least 0.004 radians may be assumed flexible for the active condition. Walls that are not capable of this movement should be assumed rigid and designed for the at-rest condition. The effect of any surcharge (dead, live, or traffic load) should be added to the preceding lateral earth pressures. A coefficient of 0.3 may be used to determine the additional earth pressure resulting from the surcharge.

Seismic Design Criteria

The value of PBA for the project site was calculated from the distances to the applicable faults in the project vicinity using the Caltrans 2007 Deterministic PGA Map and the attenuation relation by Sadigh et al. (1997). The computed PBA value was increased by 20% (per Sadigh, 1997), to account for the reverse fault effect, wherever applicable. The PBA computations based on Sadigh attenuation relation are presented in Appendix D. Based on the computations, the maximum PBA computed within the project limit is 0.46g.

Based on the available boring information in the vicinity of the project site, the subsurface soil conditions at the project site generally matches the criteria for Soil Type D, as per Caltrans Seismic Design Criteria (Version 1.4, June 2006). Based on Caltrans Seismic Design Criteria and the above information, the seismic design criteria are as follows:

1. Closest Distance to Fault = 5.5 miles (8.8 km)
2. PBA =0.46g
3. Design ARS Curve =Caltrans Seismic Design Criteria June 2006 Version 1.4 Figure B.8 (Soil Profile Type D).

4. Design ARS Curve (see Plate 4): Curve based on Caltrans SDC (v. 1.4, 6/ 2006) for different structural periods. The curve is based on (Governing Fault – Vaca Fault Zone; Mmax = 6.9) Figure B.8, PBA = 0.46 g. The curve for PBA=0.46g was obtained by interpolation of the 0.4g and 0.5g curves. The curve is modified for near fault effects as required by SDC. Figure B.8 is used since the range in Figure B.7 (e.g. 6.5+/-0.25) is below 6.9.

A copy of the ARS Design Curve is included on Plate No. 4 of this report.

Per requirements of the Designer, an ARS curve was developed for design of temporary support of the left bridge (Bridge No. 28-0399L) bent during construction. Per MTD 20-12, Section II, the ground motions for design of temporary elements for a bridge structure should be based on 10 percent exceedence in twice the expected duration of the temporary condition, but not less than 10 years. Accordingly, a probabilistic ARS curve was developed for 10 percent exceedence in 10 years (e.g. return period of 95 years) using the information from the interactive USGS website. A probabilistic ARS curve for a particular site may be developed from the website for a particular return period with the input of the site location (latitude/longitude) and the average shear wave velocity (Vs30) over the top 100 feet (30 meters). Since the data for 10 percent exceedence over 10 years is not directly available from the USGS website, the data was developed by interpolating between the available data for 10 percent exceedence in 30 years (return period of 285 years) and a 5 percent exceedence in 50 years (return period of 72 years). Also, per standard Caltrans practice for adjustment for near-fault effects, the computed spectral acceleration was increased linearly by 0 percent to 20 percent between the periods of 0.5 seconds and 1 second, and uniformly by 20 percent for periods greater than 1 second. A table showing the recommended ARS curve for temporary construction is presented below.

Period, sec.	Spectral Acceleration, g
0 (PGA)	0.2303
0.1	0.4024
0.2	0.5202
0.3	0.5084
0.5	0.4245
1.0	0.3092
2.0	0.1530
3.0	0.0911
4.0	0.0640
5.0	0.0486
Vs30 = 245 m/sec. Includes Near Fault Factor	

Grading

All grading operations should be performed in accordance with the project specifications and Caltrans Standard Specifications for Earthwork (Section 19).

Engineered Fill Engineered fill should be non-expansive and consist of relatively granular material having a P.I. of less than 15. In addition, we recommend that the material within 3 feet of the proposed pavement subgrade have minimum R-values of 15. The fill shall also be free of organic and inorganic debris, rubles and any other deleterious material. The on-site soils may be used as engineered fill, provided they meet the above criteria.

Approach Embankment The maximum embankment fill thickness is anticipated to be approximately 15 feet at all the abutment locations. The approach embankments will have a 2(H):1(V) slope on both sides. Under the bridge, paved slopes may be constructed at 1.5(H):1 (V) slope. The available boring data indicates that the subsurface soil conditions generally consist of stiff to very stiff clays. Based on the boring information, it appears that the consolidation settlement due to the placement of the embankment fill is anticipated to be relatively quick (during construction) and therefore insignificant. Standard Caltrans 30-day waiting period is considered adequate.

Corrosion

The corrosion investigations performed are in general accordance with the provisions of California Test Method 643. A summary of the corrosion test data is presented below.

Boring	Depth (ft)	pH	Resistivity (ohms-cm)	Sulfate (ppm)	Chloride (ppm)
CLO-124	7-8.5	7.96	780	108.2	22.1

Based on the data, the site subsoil is non-corrosive per Caltrans corrosion design guidelines, and standard Type II modified or Type I-P (MS) modified cement may be used for the concrete substructures. The minimum cement factor and cover thickness should be per Caltrans Bridge Design Specifications (Section 8.22).

Plan Review

We recommend that final plans for foundations be reviewed by this office prior to construction so that the intent of our recommendations is included in the project plans and specifications and to further see that no misunderstandings or misinterpretations have occurred.

Construction Observation

To a degree, the performance of any structure is dependent upon construction procedures and quality. Hence, observation of foundation excavations, and pile installations should be carried out by the regulating agencies. If the subsurface conditions different from those forming the basis of our recommendations is encountered this office should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our site reconnaissance and the assumption that the subsurface conditions do not deviate from observed conditions. All work done is in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our conclusions and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the subsurface conditions can occur with the passage of time, whether they be due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge.

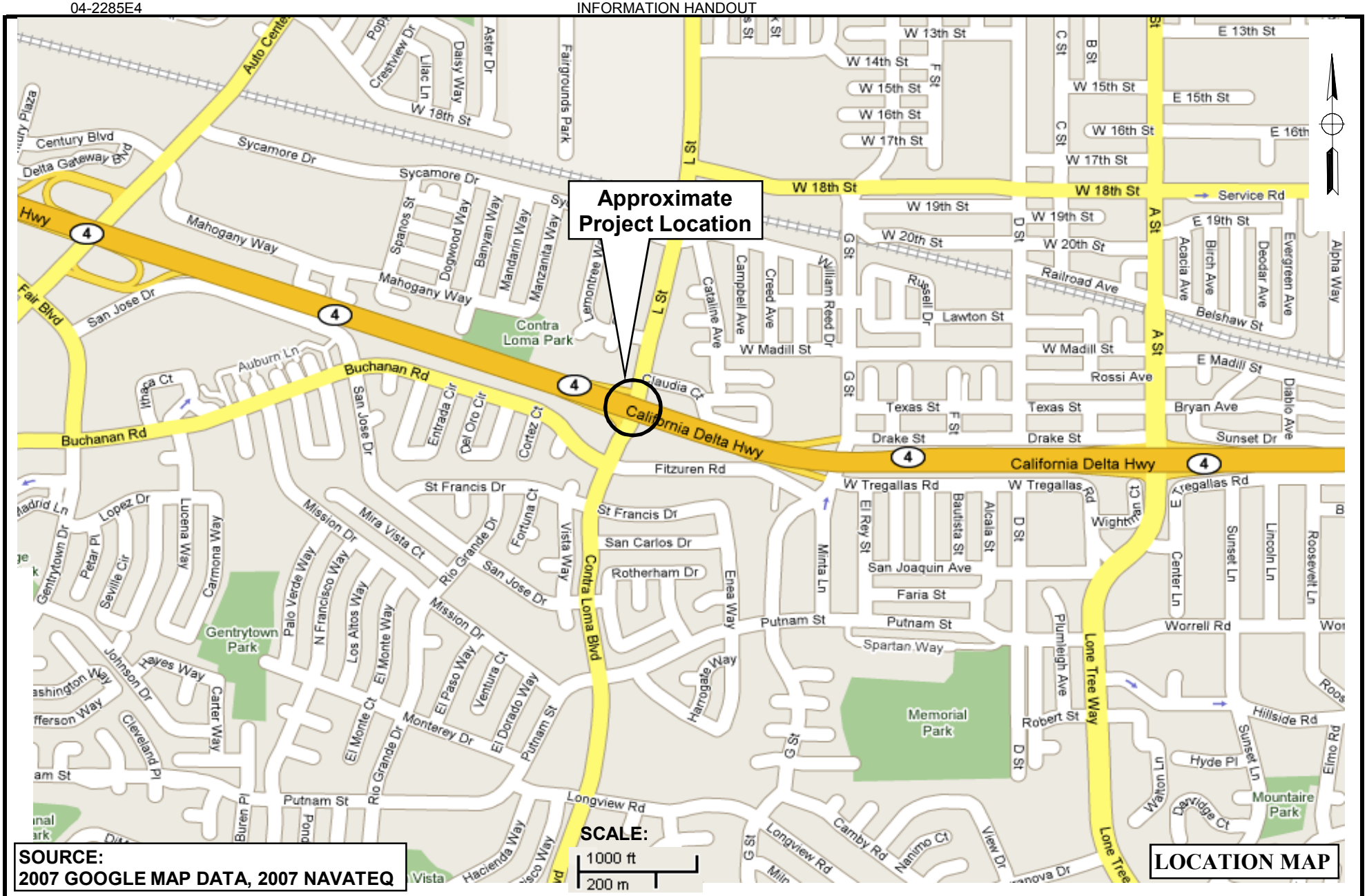
Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
PARIKH CONSULTANTS, INC.

Partha Sircar, Ph.D., P.E. C54619
Senior Engineer

Gary Parikh, G.E. 666
Project Manager

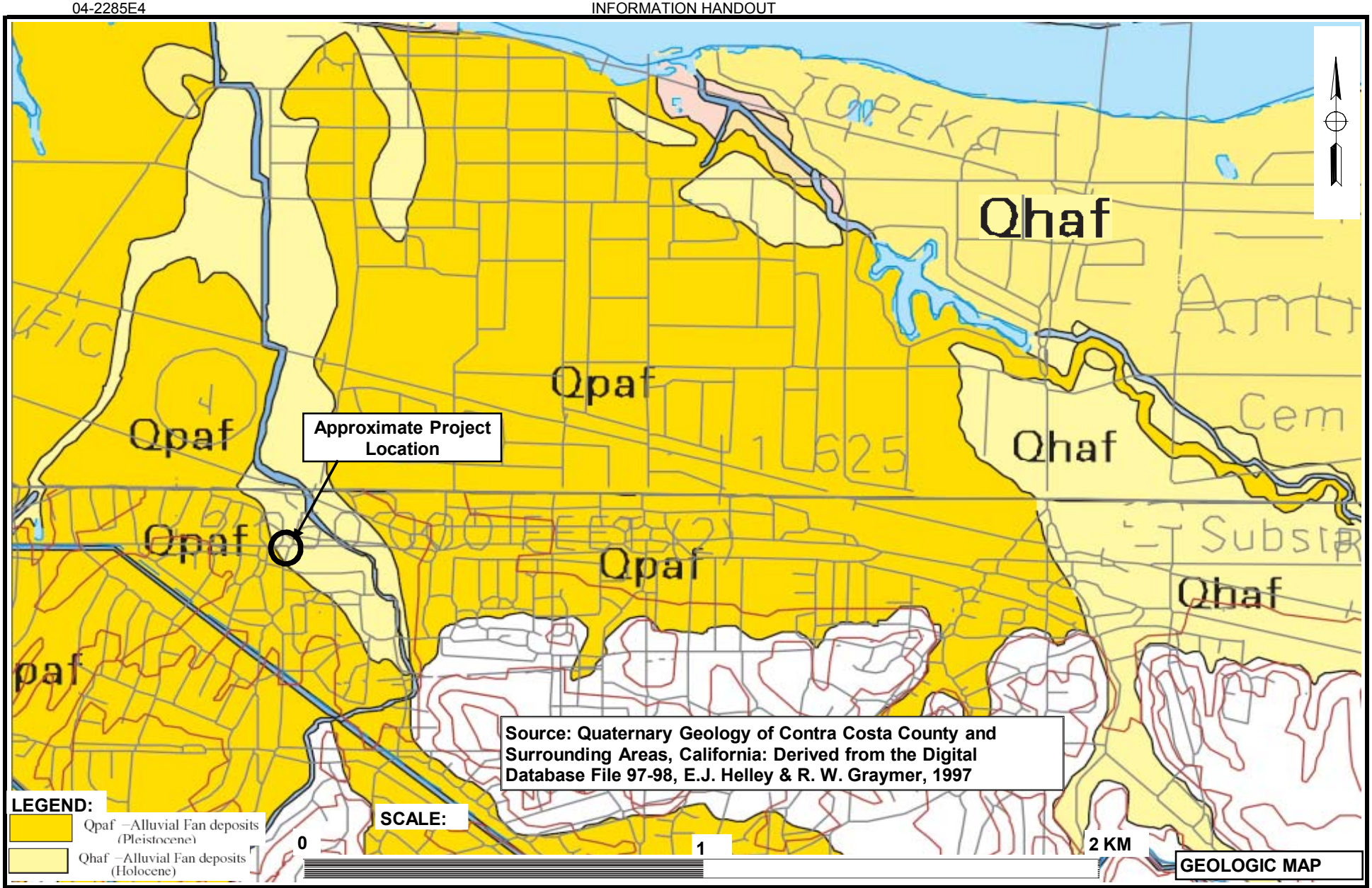
REGISTERED PROFESSIONAL ENGINEER
GARY R. PARIKH
No. 666
EXP. 12-31-11
GEOTECHNICAL
STATE OF CALIFORNIA



PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

CONTRA LOMA BOULEVARD UNDERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

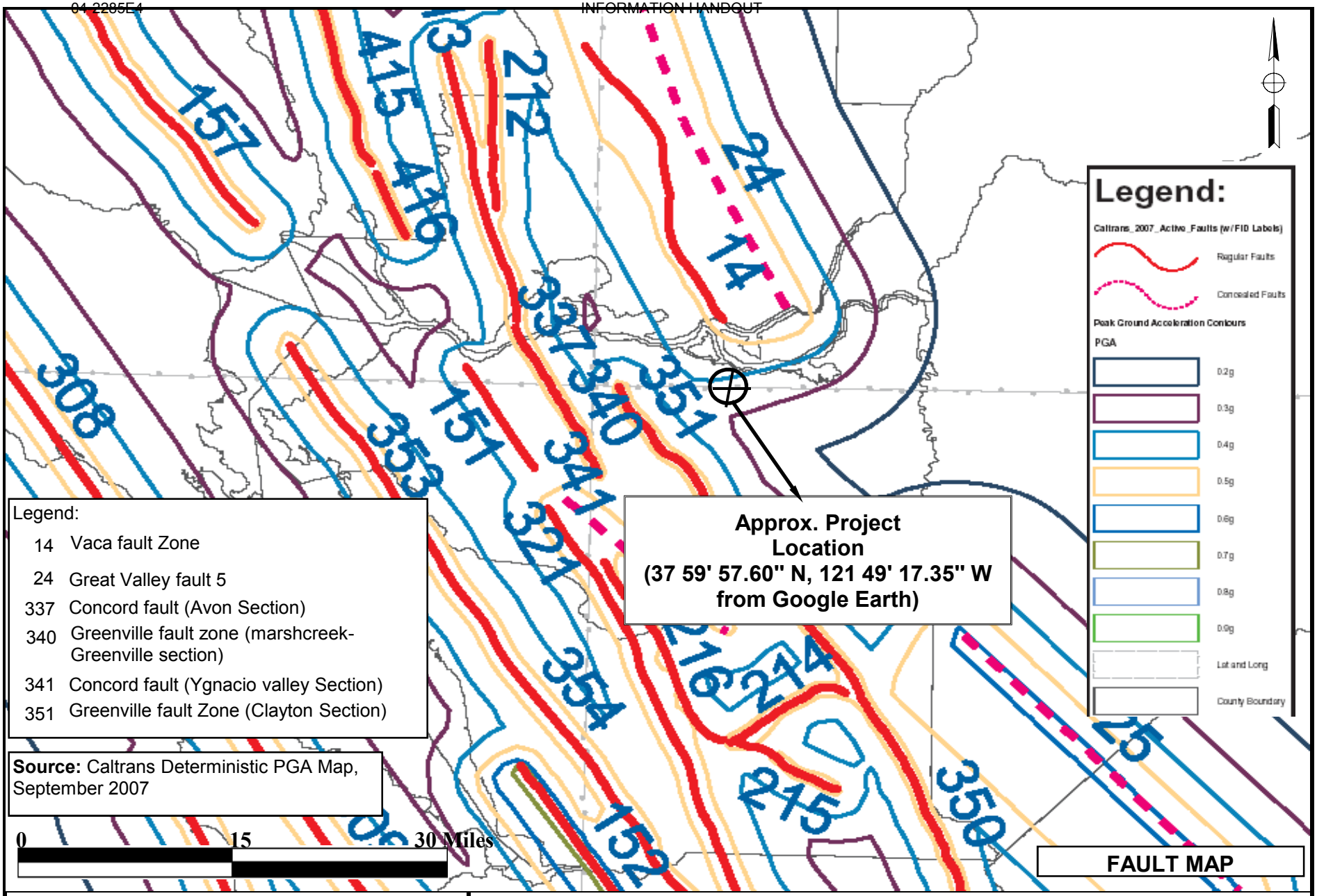
JOB NO.: 206118.CLM	PLATE NO.: 1



PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

CONTRA LOMA BOULEVARD UNDERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.: 206118.CLM	PLATE NO.: 2



Legend:

14	Vaca fault Zone
24	Great Valley fault 5
337	Concord fault (Avon Section)
340	Greenville fault zone (marshcreek-Greenville section)
341	Concord fault (Ygnacio valley Section)
351	Greenville fault Zone (Clayton Section)

Source: Caltrans Deterministic PGA Map, September 2007

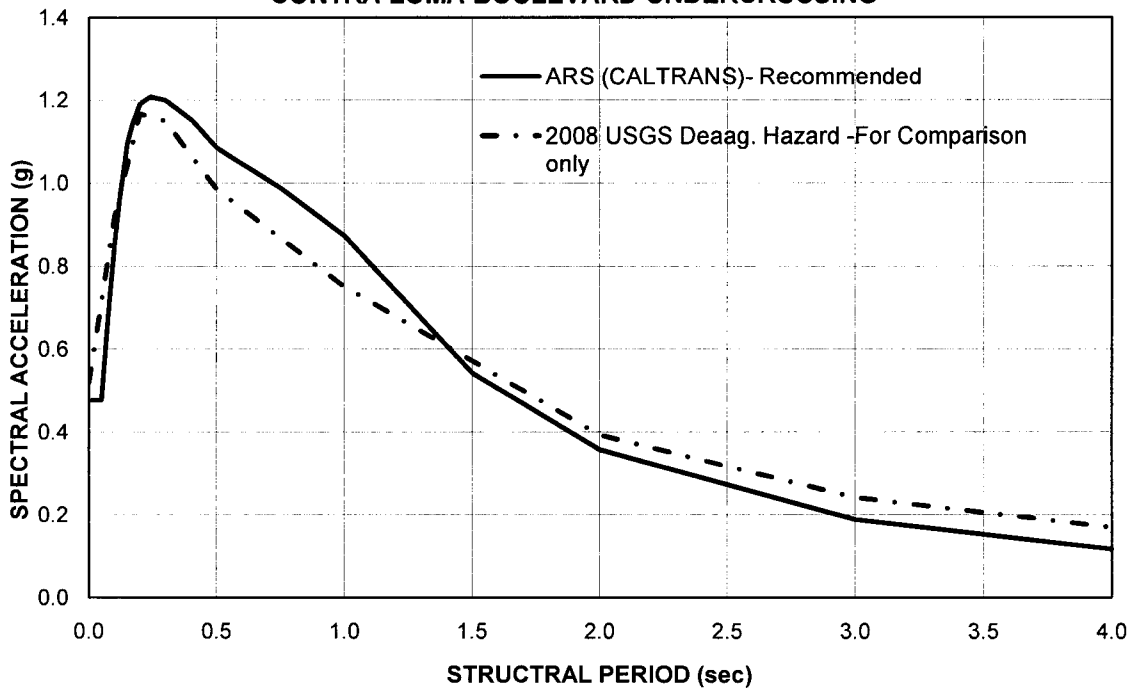
FAULT MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

CONTRA LOMA BOULEVARD UNDERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.: 206118.CLM | **PLATE NO.: 3**

ARS CURVE
CONTRA LOMA BOULEVARD UNDERCROSSING



Spectral Data

Period (sec)	Spectral Accel. (g)
0.010	0.476
0.020	0.476
0.030	0.476
0.050	0.476
0.075	0.673
0.100	0.850
0.120	0.960
0.150	1.095
0.170	1.141
0.200	1.190
0.240	1.208
0.300	1.200
0.400	1.153
0.500	1.085
0.750	0.988
1.000	0.873
1.500	0.542
2.000	0.357
3.000	0.188
4.000	0.117

Caltrans SDC (v 1.4, June 2006), Figure B.8 (M=7.25+/-0.25)
Governing Fault: Vaca Fault Zone
Fault Distance = 8.8 km (5.5 miles)
(Mmax = 6.9, Soil Profile Type D, PBA = 0.46g)

Notes:
(a) The updated Caltrans Hazard Map and Data Base were used
(b) PBA was obtained by using Sadigh Attenuation Relationship: 0.46g
(b) Curve for 0.46g was obtained by interpolating between curves for 0.4g and 0.5g
(d) The following modifications were then applied for near-fault effects:
(1) No change of Sa for structural periods ≤ 0.5 sec
(2) 20% increase of Sa for structural periods > 1 sec
(3) Linear interpolation for structural periods between 0.5 and 1 sec

For Comparison only:

Periyod (sec)	Spectral Acce.
0.000	0.518
0.100	0.919
0.200	1.166
0.300	1.149
0.500	0.985
1.000	0.751
2.000	0.392
3.000	0.242
4.000	0.169
5.000	0.136

Caltrans 2009 Seismic Design Criteria-governed by 2008 USGS Deagg. Hazard-(Beta)-Probabilistic ARS

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

CONTRA LOMA BOULEVARD UNDERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.:206118.CLM **PLATE NO.: 4**

APPENDIX A

INFORMATION HANDOUT

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4			

REGISTERED ENGINEER-GEOTECHNICAL

PLANS APPROVAL DATE

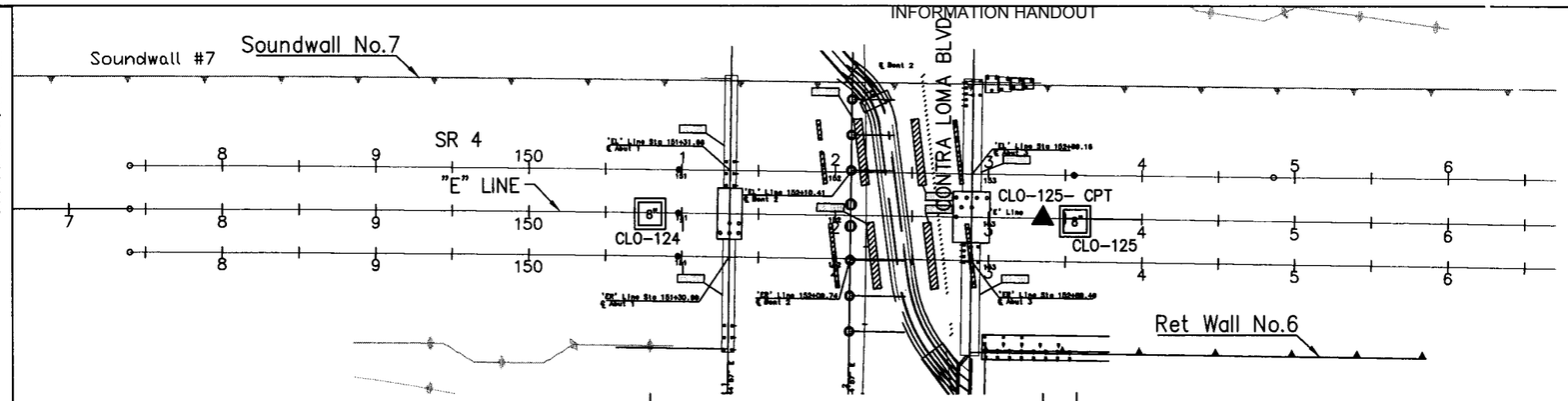
REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. GE. 666 Exp. 12/31/11 GEOTECHNICAL STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE CA 95131

CCTA
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523

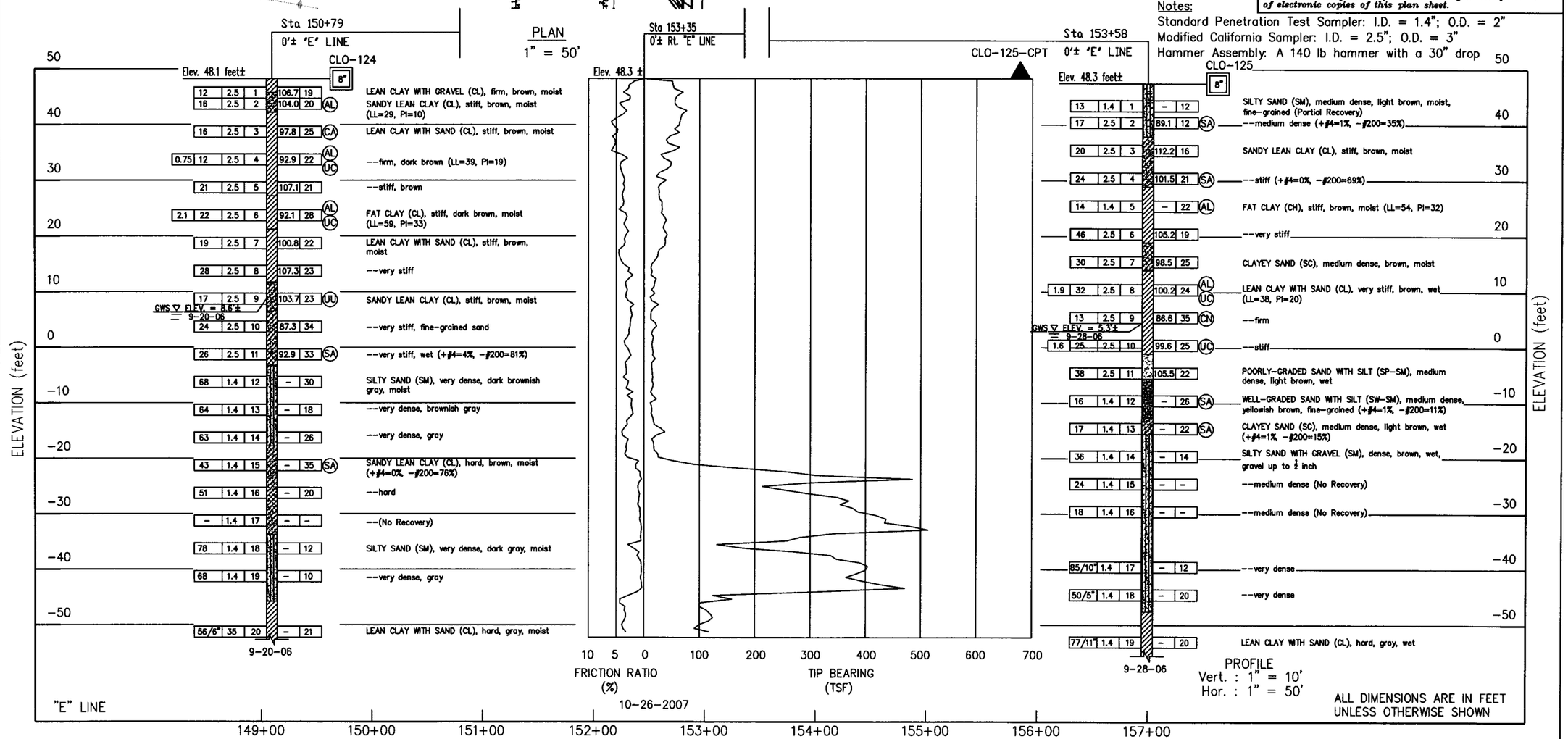
BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

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.



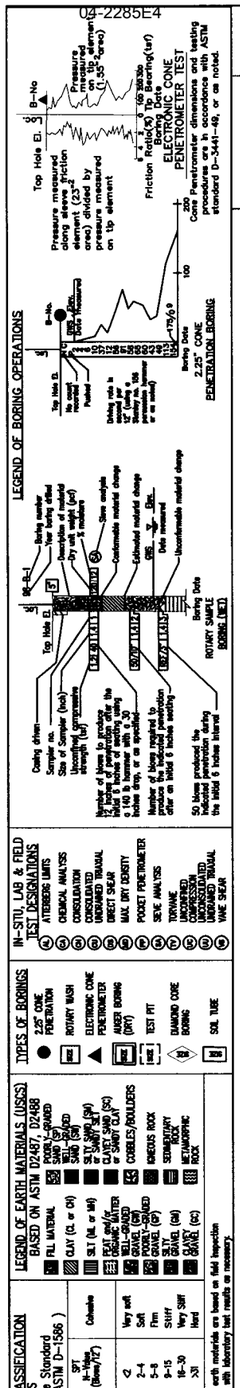
PLAN
1" = 50'

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN



DESIGN OVERSIGHT	DESIGN By: D. GOUTHIER	Field investigation by: L. BHANGOO	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR PROJECT ENGINEER
SIGN OFF DATE	CHECKED By: P. SIRCAR			

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 4 5

CU 04275
EA 2285E1

STRUCTURE NO. 28-0399 L/R
POST MILE(PM) 26.9

CONTRA LOMA BOULEVARD UNDERCROSSING

LOG OF TEST BORINGS 1 OF 2

DISREGARD PRINTS BEARING EARLIER REVISION DATES

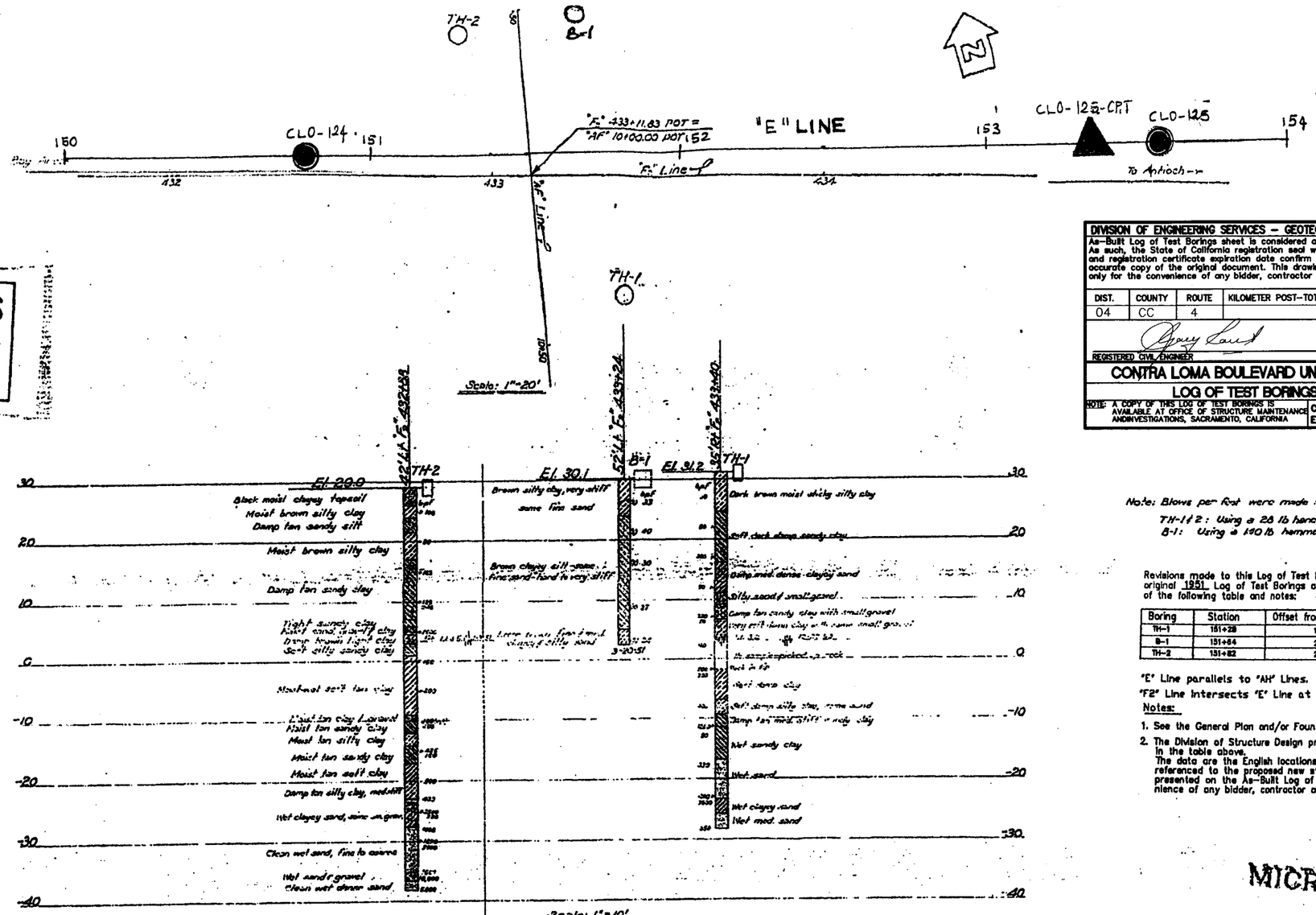
REVISION DATES (PRELIMINARY STAGE ONLY) 09/28/09 05/26/10

SHEET 32 OF 33

F-246 (3)

713 140

Stuart Mitchell
August 27 1951



AS BUILT PLANS
Contract No. 52-0KTC 27
Date Completed
Document No. 4000254Z

BM 45
North side PCC base of tower 4½ 146' Lt "F2" 431+02
Elev. 28.23'

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	CC	4			
REGISTERED CIVIL ENGINEER			5/26/10 DATE		
CONTRA LOMA BOULEVARD UNDERCROSSING					
LOG OF TEST BORINGS 2 OF 2					
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA			CU: 04275 EA: 2285E1	BRIDGE No. 28-0399 L/R	
				Sheet 33	of 33

REGISTERED PROFESSIONAL ENGINEER
GARY PARIKH
No. G.E. 666
Exp. 12/31/11
GEOTECHNICAL
STATE OF CALIFORNIA

Note: Blows per foot were made in the following manner;
TH-1 & 2: Using a 28 lb hand hammer with a 12" free fall.
B-1: Using a 140 lb hammer with a 30" free fall.

Revisions made to this Log of Test Borings from the original 1951 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from "E" LINE
TH-1	151+28	19.5 ft Rt
B-1	151+84	21 ft Rt
TH-2	151+82	22 ft Lt

"E" Line parallels to "AH" Lines.

"F2" Line intersects "E" Line at Station 109+90 ft

Notes:

1. See the General Plan and/or Foundation Plan for English Stationing.
2. The Division of Structure Design produced the data presented in the table above.
   The data are the English 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.

MICROFILMED

STEWARTVILLE ROAD UNDERCROSSING

28-98

APPENDIX B

APPENDIX B

LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented in "Log of Test Borings", Appendix A.

Moisture-Density

The natural moisture contents and dry unit weights were determined for selected undisturbed samples of the soils in general accordance with ASTM Test Method D 2216-92. This information was used to classify and correlate the soils. The results are presented at the appropriate depths on the "Log of Test Borings", Appendix A.

Atterberg Limits

The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the effective strength characteristics and expansion potential with variations in moisture content. The Atterberg Limits were determined in general accordance with ASTM Test Method D 4318-93. The results of these tests are presented on Plate B-2, "Plasticity Chart".

Grain Size Classification

Grain size classification tests (ASTM Test Method D422-63) were performed on selected samples of granular soil to aid in the classification. The results are presented on Plate B-3A and Plate B-3B, "Grain Size Distribution Curves".

Unconfined Compression Tests

Strength tests were performed on selected undisturbed samples using unconfined compression machine. Unconfined compression tests were performed in general accordance with ASTM Test Method D 2166-91. The results are presented on "Log of Test Borings", Appendix A.

Unconsolidated Undrained (UU) Triaxial Compression Tests

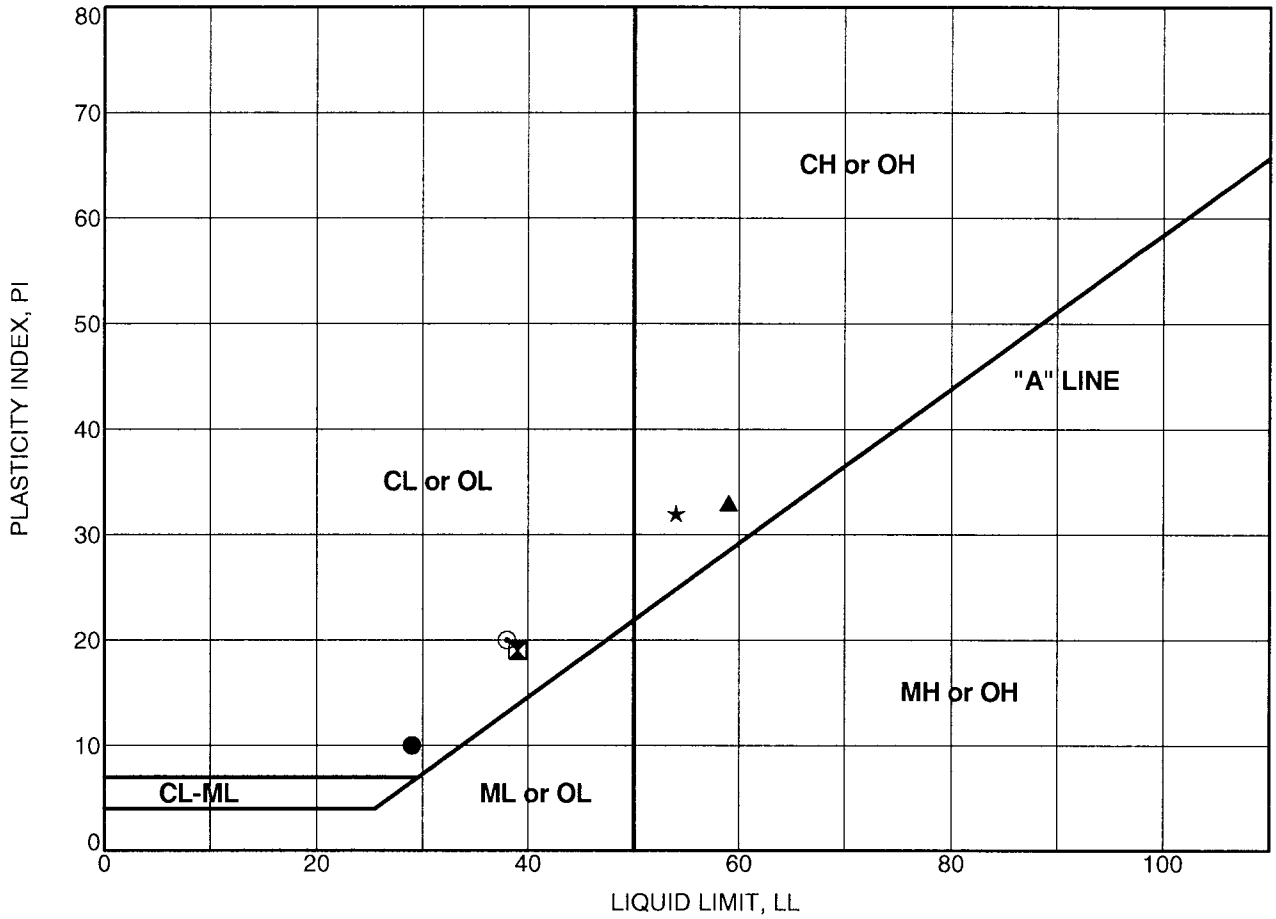
Strength test was performed on selected undisturbed sample using the triaxial cell and the compression machine. UU triaxial test was performed in general accordance with ASTM Test Method D 2850-03a. The result is presented on Plate B-4.

Consolidation Tests

Consolidation tests (California Test Method T219) were performed on selected undisturbed samples. The test results are presented on Plate B-5A through Plate B-5C

Corrosion Tests

Corrosion test was performed on selected sample to determine the corrosion potential of the soils. The pH and minimum resistively test was performed according to California Test Method 643. The test was performed by Sunland Analytical. The test result is presented on Plate B-6.



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
CLO-124	MC-2	3.5	●	20	29	19	10	SANDY LEAN CLAY (CL)
CLO-124	MC-4	13.5	⧗	22	39	20	19	LEAN CLAY WITH SAND (CL)
CLO-124	MC-6	23.5	▲	28	59	26	33	FAT CLAY (CH)
CLO-125	SPT-5	21.0	★	22	54	22	32	FAT CLAY (CH)
CLO-125	MC-8	36.0	⊙	24	38	18	20	LEAN CLAY WITH SAND (CL)

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GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

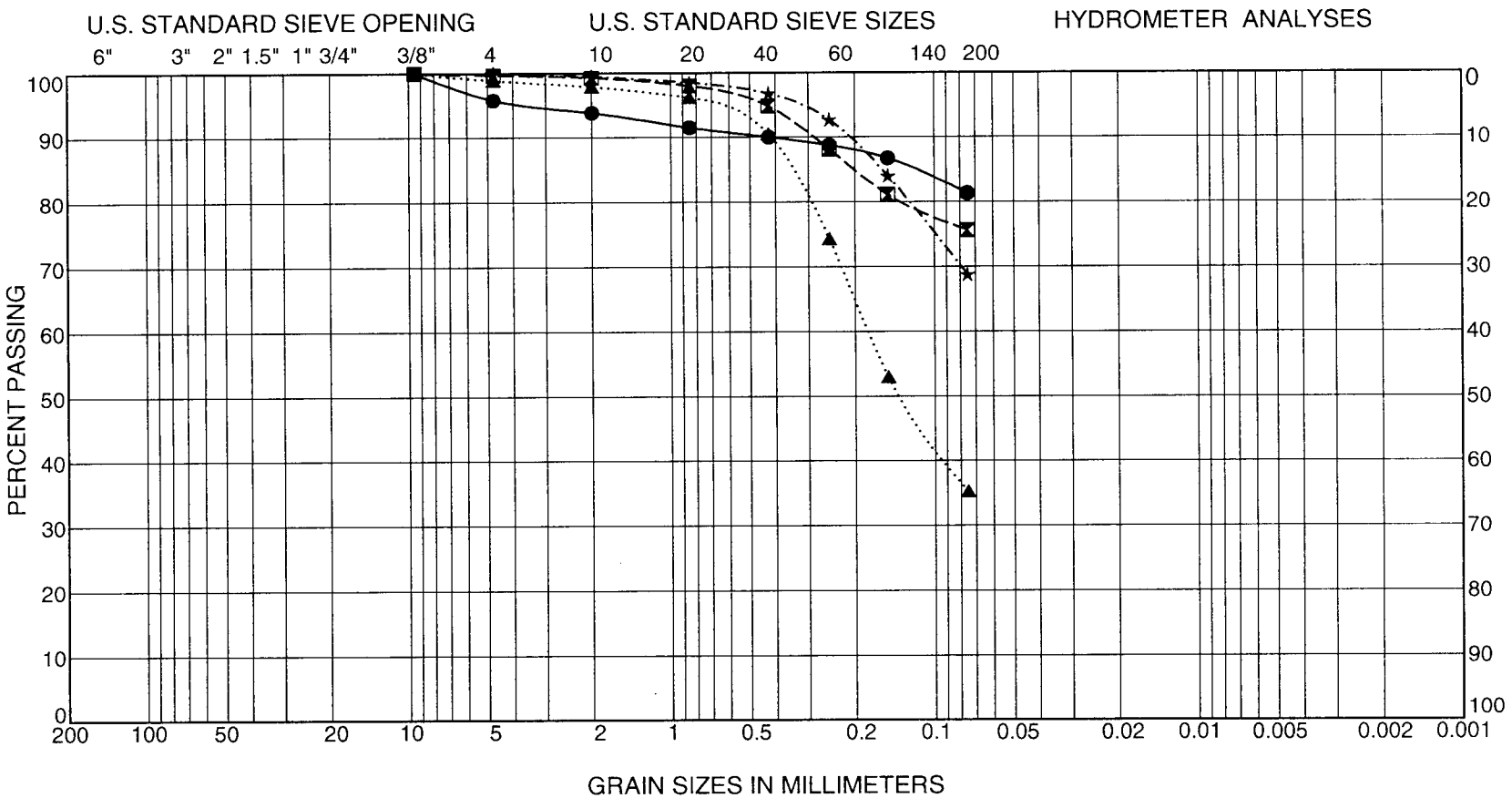
CONTRA LOMA BLVD. UNDERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO: 206118.CLM

PLATE NO: B-2

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
CLO-124	MC-11	48.5	●			SANDY LEAN CLAY (CL)
CLO-124	SPT-15	68.5	⊠			SANDY LEAN CLAY (CL)
CLO-125	MC-2	6.0	▲			SILTY SAND (SM)
CLO-125	MC-4	16.0	★			SANDY LEAN CLAY (CL)

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GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

CONTRA LOMA BLVD. UNDERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO: 206118.CLM

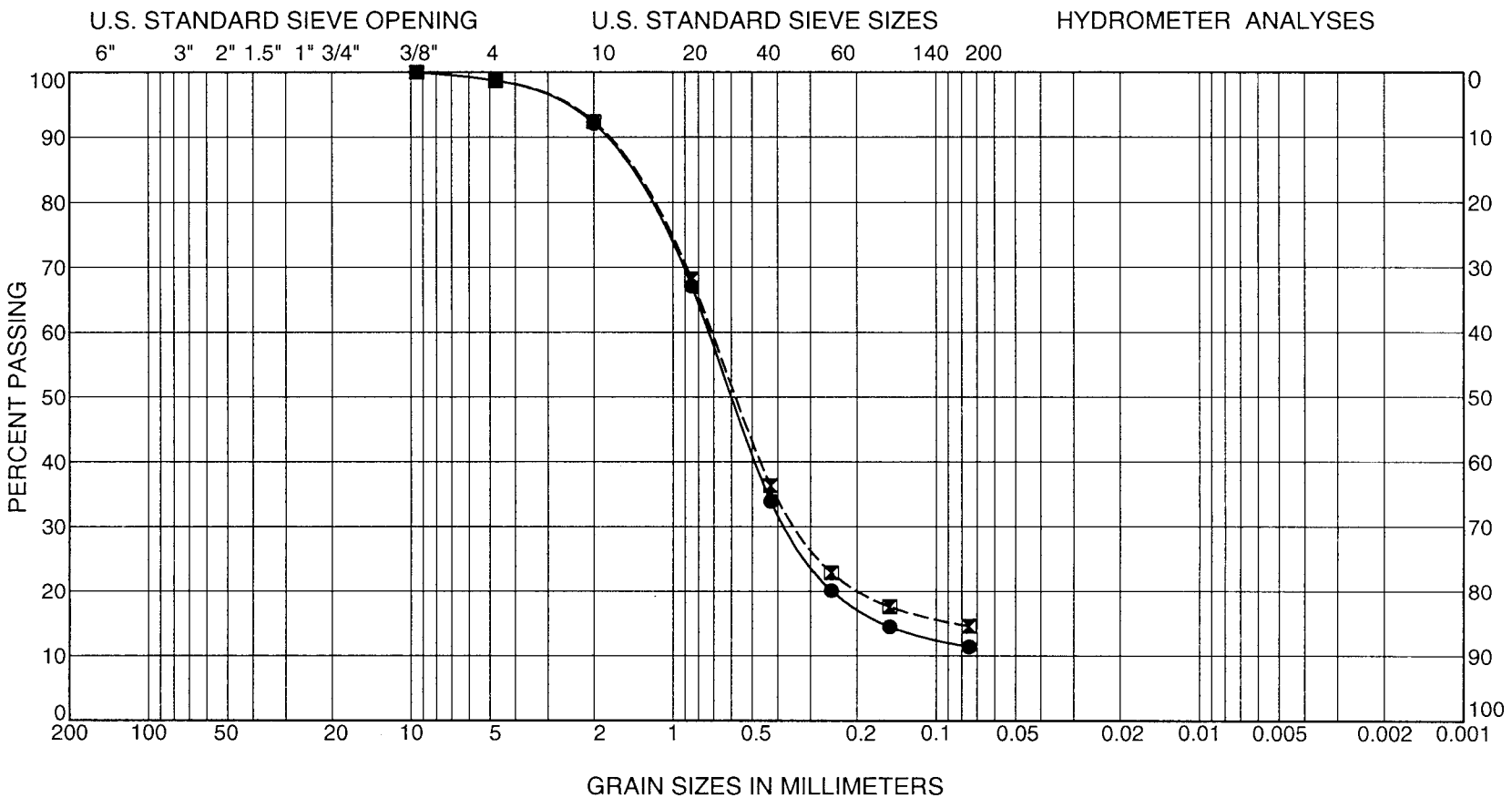
PLATE NO: B-3A

04-2285E4

INFORMATION HANDOUT

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
CLO-125	SPT-12	56.0	●			WELL-GRADED SAND WITH SILT (SW-SM)
CLO-125	SPT-13	60.0	⊠			CLAYEY SAND (SC)

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GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

CONTRA LOMA BLVD. UNDERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

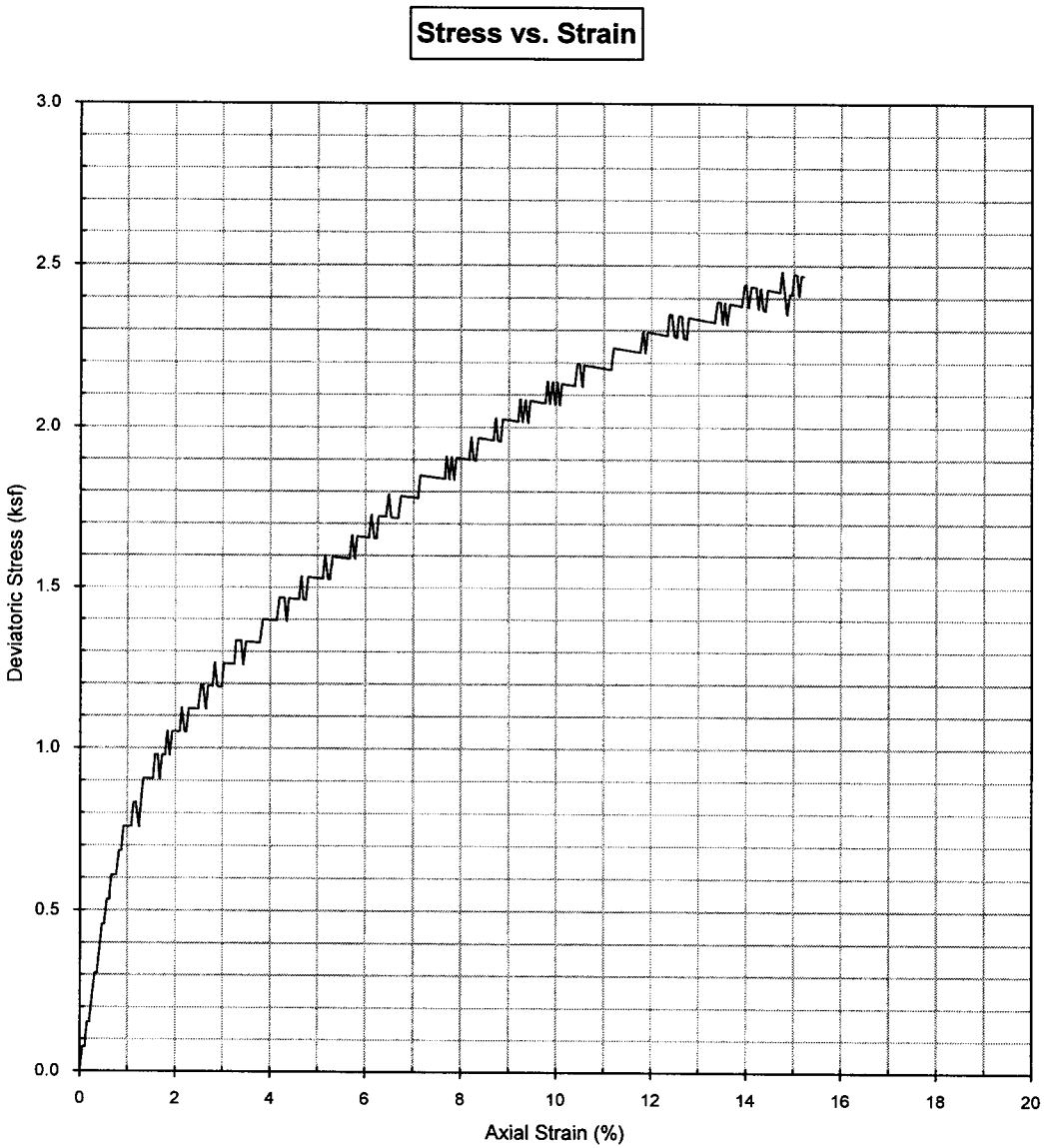
JOB NO: 206118.CLM

PLATE NO: B-3B

04-2285E4

INFORMATION HANDOUT

UNCONSOLIDATED UNDRAINED COMPRESSION TEST



Boring No.	CLO 124
Sample No.	9
Elev. or Depth (ft)	38.5
Soil Description	Sandy lean clay, yellowish brown

Height of Sample (inch)	5
Initial Diameter (inch)	2.416
% Moisture	23
Dry Density (pcf)	103.7
Cell Pressure (ksf)	4.896
Maximum Strength (ksf)	2.48
Strain @ Failure (%)	15.0

Date: 10/26/2006

File Name: clo124-9

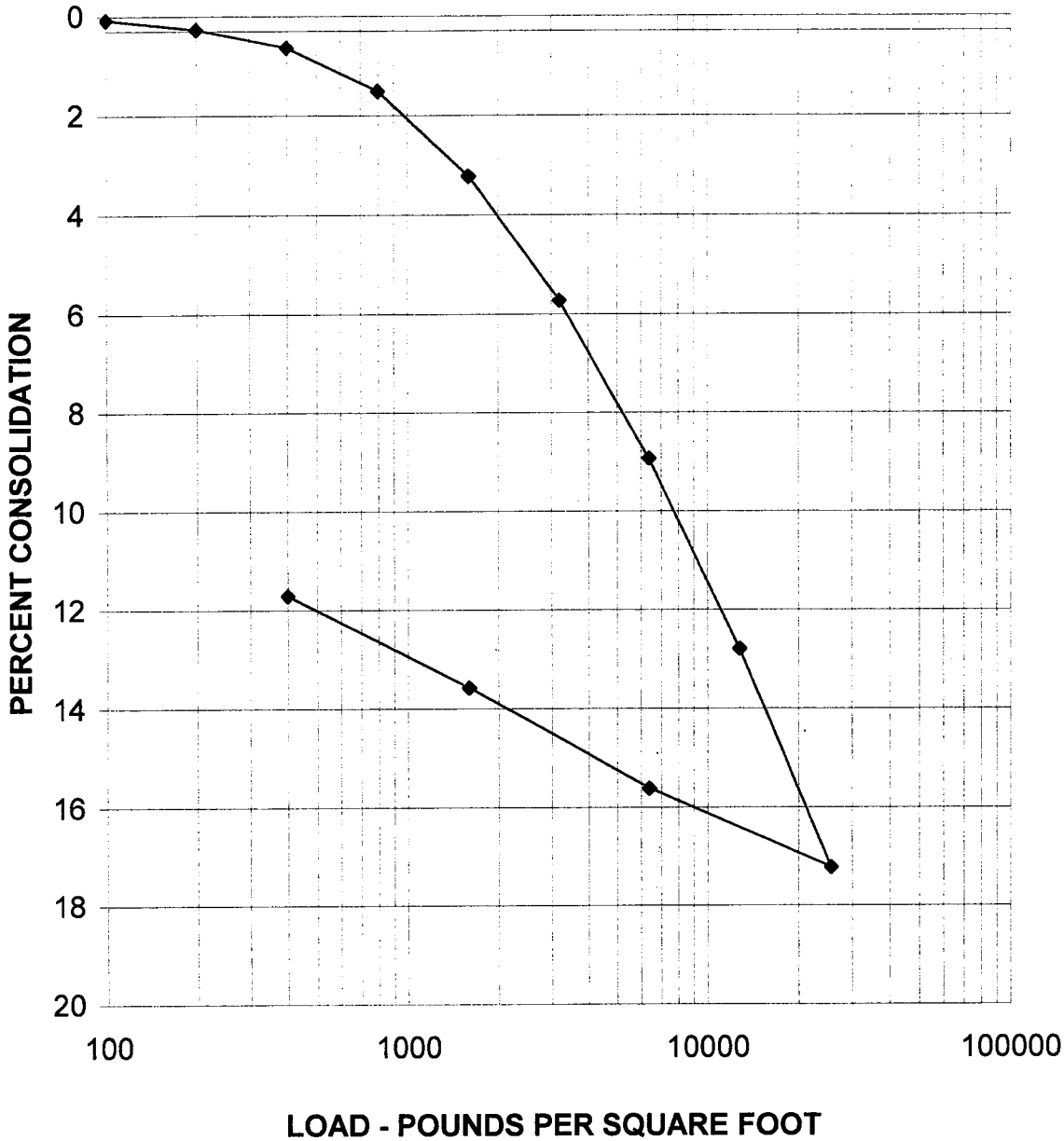
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

CONTRA LOMA BLVD / L STREET BRIDGE

JOB NO.: 206118.CLO

04-2209E4
INFORMATION HANDOUT

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	34.8	86.6	1.0000	2.416
FINAL	29.0	98.1	0.8829	2.416

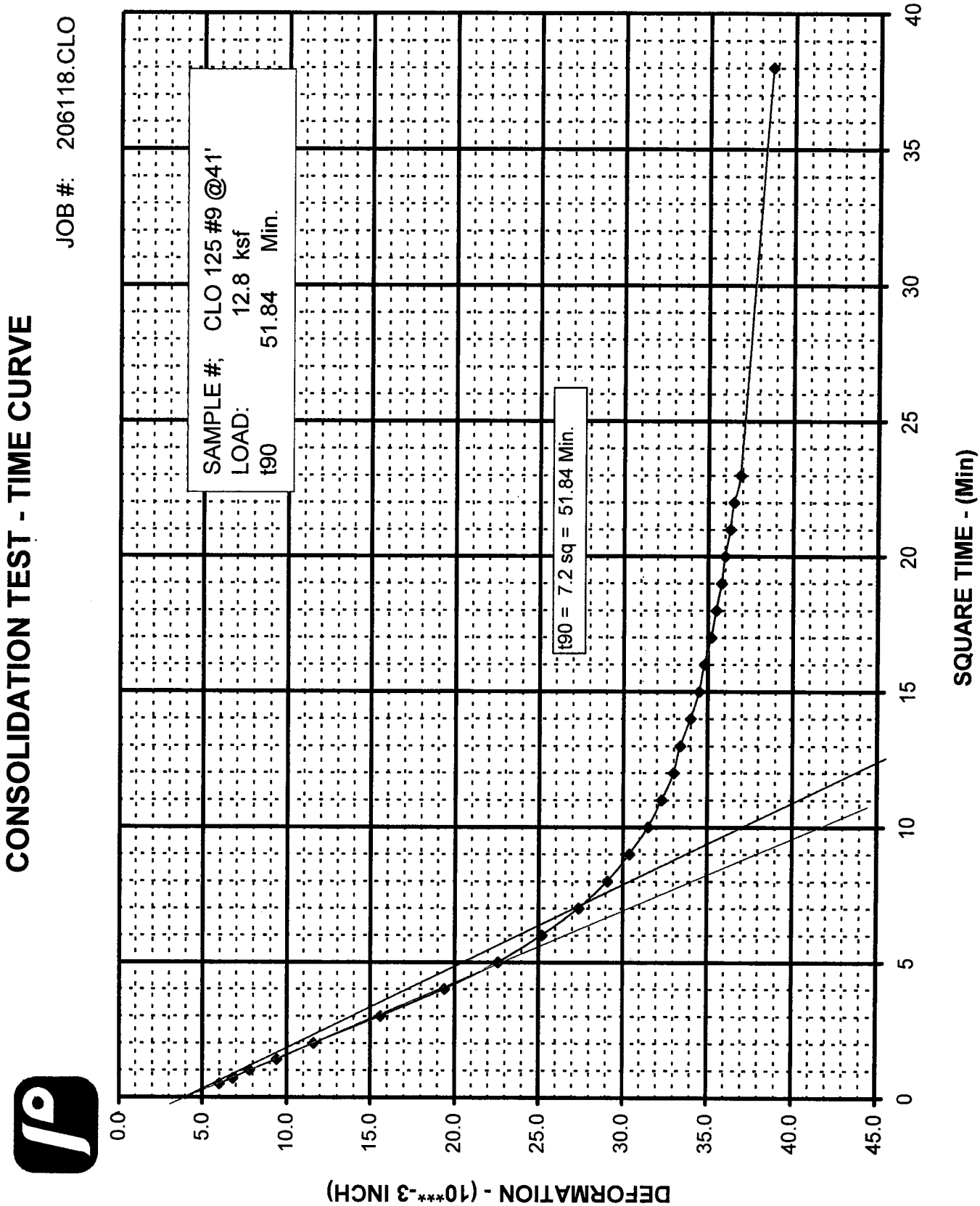
BORING NO.	CLO 125	SAMPLE NO.	9	ELEV. OR DEPTH	41'
DESCRIPTION	Lean clay, yellowish brown				

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

Contra Loma Blvd / L Street Bridge
CCTA / BKF

DATE	JOB NO:
11/02/06	206118.CLO

Reported by: Prav Dayah


CONSOLIDATION TEST - TIME CURVE
JOB #: 206118.CLO
SAMPLE #; CLO 125 #9 @41'
LOAD: 12.8 ksf
t90 51.84 Min.
t90 = 7.2 sq = 51.84 Min.
DEFORMATION - (10***-3 INCH)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
SQUARE TIME - (Min)
0
5
10
15
20
25
30
35
40

CONSOLIDATION TEST - TIME CURVE

JOB #: 206118.CLO

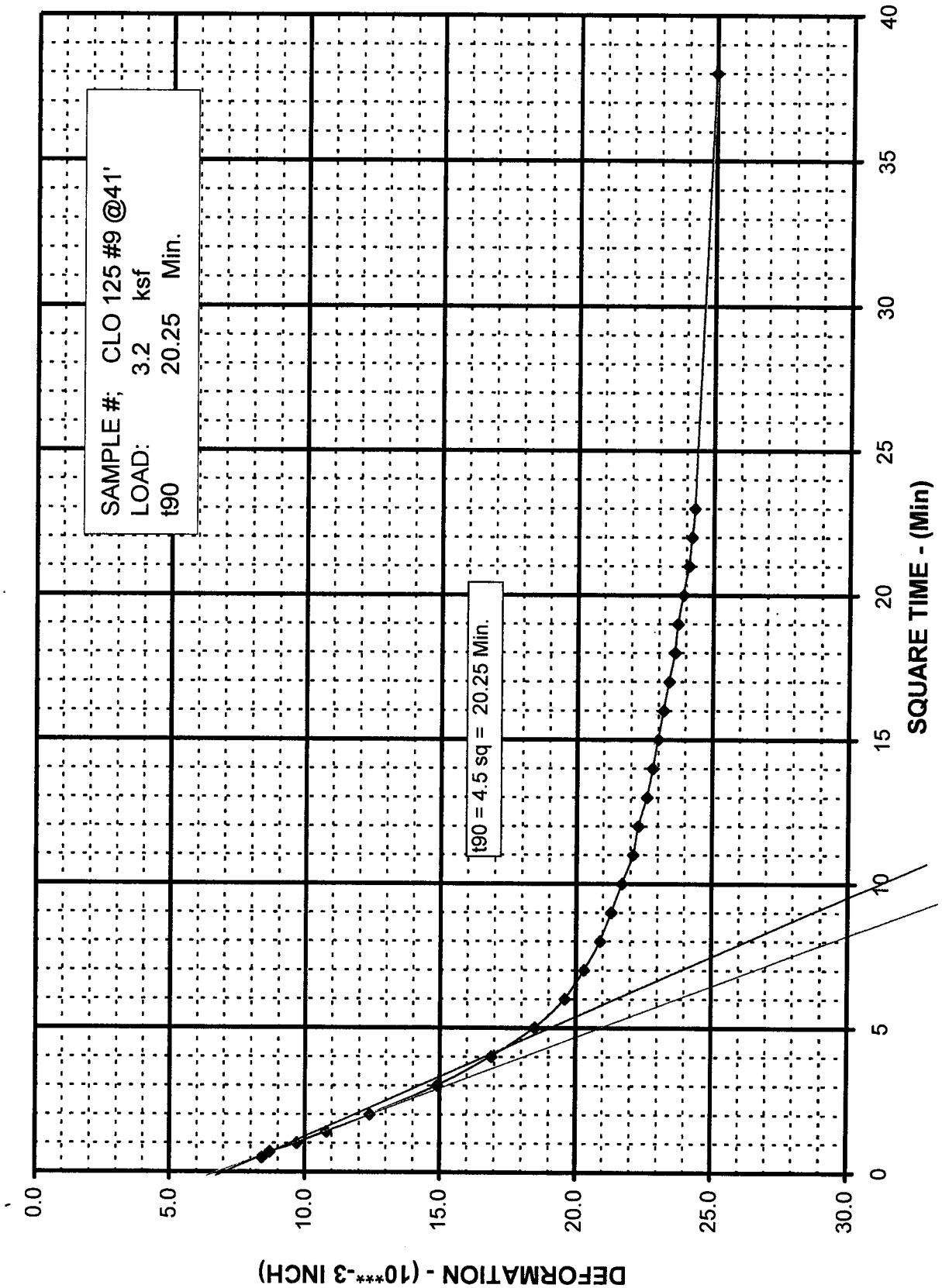


Plate B-5C

04-2285E4

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 11/15/2006
Date Submitted 11/08/2006

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118 CLO/CONTRA LO Site ID : CLO-124#3@8-1/2.
Thank you for your business.

* For future reference to this analysis please use SUN # 49312-98317.

EVALUATION FOR SOIL CORROSION

Soil pH	7.96		
Minimum Resistivity	0.78	ohm-cm (x1000)	
Chloride	22.1 ppm	00.00221	%
Sulfate	108.2 ppm	00.01082	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

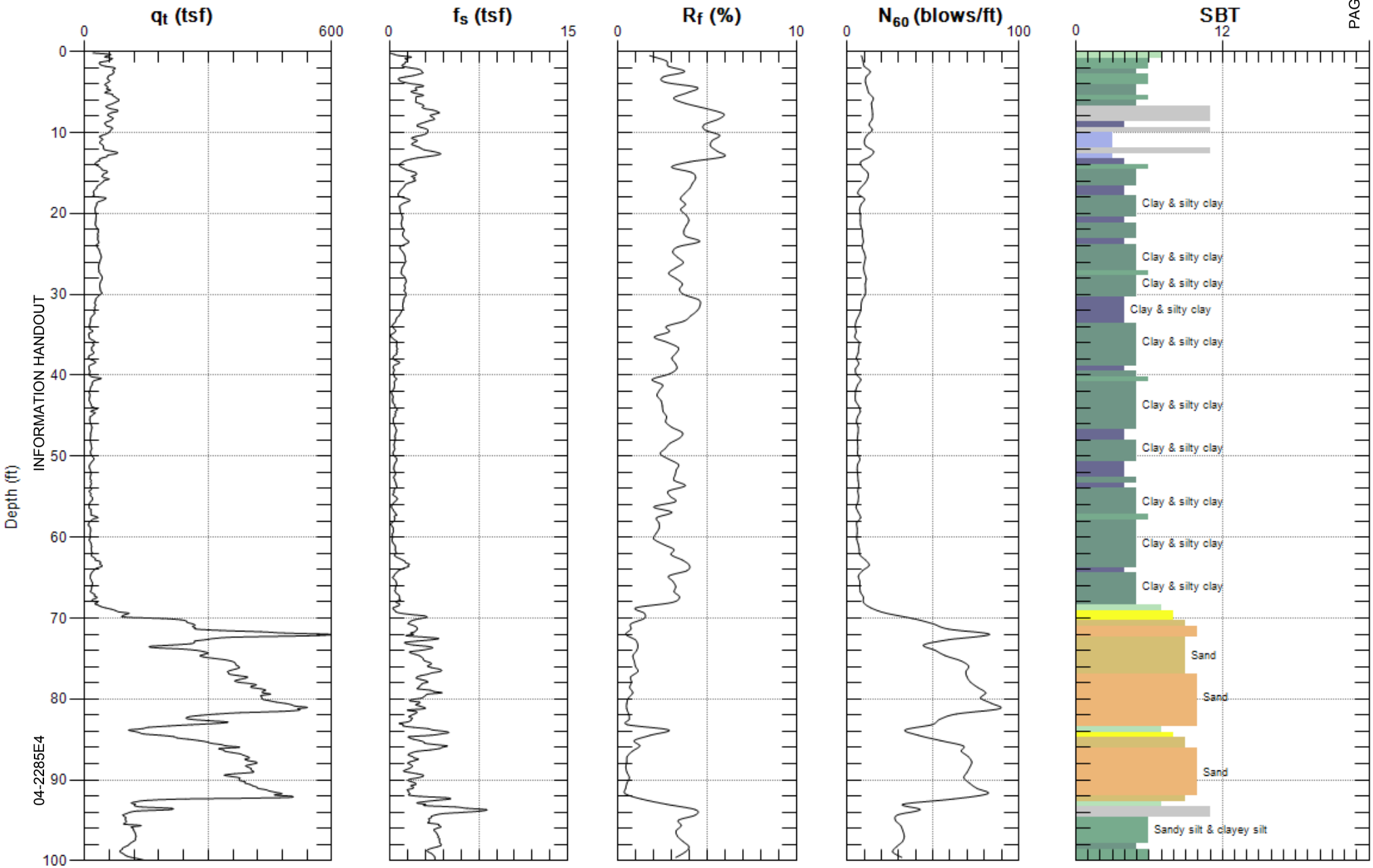
Plate B-6

APPENDIX C

PARIKH CONSULTANTS

Site: HWY 4 EAST
Sounding: CLO-125

Engineer: D.WANG
Date: 10/26/2007 12:31



Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

Plate A-17-2

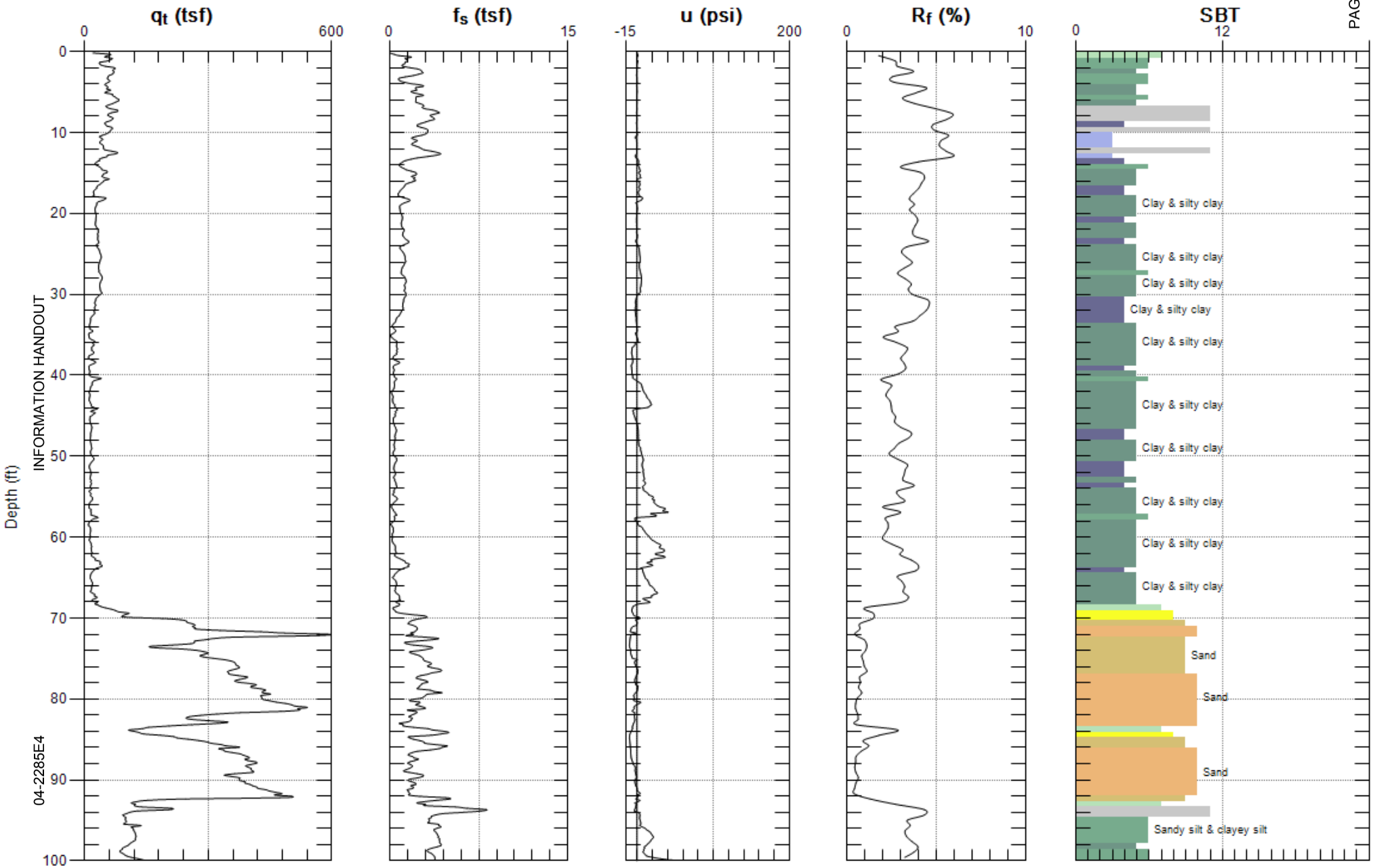
SBT: Soil Behavior Type (Robertson 1990)

INFORMATION HANDOUT
04-2285E4

PARIKH CONSULTANTS

Site: HWY 4 EAST
Sounding: CLO-125

Engineer: D.WANG
Date: 10/26/2007 12:31



Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

Plate A-17-1

SBT: Soil Behavior Type (Robertson 1990)

INFORMATION HANDOUT
04-2285E4

INFORMATION HANDOUT

LIQUEFACTION POTENTIAL ANALYSIS (per Youd & Idriss, 2001)

PROJECT NAME **ROUTE 4**
PROJECT NO. **206118.CLO**
CPT NO. **CLO-125 (CONTRA LOMA)**

FAULT INFO
COAST RANGE - SIERRAN BLOCK BOUNDARY ZONE (CSB)
a_{max} (g)= 0.7

FAULT M_w = 7
MSF = 1.19

Depth (ft)		Soil Behavior Type	CPT RESULT INPUT qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	CSR γ_d	CSR	CRR 2.5 Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	F.S.=(CRR 2.5/CSR)*MSF*Kσ*Kα Kσ	Kα	F.S.
0.492	7	Silty Sand to Sandy Silt	50.956	0.897	0.029		0.029	1.48	1.7	1.00	0.455	1.480	1.70	86.63	1.000	86.625	0.14	1.00	1	
1.148	6	Sandy Silt to Clayey Silt	51.959	1.398	0.067		0.067	1.75	1.7	1.00	0.455	1.750	1.70	88.33	1.072	94.655	0.16	1.00	1	
1.804	6	Sandy Silt to Clayey Silt	54.304	1.525	0.104		0.104	1.83	1.68712	1.00	0.454	1.830	1.69	91.62	1.129	103.452	0.18	1.00	1	
2.461	5	Clayey Silt to Silty Clay	70.023	2.605	0.142		0.142	1.95	1.63934	1.00	0.453	1.950	1.64	114.79	1.240	142.326	0.35	1.00	1	
3.117	6	Sandy Silt to Clayey Silt	59.138	1.491	0.179		0.179	1.88	1.59536	0.99	0.453	1.880	1.60	94.35	1.171	110.439	0.21	1.00	1	
3.773	6	Sandy Silt to Clayey Silt	55.602	1.457	0.217		0.217	1.95	1.55258	0.99	0.452	1.950	1.55	86.33	1.240	107.033	0.19	1.00	1	
4.429	5	Clayey Silt to Silty Clay	55.346	2.444	0.255		0.255	2.18	1.51203	0.99	0.451	2.180	1.51	83.68	1.619	135.499	0.31	1.00	1	
5.085	5	Clayey Silt to Silty Clay	60.381	2.327	0.292		0.292	2.15	1.47453	0.99	0.450	2.150	1.47	89.03	1.553	138.251	0.33	1.00	1	
5.741	6	Sandy Silt to Clayey Silt	76.707	2.379	0.33		0.33	2.04	1.43791	0.99	0.450	2.040	1.44	110.30	1.356	149.551	0.39	1.00	1	
6.398	5	Clayey Silt to Silty Clay	67.772	2.545	0.367		0.367	2.16	1.40396	0.99	0.449	2.160	1.40	95.15	1.574	149.789	0.39	1.00	1	
7.054	11	Sitff Fine-Grained	65.779	3.263	0.41		0.41	2.3	1.36646	0.99	0.448	2.300	1.37	89.88	1.949	175.161		1.00	1	
7.71	11	Sitff Fine-Grained	64.213	3.796	0.453		0.453	2.39	1.33091	0.98	0.448	2.390	1.33	85.46	2.272	194.171		1.00	1	
8.366	11	Sitff Fine-Grained	62.821	3.501	0.496		0.496	2.4	1.29717	0.98	0.447	2.400	1.30	81.49	2.312	188.434		1.00	1	
9.022	4	Silty Clay to Clay	54.816	2.631	0.533		0.533	2.4	1.26947	0.98	0.446	2.400	1.27	69.59	2.312	160.912		1.00	1	
9.678	11	Sitff Fine-Grained	63.562	3.079	0.576		0.576	2.39	1.23874	0.98	0.446	2.390	1.24	78.74	2.272	178.891		1.00	1	
10.335	3	Clay	46.043	2.609	0.613		0.613	2.55	1.21346	0.98	0.445	2.550	1.21	55.87	3.034	169.526		1.00	1	
10.991	3	Clay	39.783	2.089	0.649		0.649	2.58	1.18983	0.98	0.445	2.580	1.19	47.34	3.206	151.778	0.41	1.00	1	
11.647	3	Clay	43.598	2.251	0.686		0.686	2.56	1.16649	0.98	0.444	2.560	1.17	50.86	3.091	157.175	0.44	1.00	1	
12.303	11	Sitff Fine-Grained	63.495	3.515	0.729		0.729	2.5	1.14049	0.97	0.443	2.500	1.14	72.42	2.768	200.477		1.00	1	
12.959	3	Clay	53.034	3.139	0.765		0.765	2.58	1.11959	0.97	0.443	2.580	1.12	59.38	3.206	190.388		1.00	1	
13.615	4	Silty Clay to Clay	30.698	1.229	0.803		0.803	2.64	1.09835	0.97	0.442							1.00	1	
14.272	6	Sandy Silt to Clayey Silt	35.605	1.067	0.84		0.84	2.52	1.07843	0.97	0.441	2.520	1.08	38.40	2.872	110.263	0.20	1.00	1	
14.928	5	Clayey Silt to Silty Clay	48.344	1.989	0.878		0.878	2.53	1.05871	0.97	0.441	2.530	1.06	51.18	2.925	149.696	0.39	1.00	1	
15.584	5	Clayey Silt to Silty Clay	48.344	2.096	0.916		0.916	2.56	1.0397	0.97	0.440	2.560	1.04	50.26	3.091	155.341	0.43	1.00	1	
16.24	5	Clayey Silt to Silty Clay	40.501	1.687	0.953		0.953	2.62	1.02183	0.97	0.439							1.00	1	
16.896	4	Silty Clay to Clay	27.534	1.104	0.991		0.991	2.75	1.00411	0.96	0.439							1.00	1	
17.552	4	Silty Clay to Clay	22.058	0.816	1.028		1.028	2.82	0.98743	0.96	0.438							0.99	1	
18.209	5	Clayey Silt to Silty Clay	39.872	1.39	1.066		1.066	2.6	0.97087	0.96	0.437							0.99	1	
18.865	5	Clayey Silt to Silty Clay	29.789	1.12	1.104		1.104	2.74	0.95486	0.96	0.437							0.98	1	
19.521	5	Clayey Silt to Silty Clay	25.89	0.903	1.141		1.141	2.78	0.93977	0.96	0.436							0.97	1	
20.177	5	Clayey Silt to Silty Clay	27.394	1.037	1.179		1.179	2.79	0.92476	0.96	0.435							0.97	1	
20.833	4	Silty Clay to Clay	27.032	1.069	1.216		1.216	2.82	0.9106	0.95	0.434							0.96	1	
21.49	5	Clayey Silt to Silty Clay	27.617	1.051	1.254		1.254	2.82	0.8965	0.95	0.434							0.96	1	
22.146	5	Clayey Silt to Silty Clay	32.268	1.185	1.292		1.292	2.76	0.88283	0.95	0.433							0.95	1	
22.802	5	Clayey Silt to Silty Clay	32.04	1.207	1.329		1.329	2.78	0.86991	0.95	0.432							0.94	1	
23.458	4	Silty Clay to Clay	32.647	1.486	1.367		1.367	2.84	0.85703	0.95	0.431							0.94	1	
24.114	5	Clayey Silt to Silty Clay	31.099	1.041	1.404		1.404	2.78	0.84485	0.94	0.430							0.93	1	
24.77	5	Clayey Silt to Silty Clay	36.925	1.129	1.442		1.442	2.7	0.8327	0.94	0.429							0.93	1	
25.427	5	Clayey Silt to Silty Clay	39.498	1.318	1.479		1.479	2.71	0.8212	0.94	0.428							0.92	1	
26.083	5	Clayey Silt to Silty Clay	36.034	1.314	1.517		1.517	2.78	0.80972	0.94	0.427							0.92	1	
26.739	5	Clayey Silt to Silty Clay	34.296	1.1	1.555		1.555	2.77	0.79855	0.94	0.426							0.92	1	
27.395	6	Sandy Silt to Clayey Silt	37.593	1.063	1.592		1.592	2.71	0.78797	0.93	0.424							0.91	1	
28.051	5	Clayey Silt to Silty Clay	41.353	1.343	1.63		1.63	2.72	0.77739	0.93	0.423							0.91	1	
28.707	5	Clayey Silt to Silty Clay	37.454	1.346	1.667		1.667	2.79	0.76735	0.93	0.422							0.90	1	
29.364	5	Clayey Silt to Silty Clay	38.2	1.308	1.705		1.705	2.78	0.75731	0.92	0.420							0.90	1	
30.02	5	Clayey Silt to Silty Clay	37.042	1.363	1.743		1.743	2.82	0.74754	0.92	0.419							0.89	1	
30.676	4	Silty Clay to Clay	27.127	1.223	1.78		1.78	3	0.73826	0.92	0.417							0.89	1	
31.332	4	Silty Clay to Clay	25.133	1.149	1.818		1.818	3.04	0.72896	0.91	0.416							0.89	1	
31.988	4	Silty Clay to Clay	24.186	1.068	1.855		1.855	3.05	0.72013	0.91	0.414							0.88	1	
32.644	4	Silty Clay to Clay	19.323	0.783	1.893		1.893	3.13	0.71128	0.91	0.412							0.88	1	
33.301	4	Silty Clay to Clay	13.976	0.514	1.931		1.931	3.25	0.70265	0.90	0.410							0.88	1	
33.957	5	Clayey Silt to Silty Clay	12.322	0.332	1.968		1.968	3.25	0.69444	0.90	0.408							0.87	1	
34.613	5	Clayey Silt to Silty Clay	14.505	0.413	2.006		2.006	3.19	0.68621	0.89	0.406							0.87	1	
35.269	5	Clayey Silt to Silty Clay	12.192	0.246	2.043		2.043	3.2	0.67838	0.89	0.404							0.87	1	
35.925	5	Clayey Silt to Silty Clay	21.713	0.598	2.081		2.081	3.02	0.67053	0.88	0.402							0.86	1	
36.581	5	Clayey Silt to Silty Clay	19.067	0.638	2.119		2.119	3.14	0.66285	0.88	0.400							0.86	1	
37.238	5	Clayey Silt to Silty Clay	18.315	0.59	2.156		2.156	3.15	0.65554	0.87	0.398							0.86	1	
37.894	5	Clayey Silt to Silty Clay	14.093	0.42	2.194		2.194	3.26	0.6482	0.87	0.395							0.85	1	
38.55	5	Clayey Silt to Silty Clay	19.607	0.624	2.231		2.231	3.13	0.64121	0.86	0.393							0.85	1	
39.206	4	Silty Clay to Clay	11.419	0.37	2.269		2.269	3.4	0.63419	0.86	0.390							0.85	1	
39.862	5	Clayey Silt to Silty Clay	13.519	0.379	2.307		2.307	3.29	0.62732	0.85	0.388							0.85	1	
40.518	6	Sandy Silt to Clayey Silt	26.614	0.502	2.344		2.344	2.9	0.62077	0.85	0.385							0.84	1	
41.175	5	Clayey Silt to Silty Clay	17.084	0.426	2.382		2.382	3.16	0.61418	0.84	0.382							0.84	1	
41.831	5	Clayey Silt to Silty Clay	12.617	0.295	2.419		2.419	3.3	0.6079	0.83	0.380							0.84	1	
42.487	5	Clayey Silt to Silty Clay	11.965	0.264	2.457		2.457	3.32	0.60159	0.83	0.377							0.84	1	
43.143	5	Clayey Silt to Silty Clay	12.104	0.297	2.495		2.495	3.34	0.5954	0.82	0.374							0.83	1	
43.799	5	Clayey Silt to Silty Clay	19.674	0.49	2.532		2.532	3.12	0.5895	0.82	0.371							0.83	1	
44.455	5	Clayey Silt to Silty Clay	23.016	0.576	2.57		2.57	3.07	0.58355	0.81	0.368							0.83	1	
45.112	5	Clayey Silt to Silty Clay	15.898	0.429	2.607		2.607	3.26	0.57788	0.80	0.365							0.83	1	
45.768	5	Clayey Silt to Silty Clay	13.653	0.363	2.645		2.645	3.34	0.57217	0.80	0.362							0.82	1	
46.424	5	Clayey Silt to Silty Clay	17.017	0.511	2.682		2.682	3.26	0.56672	0.79	0.359							0.82	1	
47.08	4	Silty Clay to Clay	15.368	0.553	2.72		2.72	3.36	0.56122	0.78	0.356							0.82	1	
47.736	4	Silty Clay to Clay	14.143	0.487	2.758		2.758	3.4	0.55584	0.78	0.353							0.82	1	
48.392	5	Clayey Silt to Silty Clay	14.989	0.435	2.795		2.795	3.34	0.55069	0.77	0.350							0.81	1	
49.049	5	Clayey Silt to Silty Clay	16.198	0.428	2.833		2.833	3.28	0.5455	0.76	0.347							0.81	1	
49.705	5	Clayey Silt to Silty Clay	15.647	0.369	2.87		2.87	3.28	0.54054	0.76	0.344							0.81	1	
50.361	5	Clayey Silt to Silty Clay	20.37	0.58	2.908		2.908	3.2	0.53554	0.75	0.341							0.81	1	
51.017	4	Silty Clay to Clay	13.725	0.465	2.946		2.946	3.44	0.53063	0.74	0.338							0.81	1	
51.673	4	Silty Clay to Clay	13.274	0.435	2.983		2.983	3.46	0.52594	0.74	0.335							0.80	1	
52.329	4	Silty Clay to Clay	14.444	0.463	3.021		3.021	3.42	0.5212	0.73	0.332							0.80	1	
52.986	5	Clayey Silt to Silty Clay	14.873	0.47	3.058		3.058	3.4	0.51667	0.72	0.329							0.80	1	
53.642	4	Silty Clay to Clay	15.418	0.582	3.096		3.096	3.43	0.5121	0.72	0.326							0.80	1	
54.298	5	Clayey Silt to Silty Clay	14.343	0.408	3.134		3.134	3.41	0.50761	0.71	0.323							0.80	1	
54.954	5	Clayey Silt to Silty Clay	16.438	0.486	3.171		3.171	3.35	0.50332	0.70	0.320							0.79	1	
55.61	5	Clayey Silt to Silty Clay	14.683	0.48	3.209		3.209	3.43	0.49898	0.70	0.317							0.79	1	
56.266	5	Clayey Silt to Silty Clay	11.492	0.238	3.246		3.246	3.46	0.49483	0.69	0.315							0.79	1	
56.923	5	Clayey Silt to Silty Clay	15.079	0.465	3.284		3.284	3.41	0.49063	0.69	0.312							0.79	1	
57.579	6	Sandy Silt to Clayey Silt	22.225	0.483	3.322		3.322	3.16	0.48651	0.68	0.309							0.79	1	
58.235	5	Clayey Silt to Silty Clay	11.709	0.268	3.359		3.359	3.53	0.48256	0.67	0.307							0.78	1	
58.891	5	Clayey Silt to Silty Clay	13.057	0.301	3.397		3.397	3.46	0.47857	0.67	0.304							0.78	1	
59.547	5	Clayey Silt to Silty Clay	13.664	0.294	3.434		3.434	3.42	0.47475	0.66	0.302							0.78	1	
60.203	5	Clayey Silt to Silty Clay	12.6	0.255	3.472		3.472	3.46	0.47089	0.66	0.299							0.78	1	
60.86	5	Clayey Silt to Silty Clay	15.251	0.391	3.51		3.51	3.4	0.46709	0.65	0.297							0.78	1	
61.516	5	Clayey Silt to Silty Clay	16.449	0.526	3.547	0.006	3.541	3.42	0.46404	0.65	0.295							0.78	1	
62.172	5	Clayey Silt to Silty Clay	18.031	0.546	3.585	0.027	3.558	3.36	0.46238	0.64	0.294							0.78	1	

INFORMATION HANDOUT

LIQUEFACTION POTENTIAL ANALYSIS (per Youd & Idriss, 2001)

PROJECT NAME **ROUTE 4**
PROJECT NO. **206118.CLO**
CPT NO. **CLO-125 (CONTRA LOMA)**

FAULT INFO
COAST RANGE - SIERRAN BLOCK BOUNDARY ZONE (CSB)
a_{max} (g)= 0.7

FAULT M_w = 7
MSF = 1.19

Depth (ft)		Soil Behavior Type	CPT RESULT INPUT qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	CSR γ_d	CSR	$CRR_{7.5}$ Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	F.S.=(CRR 7.5/CSR)*MSF*Kσ*Kα Kσ	Kα	F.S.
62.828	5	Clayey Silt to Silty Clay	29.689	1.077	3.622	0.047	3.575	3.18	0.46073	0.64	0.294							0.78	1	
63.484	5	Clayey Silt to Silty Clay	37.476	1.5	3.66	0.068	3.592	3.11	0.4591	0.63	0.293							0.77	1	
64.14	4	Silty Clay to Clay	22.058	0.852	3.698	0.088	3.609	3.34	0.45748	0.63	0.293							0.77	1	
64.797	5	Clayey Silt to Silty Clay	14.215	0.406	3.735	0.109	3.627	3.5	0.45577	0.62	0.292							0.77	1	
65.453	5	Clayey Silt to Silty Clay	16.989	0.526	3.773	0.129	3.644	3.42	0.45417	0.62	0.292							0.77	1	
66.109	5	Clayey Silt to Silty Clay	17.307	0.567	3.81	0.15	3.661	3.43	0.45258	0.61	0.291							0.77	1	
66.765	5	Clayey Silt to Silty Clay	17.925	0.571	3.848	0.17	3.678	3.4	0.451	0.61	0.291							0.77	1	
67.421	5	Clayey Silt to Silty Clay	24.531	0.849	3.885	0.19	3.695	3.28	0.44944	0.61	0.290							0.77	1	
68.077	5	Clayey Silt to Silty Clay	25.679	0.771	3.923	0.211	3.712	3.23	0.44788	0.60	0.290							0.77	1	
68.734	7	Silty Sand to Sandy Silt	52.588	0.52	3.962	0.231	3.73	2.67	0.44625	0.60	0.289							0.77	1	
69.39	8	Sand to Silty Sand	91.658	1.337	4.001	0.252	3.749	2.53	0.44453	0.60	0.289	2.530	0.44	40.75	2.925	119.170	0.24	0.77	1	0.82
70.046	8	Sand to Silty Sand	172.208	2.523	4.041	0.272	3.769	2.29	0.44275	0.59	0.289	2.290	0.44	76.24	1.917	146.164	0.37	0.75	1	1.28
70.702	9	Sand	257.71	1.835	4.082	0.293	3.789	1.97	0.44097	0.59	0.288	1.970	0.44	113.64	1.263	143.499	0.35	0.68	1	1.23
71.358	10	Gravelly Sand to Sand	311.802	2.256	4.124	0.313	3.81	1.9	0.43912	0.58	0.288	1.900	0.44	136.92	1.189	162.775		0.66	1	
72.014	10	Gravelly Sand to Sand	484.946	2.075	4.165	0.334	3.832	1.62	0.4372	0.58	0.288	1.620	0.44	212.02	1.000	212.019		0.58	1	
72.671	9	Sand	302.751	2.887	4.206	0.354	3.852	1.99	0.43547	0.58	0.287	1.990	0.44	131.84	1.287	169.698		0.66	1	
73.327	9	Sand	213.595	2.341	4.247	0.375	3.872	2.15	0.43375	0.58	0.287	2.150	0.43	92.65	1.553	143.862	0.36	0.72	1	1.24
73.983	9	Sand	253.661	2.631	4.288	0.395	3.892	2.08	0.43205	0.57	0.287	2.080	0.43	109.59	1.420	155.585	0.43	0.69	1	1.50
74.639	9	Sand	294.936	2.412	4.328	0.416	3.913	1.96	0.43028	0.57	0.286	1.960	0.43	126.90	1.251	158.770	0.45	0.66	1	1.58
75.295	9	Sand	347.084	3.121	4.369	0.436	3.933	1.93	0.4286	0.57	0.286	1.930	0.43	148.76	1.218	181.259		0.64	1	
75.951	9	Sand	370.2	3.555	4.41	0.457	3.953	1.93	0.42694	0.56	0.286	1.930	0.43	158.05	1.218	192.580		0.63	1	
76.608	9	Sand	354.314	3.907	4.45	0.477	3.973	1.98	0.42529	0.56	0.286	1.980	0.43	150.68	1.275	192.083		0.64	1	
77.264	10	Gravelly Sand to Sand	376.951	2.637	4.492	0.498	3.995	1.84	0.42348	0.56	0.286	1.840	0.42	159.63	1.137	181.508		0.62	1	
77.92	10	Gravelly Sand to Sand	386.694	2.883	4.534	0.518	4.016	1.85	0.42178	0.56	0.286	1.850	0.42	163.10	1.145	186.762		0.61	1	
78.576	10	Gravelly Sand to Sand	419.006	2.7	4.576	0.539	4.037	1.79	0.42009	0.55	0.285	1.790	0.42	176.02	1.099	193.523		0.60	1	
79.232	10	Gravelly Sand to Sand	437.015	3.58	4.618	0.559	4.059	1.84	0.41833	0.55	0.285	1.840	0.42	182.82	1.137	207.868		0.60	1	
79.888	10	Gravelly Sand to Sand	434.241	2.473	4.659	0.579	4.08	1.75	0.41667	0.55	0.285	1.750	0.42	180.93	1.072	193.888		0.59	1	
80.545	10	Gravelly Sand to Sand	483.153	2.306	4.701	0.6	4.101	1.67	0.41502	0.55	0.285	1.670	0.42	200.52	1.017	204.000		0.57	1	
81.201	10	Gravelly Sand to Sand	513.315	2.439	4.743	0.62	4.122	1.65	0.41338	0.54	0.285	1.650	0.41	212.19	1.003	212.901		0.57	1	
81.857	10	Gravelly Sand to Sand	342.127	2.024	4.785	0.641	4.144	1.85	0.41168	0.54	0.285	1.850	0.41	140.85	1.145	161.280		0.63	1	
82.513	10	Gravelly Sand to Sand	281.484	1.749	4.826	0.661	4.165	1.94	0.41007	0.54	0.285	1.940	0.41	115.43	1.229	141.858	0.35	0.66	1	1.21
83.169	10	Gravelly Sand to Sand	258.073	1.351	4.868	0.682	4.186	1.94	0.40847	0.54	0.285	1.940	0.41	105.41	1.229	129.553	0.28	0.67	1	0.99
83.825	7	Silty Sand to Sandy Silt	131.379	3.711	4.907	0.702	4.204	2.61	0.40711	0.54	0.285							0.75	1	
84.482	8	Sand to Silty Sand	180.647	3.255	4.946	0.723	4.224	2.38	0.4056	0.53	0.284	2.380	0.41	73.27	2.233	163.584		0.74	1	
85.138	9	Sand	272.059	2.447	4.987	0.743	4.244	2.05	0.40411	0.53	0.284	2.050	0.40	109.94	1.371	150.738	0.40	0.67	1	1.40
85.794	9	Sand	337.436	4.078	5.028	0.764	4.264	2.05	0.40264	0.53	0.284	2.050	0.40	135.86	1.371	186.276		0.64	1	
86.45	10	Gravelly Sand to Sand	348.143	2.735	5.07	0.784	4.285	1.93	0.40109	0.53	0.284	1.930	0.40	139.64	1.218	170.144		0.63	1	
87.106	10	Gravelly Sand to Sand	389.501	1.945	5.111	0.805	4.307	1.78	0.39949	0.53	0.284	1.780	0.40	155.60	1.092	169.971		0.60	1	
87.762	10	Gravelly Sand to Sand	404.251	1.928	5.153	0.825	4.328	1.76	0.39797	0.52	0.284	1.760	0.40	160.88	1.078	173.501		0.59	1	
88.419	10	Gravelly Sand to Sand	400.006	1.736	5.195	0.846	4.349	1.74	0.39647	0.52	0.284	1.740	0.40	158.59	1.065	168.868		0.59	1	
89.075	10	Gravelly Sand to Sand	384.694	1.899	5.237	0.866	4.371	1.79	0.3949	0.52	0.284	1.790	0.39	151.92	1.099	167.023		0.60	1	
89.731	10	Gravelly Sand to Sand	364.686	2.281	5.279	0.887	4.392	1.86	0.39342	0.52	0.284	1.860	0.39	143.47	1.153	165.475		0.61	1	
90.387	10	Gravelly Sand to Sand	392.715	1.934	5.32	0.907	4.413	1.78	0.39195	0.52	0.284	1.780	0.39	153.92	1.092	168.138		0.60	1	
91.043	10	Gravelly Sand to Sand	427.083	1.785	5.362	0.928	4.435	1.72	0.39042	0.52	0.284	1.720	0.39	166.74	1.051	175.299		0.58	1	
91.699	10	Gravelly Sand to Sand	471.394	1.838	5.404	0.948	4.456	1.66	0.38897	0.52	0.284	1.660	0.39	183.36	1.010	185.265		0.56	1	
92.356	9	Sand	300.74	3.872	5.445	0.968	4.476	2.12	0.3876	0.51	0.284	2.120	0.39	116.57	1.492	173.935		0.66	1	
93.012	7	Silty Sand to Sandy Silt	124.689	3.373	5.483	0.989	4.494	2.64	0.38637	0.51	0.284							0.74	1	
93.668	11	Stiff Fine-Grained	158.706	6.835	5.526	1.009	4.517	2.69	0.38482	0.51	0.284							0.74	1	
94.324	11	Stiff Fine-Grained	100.369	4.35	5.569	1.03	4.539	2.86	0.38334	0.51	0.284							0.74	1	
94.98	6	Sandy Silt to Clayey Silt	99.74	3.362	5.606	1.05	4.556	2.79	0.38221	0.51	0.285							0.74	1	
95.636	6	Sandy Silt to Clayey Silt	112.496	3.976	5.644	1.071	4.573	2.76	0.38108	0.51	0.285							0.74	1	
96.293	6	Sandy Silt to Clayey Silt	119.871	3.891	5.682	1.091	4.59	2.71	0.37997	0.51	0.285							0.74	1	
96.949	6	Sandy Silt to Clayey Silt	123.514	4.095	5.719	1.112	4.607	2.71	0.37885	0.50	0.285							0.74	1	
97.605	6	Sandy Silt to Clayey Silt	116.813	4.243	5.757	1.132	4.625	2.76	0.37768	0.50	0.285							0.74	1	
98.261	5	Clayey Silt to Silty Clay	98.843	3.918	5.794	1.153	4.642	2.85	0.37658	0.50	0.285							0.74	1	
98.917	6	Sandy Silt to Clayey Silt	90.393	3.383	5.832	1.173	4.659	2.86	0.37549	0.50	0.285							0.74	1	
99.573	6	Sandy Silt to Clayey Silt	117.052	3.784	5.87	1.194	4.676	2.73	0.3744	0.50	0.285							0.73	1	

APPENDIX D

Attenuation Relationships for Shallow Crustal Earthquakes (Sadigh, et al, 1997)

Fault = Vaca fault zone (RLSS Fault, Map NO: 14)

Mmax = 6.9 **Rrup = 6.5** **km**

M>=6.5 *ROCK SITE:*

C1 = -1.274 C2 = 1.1 C3 = 0 C4 = -2.1

C5 = -0.48451 C6 = 0.524 C7 = 0

A=C1+C2M+C3(8.5M)^2.5= 6.316

B=C4*Ln(Rrup+exp(C5+C6M))= -7.100

C=C7*Ln(Rrup+2)= 0

Ln(y) = A+B+C = -0.784

y = Exp(Ln(y)) = 0.46 **Peak Bed Rock Acceleration PBA = 0.460**

Fault = Great valley fault 5 (Reverse Fault, Map No: 24)

Mmax = 6.5 **Rrup = 9.8** **km**

A= 5.876

B= -7.025

C= 0

Ln(y) = -1.149

y = 0.32 **Peak Bed Rock Acceleration PBA = 0.32g x 1.2 = 0.38g**

Fault = Greenville fault zone (Clayton section, RLSS Fault, Map No: 351)

Mmax = 6.6 **Rrup = 7.1** **km**

A= 5.986

B= -6.895

C= 0

Ln(y) = -0.909

y = 0.40 **Peak Bed Rock Acceleration PBA = 0.4g**

Fault = Concord fault zone (Ygnacio valley section, RLSS Fault, Map No: 341)

Mmax = 6.6 **Rrup = 18.2** **km**

A= 5.986

B= -7.626

C= 0

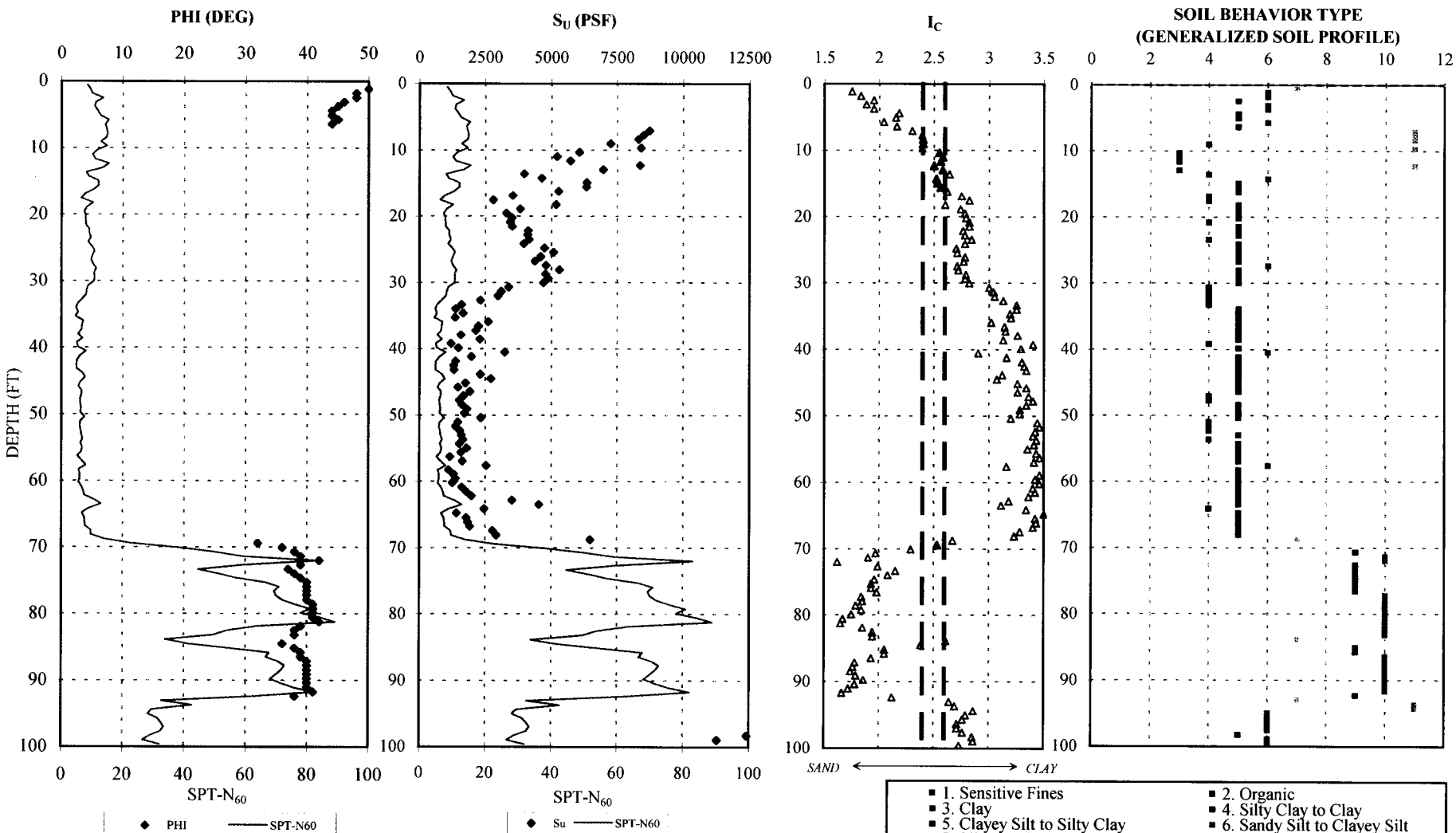
Ln(y) = -1.640

y = 0.19 **Peak Bed Rock Acceleration PBA = 0.19g**

LIQUEFACTION ANALYSES

CPT DATA CORRELATION

CLO-125



Reference: CPT data and correlation provided by Gregg Drilling and Testing, Inc.

PARIKH

Practicing in the Geosciences

ROUTE 4 - CONTRA LOMA BLVD. UNDERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.: 206118.CLM

PLATE NO.:

LIQUEFACTION POTENTIAL ANALYSIS (per Youd & Idriss, 2001)

PROJECT NAME **ROUTE 4**
PROJECT NO. **206118.CLO**
CPT NO. **CLO-125 (CONTRA LOMA)**

FAULT INFO
COAST RANGE - SIERRAN BLOCK BOUNDARY ZONE (CSB)
a_{max} *(g)=* 0.7

FAULT M_w = 7
MSF = 1.19

Depth (ft)		Soil Behavior Type	CPT RESULT INPUT qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	CSR γ_d	CSR	CRR 7.5 Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	F.S.=(CRR 7.5/CSR)*MSF*Kσ*Kα Kσ	Kα	F.S.
0.492	7	Silty Sand to Sandy Silt	50.956	0.897	0.029		0.029	1.48	1.7	1.00	0.455	1.480	1.70	86.63	1.000	86.625	0.14	1.00	1	
1.148	6	Sandy Silt to Clayey Silt	51.959	1.398	0.067		0.067	1.75	1.7	1.00	0.455	1.750	1.70	88.33	1.072	94.655	0.16	1.00	1	
1.804	6	Sandy Silt to Clayey Silt	54.304	1.525	0.104		0.104	1.83	1.68712	1.00	0.454	1.830	1.69	91.62	1.129	103.452	0.18	1.00	1	
2.461	5	Clayey Silt to Silty Clay	70.023	2.605	0.142		0.142	1.95	1.63934	1.00	0.453	1.950	1.64	114.79	1.240	142.326	0.35	1.00	1	
3.117	6	Sandy Silt to Clayey Silt	59.138	1.491	0.179		0.179	1.88	1.59536	0.99	0.453	1.880	1.60	94.35	1.171	110.439	0.21	1.00	1	
3.773	6	Sandy Silt to Clayey Silt	55.602	1.457	0.217		0.217	1.95	1.55258	0.99	0.452	1.950	1.55	86.33	1.240	107.033	0.19	1.00	1	
4.429	5	Clayey Silt to Silty Clay	55.346	2.444	0.255		0.255	2.18	1.51203	0.99	0.451	2.180	1.51	83.68	1.619	135.499	0.31	1.00	1	
5.085	5	Clayey Silt to Silty Clay	60.381	2.327	0.292		0.292	2.15	1.47453	0.99	0.450	2.150	1.47	89.03	1.553	138.251	0.33	1.00	1	
5.741	6	Sandy Silt to Clayey Silt	76.707	2.379	0.33		0.33	2.04	1.43791	0.99	0.450	2.040	1.44	110.30	1.356	149.551	0.39	1.00	1	
6.398	5	Clayey Silt to Silty Clay	67.772	2.545	0.367		0.367	2.16	1.40396	0.99	0.449	2.160	1.40	95.15	1.574	149.789	0.39	1.00	1	
7.054	11	Sitff Fine-Grained	65.779	3.263	0.41		0.41	2.3	1.36646	0.99	0.448	2.300	1.37	89.88	1.949	175.161		1.00	1	
7.71	11	Sitff Fine-Grained	64.213	3.796	0.453		0.453	2.39	1.33091	0.98	0.448	2.390	1.33	85.46	2.272	194.171		1.00	1	
8.366	11	Sitff Fine-Grained	62.821	3.501	0.496		0.496	2.4	1.29717	0.98	0.447	2.400	1.30	81.49	2.312	188.434		1.00	1	
9.022	4	Silty Clay to Clay	54.816	2.631	0.533		0.533	2.4	1.26947	0.98	0.446	2.400	1.27	69.59	2.312	160.912		1.00	1	
9.678	11	Sitff Fine-Grained	63.562	3.079	0.576		0.576	2.39	1.23874	0.98	0.446	2.390	1.24	78.74	2.272	178.891		1.00	1	
10.335	3	Clay	46.043	2.609	0.613		0.613	2.55	1.21346	0.98	0.445	2.550	1.21	55.87	3.034	169.526		1.00	1	
10.991	3	Clay	39.783	2.089	0.649		0.649	2.58	1.18983	0.98	0.445	2.580	1.19	47.34	3.206	151.778	0.41	1.00	1	
11.647	3	Clay	43.598	2.251	0.686		0.686	2.56	1.16649	0.98	0.444	2.560	1.17	50.86	3.091	157.175	0.44	1.00	1	
12.303	11	Sitff Fine-Grained	63.495	3.515	0.729		0.729	2.5	1.14049	0.97	0.443	2.500	1.14	72.42	2.768	200.477		1.00	1	
12.959	3	Clay	53.034	3.139	0.765		0.765	2.58	1.11959	0.97	0.443	2.580	1.12	59.38	3.206	190.388		1.00	1	
13.615	4	Silty Clay to Clay	30.698	1.229	0.803		0.803	2.64	1.09835	0.97	0.442							1.00	1	
14.272	6	Sandy Silt to Clayey Silt	35.605	1.067	0.84		0.84	2.52	1.07843	0.97	0.441	2.520	1.08	38.40	2.872	110.263	0.20	1.00	1	
14.928	5	Clayey Silt to Silty Clay	48.344	1.989	0.878		0.878	2.53	1.05871	0.97	0.441	2.530	1.06	51.18	2.925	149.696	0.39	1.00	1	
15.584	5	Clayey Silt to Silty Clay	48.344	2.096	0.916		0.916	2.56	1.0397	0.97	0.440	2.560	1.04	50.26	3.091	155.341	0.43	1.00	1	
16.24	5	Clayey Silt to Silty Clay	40.501	1.687	0.953		0.953	2.62	1.02183	0.97	0.439							1.00	1	
16.896	4	Silty Clay to Clay	27.534	1.104	0.991		0.991	2.75	1.00411	0.96	0.439							1.00	1	
17.552	4	Silty Clay to Clay	22.058	0.816	1.028		1.028	2.82	0.98743	0.96	0.438							0.99	1	
18.209	5	Clayey Silt to Silty Clay	39.872	1.39	1.066		1.066	2.6	0.97087	0.96	0.437							0.99	1	
18.865	5	Clayey Silt to Silty Clay	29.789	1.12	1.104		1.104	2.74	0.95486	0.96	0.437							0.98	1	
19.521	5	Clayey Silt to Silty Clay	25.89	0.903	1.141		1.141	2.78	0.93977	0.96	0.436							0.97	1	
20.177	5	Clayey Silt to Silty Clay	27.394	1.037	1.179		1.179	2.79	0.92476	0.96	0.435							0.97	1	
20.833	4	Silty Clay to Clay	27.032	1.069	1.216		1.216	2.82	0.9106	0.95	0.434							0.96	1	
21.49	5	Clayey Silt to Silty Clay	27.617	1.051	1.254		1.254	2.82	0.8965	0.95	0.434							0.96	1	
22.146	5	Clayey Silt to Silty Clay	32.268	1.185	1.292		1.292	2.76	0.88283	0.95	0.433							0.95	1	
22.802	5	Clayey Silt to Silty Clay	32.04	1.207	1.329		1.329	2.78	0.86991	0.95	0.432							0.94	1	
23.458	4	Silty Clay to Clay	32.647	1.486	1.367		1.367	2.84	0.85703	0.95	0.431							0.94	1	
24.114	5	Clayey Silt to Silty Clay	31.099	1.041	1.404		1.404	2.78	0.84485	0.94	0.430							0.93	1	
24.77	5	Clayey Silt to Silty Clay	36.925	1.129	1.442		1.442	2.7	0.8327	0.94	0.429							0.93	1	
25.427	5	Clayey Silt to Silty Clay	39.498	1.318	1.479		1.479	2.71	0.8212	0.94	0.428							0.92	1	
26.083	5	Clayey Silt to Silty Clay	36.034	1.314	1.517		1.517	2.78	0.80972	0.94	0.427							0.92	1	
26.739	5	Clayey Silt to Silty Clay	34.296	1.1	1.555		1.555	2.77	0.79855	0.94	0.426							0.92	1	
27.395	6	Sandy Silt to Clayey Silt	37.593	1.063	1.592		1.592	2.71	0.78797	0.93	0.424							0.91	1	
28.051	5	Clayey Silt to Silty Clay	41.353	1.343	1.63		1.63	2.72	0.77739	0.93	0.423							0.91	1	
28.707	5	Clayey Silt to Silty Clay	37.454	1.346	1.667		1.667	2.79	0.76735	0.93	0.422							0.90	1	
29.364	5	Clayey Silt to Silty Clay	38.2	1.308	1.705		1.705	2.78	0.75731	0.92	0.420							0.90	1	
30.02	5	Clayey Silt to Silty Clay	37.042	1.363	1.743		1.743	2.82	0.74754	0.92	0.419							0.89	1	
30.676	4	Silty Clay to Clay	27.127	1.223	1.78		1.78	3	0.73826	0.92	0.417							0.89	1	
31.332	4	Silty Clay to Clay	25.133	1.149	1.818		1.818	3.04	0.72896	0.91	0.416							0.89	1	
31.988	4	Silty Clay to Clay	24.186	1.068	1.855		1.855	3.05	0.72013	0.91	0.414							0.88	1	
32.644	4	Silty Clay to Clay	19.323	0.783	1.893		1.893	3.13	0.71128	0.91	0.412							0.88	1	
33.301	4	Silty Clay to Clay	13.976	0.514	1.931		1.931	3.25	0.70265	0.90	0.410							0.88	1	
33.957	5	Clayey Silt to Silty Clay	12.322	0.332	1.968		1.968	3.25	0.69444	0.90	0.408							0.87	1	
34.613	5	Clayey Silt to Silty Clay	14.505	0.413	2.006		2.006	3.19	0.68621	0.89	0.406							0.87	1	
35.269	5	Clayey Silt to Silty Clay	12.192	0.246	2.043		2.043	3.2	0.67838	0.89	0.404							0.87	1	
35.925	5	Clayey Silt to Silty Clay	21.713	0.598	2.081		2.081	3.02	0.67053	0.88	0.402							0.86	1	
36.581	5	Clayey Silt to Silty Clay	19.067	0.638	2.119		2.119	3.14	0.66285	0.88	0.400							0.86	1	
37.238	5	Clayey Silt to Silty Clay	18.315	0.59	2.156		2.156	3.15	0.65554	0.87	0.398							0.86	1	
37.894	5	Clayey Silt to Silty Clay	14.093	0.42	2.194		2.194	3.26	0.6482	0.87	0.395							0.85	1	
38.55	5	Clayey Silt to Silty Clay	19.607	0.624	2.231		2.231	3.13	0.64121	0.86	0.393							0.85	1	
39.206	4	Silty Clay to Clay	11.419	0.37	2.269		2.269	3.4	0.63419	0.86	0.390							0.85	1	
39.862	5	Clayey Silt to Silty Clay	13.519	0.379	2.307		2.307	3.29	0.62732	0.85	0.388							0.85	1	
40.518	6	Sandy Silt to Clayey Silt	26.614	0.502	2.344		2.344	2.9	0.62077	0.85	0.385							0.84	1	
41.175	5	Clayey Silt to Silty Clay	17.084	0.426	2.382		2.382	3.16	0.61418	0.84	0.382							0.84	1	
41.831	5	Clayey Silt to Silty Clay	12.617	0.295	2.419		2.419	3.3	0.6079	0.83	0.380							0.84	1	
42.487	5	Clayey Silt to Silty Clay	11.965	0.264	2.457		2.457	3.32	0.60159	0.83	0.377							0.84	1	
43.143	5	Clayey Silt to Silty Clay	12.104	0.297	2.495		2.495	3.34	0.5954	0.82	0.374							0.83	1	
43.799	5	Clayey Silt to Silty Clay	19.674	0.49	2.532		2.532	3.12	0.5895	0.82	0.371							0.83	1	
44.455	5	Clayey Silt to Silty Clay	23.016	0.576	2.57		2.57	3.07	0.58355	0.81	0.368							0.83	1	
45.112	5	Clayey Silt to Silty Clay	15.898	0.429	2.607		2.607	3.26	0.57788	0.80	0.365							0.83	1	
45.768	5	Clayey Silt to Silty Clay	13.653	0.363	2.645		2.645	3.34	0.57217	0.80	0.362							0.82	1	
46.424	5	Clayey Silt to Silty Clay	17.017	0.511	2.682		2.682	3.26	0.56672	0.79	0.359							0.82	1	
47.08	4	Silty Clay to Clay	15.368	0.553	2.72		2.72	3.36	0.56122	0.78	0.356							0.82	1	
47.736	4	Silty Clay to Clay	14.143	0.487	2.758		2.758	3.4	0.55584	0.78	0.353							0.82	1	
48.392	5	Clayey Silt to Silty Clay	14.989	0.435	2.795		2.795	3.34	0.55069	0.77	0.350							0.81	1	
49.049	5	Clayey Silt to Silty Clay	16.198	0.428	2.833		2.833	3.28	0.5455	0.76	0.347							0.81	1	
49.705	5	Clayey Silt to Silty Clay	15.647	0.369	2.87		2.87	3.28	0.54054	0.76	0.344							0.81	1	
50.361	5	Clayey Silt to Silty Clay	20.37	0.58	2.908		2.908	3.2	0.53554	0.75	0.341							0.81	1	
51.017	4	Silty Clay to Clay	13.725	0.465	2.946		2.946	3.44	0.53063	0.74	0.338							0.81	1	
51.673	4	Silty Clay to Clay	13.274	0.435	2.983		2.983	3.46	0.52594	0.74	0.335							0.80	1	
52.329	4	Silty Clay to Clay	14.444	0.463	3.021		3.021	3.42	0.5212	0.73	0.332							0.80	1	
52.986	5	Clayey Silt to Silty Clay	14.873	0.47	3.058		3.058	3.4	0.51667	0.72	0.329							0.80	1	
53.642	4	Silty Clay to Clay	15.418	0.582	3.096		3.096	3.43	0.5121	0.72	0.326							0.80	1	
54.298	5	Clayey Silt to Silty Clay	14.343	0.408	3.134		3.134	3.41	0.50761	0.71	0.323							0.80	1	
54.954	5	Clayey Silt to Silty Clay	16.438	0.486	3.171		3.171	3.35	0.50332	0.70	0.320							0.79	1	
55.61	5	Clayey Silt to Silty Clay	14.683	0.48	3.209		3.209	3.43	0.49898	0.70	0.317							0.79	1	
56.266	5	Clayey Silt to Silty Clay	11.492	0.238	3.246		3.246	3.46	0.49483	0.69	0.315							0.79	1	
56.923	5	Clayey Silt to Silty Clay	15.079	0.465	3.284		3.284	3.41	0.49063	0.69	0.312							0.79	1	
57.579	6	Sandy Silt to Clayey Silt	22.225	0.483	3.322		3.322	3.16	0.48651	0.68	0.309							0.79	1	
58.235	5	Clayey Silt to Silty Clay	11.709	0.268	3.359		3.359	3.53	0.48256	0.67	0.307							0.78	1	
58.891	5	Clayey Silt to Silty Clay	13.057	0.301	3.397		3.397	3.46	0.47857	0.67	0.304							0.78	1	
59.547	5	Clayey Silt to Silty Clay	13.664	0.294	3.434		3.434	3.42	0.47475	0.66	0.302							0.78	1	
60.203	5	Clayey Silt to Silty Clay	12.6	0.255	3.472		3.472	3.46	0.47089	0.66	0.299							0.78	1	
60.86	5	Clayey Silt to Silty Clay	15.251	0.391	3.51		3.51	3.4	0.46709	0.65	0.297							0.78	1	
61.516	5	Clayey Silt to Silty Clay	16.449	0.526	3.547	0.006	3.541	3.42	0.46404	0.65	0.295							0.78	1	
62.172	5	Clayey Silt to Silty Clay	18.031	0.546	3.585	0.027	3.558	3.36	0.46238	0.64	0.294							0.78	1	

LIQUEFACTION POTENTIAL ANALYSIS (per Youd & Idriss, 2001)

PROJECT NAME **ROUTE 4**
PROJECT NO. **206118.CLO**
CPT NO. **CLO-125 (CONTRA LOMA)**

FAULT INFO
COAST RANGE - SIERRAN BLOCK BOUNDARY ZONE (CSB)
a_{max} (g)= 0.7

FAULT M_w = 7
MSF = 1.19

Depth (ft)		Soil Behavior Type	CPT RESULT INPUT qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	CSR γ_d	CSR	CRR$_{7.5}$ Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	F.S.=(CRR$_{7.5}$/CSR)*MSF*Kσ*Kα Kσ	Kα	F.S.
62.828	5	Clayey Silt to Silty Clay	29.689	1.077	3.622	0.047	3.575	3.18	0.46073	0.64	0.294							0.78	1	
63.484	5	Clayey Silt to Silty Clay	37.476	1.5	3.66	0.068	3.592	3.11	0.4591	0.63	0.293							0.77	1	
64.14	4	Silty Clay to Clay	22.058	0.852	3.698	0.088	3.609	3.34	0.45748	0.63	0.293							0.77	1	
64.797	5	Clayey Silt to Silty Clay	14.215	0.406	3.735	0.109	3.627	3.5	0.45577	0.62	0.292							0.77	1	
65.453	5	Clayey Silt to Silty Clay	16.989	0.526	3.773	0.129	3.644	3.42	0.45417	0.62	0.292							0.77	1	
66.109	5	Clayey Silt to Silty Clay	17.307	0.567	3.81	0.15	3.661	3.43	0.45258	0.61	0.291							0.77	1	
66.765	5	Clayey Silt to Silty Clay	17.925	0.571	3.848	0.17	3.678	3.4	0.451	0.61	0.291							0.77	1	
67.421	5	Clayey Silt to Silty Clay	24.531	0.849	3.885	0.19	3.695	3.28	0.44944	0.61	0.290							0.77	1	
68.077	5	Clayey Silt to Silty Clay	25.679	0.771	3.923	0.211	3.712	3.23	0.44788	0.60	0.290							0.77	1	
68.734	7	Silty Sand to Sandy Silt	52.588	0.52	3.962	0.231	3.73	2.67	0.44625	0.60	0.289							0.77	1	
69.39	8	Sand to Silty Sand	91.658	1.337	4.001	0.252	3.749	2.53	0.44453	0.60	0.289	2.530	0.44	40.75	2.925	119.170	0.24	0.77	1	0.82
70.046	8	Sand to Silty Sand	172.208	2.523	4.041	0.272	3.769	2.29	0.44275	0.59	0.289	2.290	0.44	76.24	1.917	146.164	0.37	0.75	1	1.28
70.702	9	Sand	257.71	1.835	4.082	0.293	3.789	1.97	0.44097	0.59	0.288	1.970	0.44	113.64	1.263	143.499	0.35	0.68	1	1.23
71.358	10	Gravelly Sand to Sand	311.802	2.256	4.124	0.313	3.81	1.9	0.43912	0.58	0.288	1.900	0.44	136.92	1.189	162.775		0.66	1	
72.014	10	Gravelly Sand to Sand	484.946	2.075	4.165	0.334	3.832	1.62	0.4372	0.58	0.288	1.620	0.44	212.02	1.000	212.019		0.58	1	
72.671	9	Sand	302.751	2.887	4.206	0.354	3.852	1.99	0.43547	0.58	0.287	1.990	0.44	131.84	1.287	169.698		0.66	1	
73.327	9	Sand	213.595	2.341	4.247	0.375	3.872	2.15	0.43375	0.58	0.287	2.150	0.43	92.65	1.553	143.862	0.36	0.72	1	1.24
73.983	9	Sand	253.661	2.631	4.288	0.395	3.892	2.08	0.43205	0.57	0.287	2.080	0.43	109.59	1.420	155.585	0.43	0.69	1	1.50
74.639	9	Sand	294.936	2.412	4.328	0.416	3.913	1.96	0.43028	0.57	0.286	1.960	0.43	126.90	1.251	158.770	0.45	0.66	1	1.58
75.295	9	Sand	347.084	3.121	4.369	0.436	3.933	1.93	0.4286	0.57	0.286	1.930	0.43	148.76	1.218	181.259		0.64	1	
75.951	9	Sand	370.2	3.555	4.41	0.457	3.953	1.93	0.42694	0.56	0.286	1.930	0.43	158.05	1.218	192.580		0.63	1	
76.608	9	Sand	354.314	3.907	4.45	0.477	3.973	1.98	0.42529	0.56	0.286	1.980	0.43	150.68	1.275	192.083		0.64	1	
77.264	10	Gravelly Sand to Sand	376.951	2.637	4.492	0.498	3.995	1.84	0.42348	0.56	0.286	1.840	0.42	159.63	1.137	181.508		0.62	1	
77.92	10	Gravelly Sand to Sand	386.694	2.883	4.534	0.518	4.016	1.85	0.42178	0.56	0.286	1.850	0.42	163.10	1.145	186.762		0.61	1	
78.576	10	Gravelly Sand to Sand	419.006	2.7	4.576	0.539	4.037	1.79	0.42009	0.55	0.285	1.790	0.42	176.02	1.099	193.523		0.60	1	
79.232	10	Gravelly Sand to Sand	437.015	3.58	4.618	0.559	4.059	1.84	0.41833	0.55	0.285	1.840	0.42	182.82	1.137	207.868		0.60	1	
79.888	10	Gravelly Sand to Sand	434.241	2.473	4.659	0.579	4.08	1.75	0.41667	0.55	0.285	1.750	0.42	180.93	1.072	193.888		0.59	1	
80.545	10	Gravelly Sand to Sand	483.153	2.306	4.701	0.6	4.101	1.67	0.41502	0.55	0.285	1.670	0.42	200.52	1.017	204.000		0.57	1	
81.201	10	Gravelly Sand to Sand	513.315	2.439	4.743	0.62	4.122	1.65	0.41338	0.54	0.285	1.650	0.41	212.19	1.003	212.901		0.57	1	
81.857	10	Gravelly Sand to Sand	342.127	2.024	4.785	0.641	4.144	1.85	0.41168	0.54	0.285	1.850	0.41	140.85	1.145	161.280		0.63	1	
82.513	10	Gravelly Sand to Sand	281.484	1.749	4.826	0.661	4.165	1.94	0.41007	0.54	0.285	1.940	0.41	115.43	1.229	141.858	0.35	0.66	1	1.21
83.169	10	Gravelly Sand to Sand	258.073	1.351	4.868	0.682	4.186	1.94	0.40847	0.54	0.285	1.940	0.41	105.41	1.229	129.553	0.28	0.67	1	0.99
83.825	7	Silty Sand to Sandy Silt	131.379	3.711	4.907	0.702	4.204	2.61	0.40711	0.54	0.285							0.75	1	
84.482	8	Sand to Silty Sand	180.647	3.255	4.946	0.723	4.224	2.38	0.4056	0.53	0.284	2.380	0.41	73.27	2.233	163.584		0.74	1	
85.138	9	Sand	272.059	2.447	4.987	0.743	4.244	2.05	0.40411	0.53	0.284	2.050	0.40	109.94	1.371	150.738	0.40	0.67	1	1.40
85.794	9	Sand	337.436	4.078	5.028	0.764	4.264	2.05	0.40264	0.53	0.284	2.050	0.40	135.86	1.371	186.276		0.64	1	
86.45	10	Gravelly Sand to Sand	348.143	2.735	5.07	0.784	4.285	1.93	0.40109	0.53	0.284	1.930	0.40	139.64	1.218	170.144		0.63	1	
87.106	10	Gravelly Sand to Sand	389.501	1.945	5.111	0.805	4.307	1.78	0.39949	0.53	0.284	1.780	0.40	155.60	1.092	169.971		0.60	1	
87.762	10	Gravelly Sand to Sand	404.251	1.928	5.153	0.825	4.328	1.76	0.39797	0.52	0.284	1.760	0.40	160.88	1.078	173.501		0.59	1	
88.419	10	Gravelly Sand to Sand	400.006	1.736	5.195	0.846	4.349	1.74	0.39647	0.52	0.284	1.740	0.40	158.59	1.065	168.868		0.59	1	
89.075	10	Gravelly Sand to Sand	384.694	1.899	5.237	0.866	4.371	1.79	0.3949	0.52	0.284	1.790	0.39	151.92	1.099	167.023		0.60	1	
89.731	10	Gravelly Sand to Sand	364.686	2.281	5.279	0.887	4.392	1.86	0.39342	0.52	0.284	1.860	0.39	143.47	1.153	165.475		0.61	1	
90.387	10	Gravelly Sand to Sand	392.715	1.934	5.32	0.907	4.413	1.78	0.39195	0.52	0.284	1.780	0.39	153.92	1.092	168.138		0.60	1	
91.043	10	Gravelly Sand to Sand	427.083	1.785	5.362	0.928	4.435	1.72	0.39042	0.52	0.284	1.720	0.39	166.74	1.051	175.299		0.58	1	
91.699	10	Gravelly Sand to Sand	471.394	1.838	5.404	0.948	4.456	1.66	0.38897	0.52	0.284	1.660	0.39	183.36	1.010	185.265		0.56	1	
92.356	9	Sand	300.74	3.872	5.445	0.968	4.476	2.12	0.3876	0.51	0.284	2.120	0.39	116.57	1.492	173.935		0.66	1	
93.012	7	Silty Sand to Sandy Silt	124.689	3.373	5.483	0.989	4.494	2.64	0.38637	0.51	0.284							0.74	1	
93.668	11	Stiff Fine-Grained	158.706	6.835	5.526	1.009	4.517	2.69	0.38482	0.51	0.284							0.74	1	
94.324	11	Stiff Fine-Grained	100.369	4.35	5.569	1.03	4.539	2.86	0.38334	0.51	0.284							0.74	1	
94.98	6	Sandy Silt to Clayey Silt	99.74	3.362	5.606	1.05	4.556	2.79	0.38221	0.51	0.285							0.74	1	
95.636	6	Sandy Silt to Clayey Silt	112.496	3.976	5.644	1.071	4.573	2.76	0.38108	0.51	0.285							0.74	1	
96.293	6	Sandy Silt to Clayey Silt	119.871	3.891	5.682	1.091	4.59	2.71	0.37997	0.51	0.285							0.74	1	
96.949	6	Sandy Silt to Clayey Silt	123.514	4.095	5.719	1.112	4.607	2.71	0.37885	0.50	0.285							0.74	1	
97.605	6	Sandy Silt to Clayey Silt	116.813	4.243	5.757	1.132	4.625	2.76	0.37768	0.50	0.285							0.74	1	
98.261	5	Clayey Silt to Silty Clay	98.843	3.918	5.794	1.153	4.642	2.85	0.37658	0.50	0.285							0.74	1	
98.917	6	Sandy Silt to Clayey Silt	90.393	3.383	5.832	1.173	4.659	2.86	0.37549	0.50	0.285							0.74	1	
99.573	6	Sandy Silt to Clayey Silt	117.052	3.784	5.87	1.194	4.676	2.73	0.3744	0.50	0.285							0.73	1	

AXIAL PILE CAPACITY

(APILE Runs)

APILE Runs SR Bypass – Contra Loma Blvd. Undercrossing
Pile capacities computed using APILE program – API RP2A Method
May 14, 2010 (Output follows)

Abutment 1 (based on boring CLO-124)

Left & Right Bridges – 14-in Square Precast Prestressed Concrete Pile

Ground Surface Elevation 44.5 (approx.)
Botton of Footing 40.0 (approx.)
Predrill to Elev. 32.0 (bottom of Embankment)

Nominal Compression Load = 260 kips
Reqd. Pile Length per APILE output = 51.0 ft
Recommended Penetration = 54.0 feet (neglecting added bearing from sand)
Reqd. Tip Elevation = 44.5-54.0 = -9.5

Abutment 3 (based on boring CLO-125 and CPT-125)

Left Bridge – 14-in Square Precast Prestressed Concrete Pile

Ground Surface Elevation 32.0 (approx.)
Botton of Footing 27.0 (approx.)
No Predrill

Nominal Compression Load = 260 kips
Reqd. Pile Length per APILE output = 43.0 ft
Recommended Penetration = 51.0 feet (neglecting added bearing from sand)
Reqd. Tip Elevation = 32.0-51.0 = -19.0

Right Bridge – 14-in Square Precast Prestressed Concrete Pile

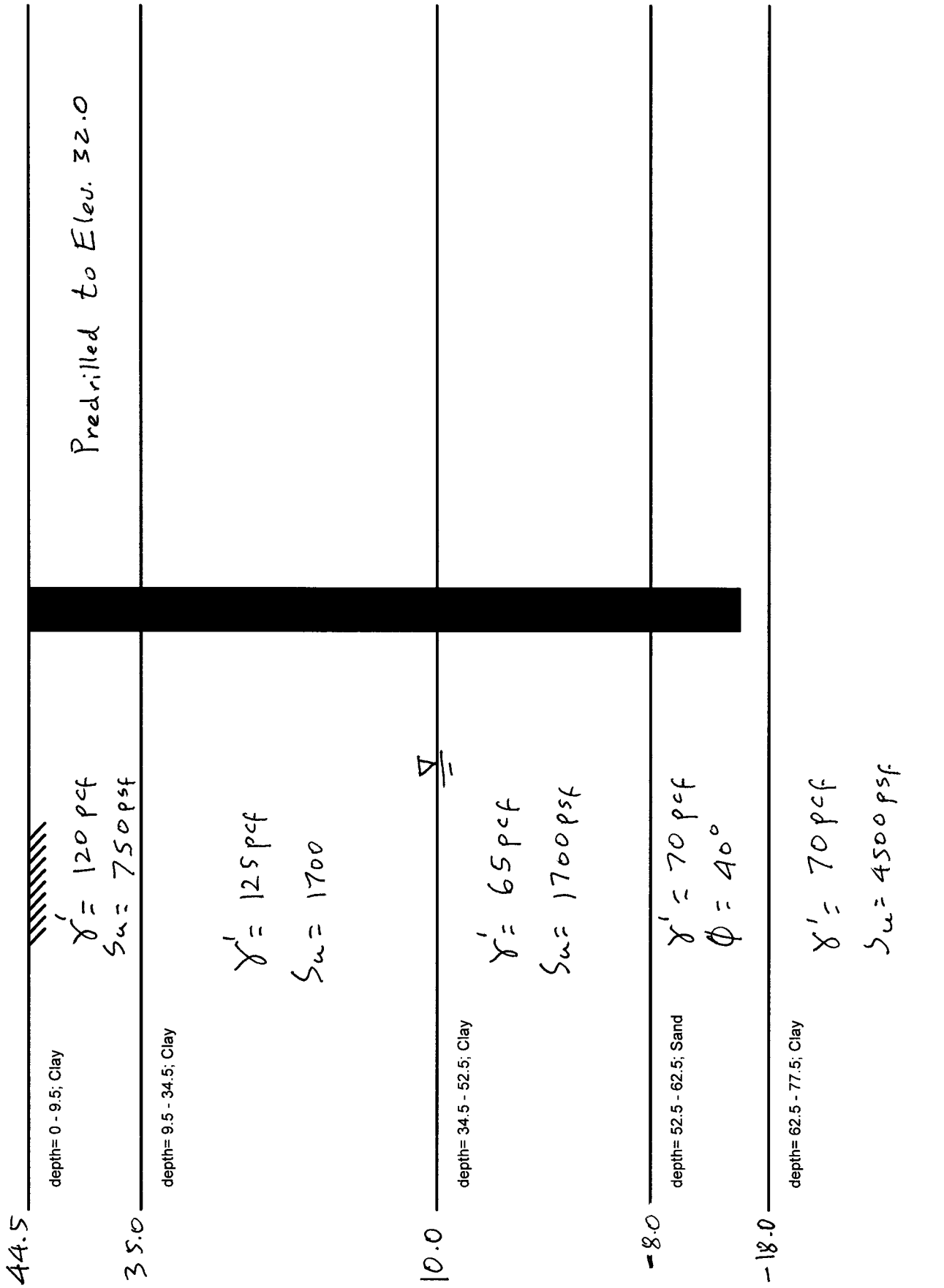
Ground Surface Elevation 32.0 (approx.)
Botton of Footing 27.0 (approx.)
Predrill to Elev. 21.0

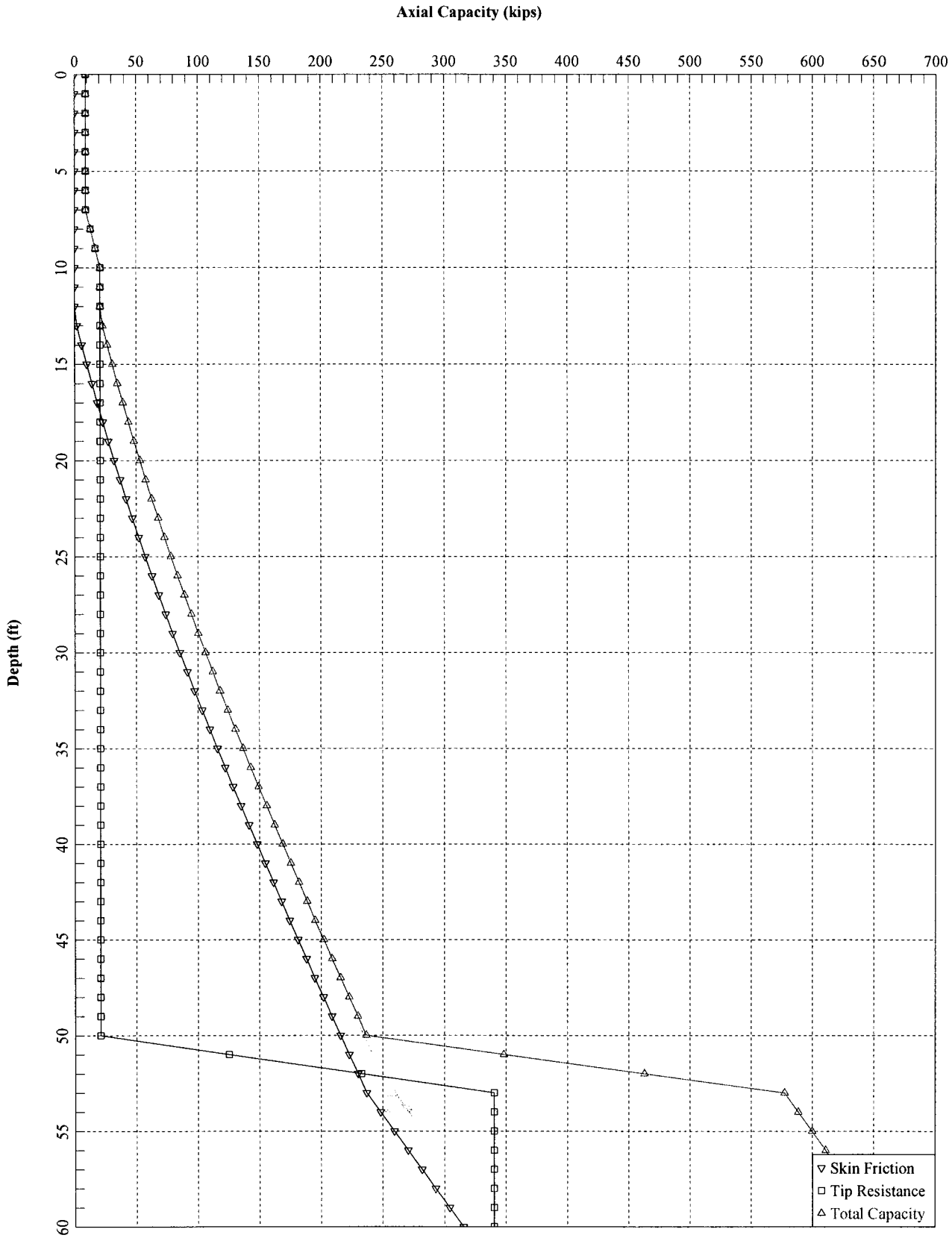
Nominal Compression Load = 260 kips
Reqd. Pile Length per APILE output = 46.0 ft
Recommended Penetration = 53.0 feet (neglecting added bearing from sand)
Reqd. Tip Elevation = 32.0-53.0 = -21.0

Wing Walls – 14-in Square Precast Prestressed Concrete Pile

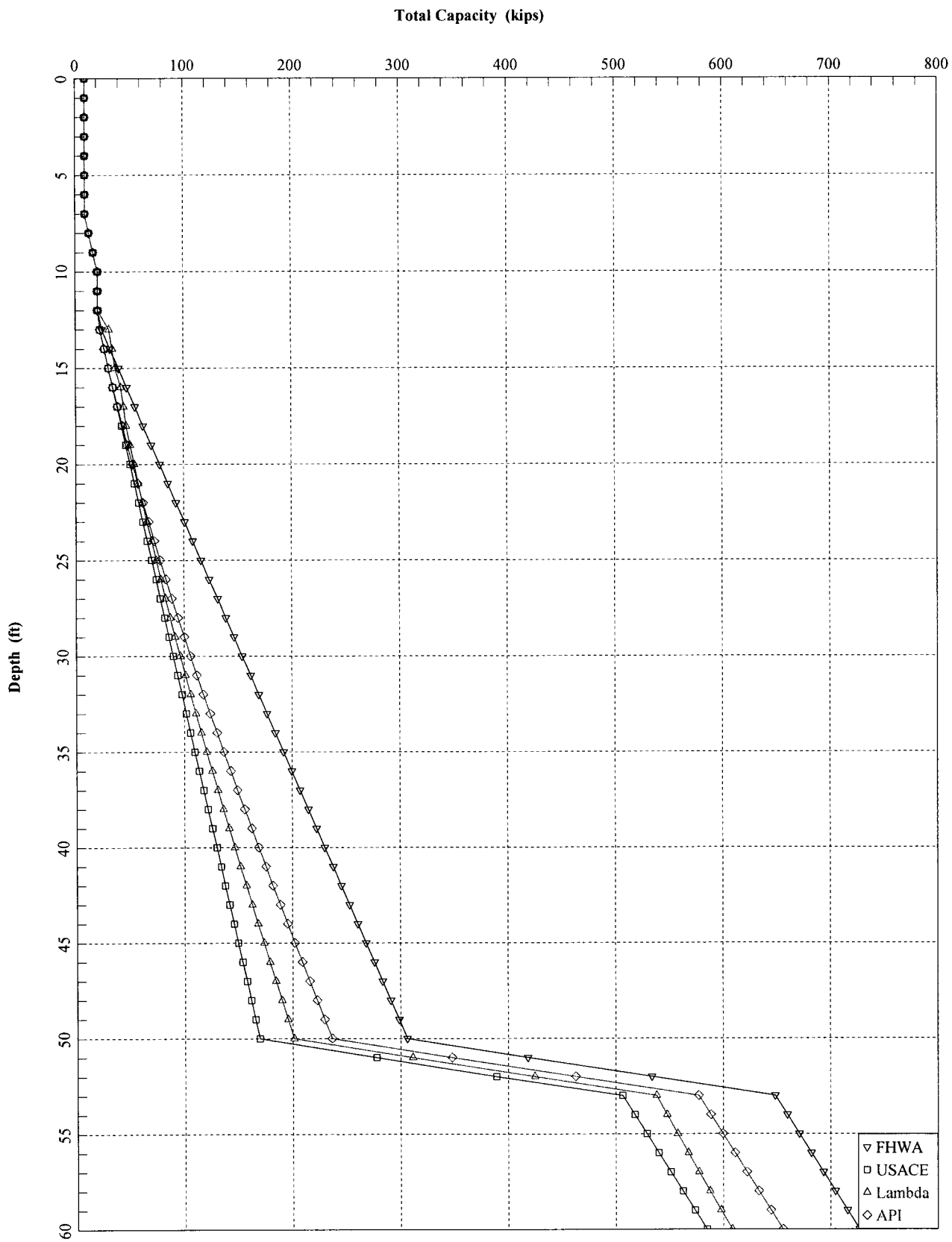
Ground Surface Elevation 38.0 (approx.)
Botton of Footing 31.0 (approx.)
No Predrill
Nominal Compression Load = 180 kips
Reqd. Pile Length per APILE output = 36.0 ft
Recommended Penetration = 39.0 feet (neglecting sand end bearing)
Reqd. Tip Elevation = 38.0-39.0 = -1.0

Abutment 1
14-in Class 200 Alt. 'X' Concrete Pile
(Based on Boring CLO-124)





SR4 Contra Loma Blvd. Undercrossing - Left and Right Bridges - Abutment 1 - 14--in Square PPC Pile - API RP2A Method



SR4 Contra Loma Blvd. Undercrossing - Left and Right Bridges - Abutment 1 - 14-in Square PPC PIle

Abutment 1 - Left and Right Bridges.apo

1

AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

SR4 Contra LOma UC - Abutment 1 - 14-in Square PPC Pile

DESIGNER : Partha Sircar

DATE : May 12, 2010

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 56.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 1.36 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 0.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 0.00 IN.
PILE LENGTH = 60.00 FT.
MODULUS OF ELASTICITY = 0.430E+07 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 12.50 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.00	120.00	0.00	0.00
9.50	CLAY	0.00	120.00	0.00	0.00
9.50	CLAY	0.00	125.00	0.00	0.00
34.50	CLAY	0.00	125.00	0.00	0.00
34.50	CLAY	0.00	65.00	0.00	0.00
52.50	CLAY	0.00	65.00	0.00	0.00
52.50	SAND	1.00	70.00	40.00	50.00
62.50	SAND	1.00	70.00	40.00	50.00
62.50	CLAY	0.00	70.00	0.00	0.00
77.50	CLAY	0.00	70.00	0.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.75	6.75	0.75	0.38	0.00	0.00	0.00
0.75	6.75	0.75	0.38	0.00	0.00	0.00
1.70	15.30	1.70	0.85	0.00	0.00	0.00
1.70	15.30	1.70	0.85	0.00	0.00	0.00
1.70	15.30	1.70	0.85	0.00	0.00	0.00
1.70	15.30	1.70	0.85	0.00	0.00	0.00
2.40	250.00	0.00	0.00	0.00	0.00	0.00
2.40	250.00	0.00	0.00	0.00	0.00	0.00
4.50	40.50	4.50	2.25	0.00	0.00	0.00
4.50	40.50	4.50	2.25	0.00	0.00	0.00

Abutment 1 - Left and Right Bridges.apo

1

****
* COMPUTATION RESULT *
****

	* FED. HWY. METHOD *			* ARMY CORPS METHOD *			* LAMBDA 2 METHOD *		
PILE PENETR-ATION FT.	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP
0.0	0.0	9.2	9.2	0.0	9.2	9.2	0.0	9.2	9.2
1.0	0.0	9.2	9.2	0.0	9.2	9.2	0.0	9.2	9.2
2.0	0.0	9.2	9.2	0.0	9.2	9.2	0.0	9.2	9.2
3.0	0.0	9.2	9.2	0.0	9.2	9.2	0.0	9.2	9.2
4.0	0.0	9.2	9.2	0.0	9.2	9.2	0.0	9.2	9.2
5.0	0.0	9.2	9.2	0.0	9.2	9.2	0.0	9.2	9.2
6.0	0.0	9.2	9.2	0.0	9.2	9.2	0.0	9.2	9.2
7.0	0.0	9.2	9.2	0.0	9.2	9.2	0.0	9.2	9.2
8.0	0.0	13.0	13.0	0.0	13.0	13.0	0.0	13.0	13.0
9.0	0.0	16.9	16.9	0.0	16.9	16.9	0.0	16.9	16.9
10.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
11.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
12.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
13.0	3.8	20.8	24.6	2.0	20.8	22.8	10.5	20.8	31.3
14.0	11.4	20.8	32.2	5.9	20.8	26.8	13.3	20.8	34.2
15.0	19.0	20.8	39.9	9.9	20.8	30.7	16.2	20.8	37.0
16.0	26.7	20.8	47.5	13.9	20.8	34.7	21.3	20.8	42.1
17.0	34.3	20.8	55.1	17.8	20.8	38.7	23.8	20.8	44.6
18.0	41.9	20.8	62.7	21.8	20.8	42.6	26.2	20.8	47.0
19.0	49.5	20.8	70.3	25.8	20.8	46.6	29.8	20.8	50.7
20.0	57.1	20.8	77.9	29.7	20.8	50.6	33.6	20.8	54.4
21.0	64.7	20.8	85.6	33.7	20.8	54.5	37.5	20.8	58.3
22.0	72.4	20.8	93.2	37.7	20.8	58.5	41.4	20.8	62.2
23.0	80.0	20.8	100.8	41.6	20.8	62.5	45.4	20.8	66.3
24.0	87.6	20.8	108.4	45.6	20.8	66.4	49.6	20.8	70.4
25.0	95.2	20.8	116.0	49.6	20.8	70.4	53.7	20.8	74.6
26.0	102.8	20.8	123.6	53.5	20.8	74.4	58.0	20.8	78.8
27.0	110.4	20.8	131.3	57.5	20.8	78.3	62.4	20.8	83.2
28.0	118.0	20.8	138.9	61.5	20.8	82.3	66.8	20.8	87.6
29.0	125.7	20.8	146.5	65.4	20.8	86.3	71.3	20.8	92.1
30.0	133.3	20.8	154.1	69.4	20.8	90.2	75.9	20.8	96.7
31.0	140.9	20.8	161.7	73.4	20.8	94.2	80.6	20.8	101.4
32.0	148.5	20.8	169.3	77.3	20.8	98.2	85.4	20.8	106.2
33.0	156.1	20.8	177.0	81.3	20.8	102.1	90.2	20.8	111.0
34.0	163.7	20.8	184.6	85.3	20.8	106.1	95.1	20.8	116.0
35.0	171.4	20.8	192.2	89.2	20.8	110.1	100.1	20.8	121.0
36.0	179.0	20.8	199.8	93.2	20.8	114.0	105.2	20.8	126.0
37.0	186.6	20.8	207.4	97.2	20.8	118.0	110.3	20.8	131.1
38.0	194.2	20.8	215.0	101.1	20.8	122.0	115.5	20.8	136.3
39.0	201.8	20.8	222.6	105.1	20.8	125.9	120.7	20.8	141.5
40.0	209.4	20.8	230.3	109.1	20.8	129.9	125.9	20.8	146.7
41.0	217.1	20.8	237.9	113.0	20.8	133.9	131.2	20.8	152.0
42.0	224.7	20.8	245.5	117.0	20.8	137.8	136.5	20.8	157.3
43.0	232.3	20.8	253.1	121.0	20.8	141.8	141.9	20.8	162.7
44.0	239.9	20.8	260.7	124.9	20.8	145.8	147.3	20.8	168.1
45.0	247.5	20.8	268.3	128.9	20.8	149.7	152.7	20.8	173.5
46.0	255.1	20.8	276.0	132.9	20.8	153.7	158.2	20.8	179.0
47.0	262.8	20.8	283.6	136.8	20.8	157.7	163.8	20.8	184.6
48.0	270.4	20.8	291.2	140.8	20.8	161.6	169.3	20.8	190.2
49.0	278.0	20.8	298.8	144.8	20.8	165.6	175.0	20.8	195.8
50.0	285.6	20.8	306.4	148.7	20.8	169.6	180.6	20.8	201.4
51.0	293.2	125.2	418.4	152.7	125.2	277.9	186.3	125.2	311.5
52.0	300.8	232.8	533.6	156.7	232.8	389.4	192.1	232.8	424.8
53.0	308.4	340.3	648.7	166.2	340.3	506.5	197.9	340.3	538.1
54.0	319.6	340.3	659.9	177.4	340.3	517.7	207.5	340.3	547.8
55.0	330.8	340.3	671.1	188.6	340.3	528.9	217.3	340.3	557.6
56.0	342.0	340.3	682.3	199.8	340.3	540.1	227.3	340.3	567.5
57.0	353.2	340.3	693.5	211.0	340.3	551.3	237.3	340.3	577.6
58.0	364.4	340.3	704.7	222.2	340.3	562.5	247.5	340.3	587.7
59.0	375.6	340.3	715.9	233.4	340.3	573.7	257.8	340.3	598.0
60.0	386.8	340.3	727.1	244.6	340.3	584.9	268.2	340.3	608.4

54' (237.9 - 20.8) ;

Abutment 1 - Left and Right Bridges.apo

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* API RP-2A (1994) *
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PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	9.2	9.2
1.00	0.0	9.2	9.2
2.00	0.0	9.2	9.2
3.00	0.0	9.2	9.2
4.00	0.0	9.2	9.2
5.00	0.0	9.2	9.2
6.00	0.0	9.2	9.2
7.00	0.0	9.2	9.2
8.00	0.0	13.0	13.0
9.00	0.0	16.9	16.9
10.00	0.0	20.8	20.8
11.00	0.0	20.8	20.8
12.00	0.0	20.8	20.8
13.00	1.9	20.8	22.8
14.00	5.9	20.8	26.7
15.00	9.9	20.8	30.7
16.00	14.1	20.8	34.9
17.00	18.4	20.8	39.2
18.00	22.9	20.8	43.7
19.00	27.4	20.8	48.3
20.00	32.1	20.8	53.0
21.00	37.0	20.8	57.8
22.00	41.9	20.8	62.7
23.00	46.9	20.8	67.8
24.00	52.1	20.8	72.9
25.00	57.4	20.8	78.2
26.00	62.8	20.8	83.6
27.00	68.3	20.8	89.1
28.00	73.9	20.8	94.7
29.00	79.6	20.8	100.4
30.00	85.4	20.8	106.2
31.00	91.3	20.8	112.1
32.00	97.3	20.8	118.1
33.00	103.4	20.8	124.2
34.00	109.6	20.8	130.4
35.00	115.8	20.8	136.7
36.00	122.2	20.8	143.0
37.00	128.6	20.8	149.4
38.00	135.0	20.8	155.9
39.00	141.5	20.8	162.4
40.00	148.1	20.8	168.9
41.00	154.7	20.8	175.5
42.00	161.3	20.8	182.1
43.00	168.0	20.8	188.8
44.00	174.7	20.8	195.5
45.00	181.4	20.8	202.3
46.00	188.2	20.8	209.1
47.00	195.1	20.8	215.9
48.00	202.0	20.8	222.8
49.00	208.9	20.8	229.8
50.00	215.9	20.8	236.7
51.00	222.9	125.2	348.2
52.00	230.0	232.8	462.8
53.00	237.1	340.3	577.4
54.00	248.3	340.3	588.6
55.00	259.5	340.3	599.8
56.00	270.7	340.3	611.0
57.00	281.9	340.3	622.2
58.00	293.1	340.3	633.4
59.00	304.3	340.3	644.6
60.00	315.5	340.3	655.8

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2852E-01
			0.0000E+00	0.5526E-01
			0.0000E+00	0.1016E+00
			0.0000E+00	0.1426E+00
			0.0000E+00	0.1783E+00
			0.0000E+00	0.3565E+00
			0.0000E+00	0.5348E+00
			0.0000E+00	0.8913E+00
			0.0000E+00	0.3565E+01
2	10	0.4775E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2852E-01
			0.0000E+00	0.5526E-01
			0.0000E+00	0.1016E+00
			0.0000E+00	0.1426E+00
			0.0000E+00	0.1783E+00
			0.0000E+00	0.3565E+00
			0.0000E+00	0.5348E+00
			0.0000E+00	0.8913E+00
			0.0000E+00	0.3565E+01

Abutment 1 - Left and Right Bridges.apo

3	10	0.9458E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2852E-01
			0.0000E+00	0.5526E-01
			0.0000E+00	0.1016E+00
			0.0000E+00	0.1426E+00
			0.0000E+00	0.1783E+00
			0.0000E+00	0.3565E+00
			0.0000E+00	0.5348E+00
			0.0000E+00	0.8913E+00
			0.0000E+00	0.3565E+01
4	10	0.9500E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2852E-01
			0.0000E+00	0.5526E-01
			0.0000E+00	0.1016E+00
			0.0000E+00	0.1426E+00
			0.0000E+00	0.1783E+00
			0.0000E+00	0.3565E+00
			0.0000E+00	0.5348E+00
			0.0000E+00	0.8913E+00
			0.0000E+00	0.3565E+01
5	10	0.2202E+02		
			0.0000E+00	0.0000E+00
			0.2257E+01	0.2852E-01
			0.3762E+01	0.5526E-01
			0.5643E+01	0.1016E+00
			0.6772E+01	0.1426E+00
			0.7524E+01	0.1783E+00
			0.6772E+01	0.3565E+00
			0.6772E+01	0.5348E+00
			0.6772E+01	0.8913E+00
			0.6772E+01	0.3565E+01
6	10	0.3446E+02		
			0.0000E+00	0.0000E+00
			0.2804E+01	0.2852E-01
			0.4673E+01	0.5526E-01
			0.7010E+01	0.1016E+00
			0.8412E+01	0.1426E+00
			0.9347E+01	0.1783E+00
			0.8412E+01	0.3565E+00
			0.8412E+01	0.5348E+00
			0.8412E+01	0.8913E+00
			0.8412E+01	0.3565E+01
7	10	0.3450E+02		
			0.0000E+00	0.0000E+00
			0.2804E+01	0.2852E-01
			0.4673E+01	0.5526E-01
			0.7010E+01	0.1016E+00
			0.8412E+01	0.1426E+00
			0.9347E+01	0.1783E+00
			0.8412E+01	0.3565E+00
			0.8412E+01	0.5348E+00
			0.8412E+01	0.8913E+00
			0.8412E+01	0.3565E+01
8	10	0.4352E+02		
			0.0000E+00	0.0000E+00
			0.2999E+01	0.2852E-01
			0.4999E+01	0.5526E-01
			0.7499E+01	0.1016E+00
			0.8998E+01	0.1426E+00
			0.9998E+01	0.1783E+00
			0.8998E+01	0.3565E+00
			0.8998E+01	0.5348E+00

Abutment 1 - Left and Right Bridges.apo

			0.8998E+01	0.8913E+00
			0.8998E+01	0.3565E+01
9	10	0.5246E+02		
			0.0000E+00	0.0000E+00
			0.3174E+01	0.2852E-01
			0.5290E+01	0.5526E-01
			0.7936E+01	0.1016E+00
			0.9523E+01	0.1426E+00
			0.1058E+02	0.1783E+00
			0.9523E+01	0.3565E+00
			0.9523E+01	0.5348E+00
			0.9523E+01	0.8913E+00
			0.9523E+01	0.3565E+01
10	10	0.5250E+02		
			0.0000E+00	0.0000E+00
			0.1058E+01	0.1000E-01
			0.2116E+01	0.2000E-01
			0.4232E+01	0.4000E-01
			0.6349E+01	0.6000E-01
			0.8465E+01	0.8000E-01
			0.9523E+01	0.9000E-01
			0.1058E+02	0.1000E+00
			0.1058E+02	0.5000E+00
			0.1058E+02	0.2000E+01
11	10	0.5752E+02		
			0.0000E+00	0.0000E+00
			0.1667E+01	0.1000E-01
			0.3333E+01	0.2000E-01
			0.6667E+01	0.4000E-01
			0.1000E+02	0.6000E-01
			0.1333E+02	0.8000E-01
			0.1500E+02	0.9000E-01
			0.1667E+02	0.1000E+00
			0.1667E+02	0.5000E+00
			0.1667E+02	0.2000E+01
12	10	0.6246E+02		
			0.0000E+00	0.0000E+00
			0.1667E+01	0.1000E-01
			0.3333E+01	0.2000E-01
			0.6667E+01	0.4000E-01
			0.1000E+02	0.6000E-01
			0.1333E+02	0.8000E-01
			0.1500E+02	0.9000E-01
			0.1667E+02	0.1000E+00
			0.1667E+02	0.5000E+00
			0.1667E+02	0.2000E+01
13	10	0.6250E+02		
			0.0000E+00	0.0000E+00
			0.5000E+01	0.2852E-01
			0.8333E+01	0.5526E-01
			0.1250E+02	0.1016E+00
			0.1500E+02	0.1426E+00
			0.1667E+02	0.1783E+00
			0.1500E+02	0.3565E+00
			0.1500E+02	0.5348E+00
			0.1500E+02	0.8913E+00
			0.1500E+02	0.3565E+01
14	10	0.7003E+02		
			0.0000E+00	0.0000E+00
			0.5000E+01	0.2852E-01
			0.8333E+01	0.5526E-01
			0.1250E+02	0.1016E+00
			0.1500E+02	0.1426E+00
			0.1667E+02	0.1783E+00

Abutment 1 - Left and Right Bridges.apo

			0.1500E+02	0.3565E+00
			0.1500E+02	0.5348E+00
			0.1500E+02	0.8913E+00
			0.1500E+02	0.3565E+01
15	10	0.7746E+02		
			0.0000E+00	0.0000E+00
			0.5000E+01	0.2852E-01
			0.8333E+01	0.5526E-01
			0.1250E+02	0.1016E+00
			0.1500E+02	0.1426E+00
			0.1667E+02	0.1783E+00
			0.1500E+02	0.3565E+00
			0.1500E+02	0.5348E+00
			0.1500E+02	0.8913E+00
			0.1500E+02	0.3565E+01

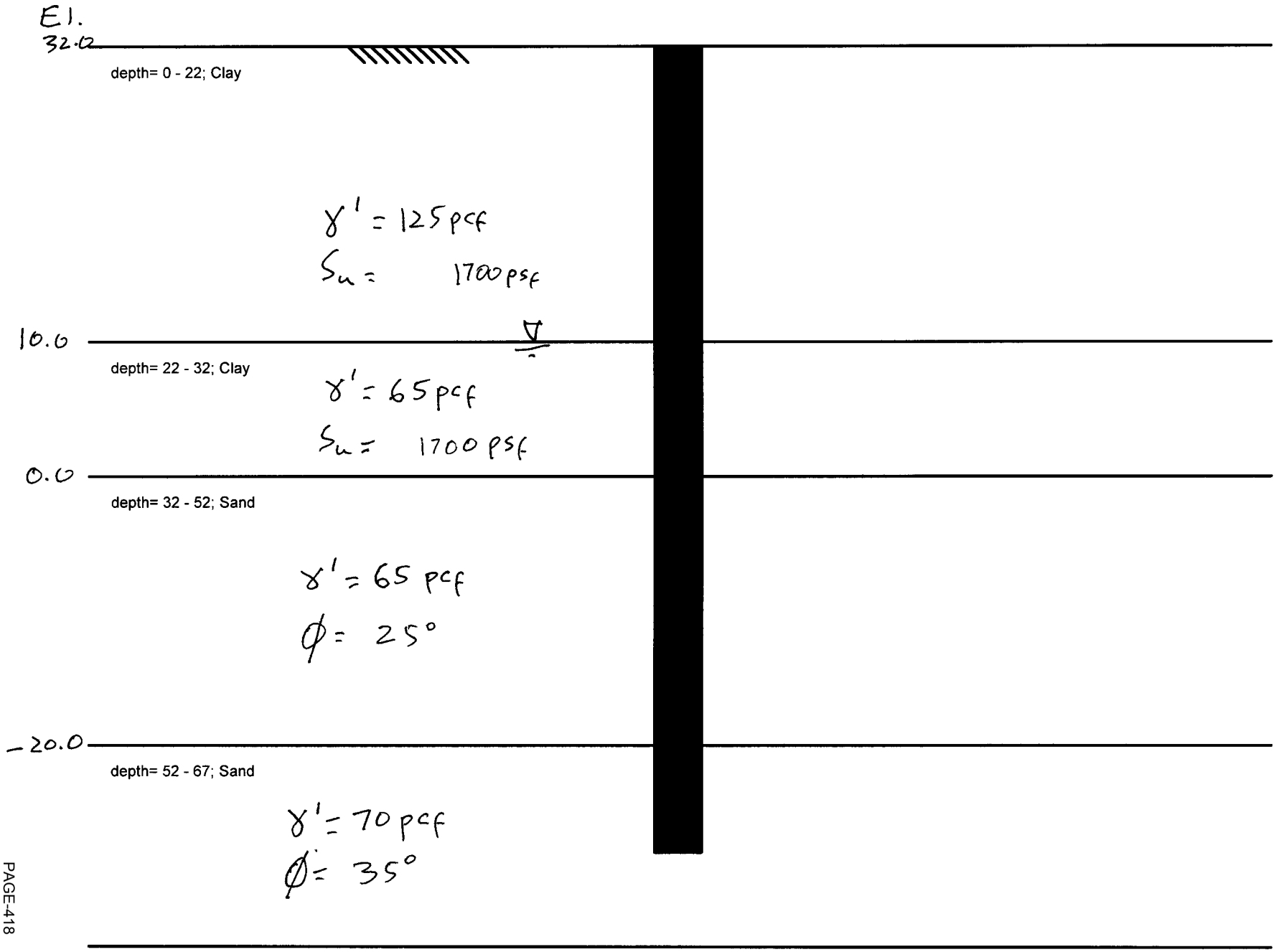
TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.2127E+02	0.8913E-02
0.4253E+02	0.1783E-01
0.8507E+02	0.3565E-01
0.1701E+03	0.2317E+00
0.2552E+03	0.7487E+00
0.3063E+03	0.1301E+01
0.3403E+03	0.1783E+01
0.3403E+03	0.2674E+01
0.3403E+03	0.3565E+01

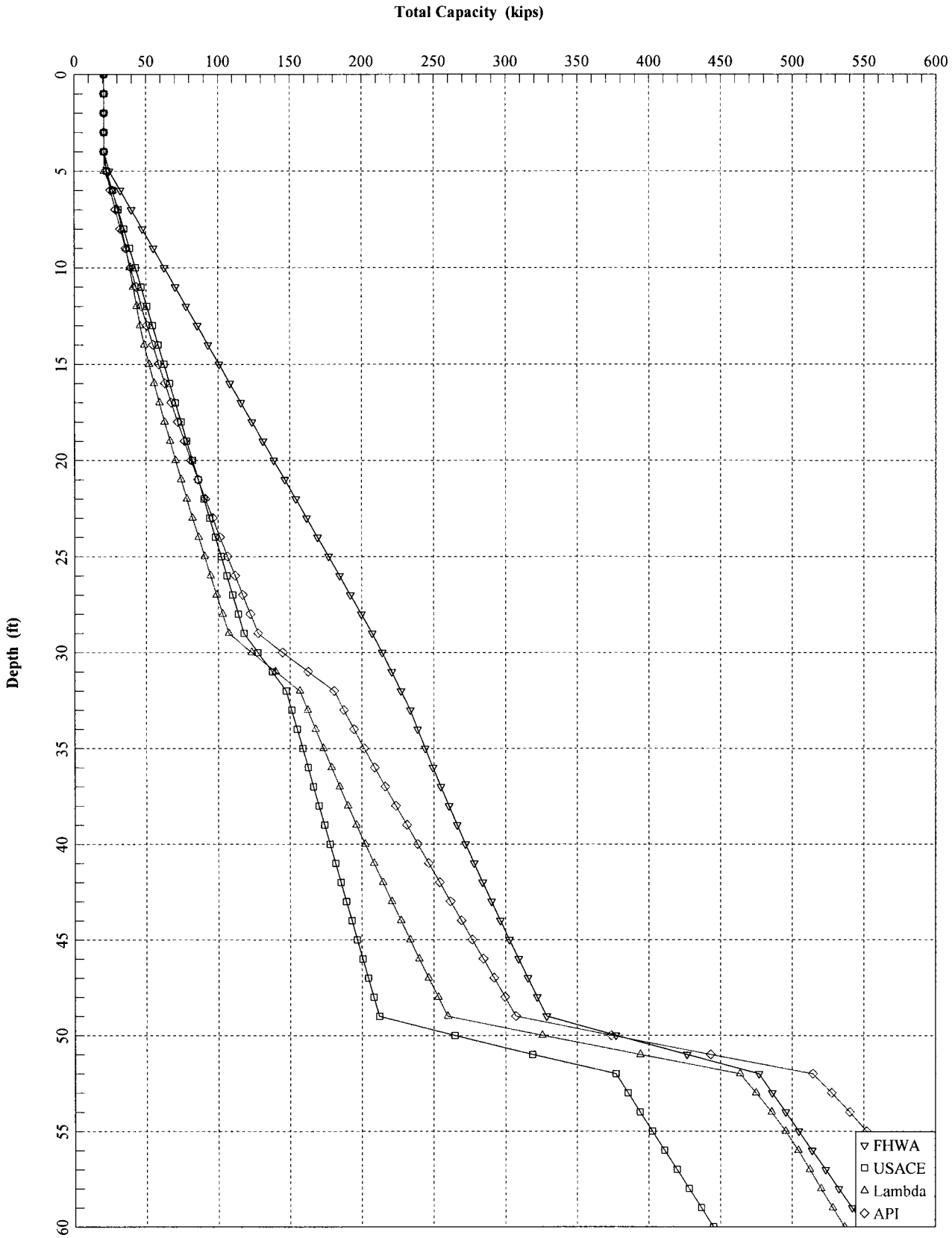
LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.8879E+00	0.6234E-03	0.2386E+00	0.1000E-03
0.8879E+01	0.6234E-02	0.2386E+01	0.1000E-02
0.4497E+02	0.3143E-01	0.1193E+02	0.5000E-02
0.8855E+02	0.6255E-01	0.2386E+02	0.1000E-01
0.2992E+03	0.2399E+00	0.9130E+02	0.5000E-01
0.3956E+03	0.3592E+00	0.1130E+03	0.1000E+00
0.4891E+03	0.8433E+00	0.2143E+03	0.5000E+00
0.5533E+03	0.1398E+01	0.2784E+03	0.1000E+01
0.6151E+03	0.2451E+01	0.3403E+03	0.2000E+01

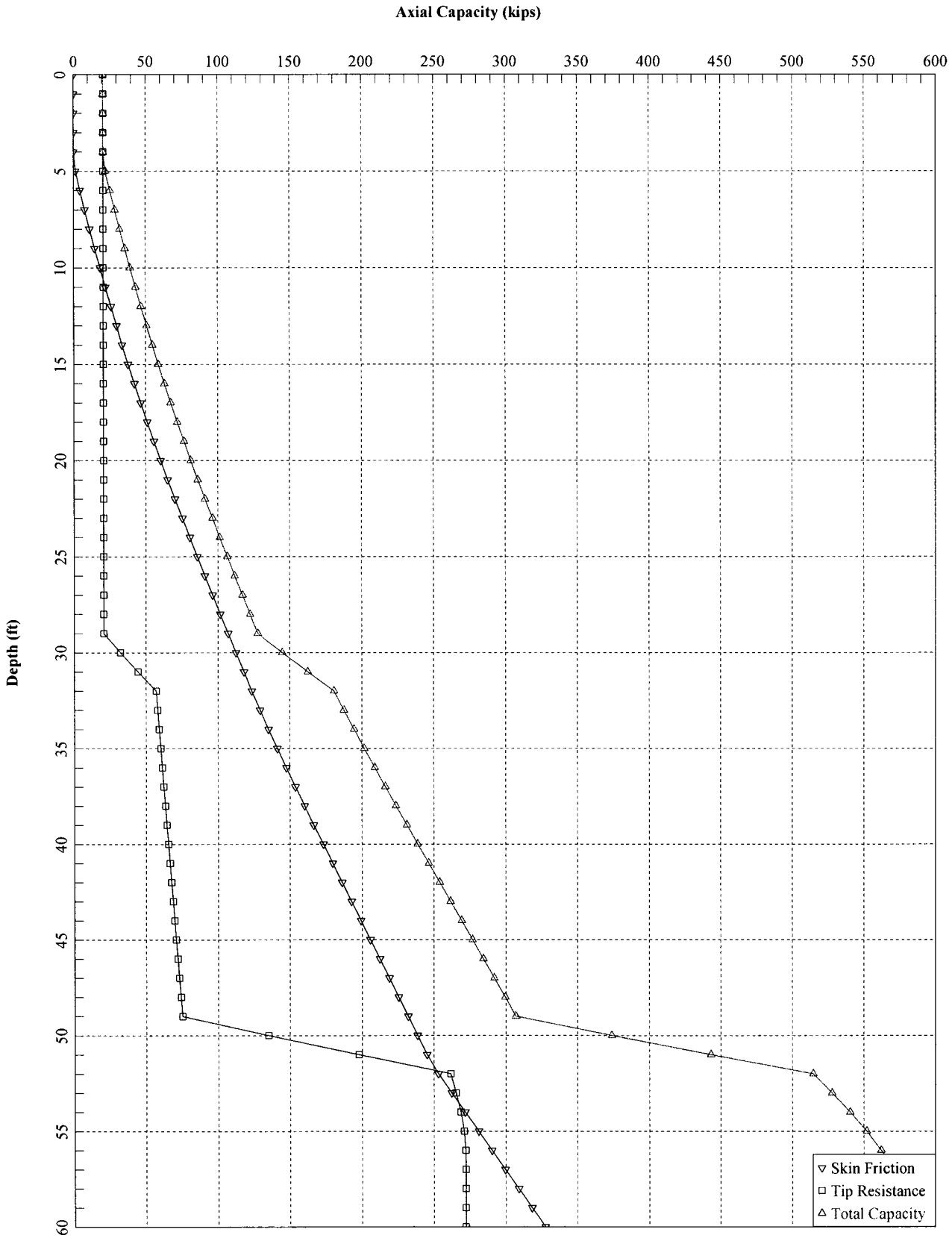
Abutment 3 - Left Bridge
14-in Class 200 Alt. 'X' Concrete Pile
(Based on Boring CLO-125)

INFORMATION HANDOUT





SR4 Contra Loma Blvd. Undercrossing - Left Bridge - Abutment 3 - 14-in Square PPC PIle



SR4 Contra Loma Blvd. Undercrossing - Left Bridge - Abutment 3 - 14--in Square PPC Pile - API RP2A Method

1

AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

SR4 Contra LOma UC - Abutment 3 - Left Bridge - 14-in Square PPC Pile

DESIGNER : Partha Sircar

DATE : May 12, 2010

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 56.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 1.36 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 0.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 0.00 IN.
PILE LENGTH = 60.00 FT.
MODULUS OF ELASTICITY = 0.430E+07 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 5.00 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.00	125.00	0.00	0.00
22.00	CLAY	0.00	125.00	0.00	0.00
22.00	CLAY	0.00	65.00	0.00	0.00
32.00	CLAY	0.00	65.00	0.00	0.00
32.00	SAND	1.00	65.00	25.00	12.00
52.00	SAND	1.00	65.00	25.00	12.00
52.00	SAND	1.00	70.00	35.00	40.00
67.00	SAND	1.00	70.00	35.00	40.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
1.70	15.30	1.70	0.85	0.00	0.00	0.00
1.70	15.30	1.70	0.85	0.00	0.00	0.00
1.70	15.30	1.70	0.85	0.00	0.00	0.00
1.70	15.30	1.70	0.85	0.00	0.00	0.00
1.40	60.00	0.00	0.00	0.00	0.00	0.00
1.40	60.00	0.00	0.00	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00

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* COMPUTATION RESULT *
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PILE PENETRATION FT.	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPACITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPACITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPACITY KIP
	********** FED. HWY. METHOD **********			********** ARMY CORPS METHOD **********			********** LAMBDA 2 METHOD **********		
0.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
1.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
2.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
3.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
4.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
5.0	3.8	20.8	24.6	2.0	20.8	22.8	0.0	20.8	20.8
6.0	11.4	20.8	32.2	5.9	20.8	26.8	6.1	20.8	27.0
7.0	19.0	20.8	39.9	9.9	20.8	30.7	9.5	20.8	30.3
8.0	26.7	20.8	47.5	13.9	20.8	34.7	12.5	20.8	33.3
9.0	34.3	20.8	55.1	17.8	20.8	38.7	15.3	20.8	36.1
10.0	41.9	20.8	62.7	21.8	20.8	42.6	17.9	20.8	38.7
11.0	49.5	20.8	70.3	25.8	20.8	46.6	20.4	20.8	41.2
12.0	57.1	20.8	77.9	29.7	20.8	50.6	22.7	20.8	43.5
13.0	64.7	20.8	85.6	33.7	20.8	54.5	24.9	20.8	45.8
14.0	72.4	20.8	93.2	37.7	20.8	58.5	28.0	20.8	48.8
15.0	80.0	20.8	100.8	41.6	20.8	62.5	31.4	20.8	52.2
16.0	87.6	20.8	108.4	45.6	20.8	66.4	34.9	20.8	55.7
17.0	95.2	20.8	116.0	49.6	20.8	70.4	38.5	20.8	59.3
18.0	102.8	20.8	123.6	53.5	20.8	74.4	42.1	20.8	62.9
19.0	110.4	20.8	131.3	57.5	20.8	78.3	45.8	20.8	66.7
20.0	118.0	20.8	138.9	61.5	20.8	82.3	49.7	20.8	70.5
21.0	125.7	20.8	146.5	65.4	20.8	86.3	53.5	20.8	74.4
22.0	133.3	20.8	154.1	69.4	20.8	90.2	57.5	20.8	78.4
23.0	140.9	20.8	161.7	73.4	20.8	94.2	61.6	20.8	82.4
24.0	148.5	20.8	169.3	77.3	20.8	98.2	65.6	20.8	86.5
25.0	156.1	20.8	177.0	81.3	20.8	102.1	69.8	20.8	90.6
26.0	163.7	20.8	184.6	85.3	20.8	106.1	73.9	20.8	94.8
27.0	171.4	20.8	192.2	89.2	20.8	110.1	78.1	20.8	99.0
28.0	179.0	20.8	199.8	93.2	20.8	114.0	82.4	20.8	103.2
29.0	186.6	20.8	207.4	97.2	20.8	118.0	86.7	20.8	107.5
30.0	194.2	19.9	214.2	101.1	26.6	127.7	91.0	32.3	123.4
31.0	201.8	19.0	220.9	105.1	32.5	137.6	95.4	44.5	140.0
32.0	209.1	18.1	227.2	108.9	38.4	147.3	99.8	57.1	156.9
33.0	215.5	18.1	233.6	112.7	38.4	151.2	104.2	58.2	162.3
34.0	220.7	18.1	238.8	116.6	38.4	155.0	108.6	59.2	167.8
35.0	226.0	18.1	244.1	120.4	38.4	158.8	113.1	60.3	173.4
36.0	231.4	18.1	249.5	124.2	38.4	162.6	117.7	61.4	179.0
37.0	236.9	18.1	255.0	128.0	38.4	166.4	122.3	62.4	184.7
38.0	242.5	18.1	260.6	131.8	38.4	170.2	127.1	63.5	190.5
39.0	248.2	18.1	266.4	135.6	38.4	174.0	131.9	64.5	196.4
40.0	254.0	18.1	272.2	139.4	38.4	177.8	136.8	65.6	202.4
41.0	259.9	18.1	278.1	143.2	38.4	181.7	141.8	66.7	208.5
42.0	265.9	18.1	284.0	147.1	38.4	185.5	146.9	67.7	214.6
43.0	272.0	18.1	290.1	150.9	38.4	189.3	152.0	68.8	220.8
44.0	278.2	18.1	296.3	154.7	38.4	193.1	157.3	69.9	227.1
45.0	284.5	18.1	302.6	158.5	38.4	196.9	162.6	70.9	233.5
46.0	290.9	18.1	309.0	162.3	38.4	200.7	168.0	72.0	239.9

47.0	297.4	18.1	315.5	166.1	38.4	204.5	173.5	73.0	246.5
48.0	303.9	18.1	322.0	169.9	38.4	208.3	179.0	74.1	253.1
49.0	310.4	18.1	328.6	173.7	38.4	212.2	184.7	75.2	259.8
50.0	317.0	60.1	377.0	177.6	87.2	264.7	190.4	135.2	325.6
51.0	323.5	103.3	426.7	181.4	137.4	318.8	196.2	197.9	394.1
52.0	330.5	146.5	476.9	189.3	187.7	377.0	202.1	261.6	463.7
53.0	339.8	146.5	486.2	197.8	187.7	385.5	209.5	265.4	474.9
54.0	349.1	146.5	495.6	206.3	187.7	394.0	217.1	268.7	485.8
55.0	358.5	146.5	504.9	214.9	187.7	402.5	224.7	271.0	495.7
56.0	367.8	146.5	514.2	223.4	187.7	411.0	232.5	272.0	504.5
57.0	377.1	146.5	523.6	231.9	187.7	419.6	240.3	272.2	512.6
58.0	386.5	146.5	532.9	240.4	187.7	428.1	248.3	272.2	520.5
59.0	395.8	146.5	542.2	249.0	187.7	436.6	256.4	272.2	528.6
60.0	405.1	146.5	551.6	257.5	187.7	445.1	264.6	272.2	536.8

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* API RP-2A (1994) *
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PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	20.8	20.8
1.00	0.0	20.8	20.8
2.00	0.0	20.8	20.8
3.00	0.0	20.8	20.8
4.00	0.0	20.8	20.8
5.00	1.5	20.8	22.4
6.00	4.7	20.8	25.5
7.00	8.0	20.8	28.8
8.00	11.4	20.8	32.2
9.00	14.9	20.8	35.8
10.00	18.6	20.8	39.4
11.00	22.3	20.8	43.1
12.00	26.1	20.8	46.9
13.00	30.0	20.8	50.8
14.00	33.9	20.8	54.8
15.00	38.0	20.8	58.9
16.00	42.3	20.8	63.1
17.00	46.6	20.8	67.5
18.00	51.1	20.8	72.0
19.00	55.8	20.8	76.6
20.00	60.5	20.8	81.3
21.00	65.4	20.8	86.2
22.00	70.4	20.8	91.2
23.00	75.5	20.8	96.3
24.00	80.6	20.8	101.4
25.00	85.8	20.8	106.6
26.00	91.0	20.8	111.9
27.00	96.3	20.8	117.2
28.00	101.7	20.8	122.5
29.00	107.1	20.8	127.9
30.00	112.6	32.3	144.9
31.00	118.1	44.5	162.7
32.00	123.7	57.1	180.8
33.00	129.4	58.2	187.6
34.00	135.4	59.2	194.6
35.00	141.4	60.3	201.7
36.00	147.6	61.4	209.0
37.00	153.9	62.4	216.3
38.00	160.3	63.5	223.7
39.00	166.7	64.5	231.3

40.00	173.3	65.6	238.9
41.00	179.8	66.7	246.5
42.00	186.3	67.7	254.1
43.00	192.9	68.8	261.7
44.00	199.4	69.9	269.3
45.00	205.9	70.9	276.9
46.00	212.5	72.0	284.5
47.00	219.0	73.0	292.0
48.00	225.5	74.1	299.6
49.00	232.1	75.2	307.2
50.00	238.6	135.2	373.8
51.00	245.1	197.9	443.1
52.00	253.1	261.6	514.6
53.00	262.4	265.4	527.8
54.00	271.7	268.7	540.5
55.00	281.1	271.0	552.1
56.00	290.4	272.0	562.4
57.00	299.7	272.2	572.0
58.00	309.1	272.2	581.3
59.00	318.4	272.2	590.6
60.00	327.7	272.2	600.0

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

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* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
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T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2852E-01
			0.0000E+00	0.5526E-01
			0.0000E+00	0.1016E+00
			0.0000E+00	0.1426E+00
			0.0000E+00	0.1783E+00
			0.0000E+00	0.3565E+00
			0.0000E+00	0.5348E+00
			0.0000E+00	0.8913E+00
			0.0000E+00	0.3565E+01
2	10	0.1103E+02		
			0.0000E+00	0.0000E+00
			0.1698E+01	0.2852E-01
			0.2830E+01	0.5526E-01
			0.4245E+01	0.1016E+00
			0.5093E+01	0.1426E+00
			0.5659E+01	0.1783E+00
			0.5093E+01	0.3565E+00
			0.5093E+01	0.5348E+00
			0.5093E+01	0.8913E+00
			0.5093E+01	0.3565E+01
3	10	0.2196E+02		
			0.0000E+00	0.0000E+00
			0.2226E+01	0.2852E-01
			0.3711E+01	0.5526E-01

Abutment 3 - Left Bridge.apo

			0.5566E+01	0.1016E+00
			0.6679E+01	0.1426E+00
			0.7421E+01	0.1783E+00
			0.6679E+01	0.3565E+00
			0.6679E+01	0.5348E+00
			0.6679E+01	0.8913E+00
			0.6679E+01	0.3565E+01
4	10	0.2200E+02		
			0.0000E+00	0.0000E+00
			0.2265E+01	0.2852E-01
			0.3776E+01	0.5526E-01
			0.5664E+01	0.1016E+00
			0.6796E+01	0.1426E+00
			0.7552E+01	0.1783E+00
			0.6796E+01	0.3565E+00
			0.6796E+01	0.5348E+00
			0.6796E+01	0.8913E+00
			0.6796E+01	0.3565E+01
5	10	0.2702E+02		
			0.0000E+00	0.0000E+00
			0.2394E+01	0.2852E-01
			0.3990E+01	0.5526E-01
			0.5985E+01	0.1016E+00
			0.7182E+01	0.1426E+00
			0.7981E+01	0.1783E+00
			0.7182E+01	0.3565E+00
			0.7182E+01	0.5348E+00
			0.7182E+01	0.8913E+00
			0.7182E+01	0.3565E+01
6	10	0.3196E+02		
			0.0000E+00	0.0000E+00
			0.2492E+01	0.2852E-01
			0.4154E+01	0.5526E-01
			0.6231E+01	0.1016E+00
			0.7477E+01	0.1426E+00
			0.8308E+01	0.1783E+00
			0.7477E+01	0.3565E+00
			0.7477E+01	0.5348E+00
			0.7477E+01	0.8913E+00
			0.7477E+01	0.3565E+01
7	10	0.3200E+02		
			0.0000E+00	0.0000E+00
			0.8553E+00	0.1000E-01
			0.1711E+01	0.2000E-01
			0.3421E+01	0.4000E-01
			0.5132E+01	0.6000E-01
			0.6842E+01	0.8000E-01
			0.7698E+01	0.9000E-01
			0.8553E+01	0.1000E+00
			0.8553E+01	0.5000E+00
			0.8553E+01	0.2000E+01
8	10	0.4202E+02		
			0.0000E+00	0.0000E+00
			0.9722E+00	0.1000E-01
			0.1944E+01	0.2000E-01
			0.3889E+01	0.4000E-01
			0.5833E+01	0.6000E-01
			0.7778E+01	0.8000E-01
			0.8750E+01	0.9000E-01
			0.9722E+01	0.1000E+00
			0.9722E+01	0.5000E+00
			0.9722E+01	0.2000E+01
9	10	0.5196E+02		
			0.0000E+00	0.0000E+00

Abutment 3 - Left Bridge.apo

			0.1180E+01	0.1000E-01
			0.2359E+01	0.2000E-01
			0.4719E+01	0.4000E-01
			0.7078E+01	0.6000E-01
			0.9438E+01	0.8000E-01
			0.1062E+02	0.9000E-01
			0.1180E+02	0.1000E+00
			0.1180E+02	0.5000E+00
			0.1180E+02	0.2000E+01
10	10	0.5200E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01
11	10	0.5952E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01
12	10	0.6696E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.1701E+02	0.8913E-02
0.3403E+02	0.1783E-01
0.6806E+02	0.3565E-01
0.1361E+03	0.2317E+00
0.2042E+03	0.7487E+00
0.2450E+03	0.1301E+01
0.2722E+03	0.1783E+01
0.2722E+03	0.2674E+01
0.2722E+03	0.3565E+01

LOAD VERSUS SETTLEMENT CURVE
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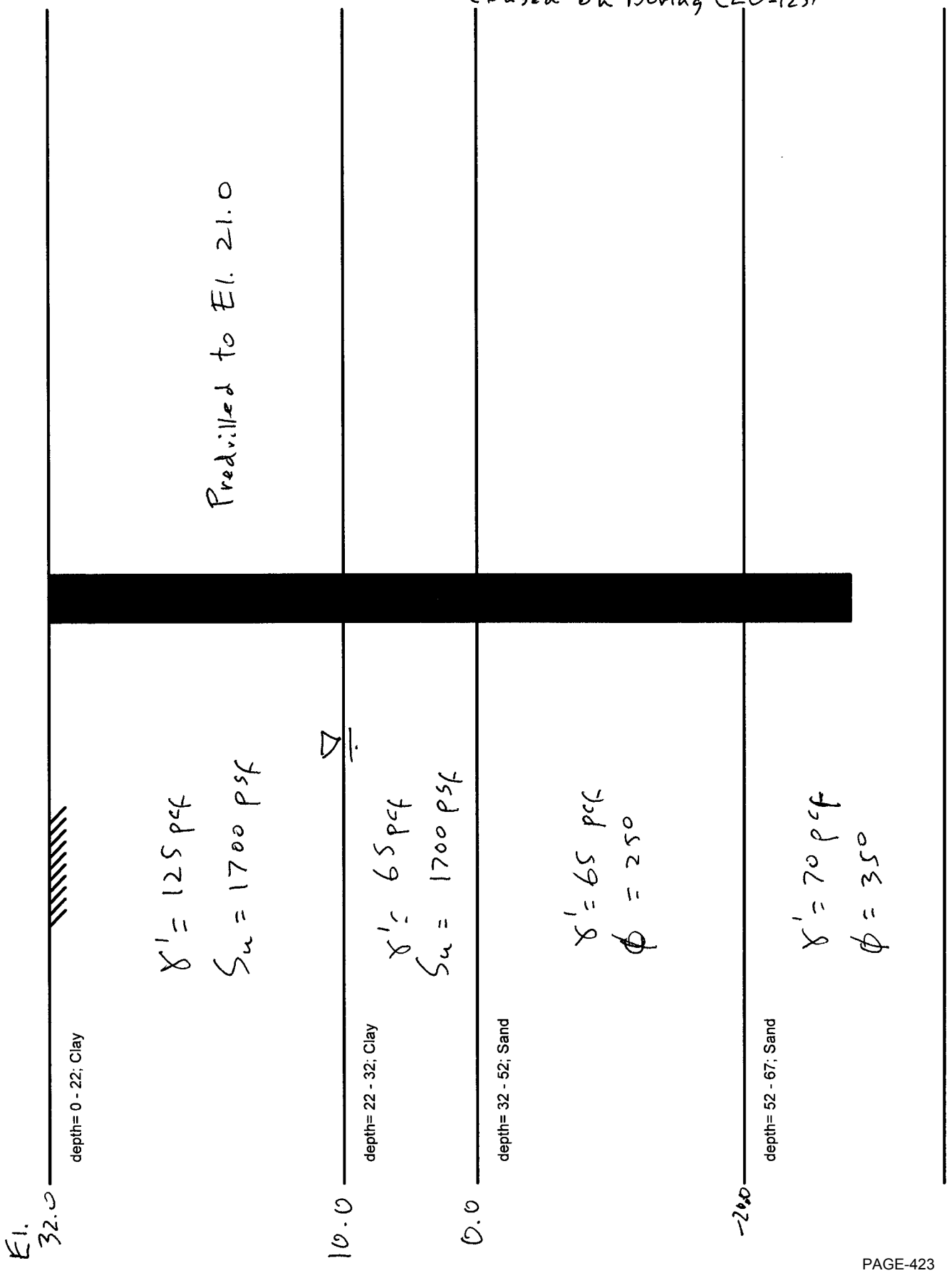
Abutment 3 - Left Bridge.apo

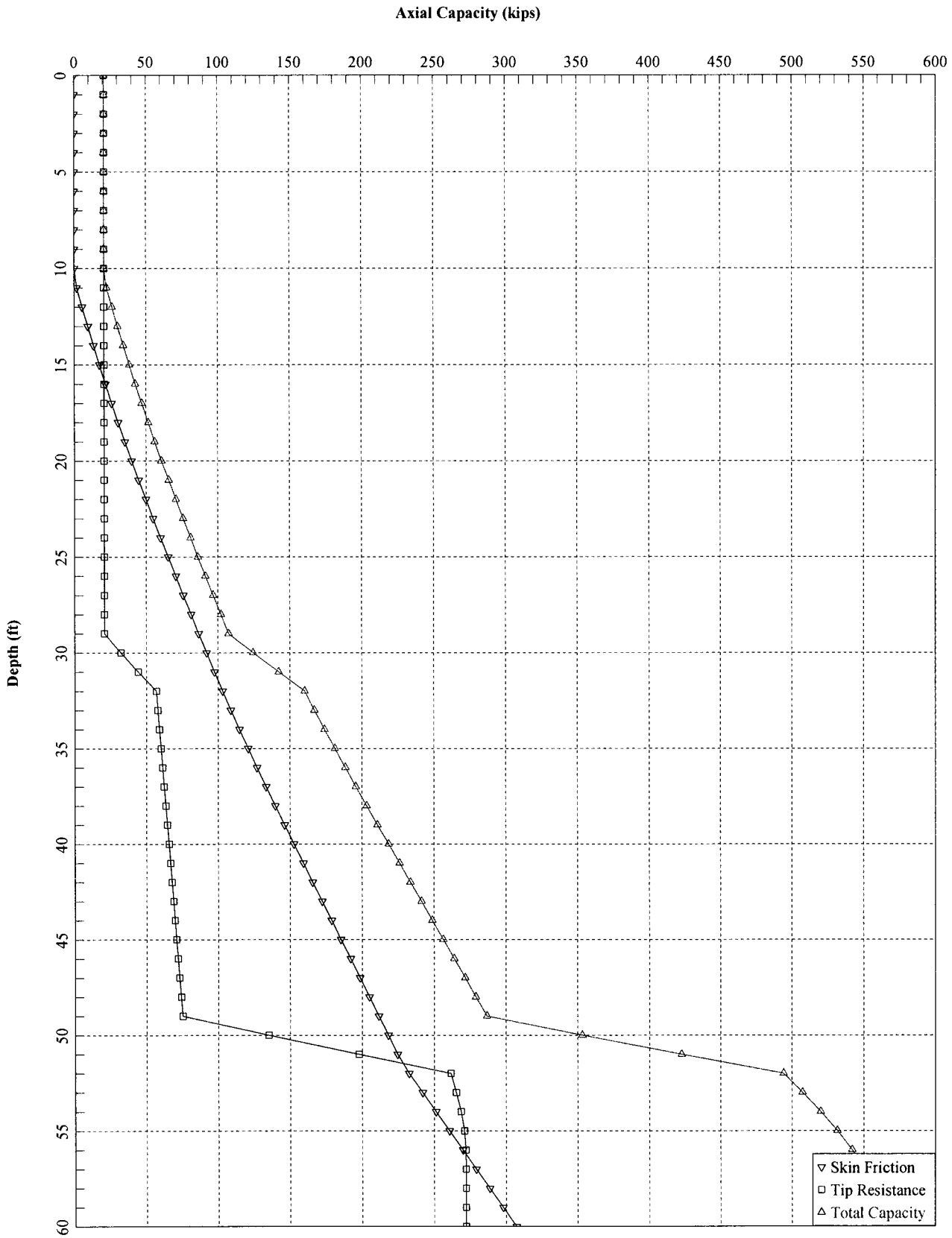
TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.9410E+00	0.5746E-03	0.1909E+00	0.1000E-03
0.9410E+01	0.5746E-02	0.1909E+01	0.1000E-02
0.4762E+02	0.2893E-01	0.9545E+01	0.5000E-02
0.9287E+02	0.5758E-01	0.1909E+02	0.1000E-01
0.3317E+03	0.2382E+00	0.7304E+02	0.5000E-01
0.4169E+03	0.3510E+00	0.9039E+02	0.1000E+00
0.4899E+03	0.8177E+00	0.1714E+03	0.5000E+00
0.5412E+03	0.1361E+01	0.2227E+03	0.1000E+01
0.5907E+03	0.2404E+01	0.2722E+03	0.2000E+01

Abutment 3 - Right Bridge

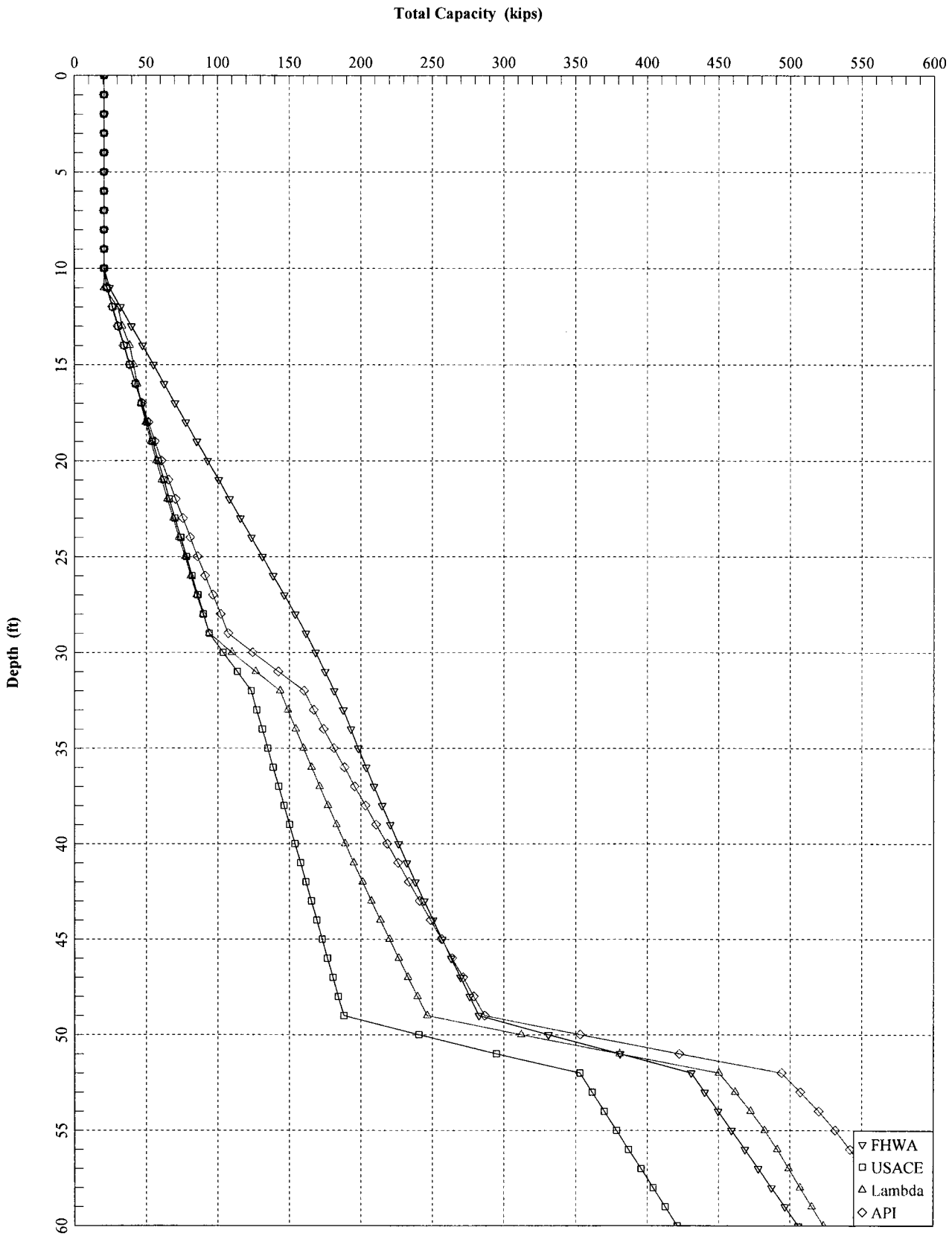
14-in Class 200 Alt. 'X' Concrete Pile

(Based on Boring CL0-125)





SR4 Contra Loma Blvd. Undercrossing - Right Bridge - Abutment 3 - 14--in Square PPC Pile - API RP2A Method



SR4 Contra Loma Blvd. Undercrossing - Right Bridge - Abutment 3 - 14-in Square PPC PIle

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AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

SR4 Contra LOma UC - Abutment 3 - Right Bridge - 14-in Square PPC Pile

DESIGNER : Partha Sircar

DATE : May 12, 2010

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 56.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 1.36 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 0.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 0.00 IN.
PILE LENGTH = 60.00 FT.
MODULUS OF ELASTICITY = 0.430E+07 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 11.00 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.00	125.00	0.00	0.00
22.00	CLAY	0.00	125.00	0.00	0.00
22.00	CLAY	0.00	65.00	0.00	0.00
32.00	CLAY	0.00	65.00	0.00	0.00
32.00	SAND	1.00	65.00	25.00	12.00
52.00	SAND	1.00	65.00	25.00	12.00
52.00	SAND	1.00	70.00	35.00	40.00
67.00	SAND	1.00	70.00	35.00	40.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
1.70	15.30	1.70	0.85	0.00	0.00	0.00
1.70	15.30	1.70	0.85	0.00	0.00	0.00
1.70	15.30	1.70	0.85	0.00	0.00	0.00
1.70	15.30	1.70	0.85	0.00	0.00	0.00
1.40	60.00	0.00	0.00	0.00	0.00	0.00
1.40	60.00	0.00	0.00	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00

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* COMPUTATION RESULT *
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PILE PENETRATION FT.	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPACITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPACITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPACITY KIP
	********** FED. HWY. METHOD **********			********** ARMY CORPS METHOD **********			********** LAMBDA 2 METHOD **********		
0.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
1.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
2.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
3.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
4.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
5.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
6.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
7.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
8.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
9.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
10.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
11.0	3.8	20.8	24.6	2.0	20.8	22.8	0.0	20.8	20.8
12.0	11.4	20.8	32.2	5.9	20.8	26.8	9.7	20.8	30.5
13.0	19.0	20.8	39.9	9.9	20.8	30.7	12.6	20.8	33.4
14.0	26.7	20.8	47.5	13.9	20.8	34.7	17.9	20.8	38.7
15.0	34.3	20.8	55.1	17.8	20.8	38.7	20.5	20.8	41.4
16.0	41.9	20.8	62.7	21.8	20.8	42.6	23.1	20.8	43.9
17.0	49.5	20.8	70.3	25.8	20.8	46.6	25.5	20.8	46.3
18.0	57.1	20.8	77.9	29.7	20.8	50.6	28.8	20.8	49.6
19.0	64.7	20.8	85.6	33.7	20.8	54.5	32.5	20.8	53.3
20.0	72.4	20.8	93.2	37.7	20.8	58.5	36.3	20.8	57.2
21.0	80.0	20.8	100.8	41.6	20.8	62.5	40.2	20.8	61.0
22.0	87.6	20.8	108.4	45.6	20.8	66.4	44.2	20.8	65.0
23.0	95.2	20.8	116.0	49.6	20.8	70.4	48.2	20.8	69.1
24.0	102.8	20.8	123.6	53.5	20.8	74.4	52.3	20.8	73.1
25.0	110.4	20.8	131.3	57.5	20.8	78.3	56.4	20.8	77.3
26.0	118.0	20.8	138.9	61.5	20.8	82.3	60.6	20.8	81.4
27.0	125.7	20.8	146.5	65.4	20.8	86.3	64.8	20.8	85.6
28.0	133.3	20.8	154.1	69.4	20.8	90.2	69.1	20.8	89.9
29.0	140.9	20.8	161.7	73.4	20.8	94.2	73.4	20.8	94.2
30.0	148.5	19.9	168.5	77.3	26.6	103.9	77.7	32.3	110.0
31.0	156.1	19.0	175.2	81.3	32.5	113.8	82.1	44.5	126.6
32.0	163.4	18.1	181.5	85.1	38.4	123.5	86.5	57.1	143.6
33.0	169.8	18.1	187.9	88.9	38.4	127.4	90.8	58.2	149.0
34.0	175.0	18.1	193.1	92.8	38.4	131.2	95.3	59.2	154.5
35.0	180.3	18.1	198.4	96.6	38.4	135.0	99.7	60.3	160.0
36.0	185.7	18.1	203.8	100.4	38.4	138.8	104.3	61.4	165.7
37.0	191.2	18.1	209.3	104.2	38.4	142.6	109.0	62.4	171.4
38.0	196.8	18.1	215.0	108.0	38.4	146.4	113.7	63.5	177.2
39.0	202.5	18.1	220.7	111.8	38.4	150.2	118.6	64.5	183.1
40.0	208.3	18.1	226.5	115.6	38.4	154.0	123.5	65.6	189.1
41.0	214.2	18.1	232.4	119.4	38.4	157.9	128.5	66.7	195.1
42.0	220.2	18.1	238.4	123.3	38.4	161.7	133.5	67.7	201.3
43.0	226.3	18.1	244.4	127.1	38.4	165.5	138.7	68.8	207.5
44.0	232.5	18.1	250.6	130.9	38.4	169.3	143.9	69.9	213.8
45.0	238.8	18.1	256.9	134.7	38.4	173.1	149.2	70.9	220.2
46.0	245.2	18.1	263.3	138.5	38.4	176.9	154.6	72.0	226.6

47.0	251.7	18.1	269.8	142.3	38.4	180.7	160.1	73.0	233.2
48.0	258.2	18.1	276.3	146.1	38.4	184.5	165.7	74.1	239.8
49.0	264.7	18.1	282.9	149.9	38.4	188.4	171.3	75.2	246.5
50.0	271.3	60.1	331.3	153.8	87.2	240.9	177.1	135.2	312.3
51.0	277.8	103.3	381.1	157.6	137.4	295.0	182.9	197.9	380.8
52.0	284.8	146.5	431.2	165.5	187.7	353.2	188.8	261.6	450.3
53.0	294.1	146.5	440.5	174.0	187.7	361.7	196.2	265.4	461.6
54.0	303.4	146.5	449.9	182.5	187.7	370.2	203.7	268.7	472.5
55.0	312.8	146.5	459.2	191.1	187.7	378.7	211.4	271.0	482.4
56.0	322.1	146.5	468.5	199.6	187.7	387.2	219.1	272.0	491.2
57.0	331.4	146.5	477.9	208.1	187.7	395.8	227.0	272.2	499.2
58.0	340.8	146.5	487.2	216.6	187.7	404.3	235.0	272.2	507.2
59.0	350.1	146.5	496.5	225.2	187.7	412.8	243.1	272.2	515.3
60.0	359.4	146.5	505.9	233.7	187.7	421.3	251.3	272.2	523.5

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* API RP-2A (1994) *
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PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	20.8	20.8
1.00	0.0	20.8	20.8
2.00	0.0	20.8	20.8
3.00	0.0	20.8	20.8
4.00	0.0	20.8	20.8
5.00	0.0	20.8	20.8
6.00	0.0	20.8	20.8
7.00	0.0	20.8	20.8
8.00	0.0	20.8	20.8
9.00	0.0	20.8	20.8
10.00	0.0	20.8	20.8
11.00	1.9	20.8	22.7
12.00	5.7	20.8	26.5
13.00	9.6	20.8	30.4
14.00	13.5	20.8	34.4
15.00	17.6	20.8	38.5
16.00	21.9	20.8	42.7
17.00	26.2	20.8	47.1
18.00	30.7	20.8	51.6
19.00	35.4	20.8	56.2
20.00	40.1	20.8	60.9
21.00	45.0	20.8	65.8
22.00	50.0	20.8	70.8
23.00	55.0	20.8	75.9
24.00	60.2	20.8	81.0
25.00	65.4	20.8	86.2
26.00	70.6	20.8	91.4
27.00	75.9	20.8	96.8
28.00	81.3	20.8	102.1
29.00	86.7	20.8	107.5
30.00	92.2	32.3	124.5
31.00	97.7	44.5	142.3
32.00	103.3	57.1	160.4
33.00	109.0	58.2	167.2
34.00	115.0	59.2	174.2
35.00	121.0	60.3	181.3
36.00	127.2	61.4	188.6
37.00	133.5	62.4	195.9
38.00	139.8	63.5	203.3
39.00	146.3	64.5	210.9

40.00	152.9	65.6	218.5
41.00	159.4	66.7	226.1
42.00	165.9	67.7	233.7
43.00	172.5	68.8	241.3
44.00	179.0	69.9	248.9
45.00	185.5	70.9	256.5
46.00	192.1	72.0	264.0
47.00	198.6	73.0	271.6
48.00	205.1	74.1	279.2
49.00	211.7	75.2	286.8
50.00	218.2	135.2	353.4
51.00	224.7	197.9	422.6
52.00	232.7	261.6	494.2
53.00	242.0	265.4	507.4
54.00	251.3	268.7	520.1
55.00	260.7	271.0	531.7
56.00	270.0	272.0	542.0
57.00	279.3	272.2	551.6
58.00	288.7	272.2	560.9
59.00	298.0	272.2	570.2
60.00	307.3	272.2	579.6

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

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* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
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T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2852E-01
			0.0000E+00	0.5526E-01
			0.0000E+00	0.1016E+00
			0.0000E+00	0.1426E+00
			0.0000E+00	0.1783E+00
			0.0000E+00	0.3565E+00
			0.0000E+00	0.5348E+00
			0.0000E+00	0.8913E+00
			0.0000E+00	0.3565E+01
2	10	0.1103E+02		
			0.0000E+00	0.0000E+00
			0.1698E+01	0.2852E-01
			0.2830E+01	0.5526E-01
			0.4245E+01	0.1016E+00
			0.5093E+01	0.1426E+00
			0.5659E+01	0.1783E+00
			0.5093E+01	0.3565E+00
			0.5093E+01	0.5348E+00
			0.5093E+01	0.8913E+00
			0.5093E+01	0.3565E+01
3	10	0.2196E+02		
			0.0000E+00	0.0000E+00
			0.2226E+01	0.2852E-01
			0.3711E+01	0.5526E-01

Abutment 3 - Right Bridge.apo

			0.5566E+01	0.1016E+00
			0.6679E+01	0.1426E+00
			0.7421E+01	0.1783E+00
			0.6679E+01	0.3565E+00
			0.6679E+01	0.5348E+00
			0.6679E+01	0.8913E+00
			0.6679E+01	0.3565E+01
4	10	0.2200E+02		
			0.0000E+00	0.0000E+00
			0.2265E+01	0.2852E-01
			0.3776E+01	0.5526E-01
			0.5664E+01	0.1016E+00
			0.6796E+01	0.1426E+00
			0.7552E+01	0.1783E+00
			0.6796E+01	0.3565E+00
			0.6796E+01	0.5348E+00
			0.6796E+01	0.8913E+00
			0.6796E+01	0.3565E+01
5	10	0.2702E+02		
			0.0000E+00	0.0000E+00
			0.2394E+01	0.2852E-01
			0.3990E+01	0.5526E-01
			0.5985E+01	0.1016E+00
			0.7182E+01	0.1426E+00
			0.7981E+01	0.1783E+00
			0.7182E+01	0.3565E+00
			0.7182E+01	0.5348E+00
			0.7182E+01	0.8913E+00
			0.7182E+01	0.3565E+01
6	10	0.3196E+02		
			0.0000E+00	0.0000E+00
			0.2492E+01	0.2852E-01
			0.4154E+01	0.5526E-01
			0.6231E+01	0.1016E+00
			0.7477E+01	0.1426E+00
			0.8308E+01	0.1783E+00
			0.7477E+01	0.3565E+00
			0.7477E+01	0.5348E+00
			0.7477E+01	0.8913E+00
			0.7477E+01	0.3565E+01
7	10	0.3200E+02		
			0.0000E+00	0.0000E+00
			0.8553E+00	0.1000E-01
			0.1711E+01	0.2000E-01
			0.3421E+01	0.4000E-01
			0.5132E+01	0.6000E-01
			0.6842E+01	0.8000E-01
			0.7698E+01	0.9000E-01
			0.8553E+01	0.1000E+00
			0.8553E+01	0.5000E+00
			0.8553E+01	0.2000E+01
8	10	0.4202E+02		
			0.0000E+00	0.0000E+00
			0.9722E+00	0.1000E-01
			0.1944E+01	0.2000E-01
			0.3889E+01	0.4000E-01
			0.5833E+01	0.6000E-01
			0.7778E+01	0.8000E-01
			0.8750E+01	0.9000E-01
			0.9722E+01	0.1000E+00
			0.9722E+01	0.5000E+00
			0.9722E+01	0.2000E+01
9	10	0.5196E+02		
			0.0000E+00	0.0000E+00

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			0.1180E+01	0.1000E-01
			0.2359E+01	0.2000E-01
			0.4719E+01	0.4000E-01
			0.7078E+01	0.6000E-01
			0.9438E+01	0.8000E-01
			0.1062E+02	0.9000E-01
			0.1180E+02	0.1000E+00
			0.1180E+02	0.5000E+00
			0.1180E+02	0.2000E+01
10	10	0.5200E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01
11	10	0.5952E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01
12	10	0.6696E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.1701E+02	0.8913E-02
0.3403E+02	0.1783E-01
0.6806E+02	0.3565E-01
0.1361E+03	0.2317E+00
0.2042E+03	0.7487E+00
0.2450E+03	0.1301E+01
0.2722E+03	0.1783E+01
0.2722E+03	0.2674E+01
0.2722E+03	0.3565E+01

LOAD VERSUS SETTLEMENT CURVE
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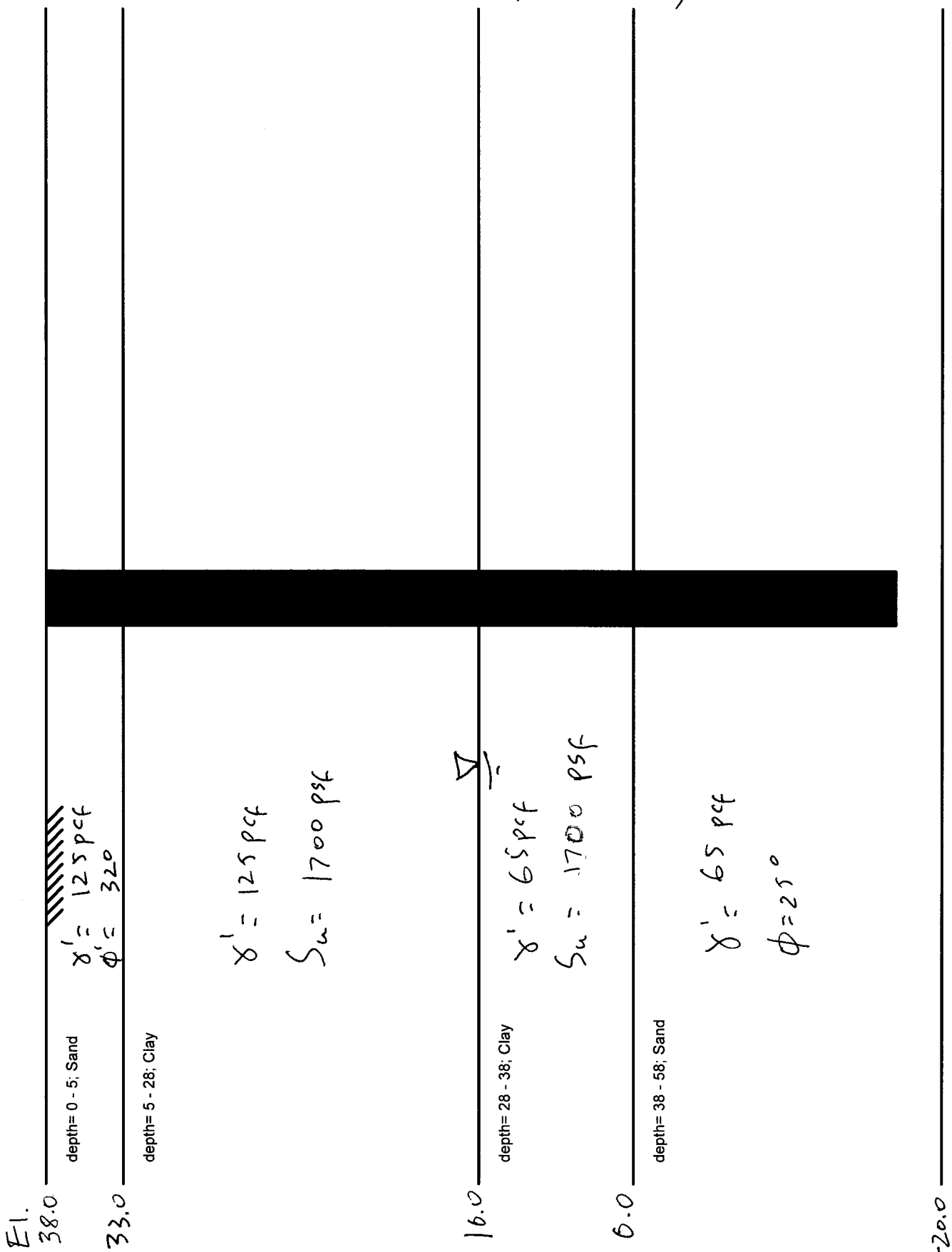
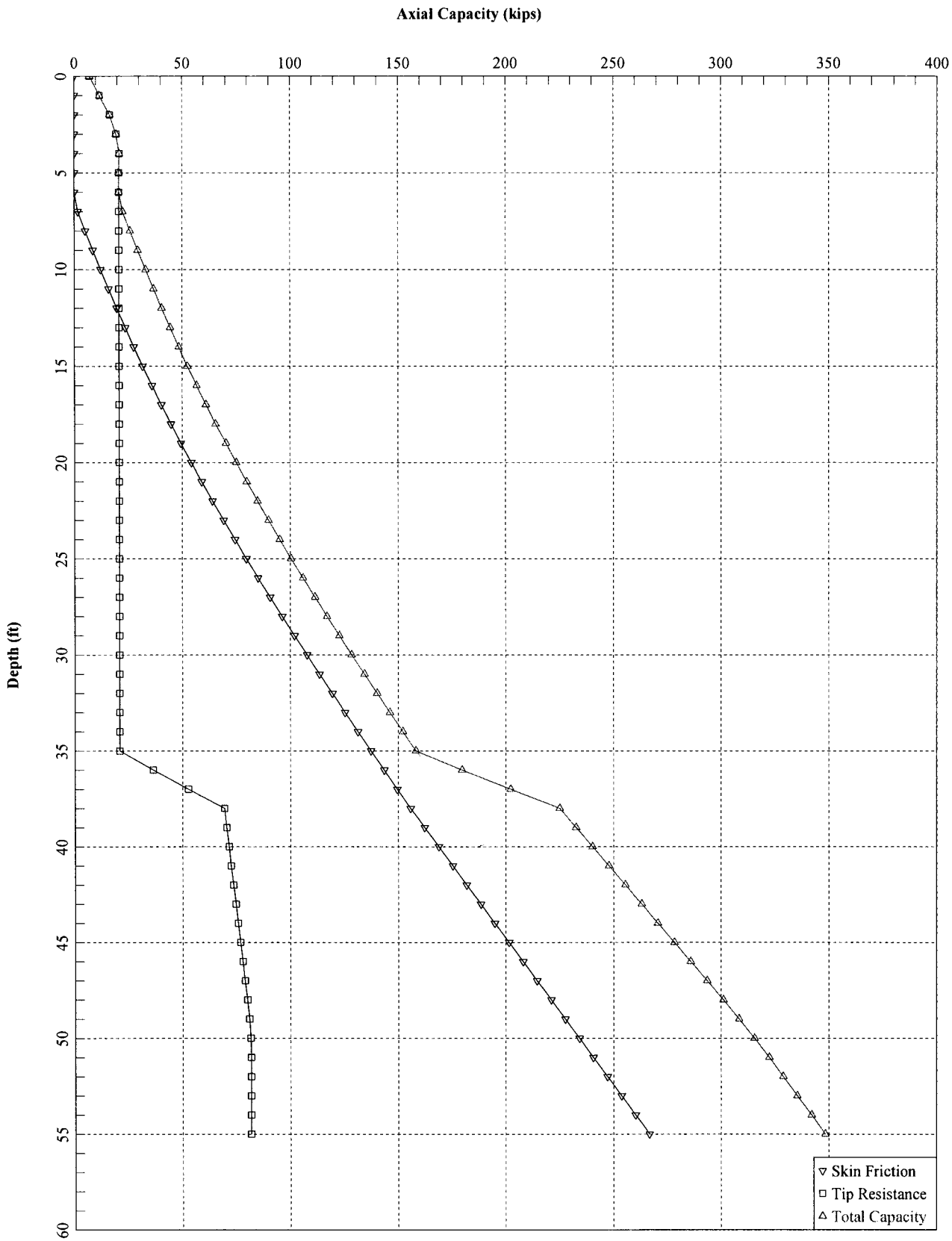
Abutment 3 - Right Bridge.apo

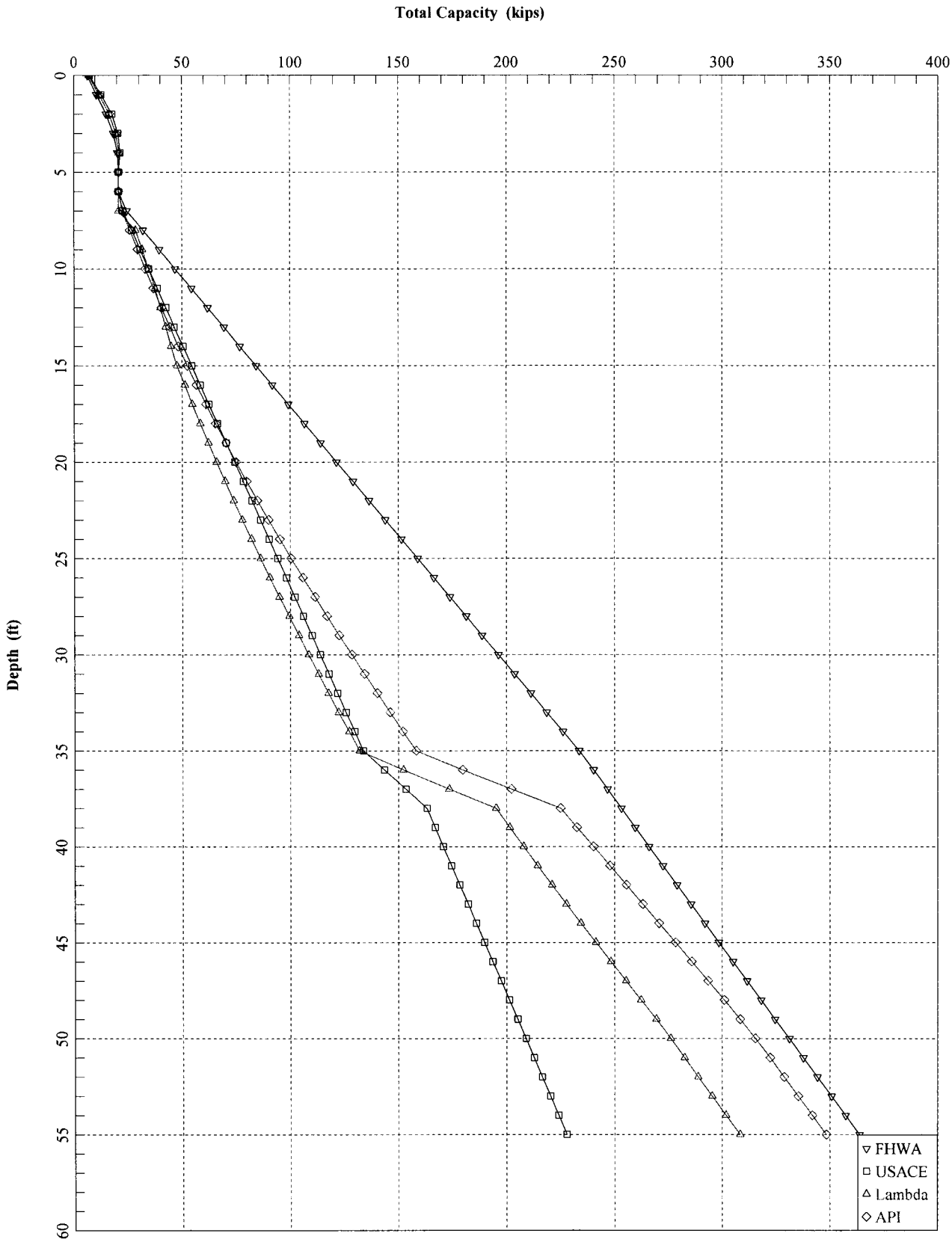
TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.9410E+00	0.5746E-03	0.1909E+00	0.1000E-03
0.9410E+01	0.5746E-02	0.1909E+01	0.1000E-02
0.4762E+02	0.2893E-01	0.9545E+01	0.5000E-02
0.9287E+02	0.5758E-01	0.1909E+02	0.1000E-01
0.3317E+03	0.2382E+00	0.7304E+02	0.5000E-01
0.4169E+03	0.3510E+00	0.9039E+02	0.1000E+00
0.4899E+03	0.8177E+00	0.1714E+03	0.5000E+00
0.5412E+03	0.1361E+01	0.2227E+03	0.1000E+01
0.5907E+03	0.2404E+01	0.2722E+03	0.2000E+01

Abutment 3 - Wingwall
14-in Class 200 Alt. 'X' Concrete Pile
(Based on Boring CLO-125





SR4 Contra Loma Blvd. Undercrossing - Left and Right Bridges - Abutment 3 Wingwall - 14-in SQuare PPC Pile - API RP2A Method



SR4 Contra LOma Blvd. Undercrossing - Left and Right Bridges - Abutment 3 Wingwall - 14-in Square PPC Pile - API RP2A Method

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AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

SR4 Contra LOma UC - Abutment 3 Wingwall - 14-in Square PPC Pile

DESIGNER : Partha Sircar

DATE : May 12, 2010

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 56.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 1.36 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 0.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 0.00 IN.
PILE LENGTH = 55.00 FT.
MODULUS OF ELASTICITY = 0.430E+07 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 7.00 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	1.00	125.00	32.00	28.00
5.00	SAND	1.00	125.00	32.00	28.00
5.00	CLAY	0.00	125.00	0.00	0.00
28.00	CLAY	0.00	125.00	0.00	0.00
28.00	CLAY	0.00	65.00	0.00	0.00
38.00	CLAY	0.00	65.00	0.00	0.00
38.00	SAND	1.00	65.00	25.00	12.00
58.00	SAND	1.00	65.00	25.00	12.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
1.70	15.30	1.70	0.85	0.00	0.00	0.00
1.70	15.30	1.70	0.85	0.00	0.00	0.00
1.70	15.30	1.70	0.85	0.00	0.00	0.00
1.70	15.30	1.70	0.85	0.00	0.00	0.00
1.40	60.00	0.00	0.00	0.00	0.00	0.00
1.40	60.00	0.00	0.00	0.00	0.00	0.00

1

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* COMPUTATION RESULT *
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PILE PENETRATION FT.	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPACITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPACITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPACITY KIP
	********** FED. HWY. METHOD **********			********** ARMY CORPS METHOD **********			********** LAMBDA 2 METHOD **********		
0.0	0.0	6.4	6.4	0.0	7.6	7.6	0.0	7.1	7.1
1.0	0.0	10.7	10.7	0.0	12.7	12.7	0.0	11.8	11.8
2.0	0.0	15.0	15.0	0.0	17.8	17.8	0.0	16.6	16.6
3.0	0.0	18.4	18.4	0.0	20.6	20.6	0.0	19.6	19.6
4.0	0.0	20.3	20.3	0.0	21.5	21.5	0.0	21.0	21.0
5.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
6.0	0.0	20.8	20.8	0.0	20.8	20.8	0.0	20.8	20.8
7.0	3.7	20.8	24.5	2.0	20.8	22.8	0.0	20.8	20.8
8.0	11.2	20.8	32.0	5.9	20.8	26.8	7.7	20.8	28.5
9.0	18.7	20.8	39.5	9.9	20.8	30.7	10.9	20.8	31.7
10.0	26.1	20.8	46.9	13.9	20.8	34.7	13.9	20.8	34.7
11.0	33.6	20.8	54.4	17.8	20.8	38.7	16.7	20.8	37.5
12.0	41.1	20.8	61.9	21.8	20.8	42.6	19.3	20.8	40.1
13.0	48.5	20.8	69.4	25.8	20.8	46.6	21.8	20.8	42.6
14.0	56.0	20.8	76.8	29.7	20.8	50.6	24.1	20.8	44.9
15.0	63.5	20.8	84.3	33.7	20.8	54.5	27.0	20.8	47.8
16.0	71.0	20.8	91.8	37.7	20.8	58.5	30.4	20.8	51.3
17.0	78.4	20.8	99.2	41.6	20.8	62.5	34.0	20.8	54.8
18.0	85.9	20.8	106.7	45.6	20.8	66.4	37.7	20.8	58.5
19.0	93.4	20.8	114.2	49.6	20.8	70.4	41.4	20.8	62.2
20.0	100.8	20.8	121.6	53.5	20.8	74.4	45.2	20.8	66.0
21.0	108.3	20.8	129.1	57.5	20.8	78.3	49.1	20.8	69.9
22.0	115.8	20.8	136.6	61.5	20.8	82.3	53.1	20.8	73.9
23.0	123.2	20.8	144.0	65.4	20.8	86.3	57.1	20.8	77.9
24.0	130.7	20.8	151.5	69.4	20.8	90.2	61.3	20.8	82.1
25.0	138.2	20.8	159.0	73.4	20.8	94.2	65.5	20.8	86.3
26.0	145.6	20.8	166.4	77.3	20.8	98.2	69.8	20.8	90.6
27.0	153.1	20.8	173.9	81.3	20.8	102.1	74.2	20.8	95.0
28.0	160.6	20.8	181.4	85.3	20.8	106.1	78.7	20.8	99.5
29.0	168.0	20.8	188.8	89.2	20.8	110.1	83.2	20.8	104.0
30.0	175.5	20.8	196.3	93.2	20.8	114.0	87.8	20.8	108.6
31.0	183.0	20.8	203.8	97.2	20.8	118.0	92.4	20.8	113.2
32.0	190.4	20.8	211.3	101.1	20.8	122.0	97.0	20.8	117.8
33.0	197.9	20.8	218.7	105.1	20.8	125.9	101.7	20.8	122.5
34.0	205.4	20.8	226.2	109.1	20.8	129.9	106.5	20.8	127.3
35.0	212.9	20.8	233.7	113.0	20.8	133.9	111.3	20.8	132.1
36.0	220.3	19.9	240.3	117.0	26.6	143.6	116.1	36.3	152.4
37.0	227.8	19.0	246.8	121.0	32.5	153.5	121.0	52.7	173.6
38.0	235.0	18.1	253.2	124.8	38.4	163.2	125.9	69.4	195.2
39.0	241.6	18.1	259.7	128.6	38.4	167.0	131.1	70.4	201.6
40.0	247.9	18.1	266.0	132.4	38.4	170.8	136.5	71.5	208.0
41.0	254.3	18.1	272.5	136.2	38.4	174.6	142.0	72.5	214.5
42.0	260.9	18.1	279.0	140.0	38.4	178.5	147.5	73.6	221.1
43.0	267.4	18.1	285.5	143.9	38.4	182.3	153.1	74.7	227.8
44.0	273.9	18.1	292.1	147.7	38.4	186.1	158.8	75.7	234.5
45.0	280.5	18.1	298.6	151.5	38.4	189.9	164.6	76.8	241.3
46.0	287.0	18.1	305.1	155.3	38.4	193.7	170.4	77.9	248.3
47.0	293.5	18.1	311.7	159.1	38.4	197.5	176.3	78.9	255.3
48.0	300.1	18.1	318.2	162.9	38.4	201.3	182.4	80.0	262.3
49.0	306.6	18.1	324.7	166.7	38.4	205.2	188.5	80.9	269.4
50.0	313.1	18.1	331.3	170.5	38.4	209.0	194.7	81.4	276.1
51.0	319.7	18.1	337.8	174.4	38.4	212.8	200.9	81.7	282.6
52.0	326.2	18.1	344.3	178.2	38.4	216.6	207.3	81.7	288.9
53.0	332.7	18.1	350.9	182.0	38.4	220.4	213.7	81.7	295.4
54.0	339.3	18.1	357.4	185.8	38.4	224.2	220.2	81.7	301.9
55.0	345.8	18.1	363.9	189.6	38.4	228.0	226.8	81.7	308.5

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* API RP-2A (1994) *
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PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	7.1	7.1
1.00	0.0	11.8	11.8
2.00	0.0	16.6	16.6
3.00	0.0	19.6	19.6
4.00	0.0	21.0	21.0
5.00	0.0	20.8	20.8
6.00	0.0	20.8	20.8
7.00	1.7	20.8	22.5
8.00	5.1	20.8	25.9
9.00	8.6	20.8	29.4
10.00	12.2	20.8	33.1
11.00	16.0	20.8	36.8
12.00	19.8	20.8	40.6
13.00	23.7	20.8	44.5
14.00	27.6	20.8	48.4
15.00	31.7	20.8	52.5
16.00	36.0	20.8	56.8
17.00	40.3	20.8	61.1
18.00	44.8	20.8	65.6
19.00	49.4	20.8	70.3
20.00	54.2	20.8	75.0
21.00	59.1	20.8	79.9
22.00	64.1	20.8	84.9
23.00	69.2	20.8	90.0
24.00	74.4	20.8	95.2
25.00	79.7	20.8	100.5
26.00	85.1	20.8	105.9
27.00	90.7	20.8	111.5
28.00	96.3	20.8	117.1
29.00	102.0	20.8	122.8
30.00	107.8	20.8	128.6
31.00	113.6	20.8	134.4
32.00	119.5	20.8	140.3
33.00	125.4	20.8	146.2
34.00	131.4	20.8	152.2
35.00	137.4	20.8	158.2
36.00	143.5	36.3	179.8
37.00	149.6	52.7	202.3
38.00	155.8	69.4	225.1
39.00	162.3	70.4	232.7
40.00	168.9	71.5	240.3
41.00	175.4	72.5	247.9
42.00	181.9	73.6	255.5
43.00	188.5	74.7	263.1
44.00	195.0	75.7	270.7
45.00	201.5	76.8	278.3
46.00	208.1	77.9	285.9
47.00	214.6	78.9	293.5
48.00	221.1	80.0	301.1
49.00	227.7	80.9	308.5
50.00	234.2	81.4	315.6
51.00	240.7	81.7	322.4
52.00	247.2	81.7	328.9
53.00	253.8	81.7	335.4
54.00	260.3	81.7	342.0
55.00	266.8	81.7	348.5

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.2525E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
3	10	0.4958E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
4	10	0.5000E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2852E-01

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			0.0000E+00	0.5526E-01
			0.0000E+00	0.1016E+00
			0.0000E+00	0.1426E+00
			0.0000E+00	0.1783E+00
			0.0000E+00	0.3565E+00
			0.0000E+00	0.5348E+00
			0.0000E+00	0.8913E+00
			0.0000E+00	0.3565E+01
5	10	0.1652E+02		
			0.0000E+00	0.0000E+00
			0.1950E+01	0.2852E-01
			0.3250E+01	0.5526E-01
			0.4876E+01	0.1016E+00
			0.5851E+01	0.1426E+00
			0.6501E+01	0.1783E+00
			0.5851E+01	0.3565E+00
			0.5851E+01	0.5348E+00
			0.5851E+01	0.8913E+00
			0.5851E+01	0.3565E+01
6	10	0.2796E+02		
			0.0000E+00	0.0000E+00
			0.2518E+01	0.2852E-01
			0.4197E+01	0.5526E-01
			0.6295E+01	0.1016E+00
			0.7554E+01	0.1426E+00
			0.8393E+01	0.1783E+00
			0.7554E+01	0.3565E+00
			0.7554E+01	0.5348E+00
			0.7554E+01	0.8913E+00
			0.7554E+01	0.3565E+01
7	10	0.2800E+02		
			0.0000E+00	0.0000E+00
			0.2553E+01	0.2852E-01
			0.4254E+01	0.5526E-01
			0.6382E+01	0.1016E+00
			0.7658E+01	0.1426E+00
			0.8509E+01	0.1783E+00
			0.7658E+01	0.3565E+00
			0.7658E+01	0.5348E+00
			0.7658E+01	0.8913E+00
			0.7658E+01	0.3565E+01
8	10	0.3302E+02		
			0.0000E+00	0.0000E+00
			0.2667E+01	0.2852E-01
			0.4446E+01	0.5526E-01
			0.6669E+01	0.1016E+00
			0.8002E+01	0.1426E+00
			0.8892E+01	0.1783E+00
			0.8002E+01	0.3565E+00
			0.8002E+01	0.5348E+00
			0.8002E+01	0.8913E+00
			0.8002E+01	0.3565E+01
9	10	0.3796E+02		
			0.0000E+00	0.0000E+00
			0.2756E+01	0.2852E-01
			0.4593E+01	0.5526E-01
			0.6890E+01	0.1016E+00
			0.8268E+01	0.1426E+00
			0.9186E+01	0.1783E+00
			0.8268E+01	0.3565E+00
			0.8268E+01	0.5348E+00
			0.8268E+01	0.8913E+00
			0.8268E+01	0.3565E+01
10	10	0.3800E+02		

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			0.0000E+00	0.0000E+00
			0.9722E+00	0.1000E-01
			0.1944E+01	0.2000E-01
			0.3889E+01	0.4000E-01
			0.5833E+01	0.6000E-01
			0.7778E+01	0.8000E-01
			0.8750E+01	0.9000E-01
			0.9722E+01	0.1000E+00
			0.9722E+01	0.5000E+00
			0.9722E+01	0.2000E+01
11	10	0.4802E+02		
			0.0000E+00	0.0000E+00
			0.9722E+00	0.1000E-01
			0.1944E+01	0.2000E-01
			0.3889E+01	0.4000E-01
			0.5833E+01	0.6000E-01
			0.7778E+01	0.8000E-01
			0.8750E+01	0.9000E-01
			0.9722E+01	0.1000E+00
			0.9722E+01	0.5000E+00
			0.9722E+01	0.2000E+01
12	10	0.5796E+02		
			0.0000E+00	0.0000E+00
			0.9722E+00	0.1000E-01
			0.1944E+01	0.2000E-01
			0.3889E+01	0.4000E-01
			0.5833E+01	0.6000E-01
			0.7778E+01	0.8000E-01
			0.8750E+01	0.9000E-01
			0.9722E+01	0.1000E+00
			0.9722E+01	0.5000E+00
			0.9722E+01	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.5104E+01	0.8913E-02
0.1021E+02	0.1783E-01
0.2042E+02	0.3565E-01
0.4083E+02	0.2317E+00
0.6125E+02	0.7487E+00
0.7350E+02	0.1301E+01
0.8167E+02	0.1783E+01
0.8167E+02	0.2674E+01
0.8167E+02	0.3565E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.4401E+00	0.3129E-03	0.5727E-01	0.1000E-03
0.4401E+01	0.3129E-02	0.5727E+00	0.1000E-02
0.2210E+02	0.1567E-01	0.2863E+01	0.5000E-02
0.4438E+02	0.3141E-01	0.5727E+01	0.1000E-01
0.1749E+03	0.1390E+00	0.2191E+02	0.5000E-01
0.2682E+03	0.2404E+00	0.2712E+02	0.1000E+00

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0.2902E+03	0.6596E+00	0.5143E+02	0.5000E+00
0.3056E+03	0.1172E+01	0.6682E+02	0.1000E+01
0.3205E+03	0.2183E+01	0.8167E+02	0.2000E+01

AXIAL PILE CAPACITY

(SHAFT Runs)

SHAFT Runs SR Bypass – Contra Loma Blvd. Undercrossing
Pile capacities computed using SHAFT program – Output follows
May 13, 2010

Bent 2 (based on boring CLO-124)

Left & Right Bridges – 78-in CIDH Pile

Ground Surface Elevation 32.0 (approx.)
Nominal Compression Load = 2950 kips = 1475 tons
Assumed Shaft tip @ 67-ft depth
Top Settlement = 1.099 in. for 1406 ton load; and 7.918 in. for 1588 ton load
Thus, by linear interpolation, top settlement = 3.68 in. for 1475 ton load
= 3.68/78 =4.7 pct

Bent 2 (based on boring CLO-125)

Left & Right Bridges – 72-in CIDH Pile

Ground Surface Elevation 32.0 (approx.)
Nominal Compression Load = 2950 kips = 1475 tons
Assumed Shaft tip @ 65-ft depth
Top Settlement = 1.103 in. for 1522 ton load

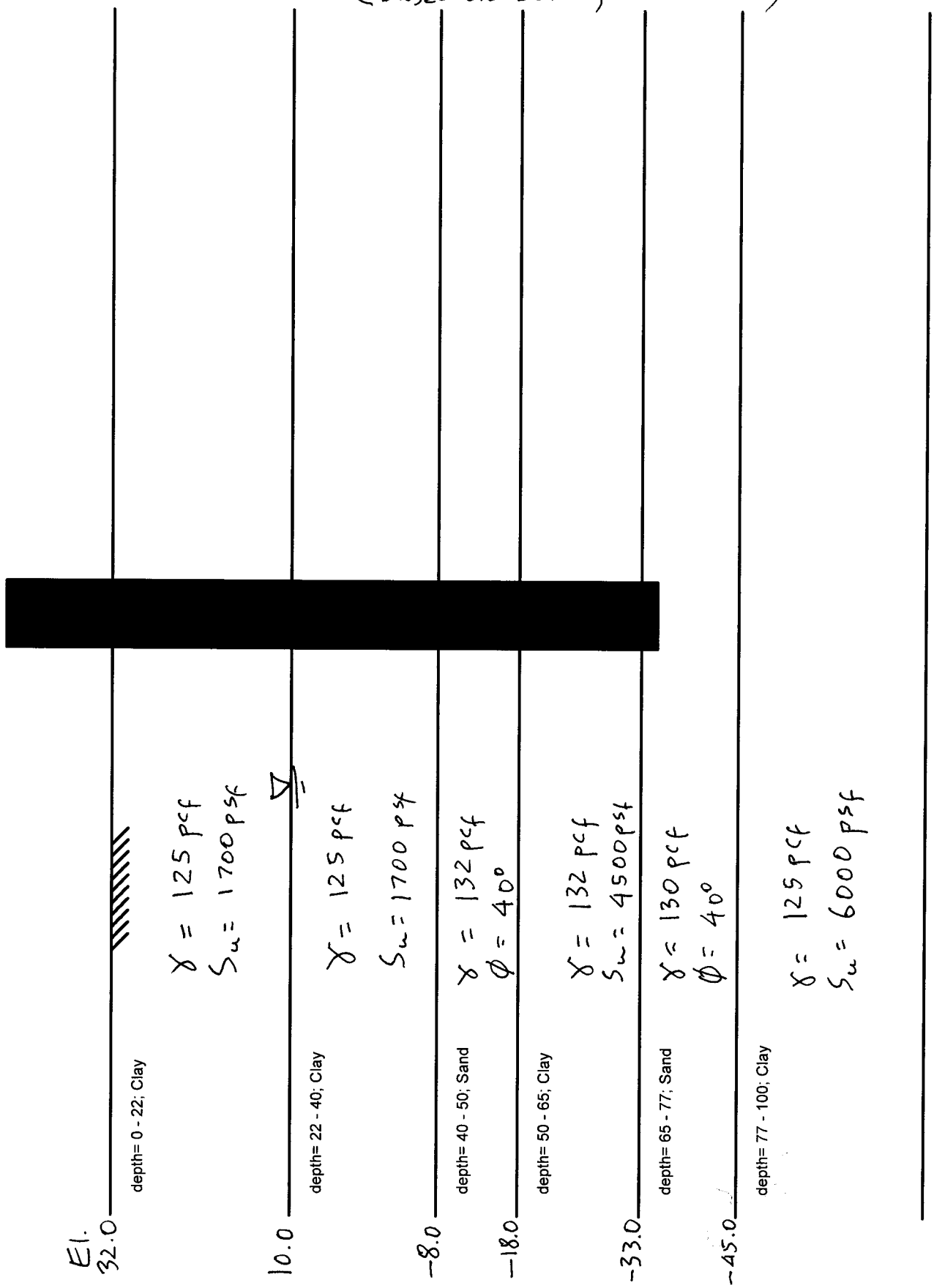
Thus, 67-ft tip depth is recommended.

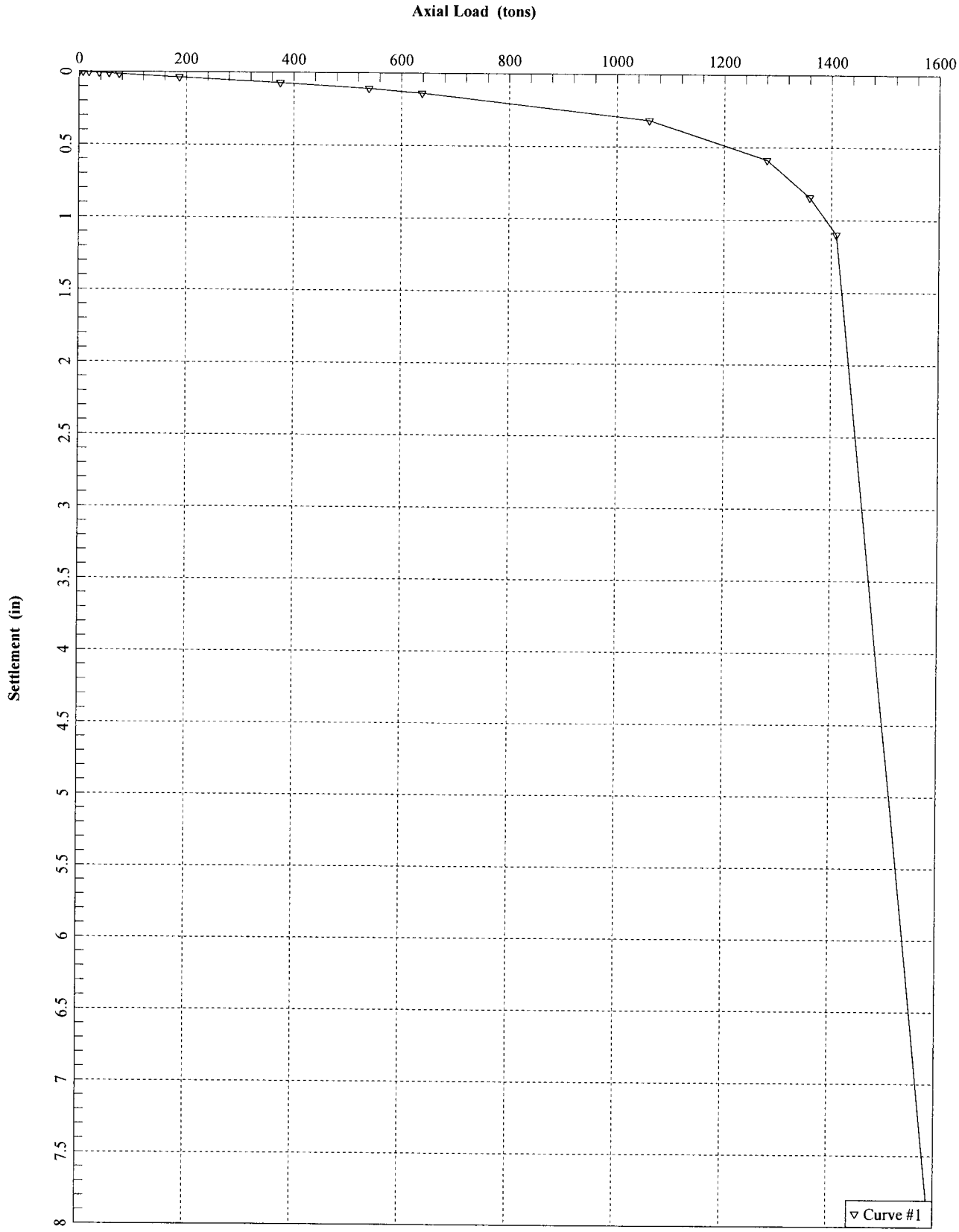
Recommended Penetration = 70.0 feet
Reqd. Tip Elevation = 32.0 - 67 = -35.0

Bent 2

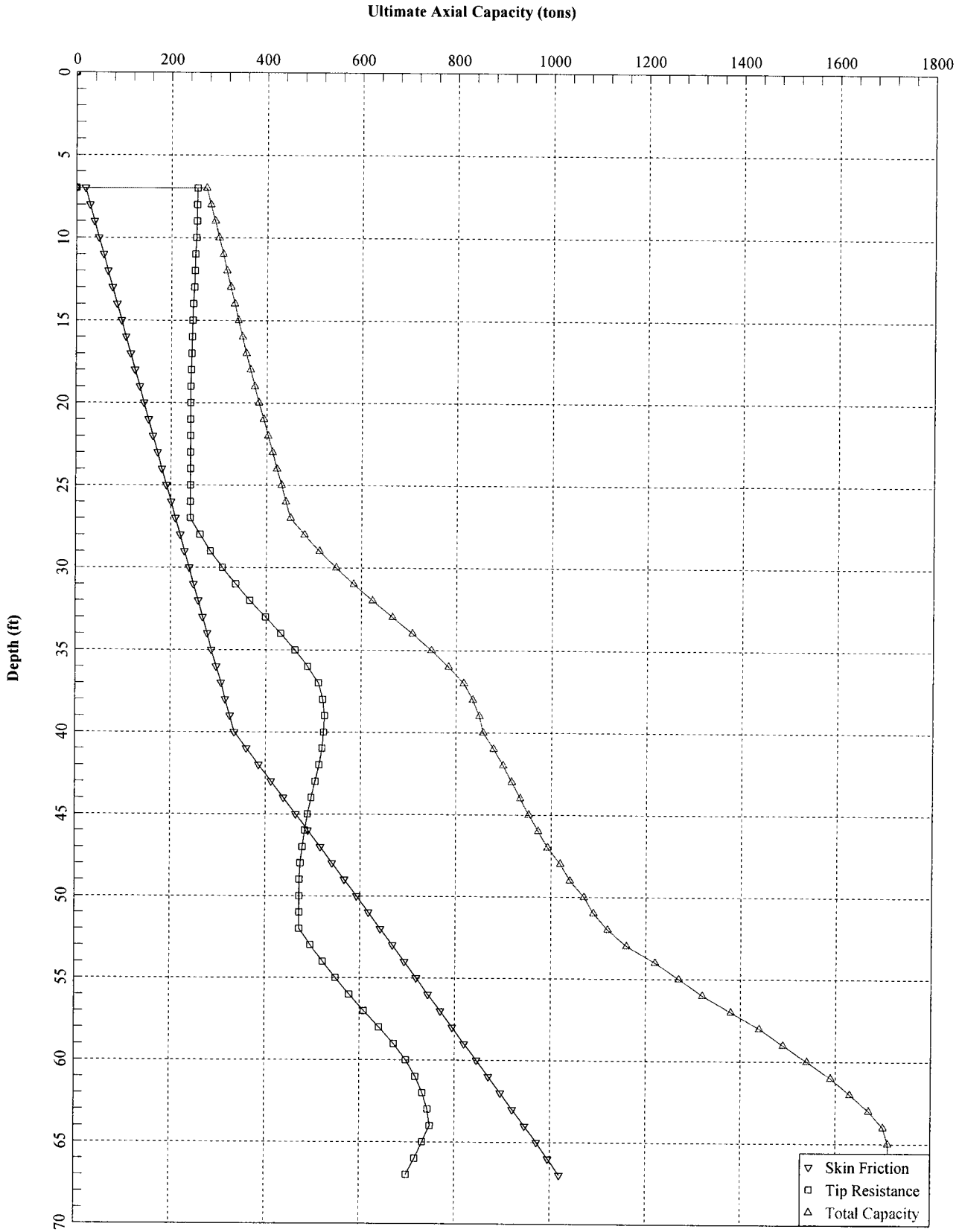
INFORMATION HANDOUT

78-in. Diameter CIDH Pile
(based on Boring CLO-124)





SR4 Contra Loma Blvd. Undercrossing - Left and Right Bridges - Bent 2 - 78-in CIDH PIle - 67-ft long (based on boring CLO-124)



SR4 Contra Loma Blvd.Undercrossing - Left and Right Bridges - Bent 2 - 78-in. CIDH PIle - 67-ft long - (based on boring CLO-124)

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                                   Bent 2-A.sfo
VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

    Highway 4 - Contra Loma - Bent 2 - 78 in CIDH - CLO-124

    PROPOSED DEPTH =       67.0 FT
    ----------------

    NUMBER OF LAYERS =     6
    ------------------

    WATER TABLE DEPTH =       22.0 FT.
    -------------------

    FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 2.50
    --------------------------------------------------------
    FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
    -------------------------------------------------------

    SOIL INFORMATION
    ----------------

    LAYER NO 1----CLAY

      AT THE TOP

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
      DEPTH, FT                                          = 0.000E+00

      AT THE BOTTOM

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
      DEPTH, FT                                          = 0.220E+02

    LAYER NO 2----CLAY

      AT THE TOP

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
```

```
                                   Bent 2-A.sfo
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.128E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
      DEPTH, FT                                          = 0.220E+02

      AT THE BOTTOM

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.128E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
      DEPTH, FT                                          = 0.400E+02

    LAYER NO 3----SAND

      AT THE TOP

      SKIN FRICTION COEFFICIENT- BETA                    = 0.646E+00
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
      INTERNAL FRICTION ANGLE, DEG.                      = 0.400E+02
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.132E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.400E+04
      DEPTH, FT                                          = 0.400E+02

      AT THE BOTTOM

      SKIN FRICTION COEFFICIENT- BETA                    = 0.545E+00
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
      INTERNAL FRICTION ANGLE, DEG.                      = 0.400E+02
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.132E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.400E+04
      DEPTH, FT                                          = 0.500E+02

    LAYER NO 4----CLAY

      AT THE TOP

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.450E+04
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.132E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.640E+04
      DEPTH, FT                                          = 0.500E+02

      AT THE BOTTOM

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.450E+04
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.132E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.640E+04
```

Bent 2-A.sfo

DEPTH, FT = 0.650E+02

LAYER NO 5----SAND

AT THE TOP

SKIN FRICTION COEFFICIENT- BETA = 0.412E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT = 0.000E+00
INTERNAL FRICTION ANGLE, DEG. = 0.400E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.400E+04
DEPTH, FT = 0.650E+02

AT THE BOTTOM

SKIN FRICTION COEFFICIENT- BETA = 0.315E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT = 0.000E+00
INTERNAL FRICTION ANGLE, DEG. = 0.400E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.400E+04
DEPTH, FT = 0.770E+02

LAYER NO 6----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA = 0.550E+00
END BEARING COEFFICIENT-Nc = 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT = 0.600E+04
INTERNAL FRICTION ANGLE, DEG. = 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.640E+04
DEPTH, FT = 0.770E+02

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA = 0.550E+00
END BEARING COEFFICIENT-Nc = 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT = 0.600E+04
INTERNAL FRICTION ANGLE, DEG. = 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.640E+04
DEPTH, FT = 0.100E+03

DRILLED SHAFT INFORMATION

DIAMETER OF STEM = 6.500 FT.
DIAMETER OF BASE = 6.500 FT.
END OF STEM TO BASE = 0.000 FT.
ANGLE OF BELL = 0.000 DEG.
IGNORED TOP PORTION = 5.000 FT.
IGNORED BOTTOM PORTION = 0.000 FT.

Bent 2-A.sfo

AREA OF ONE PERCENT STEEL = 47.790 SQ.IN.
ELASTIC MODULUS, Ec = 0.360E+07 LB/SQ IN
VOLUME OF UNDERREAM = 0.000 CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
6.0	7.37	9.55	253.88	263.43	94.18	88.45	35.72
7.0	8.60	19.10	253.67	272.76	103.65	92.19	31.70
8.0	9.83	28.64	253.23	281.87	113.05	95.87	28.66
9.0	11.06	38.19	252.54	290.73	122.37	99.46	26.28
10.0	12.29	47.74	251.60	299.34	131.61	102.96	24.35
11.0	13.52	57.29	250.40	307.69	140.75	106.38	22.76
12.0	14.75	66.83	249.04	315.87	149.85	109.75	21.42
13.0	15.98	76.38	247.62	324.00	158.92	113.09	20.28
14.0	17.21	85.93	246.22	332.15	168.00	116.44	19.30
15.0	18.44	95.48	244.88	340.36	177.10	119.82	18.46
16.0	19.67	105.03	243.68	348.70	186.25	123.24	17.73
17.0	20.90	114.57	242.66	357.24	195.46	126.72	17.10
18.0	22.12	124.12	241.88	366.00	204.75	130.28	16.54
19.0	23.35	133.67	241.34	375.01	214.12	133.91	16.06
20.0	24.58	143.22	241.00	384.22	223.55	137.62	15.63
21.0	25.81	152.76	240.81	393.58	233.03	141.38	15.25
22.0	27.04	162.31	240.73	403.04	242.55	145.17	14.90
23.0	28.27	171.86	240.71	412.57	252.10	148.98	14.59
24.0	29.50	181.41	240.71	422.12	261.64	152.80	14.31
25.0	30.73	190.96	240.71	431.66	271.19	156.62	14.05
26.0	31.96	200.50	240.71	441.21	280.74	160.44	13.81
27.0	33.19	210.05	240.71	450.76	290.29	164.26	13.58
28.0	34.42	219.60	260.73	480.33	306.51	174.75	13.96
29.0	35.65	229.15	283.17	512.32	323.54	186.05	14.37
30.0	36.87	238.69	308.11	546.81	341.40	198.18	14.83
31.0	38.10	248.24	335.62	583.86	360.11	211.17	15.32
32.0	39.33	257.79	365.77	623.56	379.71	225.04	15.85
33.0	40.56	267.34	398.62	665.96	400.21	239.81	16.42
34.0	41.79	276.88	431.40	708.29	420.69	254.55	16.95
35.0	43.02	286.43	461.17	747.60	440.16	268.30	17.38
36.0	44.25	295.98	487.71	783.69	458.55	280.96	17.71
37.0	45.48	305.53	510.82	816.35	475.80	292.49	17.95
38.0	46.71	315.08	520.33	835.41	488.52	299.47	17.89
39.0	47.94	324.62	524.27	848.90	499.38	304.61	17.71
40.0	49.17	334.17	522.36	856.53	508.29	307.79	17.42
41.0	50.40	360.08	518.60	878.67	532.94	316.90	17.44
42.0	51.62	386.00	512.91	898.91	556.97	325.37	17.41
43.0	52.85	411.93	505.24	917.17	580.34	333.18	17.35
44.0	54.08	437.86	496.93	934.78	603.50	340.78	17.28
45.0	55.31	463.77	489.46	953.24	626.93	348.66	17.23
46.0	56.54	489.67	483.07	972.74	650.69	356.89	17.20
47.0	57.77	515.53	477.95	993.48	674.85	365.53	17.20

Bent 2-A.sfo

48.0	59.00	541.36	474.33	1015.68	699.47	374.65	17.22
49.0	60.23	567.13	472.41	1039.54	724.60	384.32	17.26
50.0	61.46	592.85	472.41	1065.26	750.32	394.61	17.33
51.0	62.69	618.13	472.41	1090.53	775.60	404.72	17.40
52.0	63.92	643.40	472.41	1115.81	800.87	414.83	17.46
53.0	65.15	668.67	496.30	1164.97	834.11	432.90	17.88
54.0	66.37	693.95	521.89	1215.84	867.91	451.54	18.32
55.0	67.60	719.22	549.20	1268.41	902.28	470.75	18.76
56.0	68.83	744.49	578.20	1322.70	937.23	490.53	19.22
57.0	70.06	769.77	608.92	1378.69	972.74	510.88	19.68
58.0	71.29	795.04	641.34	1436.38	1008.82	531.80	20.15
59.0	72.52	820.31	672.06	1492.37	1044.33	552.14	20.58
60.0	73.75	845.59	697.65	1543.24	1078.14	570.79	20.93
61.0	74.98	870.86	718.13	1588.99	1110.24	587.72	21.19
62.0	76.21	896.13	733.49	1629.62	1140.63	602.95	21.38
63.0	77.44	921.41	743.72	1665.13	1169.32	616.47	21.50
64.0	78.67	946.68	748.84	1695.52	1196.29	628.29	21.55
65.0	79.90	971.95	733.44	1705.40	1216.44	633.26	21.35
66.0	81.12	995.55	716.94	1712.49	1234.53	637.20	21.11
67.0	82.35	1018.93	699.34	1718.27	1252.04	640.69	20.86

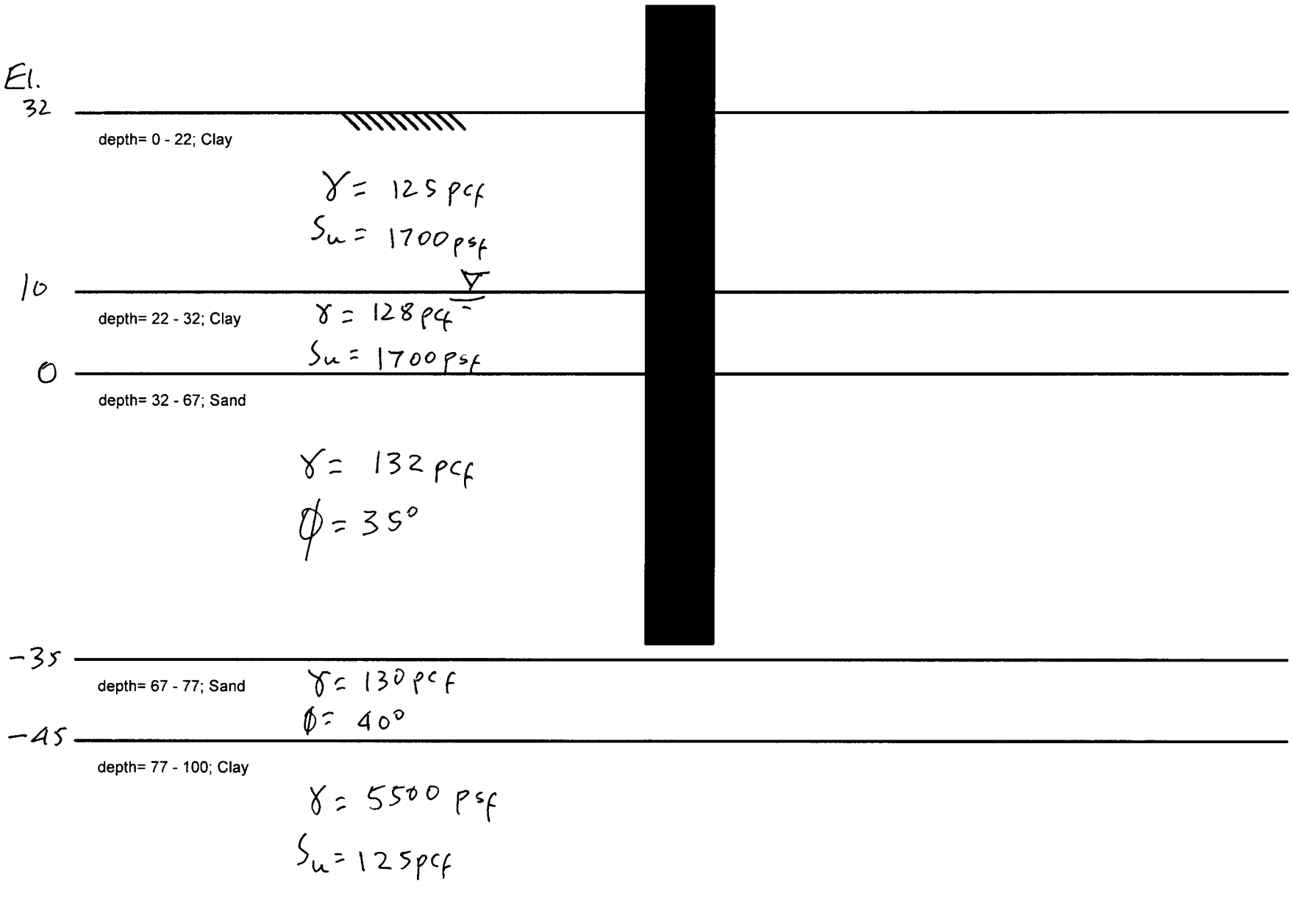
RESULT FROM TREND (AVERAGED) LINE

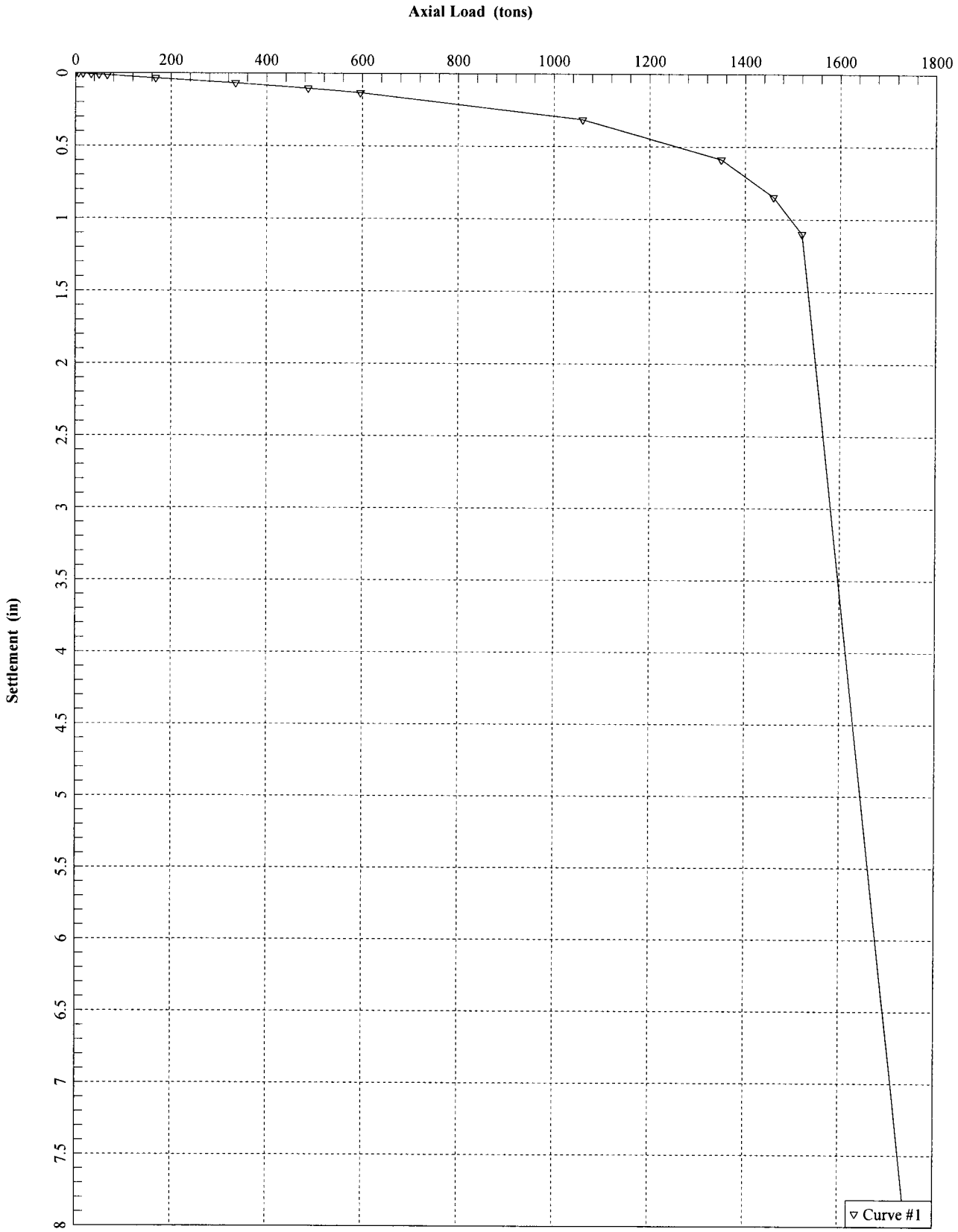
TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.7475E+00	0.1444E-03	0.7083E-01	0.1000E-03
0.7475E+01	0.1444E-02	0.7083E+00	0.1000E-02
0.1869E+02	0.3611E-02	0.1771E+01	0.2500E-02
0.3738E+02	0.7221E-02	0.3542E+01	0.5000E-02
0.5606E+02	0.1083E-01	0.5312E+01	0.7500E-02
0.7475E+02	0.1444E-01	0.7083E+01	0.1000E-01
0.1871E+03	0.3611E-01	0.1771E+02	0.2500E-01
0.3746E+03	0.7224E-01	0.3542E+02	0.5000E-01
0.5398E+03	0.1078E+00	0.5312E+02	0.7500E-01
0.6376E+03	0.1392E+00	0.7083E+02	0.1000E+00
0.1064E+04	0.3187E+00	0.1771E+03	0.2500E+00
0.1279E+04	0.5864E+00	0.3088E+03	0.5000E+00
0.1357E+04	0.8437E+00	0.3828E+03	0.7500E+00
0.1406E+04	0.1099E+01	0.4469E+03	0.1000E+01
0.1588E+04	0.7918E+01	0.6930E+03	0.7800E+01

$$\frac{7.918 - 1.099}{1588 - 1406} \times (1475 - 1406) + 1.099$$

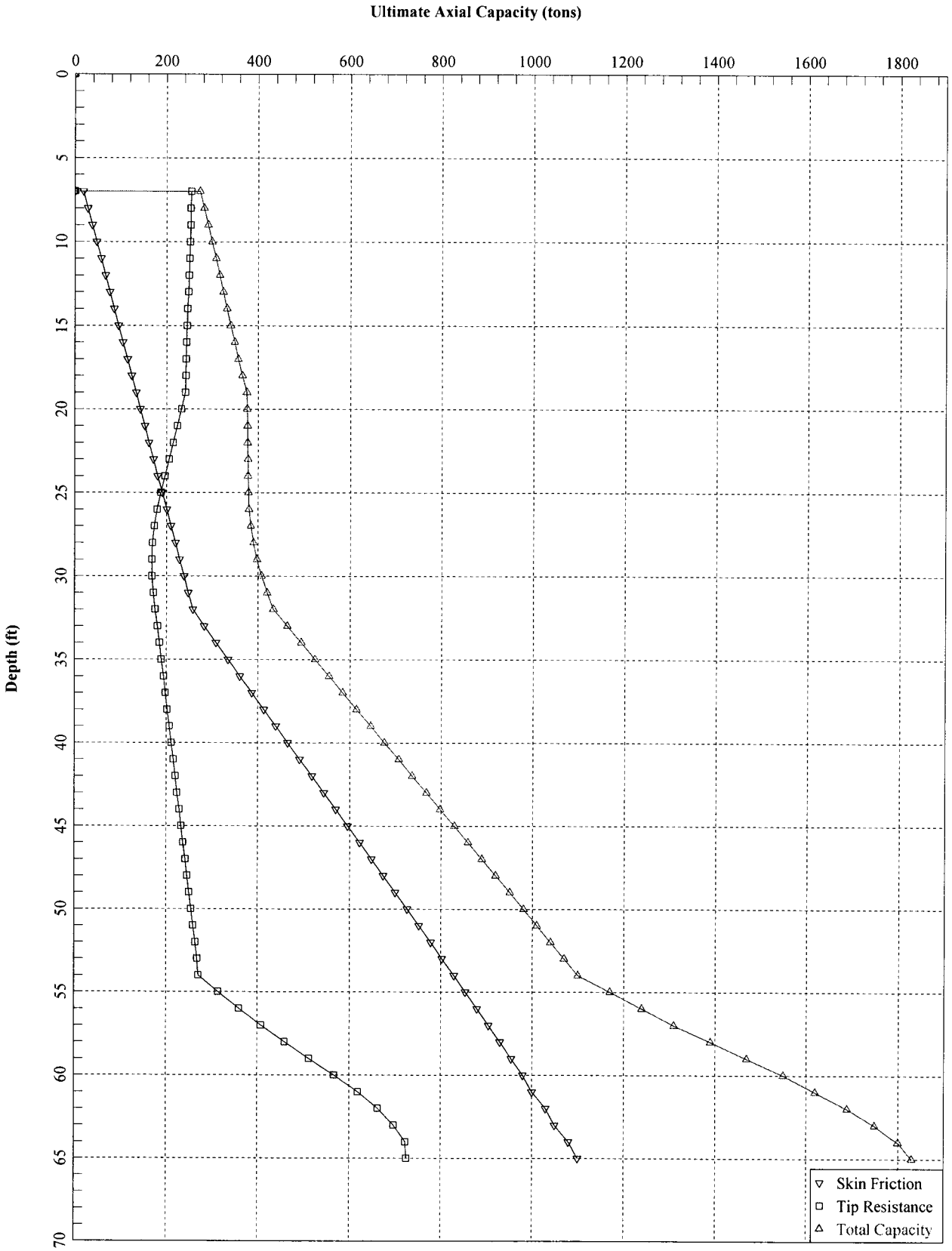
$$= \frac{6.819}{182} \times 69 + 1.099 = 3.68$$

Bent 2
78-in. Diameter CIDH Pile
(based on Boring CLO-125)





SR4 Contra Loma Blvd. Undercrossing - Left and Right Bridges - Bent 2 - 78-in CIDH PIle - 65-ft long (based on boring CLO-125)



SR4 Contra Loma Blvd.Undercrossing - Left and Right Bridges - Bent 2 - 78-in. CIDH PIle - 65-ft long - (based on boring CLO-125)

Bent 2-B.sfo

VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

Highway 4 - Contra Loma - Bent 2 - 78 in CIDH - CLO-125

PROPOSED DEPTH = 65.0 FT

NUMBER OF LAYERS = 5

WATER TABLE DEPTH = 22.0 FT.

FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 2.50

FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00

SOIL INFORMATION

LAYER NO 1----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.170E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.170E+04
DEPTH, FT	= 0.000E+00

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.170E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.170E+04
DEPTH, FT	= 0.220E+02

LAYER NO 2----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.170E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00

Bent 2-B.sfo

SOIL UNIT WEIGHT, LB/CU FT	= 0.128E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.170E+04
DEPTH, FT	= 0.220E+02

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.170E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.128E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.170E+04
DEPTH, FT	= 0.320E+02

LAYER NO 3----SAND

AT THE TOP

SKIN FRICTION COEFFICIENT- BETA	= 0.736E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.350E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.132E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.400E+04
DEPTH, FT	= 0.320E+02

AT THE BOTTOM

SKIN FRICTION COEFFICIENT- BETA	= 0.395E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.350E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.132E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.400E+04
DEPTH, FT	= 0.670E+02

LAYER NO 4----SAND

AT THE TOP

SKIN FRICTION COEFFICIENT- BETA	= 0.395E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.400E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.400E+04
DEPTH, FT	= 0.670E+02

AT THE BOTTOM

SKIN FRICTION COEFFICIENT- BETA	= 0.315E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.400E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.400E+04
DEPTH, FT	= 0.770E+02

Bent 2-B.sfo

LAYER NO 5----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.600E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.640E+04
DEPTH, FT	= 0.770E+02

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.600E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.640E+04
DEPTH, FT	= 0.100E+03

DRILLED SHAFT INFORMATION

DIAMETER OF STEM	=	6.500	FT.
DIAMETER OF BASE	=	6.500	FT.
END OF STEM TO BASE	=	0.000	FT.
ANGLE OF BELL	=	0.000	DEG.
IGNORED TOP PORTION	=	5.000	FT.
IGNORED BOTTOM PORTION	=	0.000	FT.
AREA OF ONE PERCENT STEEL	=	47.790	SQ.IN.
ELASTIC MODULUS, Ec	=	0.360E+07	LB/SQ IN
VOLUME OF UNDERREAM	=	0.000	CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
6.0	7.37	9.55	253.88	263.43	94.18	88.45	35.72
7.0	8.60	19.10	253.67	272.76	103.65	92.19	31.70
8.0	9.83	28.64	253.23	281.87	113.05	95.87	28.66
9.0	11.06	38.19	252.54	290.73	122.37	99.46	26.28

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10.0	12.29	47.74	251.60	299.34	131.61	102.96	24.35
11.0	13.52	57.29	250.40	307.69	140.75	106.38	22.76
12.0	14.75	66.83	249.04	315.87	149.85	109.75	21.42
13.0	15.98	76.38	247.62	324.00	158.92	113.09	20.28
14.0	17.21	85.93	246.22	332.15	168.00	116.44	19.30
15.0	18.44	95.48	244.88	340.36	177.10	119.82	18.46
16.0	19.67	105.03	243.68	348.70	186.25	123.24	17.73
17.0	20.90	114.57	242.66	357.24	195.46	126.72	17.10
18.0	22.12	124.12	241.88	366.00	204.75	130.28	16.54
19.0	23.35	133.67	241.34	375.01	214.12	133.91	16.06
20.0	24.58	143.22	232.64	375.86	220.76	134.83	15.29
21.0	25.81	152.76	223.88	376.64	227.39	135.73	14.59
22.0	27.04	162.31	215.03	377.34	233.99	136.60	13.95
23.0	28.27	171.86	206.08	377.94	240.55	137.44	13.37
24.0	29.50	181.41	197.01	378.41	247.08	138.23	12.83
25.0	30.73	190.96	187.82	378.78	253.56	138.99	12.33
26.0	31.96	200.50	179.75	380.25	260.42	140.12	11.90
27.0	33.19	210.05	173.95	384.00	268.03	142.00	11.57
28.0	34.42	219.60	170.34	389.94	276.38	144.62	11.33
29.0	35.65	229.15	168.85	398.00	285.43	147.94	11.17
30.0	36.87	238.69	169.39	408.08	295.16	151.94	11.07
31.0	38.10	248.24	171.88	420.12	305.54	156.59	11.03
32.0	39.33	257.79	176.25	434.04	316.54	161.86	11.03
33.0	40.56	283.47	180.61	464.08	343.67	173.59	11.44
34.0	41.79	309.23	184.98	494.21	370.89	185.35	11.83
35.0	43.02	335.09	189.34	524.43	398.20	197.15	12.19
36.0	44.25	361.01	193.71	554.72	425.58	208.97	12.54
37.0	45.48	387.00	198.07	585.07	453.02	220.82	12.86
38.0	46.71	413.04	202.43	615.47	480.52	232.69	13.18
39.0	47.94	439.12	206.80	645.92	508.05	244.58	13.47
40.0	49.17	465.24	211.16	676.40	535.62	256.48	13.76
41.0	50.40	491.38	215.53	706.90	563.22	268.39	14.03
42.0	51.62	517.53	219.89	737.42	590.83	280.31	14.28
43.0	52.85	543.68	224.26	767.94	618.44	292.23	14.53
44.0	54.08	569.83	228.62	798.45	646.04	304.14	14.76
45.0	55.31	595.97	232.99	828.95	673.63	316.05	14.99
46.0	56.54	622.08	237.35	859.43	701.19	327.95	15.20
47.0	57.77	648.15	241.71	889.87	728.73	339.83	15.40
48.0	59.00	674.19	246.08	920.27	756.21	351.70	15.60
49.0	60.23	700.17	250.44	950.61	783.65	363.55	15.78
50.0	61.46	726.09	254.81	980.89	811.02	375.37	15.96
51.0	62.69	751.93	259.17	1011.11	838.33	387.16	16.13
52.0	63.92	777.70	263.54	1041.24	865.55	398.93	16.29
53.0	65.15	803.38	267.52	1070.91	892.56	410.53	16.44
54.0	66.37	828.97	271.11	1100.07	919.34	421.96	16.57
55.0	67.60	854.44	314.46	1168.90	959.26	446.60	17.29
56.0	68.83	879.81	360.22	1240.03	999.88	472.00	18.02
57.0	70.06	905.05	408.37	1313.42	1041.17	498.14	18.75
58.0	71.29	930.15	458.88	1389.04	1083.11	525.02	19.48
59.0	72.52	955.12	511.78	1466.90	1125.71	552.64	20.23
60.0	73.75	979.94	567.14	1547.08	1168.99	581.02	20.98
61.0	74.98	1004.60	619.31	1623.91	1211.04	608.28	21.66
62.0	76.21	1029.09	662.62	1691.72	1249.97	632.51	22.20
63.0	77.44	1053.41	697.16	1750.57	1285.80	653.75	22.61
64.0	78.67	1077.55	723.00	1800.55	1318.55	672.02	22.89
65.0	79.90	1101.50	724.83	1826.33	1343.11	682.21	22.86

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.6697E+00	0.1371E-03	0.7341E-01	0.1000E-03

Bent 2-B.sfo

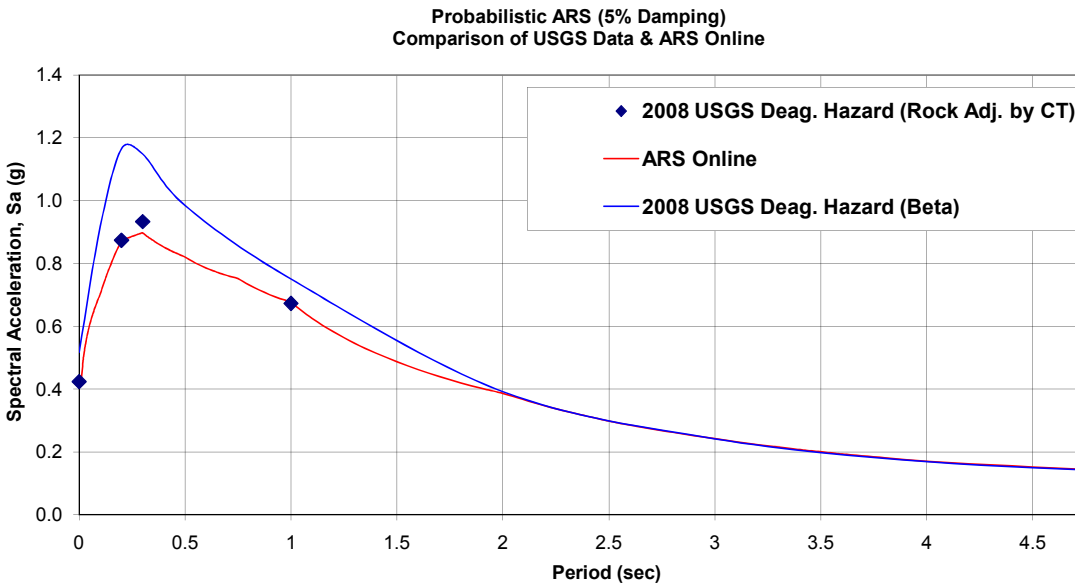
0.6697E+01	0.1371E-02	0.7341E+00	0.1000E-02
0.1674E+02	0.3428E-02	0.1835E+01	0.2500E-02
0.3349E+02	0.6855E-02	0.3671E+01	0.5000E-02
0.5023E+02	0.1028E-01	0.5506E+01	0.7500E-02
0.6697E+02	0.1371E-01	0.7341E+01	0.1000E-01
0.1676E+03	0.3428E-01	0.1835E+02	0.2500E-01
0.3355E+03	0.6858E-01	0.3671E+02	0.5000E-01
0.4873E+03	0.1025E+00	0.5506E+02	0.7500E-01
0.5965E+03	0.1343E+00	0.7341E+02	0.1000E+00
0.1056E+04	0.3147E+00	0.1835E+03	0.2500E+00
0.1354E+04	0.5875E+00	0.3200E+03	0.5000E+00
0.1456E+04	0.8464E+00	0.3967E+03	0.7500E+00
0.1522E+04	0.1103E+01	0.4631E+03	0.1000E+01
0.1743E+04	0.7924E+01	0.7183E+03	0.7800E+01

APPENDIX E

Comparison spreadsheet of the 2008 USGS Probabilistic Seismic Hazard Data and ARS Online Probabilistic Data (unlock sprea
Spectral Accelerations Points from USGS Website at http://earthquake.usgs.gov/research/hazmaps/products_data/2008/data/

*** Note: This spreadsheet uses the given latitude and longitude data provided by the user to estimate spectral acceleration values with a probability of exceedence 5% 975 yr return period). The four spectral acceleration data points plotted on the graph are from the USGS website and are based on a 0.05 degree grid. Basic interpolati to estimate intermediate values inside each grid. Raw Data points are provided in the tabs of this spreadsheet. Corner grid spectral acceleration data are shown in th "calculation" tab.**

Input Site Information	
Latitude	Longitude
37.9994	-121.8216
V_{S30} (m/s) =	250
Near Fault Factor, Derived from USGS Deagg. Dist (km) =	13.7
$Z_{1.0}$ (m) =	0
$Z_{2.5}$ (km) =	2



Place ARS Online Probabilistic Data Here "Paste"

T (sec)	Base Spectrum S(a)	Basin Factor	Near Fault Factor	Final Adj. Spectrum S(a)
0.01	0.424	1.004	1	0.425
0.02	0.493	1.004	1	0.494
0.022	0.503	1.004	1	0.505
0.025	0.517	1.004	1	0.519
0.029	0.534	1.003	1	0.536
0.03	0.538	1.003	1	0.54
0.032	0.546	1.003	1	0.548
0.035	0.557	1.003	1	0.558
0.036	0.56	1.003	1	0.562
0.04	0.573	1.003	1	0.575
0.042	0.579	1.003	1	0.581
0.044	0.585	1.003	1	0.587
0.045	0.588	1.003	1	0.59
0.046	0.591	1.003	1	0.593
0.048	0.596	1.003	1	0.598
0.05	0.601	1.003	1	0.604
0.055	0.614	1.003	1	0.616
0.06	0.626	1.003	1	0.628
0.065	0.637	1.003	1	0.639
0.067	0.641	1.003	1	0.643
0.07	0.647	1.003	1	0.649
0.075	0.657	1.003	1	0.659
0.08	0.666	1.003	1	0.668
0.085	0.675	1.003	1	0.677
0.09	0.684	1.003	1	0.686
0.095	0.692	1.003	1	0.694
0.1	0.699	1.003	1	0.702
0.11	0.721	1.003	1	0.723
0.12	0.741	1.003	1	0.743
0.13	0.76	1.003	1	0.762
0.133	0.765	1.003	1	0.768
0.14	0.778	1.003	1	0.78
0.15	0.795	1.003	1	0.797
0.16	0.811	1.003	1	0.814
0.17	0.827	1.003	1	0.83
0.18	0.842	1.003	1	0.845
0.19	0.857	1.003	1	0.859
0.2	0.871	1.003	1	0.873
0.22	0.876	1.003	1	0.879

Analysis of ARS Online Results vs USGS Deaggregation Hazard (Adj. B

Period (sec)	USGS Interpolated Spectral Accel.	Adj. for Near Fault Effect	Adj. for Soil Amplification	Adj. For Basin Effect	Final Adj. USGS Spec Accel	ARS Online Final Adj. Spect. Accel.
0	0.446	1.000	0.949	1.000	0.424	0.425
0.2	1.104	1.000	0.792	1.000	0.874	0.873
0.3	0.905	1.000	1.032	1.000	0.934	0.898
1	0.315	1.200	1.780	1.000	0.673	0.675

Max % Difference =

USGS Deaggregation Hazard (Beta) with Near Field and Basin Factors

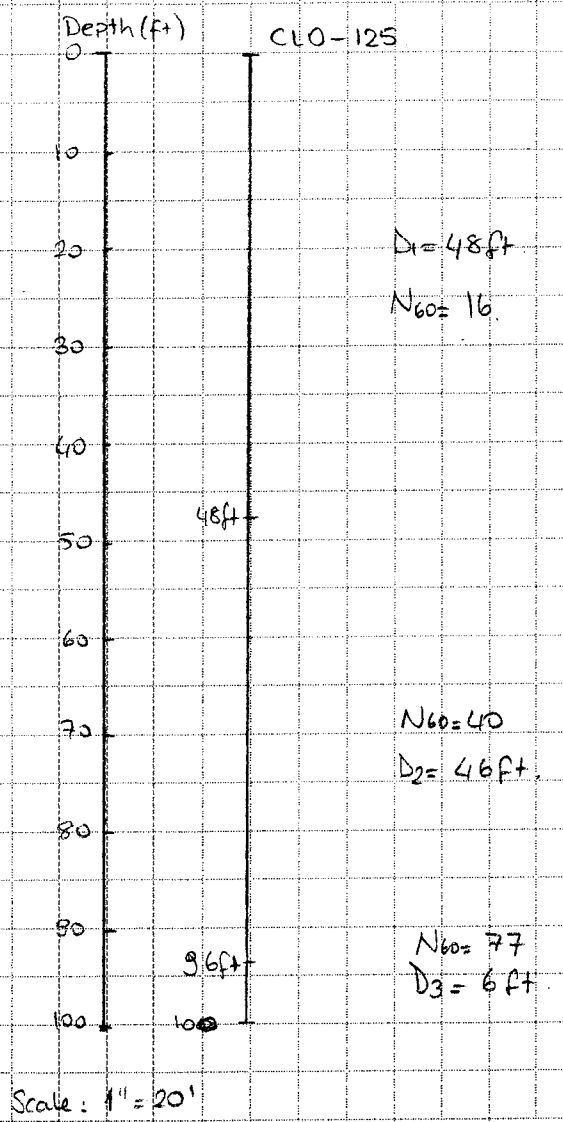
Period (sec)	INPUT USGS Deagg. Spec Accel	Adj. for Near Fault Effect	Adj. For Basin Effect	Final Adj. USGS Deagg Spec Accel	ARS Online Final Adj. Spect. Accel.	% Difference (bet. USGS & ARS Online)
0	0.5184	1.000	1.000	0.518	0.425	18.0%
0.1	0.9193	1.000	1.000	0.919	0.702	23.6%
0.2	1.1664	1.000	1.000	1.166	0.873	25.2%
0.3	1.1489	1.000	1.000	1.149	0.898	21.8%
0.5	0.9852	1.000	1.000	0.985	0.821	16.7%
1	0.6258	1.200	1.000	0.751	0.675	10.1%
2	0.3268	1.200	1.000	0.392	0.386	1.6%
3	0.2018	1.200	1.000	0.242	0.242	0.1%
4	0.14118	1.200	1.000	0.169	0.17	0.3%
5	0.11328	1.200	1.000	0.136	0.136	0.0%

Max % Difference = 16.7%

CONTRA LOMA UNDERCROSSING & UNDERPASS

Design ARS Curve per Caltrans 2009 Seismic Criteria is governed by 2008 USGS Deaggregation Hazard (Beta)- Probabilistic ARS

CONTRA LOMA BLVD. UNDERCROSSING



$$V_1 = 86.9(16)^{0.333} = 218.8 \Rightarrow 219 m/sec$$

$$V_2 = 100.5(40)^{0.29} = 292.9 \Rightarrow 293 m/sec$$

$$V_3 = 86.9(77)^{0.333} = 369.2 \Rightarrow 368 m/sec$$

$$V_{S30} = \frac{100 ft}{\frac{48 ft}{219 m/s} + \frac{46}{293 m/s} + \frac{6}{368 m/s}} =$$

$$V_{S30} = 252.5 m/sec$$

Geotechnical * Environmental * Materials Testing * Construction Inspection
Offices: Milpitas * Fremont * Sacramento * Walnut Creek

FINAL FOUNDATION REPORT
CONTRA LOMA BOULEVARD UNDERPASS (eBART)
(BRIDGE NO. 28C0486)
EAST CONTRA COSTA TRANSIT DEVELOPMENT (eBART)
CONTRA COSTA COUNTY, CALIFORNIA
EA 2285E1

For

BKF Engineers
4670 Willow Road, Suite 250
Pleasanton, CA 94588

PARIKH CONSULTANTS, INC.
1243 Alpine Road, Suite 110
Walnut Creek, California
(925) 933-6336

October, 2010

Job No. 206118.EBS

TABLE OF CONTENTS

PAGE

INTRODUCTION 1

PROPOSED CONSTRUCTION 1

PURPOSE AND SCOPE 2

SITE CONDITIONS 2

FIELD EXPLORATION AND LABORATORY TESTING 3

Soil Borings 3
Cone Penetration Testing (CPT) 4
Laboratory Testing 4
Boring and CPT Logs 4

SUBSURFACE CONDITIONS 5

GEOLOGY 5

EARTHQUAKE CONSIDERATIONS 6

SEISMIC SOURCES 6
SEISMIC HAZARDS/LIQUEFACTION IMPACT 7

FINDINGS AND RECOMMENDATIONS 8

GENERAL 8
FOUNDATIONS 8
LATERAL PILE CAPACITY 11
LATERAL EARTH PRESSURES 13
SEISMIC DESIGN CRITERIA 14
GRADING 15
CORROSION 15
PLAN REVIEW 16
CONSTRUCTION OBSERVATION 16

INVESTIGATION LIMITATIONS 16

PROJECT LOCATION MAP ..... Plate 1
GEOLOGIC MAP ..... Plate 2
FAULT MAP ..... Plate 3
ARS DESIGN CURVE ..... Plate 4

Appendix A Log of Test Borings & As-Built Log of Test Borings
Appendix B Laboratory Test Data
Appendix C CPT Data
Appendix D Calculations
Appendix E Caltrans Comments & Responses

FINAL FOUNDATION REPORT
CONTRA LOMA BOULEVARD UNDERPASS (eBART)
EAST CONTRA COSTA TRANSIT DEVELOPMENT
(BRIDGE NO. 28C0486)
CONTRA COSTA COUNTY, CALIFORNIA
EA 2285E1

INTRODUCTION

This report presents the results of our geotechnical engineering investigation for the proposed new eBART underpass structure over Contra Loma Boulevard in Antioch, Contra Costa County, CA. Our work was performed generally in accordance with the scope of work as per our agreement. The general location of the site and its vicinity are shown on the Project Location Map, Plate 1.

The geotechnical recommendations presented in this report are intended for design input and are not intended to be used as specifications. These recommendations should not be used for direct bidding purposes.

PROPOSED CONSTRUCTION

The project plans are to construct a new underpass for eBART in the median between the eastbound and westbound bridges on Highway 4 crossing Contra Loma Boulevard/L Street. The adjacent highway bridges are planned to be replaced under a different program. Per the plans provided, the new underpass will be a two-span, cast-in-place prestressed concrete box girder structure that will span over Contra Loma Boulevard. Per the plans provided, the structure will be 160 feet long and 27 feet wide and will accommodate two parallel railroad tracks. Abutment 1 will be a short seat abutment with slope paving. Abutment 3 will be an open face tall seat abutment. Support at Bent 2 will consist of two 6'x4' octagonal columns with one-way flare at the top. The abutments and the two columns at Bent 2 will all be supported on cast-in-drilled-hole (CIDH) concrete piles.

PURPOSE AND SCOPE

The purpose of this investigation was to evaluate the general soil conditions at the project site, to evaluate their engineering properties, and to provide recommendations for foundation support of the proposed project.

The scope of work performed for this investigation included a review of the readily available soils and geologic literature; review relevant information obtained from the investigations for the proposed adjacent bridges for the highway widening project, which included two drilled borings and one cone penetrometer test (CPT), and laboratory testing of the collected samples; engineering analysis of the field and laboratory data, and preparation of this report. The basis for this investigation is the preliminary plans provided to us by BKF Engineers. We have presented the descriptive log of the boreholes in Appendix A.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain a properly constructed project. We, therefore, recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction.

Our recommendations in this report are based on the above information. Any major deviation should be reported to this office for consideration.

SITE CONDITIONS

The project is located on State Route 4 across Contra Loma Boulevard-L Street in Antioch, Contra Costa County. The existing crossing consists of two parallel prestressed concrete bridges constructed in 1951. Per the As-Built drawings, both bridges (known at the time as Stewartville Road Undercrossing) are three-span structures, approximately 90 feet long and 37 feet wide. The bridge abutments at the two ends are supported on precast prestressed concrete piles. The bents are

supported on concrete frames. The bottom members of the frames are embedded and serve as spread footing foundations for the internal bents. The present bridge is built on approximately 20 feet of fill.

The top surfaces of the existing bridges are at approximately Elev. 50 feet. The top of pavement in Contra Loma Boulevard-L Street below the bridges is approximately at Elev 30 feet. Approach fill on both ends of the bridge rises from approximately Elev. 30 feet to Elev. 50 feet.

FIELD EXPLORATION AND LABORATORY TESTING

As noted earlier, two (2) exploratory borings were drilled as part of the highway widening project. Subsequently, a cone penetrometer test (CPT) was added, adjacent to one of the borings to reevaluate the liquefaction potential (see section on liquefaction). The boring and CPT locations are shown on the plan portion of the Log of Test Borings in Appendix A.

These borings, the CPT and the associated laboratory testing have been used for the eBART underpass, and no new borings were drilled.

Soil Borings

The borings were drilled on September 20 and 28, 2006, from the top of the road embankments adjacent to the existing bridge abutments. They were advanced with a truck-mounted drill rig, using hollow stem auger drilling method. Both the borings were drilled to depths of 100 feet below the existing ground surface.

Selected samples were obtained at various depths generally from 3.0-inch O.D. & 2.5 inches I.D. (Modified California) samplers above a depth of 50 feet below ground surface and from 2.0-inch O.D. & 1.4-inch I.D. (Standard Penetration Test) samplers at depths greater than 50 feet. The samplers were driven in subsurface soils under the impact of a 140-lb hammer having a free fall of 30 inches. The blow counts are presented on the "Log of Test Borings". (When correlating standard penetration data in similar soils, the blow counts for the Modified California Sampler can be taken as roughly 1.6 times that for the Standard Penetration Test in similar soils). The samples

were sealed and transported to our laboratory for further evaluation and testing. The field investigation was conducted under the supervision of our field engineer who logged the test borings and prepared the samples for subsequent laboratory testing and evaluation.

Cone Penetration Testing (CPT)

CPT work was performed by Gregg Drilling & In Situ, Inc. on October 26, 2007 using a truck mounted CPT rig. The CPTs were conducted using a 60-degree cone attached to a 1.7-inch diameter rod pushed into the subsurface. The soil resistance exerted to the tip and side of the cone were recorded and correlated to soil type, classification and strength characteristics. Groundwater level was estimated from pore pressure dissipation measurements during CPT operation. Detailed information from the CPT investigation is presented in Appendix C.

Laboratory Testing

Laboratory tests were performed on selected samples obtained during field exploration to determine the physical and engineering properties of the subsoils. Laboratory data of moisture contents, total density, grain size distribution, Atterberg Limits and unconfined compression strengths are presented on the Log of Test Borings. Other tests performed include an Unconsolidated Undrained (UU) triaxial test on a sample from boring CLO-124 and a consolidation test on a sample from boring CLO-125. A detailed description of laboratory testing performed is presented in Appendix B. Appendix B also includes Plasticity Charts for Atterberg Limits, grain size distribution curves, stress-strain curve for the UU test and the load-deformation curve for the consolidation test.

Boring and CPT Logs

The log of test borings (LOTB) sheets, consistent with current Caltrans guidelines, are presented in Appendix A. They were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs. The abrupt stratum changes shown on these logs may be gradual and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations. CPT logs are also presented on the LOTB sheets at appropriate locations.

SUBSURFACE CONDITIONS

Boring CLO-124 on the western side indicated predominantly stiff lean clays to a depth of approximately 55 feet. Alternate layers of very dense silty sands and hard clays were encountered below 55-ft depth. In Boring CLO-125 on the eastern side, medium dense silty sand was encountered to a depth of approximately 15 feet, underlain by stiff clays and medium dense clayey sand layers to a depth of approximately 50 feet. Medium dense sandy soils occurred below 50-ft depth to a depth of approximately 85 feet, underlain by layers of very dense silty sand and hard clay. In addition to the new borings, we reviewed two borings in the LOTB sheet from the As-built drawings for the existing undercrossing, which are also presented in Appendix A. The borings, drilled in 1961, also show essentially similar soil conditions, e.g. predominantly silty and sandy clays.

During field exploration in September 2006, the water levels in the borings were approximately at Elev. 8.6 feet at the western end and Elev. 5.3 feet at the eastern end. However, the groundwater may vary with the passage of time due to seasonal groundwater fluctuation, surface and subsurface flows, ground surface run-off and other factors that may not be present at the time of investigation.

GEOLOGY

General geologic features pertaining to the site were evaluated with reference to the "Geologic Map of Quaternary Geology of Contra Costa County and Surrounding Areas, CA: Derived from Digital Database open-file 97-98" by E.J. Helley and R.W. Graymer 1997; Scale 1:100000. Based on the map, the site is located at the boundary of areas covered by Holocene alluvial fan and fluvial deposits (Qhaf) and Pleistocene alluvial fan and fluvial deposits (Qpaf). A geologic map of the general project area is shown on Plate 2. Description of the main geologic units is as follows:

Qhaf (Alluvial Fans and Fluvial Deposits (Holocene)) – Alluvial fan deposits are brown or tan, medium dense to dense, gravely sand or sandy grave that generally grades upward to sandy or silty clay. Near the distal fan edges, the fluvial deposits are typically brown, never reddish, medium dense sand that fines upward to sandy or silty clay. The best developed Holocene alluvial fans in Contra Costa County are on the Richmond Bay Plain and the fans of Sand and Deer Creeks in the

Brentwood Area. All other alluvial fans and fluvial deposits are confined to narrow valley floors. Several Holocene fans along the south shore of the Carquinez Strait have bulbous surface morphology, are short, overlap older Pleistocene surfaces, and may be debris flows.

Qpaf (Alluvial Fans and Fluvial Deposits (Pleistocene)) – Brown dense gravely and clayey sand or clayey gravel that fines upward to sandy clay. These deposits display various sorting and are located in most stream channels in the county. All Qpaf deposits can be related to modern stream courses. They are distinguished from younger alluvial fans and fluvial deposits by higher topographic position, greater degree of dissection, and stronger soil profile development. They are less permeable than Holocene deposits, and locally contain fresh water mollusks and extinct late Pleistocene vertebrate fossils. They are overlain by Holocene deposits on lower parts of the alluvial plain, and incised by channels that are partly filled with Holocene alluvium on higher parts of the alluvial plain. Maximum thickness is unknown but at least 50m (150 feet).

EARTHQUAKE CONSIDERATIONS

Seismic Sources

The project is located in a seismically active part of Northern California. Many faults exist in the area, which are capable of producing earthquakes which may cause strong ground shaking at the site.

Applicable major faults in the vicinity of the project site were identified and their associated maximum earthquake magnitudes were established using the Caltrans 2007 Deterministic PGA Map and the associated Data Base. The documents were supplied to us by Caltrans, with the understanding that the fault locations in the map and the associated magnitudes in the Data Base have essentially been finalized and are appropriate for design purposes. The moment magnitudes noted in the table represent the largest earthquakes that could occur on the given fault based on the current understanding of the regional tectonic structure. A fault map of the project vicinity is shown on Plate 3.

Fault	Fault No.(1)	Fault Type	Distance from Site (miles)	Maximum Moment Magnitude
Vaca Fault Zone	14	RLSS(2)	5.5	6.9
Great Valley Fault 5	24	Reverse Fault	6.7	6.5
Greenville Fault Zone (Clayton Section)	351	RLSS	6.8	6.6
Concord Fault Zone (Ygnacio Valley Section)	341	RLSS	11.4	6.6

(1) Number of the Fault in the Data Base associated with the Caltrans 2007 Deterministic PGA Map
(2) RLSS – Right Lateral Strike Slip Fault

Based on the Caltrans 2007 Deterministic PGA Map and the attenuation relationship by Sadigh et al. (1997), the controlling fault is the Vaca Fault Zone (Fault No. 14 in the map), which is associated with a Maximum Moment Magnitude (Mmax) of 6.9. A peak bedrock acceleration (PBA) of 0.46g is anticipated at the site.

Seismic Hazards/Liquefaction Impact

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction. Since no active faults pass through the site, the potential for fault rupture is relatively low. Based on available geological and seismic information, the possibility of the site to experience strong ground shaking may be considered significant.

Liquefaction is a phenomenon in which saturated soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged, cohesionless sands and silts of low relative density are the type of soils which usually are susceptible to liquefaction - the susceptibility increases with decreasing relative density (reflected by the number of blows to drive a sampler), and decreasing fines content. Accepted procedures for the assessment of liquefaction potential for cohesionless soils have evolved over the years through research and field observations (Youd et al, 2001). Recent research and field observations have shown that clays of low plasticity are also potentially liquefiable, based on the moisture content and plasticity characteristics of the clay. Procedures for the assessment of liquefaction potential for clay soils have also been established and have received general acceptance (Bray et. al., 2004).

Initial analyses based on the blow counts by the drive sampler indicated the presence of potentially liquefiable medium dense sand layers below 50-ft depth in boring CLO-125. It is generally accepted that when hollow stem auger drilling techniques are used, the measured blow counts and the associated liquefaction analyses are less reliable. Thus, a cone penetration test (CPT) was subsequently performed 23 feet west of boring CLO-125 to confirm/negate the finding. Based on the CPT results the potential for liquefaction was found to be low.

FINDINGS AND RECOMMENDATIONS

General

Based on the findings of the investigation, it is our opinion that the site is feasible for the planned bridge structure provided the recommendations presented in this report are incorporated into the final design and construction.

This report was prepared specifically for the proposed bridge structure according to the plans provided to us. Normal construction procedures were assumed throughout our analysis and represent one of the bases of recommendations presented herein. Our design criteria have been based upon the materials encountered at the site. Therefore, we should be notified in the event that these conditions are changed, so as to modify or amend our recommendations.

Foundations

For the proposed structure, 24-inch diameter CIDH piles are recommended for foundation support at the two abutment locations and 90-inch CIDH piles are recommended for the column foundations for Bent 2.

Pile Design

Pertinent foundation design information was provided by Biggs Cardosa Associates, Structural Engineers for the project. It is our understanding that consistent with the eBART Design Basis Memorandum (DBM), the governing live load for the eBART underpass is from the DMU (diesel multiple units). The structural design follows AREMA guidelines (Service Combination & LFD

Combination) due to different jurisdiction. Based on information provided by the designer, the Foundation Design Load information is shown in the table below.

Foundation Design Load

Support	Service Case		Seismic Case		Strength Case		Nominal Load (Max.) (kips)	
	Compress. (kips)	Tension (kips)	Compress. (kips)	Tension (kips)	Compress. (kips)	Tension (kips)	Compress. (kips)	Tension (kips)
Abutment 1	140	N/A	350	140	N/A	N/A	350	140
Bent 2	N/A	N/A	890	N/A	2310	N/A	3300	N/A
Abutment 3	190	N/A	470	180	N/A	N/A	475	180
Nominal Load = 2.5 * Service Load (Service Case); 1.00 * Seismic Load (Seismic Case) & Strength Load/0.7 * (Strength Case)								

The supplied foundation design information was utilized to develop the Pile Data Table. Estimation of the pile capacities was made using the site-specific subsurface conditions for the loads and other pertinent information provided by the Structural Engineer. The computer program SHAFT developed by Ensoft, Inc. was used for the computations. The program computes capacities for drilled shafts (CIDH piles) based on procedures proposed by O'Neil and Reese (1999). The procedures utilize an α factor (α=0.55) for "Clay" and a β factor for "Sand" where β is a function of depths below ground surface and independent of soil friction angle The SHAFT program also computes the pile settlement and associated mobilization of shaft and end-bearing resistance, consistent with the O'Neil and Reese (1999) procedures. This feature is particularly useful for large diameter (90-inch) piles for Bent 2.

Per O'Neil & Reese (1999), the shaft resistance, particularly for large diameter shaft in clay soils, will be mobilized much faster than end bearing. Therefore, majority of the capacity contribution will be from shaft friction. For the large diameter CIDH piles at Bent 2, we have selected a pile tip/length so that at nominal load condition the pile head settlement is approx. 3.5% of the pile diameter (3 inches $\pm$). The anticipated pile head settlement/permissible settlement under service load (FS = 2.5) is under 0.2 inch which is about 0.2% of pile diameter. Pile capacity computations (SHAFT output) and load vs. settlement curve (Bent 2, Boring COL-124 & 71 ft length) are presented in Appendix D. For such small pile settlement, there is hardly end bearing capacity mobilized (less than 5-10%). Therefore, the design of large diameter CIDH piles is primarily

based on shaft resistance.

The pile data table is presented below. End bearing was neglected in the estimation of axial pile capacities for the 24-inch diameter abutment piles. For the 90-inch diameter piles, consideration was given to the pile head settlement and shaft capacity mobilization per O'Neil and Reese (1999) as discussed above.

PILE DATA TABLE - CONTRA LOMA BOULEVARD UNDERPASS (eBART)

Location	Pile Type	Design Loading (kips)	Nominal Resistance (kips)		Cut-off Elev. (ft)	Design Tip Elev. (ft)(1)	Specified Tip Elev. (ft)
			Compression	Tension			
Abutment 1	24-in CIDH	N/A	350	140	35.00	-16.0(a); -12.0 (b)	-16.0
Bent 2	90-in CIDH	N/A	3300	N/A	30.30	-35.0(a)	-35.0
Abutment 3	24-in CIDH	N/A	475	180	25.50	-23.0(a); -15.0 (b)	-23.0

Notes:
1. Design Tip Elevation is controlled by the following demands: (a) Compression; (b) Tension, (c)Lateral Loads
2. The Nominal Resistance exceeds the recommended Nominal Resistance for 24-in.CIDH piles per Caltrans Standard Plans. The pile design may have to be modified.

CIDH Pile Installation

Caltrans standard specifications and standard special provisions (SSP) for "Cast-in-Place Concrete Piling" should be used for the construction of CIDH piles. It is possible that groundwater may be encountered during construction and "dry" condition as per the standard specifications Section 49-4 could not be maintained.

Vertical inspection pipes for acceptance testing should be provided in all CIDH piles that are 24 inches in diameter or larger, except when the holes are dry or when the holes are dewatered without the use of temporary casing to control groundwater. The acceptance test should include Gamma-Gamma Logging and may also include cross-hole sonic logging. Gamma-Gamma Logging should be performed in accordance with California Test 233 Standard (CT233) to check the homogeneity of CIDH piles. Details of the acceptance testing and Gamma-Gamma Logging are contained in Caltrans SSP and CT233.

It is prudent to make the contractor aware of these conditions so that he takes appropriate steps to comply with the standards and maintain the integrity of the CIDH piles. The use of temporary steel

casing should be anticipated at all times to maintain the integrity of the piles. It is also recommended that the specifications set certain criteria for qualifications and previous work experience requirements to pre-qualify the potential contractors. The intent is to help select qualified contractors to reduce construction issues.

All piles excavations should be observed by the geotechnical engineer or regulatory agency prior to the placement of reinforcement and concrete so that if conditions differ from those anticipated, appropriate recommendations can be made.

Lateral Pile Capacity

Analyses for lateral load behavior of the piles were performed using the LPILE computer program. Geotechnical parameters for the development of p-y curves for the LPILE program are presented in the tables below. The parameters are based on field borings, CPT and lab testing data. The elevation information is based on the topographic data provided to us.

For the Bent 2 piles, group reduction factors of 0.73 and 0.56 are recommended for longitudinal and transverse loads, respectively, based on the pile layout provided by the Designers and the procedures presented in the GROUP7.0 Technical Manual by Ensoft Corporation. For the other supports, it is recommended to use a p-multiplier of 0.6 (60% effective) and a y-multiplier of 1.0 to consider group effect for piles spaced at minimum 3 times the maximum dimension.

Geotechnical Parameters for LPILE Analysis

Abutment 1

Elevation (ft.)	Generalized Soil Profile	LPILE Soil Type	Probable Soil Strength	K (pci)	e_{50} (in/in)	Effect Unit Weight (pci)
49 to 33	Medium Stiff Lean Clay	1, Soft Clay	Su = 5.21	100	.010	.0694
33 to 10	Stiff Lean Clay	3, STIFF CLAY w/o water	Su = 11.81 psi	500	.007	.0723
10 to -8	Stiff Sandy Lean Clay	3, STIFF CLAY w/o water	Su = 11.81 psi	500	.007	.0376
-8 to -18	Very Dense Silty Sand	8, SAND (API)	Φ= 40°	150	--	.0405
-18 to -33	Hard Lean Clay	3, STIFF CLAY w/o water	S_u = 31.25 psi	2000	.004	.0405
-33 to -45	Very Dense Silty Sand	8, SAND (API)	Φ = 40°	150	--	.0405
Ground Surface @ El +49		Groundwater Table @ El +10				

Abutment 3

Elevation (ft.)	Generalized Soil Profile	LPILE Soil Type	Probable Soil Strength	K (pci)	e_{50} (in/in)	Effect Unit Weight (pci)
49 to 33	Loose to Medium Dense Silty Sand	8, SAND (API)	Φ = 32°	60	--	.0723
33 to 10	Stiff Lean Clay	3, STIFF CLAY w/o water	Su = 11.81 psi	500	.007	.0723
10 to 0	Stiff Lean Clay	3, STIFF CLAY w/o water	Su = 11.81 psi	500	.007	.0376
0 to -35	Medium Dense Sand	8, SAND (API)	Φ = 35°	60	--	.0405
-35 to -45	Very Dense Sand	8, SAND (API)	Φ = 40°	150	--	.0405
Ground Surface @ El +49		Groundwater Table @ El +6				

For lateral pile analyses at Bent 2, LPILE analyses should be performed for both soil conditions and the more conservative results as appropriate should be used for design.

The parameters reported above are based on standard pile sizes. For piles larger than 2 feet in

diameter, such as for the 7.5-ft diameter CIDH piles at the Bent 2 location, the K values should be scaled up and the e_{50} values should be scaled down by a factor of $(\text{pile size}/2')^{0.5}$.

Generally, a 0.25-inch deflection indicates a Service Load Limit.

Lateral Earth Pressures

Abutment retaining walls and wing walls should be designed to resist the following Applied Lateral Earth Pressures and live load. These values assume no hydrostatic pore pressure buildup behind the wall and are based on well-drained backfill behind the walls supported in native soil.

Active Condition (flexible wall - wall free to rotate at least 0.4 percent of wall height

Structure Backfill:	Equivalent Fluid Pressure (EFP) – 36 pcf (backfill having a friction angle $\Phi = 33.5°$ and a unit weight of 125 pcf)
Surcharge (dead or live load):	0.3 times surcharge load

At-Rest Condition (rigid wall - wall not free to rotate at least 0.4 percent of wall height

Structure Backfill:	Equivalent Fluid Pressure (EFP) – 55 pcf (backfill having a friction angle $\Phi = 33.5°$ and a unit weight of 125 pcf)
Surcharge (dead or live load):	0.5 times surcharge load

Passive Resistance for Seismic Design of Abutment Wall

Passive Resistance	For seismic design, use 375 pcf Equivalent Fluid Pressure (EFP), engaging the total height of the wall. Alternatively, the wall may be designed for a uniform pressure of 5 ksf (ultimate) acting over twice the height of the abutment backwall. In either case, the displacement of the wall should be evaluated using the table below to assure that the wall displacement is acceptable:

Wall Deflection/Wall Height	Pmob/Pult
0.005	0.55
0.010	0.70
0.015	0.82
0.020	0.90
0.025	0.97
0.030 and greater	1.00

Intermediate values may be interpolated.

Seismic increment of Lateral Earth Pressure (based on BART Facilities Standards)

$11H^2$ (psf) per foot of wall, acting at 0.6H above the base
(The earth pressures are based on Mononobe-Okabe formulation. The accelerations used are half of the corresponding peak acceleration per BART Facilities Standards)

Seismic Design Criteria

Based on the available boring information in the vicinity of the project site, the subsurface soil conditions at the project site generally matches the criteria for Soil Type D, as per Caltrans Seismic Design Criteria (Version 1.4, June 2006). Based on Caltrans Seismic Design Criteria and the above information, the seismic design criteria are as follows:

1. Closest Distance to Fault = 5.5 miles (8.8 km)
2. PBA = 0.46g
3. Design ARS Curve = Caltrans Seismic Design Criteria June 2006 Version 1.4 Figure B.8 (Soil Profile Type D)

4. Design ARS Curve (see Plate 4): Curve based on Caltrans SDC (v. 1.4, 6/2006) for different structural periods. The curve is based on (Governing Fault – Vaca Fault Zone; Mmax =6.9) Figure B.8, PBA = 0.46g. The curve for PBA=0.46g was obtained by interpolation of the 0.4g and 0.5g curves. The curve is modified for near fault effects as required by SDC. Figure B.8 is used since the range in Figure B.7 (e.g. 6.5+/-0.25) is below 6.9.

A copy of the ARS Design Curve is included on Plate No. 4 of this report.

Grading

All grading operations should be performed in accordance with the project specifications and Caltrans Standard Specifications for Earthwork (Section 19, May 2006).

Engineered Fill. Engineered fill should be non-expansive and consist of relatively granular material having a P.I. of less than 15. In addition, we recommend that the material within 3 feet of the proposed pavement subgrade have a minimum R-value of 15. The fill shall also be free of organic and inorganic debris, rubles and any other deleterious material. The on-site soils may be used as engineered fill, provided they meet the above criteria.

Approach Embankment The maximum embankment fill thickness is anticipated to be approximately 20 feet at all the abutment locations. The approach embankments will have a 2(H): 1(V) slope on both sides. Under the bridge, paved slopes may be constructed at 1.5(H):1 (V) slope. The available boring data indicates that the subsurface soil conditions generally consist of stiff to very stiff clays. Based on the boring information, it appears that the consolidation settlement due to the placement of the embankment fill is anticipated to be relatively quick (during construction) and therefore insignificant. Standard Caltrans 30-day waiting period is considered adequate.

Corrosion

The corrosion investigations performed are in general accordance with the provisions of California Test Method 643. A summary of the corrosion test data is presented below.

Boring	Depth (ft)	pH	Resistivity (ohms-cm)	Sulfate (ppm)	Chloride (ppm)
CLO-124	7-8.5	7.96	780	108.2	22.1

Based on the data, the site subsoil is non-corrosive per Caltrans corrosion design guidelines, and standard Type II modified or Type I-P (MS) modified cement may be used for the concrete substructures. The minimum cement factor and cover thickness should be per Caltrans Bridge Design Specifications (Section 8.22).

Plan Review

We recommend that final plans for foundations be reviewed by this office prior to construction so that the intent of our recommendations is included in the project plans and specifications and to further see that no misunderstandings or misinterpretations have occurred.

Construction Observation

To a degree, the performance of any structure is dependent upon construction procedures and quality. Hence, observation of foundation excavations, and pile installations should be carried out by the regulating agencies. If the subsurface conditions different from those forming the basis of our recommendations is encountered this office should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our site reconnaissance and the assumption that the subsurface conditions do not deviate from observed conditions. All work done is in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our conclusions and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

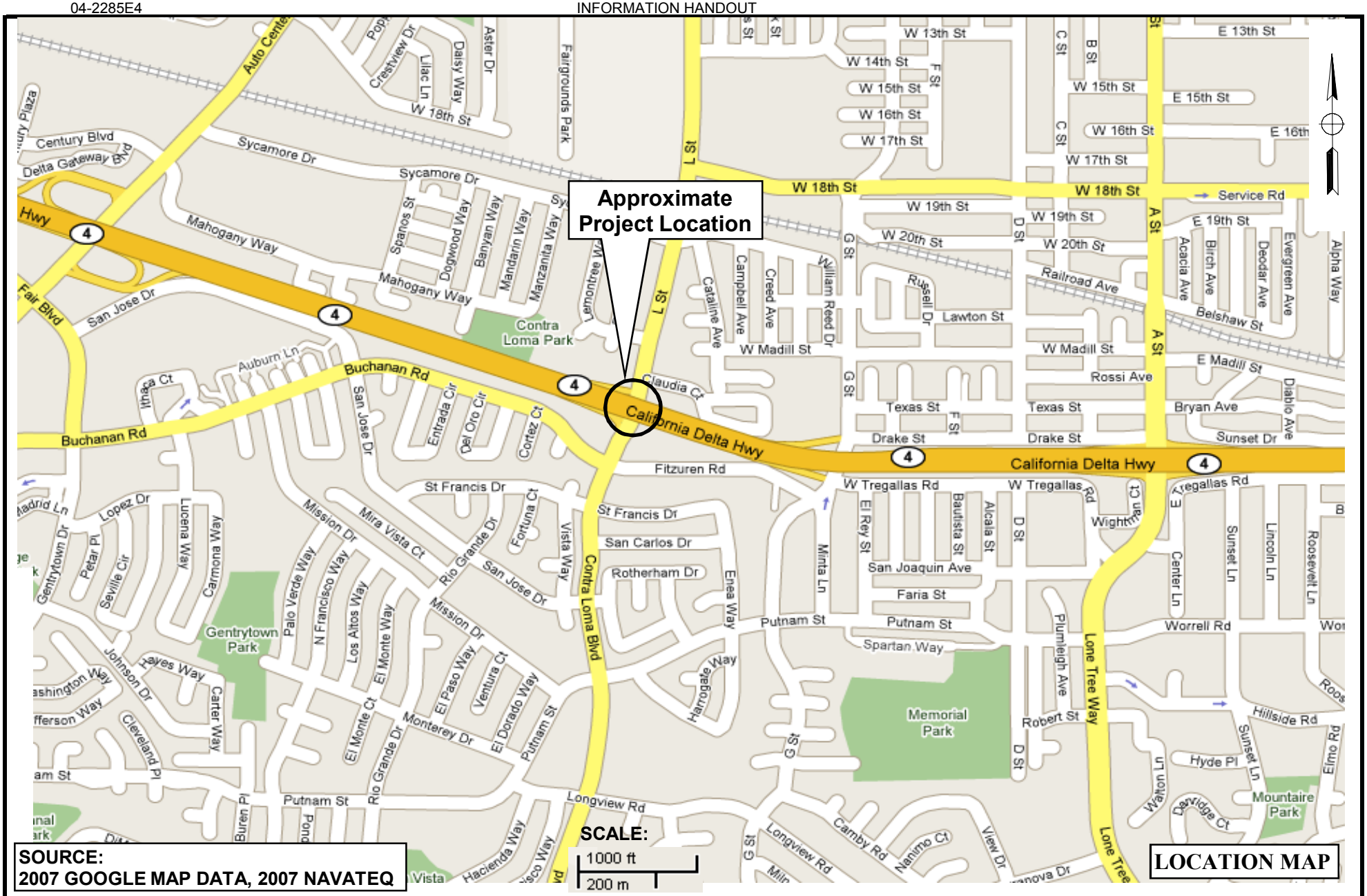
The findings in this report are valid as of the present date. However, changes in the subsurface conditions can occur with the passage of time, whether they be due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
PARIKH CONSULTANTS, INC.

Partha Sircar, Ph.D., P.E. C54619
Senior Engineer

Gary Parikh, G.E. 666
Project Manager

REGISTERED GEOTECHNICAL ENGINEER
No. 666
EXP. 12-31-11
STATE OF CALIFORNIA



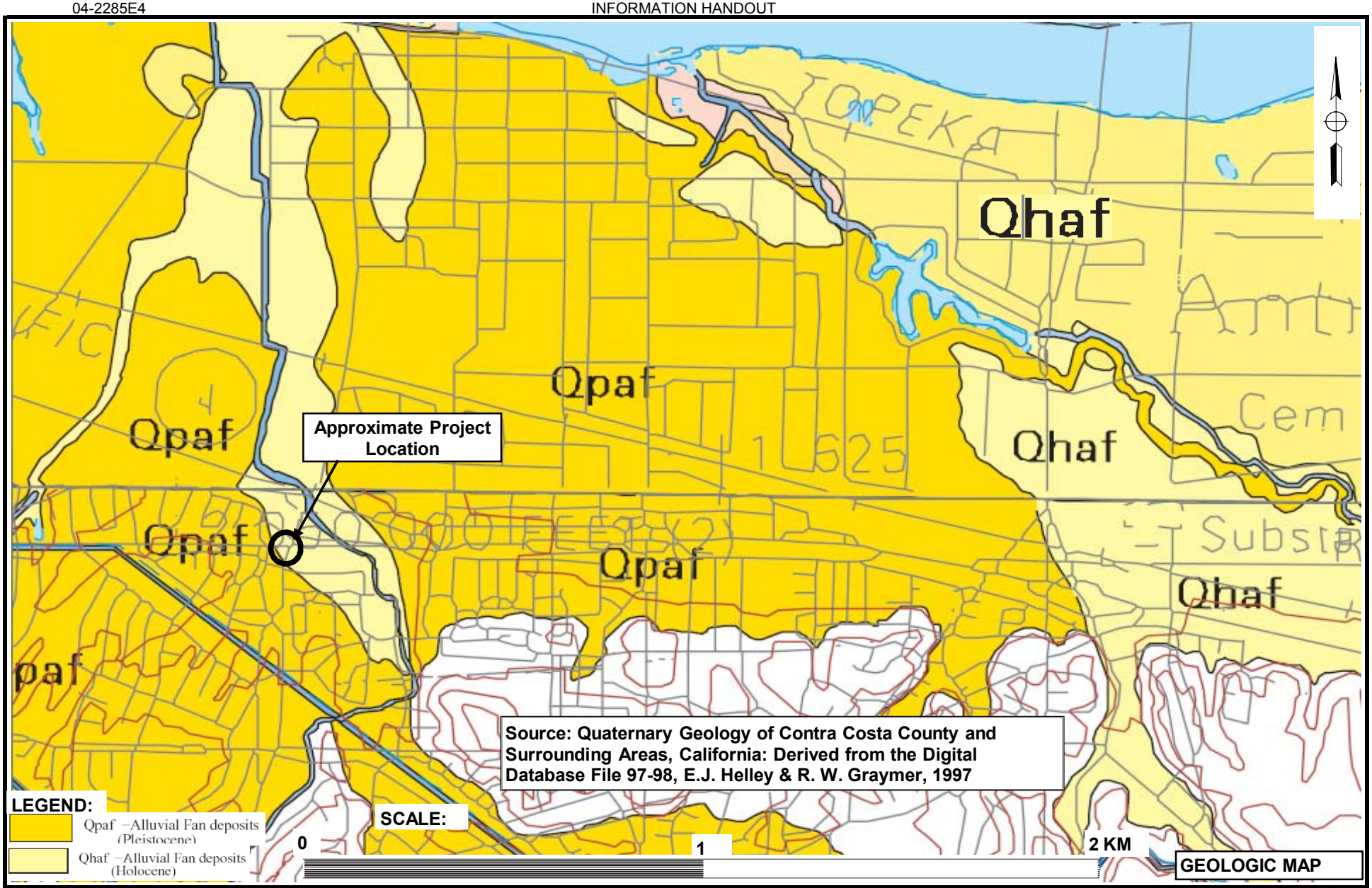
SOURCE:
2007 GOOGLE MAP DATA, 2007 NAVATEQ

LOCATION MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

CONTRA LOMA BOULEVARD UNDERPASS (eBART)
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.: 206118.EBS	PLATE NO.: 1



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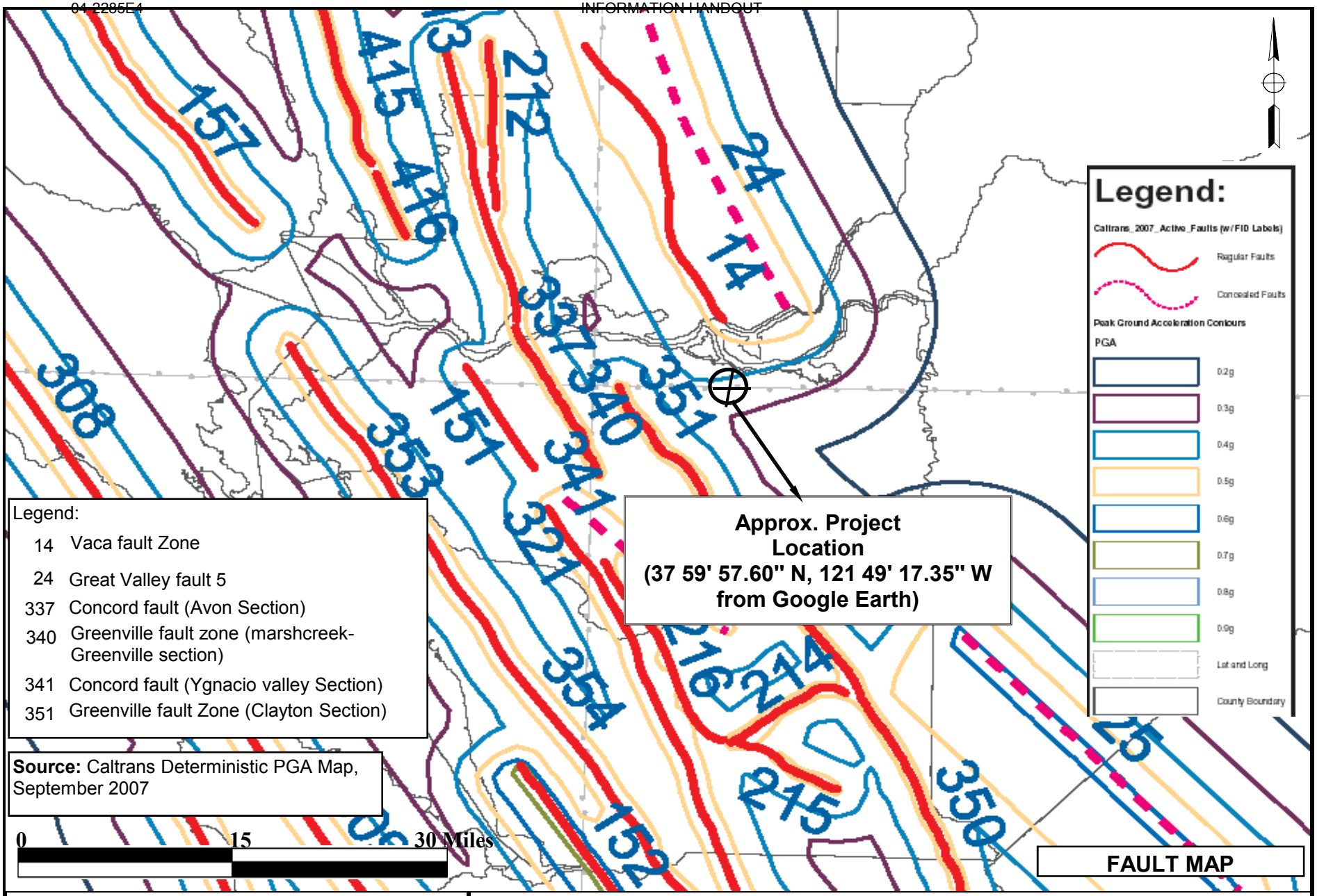
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

CONTRA LOMA BOULEVARD UNDERPASS (eBART)
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.: 206118.EBS	PLATE NO.: 2

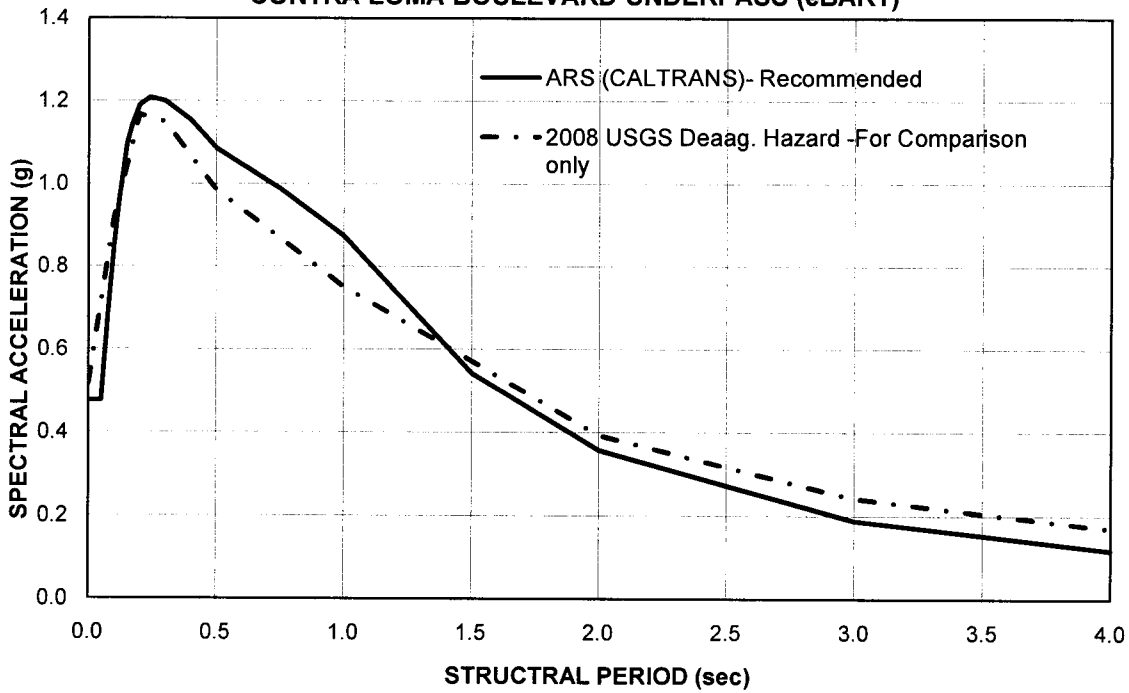


PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

CONTRA LOMA BOULEVARD UNDERPASS (eBART)
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.: 206118.EBS	PLATE NO.: 3

ARS CURVE
CONTRA LOMA BOULEVARD UNDERPASS (eBART)



Spectral Data

Period (sec)	Spectral Accel. (g)
0.010	0.476
0.020	0.476
0.030	0.476
0.050	0.476
0.075	0.673
0.100	0.850
0.120	0.960
0.150	1.095
0.170	1.141
0.200	1.190
0.240	1.208
0.300	1.200
0.400	1.153
0.500	1.085
0.750	0.988
1.000	0.873
1.500	0.542
2.000	0.357
3.000	0.188
4.000	0.117

Caltrans SDC (v 1.4, June 2006), Figure B.8 (M=7.25+/-0.25)
Governing Fault: Vaca Fault Zone
Fault Distance = 8.8 km (5.5 miles)
(Mmax = 6.9, Soil Profile Type D, PBA = 0.46g)

Notes:
(a) The updated Caltrans Hazard Map and Data Base were used
(b) PBA was obtained by using Sadigh Attenuation Relationship: 0.46g
(b) Curve for 0.46g was obtained by interpolating between curves for 0.4g and 0.5g
(d) The following modifications were then applied for near-fault effects:
(1) No change of Sa for structural periods ≤ 0.5 sec
(2) 20% increase of Sa for structural periods > 1 sec
(3) Linear interpolation for structural periods between 0.5 and 1 sec

For Comparison only:

Periyod (sec)	Spectral Acce.
0.000	0.518
0.100	0.919
0.200	1.166
0.300	1.149
0.500	0.985
1.000	0.751
2.000	0.392
3.000	0.242
4.000	0.169
5.000	0.136

Caltrans 2009 Seismic Design Criteria-governed by 2008 USGS Deagg. Hazard-(Beta)-Probabilistic ARS

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

CONTRA LOMA BOULEVARD UNDERPASS (eBART)
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.:206118.EBS **PLATE NO.: 4**

APPENDIX A

INFORMATION HANDOUT

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4			

REGISTERED ENGINEER-GEOTECHNICAL

PLANS APPROVAL DATE

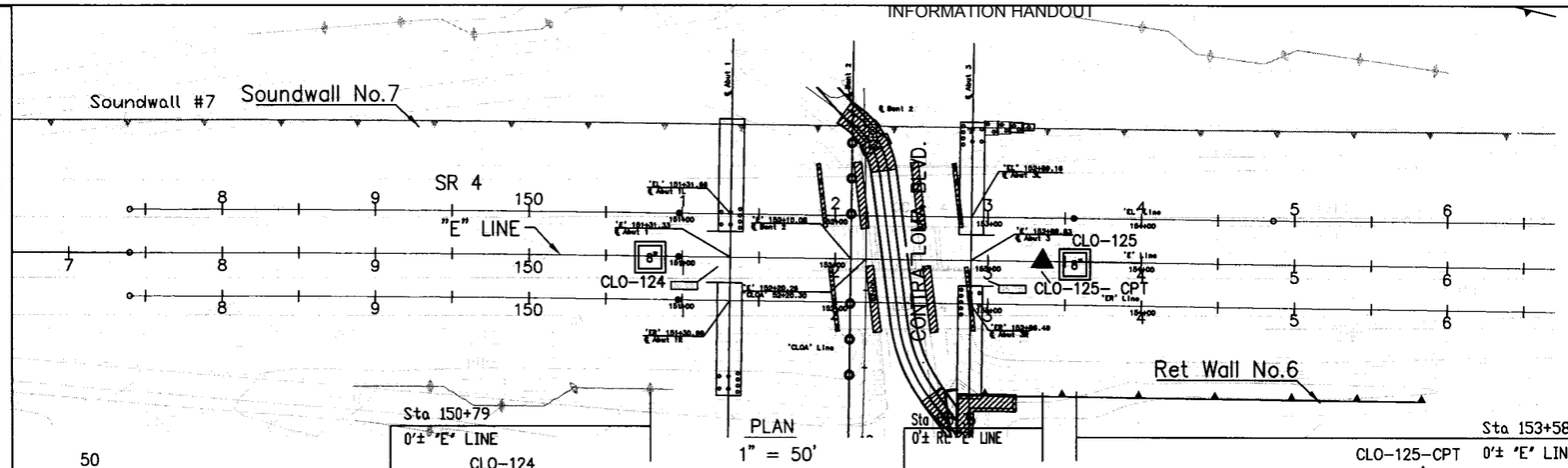
REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. GE. 666 Exp. 12/31/11 GEOTECHNICAL STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE CA 95131

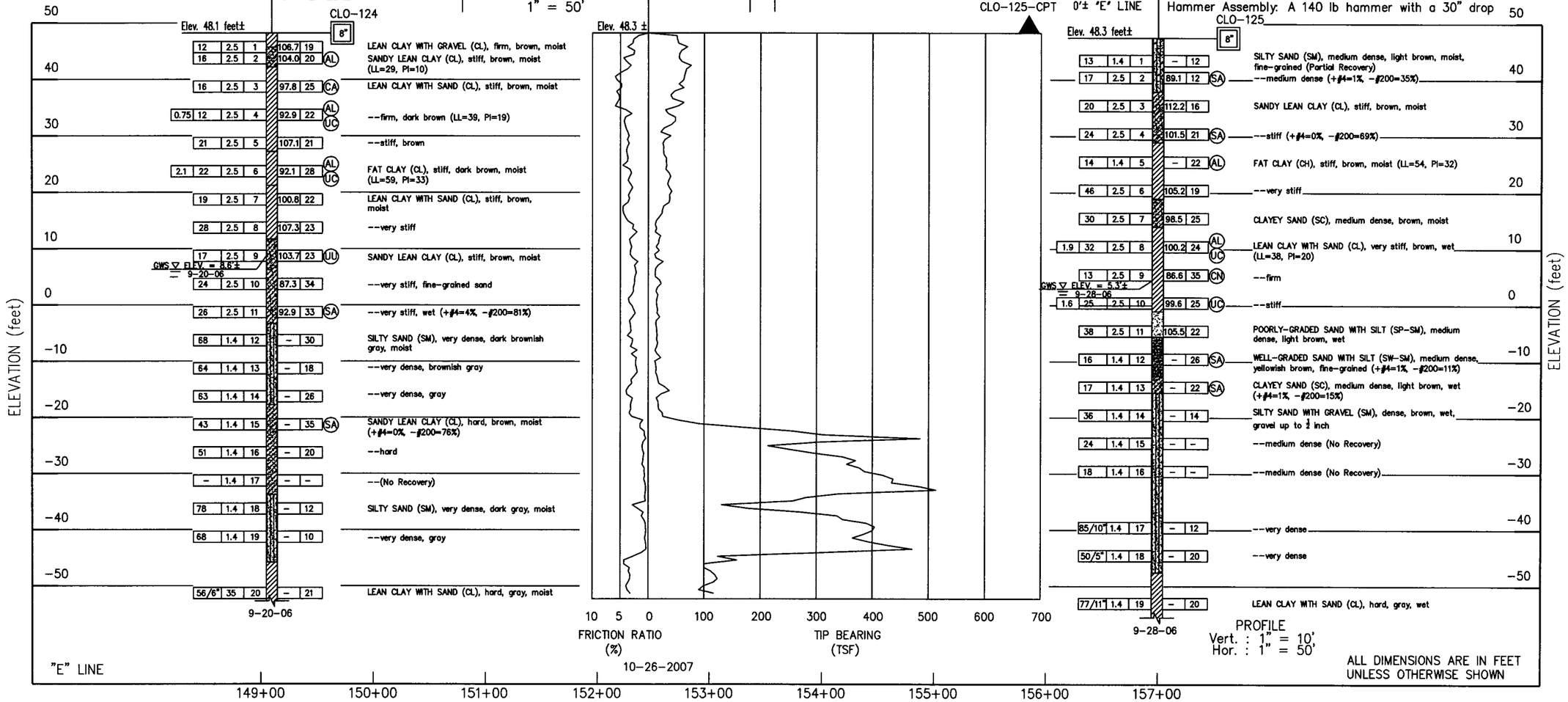
CCTA
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523

BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

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.

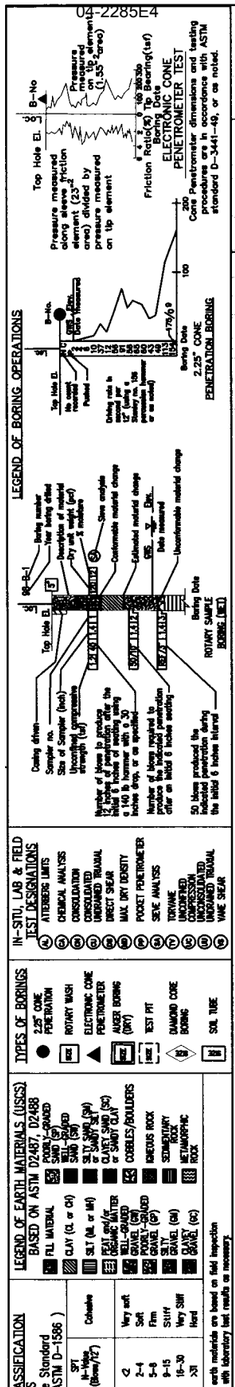


Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN



DESIGN OVERSIGHT	DESIGN By: D. GOUTHIER	Field Investigation by: L. BHANGOO	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	P. SIRCAR PROJECT ENGINEER	STRUCTURE NO. 28C0458	CONTRA LOMA BOULEVARD UNDERPASS (eBART)
SIGN OFF DATE	CHECKED By: P. SIRCAR				POST MILE(PM) 26.9	LOG OF TEST BORINGS 1 OF 2

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 4 5

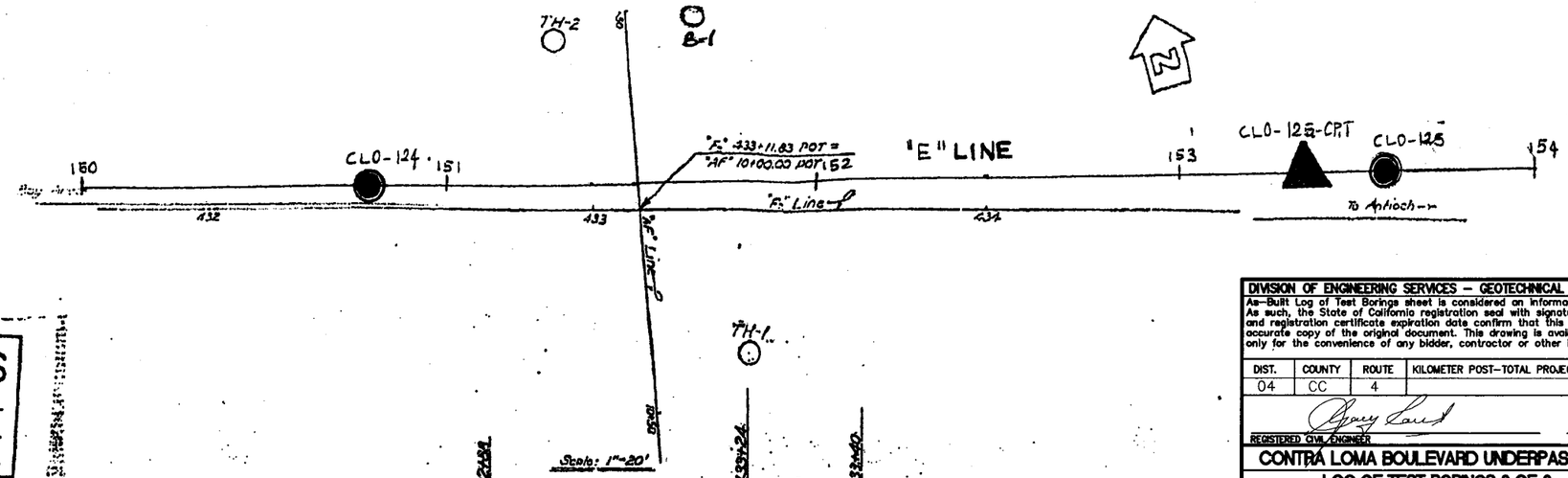
CU 04275
EA 2285E1

DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES (PRELIMINARY STAGE ONLY) 09/28/09 05/26/10

F-246 (3)

713 140

Stuart Inch
August 27 1951

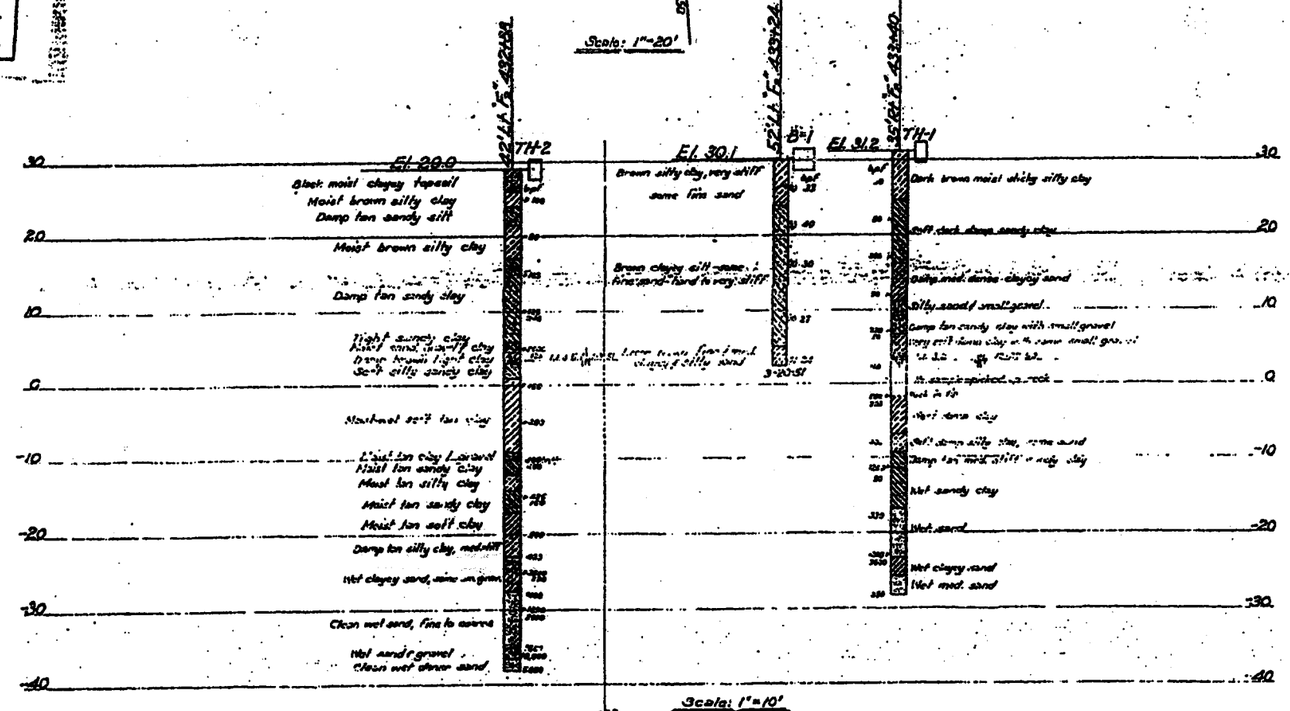


AS BUILT PLANS
Contract No. 52-0K7C 27
Date Completed
Document No. 4000254-2

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	CC	4			
REGISTERED CIVIL ENGINEER				DATE 5/26/10	
CONTRA LOMA BOULEVARD UNDERPASS (eBART)					
LOG OF TEST BORINGS 2 OF 2					
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA			CU: 04275 EA: 2285E1	BRIDGE No. 28C0486	
				Sheet 20	of 20

REGISTERED PROFESSIONAL ENGINEER
GARY PARIKH
No. G.E. 666
Exp. 12/31/11
GEOTECHNICAL
STATE OF CALIFORNIA

BM 45
North side PCC base of tower ±
126' Lt "E" 431+02
Elev. 28.23'



Note: Blows per foot were made in the following manner;
TH-1 & 2: Using a 28 lb hand hammer with a 12" free fall.
B-1: Using a 140 lb hammer with a 30" free fall.

Revisions made to this Log of Test Borings from the original 1951 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from "E" LINE
TH-1	151+28	19.5 ft Rt
B-1	151+64	21 ft Rt
TH-2	151+82	22 ft Lt

"E" Line parallels to "AH" Lines.

"F2" Line intersects "E" Line at Station 109+90 ft

Notes:

1. See the General Plan and/or Foundation Plan for English Stationing.
2. The Division of Structure Design produced the data presented in the table above.
   The data are the English 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.

MICROFILMED

STEWARTVILLE ROAD UNDERCROSSING

28-98

APPENDIX B

LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented in "Log of Test Borings", Appendix A.

Moisture-Density

The natural moisture contents and dry unit weights were determined for selected undisturbed samples of the soils in general accordance with ASTM Test Method D 2216-92. This information was used to classify and correlate the soils. The results are presented at the appropriate depths on the "Log of Test Borings", Appendix A.

Atterberg Limits

The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the effective strength characteristics and expansion potential with variations in moisture content. The Atterberg Limits were determined in general accordance with ASTM Test Method D 4318-93. The results of these tests are presented on Plate B-2, "Plasticity Chart".

Grain Size Classification

Grain size classification tests (ASTM Test Method D422-63) were performed on selected samples of granular soil to aid in the classification. The results are presented on Plate B-3A and Plate B-3B, "Grain Size Distribution Curves".

Unconfined Compression Tests

Strength tests were performed on selected undisturbed samples using unconfined compression machine. Unconfined compression tests were performed in general accordance with ASTM Test Method D 2166-91. The results are presented on "Log of Test Borings", Appendix A.

Unconsolidated Undrained (UU) Triaxial Compression Tests

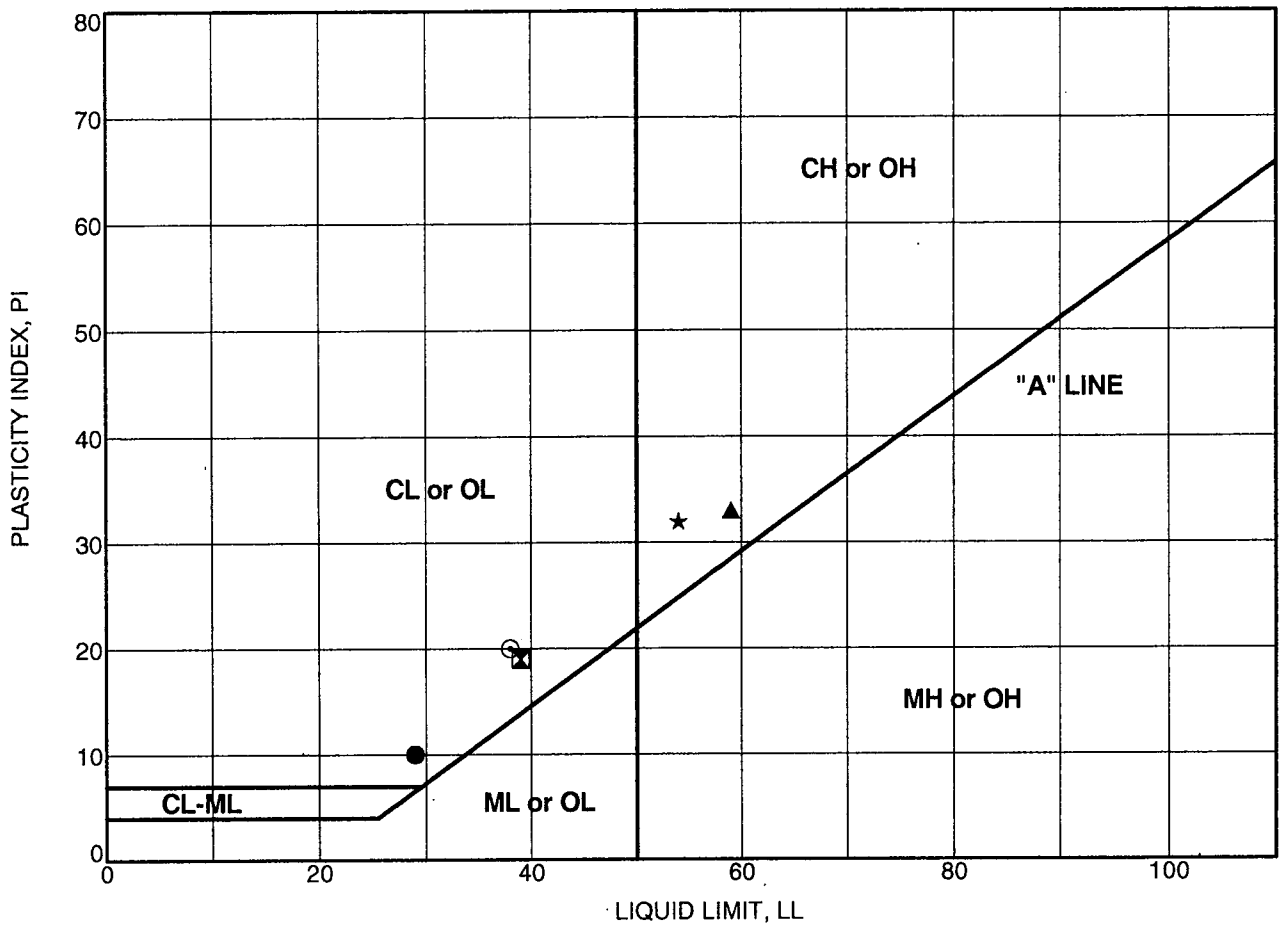
Strength test was performed on selected undisturbed sample using the triaxial cell and the compression machine. UU triaxial test was performed in general accordance with ASTM Test Method D 2850-03a. The result is presented on Plate B-4.

Consolidation Tests

Consolidation tests (California Test Method T219) were performed on selected undisturbed samples. The test results are presented on Plate B-5A through Plate B-5C

Corrosion Tests

Corrosion test was performed on selected sample to determine the corrosion potential of the soils. The pH and minimum resistively test was performed according to California Test Method 643. The test was performed by Sunland Analytical. The test result is presented on Plate B-6.



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
CLO-124	MC-2	3.5	●	20	29	19	10	SANDY LEAN CLAY (CL)
CLO-124	MC-4	13.5	⊠	22	39	20	19	LEAN CLAY WITH SAND (CL)
CLO-124	MC-6	23.5	▲	28	59	26	33	FAT CLAY (CH)
CLO-125	SPT-5	21.0	★	22	54	22	32	FAT CLAY (CH)
CLO-125	MC-8	36.0	⊙	24	38	18	20	LEAN CLAY WITH SAND (CL)

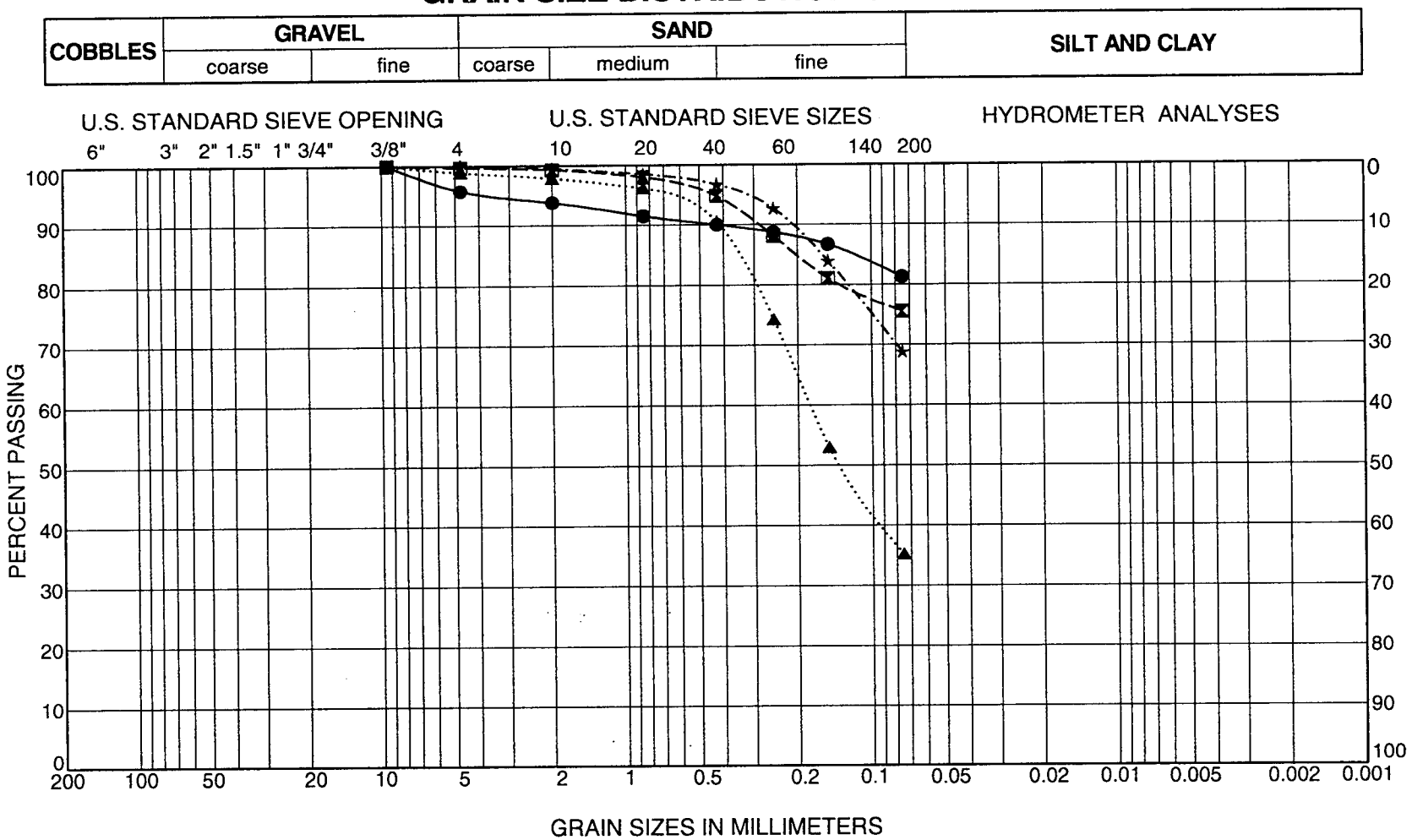
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

CONTRA LOMA BLVD. UNDERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO: 206118.CLM

PLATE NO: B-2

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
CLO-124	MC-11	48.5	●			SANDY LEAN CLAY (CL)
CLO-124	SPT-15	68.5	⊠			SANDY LEAN CLAY (CL)
CLO-125	MC-2	6.0	▲			SILTY SAND (SM)
CLO-125	MC-4	16.0	★			SANDY LEAN CLAY (CL)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

CONTRA LOMA BLVD. UNDERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

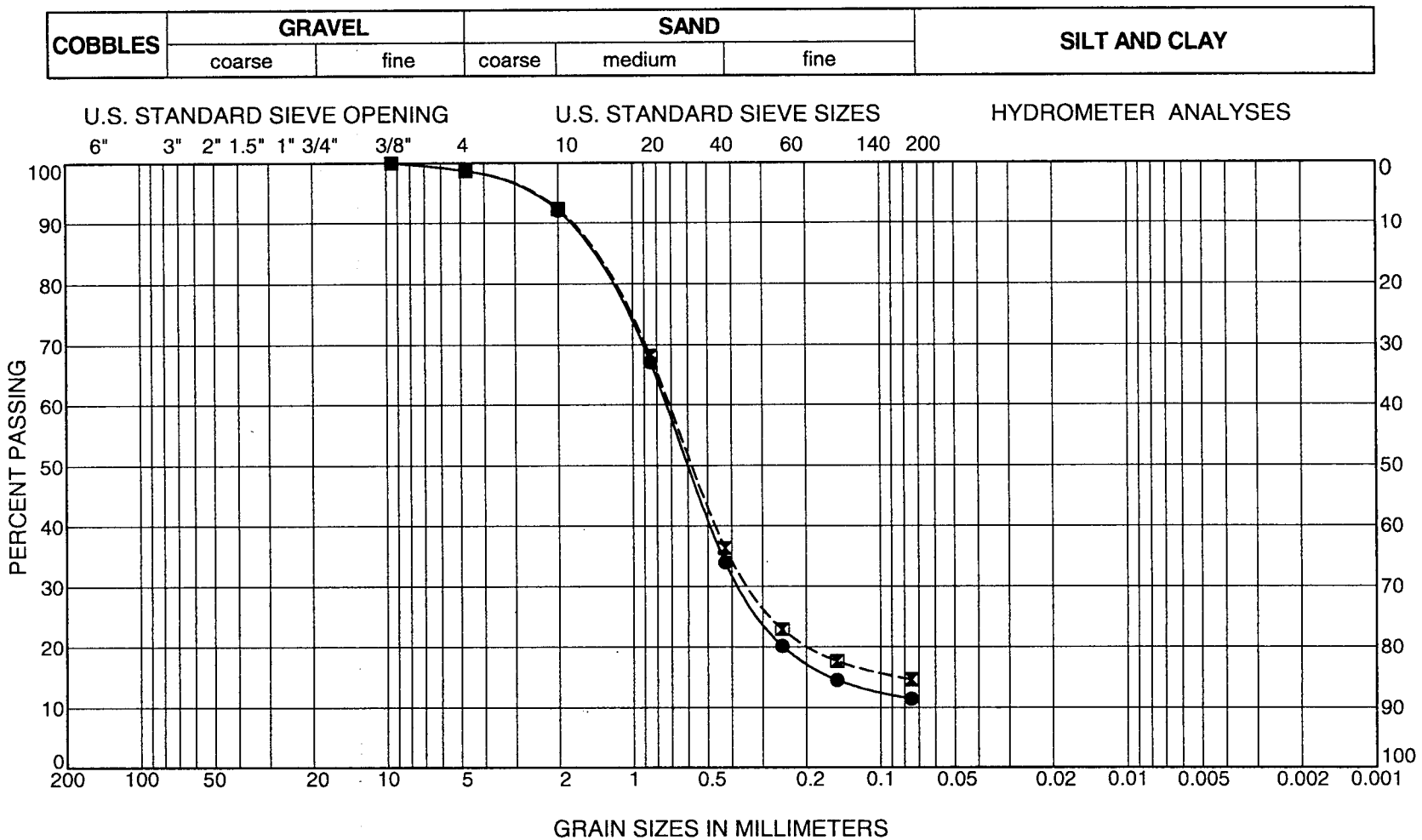
JOB NO: 206118.CLM

PLATE NO: B-3A

04-2285E4

INFORMATION HANDOUT

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
CLO-125	SPT-12	56.0	●			WELL-GRADED SAND WITH SILT (SW-SM)
CLO-125	SPT-13	60.0	⊠			CLAYEY SAND (SC)

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MATERIALS ENGINEERING

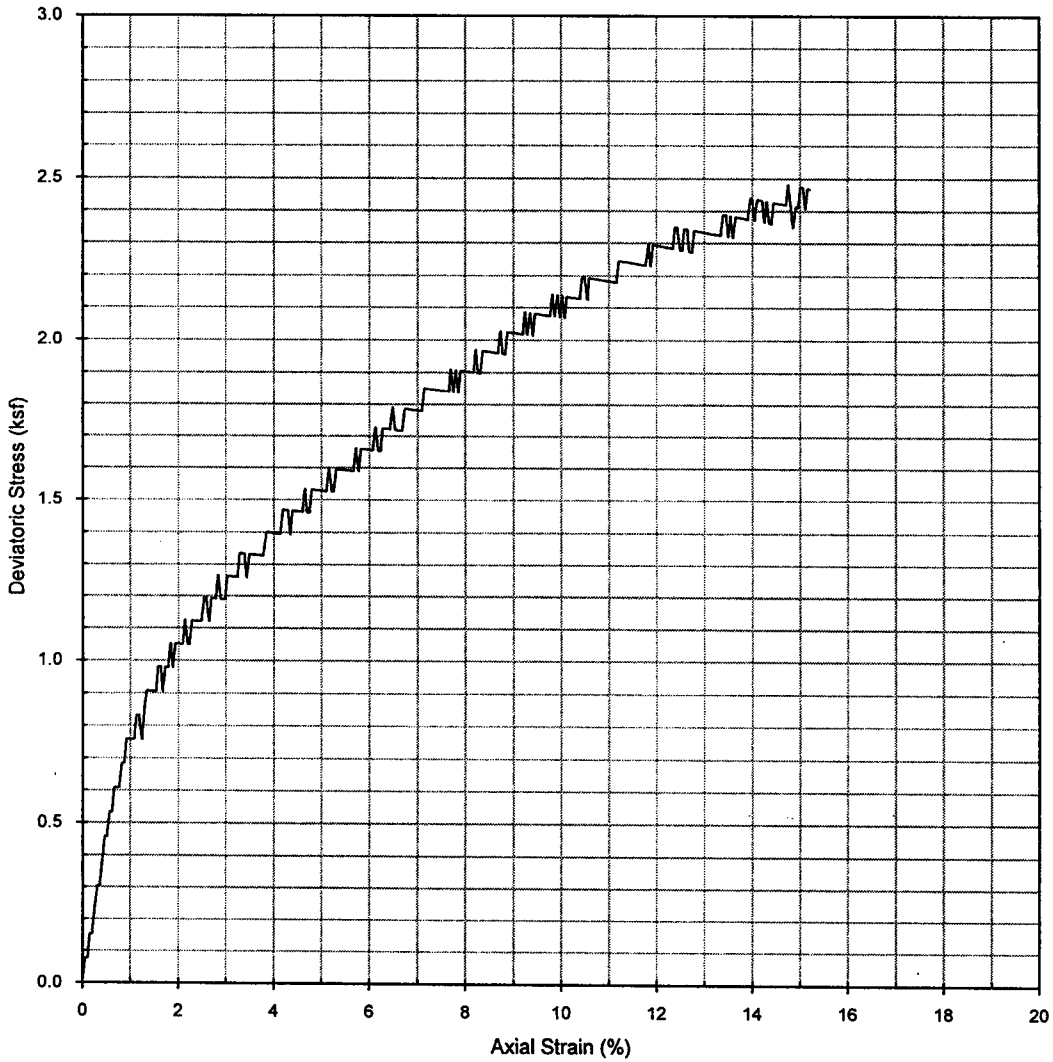
CONTRA LOMA BLVD. UNDERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO: 206118.CLM

PLATE NO: B-3B

INFORMATION HANDOUT
04-229EA

UNCONSOLIDATED UNDRAINED COMPRESSION TEST



Boring No.	CLO 124
Sample No.	9
Elev. or Depth (ft)	38.5
Soil Description	Sandy lean clay, yellowish brown

Height of Sample (inch)	5
Initial Diameter (inch)	2.416
% Moisture	23
Dry Density (pcf)	103.7
Cell Pressure (ksf)	4.896
Maximum Strength (ksf)	2.48
Strain @ Failure (%)	15.0

Date: 10/26/2006

File Name: clo124-9

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

CONTRA LOMA BLVD / L STREET BRIDGE

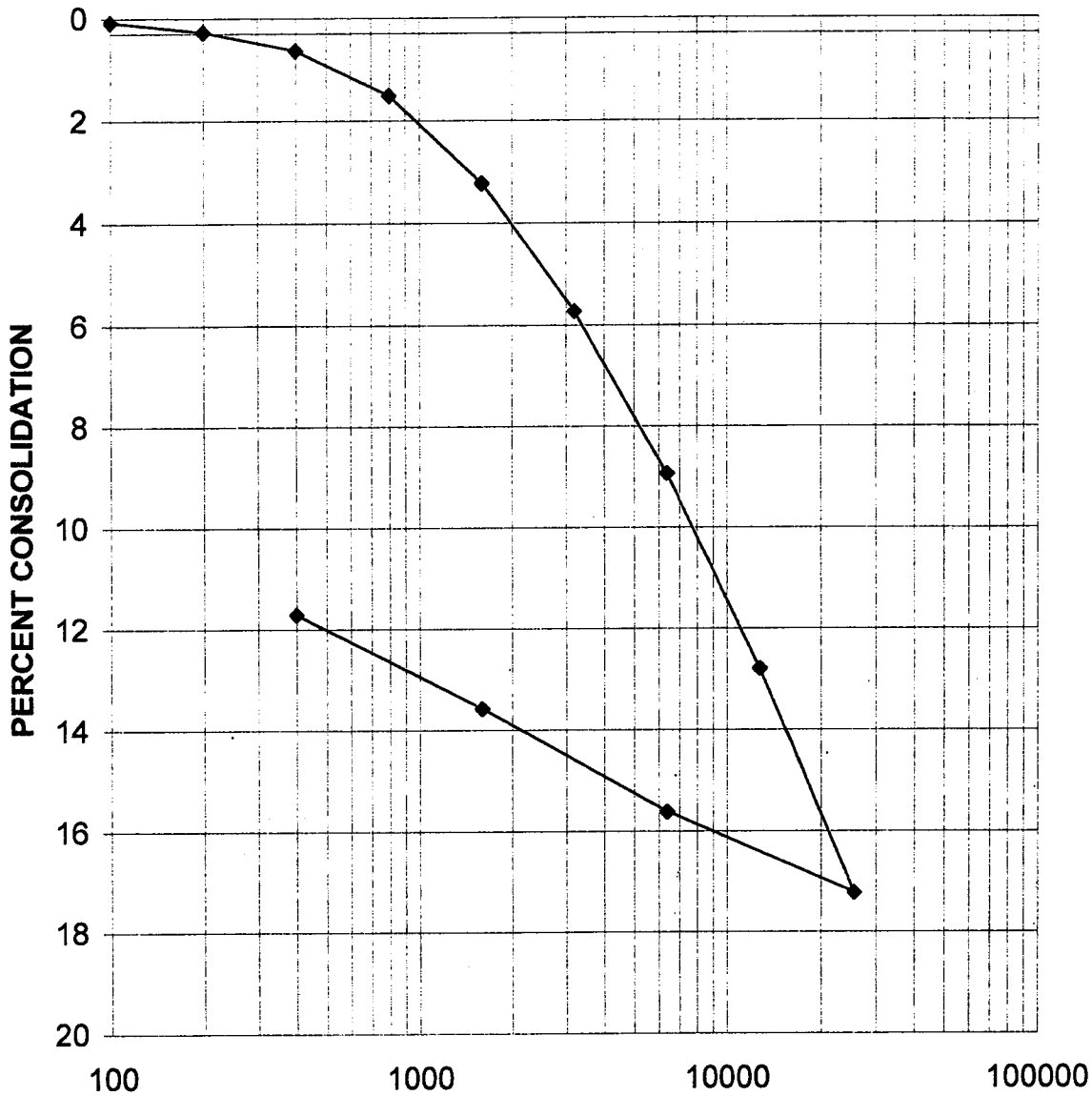
JOB NO.: 206118.CLO

Plate B-4

04-2285E4

INFORMATION HANDOUT

CONSOLIDATION TEST RESULTS



LOAD - POUNDS PER SQUARE FOOT

	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	34.8	86.6	1.0000	2.416
FINAL	29.0	98.1	0.8829	2.416

BORING NO.	CLO 125	SAMPLE NO.	9	ELEV. OR DEPTH	41'
DESCRIPTION	Lean clay, yellowish brown				

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

Contra Loma Blvd / L Street Bridge
CCTA / BKF

DATE	JOB NO:
11/02/06	206118.CLO

Reported by: Prav Dayah

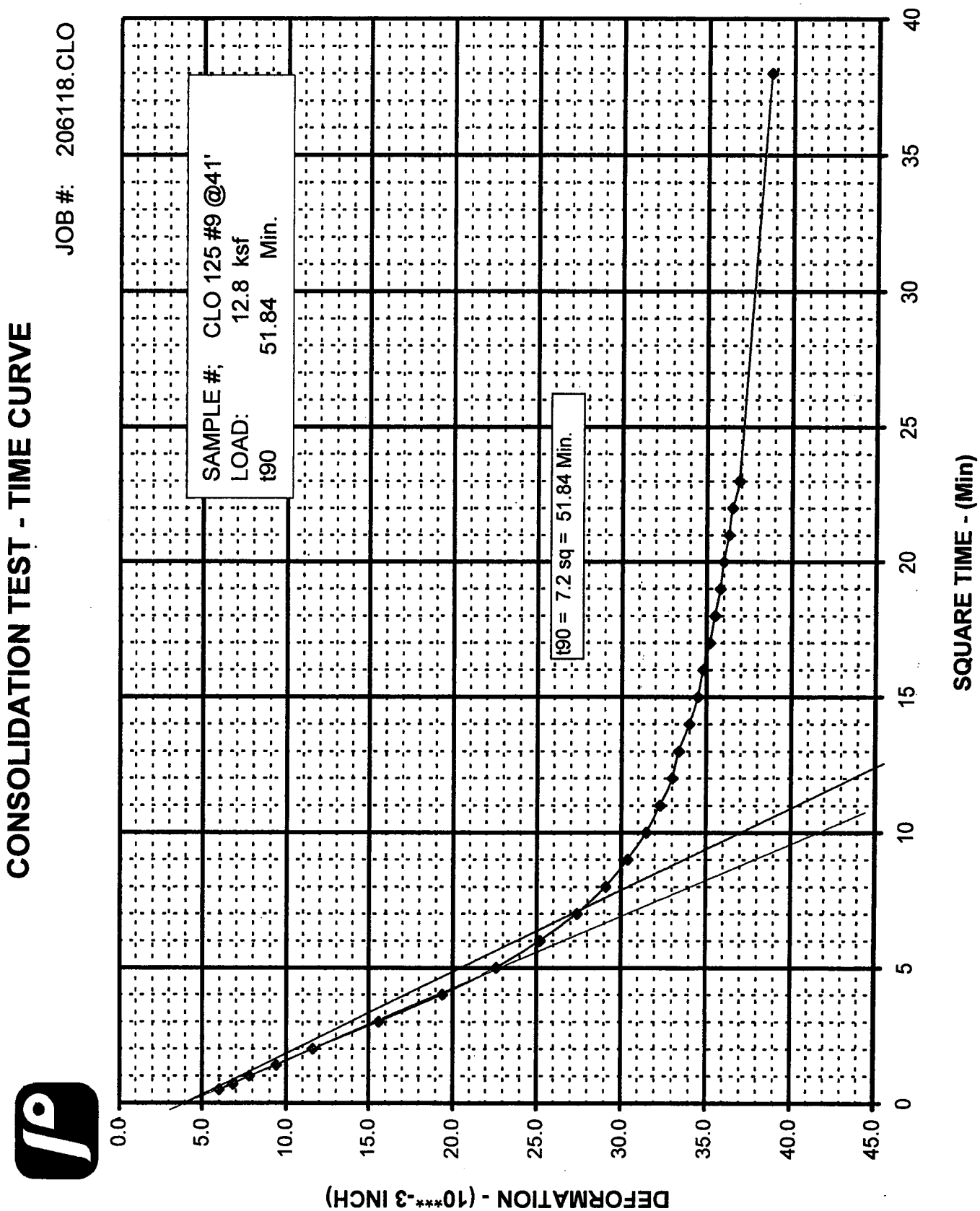

CONSOLIDATION TEST - TIME CURVE
JOB #: 206118.CLO
SAMPLE #; CLO 125 #9 @41'
LOAD: 12.8 ksf
t90 51.84 Min.
t90 = 7.2 sq = 51.84 Min.
DEFORMATION - (10***-3 INCH)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
SQUARE TIME - (Min)
0
5
10
15
20
25
30
35
40

Plate B-5B

CONSOLIDATION TEST - TIME CURVE

JOB #: 206118.CLO

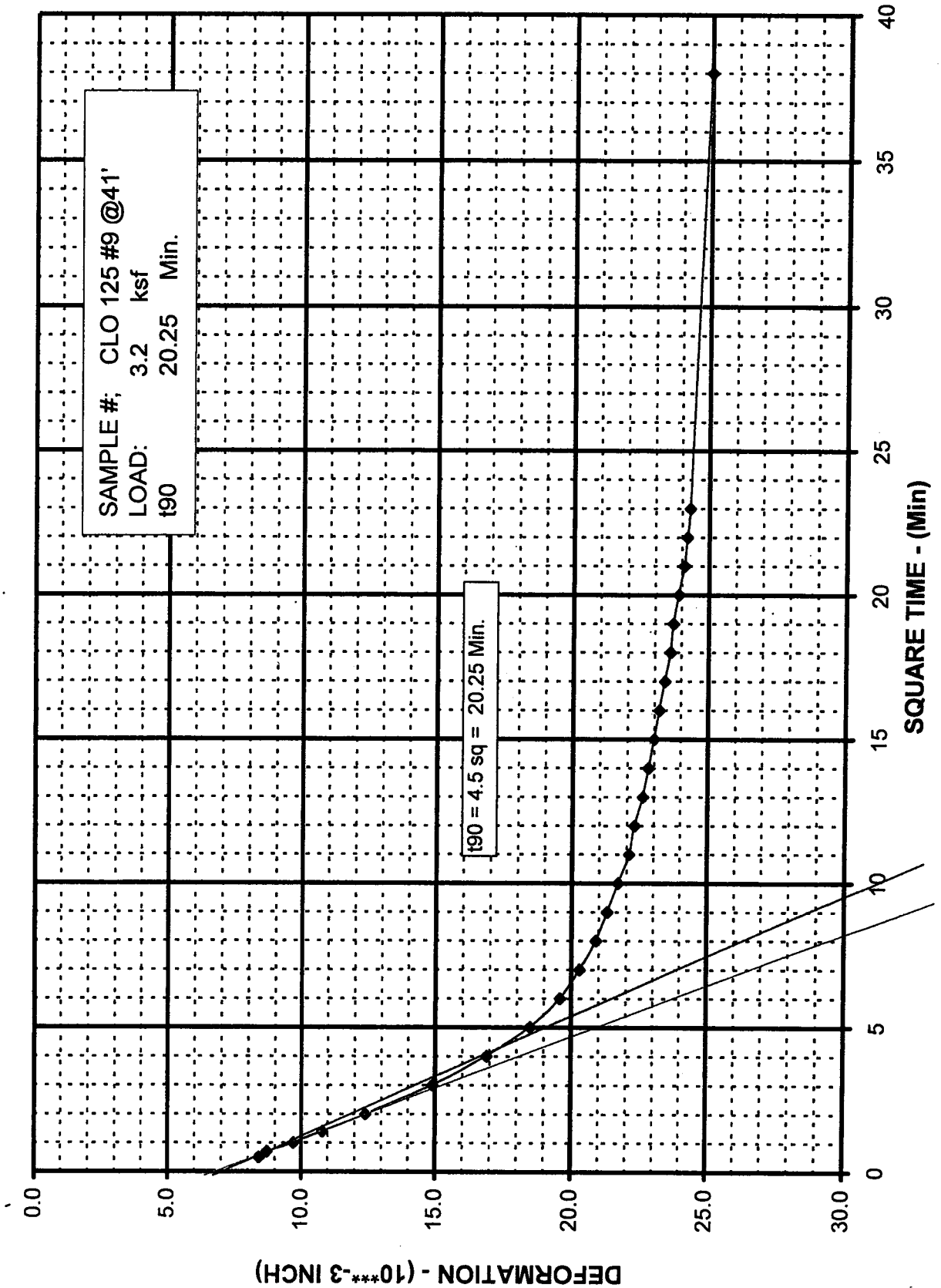


Plate B-5C

04-2285E4

Sunland Analytical

INFORMATION HANDOUT

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 11/15/2006
Date Submitted 11/08/2006

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118 CLO/CONTRA LO Site ID : CLO-124#3@8-1/2.
Thank you for your business.

* For future reference to this analysis please use SUN # 49312-98317.

EVALUATION FOR SOIL CORROSION

Soil pH	7.96		
Minimum Resistivity	0.78 ohm-cm (x1000)		
Chloride	22.1 ppm	00.00221	%
Sulfate	108.2 ppm	00.01082	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

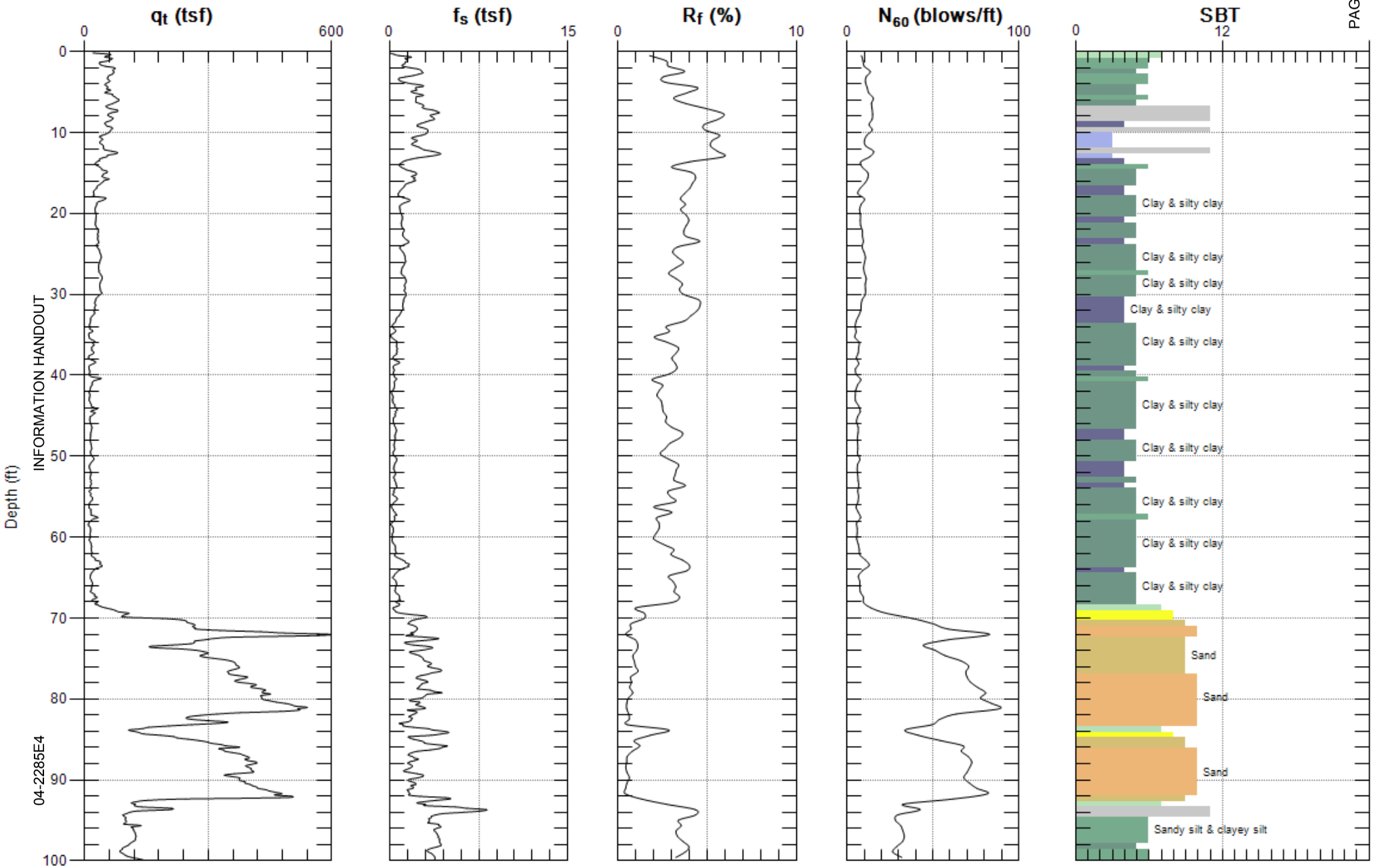
Plate B-6

APPENDIX C

PARIKH CONSULTANTS

Site: HWY 4 EAST
Sounding: CLO-125

Engineer: D.WANG
Date: 10/26/2007 12:31



Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

Plate A-17-2

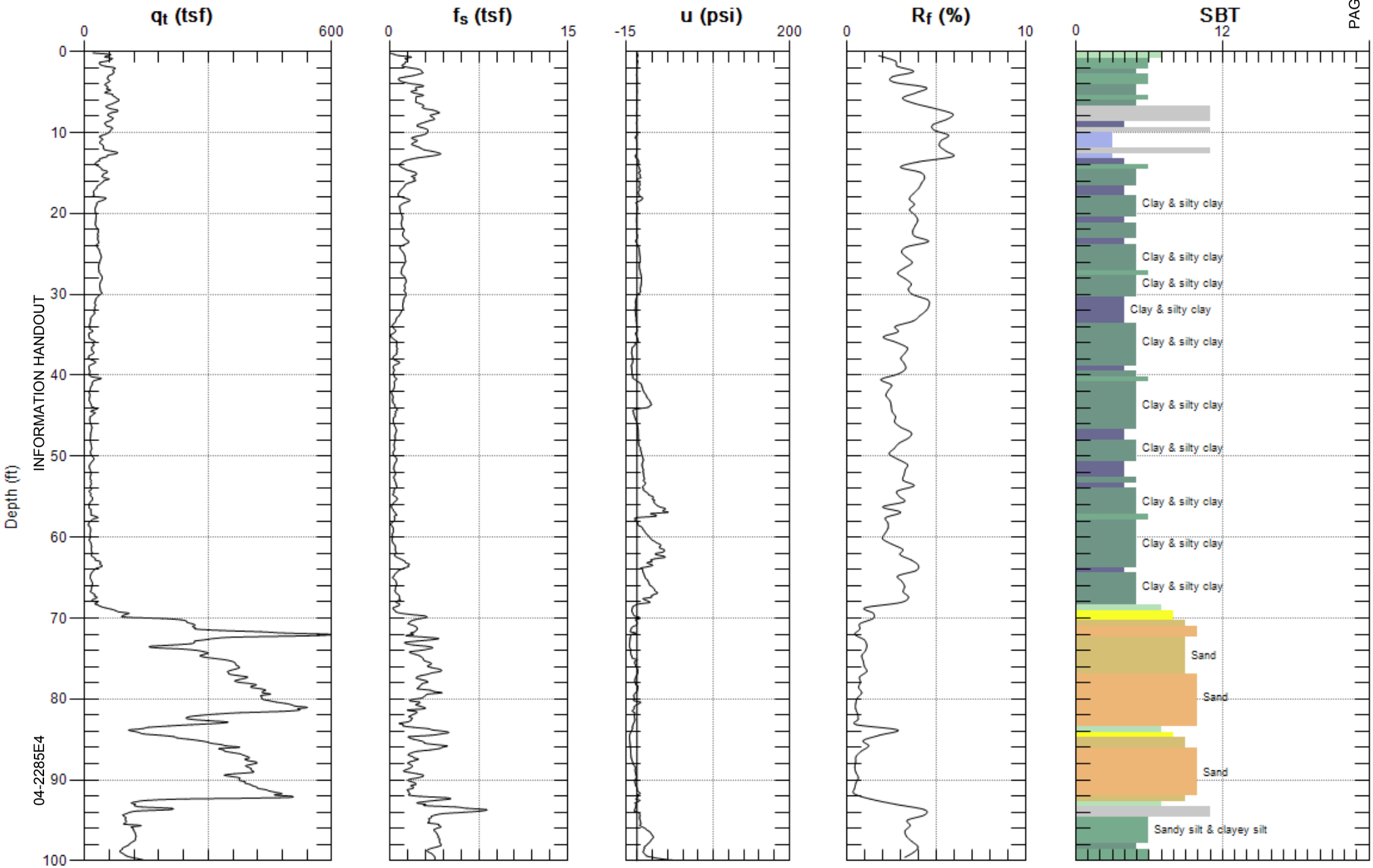
SBT: Soil Behavior Type (Robertson 1990)

INFORMATION HANDOUT
04-2285E4

PARIKH CONSULTANTS

Site: HWY 4 EAST
Sounding: CLO-125

Engineer: D.WANG
Date: 10/26/2007 12:31



Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

Plate A-17-1

SBT: Soil Behavior Type (Robertson 1990)

INFORMATION HANDOUT
04-2285E4

LIQUEFACTION POTENTIAL ANALYSIS (per Youd & Idriss, 2001)

04-2285E4

INFORMATION HANDOUT

PROJECT NAME: ROUTE 4
PROJECT NO.: 206118.CLO
CPT NO.: CLO-125 (CONTRA LOMA)

FAULT INFO
COAST RANGE - SIERRAN BLOCK BOUNDARY ZONE (CSB)
a_{max} (g)= 0.7

FAULT M_w = 7
MSF = 1.19

		CPT RESULT INPUT							CSR		CRR 2.5						F.S =(CRR 7.5/CSR)*MSF*Kσ*Kα		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
0.492	7	Silty Sand to Sandy Silt	50.956	0.897	0.029		0.029	1.48	1.7	1.00	0.455	1.480	1.70	86.63	1.000	86.625	0.14	1.00	1	
1.148	6	Sandy Silt to Clayey Silt	51.959	1.398	0.067		0.067	1.75	1.7	1.00	0.455	1.750	1.70	88.33	1.072	94.655	0.16	1.00	1	
1.804	6	Sandy Silt to Clayey Silt	54.304	1.525	0.104		0.104	1.83	1.68712	1.00	0.454	1.830	1.69	91.62	1.129	103.452	0.18	1.00	1	
2.461	5	Clayey Silt to Silty Clay	70.023	2.605	0.142		0.142	1.95	1.63934	1.00	0.453	1.950	1.64	114.79	1.240	142.326	0.35	1.00	1	
3.117	6	Sandy Silt to Clayey Silt	59.138	1.491	0.179		0.179	1.88	1.59536	0.99	0.453	1.880	1.60	94.35	1.171	110.439	0.21	1.00	1	
3.773	6	Sandy Silt to Clayey Silt	55.602	1.457	0.217		0.217	1.95	1.55258	0.99	0.452	1.950	1.55	86.33	1.240	107.033	0.19	1.00	1	
4.429	5	Clayey Silt to Silty Clay	55.346	2.444	0.255		0.255	2.18	1.51203	0.99	0.451	2.180	1.51	83.68	1.619	135.499	0.31	1.00	1	
5.085	5	Clayey Silt to Silty Clay	60.381	2.327	0.292		0.292	2.15	1.47453	0.99	0.450	2.150	1.47	89.03	1.553	138.251	0.33	1.00	1	
5.741	6	Sandy Silt to Clayey Silt	76.707	2.379	0.33		0.33	2.04	1.43791	0.99	0.450	2.040	1.44	110.30	1.356	149.551	0.39	1.00	1	
6.398	5	Clayey Silt to Silty Clay	67.772	2.545	0.367		0.367	2.16	1.40396	0.99	0.449	2.160	1.40	95.15	1.574	149.789	0.39	1.00	1	
7.054	11	Sitff Fine-Grained	65.779	3.263	0.41		0.41	2.3	1.36646	0.99	0.448	2.300	1.37	89.88	1.949	175.161		1.00	1	
7.71	11	Sitff Fine-Grained	64.213	3.796	0.453		0.453	2.39	1.33091	0.98	0.448	2.390	1.33	85.46	2.272	194.171		1.00	1	
8.366	11	Sitff Fine-Grained	62.821	3.501	0.496		0.496	2.4	1.29717	0.98	0.447	2.400	1.30	81.49	2.312	188.434		1.00	1	
9.022	4	Silty Clay to Clay	54.816	2.631	0.533		0.533	2.4	1.26947	0.98	0.446	2.400	1.27	69.59	2.312	160.912		1.00	1	
9.678	11	Sitff Fine-Grained	63.562	3.079	0.576		0.576	2.39	1.23874	0.98	0.446	2.390	1.24	78.74	2.272	178.891		1.00	1	
10.335	3	Clay	46.043	2.609	0.613		0.613	2.55	1.21346	0.98	0.445	2.550	1.21	55.87	3.034	169.526		1.00	1	
10.991	3	Clay	39.783	2.089	0.649		0.649	2.58	1.18983	0.98	0.445	2.580	1.19	47.34	3.206	151.778	0.41	1.00	1	
11.647	3	Clay	43.598	2.251	0.686		0.686	2.56	1.16649	0.98	0.444	2.560	1.17	50.86	3.091	157.175	0.44	1.00	1	
12.303	11	Sitff Fine-Grained	63.495	3.515	0.729		0.729	2.5	1.14049	0.97	0.443	2.500	1.14	72.42	2.768	200.477		1.00	1	
12.959	3	Clay	53.034	3.139	0.765		0.765	2.58	1.11959	0.97	0.443	2.580	1.12	59.38	3.206	190.388		1.00	1	
13.615	4	Silty Clay to Clay	30.698	1.229	0.803		0.803	2.64	1.09835	0.97	0.442							1.00	1	
14.272	6	Sandy Silt to Clayey Silt	35.605	1.067	0.84		0.84	2.52	1.07843	0.97	0.441	2.520	1.08	38.40	2.872	110.263	0.20	1.00	1	
14.928	5	Clayey Silt to Silty Clay	48.344	1.989	0.878		0.878	2.53	1.05871	0.97	0.441	2.530	1.06	51.18	2.925	149.696	0.39	1.00	1	
15.584	5	Clayey Silt to Silty Clay	48.344	2.096	0.916		0.916	2.56	1.0397	0.97	0.440	2.560	1.04	50.26	3.091	155.341	0.43	1.00	1	
16.24	5	Clayey Silt to Silty Clay	40.501	1.687	0.953		0.953	2.62	1.02183	0.97	0.439							1.00	1	
16.896	4	Silty Clay to Clay	27.534	1.104	0.991		0.991	2.75	1.00411	0.96	0.439							1.00	1	
17.552	4	Silty Clay to Clay	22.058	0.816	1.028		1.028	2.82	0.98743	0.96	0.438							0.99	1	
18.209	5	Clayey Silt to Silty Clay	39.872	1.39	1.066		1.066	2.6	0.97087	0.96	0.437							0.99	1	
18.865	5	Clayey Silt to Silty Clay	29.789	1.12	1.104		1.104	2.74	0.95486	0.96	0.437							0.98	1	
19.521	5	Clayey Silt to Silty Clay	25.89	0.903	1.141		1.141	2.78	0.93977	0.96	0.436							0.97	1	
20.177	5	Clayey Silt to Silty Clay	27.394	1.037	1.179		1.179	2.79	0.92476	0.96	0.435							0.97	1	
20.833	4	Silty Clay to Clay	27.032	1.069	1.216		1.216	2.82	0.9106	0.95	0.434							0.96	1	
21.49	5	Clayey Silt to Silty Clay	27.617	1.051	1.254		1.254	2.82	0.8965	0.95	0.434							0.96	1	
22.146	5	Clayey Silt to Silty Clay	32.268	1.185	1.292		1.292	2.76	0.88283	0.95	0.433							0.95	1	
22.802	5	Clayey Silt to Silty Clay	32.04	1.207	1.329		1.329	2.78	0.86991	0.95	0.432							0.94	1	
23.458	4	Silty Clay to Clay	32.647	1.486	1.367		1.367	2.84	0.85703	0.95	0.431							0.94	1	
24.114	5	Clayey Silt to Silty Clay	31.099	1.041	1.404		1.404	2.78	0.84485	0.94	0.430							0.93	1	
24.77	5	Clayey Silt to Silty Clay	36.925	1.129	1.442		1.442	2.7	0.8327	0.94	0.429							0.93	1	
25.427	5	Clayey Silt to Silty Clay	39.498	1.318	1.479		1.479	2.71	0.8212	0.94	0.428							0.92	1	
26.083	5	Clayey Silt to Silty Clay	36.034	1.314	1.517		1.517	2.78	0.80972	0.94	0.427							0.92	1	
26.739	5	Clayey Silt to Silty Clay	34.296	1.1	1.555		1.555	2.77	0.79855	0.94	0.426							0.92	1	
27.395	6	Sandy Silt to Clayey Silt	37.593	1.063	1.592		1.592	2.71	0.78797	0.93	0.424							0.91	1	
28.051	5	Clayey Silt to Silty Clay	41.353	1.343	1.63		1.63	2.72	0.77739	0.93	0.423							0.91	1	
28.707	5	Clayey Silt to Silty Clay	37.454	1.346	1.667		1.667	2.79	0.76735	0.93	0.422							0.90	1	
29.364	5	Clayey Silt to Silty Clay	38.2	1.308	1.705		1.705	2.78	0.75731	0.92	0.420							0.90	1	
30.02	5	Clayey Silt to Silty Clay	37.042	1.363	1.743		1.743	2.82	0.74754	0.92	0.419							0.89	1	
30.676	4	Silty Clay to Clay	27.127	1.223	1.78		1.78	3	0.73826	0.92	0.417							0.89	1	
31.332	4	Silty Clay to Clay	25.133	1.149	1.818		1.818	3.04	0.72896	0.91	0.416							0.89	1	
31.988	4	Silty Clay to Clay	24.186	1.068	1.855		1.855	3.05	0.72013	0.91	0.414							0.88	1	
32.644	4	Silty Clay to Clay	19.323	0.783	1.893		1.893	3.13	0.71128	0.91	0.412							0.88	1	
33.301	4	Silty Clay to Clay	13.976	0.514	1.931		1.931	3.25	0.70265	0.90	0.410							0.88	1	
33.957	5	Clayey Silt to Silty Clay	12.322	0.332	1.968		1.968	3.25	0.69444	0.90	0.408							0.87	1	
34.613	5	Clayey Silt to Silty Clay	14.505	0.413	2.006		2.006	3.19	0.68621	0.89	0.406							0.87	1	
35.269	5	Clayey Silt to Silty Clay	12.192	0.246	2.043		2.043	3.2	0.67838	0.89	0.404							0.87	1	
35.925	5	Clayey Silt to Silty Clay	21.713	0.598	2.081		2.081	3.02	0.67053	0.88	0.402							0.86	1	
36.581	5	Clayey Silt to Silty Clay	19.067	0.638	2.119		2.119	3.14	0.66285	0.88	0.400							0.86	1	
37.238	5	Clayey Silt to Silty Clay	18.315	0.59	2.156		2.156	3.15	0.65554	0.87	0.398							0.86	1	
37.894	5	Clayey Silt to Silty Clay	14.093	0.42	2.194		2.194	3.26	0.6482	0.87	0.395							0.85	1	
38.55	5	Clayey Silt to Silty Clay	19.607	0.624	2.231		2.231	3.13	0.64121	0.86	0.393							0.85	1	
39.206	4	Silty Clay to Clay	11.419	0.37	2.269		2.269	3.4	0.63419	0.86	0.390							0.85	1	
39.862	5	Clayey Silt to Silty Clay	13.519	0.379	2.307		2.307	3.29	0.62732	0.85	0.388							0.85	1	
40.518	6	Sandy Silt to Clayey Silt	26.614	0.502	2.344		2.344	2.9	0.62077	0.85	0.385							0.84	1	
41.175	5	Clayey Silt to Silty Clay	17.084	0.426	2.382		2.382	3.16	0.61418	0.84	0.382							0.84	1	
41.831	5	Clayey Silt to Silty Clay	12.617	0.295	2.419		2.419	3.3	0.6079	0.83	0.380							0.84	1	
42.487	5	Clayey Silt to Silty Clay	11.965	0.264	2.457		2.457	3.32	0.60159	0.83	0.377							0.84	1	
43.143	5	Clayey Silt to Silty Clay	12.104	0.297	2.495		2.495	3.34	0.5954	0.82	0.374							0.83	1	
43.799	5	Clayey Silt to Silty Clay	19.674	0.49	2.532		2.532	3.12	0.5895	0.82	0.371							0.83	1	
44.455	5	Clayey Silt to Silty Clay	23.016	0.576	2.57		2.57	3.07	0.58355	0.81	0.368							0.83	1	
45.112	5	Clayey Silt to Silty Clay	15.898	0.429	2.607		2.607	3.26	0.57788	0.80	0.365							0.83	1	
45.768	5	Clayey Silt to Silty Clay	13.653	0.363	2.645		2.645	3.34	0.57217	0.80	0.362							0.82	1	
46.424	5	Clayey Silt to Silty Clay	17.017	0.511	2.682		2.682	3.26	0.56672	0.79	0.359							0.82	1	
47.08	4	Silty Clay to Clay	15.368	0.553	2.72		2.72	3.36	0.56122	0.78	0.356							0.82	1	
47.736	4	Silty Clay to Clay	14.143	0.487	2.758		2.758	3.4	0.55584	0.78	0.353							0.82	1	
48.392	5	Clayey Silt to Silty Clay	14.989	0.435	2.795		2.795	3.34	0.55069	0.77	0.350							0.81	1	
49.049	5	Clayey Silt to Silty Clay	16.198	0.428	2.833		2.833	3.28	0.5455	0.76	0.347							0.81	1	
49.705	5	Clayey Silt to Silty Clay	15.647	0.369	2.87		2.87	3.28	0.54054	0.76	0.344							0.81	1	
50.361	5	Clayey Silt to Silty Clay	20.37	0.58	2.908		2.908	3.2	0.53554	0.75	0.341							0.81	1	
51.017	4	Silty Clay to Clay	13.725	0.465	2.946		2.946	3.44	0.53063	0.74	0.338							0.81	1	
51.673	4	Silty Clay to Clay	13.274	0.435	2.983		2.983	3.46	0.52594	0.74	0.335							0.80	1	
52.329	4	Silty Clay to Clay	14.444	0.463	3.021		3.021	3.42	0.5212	0.73	0.332							0.80	1	
52.986	5	Clayey Silt to Silty Clay	14.873	0.47	3.058		3.058	3.4	0.51667	0.72	0.329							0.80	1	
53.642	4	Silty Clay to Clay	15.418	0.582	3.096		3.096	3.43	0.5121	0.72	0.326							0.80	1	
54.298	5	Clayey Silt to Silty Clay	14.343	0.408	3.134		3.134	3.41	0.50761	0.71	0.323							0.80	1	
54.954	5	Clayey Silt to Silty Clay	16.438	0.486	3.171		3.171	3.35	0.50332	0.70	0.320							0.79	1	
55.61	5	Clayey Silt to Silty Clay	14.683	0.48	3.209		3.209	3.43	0.49898	0.70	0.317							0.79	1	
56.266	5	Clayey Silt to Silty Clay	11.492	0.238	3.246		3.246	3.46	0.49483	0.69	0.315							0.79	1	
56.923	5	Clayey Silt to Silty Clay	15.079	0.465	3.284		3.284	3.41	0.49063	0.69	0.312							0.79	1	
57.579	6	Sandy Silt to Clayey Silt	22.225	0.483	3.322		3.322	3.16	0.48651	0.68	0.309							0.79	1	
58.235	5	Clayey Silt to Silty Clay	11.709	0.268	3.359		3.359	3.53	0.48256	0.67	0.307							0.78	1	
58.891	5	Clayey Silt to Silty Clay	13.057	0.301	3.397		3.397	3.46	0.47857	0.67	0.304							0.78	1	
59.547	5	Clayey Silt to Silty Clay	13.664	0.294	3.434		3.434	3.42	0.47475	0.66	0.302							0.78	1	
60.203	5	Clayey Silt to Silty Clay	12.6	0.255	3.472		3.472	3.46	0.47089	0.66	0.299							0.78	1	
60.86	5	Clayey Silt to Silty Clay	15.251	0.391	3.51		3.51	3.4	0.46709	0.65	0.297							0.78	1	
61.516	5	Clayey Silt to Silty Clay	16.449	0.526	3.547	0.006	3.541	3.42	0.46404	0.65	0.295							0.78	1	
62.172	5	Clayey Silt to Silty Clay	18.031	0.546	3.585	0.027	3.558	3.36	0.46238	0.64	0.294							0.78	1	

LIQUEFACTION POTENTIAL ANALYSIS (per Youd & Idriss, 2001)

04-2285E4

INFORMATION HANDOUT

PROJECT NAME **ROUTE 4**
PROJECT NO. **206118.CLO**
CPT NO. **CLO-125 (CONTRA LOMA)**

FAULT INFO
COAST RANGE - SIERRAN BLOCK BOUNDARY ZONE (CSB)
a_{max} (g)= 0.7

FAULT M_w = 7
MSF = 1.19

Depth (ft)		Soil Behavior Type	CPT RESULT INPUT qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	CSR γ_d	CSR	CRR 2.5 Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	$K\sigma$	$K\alpha$	F.S =(CRR 2.5/CSR)*MSF*Kσ*Kα F.S
62.828	5	Clayey Silt to Silty Clay	29.689	1.077	3.622	0.047	3.575	3.18	0.46073	0.64	0.294							0.78	1	
63.484	5	Clayey Silt to Silty Clay	37.476	1.5	3.66	0.068	3.592	3.11	0.4591	0.63	0.293							0.77	1	
64.14	4	Silty Clay to Clay	22.058	0.852	3.698	0.088	3.609	3.34	0.45748	0.63	0.293							0.77	1	
64.797	5	Clayey Silt to Silty Clay	14.215	0.406	3.735	0.109	3.627	3.5	0.45577	0.62	0.292							0.77	1	
65.453	5	Clayey Silt to Silty Clay	16.989	0.526	3.773	0.129	3.644	3.42	0.45417	0.62	0.292							0.77	1	
66.109	5	Clayey Silt to Silty Clay	17.307	0.567	3.81	0.15	3.661	3.43	0.45258	0.61	0.291							0.77	1	
66.765	5	Clayey Silt to Silty Clay	17.925	0.571	3.848	0.17	3.678	3.4	0.451	0.61	0.291							0.77	1	
67.421	5	Clayey Silt to Silty Clay	24.531	0.849	3.885	0.19	3.695	3.28	0.44944	0.61	0.290							0.77	1	
68.077	5	Clayey Silt to Silty Clay	25.679	0.771	3.923	0.211	3.712	3.23	0.44788	0.60	0.290							0.77	1	
68.734	7	Silty Sand to Sandy Silt	52.588	0.52	3.962	0.231	3.73	2.67	0.44625	0.60	0.289							0.77	1	
69.39	8	Sand to Silty Sand	91.658	1.337	4.001	0.252	3.749	2.53	0.44453	0.60	0.289	2.530	0.44	40.75	2.925	119.170	0.24	0.77	1	0.82
70.046	8	Sand to Silty Sand	172.208	2.523	4.041	0.272	3.769	2.29	0.44275	0.59	0.289	2.290	0.44	76.24	1.917	146.164	0.37	0.75	1	1.28
70.702	9	Sand	257.71	1.835	4.082	0.293	3.789	1.97	0.44097	0.59	0.288	1.970	0.44	113.64	1.263	143.499	0.35	0.68	1	1.23
71.358	10	Gravelly Sand to Sand	311.802	2.256	4.124	0.313	3.81	1.9	0.43912	0.58	0.288	1.900	0.44	136.92	1.189	162.775		0.66	1	
72.014	10	Gravelly Sand to Sand	484.946	2.075	4.165	0.334	3.832	1.62	0.4372	0.58	0.288	1.620	0.44	212.02	1.000	212.019		0.58	1	
72.671	9	Sand	302.751	2.887	4.206	0.354	3.852	1.99	0.43547	0.58	0.287	1.990	0.44	131.84	1.287	169.698		0.66	1	
73.327	9	Sand	213.595	2.341	4.247	0.375	3.872	2.15	0.43375	0.58	0.287	2.150	0.43	92.65	1.553	143.862	0.36	0.72	1	1.24
73.983	9	Sand	253.661	2.631	4.288	0.395	3.892	2.08	0.43205	0.57	0.287	2.080	0.43	109.59	1.420	155.585	0.43	0.69	1	1.50
74.639	9	Sand	294.936	2.412	4.328	0.416	3.913	1.96	0.43028	0.57	0.286	1.960	0.43	126.90	1.251	158.770	0.45	0.66	1	1.58
75.295	9	Sand	347.084	3.121	4.369	0.436	3.933	1.93	0.4286	0.57	0.286	1.930	0.43	148.76	1.218	181.259		0.64	1	
75.951	9	Sand	370.2	3.555	4.41	0.457	3.953	1.93	0.42694	0.56	0.286	1.930	0.43	158.05	1.218	192.580		0.63	1	
76.608	9	Sand	354.314	3.907	4.45	0.477	3.973	1.98	0.42529	0.56	0.286	1.980	0.43	150.68	1.275	192.083		0.64	1	
77.264	10	Gravelly Sand to Sand	376.951	2.637	4.492	0.498	3.995	1.84	0.42348	0.56	0.286	1.840	0.42	159.63	1.137	181.508		0.62	1	
77.92	10	Gravelly Sand to Sand	386.694	2.883	4.534	0.518	4.016	1.85	0.42178	0.56	0.286	1.850	0.42	163.10	1.145	186.762		0.61	1	
78.576	10	Gravelly Sand to Sand	419.006	2.7	4.576	0.539	4.037	1.79	0.42009	0.55	0.285	1.790	0.42	176.02	1.099	193.523		0.60	1	
79.232	10	Gravelly Sand to Sand	437.015	3.58	4.618	0.559	4.059	1.84	0.41833	0.55	0.285	1.840	0.42	182.82	1.137	207.868		0.60	1	
79.888	10	Gravelly Sand to Sand	434.241	2.473	4.659	0.579	4.08	1.75	0.41667	0.55	0.285	1.750	0.42	180.93	1.072	193.888		0.59	1	
80.545	10	Gravelly Sand to Sand	483.153	2.306	4.701	0.6	4.101	1.67	0.41502	0.55	0.285	1.670	0.42	200.52	1.017	204.000		0.57	1	
81.201	10	Gravelly Sand to Sand	513.315	2.439	4.743	0.62	4.122	1.65	0.41338	0.54	0.285	1.650	0.41	212.19	1.003	212.901		0.57	1	
81.857	10	Gravelly Sand to Sand	342.127	2.024	4.785	0.641	4.144	1.85	0.41168	0.54	0.285	1.850	0.41	140.85	1.145	161.280		0.63	1	
82.513	10	Gravelly Sand to Sand	281.484	1.749	4.826	0.661	4.165	1.94	0.41007	0.54	0.285	1.940	0.41	115.43	1.229	141.858	0.35	0.66	1	1.21
83.169	10	Gravelly Sand to Sand	258.073	1.351	4.868	0.682	4.186	1.94	0.40847	0.54	0.285	1.940	0.41	105.41	1.229	129.553	0.28	0.67	1	0.99
83.825	7	Silty Sand to Sandy Silt	131.379	3.711	4.907	0.702	4.204	2.61	0.40711	0.54	0.285							0.75	1	
84.482	8	Sand to Silty Sand	180.647	3.255	4.946	0.723	4.224	2.38	0.4056	0.53	0.284	2.380	0.41	73.27	2.233	163.584		0.74	1	
85.138	9	Sand	272.059	2.447	4.987	0.743	4.244	2.05	0.40411	0.53	0.284	2.050	0.40	109.94	1.371	150.738	0.40	0.67	1	1.40
85.794	9	Sand	337.436	4.078	5.028	0.764	4.264	2.05	0.40264	0.53	0.284	2.050	0.40	135.86	1.371	186.276		0.64	1	
86.45	10	Gravelly Sand to Sand	348.143	2.735	5.07	0.784	4.285	1.93	0.40109	0.53	0.284	1.930	0.40	139.64	1.218	170.144		0.63	1	
87.106	10	Gravelly Sand to Sand	389.501	1.945	5.111	0.805	4.307	1.78	0.39949	0.53	0.284	1.780	0.40	155.60	1.092	169.971		0.60	1	
87.762	10	Gravelly Sand to Sand	404.251	1.928	5.153	0.825	4.328	1.76	0.39797	0.52	0.284	1.760	0.40	160.88	1.078	173.501		0.59	1	
88.419	10	Gravelly Sand to Sand	400.006	1.736	5.195	0.846	4.349	1.74	0.39647	0.52	0.284	1.740	0.40	158.59	1.065	168.868		0.59	1	
89.075	10	Gravelly Sand to Sand	384.694	1.899	5.237	0.866	4.371	1.79	0.3949	0.52	0.284	1.790	0.39	151.92	1.099	167.023		0.60	1	
89.731	10	Gravelly Sand to Sand	364.686	2.281	5.279	0.887	4.392	1.86	0.39342	0.52	0.284	1.860	0.39	143.47	1.153	165.475		0.61	1	
90.387	10	Gravelly Sand to Sand	392.715	1.934	5.32	0.907	4.413	1.78	0.39195	0.52	0.284	1.780	0.39	153.92	1.092	168.138		0.60	1	
91.043	10	Gravelly Sand to Sand	427.083	1.785	5.362	0.928	4.435	1.72	0.39042	0.52	0.284	1.720	0.39	166.74	1.051	175.299		0.58	1	
91.699	10	Gravelly Sand to Sand	471.394	1.838	5.404	0.948	4.456	1.66	0.38897	0.52	0.284	1.660	0.39	183.36	1.010	185.265		0.56	1	
92.356	9	Sand	300.74	3.872	5.445	0.968	4.476	2.12	0.3876	0.51	0.284	2.120	0.39	116.57	1.492	173.935		0.66	1	
93.012	7	Silty Sand to Sandy Silt	124.689	3.373	5.483	0.989	4.494	2.64	0.38637	0.51	0.284							0.74	1	
93.668	11	Sitff Fine-Grained	158.706	6.835	5.526	1.009	4.517	2.69	0.38482	0.51	0.284							0.74	1	
94.324	11	Sitff Fine-Grained	100.369	4.35	5.569	1.03	4.539	2.86	0.38334	0.51	0.284							0.74	1	
94.98	6	Sandy Silt to Clayey Silt	99.74	3.362	5.606	1.05	4.556	2.79	0.38221	0.51	0.285							0.74	1	
95.636	6	Sandy Silt to Clayey Silt	112.496	3.976	5.644	1.071	4.573	2.76	0.38108	0.51	0.285							0.74	1	
96.293	6	Sandy Silt to Clayey Silt	119.871	3.891	5.682	1.091	4.59	2.71	0.37997	0.51	0.285							0.74	1	
96.949	6	Sandy Silt to Clayey Silt	123.514	4.095	5.719	1.112	4.607	2.71	0.37885	0.50	0.285							0.74	1	
97.605	6	Sandy Silt to Clayey Silt	116.813	4.243	5.757	1.132	4.625	2.76	0.37768	0.50	0.285							0.74	1	
98.261	5	Clayey Silt to Silty Clay	98.843	3.918	5.794	1.153	4.642	2.85	0.37658	0.50	0.285							0.74	1	
98.917	6	Sandy Silt to Clayey Silt	90.393	3.383	5.832	1.173	4.659	2.86	0.37549	0.50	0.285							0.74	1	
99.573	6	Sandy Silt to Clayey Silt	117.052	3.784	5.87	1.194	4.676	2.73	0.3744	0.50	0.285							0.73	1	

APPENDIX D

Attenuation Relationships for Shallow Crustal Earthquakes (Sadigh, et al, 1997)

Fault = Vaca fault zone (RLSS Fault, Map NO: 14)

Mmax = 6.9 **Rrup = 6.5** **km**

M>=6.5 *ROCK SITE:*

C1 = -1.274 C2 = 1.1 C3 = 0 C4 = -2.1

C5 = -0.48451 C6 = 0.524 C7 = 0

A=C1+C2M+C3(8.5M)^2.5= 6.316

B=C4*Ln(Rrup+exp(C5+C6M))= -7.100

C=C7*Ln(Rrup+2)= 0

Ln(y) = A+B+C = -0.784

y = Exp(Ln(y)) = 0.46 **Peak Bed Rock Acceleration PBA = 0.460**

Fault = Great valley fault 5 (Reverse Fault, Map No: 24)

Mmax = 6.5 **Rrup = 9.8** **km**

A= 5.876

B= -7.025

C= 0

Ln(y) = -1.149

y = 0.32 **Peak Bed Rock Acceleration PBA = 0.32g x 1.2 = 0.38g**

Fault = Greenville fault zone (Clayton section, RLSS Fault, Map No: 351)

Mmax = 6.6 **Rrup = 7.1** **km**

A= 5.986

B= -6.895

C= 0

Ln(y) = -0.909

y = 0.40 **Peak Bed Rock Acceleration PBA = 0.4g**

Fault = Concord fault zone (Ygnacio valley section, RLSS Fault, Map No: 341)

Mmax = 6.6 **Rrup = 18.2** **km**

A= 5.986

B= -7.626

C= 0

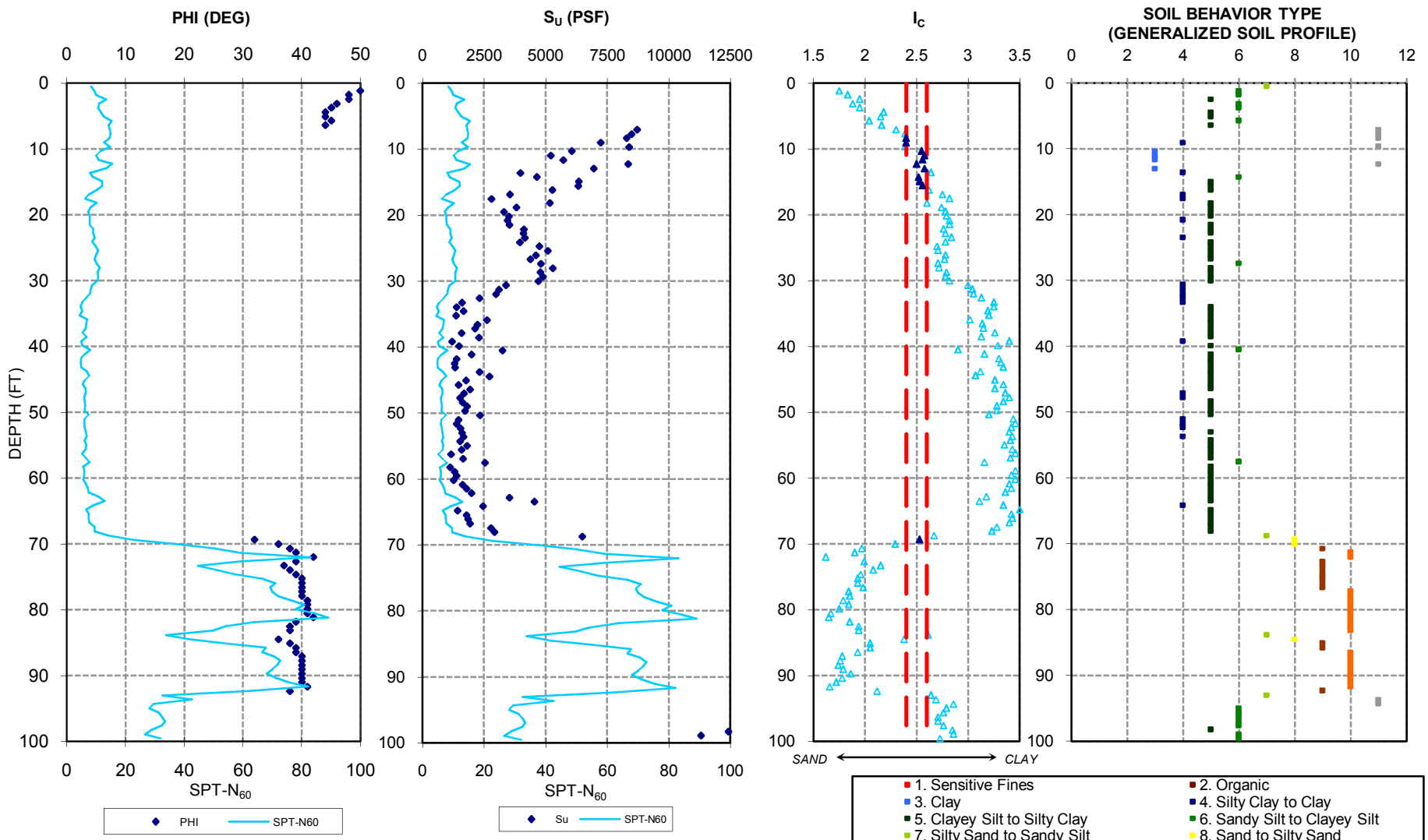
Ln(y) = -1.640

y = 0.19 **Peak Bed Rock Acceleration PBA = 0.19g**

LIQUEFACTION ANALYSES

CPT DATA CORRELATION

CLO-125



Reference: CPT data and correlation provided by Gregg Drilling and Testing, Inc.

PARIKH

Practicing in the Geosciences

ROUTE 4 - CONTRA LOMA BLVD. UNDERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.: **206118.CLM** | **PLATE NO.:** **3**

LIQUEFACTION POTENTIAL ANALYSIS (per Youd & Idriss, 2001)

04-2285E4

INFORMATION HANDOUT

PROJECT NAME **ROUTE 4**
PROJECT NO. **206118.CLO**
CPT NO. **CLO-125 (CONTRA LOMA)**

FAULT INFO
COAST RANGE - SIERRAN BLOCK BOUNDARY ZONE (CSB)
a_{max} (g)= 0.7

FAULT M_w = 7
MSF = 1.19

Depth (ft)		Soil Behavior Type	CPT RESULT INPUT qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	CSR γ_d	CSR	CRR 7.5 Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	F.S.=(CRR 7.5/CSR)*MSF*Kσ*Kα Kσ	Kα	F.S.
0.492	7	Silty Sand to Sandy Silt	50.956	0.897	0.029		0.029	1.48	1.7	1.00	0.455	1.480	1.70	86.63	1.000	86.625	0.14	1.00	1	
1.148	6	Sandy Silt to Clayey Silt	51.959	1.398	0.067		0.067	1.75	1.7	1.00	0.455	1.750	1.70	88.33	1.072	94.655	0.16	1.00	1	
1.804	6	Sandy Silt to Clayey Silt	54.304	1.525	0.104		0.104	1.83	1.68712	1.00	0.454	1.830	1.69	91.62	1.129	103.452	0.18	1.00	1	
2.461	5	Clayey Silt to Silty Clay	70.023	2.605	0.142		0.142	1.95	1.63934	1.00	0.453	1.950	1.64	114.79	1.240	142.326	0.35	1.00	1	
3.117	6	Sandy Silt to Clayey Silt	59.138	1.491	0.179		0.179	1.88	1.59536	0.99	0.453	1.880	1.60	94.35	1.171	110.439	0.21	1.00	1	
3.773	6	Sandy Silt to Clayey Silt	55.602	1.457	0.217		0.217	1.95	1.55258	0.99	0.452	1.950	1.55	86.33	1.240	107.033	0.19	1.00	1	
4.429	5	Clayey Silt to Silty Clay	55.346	2.444	0.255		0.255	2.18	1.51203	0.99	0.451	2.180	1.51	83.68	1.619	135.499	0.31	1.00	1	
5.085	5	Clayey Silt to Silty Clay	60.381	2.327	0.292		0.292	2.15	1.47453	0.99	0.450	2.150	1.47	89.03	1.553	138.251	0.33	1.00	1	
5.741	6	Sandy Silt to Clayey Silt	76.707	2.379	0.33		0.33	2.04	1.43791	0.99	0.450	2.040	1.44	110.30	1.356	149.551	0.39	1.00	1	
6.398	5	Clayey Silt to Silty Clay	67.772	2.545	0.367		0.367	2.16	1.40396	0.99	0.449	2.160	1.40	95.15	1.574	149.789	0.39	1.00	1	
7.054	11	Stiff Fine-Grained	65.779	3.263	0.41		0.41	2.3	1.36646	0.99	0.448	2.300	1.37	89.88	1.949	175.161		1.00	1	
7.71	11	Stiff Fine-Grained	64.213	3.796	0.453		0.453	2.39	1.33091	0.98	0.448	2.390	1.33	85.46	2.272	194.171		1.00	1	
8.366	11	Stiff Fine-Grained	62.821	3.501	0.496		0.496	2.4	1.29717	0.98	0.447	2.400	1.30	81.49	2.312	188.434		1.00	1	
9.022	4	Silty Clay to Clay	54.816	2.631	0.533		0.533	2.4	1.26947	0.98	0.446	2.400	1.27	69.59	2.312	160.912		1.00	1	
9.678	11	Stiff Fine-Grained	63.562	3.079	0.576		0.576	2.39	1.23874	0.98	0.446	2.390	1.24	78.74	2.272	178.891		1.00	1	
10.335	3	Clay	46.043	2.609	0.613		0.613	2.55	1.21346	0.98	0.445	2.550	1.21	55.87	3.034	169.526		1.00	1	
10.991	3	Clay	39.783	2.089	0.649		0.649	2.58	1.18983	0.98	0.445	2.580	1.19	47.34	3.206	151.778	0.41	1.00	1	
11.647	3	Clay	43.598	2.251	0.686		0.686	2.56	1.16649	0.98	0.444	2.560	1.17	50.86	3.091	157.175	0.44	1.00	1	
12.303	11	Stiff Fine-Grained	63.495	3.515	0.729		0.729	2.5	1.14049	0.97	0.443	2.500	1.14	72.42	2.768	200.477		1.00	1	
12.959	3	Clay	53.034	3.139	0.765		0.765	2.58	1.11959	0.97	0.443	2.580	1.12	59.38	3.206	190.388		1.00	1	
13.615	4	Silty Clay to Clay	30.698	1.229	0.803		0.803	2.64	1.09835	0.97	0.442							1.00	1	
14.272	6	Sandy Silt to Clayey Silt	35.605	1.067	0.84		0.84	2.52	1.07843	0.97	0.441	2.520	1.08	38.40	2.872	110.263	0.20	1.00	1	
14.928	5	Clayey Silt to Silty Clay	48.344	1.989	0.878		0.878	2.53	1.05871	0.97	0.441	2.530	1.06	51.18	2.925	149.696	0.39	1.00	1	
15.584	5	Clayey Silt to Silty Clay	48.344	2.096	0.916		0.916	2.56	1.0397	0.97	0.440	2.560	1.04	50.26	3.091	155.341	0.43	1.00	1	
16.24	5	Clayey Silt to Silty Clay	40.501	1.687	0.953		0.953	2.62	1.02183	0.97	0.439							1.00	1	
16.896	4	Silty Clay to Clay	27.534	1.104	0.991		0.991	2.75	1.00411	0.96	0.439							1.00	1	
17.552	4	Silty Clay to Clay	22.058	0.816	1.028		1.028	2.82	0.98743	0.96	0.438							0.99	1	
18.209	5	Clayey Silt to Silty Clay	39.872	1.39	1.066		1.066	2.6	0.97087	0.96	0.437							0.99	1	
18.865	5	Clayey Silt to Silty Clay	29.789	1.12	1.104		1.104	2.74	0.95486	0.96	0.437							0.98	1	
19.521	5	Clayey Silt to Silty Clay	25.89	0.903	1.141		1.141	2.78	0.93977	0.96	0.436							0.97	1	
20.177	5	Clayey Silt to Silty Clay	27.394	1.037	1.179		1.179	2.79	0.92476	0.96	0.435							0.97	1	
20.833	4	Silty Clay to Clay	27.032	1.069	1.216		1.216	2.82	0.9106	0.95	0.434							0.96	1	
21.49	5	Clayey Silt to Silty Clay	27.617	1.051	1.254		1.254	2.82	0.8965	0.95	0.434							0.96	1	
22.146	5	Clayey Silt to Silty Clay	32.268	1.185	1.292		1.292	2.76	0.88283	0.95	0.433							0.95	1	
22.802	5	Clayey Silt to Silty Clay	32.04	1.207	1.329		1.329	2.78	0.86991	0.95	0.432							0.94	1	
23.458	4	Silty Clay to Clay	32.647	1.486	1.367		1.367	2.84	0.85703	0.95	0.431							0.94	1	
24.114	5	Clayey Silt to Silty Clay	31.099	1.041	1.404		1.404	2.78	0.84485	0.94	0.430							0.93	1	
24.77	5	Clayey Silt to Silty Clay	36.925	1.129	1.442		1.442	2.7	0.8327	0.94	0.429							0.93	1	
25.427	5	Clayey Silt to Silty Clay	39.498	1.318	1.479		1.479	2.71	0.8212	0.94	0.428							0.92	1	
26.083	5	Clayey Silt to Silty Clay	36.034	1.314	1.517		1.517	2.78	0.80972	0.94	0.427							0.92	1	
26.739	5	Clayey Silt to Silty Clay.	34.296	1.1	1.555		1.555	2.77	0.79855	0.94	0.426							0.92	1	
27.395	6	Sandy Silt to Clayey Silt	37.593	1.063	1.592		1.592	2.71	0.78797	0.93	0.424							0.91	1	
28.051	5	Clayey Silt to Silty Clay	41.353	1.343	1.63		1.63	2.72	0.77739	0.93	0.423							0.91	1	
28.707	5	Clayey Silt to Silty Clay	37.454	1.346	1.667		1.667	2.79	0.76735	0.93	0.422							0.90	1	
29.364	5	Clayey Silt to Silty Clay	38.2	1.308	1.705		1.705	2.78	0.75731	0.92	0.420							0.90	1	
30.02	5	Clayey Silt to Silty Clay	37.042	1.363	1.743		1.743	2.82	0.74754	0.92	0.419							0.89	1	
30.676	4	Silty Clay to Clay	27.127	1.223	1.78		1.78	3	0.73826	0.92	0.417							0.89	1	
31.332	4	Silty Clay to Clay	25.133	1.149	1.818		1.818	3.04	0.72896	0.91	0.416							0.89	1	
31.988	4	Silty Clay to Clay	24.186	1.068	1.855		1.855	3.05	0.72013	0.91	0.414							0.88	1	
32.644	4	Silty Clay to Clay	19.323	0.783	1.893		1.893	3.13	0.71128	0.91	0.412							0.88	1	
33.301	4	Silty Clay to Clay	13.976	0.514	1.931		1.931	3.25	0.70265	0.90	0.410							0.88	1	
33.957	5	Clayey Silt to Silty Clay	12.322	0.332	1.968		1.968	3.25	0.69444	0.90	0.408							0.87	1	
34.613	5	Clayey Silt to Silty Clay	14.505	0.413	2.006		2.006	3.19	0.68621	0.89	0.406							0.87	1	
35.269	5	Clayey Silt to Silty Clay	12.192	0.246	2.043		2.043	3.2	0.67838	0.89	0.404							0.87	1	
35.925	5	Clayey Silt to Silty Clay	21.713	0.598	2.081		2.081	3.02	0.67053	0.88	0.402							0.86	1	
36.581	5	Clayey Silt to Silty Clay	19.067	0.638	2.119		2.119	3.14	0.66285	0.88	0.400							0.86	1	
37.238	5	Clayey Silt to Silty Clay	18.315	0.59	2.156		2.156	3.15	0.65554	0.87	0.398							0.86	1	
37.894	5	Clayey Silt to Silty Clay	14.093	0.42	2.194		2.194	3.26	0.6482	0.87	0.395							0.85	1	
38.55	5	Clayey Silt to Silty Clay	19.607	0.624	2.231		2.231	3.13	0.64121	0.86	0.393							0.85	1	
39.206	4	Silty Clay to Clay	11.419	0.37	2.269		2.269	3.4	0.63419	0.86	0.390							0.85	1	
39.862	5	Clayey Silt to Silty Clay	13.519	0.379	2.307		2.307	3.29	0.62732	0.85	0.388							0.85	1	
40.518	6	Sandy Silt to Clayey Silt	26.614	0.502	2.344		2.344	2.9	0.62077	0.85	0.385							0.84	1	
41.175	5	Clayey Silt to Silty Clay	17.084	0.426	2.382		2.382	3.16	0.61418	0.84	0.382							0.84	1	
41.831	5	Clayey Silt to Silty Clay	12.617	0.295	2.419		2.419	3.3	0.6079	0.83	0.380							0.84	1	
42.487	5	Clayey Silt to Silty Clay	11.965	0.264	2.457		2.457	3.32	0.60159	0.83	0.377							0.84	1	
43.143	5	Clayey Silt to Silty Clay	12.104	0.297	2.495		2.495	3.34	0.5954	0.82	0.374							0.83	1	
43.799	5	Clayey Silt to Silty Clay	19.674	0.49	2.532		2.532	3.12	0.5895	0.82	0.371							0.83	1	
44.455	5	Clayey Silt to Silty Clay	23.016	0.576	2.57		2.57	3.07	0.58355	0.81	0.368							0.83	1	
45.112	5	Clayey Silt to Silty Clay	15.898	0.429	2.607		2.607	3.26	0.57788	0.80	0.365							0.83	1	
45.768	5	Clayey Silt to Silty Clay	13.653	0.363	2.645		2.645	3.34	0.57217	0.80	0.362							0.82	1	
46.424	5	Clayey Silt to Silty Clay	17.017	0.511	2.682		2.682	3.26	0.56672	0.79	0.359							0.82	1	
47.08	4	Silty Clay to Clay	15.368	0.553	2.72		2.72	3.36	0.56122	0.78	0.356							0.82	1	
47.736	4	Silty Clay to Clay	14.143	0.487	2.758		2.758	3.4	0.55584	0.78	0.353							0.82	1	
48.392	5	Clayey Silt to Silty Clay	14.989	0.435	2.795		2.795	3.34	0.55069	0.77	0.350							0.81	1	
49.049	5	Clayey Silt to Silty Clay	16.198	0.428	2.833		2.833	3.28	0.5455	0.76	0.347							0.81	1	
49.705	5	Clayey Silt to Silty Clay	15.647	0.369	2.87		2.87	3.28	0.54054	0.76	0.344							0.81	1	
50.361	5	Clayey Silt to Silty Clay	20.37	0.58	2.908		2.908	3.2	0.53554	0.75	0.341							0.81	1	
51.017	4	Silty Clay to Clay	13.725	0.465	2.946		2.946	3.44	0.53063	0.74	0.338							0.81	1	
51.673	4	Silty Clay to Clay	13.274	0.435	2.983		2.983	3.46	0.52594	0.74	0.335							0.80	1	
52.329	4	Silty Clay to Clay	14.444	0.463	3.021		3.021	3.42	0.5212	0.73	0.332							0.80	1	
52.986	5	Clayey Silt to Silty Clay	14.873	0.47	3.058		3.058	3.4	0.51667	0.72	0.329							0.80	1	
53.642	4	Silty Clay to Clay	15.418	0.582	3.096		3.096	3.43	0.5121	0.72	0.326							0.80	1	
54.298	5	Clayey Silt to Silty Clay	14.343	0.408	3.134		3.134	3.41	0.50761	0.71	0.323							0.80	1	
54.954	5	Clayey Silt to Silty Clay	16.438	0.486	3.171		3.171	3.35	0.50332	0.70	0.320							0.79	1	
55.61	5	Clayey Silt to Silty Clay	14.683	0.48	3.209		3.209	3.43	0.49898	0.70	0.317							0.79	1	
56.266	5	Clayey Silt to Silty Clay	11.492	0.238	3.246		3.246	3.46	0.49483	0.69	0.315							0.79	1	
56.923	5	Clayey Silt to Silty Clay	15.079	0.465	3.284		3.284	3.41	0.49063	0.69	0.312							0.79	1	
57.579	6	Sandy Silt to Clayey Silt	22.225	0.483	3.322		3.322	3.16	0.48651	0.68	0.309							0.79	1	
58.235	5	Clayey Silt to Silty Clay	11.709	0.268	3.359		3.359	3.53	0.48256	0.67	0.307							0.78	1	
58.891	5	Clayey Silt to Silty Clay	13.057	0.301	3.397		3.397	3.46	0.47857	0.67	0.304							0.78	1	
59.547	5	Clayey Silt to Silty Clay	13.664	0.294	3.434		3.434	3.42	0.47475	0.66	0.302							0.78	1	
60.203	5	Clayey Silt to Silty Clay	12.6	0.255	3.472		3.472	3.46	0.47089	0.66	0.299							0.78	1	
60.86	5	Clayey Silt to Silty Clay	15.251	0.391	3.51		3.51	3.4	0.46709	0.65	0.297							0.78	1	
61.516	5	Clayey Silt to Silty Clay	16.449	0.526	3.547	0.006	3.541	3.42	0.46404	0.65	0.295							0.78	1	
62.172	5	Clayey Silt to Silty Clay	18.031	0.546	3.585	0.027	3.558	3.36	0.46238	0.64	0.294							0.78	1	

LIQUEFACTION POTENTIAL ANALYSIS (per Youd & Idriss, 2001)

04-2285E4

INFORMATION HANDOUT

PROJECT NAME **ROUTE 4**
PROJECT NO. **206118.CLO**
CPT NO. **CLO-125 (CONTRA LOMA)**

FAULT INFO
COAST RANGE - SIERRAN BLOCK BOUNDARY ZONE (CSB)
a_{max} (g)= 0.7

FAULT M_w = 7
MSF = 1.19

		CPT RESULT INPUT								CSR		CRR 7.5						F.S.=(CRR 7.5/CSR)*MSF*Kσ*Kα		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
62.828	5	Clayey Silt to Silty Clay	29.689	1.077	3.622	0.047	3.575	3.18	0.46073	0.64	0.294							0.78	1	
63.484	5	Clayey Silt to Silty Clay	37.476	1.5	3.66	0.068	3.592	3.11	0.4591	0.63	0.293							0.77	1	
64.14	4	Silty Clay to Clay	22.058	0.852	3.698	0.088	3.609	3.34	0.45748	0.63	0.293							0.77	1	
64.797	5	Clayey Silt to Silty Clay	14.215	0.406	3.735	0.109	3.627	3.5	0.45577	0.62	0.292							0.77	1	
65.453	5	Clayey Silt to Silty Clay	16.989	0.526	3.773	0.129	3.644	3.42	0.45417	0.62	0.292							0.77	1	
66.109	5	Clayey Silt to Silty Clay	17.307	0.567	3.81	0.15	3.661	3.43	0.45258	0.61	0.291							0.77	1	
66.765	5	Clayey Silt to Silty Clay	17.925	0.571	3.848	0.17	3.678	3.4	0.451	0.61	0.291							0.77	1	
67.421	5	Clayey Silt to Silty Clay	24.531	0.849	3.885	0.19	3.695	3.28	0.44944	0.61	0.290							0.77	1	
68.077	5	Clayey Silt to Silty Clay	25.679	0.771	3.923	0.211	3.712	3.23	0.44788	0.60	0.290							0.77	1	
68.734	7	Silty Sand to Sandy Silt	52.588	0.52	3.962	0.231	3.73	2.67	0.44625	0.60	0.289							0.77	1	
69.39	8	Sand to Silty Sand	91.658	1.337	4.001	0.252	3.749	2.53	0.44453	0.60	0.289	2.530	0.44	40.75	2.925	119.170	0.24	0.77	1	0.82
70.046	8	Sand to Silty Sand	172.208	2.523	4.041	0.272	3.769	2.29	0.44275	0.59	0.289	2.290	0.44	76.24	1.917	146.164	0.37	0.75	1	1.28
70.702	9	Sand	257.71	1.835	4.082	0.293	3.789	1.97	0.44097	0.59	0.288	1.970	0.44	113.64	1.263	143.499	0.35	0.68	1	1.23
71.358	10	Gravelly Sand to Sand	311.802	2.256	4.124	0.313	3.81	1.9	0.43912	0.58	0.288	1.900	0.44	136.92	1.189	162.775		0.66	1	
72.014	10	Gravelly Sand to Sand	484.946	2.075	4.165	0.334	3.832	1.62	0.4372	0.58	0.288	1.620	0.44	212.02	1.000	212.019		0.58	1	
72.671	9	Sand	302.751	2.887	4.206	0.354	3.852	1.99	0.43547	0.58	0.287	1.990	0.44	131.84	1.287	169.698		0.66	1	
73.327	9	Sand	213.595	2.341	4.247	0.375	3.872	2.15	0.43375	0.58	0.287	2.150	0.43	92.65	1.553	143.862	0.36	0.72	1	1.24
73.983	9	Sand	253.661	2.631	4.288	0.395	3.892	2.08	0.43205	0.57	0.287	2.080	0.43	109.59	1.420	155.585	0.43	0.69	1	1.50
74.639	9	Sand	294.936	2.412	4.328	0.416	3.913	1.96	0.43028	0.57	0.286	1.960	0.43	126.90	1.251	158.770	0.45	0.66	1	1.58
75.295	9	Sand	347.084	3.121	4.369	0.436	3.933	1.93	0.4286	0.57	0.286	1.930	0.43	148.76	1.218	181.259		0.64	1	
75.951	9	Sand	370.2	3.555	4.41	0.457	3.953	1.93	0.42694	0.56	0.286	1.930	0.43	158.05	1.218	192.580		0.63	1	
76.608	9	Sand	354.314	3.907	4.45	0.477	3.973	1.98	0.42529	0.56	0.286	1.980	0.43	150.68	1.275	192.083		0.64	1	
77.264	10	Gravelly Sand to Sand	376.951	2.637	4.492	0.498	3.995	1.84	0.42348	0.56	0.286	1.840	0.42	159.63	1.137	181.508		0.62	1	
77.92	10	Gravelly Sand to Sand	386.694	2.883	4.534	0.518	4.016	1.85	0.42178	0.56	0.286	1.850	0.42	163.10	1.145	186.762		0.61	1	
78.576	10	Gravelly Sand to Sand	419.006	2.7	4.576	0.539	4.037	1.79	0.42009	0.55	0.285	1.790	0.42	176.02	1.099	193.523		0.60	1	
79.232	10	Gravelly Sand to Sand	437.015	3.58	4.618	0.559	4.059	1.84	0.41833	0.55	0.285	1.840	0.42	182.82	1.137	207.868		0.60	1	
79.888	10	Gravelly Sand to Sand	434.241	2.473	4.659	0.579	4.08	1.75	0.41667	0.55	0.285	1.750	0.42	180.93	1.072	193.888		0.59	1	
80.545	10	Gravelly Sand to Sand	483.153	2.306	4.701	0.6	4.101	1.67	0.41502	0.55	0.285	1.670	0.42	200.52	1.017	204.000		0.57	1	
81.201	10	Gravelly Sand to Sand	513.315	2.439	4.743	0.62	4.122	1.65	0.41338	0.54	0.285	1.650	0.41	212.19	1.003	212.901		0.57	1	
81.857	10	Gravelly Sand to Sand	342.127	2.024	4.785	0.641	4.144	1.85	0.41168	0.54	0.285	1.850	0.41	140.85	1.145	161.280		0.63	1	
82.513	10	Gravelly Sand to Sand	281.484	1.749	4.826	0.661	4.165	1.94	0.41007	0.54	0.285	1.940	0.41	115.43	1.229	141.858	0.35	0.66	1	1.21
83.169	10	Gravelly Sand to Sand	258.073	1.351	4.868	0.682	4.186	1.94	0.40847	0.54	0.285	1.940	0.41	105.41	1.229	129.553	0.28	0.67	1	0.99
83.825	7	Silty Sand to Sandy Silt	131.379	3.711	4.907	0.702	4.204	2.61	0.40711	0.54	0.285							0.75	1	
84.482	8	Sand to Silty Sand	180.647	3.255	4.946	0.723	4.224	2.38	0.4056	0.53	0.284	2.380	0.41	73.27	2.233	163.584		0.74	1	
85.138	9	Sand	272.059	2.447	4.987	0.743	4.244	2.05	0.40411	0.53	0.284	2.050	0.40	109.94	1.371	150.738	0.40	0.67	1	1.40
85.794	9	Sand	337.436	4.078	5.028	0.764	4.264	2.05	0.40264	0.53	0.284	2.050	0.40	135.86	1.371	186.276		0.64	1	
86.45	10	Gravelly Sand to Sand	348.143	2.735	5.07	0.784	4.285	1.93	0.40109	0.53	0.284	1.930	0.40	139.64	1.218	170.144		0.63	1	
87.106	10	Gravelly Sand to Sand	389.501	1.945	5.111	0.805	4.307	1.78	0.39949	0.53	0.284	1.780	0.40	155.60	1.092	169.971		0.60	1	
87.762	10	Gravelly Sand to Sand	404.251	1.928	5.153	0.825	4.328	1.76	0.39797	0.52	0.284	1.760	0.40	160.88	1.078	173.501		0.59	1	
88.419	10	Gravelly Sand to Sand	400.006	1.736	5.195	0.846	4.349	1.74	0.39647	0.52	0.284	1.740	0.40	158.59	1.065	168.868		0.59	1	
89.075	10	Gravelly Sand to Sand	384.694	1.899	5.237	0.866	4.371	1.79	0.3949	0.52	0.284	1.790	0.39	151.92	1.099	167.023		0.60	1	
89.731	10	Gravelly Sand to Sand	364.686	2.281	5.279	0.887	4.392	1.86	0.39342	0.52	0.284	1.860	0.39	143.47	1.153	165.475		0.61	1	
90.387	10	Gravelly Sand to Sand	392.715	1.934	5.32	0.907	4.413	1.78	0.39195	0.52	0.284	1.780	0.39	153.92	1.092	168.138		0.60	1	
91.043	10	Gravelly Sand to Sand	427.083	1.785	5.362	0.928	4.435	1.72	0.39042	0.52	0.284	1.720	0.39	166.74	1.051	175.299		0.58	1	
91.699	10	Gravelly Sand to Sand	471.394	1.838	5.404	0.948	4.456	1.66	0.38897	0.52	0.284	1.660	0.39	183.36	1.010	185.265		0.56	1	
92.356	9	Sand	300.74	3.872	5.445	0.968	4.476	2.12	0.3876	0.51	0.284	2.120	0.39	116.57	1.492	173.935		0.66	1	
93.012	7	Silty Sand to Sandy Silt	124.689	3.373	5.483	0.989	4.494	2.64	0.38637	0.51	0.284							0.74	1	
93.668	11	Stiff Fine-Grained	158.706	6.835	5.526	1.009	4.517	2.69	0.38482	0.51	0.284							0.74	1	
94.324	11	Stiff Fine-Grained	100.369	4.35	5.569	1.03	4.539	2.86	0.38334	0.51	0.284							0.74	1	
94.98	6	Sandy Silt to Clayey Silt	99.74	3.362	5.606	1.05	4.556	2.79	0.38221	0.51	0.285							0.74	1	
95.636	6	Sandy Silt to Clayey Silt	112.496	3.976	5.644	1.071	4.573	2.76	0.38108	0.51	0.285							0.74	1	
96.293	6	Sandy Silt to Clayey Silt	119.871	3.891	5.682	1.091	4.59	2.71	0.37997	0.51	0.285							0.74	1	
96.949	6	Sandy Silt to Clayey Silt	123.514	4.095	5.719	1.112	4.607	2.71	0.37885	0.50	0.285							0.74	1	
97.605	6	Sandy Silt to Clayey Silt	116.813	4.243	5.757	1.132	4.625	2.76	0.37768	0.50	0.285							0.74	1	
98.261	5	Clayey Silt to Silty Clay	98.843	3.918	5.794	1.153	4.642	2.85	0.37658	0.50	0.285							0.74	1	
98.917	6	Sandy Silt to Clayey Silt	90.393	3.383	5.832	1.173	4.659	2.86	0.37549	0.50	0.285							0.74	1	
99.573	6	Sandy Silt to Clayey Silt	117.052	3.784	5.87	1.194	4.676	2.73	0.3744	0.50	0.285							0.73	1	

AXIAL PILE CAPACITY

(SHAFT Runs)

SHAFT Runs SR Bypass – Contra Loma eBART
Pile capacities computed using SHAFT program – Output follows
Revised 21 May, 2010

Abutment 1 (based on boring CLO-124)

24-in CIDH Pile

Note: Neglected End Bearing for Pile Capacity

Ground Surface Elevation 45.0 (approx.)

Nominal Compression Load = 350 kips = 175 tons
Reqd. Shaft Length per SHAFT output = 61.0 ft
Recommended Penetration = 61.0 feet
Reqd. Tip Elevation = 45.0-61.0 = -16.0

Nominal Tension Load = 140 kips = 70 tons
Equivalent Skin Friction = 70/0.5 = 140 tons
Reqd. Shaft Length per SHAFT output =57.0 ft
Recommended Penetration 57.0 feet
Reqd. Tip Elevation = 45.0-57.0 = -12.0 ft

Abutment 3 (based on boring CLO-125)

24-in CIDH PIle

Note: Neglected End Bearing for Pile Capacity

Ground Surface Elevation 32.0 (approx.)

Nominal Compression Load = 475 kips = 238 tons (240 tons approx.)
Reqd. Shaft Length per SHAFT output = 55.0 ft
Recommended Penetration = 55.0 feet
Reqd. Tip Elevation = 32.0-55.0 = -23.0

Nominal Tension Load = 180 kips = 90 tons
Equivalent Skin Friction = 90/0.5 = 180 tons
Reqd. Shaft Length per SHAFT output =47.0 ft
Recommended Penetration 47.0 feet
Reqd. Tip Elevation = 32.0 – 47.0 = -15.0 ft

Bent 2 (based on boring CLO-124)

90-in CIDH Pile

Ground Surface Elevation 32.0 (approx.)
Nominal Compression Load = 3300 kips = 1650 tons
Assumed Shaft tip @ 67-ft depth
Top Settlement = 1.083 in. for 1589 ton load; and 9.102 in. for 1823 ton load
Thus, by linear interpolation, top settlement 3.17 in. for 1650 ton load
= 3.17/90 =3.5 pct

Bent 2 (based on boring CLO-125)

90-in CIDH Pile

Ground Surface Elevation 32.0 (approx.)
Nominal Compression Load = 3300 kips = 1650 tons
Assumed Shaft tip @ 67-ft depth
Top Settlement = 1.089 in. for 1748 ton load (e.g. > 1650 ton)

Thus,67-ft tip depth is recommended.

Recommended Penetration = 67.0 feet
Reqd. Tip Elevation = 32.0 – 67.0 = -35.0

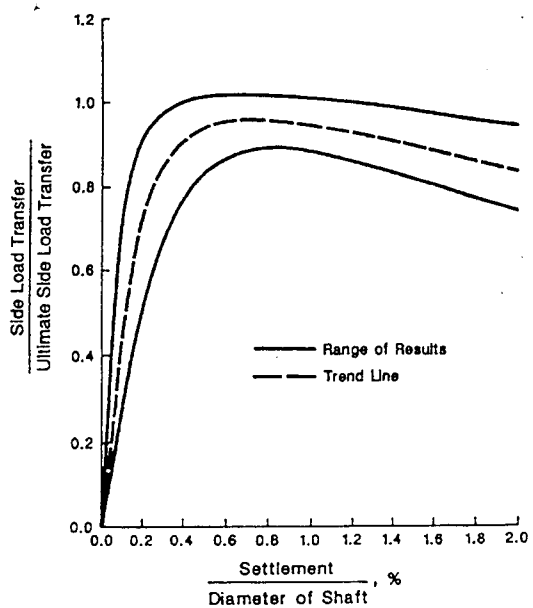
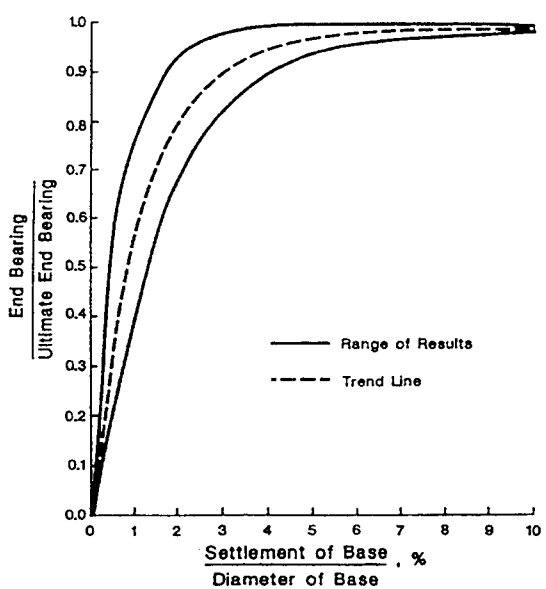


Figure 11.8. Normalized side load transfer for drilled shaft in cohesive soil.



CLAY

Figure 11.9. Normalized base load transfer for drilled shaft in cohesive soil.

REF: DRILLED SHAFTS MANUAL; FHWA-IF-99-025 (O'NEIL & REESE)

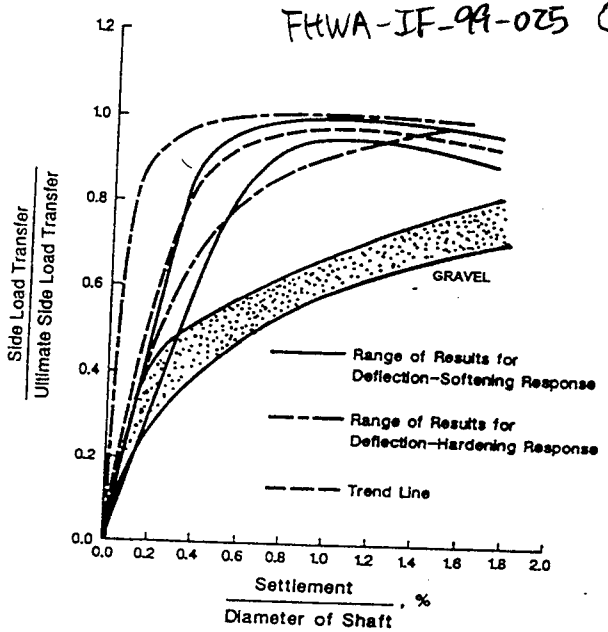
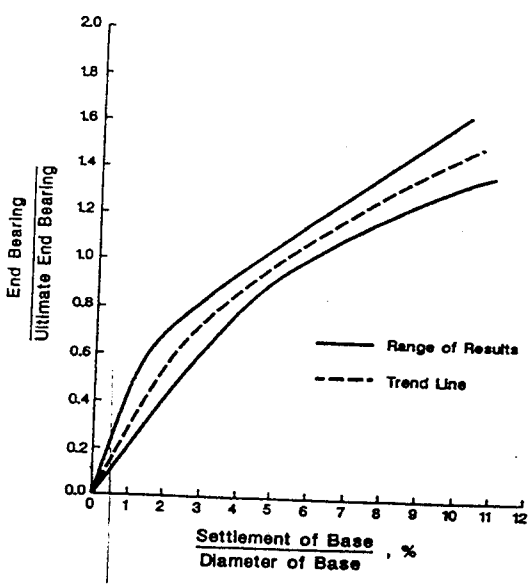


Figure 11.10. Normalized side load transfer for drilled shaft in cohesionless soil.

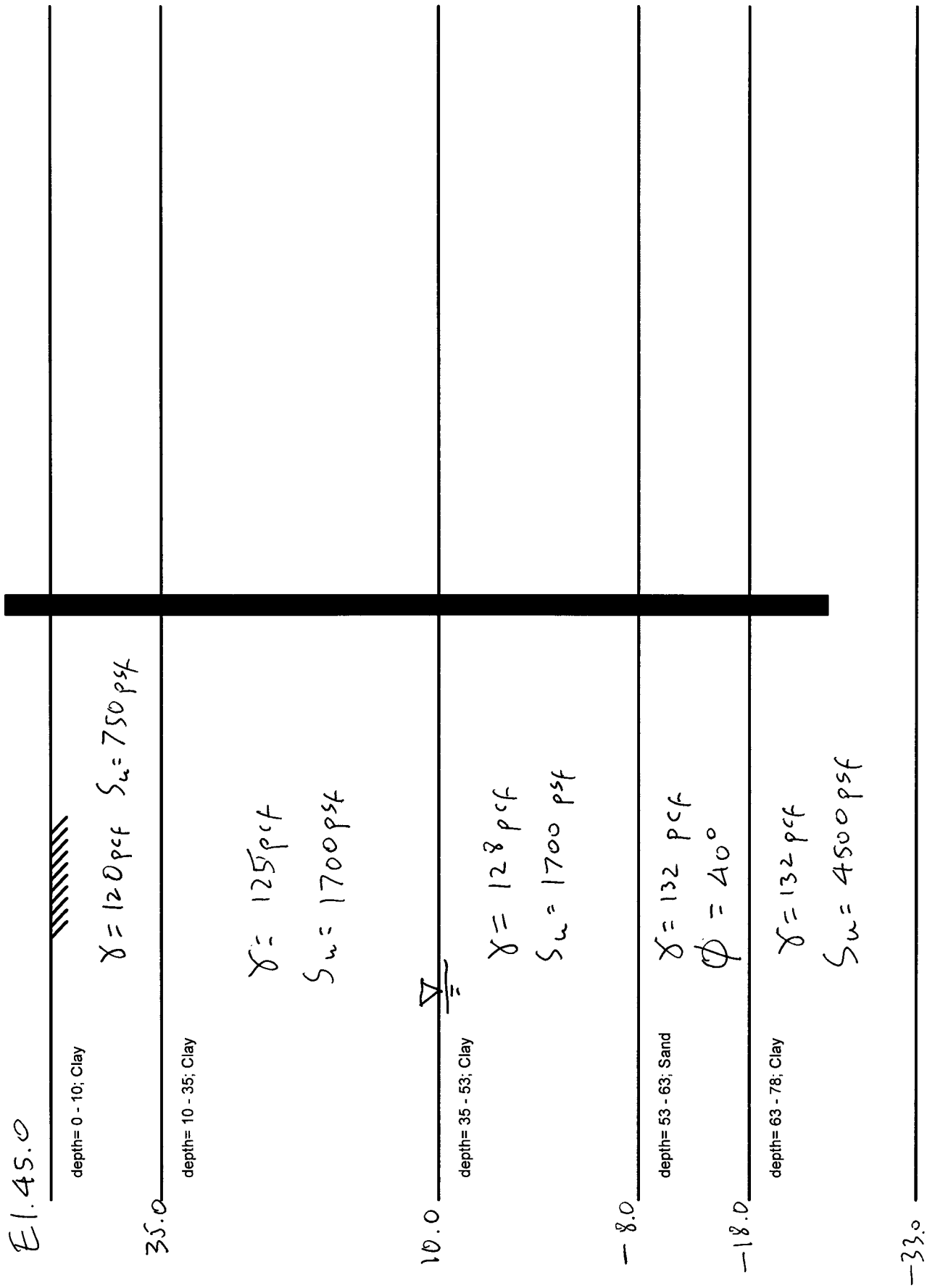


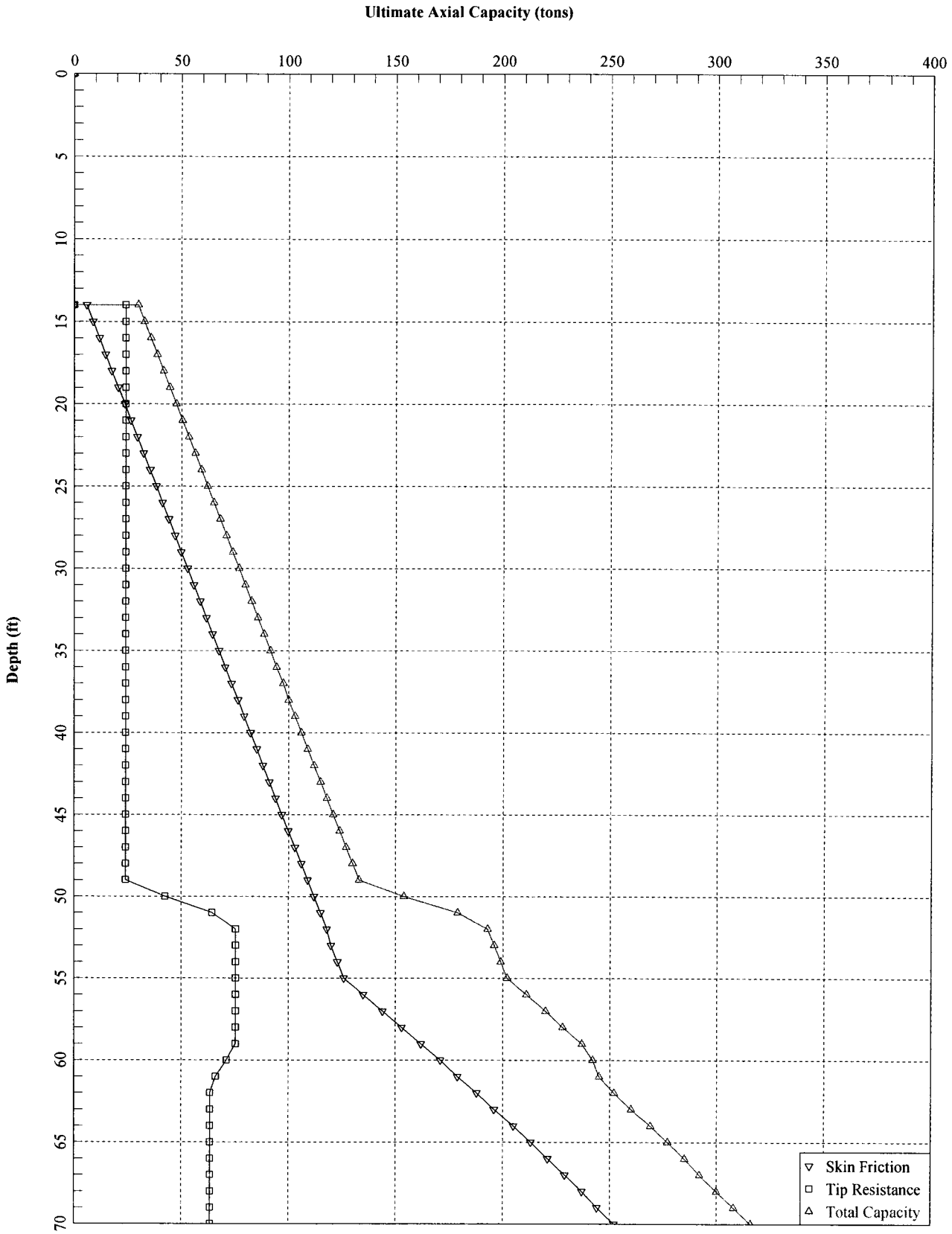
SAND

Figure 11.11. Normalized base load transfer for drilled shaft in cohesionless soil.

04-2285E4
INFORMATION HANDOUT
PAGE-501

Abutment 1
24-in. CIDH Pile
(based on boring CLO-124)





Contra Loma eBART - Abutment 1 - 24-in CIDH PIle

DEPTH, FT = 0.630E+02

LAYER NO 5----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA = 0.550E+00
END BEARING COEFFICIENT-Nc = 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT = 0.450E+04
INTERNAL FRICTION ANGLE, DEG. = 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.132E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.640E+04
DEPTH, FT = 0.630E+02

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA = 0.550E+00
END BEARING COEFFICIENT-Nc = 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT = 0.450E+04
INTERNAL FRICTION ANGLE, DEG. = 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.132E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.640E+04
DEPTH, FT = 0.780E+02

DRILLED SHAFT INFORMATION

DIAMETER OF STEM = 2.000 FT.
DIAMETER OF BASE = 2.000 FT.
END OF STEM TO BASE = 0.000 FT.
ANGLE OF BELL = 0.000 DEG.
IGNORED TOP PORTION = 10.000 FT.
IGNORED BOTTOM PORTION = 2.000 FT.
AREA OF ONE PERCENT STEEL = 4.524 SQ.IN.
ELASTIC MODULUS, Ec = 0.360E+07 LB/SQ IN
VOLUME OF UNDERREAM = 0.000 CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
13.0	1.51	2.94	24.04	26.97	10.95	9.19	17.83
14.0	1.63	5.88	24.04	29.91	13.89	10.36	18.36

15.0	1.75	8.81	24.04	32.85	16.83	11.54	18.82
16.0	1.86	11.75	24.04	35.79	19.76	12.71	19.22
17.0	1.98	14.69	24.04	38.73	22.70	13.89	19.57
18.0	2.09	17.63	24.04	41.66	25.64	15.06	19.89
19.0	2.21	20.56	24.04	44.60	28.58	16.24	20.17
20.0	2.33	23.50	24.04	47.54	31.51	17.41	20.43
21.0	2.44	26.44	24.04	50.48	34.45	18.59	20.66
22.0	2.56	29.38	24.04	53.41	37.39	19.76	20.86
23.0	2.68	32.32	24.04	56.35	40.33	20.94	21.05
24.0	2.79	35.25	24.04	59.29	43.27	22.11	21.23
25.0	2.91	38.19	24.04	62.23	46.20	23.29	21.39
26.0	3.03	41.13	24.04	65.17	49.14	24.46	21.54
27.0	3.14	44.07	24.04	68.10	52.08	25.64	21.68
28.0	3.26	47.00	24.04	71.04	55.02	26.81	21.80
29.0	3.37	49.94	24.04	73.98	57.95	27.99	21.92
30.0	3.49	52.88	24.04	76.92	60.89	29.16	22.03
31.0	3.61	55.82	24.04	79.85	63.83	30.34	22.14
32.0	3.72	58.76	24.04	82.79	66.77	31.51	22.23
33.0	3.84	61.69	24.04	85.73	69.71	32.69	22.32
34.0	3.96	64.63	24.04	88.67	72.64	33.86	22.41
35.0	4.07	67.57	24.04	91.61	75.58	35.04	22.49
36.0	4.19	70.51	24.04	94.54	78.52	36.21	22.57
37.0	4.31	73.44	24.04	97.48	81.46	37.39	22.64
38.0	4.42	76.38	24.04	100.42	84.39	38.56	22.71
39.0	4.54	79.32	24.04	103.36	87.33	39.74	22.77
40.0	4.65	82.26	24.04	106.29	90.27	40.92	22.84
41.0	4.77	85.20	24.04	109.23	93.21	42.09	22.89
42.0	4.89	88.13	24.04	112.17	96.15	43.27	22.95
43.0	5.00	91.07	24.04	115.11	99.08	44.44	23.00
44.0	5.12	94.01	24.04	118.04	102.02	45.62	23.05
45.0	5.24	96.95	24.04	120.98	104.96	46.79	23.10
46.0	5.35	99.88	24.04	123.92	107.90	47.97	23.15
47.0	5.47	102.82	24.04	126.86	110.83	49.14	23.19
48.0	5.59	105.76	24.04	129.80	113.77	50.32	23.24
49.0	5.70	108.70	24.04	132.73	116.71	51.49	23.28
50.0	5.82	111.64	42.38	154.02	125.76	58.78	26.47
51.0	5.93	114.57	64.40	178.97	136.04	67.30	30.16
52.0	6.05	117.51	75.41	192.92	142.65	72.14	31.88
53.0	6.17	120.45	75.41	195.86	145.58	73.32	31.76
54.0	6.28	123.39	75.41	198.79	148.52	74.49	31.63
55.0	6.40	126.32	75.41	201.73	151.46	75.67	31.52
56.0	6.52	135.29	75.41	210.70	160.42	79.25	32.33
57.0	6.63	144.20	75.41	219.61	169.34	82.82	33.11
58.0	6.75	153.06	75.41	228.46	178.19	86.36	33.85
59.0	6.87	161.86	75.41	237.26	186.99	89.88	34.56
60.0	6.98	170.60	71.20	241.80	194.33	91.97	34.63
61.0	7.10	179.27	66.15	245.42	201.32	93.76	34.57
62.0	7.21	187.89	63.63	251.51	209.09	96.36	34.86
63.0	7.33	196.43	63.63	260.06	217.64	99.78	35.47
64.0	7.45	204.91	63.63	268.53	226.12	103.17	36.06
65.0	7.56	213.31	63.63	276.94	234.52	106.53	36.61
66.0	7.68	221.09	63.63	284.71	242.30	109.64	37.07
67.0	7.80	228.87	63.63	292.49	250.07	112.75	37.51
68.0	7.91	236.64	63.63	300.27	257.85	115.87	37.95
69.0	8.03	244.42	63.63	308.04	265.63	118.98	38.36
70.0	8.15	252.19	63.63	315.82	273.40	122.09	38.77

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.9525E+00	0.5607E-03	0.2094E-01	0.1000E-03

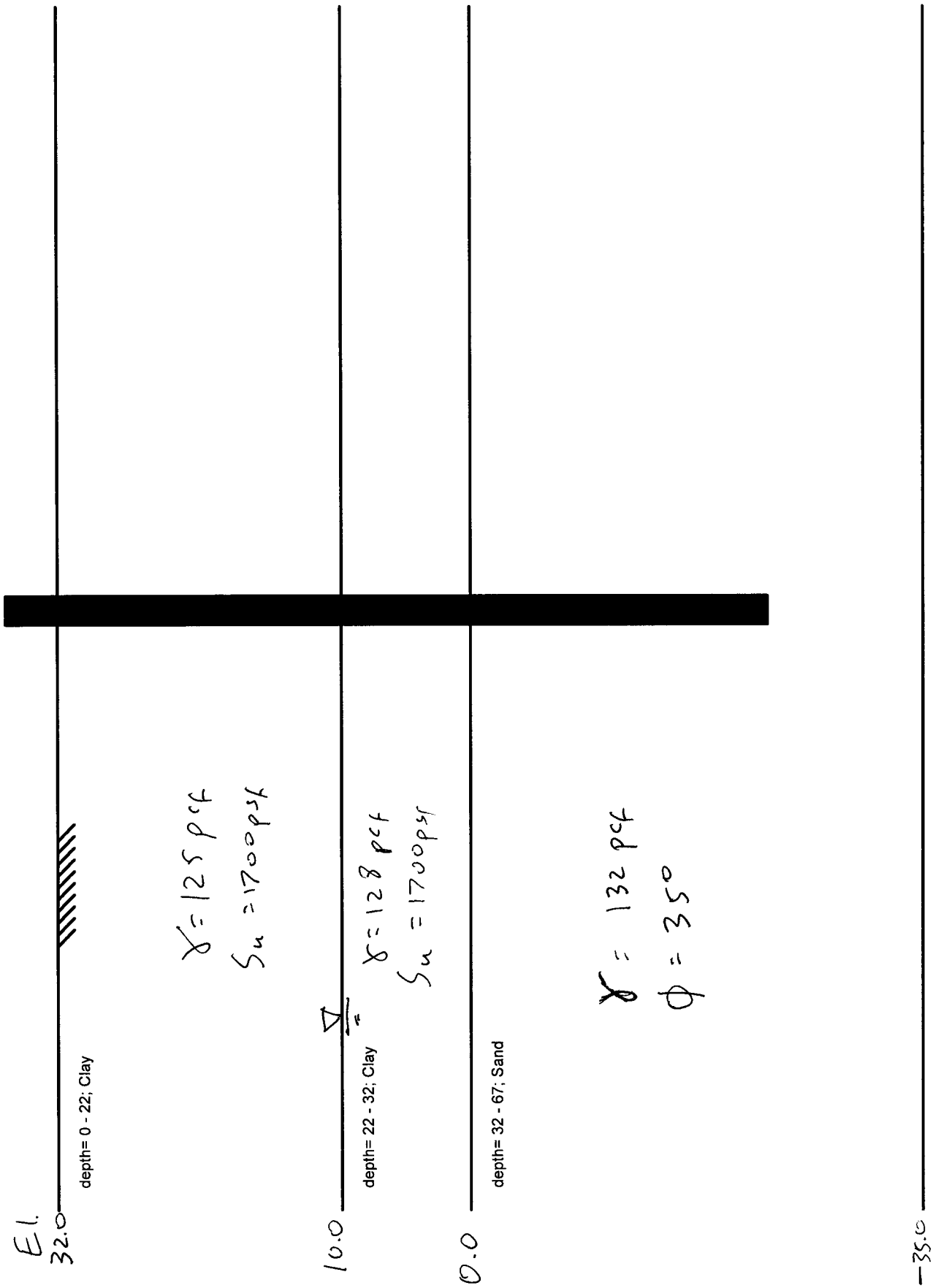
Abut 1-REvised.sfo

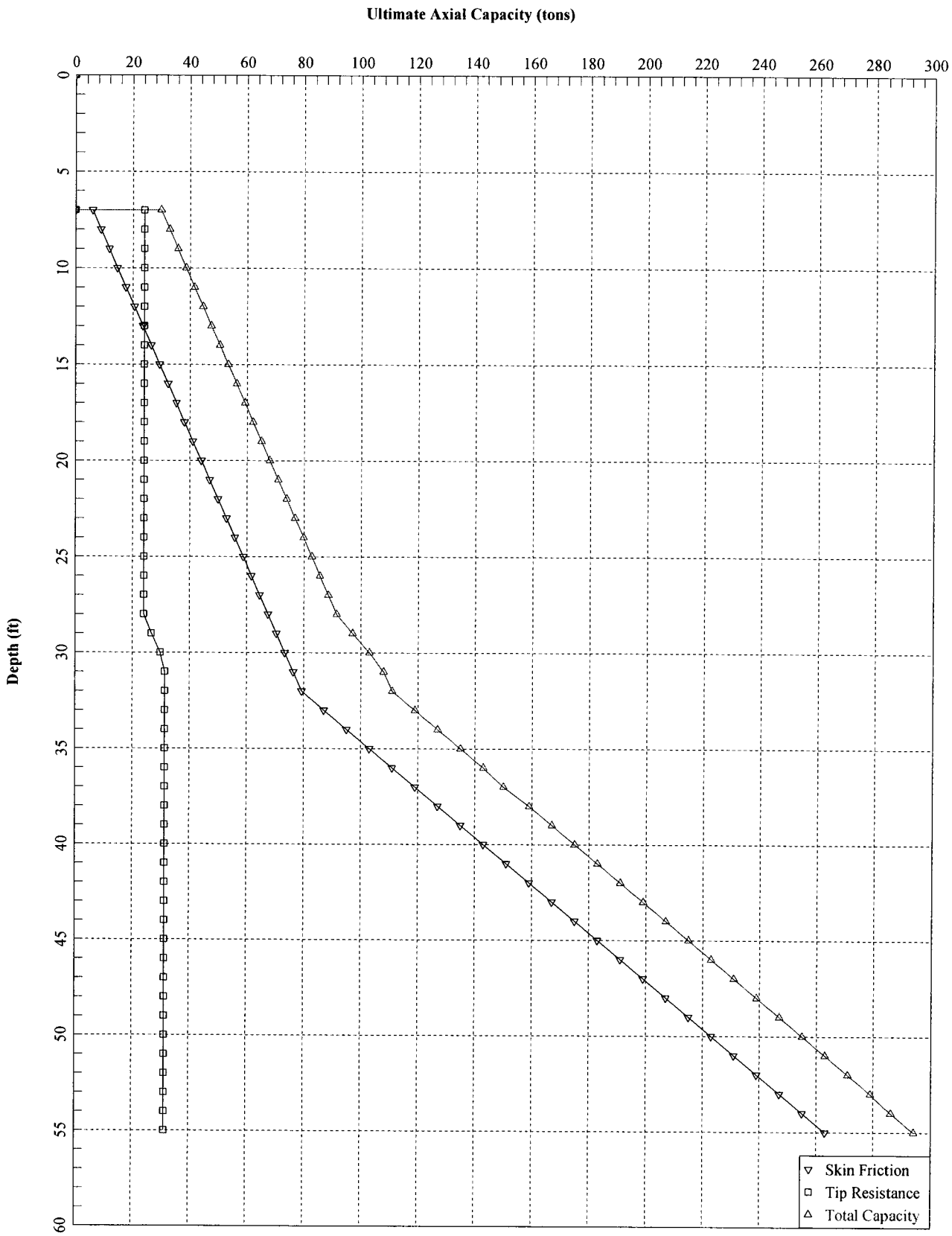
0.9525E+01	0.5607E-02	0.2094E+00	0.1000E-02
0.2405E+02	0.1407E-01	0.5236E+00	0.2500E-02
0.4831E+02	0.2828E-01	0.1047E+01	0.5000E-02
0.6983E+02	0.4212E-01	0.1571E+01	0.7500E-02
0.8776E+02	0.5499E-01	0.2094E+01	0.1000E-01
0.1570E+03	0.1152E+00	0.5236E+01	0.2500E-01
0.2061E+03	0.1789E+00	0.1047E+02	0.5000E-01
0.2294E+03	0.2245E+00	0.1571E+02	0.7500E-01
0.2420E+03	0.2611E+00	0.2094E+02	0.1000E+00
0.2640E+03	0.4352E+00	0.3637E+02	0.2500E+00
0.2643E+03	0.6917E+00	0.5066E+02	0.5000E+00
0.2712E+03	0.9488E+00	0.5766E+02	0.7500E+00
0.2741E+03	0.1202E+01	0.6066E+02	0.1000E+01
0.2760E+03	0.2604E+01	0.6305E+02	0.2400E+01

Abutment 3

24 in CIP Pile

(based on boring CLO-125)





Contra Loma eBART - Abutment 3 - 24-in CIDH PIle

```
                                   Abut 1-REvised.sfo
VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

    Highway 4 - Contra Loma eBART- Abutment 1 - 24 in CIDH-Revised

    PROPOSED DEPTH =      70.0 FT
    ----------------

    NUMBER OF LAYERS =    5
    ------------------

    WATER TABLE DEPTH =      35.0 FT.
    -------------------

    FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 2.50
    --------------------------------------------------------
    FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
    -------------------------------------------------------

    SOIL INFORMATION
    ----------------

    LAYER NO 1----CLAY

      AT THE TOP

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.750E+03
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.120E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.750E+03
      DEPTH, FT                                          = 0.000E+00

      AT THE BOTTOM

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.750E+03
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.120E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.750E+03
      DEPTH, FT                                          = 0.100E+02

    LAYER NO 2----CLAY

      AT THE TOP

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
```

```
                                   Abut 1-REvised.sfo
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
      DEPTH, FT                                          = 0.100E+02

      AT THE BOTTOM

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
      DEPTH, FT                                          = 0.350E+02

    LAYER NO 3----CLAY

      AT THE TOP

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.128E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
      DEPTH, FT                                          = 0.350E+02

      AT THE BOTTOM

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.128E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
      DEPTH, FT                                          = 0.530E+02

    LAYER NO 4----SAND

      AT THE TOP

      SKIN FRICTION COEFFICIENT- BETA                    = 0.517E+00
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
      INTERNAL FRICTION ANGLE, DEG.                      = 0.400E+02
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.132E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.400E+04
      DEPTH, FT                                          = 0.530E+02

      AT THE BOTTOM

      SKIN FRICTION COEFFICIENT- BETA                    = 0.428E+00
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
      INTERNAL FRICTION ANGLE, DEG.                      = 0.400E+02
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.132E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.400E+04
```

```
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VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
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    Highway 4 - Contra Loma eBART- Abutment 3 - 24 in CIDH-REvised

    PROPOSED DEPTH =       55.0 FT
    ----------------

    NUMBER OF LAYERS =     3
    ------------------

    WATER TABLE DEPTH =       22.0 FT.
    -------------------


    FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 2.50
    --------------------------------------------------------
    FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
    -------------------------------------------------------

    SOIL INFORMATION
    ----------------

    LAYER NO 1----CLAY

      AT THE TOP

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
      DEPTH, FT                                          = 0.000E+00

      AT THE BOTTOM

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
      DEPTH, FT                                          = 0.220E+02

    LAYER NO 2----CLAY

      AT THE TOP

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
```

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      SOIL UNIT WEIGHT, LB/CU FT                         = 0.128E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
      DEPTH, FT                                          = 0.220E+02

      AT THE BOTTOM

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.128E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
      DEPTH, FT                                          = 0.320E+02

    LAYER NO 3----SAND

      AT THE TOP

      SKIN FRICTION COEFFICIENT- BETA                    = 0.736E+00
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
      INTERNAL FRICTION ANGLE, DEG.                      = 0.350E+02
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.132E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.400E+04
      DEPTH, FT                                          = 0.320E+02

      AT THE BOTTOM

      SKIN FRICTION COEFFICIENT- BETA                    = 0.395E+00
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
      INTERNAL FRICTION ANGLE, DEG.                      = 0.350E+02
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.132E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.400E+04
      DEPTH, FT                                          = 0.670E+02


    DRILLED SHAFT INFORMATION
    -------------------------

     DIAMETER OF STEM          =    2.000  FT.
     DIAMETER OF BASE          =    2.000  FT.
     END OF STEM TO BASE       =    0.000  FT.
     ANGLE OF BELL             =    0.000  DEG.
     IGNORED TOP PORTION       =    6.500  FT.
     IGNORED BOTTOM PORTION    =    2.000  FT.
     AREA OF ONE PERCENT STEEL =    4.524  SQ.IN.
     ELASTIC MODULUS, Ec       = 0.360E+07 LB/SQ IN
     VOLUME OF UNDERREAM       =    0.000  CU.YDS.


    PREDICTED RESULTS
    -----------------

    QS     = ULTIMATE SIDE RESISTANCE;
    QB     = ULTIMATE BASE RESISTANCE;
```

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WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
10.0	1.16	2.94	24.04	26.97	10.95	9.19	23.18
11.0	1.28	5.88	24.04	29.91	13.89	10.36	23.37
12.0	1.40	8.81	24.04	32.85	16.83	11.54	23.52
13.0	1.51	11.75	24.04	35.79	19.76	12.71	23.66
14.0	1.63	14.69	24.04	38.73	22.70	13.89	23.77
15.0	1.75	17.63	24.04	41.66	25.64	15.06	23.87
16.0	1.86	20.56	24.04	44.60	28.58	16.24	23.95
17.0	1.98	23.50	24.04	47.54	31.51	17.41	24.03
18.0	2.09	26.44	24.04	50.48	34.45	18.59	24.10
19.0	2.21	29.38	24.04	53.41	37.39	19.76	24.16
20.0	2.33	32.32	24.04	56.35	40.33	20.94	24.21
21.0	2.44	35.25	24.04	59.29	43.27	22.11	24.26
22.0	2.56	38.19	24.04	62.23	46.20	23.29	24.31
23.0	2.68	41.13	24.04	65.17	49.14	24.46	24.35
24.0	2.79	44.07	24.04	68.10	52.08	25.64	24.38
25.0	2.91	49.94	24.04	73.98	57.95	27.99	25.43
26.0	3.03	52.88	24.04	76.92	60.89	29.16	25.42
27.0	3.14	55.82	24.04	79.85	63.83	30.34	25.42
28.0	3.26	58.76	24.04	82.79	66.77	31.51	25.41
29.0	3.37	61.69	26.67	88.37	70.58	33.57	26.18
30.0	3.49	64.63	29.84	94.47	74.58	35.80	27.06
31.0	3.61	67.57	31.42	98.99	78.04	37.50	27.44
32.0	3.72	70.51	31.42	101.93	80.98	38.68	27.37
33.0	3.84	73.44	31.42	104.86	83.92	39.85	27.31
34.0	3.96	76.38	31.42	107.80	86.86	41.03	27.25
35.0	4.07	84.28	31.42	115.70	94.76	44.19	28.41
36.0	4.19	92.21	31.42	123.63	102.68	47.36	29.51
37.0	4.31	100.17	31.42	131.59	110.64	50.54	30.56
38.0	4.42	108.14	31.42	139.56	118.62	53.73	31.56
39.0	4.54	116.14	31.42	147.56	126.61	56.93	32.51
40.0	4.65	124.15	31.42	155.57	134.63	60.13	33.42
41.0	4.77	132.18	31.42	163.60	142.65	63.34	34.29
42.0	4.89	140.21	31.42	171.63	150.69	66.56	35.12
43.0	5.00	148.26	31.42	179.68	158.73	69.78	35.91
44.0	5.12	156.30	31.42	187.72	166.78	72.99	36.66
45.0	5.24	164.35	31.42	195.77	174.83	76.21	37.38
46.0	5.35	172.40	31.42	203.82	182.87	79.43	38.08
47.0	5.47	180.44	31.42	211.86	190.91	82.65	38.74
48.0	5.59	188.47	31.42	219.89	198.95	85.86	39.37
49.0	5.70	196.50	31.42	227.92	206.97	89.07	39.97
50.0	5.82	204.51	31.42	235.93	214.98	92.28	40.55
51.0	5.93	212.50	31.42	243.92	222.98	95.47	41.10
52.0	6.05	220.48	31.42	251.90	230.95	98.66	41.63
53.0	6.17	228.43	31.42	259.85	238.90	101.85	42.13
54.0	6.28	236.36	31.42	267.78	246.83	105.02	42.61
55.0	6.40	244.26	31.42	275.68	254.73	108.18	43.07

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.5485E+00	0.3210E-03	0.4582E-02	0.1000E-03

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0.5485E+01	0.3210E-02	0.4582E-01	0.1000E-02
0.1375E+02	0.8028E-02	0.1146E+00	0.2500E-02
0.2771E+02	0.1611E-01	0.2291E+00	0.5000E-02
0.4167E+02	0.2421E-01	0.3437E+00	0.7500E-02
0.5507E+02	0.3228E-01	0.4582E+00	0.1000E-01
0.1099E+03	0.7377E-01	0.1146E+01	0.2500E-01
0.1603E+03	0.1265E+00	0.2291E+01	0.5000E-01
0.1812E+03	0.1645E+00	0.3437E+01	0.7500E-01
0.1940E+03	0.1975E+00	0.4582E+01	0.1000E+00
0.2184E+03	0.3653E+00	0.1121E+02	0.2500E+00
0.2184E+03	0.6189E+00	0.1808E+02	0.5000E+00
0.2237E+03	0.8732E+00	0.2353E+02	0.7500E+00
0.2284E+03	0.1127E+01	0.2836E+02	0.1000E+01
0.2449E+03	0.2541E+01	0.4587E+02	0.2400E+01

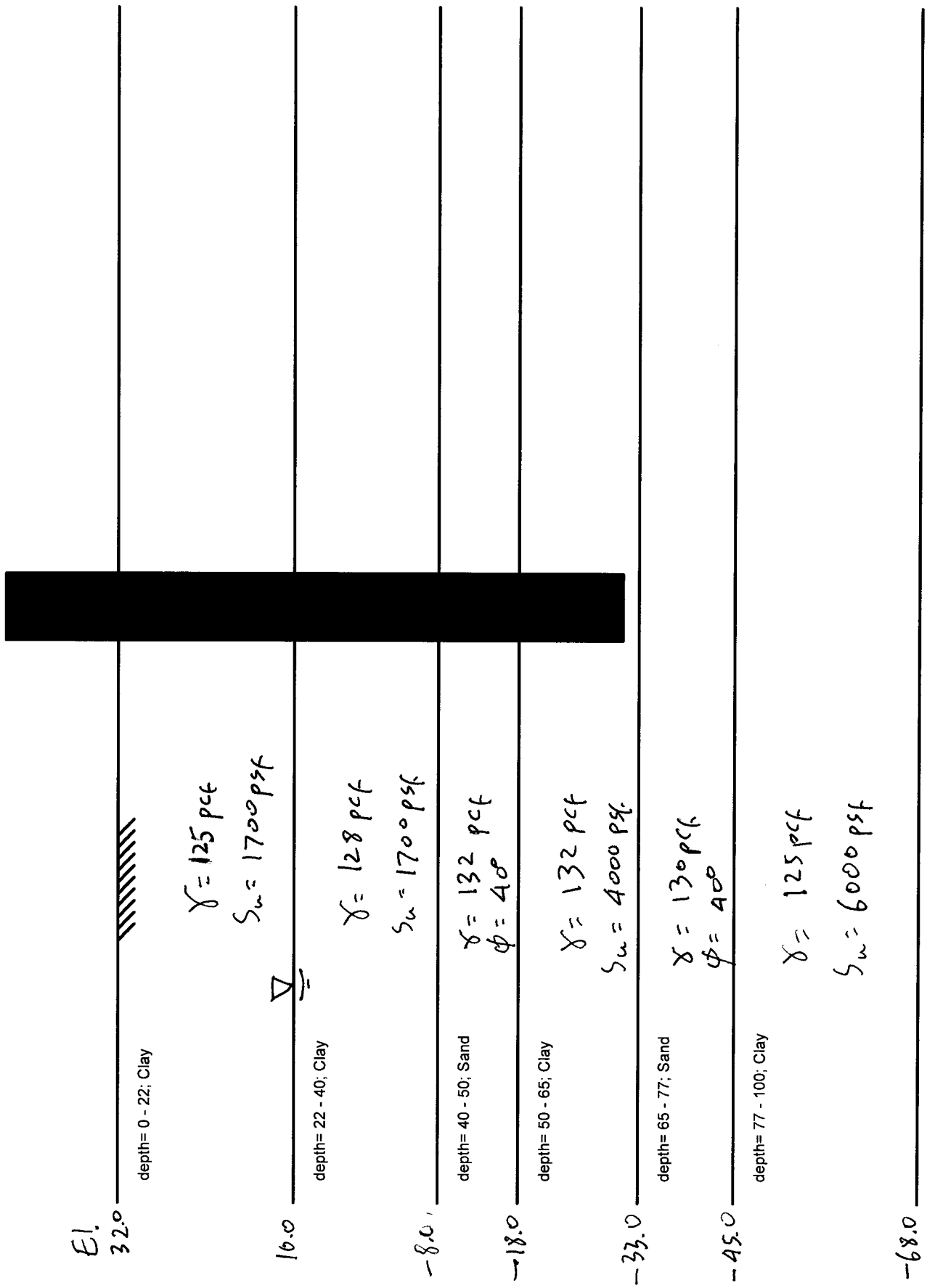
Bent 2

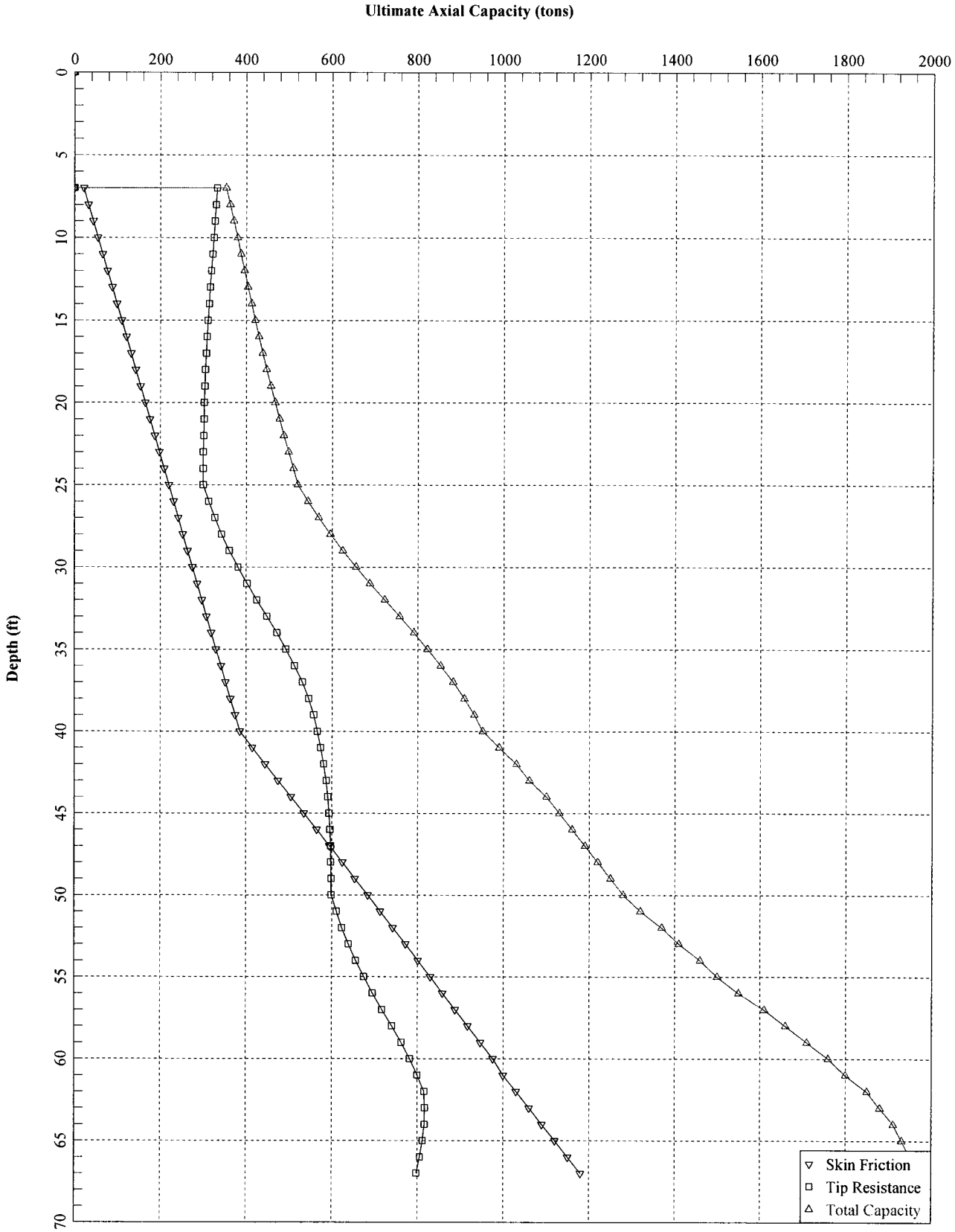
90 - in CIDH Pile

Boring: COL-124

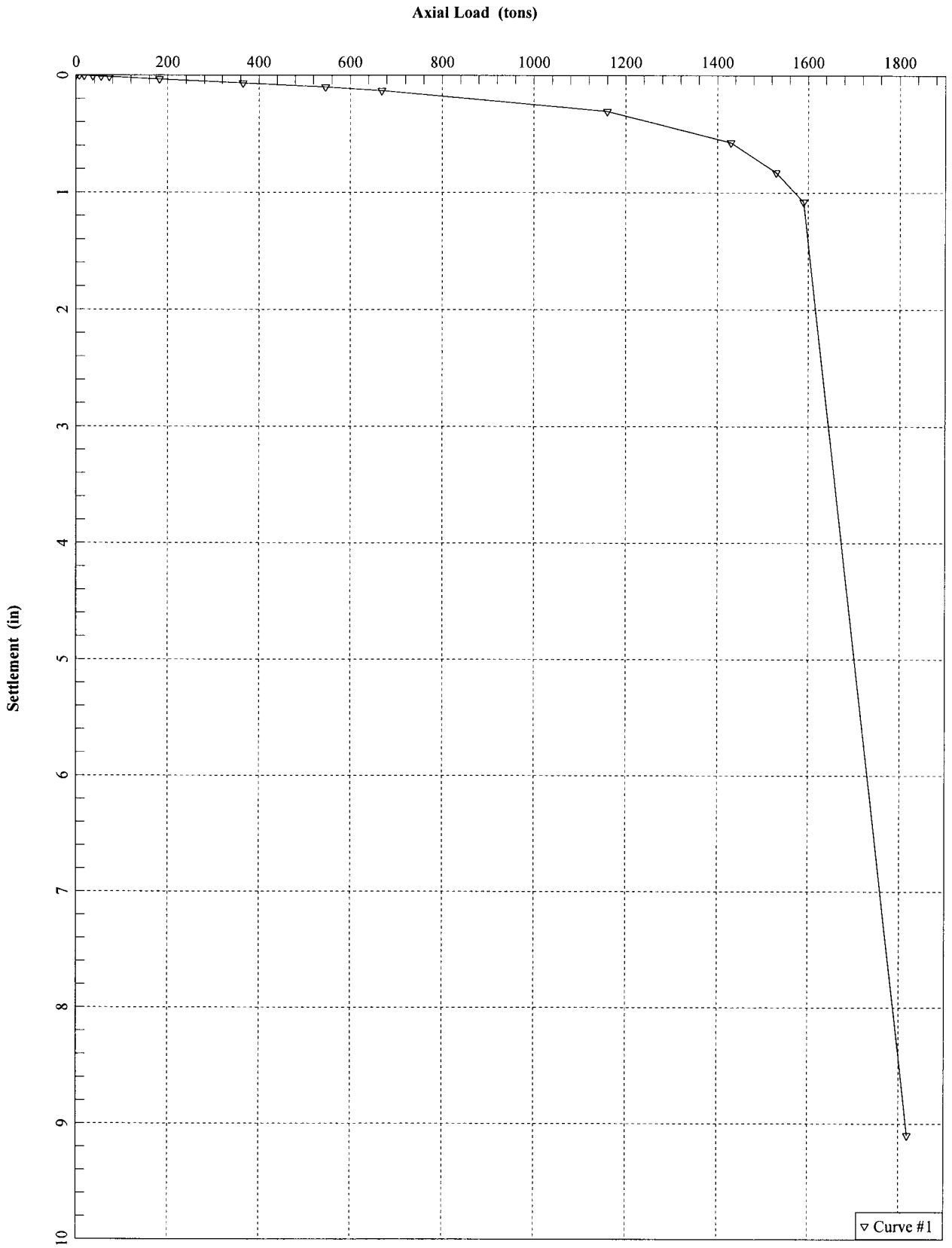
(based on boring CLO-124

Pile Length: 67'





Contra Loma eBART - Bent 2 - 90-in CIDH Pile - Boring CLO-124 - 67-ft long



Contra Loma eBART - Bent 2 - 90-in CIDH Pile - Boring CLO-124 - 67ft long

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VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

     Contra Loma eBART- Bent 2 - 84 in CIDH - CLO-124

    PROPOSED DEPTH =      67.0 FT
    ----------------

    NUMBER OF LAYERS =    6
    ------------------

    WATER TABLE DEPTH =      22.0 FT.
    -------------------

    FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 2.50
    --------------------------------------------------------
    FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
    -------------------------------------------------------

    SOIL INFORMATION
    ----------------

    LAYER NO 1----CLAY

      AT THE TOP

      STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
      END BEARING COEFFICIENT-Nc                       = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.170E+04
      DEPTH, FT                                        = 0.000E+00

      AT THE BOTTOM

      STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
      END BEARING COEFFICIENT-Nc                       = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.170E+04
      DEPTH, FT                                        = 0.220E+02

    LAYER NO 2----CLAY

      AT THE TOP

      STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
      END BEARING COEFFICIENT-Nc                       = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
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```
      SOIL UNIT WEIGHT, LB/CU FT                       = 0.128E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.170E+04
      DEPTH, FT                                        = 0.220E+02

      AT THE BOTTOM

      STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
      END BEARING COEFFICIENT-Nc                       = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                       = 0.128E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.170E+04
      DEPTH, FT                                        = 0.400E+02

    LAYER NO 3----SAND

      AT THE TOP

      SKIN FRICTION COEFFICIENT- BETA                  = 0.646E+00
      UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
      INTERNAL FRICTION ANGLE, DEG.                    = 0.400E+02
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                       = 0.132E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.400E+04
      DEPTH, FT                                        = 0.400E+02

      AT THE BOTTOM

      SKIN FRICTION COEFFICIENT- BETA                  = 0.545E+00
      UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
      INTERNAL FRICTION ANGLE, DEG.                    = 0.400E+02
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                       = 0.132E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.400E+04
      DEPTH, FT                                        = 0.500E+02

    LAYER NO 4----CLAY

      AT THE TOP

      STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
      END BEARING COEFFICIENT-Nc                       = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.450E+04
      INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                       = 0.132E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.640E+04
      DEPTH, FT                                        = 0.500E+02

      AT THE BOTTOM

      STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
      END BEARING COEFFICIENT-Nc                       = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.450E+04
      INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                       = 0.132E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.640E+04
```

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DEPTH, FT = 0.650E+02

LAYER NO 5----SAND

AT THE TOP

SKIN FRICTION COEFFICIENT- BETA = 0.412E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT = 0.000E+00
INTERNAL FRICTION ANGLE, DEG. = 0.400E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.400E+04
DEPTH, FT = 0.650E+02

AT THE BOTTOM

SKIN FRICTION COEFFICIENT- BETA = 0.315E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT = 0.000E+00
INTERNAL FRICTION ANGLE, DEG. = 0.400E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.400E+04
DEPTH, FT = 0.770E+02

LAYER NO 6----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA = 0.550E+00
END BEARING COEFFICIENT-Nc = 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT = 0.600E+04
INTERNAL FRICTION ANGLE, DEG. = 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.640E+04
DEPTH, FT = 0.770E+02

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA = 0.550E+00
END BEARING COEFFICIENT-Nc = 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT = 0.600E+04
INTERNAL FRICTION ANGLE, DEG. = 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.640E+04
DEPTH, FT = 0.100E+03

DRILLED SHAFT INFORMATION

DIAMETER OF STEM = 7.500 FT.
DIAMETER OF BASE = 7.500 FT.
END OF STEM TO BASE = 0.000 FT.
ANGLE OF BELL = 0.000 DEG.
IGNORED TOP PORTION = 5.000 FT.
IGNORED BOTTOM PORTION = 0.000 FT.

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AREA OF ONE PERCENT STEEL = 63.625 SQ.IN.
ELASTIC MODULUS, Ec = 0.360E+07 LB/SQ IN
VOLUME OF UNDERREAM = 0.000 CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
6.0	9.82	11.02	333.48	344.49	122.18	115.57	35.09
7.0	11.46	22.03	331.72	353.75	132.61	119.39	30.88
8.0	13.09	33.05	329.65	362.70	142.93	123.10	27.70
9.0	14.73	44.07	327.32	371.39	153.17	126.73	25.22
10.0	16.36	55.08	324.77	379.85	163.34	130.29	23.21
11.0	18.00	66.10	322.05	388.15	173.45	133.79	21.56
12.0	19.64	77.12	319.21	396.33	183.52	137.25	20.18
13.0	21.27	88.13	316.31	404.44	193.57	140.69	19.01
14.0	22.91	99.15	313.53	412.68	203.66	144.17	18.01
15.0	24.55	110.17	310.99	421.15	213.83	147.73	17.16
16.0	26.18	121.18	308.70	429.89	224.08	151.37	16.42
17.0	27.82	132.20	306.69	438.89	234.43	155.11	15.78
18.0	29.46	143.22	304.96	448.18	244.87	158.94	15.22
19.0	31.09	154.23	303.52	457.75	255.41	162.87	14.72
20.0	32.73	165.25	302.37	467.62	266.04	166.89	14.29
21.0	34.37	176.27	301.50	477.77	276.77	171.01	13.90
22.0	36.00	187.28	300.87	488.16	287.57	175.20	13.56
23.0	37.64	198.30	300.45	498.75	298.45	179.47	13.25
24.0	39.28	209.32	300.19	509.51	309.38	183.79	12.97
25.0	40.91	220.33	300.05	520.39	320.35	188.15	12.72
26.0	42.55	231.35	312.71	544.06	335.59	196.78	12.79
27.0	44.18	242.37	327.05	569.42	351.38	205.96	12.89
28.0	45.82	253.38	343.10	596.48	367.75	215.72	13.02
29.0	47.46	264.40	360.90	625.30	384.70	226.06	13.18
30.0	49.09	275.42	380.50	655.92	402.25	237.00	13.36
31.0	50.73	286.43	401.96	688.39	420.42	248.56	13.57
32.0	52.37	297.45	425.33	722.78	439.22	260.76	13.80
33.0	54.00	308.47	449.07	757.53	458.15	273.08	14.03
34.0	55.64	319.48	471.54	791.02	476.66	284.97	14.22
35.0	57.28	330.50	492.58	823.08	494.69	296.39	14.37
36.0	58.91	341.52	512.86	854.38	512.47	307.56	14.50
37.0	60.55	352.53	530.59	883.13	529.40	317.88	14.59
38.0	62.19	363.55	545.57	909.12	545.41	327.28	14.62
39.0	63.82	374.57	557.58	932.14	560.43	335.69	14.61
40.0	65.46	385.58	566.41	951.99	574.38	343.03	14.54
41.0	67.09	415.47	574.22	989.69	606.88	357.60	14.75
42.0	68.73	445.38	580.97	1026.36	639.04	371.81	14.93
43.0	70.37	475.30	586.51	1061.81	670.80	385.62	15.09
44.0	72.00	505.22	590.77	1095.99	702.14	399.01	15.22
45.0	73.64	535.12	593.93	1129.05	733.10	412.02	15.33
46.0	75.28	565.00	596.13	1161.13	763.71	424.71	15.42
47.0	76.91	594.84	597.55	1192.39	794.03	437.12	15.50

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48.0	78.55	624.64	598.33	1222.98	824.09	449.30	15.57
49.0	80.19	654.39	598.65	1253.03	853.93	461.30	15.63
50.0	81.82	684.06	598.65	1282.71	883.61	473.17	15.68
51.0	83.46	713.22	610.57	1323.79	916.75	488.81	15.86
52.0	85.10	742.38	624.09	1366.47	950.41	504.98	16.06
53.0	86.73	771.55	639.26	1410.80	984.63	521.70	16.27
54.0	88.37	800.71	656.12	1456.83	1019.41	538.99	16.49
55.0	90.01	829.87	674.74	1504.61	1054.78	556.86	16.72
56.0	91.64	859.03	695.17	1554.20	1090.75	575.34	16.96
57.0	93.28	888.19	717.46	1605.65	1127.35	594.43	17.21
58.0	94.91	917.35	740.17	1657.53	1164.08	613.67	17.46
59.0	96.55	946.52	761.76	1708.28	1200.44	632.53	17.69
60.0	98.19	975.68	782.07	1757.75	1236.37	650.96	17.90
61.0	99.82	1004.84	800.09	1804.93	1271.54	668.63	18.08
62.0	101.46	1034.00	815.61	1849.61	1305.87	685.47	18.23
63.0	103.10	1063.16	818.27	1881.43	1335.92	698.02	18.25
64.0	104.73	1092.32	817.37	1909.70	1364.78	709.39	18.23
65.0	106.37	1121.49	812.70	1934.18	1392.38	719.49	18.18
66.0	108.01	1148.71	806.27	1954.98	1417.47	728.24	18.10
67.0	109.64	1175.69	798.05	1973.74	1441.70	736.29	18.00

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.7292E+00	0.1329E-03	0.7005E-01	0.1000E-03
0.7292E+01	0.1329E-02	0.7005E+00	0.1000E-02
0.1823E+02	0.3322E-02	0.1751E+01	0.2500E-02
0.3646E+02	0.6644E-02	0.3503E+01	0.5000E-02
0.5469E+02	0.9967E-02	0.5254E+01	0.7500E-02
0.7292E+02	0.1329E-01	0.7005E+01	0.1000E-01
0.1823E+03	0.3322E-01	0.1751E+02	0.2500E-01
0.3651E+03	0.6646E-01	0.3503E+02	0.5000E-01
0.5456E+03	0.9968E-01	0.5254E+02	0.7500E-01
0.6688E+03	0.1309E+00	0.7005E+02	0.1000E+00
0.1164E+04	0.3057E+00	0.1751E+03	0.2500E+00
0.1433E+04	0.5722E+00	0.3299E+03	0.5000E+00
0.1534E+04	0.8288E+00	0.4030E+03	0.7500E+00
0.1589E+04	0.1083E+01	0.4717E+03	0.1000E+01
0.1823E+04	0.9102E+01	0.7909E+03	0.9000E+01

$$\frac{1650-1589}{1823-1589} \times (9.102 - 1.083) + 1.083$$

$$= \frac{61}{234} \times 8.019 + 1.083$$

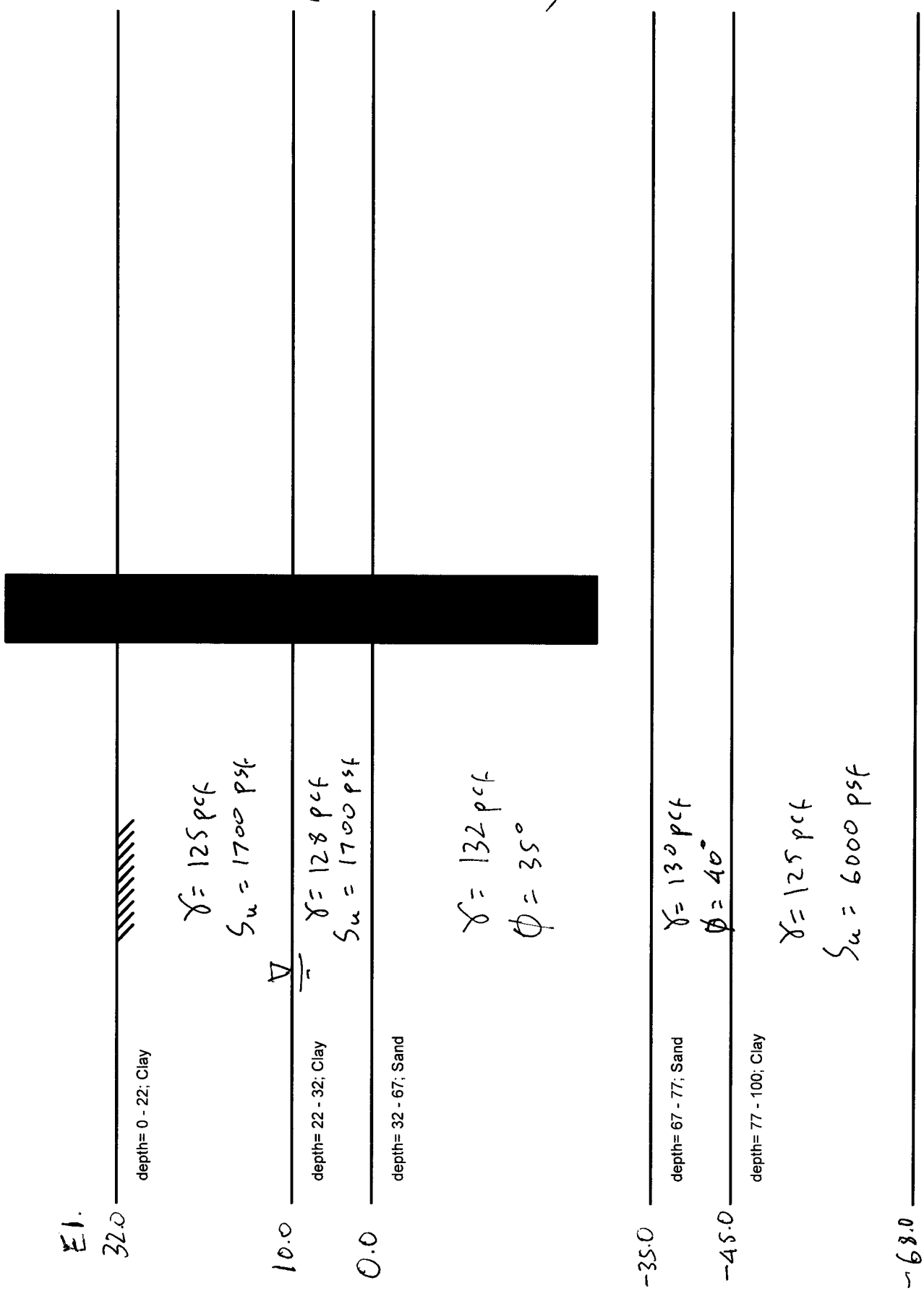
Bent 2

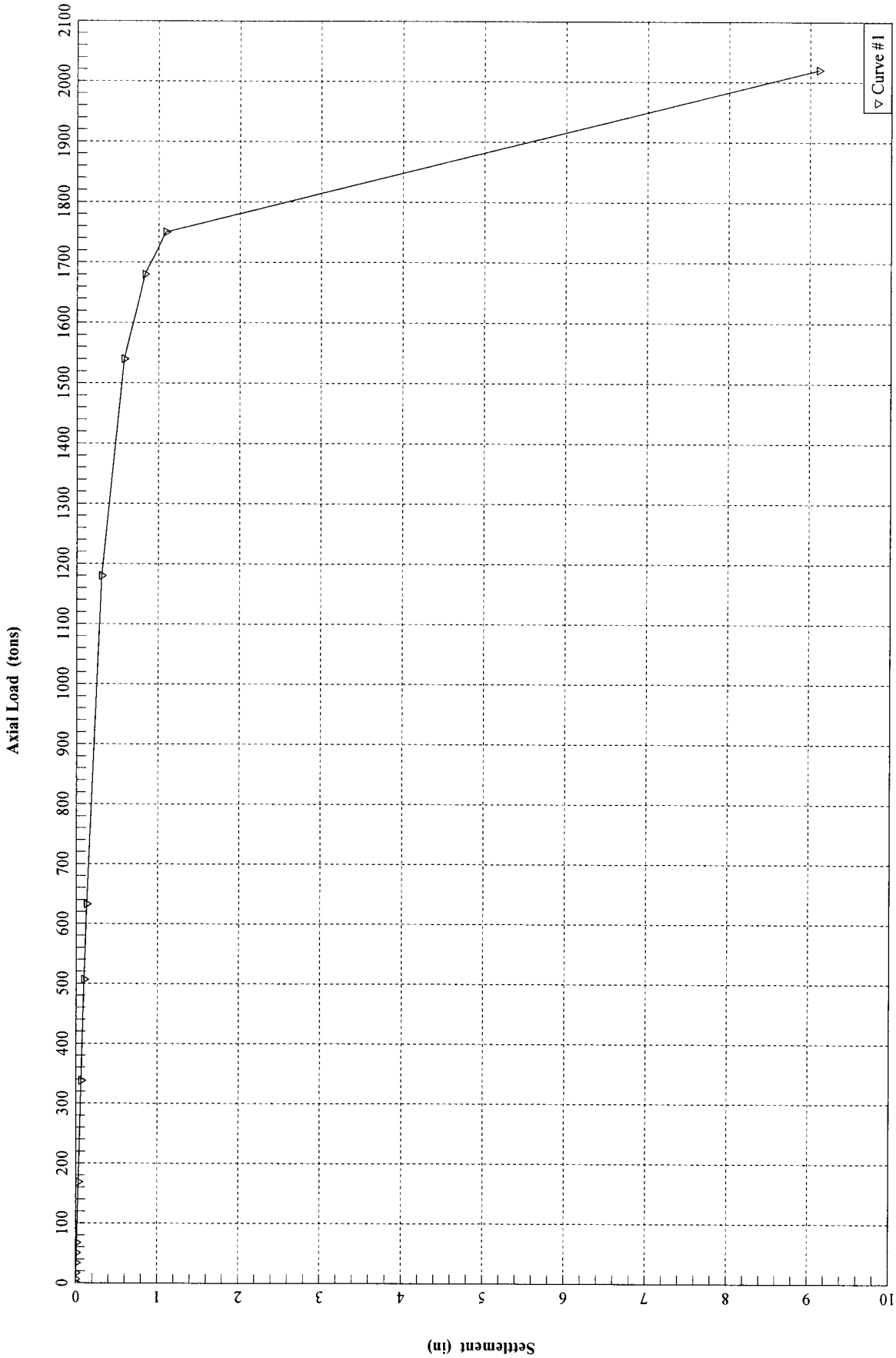
90-in. CIDH Pile

(based on boring CLO-125)

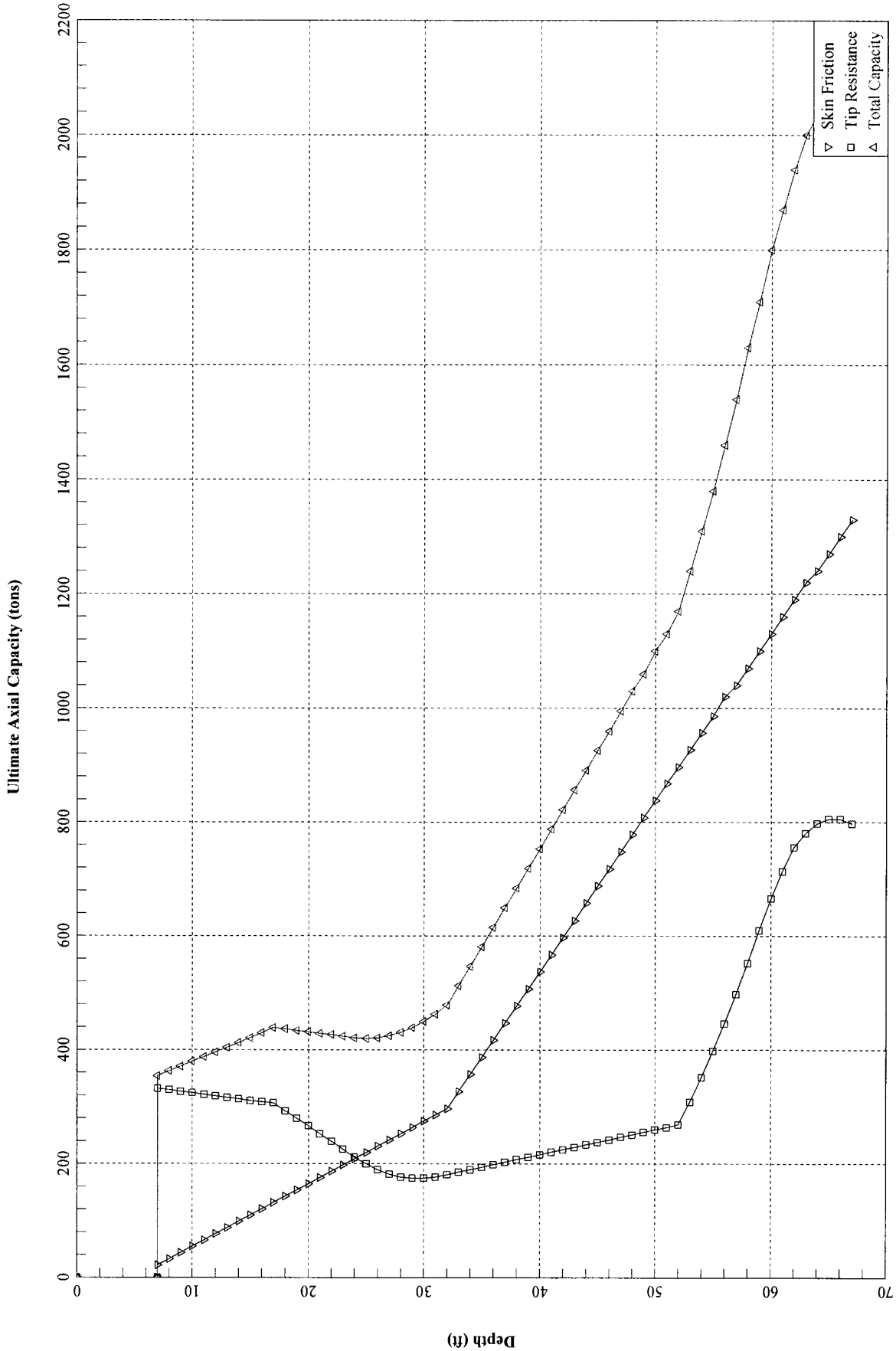
Boring: COL-125

Pile length: 67 ft





Contra Loma eBART - Bent 2 - 90-in CIDH Pile - Boring CLO-125 - 67ft long



Contra Loma eBART - Bent 2 - 90-in CIDH Pile - Boring CLO-125 - 67-ft long

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VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

     Contra Loma eBART- Bent 2  - 84 in CIDH - CLO-125-REvised

    PROPOSED DEPTH =      67.0 FT
    ----------------

    NUMBER OF LAYERS =    5
    ------------------

    WATER TABLE DEPTH =      22.0 FT.
    -------------------

    FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 2.50
    --------------------------------------------------------
    FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
    -------------------------------------------------------

    SOIL INFORMATION
    ----------------

    LAYER NO 1----CLAY

      AT THE TOP

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
      DEPTH, FT                                          = 0.000E+00

      AT THE BOTTOM

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
      DEPTH, FT                                          = 0.220E+02

    LAYER NO 2----CLAY

      AT THE TOP

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
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      SOIL UNIT WEIGHT, LB/CU FT                         = 0.128E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
      DEPTH, FT                                          = 0.220E+02

      AT THE BOTTOM

      STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
      END BEARING COEFFICIENT-Nc                         = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.170E+04
      INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.128E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.170E+04
      DEPTH, FT                                          = 0.320E+02

    LAYER NO 3----SAND

      AT THE TOP

      SKIN FRICTION COEFFICIENT- BETA                    = 0.736E+00
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
      INTERNAL FRICTION ANGLE, DEG.                      = 0.350E+02
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.132E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.400E+04
      DEPTH, FT                                          = 0.320E+02

      AT THE BOTTOM

      SKIN FRICTION COEFFICIENT- BETA                    = 0.395E+00
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
      INTERNAL FRICTION ANGLE, DEG.                      = 0.350E+02
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.132E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.400E+04
      DEPTH, FT                                          = 0.670E+02

    LAYER NO 4----SAND

      AT THE TOP

      SKIN FRICTION COEFFICIENT- BETA                    = 0.395E+00
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
      INTERNAL FRICTION ANGLE, DEG.                      = 0.400E+02
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.130E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.400E+04
      DEPTH, FT                                          = 0.670E+02

      AT THE BOTTOM

      SKIN FRICTION COEFFICIENT- BETA                    = 0.315E+00
      UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
      INTERNAL FRICTION ANGLE, DEG.                      = 0.400E+02
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                         = 0.130E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.400E+04
      DEPTH, FT                                          = 0.770E+02
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LAYER NO 5----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.600E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.640E+04
DEPTH, FT	= 0.770E+02

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.600E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.640E+04
DEPTH, FT	= 0.100E+03

DRILLED SHAFT INFORMATION

DIAMETER OF STEM	=	7.500	FT.
DIAMETER OF BASE	=	7.500	FT.
END OF STEM TO BASE	=	0.000	FT.
ANGLE OF BELL	=	0.000	DEG.
IGNORED TOP PORTION	=	5.000	FT.
IGNORED BOTTOM PORTION	=	0.000	FT.
AREA OF ONE PERCENT STEEL	=	63.625	SQ.IN.
ELASTIC MODULUS, Ec	=	0.360E+07	LB/SQ IN
VOLUME OF UNDERREAM	=	0.000	CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
6.0	9.82	11.02	333.48	344.49	122.18	115.57	35.09
7.0	11.46	22.03	331.72	353.75	132.61	119.39	30.88
8.0	13.09	33.05	329.65	362.70	142.93	123.10	27.70
9.0	14.73	44.07	327.32	371.39	153.17	126.73	25.22

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10.0	16.36	55.08	324.77	379.85	163.34	130.29	23.21
11.0	18.00	66.10	322.05	388.15	173.45	133.79	21.56
12.0	19.64	77.12	319.21	396.33	183.52	137.25	20.18
13.0	21.27	88.13	316.31	404.44	193.57	140.69	19.01
14.0	22.91	99.15	313.53	412.68	203.66	144.17	18.01
15.0	24.55	110.17	310.99	421.15	213.83	147.73	17.16
16.0	26.18	121.18	308.70	429.89	224.08	151.37	16.42
17.0	27.82	132.20	306.69	438.89	234.43	155.11	15.78
18.0	29.46	143.22	293.46	436.68	241.04	155.11	14.82
19.0	31.09	154.23	280.12	434.36	247.61	155.07	13.97
20.0	32.73	165.25	266.70	431.95	254.15	155.00	13.20
21.0	34.37	176.27	253.20	429.47	260.67	154.91	12.50
22.0	36.00	187.28	239.61	426.89	267.15	154.78	11.86
23.0	37.64	198.30	225.90	424.20	273.60	154.62	11.27
24.0	39.28	209.32	212.06	421.38	280.00	154.41	10.73
25.0	40.91	220.33	199.51	419.84	286.83	154.63	10.26
26.0	42.55	231.35	189.61	420.96	294.55	155.74	9.89
27.0	44.18	242.37	182.28	424.65	303.13	157.71	9.61
28.0	45.82	253.38	177.42	430.80	312.52	160.49	9.40
29.0	47.46	264.40	174.95	439.35	322.72	164.08	9.26
30.0	49.09	275.42	174.82	450.24	333.69	168.44	9.17
31.0	50.73	286.43	176.97	463.40	345.42	173.56	9.13
32.0	52.37	297.45	181.34	478.78	357.89	179.42	9.14
33.0	54.00	327.08	185.70	512.77	388.97	192.73	9.50
34.0	55.64	356.81	190.06	546.87	420.16	206.08	9.83
35.0	57.28	386.64	194.43	581.07	451.45	219.46	10.15
36.0	58.91	416.55	198.79	615.34	482.82	232.88	10.45
37.0	60.55	446.54	203.16	649.69	514.26	246.33	10.73
38.0	62.19	476.58	207.52	684.10	545.76	259.81	11.00
39.0	63.82	506.68	211.89	718.56	577.31	273.30	11.26
40.0	65.46	536.81	216.25	753.06	608.90	286.81	11.50
41.0	67.09	566.97	220.62	787.59	640.51	300.33	11.74
42.0	68.73	597.15	224.98	822.13	672.14	313.85	11.96
43.0	70.37	627.33	229.34	856.67	703.78	327.38	12.17
44.0	72.00	657.50	233.71	891.21	735.40	340.90	12.38
45.0	73.64	687.66	238.07	925.73	767.01	354.42	12.57
46.0	75.28	717.78	242.44	960.22	798.59	367.93	12.76
47.0	76.91	747.87	246.80	994.67	830.14	381.42	12.93
48.0	78.55	777.91	251.17	1029.07	861.63	394.89	13.10
49.0	80.19	807.89	255.53	1063.42	893.06	408.33	13.26
50.0	81.82	837.79	259.90	1097.69	924.42	421.75	13.42
51.0	83.46	867.62	264.26	1131.88	955.70	435.13	13.56
52.0	85.10	897.35	268.62	1165.97	986.89	448.48	13.70
53.0	86.73	926.98	308.87	1235.85	1029.94	473.75	14.25
54.0	88.37	956.50	351.88	1308.38	1073.80	499.89	14.81
55.0	90.01	985.90	397.70	1383.60	1118.46	526.93	15.37
56.0	91.64	1015.16	446.35	1461.52	1163.95	554.85	15.95
57.0	93.28	1044.28	497.88	1542.16	1210.24	583.67	16.53
58.0	94.91	1073.25	552.30	1625.56	1257.36	613.40	17.13
59.0	96.55	1102.06	609.66	1711.73	1305.28	644.05	17.73
60.0	98.19	1130.70	665.51	1796.20	1352.53	674.11	18.29
61.0	99.82	1159.15	714.46	1873.62	1397.31	701.82	18.77
62.0	101.46	1187.42	756.39	1943.80	1439.55	727.10	19.16
63.0	103.10	1215.48	780.97	1996.45	1475.80	746.52	19.36
64.0	104.73	1243.33	797.58	2040.91	1509.19	763.19	19.49
65.0	106.37	1270.96	806.07	2077.03	1539.65	777.07	19.53
66.0	108.01	1298.37	806.27	2104.64	1567.12	788.10	19.49
67.0	109.64	1325.53	798.05	2123.58	1591.55	796.23	19.37

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD	TOP MOVEMENT	TIP LOAD	TIP MOVEMENT

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ton	IN.	ton	IN.
0.6760E+00	0.1290E-03	0.7005E-01	0.1000E-03
0.6760E+01	0.1290E-02	0.7005E+00	0.1000E-02
0.1690E+02	0.3224E-02	0.1751E+01	0.2500E-02
0.3380E+02	0.6448E-02	0.3503E+01	0.5000E-02
0.5070E+02	0.9672E-02	0.5254E+01	0.7500E-02
0.6760E+02	0.1290E-01	0.7005E+01	0.1000E-01
0.1690E+03	0.3224E-01	0.1751E+02	0.2500E-01
0.3384E+03	0.6449E-01	0.3503E+02	0.5000E-01
0.5068E+03	0.9673E-01	0.5254E+02	0.7500E-01
0.6328E+03	0.1278E+00	0.7005E+02	0.1000E+00
0.1178E+04	0.3044E+00	0.1751E+03	0.2500E+00
0.1543E+04	0.5758E+00	0.3299E+03	0.5000E+00
0.1675E+04	0.8340E+00	0.4030E+03	0.7500E+00
0.1748E+04	0.1089E+01	0.4717E+03	0.1000E+01
0.2025E+04	0.9110E+01	0.7909E+03	0.9000E+01

Lateral Load Group Factors for ContraLoma eBART Bent 2

22' 14'

6.5' 7.5' 7.5'

Based on Group 7.0 Manual

(See attached Plan; Pile Diameter not equally spaced by 6")

Longitudinal

$S_1 = \frac{14}{7.5} = 1.87$; $(G_f)_1 = 0.64(1.87)^{0.34} = 0.79$

$S_2 = \frac{22}{7.5} = 2.93$; $(G_f)_2 = 0.64(2.93)^{0.34} = 0.92$

$G_f = (G_f)_1 \times (G_f)_2 = \underline{0.73}$

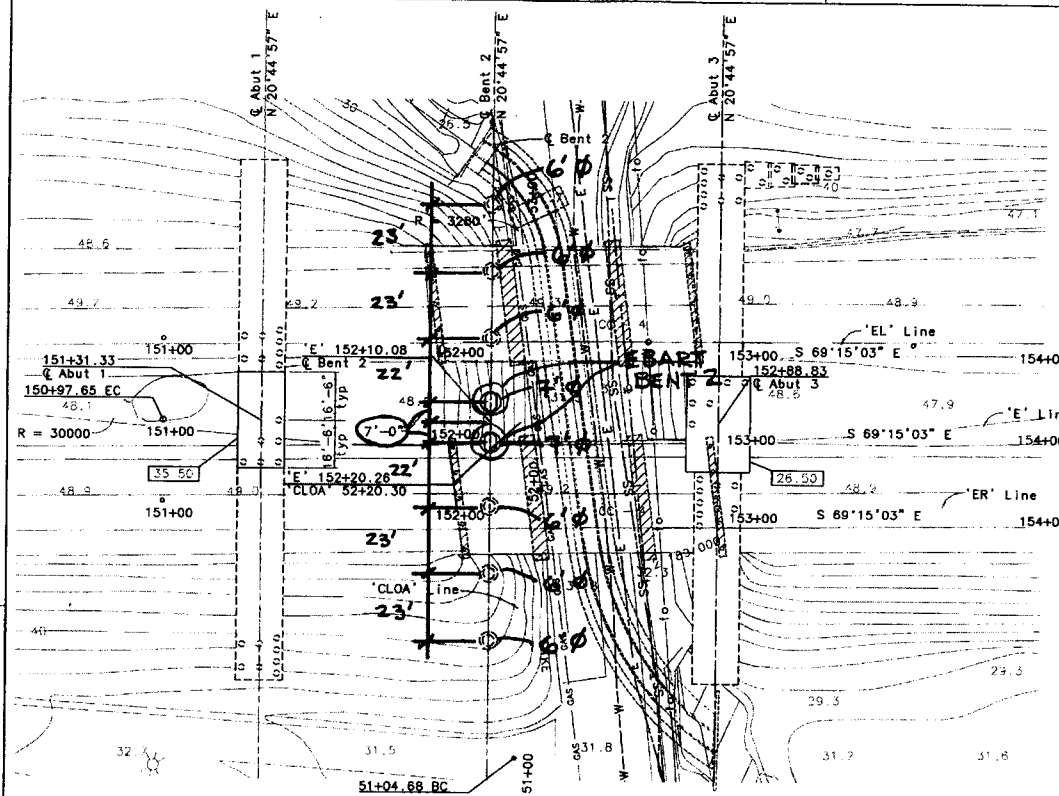
Transverse

(A) Leading: $0.7(2.93)^{0.26} = 0.925$
Trailing: $0.48(1.87)^{0.38} = 0.61$ } 0.56

(B) Leading: $0.7(1.87)^{0.26} = 0.82$
Trailing: $0.48(2.93)^{0.38} = 0.72$ } 0.59

Geotechnical * Environmental * Materials Testing * Construction Inspection
Offices: Milpitas * Fremont * Sacramento * Walnut Creek

INFORMATION HANDOUT



QUANTITIES

Wooden Superstructure	Lump Sum	LS
Structure Excavation (Bridge)	-	CY
Structure Backfill (Bridge)	-	CY
Low Expansion Material	-	CY
24" Cast-in-Drilled-Hole Concrete Piling	-	LF
84" Cast-in-Drilled-Hole Concrete Piling	-	LF
Prestressing Cast-in-Place Concrete	Lump Sum	LS
Structural Concrete, Bridge Footing	-	CY
Structural Concrete (Bridge)	-	CY
Structural Concrete Approach Slab (Type N)	-	CY
Architectural Treatment	-	SQF
Joint Seal (Mk 1")	-	LF
Bar Reinforcing Steel (Bridge)	-	LB
Concrete Barrier	-	LF
Miscellaneous Metal (Bridge)	-	LB

Notes:

1. 35.50 Indicates bottom of footing elevation.
2. 31.6 Indicates spot elevation
3. ○ Indicates CIDH pile, not all piles shown, see 'ABUTMENT PLAN & ELEVATION' sheets.
4. Utilities shown are for illustrative purposes only, verify with utility drawings.
5. ▨ Indicates exist bridge foundation to be removed.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4			

REGISTERED CIVIL ENGINEER DATE

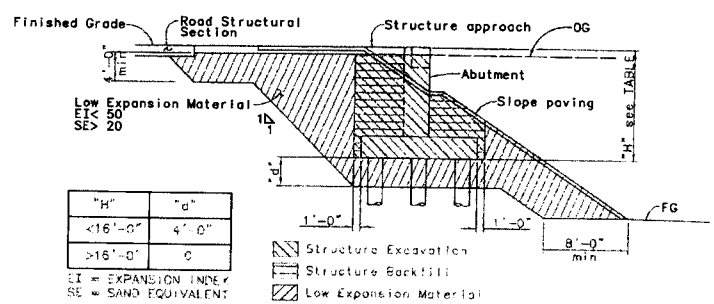
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER ANTHONY P. NOTARO No. C51739 Exp. 6/30/10 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.

CONTRA COSTA COUNTY
PUBLIC WORKS DEPARTMENT
255 GLACIER DRIVE, MARTINEZ, CALIFORNIA 94553

BIGGS CARDOSA ASSOCIATES INC.
1871 THE ALAMEDA, SUITE 200
SAN JOSE, CALIFORNIA 95126



"H"	"d"
<16'-0"	4'-0"
>16'-0"	0

EI = EXPANSION INDEX
SE = SAND EQUIVALENT

EXPANSIVE SOIL EXCLUSION ZONE DETAIL

NO SCALE

BENCH MARK AND DATUM

Monument	Coordinates North	Coordinates East	Elev	Description and location
No. 17	2126079.648	1740726.204	48.83	2002 Mag No
No. 4503	6180387.474	1183347.620	30.21	2" brass LS #4771
No. 4503	6180846.675	1188920.597	31.33	Mag No. & BKT central island

Notes:

1. For Contra Costa Horizontal Control Sheet see 15 in Work Order Notes of 1983. For Contra High Precision Geodetic Network, Epoch 2000.85, coordinates of the California Coordinate System of 1983 (CCS83), Zone 3, in feet. Combined scale factor is 0.99994. Multiply a grid distance by 1.00006 to obtain a ground distance.
2. Vertical datum is based on National Geodetic Vertical Datum of 1929 (NGVD 29).
3. Survey topography and utility data prepared on information provided by BKF Engineers.

Note:
The Contractor shall verify all conditions and dimensions before ordering or fabricating any material.

DESIGN OVERSIGHT	SCALE: AS SHOWN	VERT. DATUM	HORZ. DATUM	DESIGN BY J. HO	CHECKED	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	A. NOTARO PROJECT ENGINEER
	PHOTOGRAMMETRY AS OF:		ALIGNMENT TIES	DETAILS BY J. HO	CHECKED		
SIGN OFF DATE	SURVEYED BY		DRAFTED BY	QUANTITIES BY J. LI	CHECKED		
	FIELD CHECKED BY		CHECKED BY				

BRIDGE NO. 28C0488
POST MILE 26.9

CONTRA LOMA BLVD UNDERPASS
FOUNDATION PLAN

FOUNDATION PLAN SHEET (ENGLISH) (REV. 2-23-05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

CU 04275
EA 228511
FILE => $REQUEST

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 3 OF

04-228554

PROFESSIONAL APPROVAL DATE

FOR CONTRACT NO: 04-2285E4

INFORMATION HANDOUT

PERMITS

California Department of Fish and Game
Mitigation and Monitoring Plan for California Red Legged-Frogs
Biological Opinion and Amendment
State Water Resources Control Board
Mitigation and Monitoring Report for Impacts to Jurisdictional Water of the United States
US Army Corps of Engineer

MATERIAL INFORMATION

Final Foundation Report - Contra Loma UC
Final Foundation Report - Contra Loma UP
Final Foundation Report - G Street OC
Geotechnical Design and Materials Report
Limited Soil Investigation Report, 2610 Contra Loma Boulevard, Antioch, California

CAL-OSHA

Cal-OSHA M&T Unit Underground Classification

WATER SOURCE

Water Source Information

NON-STORMWATER

Non-Stormwater Information Package

MONITORING WELL

Information of Existing Monitoring Well and Conveyance Trench

FORMLINER

Photos of Formliner Samples and Test Panel Samples

PG&E

PG&E Standards - GS&S D-22, UO Standard S4110 and Attachment 1, S4450
Letter from PG&E dated May 13, 2011 and Standard Installation Details-
Natural Gas Pipeline in Box Girder Bridge

CONTRA COSTA TRANSPORTATION AUTHORITY

California Department of Transportation

Caltrans

SR4 (East) Widening Project
Loveridge Road to State Route 160

04-CC-04, KP 37.9/R47.6 (PM 23.7/R29.6

04275-228591

DRAFT
Mitigation and Monitoring Plan for California Red Legged-Frogs

September 2009

URS

Table of Contents

Section 1 Introduction 1-1

Section 2 Project Background 2-1

2.1 Project Description 2-1
2.2 Project Area 2-2

Section 3 Environmental Setting 3-1

3.1 Description of Biological Communities 3-1
3.1.1 Non-Native Grassland 3-1
3.1.2 Palustrine Emergent Wetland 3-1

Section 4 Impacts 4-1

4.1 Summary of Impacts to Federally Listed Species 4-1
4.1.1 California Red Legged Frog Natural History 4-1
4.1.2 Project Impacts to California Red Legged Frogs 4-1

Section 5 Avoidance and Minimization 5-1

5.1 Construction Avoidance and Minimization 5-1
5.2 Biological Monitoring 5-1

Section 6 Mitigation Goals 6-1

6.1 Species Habitat Mitigation Goals 6-1
6.1.1 On-site Restoration 6-1
6.1.2 Off-site Compensatory Mitigation 6-1

Section 7 On-Site Restoration 7-1

7.1 Site Preparation 7-1
7.2 Revegetation 7-1
7.3 Success Criteria And Monitoring 7-2
7.3.1 Upland Areas 7-2
7.3.2 Aquatic Areas 7-3
7.4 Adaptive Management 7-4
7.5 Reporting 7-4

Section 8 Off–Site Mitigation 8-1

8.1 Selection of Off-site Mitigation 8-1
8.2 Off-Site Mitigation For Species Habitat 8-2
8.2.1 Ohlone Preserve Conservation Bank 8-2
8.2.2 Off-Site Mitigation Monitoring of Purchased Credits 8-2

Section 9 References 9-1

Table of Contents

Appendices .....Appendix A: Executed Mitigation Agreement and Payment Reciept

List of Tables, Plates, Figures, and Appendices

Tables

4-1	Temporary and Permanent Impacts to CRLF Habitat
6-1	Mitigation for Aquatic and Upland Impacts to CRLF Habitat
7-1	Success Criteria for On-Site Upland Restoration
7-2	Success Criteria for On-Site Aquatic Areas
8-1	Summary of Mitigation Opportunities Considered in Contra Costa County for the Proposed SR 4 Widening Project

Figures

1	Project Location Map
2	CNDDB Occurrences Map
3	Areas of Impact to California Red-Legged Frog Habitat
4	Revegetation Monitoring Sectors
5	OPCB Service Area

Abbreviations and Acronyms

BO	Biological Opinion
Caltrans	California Department of Transportation
CCTA	Contra Costa Transportation Authority
CDFG	California Department of Fish and Game
CNDDB	California Natural Diversity Database
CRLF	California Red-Legged Frog
ESA	Endangered Species Act
FHWA	Federal Highway Administration
HCP	Habitat Conservation Plan
HOV	High Occupancy Vehicle
KP R	Kilometer Post Revised
Km	Kilometer
OPCB	Ohlone Preserve Conservation Bank
PM	Post Mile
RCB	Reinforced Concrete Box
SR 4	State Route 4
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service

SECTIONONE Introduction

This document describes the proposed on-site restoration and off-site compensatory mitigation proposed for potential impacts to habitat of the federally-threatened California red-legged frog (*Rana aurora draytonii*) resulting from the State Route 4 (SR 4) Widening Project. The SR 4 Widening Project, located in Contra Costa County, would widen a portion of the highway from four to eight lanes. The purpose of the project is to reduce existing congestion, improve traffic operations, encourage high occupancy vehicle (HOV) use, and accommodate anticipated travel demand set in the 20-year Caltrans design criteria, by providing sufficient right-of-way for multi-modal transportation.

The project is estimated to permanently impact 0.221 acre of aquatic habitat and 1.372 acres of upland habitat for California red-legged frog (CRLF). Temporary impacts to CRLF habitat would disturb 0.112 acres of aquatic habitat and 2.410 acres of upland habitat. This report will discuss the project background, avoidance and minimization measures, on-site habitat restoration, and off-site compensation for temporary and permanent impacts to CRLF habitat.

2.1 PROJECT DESCRIPTION

The California Department of Transportation (Caltrans), in cooperation with the Federal Highway Administration (FHWA) and Contra Costra Transportation Authority (CCTA), proposes to widen SR 4, its interchanges, and affected local roadways from approximately 0.8 mile west of Loveridge Road to approximately 0.7 mile east of Hillcrest Avenue (Figure 1). The project will require reconstruction of all interchanges within the project limits and would include the addition of auxiliary lanes between interchanges to facilitate on and off traffic movements.

This project has been separated into 2 phases: The Loveridge Segment (PM 23.7 to 25.8), and the Somersville to SR 160 Segment (PM 25.8 to 29.6). Construction of the Loveridge segment will begin in the summer of 2009 and is expected to be completed in the winter of 2012. Construction of the Somersville to SR 160 Segment are planned to begin in 2010 and will continue for 5 years, ending in 2015.

Project activities for both segments are described below:

- Widen SR 4 from the existing four lanes to eight lanes. The widened freeway would consist of an HOV lane and three mixed-flow lanes in each direction.
- Preserve sufficient width in the SR 4 median through the Loveridge Road Interchange to accommodate the possibility of future public transit improvements.
- Eliminate partial interchange at G Street and reconstruct the overcrossing.
- Add auxiliary lanes on SR 4 between interchanges from the on-ramps to the off-ramps.
- Provide capability to create ramp metering facilities, including HOV preferential lanes and California Highway Patrol (CHP) enforcement areas, where feasible.
- Widen Roosevelt Lane pedestrian undercrossing and the Cavallo Road undercrossing.
- Extend drainage facilities that cross SR 4 in the project area.
- Reconstruct SR 4 interchanges to accommodate the freeway widening at:
  - Loveridge Road
  - Somersville Road
  - Contra Loma Boulevard- L Street
  - Lone Tree Way –A Street
  - Hillcrest Avenue
- The proposed project would conform to improvements currently being constructed to the west of the project area as part of the Route 4/ Railroad Avenue Interchange Project (by others) as well as improvements proposed to the east of the project as part of the SR 4 Bypass Project (by others).
- Within the Loveridge Segment, Existing drainage culverts (Kirker Creek, Old Kirker Creek, Los Medanos Waste Way) will be modified to accommodate the freeway widening.Within the Somersville to SR 160 Segment, Existing drainange culverts that transmit the waters of

West Antioch Creek will be modified to accommodate freeway widening. Details of these modifications are as follows:

- Kirker Creek (Sheet 1) currently crosses SR 4 in a 72” Reinforced Concrete Pipe combined with a twin 10’x 8’ Reinforced Concrete Box (RCB). This project proposes to extend these culverts in-kind to accommodate the roadway widening. The system is capable of handling an ultimate Q50 (2880 CFS) as determined by the Contra Costa Flood Control District (Flood Control District).
- The existing box culvert at Old Kirker Creek (Sheet 2) will be replaced to accommodate the freeway widening. It will be replaced with a double 12’ x 4’ Reinforced Concrete Box capable of passing a Q100 (1060 CFS) as determined by the Contra Costa Flood Control District.
- The Los Medanos Wasteway (Sheet 3) crosses SR 4 in an 8’x 7’ RCB. The project proposes to extend this culvert in-kind to accommodate the roadway widening. The Contra Costa County Water District currently transports raw water through this channel, which is owned by the U.S. Bureau of Reclamation.
- West Antioch Creek (Sheets 4 and 5) crosses SR 4 in a 120-inch diameter concrete pipe which eventually transitions to a 10" x 8' RCB at the downstream outfall. This project proposes to install an additional 120-inch concrete pipe which, when combined with the original culvert, can pass a Q100 (2100 CFS Undeveloped Condition) as determined by Contra Costa County Flood Control District. Improvements to the L Street/Contra Loma Interchange will require the partial removal of an existing triple 5' x 3' RCB and installation of a new 10' x 5' RCB on one of the laterals feeding the Creek. Another major lateral to West Antioch Creek slightly west of this interchange consists of a 42" and a 72" RCP which will need to be extended in-kind to accommodate the widening.

2.2 PROJECT AREA

The project area is defined as the area that may be disturbed during project construction, located on the SR 4 corridor in Contra Costa County, west of Loveridge Road (PM 23.7) to approximately 0.7 miles east of Hillcrest Avenue (PM R29.6). The SR 4 project area is approximately 6.1 miles in length. The project area extends slightly beyond the anticipated 8-lane area of the proposed highway, to accommodate for construction equipment. The proposed project location is depicted in Figure 1.

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

0 1 2
Miles

N

Caltrans

Project Location Map

Figure 1

URS Corporation L:\Projects\State_Route_4_East_Widening_Project_26814914\MXD\Current Working Documents\Project Location_Map_Figure_1.mxd

3.1 DESCRIPTION OF BIOLOGICAL COMMUNITIES

The project corridor encompasses approximately 6.1 miles of highway and ranges in elevation from 12 feet to 35 feet above sea level. Current land use in the project area is primarily commercial, but also includes residential developments and some open agricultural fields.

The vegetation communities identified within the project area include ruderal/disturbed, cropland areas, non-native grassland, and palustrine emergent wetland. Non-native grassland and freshwater emergent wetlands are the two biological communities identified within the project corridor that provide California red-legged Frog (CRLF) -specific habitat.

3.1.1 Non-Native Grassland

This community, primarily composed of non-native annual grasses, native, and non-native forbs, occurs intermittently along SR 4. It is found on a variety of fine-textured soils, which may range from moist, possibly even waterlogged, during the rainy season to very dry during the dry season. Soils along West Antioch Creek that support this community are sandy in nature. This community provides foraging and nesting habitat for a wide variety of wildlife species including raptors, small mammals, amphibians, and reptiles.

3.1.2 Palustrine Emergent Wetland

These wetland areas consisted mainly of the vegetated portions of creeks and flood control channels. This habitat type was found at Kirker Creek, Old Kirker Creek, Los Medanos Wasteway, West Antioch Creek and several unnamed channels. All waterways within the study area have been straightened or diverted into concrete channels.

Vegetation found within these areas included cattails (Typha ssp.), barnyard grass (Echinochloa crus-galli), willows (Salix ssp.), and rabbitsfoot grass (Polypogon monspeliensis). Soils found within this habitat ranged from loamy sands to clay loams (URS 2008). CRLF are among the species that could use these freshwater wetland communities in the greater project area. Within the project area, the only suitable aquatic habitat for CRLF is located along West Antioch Creek. The habitat consists of a perennial flood control channel with vegetated banks.

4.1 SUMMARY OF IMPACTS TO FEDERALLY LISTED SPECIES

The construction activities for the SR 4 Widening Project will result in temporary and permanent loss of habitat for the California Red-Legged Frog, a federally threatened species. The temporary and permanent CRLF habitat impacts are separated into upland and aquatic habitat.

4.1.1 California Red Legged Frog Natural History

The CRLF is listed as threatened under the federal endangered species act (ESA). Currently, CRLF are primarily limited to small coastal drainages between Santa Barbara and areas just north of San Francisco (Jennings and Hayes 1994).

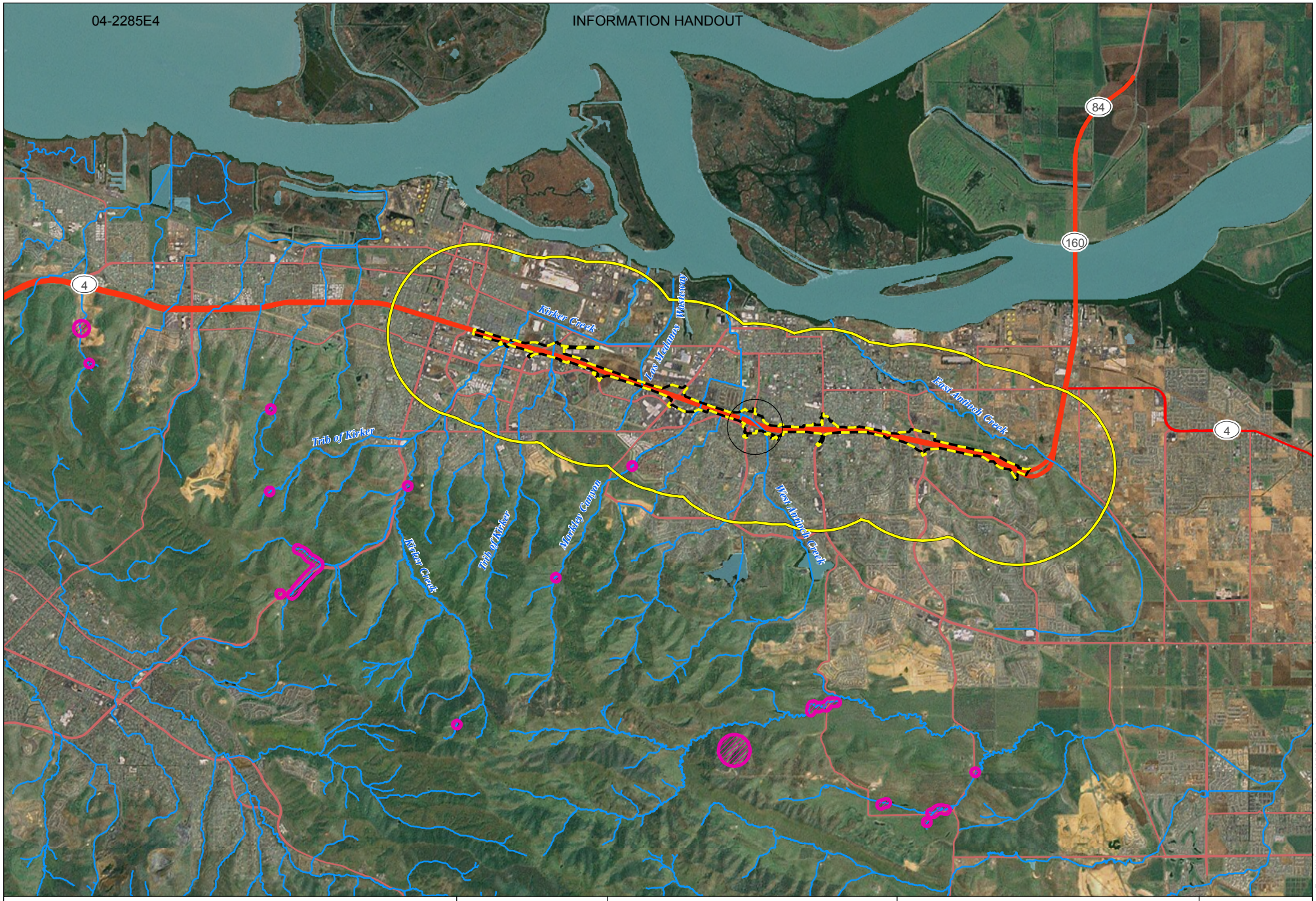
CRLF are generally found along marshes, streams, ponds, and other permanent sources of water where dense woody and emergent vegetation, such as willows, cattails, and bulrushes, dominate. Typical habitat for this species is dense shrubby or emergent riparian vegetation closely associated with deep water (more than 2.3 ft deep). The combination of the above vegetation, as well as the absence of predatory fish and bullfrogs, create ideal habitat for CRLF. Breeding sites occur along watercourses with pools that remain long enough for breeding and will later support the development of larvae. During the dry season, CRLF occupy small mammal burrows and moist leaf litter. This species has been found up to 200 feet from water in adjacent riparian vegetation (Alameda County 2004). CRLF are known to migrate up to 1 mile from aquatic habitats (USFWS 1997).

Although still widespread in the San Francisco Bay Area, the CRLF has been extirpated from 70 percent of its historic range due to excessive destruction of habitat from development, flood control practices, and the introduction of exotic predators.

4.1.2 Project Impacts to California Red Legged Frogs

The quality of CRLF habitat in the SR 4 Widening Project area is extremely low and highly fragmented. Consulting firm Parsons biologists conducted two daytime and two nighttime surveys for CRLF in accordance with USFWS protocol requirements as stated in *Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (USFWS, 1997). These surveys were conducted on all potential habitats within the project limits in May and June 2003. The surveys did not identify any CRLF in the project area (Parsons 2004). Furthermore, a California Department of Fish and Game (CDFG) Natural Diversity Database (CNDDB) search conducted in April 2008 determined that there is only one documented CRLF occurrence within a one-mile radius of the project area. This single occurrence was recorded in July 2002, and is located south of the Somersville Road interchange (Figure 2).

However, after a field review, the USFWS determined that the West Antioch Creek area at the SR 4/ Contra Loma Boulevard – L Street Interchange provides potential habitat for CRLF. USFWS issued a Biological Opinion (BO) on June 13, 2005 (1-1-05-F-0158), stating that it assumes presence of CRLF at West Antioch Creek. Caltrans sent USFWS an amendment to the Biological Opinion on March 27, 2008, in an effort to update the impact acreages based on modified design plans. On April 15, 2008 USFWS responded by issuing an amendment to the BO (1-1-05-F-0158-2).The permanent and temporary impact acreages determined by USFS, as



Highway
Major road
Creek
Area of impact
Project boundary
1-mile buffer
CRLF Occurrence

N

Caltrans

State Route 4 (East) Widening Project
Loveridge to State Route 160

0 1 2
Miles

CNDDB Recorderd
California Red-legged Frog
Occurrences

Figure
2

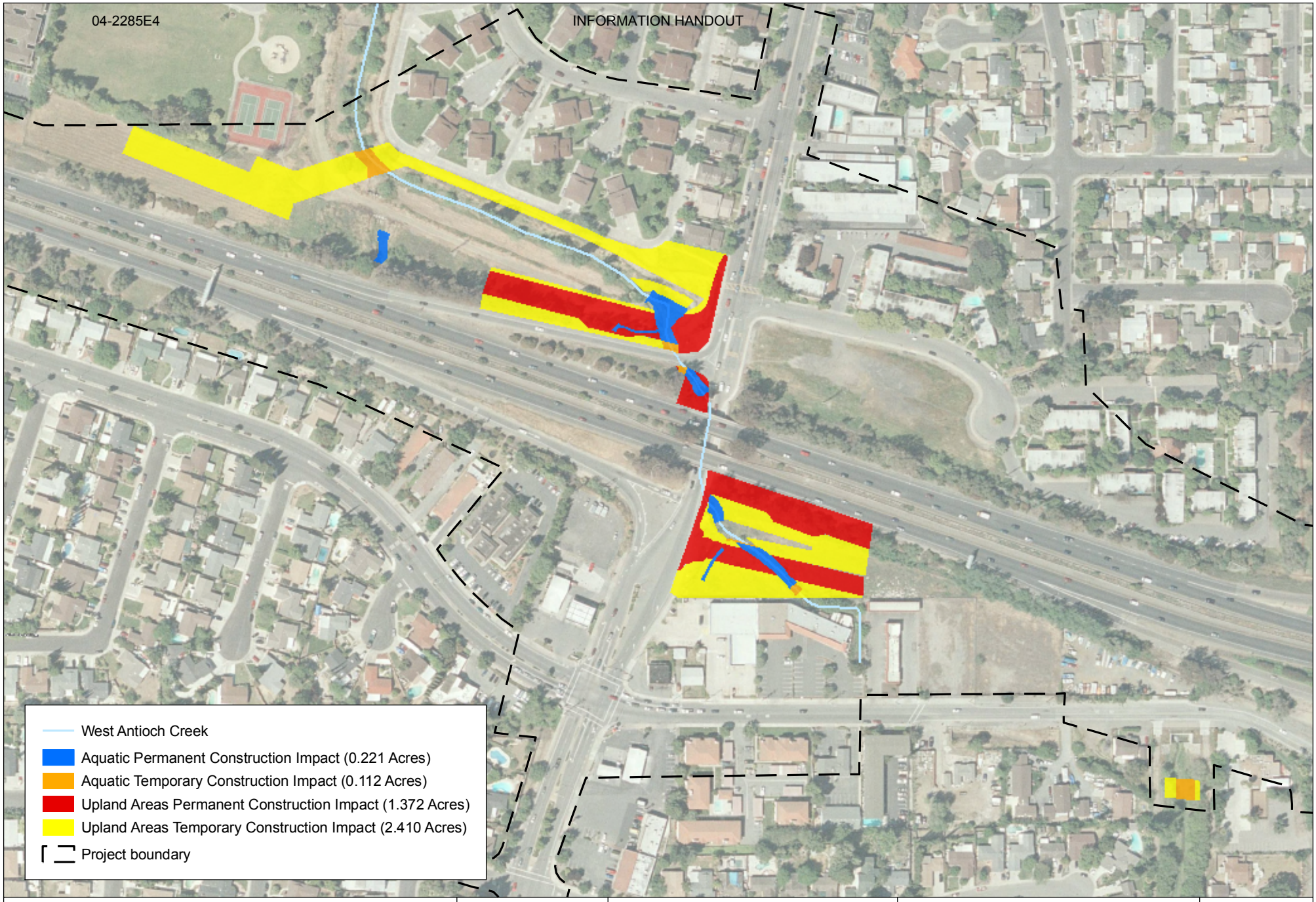
L:\Projects\State_Route_4_East_Widening_Project_26814914\MXD\Current Working Documents\CRLF_Report\Fig_2_CRLF.mxd

discussed, above are shown in Table 4-1. The most recent impacts, based on final design and permitting, are displayed on Figure 3.

Table 4-1 Temporary and Permanent Impacts to CRLF Habitat

	Impacts Stated In The 2005 USFWS Biological Opinion	**Impacts Stated In The 2008 Amendment to USFWS Biological Opinion**
Temporary Aquatic	0.0208	0.112
Temporary Upland	1.0400	2.410
Permanent Aquatic	0.1518	0.221
Permanent Upland	1.4200	1.372
Total	**2.6326**	**4.115**

INFORMATION HANDOUT



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Caltrans

State Route 4 (East) Widening Project
Loveridge to State Route 160

0 200 400
Feet

Areas of Impact to Potential California Red-legged Frog

Figure 3

\\S021emc2\gisdata\Projects\State_Route_4_East_Widening_Project_26814914\MXD\Current Working Documents\CRLF_Report\Fig_3_CRLF_Impacts.mxd

In accordance with the USFWS BO, the amendment to the BO, as well as the Lake and Streambed Alteration Agreement with CDFG, the following measures will be implemented to avoid and minimize impacts to CRLF habitat during project activity:

5.1 CONSTRUCTION AVOIDANCE AND MINIMIZATION

- All construction activities in streambed areas shall be restricted to the dry season, April 15 to October 15, to minimize the potential for take of CRLF.
- A highly visible construction fence outlining environmentally sensitive areas will be installed as a first order of work and will remain until job completion. No work, storage, or other activities shall occur within the environmentally sensitive area.
- When possible, landscape trees growing on the banks of drainages will be cut down, rather than bulldozed or pulled out.

5.2 BIOLOGICAL MONITORING

- The contractor shall furnish a permitted Biological Monitor. The permitted Biological Monitor shall be permitted by the USFWS to handle listed species, specifically the CRLF.
- A general Biological Monitor may be used instead of the permitted Biological Monitor for onsite monitoring in certain instances so long as the general Biological Monitor possesses a 4-year degree in Biology or Environmental Sciences, 1 year of experience in biological wildlife, and the ability to identify the CRLF.
- The permitted Biological Monitor shall be on site during the installation of perimeter barriers and temporary fencing for CRLF,, and during any clearing and grubbing activities in sensitive areas to ensure work areas are clear of listed species. During these activities, the Biological Monitor shall conduct monitoring in the area where work is scheduled and visually survey the entire area where activities will take place before each construction work shift begins.
- When a Biological Monitor is not needed onsite (for the activities outside of the above list), one shall be on call and capable of responding to the work site within 1 hour.
- The Biological Monitor shall maintain complete monitoring records in their possession while conducting monitoring activities.
- When any CRLF is encountered by a Biological Monitor or Contractor’s personnel, construction activities in the immediate area (within a 15-meter radius) of where the frog is found shall be immediately halted. If encountered by the general Biological Monitor, the permitted Biological Monitor, Resident Engineer, and Contractor shall be immediately notified.
- If the general Biological Monitor is onsite and a frog is encountered, the monitor shall protect the frog, at the location where encountered, underneath an inverted 5-gallon white plastic bucket until the permitted Biological Monitor arrives at the site to identify the specimen to species. Any injured or dead CRLF found shall be reported immediately to the on-site

Biological Monitor, who will then notify the USFWS within 24 hours, and prepare a written report by the end of the work shift.

- The permitted Biological Monitor shall conduct a pre-construction employee education program for contractor and state personnel prior to the start of construction. All contractor personnel working on the project shall attend the program. CRLF photo identification cards and information sheets shall be passed out to all workers.
- All sightings of any incidental take shall be reported to the USFWS immediately by telephone.

Caltrans proposes to implement on-site restoration and off-site mitigation for impacts to CRLF habitat. This section describes the long-term goals of the proposed mitigation. These goals are defined by the amount of compensatory mitigation is required due to habitat impacts.

6.1 SPECIES HABITAT MITIGATION GOALS

The proposed CRLF mitigation plan has two primary goals:

- On-site habitat restoration following project completion.
- Off-site compensatory mitigation for permanent habitat losses.

6.1.1 On-site Restoration

The primary onsite mitigation goal is to restore 2.410 acres of upland and 0.112 acres of aquatic temporarily impacted CRLF habitat to pre-project habitat conditions (Table 6-1). CRLF habitat affected by the SR 4 Widening Project will be restored by returning topography to pre-construction conditions and revegetating the project area with native species. Since the current vegetation is primarily composed of non-native ruderal species, the restored habitat is expected to be superior to that currently present in the project area. A brief overview of the restoration plan is provided in Section 7 (On-Site Restoration).

The mitigation ratio for temporary impacts, included in the amendment to the BO, consists of a 1:1 for onsite restoration and 0.1:1 for off-site compensatory mitigation (Table 6-1).

Table 6-1 Mitigation for Aquatic and Upland Impacts to CRLF Habitat

Impact Type	Impact (acres)	Mitigation ratio	On-site Mitigation	Off-site Mitigation
Permanent aquatic	0.221	3:1	--	0.663
Temporary aquatic	0.112	1.1:1	0.112	0.011
Permanent upland	1.372	3:1	--	4.116
Temporary upland	2.410	1.1:1	2.410	0.241
Total	**4.115**	**--**	**2.475**	**5.031**

6.1.2 Off-site Compensatory Mitigation

Caltrans proposes to provide off-site compensation, at a 3:1 mitigation ratio, for the permanent loss of 0.221 acre of aquatic CRLF habitat and the permanent loss of 1.372 acres of upland CRLF habitat (Table 6-2). Caltrans will also provide off-site compensation, at a 0.1:1 mitigation ratio, for the temporary loss of 0.112 acres of aquatic and 2.410 acres of upland CRLF habitat. Total off-site compensation for both permanent and temporary impacts will be 5.031 acres.

SECTIONSEVEN On-Site Restoration

This section describes the methods that will be used to restore the temporarily disturbed on-site areas. On-site restoration will begin by grading the site to pre-construction contours. Following that, the site will be seeded, as described.

7.1 SITE PREPARATION

Before construction begins, photo points will be designated for use during restoration monitoring. Photographs will be taken from these locations prior to the start of construction. Prior to construction disturbance, the top six inches of topsoil will be stripped and stockpiled onsite. The temporarily impacted areas will be re-graded to preconstruction elevations prior to the onset of revegetation. Soils that are not part of fill material used for roadway construction will be ripped or disked (if compacted by construction equipment) to loosen the soil, encouraging water infiltration and plant growth. Stockpiled topsoil will be re-dispersed over the temporarily disturbed areas prior to installation of erosion control measures. Following final grading, a USFWS approved pre-emergence herbicide that affects only broadleaf species will be applied to the upland revegetation sites to prevent the establishment of highly invasive broadleaf plants, such as star thistle (*Centaurea* ssp.) and mustard (*Brassica* ssp.).

Streambank areas receiving rock slope protection shall be back-filled with topsoil (from the project area, if possible). The topsoil will be placed in a manner that fills voids between the rock slope protection and provides a substrate for revegetation.

Erosion control measures will be installed prior to the first winter storms. Erosion control measures will include installing bio-straw or coconut wattles at the top and toe of the banks. Wattles constructed of plastic netting will not be used. Plastic netting commonly used in erosion control products may entrap and injure/kill reptiles and amphibians. Bio-wattles are encased in a tight weave of jute netting that does not cause accidental entrapment of animals. After seeding, erosion control will be completed by placing the above-mentioned materials on slopes.

7.2 REVEGETATION

All temporarily disturbed upland and aquatic areas will be revegetated following project completion. Revegetation plans for this project have been determined by assessing post-construction topography, surrounding plant communities, appropriate native species for planting, and current land use.

The City of Antioch is responsible for preventing pollution and maintaining the storm water system, primarily for flood protection. Maintenance activities in West Antioch Creek include mowing and periodic removal of debris or vegetation that may block flows and significantly increase the potential for flooding. As a result, no trees or shrubs will be planted on site. Construction impacts to existing riparian trees will be mitigated for off-site, and a separate Riparian Enhancement Plan has been developed for that activity. Thus, on-site revegetation is designed to create a grassland community in upland areas bordering West Antioch Creek (Figure 3).

Temporarily disturbed upland areas will be reseeded with native grassland species including species such as California brome grass (*Bromus carinatus*), California poppy (*Eschscholzia californica*), yarrow (*Achillea millefolium*), purple needle grass (*Nassella pulchra*), wild rye (*Leymus triticoides*), California oat grass (*Danthonia californica* var. *californica*), hair grass

(*Deschampsia danthonioides*), Tomcat clover (*Trifolium wildenovii*), bicolor lupine (*Lupinus bicolor*), California meadow barley (*Hordeum brachyantherum*) and California fescue (*Festuca californica*).

In temporarily disturbed aquatic habitat, the banks of the channel will be hydroseeded with the same seed mixture as is applied to the upland areas. Additionally, wetland plants including such species as spreading rush (*Juncus patens*), Baltic rush (*Juncus balticus*), umbrella sedge (*Cyperus* sp.), and other sedges (*Carex* sp.) will be planted, using D 16 container plants, along the active channel. The rhizomatous root structures of rushes and sedges offer great soil binding strength and are flexible, allowing water to flow over the plants without obstructing flow. Sedges and rushes also help filter sediment and provide needed refugia for the California red-legged frog, as well as other species.

Seed mix and plants used for the revegetation will be purchased from a native seed vendor that collects planting materials from local or regional sources in California. In upland areas, seed will be applied to the site following construction before the first winter rains through hydroseeding. If hydro-mulch is used as erosion control, the seed mix shall be added to the hydro-mulch as specified. The seed shall be applied at a rate of at least 50 lbs per acre, along with a guar gum based tackifier and paper or cellulose fiber hydro-mulch. No hydro-mulch will be sprayed into the low flow channel of West Antioch Creek.

After seeding, banks with greater than 2:1 slopes (2h:1v) should have erosion control blankets installed and keyed into the trench used for wattles (Section 7.1), or stabilized in similar ways based on geotechnical design. Erosion control blankets will also be made from jute, straw, or coconut fibers and not contain plastic netting. An alternative to using erosion control blankets on the slopes is to use a higher quality wood cellulose bonded fiber matrix hydro-mulch (or similar product) on steep slopes and a less expensive paper or cellulose fiber hydro-mulch for upland slopes less than 4h:1v. Wetland plants will be installed from container plantings following the installation of erosion control materials.

Following the completion of seeding and planting, photos will be taken from the photopoints established before construction for inclusion in the first monitoring report.

7.3 SUCCESS CRITERIA AND MONITORING

Monitoring will occur once per year during the peak flowering period for grasses, which is the month of May. Monitoring will determine if the following success criteria are being met. If success criteria are not met, adaptive management will be used to meet success criteria the following year, as described in Section 7.4.

7.3.1 Upland Areas

Because no rooted stock will be installed in the upland areas, success will be based on percent cover over a three year monitoring period. Table 7-1 displays the percent cover criteria that will be used to determine success in each of the three years of monitoring.

Table 7-1 Success Criteria for On-site Restoration of Upland Areas

Year	Total Percent Cover	Percent Native Cover
1	30	10
2	40	10
3	60	15

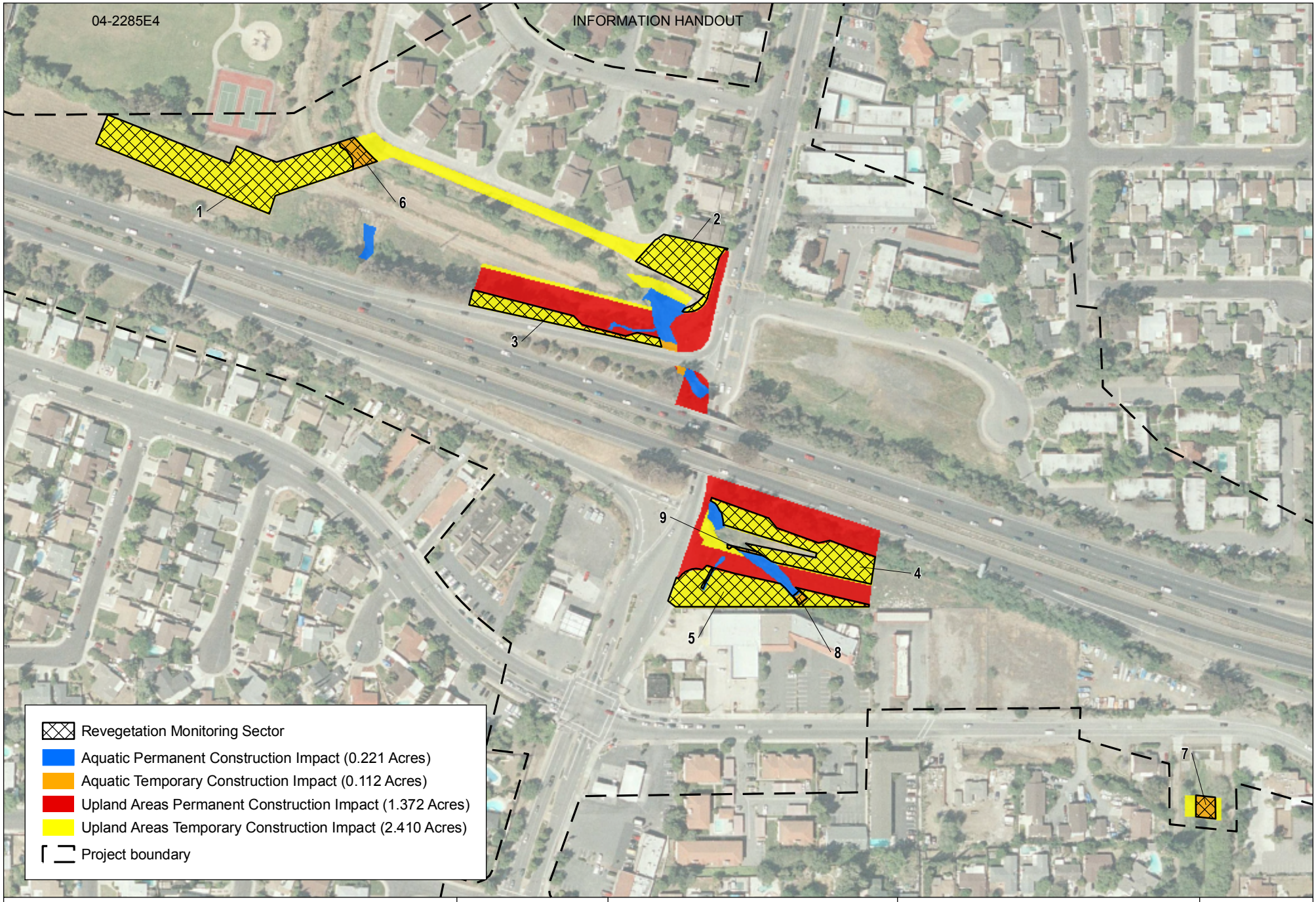
Percent native and non-native cover will be estimated in five randomly selected one-meter square quadrats in each of the five monitoring sectors displayed in Figure 4. Some portions of the revegetation area are excluded from the monitoring sectors due to their thin, linear shape that would make cover analysis difficult. Quadrat location will be randomly selected by walking in a meandering path within each sector and stopping after a predetermined randomly generated number of paces have been taken. The one-meter quadrat will then be placed on the ground in front of the monitor and the percent cover for each species will be determined. In order to randomly generate numbers of paces, a random number list will be generated using the following web site: http://www.random.org/integers/. Before going to the field to conduct monitoring, the monitors will create a set of 100 random numbers between 5 and 25 for this purpose. When using the list, the monitors must proceed down the list, using each number unless infeasible. Quadrats will only be taken in the upland revegetation areas (aquatic habitats and access roads are excluded). An inventory of the plant species will be maintained to assess success of plant establishment and determine if any new seeding will be required.

7.3.2 Aquatic Areas

Rushes and other wetland plants will be installed as rooted stock along the edges of waterways. Success criteria in these locations will be more qualitative, due to the presence of open water in these areas. In addition to vegetative cover, water depth and habitat characteristics will be monitored.

The aquatic areas to be restored have been divided into monitoring sectors in a manner similar to the upland areas. However, monitoring within these sectors will be done by visually estimating the percent cover of aquatic vegetation, open water, and bare banks. Success criteria, as given in Table 7-2, is based on maintaining a range of aquatic habitat characteristics for CRLF. These habitat characteristics are defined as:

- Vegetation/Cover - Includes the basal area of plants as well as any vegetation that overhangs bare areas or open water;
- Bare Banks - Includes gravel or sand banks, and areas of wet mud;
- Open Water/Channel - Includes areas of open pools or flowing water that lack cover, or such otherwise wetted areas that are currently dry due to low seasonal flows.



N

Caltrans

State Route 4 (East) Widening Project
Loveridge to State Route 160

0 100 200
Feet

Revegetation Monitoring Sectors

Figure 4

\\S021emc2\gisdata\Projects\State_Route_4_East_Widening_Project_26814914\MXD\Current Working Documents\CRLF_Report\Fig_4_Monitoring_sectors.mxd

Table 7-2 Success Criteria for On-Site Restoration of Aquatic Areas

Year	Percent Vegetation/Cover	Percent Bare Banks	Percent Open Water/Channel
1	10-40	< 40	50-70
2	15-40	< 40	50-70
3	20-40	< 30	50-70

Within each monitoring sector, a cross section of water depths will be taken across the channel of each monitoring sector . At each cross section, depths will be taken at mid channel and at the quarter width on each side (3 depths total). There are no specific criteria set for depths, but adaptive management may be needed if excessive scouring or sedimentation is occurring.

7.4 ADAPTIVE MANAGEMENT

Adaptive management of the site will occur as needed during the three year monitoring period. The monitoring period should remain (not restart) if a major unforeseeable or uncontrollable event (e.g., fire or flood) occurs requiring the site to be reseeded. Contractors for the site monitoring and maintenance will not be held responsible for such losses as per Caltrans Standard Specification 7-1.165. Portions of the on-site restoration areas are under the jurisdiction of the City of Antioch and the Flood Control District. This plan does not account for future, separate actions taken by these agencies that may result in alterations to the vegetation within the restoration areas. Adaptive management will be used when feasible in the event of such changes.

Management techniques during the monitoring period will be adaptive to particular site characteristics and plant needs to reach desired success criteria. Grassland vegetation will be monitored for total percent cover and percent native cover, and management actions, such as mowing, will be taken as needed. Several native grassland restoration studies have demonstrated that regular disturbance, such as mowing, grazing, or fires, can significantly reduce the abundance of non-native annual grasses, and favors the establishment of perennial grasses (Amme 2003; Barry et al. 2006; DiGregoria 2009). In order to promote perennial grasses, it is recommended that mowing or weed-whacking is conducted no lower than 2-inches above the ground surface, and no higher than 6-inches above the ground surface.

Other maintenance activities may include use of compost, mulching, limited use of herbicides (only after obtaining authorization from USFWS), the correction of any erosion issues, and spot reseeding/replanting where needed.

7.5 REPORTING

Monitoring reports evaluating the performance of the revegetation will be prepared and submitted to USFWS, CDFG, and any other appropriate resource agency at the end of each of the three monitoring years. Monitoring reports will be submitted to USFWS by January 1st of

each year during the monitoring period, beginning on the first January following seeding. All monitoring reports will include the following information:

- Names, titles, and affiliations of all persons who prepared the report and conducted field work;
- An up to date list of consultation history with USFWS regarding the project;
- Analysis of all quantitative monitoring data (percent cover by native and non-native species);
- Electronic or color copies of the annual photo-documentation:
- Maps showing the monitoring area and photo-documentation points; and
- Remedial action recommendations, as needed.

8.1 SELECTION OF OFF-SITE MITIGATION

Locations for off-site mitigation were evaluated based on the following criteria to determine the best replacement habitat:

- Compatibility with CRLF habitat values
- Availability and proximity of lands or projects for enhancement, restoration, and/or creation of CRLF habitat to the proposed project area, ideally within Contra Costa County

All possible mitigation or conservation banks, as well as sites for habitat enhancement and/or creation, in Contra Costa County and the surrounding counties were investigated as possible mitigation opportunities for this project. Potential sites were found in listings from the USFWS and California Department of Fish and Game (CDFG) websites, web searches, and other potential sources. Caltrans contacted multiple organizations and identified projects and potential options for the off-site mitigation project (Table 8-1).

Table 8-1 Summary of Mitigation Opportunities Considered in Contra Costa County and Alameda County for the Proposed SR 4 Widening Project

Site/Organization	Species/Habitat	Acres/Credits Available	Location	Description/Project Status
Ohlone Preserve Conservation Bank	CRLF	Yes	Alameda County	Approved by USFWS to sell CRLF mitigation credits.
East Bay Regional Parks	CRLF, WL	Yes	East Contra Costa County	An HCP covers the restoration of a riparian channel providing habitat for CRLF.
Muir Heritage Land Trust	CRLF, WL	No*	Contra Costa County	Several potential projects available for restoration, protection, and preservation purposes. Nothing concrete specified.
Pleasanton Ridge Conservation Bank	CRLF	No*	Alameda County	Not currently approved by USFWS to sell mitigation credits
California State Parks, Cowell Ranch	CRLF, WL	No*	Contra Costa County	No current projects available for mitigation

CRLF = California Red-Legged Frogs
WL = Wetlands
USFWS = United States Fish and Wildlife Service
HCP = Habitat Conservation Plan
USACE = United States Army Corps of Engineers
*Denotes organizations which do not currently have available programs (as of Nov. 2007), but may become open in the future.

8.2 OFF-SITE MITIGATION FOR SPECIES HABITAT

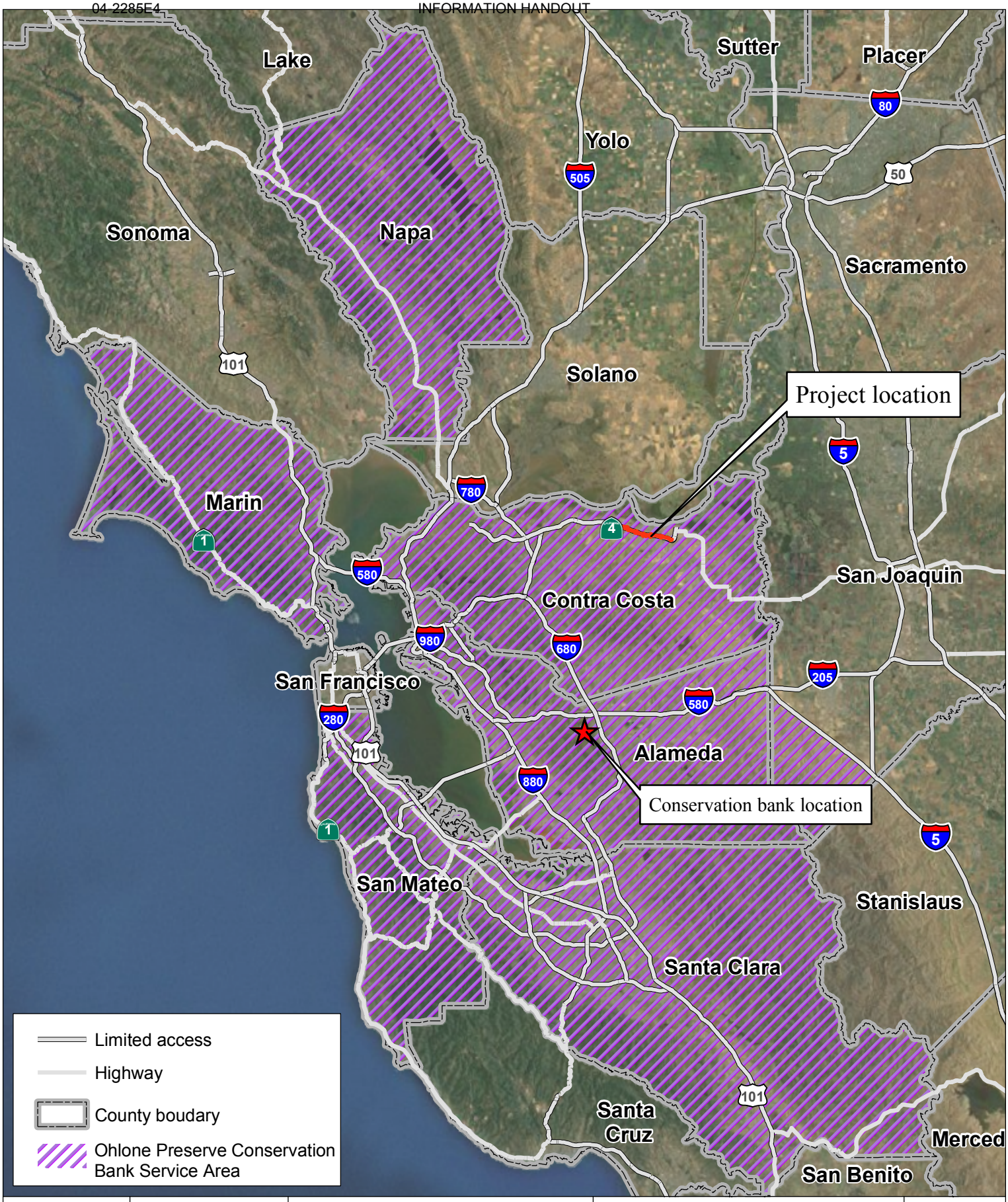
Caltrans proposes the purchase of credits from an approved mitigation bank as compensation for the loss of CRLF habitat resulting from the SR 4 Widening Project. The impacted habitat will be mitigated off-site at a ratio of 3:1 for permanent impacts and 0.1:1 for temporary impacts (5.031 acres total).

8.2.1 Ohlone Preserve Conservation Bank

Located in Livermore, California, the Ohlone Preserve Conservation Bank (OPCB) has 640 acres of sensitive species habitat approved by USFWS and CDFG, including CRLF habitat, available in the form of mitigation credits. The preserve is owned and operated by Fletcher Conservation Properties. This particular approved CRLF conservation bank is in closer proximity to the project area than any other available mitigation bank and offers high-quality riparian habitat similar to that being affected by the SR 4 Widening Project. Also, since the SR 4 project area is located within the OPCB service area (Figure 5), OPBC would be well-suited mitigation site for the SR 4 Widening Project. USFWS gave written approval for Caltrans to purchase mitigation credits at OPCB to cover its SR 4 mitigation obligations for CRLF (written communication with John Cleckler, April 1, 2008). Following this approval, Caltrans proceeded to negotiate the purchase of 5.04 acres of CRLF mitigation from OPCB. This process was completed on August 1, 2008. A copy of the executed agreement and payment receipt has been provided in Appendix A.

8.2.2 Off-Site Mitigation Monitoring of Purchased Credits

Monitoring of the habitats at the OPCB is the responsibility of the mitigation bank manager or owner.



N

Caltrans

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

0 10 20
Miles

Ohlone Preserve Conservation Bank Service Area

Figure 5

L:\Projects\State_Route_4_East_Widening_Project_26814914\MXD\Current Working Documents\CRLF_Report\Fig_4_Ohlone_Service_Area.mxd

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Appendix A

Executed California Red-Legged Frog Agreement and Bill of Sale between Contra Costa Transportation Authority and Ohlone Mitigation Bank

OHLONE PRESERVE CONSERVATION BANK

1576 CATALINA CT
LIVERMORE, CA 94550
925-447-2344
EMAIL: rob.fletcher@sbcglobal.net

RECEIVED
OCT 10 2008
By

Thursday, October 09, 2008

Jack Hall
CCTA
3478 Buskirk Ave. Suite 100
Pleasant Hill, CA 94523

Re: Bill of Sale and Payment Receipt for the purchase of CRF Credits for SR 4 Widening Project, Contra Costa County

Dear Jack:

Enclosed is the Bill of Sale and Payment Receipt for the purchase of CRF credits. Copies are being sent to USFWS and CDFG to confirm your purchase.

Thanks again for all of your help on this project.

Sincerely,

Robert N. Fletcher
General Manager

CT255

ORIGINAL

AGREEMENT FOR SALE OF CONSERVATION CREDITS

Bank Service File No. 1-1-00TA-3256
Bank CDFG Tacking No. 1802-2000-050-3

This Agreement for Sale of Conservation Credits ("Agreement") is made and entered into this 1st day of August, 2008 ("Effective Date"), by Robert N. Fletcher and Patricia A Fletcher, husband and wife as joint tenants, Richard S. Fletcher, and C. Nelson and Betty S. Fletcher, Trustees of the C. Nelson and Betty S. Fletcher Revocable Inter Vivos Trust, dated July 21, 1976, DBA Ohlone Preserve Conservation Bank ("Bank"), and the Contra Costa Transportation Authority ("Project Applicant") as follows:

Recitals

A. The Bank has developed the Ohlone Preserve Conservation Bank located in Alameda County, California; and

B. The Bank was approved by the U.S. Fish and Wildlife Service ("Service") and the California Department of Fish and Game ("CDFG") on June 23rd, 2005 and is currently in good standing with these agencies to offer California red-legged frog, Alameda whipsnake, and California tiger salamander Conservation Credits ("Credits") for sale as compensation for the loss of California red-legged frog, Alameda whipsnake, or California tiger salamander habitat through the Ohlone Preserve Conservation Bank Agreement ("Bank Agreement"); and

C. The Bank has authorized Robert N. Fletcher to act as General Manager and to process sales agreements, collect funds and disburse funds relating to the sale of Credits of the bank; and

D. Project Applicant is seeking to implement the project described in Exhibit "A" attached hereto ("Project"), which would unavoidably and adversely impact the California red-legged frog (CRF), and seeks to compensate for the loss of CRF habitat by purchasing Credits from the Bank; and

E. Project Applicant has been authorized by the Service, Service File No.1-1-05-F-0158, to purchase from the Bank 8.4 CRF Credits (5.04 acres of CRF Credits) upon confirmation by the Bank Owner of Credit availability /adequate balance of Credits remaining for sale; and

F. Project Applicant desires to purchase from Bank and Bank desires to sell to Project Applicant 8.4 CRF Credits. The Bank hereby confirms Credit availability/adequate balance of Credits remaining for sale;

Req. 36
8901
A.I-1981
Proj. 3001J
Res. 07-08-PJ
$84,000

NOW, THEREFORE, THE PARTIES AGREE AS FOLLOWS:

1. Bank hereby sells to Project Applicant and Project Applicant hereby purchases from Bank 8.4 CRF Credits (5.04 acres of CRF Credits) for the purchase price of $84,000.00. Upon payment of the purchase price, the Bank will then deliver to Project Applicant an executed Bill of Sale in the manner and form as attached hereto and marked Exhibit "B". The purchase price for said Credits shall be paid by check or, at the option of Bank, wire transfer of funds according to written instruction by Bank to Project Applicant.

2. The sale and transfer herein is not intended as a sale or transfer to Project Applicant of a security, license, lease, easement, or possessory or non-possessory interest in real property, nor the granting of any interest of the foregoing.

3. Project Applicant shall have no obligation whatsoever by reason of the purchase of the Credits, to support, pay for, monitor, report on, sustain, continue in perpetuity, or otherwise be obligated or liable for the success or continued expense or maintenance in perpetuity of the Credits sold, or the Bank. Pursuant to the Bank Agreement and any amendments thereto, and as required by law, Bank shall monitor and make reports to the appropriate agency or agencies on the status of any Credits sold to Project Applicant. Bank shall be fully and exclusively responsible for satisfying any and all conditions placed on the Bank or the Credits by all state or federal jurisdictional agencies.

4. The Credits sold and transferred to Project Applicant shall be non-transferable and non-assignable, and shall not be used as compensatory mitigation for any other Project or purpose, except as agreed to by the Service.

5. Project Applicant must submit payment within thirty (60) days of the Effective Date of this Agreement. If Project Applicant fails to submit payment within the thirty (60) day period, this Agreement will be considered null and void.

6. Upon acquisition of the Credits, the sale is final and under no circumstances shall the Bank be obligated to re-purchase any or part of the Credits.

7. Upon purchase of the Credits specified in paragraph F above, the Bank shall submit to the parties listed in the Notice section of the Bank Agreement copies of the: a) Agreement ; b) Description of Project to be Mitigated (Exhibit A); c) Bill of Sale (Exhibit B); d) Payment Receipt (Exhibit C); e) Copy of e-mail approving use of the Ohlone Bank (Exhibit D) and f) an updated ledger. The updated inventory / ledger must detail: i) Project Applicant; ii) Project Name; iii) Status (sale complete/sale not complete); iv) Credit Sale Date; v) Service File Number and /or CDFG tracking number; vi) U.S. Army Corps of Engineers File Number (if applicable); vii) Total Number of Credits Authorized to Sell; viii) Total Number of Credits Sold to Date (inclusive); and ix) Balance of all Credits Available. The inventory / ledger should include all sales data from bank opening/establishment to the present.

IN WITNESS WHEREOF, the parties have executed this Agreement the day and year first above written.

BANK

Ohlone Preserve Conservation Bank

By: _____ Date: 8/1/2008
Robert N. Fletcher, General Manager

Contra Costa Transportation Authority

By: _____ Date: 23 Sept 2008

Print Name: Robert K. McCleary

Title: Executive Director

Exhibit "A"

DESCRIPTION OF PROJECT
TO BE MITIGATED

State Route 4 Widening Project (Loveridge Road to State Route 160), Contra Costa County, California (Caltrans EA 228511); (Service File No. 1-1-05-F-0158).

Exhibit "B"

BILL OF SALE

Sales No. 1035 (Bank sales number)

Bank Service File No. 1-1-00TA-3256
Bank CDFG Tacking No. 1802-2000-050-3

Project Applicant Service File No. 1-1-05-F-0158

In consideration of $84,000.00, receipt of which is hereby acknowledged, Ohlone Preserve Conservation Bank does hereby bargain, sell and transfer to Contra Costa Transportation Authority (Project Applicant) 8.4 CRF Credits (5.04 acres of CRF Credits) in the Ohlone Preserve Conservation Bank in Alameda County, California, developed and approved by the U. S. Fish and Wildlife Service and the California Department of Fish and Game.

Ohlone Preserve Conservation Bank represents and warrants that it has good title to the Credits, has good right to sell the same, and that they are free and clear of all claims, liens, or encumbrances.

Ohlone Preserve Conservation Bank covenants and agrees with the buyer to warrant and defend the sale of the Credits hereinbefore described against all and every person and persons whomsoever lawfully claiming or to claim the same.

Dated:

Ohlone Preserve Conservation Bank

By: _____
Robert N. Fletcher, General Manager

Exhibit "C"

OHLONE PRESERVE CONSERVATION BANK

PAYMENT RECEIPT

PARTICIPANT INFORMATION

Name: Contra Costa Transportation Authority

Address: 3478 Buskirk Avenue, Suite 100
Pleasant Hill, CA 94523

Telephone: 925-256-4700

Contact: Jack Hall

PROJECT INFORMATION

Project Description: State Route 4 Widening Project (Loveridge Road to State Route 160), Contra Costa County, California (Caltrans EA 228511)

Service File Number: No.1-1-05-F-0158

Species/Habitat Affected: California red-legged frog habitat

Credits to be Purchased: 8.4 California red-legged frog Credits (5.04 acres of CRF Credits)

Payment Amount: $84,000.00

Project Location: State Route 4 Widening Project (Loveridge Road to State Route 160), Contra Costa County, California

County/Address: Contra Costa County

PAYMENT INFORMATION

Payee: Ohlone Preserve Conservation Bank

Payer: Contra Costa Transportation Authority

Amount: $84,000.00

Method of payment:Cash _____ Check No. _____ Money Order No. _____

Received by: _____ Date: _____
(Signature)

Name: Robert N. Fletcher

Exhibit "D"

E-MAIL CORRESPONDANCE APPROVING USE OF OHLONE PRESERVE CONSERVATION BANK

04/01/2008
02:46 PM

Jan

Sheila confirmed that the SR 4 project is not a covered action under the HCP. Although the Service would prefer that the compensation be satisfied closer to the action area and within Contra Costa County, Caltrans/CCTA have approval to use the Ohlone Bank as an option for satisfying the compensation needs for the State Route 4 Widening project, Loveridge to the 160.

Let me know if you have any questions or if I can offer other assistance.

John Cleckler
Coast Bay Delta Branch
U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office
2800 Cottage Way
Sacramento, CA 95825
(916) 414-6600

BILL OF SALE

Sales No. 1035 (Bank sales number)

Bank Service File No. 1-1-00TA-3256
Bank CDFG Tacking No. 1802-2000-050-3

Project Applicant Service File No. 1-1-05-F-0158

In consideration of $84,000.00, receipt of which is hereby acknowledged, Ohlone Preserve Conservation Bank does hereby bargain, sell and transfer to Contra Costa Transportation Authority (Project Applicant) 8.4 CRF Credits (5.04 acres of CRF Credits) in the Ohlone Preserve Conservation Bank in Alameda County, California, developed and approved by the U. S. Fish and Wildlife Service and the California Department of Fish and Game.

Ohlone Preserve Conservation Bank represents and warrants that it has good title to the Credits, has good right to sell the same, and that they are free and clear of all claims, liens, or encumbrances.

Ohlone Preserve Conservation Bank covenants and agrees with the buyer to warrant and defend the sale of the Credits hereinbefore described against all and every person and persons whomsoever lawfully claiming or to claim the same.

Dated: 10/9/2008

Ohlone Preserve Conservation Bank

By: _____
Robert N. Fletcher, General Manager

OHLONE PRESERVE CONSERVATION BANK

PAYMENT RECEIPT

PARTICIPANT INFORMATION

Name: Contra Costa Transportation Authority

Address: 3478 Buskirk Avenue, Suite 100
Pleasant Hill, CA 94523

Telephone: 925-256-4700

Contact: Jack Hall

PROJECT INFORMATION

Project Description: State Route 4 Widening Project (Loveridge Road to State Route 160), Contra Costa County, California (Caltrans EA 228511)

Service File Number: No.1-1-05-F-0158

Species/Habitat Affected: California red-legged frog habitat

Credits to be Purchased: 8.4 California red-legged frog Credits (5.04 acres of CRF Credits)

Payment Amount: $84,000.00

Project Location: State Route 4 Widening Project (Loveridge Road to State Route 160), Contra Costa County, California

County/Address: Contra Costa County

PAYMENT INFORMATION

Payee: Ohlone Preserve Conservation Bank

Payer: Contra Costa Transportation Authority

Amount: $84,000.00

Method of payment:Cash _____ Check No. Wire transfer Money Order No. _____

Received by: Robert N. Fletcher Date: 10/9/08
(Signature)

Name: Robert N. Fletcher

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	CC	4	25.6/26.6	334	619

REGISTERED CIVIL ENGINEER 11/03/09 DATE

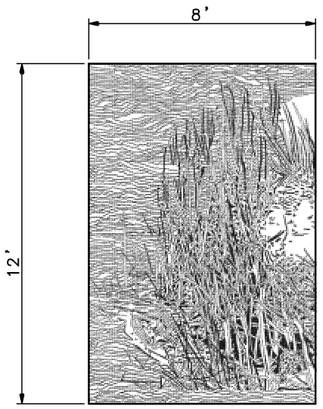
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER S. D. DANSKY No. 60220 Exp. 6/30/10 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.

MARK THOMAS & CO., INC.
1243 ALPINE RD, SUITE 222
WALNUT CREEK, CA 94596

CCTA
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523



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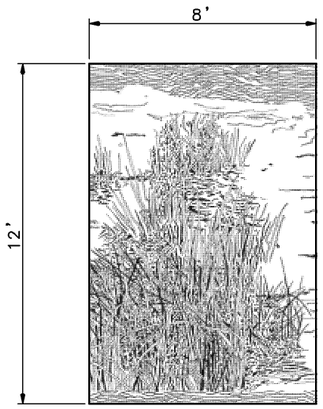

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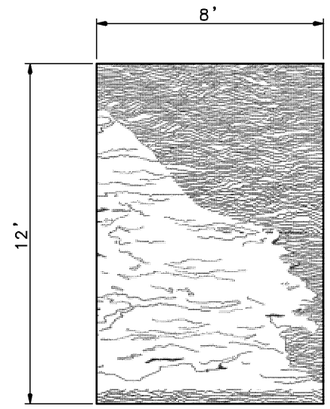

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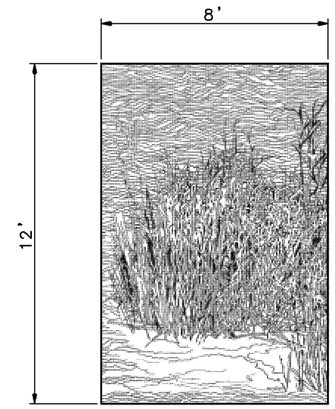

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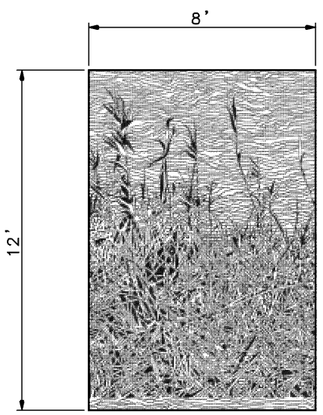

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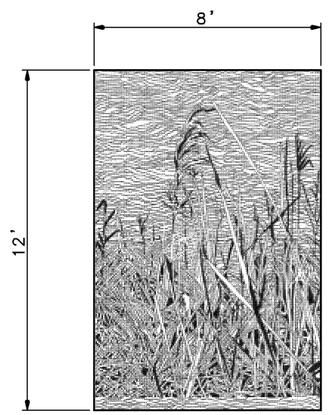

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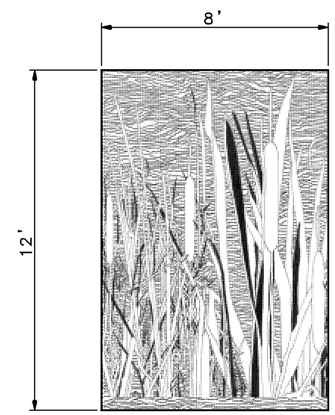

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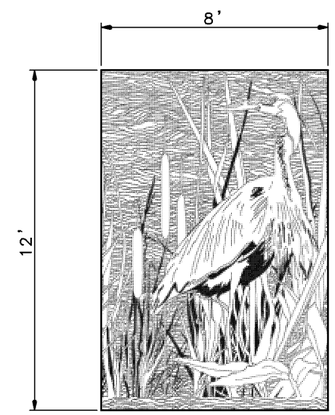

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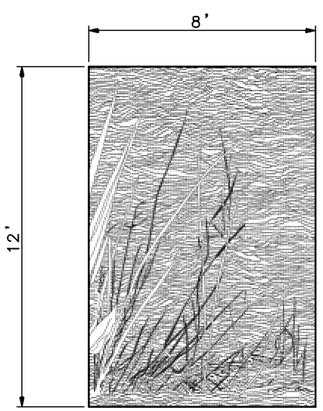

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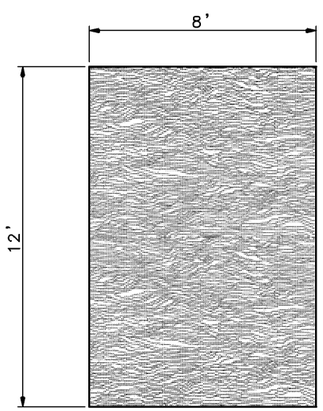

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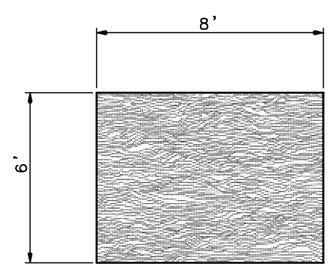


PANEL 11

NOTE:

FORM LINER PANELS SHOWN ARE FOR INFORMATION ONLY. FORM LINERS WILL BE FURNISHED TO THE CONTRACTOR.

LEGEND

(1) IDENTIFIES THE SPECIFIC SINGLE LINER PANEL DESIGN AS SHOWN ON THIS SHEET.

[A] REFERS TO THE SPECIFIC DESIGN GROUPING OF THREE OF THESE SINGLE LINER PANELS AS SHOWN ON SHEET R-12.

100% SUBMITTAL 11/03/09

RETAINING WALL ARCHITECTURAL TREATMENT DETAILS

NO SCALE

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION
Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: MICHAEL J. LOHMAN
CALCULATED-DESIGNED BY: QUYNH NGUYEN
CHECKED BY
REVISED BY
DATE REVISED

PATH: Y:\DATA\56-0104B-Somersville Road Interchange-CCTA\CADD\Drawing\ FILE NAME: SOM-R 11 Arch Treat-1 PLOT DATE: Oct 29, 2009-10:11:08am CAD USER: kyip

LAST REVISION 00-00-00 DATE PLOTTED => $DATE TIME PLOTTED => $TIME

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	CC	4	25.6/26.6	335	619

REGISTERED CIVIL ENGINEER 11/03/09 DATE

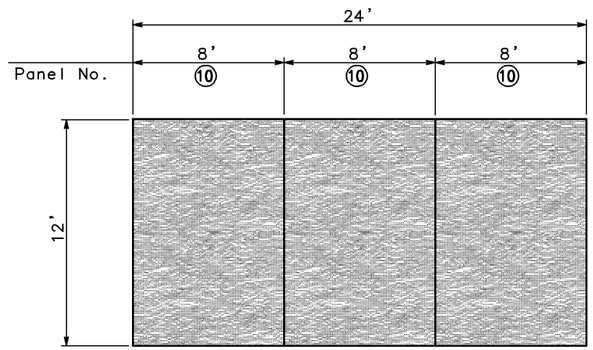
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER S. D. DANSKY No. 60220 Exp. 6/30/10 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.

MARK THOMAS & CO., INC.
1243 ALPINE RD, SUITE 222
WALNUT CREEK, CA 94596

CCTA
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523



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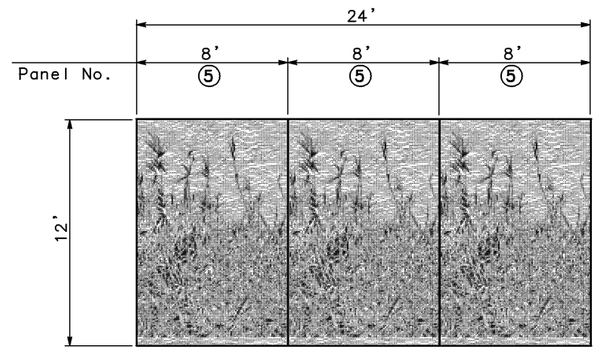

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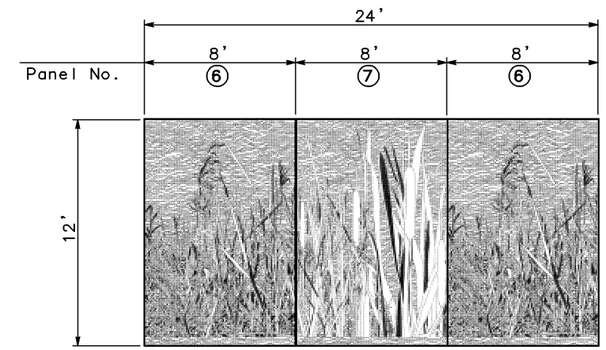

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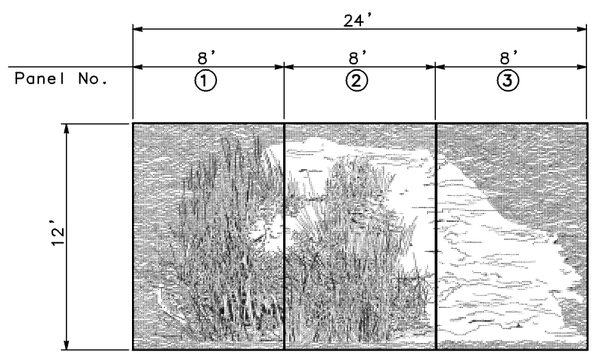
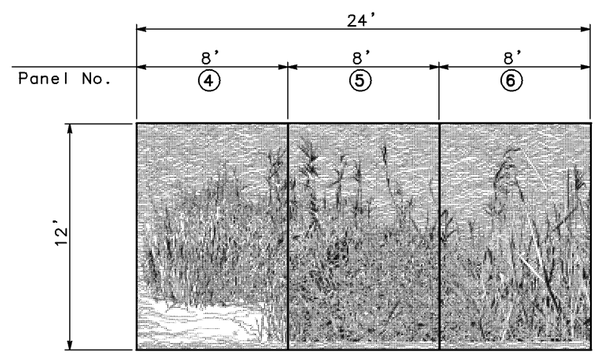
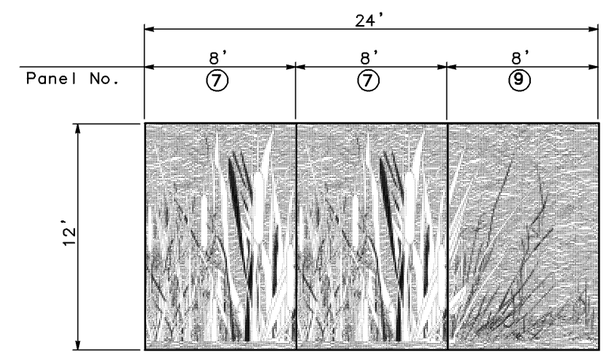


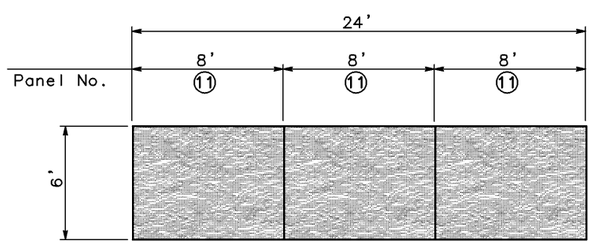
GROUP D



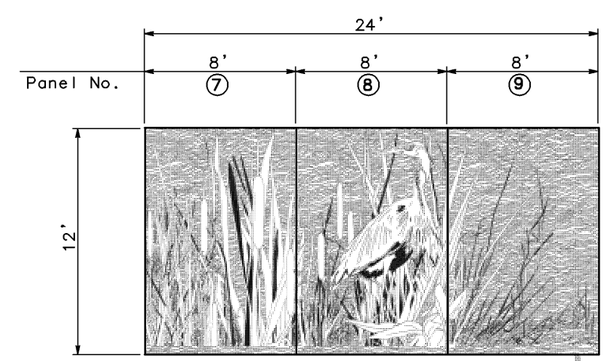
GROUP E



GROUP F1



GROUP G



GROUP F2

NOTE:
FORM LINER PANELS SHOWN ARE FOR INFORMATION ONLY. FORM LINERS WILL BE FURNISHED TO THE CONTRACTOR.

100% SUBMITTAL 11/03/09

RETAINING WALL ARCHITECTURAL TREATMENT DETAILS

NO SCALE

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: MICHAEL J. LOHMAN
CALCULATED-DESIGNED BY: QUYNH NGUYEN
CHECKED BY
REVISED BY
DATE REVISED

PATH: Y:\DATA\56-0104-B-Somersville Road Interchange-CCTA\CADD\Drawing\
FILE NAME: SOM-R 12 Arch Treat-2
PLOT DATE: Oct 29, 2009-10:11:01am
CAD USER: kyip

LAST REVISION 00-00-00
DATE PLOTTED => $DATE
TIME PLOTTED => $TIME

Monitoring Well	Total Depth (ft)	Borehole Diameter (in)	Casing Diameter (in)
MW-6A	32	8*	4
MW-7A	40	8*	4
MW-9U	43	8*	2
MW-10L	55	8*	2
MW-10U	28	8	2
MW-10U-R	31	8	4
MW-11L	47	8	2

* = assumed borehole diameter

04-2285E4

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT
(33 CFR 325)

INFORMATION HANDOUT

OMB APPROVAL NO. 0710-003
Expires October 1996

Public reporting burden for this collection of information is estimated to average 5 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Service Directorate of Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302; and to the Office of Management and Budget, Paperwork Reduction Project (0710-0003), Washington, DC 20503. Please DO NOT RETURN your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY ACT STATEMENT

Authority: 33 USC 401, Section 10; 1413, Section 404. Principal Purpose: These laws require permits authorizing activities in, or affecting, navigable waters of the United States, the discharge of dredged or fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters. Routine Uses: Information provided on this form will be used in evaluating the application for a permit. Disclosure: Disclosure of requested information is voluntary. If information is not provided, however, the permit application cannot be processed nor can a permit be issued.

One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETED

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME Contra Costa Transportation Agency, ATTN: Susan Miller	8. AUTHORIZED AGENT'S NAME AND TITLE *(an agent is not required)* URS Corporation, ATTN: Jan Novak
6. APPLICANT'S ADDRESS 3478 Buskirk Avenue Suite 100 Pleasant Hill, CA 94523	9. AGENT'S ADDRESS 1333 Broadway, Suite 800 Oakland, CA 94612
7. APPLICANT'S PHONE NOS. W/AREA CODE a. Residence b. (925) 256-4736 b. Business	10. AGENT'S PHONE NOS. W/AREA CODE a. Residence b. (510) 874-1733 b. Business

11. STATEMENT OF AUTHORIZATION

I hereby authorize, URS Corporation to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

APPLICANT'S SIGNATURE DATE

NAME, LOCATION AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE *(see instructions)*

SR4 (East) Widening Project Loveridge Road to State Route 160

13. NAME OF WATERBODY, IF KNOWN *(if applicable)* KIRKER CREEK, LOS MEDANOS WASTEWAY, WEST OLD KIRKER CREEK, ANTIOCH CREEK,	14. PROJECT STREET ADDRESS *(if applicable)* N/A
15. LOCATION OF PROJECT Contra Costa (COUNTY) California (STATE)	

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN *(see instructions)*

Please see Attachment Block 16

17. DIRECTIONS TO THE SITE

From **1455 Market Street**
Head **northeast** on **Market St** toward **Polk St**
Turn **right** at **10th St**

Turn **right** at **Howard St**
Slight **left** at **S Van Ness Ave**
Merge onto **Central Fwy/US-101 S** via the ramp to **Oakland/San Jose/US-80**
Take the exit on the **left** onto **I-80 E** toward **Oakland/Bay Bridge**
Take the exit onto **I-580 E** toward **Downtown Oakland/Hayward-Stockton/CA-24**
Take the exit onto **CA-24 E** toward **Walnut Creek**
Take the exit onto **I-680 N** toward **Concord/Sacramento**
Take exit **50** to merge onto **CA-242 N** toward **Pittsburg/Concord**
Take the exit onto **CA-4 E** toward **Pittsburg/Stockton**
Arrive at **Loveridge Road** Interchange

18. Nature of Activity *(Description of project, include all features)*

Please see Attachment Block 18

19. Project Purpose *(Describe the reason or purpose of the project, see instructions)*

Please see Attachment Block 19

USE BLOCKS 20-22 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

Area will be filled to allow for the expansion of State Route 4 from a four (4) lane to an eight (8) lane highway, in order to accommodate present and future growth in Contra Costa County. The primary types of discharges will be roadway fill, culvert extensions and rock slope protection (RSP).

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards

1,008 yd.^{3} Roadway Fill
1,048 yd.^{3} RSP
569 yd.^{3} Concrete
4 yd.^{3} Concrete FES
640 yd.^{3} Concrete Box
150 yd.^{3} Grading
240 yd.^{3} Gravel (temporary fill)
12 yd.^{3} Sand Bags (temporary fill)
8 yd.^{3} Water Filled Cofferdam (temporary fill)

Please see Attachment Block 21 for specific locations and types of discharges.

22. Surface Area in Acres of Wetlands or Other Waters Filled *(see instructions)*

Wetland/Waters of the U.S. (Permanent Impacts): 0.091 acres

Wetland/Waters of the U.S. (Temporary Impacts): 0.048 acres

Other Waters of the US (Permanent Impacts): 0.089 acres

Other Waters of the U.S. (Temporary Impacts): 0.009 acres

Culvert Waters of the U.S. (Temporary Impacts): 0.140 acres

Please see Attachment Block 22 for specific locations and impacts.

23. Is Any Portion of the Work Already Complete? Yes ____ No _X_ IF YES, DESCRIBE THE COMPLETED WORK

24. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the waterbody (If more than can be entered here, please attach a supplemental list).

Please see Attachment Block 24

25. List of Other Certifications or Approvals/Denials Received from other Federal, State or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED

Please see Attachment Block 25

*Would include but is not restricted to zoning, building and flood plain permits

26. Application is hereby made for a permit or permits to authorize the work described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

SIGNATURE OF APPLICANT	DATE	SIGNATURE OF AGENT	DATE

The application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

*U.S.GPO: 1994-520-478/82018

BLOCK 16

The project site is shown on the Antioch North, California U.S. Geological Survey map:

Section: 19 Township: 02N Range: 02E

The project site is shown on the Antioch South, California U.S. Geological Survey map:

Section: 19, 25 Township: 02N Range: 01E

The project site is shown on the Antioch South, California U.S. Geological Survey map:

Section: 20, 28, 29, 30 Township: 02N Range: 02E

The project site is shown on the Honker Bay/ Antioch North, California U.S. Geological Survey map:

Section: Los Medanos Land Grant

The project site is located on SR4 from 1.33 kilometers (0.8 mile) west of Loveridge Road to approximately 1.24 kilometers (0.7 mile) east of Hillcrest Avenue.

BLOCK 18

The California Department of Transportation (Caltrans), in cooperation with the Federal Highway Administration (FHWA) and Contra Costa Transportation Authority (CCTA), proposes to widen State Route 4 (SR4), its interchanges, and affected local roadways from approximately 1.33 kilometers (0.8 mile) west of Loveridge Road to approximately 1.24 kilometers (0.7 mile) east of Hillcrest Avenue. The SR 4 corridor is currently facing severe problems which include traffic congestion and inefficient energy use, as well as deteriorating air quality and traffic safety. Correcting conditions on SR 4 is a necessary component of the overall program to improve transportation through Contra Costa County. The project will require reconstruction of all interchanges within the project limits and would include the addition of auxiliary lanes between interchanges to facilitate on and off traffic movements.

The proposed project will consist of the following actions:

- Widen SR4 from the existing four lanes to eight lanes. The widened freeway would consist of an HOV lane and three mixed-flow lanes in each direction.
- Preserve sufficient width in the SR 4 median through the Loveridge Road Interchange to accommodate the possibility of future public transit improvements.
- Eliminate partial interchange at G Street and reconstruct the overcrossing.
- Add auxiliary lanes on SR 4 between interchanges from the on-ramps to the off-ramps.
- Provide capability to create ramp metering facilities, including high occupancy vehicle (HOV) preferential lanes and California Highway Patrol (CHP) enforcement areas, where feasible.
- Widen Roosevelt Lane pedestrian undercrossing and the Cavallo Road undercrossing.
- Extend drainage facilities that cross SR4 in the project area.
- Reconstruct SR4 interchanges to accommodate the freeway widening at:
    - Loveridge Road
    - Somersville Road
    - Contra Loma Boulevard- L Street
    - Lone Tree Way –A Street
    - Hillcrest Avenue
- The proposed project would conform to improvements currently being constructed to the west of the project area as part of the Route 4/ Railroad Avenue Interchange Project (by others) as well as improvements proposed to the east of the project as part of the SR4 Bypass Project (by others).

- Caltrans is undertaking final design of the first segment of the project, Loveridge Road to Somersville Road. Considerations for the remainder of the SR4 East corridor from Somersville Road to the eastern project limit (1.6 kilometers east of Hillcrest) is based on project design plans.
- Existing drainage culverts (Kirker Creek, Old Kirker Creek, Los Medanos Waste Way, and West Antioch Creek) will be modified to accommodate the freeway widening:
    - Kirker Creek (Sheet 1) currently crosses SR4 in a 72” Reinforced Concrete Pipe combined with a twin 10’x8’ Reinforced Concrete Box (RCB). This project proposes to extend these culverts in-kind to accommodate the roadway widening. The system is capable of handling an ulitimate Q50 (2880 CFS) as determined by the Contra Costa Flood Control District.
    - The existing box culvert at Old Kirker Creek (Sheet 2) will be replaced to accommodate the freeway widening. It will be replaced with a double 12’ x 4’ Reinforced Concrete Box capable of passing a Q100 (1060 CFS) as determined by the Contra Costa Flood Control District. This design flow across Route 4 is currently restricted by inadequate downstream drainage facilities within the City of Pittsburg. The existing 36” sanitary sewer line that currently crosses Old Kirker Creek (just south of upstream end of the existing RCB) will also be relocated south of the existing crossing.
    - The Los Medanos Wasteway (Sheet 3) crosses SR 4 in an 8’x7’ RCB. The project proposes to extend this culvert in-kind to accommodate the roadway widening. The Contra Costa County Water District currently transports raw water through this channel, which is owned by the U.S. Bureau of Reclamation.
    - West Antioch Creek (Sheets 4 and 5) crosses SR 4 in a 120-inch diameter concrete pipe which eventually transitions to a 10" x 8' RCB at the downstream outfall. This project proposes to install an additional 120-inch concrete pipe which, when combined with the original culvert, can pass a Q100 (2100 CFS Undeveloped Condition) as determined by Contra Costa County Flood Control District. Improvements to the L Street/Contra Loma Interchange will require the partial removal of an existing triple 5' x 3' RCB and installation of a new 10' x 5' RCB on one of the laterals feeding the Creek. Another major lateral to West Antioch Creek slightly west of this interchange consists of a 42" and a 72" RCP which will need to be extended in-kind to accommodate the widening. Work within West Antioch Creek will also require the installation of temporary cofferdams both upstream and downstream of the work area. Base flows of West Antioch Creek will be diverted through an existing drainage by these cofferdams and re-enter West Antioch Creek downstream of the work area.

BLOCK 19

The purpose of the proposed State Route (SR) 4 (East) Widening Project – Loveridge Road to SR 160 project is to reduce existing congestion, improve traffic operations, encourage use of high occupancy vehicles (HOVs), and accommodate anticipated travel demand through the year 2030 by providing additional capacity and sufficient right-of-way to accommodate multi-modal transportation.

The project would widen SR 4 within the limits above from its current four lanes to an eight-lane facility. This project is part of Contra Costa Transportation Authority's overall plan to continue the widening of SR 4 further into the eastern portion of the county and is consistent with the Phase 1 Implementation Plan recommendation made in the SR 4 (east) Railroad Ave. to SR 160 Major Investment Study (MIS).

The SR 4 corridor is currently facing severe problems which include traffic congestion, inefficient energy use, deteriorating air quality, and deteriorating levels of traffic safety. Correcting conditions on SR 4 is a necessary component of the overall program to improve transportation through northern Contra Costa County.

The project will begin in 2009, and the estimated completion date is 2017.

BLOCK 21

The following describes the jurisdictional areas that will be filled, the acreage, type of fill, and the proposed discharge site(s).

Water Name/Description	**Map of area (impacts)**	**Impact Type* and Number**	**Total Area of Impact – Permanent (P) or Temporary (T) (Acres)**	**Fill**	**Fill Material (RSP = Rock Slope Protection) (FES = Flared End Section)**
Kirker Creek	Sheet 1	wl/wus 1 cwus 1 cwus 22 cwus 23 owus 1	0.048 (T) 0.011 (P) 0.010 (P) 0.019 (P) 0.005 (T)	Culvert Extension (temp. cofferdam)	216 yd.^{3} concrete 451 yd.^{3} RSP 40 yd.^{3} gravel (temp**) 1 yd.^{3} sand bags (temp**)
Old Kirker Creek	Sheet 2	wl/wus 2 wl/wus 3 owus 4 cwus 2	0.010 (P) 0.021 (P) 0.005 (P) 0.042 (P)	Culvert Extension (temp. cofferdam)	229 yd.^{3} concrete 73 yd.^{3} RSP 64 yd.^{3} gravel (temp**) 1 yd.^{3} sand bags (temp**)
Los Medanos Wasteway	Sheet 3	owus 5 owus 5 owus 6	0.011 (P) 0.004 (T) 0.007 (P)	Culvert Extension (temp. cofferdam)	124 yd.^{3} concrete 66 yd.^{3} gravel (temp**) 5 yd.^{3} sand bags (temp**)
West Antioch Creek Impacts:					
Extend existing 72” & 42” cross culverts underneath SR 4	Sheet 4	wl/wus 6 owus 8	0.011 (P) 0.004 (P)	Place RSP Culvert Extension	44 yd.^{3} RSP 300 yd.^{3} Roadway Fill
Small culvert crossing of “REN” Ramp. Southeast Quadrant of Contra Loma I/C	Sheet 5	wl/wus 10	0.002 (P)	Place 24” Pipe Place concrete flared end sections	28 yd.^{3} roadway fill 4 yd.^{3} concrete FES
Large culvert crossing of “REN” Ramp. Southeast quadrant of Contra Loma I/C	Sheet 5	wl/wus 9b owus 10b	0.007 (P) 0.007 (P)	Place 2 -36” Pipes Place RSP	380 yd.^{3} roadway fill 220 yd.^{3} RSP

Water Name/Description	**Map of area (impacts)**	**Impact Type* and Number**	**Total Area of Impact – Permanent (P) or Temporary (T) (Acres)**	**Fill**	**Fill Material (RSP = Rock Slope Protection) (FES = Flared End Section)**
Entrance to triple 5' x 3' RCB in Southeast Quadrant of Contra Loma I/C	Sheet 5	wl/wus 9a owus 10a	0.002 (P) 0.002 (P)	Culvert Extension Place RSP	90 yd.^{3} concrete box 55 yd.^{3} RSP
Open Channel immediately upstream of "RWN" on-ramp from L Street	Sheet 4	wl/wus 8 owus 9	0.005 (P) 0.004 (P)	Culvert Extension (temp. cofferdam)	150 yd.^{3} concrete box 70 yd.^{3} gravel (temp**) 150 yd.^{3} roadway fill
Existing triple 5' x 3' RCB under WB on-ramp from L Street	Sheet 4	cwus 11 cwus 12	0.044 (P) 0.014 (P)	Remove Culvert	115 yd.^{3} roadway fill
Small lateral tributary discharging to existing triple 5' x 3' RCB outfall	Sheet 4	wl/wus 7	0.003 (P)	Covered by proposed "RWN" ramp	35 yd.^{3} roadway fill
Outfall to West Antioch Creek adjacent to L Street at headwall	Sheet 4	wl/wus 5b owus 7b	0.013 (P) 0.031 (P)	Culvert Extension (temp. cofferdam) Headwall & RSP Widen Channel	400 yd.^{3} concrete box 5 yd.^{3} sand bags (temp**) 400 yd.^{3} RSP 150 yd.^{3} grading
Utility relocation north of existing 72" & 42" cross culverts underneath SR 4	Sheet 4	wl/wus 5a owus 7a	0.008 (P) 0.015 (P)	Utility Relocation	Trenching and Grading
Entrance to culvert south of Fitzuren Rd.	Sheet 5	wl/wus 11 owus 11	0.009 (P) 0.003 (P)	Temp. Cofferdam	8 yd.^{3} water filled cofferdam (temp**)

Water Name/Description	Map of area (impacts)	Impact Type* and Number	Total Area of Impact – Permanent (P) or Temporary (T) (Acres)	Fill	Fill Material (RSP = Rock Slope Protection) (FES = Flared End Section)
TOTAL		**WL/WUS** **OWUS** **CWUS**	**0.091 (P)** **0.048 (T)** **0.089 (P)** **0.009 (T)** **0.140 (T)**		**1,008 yd.^{3} Roadway Fill** **1,048 yd.^{3} RSP** **569 yd.^{3} Concrete** **4 yd.^{3} Concrete FES** **640 yd.^{3} Concrete Box** **150 yd.^{3} Grading** **240 yd.^{3}Gravel (temp**)** **12 yd.^{3} Sand Bags (temp**)** **8 yd.^{3} Water Filled Cofferdam (temp**)**

***wl/wus = Wetland/Waters of the U.S.**
owus = Other Waters of the U.S.
cwus = Culvert Waters of the U.S.

temp = temporary fills for water diversion**

BLOCK 22

The following describes the jurisdictional areas that will be filled, the acreage, type of fill, and the proposed fill method

Water Name/Description	Plan View location (Illus. 2)	Impact Type* and Number	Total Area of Impact – Permanent (P) or Temporary (T) (Acres)	Fill Type	Fill Method
Kirker Creek	Sheet 1	wl/wus 1 cwus 1 cwus 22 cwus 23 owus 1	0.048 (T) 0.011 (P) 0.010 (P) 0.019 (P) 0.005 (T)	Culvert Extension (temp. cofferdam)	Poured Concrete Excavator Excavator
Old Kirker Creek	Sheet 2	wl/wus 2 wl/wus 3 owus 4 cwus 2	0.010 (P) 0.021 (P) 0.005 (P) 0.042 (P)	Culvert Extension (temp. cofferdam)	Poured Concrete Excavator
Los Medanos Wasteway	Sheet 3	owus 5 owus 5 owus 6	0.011 (P) 0.004 (T) 0.007 (P)	Culvert Extension (temp. cofferdam)	Poured Concrete
West Antioch Creek Impacts:					
Station "E" 145+00 Extend existing 72" & 42" cross culverts	Sheet 4	wl/wus 6 owus 8	0.011 (P) 0.004 (P)	Culvert Extension Place RSP	Excavator Excavator
Small culvert crossing of "REN" Ramp. Southeast Quadrant of Contra Loma I/C	Sheet 5	wl/wus 10	0.002 (P)	Place 24" Pipe Place concrete flared end sections	Excavator Excavator
Large culvert crossing of "REN" Ramp. Southeast quadrant of Contra Loma I/C	Sheet 5	wl/wus 9b owus 10b	0.007 (P) 0.007 (P)	Place 2 -36" Pipes Place RSP	Excavator Excavator

Water Name/Description	**Plan View location (Illus. 2)**	**Impact Type* and Number**	**Total Area of Impact – Permanent (P) or Temporary (T) (Acres)**	**Fill Type**	**Fill Method**
Entrance to triple 5' x 3' RCB in Southeast Quadrant of Contra Loma I/C	Sheet 5	wl/wus 9a owus 10a	0.002 (P) 0.002 (P)	Culvert Extension Place RSP	Preformed Concrete Excavator
Open Channel immediately upstream of "RWN" on-ramp from L Street.	Sheet 4	wl/wus 8 owus 9	0.005 (P) 0.004 (P)	Culvert Extension (temp. cofferdam)	Preformed Concrete Excavator
Existing triple 5' x 3' RCB under WB on-ramp from L Street	Sheet 4	cwus 11 cwus 12	0.044 (P) 0.014 (P)	Remove Culvert	Excavator
Small lateral tributary discharging to existing triple 5' x 3' RCB outfall.	Sheet 4	wl/wus 7	0.003 (P)	Covered by proposed "RWN" ramp	Excavator
Outfall to West Antioch Creek adjacent to L Street at headwall	Sheet 4	wl/wus 5b owus 7b	0.013 (P) 0.031 (P)	Culvert Extension (temp. cofferdam) Headwall & RSP Widen Channel	Preformed Concrete Excavator Grading
Utility relocation north of existing 72" & 42" cross culverts underneath SR 4	Sheet 4	wl/wus 5a owus 7a	0.008 (P) 0.015 (P)	Utility Relocation	Trenching and Grading
Entrance to culvert south of Fitzuren Rd.	Sheet 5	wl/wus 11 owus 11	0.009 (P) 0.003 (P)	Temporary Cofferdam	Construction
TOTAL		**WL/WUS** **OWUS** **CWUS**	**0.091 (P)** **0.048 (T)** **0.089 (P)** **0.009 (T)** **0.140 (T)**		

Water Name/Description	Plan View location (Illus. 2)	Impact Type* and Number	Total Area of Impact – Permanent (P) or Temporary (T) (Acres)	Fill Type	Fill Method
*wl/wus = Wetland/Waters of the U.S. owus = Other Waters of the U.S. cwus = Culvert Waters of the U.S.					

BLOCK 24

Property Owners: Street Address:

APN	Site	Owner	Owner Notification
074-411-007	Park	City of Antioch Public Works	P.O. Box 5007, Antioch, CA 94531
074-353-127	vacant	City of Antioch Public Works	P.O. Box 5007, Antioch, CA 94531
074-353-126	vacant	City of Antioch Public Works	P.O. Box 5007, Antioch, CA 94531
074-353-125	vacant	City of Antioch Public Works	P.O. Box 5007, Antioch, CA 94531
067-342-004	992-1008 Fitzuren Rd., Antioch, CA 94509	Skyland Properties	1004 Fitzuren Rd., Antioch, CA 94509
067-342-012	924 Fitzuren Rd., Antioch	Eileen Davis	1120 Bond Ct., Antioch, CA 94509
071-021-003	Fitzuren Rd.,	City of Antioch Public Works	P.O. Box 5007, Antioch, CA 94531
071-021-013	909 Fitzuren Rd., Antioch, CA 94509	Poonam Chillappagari	909 Fitzuren Rd., Antioch, CA 94509
071-021-018	Fitzuren Rd.,	City of Antioch Public Works	P.O. Box 5007, Antioch, CA 94531
071-021-022	911 Fitzuren Rd., Antioch	Frank Davi/Charles Johnson	P.O. Box 1171, Antioch, CA 94509
071-021-023	909 Fitzuren Rd., Antioch, CA 94509	Llyod Harris IV	909 Fitzuren Rd., Antioch, CA 94509
071-021-024	915 Fitzuren Rd., Antioch	Frank Davi/Charles Johnson	P.O. Box 1171, Antioch, CA 94509

APN	Site	Owner	Owner Notification
068-351-003	2812 Harbour Drive, Antioch, 94509	Church of Christ of Antioch	1020 E Tregallas, Antioch, CA 94509
068-351-002	Harbour Drive, Antioch, 94509	Church of Christ of Antioch	1020 E Tregallas, Antioch, CA 94509
068-351-001	Harbour Drive, Antioch, 94509	Church of Christ of Antioch	1020 E Tregallas, Antioch, CA 94509
068-252-045	2709 Windsor Drive, Antioch, 94509	First Missionary Baptist Church	640 E Tregallas, Antioch, CA 94509
068-252-041	2721 Windsor Drive, Antioch, 94509	First Missionary Baptist Church	640 E Tregallas, Antioch, CA 94509
068-352-001	1105 Ames Ct., Antioch, 94509	Margaret Aragon	1105 Ames Ct., Antioch, 94509
068-352-002	1109 Ames Ct., Antioch, 94509	Jack P. Leardini TRE	27 Rolph Park Ave., Crockett, CA 94525
068-352-003	1113 Ames Ct., Antioch, 94509	Ramon & Teresa Ramirez	1113 Ames Ct., Antioch, 94509
068-352-004	1117 Ames Ct., Antioch, 94509	Abraham Y. Dabis	1117 Ames Ct., Antioch, 94509
068-352-005	1116 Ames Ct., Antioch, 94509	Troy & Monica Coray	1116 Ames Ct., Antioch, 94509
068-352-006	1112 Ames Ct., Antioch, 94509	Helen P Platt	1112 Ames Ct., Antioch, 94509
068-352-007	1108 Ames Ct., Antioch, 94509	Donald & Sandra Harrison	1108 Ames Ct., Antioch, 94509
068-352-008	1104 Ames Ct., Antioch, 94509	Marion Jones	2782 Manzanita Way, Hemet, CA 92545
068-352-009	1100 Ames Ct., Antioch, 94509	Neil & Rose Ann Jortner	1100 Ames Ct., Antioch, 94509

APN	Site	Owner	Owner Notification
068-100-032	917 Sunset Dr., Antioch, 94509	Lewis & Leslie Mathews	1661 Ramona Way, Alamo, CA 94507
068-300-017	Sunset Dr.	David & Thea Shupe, Shannon & Ann Creson	2200 Wymore Way, Antioch, CA 94509
052-014-005	Sunset Dr.	Ennco & Rose Cinquini, David & Mary Brink	224 Cobblestone Dr., Antioch, CA 94509
052-014-006	1305 Sunset Dr., Antioch, CA 94509	Robert & Marie Lister	1305 Sunset Dr., Antioch, CA 94509
052-014-007	Hillcrest Ave	Ennco & Rose Cinquini, David & Mary Brink	224 Cobblestone Dr., Antioch, CA 94509
052-052-018	No address	FKP Inc.	1955 Lake Park Dr., #250, Smyrna, GA 30080
052-150-008	State Highway 4	City of Antioch Public Works	P.O. Box 5007, Antioch, CA 94531
88-540-15 88-540-09	2153 Martin Way Pittsburg (vacant land)	Albert D Seeno Construction Co	P O Box 4113 Concord CA 94524
88-240-38	vacant land	City of Pittsburg	
88-240-57	2100 2104 2106 Loveridge Pittsburg (commercial improved)	Pittsburg Storage Partners	P O Box 25025 Glendale CA 91201
88-152-28	2025 Leland E Pittsburg (vacant land)	A-S Pipelines Co Inc.	2025 Leland Pittsburg CA 94565
88-152-30	Commerce Pittsburg (vacant land)	Albert D Seeno Construction	P O Box 4113 Concord CA 94524
Contra Costa Canal	Drainage channel	U. S. Bureau of Reclamation	
74-122-23	3600 3698 Delta Fair Antioch (commercial improved)	Delta Square Associates	P.O. Box 177 Lafayette CA 94549

APN	Site	Owner	Owner Notification
74-460-29	Century Blvd Pittsburg (vacant land)	Century Plaza Dev Corp.	4021 Port Chicago Hwy Concord CA 94520
Contra Costa Canal	Drainage channel	U. S. Bureau of Reclamation	
74-090-21	Century CT Pittsburg (commercial improved)	Century Plaza Dev Corp/Mazzei Hyundai	4021 Port Chicago Hwy Concord CA 94520
74-112-07	3900 Belle Antioch (single family improved)	Pawlowski Anna E	4356 Whitehaven Baton Rouge CA 70808

BLOCK 25

The following table summarizes the permits and approvals that are anticipated to be needed from other agencies, and their status.

Agency	Permit or Approval	Status
Regional Water Quality Control Board	§401 Water Quality Certification	Pending
California Department of Fish and Game	California Fish and Game Code §1602	Pending
US Fish and Wildlife Service	BO	BO issued (1-1-05-F-0158) on 6/13/05 (included in Appendix A)

FINAL FOUNDATION REPORT
G STREET OVERCROSSING (REPLACE)
AT ROUTE 4
(BRIDGE NO. 28-0400)
CONTRA COSTA COUNTY, CALIFORNIA
EA 2285E1

For

BKF Engineers
4670 Willow Road, Suite 250
Pleasanton, CA 94588

PARIKH CONSULTANTS, INC.
1243 Alpine Road, Suite 110
Walnut Creek, California
(925) 933-6336

October, 2010

Job No. 206118.GST

TABLE OF CONTENTS

PAGE

INTRODUCTION **1**

PROPOSED CONSTRUCTION **1**

PURPOSE AND SCOPE **2**

SITE CONDITIONS **2**

FIELD EXPLORATION **3**

Soil Borings *3*
Cone Penetration Testing (CPT) *4*
Laboratory Testing *4*
Boring and CPT Logs *4*

SUBSURFACE CONDITIONS **4**

GEOLOGY **5**

EARTHQUAKE CONSIDERATIONS **6**

SEISMIC SOURCES 6
SEISMIC HAZARDS/LIQUEFACTION IMPACT 7

FINDINGS AND RECOMMENDATIONS **8**

GENERAL 8
FOUNDATIONS 8
LATERAL PILE CAPACITY 12
LATERAL EARTH PRESSURES 14
SEISMIC DESIGN CRITERIA 15
GRADING 16
CORROSION 17
PLAN REVIEW 17
CONSTRUCTION OBSERVATION 17

INVESTIGATION LIMITATIONS **18**

PROJECT LOCATION MAP ..... Plate 1
GEOLOGIC MAP ..... Plate 2
FAULT MAP ..... Plate 3
ARS DESIGN CURVE ..... Plate 4

Appendix A Log of Test Borings & As-Built Log of Test Borings
Appendix B Laboratory Test Data
Appendix C CPT Data
Appendix D Pile Capacity Calculations
Appendix E Caltrans Comment & Response Form (5/14/2009)
Caltrans Comment & Response Form (7/8/2009)
Caltrans Comment & Response Form (11/3/2009)
Caltrans Comment & Response Form (6/30/2010)

FINAL FOUNDATION REPORT
G STREET OVERCROSSING (REPLACE) AT ROUTE 4
(BRIDGE NO. 28-0400)
CONTRA COSTA COUNTY, CALIFORNIA
EA 2285E1

INTRODUCTION

This report presents the results of our geotechnical engineering investigation for the proposed bridge replacement for the G Street Overcrossing at Route 4 in Antioch, Contra Costa County, California. Our work was performed generally in accordance with the scope of work as per our agreement. The general location of the site and its vicinity are shown on the Project Location Map, Plate 1.

The geotechnical recommendations presented in this report are intended for design input and are not intended to use as specifications. These recommendations should not be used for direct bidding purposes.

PROPOSED CONSTRUCTION

The proposed project will consist of the demolition of the existing two-lane bridge and replacement by a new bridge. The new bridge will span over the widened State Route 4. Significant cuts will be required on the northern end of the existing bridge to facilitate the widening State Route 4.

The new bridge will be 68 feet wide and include three 12-foot traffic lanes with a 5-ft wide shoulder and 10-ft wide sidewalk on either side. The bridge will be continuous two-span structure, with spans 145 feet and 120 feet in length, a total length of 265 feet. The proposed structures will consist of a 6-foot deep cast in place prestressed concrete box girder. The superstructure will be supported on a two column bent, and high cantilevered seat-type abutments at both ends. The two columns in the bent will be 5'-6" by 7' octagonal columns, each supported on a separate identical pile cap, founded on Caltrans Standard Class 200 open-ended steel pipe piles (Alternative W). The abutments will be high cantilever type abutments and will be supported on Caltrans Standard Class 140 open-ended steel pipe piles (Alternative W).

PURPOSE AND SCOPE

The purpose of this investigation was to evaluate the general soil conditions at the project site, to evaluate their engineering properties, and to provide recommendations for foundation support of the proposed project.

The scope of work performed for this investigation included a review of the readily available soils and geologic literature, obtaining representative soil samples and logging soil materials encountered in two drilled borings and one cone penetrometer test (CPT), laboratory testing of the collected samples, engineering analysis of the field and laboratory data, and preparation of this report. The basis for this investigation is the preliminary plans provided to us by BKF Engineers. We have presented the descriptive log of the boreholes in Appendix A.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain a properly constructed project. We, therefore, recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction.

Our recommendations in this report are based on the above information. Any major deviation should be reported to this office for consideration.

SITE CONDITIONS

The project is located across State Route 4 along G Street in Antioch, Contra Costa County. Per the As-Built drawings, the existing overcrossing (originally "H" Street Overcrossing) consists of a 94-ft long two-span concrete bridge constructed in 1951. The bent rests on two columns. The bridge abutments and the two columns at the bent appear to be supported on shallow spread footing foundations. The deck of the overcrossing is roughly at the same elevation as the adjacent grade. Highway 4 passes under the bridge through a cut, approximately 20 feet deep.

The top surface of the existing bridge is at approximately existing Elev. 72 feet. State Route 4 passing below the bridge is built in a cut: the top of pavement in State Route 4 passing below the bridge is approximately at Elev. 53 feet. The terrain at the location adjacent to the highway is relatively flat, sloping gently towards the north. The elevation of the existing terrain is approximately 74 feet at the southern end of the bridge and 68 feet at the northern end.

FIELD EXPLORATION

Initially, based on the plans, discussions with design engineer, and readily available data of the proposed project, two (2) exploratory borings were drilled. The boring locations are shown on the plan portion of the Log of Test Borings in Appendix A. Subsequently, a cone penetrometer test (CPT) was added, adjacent to one of the borings to reevaluate the liquefaction potential (see section on liquefaction). The boring and CPT locations are shown on the plan portion of the Log of Test Borings in Appendix A.

Soil Borings

The borings were drilled on September 26 and 27, 2006, from the top of the road embankments on either end of the existing G Street Overcrossing. They were advanced with a truck-mounted drill rig, using hollow stem auger drilling method. Both the borings were drilled to depths of 100 feet below the existing ground surface.

Selected samples were obtained at various depths primarily from 3.0-inch O.D. & 2.5 inches I.D. (Modified California) samplers; or 2.0-inch O.D. & 1.4-inch I.D. (Standard Penetration Test) samplers. The samplers were driven in subsurface soils under the impact of a 140-lb hammer having a free fall of 30 inches. The blow counts are presented on the "Log of Test Borings". (When correlating standard penetration data in similar soils, the blow counts for the Modified California Sampler can be taken as roughly 1.6 times that for the Standard Penetration Test in similar soils). The samples were sealed and transported to our laboratory for further evaluation and testing. The field investigation was conducted under the supervision of our field engineer who logged the test borings and prepared the samples for subsequent laboratory testing and evaluation.

Cone Penetration Testing (CPT)

CPT work was performed by Gregg Drilling & In Situ, Inc. on October 26, 2007 using a truck mounted CPT rig. The CPTs were conducted using a 60-degree cone attached to a 1.7-inch diameter rod pushed into the subsurface. The soil resistance exerted to the tip and side of the cone were recorded and correlated to soil type, classification and strength characteristics. Groundwater level was estimated from pore pressure dissipation measurements during CPT operation. In addition, shear wave velocities were measured at various depths during the investigation. Detailed information from the CPT investigation is presented in Appendix C.

Laboratory Testing

Laboratory tests were performed on selected samples obtained during field exploration to determine the physical and engineering properties of the subsoils. Laboratory data of moisture contents, total density, grain size distribution, Atterberg Limits, unconfined compression strengths and consolidation test are presented on the Log of Test Borings. A detailed description of laboratory testing performed is presented in Appendix B. Appendix B also includes Plasticity Charts for Atterberg Limits, grain size distribution curves, and the load-deformation and time-deformation curves for the consolidation test.

Boring and CPT Logs

The bore logs presented in Appendix A were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs. The abrupt stratum changes shown on these logs may be gradual and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations. CPT logs are also presented on the LOTB sheets at appropriate locations.

SUBSURFACE CONDITIONS

Boring GST-137 on the southern side indicated stiff lean clays to a depth of approximately 8 feet, predominantly underlain by medium dense to dense sandy soils to a depth of approximately 38 feet. The sandy soils were underlain by a 10-ft layer of very stiff fat clay/elastic silt, underlain in turn by approximately 10 feet of stiff to very stiff lean clays and sandy clays to a depth of approximately 72 feet. A 10-ft layer of dense silty sand was encountered below 75-ft depth, underlain by hard lean clay with sand to 100-foot depth, the maximum depth explored. Similar

conditions were encountered in Boring GST-138. An 8-ft thick surficial layer of stiff lean clay was underlain by sandy soils, generally medium dense, to a depth of 50 feet. The sandy soils were underlain by stiff to very stiff lean clays and silts to 75-ft depth, underlain successively by 10-ft layers of medium dense sand, very stiff to hard clay and dense silty sand to the maximum depth explored.

During field exploration in September 2006, the water levels in the borings were approximately at Elev. 3 feet at the northern end and Elev. 8 feet at the southern end. However, the groundwater may vary with the passage of time due to seasonal groundwater fluctuation, surface and subsurface flows, ground surface run-off and other factors that may not be present at the time of investigation.

GEOLOGY

General geologic features pertaining to the site were evaluated with reference to the "Geologic Map of Quaternary Geology of Contra Costa County and Surrounding Areas, CA: Derived from Digital Database open-file 97-98" by E.J. Helley and R.W. Graymer 1997; Scale 1:100000. Based on the map, the site is located in an area covered by Pleistocene alluvial deposits (Qpaf). A geologic map of the general project area is shown on Plate 2. Description of the main geologic units is as follows:

> *Qpaf (Alluvial Fans and Fluvial Deposits (Pleistocene)) – Brown dense gravely and clayey sand or clayey gravel that fines upward to sandy clay. These deposits display various sorting and are located in most stream channels in the county. All Qpaf deposits can be related to modern stream courses. They are distinguished from younger alluvial fans and fluvial deposits by higher topographic position, greater degree of dissection, and stronger soil profile development. They are less permeable than Holocene deposits, and locally contain fresh water mollusks and extinct late Pleistocene vertebrate fossils. They are overlain by Holocene deposits on lower parts of the alluvial plain, and incised by channels that are partly filled with Holocene alluvium on higher parts of the alluvial plain. Maximum thickness is unknown but at least 50m (150 feet).*

EARTHQUAKE CONSIDERATIONS

Seismic Sources

The project is located in a seismically active part of Northern California. Many faults exist in the area, which are capable of producing earthquakes which may cause strong ground shaking at the site.

Applicable major faults in the vicinity of the project site were identified and their associated maximum earthquake magnitudes were established using Caltrans 2007 Deterministic PGA Map and the associated Data Base. The documents were supplied to us by Caltrans, with the understanding that the fault locations in the map and the associated magnitudes in the Data Base have essentially been finalized and are appropriate for design purposes. The moment magnitudes noted in the table represent the largest earthquakes that could occur on the given fault based on the current understanding of the regional tectonic structure. A fault map of the project vicinity is shown on Plate 3.

SEISMIC SOURCES

Fault	Fault No.(1)	Fault Type	Distance from Site (miles)	Maximum Moment Magnitude
Vaca Fault Zone	14	RLSS(2)	5.8	6.9
Great Valley Fault 5	24	Reverse Fault	6.8	6.5
Greenville Fault Zone (Clayton Section)	351	RLSS	7.0	6.6
Concord Fault Zone (Ygnacio Valley Section)	341	RLSS	11.4	6.6

(1) Number of the Fault in the Data Base associated with the Caltrans 2007 Deterministic PGA Map
(2) RLSS – Right Lateral Strike Slip Fault

Based on the Caltrans Map and the attenuation relationship by Sadigh et al. (1997), the controlling fault is the Vaca Fault Zone (Fault No. 14 in the map), which is associated with a Maximum Moment Magnitude (Mmax) of 6.9. A peak bedrock acceleration (PBA) of 0.47g is anticipated at the site.

Seismic Hazards/Liquefaction Impact

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction. Since no active faults pass through the site, the potential for fault rupture is relatively low. Based on available geological and seismic information, the possibility of the site experiencing strong ground shaking may be considered significant.

Liquefaction is a phenomenon in which saturated soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged, cohesionless sands and silts of low relative density are the type of soils which usually are susceptible to liquefaction - the susceptibility increases with decreasing relative density (reflected by the number of blows (blow counts) to drive a sampler), and decreasing fines content. Accepted procedures for the assessment for liquefaction potential for cohesionless soils have evolved over the years through research and field observations (Youd et al, 2001). Recent research and field observations have shown that clays of low plasticity are also potentially liquefiable, based on the moisture content and plasticity characteristics of the clay. Procedures for the assessment of liquefaction potential for clay soils have also been established and have received general acceptance. (Bray et. al., 2004).

Initial analyses based on the blow counts by the drive sampler indicated the presence of potentially liquefiable medium dense sand layer at 75 to 85-ft depth in boring GST-138. It is generally accepted that when hollow stem auger drilling techniques are used, the measured blow counts and the associated liquefaction analyses are less reliable. Thus, a cone penetration test (CPT) was subsequently performed near the location of boring GST-138 to confirm/negate the finding. Based on the CPT results the potential for liquefaction was found to be low.

FINDINGS AND RECOMMENDATIONS

General

Based on the findings of the investigation, it is our opinion that the site is feasible for the planned bridge structure provided the recommendations presented in this report are incorporated into the final design and construction.

This report was prepared specifically for the proposed bridge structure according to the plans provided to us. Normal construction procedures were assumed throughout our analysis and represent one of the bases of recommendations presented herein. Our design criteria have been based upon the materials encountered at the site. Therefore, we should be notified in the event that these conditions are changed, so as to modify or amend our recommendations.

Foundations

For the proposed structures, open–ended steel pipe piles (Caltrans Standard Class 140 Alt. "W") are recommended for foundation support at the abutment locations and open–ended steel pipe piles (Caltrans Standard Class 200 Alt. "W") are recommended for the column foundations for Bent 2.

Pile Design

Pertinent foundation design information was provided by Biggs Cordosa (Structural Engineers for the project), which are presented in the following tables (Foundation Design Data and Foundation Design Loads).

BKF Engineers
Job No. 206118.GST (G Street Overcrossing)
October, 2010
Page 9

FOUNDATION DESIGN DATA – G Street Overcrossing

Support No	Design Method	Pile Type	Finish Grade Elev. (ft)	Bottom of Footing Elev. (ft)	Pile Cap Size (ft)		Permissible Settlement (inch)	No. of Piles per Support(1)
					B	L		
Abutment 1	WSD	Class 140 Alt. "W"	60.36	52.25	11	74	1.0(1)	32
Bent 2(1)	LRFD	Class 200 Alt. "W"	51.0	40.0	16.5	16.5	1.0(1)	16
Abutment 3	WSD	Class 140 Alt. "W"	61.57	51.60	14	80.1	1.0(1)	44
Abutment 1 Wingwall	WSD	Class 140 Alt. "W"	57.0	49.0	N/A	N/A	N/A	6
Abutment 3 Wingwall	WSD	Class 140 Alt. "W"	55.0	47.35	N/A	N/A	N/A	6

(1) Information pertains to each individual (identical pile cap in the bent)

FOUNDATION DESIGN LOADS – G Street Overcrossing

Support No.	Service-I Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Limit State (Controlling Group, kips)			
	Total Load		Permanent Loads	Compression		Tension		Compression		Tension	
	Per Supp.	Per Pile	Per Support	Per Supp.	Max. Per Pile.	Per Supp.	Max. Per Pile.	Per Supp.	Max. Per Pile.	Per Supp.	Max. Per Pile.
Abutment 1	2956	128	2661	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bent 2(1)	3121	200	2430	3985	257	0	0	3385	341	0	0
Abutment 3	4313	124	3996	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Abutment 1 Wingwall	N/A	108	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Abutment 3 Wingwall	N/A	125	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

(1) Information pertains to each individual (identical pile cap in the bent)

Consistent with the current Caltrans requirements, Working Stress Design (WSD) will be used for the abutment foundations and Load Resistance Factor Design (LRFD) will be used for the foundations for Bent 2. The abutment foundations will be evaluated for the foundation design data and loading conditions using Caltrans November 2003 Bridge Design Specifications for foundations, using Working Stress Design (WSD) methods. The Bent 2 foundations will be evaluated for the foundation design data and loading conditions using AASHTO LRFD Bridge Design Specifications – 3rd Edition, with Interims Through 2006 and current Caltrans Memo To Designer (July 2008), Section 3-1 (Attachment 1). The actual load demands on the piles, based

upon WSD and LRFD are presented in the table below.

LOAD DEMANDS – G Street Overcrossing

Support No.	Design Method	Service Loads (kips)		Required Factored Nominal Resistance (kips)			
				Strength Limit		Extreme Limit	
		Comp.	Tens.	Comp. (ϕ=0.7)	Tens. (ϕ=0.7)	Comp. (ϕ=1.0)	Tens. (ϕ=1.0)
Abutment 1	WSD	128	0	N/A	N/A	N/A	N/A
Bent 2(1)	LRFD	200	0	257	0	341	0
Abutment 3	WSD	124	0	N/A	N/A	N/A	N/A
Abutment 1 Wingwall	WSD	108	0	N/A	N/A	N/A	N/A
Abutment 3 Wingwall	WSD	125	0	N/A	N/A	N/A	N/A

(1) Information pertains to each individual (identical pile cap in the bent)

Estimation of the pile capacities was made for each support location using the site-specific subsurface conditions. The top of pile (bottom of footing) elevations were based on the information provided by the designer. The computer program APILE developed by Ensoft, Inc. was used for the computations. The program computes pile capacities for driven piles using four different methods: FHWA Method; US Corps of Engineers Method; Lambda Method; and API-RP2A Method from the American Petroleum Institute. The API RP-2A Method was chosen as the basis for the recommended pile tip elevations, since this method was judged to be the most appropriate for steel pipe piles and in clay soils. Pile capacity computations (APILE output) are presented in Appendix D. The recommended specified pile tip elevations are shown in the following tables per Memo To Designers 3-1.

BKF Engineers
Job No. 206118.GST (G Street Overcrossing)
October, 2010
Page 11

FOUNDATION RECOMMENDAIONS FOR ABUTMENTS AND WINGWALLS

Support	Pile Type	Cut-off Elev. (ft)	LRFD Service-I Limit State Load (kips) per Support		LRFD Service-I Limit State Total Load (kips) per Pile (Compression)	Nominal Resistance (kips)	Design Tip Elev. (ft)	Specified Tip Elev. (ft)	Nominal Driving Resistance Required (kips)
			Total	Perma-nent					
Abut 1	Class 140 Alt. "W"	52.25	2956	2661	128	256	9.0 (a) 28.0 (b)	9.0	240
Abut 3	Class 140 Alt. "W"	51.60	4313	3994	124	248	12.0 (a) 32.0 (b)	12.0	230
Abut 1 Wingwall	Class 140 Alt. "W"	49.0	N/A	N/A	108	216	8.0 (a) 25.0 (b)	8.0	220
Abut 3 Wingwall	Class 140 Alt. "W"	47.35	N/A	N/A	125	250	4.0 (a) 30.0 (b)	4.0	250

Design tip elevations are controlled by (a) compression, (b) lateral load

FOUNDATION RECOMMENDAIONS FOR BENT

Support Location	Pile Type	Cut-off Elev. (ft)	Service-I Limit State Load (kips) per Pile	Total Permissible Support Settlement (in.)	Required Nominal Resistance (kips)				Design Tip Elev. (ft)	Specified Tip Elev. (ft)	Nominal Driving Resistance Required (kips)
					Strength Limit		Extreme Event				
					Comp. (ϕ=0.7)	Tension (ϕ=0.7)	Comp. (ϕ=1)	Tension (ϕ=1)			
Bent 2	Class 200 Alt. "W"	40.0	200	1.0	370	0	341	0	-10.0 (a-I) -4.0 (a-II)	-10.0	400

Design tip elevations are controlled by (a-I) Compression (Strength Limit), (a-II) Compression (Extreme Event)

PILE DATA TABLE – G Street Overcrossing

Location	**Pile Type**	**Nominal Resistance (kips)**		**Finish Grade (ft)**	**Bottom of Footing Elev. (ft)**	**Design Tip Elev. (ft)(1)**	**Specified Tip Elev. (ft)**	**Nominal Driving Resistance (kips)**
		Compression	**Tension**					
Abutment 1	Class 140 Alt. "W"	260	0	60.36	52.25	4.5 (a) 32.0 (b)	4.5	260
Bent 2(2)	Class 200 Alt. "W"	400	0	51.0	40.0	-10.0 (a) 11.0 (b)	-10.0	400
Abutment 3	Class 140 Alt. "W"	250	0	61.57	51.60	9.5 (a) 25.7 (b)	9.5	250
Abutment 1 Wingwall	Class 140 Alt. "W"	220	0	57.0	49.0	8.0 (a) 20.6 (b)	8.0	220
Abutment 3 (Wingwall	Class 140 Alt. "W"	250	0	55.0	47.35	4.0 (a) 21.5- (b)	4.0	250

Notes:
1. Design Tip Elevation is controlled by the following demands: (a) Compression; (b) Lateral Loads
2. Information pertains to each individual (identical pile cap in the bent)

Pile Installation

An adequate hammer should be chosen for the pile driving. It is highly recommended that prior to start of production pile driving, a pile drivability analysis be performed to assess the adequacy of the hammer and to establish a field pile driving criterion. It is also recommended that a selected number of piles be monitored to assure that the desired capacity is achieved and the piles are not damaged by overstressing. The monitoring should be performed using a Pile Driving Analyzer (PDA) and the associated CAPWAP program should be used to estimate the pile capacities both during driving and with restrike after a few days for effects of set-up. We recommend at least one pile in each abutment and one pile at each pile cap in Bent 2 be driven and monitored prior to start of production pile driving. The 'indicator' piles should be located approximately at the center of the pile caps for the abutments and the bent. The piles may be used as production piles.

In the event of a premature refusal, driving to the tip elevation may require "central relief drilling" inside the pile to reduce the resistance to driving. Central relief drilling shall be restricted to 10 feet above the final pile tip elevation.

Lateral Pile Capacity

Analyses for lateral load behavior of the piles may be performed using the LPILE computer program. Geotechnical parameters for the development of p-y curves for the LPILE program are presented in the tables below. The parameters are based on field borings, CPT and lab testing data. The elevation information is based on the topographic data provided to us. It is recommended to use a p-multiplier of 0.6 (60% effective) and a y-multiplier of 1.0 to consider group effect for piles spaced at minimum 3 times the maximum dimension.

BKF Engineers
Job No. 206118.GST (G Street Overcrossing)
October, 2010
Page 13

Geotechnical Parameters For LPILE Analysis

Abutment 1

Elevation (ft.)	Generalized Soil Profile	LPILE Soil Type	Probable Soil Strength	K (pci)	e_{50} (in/in)	Effect Unit Weight (pci)
65 to 58	Lean, Stiff to very stiff clay	3, STIFF CLAY w/o water	S_u= 13.89 psi	750	.006	.0694
58 to 13	Medium dense Silty to Clayey Sand	8, SAND (API)	ϕ= 30°	90	--	.0723
13 to 5	Lean, very stiff Clay with Sand	3, STIFF CLAY w/o water	S_u= 20.83 psi	1000	.005	.0723
5 to -8	Stiff Silt with Sand	3, CLAY	S_u= 10.42 psi	500	.007	.0376
-8 to -18	Medium dense Sand	4, SAND	ϕ = 35°	60	--	.0406
-18 to -28	Lean, very stiff Clay with Sand	3, STIFF CLAY w/o water	S_u= 24.31 psi	2000	.005	.0376
Ground Surface @ El +65		Groundwater Table @ El +5				

Abutment 3

Elevation (ft.)	Generalized Soil Profile	LPILE Soil Type	Probable Soil Strength	K (pci)	e_{50} (in/in)	Effect Unit Weight (pci)
70 to 62	Stiff Lean Clay	3, STIFF CLAY w/o water)	S_u= 10.83 psi	1000	--	.0666
62 to 45	Sandy Silt to Silty Sand	8, SAND (API)	ϕ = 30°	90	--	.0723
45 to 32	Dense to Very Dense Silty Sand to Sand	8, SAND (API)	ϕ = 35°	225	--	.0752
32 to 10	Very Stiff Clay	3, STIFF CLAY w/o water	S_u= 17.36 psi	1000	.005	.0723
10 to -5	Very Stiff Sandy Clay	3, STIFF CLAY w/o water	S_u= 17.36 psi	1000	.005	.0376
-5 to -15	Dense Silty Sand	8, SAND (API)	ϕ = 35°	125	--	.0406
-15 to -30	Hard Clay	3, STIFF CLAY w/o water	S_u= 27.78 psi	2000	.004	.0376
Ground Surface @ El +70		Groundwater Table @ El +10				

Information from the as-built boring drilled near Bent 2 in 1951 was judged to be not sufficiently

reliable. Therefore, for lateral pile analyses at Bent 2, LPILE analyses should be performed for both soil conditions and the more conservative results as appropriate should be used for design.

A calculation was performed to determine the group reduction factors for the piles in Abutment 1 wingwall based on the pile layout provided by the designers. The calculation was based on the procedures presented in the GROUP7.0 Technical Manual by Ensoft Corporation. Computed Group Reduction Factors were 0.85 and 0.98 for transverse and longitudinal directions, respectively.

Lateral Earth Pressures

Abutment retaining walls and wing walls should be designed to resist the following Applied Lateral Earth Pressures and live load. These values assume no hydrostatic pore pressure buildup behind the wall and are based on well-drained backfill behind the walls supported in native soil.

	Applied Lateral Earth Pressure
Active Condition	36 pcf Equivalent Fluid Pressure (EFP) for engineered fill
At-Rest Condition	55 pcf Equivalent Fluid Pressure (EFP) for engineered fill
Passive Resistance	310 pcf EFP with a maximum value of 3100 psf. 5 ksf (ultimate) for seismic design of the abutment backwall (5.5 feet high or greater); for activated height less than 5.5 feet modify proportionally, i.e. 5 x (H/5.5) ksf. A minimum lateral wall movement of 2% of wall height to mobilize the full ultimate passive pressure is required.

Cantilever walls which are free to rotate at least 0.004 radian may be assumed flexible for the active condition. Walls that are not capable of this movement should be assumed rigid and designed for the at-rest condition. The effect of any surcharge (dead, live, or traffic load) should be added to the preceding lateral earth pressures. A coefficient of 0.3 may be used to determine the additional earth pressure resulting from the surcharge.

Seismic Design Criteria

The value of PBA for the project site was calculated from the distances to the applicable faults in the project vicinity using the Caltrans 2007 Deterministic PGA Map and the attenuation relation by Sadigh et al. (1997). The computed PBA value was increased by 20% (per Sadigh 1997) to account for the reverse fault effect, wherever applicable. The PBA computations based on Sadigh attenuation relation are presented in Appendix D. Based on the calculations, the maximum PBA within the project limit is 0.47g.

Based on the available boring information in the vicinity of the project site, the subsurface soil conditions at the project site generally matches the criteria for Soil Type D, as per Caltrans Seismic Design Criteria (Version 1.4, June 2006). Based on Caltrans Seismic Design Criteria and the above information, the seismic design criteria are as follows:

1.	Closest Distance to Fault	=	5.8 miles (9.3 km)
2.	PBA	=	0.47g
3.	Design ARS Curve	=	Caltrans Seismic Design Criteria June 2006 Version 1.4 Figure B.8 (Soil Profile Type D).

4. Design ARS Curve (see Plate 4): Curve based on Caltrans SDC (v. 1.4, 6/2006) for different structural periods. The curve is based on (Governing Fault – Vaca Fault Zone; Mmax =6.9) Figure B.8. The curve for PBA=0.47g was obtained by interpolation of the 0.4g and 0.5g curves. Figure B.8 is used since the range in Figure B.7 (e.g. 6.5+/-0.25) is below 6.9.

A copy of the ARS Design Curve is included on Plate No. 4 of this report.

Per requirements of the Designer, an ARS curve was developed for design of temporary support of the bent during construction. Per MTD 20-12, Section II, the ground motions for design of temporary elements for a bridge structure should be based on 10 percent exceedence in twice the

expected duration of the temporary condition, but not less than 10 years. Accordingly, a probabilistic ARS curve was developed for 10 percent exceedence in 10 years (e.g. return period of 95 years) using the information from the interactive USGS website. A probabilistic ARS curve for a particular site may be developed from the website for a particular return period with the input of the site location (latitude/longitude) and the average shear wave velocity (Vs30) over the top 100 feet (30 meters). Since the data for 10 percent exceedence over 10 years is not directly available from the USGS website, the data was developed by interpolating between the available data for 10 percent exceedence in 30 years (return period of 285 years) and a 5 percent exceedence in 50 years (return period of 72 years). Also, per standard Caltrans practice for adjustment for near-fault effects, the computed spectral acceleration was increased linearly by 0 percent to 20 percent between the periods of 0.5 seconds and 1 second, and uniformly by 20 percent for periods greater than 1 second. A table showing the recommended ARS curve for temporary construction is presented below.

Period, sec.	Spectral Acceleration, g
0 (PGA)	0.2263
0.1	0.4002
0.2	0.5167
0.3	0.5035
0.5	0.4184
1.0	0.3037
2.0	0.1497
3.0	0.0892
4.0	0.0618
5.0	0.0476
Vs30 = 250 m/sec. Includes Near Fault Factor	

Grading

All grading operations should be performed in accordance with the project specifications and Caltrans Standard Specifications for Earthwork (Section 19, May 2006).

Engineered Fill. Engineered fill should be non-expansive and consist of relatively granular

material having a P.I. of less than 15. In addition, we recommend that the material within 3 feet of the proposed pavement subgrade have a minimum R-value of 15. The fill shall also be free of organic and inorganic debris, rubles and any other deleterious material. The on-site soils may be used as engineered fill, provided they meet the above criteria.

Slopes. Under the bridge, paved slopes may be constructed at 1.5(H):1 (V) slope.

Corrosion

The corrosion investigations performed are in general accordance with the provisions of California Test Method 643. A summary of the corrosion test data is presented below.

Boring	Depth (ft)	pH	Resistivity (ohms-cm)	Sulfate (ppm)	Chloride (ppm)
GST-138	4-5.5	7.61	430.0	230.0	380.6

Based on the data, the site subsoil is non-corrosive per Caltrans corrosion design guidelines, and standard Type II modified or Type I-P (MS) modified cement may be used for the concrete substructures. The minimum cement factor and cover thickness should be per Caltrans Bridge Design Specifications (Section 8.22).

Plan Review

We recommend that final plans for foundations be reviewed by this office prior to construction so that the intent of our recommendations is included in the project plans and specifications and to further see that no misunderstandings or misinterpretations have occurred.

Construction Observation

To a degree, the performance of any structure is dependent upon construction procedures and quality. Hence, observation of foundation excavations, and pile installations should be carried out by the regulating agencies. If the subsurface conditions different from those forming the basis of our recommendations is encountered this office should be informed in order to assess the need for

design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our site reconnaissance and the assumption that the subsurface conditions do not deviate from observed conditions. All work done is in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our conclusions and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the subsurface conditions can occur with the passage of time, whether they be due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate

standards occur, whether they result from legislation or from the broadening of knowledge.

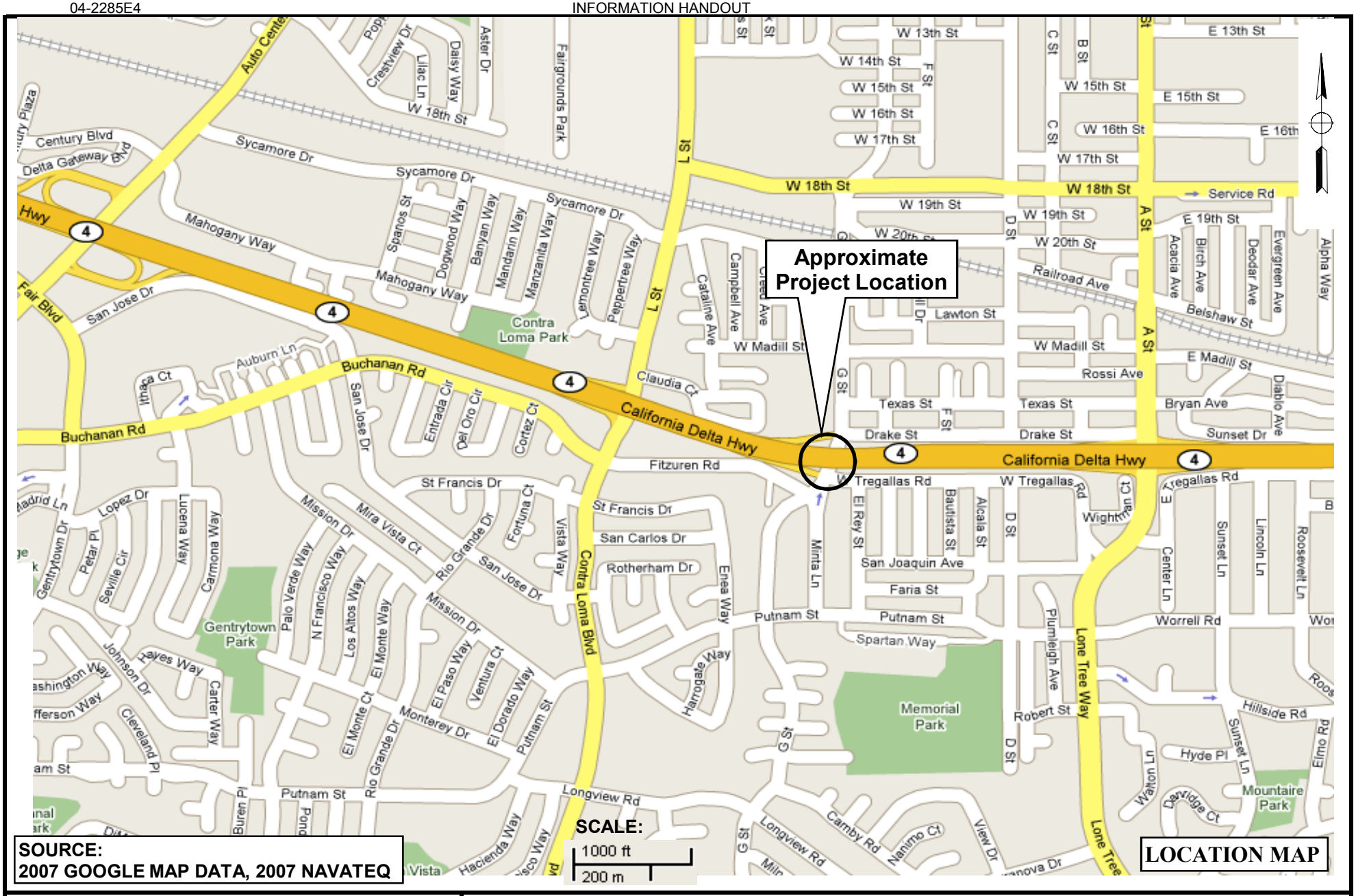
Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
PARIKH CONSULTANTS, INC.

Partha Sircar, Ph.D., P.E. C54619
Senior Engineer

Gary Parikh, G.E. 666
Project Manager

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-11
GEOTECHNICAL
STATE OF CALIFORNIA



SOURCE:
2007 GOOGLE MAP DATA, 2007 NAVATEQ

LOCATION MAP

PARIKH CONSULTANTS, INC.
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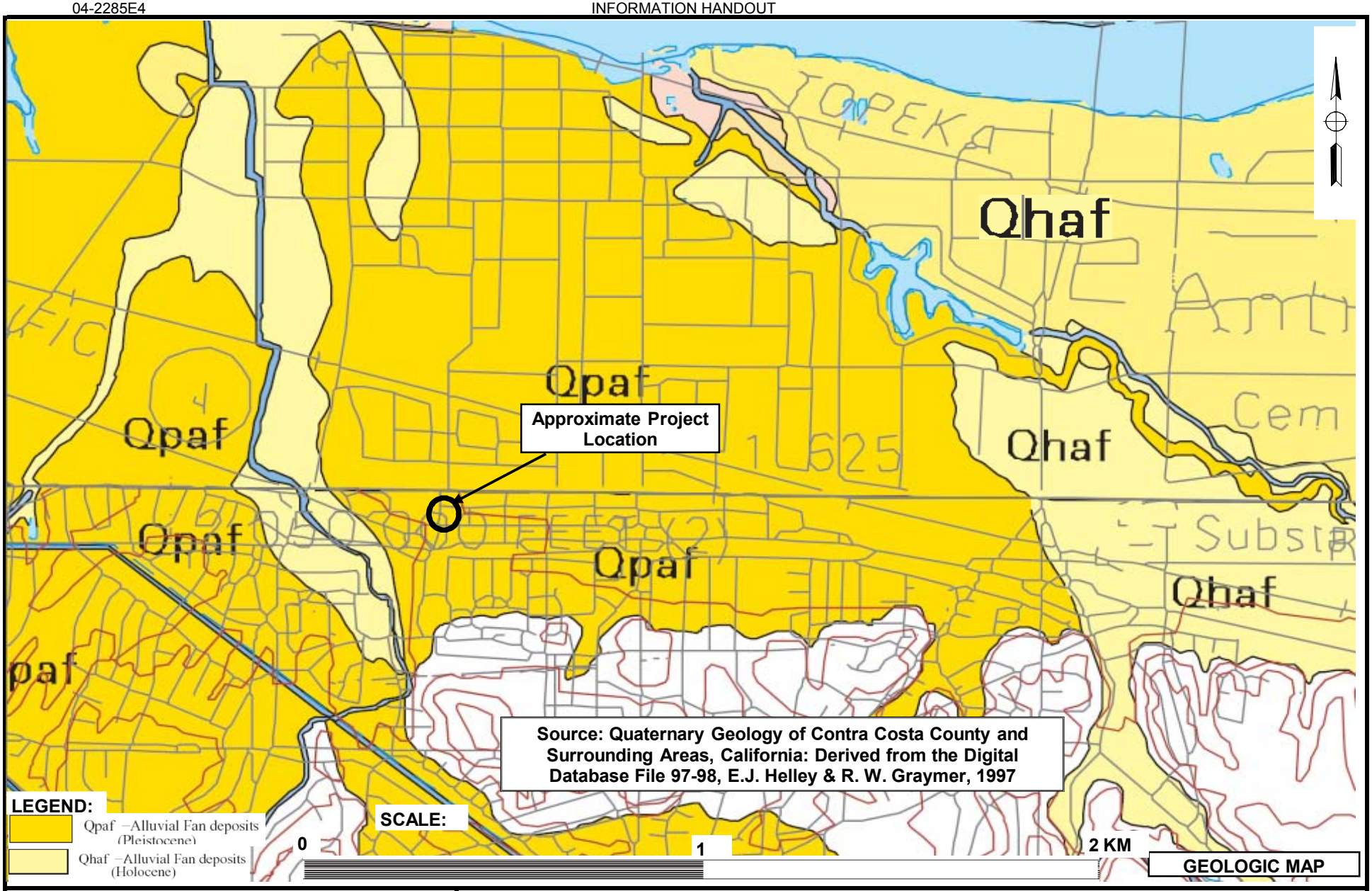
MATERIALS TESTING

G STREET OVERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.: 206118.GST	PLATE NO.: 1



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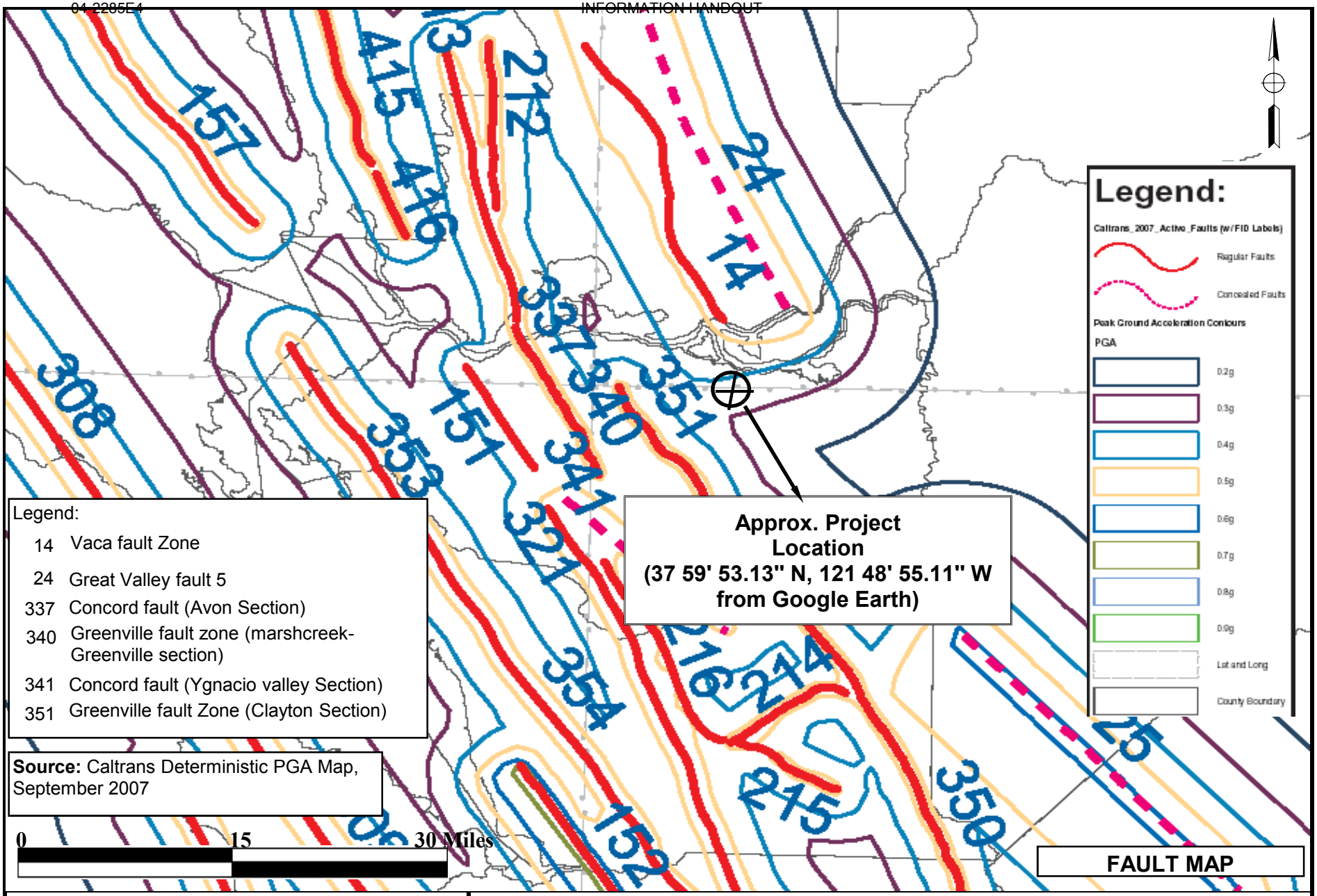
MATERIALS TESTING

G STREET OVERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.: 206118.GST | **PLATE NO.: 2**



Legend:

14	Vaca fault Zone
24	Great Valley fault 5
337	Concord fault (Avon Section)
340	Greenville fault zone (marshcreek-Greenville section)
341	Concord fault (Ygnacio valley Section)
351	Greenville fault Zone (Clayton Section)

Source: Caltrans Deterministic PGA Map, September 2007

FAULT MAP

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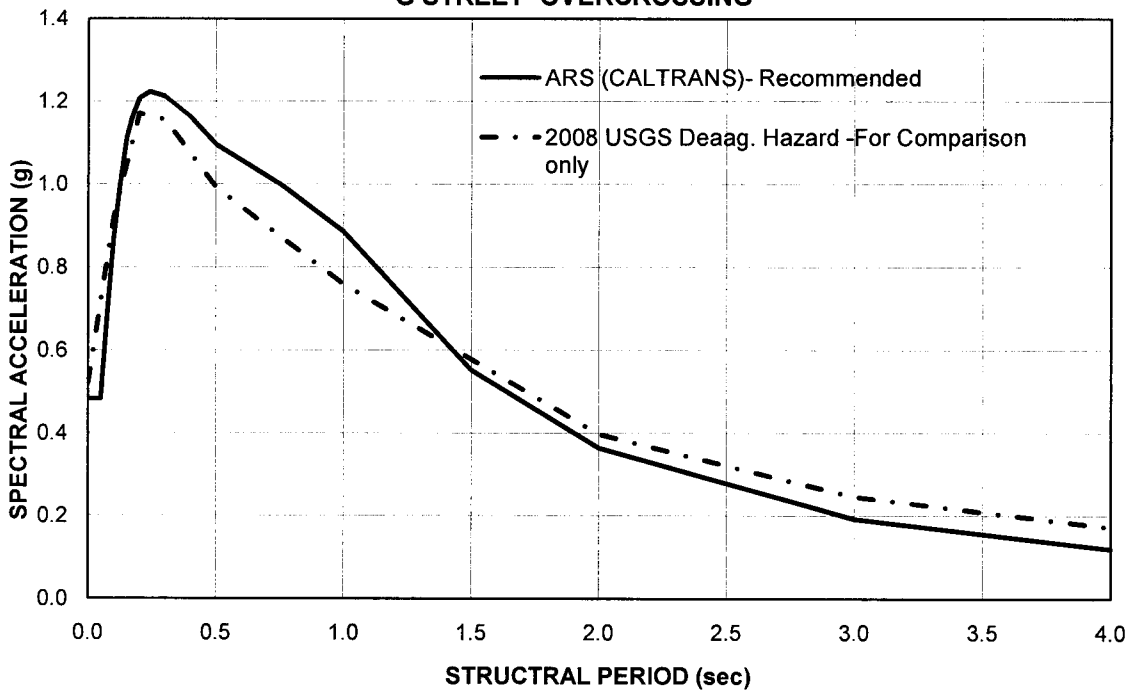
MATERIALS TESTING

G STREET OVERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.: 206118.GST | **PLATE NO.: 3**

ARS CURVE
G STREET OVERCROSSING



Spectral Data

Period (sec)	Spectral Accel. (g)
0.010	0.482
0.020	0.482
0.030	0.482
0.050	0.482
0.075	0.685
0.100	0.867
0.120	0.979
0.150	1.110
0.170	1.158
0.200	1.207
0.240	1.222
0.300	1.211
0.400	1.162
0.500	1.095
0.750	1.000
1.000	0.886
1.500	0.552
2.000	0.364
3.000	0.192
4.000	0.120

Caltrans SDC (v 1.4, June 2006), Figure B.8 (M=7.25+/-0.25)
Governing Fault: Vaca Fault Zone
Fault Distance = 9.28 km (5.8 miles)
(Mmax = 6.9, Soil Profile Type D, PBA = 0.47g)

Notes:
(a) The updated Caltrans Hazard Map and Data Base were used
(b) PBA was obtained by using Sadigh Attenuation Relationship: 0.47g
(b) Curve for 0.47g was obtained by interpolating between curves for 0.4g and 0.5g
(d) The following modifications were then applied for near-fault effects:
(1) No change of Sa for structural periods ≤ 0.5 sec
(2) 20% increase of Sa for structural periods > 1 sec
(3) Linear interpolation for structural periods between 0.5 and 1 sec

For Comparison only:

Periyod (sec)	Spectral Acce.
0.000	0.520
0.100	0.922
0.200	1.171
0.300	1.156
0.500	0.992
1.000	0.759
2.000	0.397
3.000	0.245
4.000	0.172
5.000	0.138

Caltrans 2009 Seismic Design Criteria-governed by 2008 USGS Deagg. Hazard-(Beta)-Probabilistic ARS

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MATERIALS TESTING

G STREET OVERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.:206118.GST

PLATE NO.: 4

APPENDIX A

INFORMATION HANDOUT

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4			

REGISTERED ENGINEER-GEOTECHNICAL

PLANS APPROVAL DATE

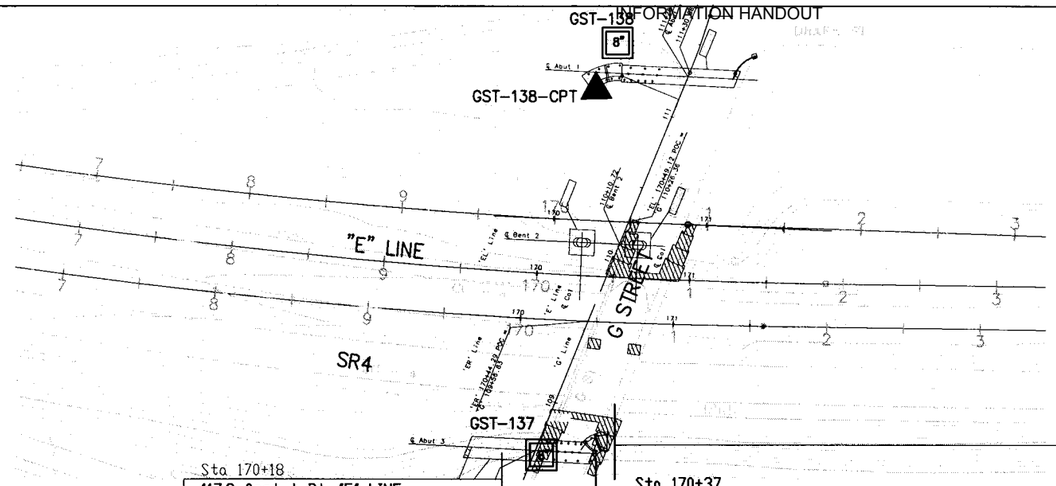
REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. GE. 666 Exp. 12/31/11 GEOTECHNICAL STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE CA 95131

CCTA
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523

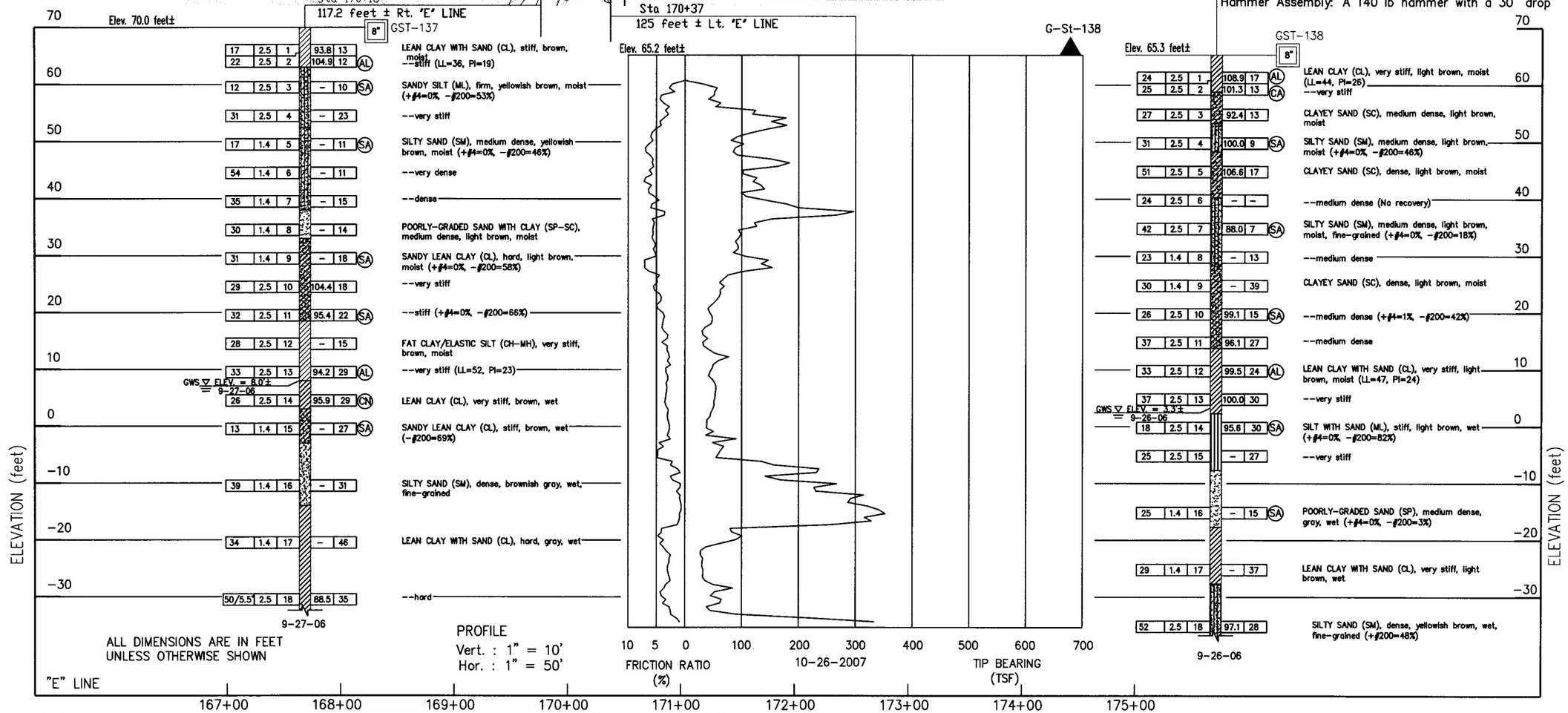
BKF ENGINEERS
4670 WILLOW ROAD, SUITE 250
PLEASANTON, CA 94588

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.



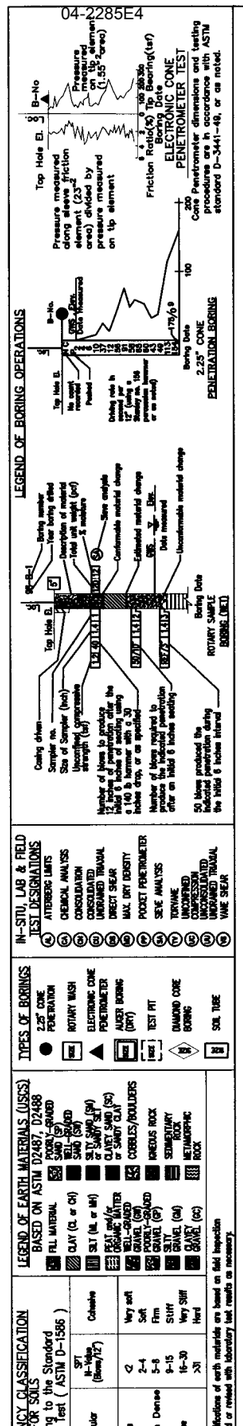
PLAN
1"=50'

Note:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop



ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'



DESIGN OVERSIGHT	DRAWN BY: OKSAN GOUTHIER	L. Bhangoo FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	PARTHA SIRCAR PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY: PARTHA SIRCAR	DATE: Sep 2006		

BRIDGE NO. 28-0400
POST MILE 27.3

G STREET OVERCROSSING

LOG OF TEST BORINGS 1 OF 2

CU 04275
EA 2285E1

DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES (PRELIMINARY STAGE ONLY) 09/28/09 05/26/10

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

OSF GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 2/25/05)

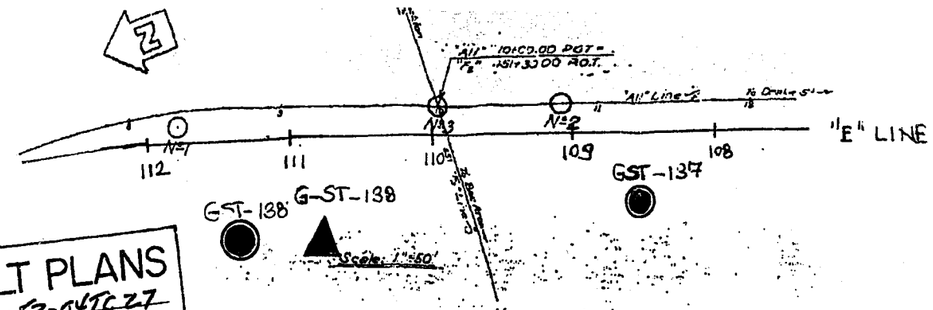
F-246 (3)

118 140

IV CC 75 F 38 4.4

Stewart Mitchell

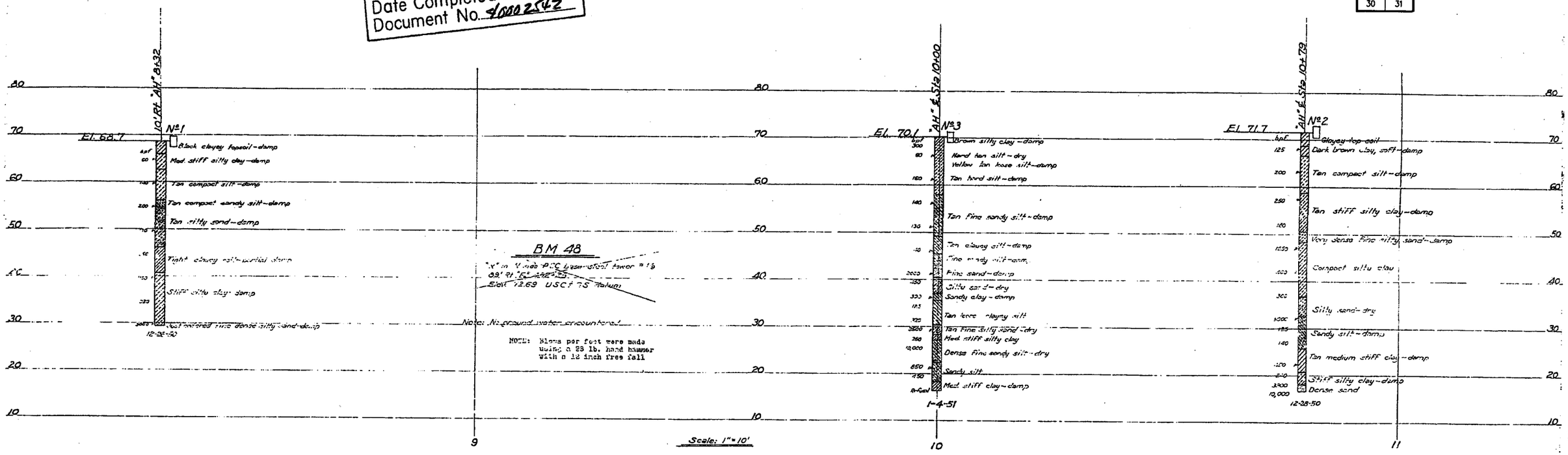
August. 27, 1951



AS BUILT PLANS
Contract No. 52-047C27
Date Completed
Document No. 4000025462

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	CC	4			
REGISTERED CIVIL ENGINEER			5/26/10 DATE		
G STREET OVERCROSSING					
LOG OF TEST BORINGS 2 OF 2					
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA			CU: 04275 EA: 2285E1	BRIDGE No. 28-0400	
				Sheet 30	of 31

REGISTERED PROFESSIONAL ENGINEER
GARY PARIKH
No. C.E. 666
Exp. 12/31/11
GEOTECHNICAL
STATE OF CALIFORNIA



Revisions made to this Log of Test Borings from the original 1951 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from "E" LINE
No.1	109+16	50 ft Lt
No.2	109+90	100 ft Lt
No.3	111+78	100 ft Lt

'E' Line parallels to 'AH' Lines.

'F2' Line intersects 'E' Line at Station 109+90 ft

Notes:

1. See the General Plan and/or Foundation Plan for English Stationing.
2. The Division of Structure Design produced the data presented in the table above.
   The data are the English 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.

"H" STREET OVERCROSSING

28-97 C-2571-5

APPENDIX B

APPENDIX B

LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented in "Log of Test Borings", Appendix A.

Moisture-Density

The natural moisture contents and dry unit weights were determined for selected undisturbed samples of the soils in general accordance with ASTM Test Method D 2216-92. This information was used to classify and correlate the soils. The results are presented at the appropriate depths on the "Log of Test Borings", Appendix A.

Atterberg Limits

The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the effective strength characteristics and expansion potential with variations in moisture content. The Atterberg Limits were determined in general accordance with ASTM Test Method D 4318-93. The results of these tests are presented on Plate B-2, "Plasticity Chart".

Grain Size Classification

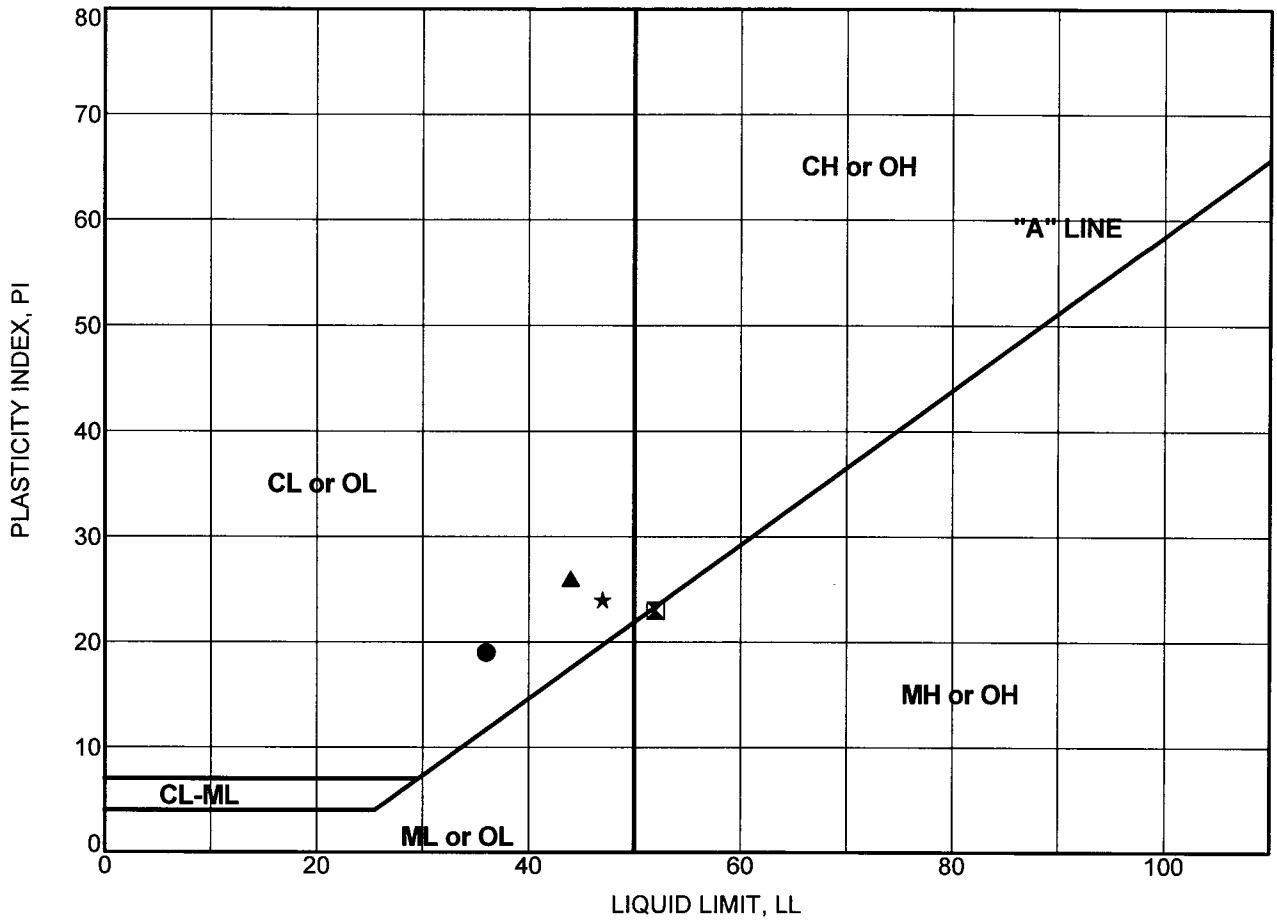
Grain size classification tests (ASTM Test Method D422-63) were performed on selected samples of granular soil to aid in the classification. The results are presented on Plate B-3A trough Plate B-3C, "Grain Size Distribution Curves".

Consolidation Tests

Consolidation tests (California Test Method T219) were performed on selected undisturbed samples. The test results are presented on Plate B-4A and Plate- B-4B

Corrosion Tests

Corrosion test was performed on selected sample to determine the corrosion potential of the soils. The pH and minimum resistively test was performed according to California Test Method 643. The test was performed by Sunland Analytical. The test result is presented on Plate B-5.



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
GST-137	MC-2	4.5	●	12	36	17	19	LEAN CLAY WITH SAND (CL)
GST-137	MC-13	59.5	⊠	29	52	29	23	FAT CLAY / ELASTIC SILT (CH-MH)
GST-138	MC-1	3.0	▲	17	44	18	26	LEAN CLAY (CL)
GST-138	MC-12	54.5	★	24	47	23	24	LEAN CLAY WITH SAND (CL)

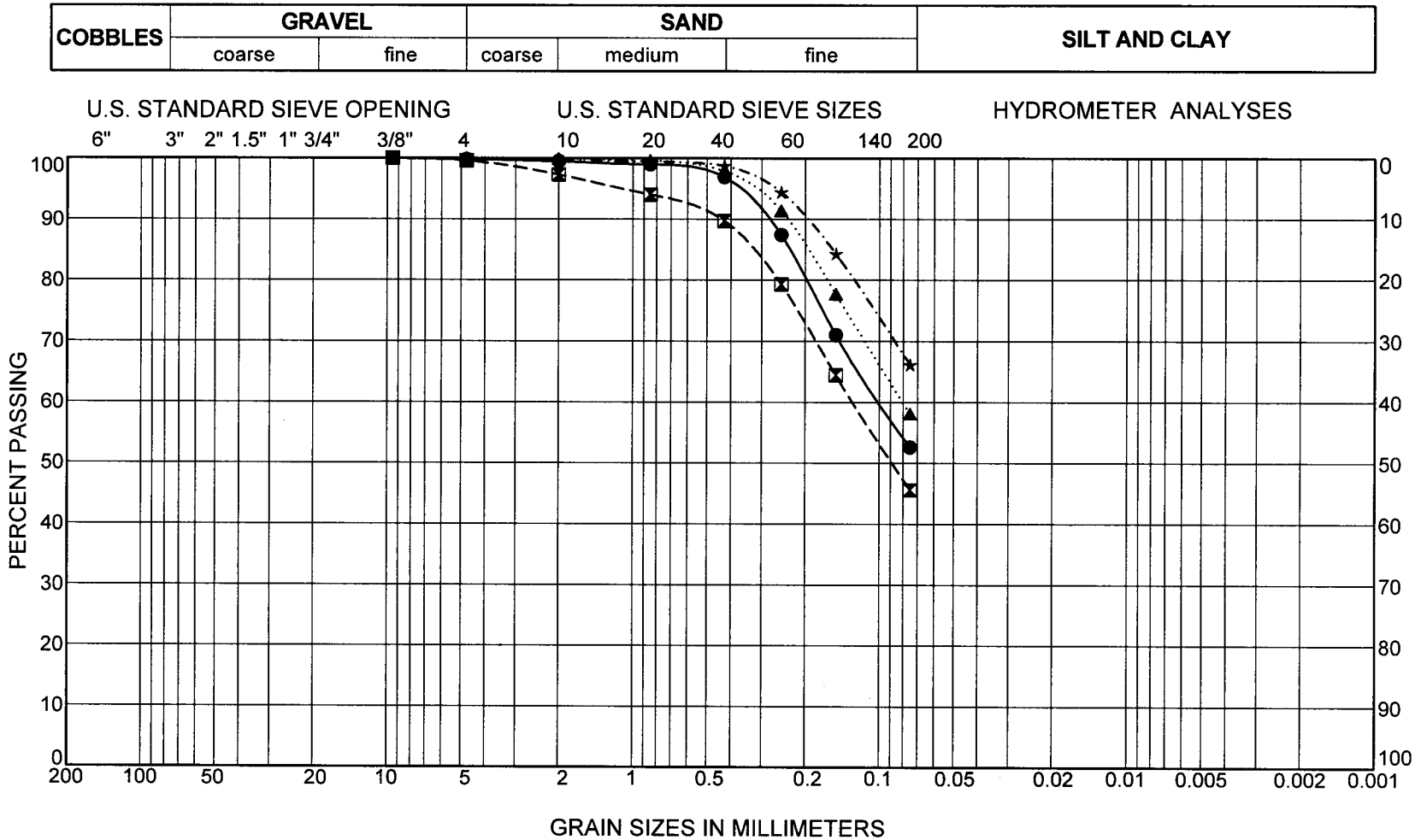
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

G STREET OVERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO: 206118.GST

PLATE NO: B-2

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
GST-137	MC-3	9.5	●			SANDY SILT (ML)
GST-137	SPT-5	19.5	⊠			SILTY SAND (SM)
GST-137	SPT-9	39.5	▲			SANDY LEAN CLAY (CL)
GST-137	MC-11	49.5	★			SANDY LEAN CLAY (CL)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

G STREET OVERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

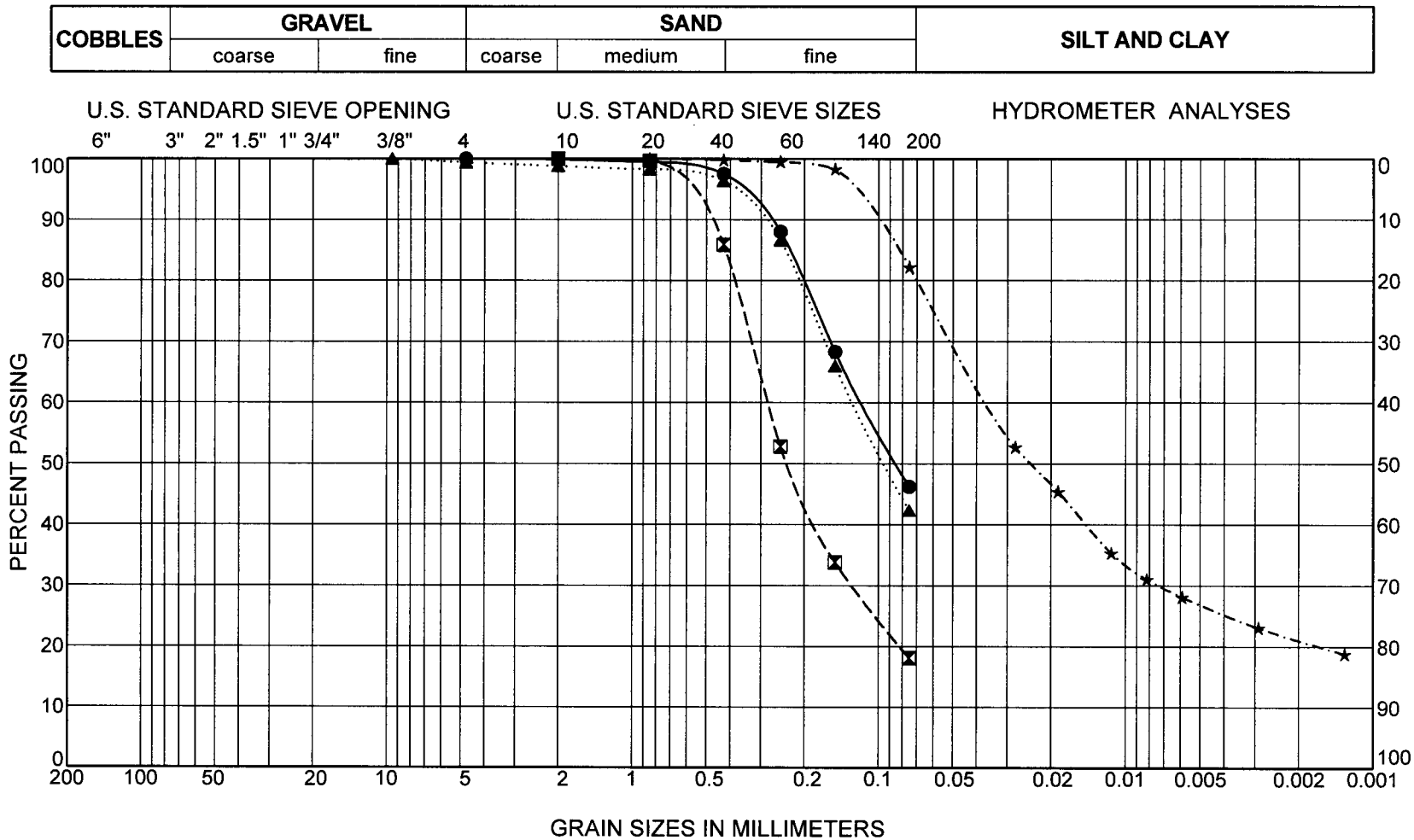
JOB NO: 206118.GST

PLATE NO: B-3A

04-2285E4

INFORMATION HANDOUT

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
GST-138	MC-4	14.5	●			SILTY SAND (SM)
GST-138	MC-7	29.5	⊠			SILTY SAND (SM)
GST-138	MC-10	44.5	▲			CLAYEY SAND (SC)
GST-138	MC-14	64.5	★			SILT WITH SAND (ML)

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GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

G STREET OVERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO: 206118.GST

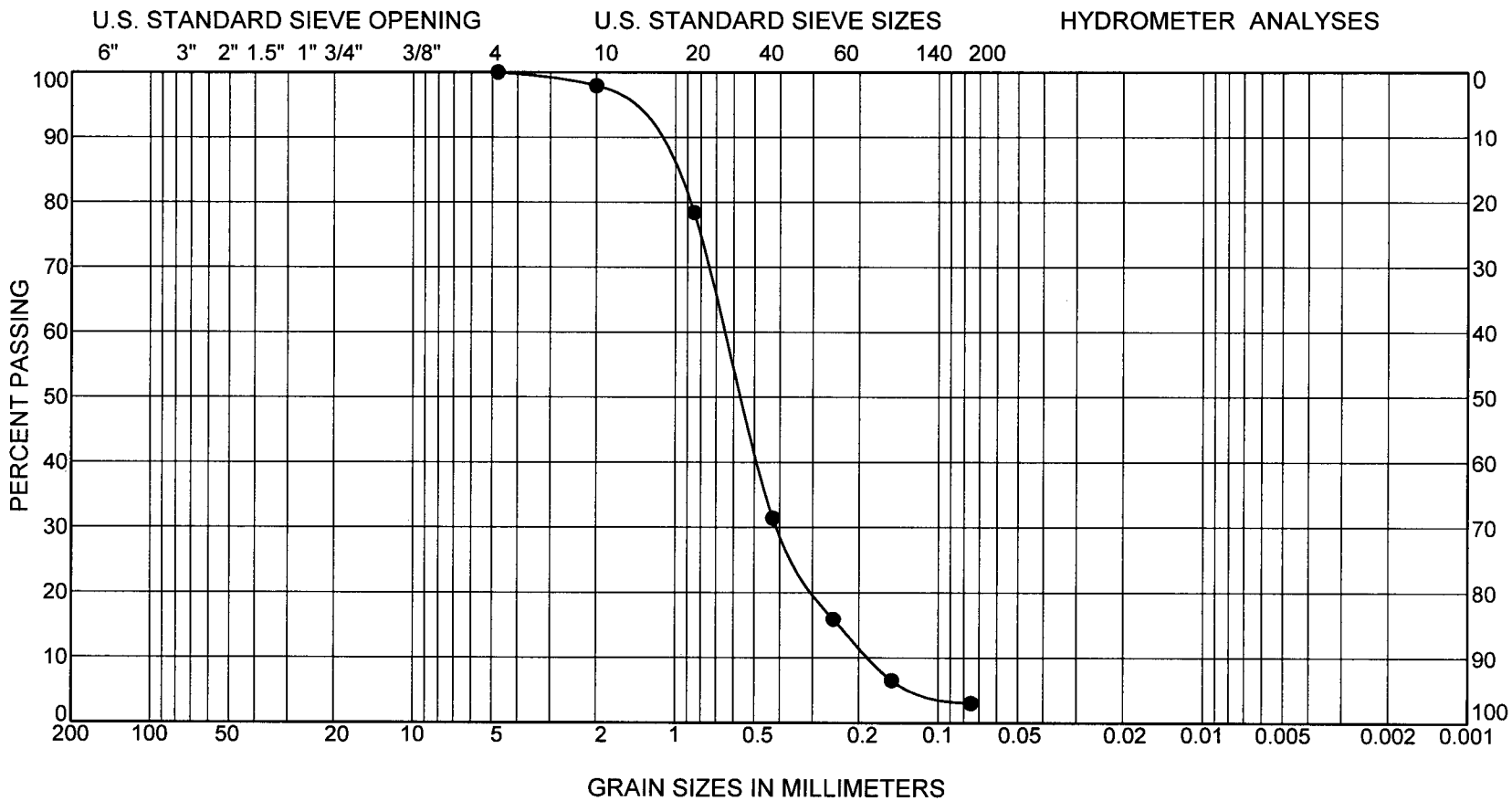
PLATE NO: B-3B

04-2285E4

INFORMATION HANDOUT

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
GST-138	SPT-16	79.0	●			POORLY-GRADED SAND (SP)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

G STREET OVERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

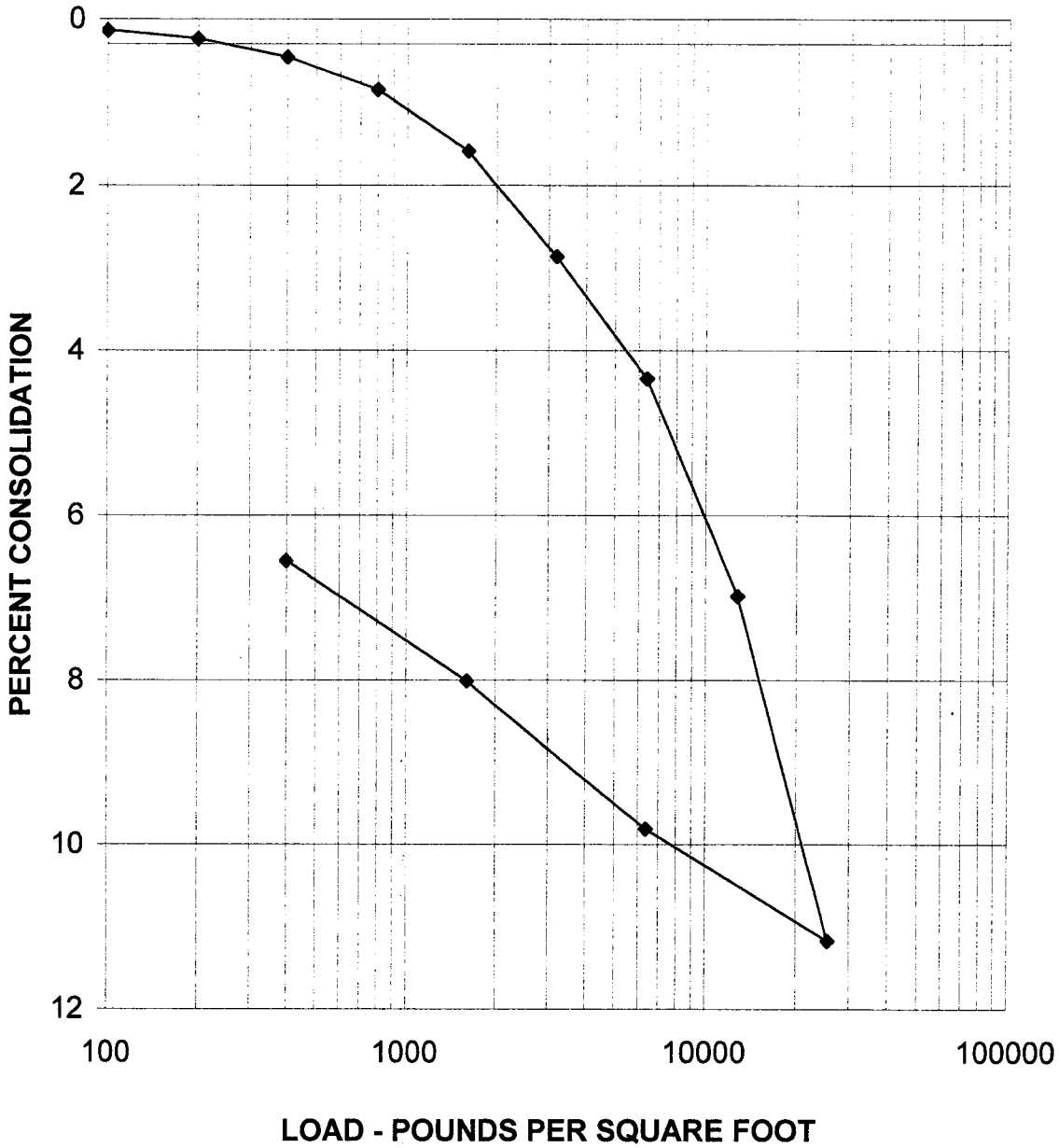
JOB NO: 206118.GST

PLATE NO: B-3C

04-2285E4

INFORMATION HANDOUT

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	28.5	95.9	1.0000	2.416
FINAL	26.0	102.7	0.9345	2.416

BORING NO.	GST 137	SAMPLE NO.	14	ELEV. OR DEPTH	64.5'
DESCRIPTION	Lean clay, yellowish brown				

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

G Street Bridge
CCTA / BKF

DATE	JOB NO:
11/14/06	206118.GST

Reported by: Prav Dayah

CONSOLIDATION TEST - TIME CURVE

JOB #: 206118.GST

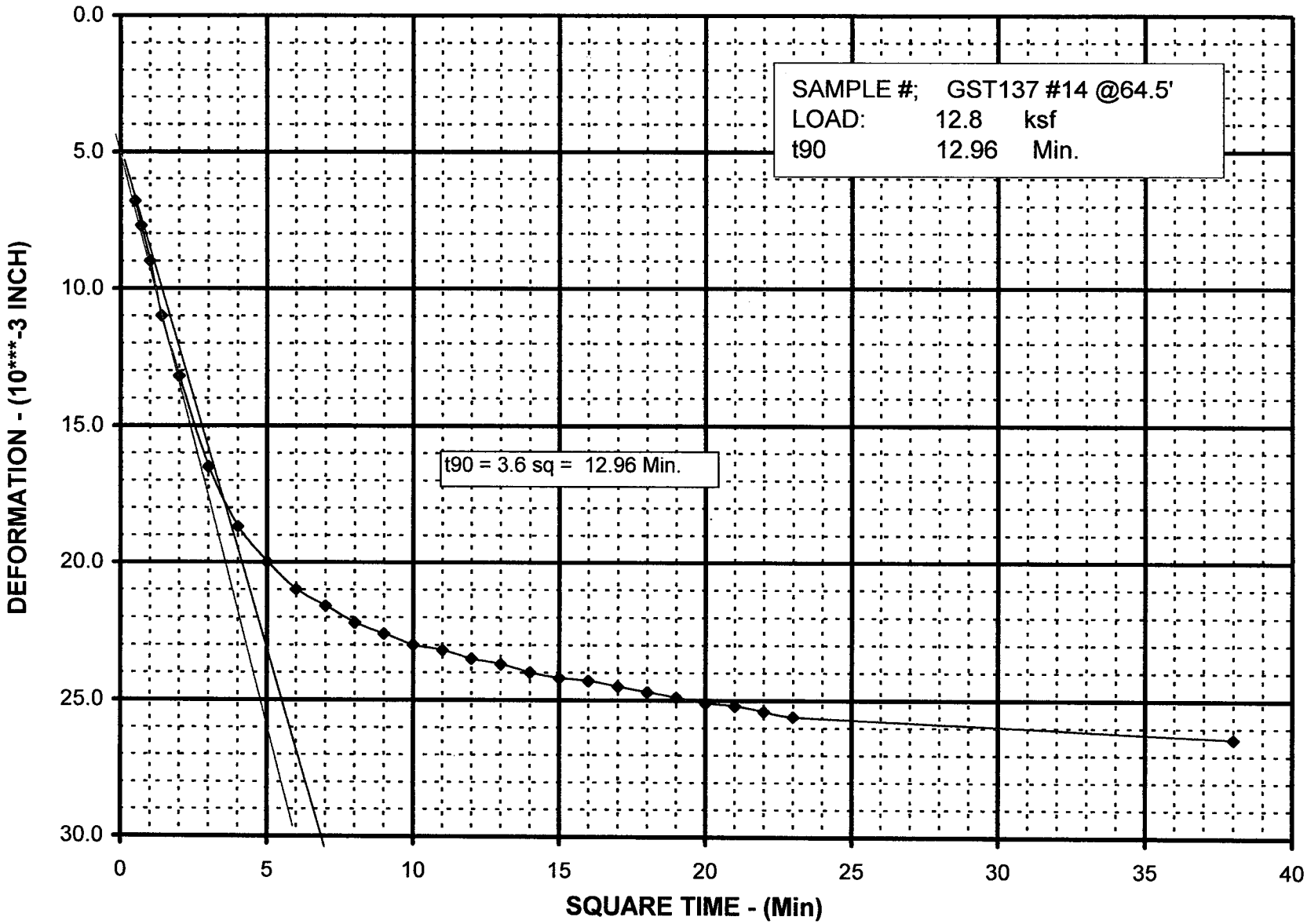


Plate- B-4B

04-2285E4
INFORMATION HANDOUT

04-2285E4

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 11/17/2006
Date Submitted 11/14/2006

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206118.G ST. Site ID : GST138#2@4.
Thank you for your business.

* For future reference to this analysis please use SUN # 49345-98396.

EVALUATION FOR SOIL CORROSION

Soil pH	7.61		
Minimum Resistivity	0.43	ohm-cm (x1000)	
Chloride	380.6 ppm	00.03806	%
Sulfate	230.0 ppm	00.02300	%

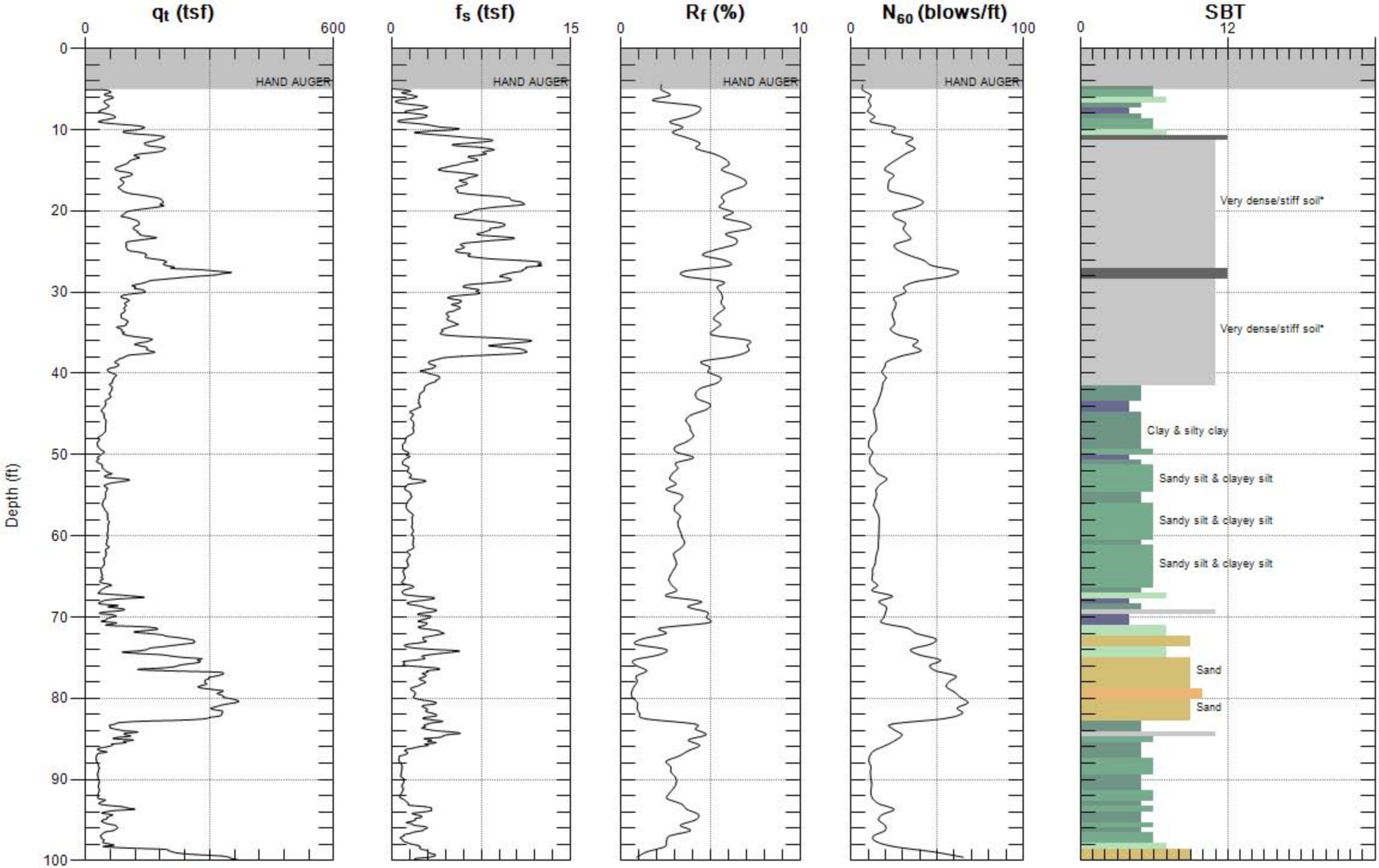
METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

APPENDIX C

PARIKH CONSULTANTS

Site: HWY 4 EAST
Sounding: G-St-138

Engineer: D.WANG
Date: 10/26/2007 09:40



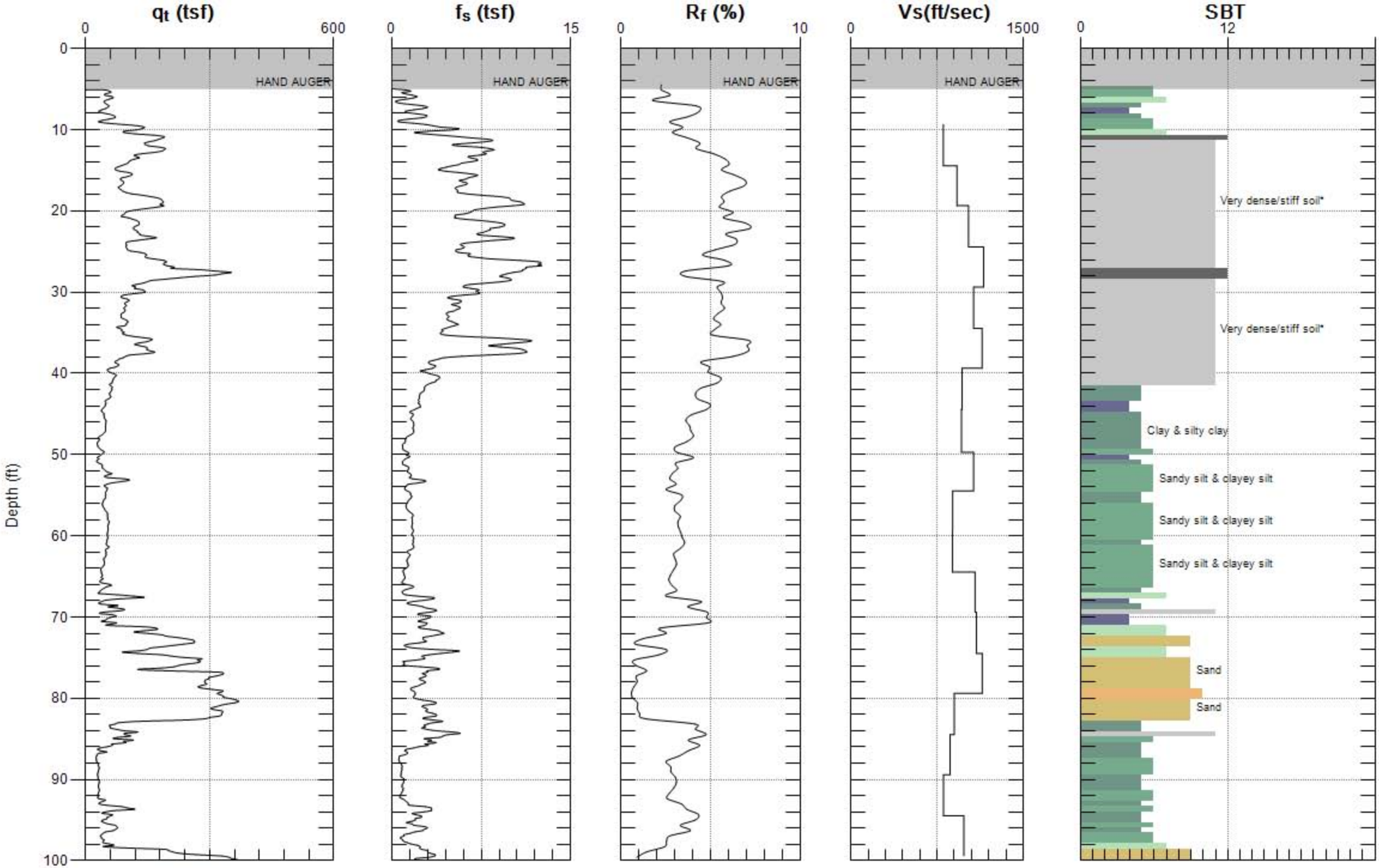
Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: HWY 4 EAST
Sounding: G-St-138

Engineer: D.WANG
Date: 10/26/2007 09:40



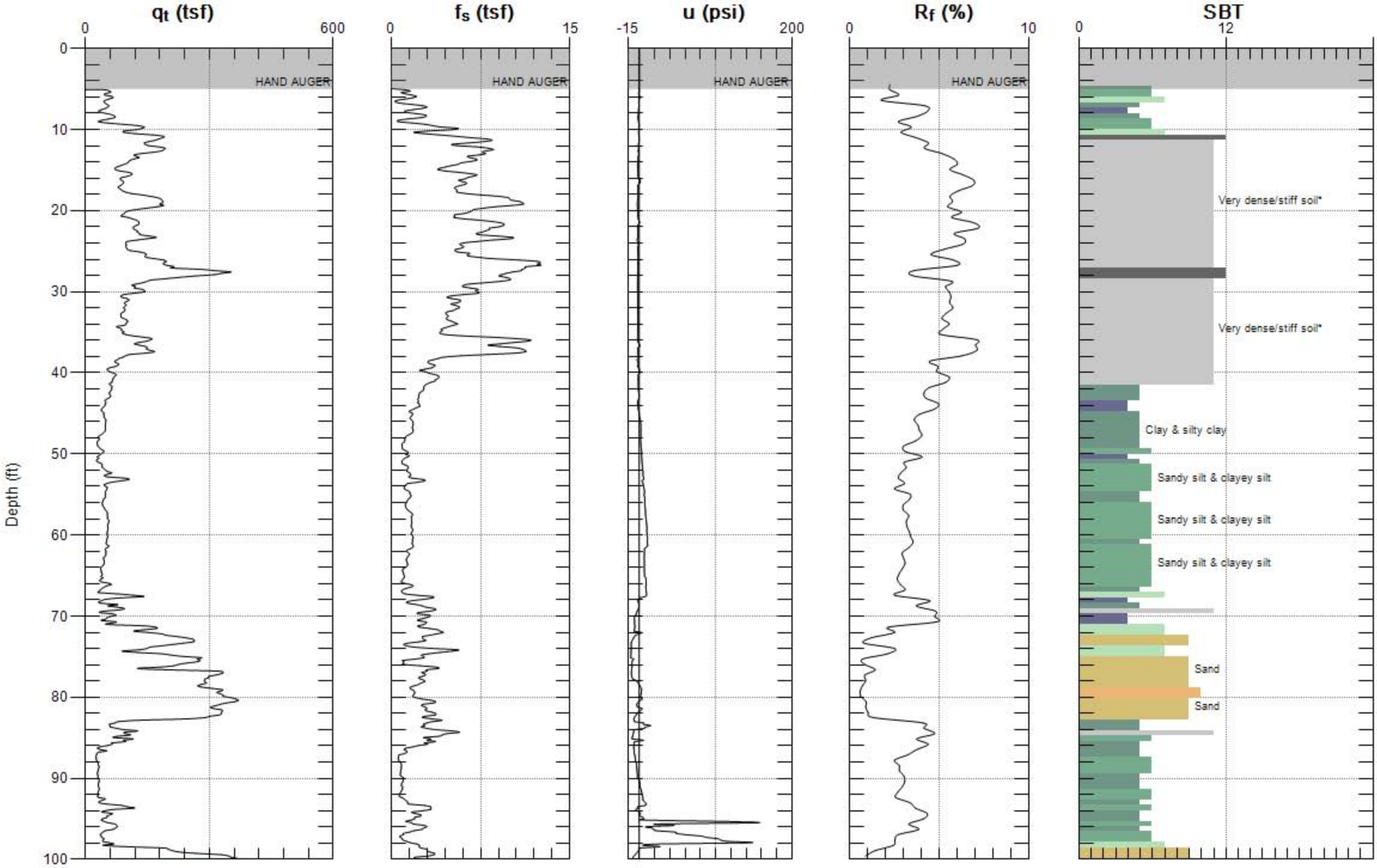
Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: HWY 4 EAST
Sounding: G-St-138

Engineer: D.WANG
Date: 10/26/2007 09:40



Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

07-2285E4

Shear Wave Velocity Calculations

INFORMATION HANDOUT

HWY 4 EAST

G-St-138

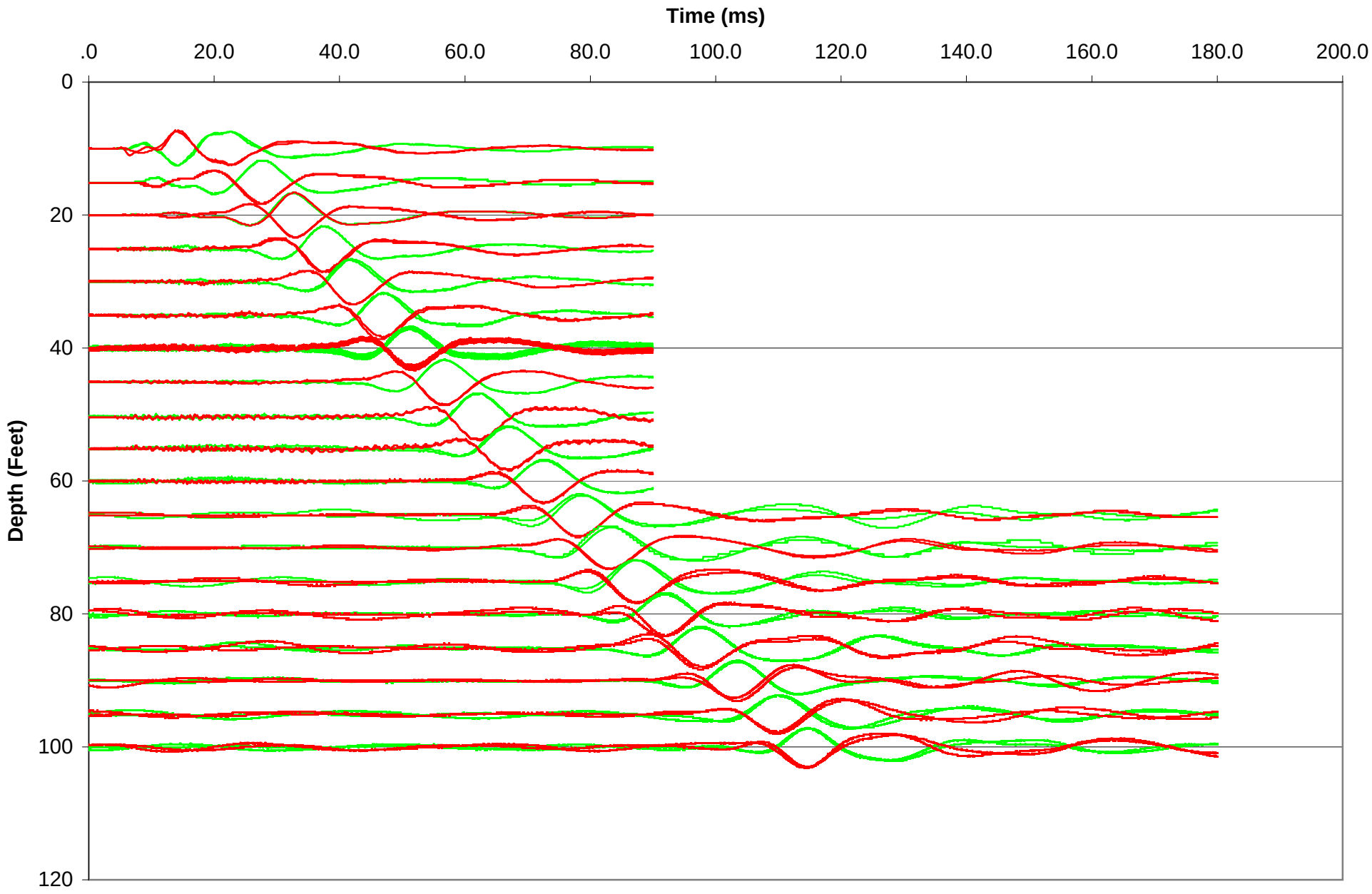
Geophone Offset: 0.66 Feet

Source Offset: 1.67 Feet

10/26/2007

Test Depth (Feet)	Geophone Depth (Feet)	Waveform Ray Path (Feet)	Incremental Distance (Feet)	Characteristic Arrival Time (ms)	Incremental Time Interval (ms)	Interval Velocity (Ft/Sec)	Interval Depth (Feet)
10.01	9.35	9.49	9.49	17.1500			
15.09	14.43	14.53	5.03	23.4000	6.2500	805.4	11.89
20.01	19.35	19.42	4.90	28.7000	5.3000	923.9	16.89
25.10	24.44	24.50	5.07	33.6500	4.9500	1024.3	21.90
30.02	29.36	29.41	4.91	37.9000	4.2500	1155.7	26.90
35.10	34.44	34.49	5.08	42.6500	4.7500	1069.1	31.90
40.03	39.37	39.40	4.92	46.9500	4.3000	1143.3	36.91
45.11	44.45	44.48	5.08	52.2000	5.2500	967.9	41.91
50.36	49.70	49.73	5.25	57.6500	5.4500	962.6	47.08
55.12	54.46	54.48	4.75	62.1000	4.4500	1068.5	52.08
60.04	59.38	59.40	4.92	67.6500	5.5500	886.3	56.92
65.12	64.46	64.49	5.08	73.4000	5.7500	884.1	61.92
70.05	69.39	69.41	4.92	77.9500	4.5500	1081.3	66.93
75.13	74.47	74.49	5.08	82.6000	4.6500	1093.3	71.93
80.05	79.39	79.41	4.92	86.9000	4.3000	1144.2	76.93
85.14	84.48	84.49	5.08	92.5500	5.6500	899.9	81.93
90.06	89.40	89.41	4.92	98.2500	5.7000	863.2	86.94
95.14	94.48	94.50	5.08	104.5500	6.3000	807.1	91.94
100.07	99.41	99.42	4.92	109.5500	5.0000	984.1	96.94

Waveforms for Sounding G-ST-138



LIQUEFACTION POTENTIAL ANALYSIS (per Youd & Idriss, 2001)

04-228E4

INFORMATION HANDOUT

PROJECT NAME **ROUTE 4**
PROJECT NO. **206118.CLO**
CPT NO. **GST-138 (G ST.)**

FAULT INFO
COAST RANGE - SIERRAN BLOCK BOUNDARY ZONE (CSB)
a_{max} (g)= 0.76

FAULT M_w = 7
MSF = 1.19

Depth (ft)		Soil Behavior Type	CPT RESULT INPUT qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	CSR γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	F.S.=(CRR 7.5/CSR)*MSF*Kσ*Kα Kσ	Kα	F.S.
0.492									1.7	1.00	#VALUE!							#VALUE!	1	
1.148									1.7	1.00	#VALUE!							#VALUE!	1	
1.804									1.7	1.00	#VALUE!							#VALUE!	1	
2.461									1.7	1.00	#VALUE!							#VALUE!	1	
3.117									1.7	0.99	#VALUE!							#VALUE!	1	
3.773									1.7	0.99	#VALUE!							#VALUE!	1	
4.429									1.7	0.99	#VALUE!							#VALUE!	1	
5.085	6	Sandy Silt to Clayey Silt	32.786	0.735	0.291		0.291	2.12	1.47552	0.99	0.489	2.120	1.48	48.38	1.492	72.185	0.11	1.00	1	
5.741	6	Sandy Silt to Clayey Silt	57.167	1.562	0.329		0.329	2.07	1.43885	0.99	0.488	2.070	1.44	82.25	1.403	115.397	0.22	1.00	1	
6.398	7	Silty Sand to Sandy Silt	52.549	0.93	0.368		0.368	1.97	1.40306	0.99	0.488	1.970	1.40	73.73	1.263	93.100	0.16	1.00	1	
7.054	5	Clayey Silt to Silty Clay	51.741	2.152	0.405		0.405	2.29	1.37072	0.99	0.487	2.290	1.37	70.92	1.917	135.961	0.31	1.00	1	
7.71	4	Silty Clay to Clay	41.938	1.825	0.443		0.443	2.39	1.33901	0.98	0.486	2.390	1.34	56.16	2.272	127.586	0.27	1.00	1	
8.366	5	Clayey Silt to Silty Clay	63.433	2.38	0.48		0.48	2.25	1.30952	0.98	0.485	2.250	1.31	83.07	1.798	149.376	0.39	1.00	1	
9.022	6	Sandy Silt to Clayey Silt	54.543	1.479	0.518		0.518	2.2	1.28056	0.98	0.485	2.200	1.28	69.85	1.667	116.416	0.23	1.00	1	
9.678	6	Sandy Silt to Clayey Silt	124.338	4.269	0.556		0.556	2.09	1.25285	0.98	0.484	2.090	1.25	155.78	1.437	223.839		1.00	1	
10.335	7	Silty Sand to Sandy Silt	119.085	3.411	0.594		0.594	2.05	1.22631	0.98	0.483	2.050	1.23	146.04	1.371	200.222		1.00	1	
10.991	12	Sand to Clayey Sand	177.845	6.54	0.634		0.634	2.06	1.19956	0.98	0.483	2.060	1.20	213.34	1.387	295.839		1.00	1	
11.647	11	Sitff Fine-Grained	152.283	6.666	0.677		0.677	2.17	1.17208	0.98	0.482	2.170	1.17	178.49	1.596	284.935		1.00	1	
12.303	11	Sitff Fine-Grained	179.566	7.491	0.72		0.72	2.13	1.14583	0.97	0.481	2.130	1.15	205.75	1.512	311.047		1.00	1	
12.959	11	Sitff Fine-Grained	144.635	7.452	0.762		0.762	2.27	1.1213	0.97	0.481	2.270	1.12	162.18	1.856	301.020		1.00	1	
13.615	11	Sitff Fine-Grained	116.924	6.784	0.805		0.805	2.38	1.09726	0.97	0.480	2.380	1.10	128.30	2.233	286.430		1.00	1	
14.272	11	Sitff Fine-Grained	92.744	5.564	0.848		0.848	2.46	1.07422	0.97	0.479	2.460	1.07	99.63	2.574	256.468		1.00	1	
14.928	11	Sitff Fine-Grained	81.464	4.552	0.891		0.891	2.49	1.05213	0.97	0.479	2.490	1.05	85.71	2.718	232.994		1.00	1	
15.584	11	Sitff Fine-Grained	103.45	6.534	0.934		0.934	2.48	1.03093	0.97	0.478	2.480	1.03	106.65	2.669	284.684		1.00	1	
16.24	11	Sitff Fine-Grained	88.638	6.121	0.976		0.976	2.56	1.01103	0.97	0.477	2.560	1.01	89.62	3.091	276.962		1.00	1	
16.896	11	Sitff Fine-Grained	85.224	5.837	1.019		1.019	2.58	0.99144	0.96	0.476	2.580	0.99	84.49	3.206	270.927		1.00	1	
17.552	11	Sitff Fine-Grained	93.072	5.63	1.062		1.062	2.52	0.97259	0.96	0.476	2.520	0.97	90.52	2.872	259.942		0.99	1	
18.209	11	Sitff Fine-Grained	151.464	8.462	1.105		1.105	2.38	0.95445	0.96	0.475	2.380	0.95	144.56	2.233	322.751		0.98	1	
18.865	11	Sitff Fine-Grained	184.284	10.563	1.148		1.148	2.35	0.93697	0.96	0.474	2.350	0.94	172.67	2.120	365.996		0.97	1	
19.521	11	Sitff Fine-Grained	163.039	8.924	1.19		1.19	2.37	0.9205	0.96	0.473	2.370	0.92	150.08	2.194	329.277		0.97	1	
20.177	11	Sitff Fine-Grained	102.096	6.361	1.233		1.233	2.55	0.90423	0.96	0.472	2.550	0.90	92.32	3.034	280.116		0.96	1	
20.833	11	Sitff Fine-Grained	103.232	5.874	1.276		1.276	2.53	0.88853	0.95	0.472	2.530	0.89	91.72	2.925	268.274		0.95	1	
21.49	11	Sitff Fine-Grained	126.759	8.766	1.319		1.319	2.55	0.87336	0.95	0.471	2.550	0.87	110.71	3.034	335.909		0.95	1	
22.146	11	Sitff Fine-Grained	120.065	8.59	1.362		1.362	2.58	0.8587	0.95	0.470	2.580	0.86	103.10	3.206	330.586		0.94	1	
22.802	11	Sitff Fine-Grained	134.13	7.825	1.405		1.405	2.49	0.84453	0.95	0.469	2.490	0.84	113.28	2.718	307.930		0.93	1	
23.458	11	Sitff Fine-Grained	140.514	8.992	1.447		1.447	2.52	0.83113	0.95	0.468	2.520	0.83	116.79	2.872	335.363		0.93	1	
24.114	11	Sitff Fine-Grained	99.01	6.252	1.49		1.49	2.62	0.81784	0.94	0.467							0.92	1	
24.77	11	Sitff Fine-Grained	108.34	5.691	1.533		1.533	2.54	0.80498	0.94	0.466	2.540	0.80	87.21	2.979	259.799		0.92	1	
25.427	11	Sitff Fine-Grained	143.193	6.496	1.576		1.576	2.42	0.79251	0.94	0.465	2.420	0.79	113.48	2.396	271.886		0.91	1	
26.083	11	Sitff Fine-Grained	178.129	10.271	1.619		1.619	2.45	0.78042	0.94	0.463	2.450	0.78	139.02	2.528	351.460		0.91	1	
26.739	11	Sitff Fine-Grained	199.819	11.969	1.661		1.661	2.44	0.76896	0.94	0.462	2.440	0.77	153.65	2.483	381.542		0.90	1	
27.395	12	Sand to Clayey Sand	296.963	10.601	1.701		1.701	2.16	0.75836	0.93	0.461	2.160	0.76	225.20	1.574	354.531		0.82	1	
28.051	12	Sand to Clayey Sand	266.283	9.52	1.741		1.741	2.19	0.74804	0.93	0.459	2.190	0.75	199.19	1.643	327.197		0.82	1	
28.707	11	Sitff Fine-Grained	153.809	8.734	1.784		1.784	2.51	0.73727	0.93	0.458	2.510	0.74	113.40	2.820	319.727		0.89	1	
29.364	11	Sitff Fine-Grained	122.421	6.533	1.826		1.826	2.56	0.72703	0.92	0.456	2.560	0.73	89.00	3.091	275.072		0.89	1	
30.02	11	Sitff Fine-Grained	126.365	7.007	1.869		1.869	2.57	0.71685	0.92	0.455	2.570	0.72	90.58	3.148	285.156		0.88	1	
30.676	11	Sitff Fine-Grained	94.504	5.331	1.912		1.912	2.67	0.70694	0.92	0.453							0.88	1	
31.332	11	Sitff Fine-Grained	99.233	5.516	1.955		1.955	2.65	0.69731	0.91	0.451							0.87	1	
31.988	11	Sitff Fine-Grained	95.373	5.479	1.998		1.998	2.68	0.68793	0.91	0.449							0.87	1	
32.644	11	Sitff Fine-Grained	89.201	4.798	2.041		2.041	2.69	0.6788	0.91	0.448							0.87	1	
33.301	11	Sitff Fine-Grained	93.412	4.798	2.083		2.083	2.67	0.67012	0.90	0.446							0.86	1	
33.957	11	Sitff Fine-Grained	94.236	5.218	2.126		2.126	2.69	0.66146	0.90	0.443							0.86	1	
34.613	11	Sitff Fine-Grained	85.096	4.416	2.169		2.169	2.71	0.65301	0.89	0.441							0.86	1	
35.269	11	Sitff Fine-Grained	107.154	5.444	2.212		2.212	2.64	0.64478	0.89	0.439							0.85	1	
35.925	11	Sitff Fine-Grained	147.147	10.434	2.255		2.255	2.66	0.63676	0.88	0.437							0.85	1	
36.581	11	Sitff Fine-Grained	134.436	9.428	2.297		2.297	2.69	0.62911	0.88	0.434							0.85	1	
37.238	11	Sitff Fine-Grained	153.648	10.872	2.34		2.34	2.66	0.62147	0.87	0.432							0.84	1	
37.894	11	Sitff Fine-Grained	104.569	6.539	2.383		2.383	2.74	0.61401	0.87	0.429							0.84	1	
38.55	11	Sitff Fine-Grained	76.618	3.414	2.426		2.426	2.74	0.60673	0.86	0.427							0.84	1	
39.206	11	Sitff Fine-Grained	68.725	3.381	2.469		2.469	2.81	0.59962	0.86	0.424							0.83	1	
39.862	11	Sitff Fine-Grained	61.517	2.989	2.511		2.511	2.85	0.59283	0.85	0.421							0.83	1	
40.518	11	Sitff Fine-Grained	69.828	3.865	2.554		2.554	2.85	0.58604	0.85	0.418							0.83	1	
41.175	11	Sitff Fine-Grained	62.564	3.332	2.597		2.597	2.88	0.5794	0.84	0.415							0.83	1	
41.831	5	Clayey Silt to Silty Clay	62.81	2.776	2.635		2.635	2.83	0.57366	0.83	0.412							0.82	1	
42.487	5	Clayey Silt to Silty Clay	59.785	2.473	2.672		2.672	2.83	0.56818	0.83	0.409							0.82	1	
43.143	5	Clayey Silt to Silty Clay	54.376	2.314	2.71		2.71	2.88	0.56266	0.82	0.406							0.82	1	
43.799	4	Silty Clay to Clay	47.519	2.351	2.747		2.747	2.98	0.55739	0.82	0.403							0.82	1	
44.455	4	Silty Clay to Clay	40.93	1.937	2.785		2.785	3.03	0.55207	0.81	0.400							0.81	1	
45.112	5	Clayey Silt to Silty Clay	43.871	1.708	2.823		2.823	2.95	0.54686	0.80	0.396							0.81	1	
45.768	5	Clayey Silt to Silty Clay	47.948	1.727	2.86		2.86	2.9	0.54187	0.80	0.393							0.81	1	
46.424	5	Clayey Silt to Silty Clay	48.455	1.842	2.898		2.898	2.92	0.53685	0.79	0.390							0.81	1	
47.08	5	Clayey Silt to Silty Clay	46.979	1.826	2.935		2.935	2.94	0.53204	0.78	0.387							0.81	1	
47.736	5	Clayey Silt to Silty Clay	35.655	1.436	2.973		2.973	3.06	0.5272	0.78	0.383							0.80	1	
48.392	5	Clayey Silt to Silty Clay	30.358	1.111	3.011		3.011	3.11	0.52244	0.77	0.380							0.80	1	
49.049	5	Clayey Silt to Silty Clay	31.678	0.951	3.048		3.048	3.04	0.51789	0.76	0.377							0.80	1	
49.705	6	Sandy Silt to Clayey Silt	40.345	1.246	3.086		3.086	2.96	0.5133	0.76	0.373							0.80	1	
50.361	4	Silty Clay to Clay	31.6	1.276	3.123		3.123	3.13	0.50891	0.75	0.370							0.80	1	
51.017	5	Clayey Silt to Silty Clay	32.992	1.009	3.161		3.161	3.05	0.50447	0.74	0.367							0.79	1	
51.673	6	Sandy Silt to Clayey Silt	43.186	1.361	3.199		3.199	2.95	0.50011	0.74	0.363							0.79	1	
52.329	6	Sandy Silt to Clayey Silt	53.067	1.513	3.236		3.236	2.85	0.49594	0.73	0.360							0.79	1	
52.986	6	Sandy Silt to Clayey Silt	77.509	2.102	3.274		3.274	2.7	0.49173	0.72	0.357							0.79	1	
53.642	6	Sandy Silt to Clayey Silt	58.922	1.803	3.311		3.311	2.83	0.4877	0.72	0.354							0.79	1	
54.298	6	Sandy Silt to Clayey Silt	50.154	1.256	3.349		3.349	2.85	0.48362	0.71	0.351							0.79	1	
54.954	5	Clayey Silt to Silty Clay	48.338	1.627	3.387	0.007	3.379	2.94	0.48045	0.70	0.348							0.78	1	
55.61	5	Clayey Silt to Silty Clay	44.467	1.48	3.424	0.028	3.396	2.97	0.47868	0.70	0.347							0.78	1	
56.266	6	Sandy Silt to Clayey Silt	41.815	1.255	3.462	0.048	3.413	2.98	0.47691	0.69	0.347							0.78	1	
56.923	6	Sandy Silt to Clayey Silt	48.739	1.458	3.499	0.069	3.43	2.92	0.47516	0.69	0.346							0.78	1	
57.579	6	Sandy Silt to Clayey Silt	53.078	1.751	3.537	0.089	3.448	2.91	0.47332	0.68	0.344							0.78	1	
58.235	6	Sandy Silt to Clayey Silt	55.017	1.742	3.575	0.11	3.465	2.89	0.4716	0.67	0.344							0.78	1	
58.891	6	Sandy Silt to Clayey Silt	54.393	1.732	3.612	0.13	3.482	2.9	0.46988	0.67	0.343							0.78	1	
59.547	6	Sandy Silt to Clayey Silt	53.257	1.769	3.65	0.151	3.499	2.92	0.46818	0.66	0.342							0.78	1	
60.203	6	Sandy Silt to Clayey Silt	52.816	1.803	3.687	0.171	3.516	2.93	0.4665	0.66	0.341							0.78	1	
60.86	5	Clayey Silt to Silty Clay	51.068	1.81	3.725	0.192	3.533	2.95	0.46482	0.65	0.340							0.78	1	
61.516	6	Sandy Silt to Clayey Silt	51.725	1.715	3.763	0.212	3.55	2.93	0.46316	0.65	0.339							0.78	1	
62.172	6	Sandy Silt to Clayey Silt	49.146	1.443	3.8	0.233	3.567	2.93	0.46151	0.64	0.338							0.78	1	
62.828	6	Sandy Silt to Clayey Silt	45.631	1.374	3.838	0.253	3.585	2.96	0.45977	0.64	0.337							0.77	1	
63.484	6	Sandy Silt to Clayey Silt	44.222	1.364	3.875	0.274	3.602	2.99	0.45814	0.63	0.336							0.77	1	

INFORMATION HANDOUT

LIQUEFACTION POTENTIAL ANALYSIS (per Youd & Idriss, 2001)

PROJECT NAME **ROUTE 4**
PROJECT NO. **206118.CLO**
CPT NO. **GST-138 (G ST.)**

FAULT INFO
COAST RANGE - SIERRAN BLOCK BOUNDARY ZONE (CSB)
a_{max} (g)= 0.76

FAULT M_w = 7
MSF = 1.19

Depth (ft)		Soil Behavior Type	CPT RESULT INPUT qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_{H}*	CSR γ_d	CSR	CRR 7.5 Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	F.S.=(CRR 7.5/CSR)*MSF*Kσ*Kα Kσ	Kα	F.S.
64.14	6	Sandy Silt to Clayey Silt	38.251	1.124	3.913	0.294	3.619	3.04	0.45653	0.63	0.335							0.77	1	
64.797	6	Sandy Silt to Clayey Silt	38.924	1.071	3.95	0.315	3.636	3.01	0.45492	0.62	0.335							0.77	1	
65.453	6	Sandy Silt to Clayey Silt	38.027	1.012	3.988	0.335	3.653	3.02	0.45333	0.62	0.334							0.77	1	
66.109	6	Sandy Silt to Clayey Silt	50.739	1.44	4.026	0.356	3.67	2.92	0.45175	0.61	0.333							0.77	1	
66.765	5	Clayey Silt to Silty Clay	37.075	1.144	4.063	0.376	3.687	3.07	0.45017	0.61	0.332							0.77	1	
67.421	7	Silty Sand to Sandy Silt	90.794	2.272	4.102	0.396	3.705	2.66	0.44852	0.61	0.332							0.77	1	
68.077	4	Silty Clay to Clay	49.084	2.182	4.14	0.417	3.723	3.06	0.44688	0.60	0.331							0.77	1	
68.734	5	Clayey Silt to Silty Clay	68.658	2.549	4.177	0.437	3.74	2.88	0.44534	0.60	0.330							0.77	1	
69.39	11	Sitff Fine-Grained	63.784	3.05	4.22	0.458	3.762	2.98	0.44337	0.60	0.330							0.77	1	
70.046	4	Silty Clay to Clay	59.623	2.825	4.258	0.478	3.779	3.01	0.44186	0.59	0.329							0.77	1	
70.702	4	Silty Clay to Clay	55.184	2.672	4.295	0.499	3.796	3.04	0.44035	0.59	0.329							0.77	1	
71.358	7	Silty Sand to Sandy Silt	134.888	2.931	4.334	0.519	3.814	2.49	0.43877	0.58	0.328	2.490	0.44	59.19	2.718	160.888		0.77	1	
72.014	7	Silty Sand to Sandy Silt	157.213	3.922	4.372	0.54	3.833	2.48	0.43712	0.58	0.328	2.480	0.44	68.72	2.669	183.438		0.76	1	
72.671	9	Sand	236.187	2.846	4.413	0.56	3.853	2.14	0.43538	0.58	0.327	2.140	0.44	102.83	1.532	157.535	0.44	0.70	1	1.36
73.327	9	Sand	231.937	1.821	4.454	0.581	3.873	2.04	0.43367	0.58	0.327	2.040	0.43	100.58	1.356	136.380	0.32	0.70	1	0.97
73.983	7	Silty Sand to Sandy Silt	141.728	3.521	4.492	0.601	3.891	2.52	0.43214	0.57	0.326	2.520	0.43	61.25	2.872	175.874		0.76	1	
74.639	7	Silty Sand to Sandy Silt	168.927	3.554	4.531	0.622	3.909	2.41	0.43061	0.57	0.326	2.410	0.43	72.74	2.354	171.209		0.76	1	
75.295	9	Sand	267.542	1.923	4.572	0.642	3.93	1.97	0.42885	0.57	0.326	1.970	0.43	114.74	1.263	144.879	0.36	0.68	1	1.11
75.951	9	Sand	227.414	1.891	4.613	0.663	3.95	2.07	0.42718	0.56	0.325	2.070	0.43	97.15	1.403	136.291	0.32	0.70	1	0.97
76.608	9	Sand	230.689	3.281	4.653	0.683	3.97	2.2	0.42553	0.56	0.325	2.200	0.43	98.17	1.667	163.619		0.71	1	
77.264	9	Sand	314.888	2.647	4.694	0.704	3.99	1.95	0.42389	0.56	0.324	1.950	0.42	133.48	1.240	165.495		0.65	1	
77.92	9	Sand	291.775	2.587	4.735	0.724	4.011	2	0.42218	0.56	0.324	2.000	0.42	123.18	1.300	160.137		0.66	1	
78.576	9	Sand	286.759	2.024	4.775	0.744	4.031	1.95	0.42057	0.55	0.324	1.950	0.42	120.60	1.240	149.530	0.39	0.66	1	1.21
79.232	10	Gravelly Sand to Sand	322.09	1.865	4.817	0.765	4.052	1.86	0.41889	0.55	0.324	1.860	0.42	134.92	1.153	155.609	0.43	0.64	1	1.33
79.888	10	Gravelly Sand to Sand	341.842	2.076	4.859	0.785	4.074	1.85	0.41714	0.55	0.323	1.850	0.42	142.60	1.145	163.284		0.63	1	
80.545	9	Sand	352.687	3.204	4.9	0.806	4.094	1.94	0.41556	0.55	0.323	1.940	0.42	146.56	1.229	180.126		0.63	1	
81.201	9	Sand	316.242	2.807	4.94	0.826	4.114	1.98	0.414	0.54	0.323	1.980	0.41	130.92	1.275	166.894		0.65	1	
81.857	9	Sand	328.357	3.357	4.981	0.847	4.134	2	0.41245	0.54	0.323	2.000	0.41	135.43	1.300	176.059		0.64	1	
82.513	9	Sand	256.407	3.401	5.022	0.867	4.155	2.16	0.41083	0.54	0.322	2.160	0.41	105.34	1.574	165.833		0.69	1	
83.169	5	Clayey Silt to Silty Clay	79.598	3.263	5.06	0.888	4.172	2.9	0.40953	0.54	0.322							0.75	1	
83.825	5	Clayey Silt to Silty Clay	82.934	3.436	5.097	0.908	4.189	2.88	0.40824	0.54	0.322							0.75	1	
84.482	11	Sitff Fine-Grained	100.937	4.766	5.14	0.929	4.211	2.85	0.40658	0.53	0.322							0.75	1	
85.138	6	Sandy Silt to Clayey Silt	90.27	3.371	5.178	0.949	4.228	2.83	0.40531	0.53	0.322							0.75	1	
85.794	5	Clayey Silt to Silty Clay	62.976	2.75	5.215	0.97	4.245	3.01	0.40404	0.53	0.322							0.75	1	
86.45	5	Clayey Silt to Silty Clay	36.724	1.37	5.253	0.99	4.263	3.2	0.40271	0.53	0.322							0.75	1	
87.106	5	Clayey Silt to Silty Clay	27.734	0.894	5.29	1.011	4.28	3.3	0.40146	0.53	0.322							0.75	1	
87.762	6	Sandy Silt to Clayey Silt	27.689	0.69	5.328	1.031	4.297	3.24	0.40022	0.52	0.321							0.75	1	
88.419	6	Sandy Silt to Clayey Silt	31.75	0.874	5.365	1.052	4.314	3.2	0.39898	0.52	0.321							0.75	1	
89.075	6	Sandy Silt to Clayey Silt	30.396	0.841	5.403	1.072	4.331	3.22	0.39776	0.52	0.321							0.75	1	
89.731	5	Clayey Silt to Silty Clay	30.196	0.91	5.441	1.093	4.348	3.25	0.39654	0.52	0.321							0.75	1	
90.387	5	Clayey Silt to Silty Clay	32.223	0.989	5.478	1.113	4.365	3.22	0.39533	0.52	0.321							0.74	1	
91.043	5	Clayey Silt to Silty Clay	32.006	0.939	5.516	1.133	4.382	3.22	0.39412	0.52	0.321							0.74	1	
91.699	6	Sandy Silt to Clayey Silt	31.293	0.841	5.553	1.154	4.4	3.21	0.39286	0.52	0.321							0.74	1	
92.356	6	Sandy Silt to Clayey Silt	36.189	0.93	5.591	1.174	4.417	3.13	0.39167	0.51	0.321							0.74	1	
93.012	5	Clayey Silt to Silty Clay	49.463	1.666	5.629	1.195	4.434	3.06	0.39049	0.51	0.321							0.74	1	
93.668	6	Sandy Silt to Clayey Silt	84.65	3.101	5.666	1.215	4.451	2.87	0.38931	0.51	0.321							0.74	1	
94.324	5	Clayey Silt to Silty Clay	53.04	2.285	5.704	1.236	4.468	3.1	0.38814	0.51	0.321							0.74	1	
94.98	5	Clayey Silt to Silty Clay	45.509	1.894	5.741	1.256	4.485	3.15	0.38698	0.51	0.321							0.74	1	
95.636	6	Sandy Silt to Clayey Silt	63.829	2.134	5.779	1.277	4.502	2.95	0.38583	0.51	0.321							0.74	1	
96.293	5	Clayey Silt to Silty Clay	61.311	2.371	5.817	1.297	4.519	3.01	0.38468	0.51	0.321							0.74	1	
96.949	6	Sandy Silt to Clayey Silt	37.883	1.05	5.854	1.318	4.536	3.13	0.38354	0.50	0.321							0.74	1	
97.605	6	Sandy Silt to Clayey Silt	43.631	1.138	5.892	1.338	4.554	3.04	0.38234	0.50	0.321							0.74	1	
98.261	7	Silty Sand to Sandy Silt	90.643	2.214	5.93	1.359	4.572	2.74	0.38115	0.50	0.321							0.74	1	
98.917	9	Sand	218.802	3.098	5.971	1.379	4.592	2.27	0.37983	0.50	0.322	2.270	0.38	83.11	1.856	154.256	0.42	0.70	1	1.31
99.573	9	Sand	332.908	2.889	6.012	1.4	4.612	2	0.37853	0.50	0.322	2.000	0.38	126.01	1.300	163.819		0.63	1	

APPENDIX D

Attenuation Relationships for Shallow Crustal Earthquakes (Sadigh, et al, 1997)

Fault = Vaca Fault Zone (RLSS Fault, Map NO: 14)

Mmax = 6.9 **Rrup = 6.2** **km**

M>=6.5 *ROCK SITE:*

C1 = -1.274 C2 = 1.1 C3 = 0 C4 = -2.1

C5 = -0.48451 C6 = 0.524 C7 = 0

A=C1+C2M+C3(8.5M)^2.5= 6.316

B=C4*Ln(Rrup+exp(C5+C6M))= -7.078

C=C7*Ln(Rrup+2)= 0

Ln(y) = A+B+C = -0.762

y = Exp(Ln(y)) = 0.47 **Peak Bed Rock Acceleration PBA = 0.470**

Fault = Great Valley Fault 5 (Reverse Fault, Map No: 24)

Mmax = 6.5 **Rrup = 9.8** **km**

A= 5.876

B= -7.025

C= 0

Ln(y) = -1.149

y = 0.32 **Peak Bed Rock Acceleration PBA = 0.32g x 1.2 = 0.38g**

Fault = Greenville Fault Zone (Clayton section, RLSS Fault, Map No: 351)

Mmax = 6.6 **Rrup = 7.1** **km**

A= 5.986

B= -6.895

C= 0

Ln(y) = -0.909

y = 0.40 **Peak Bed Rock Acceleration PBA = 0.4g**

Fault = Concord Fault Zone (Ygnacio valley section, RLSS Fault, Map No: 341)

Mmax = 6.6 **Rrup = 18.2** **km**

A= 5.986

B= -7.626

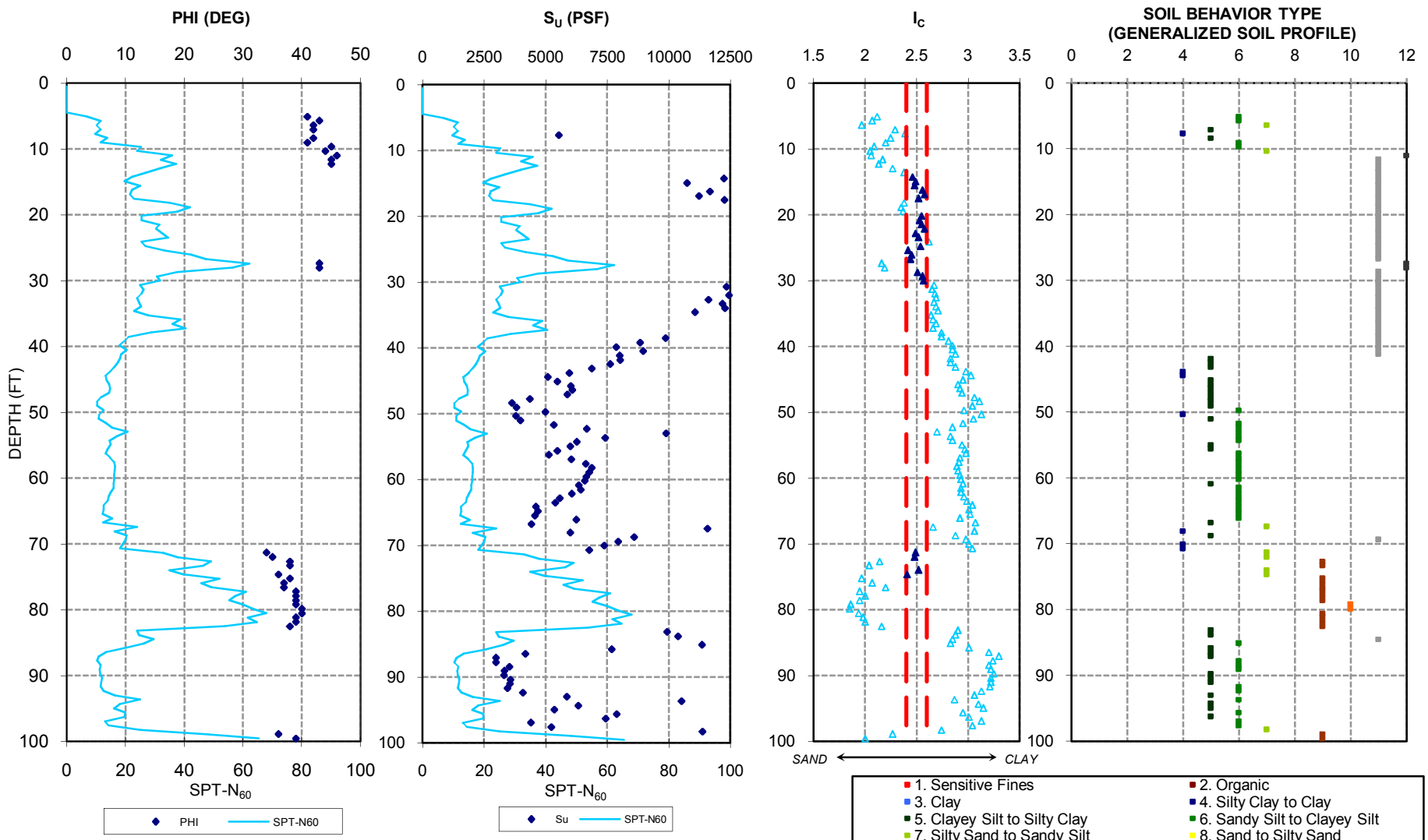
C= 0

Ln(y) = -1.640

y = 0.19 **Peak Bed Rock Acceleration PBA = 0.19g**

CPT DATA CORRELATION

GST-138



Reference: CPT data and correlation provided by Gregg Drilling and Testing, Inc.

PARIKH

Practicing in the Geosciences

G STREET OVERCROSSING
CONTRA COSTA COUNTY, CALIFORNIA

JOB NO.:	206118.GST	PLATE NO.:	3

LIQUEFACTION POTENTIAL ANALYSIS (per Youd & Idriss, 2001)

PROJECT NAME **ROUTE 4**
PROJECT NO. **206118.CLO**
CPT NO **GST-138 (G ST.)**

FAULT INFO
COAST RANGE - SIERRAN BLOCK BOUNDARY ZONE (CSB)
a_{max} (g)= 0.76

FAULT M_w = 7
MSF = 1.19

Depth (ft)		Soil Behavior Type	CPT RESULT INPUT qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	CSR γ_d	CSR	CRR 7.5 Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	F.S.=(CRR 7.5/(CSR)*MSF*Kσ*Kα Kσ	Kα	F.S.
0.492									1.7	1.00	#VALUE!							#VALUE!	1	
1.148									1.7	1.00	#VALUE!							#VALUE!	1	
1.804									1.7	1.00	#VALUE!							#VALUE!	1	
2.461									1.7	1.00	#VALUE!							#VALUE!	1	
3.117									1.7	0.99	#VALUE!							#VALUE!	1	
3.773									1.7	0.99	#VALUE!							#VALUE!	1	
4.429									1.7	0.99	#VALUE!							#VALUE!	1	
5.085	6	Sandy Silt to Clayey Silt	32.786	0.735	0.291		0.291	2.12	1.47552	0.99	0.489	2.120	1.48	48.38	1.492	72.185	0.11	1.00	1	
5.741	6	Sandy Silt to Clayey Silt	57.167	1.562	0.329		0.329	2.07	1.43885	0.99	0.488	2.070	1.44	82.25	1.403	115.397	0.22	1.00	1	
6.398	7	Silty Sand to Sandy Silt	52.549	0.93	0.368		0.368	1.97	1.40306	0.99	0.488	1.970	1.40	73.73	1.263	93.100	0.16	1.00	1	
7.054	5	Clayey Silt to Silty Clay	51.741	2.152	0.405		0.405	2.29	1.37072	0.99	0.487	2.290	1.37	70.92	1.917	135.961	0.31	1.00	1	
7.71	4	Silty Clay to Clay	41.938	1.825	0.443		0.443	2.39	1.33901	0.98	0.486	2.390	1.34	56.16	2.272	127.586	0.27	1.00	1	
8.366	5	Clayey Silt to Silty Clay	63.433	2.38	0.48		0.48	2.25	1.30952	0.98	0.485	2.250	1.31	83.07	1.798	149.376	0.39	1.00	1	
9.022	6	Sandy Silt to Clayey Silt	54.543	1.479	0.518		0.518	2.2	1.28056	0.98	0.485	2.200	1.28	69.85	1.667	116.416	0.23	1.00	1	
9.678	6	Sandy Silt to Clayey Silt	124.338	4.269	0.556		0.556	2.09	1.25285	0.98	0.484	2.090	1.25	155.78	1.437	223.839		1.00	1	
10.335	7	Silty Sand to Sandy Silt	119.085	3.411	0.594		0.594	2.05	1.22631	0.98	0.483	2.050	1.23	146.04	1.371	200.222		1.00	1	
10.991	12	Sand to Clayey Sand	177.845	6.54	0.634		0.634	2.06	1.19956	0.98	0.483	2.060	1.20	213.34	1.387	295.839		1.00	1	
11.647	11	Sitff Fine-Grained	152.283	6.666	0.677		0.677	2.17	1.17208	0.98	0.482	2.170	1.17	178.49	1.596	284.935		1.00	1	
12.303	11	Sitff Fine-Grained	179.566	7.491	0.72		0.72	2.13	1.14583	0.97	0.481	2.130	1.15	205.75	1.512	311.047		1.00	1	
12.959	11	Sitff Fine-Grained	144.635	7.452	0.762		0.762	2.27	1.1213	0.97	0.481	2.270	1.12	162.18	1.856	301.020		1.00	1	
13.615	11	Sitff Fine-Grained	116.924	6.784	0.805		0.805	2.38	1.09726	0.97	0.480	2.380	1.10	128.30	2.233	286.430		1.00	1	
14.272	11	Sitff Fine-Grained	92.744	5.564	0.848		0.848	2.46	1.07422	0.97	0.479	2.460	1.07	99.63	2.574	256.468		1.00	1	
14.928	11	Sitff Fine-Grained	81.464	4.552	0.891		0.891	2.49	1.05213	0.97	0.479	2.490	1.05	85.71	2.718	232.994		1.00	1	
15.584	11	Sitff Fine-Grained	103.45	6.534	0.934		0.934	2.48	1.03093	0.97	0.478	2.480	1.03	106.65	2.669	284.684		1.00	1	
16.24	11	Sitff Fine-Grained	88.638	6.121	0.976		0.976	2.56	1.01103	0.97	0.477	2.560	1.01	89.62	3.091	276.962		1.00	1	
16.896	11	Sitff Fine-Grained	85.224	5.837	1.019		1.019	2.58	0.99144	0.96	0.476	2.580	0.99	84.49	3.206	270.927		1.00	1	
17.552	11	Sitff Fine-Grained	93.072	5.63	1.062		1.062	2.52	0.97259	0.96	0.476	2.520	0.97	90.52	2.872	259.942		0.99	1	
18.209	11	Sitff Fine-Grained	151.464	8.462	1.105		1.105	2.38	0.95445	0.96	0.475	2.380	0.95	144.56	2.233	322.751		0.98	1	
18.865	11	Sitff Fine-Grained	184.284	10.563	1.148		1.148	2.35	0.93697	0.96	0.474	2.350	0.94	172.67	2.120	365.996		0.97	1	
19.521	11	Sitff Fine-Grained	163.039	8.924	1.19		1.19	2.37	0.9205	0.96	0.473	2.370	0.92	150.08	2.194	329.277		0.97	1	
20.177	11	Sitff Fine-Grained	102.096	6.361	1.233		1.233	2.55	0.90423	0.96	0.472	2.550	0.90	92.32	3.034	280.116		0.96	1	
20.833	11	Sitff Fine-Grained	103.232	5.874	1.276		1.276	2.53	0.88853	0.95	0.472	2.530	0.89	91.72	2.925	268.274		0.95	1	
21.49	11	Sitff Fine-Grained	126.759	8.766	1.319		1.319	2.55	0.87336	0.95	0.471	2.550	0.87	110.71	3.034	335.909		0.95	1	
22.146	11	Sitff Fine-Grained	120.065	8.59	1.362		1.362	2.58	0.8587	0.95	0.470	2.580	0.86	103.10	3.206	330.586		0.94	1	
22.802	11	Sitff Fine-Grained	134.13	7.825	1.405		1.405	2.49	0.84453	0.95	0.469	2.490	0.84	113.28	2.718	307.930		0.93	1	
23.458	11	Sitff Fine-Grained	140.514	8.992	1.447		1.447	2.52	0.83113	0.95	0.468	2.520	0.83	116.79	2.872	335.363		0.93	1	
24.114	11	Sitff Fine-Grained	99.01	6.252	1.49		1.49	2.62	0.81784	0.94	0.467							0.92	1	
24.77	11	Sitff Fine-Grained	108.34	5.691	1.533		1.533	2.54	0.80498	0.94	0.466	2.540	0.80	87.21	2.979	259.799		0.92	1	
25.427	11	Sitff Fine-Grained	143.193	6.496	1.576		1.576	2.42	0.79251	0.94	0.465	2.420	0.79	113.48	2.396	271.886		0.91	1	
26.083	11	Sitff Fine-Grained	178.129	10.271	1.619		1.619	2.45	0.78042	0.94	0.463	2.450	0.78	139.02	2.528	351.460		0.91	1	
26.739	11	Sitff Fine-Grained	199.819	11.969	1.661		1.661	2.44	0.76896	0.94	0.462	2.440	0.77	153.65	2.483	381.542		0.90	1	
27.395	12	Sand to Clayey Sand	296.963	10.601	1.701		1.701	2.16	0.75836	0.93	0.461	2.160	0.76	225.20	1.574	354.531		0.82	1	
28.051	12	Sand to Clayey Sand	266.283	9.52	1.741		1.741	2.19	0.74804	0.93	0.459	2.190	0.75	199.19	1.643	327.197		0.82	1	
28.707	11	Sitff Fine-Grained	153.809	8.734	1.784		1.784	2.51	0.73727	0.93	0.458	2.510	0.74	113.40	2.820	319.727		0.89	1	
29.364	11	Sitff Fine-Grained	122.421	6.533	1.826		1.826	2.56	0.72703	0.92	0.456	2.560	0.73	89.00	3.091	275.072		0.89	1	
30.02	11	Sitff Fine-Grained	126.365	7.007	1.869		1.869	2.57	0.71685	0.92	0.455	2.570	0.72	90.58	3.148	285.156		0.88	1	
30.676	11	Sitff Fine-Grained	94.504	5.331	1.912		1.912	2.67	0.70694	0.92	0.453							0.88	1	
31.332	11	Sitff Fine-Grained	99.233	5.516	1.955		1.955	2.65	0.69731	0.91	0.451							0.87	1	
31.988	11	Sitff Fine-Grained	95.373	5.479	1.998		1.998	2.68	0.68793	0.91	0.449							0.87	1	
32.644	11	Sitff Fine-Grained	89.201	4.798	2.041		2.041	2.69	0.6788	0.91	0.448							0.87	1	
33.301	11	Sitff Fine-Grained	93.412	4.798	2.083		2.083	2.67	0.67012	0.90	0.446							0.86	1	
33.957	11	Sitff Fine-Grained	94.236	5.218	2.126		2.126	2.69	0.66146	0.90	0.443							0.86	1	
34.613	11	Sitff Fine-Grained	85.096	4.416	2.169		2.169	2.71	0.65301	0.89	0.441							0.86	1	
35.269	11	Sitff Fine-Grained	107.154	5.444	2.212		2.212	2.64	0.64478	0.89	0.439							0.85	1	
35.925	11	Sitff Fine-Grained	147.147	10.434	2.255		2.255	2.66	0.63676	0.88	0.437							0.85	1	
36.581	11	Sitff Fine-Grained	134.436	9.428	2.297		2.297	2.69	0.62911	0.88	0.434							0.85	1	
37.238	11	Sitff Fine-Grained	153.648	10.872	2.34		2.34	2.66	0.62147	0.87	0.432							0.84	1	
37.894	11	Sitff Fine-Grained	104.569	6.539	2.383		2.383	2.74	0.61401	0.87	0.429							0.84	1	
38.55	11	Sitff Fine-Grained	76.618	3.414	2.426		2.426	2.74	0.60673	0.86	0.427							0.84	1	
39.206	11	Sitff Fine-Grained	68.725	3.381	2.469		2.469	2.81	0.59962	0.86	0.424							0.83	1	
39.862	11	Sitff Fine-Grained	61.517	2.989	2.511		2.511	2.85	0.59283	0.85	0.421							0.83	1	
40.518	11	Sitff Fine-Grained	69.828	3.865	2.554		2.554	2.85	0.58604	0.85	0.418							0.83	1	
41.175	11	Sitff Fine-Grained	62.564	3.332	2.597		2.597	2.88	0.5794	0.84	0.415							0.83	1	
41.831	5	Clayey Silt to Silty Clay	62.81	2.776	2.635		2.635	2.83	0.57366	0.83	0.412							0.82	1	
42.487	5	Clayey Silt to Silty Clay	59.785	2.473	2.672		2.672	2.83	0.56818	0.83	0.409							0.82	1	
43.143	5	Clayey Silt to Silty Clay	54.376	2.314	2.71		2.71	2.88	0.56266	0.82	0.406							0.82	1	
43.799	4	Silty Clay to Clay	47.519	2.351	2.747		2.747	2.98	0.55739	0.82	0.403							0.82	1	
44.455	4	Silty Clay to Clay	40.93	1.937	2.785		2.785	3.03	0.55207	0.81	0.400							0.81	1	
45.112	5	Clayey Silt to Silty Clay	43.871	1.708	2.823		2.823	2.95	0.54686	0.80	0.396							0.81	1	
45.768	5	Clayey Silt to Silty Clay	47.948	1.727	2.86		2.86	2.9	0.54187	0.80	0.393							0.81	1	
46.424	5	Clayey Silt to Silty Clay	48.455	1.842	2.898		2.898	2.92	0.53685	0.79	0.390							0.81	1	
47.08	5	Clayey Silt to Silty Clay	46.979	1.826	2.935		2.935	2.94	0.53204	0.78	0.387							0.81	1	
47.736	5	Clayey Silt to Silty Clay	35.655	1.436	2.973		2.973	3.06	0.5272	0.78	0.383							0.80	1	
48.392	5	Clayey Silt to Silty Clay	30.358	1.111	3.011		3.011	3.11	0.52244	0.77	0.380							0.80	1	
49.049	5	Clayey Silt to Silty Clay	31.678	0.951	3.048		3.048	3.04	0.51789	0.76	0.377							0.80	1	
49.705	6	Sandy Silt to Clayey Silt	40.345	1.246	3.086		3.086	2.96	0.5133	0.76	0.373							0.80	1	
50.361	4	Silty Clay to Clay	31.6	1.276	3.123		3.123	3.13	0.50891	0.75	0.370							0.80	1	
51.017	5	Clayey Silt to Silty Clay	32.992	1.009	3.161		3.161	3.05	0.50447	0.74	0.367							0.79	1	
51.673	6	Sandy Silt to Clayey Silt	43.186	1.361	3.199		3.199	2.95	0.50011	0.74	0.363							0.79	1	
52.329	6	Sandy Silt to Clayey Silt	53.067	1.513	3.236		3.236	2.85	0.49594	0.73	0.360							0.79	1	
52.986	6	Sandy Silt to Clayey Silt	77.509	2.102	3.274		3.274	2.7	0.49173	0.72	0.357							0.79	1	
53.642	6	Sandy Silt to Clayey Silt	58.922	1.803	3.311		3.311	2.83	0.4877	0.72	0.354							0.79	1	
54.298	6	Sandy Silt to Clayey Silt	50.154	1.256	3.349		3.349	2.85	0.48362	0.71	0.351							0.79	1	
54.954	5	Clayey Silt to Silty Clay	48.338	1.627	3.387	0.007	3.379	2.94	0.48045	0.70	0.348							0.78	1	
55.61	5	Clayey Silt to Silty Clay	44.467	1.48	3.424	0.028	3.396	2.97	0.47868	0.70	0.347							0.78	1	
56.266	6	Sandy Silt to Clayey Silt	41.815	1.255	3.462	0.048	3.413	2.98	0.47691	0.69	0.347							0.78	1	
56.923	6	Sandy Silt to Clayey Silt	48.739	1.458	3.499	0.069	3.43	2.92	0.47516	0.69	0.346							0.78	1	
57.579	6	Sandy Silt to Clayey Silt	53.078	1.751	3.537	0.089	3.448	2.91	0.47332	0.68	0.344							0.78	1	
58.235	6	Sandy Silt to Clayey Silt	55.017	1.742	3.575	0.11	3.465	2.89	0.4716	0.67	0.344							0.78	1	
58.891	6	Sandy Silt to Clayey Silt	54.393	1.732	3.612	0.13	3.482	2.9	0.46988	0.67	0.343							0.78	1	
59.547	6	Sandy Silt to Clayey Silt	53.257	1.769	3.65	0.151	3.499	2.92	0.46818	0.66	0.342							0.78	1	
60.203	6	Sandy Silt to Clayey Silt	52.816	1.803	3.687	0.171	3.516	2.93	0.4665	0.66	0.341							0.78	1	
60.86	5	Clayey Silt to Silty Clay	51.068	1.81	3.725	0.192	3.533	2.95	0.46482	0.65	0.340							0.78	1	
61.516	6	Sandy Silt to Clayey Silt	51.725	1.715	3.763	0.212	3.55	2.93	0.46316	0.65	0.339							0.78	1	
62.172	6	Sandy Silt to Clayey Silt	49.146	1.443	3.8	0.233	3.567	2.93	0.46151	0.64	0.338							0.78	1	
62.828	6	Sandy Silt to Clayey Silt	45.631	1.374	3.838	0.253	3.585	2.96	0.45977	0.64	0.337							0.77	1	
63.484	6	Sandy Silt to Clayey Silt	44.222	1.364	3.875	0.274	3.602	2.99	0.45814	0.63	0.336							0.77	1	

LIQUEFACTION POTENTIAL ANALYSIS (per Youd & Idriss, 2001)

PROJECT NAME **ROUTE 4**
PROJECT NO. **206118.CLO**
CPT NO. **GST-138 (G ST.)**

FAULT INFO
COAST RANGE - SIERRAN BLOCK BOUNDARY ZONE (CSB)
a_{max} (g)= 0.76

FAULT M_w = 7
MSF = 1.19

			CPT RESULT INPUT							CSR		CRR 7.5						F.S.=(CRR 7.5/(CSR)*MSF*Kσ*Kα		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
64.14	6	Sandy Silt to Clayey Silt	38.251	1.124	3.913	0.294	3.619	3.04	0.45653	0.63	0.335							0.77	1	
64.797	6	Sandy Silt to Clayey Silt	38.924	1.071	3.95	0.315	3.636	3.01	0.45492	0.62	0.335							0.77	1	
65.453	6	Sandy Silt to Clayey Silt	38.027	1.012	3.988	0.335	3.653	3.02	0.45333	0.62	0.334							0.77	1	
66.109	6	Sandy Silt to Clayey Silt	50.739	1.44	4.026	0.356	3.67	2.92	0.45175	0.61	0.333							0.77	1	
66.765	5	Clayey Silt to Silty Clay	37.075	1.144	4.063	0.376	3.687	3.07	0.45017	0.61	0.332							0.77	1	
67.421	7	Silty Sand to Sandy Silt	90.794	2.272	4.102	0.396	3.705	2.66	0.44852	0.61	0.332							0.77	1	
68.077	4	Silty Clay to Clay	49.084	2.182	4.14	0.417	3.723	3.06	0.44688	0.60	0.331							0.77	1	
68.734	5	Clayey Silt to Silty Clay	68.658	2.549	4.177	0.437	3.74	2.88	0.44534	0.60	0.330							0.77	1	
69.39	11	Stiff Fine-Grained	63.784	3.05	4.22	0.458	3.762	2.98	0.44337	0.60	0.330							0.77	1	
70.046	4	Silty Clay to Clay	59.623	2.825	4.258	0.478	3.779	3.01	0.44186	0.59	0.329							0.77	1	
70.702	4	Silty Clay to Clay	55.184	2.672	4.295	0.499	3.796	3.04	0.44035	0.59	0.329							0.77	1	
71.358	7	Silty Sand to Sandy Silt	134.888	2.931	4.334	0.519	3.814	2.49	0.43877	0.58	0.328	2.490	0.44	59.19	2.718	160.888		0.77	1	
72.014	7	Silty Sand to Sandy Silt	157.213	3.922	4.372	0.54	3.833	2.48	0.43712	0.58	0.328	2.480	0.44	68.72	2.669	183.438		0.76	1	
72.671	9	Sand	236.187	2.846	4.413	0.56	3.853	2.14	0.43538	0.58	0.327	2.140	0.44	102.83	1.532	157.535	0.44	0.70	1	1.36
73.327	9	Sand	231.937	1.821	4.454	0.581	3.873	2.04	0.43367	0.58	0.327	2.040	0.43	100.58	1.356	136.380	0.32	0.70	1	0.97
73.983	7	Silty Sand to Sandy Silt	141.728	3.521	4.492	0.601	3.891	2.52	0.43214	0.57	0.326	2.520	0.43	61.25	2.872	175.874		0.76	1	
74.639	7	Silty Sand to Sandy Silt	168.927	3.554	4.531	0.622	3.909	2.41	0.43061	0.57	0.326	2.410	0.43	72.74	2.354	171.209		0.76	1	
75.295	9	Sand	267.542	1.923	4.572	0.642	3.93	1.97	0.42885	0.57	0.326	1.970	0.43	114.74	1.263	144.879	0.36	0.68	1	1.11
75.951	9	Sand	227.414	1.891	4.613	0.663	3.95	2.07	0.42718	0.56	0.325	2.070	0.43	97.15	1.403	136.291	0.32	0.70	1	0.97
76.608	9	Sand	230.689	3.281	4.653	0.683	3.97	2.2	0.42553	0.56	0.325	2.200	0.43	98.17	1.667	163.619		0.71	1	
77.264	9	Sand	314.888	2.647	4.694	0.704	3.99	1.95	0.42389	0.56	0.324	1.950	0.42	133.48	1.240	165.495		0.65	1	
77.92	9	Sand	291.775	2.587	4.735	0.724	4.011	2	0.42218	0.56	0.324	2.000	0.42	123.18	1.300	160.137		0.66	1	
78.576	9	Sand	286.759	2.024	4.775	0.744	4.031	1.95	0.42057	0.55	0.324	1.950	0.42	120.60	1.240	149.530	0.39	0.66	1	1.21
79.232	10	Gravelly Sand to Sand	322.09	1.865	4.817	0.765	4.052	1.86	0.41889	0.55	0.324	1.860	0.42	134.92	1.153	155.609	0.43	0.64	1	1.33
79.888	10	Gravelly Sand to Sand	341.842	2.076	4.859	0.785	4.074	1.85	0.41714	0.55	0.323	1.850	0.42	142.60	1.145	163.284		0.63	1	
80.545	9	Sand	352.687	3.204	4.9	0.806	4.094	1.94	0.41556	0.55	0.323	1.940	0.42	146.56	1.229	180.126		0.63	1	
81.201	9	Sand	316.242	2.807	4.94	0.826	4.114	1.98	0.414	0.54	0.323	1.980	0.41	130.92	1.275	166.894		0.65	1	
81.857	9	Sand	328.357	3.357	4.981	0.847	4.134	2	0.41245	0.54	0.323	2.000	0.41	135.43	1.300	176.059		0.64	1	
82.513	9	Sand	256.407	3.401	5.022	0.867	4.155	2.16	0.41083	0.54	0.322	2.160	0.41	105.34	1.574	165.833		0.69	1	
83.169	5	Clayey Silt to Silty Clay	79.598	3.263	5.06	0.888	4.172	2.9	0.40953	0.54	0.322							0.75	1	
83.825	5	Clayey Silt to Silty Clay	82.934	3.436	5.097	0.908	4.189	2.88	0.40824	0.54	0.322							0.75	1	
84.482	11	Stiff Fine-Grained	100.937	4.766	5.14	0.929	4.211	2.85	0.40658	0.53	0.322							0.75	1	
85.138	6	Sandy Silt to Clayey Silt	90.27	3.371	5.178	0.949	4.228	2.83	0.40531	0.53	0.322							0.75	1	
85.794	5	Clayey Silt to Silty Clay	62.976	2.75	5.215	0.97	4.245	3.01	0.40404	0.53	0.322							0.75	1	
86.45	5	Clayey Silt to Silty Clay	36.724	1.37	5.253	0.99	4.263	3.2	0.40271	0.53	0.322							0.75	1	
87.106	5	Clayey Silt to Silty Clay	27.734	0.894	5.29	1.011	4.28	3.3	0.40146	0.53	0.322							0.75	1	
87.762	6	Sandy Silt to Clayey Silt	27.689	0.69	5.328	1.031	4.297	3.24	0.40022	0.52	0.321							0.75	1	
88.419	6	Sandy Silt to Clayey Silt	31.75	0.874	5.365	1.052	4.314	3.2	0.39898	0.52	0.321							0.75	1	
89.075	6	Sandy Silt to Clayey Silt	30.396	0.841	5.403	1.072	4.331	3.22	0.39776	0.52	0.321							0.75	1	
89.731	5	Clayey Silt to Silty Clay	30.196	0.91	5.441	1.093	4.348	3.25	0.39654	0.52	0.321							0.75	1	
90.387	5	Clayey Silt to Silty Clay	32.223	0.989	5.478	1.113	4.365	3.22	0.39533	0.52	0.321							0.74	1	
91.043	5	Clayey Silt to Silty Clay	32.006	0.939	5.516	1.133	4.382	3.22	0.39412	0.52	0.321							0.74	1	
91.699	6	Sandy Silt to Clayey Silt	31.293	0.841	5.553	1.154	4.4	3.21	0.39286	0.52	0.321							0.74	1	
92.356	6	Sandy Silt to Clayey Silt	36.189	0.93	5.591	1.174	4.417	3.13	0.39167	0.51	0.321							0.74	1	
93.012	5	Clayey Silt to Silty Clay	49.463	1.666	5.629	1.195	4.434	3.06	0.39049	0.51	0.321							0.74	1	
93.668	6	Sandy Silt to Clayey Silt	84.65	3.101	5.666	1.215	4.451	2.87	0.38931	0.51	0.321							0.74	1	
94.324	5	Clayey Silt to Silty Clay	53.04	2.285	5.704	1.236	4.468	3.1	0.38814	0.51	0.321							0.74	1	
94.98	5	Clayey Silt to Silty Clay	45.509	1.894	5.741	1.256	4.485	3.15	0.38698	0.51	0.321							0.74	1	
95.636	6	Sandy Silt to Clayey Silt	63.829	2.134	5.779	1.277	4.502	2.95	0.38583	0.51	0.321							0.74	1	
96.293	5	Clayey Silt to Silty Clay	61.311	2.371	5.817	1.297	4.519	3.01	0.38468	0.51	0.321							0.74	1	
96.949	6	Sandy Silt to Clayey Silt	37.883	1.05	5.854	1.318	4.536	3.13	0.38354	0.50	0.321							0.74	1	
97.605	6	Sandy Silt to Clayey Silt	43.631	1.138	5.892	1.338	4.554	3.04	0.38234	0.50	0.321							0.74	1	
98.261	7	Silty Sand to Sandy Silt	90.643	2.214	5.93	1.359	4.572	2.74	0.38115	0.50	0.321							0.74	1	
98.917	9	Sand	218.802	3.098	5.971	1.379	4.592	2.27	0.37983	0.50	0.322	2.270	0.38	83.11	1.856	154.256	0.42	0.70	1	1.31
99.573	9	Sand	332.908	2.889	6.012	1.4	4.612	2	0.37853	0.50	0.322	2.000	0.38	126.01	1.300	163.819		0.63	1	

AXIAL PILE CAPACITY

(APILE Runs)

APILE Runs SR 4 – G Street Overcrossing
Pile capacities computed using APILE program – Output follows
(Pile Capacities Based On API RP2A Procedure)
Revised 01 – 28 - 10

Abutment 1 (based on boring GST-138)

14-in Class 140 Alt. "W" Steel Pipe Pile
Ground Surface Elevation 60.36 = 60.5 (approx.)
Nominal Compression Load = 260 kips
Reqd. Pile Length per APILE output = 56.0 ft
Recommended Penetration = 56.0 feet
Reqd. Tip Elevation = 60.5.0-56.0 = 4.5

Abutment 3 (based on boring GST-137)

14-in Class 140 Alt. "W" Steel Pipe Pile
Ground Surface Elevation 661.57 = 61.5 (approx.)
Nominal Compression Load = 250 kips
Reqd. Pile Length per APILE output = 52.0 ft
Recommended Penetration = 52.0 feet
Reqd. Tip Elevation = 61.5-52.0 = 9.5

Bent 2 (based on boring GST-137)

16-in Class 200 Alt. "W" Steel Pipe Pile
Ground Surface Elevation 51.0 (approx.)
Nominal Compression Load = 400 kips
Reqd. Pile Length per APILE output = 54.5 ft
Recommended Penetration = 58.0 feet (2 feet into sand layer)
Reqd. Tip Elevation = 51.0-58.0 = -7.0
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Bent 2 (based on boring GST-138)

16-in Class 200 Alt. "W" Steel Pipe Pile
Ground Surface Elevation 51.0 (approx.)
Nominal Compression Load = 400 kips
Reqd. Pile Length per APILE output = 57.5 ft
Recommended Penetration = 61.0 feet (2 feet into sand layer)
Reqd. Tip Elevation = 51.0-61.0 = -10.0 ---------Use This

Abutment 1 Wingwall (based on boring GST-138)

14-in Class 140 Alt. "W" Steel Pipe Pile

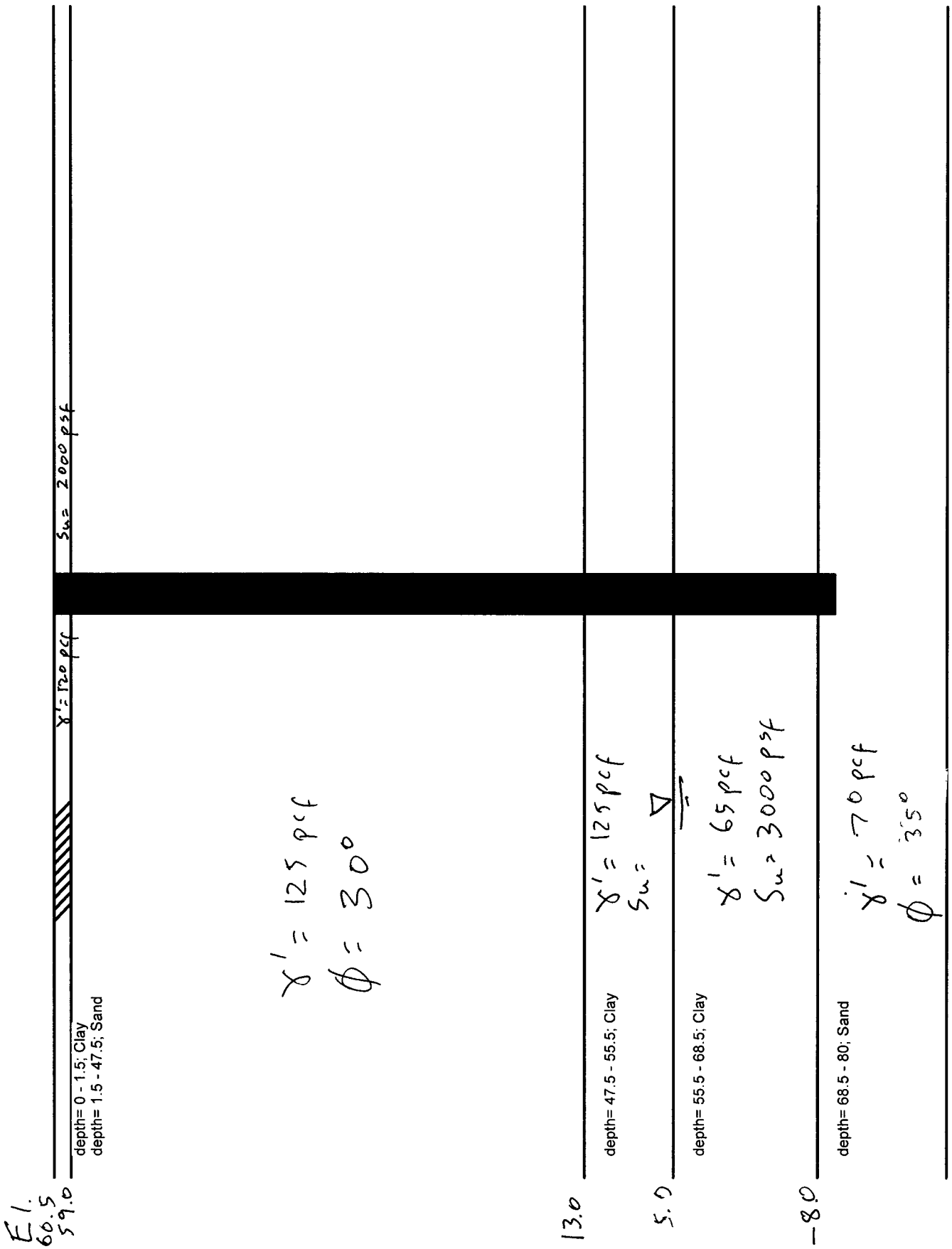
Ground Surface Elevation 57.0 (approx.) –
Bottom of Footing at 49.0 (top @ 51.75)
Nominal Compression Load = 220 kips (108-kip design load)
Reqd. Pile Length per APILE output = 49.0 ft
Recommended Penetration = 49.0 feet
Reqd. Tip Elevation = 57.0.0-49.0 =8.0

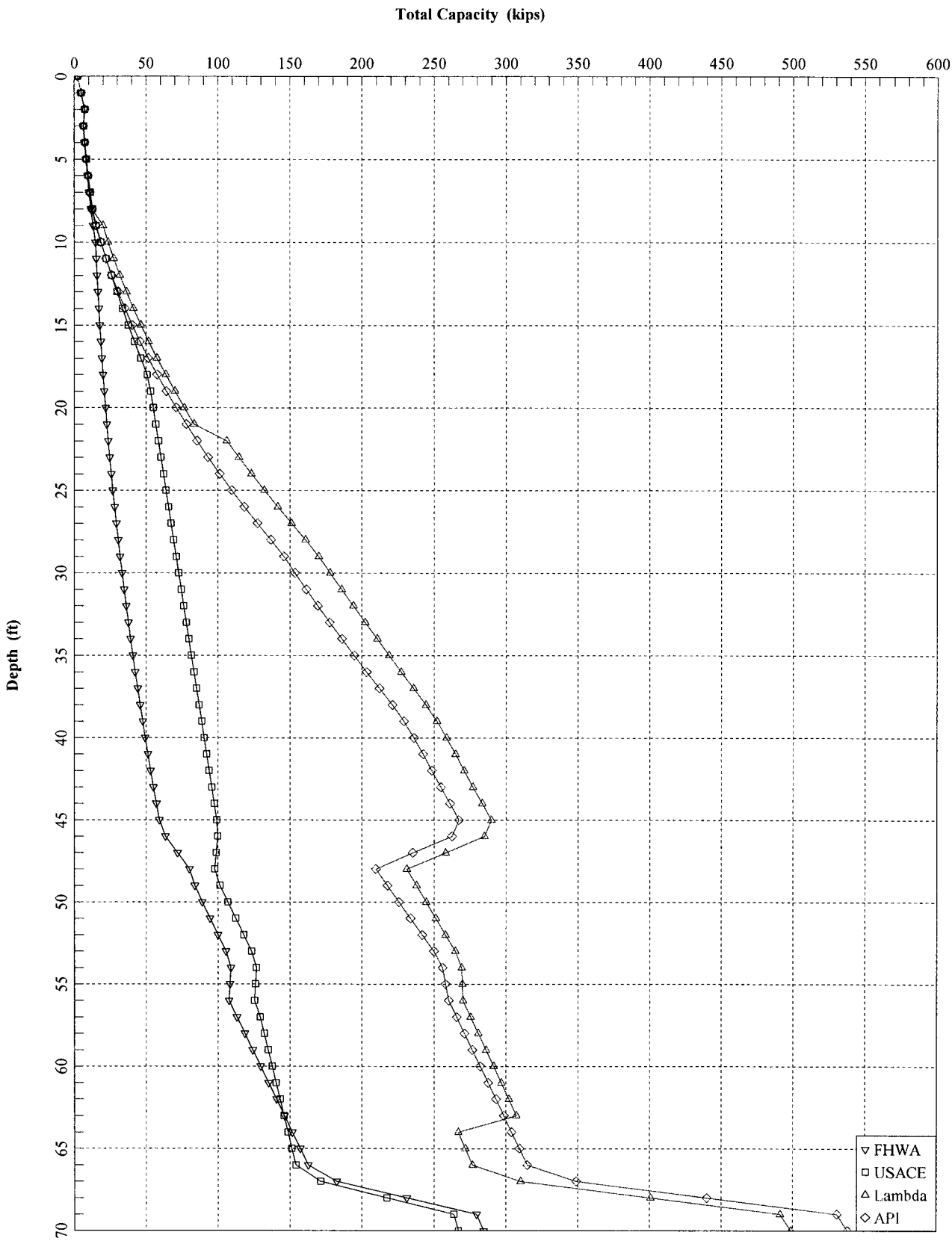
Abutment 3 (based on boring GST-137)

14-in Class 140 Alt. "W" Steel Pipe Pile

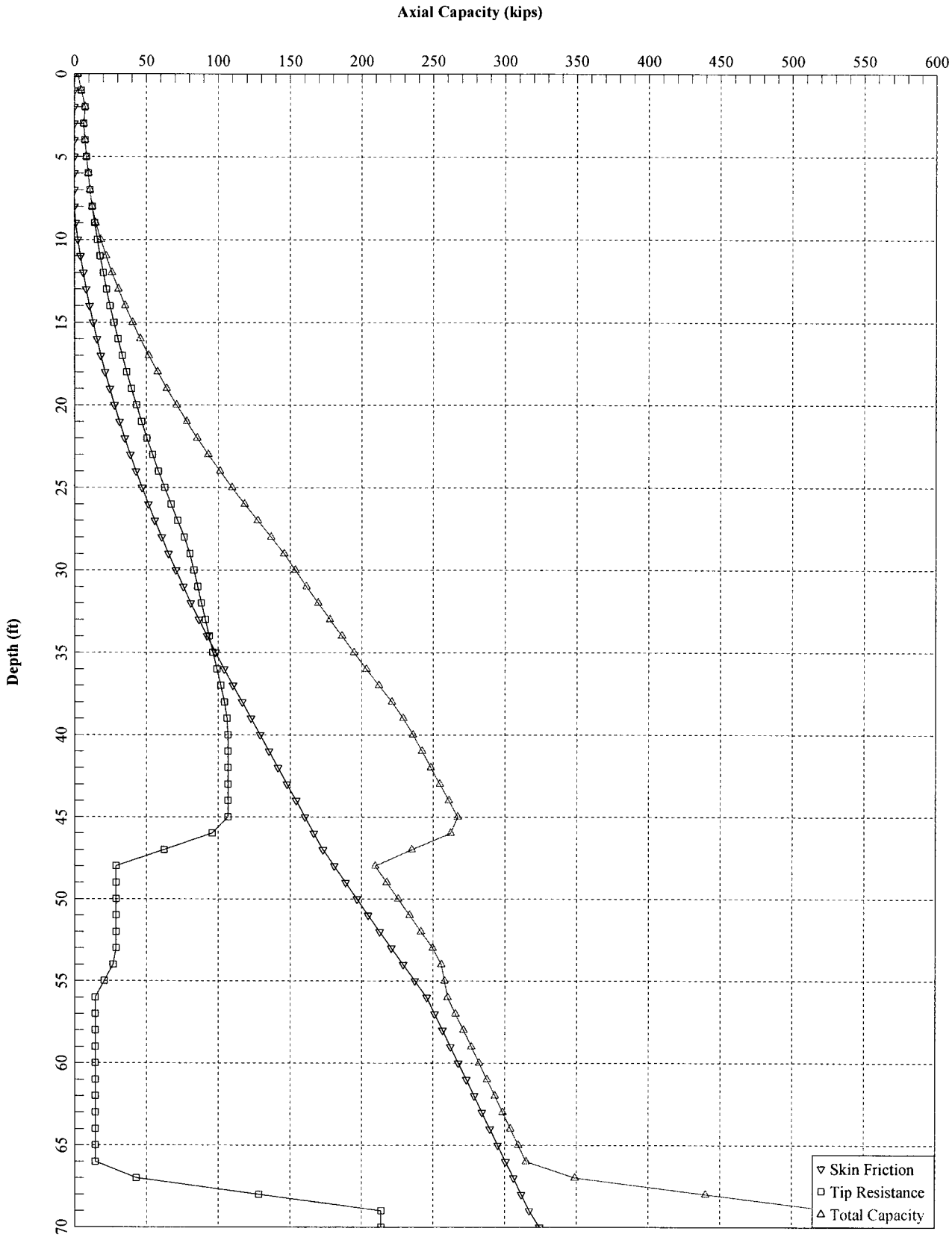
Ground Surface Elevation 55.0 (approx.)
Bottom of Footing at 47.35 (top @ 50.10)
Nominal Compression Load = 250 kips (125-kip design load)
Reqd. Pile Length per APILE output = 51.0 ft
Recommended Penetration = 51.0 feet
Reqd. Tip Elevation = 55.0-51.0 = 4.0

Abutment 1
14-in Open-ended Steel Pipe Pile (Alt. 'W')
(based on Boring GST-138)





SR4 G Streer Overcrossing - Abutment 1 - 14-in Steel Pipe PIle



SR4 G Street Overcrossing - Abutment 1 - 14-in Steel PIpe Pile - API RP2A Method

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AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

G Street OC - Abutment 1 (North Abutment)- 14-in Steel Pipe Pile

DESIGNER : Partha Sircar

DATE : October 30, 2008

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 0.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 0.00 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 14.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 13.13 IN.
PILE LENGTH = 70.00 FT.
MODULUS OF ELASTICITY = 0.290E+08 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 8.25 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.00	120.00	0.00	0.00
1.50	CLAY	0.00	120.00	0.00	0.00
1.50	SAND	0.80	125.00	30.00	20.00
47.50	SAND	0.80	125.00	30.00	20.00
47.50	CLAY	0.00	125.00	0.00	0.00
55.50	CLAY	0.00	125.00	0.00	0.00
55.50	CLAY	0.00	65.00	0.00	0.00
68.50	CLAY	0.00	65.00	0.00	0.00
68.50	SAND	0.80	70.00	35.00	40.00
80.00	SAND	0.80	70.00	35.00	40.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
2.00	18.00	2.00	1.00	0.00	0.00	0.00
2.00	18.00	2.00	1.00	0.00	0.00	0.00
1.70	100.00	0.00	0.00	0.00	0.00	0.00
1.70	100.00	0.00	0.00	0.00	0.00	0.00
3.00	27.00	3.00	1.50	0.00	0.00	0.00
3.00	27.00	3.00	1.50	0.00	0.00	0.00
1.50	13.50	1.50	0.75	0.00	0.00	0.00

1.50	13.50	1.50	0.75	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00

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* COMPUTATION RESULT *
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PILE PENETRATION FT.	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPACITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPACITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPACITY KIP
	********** FED. HWY. METHOD **********			********** ARMY CORPS METHOD **********			********** LAMBDA 2 METHOD **********		
0.0	0.0	2.3*	2.3	0.0	2.3*	2.3	0.0	2.3*	2.3
1.0	0.0	4.9*	4.9	0.0	4.9*	4.9	0.0	4.9*	4.9
2.0	0.0	7.2*	7.2	0.0	7.5*	7.5	0.0	7.5*	7.5
3.0	0.0	6.4*	6.4	0.0	6.6*	6.6	0.0	6.5*	6.5
4.0	0.0	7.2*	7.2	0.0	7.5*	7.5	0.0	7.4*	7.4
5.0	0.0	8.2*	8.2	0.0	8.6*	8.6	0.0	8.4*	8.4
6.0	0.0	9.3*	9.3	0.0	9.9*	9.9	0.0	9.6*	9.6
7.0	0.0	10.4*	10.4	0.0	11.3*	11.3	0.0	10.9*	10.9
8.0	0.0	11.6*	11.6	0.0	12.8*	12.8	0.0	12.4*	12.4
9.0	0.2	13.0*	13.2	0.7	14.6*	15.2	5.9	14.1*	20.0
10.0	0.6	14.2*	14.9	2.1	16.4*	18.5	7.7	16.0*	23.6
11.0	1.1	14.2*	15.4	3.7	18.5*	22.2	9.7	17.9*	27.6
12.0	1.6	14.2*	15.9	5.4	20.6*	26.0	11.8	20.1*	31.9
13.0	2.2	14.2*	16.5	7.2	22.5*	29.8	14.1	22.4*	36.5
14.0	2.8	14.2*	17.1	9.0	24.7*	33.7	16.5	24.9*	41.4
15.0	3.5	14.2*	17.7	10.7	27.0*	37.7	19.0	27.5*	46.5
16.0	4.2	14.2*	18.5	12.5	29.5*	42.0	21.7	30.3*	52.0
17.0	5.0	14.2*	19.2	14.2	32.1*	46.4	24.5	33.3*	57.7
18.0	5.8	14.2*	20.0	16.0	34.9*	50.9	27.4	36.4*	63.8
19.0	6.6	14.2*	20.9	17.8	35.6*	53.4	30.4	39.7*	70.1
20.0	7.5	14.2*	21.8	19.5	35.6*	55.1	33.6	43.1*	76.7
21.0	8.5	14.2*	22.7	21.3	35.6*	56.9	36.8	46.7*	83.5
22.0	9.5	14.2*	23.7	23.0	35.6*	58.6	55.8	50.4*	106.2
23.0	10.5	14.2*	24.7	24.8	35.6*	60.4	60.3	54.4*	114.7
24.0	11.6	14.2*	25.8	26.6	35.6*	62.2	65.0	58.4*	123.4
25.0	12.7	14.2*	26.9	28.3	35.6*	63.9	69.7	62.7*	132.4
26.0	13.9	14.2*	28.1	30.1	35.6*	65.7	74.6	67.1*	141.6
27.0	15.1	14.2*	29.3	31.8	35.6*	67.4	79.5	71.6*	151.2
28.0	16.4	14.2*	30.6	33.6	35.6*	69.2	84.6	76.3*	160.9
29.0	17.7	14.2	31.9	35.4	35.6	71.0	89.7	80.4	170.1
30.0	19.0	14.2	33.3	37.1	35.6	72.7	95.0	83.1	178.0
31.0	20.4	14.2	34.7	38.9	35.6	74.5	100.3	85.8	186.0
32.0	21.9	14.2	36.1	40.6	35.6	76.2	105.7	88.4	194.1
33.0	23.4	14.2	37.6	42.4	35.6	78.0	111.2	91.1	202.3
34.0	24.9	14.2	39.2	44.1	35.6	79.8	116.8	93.8	210.6
35.0	26.5	14.2	40.8	45.9	35.6	81.5	122.4	96.4	218.9
36.0	28.2	14.2	42.4	47.7	35.6	83.3	128.2	99.1	227.3
37.0	29.8	14.2	44.1	49.4	35.6	85.0	134.0	101.8	235.8
38.0	31.6	14.2	45.8	51.2	35.6	86.8	139.9	104.4	244.3
39.0	33.3	14.2	47.6	52.9	35.6	88.6	145.8	106.2	252.0
40.0	35.2	14.2	49.4	54.7	35.6	90.3	151.8	106.9	258.7
41.0	37.0	14.2	51.3	56.5	35.6	92.1	157.9	106.9	264.8
42.0	38.9	14.2	53.2	58.2	35.6	93.8	164.1	106.9	271.0

43.0	40.9	14.2	55.1	60.0	35.6	95.6	170.3	106.9	277.2
44.0	42.9	14.2	57.1	61.7	35.6	97.3	176.6	106.9	283.5
45.0	45.0	14.2	59.2	63.5	35.6	99.1	182.9	106.9	289.8
46.0	47.1	16.3	63.4	65.3	34.6	99.9	189.3	95.8	285.0
47.0	49.2	22.6	71.8	67.0	31.8	98.8	195.7	62.3	258.0
48.0	51.4	28.9	80.2	68.8	28.9	97.6	202.2	28.9	231.1
49.0	54.9	28.9	83.8	72.4	28.9	101.3	208.9	28.9	237.8
50.0	60.1	28.9	89.0	77.9	28.9	106.8	215.7	28.9	244.5
51.0	65.6	28.9	94.5	83.4	28.9	112.3	222.4	28.9	251.2
52.0	71.1	28.9	100.0	88.9	28.9	117.8	229.1	28.9	257.9
53.0	76.6	28.9	105.5	94.4	28.9	123.3	235.8	28.9	264.6
54.0	82.2	26.8	109.0	99.9	26.8	126.7	242.4	26.8	269.2
55.0	87.7	20.6	108.3	105.4	20.6	126.0	249.1	20.6	269.7
56.0	93.2	14.4	107.6	110.9	14.4	125.3	255.8	14.4	270.2
57.0	98.7	14.4	113.1	115.0	14.4	129.4	261.1	14.4	275.5
58.0	104.2	14.4	118.6	117.8	14.4	132.2	266.4	14.4	280.9
59.0	109.7	14.4	124.1	120.5	14.4	134.9	271.8	14.4	286.2
60.0	115.2	14.4	129.6	123.3	14.4	137.7	277.1	14.4	291.5
61.0	120.7	14.4	135.1	126.0	14.4	140.4	282.4	14.4	296.8
62.0	126.2	14.4	140.6	128.8	14.4	143.2	287.6	14.4	302.1
63.0	131.7	14.4	146.1	131.5	14.4	145.9	292.9	14.4	307.4
64.0	137.2	14.4	151.6	134.3	14.4	148.7	252.4	14.4	266.8
65.0	142.7	14.4	157.1	137.0	14.4	151.4	257.4	14.4	271.8
66.0	148.2	14.4	162.6	139.8	14.4	154.2	262.4	14.4	276.9
67.0	153.7	28.8	182.5	142.5	28.8	171.3	267.5	42.9	310.4
68.0	159.2	71.9	231.1	145.2	72.0	217.3	272.5	128.4	400.9
69.0	164.7	115.0	279.7	148.4	115.2	263.6	277.6	213.8	491.4
70.0	169.4	115.0	284.5	151.5	115.2	266.8	285.1	213.8	498.9

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* API RP-2A (1994) *
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PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	2.3*	2.3
1.00	0.0	4.9*	4.9
2.00	0.0	7.5*	7.5
3.00	0.0	6.5*	6.5
4.00	0.0	7.4*	7.4
5.00	0.0	8.4*	8.4
6.00	0.0	9.6*	9.6
7.00	0.0	10.9*	10.9
8.00	0.0	12.4*	12.4
9.00	0.8	14.1*	14.9
10.00	2.4	16.0*	18.3
11.00	4.2	17.9*	22.1
12.00	6.1	20.1*	26.2
13.00	8.2	22.4*	30.6
14.00	10.5	24.9*	35.4
15.00	13.0	27.5*	40.5
16.00	15.6	30.3*	45.9
17.00	18.4	33.3*	51.7
18.00	21.4	36.4*	57.8
19.00	24.6	39.7*	64.2
20.00	27.9	43.1*	71.0
21.00	31.4	46.7*	78.1
22.00	35.0	50.4*	85.5
23.00	38.9	54.4*	93.2
24.00	42.9	58.4*	101.3
25.00	47.0	62.7*	109.7

26.00	51.4	67.1*	118.4
27.00	55.9	71.6*	127.5
28.00	60.6	76.3*	136.9
29.00	65.4	80.4	145.8
30.00	70.5	83.1	153.5
31.00	75.7	85.8	161.4
32.00	81.0	88.4	169.5
33.00	86.6	91.1	177.7
34.00	92.3	93.8	186.1
35.00	98.2	96.4	194.6
36.00	104.2	99.1	203.3
37.00	110.4	101.8	212.2
38.00	116.7	104.4	221.1
39.00	122.9	106.2	229.1
40.00	129.1	106.9	236.0
41.00	135.4	106.9	242.3
42.00	141.6	106.9	248.5
43.00	147.8	106.9	254.7
44.00	154.1	106.9	261.0
45.00	160.3	106.9	267.2
46.00	166.5	95.8	262.3
47.00	172.8	62.3	235.1
48.00	180.9	28.9	209.7
49.00	188.9	28.9	217.7
50.00	196.8	28.9	225.6
51.00	204.7	28.9	233.6
52.00	212.8	28.9	241.6
53.00	220.9	28.9	249.8
54.00	229.1	26.8	255.9
55.00	237.4	20.6	258.0
56.00	245.6	14.4	260.1
57.00	251.1	14.4	265.6
58.00	256.6	14.4	271.1
59.00	262.1	14.4	276.6
60.00	267.6	14.4	282.1
61.00	273.1	14.4	287.6
62.00	278.6	14.4	293.1
63.00	284.1	14.4	298.6
64.00	289.6	14.4	304.0
65.00	295.1	14.4	309.5
66.00	300.6	14.4	315.0
67.00	306.1	42.9	349.0
68.00	311.6	128.4	440.0
69.00	317.1	213.8	530.9
70.00	324.4	213.8	538.2

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00	0.0000E+00	0.0000E+00

Abut 1 - GST - 14 in Alt W.apo

			0.0000E+00	0.2240E-01
			0.0000E+00	0.4340E-01
			0.0000E+00	0.7980E-01
			0.0000E+00	0.1120E+00
			0.0000E+00	0.1400E+00
			0.0000E+00	0.2800E+00
			0.0000E+00	0.4200E+00
			0.0000E+00	0.7000E+00
			0.0000E+00	0.2800E+01
2	10	0.7750E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2240E-01
			0.0000E+00	0.4340E-01
			0.0000E+00	0.7980E-01
			0.0000E+00	0.1120E+00
			0.0000E+00	0.1400E+00
			0.0000E+00	0.2800E+00
			0.0000E+00	0.4200E+00
			0.0000E+00	0.7000E+00
			0.0000E+00	0.2800E+01
3	10	0.1458E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2240E-01
			0.0000E+00	0.4340E-01
			0.0000E+00	0.7980E-01
			0.0000E+00	0.1120E+00
			0.0000E+00	0.1400E+00
			0.0000E+00	0.2800E+00
			0.0000E+00	0.4200E+00
			0.0000E+00	0.7000E+00
			0.0000E+00	0.2800E+01
4	10	0.1500E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
5	10	0.2452E+02		
			0.0000E+00	0.0000E+00
			0.7908E+00	0.1000E-01
			0.1582E+01	0.2000E-01
			0.3163E+01	0.4000E-01
			0.4745E+01	0.6000E-01
			0.6326E+01	0.8000E-01
			0.7117E+01	0.9000E-01
			0.7908E+01	0.1000E+00
			0.7908E+01	0.5000E+00
			0.7908E+01	0.2000E+01
6	10	0.4746E+02		
			0.0000E+00	0.0000E+00
			0.1536E+01	0.1000E-01
			0.3071E+01	0.2000E-01
			0.6142E+01	0.4000E-01
			0.9213E+01	0.6000E-01
			0.1228E+02	0.8000E-01
			0.1382E+02	0.9000E-01
			0.1536E+02	0.1000E+00
			0.1536E+02	0.5000E+00
			0.1536E+02	0.2000E+01

Abut 1 - GST - 14 in Alt W.apo

7	10	0.4750E+02		
			0.0000E+00	0.0000E+00
			0.4607E+01	0.2240E-01
			0.7678E+01	0.4340E-01
			0.1152E+02	0.7980E-01
			0.1382E+02	0.1120E+00
			0.1536E+02	0.1400E+00
			0.1382E+02	0.2800E+00
			0.1382E+02	0.4200E+00
			0.1382E+02	0.7000E+00
			0.1382E+02	0.2800E+01
8	10	0.5152E+02		
			0.0000E+00	0.0000E+00
			0.4574E+01	0.2240E-01
			0.7623E+01	0.4340E-01
			0.1144E+02	0.7980E-01
			0.1372E+02	0.1120E+00
			0.1525E+02	0.1400E+00
			0.1372E+02	0.2800E+00
			0.1372E+02	0.4200E+00
			0.1372E+02	0.7000E+00
			0.1372E+02	0.2800E+01
9	10	0.5546E+02		
			0.0000E+00	0.0000E+00
			0.4687E+01	0.2240E-01
			0.7812E+01	0.4340E-01
			0.1172E+02	0.7980E-01
			0.1406E+02	0.1120E+00
			0.1562E+02	0.1400E+00
			0.1406E+02	0.2800E+00
			0.1406E+02	0.4200E+00
			0.1406E+02	0.7000E+00
			0.1406E+02	0.2800E+01
10	10	0.5550E+02		
			0.0000E+00	0.0000E+00
			0.4687E+01	0.2240E-01
			0.7812E+01	0.4340E-01
			0.1172E+02	0.7980E-01
			0.1406E+02	0.1120E+00
			0.1562E+02	0.1400E+00
			0.1406E+02	0.2800E+00
			0.1406E+02	0.4200E+00
			0.1406E+02	0.7000E+00
			0.1406E+02	0.2800E+01
11	10	0.6202E+02		
			0.0000E+00	0.0000E+00
			0.3125E+01	0.2240E-01
			0.5208E+01	0.4340E-01
			0.7812E+01	0.7980E-01
			0.9375E+01	0.1120E+00
			0.1042E+02	0.1400E+00
			0.9375E+01	0.2800E+00
			0.9375E+01	0.4200E+00
			0.9375E+01	0.7000E+00
			0.9375E+01	0.2800E+01
12	10	0.6846E+02		
			0.0000E+00	0.0000E+00
			0.3125E+01	0.2240E-01
			0.5208E+01	0.4340E-01
			0.7812E+01	0.7980E-01
			0.9375E+01	0.1120E+00
			0.1042E+02	0.1400E+00
			0.9375E+01	0.2800E+00
			0.9375E+01	0.4200E+00

Abut 1 - GST - 14 in Alt W.apo

			0.9375E+01	0.7000E+00
			0.9375E+01	0.2800E+01
13	10	0.6850E+02		
			0.0000E+00	0.0000E+00
			0.1042E+01	0.1000E-01
			0.2083E+01	0.2000E-01
			0.4167E+01	0.4000E-01
			0.6250E+01	0.6000E-01
			0.8333E+01	0.8000E-01
			0.9375E+01	0.9000E-01
			0.1042E+02	0.1000E+00
			0.1042E+02	0.5000E+00
			0.1042E+02	0.2000E+01
14	10	0.7428E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01
15	10	0.7996E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01

Abut 1 - GST - 14 in Alt W.apo

0.1559E+03	0.1455E+00	0.1909E+02	0.1000E-01
0.3578E+03	0.4153E+00	0.6109E+02	0.5000E-01
0.4153E+03	0.5452E+00	0.7844E+02	0.1000E+00
0.4774E+03	0.1045E+01	0.1488E+03	0.5000E+00
0.5195E+03	0.1610E+01	0.1908E+03	0.1000E+01
0.5425E+03	0.2646E+01	0.2138E+03	0.2000E+01

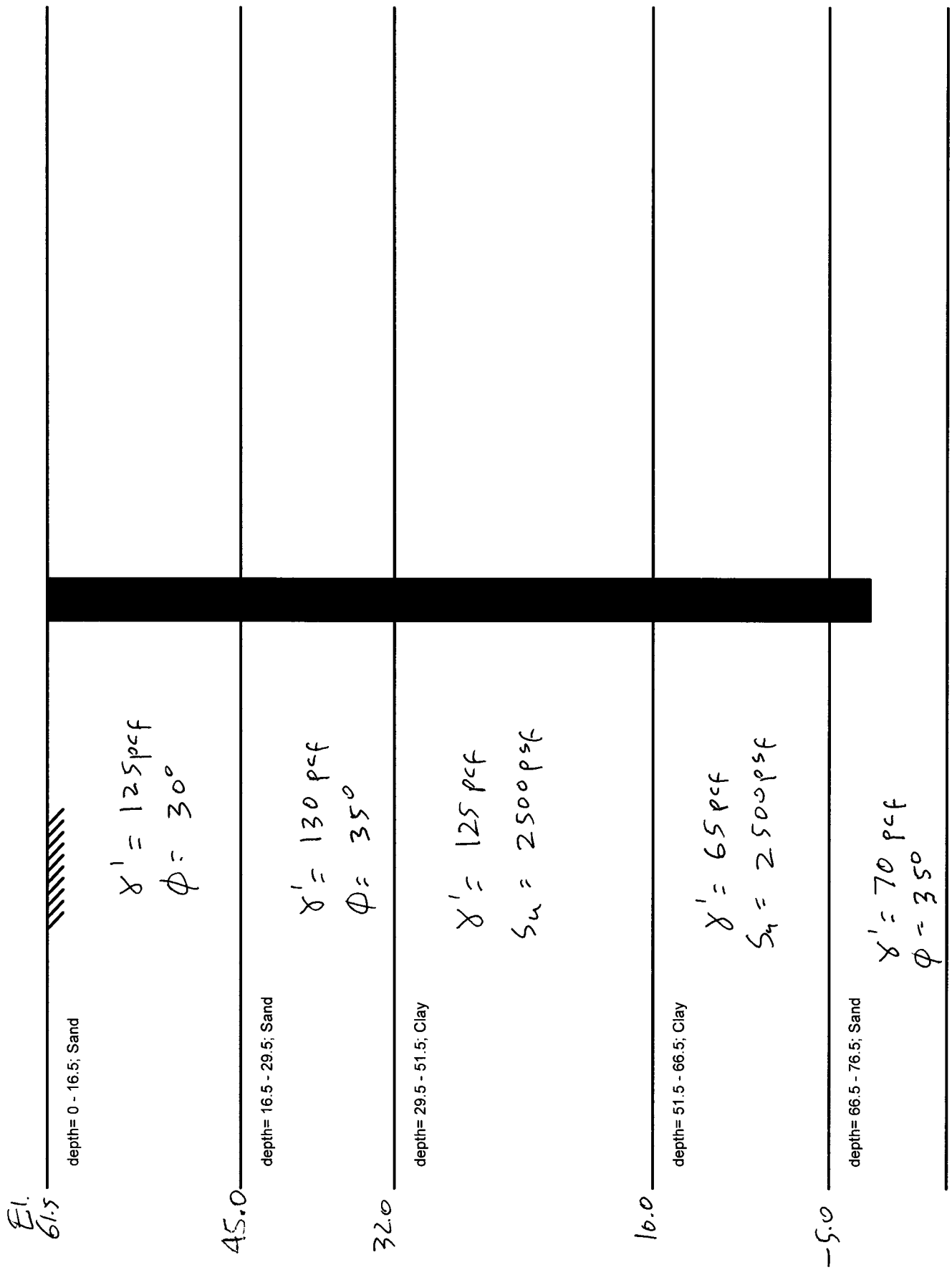
TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.1336E+02	0.7000E-02
0.2673E+02	0.1400E-01
0.5345E+02	0.2800E-01
0.1069E+03	0.1820E+00
0.1604E+03	0.5880E+00
0.1924E+03	0.1022E+01
0.2138E+03	0.1400E+01
0.2138E+03	0.2100E+01
0.2138E+03	0.2800E+01

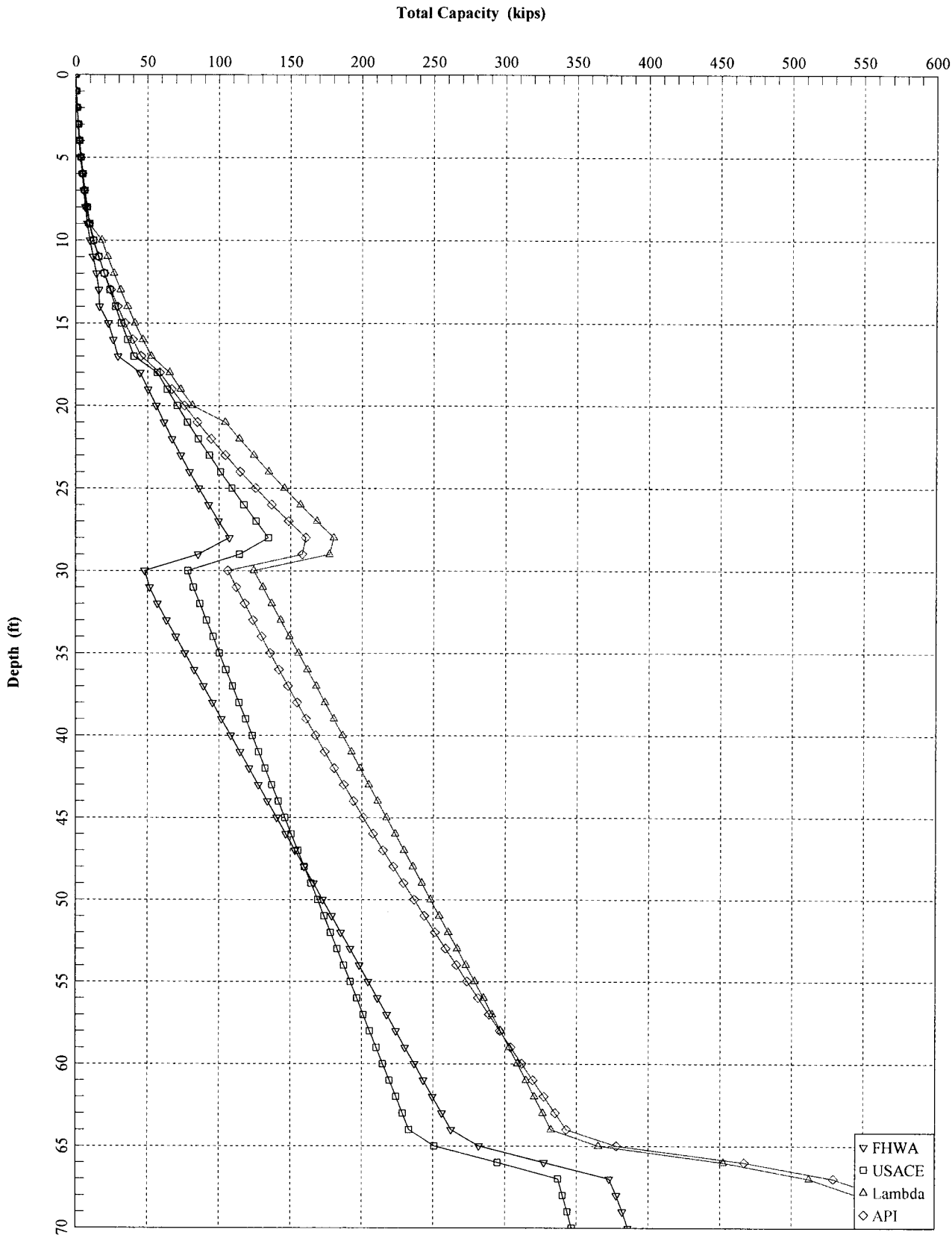
LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1539E+01	0.1431E-02	0.1909E+00	0.1000E-03
0.1550E+02	0.1436E-01	0.1909E+01	0.1000E-02
0.7899E+02	0.7305E-01	0.9545E+01	0.5000E-02

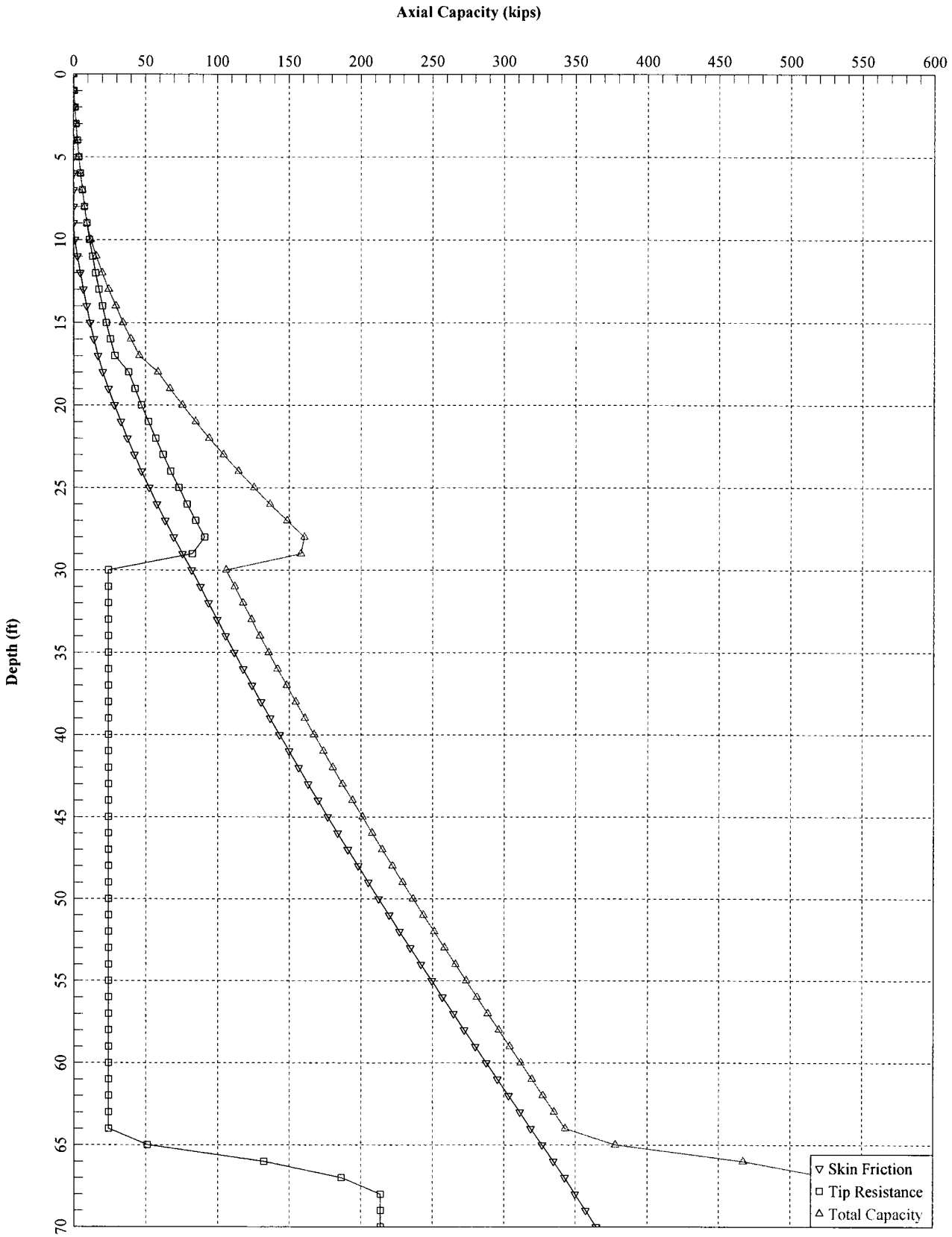
INFORMATION HANDOUT

Abutment 3
14-in. Open-ended Steel Pipe Pile (Alt. 'W')
(based on Boring GST-137)





SR4 G Streer Overcrossing - Abutment 3 - 14-in Steel Pipe PIle



SR4 G Street Overcrossing - Abutment 3 - 14-in Steel PIpe Pile - API RP2A Method

1

AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

G Street OC - Abutment 3 (South Abutment) - 14-in Steel Pipe Pile

DESIGNER : Partha Sircar

DATE : October 30, 2008

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 0.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 0.00 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 14.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 13.13 IN.
PILE LENGTH = 70.00 FT.
MODULUS OF ELASTICITY = 0.290E+08 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 9.90 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.80	125.00	30.00	20.00
16.50	SAND	0.80	125.00	30.00	20.00
16.50	SAND	0.80	130.00	35.00	40.00
29.50	SAND	0.80	130.00	35.00	40.00
29.50	CLAY	0.00	125.00	0.00	0.00
51.50	CLAY	0.00	125.00	0.00	0.00
51.50	CLAY	0.00	65.00	0.00	0.00
66.50	CLAY	0.00	65.00	0.00	0.00
66.50	SAND	0.80	70.00	35.00	40.00
76.50	SAND	0.80	70.00	35.00	40.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
1.70	100.00	0.00	0.00	0.00	0.00	0.00
1.70	100.00	0.00	0.00	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00
2.50	22.50	2.50	1.25	0.00	0.00	0.00
2.50	22.50	2.50	1.25	0.00	0.00	0.00
2.50	22.50	2.50	1.25	0.00	0.00	0.00

2.50	22.50	2.50	1.25	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00

1

****
* COMPUTATION RESULT *
****

PILE PENETR-ATION FT.	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP
	********** FED. HWY. METHOD **********			********** ARMY CORPS METHOD **********			********** LAMBDA 2 METHOD **********		
0.0	0.0	0.0*	0.0	0.0	0.0*	0.0	0.0	0.0*	0.0
1.0	0.0	0.4*	0.4	0.0	0.5*	0.5	0.0	0.4*	0.4
2.0	0.0	0.9*	0.9	0.0	1.1*	1.1	0.0	1.0*	1.0
3.0	0.0	1.6*	1.6	0.0	1.8*	1.8	0.0	1.7*	1.7
4.0	0.0	2.4*	2.4	0.0	2.8*	2.8	0.0	2.6*	2.6
5.0	0.0	3.4*	3.4	0.0	3.9*	3.9	0.0	3.6*	3.6
6.0	0.0	4.6*	4.6	0.0	5.1*	5.1	0.0	4.8*	4.8
7.0	0.0	5.6*	5.6	0.0	6.5*	6.5	0.0	6.2*	6.2
8.0	0.0	6.9*	6.9	0.0	8.1*	8.1	0.0	7.7*	7.7
9.0	0.0	8.2*	8.2	0.0	9.8*	9.8	0.0	9.4*	9.4
10.0	0.2	9.7*	10.0	0.8	11.7*	12.5	7.1	11.2*	18.4
11.0	0.7	11.4*	12.1	2.4	13.8*	16.1	9.1	13.3*	22.3
12.0	1.2	13.3*	14.5	4.1	15.9*	20.0	11.2	15.4*	26.7
13.0	1.8	14.2*	16.1	5.9	17.9*	23.8	13.5	17.7*	31.3
14.0	2.4	14.2*	16.7	7.7	20.0*	27.7	16.0	20.2*	36.2
15.0	3.1	19.8*	22.9	9.4	22.4*	31.8	18.5	22.9*	41.4
16.0	3.8	22.2*	26.1	11.2	24.9*	36.1	21.2	25.7*	46.9
17.0	4.6	24.9*	29.5	13.0	27.5*	40.5	24.0	28.7*	52.7
18.0	5.6	39.3*	44.9	16.1	40.6*	56.8	27.2	38.3*	65.5
19.0	6.7	43.7*	50.5	19.3	44.3*	63.6	30.6	42.7*	73.2
20.0	8.0	48.1*	56.1	22.5	48.2*	70.7	34.0	47.2*	81.3
21.0	9.3	52.2*	61.5	25.6	52.3*	77.9	52.4	52.0*	104.4
22.0	10.7	56.5*	67.2	28.8	56.6*	85.4	57.3	57.0*	114.3
23.0	12.1	61.0*	73.2	32.0	61.1*	93.1	62.3	62.1*	124.4
24.0	13.7	65.7*	79.4	35.1	65.8*	101.0	67.4	67.5*	134.9
25.0	15.2	70.7*	85.9	38.3	70.8*	109.0	72.6	73.1*	145.7
26.0	16.9	75.8*	92.7	41.4	75.9*	117.3	78.0	78.9*	156.9
27.0	18.6	81.1*	99.7	44.6	81.2*	125.8	83.4	84.9*	168.3
28.0	20.4	86.7*	107.1	47.8	86.8*	134.5	89.0	91.1*	180.1
29.0	22.2	63.0	85.3	50.9	63.4	114.3	94.6	82.5	177.1
30.0	24.2	24.1	48.2	54.1	24.1	78.2	100.4	24.1	124.4
31.0	27.4	24.1	51.5	58.0	24.1	82.0	106.6	24.1	130.7
32.0	32.9	24.1	57.0	62.6	24.1	86.6	112.9	24.1	136.9
33.0	39.3	24.1	63.4	67.1	24.1	91.2	119.1	24.1	143.2
34.0	45.8	24.1	69.8	71.7	24.1	95.8	125.3	24.1	149.4
35.0	52.2	24.1	76.2	76.3	24.1	100.4	131.5	24.1	155.6
36.0	58.6	24.1	82.7	80.9	24.1	104.9	137.7	24.1	161.8
37.0	65.0	24.1	89.1	85.5	24.1	109.5	143.9	24.1	168.0
38.0	71.5	24.1	95.5	90.0	24.1	114.1	150.1	24.1	174.1
39.0	77.9	24.1	101.9	94.6	24.1	118.7	156.3	24.1	180.3
40.0	84.3	24.1	108.4	99.2	24.1	123.3	162.4	24.1	186.5
41.0	90.7	24.1	114.8	103.8	24.1	127.8	168.6	24.1	192.6
42.0	97.2	24.1	121.2	108.4	24.1	132.4	174.8	24.1	198.8

43.0	103.6	24.1	127.6	113.0	24.1	137.0	180.9	24.1	205.0
44.0	110.0	24.1	134.0	117.5	24.1	141.6	187.1	24.1	211.1
45.0	116.4	24.1	140.5	122.1	24.1	146.2	193.3	24.1	217.3
46.0	122.8	24.1	146.9	126.7	24.1	150.7	199.4	24.1	223.5
47.0	129.3	24.1	153.3	131.3	24.1	155.3	205.6	24.1	229.6
48.0	135.7	24.1	159.7	135.9	24.1	159.9	211.8	24.1	235.8
49.0	142.1	24.1	166.2	140.4	24.1	164.5	217.9	24.1	242.0
50.0	148.5	24.1	172.6	145.0	24.1	169.1	224.1	24.1	248.2
51.0	155.0	24.1	179.0	149.6	24.1	173.7	230.3	24.1	254.3
52.0	161.4	24.1	185.4	154.2	24.1	178.2	236.5	24.1	260.5
53.0	167.8	24.1	191.9	158.8	24.1	182.8	242.6	24.1	266.7
54.0	174.2	24.1	198.3	163.3	24.1	187.4	248.8	24.1	272.8
55.0	180.7	24.1	204.7	167.9	24.1	192.0	254.9	24.1	278.9
56.0	187.1	24.1	211.1	172.5	24.1	196.6	260.9	24.1	285.0
57.0	193.5	24.1	217.6	177.1	24.1	201.1	266.9	24.1	291.0
58.0	199.9	24.1	224.0	181.7	24.1	205.7	272.9	24.1	297.0
59.0	206.3	24.1	230.4	186.3	24.1	210.3	278.9	24.1	303.0
60.0	212.8	24.1	236.8	190.8	24.1	214.9	284.8	24.1	308.9
61.0	219.2	24.1	243.2	195.4	24.1	219.5	290.7	24.1	314.8
62.0	225.6	24.1	249.7	200.0	24.1	224.1	296.6	24.1	320.7
63.0	232.0	24.1	256.1	204.6	24.1	228.6	302.5	24.1	326.5
64.0	238.5	24.1	262.5	209.2	24.1	233.2	308.3	24.1	332.3
65.0	244.9	37.0	281.9	213.7	37.2	250.9	314.1	51.2	365.3
66.0	251.3	76.0	327.3	218.3	76.5	294.8	319.9	132.5	452.3
67.0	257.7	115.0*	372.8	221.5	115.8*	337.2	325.6	186.7*	512.3
68.0	262.9	115.0	377.9	224.7	115.8	340.4	332.6	213.8	546.4
69.0	266.8	115.0	381.8	227.8	115.8	343.6	339.6	213.8	553.4
70.0	270.7	115.0	385.8	231.0	115.8	346.7	346.6	213.8	560.4

****
* API RP-2A (1994) *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.0*	0.0
1.00	0.0	0.4*	0.4
2.00	0.0	1.0*	1.0
3.00	0.0	1.7*	1.7
4.00	0.0	2.6*	2.6
5.00	0.0	3.6*	3.6
6.00	0.0	4.8*	4.8
7.00	0.0	6.2*	6.2
8.00	0.0	7.7*	7.7
9.00	0.0	9.4*	9.4
10.00	0.9	11.2*	12.1
11.00	2.6	13.3*	15.9
12.00	4.6	15.4*	20.0
13.00	6.8	17.7*	24.5
14.00	9.1	20.2*	29.3
15.00	11.5	22.9*	34.4
16.00	14.2	25.7*	39.9
17.00	17.0	28.7*	45.7
18.00	20.4	38.3*	58.7
19.00	24.3	42.7*	67.0
20.00	28.4	47.2*	75.7
21.00	32.8	52.0*	84.8
22.00	37.4	57.0*	94.4
23.00	42.2	62.1*	104.3
24.00	47.2	67.5*	114.8
25.00	52.5	73.1*	125.6

26.00	57.9	78.9*	136.9
27.00	63.6	84.9*	148.6
28.00	69.5	91.1*	160.7
29.00	75.7	82.5	158.1
30.00	82.0	24.1	106.1
31.00	88.1	24.1	112.2
32.00	93.9	24.1	118.0
33.00	99.8	24.1	123.9
34.00	105.8	24.1	129.8
35.00	111.8	24.1	135.9
36.00	118.0	24.1	142.0
37.00	124.2	24.1	148.3
38.00	130.5	24.1	154.6
39.00	136.9	24.1	161.0
40.00	143.4	24.1	167.5
41.00	150.0	24.1	174.0
42.00	156.6	24.1	180.7
43.00	163.3	24.1	187.4
44.00	170.1	24.1	194.2
45.00	177.0	24.1	201.1
46.00	184.0	24.1	208.0
47.00	191.0	24.1	215.0
48.00	198.1	24.1	222.1
49.00	205.3	24.1	229.3
50.00	212.5	24.1	236.6
51.00	219.8	24.1	243.9
52.00	227.2	24.1	251.3
53.00	234.7	24.1	258.7
54.00	242.1	24.1	266.2
55.00	249.7	24.1	273.7
56.00	257.2	24.1	281.3
57.00	264.8	24.1	288.8
58.00	272.4	24.1	296.5
59.00	280.1	24.1	304.1
60.00	287.8	24.1	311.8
61.00	295.5	24.1	319.6
62.00	303.3	24.1	327.3
63.00	311.1	24.1	335.1
64.00	318.9	24.1	343.0
65.00	326.8	51.2	377.9
66.00	334.7	132.5	467.2
67.00	342.6	186.7*	529.3
68.00	349.9	213.8	563.7
69.00	357.3	213.8	571.1
70.00	364.6	213.8	578.4

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00	0.0000E+00	0.0000E+00

Abut 3 - GST - 14 in Alt W.apo

			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.8275E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
3	10	0.1646E+02		
			0.0000E+00	0.0000E+00
			0.5343E+00	0.1000E-01
			0.1069E+01	0.2000E-01
			0.2137E+01	0.4000E-01
			0.3206E+01	0.6000E-01
			0.4274E+01	0.8000E-01
			0.4809E+01	0.9000E-01
			0.5343E+01	0.1000E+00
			0.5343E+01	0.5000E+00
			0.5343E+01	0.2000E+01
4	10	0.1650E+02		
			0.0000E+00	0.0000E+00
			0.5343E+00	0.1000E-01
			0.1069E+01	0.2000E-01
			0.2137E+01	0.4000E-01
			0.3206E+01	0.6000E-01
			0.4274E+01	0.8000E-01
			0.4809E+01	0.9000E-01
			0.5343E+01	0.1000E+00
			0.5343E+01	0.5000E+00
			0.5343E+01	0.2000E+01
5	10	0.2302E+02		
			0.0000E+00	0.0000E+00
			0.9526E+00	0.1000E-01
			0.1905E+01	0.2000E-01
			0.3810E+01	0.4000E-01
			0.5716E+01	0.6000E-01
			0.7621E+01	0.8000E-01
			0.8574E+01	0.9000E-01
			0.9526E+01	0.1000E+00
			0.9526E+01	0.5000E+00
			0.9526E+01	0.2000E+01
6	10	0.2946E+02		
			0.0000E+00	0.0000E+00
			0.1203E+01	0.1000E-01
			0.2406E+01	0.2000E-01
			0.4811E+01	0.4000E-01
			0.7217E+01	0.6000E-01
			0.9622E+01	0.8000E-01
			0.1083E+02	0.9000E-01
			0.1203E+02	0.1000E+00
			0.1203E+02	0.5000E+00
			0.1203E+02	0.2000E+01

Abut 3 - GST - 14 in Alt W.apo

7	10	0.2950E+02		
			0.0000E+00	0.0000E+00
			0.3608E+01	0.2240E-01
			0.6014E+01	0.4340E-01
			0.9021E+01	0.7980E-01
			0.1083E+02	0.1120E+00
			0.1203E+02	0.1400E+00
			0.1083E+02	0.2800E+00
			0.1083E+02	0.4200E+00
			0.1083E+02	0.7000E+00
			0.1083E+02	0.2800E+01
8	10	0.4052E+02		
			0.0000E+00	0.0000E+00
			0.3729E+01	0.2240E-01
			0.6216E+01	0.4340E-01
			0.9324E+01	0.7980E-01
			0.1119E+02	0.1120E+00
			0.1243E+02	0.1400E+00
			0.1119E+02	0.2800E+00
			0.1119E+02	0.4200E+00
			0.1119E+02	0.7000E+00
			0.1119E+02	0.2800E+01
9	10	0.5146E+02		
			0.0000E+00	0.0000E+00
			0.4200E+01	0.2240E-01
			0.7000E+01	0.4340E-01
			0.1050E+02	0.7980E-01
			0.1260E+02	0.1120E+00
			0.1400E+02	0.1400E+00
			0.1260E+02	0.2800E+00
			0.1260E+02	0.4200E+00
			0.1260E+02	0.7000E+00
			0.1260E+02	0.2800E+01
10	10	0.5150E+02		
			0.0000E+00	0.0000E+00
			0.4200E+01	0.2240E-01
			0.7000E+01	0.4340E-01
			0.1050E+02	0.7980E-01
			0.1260E+02	0.1120E+00
			0.1400E+02	0.1400E+00
			0.1260E+02	0.2800E+00
			0.1260E+02	0.4200E+00
			0.1260E+02	0.7000E+00
			0.1260E+02	0.2800E+01
11	10	0.5902E+02		
			0.0000E+00	0.0000E+00
			0.4374E+01	0.2240E-01
			0.7290E+01	0.4340E-01
			0.1093E+02	0.7980E-01
			0.1312E+02	0.1120E+00
			0.1458E+02	0.1400E+00
			0.1312E+02	0.2800E+00
			0.1312E+02	0.4200E+00
			0.1312E+02	0.7000E+00
			0.1312E+02	0.2800E+01
12	10	0.6646E+02		
			0.0000E+00	0.0000E+00
			0.4513E+01	0.2240E-01
			0.7521E+01	0.4340E-01
			0.1128E+02	0.7980E-01
			0.1354E+02	0.1120E+00
			0.1504E+02	0.1400E+00
			0.1354E+02	0.2800E+00
			0.1354E+02	0.4200E+00

Abut 3 - GST - 14 in Alt W.apo

			0.1354E+02	0.7000E+00
			0.1354E+02	0.2800E+01
13	10	0.6650E+02		
			0.0000E+00	0.0000E+00
			0.1504E+01	0.1000E-01
			0.3009E+01	0.2000E-01
			0.6017E+01	0.4000E-01
			0.9026E+01	0.6000E-01
			0.1203E+02	0.8000E-01
			0.1354E+02	0.9000E-01
			0.1504E+02	0.1000E+00
			0.1504E+02	0.5000E+00
			0.1504E+02	0.2000E+01
14	10	0.7153E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01
15	10	0.7646E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01

Abut 3 - GST - 14 in Alt W.apo

0.1721E+03	0.1622E+00	0.1909E+02	0.1000E-01
0.3677E+03	0.4312E+00	0.6109E+02	0.5000E-01
0.4289E+03	0.5701E+00	0.7844E+02	0.1000E+00
0.4870E+03	0.1066E+01	0.1488E+03	0.5000E+00
0.5290E+03	0.1631E+01	0.1908E+03	0.1000E+01
0.5520E+03	0.2667E+01	0.2138E+03	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.1336E+02	0.7000E-02
0.2673E+02	0.1400E-01
0.5345E+02	0.2800E-01
0.1069E+03	0.1820E+00
0.1604E+03	0.5880E+00
0.1924E+03	0.1022E+01
0.2138E+03	0.1400E+01
0.2138E+03	0.2100E+01
0.2138E+03	0.2800E+01

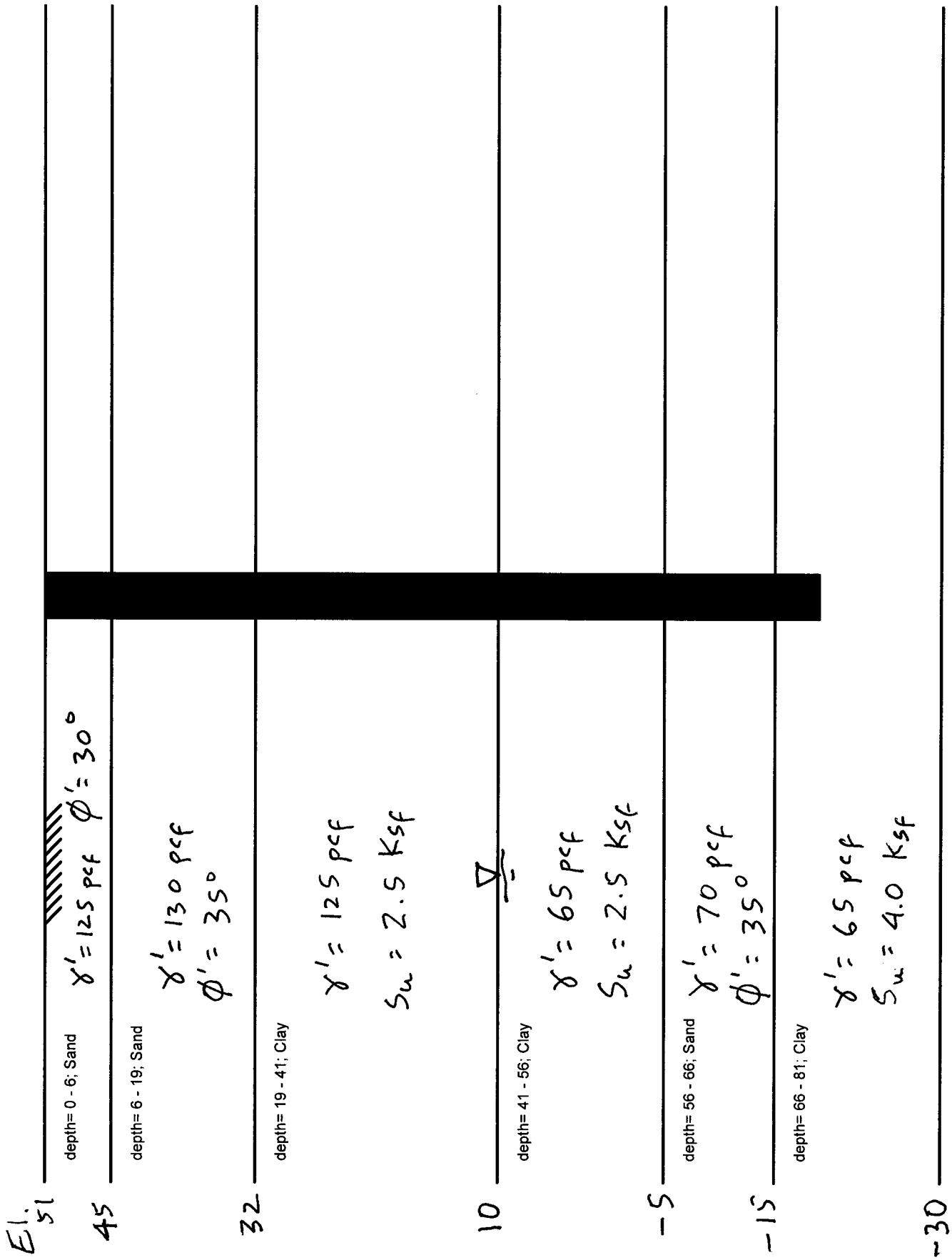
LOAD VERSUS SETTLEMENT CURVE
****

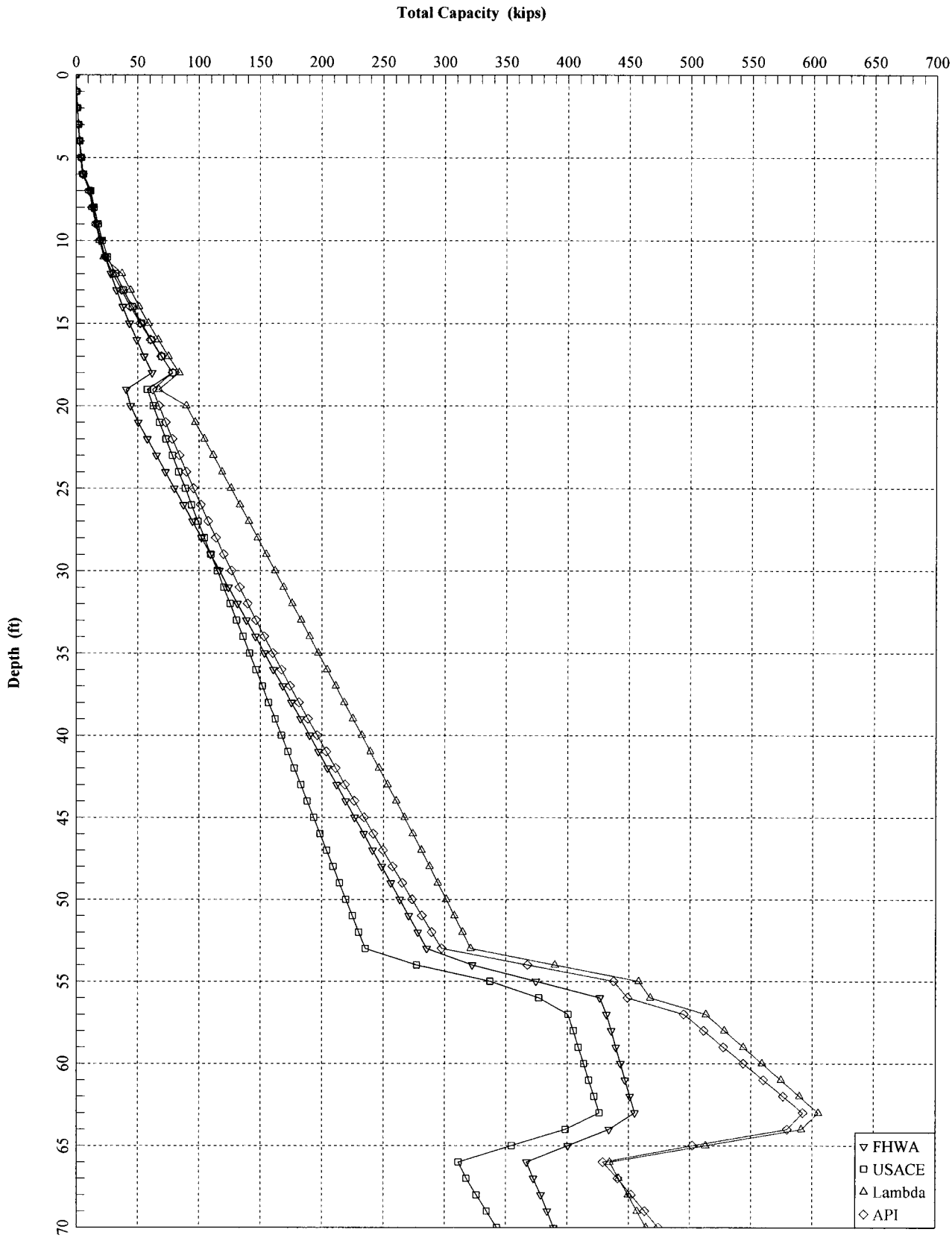
TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1810E+01	0.1682E-02	0.1909E+00	0.1000E-03
0.1830E+02	0.1692E-01	0.1909E+01	0.1000E-02
0.9244E+02	0.8557E-01	0.9545E+01	0.5000E-02

Bent 2

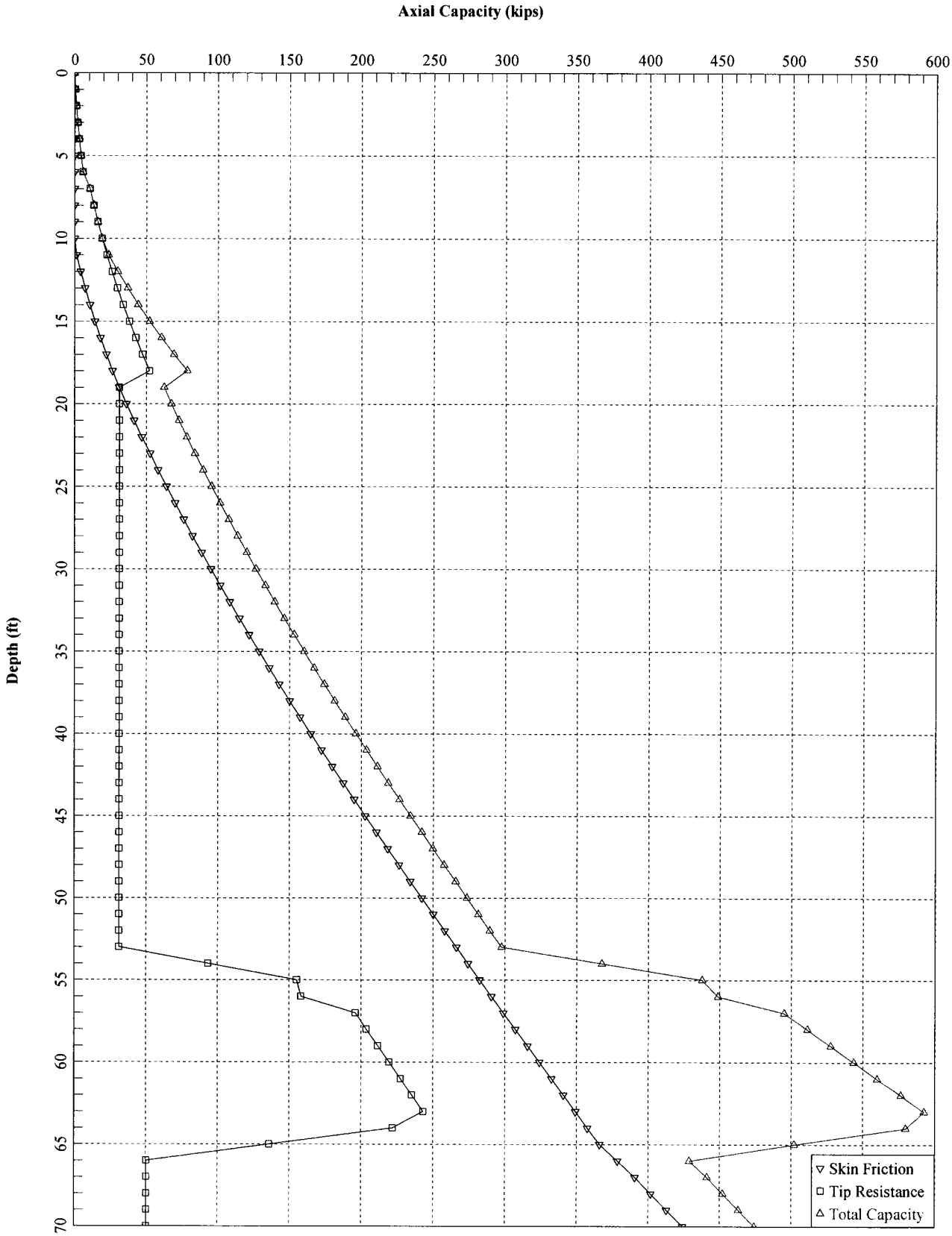
16-in. Open-ended Steel Pipe Pile (Alt. "W")

(based on boring GST-137)





SR4 G Street Overcrossing - Bent 2 (GST-137) - 16-in Steel PIpe PIle



SR4 G Street Overcrossing - Bent 2 (GST-137) - 16-in Steel Pipe PIle - API

1

AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

G Street OC - Bent 2A (Boring GST-137)) - 16-in open-ended Steel Pipe

DESIGNER : Partha Sircar

DATE : October 30, 2008

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 0.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 0.00 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 16.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 15.00 IN.
PILE LENGTH = 70.00 FT.
MODULUS OF ELASTICITY = 0.290E+08 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 11.00 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.80	125.00	30.00	20.00
6.00	SAND	0.80	125.00	30.00	20.00
6.00	SAND	0.80	130.00	35.00	40.00
19.00	SAND	0.80	130.00	35.00	40.00
19.00	CLAY	0.00	125.00	0.00	0.00
41.00	CLAY	0.00	125.00	0.00	0.00
41.00	CLAY	0.00	65.00	0.00	0.00
56.00	CLAY	0.00	65.00	0.00	0.00
56.00	SAND	0.80	70.00	35.00	40.00
66.00	SAND	0.80	70.00	35.00	40.00
66.00	CLAY	0.00	65.00	0.00	0.00
81.00	CLAY	0.00	65.00	0.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
1.70	100.00	0.00	0.00	0.00	0.00	0.00
1.70	100.00	0.00	0.00	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00
2.50	22.50	2.50	1.25	0.00	0.00	0.00

2.50	22.50	2.50	1.25	0.00	0.00	0.00
2.50	22.50	2.50	1.25	0.00	0.00	0.00
2.50	22.50	2.50	1.25	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00
4.00	36.00	4.00	2.00	0.00	0.00	0.00
4.00	36.00	4.00	2.00	0.00	0.00	0.00

1

****
* COMPUTATION RESULT *
****

PILE PENETR-ATION FT.	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP
	**********			**********			**********		
	* FED. HWY. METHOD *			* ARMY CORPS METHOD *			* LAMBDA 2 METHOD *		
	**********			**********			**********		
0.0	0.0	0.0*	0.0	0.0	0.0*	0.0	0.0	0.0*	0.0
1.0	0.0	0.5*	0.5	0.0	0.6*	0.6	0.0	0.5*	0.5
2.0	0.0	1.1*	1.1	0.0	1.3*	1.3	0.0	1.2*	1.2
3.0	0.0	1.9*	1.9	0.0	2.3*	2.3	0.0	2.1*	2.1
4.0	0.0	2.9*	2.9	0.0	3.4*	3.4	0.0	3.2*	3.2
5.0	0.0	4.1*	4.1	0.0	4.7*	4.7	0.0	4.4*	4.4
6.0	0.0	5.5*	5.5	0.0	6.2*	6.2	0.0	5.8*	5.8
7.0	0.0	11.2*	11.2	0.0	12.1*	12.1	0.0	10.7*	10.7
8.0	0.0	13.9*	13.9	0.0	14.9*	14.9	0.0	13.3*	13.3
9.0	0.0	16.8*	16.8	0.0	18.0*	18.0	0.0	16.1*	16.1
10.0	0.0	20.0*	20.0	0.0	21.3*	21.3	0.0	19.2*	19.2
11.0	0.4	23.3*	23.8	1.2	24.8*	25.9	0.0	22.5*	22.5
12.0	1.3	27.0*	28.3	3.6	28.5*	32.1	11.6	26.1*	37.6
13.0	2.2	30.8*	33.1	6.2	32.5*	38.7	14.4	29.8*	44.3
14.0	3.3	34.9*	38.2	9.1	36.7*	45.8	17.6	33.8*	51.4
15.0	4.4	39.2*	43.6	12.1	41.2*	53.3	20.9	38.1*	58.9
16.0	5.6	43.8*	49.3	15.4	45.8*	61.3	24.4	42.6*	66.9
17.0	6.8	48.6*	55.4	18.9	50.8*	69.7	28.0	47.3*	75.3
18.0	8.2	53.6*	61.8	22.6	55.9*	78.5	31.8	52.2*	84.0
19.0	9.6	31.4	41.0	26.5	31.4	58.0	35.8	31.4	67.2
20.0	12.9	31.4	44.3	31.2	31.4	62.6	58.1	31.4	89.6
21.0	19.2	31.4	50.6	36.4	31.4	67.8	65.6	31.4	97.0
22.0	26.6	31.4	58.0	41.6	31.4	73.1	72.9	31.4	104.4
23.0	33.9	31.4	65.3	46.9	31.4	78.3	80.3	31.4	111.7
24.0	41.2	31.4	72.7	52.1	31.4	83.5	87.5	31.4	118.9
25.0	48.6	31.4	80.0	57.4	31.4	88.8	94.8	31.4	126.2
26.0	55.9	31.4	87.3	62.6	31.4	94.0	101.9	31.4	133.4
27.0	63.3	31.4	94.7	67.8	31.4	99.2	109.1	31.4	140.5
28.0	70.6	31.4	102.0	73.1	31.4	104.5	116.2	31.4	147.7
29.0	77.9	31.4	109.4	78.3	31.4	109.7	123.4	31.4	154.8
30.0	85.3	31.4	116.7	83.5	31.4	114.9	130.5	31.4	161.9
31.0	92.6	31.4	124.0	88.8	31.4	120.2	137.5	31.4	169.0
32.0	100.0	31.4	131.4	94.0	31.4	125.4	144.6	31.4	176.0
33.0	107.3	31.4	138.7	99.2	31.4	130.7	151.7	31.4	183.1
34.0	114.6	31.4	146.1	104.5	31.4	135.9	158.7	31.4	190.2
35.0	122.0	31.4	153.4	109.7	31.4	141.1	165.8	31.4	197.2
36.0	129.3	31.4	160.7	114.9	31.4	146.4	172.8	31.4	204.3
37.0	136.7	31.4	168.1	120.2	31.4	151.6	179.9	31.4	211.3
38.0	144.0	31.4	175.4	125.4	31.4	156.8	186.9	31.4	218.4

39.0	151.3	31.4	182.8	130.7	31.4	162.1	194.0	31.4	225.4
40.0	158.7	31.4	190.1	135.9	31.4	167.3	201.0	31.4	232.5
41.0	166.0	31.4	197.4	141.1	31.4	172.5	208.1	31.4	239.5
42.0	173.4	31.4	204.8	146.4	31.4	177.8	215.1	31.4	246.6
43.0	180.7	31.4	212.1	151.6	31.4	183.0	222.1	31.4	253.5
44.0	188.1	31.4	219.5	156.8	31.4	188.3	229.1	31.4	260.5
45.0	195.4	31.4	226.8	162.1	31.4	193.5	236.0	31.4	267.4
46.0	202.7	31.4	234.2	167.3	31.4	198.7	242.8	31.4	274.2
47.0	210.1	31.4	241.5	172.5	31.4	204.0	249.7	31.4	281.1
48.0	217.4	31.4	248.8	177.8	31.4	209.2	256.4	31.4	287.8
49.0	224.8	31.4	256.2	183.0	31.4	214.4	263.2	31.4	294.6
50.0	232.1	31.4	263.5	188.3	31.4	219.7	269.9	31.4	301.3
51.0	239.4	31.4	270.9	193.5	31.4	224.9	276.6	31.4	308.0
52.0	246.8	31.4	278.2	198.7	31.4	230.1	283.2	31.4	314.6
53.0	254.1	31.4	285.5	204.0	31.4	235.4	289.8	31.4	321.2
54.0	261.5	61.1	322.6	209.2	68.0	277.2	296.4	93.4	389.8
55.0	268.8	105.7*	374.5	214.4	122.8*	337.2	303.0	155.2*	458.1
56.0	276.1	150.2*	426.4	218.7	158.2*	376.9	309.5	158.2*	467.7
57.0	281.7	150.2*	431.9	222.9	177.6*	400.6	317.0	196.1*	513.1
58.0	285.4	150.2*	435.7	227.2	177.6*	404.8	324.5	203.9*	528.4
59.0	289.2	150.2*	439.4	231.4	177.6*	409.0	332.0	211.8*	543.8
60.0	293.0	150.2*	443.3	235.7	177.6*	413.3	339.5	219.7*	559.1
61.0	296.9	150.2*	447.1	239.9	177.6*	417.5	347.0	227.5*	574.5
62.0	300.8	150.2*	451.0	244.2	177.6*	421.8	354.4	235.4*	589.8
63.0	304.7	150.2*	455.0	248.4	177.6*	426.0	361.9	243.2*	605.1
64.0	308.7	125.2	434.0	252.7	145.8	398.4	369.3	222.0	591.3
65.0	312.8	87.8	400.5	256.9	98.0	354.9	376.8	136.1	512.9
66.0	316.8	50.3	367.1	261.2	50.3	311.4	384.2	50.3	434.5
67.0	322.2	50.3	372.5	267.5	50.3	317.7	391.8	50.3	442.0
68.0	328.2	50.3	378.5	275.8	50.3	326.1	399.2	50.3	449.5
69.0	333.5	50.3	383.8	284.2	50.3	334.5	406.7	50.3	457.0
70.0	338.8	50.3	389.0	292.6	50.3	342.9	414.1	50.3	464.4

****
* API RP-2A (1994) *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.0*	0.0
1.00	0.0	0.5*	0.5
2.00	0.0	1.2*	1.2
3.00	0.0	2.1*	2.1
4.00	0.0	3.2*	3.2
5.00	0.0	4.4*	4.4
6.00	0.0	5.8*	5.8
7.00	0.0	10.7*	10.7
8.00	0.0	13.3*	13.3
9.00	0.0	16.1*	16.1
10.00	0.0	19.2*	19.2
11.00	1.4	22.5*	23.9
12.00	4.2	26.1*	30.2
13.00	7.3	29.8*	37.1
14.00	10.6	33.8*	44.4
15.00	14.2	38.1*	52.3
16.00	18.0	42.6*	60.6
17.00	22.1	47.3*	69.4
18.00	26.5	52.2*	78.7
19.00	31.1	31.4	62.5
20.00	36.1	31.4	67.5
21.00	41.5	31.4	72.9

22.00	46.9	31.4	78.4
23.00	52.6	31.4	84.0
24.00	58.3	31.4	89.7
25.00	64.2	31.4	95.6
26.00	70.1	31.4	101.5
27.00	76.2	31.4	107.6
28.00	82.4	31.4	113.8
29.00	88.7	31.4	120.1
30.00	95.1	31.4	126.5
31.00	101.7	31.4	133.1
32.00	108.3	31.4	139.7
33.00	115.0	31.4	146.4
34.00	121.8	31.4	153.3
35.00	128.8	31.4	160.2
36.00	135.8	31.4	167.2
37.00	142.9	31.4	174.3
38.00	150.1	31.4	181.5
39.00	157.4	31.4	188.9
40.00	164.9	31.4	196.3
41.00	172.3	31.4	203.8
42.00	179.9	31.4	211.3
43.00	187.5	31.4	218.9
44.00	195.2	31.4	226.6
45.00	202.9	31.4	234.3
46.00	210.7	31.4	242.1
47.00	218.5	31.4	249.9
48.00	226.3	31.4	257.7
49.00	234.2	31.4	265.6
50.00	242.1	31.4	273.5
51.00	250.1	31.4	281.5
52.00	258.1	31.4	289.5
53.00	266.2	31.4	297.6
54.00	274.3	93.4	367.7
55.00	282.5	155.2*	437.6
56.00	290.7	158.2*	448.9
57.00	299.0	196.1*	495.1
58.00	307.4	203.9*	511.4
59.00	315.8	211.8*	527.6
60.00	324.2	219.7*	543.8
61.00	332.6	227.5*	560.1
62.00	340.9	235.4*	576.3
63.00	349.3	243.2*	592.5
64.00	357.7	222.0	579.7
65.00	366.1	136.1	502.2
66.00	378.6	50.3	428.9
67.00	390.8	50.3	441.1
68.00	401.8	50.3	452.1
69.00	412.9	50.3	463.2
70.00	424.1	50.3	474.4

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO. OF DEPTH TO CURVE LOAD TRANSFER PILE MOVEMENT

Bent 2A - GST - 16 in Alt W.apo

NO.	POINTS	FT.	PSI	IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.3025E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
3	10	0.5958E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
4	10	0.6000E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
5	10	0.1253E+02		
			0.0000E+00	0.0000E+00
			0.5116E+00	0.1000E-01
			0.1023E+01	0.2000E-01
			0.2046E+01	0.4000E-01
			0.3070E+01	0.6000E-01
			0.4093E+01	0.8000E-01
			0.4604E+01	0.9000E-01
			0.5116E+01	0.1000E+00
			0.5116E+01	0.5000E+00
			0.5116E+01	0.2000E+01
6	10	0.1896E+02		
			0.0000E+00	0.0000E+00
			0.7618E+00	0.1000E-01
			0.1524E+01	0.2000E-01
			0.3047E+01	0.4000E-01
			0.4571E+01	0.6000E-01
			0.6094E+01	0.8000E-01

Bent 2A - GST - 16 in Alt W.apo

			0.6856E+01	0.9000E-01
			0.7618E+01	0.1000E+00
			0.7618E+01	0.5000E+00
			0.7618E+01	0.2000E+01
7	10	0.1900E+02		
			0.0000E+00	0.0000E+00
			0.2493E+01	0.2560E-01
			0.4155E+01	0.4960E-01
			0.6232E+01	0.9120E-01
			0.7479E+01	0.1280E+00
			0.8309E+01	0.1600E+00
			0.7479E+01	0.3200E+00
			0.7479E+01	0.4800E+00
			0.7479E+01	0.8000E+00
			0.7479E+01	0.3200E+01
8	10	0.3002E+02		
			0.0000E+00	0.0000E+00
			0.3243E+01	0.2560E-01
			0.5405E+01	0.4960E-01
			0.8108E+01	0.9120E-01
			0.9729E+01	0.1280E+00
			0.1081E+02	0.1600E+00
			0.9729E+01	0.3200E+00
			0.9729E+01	0.4800E+00
			0.9729E+01	0.8000E+00
			0.9729E+01	0.3200E+01
9	10	0.4096E+02		
			0.0000E+00	0.0000E+00
			0.3729E+01	0.2560E-01
			0.6216E+01	0.4960E-01
			0.9324E+01	0.9120E-01
			0.1119E+02	0.1280E+00
			0.1243E+02	0.1600E+00
			0.1119E+02	0.3200E+00
			0.1119E+02	0.4800E+00
			0.1119E+02	0.8000E+00
			0.1119E+02	0.3200E+01
10	10	0.4100E+02		
			0.0000E+00	0.0000E+00
			0.3764E+01	0.2560E-01
			0.6273E+01	0.4960E-01
			0.9410E+01	0.9120E-01
			0.1129E+02	0.1280E+00
			0.1255E+02	0.1600E+00
			0.1129E+02	0.3200E+00
			0.1129E+02	0.4800E+00
			0.1129E+02	0.8000E+00
			0.1129E+02	0.3200E+01
11	10	0.4852E+02		
			0.0000E+00	0.0000E+00
			0.3924E+01	0.2560E-01
			0.6541E+01	0.4960E-01
			0.9811E+01	0.9120E-01
			0.1177E+02	0.1280E+00
			0.1308E+02	0.1600E+00
			0.1177E+02	0.3200E+00
			0.1177E+02	0.4800E+00
			0.1177E+02	0.8000E+00
			0.1177E+02	0.3200E+01
12	10	0.5596E+02		
			0.0000E+00	0.0000E+00
			0.4079E+01	0.2560E-01
			0.6798E+01	0.4960E-01
			0.1020E+02	0.9120E-01

Bent 2A - GST - 16 in Alt W.apo

			0.1224E+02	0.1280E+00
			0.1360E+02	0.1600E+00
			0.1224E+02	0.3200E+00
			0.1224E+02	0.4800E+00
			0.1224E+02	0.8000E+00
			0.1224E+02	0.3200E+01
13	10	0.5600E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01
14	10	0.6102E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01
15	10	0.6596E+02		
			0.0000E+00	0.0000E+00
			0.2083E+01	0.1000E-01
			0.4167E+01	0.2000E-01
			0.8333E+01	0.4000E-01
			0.1250E+02	0.6000E-01
			0.1667E+02	0.8000E-01
			0.1875E+02	0.9000E-01
			0.2083E+02	0.1000E+00
			0.2083E+02	0.5000E+00
			0.2083E+02	0.2000E+01
16	10	0.6600E+02		
			0.0000E+00	0.0000E+00
			0.6045E+01	0.2560E-01
			0.1008E+02	0.4960E-01
			0.1511E+02	0.9120E-01
			0.1814E+02	0.1280E+00
			0.2015E+02	0.1600E+00
			0.1814E+02	0.3200E+00
			0.1814E+02	0.4800E+00
			0.1814E+02	0.8000E+00
			0.1814E+02	0.3200E+01
17	10	0.7353E+02		
			0.0000E+00	0.0000E+00
			0.5548E+01	0.2560E-01
			0.9247E+01	0.4960E-01
			0.1387E+02	0.9120E-01
			0.1664E+02	0.1280E+00
			0.1849E+02	0.1600E+00
			0.1664E+02	0.3200E+00
			0.1664E+02	0.4800E+00
			0.1664E+02	0.8000E+00
			0.1664E+02	0.3200E+01
18	10	0.8096E+02		
			0.0000E+00	0.0000E+00
			0.5548E+01	0.2560E-01

Bent 2A - GST - 16 in Alt W.apo

			0.9247E+01	0.4960E-01
			0.1387E+02	0.9120E-01
			0.1664E+02	0.1280E+00
			0.1849E+02	0.1600E+00
			0.1664E+02	0.3200E+00
			0.1664E+02	0.4800E+00
			0.1664E+02	0.8000E+00
			0.1664E+02	0.3200E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.3142E+01	0.8000E-02
0.6283E+01	0.1600E-01
0.1257E+02	0.3200E-01
0.2513E+02	0.2080E+00
0.3770E+02	0.6720E+00
0.4524E+02	0.1168E+01
0.5027E+02	0.1600E+01
0.5027E+02	0.2400E+01
0.5027E+02	0.3200E+01

LOAD VERSUS SETTLEMENT CURVE
****

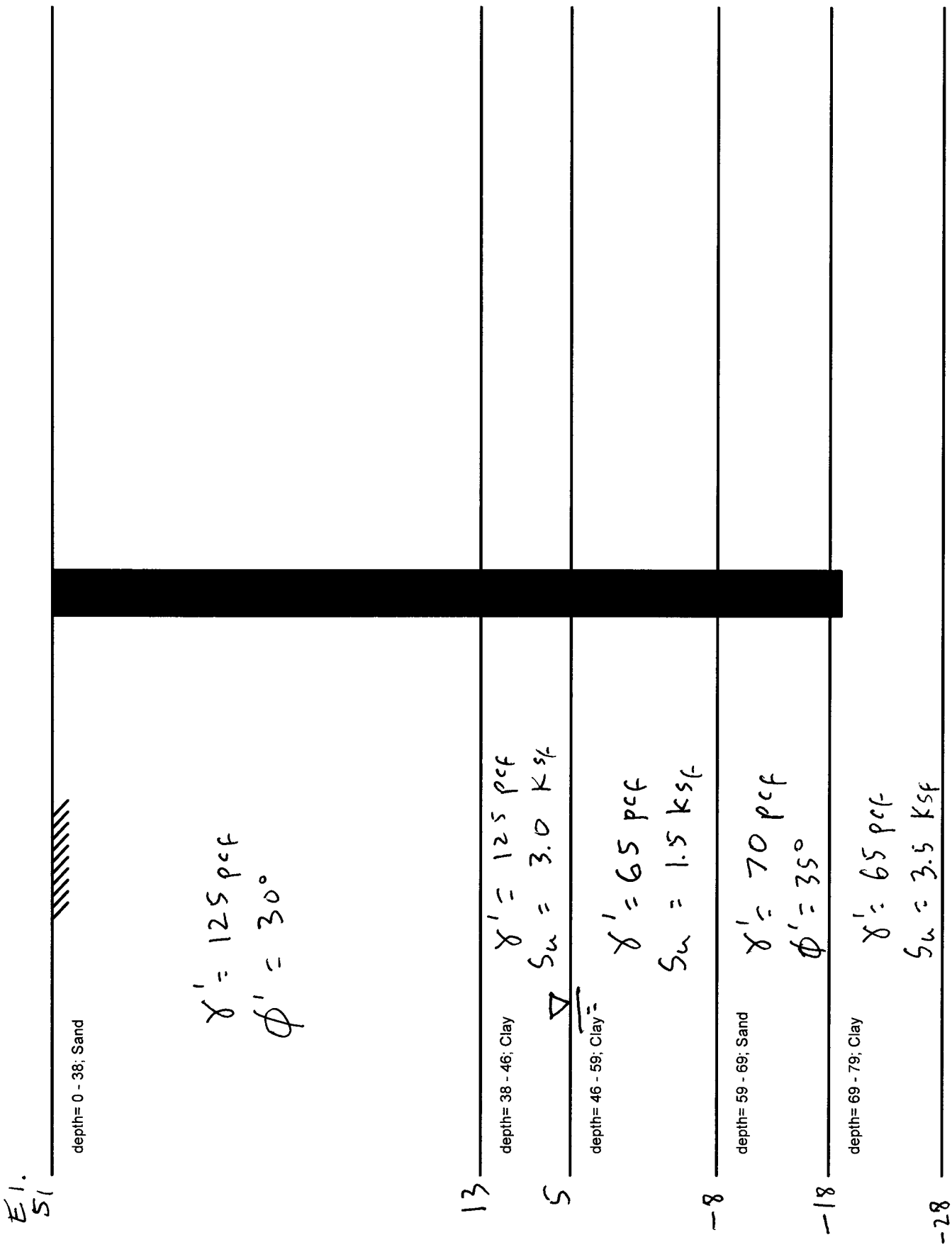
TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1113E+01	0.8000E-03	0.3927E-01	0.1000E-03
0.1113E+02	0.8000E-02	0.3927E+00	0.1000E-02
0.5658E+02	0.4045E-01	0.1963E+01	0.5000E-02
0.1103E+03	0.7983E-01	0.3927E+01	0.1000E-01
0.3311E+03	0.2874E+00	0.1385E+02	0.5000E-01
0.4305E+03	0.4335E+00	0.1742E+02	0.1000E+00
0.4379E+03	0.8495E+00	0.3304E+02	0.5000E+00
0.4476E+03	0.1361E+01	0.4269E+02	0.1000E+01
0.4551E+03	0.2370E+01	0.5027E+02	0.2000E+01

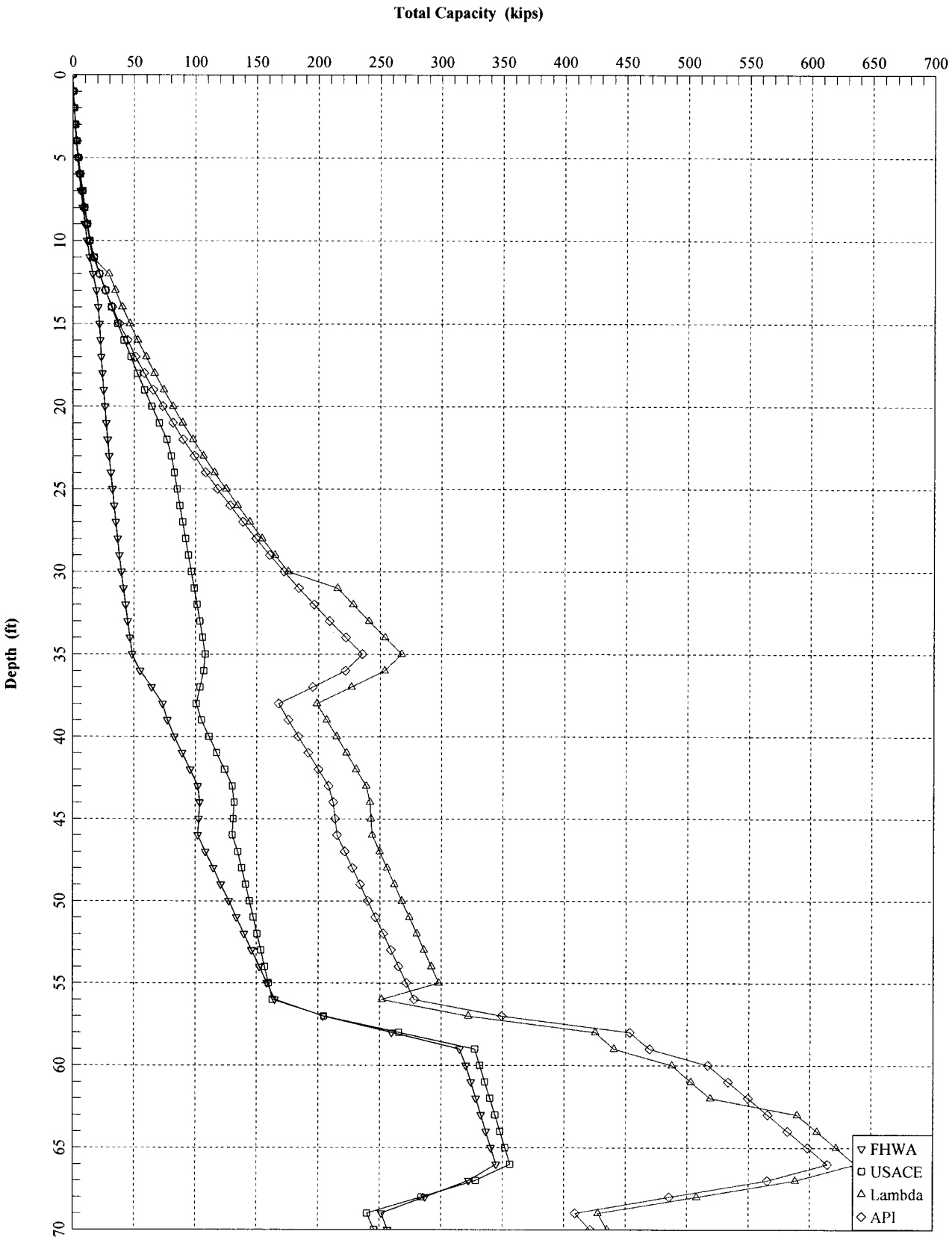
Bent 2

INFORMATION HANDOUT

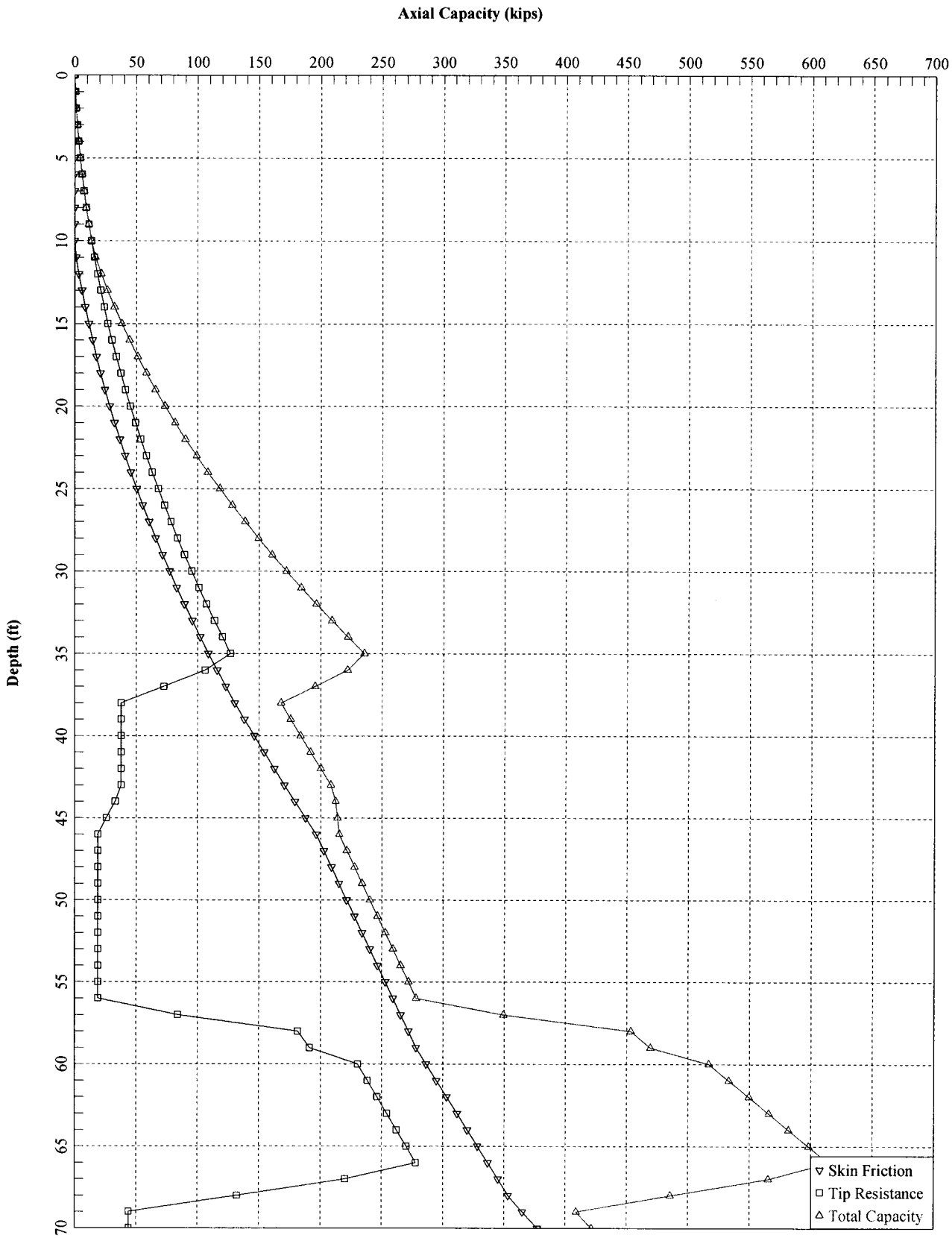
18 in. Open-ended Steel Pipe Pile (Alt. 'W)

(based on boring CrST - 138)





SR4 G Street Overcrossing - Bent 2 (GST-138) - 16-in. Steel PIpe PIle



SR4 G Street Overcrossing - Bent 2 (GST-138) - 16-in. Steel PIpe PIle - API

1

AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

G Street OC - Bent 2 - 16-in Steel Pipe Pile - Open ended - Boring 138

DESIGNER : Partha Sircar

DATE : October 30, 2008

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 0.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 0.00 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 16.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 15.00 IN.
PILE LENGTH = 70.00 FT.
MODULUS OF ELASTICITY = 0.290E+08 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 11.00 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.80	125.00	30.00	20.00
38.00	SAND	0.80	125.00	30.00	20.00
38.00	CLAY	0.00	125.00	0.00	0.00
46.00	CLAY	0.00	125.00	0.00	0.00
46.00	CLAY	0.00	65.00	0.00	0.00
59.00	CLAY	0.00	65.00	0.00	0.00
59.00	SAND	0.80	70.00	35.00	40.00
69.00	SAND	0.80	70.00	35.00	40.00
69.00	CLAY	0.00	65.00	0.00	0.00
79.00	CLAY	0.00	65.00	0.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
1.70	100.00	0.00	0.00	0.00	0.00	0.00
1.70	100.00	0.00	0.00	0.00	0.00	0.00
3.00	27.00	3.00	1.50	0.00	0.00	0.00
3.00	27.00	3.00	1.50	0.00	0.00	0.00
1.50	13.50	1.50	0.75	0.00	0.00	0.00
1.50	13.50	1.50	0.75	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00

2.00	200.00	0.00	0.00	0.00	0.00	0.00
3.50	31.50	3.50	1.75	0.00	0.00	0.00
3.50	31.50	3.50	1.75	0.00	0.00	0.00

1

****
* COMPUTATION RESULT *
****

PILE PENETR-ATION FT.	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP
	********** FED. HWY. METHOD **********			********** ARMY CORPS METHOD **********			********** LAMBDA 2 METHOD **********		
0.0	0.0	0.0*	0.0	0.0	0.0*	0.0	0.0	0.0*	0.0
1.0	0.0	0.5*	0.5	0.0	0.6*	0.6	0.0	0.5*	0.5
2.0	0.0	1.1*	1.1	0.0	1.3*	1.3	0.0	1.2*	1.2
3.0	0.0	1.9*	1.9	0.0	2.3*	2.3	0.0	2.1*	2.1
4.0	0.0	2.9*	2.9	0.0	3.4*	3.4	0.0	3.2*	3.2
5.0	0.0	4.1*	4.1	0.0	4.7*	4.7	0.0	4.4*	4.4
6.0	0.0	5.5*	5.5	0.0	6.2*	6.2	0.0	5.8*	5.8
7.0	0.0	6.7*	6.7	0.0	7.9*	7.9	0.0	7.4*	7.4
8.0	0.0	8.1*	8.1	0.0	9.7*	9.7	0.0	9.2*	9.2
9.0	0.0	9.7*	9.7	0.0	11.8*	11.8	0.0	11.2*	11.2
10.0	0.0	11.4*	11.4	0.0	14.0*	14.0	0.0	13.4*	13.4
11.0	0.3	13.3*	13.6	1.0	16.4*	17.4	0.0	15.7*	15.7
12.0	0.9	15.4*	16.3	2.9	19.0*	22.0	11.3	18.3*	29.5
13.0	1.6	17.7*	19.3	5.1	21.8*	26.9	13.8	21.0*	34.8
14.0	2.3	18.6*	20.9	7.4	24.3*	31.7	16.6	23.9*	40.5
15.0	3.1	18.6*	21.7	9.7	26.9*	36.7	19.6	26.9*	46.5
16.0	3.9	18.6*	22.5	12.1	29.8*	41.8	22.7	30.2*	52.9
17.0	4.8	18.6*	23.4	14.4	32.8*	47.2	26.0	33.6*	59.6
18.0	5.7	18.6*	24.3	16.7	36.0*	52.7	29.4	37.3*	66.7
19.0	6.7	18.6*	25.3	19.0	39.4*	58.4	32.9	41.1*	74.0
20.0	7.8	18.6*	26.4	21.3	42.9*	64.3	36.6	45.1*	81.7
21.0	8.9	18.6*	27.5	23.6	46.7*	70.3	40.4	49.3*	89.7
22.0	10.0	18.6*	28.6	25.9	50.6*	76.6	44.4	53.6*	98.0
23.0	11.2	18.6*	29.8	28.3	52.2*	80.4	48.5	58.2*	106.6
24.0	12.5	18.6*	31.1	30.6	52.2*	82.8	52.7	62.9*	115.5
25.0	13.8	18.6*	32.4	32.9	52.2*	85.1	57.0	67.8*	124.8
26.0	15.2	18.6*	33.8	35.2	52.2*	87.4	61.4	72.9*	134.3
27.0	16.6	18.6*	35.2	37.5	52.2*	89.7	66.0	78.2*	144.2
28.0	18.1	18.6*	36.7	39.8	52.2*	92.0	70.7	83.6*	154.3
29.0	19.6	18.6*	38.2	42.1	52.2*	94.3	75.5	89.3*	164.8
30.0	21.2	18.6*	39.8	44.4	52.2*	96.6	80.4	95.1*	175.5
31.0	22.8	18.6*	41.4	46.8	52.2*	98.9	114.6	101.1*	215.7
32.0	24.5	18.6*	43.1	49.1	52.2*	101.3	121.0	107.3*	228.3
33.0	26.2	18.6*	44.8	51.4	52.2*	103.6	127.4	113.7*	241.1
34.0	28.0	18.6*	46.6	53.7	52.2*	105.9	134.0	120.2*	254.2
35.0	29.9	18.6	48.5	56.0	52.2	108.2	140.7	126.8	267.5
36.0	31.8	23.4	55.1	58.3	48.6	106.9	147.4	106.3	253.7
37.0	33.7	30.5	64.3	60.6	43.1	103.8	154.3	72.6	226.9
38.0	35.7	37.7	73.4	63.0	37.7	100.7	161.2	37.7	198.9
39.0	39.5	37.7	77.2	67.3	37.7	105.0	169.2	37.7	206.9
40.0	45.4	37.7	83.1	73.5	37.7	111.2	177.3	37.7	215.0
41.0	51.7	37.7	89.4	79.8	37.7	117.5	185.3	37.7	223.0
42.0	58.1	37.7	95.8	86.1	37.7	123.8	193.2	37.7	230.9

43.0	64.4	37.7	102.1	92.4	37.7	130.1	201.2	37.7	238.9
44.0	70.7	33.0	103.7	98.7	33.0	131.7	209.1	33.0	242.1
45.0	77.0	25.9	102.9	105.0	25.9	130.9	217.0	25.9	242.9
46.0	83.3	18.8	102.1	111.2	18.8	130.1	224.9	18.8	243.8
47.0	89.6	18.8	108.4	115.9	18.8	134.8	231.0	18.8	249.9
48.0	95.9	18.8	114.7	119.1	18.8	137.9	237.1	18.8	255.9
49.0	102.1	18.8	121.0	122.2	18.8	141.1	243.1	18.8	262.0
50.0	108.4	18.8	127.3	125.4	18.8	144.2	249.2	18.8	268.0
51.0	114.7	18.8	133.6	128.5	18.8	147.4	255.2	18.8	274.1
52.0	121.0	18.8	139.8	131.7	18.8	150.5	261.2	18.8	280.1
53.0	127.3	18.8	146.1	134.8	18.8	153.6	267.3	18.8	286.1
54.0	133.6	18.8	152.4	137.9	18.8	156.8	273.3	18.8	292.1
55.0	139.8	18.8	158.7	141.1	18.8	159.9	279.3	18.8	298.1
56.0	146.1	18.8	165.0	144.2	18.8	163.1	232.8	18.8	251.7
57.0	152.4	51.7	204.1	147.4	57.3	204.7	238.3	84.0	322.2
58.0	158.7	101.0	259.7	150.5	115.1	265.6	243.7	181.6	425.3
59.0	165.0	150.2*	315.2	154.6	172.8*	327.4	249.2	191.3*	440.5
60.0	170.1	150.2*	320.3	158.8	172.8*	331.6	256.9	230.7*	487.6
61.0	174.1	150.2*	324.3	162.9	172.8*	335.7	264.7	238.6*	503.2
62.0	178.1	150.2*	328.4	167.0	172.8*	339.8	272.4	246.4*	518.9
63.0	182.2	150.2*	332.5	171.2	172.8*	343.9	335.6	254.3*	589.8
64.0	186.3	150.2*	336.6	175.3	172.8*	348.1	343.6	262.1*	605.8
65.0	190.5	150.2*	340.7	179.4	172.8*	352.2	351.7	270.0*	621.7
66.0	194.7	150.2*	344.9	183.6	172.8*	356.3	359.7	277.8*	637.5
67.0	199.0	123.7	322.6	187.7	140.6	328.3	367.7	220.4	588.1
68.0	203.2	83.8	287.1	191.8	92.3	284.1	375.7	132.2	507.9
69.0	207.6	44.0	251.6	195.9	44.0	239.9	383.6	44.0	427.6
70.0	212.7	44.0	256.7	201.7	44.0	245.7	391.0	44.0	435.0

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* API RP-2A (1994) *
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PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.0*	0.0
1.00	0.0	0.5*	0.5
2.00	0.0	1.2*	1.2
3.00	0.0	2.1*	2.1
4.00	0.0	3.2*	3.2
5.00	0.0	4.4*	4.4
6.00	0.0	5.8*	5.8
7.00	0.0	7.4*	7.4
8.00	0.0	9.2*	9.2
9.00	0.0	11.2*	11.2
10.00	0.0	13.4*	13.4
11.00	1.1	15.7*	16.8
12.00	3.3	18.3*	21.6
13.00	5.8	21.0*	26.7
14.00	8.4	23.9*	32.3
15.00	11.2	26.9*	38.2
16.00	14.3	30.2*	44.5
17.00	17.5	33.6*	51.1
18.00	20.9	37.3*	58.2
19.00	24.5	41.1*	65.6
20.00	28.3	45.1*	73.4
21.00	32.3	49.3*	81.6
22.00	36.5	53.6*	90.1
23.00	40.9	58.2*	99.1
24.00	45.5	62.9*	108.4
25.00	50.3	67.8*	118.1

26.00	55.3	72.9*	128.2
27.00	60.5	78.2*	138.6
28.00	65.8	83.6*	149.4
29.00	71.4	89.3*	160.7
30.00	77.2	95.1*	172.2
31.00	83.1	101.1*	184.2
32.00	89.3	107.3*	196.5
33.00	95.6	113.7*	209.3
34.00	102.2	120.2*	222.4
35.00	108.9	126.8	235.7
36.00	115.8	106.3	222.1
37.00	122.9	72.6	195.6
38.00	130.3	37.7	168.0
39.00	138.0	37.7	175.7
40.00	146.1	37.7	183.7
41.00	154.2	37.7	191.9
42.00	162.5	37.7	200.2
43.00	170.8	37.7	208.5
44.00	179.3	33.0	212.3
45.00	187.9	25.9	213.8
46.00	196.5	18.8	215.4
47.00	202.8	18.8	221.6
48.00	209.0	18.8	227.8
49.00	215.2	18.8	234.1
50.00	221.5	18.8	240.3
51.00	227.8	18.8	246.6
52.00	234.1	18.8	252.9
53.00	240.3	18.8	259.2
54.00	246.6	18.8	265.5
55.00	252.9	18.8	271.8
56.00	259.2	18.8	278.0
57.00	265.5	84.0	349.4
58.00	271.8	181.6	453.4
59.00	278.0	191.3*	469.4
60.00	286.4	230.7*	517.1
61.00	294.8	238.6*	533.4
62.00	303.2	246.4*	549.6
63.00	311.6	254.3*	565.8
64.00	319.9	262.1*	582.0
65.00	328.3	270.0*	598.3
66.00	336.7	277.8*	614.5
67.00	345.1	220.4	565.5
68.00	353.4	132.2	485.6
69.00	365.0	44.0	408.9
70.00	377.3	44.0	421.3

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00	0.0000E+00	0.0000E+00

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			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.1902E+02		
			0.0000E+00	0.0000E+00
			0.6315E+00	0.1000E-01
			0.1263E+01	0.2000E-01
			0.2526E+01	0.4000E-01
			0.3789E+01	0.6000E-01
			0.5052E+01	0.8000E-01
			0.5683E+01	0.9000E-01
			0.6315E+01	0.1000E+00
			0.6315E+01	0.5000E+00
			0.6315E+01	0.2000E+01
3	10	0.3796E+02		
			0.0000E+00	0.0000E+00
			0.1214E+01	0.1000E-01
			0.2429E+01	0.2000E-01
			0.4857E+01	0.4000E-01
			0.7286E+01	0.6000E-01
			0.9715E+01	0.8000E-01
			0.1093E+02	0.9000E-01
			0.1214E+02	0.1000E+00
			0.1214E+02	0.5000E+00
			0.1214E+02	0.2000E+01
4	10	0.3800E+02		
			0.0000E+00	0.0000E+00
			0.3838E+01	0.2560E-01
			0.6396E+01	0.4960E-01
			0.9594E+01	0.9120E-01
			0.1151E+02	0.1280E+00
			0.1279E+02	0.1600E+00
			0.1151E+02	0.3200E+00
			0.1151E+02	0.4800E+00
			0.1151E+02	0.8000E+00
			0.1151E+02	0.3200E+01
5	10	0.4202E+02		
			0.0000E+00	0.0000E+00
			0.4158E+01	0.2560E-01
			0.6931E+01	0.4960E-01
			0.1040E+02	0.9120E-01
			0.1248E+02	0.1280E+00
			0.1386E+02	0.1600E+00
			0.1248E+02	0.3200E+00
			0.1248E+02	0.4800E+00
			0.1248E+02	0.8000E+00
			0.1248E+02	0.3200E+01
6	10	0.4596E+02		
			0.0000E+00	0.0000E+00
			0.4303E+01	0.2560E-01
			0.7171E+01	0.4960E-01
			0.1076E+02	0.9120E-01
			0.1291E+02	0.1280E+00
			0.1434E+02	0.1600E+00
			0.1291E+02	0.3200E+00
			0.1291E+02	0.4800E+00
			0.1291E+02	0.8000E+00
			0.1291E+02	0.3200E+01

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7	10	0.4600E+02		
			0.0000E+00	0.0000E+00
			0.3125E+01	0.2560E-01
			0.5208E+01	0.4960E-01
			0.7812E+01	0.9120E-01
			0.9375E+01	0.1280E+00
			0.1042E+02	0.1600E+00
			0.9375E+01	0.3200E+00
			0.9375E+01	0.4800E+00
			0.9375E+01	0.8000E+00
			0.9375E+01	0.3200E+01
8	10	0.5252E+02		
			0.0000E+00	0.0000E+00
			0.3125E+01	0.2560E-01
			0.5208E+01	0.4960E-01
			0.7812E+01	0.9120E-01
			0.9375E+01	0.1280E+00
			0.1042E+02	0.1600E+00
			0.9375E+01	0.3200E+00
			0.9375E+01	0.4800E+00
			0.9375E+01	0.8000E+00
			0.9375E+01	0.3200E+01
9	10	0.5896E+02		
			0.0000E+00	0.0000E+00
			0.3125E+01	0.2560E-01
			0.5208E+01	0.4960E-01
			0.7812E+01	0.9120E-01
			0.9375E+01	0.1280E+00
			0.1042E+02	0.1600E+00
			0.9375E+01	0.3200E+00
			0.9375E+01	0.4800E+00
			0.9375E+01	0.8000E+00
			0.9375E+01	0.3200E+01
10	10	0.5900E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01
11	10	0.6403E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01
12	10	0.6896E+02		
			0.0000E+00	0.0000E+00
			0.1910E+01	0.1000E-01
			0.3819E+01	0.2000E-01
			0.7639E+01	0.4000E-01
			0.1146E+02	0.6000E-01
			0.1528E+02	0.8000E-01
			0.1719E+02	0.9000E-01
			0.1910E+02	0.1000E+00

BENT2B~1.apo

			0.1910E+02	0.5000E+00
			0.1910E+02	0.2000E+01
13	10	0.6900E+02		
			0.0000E+00	0.0000E+00
			0.6153E+01	0.2560E-01
			0.1026E+02	0.4960E-01
			0.1538E+02	0.9120E-01
			0.1846E+02	0.1280E+00
			0.2051E+02	0.1600E+00
			0.1846E+02	0.3200E+00
			0.1846E+02	0.4800E+00
			0.1846E+02	0.8000E+00
			0.1846E+02	0.3200E+01
14	10	0.7403E+02		
			0.0000E+00	0.0000E+00
			0.6153E+01	0.2560E-01
			0.1026E+02	0.4960E-01
			0.1538E+02	0.9120E-01
			0.1846E+02	0.1280E+00
			0.2051E+02	0.1600E+00
			0.1846E+02	0.3200E+00
			0.1846E+02	0.4800E+00
			0.1846E+02	0.8000E+00
			0.1846E+02	0.3200E+01
15	10	0.7896E+02		
			0.0000E+00	0.0000E+00
			0.6153E+01	0.2560E-01
			0.1026E+02	0.4960E-01
			0.1538E+02	0.9120E-01
			0.1846E+02	0.1280E+00
			0.2051E+02	0.1600E+00
			0.1846E+02	0.3200E+00
			0.1846E+02	0.4800E+00
			0.1846E+02	0.8000E+00
			0.1846E+02	0.3200E+01

BENT2B~1.apo

0.8994E+02	0.6668E-01	0.3436E+01	0.1000E-01
0.3066E+03	0.2639E+00	0.1212E+02	0.5000E-01
0.3973E+03	0.4025E+00	0.1524E+02	0.1000E+00
0.4072E+03	0.8170E+00	0.2891E+02	0.5000E+00
0.4156E+03	0.1327E+01	0.3735E+02	0.1000E+01
0.4223E+03	0.2335E+01	0.4398E+02	0.2000E+01

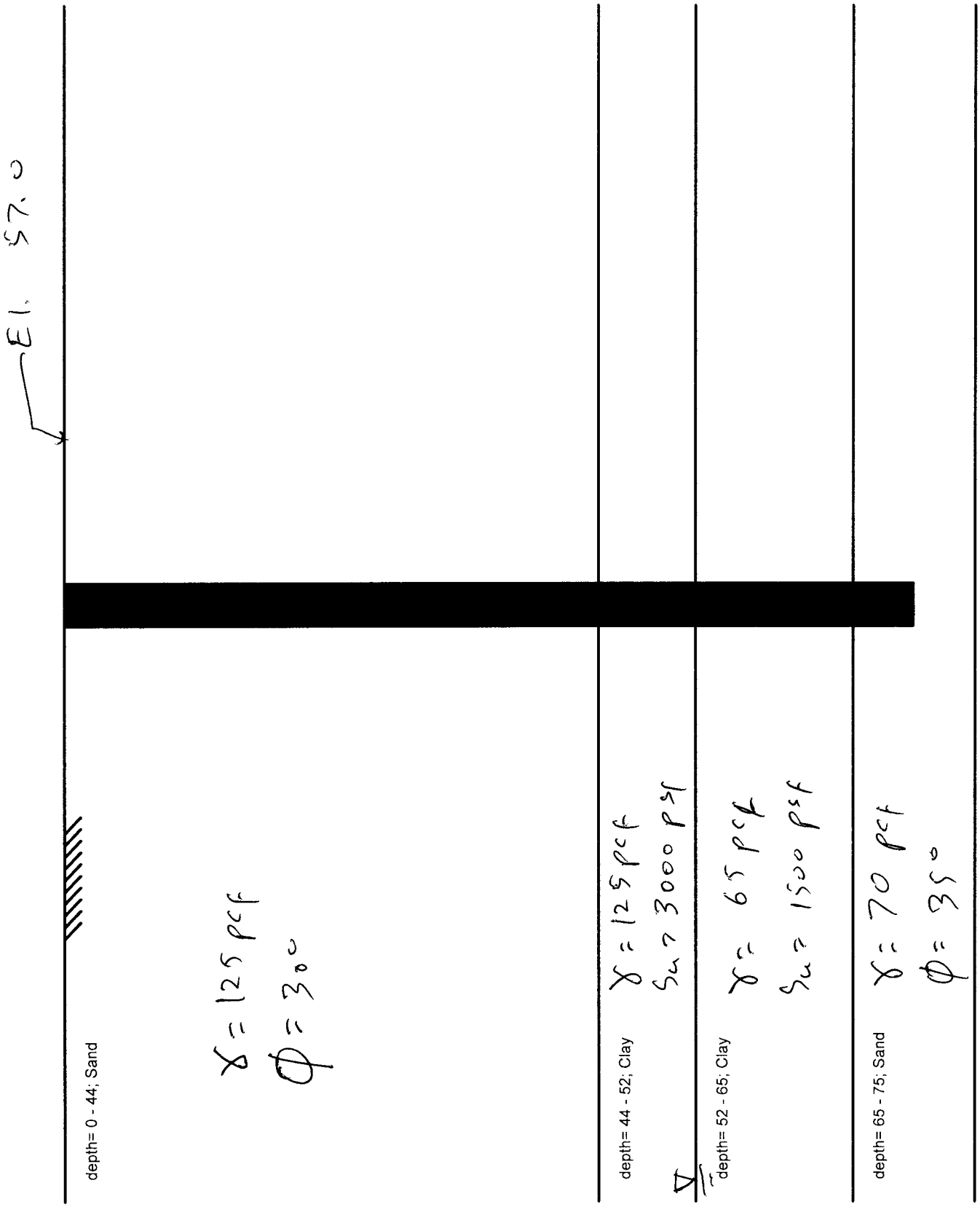
TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.2749E+01	0.8000E-02
0.5498E+01	0.1600E-01
0.1100E+02	0.3200E-01
0.2199E+02	0.2080E+00
0.3299E+02	0.6720E+00
0.3958E+02	0.1168E+01
0.4398E+02	0.1600E+01
0.4398E+02	0.2400E+01
0.4398E+02	0.3200E+01

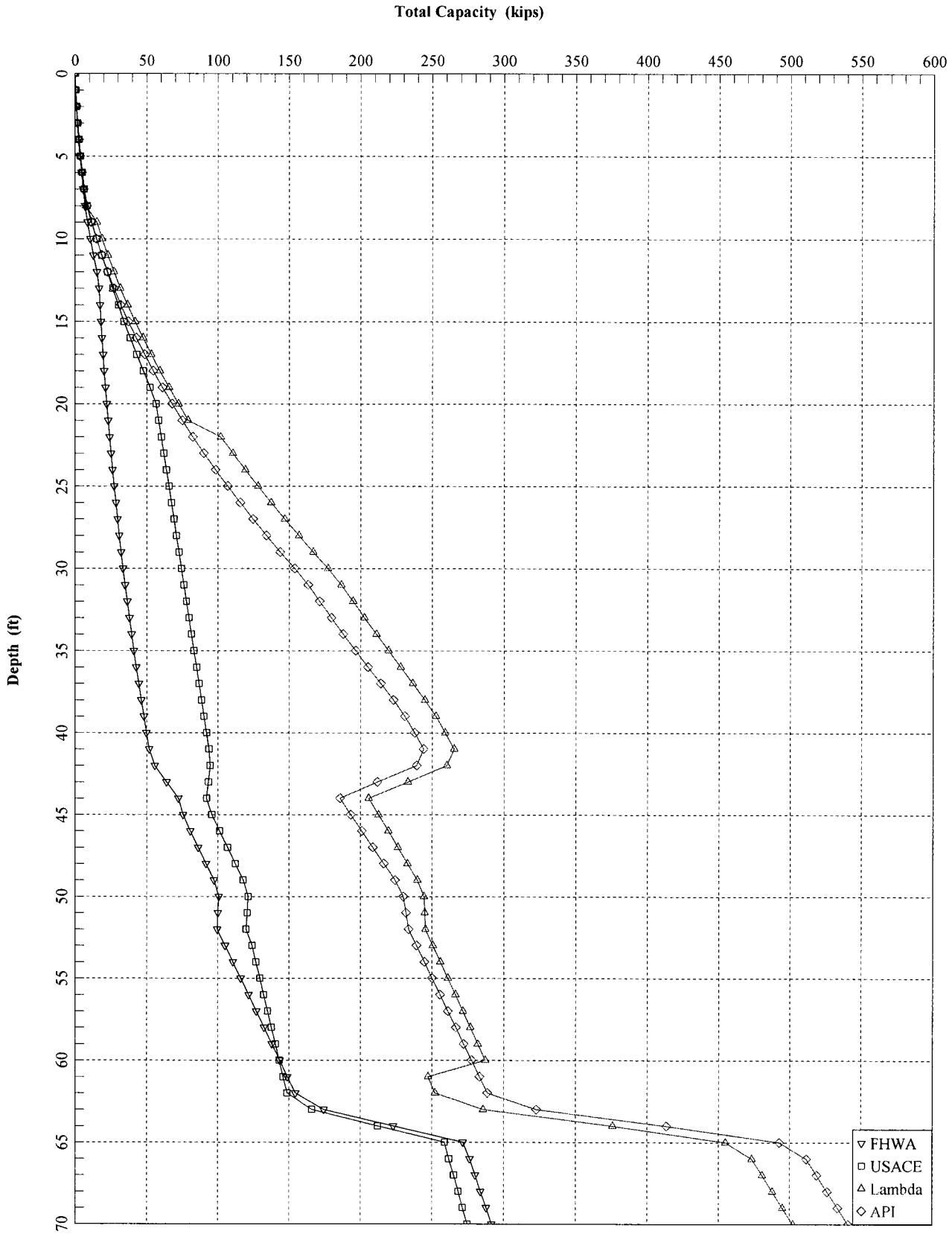
LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.8845E+00	0.6593E-03	0.3436E-01	0.1000E-03
0.8845E+01	0.6593E-02	0.3436E+00	0.1000E-02
0.4483E+02	0.3324E-01	0.1718E+01	0.5000E-02

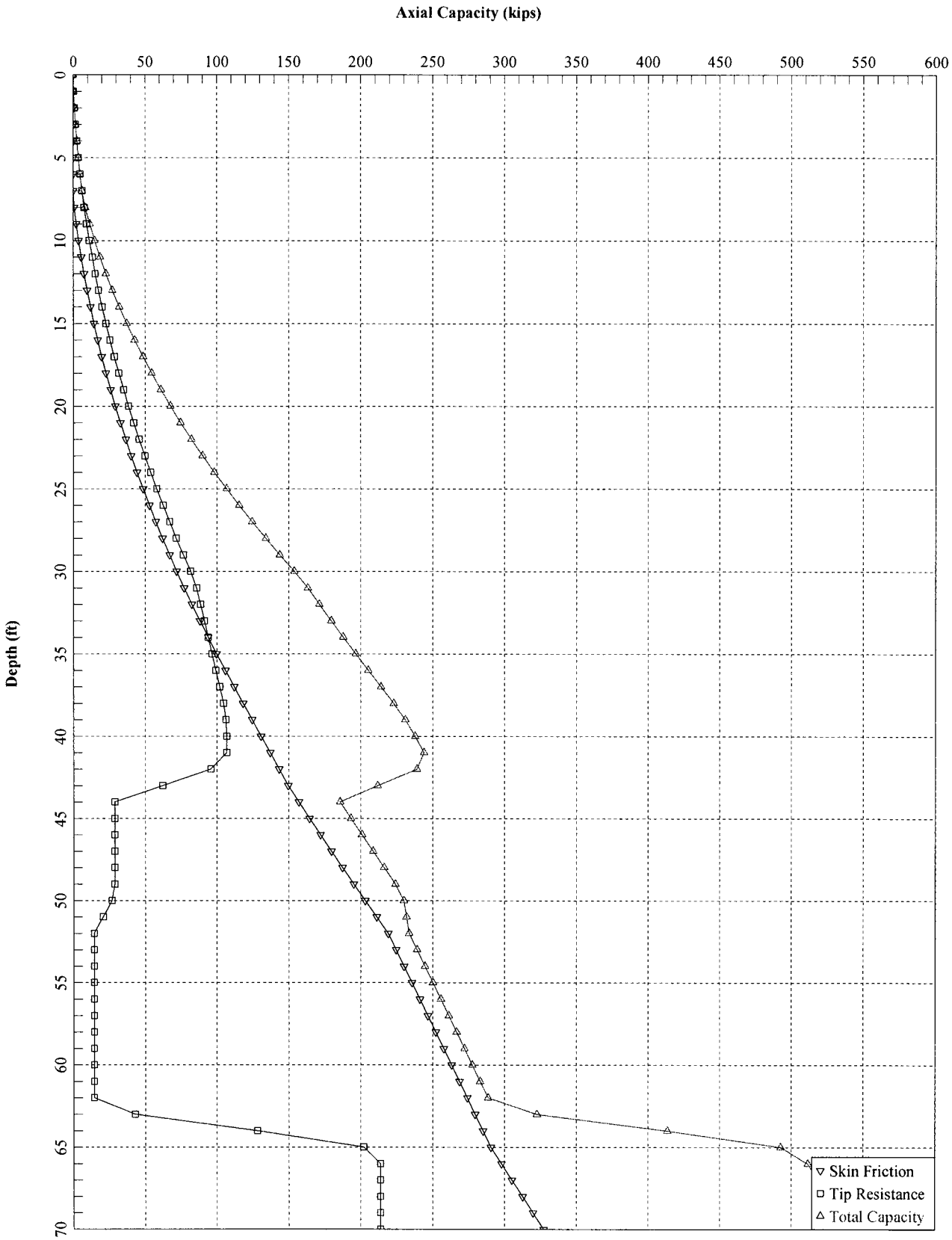
Abutment 1 - Wingwall
(based on GST-138)

INFORMATION HANDOUT





SR4 G Streer Overcrossing - Abutment 1 Wingwall- 14-in Steel Pipe PIle



SR4 G Street Overcrossing - Abutment 1 Wingwall- 14-in Steel PIpe Pile - API RP2A Method

1

AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

G Street OC - Abutment 1West Wingwall (North Abutment)- 14-in Steel Pi

DESIGNER : Partha Sircar

DATE : October 30, 2008

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 0.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 0.00 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 14.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 13.13 IN.
PILE LENGTH = 70.00 FT.
MODULUS OF ELASTICITY = 0.290E+08 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 8.00 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.80	125.00	30.00	20.00
44.00	SAND	0.80	125.00	30.00	20.00
44.00	CLAY	0.00	125.00	0.00	0.00
52.00	CLAY	0.00	125.00	0.00	0.00
52.00	CLAY	0.00	65.00	0.00	0.00
65.00	CLAY	0.00	65.00	0.00	0.00
65.00	SAND	0.80	70.00	35.00	40.00
75.00	SAND	0.80	70.00	35.00	40.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
1.70	100.00	0.00	0.00	0.00	0.00	0.00
1.70	100.00	0.00	0.00	0.00	0.00	0.00
3.00	27.00	3.00	1.50	0.00	0.00	0.00
3.00	27.00	3.00	1.50	0.00	0.00	0.00
1.50	13.50	1.50	0.75	0.00	0.00	0.00
1.50	13.50	1.50	0.75	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00

1

****
* COMPUTATION RESULT *
****

PILE PENETR-ATION FT.	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP
	********** FED. HWY. METHOD **********			********** ARMY CORPS METHOD **********			********** LAMBDA 2 METHOD **********		
0.0	0.0	0.0*	0.0	0.0	0.0*	0.0	0.0	0.0*	0.0
1.0	0.0	0.4*	0.4	0.0	0.5*	0.5	0.0	0.4*	0.4
2.0	0.0	0.9*	0.9	0.0	1.1*	1.1	0.0	1.0*	1.0
3.0	0.0	1.6*	1.6	0.0	1.8*	1.8	0.0	1.7*	1.7
4.0	0.0	2.4*	2.4	0.0	2.8*	2.8	0.0	2.6*	2.6
5.0	0.0	3.4*	3.4	0.0	3.9*	3.9	0.0	3.6*	3.6
6.0	0.0	4.6*	4.6	0.0	5.1*	5.1	0.0	4.8*	4.8
7.0	0.0	5.6*	5.6	0.0	6.5*	6.5	0.0	6.2*	6.2
8.0	0.2	6.9*	7.0	0.6	8.1*	8.7	0.0	7.7*	7.7
9.0	0.6	8.2*	8.8	1.9	9.8*	11.7	5.9	9.4*	15.3
10.0	1.0	9.7*	10.8	3.3	11.7*	15.1	7.8	11.2*	19.0
11.0	1.5	11.4*	12.9	4.9	13.8*	18.7	9.8	13.3*	23.0
12.0	2.0	13.3*	15.3	6.7	15.9*	22.6	11.9	15.4*	27.3
13.0	2.6	14.2*	16.8	8.5	17.9*	26.4	14.2	17.7*	31.9
14.0	3.2	14.2*	17.5	10.2	20.0*	30.3	16.6	20.2*	36.9
15.0	3.9	14.2*	18.1	12.0	22.4*	34.4	19.2	22.9*	42.0
16.0	4.6	14.2*	18.9	13.8	24.9*	38.6	21.8	25.7*	47.5
17.0	5.4	14.2*	19.6	15.6	27.5*	43.1	24.6	28.7*	53.3
18.0	6.2	14.2*	20.4	17.3	30.3*	47.6	27.6	31.8*	59.4
19.0	7.0	14.2*	21.3	19.1	33.3*	52.4	30.6	35.1*	65.7
20.0	7.9	14.2*	22.2	20.9	35.9*	56.7	33.8	38.5*	72.3
21.0	8.9	14.2*	23.1	22.6	35.9*	58.5	37.0	42.1*	79.2
22.0	9.9	14.2*	24.1	24.4	35.9*	60.3	56.1	45.9*	102.0
23.0	10.9	14.2*	25.2	26.2	35.9*	62.0	60.6	49.8*	110.5
24.0	12.0	14.2*	26.2	28.0	35.9*	63.8	65.3	53.9*	119.2
25.0	13.1	14.2*	27.4	29.7	35.9*	65.6	70.1	58.2*	128.2
26.0	14.3	14.2*	28.6	31.5	35.9*	67.4	74.9	62.6*	137.5
27.0	15.5	14.2*	29.8	33.3	35.9*	69.1	79.9	67.1*	147.0
28.0	16.8	14.2*	31.0	35.0	35.9*	70.9	85.0	71.9*	156.8
29.0	18.1	14.2*	32.4	36.8	35.9*	72.7	90.1	76.8*	166.9
30.0	19.5	14.2*	33.7	38.6	35.9*	74.4	95.4	81.8*	177.2
31.0	20.9	14.2	35.1	40.4	35.9	76.2	100.7	86.0	186.7
32.0	22.3	14.2	36.6	42.1	35.9	78.0	106.1	88.6	194.8
33.0	23.8	14.2	38.1	43.9	35.9	79.8	111.6	91.3	202.9
34.0	25.4	14.2	39.6	45.7	35.9	81.5	117.2	94.0	211.2
35.0	27.0	14.2	41.2	47.4	35.9	83.3	122.9	96.7	219.5
36.0	28.6	14.2	42.9	49.2	35.9	85.1	128.6	99.3	228.0
37.0	30.3	14.2	44.6	51.0	35.9	86.8	134.4	102.0	236.5
38.0	32.0	14.2	46.3	52.8	35.9	88.6	140.3	104.6	244.9
39.0	33.8	14.2	48.1	54.5	35.9	90.4	146.3	106.3	252.6
40.0	35.6	14.2	49.9	56.3	35.9	92.2	152.3	106.9	259.2
41.0	37.5	14.2	51.8	58.1	35.9	93.9	158.4	106.9	265.3
42.0	39.4	16.3	55.8	59.8	34.9	94.7	164.6	95.8	260.3
43.0	41.4	22.6	64.0	61.6	31.9	93.5	170.8	62.3	233.1
44.0	43.4	28.9	72.3	63.4	28.9	92.2	177.1	28.9	205.9
45.0	46.8	28.9	75.7	67.0	28.9	95.9	183.8	28.9	212.7
46.0	52.0	28.9	80.9	72.5	28.9	101.4	190.6	28.9	219.5

47.0	57.5	28.9	86.4	78.0	28.9	106.9	197.3	28.9	226.2
48.0	63.1	28.9	91.9	83.5	28.9	112.4	204.1	28.9	232.9
49.0	68.6	28.9	97.4	89.0	28.9	117.9	210.8	28.9	239.7
50.0	74.1	26.8	100.9	94.5	26.8	121.3	217.5	26.8	244.3
51.0	79.6	20.6	100.2	100.0	20.6	120.6	224.2	20.6	244.8
52.0	85.1	14.4	99.6	105.5	14.4	119.9	230.9	14.4	245.3
53.0	90.6	14.4	105.1	109.6	14.4	124.1	236.2	14.4	250.6
54.0	96.1	14.4	110.6	112.4	14.4	126.8	241.4	14.4	255.9
55.0	101.6	14.4	116.1	115.1	14.4	129.6	246.7	14.4	261.1
56.0	107.1	14.4	121.6	117.9	14.4	132.3	251.9	14.4	266.4
57.0	112.6	14.4	127.1	120.6	14.4	135.1	257.2	14.4	271.6
58.0	118.1	14.4	132.6	123.4	14.4	137.8	262.4	14.4	276.8
59.0	123.6	14.4	138.1	126.1	14.4	140.6	267.6	14.4	282.0
60.0	129.1	14.4	143.6	128.9	14.4	143.3	272.8	14.4	287.2
61.0	134.6	14.4	149.0	131.6	14.4	146.0	232.9	14.4	247.3
62.0	140.1	14.4	154.5	134.4	14.4	148.8	237.8	14.4	252.2
63.0	145.6	28.8	174.4	137.1	28.9	166.0	242.7	42.9	285.6
64.0	151.1	71.9	223.0	139.9	72.3	212.2	247.6	128.4	376.0
65.0	156.6	115.0*	271.6	143.0	115.8*	258.8	252.6	202.2*	454.8
66.0	161.2	115.0	276.3	146.2	115.8	261.9	259.7	213.8	473.5
67.0	165.1	115.0	280.1	149.4	115.8	265.1	266.9	213.8	480.7
68.0	168.9	115.0	283.9	152.5	115.8	268.3	274.0	213.8	487.8
69.0	172.8	115.0	287.8	155.7	115.8	271.4	281.2	213.8	495.0
70.0	176.7	115.0	291.7	158.8	115.8	274.6	288.5	213.8	502.3

****
* API RP-2A (1994) *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.0*	0.0
1.00	0.0	0.4*	0.4
2.00	0.0	1.0*	1.0
3.00	0.0	1.7*	1.7
4.00	0.0	2.6*	2.6
5.00	0.0	3.6*	3.6
6.00	0.0	4.8*	4.8
7.00	0.0	6.2*	6.2
8.00	0.7	7.7*	8.4
9.00	2.1	9.4*	11.5
10.00	3.8	11.2*	15.0
11.00	5.6	13.3*	18.8
12.00	7.5	15.4*	22.9
13.00	9.7	17.7*	27.4
14.00	12.0	20.2*	32.2
15.00	14.4	22.9*	37.3
16.00	17.1	25.7*	42.8
17.00	19.9	28.7*	48.6
18.00	22.9	31.8*	54.7
19.00	26.1	35.1*	61.1
20.00	29.4	38.5*	67.9
21.00	32.9	42.1*	75.0
22.00	36.6	45.9*	82.5
23.00	40.4	49.8*	90.2
24.00	44.4	53.9*	98.3
25.00	48.6	58.2*	106.8
26.00	53.0	62.6*	115.6
27.00	57.5	67.1*	124.7
28.00	62.2	71.9*	134.1
29.00	67.1	76.8*	143.8

30.00	72.1	81.8*	153.9
31.00	77.3	86.0	163.3
32.00	82.7	88.6	171.4
33.00	88.3	91.3	179.6
34.00	94.0	94.0	188.0
35.00	99.9	96.7	196.6
36.00	106.0	99.3	205.3
37.00	112.2	102.0	214.2
38.00	118.4	104.6	223.0
39.00	124.7	106.3	231.0
40.00	130.9	106.9	237.8
41.00	137.1	106.9	244.0
42.00	143.3	95.8	239.1
43.00	149.6	62.3	211.9
44.00	157.0	28.9	185.9
45.00	164.5	28.9	193.4
46.00	172.1	28.9	201.0
47.00	179.8	28.9	208.6
48.00	187.5	28.9	216.4
49.00	195.3	28.9	224.2
50.00	203.2	26.8	230.0
51.00	211.2	20.6	231.8
52.00	219.2	14.4	233.7
53.00	224.7	14.4	239.2
54.00	230.2	14.4	244.7
55.00	235.7	14.4	250.2
56.00	241.2	14.4	255.7
57.00	246.7	14.4	261.2
58.00	252.2	14.4	266.7
59.00	257.7	14.4	272.2
60.00	263.2	14.4	277.6
61.00	268.7	14.4	283.1
62.00	274.2	14.4	288.6
63.00	279.7	42.9	322.6
64.00	285.2	128.4	413.6
65.00	290.7	202.2*	492.9
66.00	298.0	213.8	511.8
67.00	305.4	213.8	519.2
68.00	312.7	213.8	526.5
69.00	320.0	213.8	533.8
70.00	327.4	213.8	541.2

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01

Abut 1 Wingwall - GST - 14 in Alt W.apo

			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.2202E+02		
			0.0000E+00	0.0000E+00
			0.7286E+00	0.1000E-01
			0.1457E+01	0.2000E-01
			0.2914E+01	0.4000E-01
			0.4372E+01	0.6000E-01
			0.5829E+01	0.8000E-01
			0.6557E+01	0.9000E-01
			0.7286E+01	0.1000E+00
			0.7286E+01	0.5000E+00
			0.7286E+01	0.2000E+01
3	10	0.4396E+02		
			0.0000E+00	0.0000E+00
			0.1409E+01	0.1000E-01
			0.2817E+01	0.2000E-01
			0.5635E+01	0.4000E-01
			0.8452E+01	0.6000E-01
			0.1127E+02	0.8000E-01
			0.1268E+02	0.9000E-01
			0.1409E+02	0.1000E+00
			0.1409E+02	0.5000E+00
			0.1409E+02	0.2000E+01
4	10	0.4400E+02		
			0.0000E+00	0.0000E+00
			0.4277E+01	0.2240E-01
			0.7128E+01	0.4340E-01
			0.1069E+02	0.7980E-01
			0.1283E+02	0.1120E+00
			0.1426E+02	0.1400E+00
			0.1283E+02	0.2800E+00
			0.1283E+02	0.4200E+00
			0.1283E+02	0.7000E+00
			0.1283E+02	0.2800E+01
5	10	0.4802E+02		
			0.0000E+00	0.0000E+00
			0.4442E+01	0.2240E-01
			0.7404E+01	0.4340E-01
			0.1111E+02	0.7980E-01
			0.1333E+02	0.1120E+00
			0.1481E+02	0.1400E+00
			0.1333E+02	0.2800E+00
			0.1333E+02	0.4200E+00
			0.1333E+02	0.7000E+00
			0.1333E+02	0.2800E+01
6	10	0.5196E+02		
			0.0000E+00	0.0000E+00
			0.4578E+01	0.2240E-01
			0.7629E+01	0.4340E-01
			0.1144E+02	0.7980E-01
			0.1373E+02	0.1120E+00
			0.1526E+02	0.1400E+00
			0.1373E+02	0.2800E+00
			0.1373E+02	0.4200E+00
			0.1373E+02	0.7000E+00
			0.1373E+02	0.2800E+01
7	10	0.5200E+02		
			0.0000E+00	0.0000E+00
			0.3125E+01	0.2240E-01
			0.5208E+01	0.4340E-01

Abut 1 Wingwall - GST - 14 in Alt W.apo

			0.7812E+01	0.7980E-01
			0.9375E+01	0.1120E+00
			0.1042E+02	0.1400E+00
			0.9375E+01	0.2800E+00
			0.9375E+01	0.4200E+00
			0.9375E+01	0.7000E+00
			0.9375E+01	0.2800E+01
8	10	0.5852E+02		
			0.0000E+00	0.0000E+00
			0.3125E+01	0.2240E-01
			0.5208E+01	0.4340E-01
			0.7812E+01	0.7980E-01
			0.9375E+01	0.1120E+00
			0.1042E+02	0.1400E+00
			0.9375E+01	0.2800E+00
			0.9375E+01	0.4200E+00
			0.9375E+01	0.7000E+00
			0.9375E+01	0.2800E+01
9	10	0.6496E+02		
			0.0000E+00	0.0000E+00
			0.3125E+01	0.2240E-01
			0.5208E+01	0.4340E-01
			0.7812E+01	0.7980E-01
			0.9375E+01	0.1120E+00
			0.1042E+02	0.1400E+00
			0.9375E+01	0.2800E+00
			0.9375E+01	0.4200E+00
			0.9375E+01	0.7000E+00
			0.9375E+01	0.2800E+01
10	10	0.6500E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01
11	10	0.7003E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01
12	10	0.7496E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01

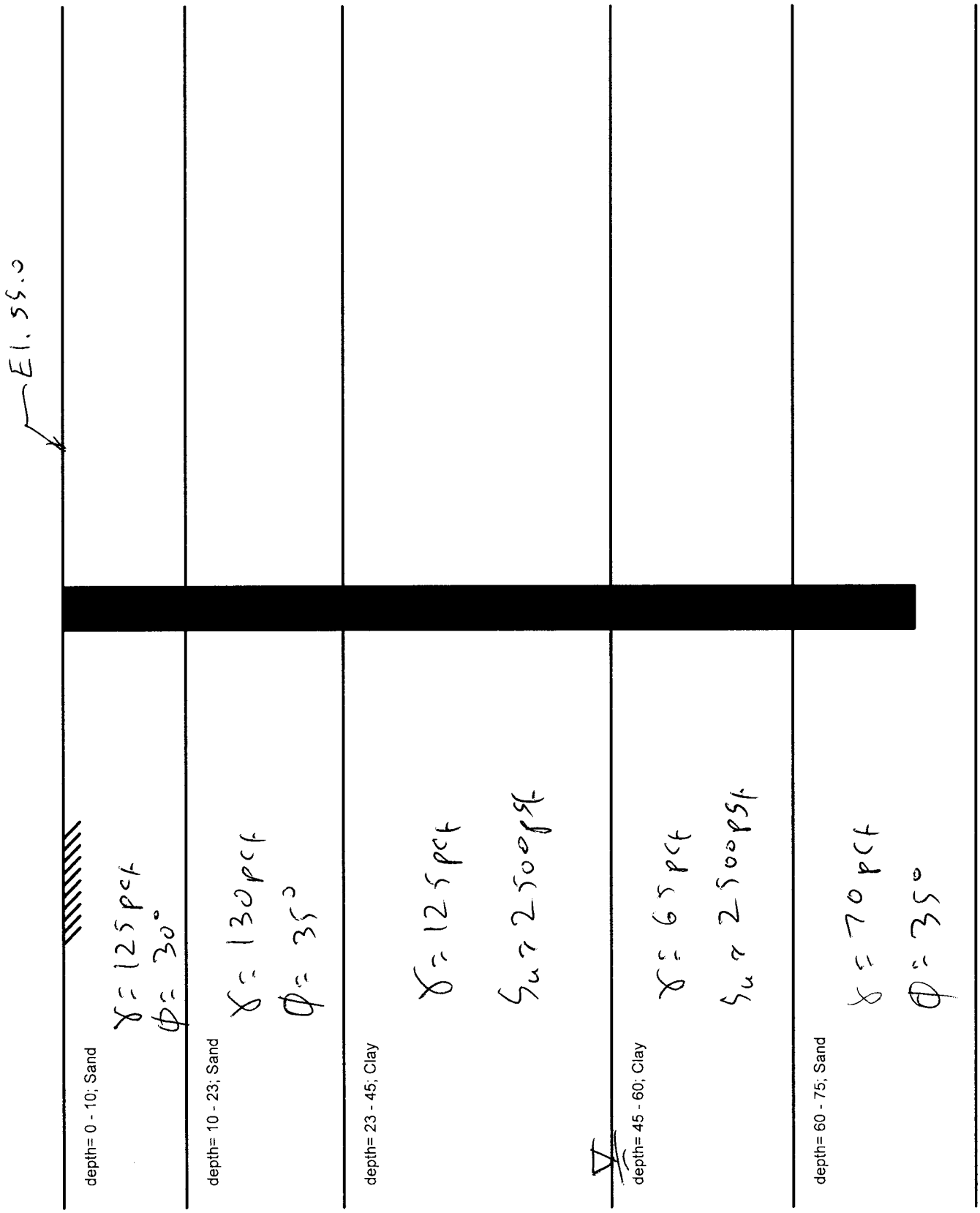
Abut 1 Wingwall - GST - 14 in Alt W.apo

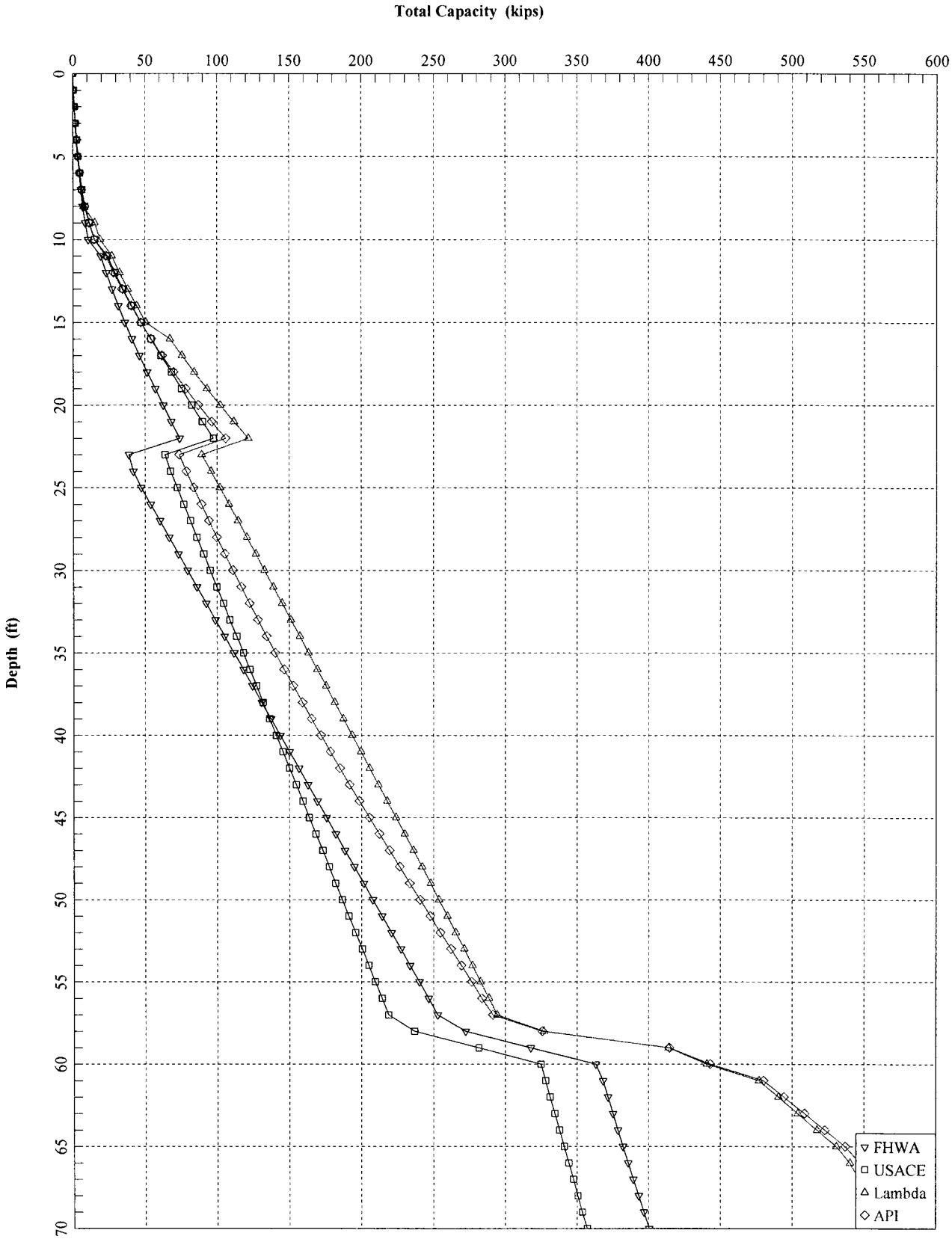
TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.1336E+02	0.7000E-02
0.2673E+02	0.1400E-01
0.5345E+02	0.2800E-01
0.1069E+03	0.1820E+00
0.1604E+03	0.5880E+00
0.1924E+03	0.1022E+01
0.2138E+03	0.1400E+01
0.2138E+03	0.2100E+01
0.2138E+03	0.2800E+01

LOAD VERSUS SETTLEMENT CURVE
****

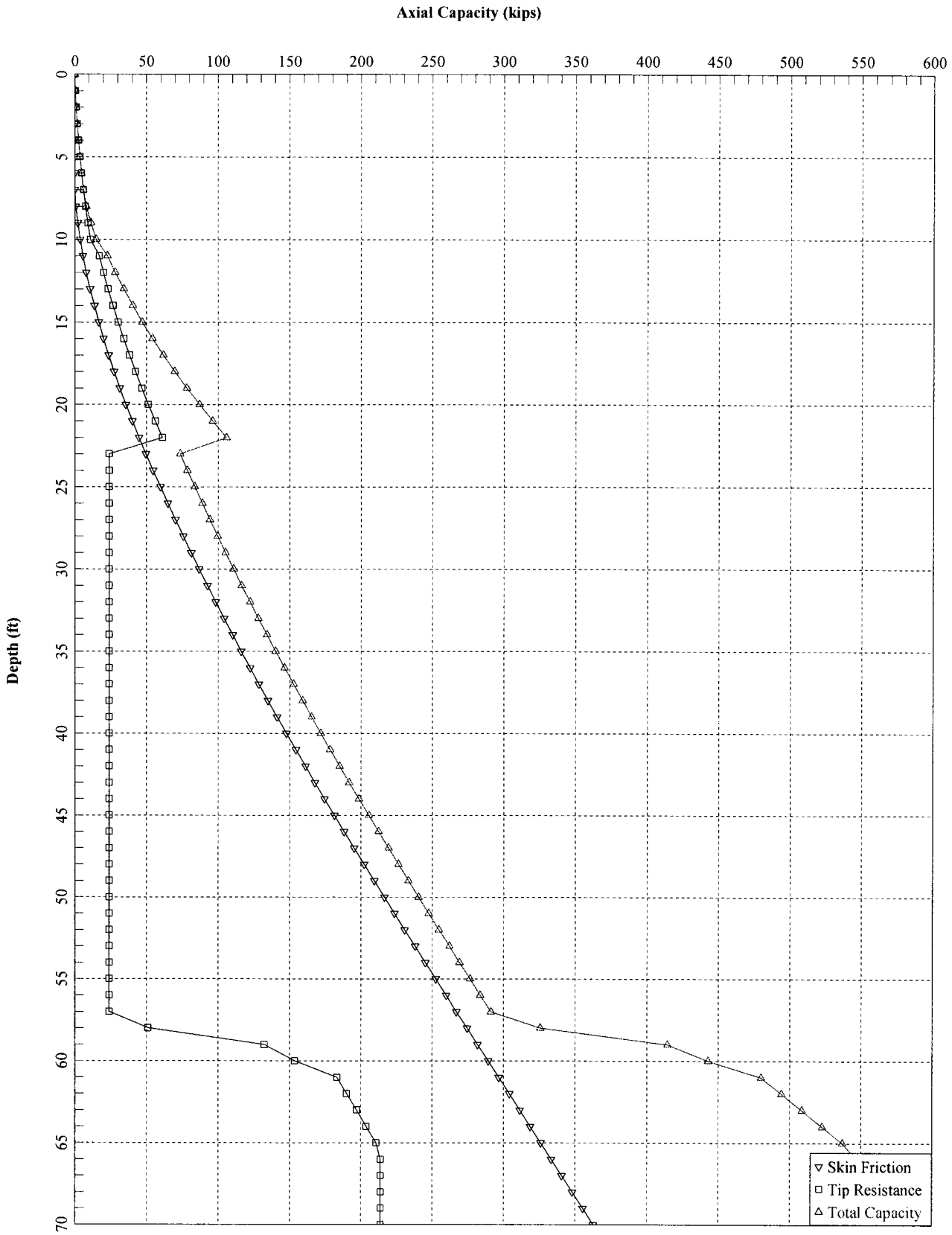
TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1530E+01	0.1391E-02	0.1909E+00	0.1000E-03
0.1541E+02	0.1396E-01	0.1909E+01	0.1000E-02
0.7850E+02	0.7095E-01	0.9545E+01	0.5000E-02
0.1542E+03	0.1408E+00	0.1909E+02	0.1000E-01
0.3502E+03	0.4033E+00	0.6109E+02	0.5000E-01
0.4115E+03	0.5391E+00	0.7844E+02	0.1000E+00
0.4729E+03	0.1038E+01	0.1488E+03	0.5000E+00
0.5150E+03	0.1603E+01	0.1908E+03	0.1000E+01
0.5380E+03	0.2639E+01	0.2138E+03	0.2000E+01

Abutment 3 - Wingwall
(based on CiST-137)





SR4 G Streer Overcrossing - Abutment 3 Wingwall - 14-in Steel Pipe PIle



SR4 G Street Overcrossing - Abutment 3 Wingwall - 14-in Steel PIpe Pile - API RP2A Method

1

AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

G Street OC - Abutment 3 East Wingwall (South Abutment) - 14-in Steel

DESIGNER : Partha Sircar

DATE : October 30, 2008

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 0.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 0.00 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 14.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 13.13 IN.
PILE LENGTH = 70.00 FT.
MODULUS OF ELASTICITY = 0.290E+08 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 8.00 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.80	125.00	30.00	20.00
10.00	SAND	0.80	125.00	30.00	20.00
10.00	SAND	0.80	130.00	35.00	40.00
23.00	SAND	0.80	130.00	35.00	40.00
23.00	CLAY	0.00	125.00	0.00	0.00
45.00	CLAY	0.00	125.00	0.00	0.00
45.00	CLAY	0.00	65.00	0.00	0.00
60.00	CLAY	0.00	65.00	0.00	0.00
60.00	SAND	0.80	70.00	35.00	40.00
75.00	SAND	0.80	70.00	35.00	40.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
1.70	100.00	0.00	0.00	0.00	0.00	0.00
1.70	100.00	0.00	0.00	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00
2.50	22.50	2.50	1.25	0.00	0.00	0.00
2.50	22.50	2.50	1.25	0.00	0.00	0.00
2.50	22.50	2.50	1.25	0.00	0.00	0.00

2.50	22.50	2.50	1.25	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00
2.00	200.00	0.00	0.00	0.00	0.00	0.00

1

****
* COMPUTATION RESULT *
****

PILE PENETR-ATION FT.	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP
	********** FED. HWY. METHOD **********			********** ARMY CORPS METHOD **********			********** LAMBDA 2 METHOD **********		
0.0	0.0	0.0*	0.0	0.0	0.0*	0.0	0.0	0.0*	0.0
1.0	0.0	0.4*	0.4	0.0	0.5*	0.5	0.0	0.4*	0.4
2.0	0.0	0.9*	0.9	0.0	1.1*	1.1	0.0	1.0*	1.0
3.0	0.0	1.6*	1.6	0.0	1.8*	1.8	0.0	1.7*	1.7
4.0	0.0	2.4*	2.4	0.0	2.8*	2.8	0.0	2.6*	2.6
5.0	0.0	3.4*	3.4	0.0	3.9*	3.9	0.0	3.6*	3.6
6.0	0.0	4.6*	4.6	0.0	5.1*	5.1	0.0	4.8*	4.8
7.0	0.0	5.6*	5.6	0.0	6.5*	6.5	0.0	6.2*	6.2
8.0	0.2	6.9*	7.0	0.6	8.1*	8.7	0.0	7.7*	7.7
9.0	0.6	8.2*	8.8	1.9	9.8*	11.7	5.9	9.4*	15.3
10.0	1.0	9.7*	10.8	3.3	11.7*	15.1	7.8	11.2*	19.0
11.0	1.6	17.9*	19.5	5.1	18.9*	24.0	10.0	17.2*	27.2
12.0	2.3	20.9*	23.2	7.2	22.1*	29.3	12.3	20.2*	32.5
13.0	3.1	24.1*	27.3	9.5	25.4*	34.9	14.8	23.4*	38.2
14.0	4.0	27.6*	31.6	11.9	28.9*	40.9	17.5	26.8*	44.3
15.0	4.9	31.2*	36.2	14.6	32.7*	47.3	20.3	30.3*	50.7
16.0	6.0	35.1*	41.0	17.4	36.6*	54.1	33.3	34.1*	67.4
17.0	7.0	39.1*	46.1	20.5	40.8*	61.2	37.4	38.1*	75.6
18.0	8.2	43.4*	51.5	23.7	44.7*	68.4	41.7	42.3*	84.1
19.0	9.4	47.9*	57.2	26.9	48.5*	75.4	46.2	46.8*	93.0
20.0	10.6	52.1*	62.7	30.1	52.4*	82.5	50.8	51.4*	102.2
21.0	12.0	56.2*	68.2	33.3	56.6*	89.9	55.5	56.2*	111.7
22.0	13.4	60.6*	74.0	36.5	60.9*	97.5	60.4	61.2*	121.6
23.0	14.8	24.1	38.9	39.8	24.1	63.8	65.4	24.1	89.4
24.0	17.9	24.1	41.9	43.7	24.1	67.7	71.7	24.1	95.8
25.0	23.4	24.1	47.4	48.2	24.1	72.3	78.0	24.1	102.0
26.0	29.8	24.1	53.8	52.8	24.1	76.9	84.2	24.1	108.3
27.0	36.2	24.1	60.3	57.4	24.1	81.5	90.4	24.1	114.5
28.0	42.6	24.1	66.7	62.0	24.1	86.0	96.6	24.1	120.6
29.0	49.1	24.1	73.1	66.6	24.1	90.6	102.7	24.1	126.8
30.0	55.5	24.1	79.5	71.1	24.1	95.2	108.9	24.1	132.9
31.0	61.9	24.1	86.0	75.7	24.1	99.8	115.0	24.1	139.0
32.0	68.3	24.1	92.4	80.3	24.1	104.4	121.1	24.1	145.1
33.0	74.8	24.1	98.8	84.9	24.1	108.9	127.2	24.1	151.2
34.0	81.2	24.1	105.2	89.5	24.1	113.5	133.3	24.1	157.3
35.0	87.6	24.1	111.7	94.1	24.1	118.1	139.3	24.1	163.4
36.0	94.0	24.1	118.1	98.6	24.1	122.7	145.4	24.1	169.5
37.0	100.5	24.1	124.5	103.2	24.1	127.3	151.5	24.1	175.5
38.0	106.9	24.1	130.9	107.8	24.1	131.8	157.5	24.1	181.6
39.0	113.3	24.1	137.4	112.4	24.1	136.4	163.6	24.1	187.6
40.0	119.7	24.1	143.8	117.0	24.1	141.0	169.6	24.1	193.7
41.0	126.1	24.1	150.2	121.5	24.1	145.6	175.7	24.1	199.8
42.0	132.6	24.1	156.6	126.1	24.1	150.2	181.8	24.1	205.8

43.0	139.0	24.1	163.0	130.7	24.1	154.8	187.8	24.1	211.9
44.0	145.4	24.1	169.5	135.3	24.1	159.3	193.9	24.1	217.9
45.0	151.8	24.1	175.9	139.9	24.1	163.9	199.9	24.1	224.0
46.0	158.3	24.1	182.3	144.4	24.1	168.5	206.0	24.1	230.0
47.0	164.7	24.1	188.7	149.0	24.1	173.1	212.0	24.1	236.1
48.0	171.1	24.1	195.2	153.6	24.1	177.7	218.0	24.1	242.0
49.0	177.5	24.1	201.6	158.2	24.1	182.2	223.9	24.1	248.0
50.0	184.0	24.1	208.0	162.8	24.1	186.8	229.8	24.1	253.9
51.0	190.4	24.1	214.4	167.4	24.1	191.4	235.7	24.1	259.7
52.0	196.8	24.1	220.9	171.9	24.1	196.0	241.5	24.1	265.5
53.0	203.2	24.1	227.3	176.5	24.1	200.6	247.3	24.1	271.3
54.0	209.6	24.1	233.7	181.1	24.1	205.2	253.1	24.1	277.1
55.0	216.1	24.1	240.1	185.7	24.1	209.7	258.8	24.1	282.9
56.0	222.5	24.1	246.5	190.3	24.1	214.3	264.5	24.1	288.6
57.0	228.9	24.1	253.0	194.8	24.1	218.9	270.2	24.1	294.3
58.0	235.3	37.0	272.4	199.4	37.4	236.9	275.9	51.2	327.0
59.0	241.8	76.0	317.8	204.0	77.6	281.6	281.5	132.5	414.0
60.0	248.2	115.0*	363.2	207.2	117.7*	325.0	287.1	153.5*	440.6
61.0	253.1	115.0*	368.1	210.4	117.7*	328.2	293.7	183.3*	477.0
62.0	256.6	115.0*	371.6	213.7	117.7*	331.4	300.3	190.2*	490.5
63.0	260.1	115.0*	375.1	216.9	117.7*	334.6	306.9	197.1*	504.0
64.0	263.6	115.0*	378.6	220.1	117.7*	337.8	313.5	203.9*	517.4
65.0	267.2	115.0*	382.2	223.3	117.7*	341.1	320.0	210.8*	530.8
66.0	270.8	115.0	385.8	226.5	117.7	344.3	326.6	213.8	540.4
67.0	274.4	115.0	389.4	229.7	117.7	347.5	333.1	213.8	546.9
68.0	278.1	115.0	393.1	233.0	117.7	350.7	339.6	213.8	553.4
69.0	281.8	115.0	396.8	236.2	117.7	353.9	346.1	213.8	559.9
70.0	285.5	115.0	400.5	239.4	117.7	357.1	352.6	213.8	566.4

****
* API RP-2A (1994) *
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PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.0*	0.0
1.00	0.0	0.4*	0.4
2.00	0.0	1.0*	1.0
3.00	0.0	1.7*	1.7
4.00	0.0	2.6*	2.6
5.00	0.0	3.6*	3.6
6.00	0.0	4.8*	4.8
7.00	0.0	6.2*	6.2
8.00	0.7	7.7*	8.4
9.00	2.1	9.4*	11.5
10.00	3.8	11.2*	15.0
11.00	5.8	17.2*	23.0
12.00	8.2	20.2*	28.4
13.00	10.9	23.4*	34.3
14.00	13.8	26.8*	40.5
15.00	16.9	30.3*	47.2
16.00	20.2	34.1*	54.4
17.00	23.8	38.1*	61.9
18.00	27.5	42.3*	69.9
19.00	31.5	46.8*	78.3
20.00	35.7	51.4*	87.1
21.00	40.1	56.2*	96.3
22.00	44.8	61.2*	106.0
23.00	49.7	24.1	73.7
24.00	54.7	24.1	78.7
25.00	59.8	24.1	83.9

26.00	65.0	24.1	89.1
27.00	70.4	24.1	94.4
28.00	75.8	24.1	99.8
29.00	81.3	24.1	105.4
30.00	86.9	24.1	111.0
31.00	92.6	24.1	116.7
32.00	98.4	24.1	122.5
33.00	104.3	24.1	128.4
34.00	110.3	24.1	134.3
35.00	116.3	24.1	140.4
36.00	122.5	24.1	146.5
37.00	128.7	24.1	152.8
38.00	135.0	24.1	159.1
39.00	141.4	24.1	165.5
40.00	147.9	24.1	172.0
41.00	154.5	24.1	178.5
42.00	161.1	24.1	185.2
43.00	167.8	24.1	191.9
44.00	174.6	24.1	198.7
45.00	181.5	24.1	205.6
46.00	188.4	24.1	212.5
47.00	195.4	24.1	219.5
48.00	202.4	24.1	226.5
49.00	209.5	24.1	233.5
50.00	216.6	24.1	240.6
51.00	223.7	24.1	247.7
52.00	230.8	24.1	254.9
53.00	238.1	24.1	262.1
54.00	245.3	24.1	269.3
55.00	252.6	24.1	276.6
56.00	259.9	24.1	283.9
57.00	267.2	24.1	291.3
58.00	274.6	51.2	325.8
59.00	282.0	132.5	414.5
60.00	289.5	153.5*	443.0
61.00	296.8	183.3*	480.2
62.00	304.2	190.2*	494.4
63.00	311.5	197.1*	508.6
64.00	318.8	203.9*	522.8
65.00	326.2	210.8*	537.0
66.00	333.5	213.8	547.3
67.00	340.8	213.8	554.6
68.00	348.2	213.8	562.0
69.00	355.5	213.8	569.3
70.00	362.8	213.8	576.6

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00	0.0000E+00	0.0000E+00

Abut 3 Wingwall - GST - 14 in Alt W.apo

			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.5025E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
3	10	0.9958E+01		
			0.0000E+00	0.0000E+00
			0.3076E+00	0.1000E-01
			0.6153E+00	0.2000E-01
			0.1231E+01	0.4000E-01
			0.1846E+01	0.6000E-01
			0.2461E+01	0.8000E-01
			0.2769E+01	0.9000E-01
			0.3076E+01	0.1000E+00
			0.3076E+01	0.5000E+00
			0.3076E+01	0.2000E+01
4	10	0.1000E+02		
			0.0000E+00	0.0000E+00
			0.3832E+00	0.1000E-01
			0.7665E+00	0.2000E-01
			0.1533E+01	0.4000E-01
			0.2299E+01	0.6000E-01
			0.3066E+01	0.8000E-01
			0.3449E+01	0.9000E-01
			0.3832E+01	0.1000E+00
			0.3832E+01	0.5000E+00
			0.3832E+01	0.2000E+01
5	10	0.1652E+02		
			0.0000E+00	0.0000E+00
			0.6720E+00	0.1000E-01
			0.1344E+01	0.2000E-01
			0.2688E+01	0.4000E-01
			0.4032E+01	0.6000E-01
			0.5376E+01	0.8000E-01
			0.6048E+01	0.9000E-01
			0.6720E+01	0.1000E+00
			0.6720E+01	0.5000E+00
			0.6720E+01	0.2000E+01
6	10	0.2296E+02		
			0.0000E+00	0.0000E+00
			0.9222E+00	0.1000E-01
			0.1844E+01	0.2000E-01
			0.3689E+01	0.4000E-01
			0.5533E+01	0.6000E-01
			0.7377E+01	0.8000E-01
			0.8299E+01	0.9000E-01
			0.9222E+01	0.1000E+00
			0.9222E+01	0.5000E+00
			0.9222E+01	0.2000E+01

Abut 3 Wingwall - GST - 14 in Alt W.apo

7	10	0.2300E+02		
			0.0000E+00	0.0000E+00
			0.2856E+01	0.2240E-01
			0.4760E+01	0.4340E-01
			0.7141E+01	0.7980E-01
			0.8569E+01	0.1120E+00
			0.9521E+01	0.1400E+00
			0.8569E+01	0.2800E+00
			0.8569E+01	0.4200E+00
			0.8569E+01	0.7000E+00
			0.8569E+01	0.2800E+01
8	10	0.3402E+02		
			0.0000E+00	0.0000E+00
			0.3446E+01	0.2240E-01
			0.5743E+01	0.4340E-01
			0.8615E+01	0.7980E-01
			0.1034E+02	0.1120E+00
			0.1149E+02	0.1400E+00
			0.1034E+02	0.2800E+00
			0.1034E+02	0.4200E+00
			0.1034E+02	0.7000E+00
			0.1034E+02	0.2800E+01
9	10	0.4496E+02		
			0.0000E+00	0.0000E+00
			0.3907E+01	0.2240E-01
			0.6512E+01	0.4340E-01
			0.9768E+01	0.7980E-01
			0.1172E+02	0.1120E+00
			0.1302E+02	0.1400E+00
			0.1172E+02	0.2800E+00
			0.1172E+02	0.4200E+00
			0.1172E+02	0.7000E+00
			0.1172E+02	0.2800E+01
10	10	0.4500E+02		
			0.0000E+00	0.0000E+00
			0.3940E+01	0.2240E-01
			0.6567E+01	0.4340E-01
			0.9850E+01	0.7980E-01
			0.1182E+02	0.1120E+00
			0.1313E+02	0.1400E+00
			0.1182E+02	0.2800E+00
			0.1182E+02	0.4200E+00
			0.1182E+02	0.7000E+00
			0.1182E+02	0.2800E+01
11	10	0.5252E+02		
			0.0000E+00	0.0000E+00
			0.4094E+01	0.2240E-01
			0.6823E+01	0.4340E-01
			0.1023E+02	0.7980E-01
			0.1228E+02	0.1120E+00
			0.1365E+02	0.1400E+00
			0.1228E+02	0.2800E+00
			0.1228E+02	0.4200E+00
			0.1228E+02	0.7000E+00
			0.1228E+02	0.2800E+01
12	10	0.5996E+02		
			0.0000E+00	0.0000E+00
			0.4242E+01	0.2240E-01
			0.7069E+01	0.4340E-01
			0.1060E+02	0.7980E-01
			0.1272E+02	0.1120E+00
			0.1414E+02	0.1400E+00
			0.1272E+02	0.2800E+00
			0.1272E+02	0.4200E+00

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			0.1272E+02	0.7000E+00
			0.1272E+02	0.2800E+01
13	10	0.6000E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01
14	10	0.6753E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01
15	10	0.7496E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01

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0.1716E+03	0.1544E+00	0.1909E+02	0.1000E-01
0.3661E+03	0.4214E+00	0.6109E+02	0.5000E-01
0.4286E+03	0.5631E+00	0.7844E+02	0.1000E+00
0.4875E+03	0.1060E+01	0.1488E+03	0.5000E+00
0.5296E+03	0.1625E+01	0.1908E+03	0.1000E+01
0.5526E+03	0.2661E+01	0.2138E+03	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.1336E+02	0.7000E-02
0.2673E+02	0.1400E-01
0.5345E+02	0.2800E-01
0.1069E+03	0.1820E+00
0.1604E+03	0.5880E+00
0.1924E+03	0.1022E+01
0.2138E+03	0.1400E+01
0.2138E+03	0.2100E+01
0.2138E+03	0.2800E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1885E+01	0.1642E-02	0.1909E+00	0.1000E-03
0.1907E+02	0.1652E-01	0.1909E+01	0.1000E-02
0.9480E+02	0.8271E-01	0.9545E+01	0.5000E-02

Prepared by: JZB1

ARC WELDING PROCEDURE REQUIREMENT ALL STRESS LEVELS

D-22

Asset Type:	Gas Transmission and Distribution	**Function:**	Design and Construction
Issued by:	R. D. White Original Signed By	**Date:**	04-29-09

Rev. #05: This document replaces Revision #04. For a description of the changes, see Page 14.

This document also appears in the following manual:

- *Gas Applicant Design Manual*

Purpose and Scope

This numbered document shall be included as a part of all welding procedure specifications used on natural gas facilities governed by 49 CFR Part 192 (latest revision), Subpart E, and API 1104. Changes or deviations to these welding standards shall be approved by the responsible engineer following consultation with the welding specialist.

Acronyms

API:	American Petroleum Institute
ASME:	American Society of Mechanical Engineers
ASTM:	American Society for Testing and Materials
ATS:	Applied Technology Services
AWS:	American Welding Society
CE:	carbon equivalent
CFR:	*Code of Federal Regulations*
dc:	direct current
FCAW:	flux cored arc welding
GIS:	Geographic Information System
GMAW:	gas metal arc welding
GTAW:	gas tungsten arc welding
GT&D:	Gas Transmission and Distribution
MAOP:	maximum allowable operating pressure
OD:	outside diameter
psi:	pounds per square inch
psig:	pounds per square inch gauge
SAW:	submerged arc welding
SMAW:	shielded metal arc welding
SMYS:	specified minimum yield strength
WPS:	Weld Procedure Specification

References

	Document
Drain Tube on 2” to 6” Pipelines and Sample Tube on All Pipeline Sizes	A-32
Drain Tube Installation for 8” to 34” Pipelines in Service	A-32.1
Gas Main Welding Sleeves (Type B Sleeves With Circumferential Welds)	A-60
In-Service Welding	D-23
Direct Deposition Welding	D-23.1
Welder Qualification for Under 20% of SMYS	D-30
Arc Welder Qualification for Working on Pipelines That Operate at Over 20% of SMYS	D-30.2
Weld Inspection	D-40
Welding of Pipelines and Related Facilities	API 1104

Arc Welding Procedure Requirement
All Stress Levels

Welding Specifications

1. Materials to be welded using the procedures in this numbered document include the following. Any exceptions shall be noted in the particular welding procedure specification.
   - API 5L, Grade B up to and including X-70
   - ASTM A-53, Grade B
   - ASTM A-106, Grade B
   - ASTM A-516, Grade 70 (38,000 psi yield)
   - ASTM A-242 (50,000 psi yield)
   - ASTM A-633, Grade E (60,000 psi yield)
   - ASTM A-234, Grade WPB
   - ASTM A-105 (35,000 psi yield)
   - ASTM A-572 (50,000 psi yield)
2. All welding on pipe and fittings shall be completed using detailed procedure specifications established, qualified, and recorded in accordance with 49 CFR Part 192 and API 1104.
3. Weld Procedure Selection

   A. Before welding pipe or fittings, the welder must first identify the pipe size, the type of material be welded, the SMYS, and the stress level at which the pipe is designed to operate. The maximum hoop stress permitted, the appropriate welding process, and the procedure shall be determined from Items 3B through 3E below.

   B. All piping, fittings, and appurtenances designed to operate above 60 psi or 20% SMYS, regardless of size, shall be welded by using one, or a combination of, the following processes:
      - SMAW (See Numbered Document D-30.2 for qualification procedure)
      - GMAW
      - FCAW
      - GTAW
      - SAW

   C. This numbered document covers the SMAW process using cellulose and low-hydrogen electrodes and the GMAW process for all stress levels.

   D. SMAW and GMAW shall be the preferred welding processes used for all piping larger than 2” nominal diameter, with a wall thickness greater than 0.154”, and designed to be operated above 60 psi or 20% SMYS.

   E. Piping designed to operate at less than or equal to 60 psi may be welded using any of the arc welding processes listed in Item 3B above.

   F. GMAW is the preferred process for making branch-connection welds on piping designed to operate above 60 psi or 20% SMYS. If the SMAW process is performed to weld branch connections, cellulose electrodes can be used for the first and second passes, followed by low-hydrogen electrodes for the filler and cover passes.

   G. When performing a circumferential welding on pipe greater than 12” in diameter (nominal), a minimum of two welders shall work simultaneously on opposite sides of the pipe.

   H. Before welding, ensure that there are no liquids in the segment of the pipeline to be welded. If liquids are suspected, take one of the following steps:
      (1) Remove liquid using an existing drain.
      (2) Install a drain per Numbered Document A-32 or A-32.1, and remove the liquid.
      (3) Perform in-service welding as described in Numbered Document D-23.

   I. The maximum hoop stress permitted when welding on pressurized piping shall be determined as follows:
      (1) When applicable, welding may be performed with no reduction of operating pressure in accordance with Numbered Documents D-23 and D-23.1.

(2) If in-service welding is not the preferred choice or is not applicable, evaluate the operating pressure before welding. The maximum operating pressure permitted during welding is the least pressure given in Items 3I(2)(a), 3I(2)(b), and 3I(2)(c) below.

The maximum pressures are also shown on the Gas Transmission GIS. Where the condition of the pipe is found to be poor, or where other conditions exist which could cause problems while welding, it may be necessary to lower the operating pressure. This lower pressure should be determined based on evaluating the observed condition of the pipe and by good engineering judgment.

(a) For seamless and double-submerged arc welded pipe, the maximum pressure permitted during welding shall be determined using the formula given below, the MAOP, or a pressure which will produce a hoop stress of 50% of the SMYS, whichever is lowest.

$$P = \frac{2S \times (t - 0.094) \times 0.72}{D}$$

where,

P = internal pressure, psig
S = specified minimum yield strength, psi
t = nominal pipe wall thickness, inches
D = outside pipe diameter, inches

For all other pipe, the maximum pressure permitted during welding shall be determined using the formula given above, the MAOP, or a pressure which will produce a hoop stress of 40% of the SMYS, whichever is lowest.

(b) The maximum hoop stress permitted during welding shall not exceed 20% of the SMYS when:

- Welding within 3” of the longitudinal seam, the circumferential, and any branch weld on any type of pipe (except the longitudinal seam of double-submerged arc welded pipe).
- Welding within 3” of any defect (gouges, corrosion, laminations, etc.) in the pipe which exceeds 1/3 of the nominal wall thickness in depth and/or 1/4 of the nominal pipe diameter in length. Any number of closely spaced adjacent defects shall be treated as one defect of a size and depth encompassing all the defects.
- More than one weld repair is required in any length equal to five pipe diameters or 5’, whichever is less.

(c) Preheating above 450°F, or high-temperature stress relieving, is not permitted on pipelines under pressure. The yield point and fracture sensitivity of non-expanded, high-strength pipe are adversely affected when pipe is heated above 600°F, unless it is heated and cooled under controlled conditions. The yield point of expanded pipe is permanently lowered by approximately 20% when it is heated above this temperature.

J. Low-hydrogen electrodes or GMAW shall be used, if the line flow cannot be made static, or if the temperature of the pipe is less than 50°F, and operates above 60 psi.

4. Weld Preparation

A. Welding electrodes shall conform to AWS Specifications A-5.1, A-5.5, or A-5.18. Refer to the “Welding With Cellulose-Coated and Wire Electrodes” section on Page 10, Table 3 on Page 10, Table 4 on Page 11, Figure 9 and Figure 10 on Page 11, the “Welding With Low-Hydrogen Electrodes” section on Page 12, and Figure 11 and Figure 12 on Page 12.

B. The welding operation must be protected (shielded) from any weather conditions (rain, snow, ice, or high winds) that would impair the quality of the completed weld.

C. Before welding, the weld groove and the adjacent surfaces up to 1” around it shall be cleaned and kept free of all dirt, paint, rust, scale, moisture, oil, grease, or other foreign material harmful to welding. Clean by filing, hand or power wire brushing or grinding, and/or by using approved solvents. Alcohol (methanol or ethanol) or acetone are acceptable solvents for cleaning and drying. Do not expose these solvents or their fumes to open flame, arcs, or hot surfaces.

D. Before sections of pipe and fittings are assembled for welding, all rust, scale, slag, dirt, liquids, or other foreign matter shall be removed from the inside surface of the pipe by swabbing with clean rags or by other

acceptable methods. The responsible person (people) on the job shall ensure compliance with this requirement.

E. Pipe and/or fittings joined by welding shall be aligned to minimize any offset (high or low) of the pipe wall surfaces around the circumference of the pipe. For joining pipe and/or fittings of the same nominal wall thickness, the internal offset should not exceed 1/8”. Internal offset greater than this dimension is permissible provided the pipe end dimension is within the tolerances contained in the material specification and is distributed evenly around the circumference of the pipe. If the pipe or fitting ends are defective or damaged (scratches, gouges, dents, etc.), the ends shall be rebeveled. For joining pipe of unequal wall thickness, the internal offset shall not exceed 3/32”. If this value is exceeded, refer to Figure 2 through Figure 8 on Page 9 of this numbered document. The external offset shall be limited to the out-of-roundness and the pipe and fitting end-diameter tolerances given in the material specifications.

F. All hammers used for aligning pipe and fittings must be bronze or brass faced. Avoid denting, gouging, or scratching the pipe and/or fittings.

G. When aligning abutting lengths of the pipe for welding, the longitudinal seams shall be staggered (no closer than 3”) within the top quadrant (10 to 2 o’clock).

H. A lineup clamp shall be used on pipe with a nominal diameter 3” or larger. It is recommended that the lineup clamp be left in place until the root pass is at least 50% completed and equally deposited around the weld groove. No stress (movement) shall be placed on the weld groove until the root pass and second pass are completed.

I. The minimum separation between any two circumferential welds, wherever possible, shall be as follows:

(1) One pipe diameter for welds on pipelines and station piping but never less than 3” (except as allowed by Item (2) below).

(2) 1”, as measured along the inside arc radius of any welding elbow and the transverse segments of this elbow for 2” or more in nominal diameter. See 49 CFR 192.313(c).

(3) Branch-connection welds, including reinforcing member welds, shall be located at least 3” away from circumferential welds whenever possible.

J. To perform work safely, adequate working clearance shall be provided and maintained around the pipe and/or fittings at all points to be welded.

K. When cutting or welding near fittings containing rubber stoppers, it is recommended that the minimum distance between the face of the stopper and the cutting or welding operation be as indicated in Table 1 below.

Table 1 Minimum Distance Between Stopper and Weld or Cut

Pipe Size (Inches)	Minimum Distance Between Stopper and Weld or Cut [1] (Inches)
3/4	6
1	6
1-1/4	6
1-1/2	7
2	8
2-1/2	9
3	10
4	12
6	14
8	16
10	18
12 and larger	20

[1] In those cases where it is not possible to maintain the recommended minimum distance between the stopper face and the cutting or welding operation, some auxiliary cooling means such as wet burlap or wet rags should be placed around the fitting to reduce the temperature.

Arc Welding Procedure Requirement
All Stress Levels

5. Preheating

   A. Preheating of 200°F minimum to 400°F maximum must be achieved and maintained at the weld location until the completion of welding when any of the following conditions exist:

      (1) When the pipe or fitting wall thickness (regardless of pipe grade) is greater than 0.5”.

      (2) When welding on pressurized pipe with the MAOP above 60 psi pressure.

      (3) When the pipe mill heat analysis shows a carbon content in excess of 0.32%.

      (4) When CE exceeds 0.65% (CE% = carbon % + 1/4 manganese %).

      Pipe material meeting API Specification 5L and ASTM A-53 or A-106, Grade B specifications, does not exceed the chemical limits required for preheating that are shown above. Certain fitting materials may exceed the limits and therefore would require preheating.

      (5) When specified by the WPS.

   B. The preheated area shall be at least 6” wide around all points where weld metal will be deposited.

   C. The preheat temperature shall be checked at the weld area outside of the weld groove using temperature-sensitive crayons, such as “Tempilsticks”, or a contact pyrometer.

   D. If welding is interrupted, the weld area shall be preheated again before welding is resumed.

   E. The interpass temperature is the temperature of the weld area between each deposit of weld beads. The minimum interpass temperature shall comply with the minimum preheat temperature requirements.

6. Stress Relieving

   A. Stress relieving shall be required under the following conditions:

      (1) When the carbon content of the pipe fitting material, as determined by heat analysis, exceeds 0.32% or the CE exceeds 0.65%. (Pipe meeting API Specification 5L and ASTM A-53 or A-106, Grade B specifications, does not exceed these limits. Certain fitting materials may exceed these limits and therefore require stress relieving.)

      (2) When the wall thickness of the pipe or fitting being welded is 0.750” or greater, unless low-hydrogen or GMAW welding processes are used. Stress relieving is mandatory for all thickness 1-1/4” or greater.

      (3) When couplings, weldolets, or socket-weld fittings larger than 2” are welded to a header wall with a thickness 0.750” or greater, unless low-hydrogen or GMAW welding processes are used. Stress relieving is mandatory for all header wall thickness 1-1/4” or greater.

   B. Stress-Relieving Temperature

      (1) For welding being performed under API specifications as in this numbered document, heat uniformly to achieve stress-relieving temperatures at a rate suitable to the type of equipment being used. When welding to ASME specifications, heat uniformly at a rate not to exceed 600°F per hour, while the temperature is below 600°F, and not to exceed 400°F per hour when above 600°F.

      (2) The weld being stress relieved shall be held in the range of 1,100°F to 1,200°F for a period of 1 hour per inch of wall thickness, but in no case less than 45 minutes.

      (3) After stress relieving is completed, the weld shall be cooled to 600°F at a cooling rate not to exceed 500°F per hour. For 600°F and below, the weld may be cooled in still air. Accelerated cooling is not allowed.

      (4) The minimum width of the area on each side of the weld that will be stress relieved shall be equal to four times the wall thickness, or 2”, whichever is greater.

   C. Equipment for Local Stress Relieving

      (1) Stress relieving may be accomplished by electric induction, electric resistance, or other suitable means of heating in compliance with Item 6B above.

      (2) The stress-relieving temperature shall be checked with recording, thermocouple pyrometers. The recording charts shall be properly identified and kept as part of the job records.

7. Horizontal and Vertical Fixed-Position Welding; Cellulose-Type Electrode or Wire-Type Electrode for GMAW

   Horizontal and vertical, fixed-position, shielded, metal-arc welding with cellulose-covered electrodes (AWS E6010, E7010, or E8010) or wire electrodes (ER70S-6) shall be performed using the “downhill” method. Refer to Figure 10 on Page 11 for the proper electrode to use with specific materials.

   A. Root Pass and Hot Pass (Second Pass)

      (1) The amount of root opening (gap) for the welding process used shall fall within the range given in Figure 9 on Page 11 and should suit the preference of the welder responsible for the integrity of the root pass. During alignment and tacking, hold the joint together by a lineup clamp. Ensure full penetration and complete fusion during tacking and the root pass.

      (2) Strike the arc in the weld groove only. Make the stringer bead for SMAW by using a drag technique (the electrode coating resting on the bevel as the electrode is dragged downhill). Thoroughly clean the stringer before applying the hot pass (second pass). Use disc grinding to remove bumpy starts and slag, improve the bead contour, or remove excessive wagon tracks (see Figure 1 below) before applying the hot pass (second pass).

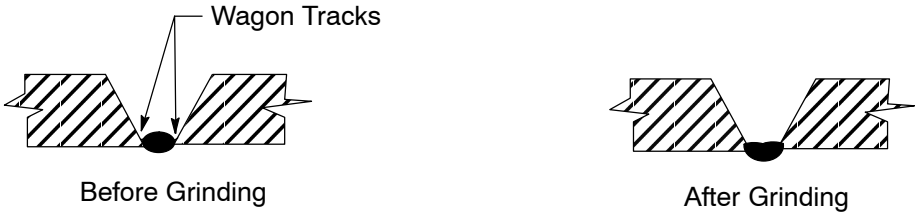


Figure 1
Wagon Tracks – Slag-Filled Crevices on Either Side of Root Pass

      (3) When applying the hot pass with SMAW, sufficient heat (amperage) will be needed to melt out shallow wagon tracks and float any remaining slag to the surface. Use a slight up-and-down whipping motion. Start the hot pass immediately after completion of the root pass (within 5 minutes).

   B. Filler and Cover Passes

      (1) Use a side-to-side weave motion when applying the filler passes. Filler metal shall be added to any concave portion of the groove, before applying the cover pass.

      (2) On heavy wall pipe and fittings with a wide welding groove, more than one bead per layer shall be used for filling in the downhill direction.

      (3) Strip capping shall be used for the cover pass when welding in the vertical, fixed position. Wash passes are not acceptable when welding in this position.

      (4) Filler and cover passes made using the weave motion when welding downhill on horizontally fixed pipe and fittings shall be no wider than four times the electrode diameter for SMAW and 3/4” for GMAW. Welds shall be uniform and without undercutting.

      (5) The face of the completed weld should be approximately 1/8” greater than the width of the original groove. At no point shall the crown surface be below the outside surface of the pipe, nor should it be raised above the parent metal more than 3/32”.

      (6) The completed weld shall be thoroughly brushed and cleaned.

8. Horizontal and Vertical, Fixed-Position Welding – Low-Hydrogen Electrodes (see Item 4 on Page 12 for recommended use)

   A. To perform properly, low-hydrogen electrodes must be stored and handled in a manner which will prevent the absorption of moisture. They shall either be stored in the manufacturer’s hermetically sealed, unopened containers, or in holding ovens if the containers have been opened. Electrodes in unopened sealed containers remain dry indefinitely under good storage conditions. The storage area should be enclosed, clean, dry, and have adequate facilities for safe storage to prevent deterioration.

   B. If used immediately, low-hydrogen electrodes may be taken directly from freshly opened, hermetically sealed containers. The remaining electrodes shall be removed from the containers and placed in an electric holding oven or portable rod warmer and held at a temperature of 250°F to 350°F.

C. Electrodes shall be withdrawn from the holding oven or portable rod warmer in small quantities and used immediately.

D. The electric holding oven or portable rod warmer shall be powered by a reliable electric source.

E. Electrodes shall not be exposed to moisture. They shall not be used after having been removed from their sealed containers or holding oven for a period exceeding 4 hours.

F. Electrodes subjected to the conditions described in Item 8E must be dried or discarded. Dry electrodes by baking them in an electric oven at 700°F to 800°F for a minimum of 1 hour. Transfer them to a holding oven and hold them there until used. Discard any electrodes if the coating becomes fragile. Discard any electrodes that flake or break off while welding, or that develop a noticeable difference in handling or arc characteristics.

G. Qualified welders using low-hydrogen electrodes shall be thoroughly instructed in storage and handling requirements and be issued an electric heater or portable electrode warmer. Low-hydrogen electrodes shall always be issued in portable rod warmers, or the electrodes shall be returned to the heated storage oven within the time specified in Item 8E.

H. Welding Technique With Low-Hydrogen Electrodes (refer to Figure 11 through Figure 20 on Pages 12 and 13)

(1) On horizontally fixed pipe and fittings, the root pass and hot pass shall be made by welding downhill, using shielded metal-arc welding with E6010(5P), E7010(HYP+), or E8010(70+) electrodes.

(2) On horizontally fixed pipe and fittings, filler and cover passes shall be made by welding uphill using E7016 or E7018 electrodes for all grades of pipe through X-60, and E8016 or E8018 electrodes for X-65 and X-70 pipe. See specific WPS.

(3) On heavy wall pipe or fittings (greater than Schedule 40) with a wide welding groove, use more than one filler and/or cover pass per layer.

(4) Filler and cover passes made by welding uphill using the weave motion on horizontally fixed pipe and fittings shall be no wider than 5/8” if using a 3/32” diameter rod and 3/4” if using a 1/8” diameter rod.

(5) On pipe or fittings in the vertically fixed position, each weld layer shall be deposited with multiple passes in the horizontal plane when the weld groove is three times the electrode diameter. Large weave passes shall not be permitted.

(6) On vertically fixed pipe and fittings, the root pass and hot pass shall be made by using SMAW with E6010(5P), E7010(HYP+), or E8010(70+) electrodes.

9. Roll Welding

For roll or flat welding, the welding arc is struck on the top of the pipe or fitting and held there to deposit the bead as the pipe or fitting is steadily revolved. When applicable, roll welding will be permitted, providing alignment and support are maintained.

10. Fillet Weld

The bead shape of all fillet welds shall be flat or slightly convex, and the length of each weld leg shall be equal. All attachments using fillet welds shall be made in accordance with Figure 13 through Figure 20 on Page 13 of this numbered document.

A. When welding slip-on flanges to pipe, the inside weld joining the pipe end to the flange’s inside-diameter bore surface shall be completed first, followed by the weld at the outside of the flange to the outside circumference of the pipe, as shown in Figure 16 on Page 13.

B. Fillet welds to attach supports and other non-pressure attachments to pressure piping must be designed and approved by the responsible pipeline engineer.

11. Back Welding

A. Back welding and end preparation when joining unequal wall thicknesses shall be performed as specified on Page 9 of this numbered document. Before back welding, disc grind or wire buff any loose scale from the backside of the weld groove.

B. When 16” and larger diameter valves and fittings are welded to each other or to pipe, the joint shall have a two-pass weld on the inside as well as the outside weld, if the internal misalignment exceeds 3/32”. This requirement also applies to smaller diameter valves and fittings when it is practical. Back welding is not required if the valves and fittings are supplied already shop welded to pipe of the same wall thickness as the line pipe.

C. Back welding shall be done using SMAW with E6010, E7010, or E8010 electrodes. Use a small weave to penetrate and fuse the backside of the weld groove. The bead width and height should exceed the minimum requirements shown in Figure 2 through Figure 8 on Page 9 by as small a margin as practical. If a second fill pass is needed, this pass should form a smooth transition from one side of the pipe to the other. Do not overweld.

12. Repair or Removal of Defects and Cracks

A. Preheating the segment(s) to be repaired is required if conditions exist which would adversely affect the quality of the weld repair. Post-weld heat treatment and nondestructive examination shall be the same as that required for the original weld joint.

B. If a section of pipe has arc burns that are repaired by grinding, the remaining wall thickness must at least be equal to either:

(1) The nominal wall thickness required for the design pressure of the pipeline, or

(2) The minimum wall thickness required by the tolerance in the specification to which the pipe was manufactured. The amount of allowable wall thickness reduction based on the manufactured pipe specifications is as follows:

- 12-1/2% for ASTM A-106 pipe
- 10% for API-5L pipe
- 8% for API-5LX pipe
- 12-1/2% for ASTM A-53 pipe

(3) Alternate acceptance criteria to establish the minimum required remaining wall thickness may be applicable (such as RSTRENG), but must be approved by GT&D gas engineering personnel.

C. Grinding and fill welding

(1) A facility engineer or a pipeline engineer is responsible for having a written weld repair procedure prepared when grinding and fill welding is to be used for any of the following conditions:

(a) Repair of cracks.

(b) Any defect in a previously repaired area for new construction.

(c) All repairs on existing pipelines.

(2) If the repair is to be performed on a pressurized pipeline with an MAOP above 60 psi refer to Numbered Documents D-23 and D-23.1.

(3) Areas to be repaired shall be thoroughly cleaned and prepared in accordance with the requirements given in this numbered document before grinding or welding.

(4) Cracks in circumferential or branch-connection welds that exceed 8% of the total weld length and cracks in original pipe longitudinal seam welds may not be repaired using grinding and fill welding.

(5) Oxy-fuel gas gouging (flame gouging), air carbon-arc gouging, grinding, and chipping are acceptable methods for removing cracks and other defects. However, only grinding or chipping may be used on pressurized lines.

(6) After removing any cracks, the repair groove must be examined by a magnetic particle test to ensure complete removal of the cracks (per requirements of Numbered Document D-40).

(7) After removing any defects other than cracks, the area shall be visually examined to verify that the defects have been completely removed.

(8) Weld metal shall be deposited to restore the original material contour. The surface of the finished repair shall be ground smooth to the contour of the pipe on all lines operating over 100 psig.

(9) The completed repair shall be inspected per the requirements of Numbered Document D-40.

13. Identifying Welds

Where the number of welders makes identifying an individual welder's work difficult, welders shall identify their work by using a paint pen or other suitable marker to apply an assigned number or initials.

Arc Welding Procedure Requirement
All Stress Levels

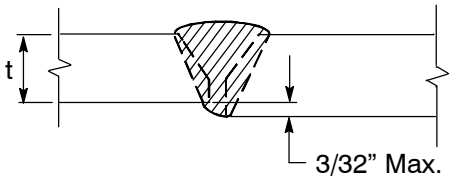


Figure 2

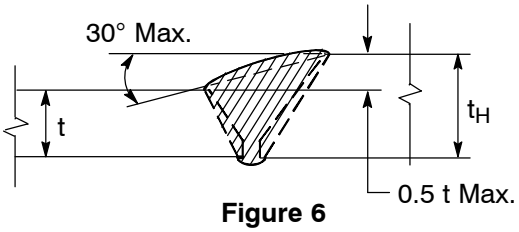


Figure 6

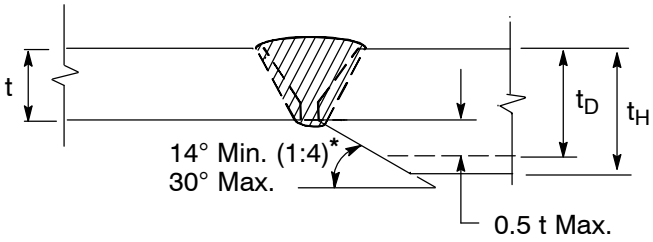


Figure 3

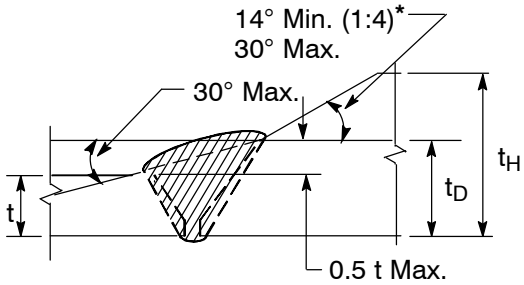


Figure 7

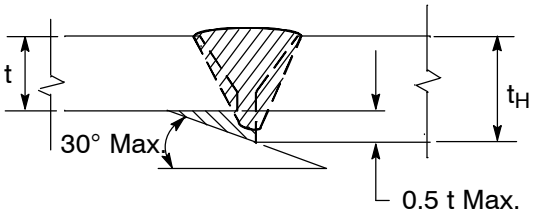


Figure 4

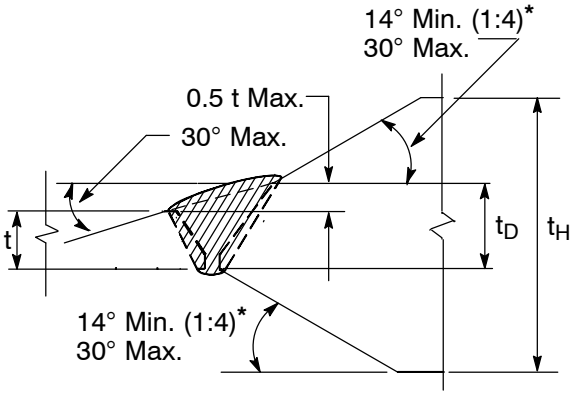


Figure 8

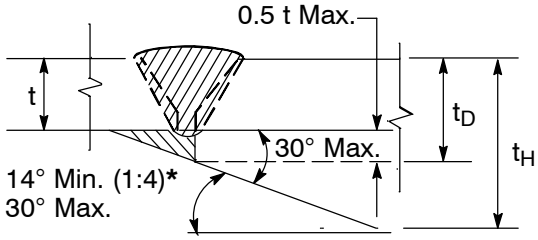


Figure 5

Notes

1. The joint design shown in Figure 3 shall not be used where a thicker pipe wall has a lower yield strength. A joint of this type can be used where the location class changes.
2. If the materials being joined have different yield strengths, the welding electrodes used must be suitable for the highest yield material in each joint.
3. A legend of values and symbols used in Figure 3 through Figure 8 is shown as follows:

   t_D – The required wall thickness designed for heavy wall pipe which is being joined to thinner pipe. The t_D value may not exceed 1.5 t.

   t_H – The actual wall thickness of the heavier wall pipe.

   ***** – No minimum when joined materials have equal yield strength.

Arc Welding Procedure Requirement
All Stress Levels

Welding With Cellulose-Coated and Wire Electrodes

1. All current used shall be as specified in the applicable WPS.
2. If back welding, use “hot pass” techniques for the first back-weld pass. Use conventional filler and cover techniques if multiple passes are required.
3. In some older pipeline installations, “PG&E Specified” pipe was installed. This pipe does not necessarily comply with API, ASTM, or any other pipeline standard. Before welding on “PG&E Specified” pipe, consult GT&D gas engineering personnel for the proper welding procedures and electrodes to use.
4. When welding fittings in pipelines, and there is more than one suitable electrode given in Table 3, use the higher-strength electrodes (i.e., E7010 instead of E6010, or E8010 instead of E7010).

Table 2 Codes for the Cellulose-Coated and Wire Electrodes

Electrodes	Code
3/32”, E6010, Fleetweld 5P or Equal	159252
1/8”, E6010, Fleetweld 5P or Equal	159026
5/32”, E6010, Fleetweld 5P or Equal	159027
3/16”, E6010, Fleetweld or Equal	159028
1/8”, E7010, Shield Arc Hyp+ or Equal	159285
5/32”, E7010, Shield Arc Hyp+ or Equal	159286
3/16”, E7010, Shield Arc Hyp+ or Equal	159287
1/8”, E8010, Shield Arc 70+ or Equal	159405
5/32”, E8010, Shield Arc 70+ or Equal	159406
3/16”, E8010, Shield Arc 70+ or Equal	159407
0.035”, ER70S-6, Lincoln L-56 or Equal	150075

Table 3 Electrodes Suitable for Welding Various Materials

Material		Electrode	
		AWS A-5.1 and 5.5 SMAW	AWS A-5.18 GMAW
Pipe (See Item 3 Above)	API 5L, Grade B and A-25	E6010	ER70S-6
	API 5L, Grade X-42 to X-48	E6010	ER70S-6
	API 5L, Grade X-52 to X-60	E7010	ER70S-6
	API 5L, Grade X-65	E8010	ER70S-6
	API 5L, Grade X-70	E8010	ER70S-6
Pipe (See Item 3 Above)	ASTM A-53, Grade B	E6010	ER70S-6
	ASTM A-106, Grade B	E6010	ER70S-6
Fittings	ASTM A-105	E6010	ER70S-6
	ASTM A-234, Grade WPB	E6010	ER70S-6
	ASTM A-242 and A-441	E6010	ER70S-6
	ASTM-A516, Grade 70	E6010	ER70S-6
	ASTM A-633, Grade E	E7010	ER70S-6

Arc Welding Procedure Requirement
All Stress Levels

Table 4 Weld Detail for SMAW and GMAW With Cellulose-Coated and Wire Electrodes

Weld Layer	Method		Electrode		Recommended	
	Horizontal Fixed Position	Vertical Fixed Position [1]	Class	Size	Amperes	Volts
First Pass	Downhill	Bead	Table 3	All	90 to 100 (GMAW) 100 to 170 (SMAW)	18 to 20 (GMAW) 26 to 28 (SMAW)
Hot Pass (See Item 2 on Page 10)	Downhill	Bead	Table 3	1/8” or 5/32”	120 to 160	24 to 28
Filler Passes	Downhill [2]	Bead	Table 3	All	140 to 180	24 to 28
Cover Pass	Downhill [2]	Bead	Table 3	All	140 to 180	24 to 28

[1] Large weave passes shall not be used for the vertically fixed position.
[2] Exceptionally wide, downhill, large weave passes are not permitted.

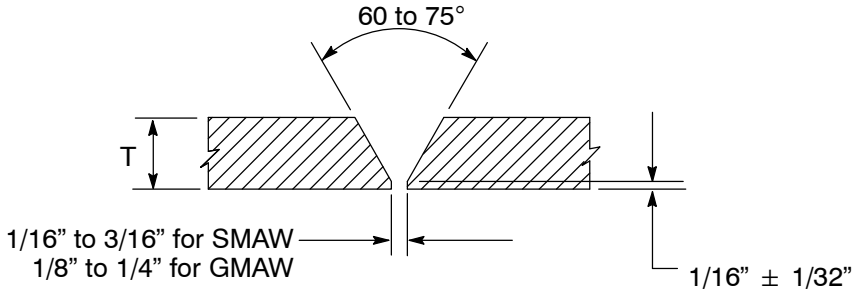
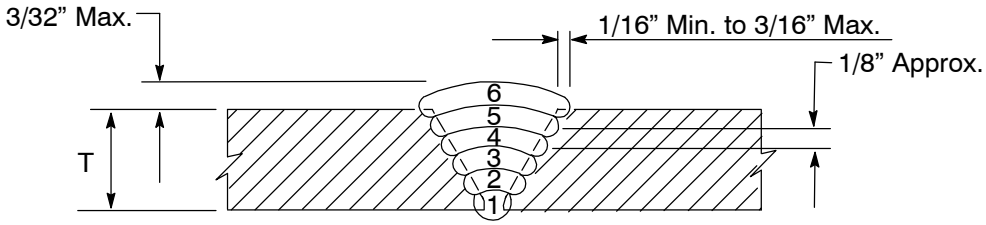


Figure 9
Weld Design With Cellulose-Coated and Wire Electrodes



Sequence of Beads (The number will vary with changes in the wall thickness, etc.)

Figure 10
Standard V Bevel Butt Joint

Welding With Low-Hydrogen Electrodes

1. All current used shall be as specified in the applicable WPS.
2. The electrodes specified in Table 5 below are suitable for all API grades through X-60. For Grade X-65 and X-70, use E8016 or E8018. See specific WPS for electrodes for filler and cover passes.
3. The handling instructions and weld techniques in “Welding Specifications,” Item 8 on Page 6 must be followed.
4. Low-hydrogen electrodes are recommended for high-yield, heavy wall pipe for station piping, river crossings, or other locations where vibration or external loading may occur. Contact one of the following if more information is required:
   - ATS welding services engineer
   - GT&D gas field support personnel
5. For the root pass and the hot pass, use the electrodes as shown in Table 3 on Page 10.
6. Low-hydrogen electrodes: To order the 1/8” E7018 (Alt: E7016) Hobart, Airco, Alloy Rods, or Lincoln, use Code 159194.

Table 5 Weld Detail With Low-Hydrogen Electrodes

Weld Layer	Method		Electrode		Recommended	
	Horizontal Fixed Position	Vertical Fixed Position [1]	Class	Size	Amps	Volts
First Pass	Downhill	Bead	See Note 5 Above	All	100 to 170	26 to 28
Hot Pass [2]	Downhill	Bead	See Note 5 Above	1/8” or 5/32”	120 to 160	24 to 28
Filler Passes	Uphill	Bead	E7016 or E7018	3/32” or 1/8”	100 to 150	22 to 25
Cover Pass	Uphill	Bead	E7016 or E7018	3/32” or 1/8”	100 to 150	22 to 25

[1] Large weave passes shall not be used for the vertically fixed position.
[2] If back welding, use hot-pass techniques for the first back-weld pass. Use conventional filler and cover techniques if multiple passes are required.

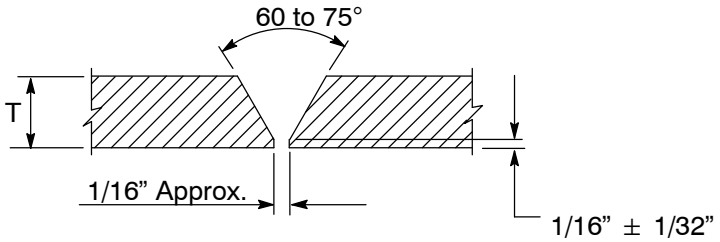
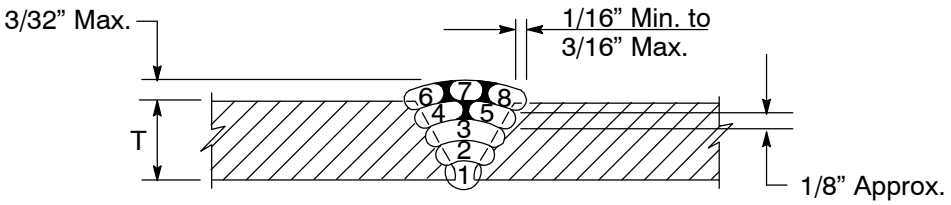


Figure 11
Weld Design With Low-Hydrogen Electrodes



Sequence of Beads (The number and position will vary with changes in the wall thickness, etc.)

Figure 12
Standard V Bevel Butt Joint

Arc Welding Procedure Requirement
All Stress Levels

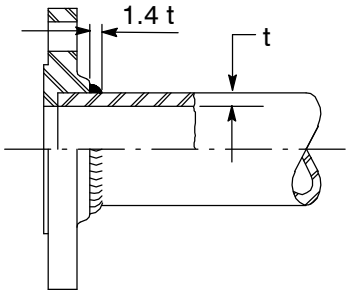


Figure 13
Socket-Welding Flange

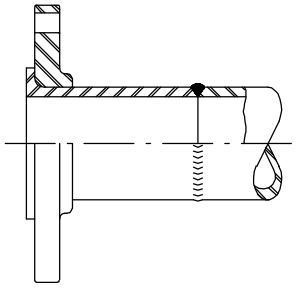


Figure 14
Lap-Joint Flange

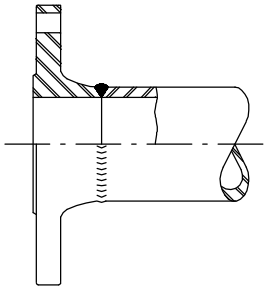
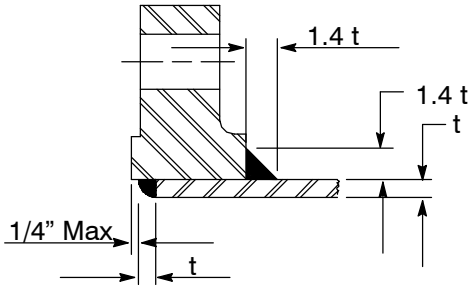
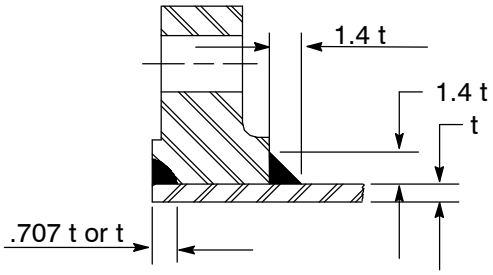


Figure 15
Butt-Welding Flange



Front and Back Weld



Face and Back Weld

Figure 16
Slip-On Flanges

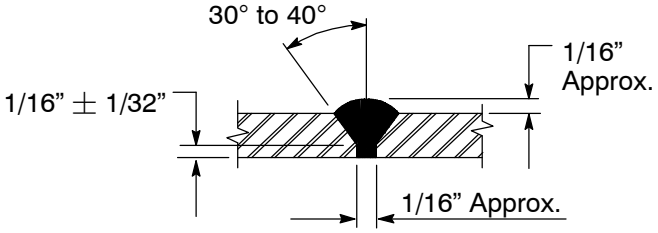
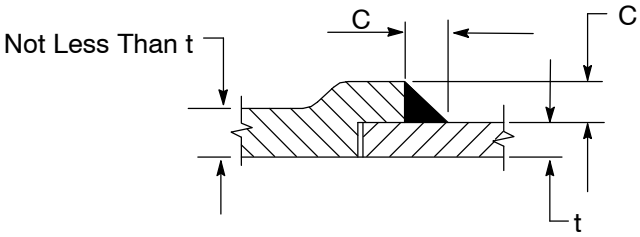


Figure 17
Butt-Welding Joint



t = Wall Thickness Nominal
C $_{Minimum}$ = 1-1/4 t, But Not Less Than 5/32"

Figure 18
Socket-Welding Joint

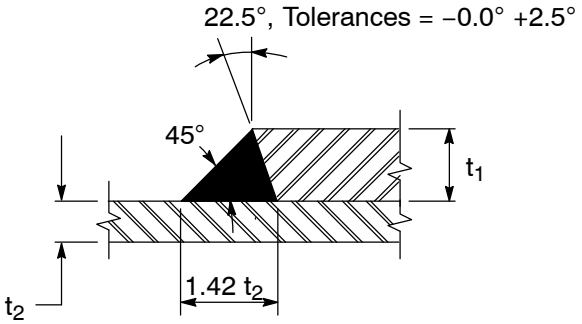


Figure 19
Welding Sleeve Attachments for Any Pipe Diameter
(Must be used for 18" OD and larger pipe.
Refer to Numbered Document A-60 for the weld details.)

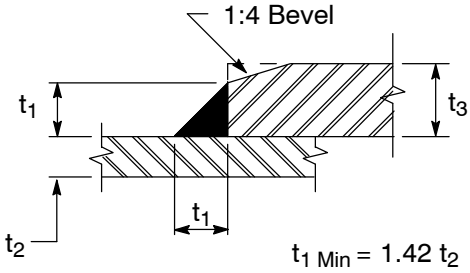


Figure 20
Welding Sleeve Attachments
for 16" OD and Smaller Pipe

A legend of the symbols for Figure 21 and Figure 22 are as follows:
$W_{1\ Min.}$ = 0.375 B, But Not Less Than 1/4”
$W_{2\ Min.}$ = 0.5 M, But Not Less Than 1/4” or t, Whichever is Smaller
N = 1/16” Min., 3/16” Max.

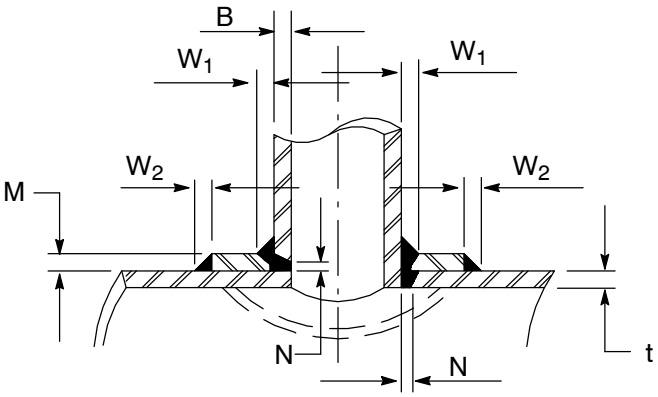


Figure 21
Pad-Type Reinforcement

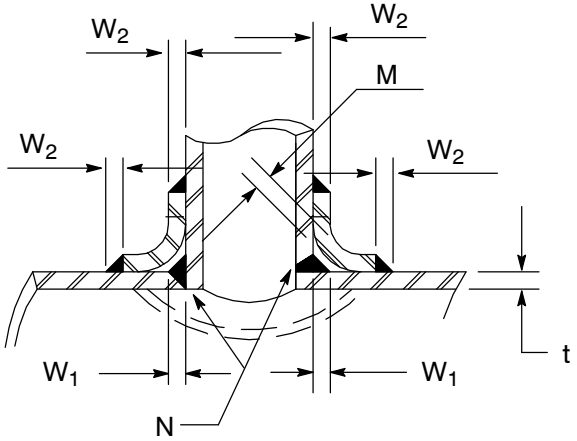
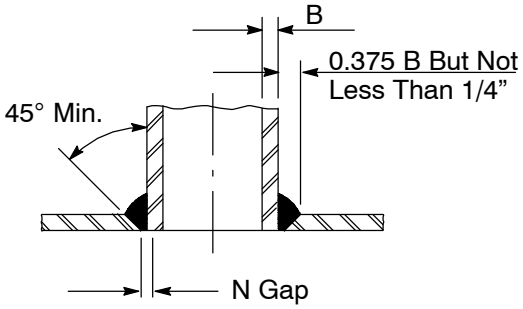
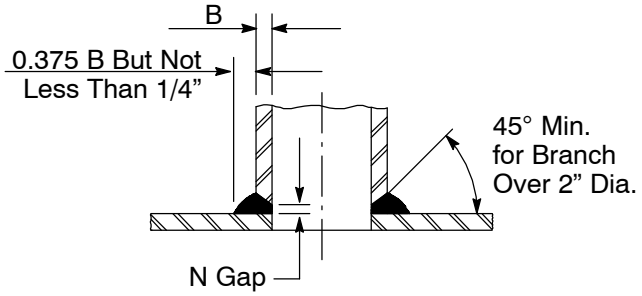


Figure 22
Saddle-Type Reinforcement



Branch Cut Into a Header



Branch-Abutting Header

Figure 23
Welding of Branch Connections Joint Design

Revision Notes

Revision 05 has the following changes:

1. Updated the “Acronyms” section.
2. Clarified the list of the materials to be welded using the procedures in this numbered document. See Item 1 on Page 2.
3. Added the “60 psi” criteria to existing “20% SMYS” criteria in Items 3B, 3D, and 3F on Page 2.
4. Deleted oxyacetylene gas welding from weld procedure selection list in Item 3 on Page 2.
5. Revised Items 3J on Page 3 and 4H on Page 4.
6. Added Item 4K and Table 1 on Page 4.
7. Revised completely Items 5A(2) and 5A(5) on Page 5.
8. Revised Item 7 on Page 6 in several places to clarify language and update requirements.
9. Revised Item 8E on Page 7.

10. Added Item 8H(6) on Page 7.
11. Revised Item 10 on Page 7.
12. Revised Item 12C(2) on Page 8.
13. Deleted former Items 12C(2)(a) and (b).
14. Revised Item 1 on Page 10.
15. Revised a code number for 0.035”, ER70S-6, Lincoln L-56 or equal electrodes in Table 2 on Page 10.
16. Revised an API 5LX material to an API 5L in Table 3 on Page 10.
17. Revised Items 1, 2, 4, and 5 on Page 12.
18. Updated the naming of the weld passes throughout this document.
19. Revised some dimensions in Figures 9, 10, 12, 16, 18, 21, 22, and 23.
20. This document is part of Change 61.

LIMITED SOIL INVESTIGATION REPORT

2610 CONTRA LOMA BOULEVARD
ANTIOCH, CALIFORNIA

PREPARED FOR:
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ENGINEERS/SURVEYORS/PLANNERS
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SAN JOSE, CALIFORNIA 95110

PREPARED BY:
GEOCON CONSULTANTS, INC.
6671 BRISA STREET
LIVERMORE, CALIFORNIA 94550

GEOCON

GEOCON PROJECT NO. E8328-06-01

JULY 2007

GEOCON
CONSULTANTS, INC.
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. E8328-06-01
July 17, 2007

Ms. Christine Neri
BKF Engineers
Engineers/Surveyors/Planners
1650 Technology Drive, Suite 650
San Jose, California 95110

Subject: LIMITED SOIL INVESTIGATION REPORT
STATE ROUTE 4 WIDENING PROJECT
2610 CONTRA LOMA BOULEVARD
ANTIOCH, CALIFORNIA
CALTRANS EA 1A5101

Dear Ms. Neri:

We have prepared this report to document the results of a limited soil investigation at the above-referenced project site. Our scope of services included collection of soil samples, submitting the samples for laboratory analyses, and report preparation. The accompanying report summarizes the services performed and presents the laboratory analytical results.

Please contact us if you have questions concerning the contents of this report or if we may be of further service.

Sincerely,

GEOCON CONSULTANTS, INC.

Chris Giuntoli, CAC, REA
Project Scientist

CHRIS MERRITT, PG (FOR)
Richard Day, CEG, CHG
Regional Manager

PROFESSIONAL GEOLOGIST
CHRISTOPHER G. MERRITT
No. 7156
Exp. 7/09
STATE OF CALIFORNIA

CG:RWD:cg

(1) Addressee
(2) Bonnita Chow – Caltrans District 4
(1) Trudy Presser – CCTA (Nolte Associates)

TABLE OF CONTENTS

LIMITED SOIL INVESTIGATION REPORT — Page

1.0 INTRODUCTION 1
- 1.1 Proposed Improvements 1
- 1.2 General Objectives 1

2.0 BACKGROUND 1

3.0 SCOPE OF SERVICES 2

4.0 RESULTS 3

5.0 CONCLUSIONS AND RECOMMENDATIONS 4

6.0 REPORT LIMITATIONS 5

FIGURES

1. Vicinity Map
2. Site Plan

TABLES

1. Summary of Metals Results
2. Summary of Organics Results

APPENDICES

A. SOMA Environmental Engineering, Inc. Report
B. Analytical Laboratory Reports and Chain-of-Custody Documentation

1.0 INTRODUCTION

We performed a limited soil investigation associated with the 2610 Contra Loma Boulevard property located in Antioch, California (Site). The limited soil investigation was conducted as part of the State Route (SR) 4 Widening Project. The Site consists of a paved asphalt parking area associated with an adjacent Arco gas station on the southern portion of the Site. The approximate Site location is depicted on Figure 1, Vicinity Map.

1.1 Proposed Improvements

The proposed project involves the re-alignment of the exit ramp from eastbound SR 4 to Contra Loma Boulevard and will involve partial acquisition of the northern portion of the 2610 Contra Loma Boulevard property (Assessor Parcel Number [APN] 076-191-015). The project will improve traffic flow exiting SR 4 onto Contra Loma Boulevard.

1.2 General Objectives

There are known impacts to groundwater at the Site (see Section 2.0). The purposes of our scope of services were to evaluate whether impacts due to metals, petroleum hydrocarbons, or volatile organic compounds (VOCs) exist in near surface soil at the Site. The soil sample results will be used to determine if the soil should be classified as a hazardous waste, with respect to contaminant concentrations, in accordance with California Code.

2.0 BACKGROUND

We reviewed a report for the Site titled, *Second Quarter 2006 Groundwater Monitoring and Groundwater Remediation System, Bhalla's Service Station (Former Exxon#73615), 2610 Contra Loma Boulevard, Antioch, California*, prepared by SOMA Environmental Engineering, Inc., and dated July 5, 2006 (SOMA Report). Information presented in the SOMA Report identified petroleum hydrocarbons as gasoline (TPHg) and diesel (TPHd) impacts to groundwater beneath the Site from historical operations of the adjacent gas station. The measured depth to first encountered groundwater at the Site ranged from 16 to 21 feet below ground surface (bgs). The known groundwater impacts originate at the existing ARCO station and extend north under the portion of the Site proposed for partial acquisition. This portion of the Site also contains one groundwater extraction well and associated underground conveyance piping, two piezometers, and six groundwater monitoring wells. The locations of the wells and the groundwater plume extent are presented in the SOMA Report, included in Appendix A.

Prior to commencement of field activities, we prepared a workplan titled, *Draft Site Investigation Workplan, SR 4 Somersville Road to SR 160 Widening Project, Antioch, California*, dated October 25, 2006 (Workplan). The Workplan was submitted to Caltrans for review on October 25, 2006, and Caltrans approved the Workplan on November 1, 2006.

Regulatory criteria to classify waste as a California hazardous waste for handling and disposal purposes are contained in the CCR, Title 22, Division 4.5, Chapter 11, Article 3, §66261.24. Criteria to classify waste as Resource, Conservation, and Recovery Act (RCRA) hazardous are contained in Chapter 40 of the Code of Federal Regulations (40 CFR), Section 261.

For a waste containing metals, the waste is classified as a California hazardous waste when: 1) the total metal content exceeds the respective Total Threshold Limit Concentration (TTLC); or 2) the soluble metal content exceeds the respective Soluble Threshold Limit Concentration (STLC) based on the standard WET analysis. A waste has the potential of exceeding the STLC when the waste's total metal content is greater than or equal to ten times the respective STLC value since the WET uses a 1:10 dilution ratio. Hence, when a total metal is detected at a concentration greater than or equal to ten times the respective STLC, and assuming that 100 percent of the total metals are soluble, soluble metal analysis is required. A material is classified as RCRA hazardous, or Federal hazardous, when the soluble metal content exceeds the Federal regulatory level based on the Toxicity Characteristic Leaching Procedure (TCLP).

State and Federal regulatory levels have also been established for other compounds such as pesticides. The above regulatory criteria are based on chemical concentrations. Wastes may also be classified as hazardous based on other criteria such as ignitability and corrosivity; however, for the purposes of this investigation, toxicity (i.e., lead concentrations) is the primary factor considered for waste classification since waste generated during the construction activities would not likely warrant testing for ignitability or other criteria. Waste that is classified as either a California hazardous waste or a RCRA hazardous waste requires management as a hazardous waste.

3.0 SCOPE OF SERVICES

Prior to the commencement of sampling activities, we marked the proposed soil boring locations at the Site, notified Underground Service Alert (USA) of the planned work, and had a private utility locator clear the boring locations for subsurface utilities. On January 30, 2007, we mobilized to the Site to collect soil samples from six soil borings (DPB-1 through DPB-6) that were advanced using a direct-push rig. The soil boring locations are shown on Figure 2.

Soil borings DPB-1 through DPB-3 were advanced to a maximum depth of approximately 10 feet bgs. Soil borings DPB-4 through DPB-6 were advanced to a maximum depth of approximately 15 feet bgs.

Soil samples from borings DPB-1 through DPB-3 were collected at approximate depths of 1.4 to 1.5 meters (4.5 to 5 ft) bgs and 2.9 to 3.0 meters (9.5 to 10 ft) bgs. At soil borings DPB-4 through DPB-6, soil samples were collected at the approximate depths of 1.4 to 1.6 meters (4.5 to 5 ft) bgs, 2.9 to 3.0 meters (9.5 to 10 ft) bgs, and 4.4 to 4.5 meters (14.5 to 15 feet) bgs.

All of the soil samples were submitted to Advanced Technology Laboratory (ATL) and analyzed for the following:

- California Administration Manual (CAM) 17 metals by Environmental Protection Agency (EPA) Test Method 6010B;
- Mercury by EPA Method 7471A;
- Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX), Methyl Tert-Butyl Ether (MTBE), and VOCs by EPA Method 8260B; and
- Total petroleum hydrocarbons (TPH) [gas, diesel, and motor oil] by EPA Method 8015B(M).

4.0 RESULTS

The findings of the limited site investigation are presented below. Soil sample analytical results are summarized in Tables 1 and 2. Soil boring locations are depicted on Figure 2. Reproductions of laboratory reports and chain-of-custody documentation are presented in Appendix A.

CAM 17 Metals

None of the CAM 17 metal concentrations were above their respective TTLCs or greater than ten times their respective STLCs in any of the soil samples. The CAM 17 Metals results are summarized in Table 1.

Total Petroleum Hydrocarbons

TPH as gasoline (TPHg) was not detected above laboratory reporting limits in any of the soil samples. TPH as diesel (TPHd) was reported in the soil samples at concentrations ranging from <1.0 milligrams per kilogram (mg/kg) to 96 mg/kg. TPH as motor oil (TPHmo) was reported in the soil samples at concentrations ranging from 2.5 mg/kg to 560 mg/kg. The TPH results are summarized in Table 2.

VOCs

VOCs were not detected in any of the soil samples above the reporting limits for the respective compounds. The VOC results are summarized in Table 2.

5.0 CONCLUSIONS AND RECOMMENDATIONS

There are two piezometers, one groundwater extraction well and associated underground conveyance piping, and six groundwater monitoring wells on the northern portion of the Site that will need to be abandoned or protected during project construction. Additionally, excavations that extend into groundwater will encounter petroleum-hydrocarbon-impacted groundwater.

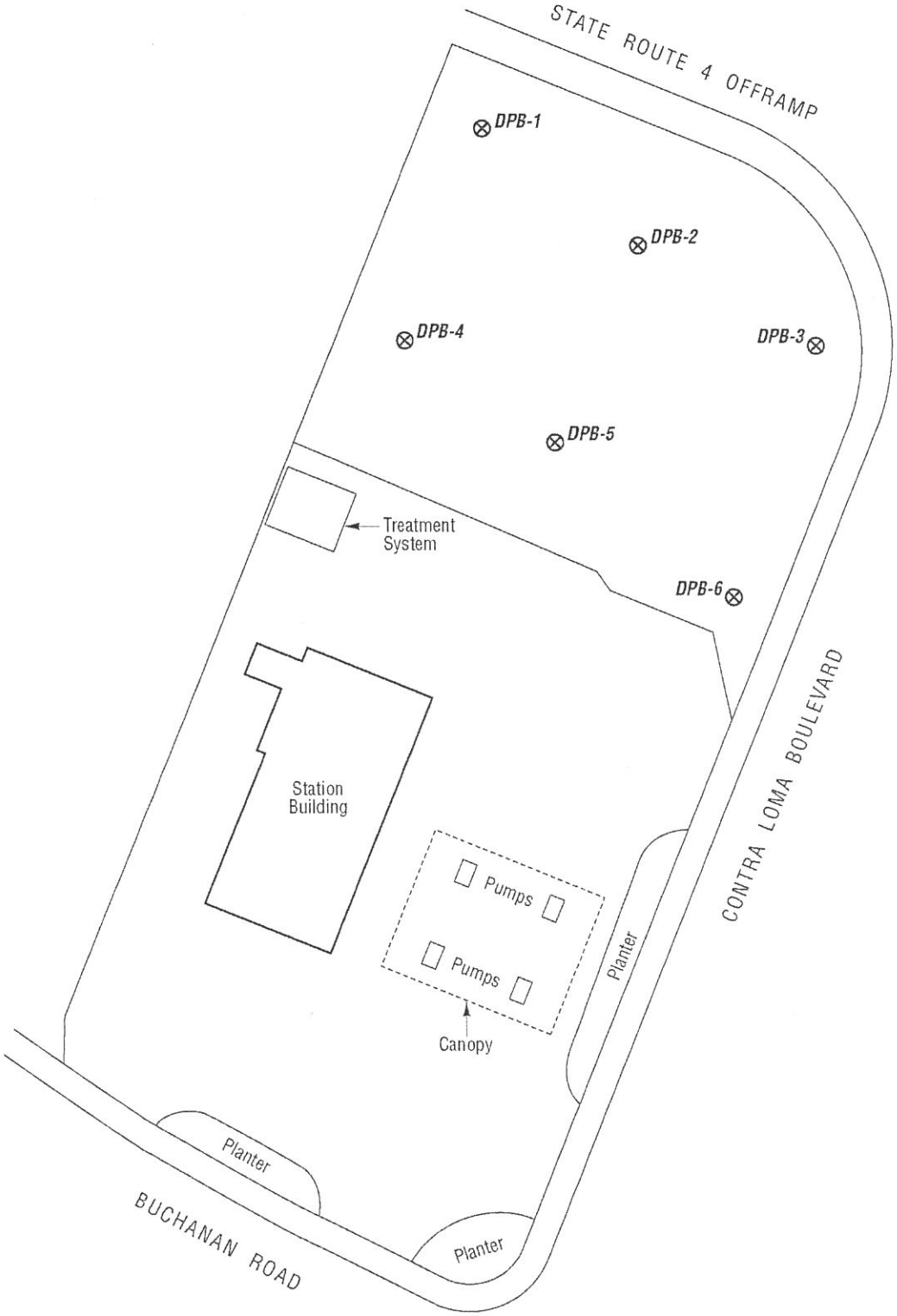
Based on the reported CAM 17 metal concentrations and the lack of VOC detections, soil at the Site will not be classified as a hazardous waste and should not require special handling or disposal practices during construction.

State or Federal waste classification thresholds have not been established for petroleum hydrocarbons. Therefore, soil containing petroleum hydrocarbons is not considered hazardous. The TPHd concentrations are below the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) Environmental Screening Level (ESL) for TPH (middle distillates) in shallow soil of 100 mg/kg for residential and 500 mg/kg for commercial/industrial land use. The TPHmo concentrations are below the SFBRWQCB ESLs for TPH (residual fuels) in shallow soil of 500 mg/kg (residential) and 1,000 mg/kg (commercial/industrial), and deep soil of 1,000 mg/kg (residential and commercial/industrial) land use.

Based on the reported TPHd and TPHmo concentrations, soil disposal options may be restricted due to TPH concentrations. Landfill disposal criteria are facility-specific based on permit conditions established by the regulatory agencies. We anticipate that the contractor may be required to complete a waste profile and may be required to perform additional sampling and analysis prior to acceptance for offsite reuse or disposal. The analytical methods and sample frequency will be dependent on the volume of material to be exported and facility-specific acceptance criteria.

6.0 REPORT LIMITATIONS

This report has been prepared exclusively for BKF. The information contained herein is only valid as of the date of the report, and will require an update to reflect additional information obtained. This report is not a comprehensive site characterization and should not be construed as such. The findings as presented in this report are predicated on the results of the limited sampling and laboratory testing performed. In addition, the information obtained is not intended to address potential impacts related to sources other than those specified herein. Therefore, the report should be deemed conclusive with respect to only the information obtained. We make no warranty, express or implied, with respect to the content of this report or any subsequent reports, correspondence or consultation. We strived to perform the services summarized herein in accordance with the local standard of care in the geographic region at the time the services were rendered.



NOT TO SCALE

LEGEND:

DPB-1 ⊗ Approximate Soil Boring Location

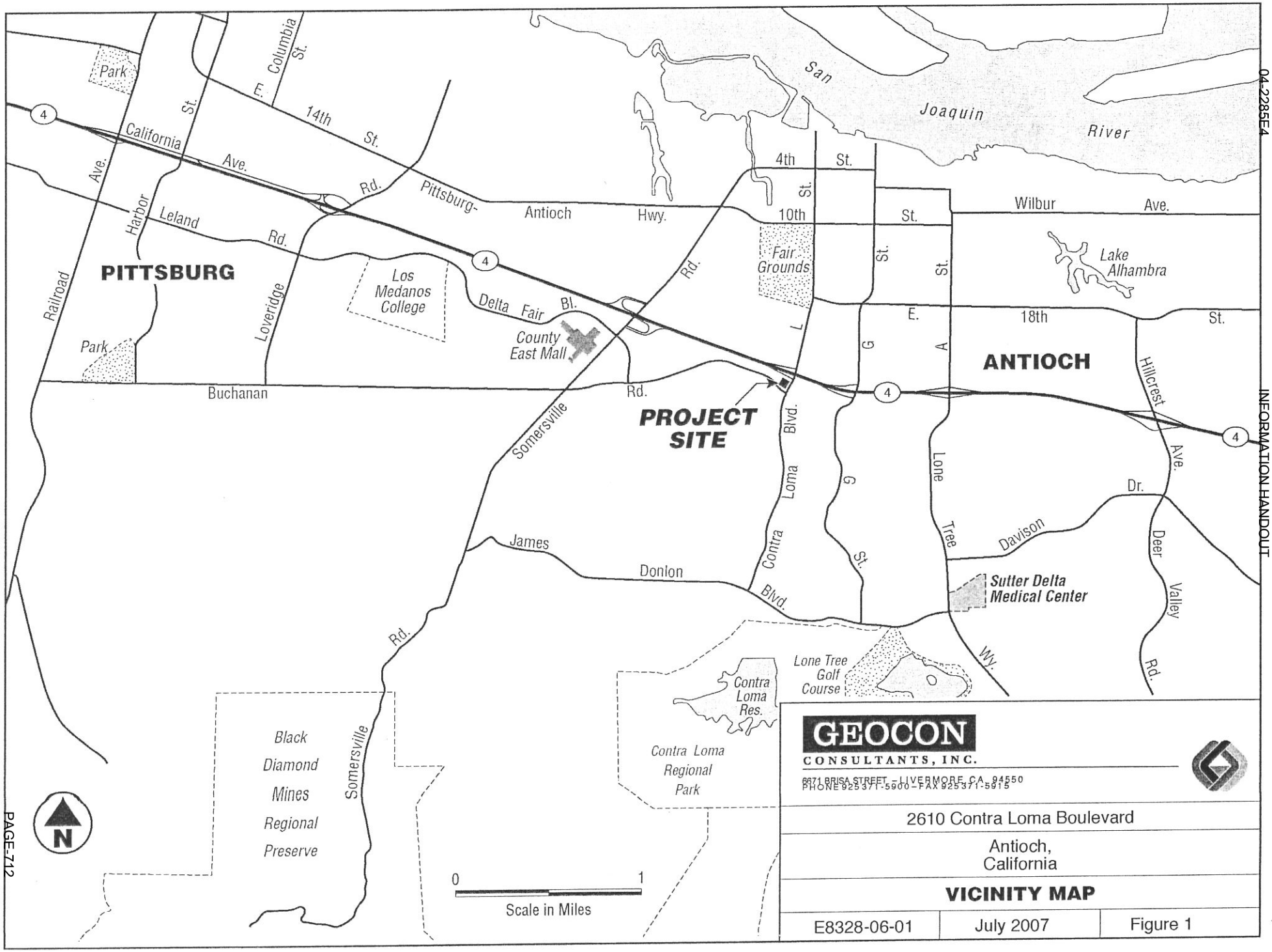
GEOCON
CONSULTANTS, INC.
6671 BRISA STREET – LIVERMORE, CA. 94550
PHONE 925 371-5900 – FAX 925 371-5915

2610 Contra Loma Boulevard

Antioch, California

SITE PLAN

E8328-06-01	July 2007	Figure 2



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2610 Contra Loma Boulevard

Antioch, California

VICINITY MAP

E8328-06-01	July 2007	Figure 1

TABLE 1
Summary of Metals Results
SR 4 Widening
2610 Contra Loma Boulevard
Antioch, California

Sample ID	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Mercury
DPB-1-5	5	<2.0	4.0	130	<1.0	<1.0	18	8.6	18	4.8	<1.0	17	<1.0	<1.0	<1.0	42	40	<0.10
DPB-1-10	10	<2.0	4.1	180	<1.0	<1.0	20	9.1	21	6.5	<1.0	17	<1.0	<1.0	<1.0	47	43	<0.10
DPB-2-5	5	<2.0	3.6	120	<1.0	<1.0	18	8.3	18	4.7	<1.0	16	<1.0	<1.0	<1.0	40	36	<0.10
DPB-2-10	10	<2.0	3.0	140	<1.0	<1.0	17	7.8	18	11	<1.0	15	<1.0	<1.0	<1.0	36	40	<0.10
DPB-3-5	5	<2.0	2.5	99	<1.0	<1.0	29	12	54	6.9	<1.0	26	<1.0	<1.0	<1.0	50	40	0.52
DPB-3-10	10	<2.0	3.5	120	<1.0	<1.0	15	8.1	15	4.3	<1.0	14	<1.0	<1.0	<1.0	41	32	<0.10
DPB-4-5	5	<2.0	3.3	120	<1.0	<1.0	16	7.7	15	4.2	<1.0	15	<1.0	<1.0	<1.0	41	34	<0.10
DPB-4-10	10	<2.0	4.4	140	<1.0	<1.0	20	10	18	6.5	<1.0	20	<1.0	<1.0	<1.0	41	44	<0.10
DPB-4-15	15	<2.0	3.3	160	<1.0	<1.0	22	8.4	24	6.0	<1.0	17	<1.0	<1.0	<1.0	39	49	0.16
DPB-5-5	5	<2.0	3.6	110	<1.0	<1.0	20	8.4	18	4.7	<1.0	20	<1.0	<1.0	<1.0	41	38	<0.10
DPB-5-10	10	<2.0	3.0	210	<1.0	<1.0	20	8.1	16	4.8	<1.0	17	<1.0	<1.0	<1.0	41	33	<0.10
DPB-5-15	15	<2.0	3.4	140	<1.0	<1.0	19	8.6	21	4.5	<1.0	17	<1.0	<1.0	<1.0	44	41	<0.10

TABLE 1
Summary of Metals Results
SR 4 Widening
2610 Contra Loma Boulevard
Antioch, California

Sample ID	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Mercury
DPB-6-5		<2.0	3.3	120	<1.0	<1.0	17	8.3	16	4.4	<1.0	15	<1.0	<1.0	<1.0	40	33	<0.10
DPB-6-10		<2.0	3.5	110	<1.0	<1.0	14	6.7	13	4.0	<1.0	12	<1.0	<1.0	<1.0	35	31	<0.10
DPB-6-15		<2.0	4.9	140	<1.0	<1.0	13	5.9	14	5.0	<1.0	11	<1.0	<1.0	<1.0	35	32	<0.10

Notes:

Results are shown in milligrams per kilogram

< = Not detected above the laboratory reporting limit

TABLE 2
Summary of Organics Results
SR 4 Widening
2610 Contra Loma Boulevard
Antioch, California

Sample ID	Sample Depth (ft)	TPHd (mg/kg)	TPHmo (mg/kg)	TPHg (mg/kg)	VOCs (ug/kg)
DPB-1-5	5	2.3	10	<1.0	ND
DPB-1-10	10	5.5	30	<1.0	ND
DPB-2-5	5	74	370	<1.0	ND
DPB-2-10	10	4.7	25	<1.0	ND
DPB-3-5	5	37	160	<1.0	ND
DPB-3-10	10	5.3	18	<1.0	ND
DPB-4-5	5	2.4	14	<1.0	ND
DPB-4-10	10	5.6	32	<1.0	ND
DPB-4-15	15	6.3	36	<1.0	ND
DPB-5-5	5	5.7	23	<1.0	ND
DPB-5-10	10	3.8	9.1	<1.0	ND
DPB-5-15	15	96	560	<1.0	ND
DPB-6-5	5	5.4	25	<1.0	ND
DPB-6-10	10	3.8	10	<1.0	ND
DPB-6-15	15	<1.0	2.5	<1.0	ND

Notes:

TPHd	= Total Petroleum Hydrocarbons as diesel
TPHmo	= Total Petroleum Hydrocarbons as motor oil
TPHg	= Total Petroleum Hydrocarbons as gasoline
VOCs	= Volatile Organic Compounds by EPA Method 8260B
<=	= Not detected above the laboratory reporting limit
ND	= No compounds detected above the respective laboratory reporting limits
mg/kg	= milligrams per kilogram
ug/kg	= micrograms per kilogram

APPENDIX A

ENVIRONMENTAL ENGINEERING, INC
6620 Owens Drive, Suite A • Pleasanton, CA 94588-3334
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July 5, 2006

Ms. Pat Vellines, Engineering Geologist
Regional Water Quality Control Board
11020 Sun Center Drive, Suite 200
Rancho Cordova, CA 95670-6114

Subject: Site Located at 2610 Contra Loma Boulevard, Antioch, California

Dear Pat:

Enclosed for your review is SOMA's "Second Quarter 2006 Groundwater Monitoring Report" for the subject site. This report has been uploaded to the State's GeoTracker database.

Thank you for your time in reviewing our report. Please do not hesitate to call me at (925) 734-6400, if you have any questions or comments.

Sincerely,

Mansour Sepehr, Ph.D., PE
Principal Hydrogeologist

REGISTERED PROFESSIONAL ENGINEER
MANSOUR SEPEHR
No. C042028
Exp. 3-31-08
CIVIL
STATE OF CALIFORNIA

Enclosure

cc: Mr. Jagdish Bhalla w/enclosure
Ms. Janice Jacobson, Environmental Resolutions, Inc. w/enclosure
Mr. Paul Andrews, Contra Costa Health Services, Martinez w/enclosure

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Second Quarter 2006 Groundwater Monitoring and Groundwater Remediation System

Bhalla's Service Station (Former Exxon#73615)
2610 Contra Loma Boulevard
Antioch, California

July 5, 2006

Project 2701

Prepared for

Mr. Jagdish Bhalla
2610 Contra Loma Boulevard
Antioch, California

Prepared by

SOMA Environmental Engineering, Inc.
6620 Owens Drive, Suite A
Pleasanton, California

Certification

This report has been prepared by SOMA Environmental Engineering, Inc. on behalf of Mr. Jagdish Bhalla, for the property located at 2610 Contra Loma Boulevard, Antioch, California, to comply with the requirements of the Central Valley Regional Water Quality Control Board for the Second Quarter 2006 groundwater monitoring event.

Mansour Sepehr, Ph.D., P.E.
Principal Hydrogeologist

REGISTERED PROFESSIONAL ENGINEER
MANSOUR SEPEHR
No. C042928
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CIVIL
STATE OF CALIFORNIA

TABLE OF CONTENTS

CERTIFICATION II

TABLE OF CONTENTS III

LIST OF FIGURES IV

LIST OF TABLES V

LIST OF APPENDICES V

1.0 INTRODUCTION 1

1.1 PREVIOUS ACTIVITIES 1

2.0 RESULTS 3

2.1 FIELD MEASUREMENTS IN THE UPPER WATER-BEARING ZONE 3

2.2 LABORATORY ANALYSIS IN THE UPPER WATER-BEARING ZONE 4

2.3 FIELD MEASUREMENTS AND LABORATORY ANALYSIS IN THE LOWER ZONE 5

3.0 GROUNDWATER TREATMENT SYSTEM OPERATION 6

4.0 CONCLUSION AND RECOMMENDATIONS 7

5.0 REPORT LIMITATIONS 8

List of Figures

Figure 1: Site vicinity map.

Figure 2: Site map showing approximate locations of existing monitoring wells, piezometers, groundwater extraction wells, air sparging wells, vapor extraction wells, the groundwater treatment system and newly installed groundwater monitoring wells.

Figure 3: Groundwater elevation contour map in feet, in the Upper Water Bearing-Zone. May 23, 2006.

Figure 4: Contour map of TPH-g concentrations in groundwater, in the Upper Water Bearing-Zone. May 23-24, 2006.

Figure 5: Contour map of TPH-d concentrations in groundwater, in the Upper Water Bearing-Zone. May 23-24, 2006.

Figure 6: Contour map of MtBE concentrations in groundwater, in the Upper Water Bearing-Zone (EPA Method 8260B). May 23-24, 2006.

Figure 7: Contour map of TBA concentrations in groundwater, in the Upper Water Bearing-Zone. May 23-24, 2006.

Figure 8: Groundwater elevation contour map in feet, in the Lower Water Bearing-Zone. May 23, 2006.

Figure 9: Map showing TPH-g, TPH-d, MtBE and TBA concentrations in groundwater, in the Lower Water Bearing-Zone. May 23, 2006.

Figure 10: Schematic diagram of the groundwater treatment system located at 2610 Contra Loma Blvd, Antioch, CA

List of Tables

Table 1: Historical Groundwater Elevation Data and Analytical Results

Table 2: Historical Groundwater Analytical Data
Gasoline Oxygenates, Lead Scavengers, Ethanol, & Methanol

Table 3: Total Volume of Treated Water, Historical Effluent Chemical Analytical Results, and Operational History of Remediation System

Table 4: Cumulative Masses of Petroleum Hydrocarbons & MtBE Removed from Groundwater Since Installation of Treatment System

List of Appendices

Appendix A: SOMA's Groundwater Monitoring Procedures

Appendix B: Table of Elevations & Coordinates on Monitoring Wells Measured by Harrington Surveys, Inc., and Field Measurements of Physical, Chemical, & Biodegradation Parameters of the Groundwater Samples at Time of Sampling

Appendix C: Laboratory Reports and Chain of Custody Forms for the Second Quarter 2006 Monitoring Event

Appendix D: Laboratory Report and Chain of Custody Form for the Groundwater Treatment System Samples

1.0 INTRODUCTION

This monitoring report has been prepared by SOMA Environmental Engineering, Inc. (SOMA) on behalf of Mr. Jagdish Bhalla, the property owner of 2610 Contra Loma Boulevard, Antioch, California ("the Site"). The Site is an active gasoline service station operating under the name of Bhalla's Gas and Auto Service. Figure 1 shows the location of the Site.

This report summarizes the results of the Second Quarter 2006 groundwater monitoring event conducted at the Site on May 23-24, 2006 and includes the laboratory analytical results on the groundwater samples.

A natural attenuation study was conducted during this monitoring event. The objective of the natural attenuation study was to evaluate whether the petroleum hydrocarbons found in the groundwater were biodegrading.

These activities were performed in accordance with the general guidelines of the Central Valley Regional Water Quality Control Board (CVRWQCB). Appendix A details the groundwater monitoring procedures implemented during this monitoring event.

This report also details the historic operation of the groundwater treatment system and includes an estimate of the amount of contaminants removed from the subsurface.

1.1 Previous Activities

In September 1987, four steel underground storage tanks (USTs) were removed from the Site. One 1,000-gallon waste oil UST reportedly showed evidence of leakage. Following the removal of the tanks, the existing gasoline USTs were installed; the diesel UST was installed at a later date.

From January 1991 to January 2000, Environmental Science and Engineering (ESE) conducted site investigations. This included drilling two soil borings, advancing eight direct push soil borings, installing seven groundwater monitoring wells, two recovery wells, three piezometers, two vapor sparging wells, and two air sparging/soil vapor extraction wells. Figure 2 illustrates the locations of the wells.

In May 1994, soil vapor extraction (SVE) and groundwater treatment systems were installed. During Fourth Quarter 1998, air sparging (AS) was initiated at the Site. From July 1999 to February 2000, the AS/SVE system was shutdown for the installation of a biofilter. In July 2001, Environmental Resources, Inc. (ERI) shut the remediation systems down.

In February 2003, the CVRWQCB requested an enhanced leak detection (ELD) test be conducted to determine whether or not a release occurred during the Site's current ownership. On May 21, 2003, SOMA oversaw the performance of an ELD test at the Site. The results of the ELD test revealed that the USTs and the associated piping were releasing vapor phase petroleum hydrocarbons. The results of the ELD test are presented in SOMA's "Enhanced Leak Test Report," dated June 25, 2003.

In March 2004, SOMA conducted an additional soil and groundwater investigation at the Site. Based on this study there appears to be an upper ("Upper") and lower ("Lower") water-bearing zone, with an intervening confining zone, underlying the Site. Petroleum hydrocarbons and Methyl tertiary Butyl Ether (MtBE) were detected in the Upper and Lower water-bearing zones. The results of the Cone Penetrometer Test (CPT) study and the existing lithologic logs indicated that wells MW-1 and MW-5 appear to be cross-contaminating the Lower water-bearing zone, due to their longer screen intervals.

Pneumatic slug test results showed that hydraulic conductivity ranges between 1.44 feet/day and 25.5 feet/day in the Upper water-bearing zone and 6.5 and 106 feet/day in the Lower water-bearing zone. Since 1999, the MtBE plume has shown a dramatic increase around the USTs. Based on the January 2004 monitoring event, the MtBE plume may have migrated beyond the Site's northeastern boundary. Based on SOMA's groundwater flow model, a pumping rate of five gallons per minute (gpm) from EW-101 will prevent further migration of the chemically-impacted groundwater.

In October 2004, SOMA oversaw the installation of two Upper water-bearing zone wells (MW-8U and MW-9U), and one Lower water-bearing zone well (MW-10L). The wells were installed to further delineate the extent of the groundwater plume. On November 4, 2004, SOMA oversaw the decommissioning of wells MW-1 and MW-5. The field activities associated with the well installation and decommissioning are presented in SOMA's "Shallow and Lower Zone Monitoring Well Installation and Well Decommissioning Report, Bhalla's Gas and Auto Service, at 2610 Contra Loma Boulevard, Antioch, California," dated November 11, 2004. The well locations are shown on Figure 2.

Also, based upon the request of the CVRWQCB, SOMA received approval from Delta Diablo Sanitation District, on January 3, 2005, to begin discharging the treated groundwater into the on-site sewer main.

In March 2006, SOMA oversaw the installation of two Lower water-bearing zone wells (MW-11L and MW-12L) and one Upper water-bearing zone well (MW-10U). The Upper zone well was installed off-site to determine the extent of the MtBE plume and the two Lower zone wells were installed to define the Lower water-bearing zone and to determine the groundwater flow direction.

2.0 RESULTS

The following sections provide the results of the field measurements and laboratory analyses for this groundwater monitoring event.

2.1 Field Measurements in the Upper Water-Bearing Zone

Table 1 presents the depths to groundwater, as well as the corresponding groundwater elevations for the monitoring wells. Depths to groundwater in the Upper water-bearing zone ranged from 16.19 feet in well MW-10U to 21.46 feet in well MW-7A. The corresponding groundwater elevations ranged from 19.70 feet in well MW-10U to 21.31 feet in well MW-8U. The lowest overall groundwater elevation was in extraction well EW-101 at 14.63 feet.

The groundwater elevation contour map for the Upper water-bearing zone is displayed in Figure 3. The measured groundwater elevation data shows that the extraction well is providing excellent hydraulic control and preventing further migration of the contaminants. The groundwater flow direction is towards the extraction well at a gradient of approximately 0.108 feet/feet. A rose diagram was not included within the groundwater elevation figure because the overall groundwater flow direction is towards extraction well EW-101.

Refer to Table 1 for the historical site-wide groundwater elevation trends.

The field notes for the physical, chemical and biodegradation parameters measured during this monitoring event are included in Appendix B. The more positive the redox potential of an electron acceptor, the more energetically favorable is the reaction utilizing that electron acceptor. The most energetically preferred electron acceptor for redox reactions is dissolved oxygen (DO). Evaluating the distribution of electron acceptors can provide evidence of where and to what extent hydrocarbon biodegradation is occurring.

Detectable DO concentrations ranged from 2.17 mg/L in well MW-9U to 8.58 mg/L in well MW-8U. ORP showed negative redox potentials in wells MW-2 and MW-3. Oxidation of petroleum hydrocarbons could be occurring in wells MW-2 and MW-3. Negative redox potentials indicate that contaminants in the groundwater are conducive to anaerobic biodegradation.

Ferrous iron concentrations can be used as an indicator of anaerobic biodegradation. Detectable ferrous iron concentrations ranged from 0.2 mg/L in well MW-7A to the equipment's maximum allowable tolerance range of 3.30 mg/L in well MW-3. Ferrous iron was not detected in well MW-9U.

Nitrate concentrations were below the equipment's minimum allowable level in wells MW-2 and MW-3. Detectable nitrate concentrations ranged from 4.2 mg/L in well MW-8U to 14.3 mg/L in well MW-10U. High ferrous iron concentrations in

combination with non-detectable nitrate levels are indicative of anaerobic biodegradation beneath the Site.

The absence of sulfate in the groundwater samples may be indicative of an anaerobic methanogenesis process. However, during this monitoring event, sulfate concentrations were at the equipment's maximum allowable tolerance range of 80 mg/L in all of the wells, with the exception of well MW-6A (27 mg/L).

2.2 Laboratory Analysis in the Upper Water-Bearing Zone

The historical total petroleum hydrocarbons as gasoline (TPH-g), total petroleum hydrocarbons as diesel (TPH-d), benzene, toluene, ethylbenzene, total xylenes (BTEX), and Methyl tertiary Butyl Ether (MtBE) groundwater analytical data are shown in Table 1. The historical gasoline oxygenates and lead scavenger groundwater analytical results are shown in Table 2. Ethanol analytical results are also shown in Table 2.

TPH-g was detected in well MW-2 at 5,860 ug/L, and was below the laboratory reporting limit in the remaining tested Upper water-bearing zone wells. Figure 4 displays the contour map of TPH-g concentrations in the Upper water-bearing zone. There appears to be one distinct TPH-g plume located in the vicinity of the UST cavity, around well MW-2.

TPH-d was detected in wells MW-2, MW-3, and MW-6A at 939 ug/L, 257 ug/L, and 134 ug/L, respectively; TPH-d was below the laboratory reporting limit in the remaining Upper water-bearing zone wells. The TPH-d concentration detected in the wells may have been misrepresentative. The laboratory designated these variations in the analytical testing by using D-06, D-09, D-30, and D-35 flags. The laboratory report presented in Appendix C and Table 1 provide further clarification.

Figure 5 displays the contour map of TPH-d concentrations in the Upper water-bearing zone. TPH-d appears to have originated in the vicinity of the UST cavity, around well MW-2. The plume appears to have migrated off-site towards well MW-6A.

All BTEX concentrations were below the laboratory reporting limit in all of the groundwater samples collected throughout this zone, with the exception of the sample collected from well MW-2. In well MW-2, ethylbenzene was detected at 45.1 ug/L. No iso-concentration figure was drawn for the BTEX constituents due to the mostly non-detectable levels throughout this zone.

MtBE was below the laboratory reporting limit in all wells except MW-6A, MW-7A, MW-9U, and MW-10U; MtBE was detected in these wells at 1,380 ug/L, 1.2 ug/L, 1.54 ug/L, and 176 ug/L, respectively. Figure 6 displays a contour map of MtBE concentrations in the Upper water-bearing zone. The highest MtBE concentration

was detected in well MW-6A. This denotes that the MtBE plume has migrated northeasterly from the UST cavity. However, the MtBE plume is centrally located around well MW-6A, and has shown a decreasing trend in this well.

Tert-Butyl-Alcohol (TBA) appears to be the main constituent of concern. All other gasoline oxygenates, lead scavengers, and ethanol constituents were below the laboratory reporting limit throughout the Upper water-bearing zone.

Figure 7 displays a contour map of TBA concentrations in the Upper water-bearing zone. The highest TBA concentration was detected northwest of the UST cavity, in well MW-3 at 7,090 ug/L; the plume appears to have migrated off-site to well MW-6A. However, TBA was not deteted in off-site wells MW-9U, MW-10U or MW-7A, as well as, on-site well MW-2.

Appendix C includes the laboratory report and chain-of-custody (COC) form for this groundwater monitoring event.

2.3 Field Measurements and Laboratory Analysis in the Lower Zone

Table 1 presents the depths to groundwater, as well as the corresponding groundwater elevations for the monitoring wells. Depths to groundwater in the Lower water-bearing zone ranged from 16.56 feet in well MW-12L to 21.50 feet in well MW-10L. The corresponding groundwater elevations ranged from 19.76 feet in well MW-10L to 20.27 feet in well MW-12L.

The groundwater elevation contour map for the Lower water-bearing zone is displayed in Figure 8. The groundwater flow direction is north to northeasterly across the Site, at a gradient of approximately 0.002 feet/feet.

Detectable DO concentrations ranged from 2.40 mg/L in well MW-10L to 5.60 mg/L in well MW-12L. ORP showed positive redox potentials in all Lower water-bearing zone wells MW-10L through MW-12L. Positive redox potentials indicate reactions are more energetically favorable in utilizing electron acceptors. The utilization of electron acceptors promotes the removal of organic mass from the contaminated groundwater by indigenous bacteria in the subsurface during the release of the transfer of electrons.

Ferrous iron concentrations were below the equipment's minimum allowable level in wells MW-10L and MW-11L, and detected at 0.74 mg/L in well MW-12L. Nitrate concentrations were above the equipment's maximum allowable level (35 mg/L) in wells MW-10L and MW-11L, and below the equipment's minimum allowable level in well MW-12L. Sulfate concentrations were above the equipment's maximum allowable level (80 mg/L) in wells MW-10L to MW-12L.

The field notes for the physical, chemical and biodegradation parameters measured during this monitoring event are included in Appendix B.

Based on the lab results, TPH-g was only detected in well MW-12L at 55.9 ug/L; TPH-d was detected in wells MW-10L and MW-12L at 102 ug/L and 75.1 ug/L, respectively; low MtBE concentrations were detected in all the Lower water-bearing zone wells MW-10L through MW-12L, at 0.95 ug/L, 0.89 ug/L, and 1.86 ug/L, respectively. Figure 9 displays the TPH-g, TPH-d, MtBE, and TBA concentrations in Lower water-bearing zone groundwater.

3.0 Groundwater Treatment System Operation

On December 2, 2003, SOMA proposed to evaluate the effectiveness of the existing groundwater remediation system and conduct groundwater flow modeling. The results of the groundwater flow modeling indicated that pumping at a rate of four gallons per minute (gpm), from well EW-101, would create a sizeable capture zone and prevent further migration of the impacted groundwater to the off-site areas.

The previously existing on-site groundwater remediation system was removed on November 16, 2004 and replaced with a Granular Activated Carbon (GAC) adsorption system on November 24, 2004. On January 3, 2005, SOMA received approval from Delta Diablo Sanitation District to begin discharging the treated groundwater into the on-site sewer main. The GAC system was initially started on January 10, 2005. The location of the treatment system is shown in Figure 2.

Since the initial start-up of the system to June 8, 2006, approximately 171,840 gallons of groundwater has been treated and discharged into the on-site sewer main, under the existing Delta Diablo Sanitation District, Special Discharge permit.

To determine whether the treated discharged groundwater from the treatment system to the site's sewer main remains below the discharge permit's limits, samples are routinely collected from the system effluent. Table 3 presents the total volume of treated groundwater, as well as the chemical composition of the samples collected at the system effluent. The discharged groundwater from the treatment system has remained in compliance with the permit's requirements.

Table 3 also presents the historical operational data for the remedial system. A carbon change-out was conducted on April 19, 2006; at this time the 2,000 pound carbon vessel was refurbished with newer carbon and the 55-gallon polishing vessel was replaced.

Treatment system influent samples have been collected to evaluate the mass removal rate of impacted groundwater by the remedial system. Table 4 shows the cumulative masses of TPH-g, TPH-d, and MtBE.

Figure 10 shows the schematic diagram of the treatment system. The most current laboratory reports for the groundwater treatment system samples are included in Appendix D. TBA was detected throughout the remedial system during the June 2006 system sampling. TBA was tested to reflect the overall groundwater concentration pattern being treated by the remedial system; however, TBA is not a required constituent for observation by the Delta Diablo Sanitation District.

4.0 CONCLUSION AND RECOMMENDATIONS

This was the first time newly installed wells MW-10U, MW-11L, and MW-12L were monitored; further monitoring events will aid in determining groundwater flow patterns and concentrations trends at these locations. However, based on the results from this groundwater monitoring event, the following can be summarized.

- The reduction in off-site migration can be attributed to the capture zone created by the extraction well. Low or non-detectable levels for all constituents were observed in Upper water-bearing zone wells MW-7A, MW-8U to MW-10U, and Lower water-bearing zone wells MW-10L to MW-12L. Well MW-6A showed a slight increase in TPH-d and TBA, and a decrease in TPH-g and MtBE concentrations.

- The bio-attenuation study confirmed the occurrence of biodegradation at the Site and determined the affected areas to be in the vicinity of the USTs and fuel islands, around wells MW-2 and MW-3.

- The hydrocarbon (TPH-g and TPH-d) source region in the Upper water-bearing zone appears to be centrally located north of the fuel islands, around well MW-2. Based on the results of the enhanced leak detection (ELD) test, conducted on May 21, 2003, as well as the quarterly monitoring events, the region around the associated product line piping may have been impacted by the release of vapor phase petroleum hydrocarbons. The higher concentrations detected in well MW-2 may be the result of a release of vapor phase hydrocarbons into the groundwater.

- The highest MtBE concentration was detected in the northeastern section of the Site, in well MW-6A. This is attributable to the high mobility rate of this compound in groundwater. However, MtBE has shown a significant decreasing trend since March 2005, with the exception of a slight increase between September 2005 and November 2005.

- The GAC remediation system began operating on January 10, 2005. Since the initial start-up of the remedial system, the migration of impacted groundwater has greatly reduced.

- In general, MtBE has shown a decreasing trend throughout the Site, especially in well MW-3; TBA, however, appears to have slightly increased in wells MW-3 and MW-6A. TBA is formed in the environment through oxidation of MtBE in the atmosphere followed by hydrolysis or through microbial oxidation of MtBE in impacted aquifer materials.

SOMA recommends the following action items:

1. Routine monitoring of the Site's remedial activities to determine the efficiency of the treatment system in removing contaminant mass from the groundwater.

2. Continued quarterly monitoring programs to better understand the seasonal variation in the groundwater quality conditions and rate of contaminant removal.

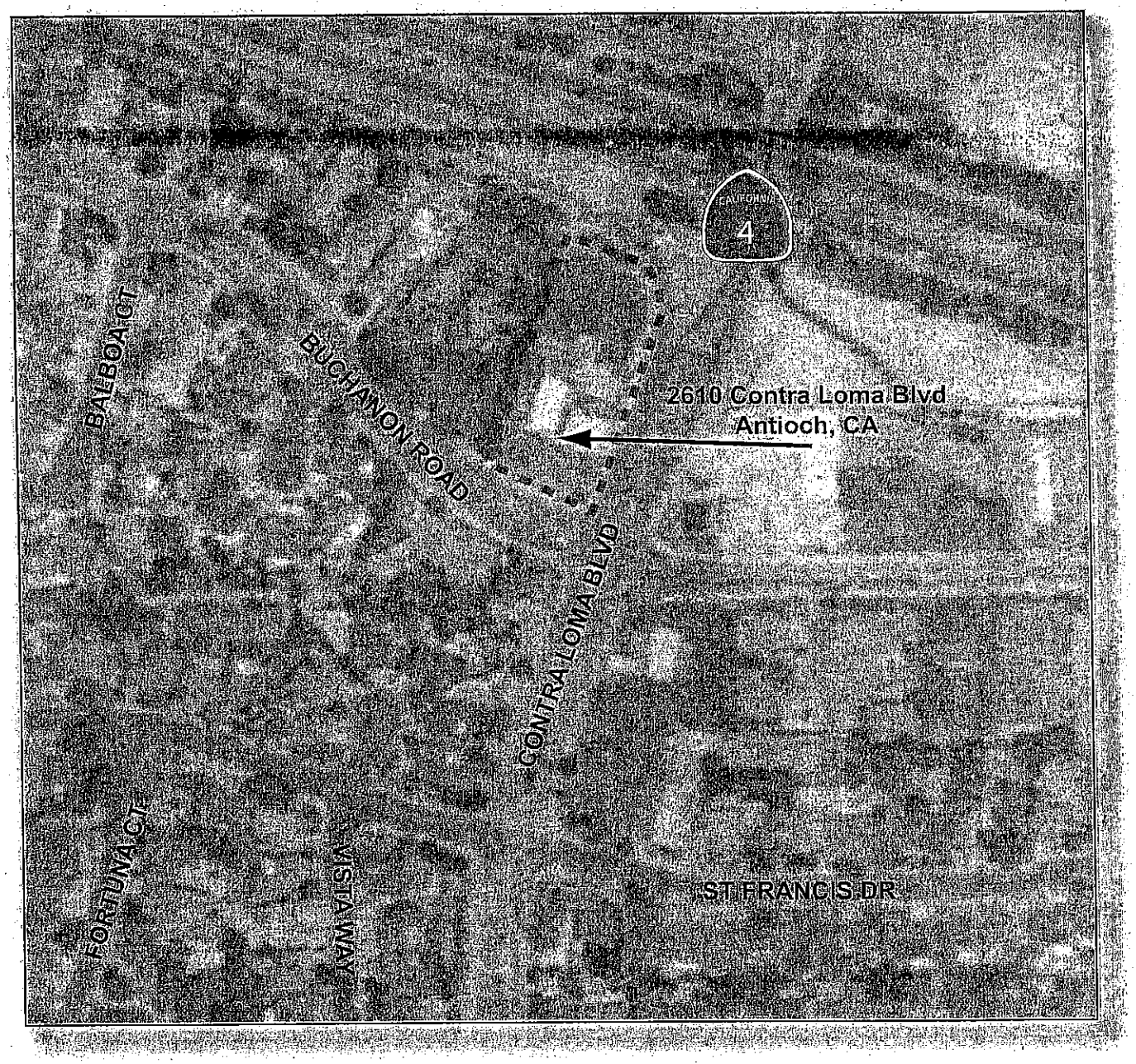
3. Continued monitoring of the bio-attenuation parameters to determine whether biodegradation alone could be a feasible option for the significant reduction of petroleum hydrocarbon concentrations. In general, based on the observed low to non-detectable levels of nitrate in several wells, with the exception of wells MW-10L and MW-11L, injection of nitrate into the groundwater may enhance biodegradation.

5.0 REPORT LIMITATIONS

This report is the summary of work done by SOMA, including observations and descriptions of the Site's conditions. It includes the analytical results produced by Pacific Analytical Laboratory for the current groundwater monitoring event. The number and location of the wells were selected to provide the required information, but may not be completely representative of the entire site's conditions. All conclusions and recommendations are based on the results of the laboratory analysis. Conclusions beyond those specifically stated in this document should not be inferred from this report.

SOMA warrants that the services provided were done in accordance with the generally accepted practices in the environmental engineering and consulting field at the time of this sampling.

Figures



N

approximate scale in feet

0 200 400

Figure 1: Site vicinity map.

ENVIRONMENTAL ENGINEERING, INC.

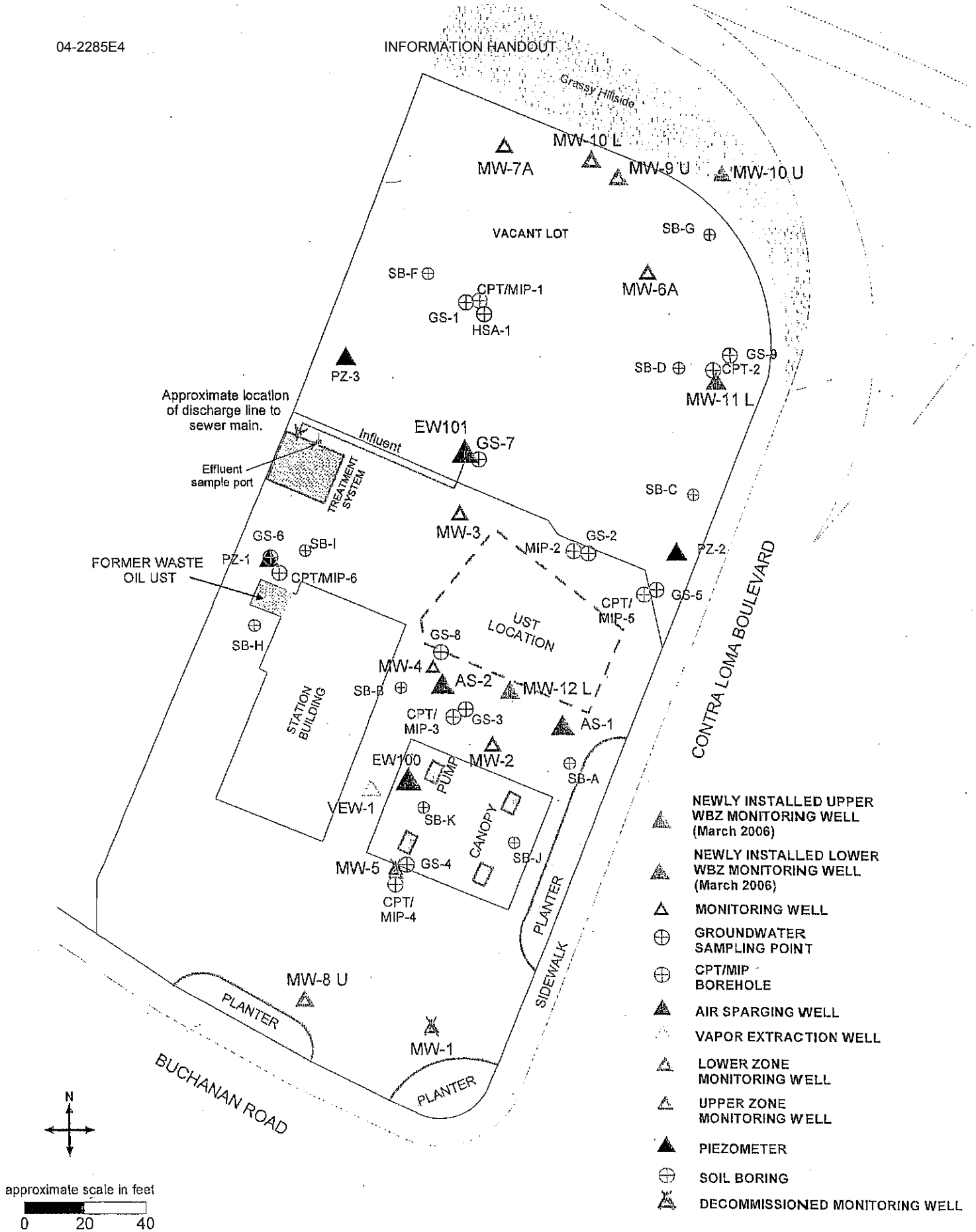
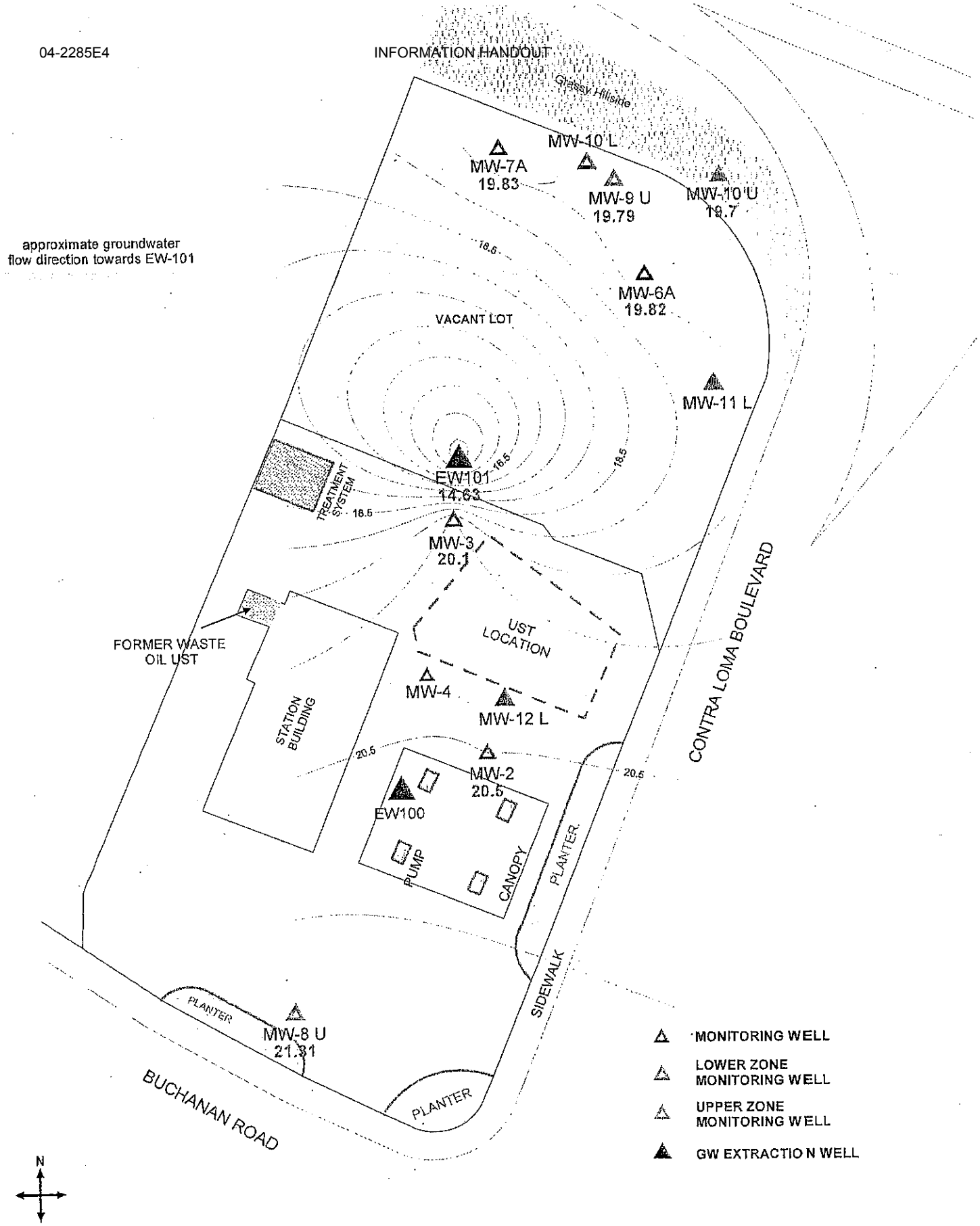


Figure 2: Site map showing approximate locations of existing monitoring wells, piezometers, groundwater extraction wells, air sparging wells, vapor extraction wells, the groundwater treatment system and newly installed groundwater monitoring wells.

ENVIRONMENTAL ENGINEERING, INC



approximate scale in feet

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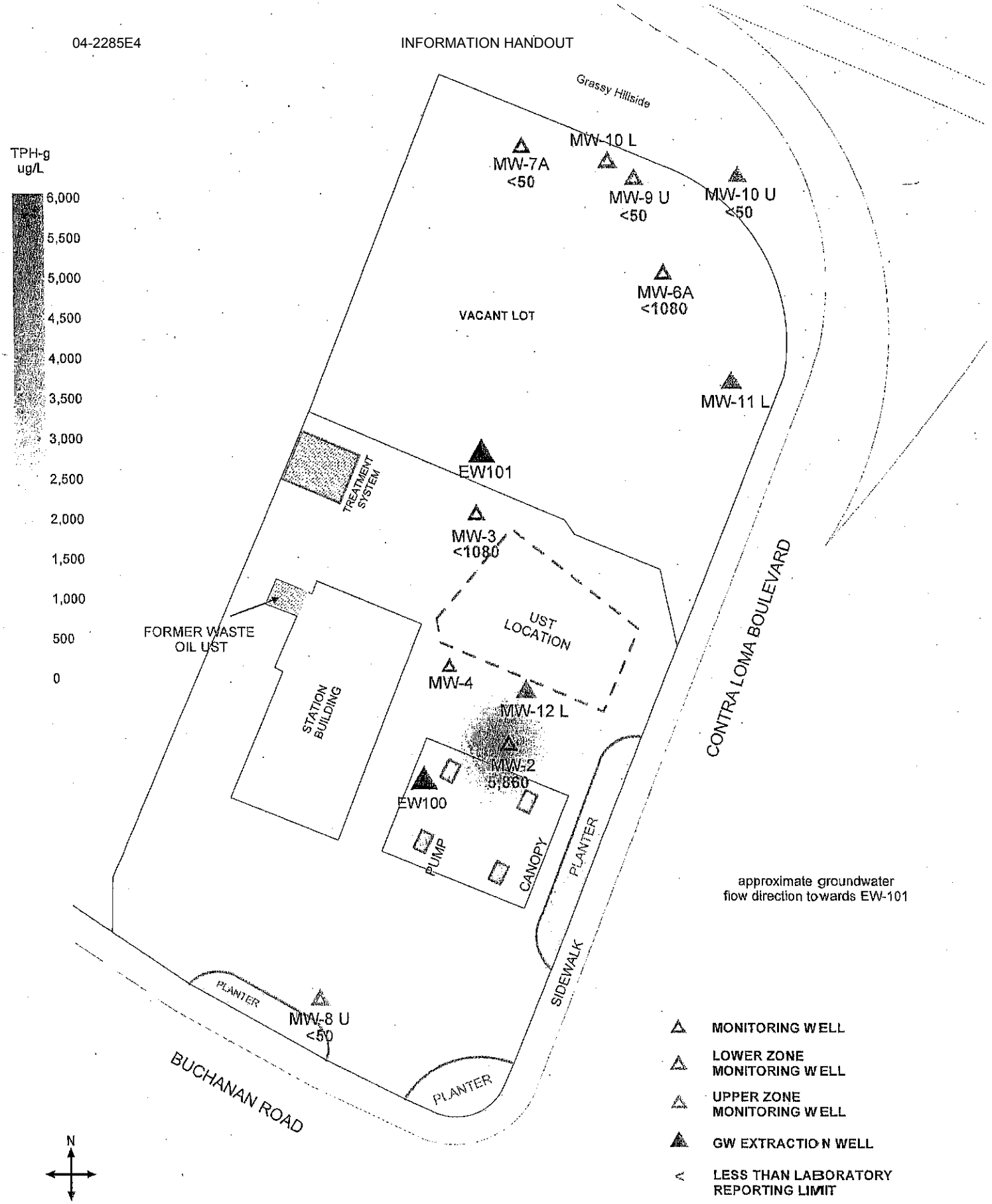
Figure 3: Groundwater elevation contour map in feet, in the Upper Water Bearing-Zone. May 23, 2006.

ENVIRONMENTAL ENGINEERING, INC.



approximate scale in feet
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Figure 4: Contour map of TPH-g concentrations in groundwater, in the Upper Water Bearing-Zone. May 23-24, 2006.

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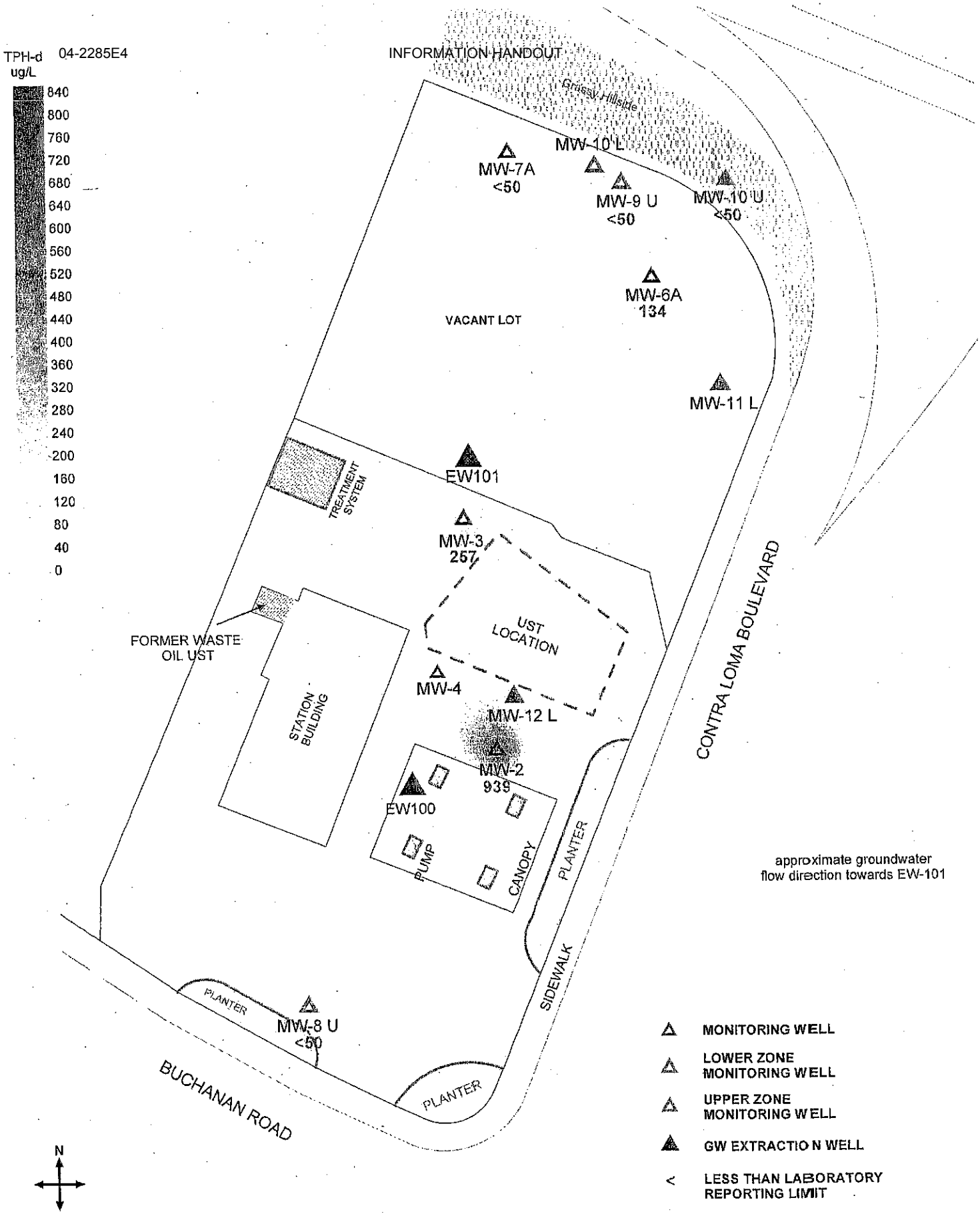
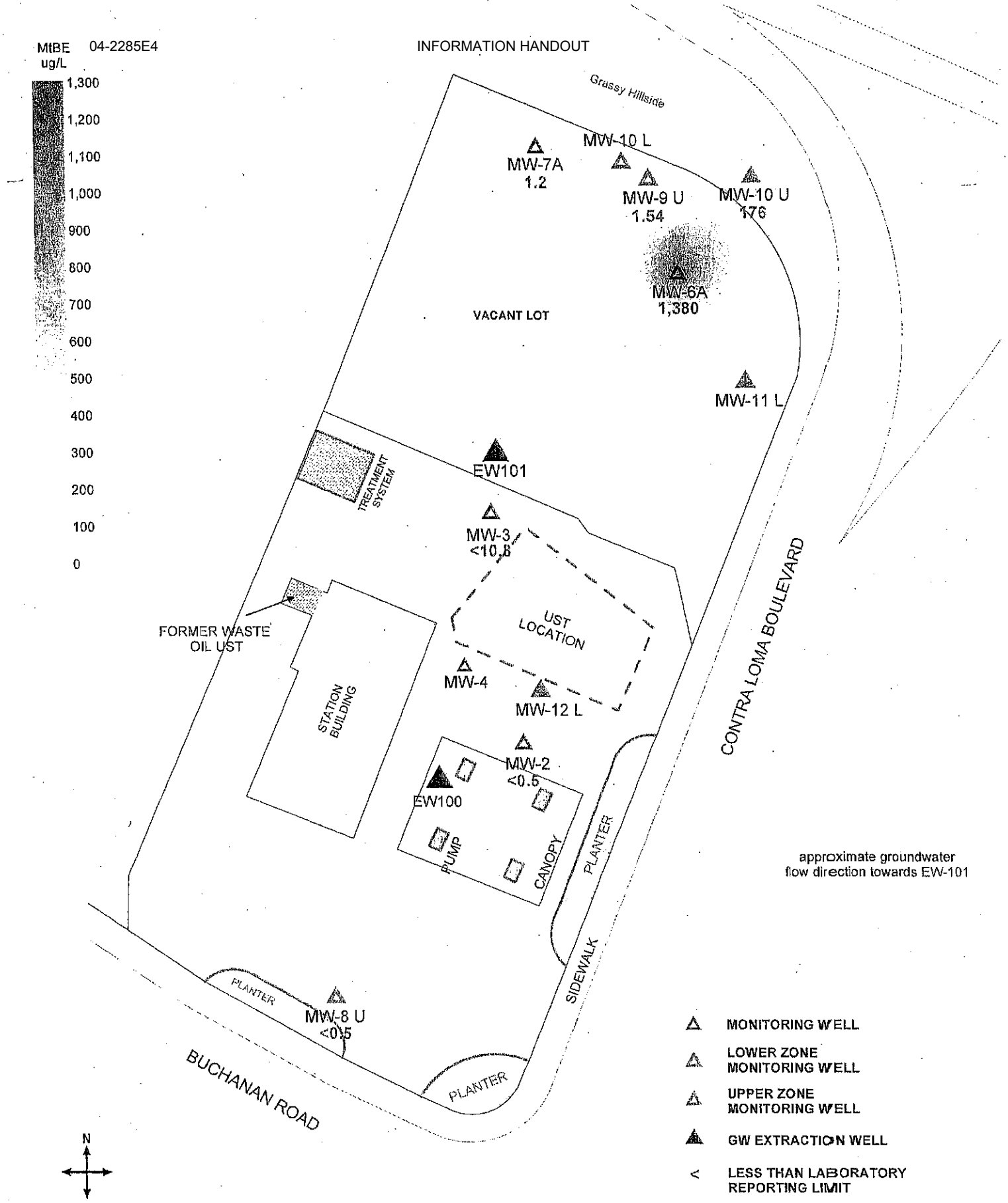


approximate scale in feet

0 20 40

Figure 5: Contour map of TPH-d concentrations in groundwater, in the Upper Water Bearing-Zone. May 23-24, 2006.

ENVIRONMENTAL ENGINEERING, INC.



approximate scale in feet

0 20 40

Figure 6: Contour map of MtBE concentrations in groundwater, in the Upper Water Bearing-Zone (EPA Method 8260B). May 23-24, 2006.

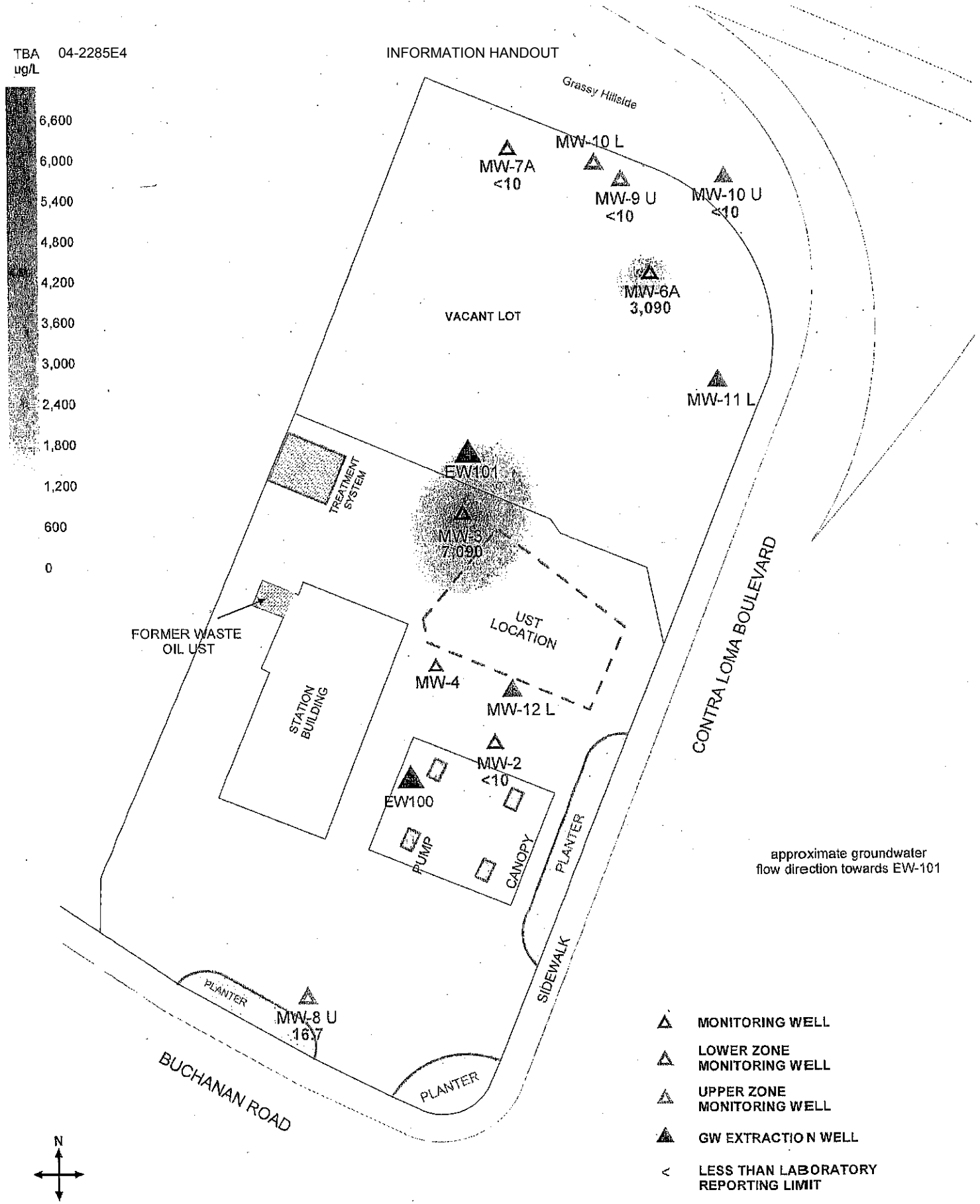
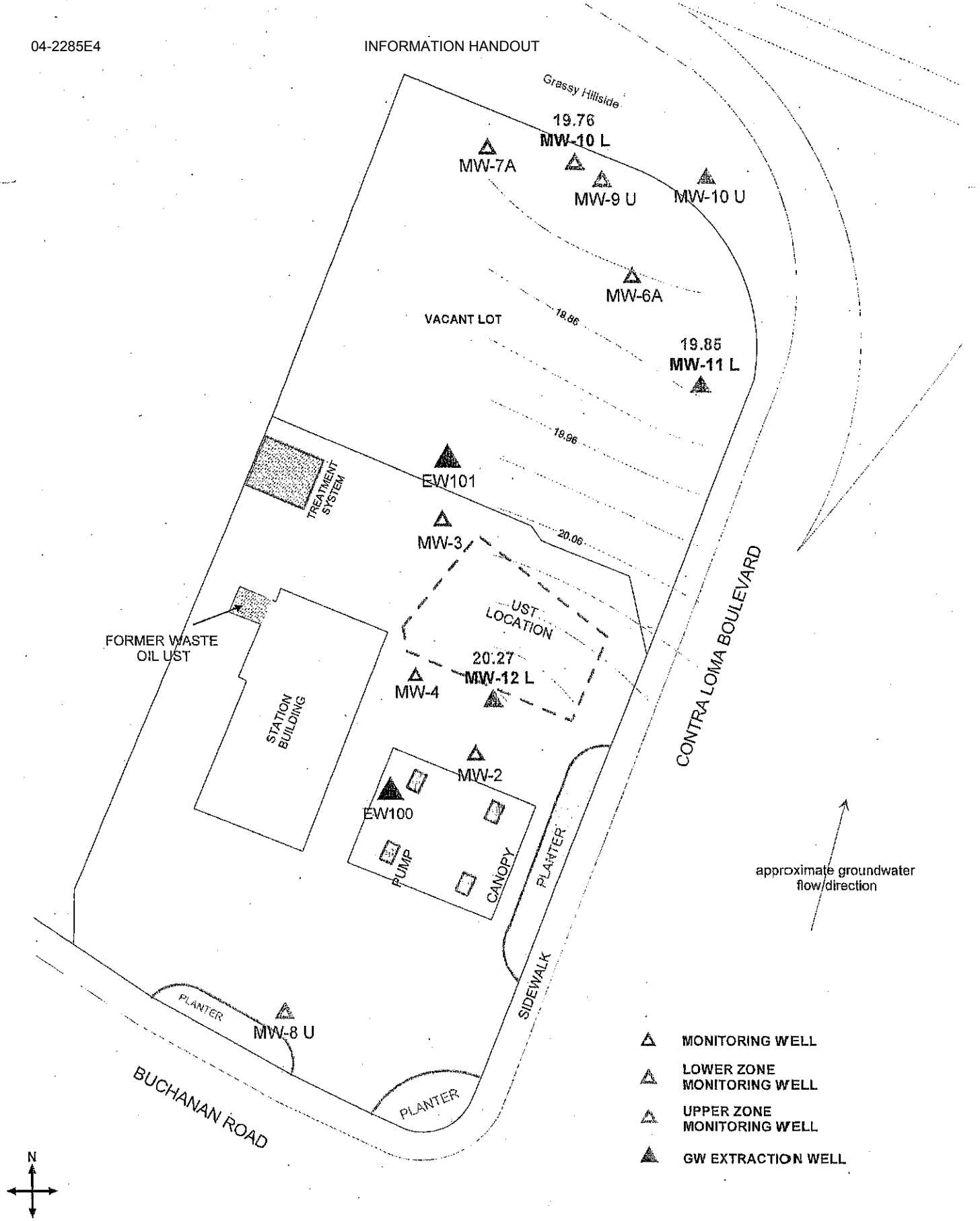


Figure 7: Contour map of TBA concentrations in groundwater, in the Upper Water Bearing-Zone. May 23-24, 2006.

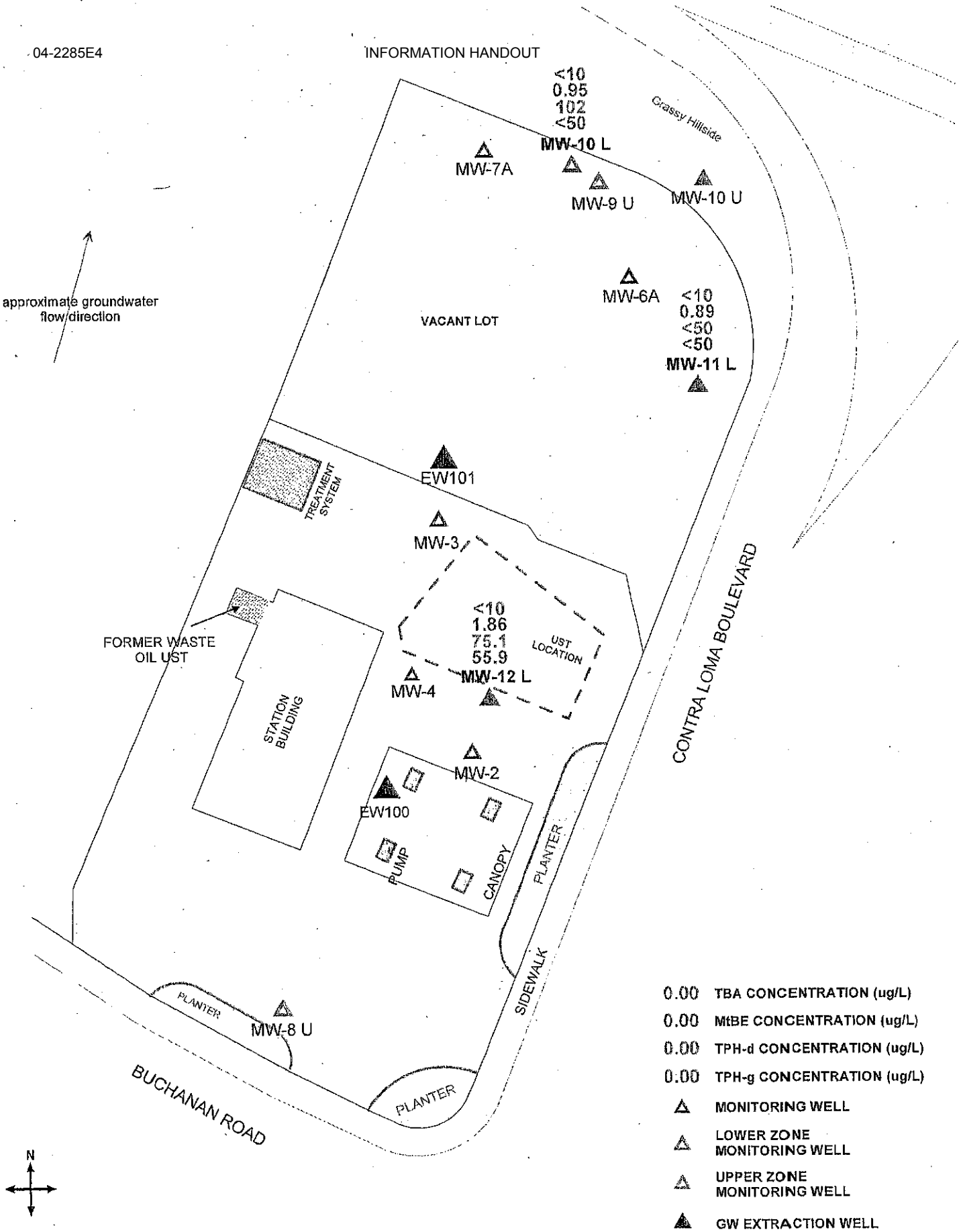
ENVIRONMENTAL ENGINEERING, INC.



approximate scale in feet

0 20 40

Figure 8: Groundwater elevation contour map in feet, in the Lower Water Bearing-Zone. May 23, 2006.



approximate scale in feet

0 20 40

Figure 9: Map showing TPH-g, TPH-d, MtBE and TBA concentrations in groundwater, in the Lower Water Bearing-Zone. May 23, 2006.

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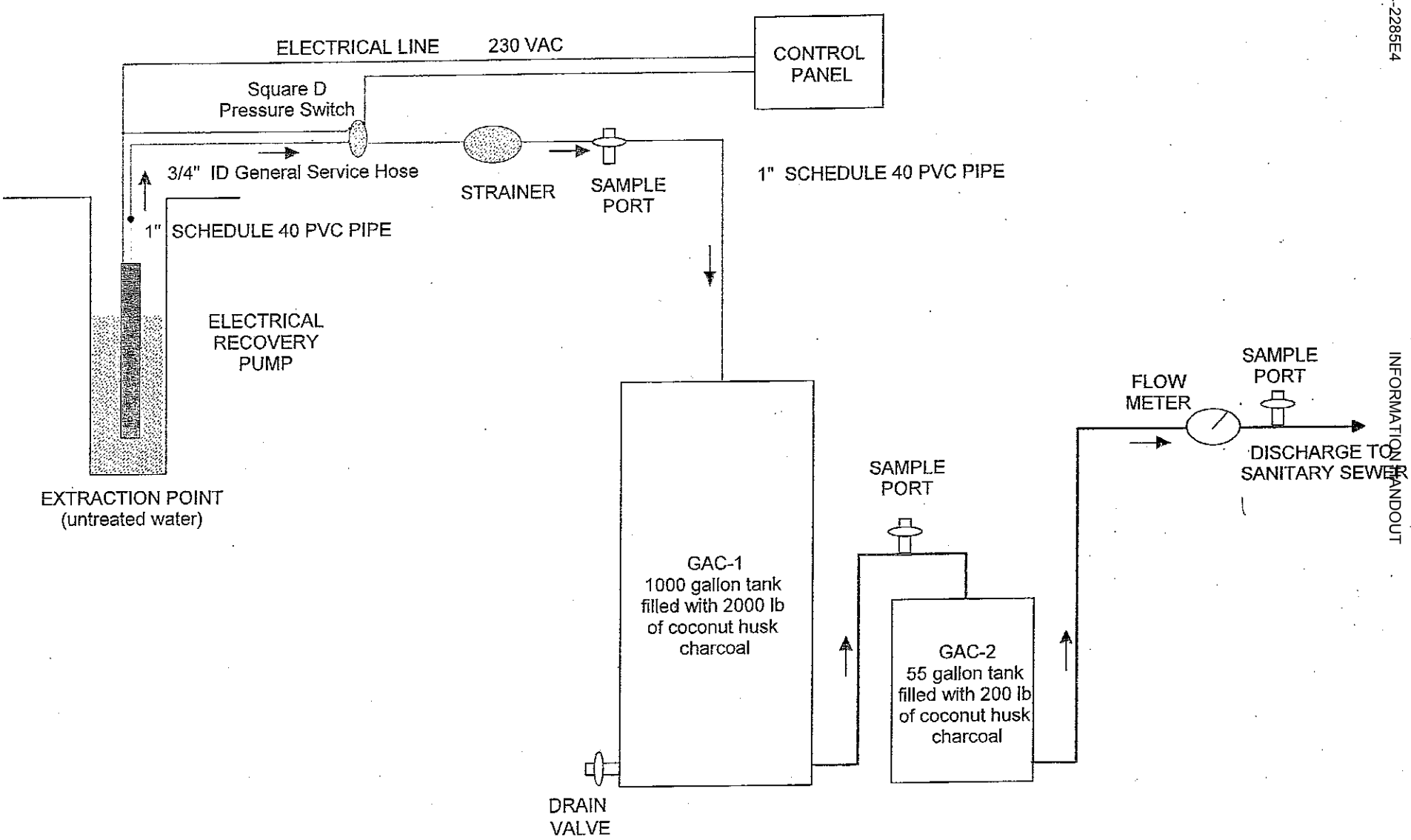

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Figure 10: Schematic Diagram of the groundwater treatment system located at 2610 Contra Loma Blvd, Antioch, CA

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Tables

Table 1
Historical Groundwater Elevation Data & Analytical Results
2610 Contra Loma Blvd, Antioch

Monitoring Well	Date	Top of casing elevation (feet)	Groundwater Elevation (feet)	Depth to Groundwater (feet)	TPH-g (µg/L)	TPH-d (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MtBE (µg/L) EPA 8021B	MtBE (µg/L) EPA 8260B
Upper Water-Bearing Zone												
MW-1	Jan-91	33.35	12.23	21.12	<30	NA	<0.3	<0.3	<0.3	0.32	NA	NA
	Aug-91	33.35	11.79	21.56	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Sep-91	33.35	11.42	21.93	NA	NA	NA	NA	NA	NA	NA	NA
	Oct-91	33.35	11.17	22.18	NA	NA	NA	NA	NA	NA	NA	NA
	Nov-91	33.35	11.3	22.05	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Dec-91	33.35	11.61	21.74	NA	NA	NA	NA	NA	NA	NA	NA
	Feb-92	33.35	11.94	21.41	NA	NA	NA	NA	NA	NA	NA	NA
	Feb-92	33.35	12.37	20.98	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Apr-92	33.35	12.81	20.54	NA	NA	NA	NA	NA	NA	NA	NA
	Apr-92	33.35	12.71	20.64	NA	NA	NA	NA	NA	NA	NA	NA
	May-92	33.35	12.32	21.03	NA	NA	NA	NA	NA	NA	NA	NA
	Jul-92	33.35	11.63	21.72	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Aug-92	33.35	10.73	22.62	NA	NA	NA	NA	NA	NA	NA	NA
	Sep-92	33.35	10.73	22.62	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Nov-92	33.35	11.01	22.34	NA	NA	NA	NA	NA	NA	NA	NA
	Dec-92	33.35	11.06	22.29	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Mar-93	33.35	13.61	19.74	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	May-93	33.35	13.58	19.77	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Aug-93	33.35	12.51	20.84	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Nov-93	33.35	12.34	21.01	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Feb-94	33.35	13.02	20.33	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Jun-94	33.35	12.88	20.47	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA

Table 1
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Monitoring Well	Date	Top of casing elevation (feet)	Groundwater Elevation (feet)	Depth to Groundwater (feet)	TPH-g (µg/L)	TPH-d (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MtBE (µg/L) EPA 8021B	MtBE (µg/L) EPA 8260B
MW-1 cont.	Mar-95	33.35	14.65	18.7	240	NA	1.1	1.7	2.5	5.5	NA	NA
	May-95	33.35	15.43	17.92	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Jul-95	33.35	14.92	18.43	NA	NA	NA	NA	NA	NA	NA	NA
	Jul-95	33.35	14.69	18.66	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Oct-95	33.35	13.63	19.72	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Jan-96	33.35	14.15	19.2	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Feb-96	33.35	14.87	18.48	NA	NA	NA	NA	NA	NA	NA	NA
	Apr-96	33.35	15.74	17.61	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Jul-96	33.35	14.50	18.85	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Oct-96	33.35	13.56	19.79	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Jan-97	33.35	14.69	18.66	<50	NA	<0.5	<0.5	<0.5	0.79	<2.5	NA
	Apr-97	33.35	15.34	18.01	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Jul-97	33.35	14.09	19.26	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Oct-97	33.35	13.45	19.9	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Jan-98	33.35	14.57	18.78	<50	NA	0.55	<0.5	<0.5	<0.5	<2.5	NA
	Apr-98	33.35	17.84	15.51*	<50	NA	0.87	<0.5	<0.5	<0.5	<2.5	NA
	Jul-98	33.35	16.89	16.46	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Oct-98	33.35	15.66	17.69	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Jan-99	33.35	15.66	17.69	<50	NA	<0.5	<0.5	<0.5	<0.5	2.5	NA
	Feb-99	33.35	15.85	17.5	NA	NA	NA	NA	NA	NA	NA	NA
	Dec-99	33.35	14.44	18.91	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Feb-00	33.35	15.28	18.07	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	May-00	33.35	16.28	17.07	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Aug-00	33.35	14.99	18.36	<50	NA	<0.5	0.56	<0.5	0.79	<2.0	NA
	Nov-00	33.35	14.93	18.42	<50	NA	0.99	1.1	<0.5	0.54	<2.0	NA
	Feb-01	33.35	15.20	18.15	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Nov-01	33.35	14.12	19.23	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Nov-01	well resurveyed										

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2610 Contra Loma Blvd, Antioch

Monitoring Well	Date	Top of casing elevation (feet)	Groundwater Elevation (feet)	Depth to Groundwater (feet)	TPH-g (µg/L)	TPH-d (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MtBE (µg/L) EPA 8021B	MtBE (µg/L) EPA 8260B
MW-1 cont.	Feb-02	34.49	18.01	16.48	<50	NA	<0.5	<0.5	<0.5	<0.5	<0.5	NA
	May-02	34.49	16.62	17.87	<50	NA	<0.5	<0.5	<0.5	<0.5	0.5	NA
	Aug-02	34.49	14.38	20.11	<50	NA	<0.5	<0.5	<0.5	<0.5	<0.5	NA
	Nov-02	34.49	16.43	18.06	<50	NA	<0.5	0.7	<0.5	0.8	<0.5	NA
	Feb-03	34.49	16.76	17.73	<50	NA	1.4	<0.5	<0.5	0.7	<0.5	NA
	Jun-03	34.49	16.87	17.62	<50	NA	<0.5	0.8	<0.5	<0.5	<0.5	NA
	Aug-03	34.49	15.78	18.71	<50	NA	<0.5	<0.5	<0.5	<0.5	<0.5	NA
	Oct-03	34.49	15.47	19.02	<50	NA	<0.5	<0.5	<0.5	<0.5	<0.5	NA
	Jan-04	34.49	16.47	18.02	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	1.9
	Sep-04	34.49	15.21	19.28	<50	<50	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Nov-06	well decommissioned										
MW-2	Jan-91	33.21	11.54	21.67	5,100	NA	<3.0	<3.0	4.9	37	NA	NA
	Aug-91	33.21	11.06	22.15	26,000	NA	900	58	2400	1700	NA	NA
	Sep-91	33.21	10.67	22.54	NA	NA	NA	NA	NA	NA	NA	NA
	Oct-91	33.21	10.43	22.78	NA	NA	NA	NA	NA	NA	NA	NA
	Nov-91	33.21	10.57	22.64	23,000	NA	590	<25	2200	1100	NA	NA
	Dec-91	33.21	10.97	22.24	NA	NA	NA	NA	NA	NA	NA	NA
	Feb-92	33.21	11.30	21.91	NA	NA	NA	NA	NA	NA	NA	NA
	Feb-92	33.21	11.73	21.48	19,000	NA	570	37	1600	500	NA	NA
	Apr-92	33.21	12.18	21.03	NA	NA	NA	NA	NA	NA	NA	NA
	Apr-92	33.21	12.05	21.16	NA	NA	NA	NA	NA	NA	NA	NA
	May-92	33.21	11.65	21.56	NA	NA	NA	NA	NA	NA	NA	NA
	Jul-92	33.21	10.95	22.26	23,000	NA	590	52	2200	600	NA	NA
	Aug-92	33.21	10.03	23.18	NA	NA	NA	NA	NA	NA	NA	NA
	Sep-92	33.21	10.02	23.19	23,000	NA	500	140	1900	500	NA	NA
	Nov-92	33.21	10.36	22.85	NA	NA	NA	NA	NA	NA	NA	NA
	Dec-92	33.21	10.43	22.78	18,000	NA	560	110	2300	370	NA	NA

Table 1
Historical Groundwater Elevation Data & Analytical Results
2610 Contra Loma Blvd, Antioch

Monitoring Well	Date	Top of casing elevation (feet)	Groundwater Elevation (feet)	Depth to Groundwater (feet)	TPH-g (µg/L)	TPH-d (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MtBE (µg/L) EPA 8021B	MtBE (µg/L) EPA 8260B
MW-2 cont.	Mar-93	33.21	13.01	20.2	16,000	NA	390	<5.0	1700	190	NA	NA
	May-93	33.21	12.92	20.29	26,000	NA	870	140	2600	460	NA	NA
	Aug-93	33.21	11.78	21.43	52,000	NA	1600	92	5600	570	NA	NA
	Nov-93	33.21	11.64	21.57	21,000	NA	170	6.9	1900	74	140	NA
	Feb-94	33.21	12.44	20.77	5,100	NA	<0.5	<0.5	12	<0.5	NA	NA
	Jun-94	33.21	12.21	21	7,600	NA	250	<2.5	200	35	NA	NA
	Mar-95	33.21	13.67	19.54	13,000	NA	91	<20	2100	<20	NA	NA
	May-95	33.21	14.35	18.86	15,000	NA	88	<20	1900	1700	NA	NA
	Jul-95	33.21	13.83	19.38	NA	NA	NA	NA	NA	NA	NA	NA
	Jul-95	33.21	13.63	19.58	14,000	NA	<25	<25	2100	<25	NA	NA
	Oct-95	33.21	12.70	20.51	6,200	NA	<13	<13	740	<13	NA	NA
	Jan-96	33.21	13.33	19.88	9,900	NA	31	<20	1400	<20	NA	NA
	Feb-96	33.21	14.28	18.93	NA	NA	NA	NA	NA	NA	NA	NA
	Apr-96	33.21	14.93	18.28	8,700	NA	<50	<50	1600	<50	NA	NA
	Jul-96	33.21	13.63	19.58	8,200	NA	31	<20	1500	<20	NA	NA
	Oct-96	33.21	12.68	20.53	14,000	NA	<20	<20	1800	<20	210	NA
	Jan-97	33.21	13.91	19.3	12,000	NA	44	<20	1500	<20	380	NA
	Apr-97	33.21	14.52	18.69	9,700	NA	<20	<20	1100	<20	<100	NA
	Jul-97	33.21	13.36	19.85	15,000	NA	63	<25	1400	27	340	20
	Oct-97	33.21	12.58	20.63	11,000	NA	49	15	880	21	<17	NA
	Jan-98	33.21	13.74	19.47	12,000	NA	56	<20	1000	22	150	NA
	Apr-98	33.21	17.19	16.02	11,000	NA	77	<10	1000	41	330	NA
	Jul-98	33.21	16.19	17.02	11,000	NA	80	<25	1100	<25	<125	NA
	Oct-98	33.21	14.92	18.29	15,000	NA	130	<50	980	<50	470	NA
	Jan-99	33.21	13.90	19.31	9,100	NA	15	<10	560	12	<50	NA
	Feb-99	33.21	15.00	18.21	NA	NA	NA	NA	NA	NA	NA	NA
	May-99	33.21	15.04	18.17	5,090	NA	<2.5	<2.5	246	<2.5	<10	NA
	Aug-99	33.21	13.94	19.27	8,490	NA	<2.5	<2.5	471	16.3	<10	NA
	Dec-99	33.21	13.74	19.47	5,200	NA	<2.5	7.6	470	20	<10	NA

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MW-2 cont.	Feb-00	33.21	14.69	18.52	5,900	NA	12	16	370	3.1	83	NA
	May-00	33.21	15.65	17.56	3,100	NA	12	1.5	280	3.82	<2	NA
	Aug-00	33.21	14.18	19.03	5,700	NA	4.4	7.6	430	13.8	<10	NA
	Nov-00	33.21	14.16	19.05	7,400	NA	<5	<5	400	8.1	<20	NA
	Feb-01	33.21	14.78	18.43	6,900	NA	<2.5	<2.5	370	4.1	<10	NA
	Jun-01	33.21	13.91	19.3	5,400	NA	<2.5	<2.5	300	<2.5	<10	NA
	Aug-01	33.21	14.01	19.2	8,800	NA	<2.5	<2.5	330	<2.5	12	NA
	Nov-01	33.21	13.38	19.83	7,200	NA	5.7	<0.5	360	13.2	29	NA
	Nov-01	well resurveyed										
	Feb-02	34.38	17.28	17.1	6,690	NA	26	10	332	24	68	NA
	May-02	34.38	15.93	18.45	7,210	NA	22	10	291	19	66	NA
	Aug-02	34.38	14.58	19.8	6,080	NA	30	<5	289	10	81	NA
	Nov-02	34.38	14.78	19.6	7,230	NA	114	558	48	970	2950	NA
	Feb-03	34.38	16.14	18.24	5,320	NA	14.2	1.8	206	15.5	101	NA
	Jun-03	34.38	16.13	18.25	5,170	NA	21.8	10.2	179	8.1	94.4	NA
	Aug-03	34.38	15.17	19.21	6,170	NA	23.5	3	199	16	138	NA
	Oct-03	34.38	14.80	19.58	5,860	NA	43.1	2.4	188	6.7	65.4	NA
	Jan-04	34.38	15.84	18.54	7,540	NA	<0.5	<0.5	175	3.1	NA	<0.5
	Sep-04	34.38	14.50	19.88	4,500	2700 L Y	<0.5	<0.5	140	2.9	<2.0	NA
	Dec-04	37.06	18.22	18.84	3,397	2600 LY	<21.5	<21.5	68	<43	NA	<21.5
	Mar-05	37.06	20.11	16.95	8,160	2500 LY	<0.5	<0.5	91.8	1.55	NA	<0.5
	Jun-05	37.06	19.88	17.18	8,290	1500 LY	0.74	2.01	92.4	0.87	NA	<0.5
	Sep-05	37.06	18.77	18.29	7,830	1400 LY	<0.5	<2.0	97.2	0.74	NA	<0.5
	Nov-05	37.06	18.56	18.50	5,970	960 LY	<0.5	<2.0	71.8	0.54	NA	<0.5
	Feb-06	37.06	17.08	19.98	2,400	969 C03,D06,D30	<0.5	<2.0	3.36	0.77	NA	<0.5
	May-06	37.06	20.50	16.56	5,860	939 C03,D06,D30	<0.5	<2.0	45.1	<1.0	NA	<0.5

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MW-3	Jan-91	33.21	11.16	22.05	33,000	NA	740	41	2000	4.9	NA	NA
	Aug-91	33.21	10.64	22.57	2,800	NA	1.7	13	6.5	1	NA	NA
	Sep-91	33.21	10.24	22.97	NA	NA	NA	NA	NA	NA	NA	NA
	Oct-91	33.21	9.99	23.22	NA	NA	NA	NA	NA	NA	NA	NA
	Nov-91	33.21	10.21	23	1,800	NA	4.6	2.7	3.8	6.8	NA	NA
	Nov-91	33.21	NM	NM	1,700	NA	4.4	2.3	0.9	4.9	NA	NA
	Dec-91	33.21	10.60	22.61	NA	NA	NA	NA	NA	NA	NA	NA
	Feb-92	33.21	10.91	22.3	NA	NA	NA	NA	NA	NA	NA	NA
	Feb-92	33.21	11.33	21.88	1,400	NA	3.6	3.6	7.6	6	NA	NA
	Apr-92	33.21	11.74	21.47	NA	NA	NA	NA	NA	NA	NA	NA
	Apr-92	33.21	11.61	21.6	NA	NA	NA	NA	NA	NA	NA	NA
	May-92	33.21	11.22	21.99	NA	NA	NA	NA	NA	NA	NA	NA
	Jul-92	33.21	10.46	22.75	1,800	NA	4.1	1.6	2.9	5.1	NA	NA
	Aug-92	33.21	9.57	23.64	NA	NA	NA	NA	NA	NA	NA	NA
	Sep-92	33.21	9.56	23.65	1,700	NA	50	73	27	77	NA	NA
	Sep-92	33.21	NM	NM	1,500	NA	44	66	21	71	NA	NA
	Nov-92	33.21	9.98	23.23	NA	NA	NA	NA	NA	NA	NA	NA
	Dec-92	33.21	10.02	23.19	1,000	NA	6.1	7.1	5.6	9.8	NA	NA
	Mar-93	33.21	12.59	20.62	3,100	NA	21	8.3	10	4.7	NA	NA
	May-93	33.21	12.44	20.77	2,900	NA	21	1	7.1	5.4	NA	NA
	Aug-93	33.21	11.30	21.91	1,700	NA	3.9	13	2.7	4.8	NA	NA
	Nov-93	33.21	11.21	22	3,400	NA	4.8	3.7	10	19	NA	NA
	Feb-94	33.21	11.98	21.23	2,100	NA	4.2	11	6.2	5.5	NA	NA
	Jun-94	33.21	11.68	21.53	2,100	NA	3.4	14	7	13	NA	NA
	Mar-95	33.21	13.44	19.77	1,700	NA	8.9	<5.0	<5.0	<5.0	NA	NA
	May-95	33.21	14.03	19.18	3,800	NA	18	23	15	22	NA	NA
	Jul-95	33.21	13.47	19.74	NA	NA	NA	NA	NA	NA	NA	NA
	Jul-95	33.21	13.24	19.97	1,800	NA	<2.5	<2.5	<2.5	<2.5	NA	NA
	Oct-95	33.21	12.27	20.94	2,400	NA	<1.3	<1.3	<1.3	<1.3	NA	NA

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MW-3 cont.	Jan-96	33.21	12.92	20.29	1,300	NA	<2.5	<2.5	<2.5	<2.5	NA	NA
	Feb-96	33.21	13.70	19.51	NA	NA	NA	NA	NA	NA	NA	NA
	Apr-96	33.21	14.48	18.73	900	NA	<2.0	<2.0	<2.0	<2.0	NA	NA
	Jul-96	33.21	13.10	20.11	140	NA	0.61	<0.5	<0.5	<0.5	NA	NA
	Oct-96	33.21	12.15	21.06	1,700	NA	6.2	<5	<5	6.7	<25	NA
	Jan-97	33.21	13.49	19.72	2,300	NA	8.7	<2.5	3.5	<2.5	15	NA
	Apr-97	33.21	13.97	19.24	1,800	NA	<5	8.5	5.5	7.7	<25	NA
	Jul-97	33.21	12.63	20.58	2,300	NA	12	<2	3.4	5.5	<2.5	NA
	Oct-97	33.21	12.13	21.08	1,700	NA	<1	<1	10	7.7	<3.3	NA
	Jan-98	33.21	13.35	19.86	1,700	NA	6.7	<2.5	<2.5	<2.5	<12	NA
	Apr-98	33.21	16.69	16.52	1,600	NA	11	<2.5	31	<2.5	13	NA
	Jul-98	33.21	14.44	18.77	1,200	NA	6.2	2.7	6.9	<2.5	<12	NA
	Oct-98	33.21	14.41	18.80	1,600	NA	<2	<2	5.2	9.6	<10	NA
	Feb-99	33.21	14.63	18.58	660	NA	7.5	5.5	3.7	1.8	2.7	NA
	Dec-99	33.21	13.26	19.95	380	NA	<2.5	<2.5	3.6	<2.5	<10	NA
	Feb-00	33.21	13.93	19.28	410	NA	<0.5	<0.5	0.55	0.83	2.1	NA
	May-00	33.21	15.16	18.05	660	NA	0.75	0.93	3.1	5	88	NA
	Aug-00	33.21	13.63	19.58	930	NA	1	6.3	1.9	<0.5	1600	NA
	Nov-00	33.21	13.74	19.47	920	NA	6.7	0.82	6.5	10.4	2500	NA
	Feb-01	33.21	14.06	19.15	720	NA	4.4	<0.5	4.2	7.9	4400	NA
	Jun-01	33.21	13.46	19.75	700	NA	<0.5	<0.5	2.7	8.7	4200	NA
	Aug-01	33.21	13.53	19.68	810	NA	<0.5	<0.5	2.6	4.7	3600	NA
	Nov-01	33.21	12.94	20.27	1,000	NA	<0.5	<0.5	2.8	5.7	3000	NA
	Nov-01	well resurveyed										
	Feb-02	34.43	17.59	16.84	2,960	NA	4.5	1.5	1.6	8.2	2920	NA
	May-02	34.43	15.50	18.93	1,980	NA	2.3	0.9	1.4	7.4	2750	NA
	Aug-02	34.43	14.33	20.10	3,320	NA	<10	<10	<10	<10	5030	NA
	Nov-02	34.43	14.35	20.08	4,590	NA	5	<5	<5	<5	4360	NA

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MW-3 cont.	Feb-03	34.43	15.73	18.70	3,580	NA	5.8	1.2	3.3	12.7	3900	NA
	Jun-03	34.43	15.73	18.70	8,310	NA	<10	<10	<10	<10	9940	NA
	Aug-03	34.43	14.53	19.90	4,330	NA	9.2	1.7	5.2	13.7	3590	NA
	Jan-04	34.43	15.39	19.04	18,900	NA	<0.5	<0.5	<0.5	<0.5	NA	10,000
	Sep-04	34.43	14.04	20.39	1,100	720 L Y	<0.5	<0.5	<0.5	3.3 C	2200	6,100
	Dec-04	37.10	17.77	19.33	585	680 LY	<43	<43	<43	<86	NA	1,158
	Mar-05	37.10	19.57	17.53	<8,600	340 LY	<21.5	<21.5	<21.5	<43.0	NA	199
	Jun-05	37.10	19.27	17.83	<860	310 LY	2.63	<8.6	<2.15	<4.3	NA	47.6
	Sep-05	37.10	18.30	18.80	<550	170 LY	<5.50	<22	<5.5	<11	NA	8.74
	Nov-05	37.10	19.02	18.08	<550	190 LY	<5.5	<22	<5.5	<11	NA	<5.5
	Feb-06	37.10	17.52	19.58	661	327 C03,D06,D30	<5.50	<22.0	<5.5	<11.0	NA	<5.50
	May-06	**37.10**	**20.10**	**17.00**	**<1080**	**257 C03,D06,D30**	**<10.8**	**<43.0**	**<10.8**	**<21.5**	**NA**	**<10.8**
MW-4	Aug-91	33.81	10.90	22.91	64,000	NA	11000	12000	500	6100	NA	NA
	Sep-91	33.81	10.54	23.27	NA	NA	NA	NA	NA	NA	NA	NA
	Oct-91	33.81	10.27	23.54	NA	NA	NA	NA	NA	NA	NA	NA
	Nov-91	33.81	10.46	23.35	56,000	NA	10000	13000	820	6900	NA	NA
	Dec-91	33.81	10.84	22.97	NA	NA	NA	NA	NA	NA	NA	NA
	Feb-92	33.81	11.17	22.64	NA	NA	NA	NA	NA	NA	NA	NA
	Feb-92	33.81	11.61	22.20	33,000	NA	7400	4900	570	3600	NA	NA
	Apr-92	33.81	12.03	21.78	NA	NA	NA	NA	NA	NA	NA	NA
	Apr-92	33.81	12.62	21.19	NA	NA	NA	NA	NA	NA	NA	NA
	May-92	33.81	12.21	21.60	NA	NA	NA	NA	NA	NA	NA	NA
	Jul-92	33.81	10.75	23.06	54,000	NA	6200	8200	800	5600	NA	NA
	Aug-92	33.81	9.84	23.97	NA	NA	NA	NA	NA	NA	NA	NA
	Sep-92	33.81	9.87	23.94	24,000	NA	2800	2700	300	2400	NA	NA
	Nov-92	33.81	10.22	23.59	NA	NA	NA	NA	NA	NA	NA	NA
	Dec-92	33.81	10.27	23.54	34,000	NA	5400	7100	860	6200	NA	NA
	Mar-93	33.81	12.86	20.95	NA	NA	NA	NA	NA	NA	NA	NA
	May-93	33.81	12.72	21.09	NA	NA	NA	NA	NA	NA	NA	NA
	Aug-93	33.81	11.59	22.22	NA	NA	NA	NA	NA	NA	NA	NA
	Nov-93	33.81	11.48	22.33	NA	NA	NA	NA	NA	NA	NA	NA

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MW-4 cont.	Feb-94	33.81	12.23	21.58	NA	NA	NA	NA	NA	NA	NA	NA
	Jun-94	33.81	NM	NM	11,000	NA	1600	870	220	1300	NA	NA
	Mar-95	33.81	6.19	27.62	16,000	NA	13	62	42	88	NA	NA
	May-95	33.81	NM	NM	1,400	NA	7	23	26	60	NA	NA
	Jul-95	33.81	8.18	25.63	NA	NA	NA	NA	NA	NA	NA	NA
	Jul-95	33.81	8.05	25.76	16,000	NA	230	1500	410	1800	NA	NA
	Oct-95	33.81	7.97	25.84	630	NA	11	7.7	<0.5	25	NA	NA
	Jan-96	33.81	13.84	19.97	NA	NA	NA	NA	NA	NA	NA	NA
	Feb-96	33.81	8.09	25.72	430	NA	3.3	4.2	7.2	21	NA	NA
	Apr-96	33.81	7.54	26.27	1,100	NA	33	27	75	96	NA	NA
	Jul-96	33.81	8.03	25.78	410	NA	0.98	6.1	4	21	NA	NA
	Oct-96	33.81	NM	NM	210	NA	<0.5	<0.5	3.3	3.1	<2.5	NA
	Jan-97	33.81	NM	NM	790	NA	8	4.6	28	24	17	NA
	Apr-97	33.81	NM	NM	420	NA	3.8	3.7	24	11	6.3	NA
	Jul-97	33.81	NM	NM	210	NA	0.89	<0.5	<0.5	<0.5	<2.5	NA
	Oct-97	33.81	8.00	25.81	300	NA	1.5	2.2	6.6	6.9	<2.0	NA
	Jan-98	33.81	8.09	25.72	5,500	NA	38	86	130	490	110	NA
	Apr-98	33.81	15.96	17.85	140	NA	0.97	1	3.1	7.3	2.5	NA
	Jul-98	33.81	NM	NM	2,000	NA	21	19	230	100	<25	NA
	Oct-98	33.81	NM	NM	65	NA	<0.5	<0.5	1.7	<0.5	<2.5	NA
	Jan-99	33.81	14.09	19.72	NA	NA	NA	NA	NA	NA	NA	NA
	Feb-99	33.81	13.81	20.00	1,100	NA	5.9	6.5	2	100	16	NA
	May-99	33.81	8.60	25.21	2,210	NA	<5	<5	42.2	7.4	1970	NA
	Aug-99	33.81	13.86	19.95	2,160	NA	13	21.4	94.3	30.7	136	NA
	Dec-99	33.81	12.39	21.42	2,400	NA	15	39	400	100	1800	NA
	May-00	33.81	NM	NM	<50	NA	<0.5	<0.5	0.94	1.5	24	NA
	Aug-00	33.81	NM	NM	52	NA	<0.5	<0.5	4.3	0.73	NA	NA
	Nov-00	33.81	NM	NM	2,000	NA	<0.5	<0.5	<0.5	<0.5	<0.5	NA

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MW-4 cont.	Feb-01	33.81	NM	NM	3,000	NA	12	<2.5	91	124	<10	NA
	Jun-01	33.81	NM	NM	<50	NA	<0.5	<0.5	<0.5	<0.5	<2	NA
	Aug-01	33.81	NM	NM	NA	NA	NA	NA	NA	NA	NA	NA
	Nov-01	well resurveyed										
	Feb-92	34.43	14.79	19.64	637	NA	2.7	5.5	48.6	7.6	28.7	NA
	May-02	34.43	15.07	19.36	1,070	NA	<10	<10	100	10	188	NA
	Aug-02	34.43	14.06	20.37	1,470	NA	13	9	151	14	64	NA
	Feb-03	34.96	15.90	19.06	NA	NA	NA	NA	NA	NA	NA	NA
	Jun-03	34.96	15.95	19.01	1,770	NA	3.6	9.3	94.6	13.8	382	NA
	Aug-03	34.96	14.67	20.29	3,600	NA	7	12.3	186	32.1	1160	NA
	Oct-03	34.96	14.66	20.30	4,070	NA	16.9	15.2	145	24.6	1800	NA
	Jan-04	34.96	15.51	19.45	2,340	NA	<0.5	13.4	139	28.1	NA	178
MW-5	Aug-91	33.82	11.34	22.48	9,300	NA	5.7	18	7.2	99	NA	NA
	Aug-91	33.82	NM	NM	9,600	NA	6.2	19	7.1	100	NA	NA
	Oct-91	33.82	10.70	23.12	NA	NA	NA	NA	NA	NA	NA	NA
	Nov-91	33.82	10.86	22.96	2,700	NA	20	13	5.9	11	NA	NA
	Dec-91	33.82	11.24	22.58	NA	NA	NA	NA	NA	NA	NA	NA
	Feb-92	33.82	11.58	22.24	NA	NA	NA	NA	NA	NA	NA	NA
	Feb-92	33.82	11.99	21.83	3,700	NA	<2.5	<2.5	7.8	7.9	NA	NA
	Feb-92	33.82	NM	NM	4,200	NA	6.9	9.8	10	8	NA	NA
	Apr-92	33.82	12.43	21.39	NA	NA	NA	NA	NA	NA	NA	NA
	Apr-92	33.82	12.31	21.51	NA	NA	NA	NA	NA	NA	NA	NA
	May-92	33.82	11.91	21.91	NA	NA	NA	NA	NA	NA	NA	NA
	Jul-92	33.82	11.20	22.62	9,100	NA	46	18	8.7	5.7	NA	NA
	Aug-92	33.82	10.31	23.51	NA	NA	NA	NA	NA	NA	NA	NA
	Sep-92	33.82	10.32	23.50	5,300	NA	<5	<5	<5	<5	NA	NA
	Nov-92	33.82	10.62	23.20	NA	NA	NA	NA	NA	NA	NA	NA

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2610 Contra Loma Blvd, Antioch

Monitoring Well	Date	Top of casing elevation (feet)	Groundwater Elevation (feet)	Depth to Groundwater (feet)	TPH-g (µg/L)	TPH-d (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MtBE (µg/L) EPA 8021B	MtBE (µg/L) EPA 8260B
MW-5 cont.	Dec-92	33.82	10.67	23.15	11,000	NA	20	<2.5	19	9	120	NA
	Mar-93	33.82	13.27	20.55	6,400	NA	4.7	6.8	13	7.8	NA	NA
	May-93	33.82	13.17	20.65	5,400	NA	8.2	<0.5	14	7.1	NA	NA
	Aug-93	33.82	12.08	21.74	5,300	NA	2.3	11	8	2.7	NA	NA
	Nov-93	33.82	11.93	21.89	6,700	NA	<5	<5	21	45	NA	NA
	Feb-94	33.82	12.69	21.13	20,000	NA	360	13	2000	170	NA	NA
	Jun-94	33.82	12.44	21.38	5,200	NA	4.4	6.9	14	4.2	NA	NA
	Mar-95	33.82	14.34	19.48	68	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	May-95	33.82	15.05	18.77	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Jul-95	33.82	14.44	19.38	NA	NA	NA	NA	NA	NA	NA	NA
	Jul-95	33.82	14.20	19.62	75	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Oct-95	33.82	13.19	20.63	750	NA	<0.5	<0.5	1.3	<0.5	NA	NA
	Jan-96	33.82	13.71	20.11	360	NA	<1	<1	<1	<1	NA	NA
	Feb-96	33.82	14.48	19.34	NA	NA	NA	NA	NA	NA	NA	NA
	Apr-96	33.82	15.28	18.54	350	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Jul-96	33.82	14.05	19.77	570	NA	3.6	<0.5	<0.5	0.79	NA	NA
	Oct-96	33.82	13.09	20.73	600	NA	<0.5	<0.5	<0.5	<0.5	19	NA
	Jan-97	33.82	14.28	19.54	100	NA	<0.5	<0.5	<0.5	0.75	3.1	NA
	Apr-97	33.82	14.89	18.93	1,000	NA	5.3	<1	<1	<1	16	NA
	Jul-97	33.82	13.26	20.56	1,600	NA	11	<2	<2	<2	10	NA
	Oct-97	33.82	13.00	20.82	1,100	NA	<1	<1	3.1	5.1	<2	NA
	Jan-98	33.82	14.15	19.67	860	NA	6.6	2.1	<0.5	2	7.3	NA
	Apr-98	33.82	17.46	16.36	260	NA	2.6	0.85	<0.5	<0.5	<2.5	NA
	Jul-98	33.82	16.42	17.40	480	NA	5.4	1.9	1.4	<0.5	8.7	NA
	Oct-98	33.82	15.24	18.58	860	NA	9.4	<0.5	<0.5	2.5	7.6	NA
	Jan-99	33.82	14.24	19.58	250	NA	<0.5	3.2	<0.5	<0.5	<2.5	NA
	Feb-99	33.82	15.44	18.38	NA	NA	NA	NA	NA	NA	NA	NA
	May-99	33.82	15.46	18.36	605	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Aug-99	33.82	14.35	19.47	152	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Dec-99	33.82	14.04	19.78	170	NA	<0.5	0.71	<0.5	<0.5	<2.0	NA

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Historical Groundwater Elevation Data & Analytical Results
2610 Contra Loma Blvd, Antioch

Monitoring Well	Date	Top of casing elevation (feet)	Groundwater Elevation (feet)	Depth to Groundwater (feet)	TPH-g (µg/L)	TPH-d (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MtBE (µg/L) EPA 8021B	MtBE (µg/L) EPA 8260B
MW-5 cont.	Feb-00	33.82	14.33	19.49	230	NA	1.2	<0.5	<0.5	<0.5	<2	NA
	May-00	33.82	15.95	17.87	320	NA	<0.5	1.2	1.8	<0.5	<2	NA
	Aug-00	33.82	14.54	19.28	230	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Nov-00	33.82	14.52	19.30	270	NA	3	<0.5	<0.5	1.48	<2.0	NA
	Feb-01	33.82	14.80	19.02	470	NA	5.5	<0.5	1.2	3.7	<2.0	NA
	Jun-01	33.82	14.31	19.51	360	NA	<0.5	<0.5	<0.5	1	<2.0	NA
	Aug-01	33.82	14.31	19.51	170	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Nov-01	33.82	13.69	20.13	390	NA	<0.5	<0.5	0.64	1.67	<2.0	NA
	Nov-01	well resurveyed										
	Feb-02	35.01	17.47	17.54	414	NA	5.7	3	1.2	5.3	2.9	NA
	May-02	35.01	16.27	18.74	311	NA	3.8	.5	0.5	2.1	2.5	NA
	Aug-02	35.01	15.10	19.91	286	NA	4.1	<0.5	<0.5	0.8	2.4	NA
	Nov-02	35.01	15.08	19.93	254	NA	3.6	1.6	0.9	4.4	2.3	NA
	Feb-03	35.01	16.43	18.58	334	NA	4.9	0.8	0.7	1.1	<0.5	NA
	Jun-03	35.01	16.48	18.53	368	NA	5.7	0.5	<0.5	0.8	1.8	NA
	Aug-03	35.01	15.38	19.63	333	NA	4.1	0.5	<0.5	0.8	1.5	NA
	Oct-03	35.01	15.11	19.90	257	NA	3.2	<0.5	0.6	<0.5	1.8	NA
	Jan-04	35.01	16.11	18.90	509	NA	<0.5	<0.5	<0.5	<0.5	NA	<0.5
	Sep-04	35.01	14.81	20.20	390	150 L Y	<0.5	<0.5	<0.5	<0.5	<2.0	NA
MW-6	Jul-92	35.52	10.17	25.35	250	NA	<0.5	0.9	1.3	1.4	NA	NA
	Aug-92	35.52	9.25	26.27	NA	NA	NA	NA	NA	NA	NA	NA
	Sep-92	35.52	9.29	26.23	290	NA	2.6	7	4.4	14	NA	NA
	Nov-92	35.52	9.71	25.81	NA	NA	NA	NA	NA	NA	NA	NA
	Dec-92	35.52	9.77	25.75	110	NA	0.6	1.6	0.8	2.5	NA	NA
	Dec-92	35.52	NM	NM	91	NA	1.1	2.2	0.9	3	NA	NA
	Mar-93	35.52	12.42	23.10	86	NA	<0.5	0.9	<0.5	<0.5	NA	NA
	May-93	35.52	12.22	23.30	110	NA	<0.5	<0.5	<0.5	<1	NA	NA
	Aug-93	35.52	11.04	24.48	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Nov-93	35.52	10.96	24.56	180	NA	<0.5	<0.5	<0.5	<0.5	NA	NA

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2610 Contra Loma Blvd, Antioch

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MW-6 cont.	Feb-94	35.52	11.72	23.80	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Jun-94	35.52	11.41	24.11	68	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Mar-95	35.52	13.53	21.99	88	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	May-95	35.52	14.12	21.40	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Jul-95	35.52	13.45	22.07	NA	NA	NA	NA	NA	NA	NA	NA
	Jul-95	35.52	13.16	22.36	52	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Oct-95	35.52	12.16	23.36	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Jan-96	35.52	12.81	22.71	81	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Feb-96	35.52	13.61	21.91	NA	NA	NA	NA	NA	NA	NA	NA
	Apr-96	35.52	14.40	21.12	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Jul-96	35.52	12.96	22.56	55	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Oct-96	35.52	12.00	23.52	99	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Jan-97	35.52	13.33	22.19	68	NA	<0.5	<0.5	<0.5	0.57	<2.5	NA
	Apr-97	35.52	13.80	21.72	85	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Jul-97	35.52	12.41	23.11	60	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Oct-97	35.52	11.97	23.55	63	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Jan-98	35.52	13.26	22.26	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Apr-98	35.52	16.45	19.07	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Jul-98	35.52	15.22	20.30	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Oct-98	35.52	14.12	21.40	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Jan-99	35.52	14.25	21.27	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Feb-99	35.52	14.48	21.04	NA	NA	NA	NA	NA	NA	NA	NA
	Dec-99	well destroyed										

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2610 Contra Loma Blvd, Antioch

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MW-6A	Feb-00	37.18	15.29	21.89	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	May-00	37.18	16.01	21.17	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Aug-00	37.18	14.54	22.64	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Nov-00	37.18	14.59	22.59	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Feb-01	37.18	14.91	22.27	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Jun-01	37.18	14.28	22.90	<50	NA	<0.5	<0.5	<0.5	<0.5	9	NA
	Aug-01	37.18	14.37	22.81	<50	NA	<0.5	<0.5	<0.5	<0.5	46	NA
	Nov-01	37.18	13.75	23.43	<50	NA	<0.5	<0.5	<0.5	<0.5	150	NA
	Nov-01	well resurveyed										
	Feb-02	37.22	14.46	22.76	269	NA	<0.5	<0.5	<0.5	<0.5	224	NA
	May-02	37.22	15.14	22.08	329	NA	<0.5	<0.5	<0.5	<0.5	480	NA
	Aug-02	37.22	13.95	23.27	328	NA	<0.5	<0.5	<0.5	<0.5	627	NA
	Nov-02	37.22	14.04	23.18	770	NA	<0.5	<0.5	<0.5	<0.5	744	NA
	Feb-03	37.22	15.40	21.82	527	NA	<0.5	<0.5	<0.5	<0.5	816	NA
	Jun-03	37.22	15.42	21.80	978	NA	<0.5	<0.5	<0.5	<0.5	1190	NA
	Aug-03	37.22	14.23	22.99	1,110	NA	<0.5	<0.5	<0.5	<0.5	1280	NA
	Oct-03	37.22	14.09	23.13	1,790	NA	<0.5	<0.5	<0.5	<0.5	1700	NA
	Jan-04	37.22	15.10	22.12	1,920	NA	<0.5	<0.5	<0.5	<0.5	NA	1,770
	Sep-04	37.22	13.72	23.50	<50	72 Y	<0.5	<0.5	<0.5	<0.5	2200	5,800
	Dec-04	39.89	17.51	22.38	<50	940 Y	<21.5	<21.5	<21.5	<43	NA	9,589
	Mar-05	39.89	19.47	20.42	<8,600	<50	<21.5	<21.5	<21.5	<43.0	NA	10,500
	Jun-05	39.89	19.07	20.82	<8600	<50	<21.5	<86	<21.5	<43	NA	4,590
	Sep-05	39.89	17.86	22.03	<2150	<50	<21.5	<86	<21.5	<43	NA	4,060
	Nov-05	39.89	17.77	22.12	<2150	<50	<21.5	<86	<21.5	<43	NA	4,190
	Feb-06	39.89	20.95	18.94	1,610	103 C03,D06,D30, A01	<5.50	<22.0	<5.50	<11.0	NA	2,130
	May-06	39.89	19.82	20.07	<1080	134 C03,D06,D09	<10.8	<43	<10.8	<21.5	NA	1,380

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2610 Contra Loma Blvd, Antioch

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MW-7	Jul-92	36.93	10.15	26.78	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Aug-92	36.93	9.24	27.69	NA	NA	NA	NA	NA	NA	NA	NA
	Sep-92	36.93	9.28	27.65	70	NA	1.6	4.1	2.3	6.8	NA	NA
	Nov-92	36.93	9.71	27.22	NA	NA	NA	NA	NA	NA	NA	NA
	Dec-92	36.93	9.77	27.16	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Mar-93	36.93	12.40	24.53	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	May-93	36.93	12.18	24.75	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Aug-93	36.93	11.01	25.92	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Nov-93	36.93	10.93	26.00	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Feb-94	36.93	11.71	25.22	<50	NA	<0.5	1.6	0.8	5.4	NA	NA
	Jun-94	36.93	11.37	25.56	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Mar-95	36.93	13.46	23.47	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	May-95	36.93	14.04	22.89	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Jul-95	36.93	13.36	23.57	NA	NA	NA	NA	NA	NA	NA	NA
	Jul-95	36.93	13.08	23.85	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Oct-95	36.93	12.07	24.86	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Jan-96	36.93	12.72	24.21	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Feb-96	36.93	13.55	23.38	NA	NA	NA	NA	NA	NA	NA	NA
	Apr-96	36.93	14.32	22.61	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Jul-96	36.93	12.88	24.05	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Oct-96	36.93	11.92	25.01	83	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Jan-97	36.93	13.25	23.68	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Apr-97	36.93	13.72	23.21	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Jul-97	36.93	12.31	24.62	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Oct-97	36.93	11.88	25.05	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Jan-98	well resurveyed										
	Jan-98	38.60	13.17	25.43	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Apr-98	38.60	16.34	22.26	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Jul-98	38.60	15.12	23.48	<50	NA	1.3	<0.5	<0.5	<0.5	<2.5	NA
	Oct-98	38.60	14.02	24.58	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA

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2610 Contra Loma Blvd, Antioch

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MW-7 cont.	Jan-99	38.60	14.15	24.45	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Feb-99	38.60	14.37	24.23	NA	NA	NA	NA	NA	NA	NA	NA
	May-99	38.60	14.60	24.00	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	May-99	38.60	13.02	25.58	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Dec-99	well destroyed										
MW-7A	Feb-00	38.60	15.21	23.39	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	May-00	38.60	16.01	22.59	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Aug-00	38.60	14.56	24.04	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Nov-00	38.60	14.65	23.95	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Feb-01	38.60	14.93	23.67	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Jun-01	38.60	14.21	24.39	<50	NA	<0.5	1.2	<0.5	<0.5	<2.0	NA
	Aug-01	38.60	14.40	24.20	<50	NA	<0.5	<0.5	<0.5	<0.5	2.9	NA
	Nov-01	38.60	13.77	24.83	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Nov-01	well resurveyed										
	Feb-02	38.61	15.07	23.54	<50	NA	<0.5	<0.5	<0.5	<0.5	0.5	NA
	May-02	38.61	15.14	23.47	<50	NA	<0.5	<0.5	<0.5	<0.5	<0.5	NA
	Aug-02	38.61	13.95	24.66	<50	NA	<0.5	<0.5	<0.5	<0.5	<0.5	NA
	Nov-02	38.61	14.02	24.59	<50	NA	<0.5	<0.5	<0.5	<0.5	<0.5	NA
	Feb-03	38.61	15.37	23.24	<50	NA	1.6	<0.5	<0.5	0.9	<0.5	NA
	Jun-03	38.61	15.37	23.24	<50	NA	<0.5	0.5	<0.5	<0.5	<0.5	NA
	Aug-03	38.61	14.30	24.31	<50	NA	<0.5	<0.5	<0.5	<0.5	0.7	NA
	Oct-03	38.61	14.08	24.53	<50	NA	<0.5	<0.5	<0.5	<0.5	0.9	NA
	Jan-04	38.61	15.09	23.52	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	8
	Sep-04	38.61	13.68	24.93	<50	<50	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Dec-04	41.29	17.45	23.84	<50	270 HY	<0.5	<0.5	<0.5	<1.0	NA	<0.5
	Mar-05	41.29	19.44	21.85	<200	<50	<0.5	<0.5	<0.5	<1.0	NA	<0.5
	Jun-05	41.29	19.09	22.20	<200	<50	0.8	<2.0	<0.5	<1.0	NA	<0.5
	Sep-05	41.29	17.92	23.37	<50	<50	<0.5	<2.0	<0.5	<1.0	NA	<0.5
	Nov-05	41.29	16.77	24.52	<50	<50	<0.5	<2.0	<0.5	<1.0	NA	<0.5
	Feb-06	41.29	22.10	19.19	<50	<50 [C03]	<0.5	<2.0	<0.5	<1.0	NA	<0.5
	May-06	41.29	19.83	21.46	<50	<50 [C03]	<0.5	<2.0	<0.5	<1.0	NA	1.2

Table 1

Historical Groundwater Elevation Data & Analytical Results

2610 Contra Loma Blvd, Antioch

Monitoring Well	Date	Top of casing elevation (feet)	Groundwater Elevation (feet)	Depth to Groundwater (feet)	TPH-g (µg/L)	TPH-d (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MtBE (µg/L) EPA 8021B	MtBE (µg/L) EPA 8260B
MW-8U	Dec-04	38.16	18.79	19.37	<50	89 HY	<0.5	<0.5	<0.5	<1.0	NA	2
	Mar-05	38.16	20.72	17.44	<200	<50	<0.5	<0.5	0.65	<1.0	NA	<0.5
	Jun-05	38.16	20.61	17.55	<200	<50	0.51	<2.0	<0.5	<1.0	NA	<0.5
	Sep-05	38.16	19.44	18.72	<50	<50	<0.5	<2.0	<0.5	<1.0	NA	<0.5
	Nov-05	38.16	19.26	18.90	<50	<50	<0.5	<2.0	<0.5	<1.0	NA	<0.5
	Feb-06	38.16	17.54	20.62	<50	<50 C03	<0.5	<2.0	<0.5	<1.0	NA	<0.5
	May-06	38.16	21.31	16.85	<50	<50 C03	<0.5	<2.0	<0.5	<1.0	NA	<0.5
MW-9U	Dec-04	40.57	17.40	23.17	<50	170 HY	<0.5	<0.5	<0.5	<1.0	NA	150
	Mar-05	40.57	19.37	21.2	<200	<50	<0.5	<0.5	<0.5	<1.0	NA	152
	Jun-05	40.57	19.01	21.56	<200	<50	<0.5	<2.0	<0.5	<1.0	NA	17.6
	Sep-05	40.57	16.87	23.70	<50	<50	<0.5	<2.0	<0.5	<1.0	NA	6.05
	Nov-05	40.57	17.74	22.83	<50	<50	<0.5	<2.0	<0.5	<1.0	NA	2.07
	Feb-06	40.57	21.56	19.01	<50	54.3 C03,D06,D30	<0.5	<2.0	<0.5	<1.0	NA	0.65
	May-06	40.57	19.79	20.78	<50	<50 C03	<0.5	<2.0	<0.5	<1.0	NA	1.54
MW-10U	May-06	35.89	19.70	16.19	<50	<50 C03	<0.5	<2.0	<0.5	<1.0	NA	176
Lower Water-Bearing Zone												
MW-10L	Dec-04	41.26	17.38	23.88	75	1300 HY	<0.5	<0.5	1.4	<1.0	NA	<0.5
	Mar-05	41.26	19.37	21.89	<860	<50	<2.15	<2.15	<2.15	<4.30	NA	<2.15
	Jun-05	41.26	19.02	22.24	<400	<50	2.03	<4.0	<1.0	<2.0	NA	<1.0
	Sep-05	41.26	17.86	23.40	<50	<50	<0.5	<2.0	<0.5	<1.0	NA	1.27
	Nov-05	41.26	17.68	23.58	<50	<50	<0.5	<2.0	<0.5	<1.0	NA	0.89
	Feb-06	41.26	22.05	19.21	<50	50.6 C03,D06,D30	<0.5	<2.0	<0.5	<1.0	NA	1.08
	May-06	41.26	19.76	21.50	<50	102 C03,D35	<0.5	<2.0	<0.5	<1.0	NA	0.95
MW-11L	May-06	39.63	19.85	19.78	<50	<50 C03	<0.5	<2.0	<0.5	<1.0	NA	0.89
MW-12L	May-06	36.83	20.27	16.56	55.9	75.1 C03,D06,D30	<0.5	<2.0	<0.5	<1.0	NA	1.86

Table 1
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2610 Contra Loma Blvd, Antioch

Monitoring Well	Date	Top of casing elevation (feet)	Groundwater Elevation (feet)	Depth to Groundwater (feet)	TPH-g (µg/L)	TPH-d (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MtBE (µg/L) EPA 8021B	MtBE (µg/L) EPA 8260B
Extraction wells												
EW100	Jul-92	33.47	10.93	22.54	37,000	NA	330	2100	1200	5300	NA	NA
	Aug-92	33.47	10.04	23.43	NA	NA	NA	NA	NA	NA	NA	NA
	Sep-92	33.47	10.03	23.44	6,000	NA	68	210	160	520	NA	NA
	Nov-92	33.47	10.36	23.11	NA	NA	NA	NA	NA	NA	NA	NA
	Dec-92	33.47	10.42	23.05	25,000	NA	570	1600	1100	2600	NA	NA
	Mar-93	33.47	12.67	20.80	NA	NA	NA	NA	NA	NA	NA	NA
	May-93	33.47	12.91	20.56	NA	NA	NA	NA	NA	NA	NA	NA
	Aug-93	33.47	11.80	21.67	NA	NA	NA	NA	NA	NA	NA	NA
	Nov-93	33.47	11.64	21.83	NA	NA	NA	NA	NA	NA	NA	NA
EW100 cont.	Feb-94	33.47	12.38	21.09	NA	NA	NA	NA	NA	NA	NA	NA
	Jun-94	33.47	NM	NM	6,700	NA	87	950	220	1300	NA	NA
	Mar-95	33.47	7.25	26.22	12,000	NA	110	1000	390	1300	NA	NA
	May-95	33.47	NM	NM	17,000	NA	230	1200	330	1700	NA	NA
	Jul-95	33.47	7.91	25.56	NA	NA	NA	NA	NA	NA	NA	NA
	Jul-95	33.47	3.16	30.31	12,000	NA	130	950	26	1100	NA	NA
	Oct-95	33.47	7.04	26.43	NA	NA	NA	NA	NA	NA	NA	NA
	Jan-96	33.47	13.33	20.14	NA	NA	NA	NA	NA	NA	NA	NA
	Feb-96	33.47	6.83	26.64	240	NA	0.73	1.7	1.3	12	NA	NA
	Apr-96	33.47	7.82	25.65	4,300	NA	17	160	27	420	NA	NA
	Jul-96	33.47	7.24	26.23	1,900	NA	15	77	37	250	NA	NA
	Oct-96	33.47	7.52	25.95	200	NA	<0.5	<0.5	1.4	2.6	<2.5	NA
	Jan-97	33.47	7.40	26.07	460	NA	1.6	3.2	5	12	2.7	NA
	Apr-97	33.47	7.96	25.51	220	NA	<0.5	1.1	0.88	1.8	<2.5	NA
	Jul-97	33.47	13.35	20.12	9,200	NA	44	70	310	380	120	NA
	Oct-97	33.47	7.50	25.97	490	NA	2.5	2.7	11	17	<2.0	NA
	Jan-98	33.47	7.54	25.93	180	NA	1.1	0.67	3	5.1	2.7	NA
	Apr-98	33.47	NM	NM	240	NA	1.1	1.9	6	21	6	NA
	Jul-98	33.47	NM	NM	290	NA	<0.5	0.81	5	11	<2.5	NA
	Oct-98	33.47	NM	NM	51	NA	0.66	<0.5	1.1	<0.5	2.5	NA
	Feb-99	33.47	7.93	25.54	9,700	NA	50	80	310	680	170	NA
	May-99	33.47	NM	NM	1,260	NA	<2.5	<2.5	13.9	18	1750	NA
	Aug-99	33.47	13.94	19.53	6,700	NA	<2.5	3.17	231	152	<10	NA
	May-00	33.47	NM	NM	<50	NA	<0.5	<0.5	<0.5	1.27	28	NA
	Aug-00	33.47	14.15	19.32	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Nov-00	33.47	14.19	19.28	98	NA	<0.5	<0.5	<0.5	<0.5	1700	NA
	Feb-01	NS	NM	NM	3,100	NA	13	<2.5	91	128	<10	NA
	Jun-01		NM	NM	<50	NA	<0.5	<0.5	<0.5	<0.5	<2	NA
	Nov-01	well resurveyed										

Table 1
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2610 Contra Loma Blvd, Antioch

Monitoring Well	Date	Top of casing elevation (feet)	Groundwater Elevation (feet)	Depth to Groundwater (feet)	TPH-g (µg/L)	TPH-d (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MtBE (µg/L) EPA 8021B	MtBE (µg/L) EPA 8260B
EW100 cont.	Feb-02	38.50	13.76	24.74	148	NA	1.4	0.7	1.2	1.9	2.6	NA
	May-02	38.50	17.83	20.67	438.0	NA	2.8	0.6	9.9	5.6	7.8	NA
	Aug-02	38.50	18.65	19.85	414	NA	0.9	<0.5	14.9	3.2	8.8	NA
	Nov-02	38.50	18.66	19.84	626	NA	4.7	1.2	20.2	4.3	<0.5	NA
	Feb-03	34.72	16.22	18.50	NA	NA	NA	NA	NA	NA	NA	NA
	Jun-03	34.72	14.16	20.56	1,070	NA	9	1.5	25.1	4.2	17	NA
	Aug-03	34.72	15.22	19.50	645	NA	6.4	0.5	11.4	4.9	17.5	NA
	Oct-03	34.72	14.89	19.83	1,040	NA	8.4	1.5	24.2	2.4	20.4	NA
	Jan-04	34.72	13.97	20.75	1,360	NA	<0.5	<0.5	12.6	1.4	NA	<0.5
EW101	Jul-92	34.96	10.36	24.60	3,700	NA	4.4	3.7	3.3	7.5	NA	NA
	Jul-92	34.96	NM	NM	3,100	NA	5.5	2.8	3.6	12	NA	NA
	Aug-92	34.96	9.45	25.51	NA	NA	NA	NA	NA	NA	NA	NA
	Sep-92	34.96	9.47	25.49	2,100	NA	6.3	15	4.4	4.4	NA	NA
	Nov-92	34.96	9.87	25.09	NA	NA	NA	NA	NA	NA	NA	NA
	Dec-92	34.96	9.94	25.02	1,500	NA	4.8	9.8	4	1.5	NA	NA
	Mar-93	34.96	12.56	22.40	3,100	NA	4.4	12	6.5	6.3	NA	NA
	May-93	34.96	12.39	22.57	2,500	NA	4.1	0.5	4.2	7.2	NA	NA
	Aug-93	34.96	11.21	23.75	1,500	NA	3.7	11	2.5	3.7	NA	NA
	Nov-93	34.96	11.15	23.81	4,000	NA	12	18	7.8	18	NA	NA
	Jun-94	34.96	NM	NM	720	NA	1	5.2	2.7	5	NA	NA
	Mar-95	34.96	4.92	30.04	480	NA	4.7	21	14	19	NA	NA
	May-95	34.96	NM	NM	490	NA	3.2	1.7	3.4	5.8	NA	NA
	Jul-95	34.96	4.61	30.35	NA	NA	NA	NA	NA	NA	NA	NA
	Jul-95	34.96	8.45	26.51	290	NA	<0.5	2.5	1.4	5.6	NA	NA
	Oct-95	34.96	4.78	30.18	230	NA	<0.5	1.1	<0.5	0.77	NA	NA

Table 1
Historical Groundwater Elevation Data & Analytical Results
2610 Contra Loma Blvd, Antioch

Monitoring Well	Date	Top of casing elevation (feet)	Groundwater Elevation (feet)	Depth to Groundwater (feet)	TPH-g (µg/L)	TPH-d (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MtBE (µg/L) EPA 8021B	MtBE (µg/L) EPA 8260B
EW101 cont.	Jan-96	34.96	12.93	22.03	NA	NA	NA	NA	NA	NA	NA	NA
	Feb-96	34.96	4.64	30.32	210	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Apr-96	34.96	5.67	29.29	100	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Jul-96	34.96	4.75	30.21	82	NA	<0.5	0.96	<0.5	<0.5	NA	NA
	Oct-96	34.96	4.85	30.11	310	NA	<0.5	<0.5	0.66	0.89	3.2	NA
	Jan-97	34.96	4.77	30.19	7,500	NA	44	180	250	570	150	NA
	Apr-97	34.96	5.00	29.96	140	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Jul-97	34.96	4.85	30.11	180	NA	1	<0.5	<0.5	<0.5	<2.5	NA
	Oct-97	34.96	4.50	30.46	140	NA	<0.5	<0.5	<0.5	<0.5	<2.0	NA
	Jan-98	34.96	4.79	30.17	6,600	NA	46	110	200	560	130	NA
	Apr-98	34.96	NM	NM	<50	NA	<0.5	<0.5	<0.5	<0.5	<2.5	NA
	Jul-98	34.96	NM	NM	490	NA	3.6	1.5	<0.5	<0.5	6.3	NA
	Oct-98	34.96	14.38	20.58	<50	NA	<0.5	<0.5	1.1	<0.5	<2.5	NA
	Feb-99	34.96	5.11	29.85	170	NA	1.4	0.85	1.1	0.92	<2.5	NA
	May-99	34.96	NM	NM	<50	NA	<0.5	<0.5	<0.5	<0.5	2.1	NA
	May-00	34.96	NM	NM	<50	NA	<0.5	<0.5	<0.5	<0.5	49	NA
	Aug-00	34.96	10.26	24.70	<50	NA	<0.5	<0.5	<0.5	<0.5	NA	NA
	Nov-00	34.96	8.31	26.65	110	NA	<0.5	<0.5	<0.5	<0.5	1400	NA
	Feb-01	34.96	NM	NM	2,600	NA	9.6	<2.5	83	118	<10	NA
	Jun-01	34.96	NM	NM	<50	NA	<0.5	<0.5	<0.5	<0.5	580	NA
	Nov-01	well resurveyed										
	Feb-02	36.08	14.48	21.60	4,420	NA	<5	<5	<5	<5	3370	NA
	May-02	36.08	15.30	20.78	1,970	NA	1.7	0.6	0.8	4.7	2670	NA
	Nov-02	36.08	14.20	21.88	3,680	NA	<0.5	0.8	1	1.4	3330	NA
	Feb-03	36.08	14.65	21.43	3,320	NA	1.6	<0.5	0.8	5.8	4860	NA
	Aug-03	36.08	14.21	21.87	6,410	NA	1.2	<1	<1	1.6	8440	NA
	Oct-03	36.08	14.22	21.86	12,300	NA	<2.5	<2.5	<2.5	<2.5	10400	NA
	Jan-04	36.08	15.08	21.00	12,000	NA	<0.5	<0.5	<0.5	<0.5	NA	12200
	Sep-05	36.08	7.26	28.82	NA	NA	NA	NA	NA	NA	NA	NA
	Nov-05	36.08	12.88	23.20	NA	NA	NA	NA	NA	NA	NA	NA
	Feb-06	36.08	16.73	19.35	NA	NA	NA	NA	NA	NA	NA	NA
	May-06	36.08	14.63	21.45	NA	NA	NA	NA	NA	NA	NA	NA

Table 1
Historical Groundwater Elevation Data & Analytical Results
2610 Contra Loma Blvd, Antioch

Monitoring Well	Date	Top of casing elevation (feet)	Groundwater Elevation (feet)	Depth to Groundwater (feet)	TPH-g (µg/L)	TPH-d (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	MtBE (µg/L) EPA 8021B	MtBE (µg/L) EPA 8260B

Notes:

*: Confirmed using EPA Method 8260B
<: Not detected above laboratory reporting limit.
C: Presence confirmed, but RPD between columns exceeds 40%.
H: Heavier hydrocarbons contributed to the quantitation.
L: Lighter hydrocarbons contributed to the quantitation.
Y: Sample exhibits chromatographic pattern which does not resemble standard.

D-06 Sample chromatographic pattern does not resemble fuel standard used for quantitation.
D09: Results in the disel organics range are primarily due to overlap from a heavy oil range product.
D-30 Unidentified hydrocarbons C9-C16.
D35: Sample does not display a fuel pattern. Sample contains several discreet peaks.
C-03 To reduce matrix interference, sample extract has undergone silica gel clean-up method 3630, which is specific to polar compound contamination.
A-01 Surrogate double spiked.

The first time SOMA monitored the site was in the Third Quarter 2004.
Extraction system was off, therefore, wells MW-4, EW-100, and EW-101 were not sampled in Third Quarter 2004.
Monitoring wells MW-8U, MW-9U, and MW-10L first monitored in the Fourth Quarter 2004.
Monitoring wells MW-8U and MW-9U installed in upper water bearing zone, and MW-10L installed in lower water bearing zone. Wells installed by SOMA in October 2004.
Monitoring wells MW-10U installed in upper water bearing zone, and MW-11L and 12L installed in lower water bearing zone. Wells installed by SOMA in March 2006.
Monitoring wells MW-1 and MW-5 decommissioned in November 2004.
Monitoring wells re-surveyed by Harrington Surveys, Inc in November 2004.
In the Fourth Quarter 2004, SOMA installed an electric downhole pump in extraction well EW-101, extraction well EW-100 is currently inactive.

Table 2
Historical Groundwater Analytical Data
Gasoline Oxygenates, Lead Scavengers, Ethanol, & Methanol
2610 Contra Loma Blvd, Antioch, CA

Well	Date	TBA (µg/L)	DIPE (µg/L)	ETBE (µg/L)	TAME (µg/L)	1,2-DCA (µg/L)	EDB (µg/L)	Ethanol (µg/L)	Methanol (µg/L)
Upper Water Bearing Zone									
MW-1	Oct-97	NA	<2.0	<2.0	<20	NA	NA	NA	NA
	Jan-04	<10	<0.5	<0.5	<0.5	<0.5	<0.5	NA	NA
	Nov-04	well decommissioned							
MW-2	Oct-97	NA	<17	<17	<17	NA	NA	NA	NA
	Jan-04	<10	<0.5	<0.5	<0.5	<0.5	<0.5	NA	NA
	Dec-04	<21.5	<21.5	<21.5	<86	<21.5	<21.5	<1000	<1000
	Mar-05	<2.5	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	<1000
	Jun-05	<10	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	<1000
	Sep-05	<10	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	<1000
	Nov-05	<10	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	NR
	Feb-06	<10	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	NR
	May-06	**<10**	**<0.5**	**<0.5**	**<2.0**	**<0.5**	**<0.5**	**<1000**	**NR**
MW-3	Oct-97	NA	<3.3	<3.3	<3.3	NA	NA	NA	NA
	Jan-04	3800	<0.5	<0.5	80.3	0.6	<0.5	NA	NA
	Dec-04	6,361	<43	<43	<172	<43	<43	<1000	<1000
	Mar-05	13,900	<21.5	<21.5	<86.0	<21.5	<21.5	<1000	<1000
	Jun-05	<43	<2.15	<2.15	<8.6	<2.15	<2.15	<1000	<1000
	Sep-05	13,300	<5.50	<5.50	<22	<5.50	<5.50	<1000	<1000
	Nov-05	5,420	<5.50	<5.50	<22	<5.50	<5.50	<11,000	NR
	Feb-06	6,760	<5.50	<5.50	<22.0	<5.50	<5.50	<11,000	NR
	May-06	**7,090**	**<10.8**	**<10.8**	**<43.0**	**<10.8**	**<10.8**	**<21,500**	**NR**
MW-4	Oct-97	NA	<2	<2	<2	NA	NA	NA	NA
	Jan-04	629	<0.5	<0.5	<0.5	<0.5	<0.5	NA	NA
MW-5	Oct-97	NA	<2	<2	<2	NA	NA	NA	NA
	Jan-04	<10	<0.5	<0.5	<0.5	<0.5	<0.5	NA	NA
	Nov-04	well decommissioned							
MW-6	Oct-97	NA	<2	<2	<2	NA	NA	NA	NA
	Dec-99	well decommissioned							

Table 2
Historical Groundwater Analytical Data
Gasoline Oxygenates, Lead Scavengers, Ethanol, & Methanol
2610 Contra Loma Blvd, Antioch, CA

Well	Date	TBA (µg/L)	DIPE (µg/L)	ETBE (µg/L)	TAME (µg/L)	1,2-DCA (µg/L)	EDB (µg/L)	Ethanol (µg/L)	Methanol (µg/L)
MW-6A	Jan-04	727	<0.5	<0.5	<0.5	<0.5	<0.5	NA	NA
	Dec-04	<21.5	<21.5	<21.5	108	<21.5	<21.5	<1000	<1000
	Mar-05	3,160	<21.5	<21.5	<86.0	<21.5	<21.5	<1000	<1000
	Jun-05	<430	<21.5	<21.5	<86	<21.5	<21.5	<1000	<1000
	Sep-05	4,770	<21.5	<21.5	<86	<21.5	<21.5	<1000	<1000
	Nov-05	8,350	<21.5	<21.5	<86	<21.5	<21.5	<43,000	NR
	Feb-06	2,830	<5.50	<5.50	22.1	<5.50	<5.50	<11,000	NR
	May-06	**3,090**	**<10.8**	**<10.8**	**<43**	**<10.8**	**<10.8**	**<21,500**	**NR**
MW-7	Oct-97	NA	<2	<2	<2	NA	NA	NA	NA
	Dec-99	well decommissioned							
MW-7A	Jan-04	<10	<0.5	<0.5	<0.5	<0.5	<0.5	NA	NA
	Dec-04	<2.5	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	<1000
	Mar-05	<2.5	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	<1000
	Jun-05	<10	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	<1000
	Sep-05	24	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	<1000
	Nov-05	<10	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	NR
	Feb-06	<10	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	NR
	May-06	**<10**	**<0.5**	**<0.5**	**<2.0**	**<0.5**	**<0.5**	**<1000**	**NR**
Upper Water Bearing Zone									
MW-8U	Dec-04	<0.5	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	<1000
	Mar-05	<2.5	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	<1000
	Jun-05	<10	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	<1000
	Sep-05	<10	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	<1000
	Nov-05	<10	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	NR
	Feb-06	<10	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	NR
	May-06	**16.7**	**<0.5**	**<0.5**	**<2.0**	**<0.5**	**<0.5**	**<1000**	**NR**
MW-9U	Dec-04	<0.5	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	<1000
	Mar-05	21.1	<0.5	<0.5	<2.0	0.82	<0.5	<1000	<1000
	Jun-05	<10	<0.5	<0.5	<2.0	0.88	<0.5	<1000	<1000
	Sep-05	<10	<0.5	<0.5	<2.0	0.73	<0.5	<1000	<1000
	Nov-05	<10	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	NR
	Feb-06	<10	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	NR
	May-06	**<10**	**<0.5**	**<0.5**	**<2.0**	**<0.5**	**<0.5**	**<1000**	**NR**
MW-10U	**May-06**	**<10**	**<0.5**	**<0.5**	**<2.0**	**<0.5**	**<0.5**	**<1000**	**NR**

Table 2
Historical Groundwater Analytical Data
Gasoline Oxygenates, Lead Scavengers, Ethanol, & Methanol
2610 Contra Loma Blvd, Antioch, CA

Well	Date	TBA (µg/L)	DIPE (µg/L)	ETBE (µg/L)	TAME (µg/L)	1,2-DCA (µg/L)	EDB (µg/L)	Ethanol (µg/L)	Methanol (µg/L)
Lower Water Bearing Zone									
MW-10L	Dec-04	<2.5	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	<1000
	Mar-05	<10.8	<2.15	<2.15	<8.6	<2.15	<2.15	<1000	<1000
	Jun-05	<20	<1.0	<1.0	<4.0	<1.0	<1.0	<1000	<1000
	Sep-05	<10	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	<1000
	Nov-05	<10	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	NR
	Feb-06	<10	<0.5	<0.5	<2.0	<0.5	<0.5	<1000	NR
	May-06	**<10**	**<0.5**	**<0.5**	**<2.0**	**<0.5**	**<0.5**	**<1000**	**NR**
MW-11L	**May-06**	**<10**	**<0.5**	**<0.5**	**<2.0**	**<0.5**	**<0.5**	**<1000**	**NR**
MW-12L	**May-06**	**<10**	**<0.5**	**<0.5**	**<2.0**	**<0.5**	**<0.5**	**<1000**	**NR**
Extraction Wells									
EW-100	Oct-97	NA	<2	<2	<2	NA	NA	NA	NA
	Jan-04	<10	<0.5	<0.5	<0.5	<0.5	<0.5	NA	NA
EW-101	Oct-97	NA	<2	<2	<2	NA	NA	NA	NA
	Jan-04	4950	<0.5	<0.5	91	<0.5	<0.5	NA	NA

Notes:

<: Not detected above laboratory reporting limits.

NA: Not analyzed, not available. The first time SOMA tested for ethanol and methanol was in the Fourth Quarter 2004. Previous analysis for these compounds was not available at time of this report, and may not have been analyzed by previous consultant.

NR: Not required. Based on the approval of the RWQCB (Pat Vellines), methanol analysis analysis is no longer needed after the Third Quarter 2005.

The first time SOMA monitored the site was in the Third Quarter 2004.

The first time SOMA monitored wells MW-8U, MW-9U, and MW-10L was in the Fourth Quarter 2004. These wells were installed by SOMA in Oct. 2004

MW-4 was converted into an extraction well, the well is currently inactive.

Gasoline Oxygenates:
- TBA: tertiary Butyl Alcohol
- DIPE: Isopropyl Ether
- ETBE: Ethyl tertiary Butyl Ether
- TAME: Methyl tertiary Amyl Ether
- Ethanol

Lead Scavengers:
- EDB: 1,2-Dibromoethane
- 1,2-DCA: 1,2-Dichloroethane

Alcohol:
- Methanol

Table 3

Total Volume of Treated Water, Historical Effluent Chemical Analytical Results, and Operational History of Remediation System

Jack Bhalla's Gas and Auto Service

2610 Contra Loma Blvd, Antioch, California

Date	Volume (gallons)	TPH-g (ug/L)	TPH-d (ug/L)	MtBE * (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
2005								
10-Jan-2005	0	Initial System Start-up Date, began discharging treated groundwater to site sewer main						
17-Jan-2005	2,327	<50	NA	<0.5	<0.5	<0.5	<0.5	<0.5
20-Jan-2005	3,222	NA	<50	NA	NA	NA	NA	NA
3-Feb-2005	6,175	<50	<50	<0.5	<0.5	<0.5	<0.5	<0.5
9-Mar-2005	15,527	<200	<50	<0.5	<0.5	<0.5	<0.5	<1.0
14-Apr-2005	30,900	<200	<50	<0.5	<0.5	<0.5	<0.5	<1.0
9-May-2005	33,031	<200	<50	<0.5	<0.5	<0.5	<0.5	<1.0
21-Jun-2005	36,300	new flow meter replaced after previous meter was stolen off system						
4-Aug-2005	51,480	new flow meter replaced after previous meter was stolen off system						
24-Aug-2005	51,480	well EW-101 was redeveloped by Woodward Drilling due to sedimentation in well						
14-Sep-2005	51,540	<50	<50	1.74	<0.5	<2.0	<0.5	<1.0
17-Sep-2005	51,540	new pump was installed in well EW-101						
18-Nov-2005	86,810	Carbon Change-out of 2000 lb vessel and 55 gallon polishing vessel						
5-Dec-2005	90,920	<50	<50	<0.5	<0.5	<2.0	<0.5	<1.0
2006								
27-Feb-2006	118,060	Carbon Change-out of 55 gallon polishing vessel						
14-Mar-2006	125,580	<50	<50 [1]	<0.5	<0.5	<2.0	<0.5	<1.0
19-Apr-2006	156,560	Carbon Change-out of 2000 lb vessel and 55 gallon polishing vessel						
8-Jun-2006	**171,840**	**<50**	**<50 [1]**	**<0.5**	**<0.5**	**<2.0**	**<0.5**	**<1.0**

Notes:

SOMA received approval from Delta Diablo Sanitation District to begin discharging the treated groundwater into the on-site sewer main on January 3, 2005. The GAC system was initially started on January 10, 2005.

*: Confirmed by EPA Method 8260B.

1: For diesel sample, March & June-2006, to reduce matrix interference, sample extract has undergone silica gel clean-up method 3630, which is specific to polar compound contamination.

NA: Not Analyzed. Only diesel samples were collected on January 20, 2005.

Semi-Annual samples collected from system effluent only on April 29, 2005, samples analyzed for Volatile Organics, Semi-volatile Organics, Metals, Total cyanide, total suspended solids, and pH

Annual samples collected from system effluent only on October 27, 2005, samples analyzed for metals, total suspended solids, pH, COD, purgeable organics, semi-volatile organics

Table 4

Cumulative Masses of Petroleum Hydrocarbons & MtBE Removed from the Groundwater Since Installation of the Treatment System

Jack Bhalla's Gas and Auto Service

2610 Contra Loma Blvd, Antioch, California

Date	Volume (gallons)	Influent Concentration (µg/L)			Mass removed (pounds)		
		TPH-g	TPH-d	MtBE	TPH-g	TPH-d	MtBE
2005							
10-Jan-2005	0	Initial System Start-up Date, began discharging treated groundwater to site sewer main					
17-Jan-2005	2,327	410	NA	3,000	0.008	NA	0.058
20-Jan-2005	3,222	NA	420 LY	NA	NA	0.011	NA
3-Feb-2005	6,175	500	510 LY	2,300	0.024	0.024	0.132
9-Mar-2005	15,527	<2200	<50	1,450	0.024	0.024	0.245
14-Apr-2005	30,900	<2200	<50	1,270	0.024	0.024	0.407
9-May-2005	33,031	<2200	<50	590	0.024	0.024	0.418
14-Sep-2005	51,540	58.3	<50	153	0.033	0.024	0.441
5-Dec-2005	90,920	127	<50	63.1	0.075	0.024	0.462
2006							
14-Mar-2006	125,580	119	380 [1]	55.4	0.109	0.133	0.478
8-Jun-2006	**171,840**	**2,100**	**143 [1,Y,2]**	**<21.5**	**0.918**	**0.189**	**0.478**

Notes:
Mass of constituents removed from groundwater is calculated by the following equation
Mass removed= ((differential in gallons between events)*(3.78 liters/gallon)* influent conc.*(10^-6 g/ug)*(lbs/454 gram))+ previous mass removed reading

<: Below the laboratory reporting limit.
L: Lighter hydrocarbons contributed to the quantitation.
NA: Not Analyzed.
Y: Sample exhibits chromatographic pattern which does not resemble standard.
1: For diesel sample, March & June 2006, to reduce interference, sample extract has undergone silica gel clean-up, method 3630, which is specific to polar compound contamination.
2: Unidentified hydrocarbons C9-C16.

Benzene was not detected in the influent samples in the January to May 2005 treatment system sampling events.
SOMA received approval from Delta Diablo Sanitation District to begin discharging the treated groundwater into the on-site sewer main on January 3, 2005. The GAC system was initially started on January 10, 2005.

Appendix A

SOMA's Groundwater Monitoring Procedures

Field Activities

On May 23 and 24, 2006, SOMA's field crew conducted a groundwater monitoring event in accordance with the procedures and guidelines of the Central Valley Regional Water Quality Control Board.

- **Water Level Measurements**

On May 23, 2006 a total of seven Upper Water-Bearing Zone wells (MW-2, MW-3, MW-6A, MW-7A, MW-8U, MW-9U, and MW-10U) and three Lower-water bearing zone wells (MW-10L, MW-11L, and MW-12L) were measured for depth to groundwater. The depth to groundwater in extraction well EW-101 was also measured to determine the extent of the capture zone of the remedial system. On May 23 and 24, 2006, additional field measurements and grab groundwater samples were collected from all of the wells. Figure 2 shows the locations of the wells.

Prior to measuring the groundwater depth at each well, equalization with the surrounding aquifer was achieved. The well cap was removed from each well, and the pressure in each well was then allowed to dissipate. This allowed for a more stable water table level within the well. After a few minutes, and once the water level in the well stabilized, the depth to groundwater in each monitoring well was measured from the top of the casing to the nearest 0.01 foot using an electric sounder. Since the extraction well is part of the remedial system, the depth to groundwater at well EW-101 was measured with the system still operational.

The Site was re-surveyed by Harrington Surveys Inc., of Walnut Creek, on November 23, 2004. The survey datum was based on California Coordinate System, Zone 3, NAD 83, NAVD 1988. Wells MW-10U, MW-11L, and MW-12L were surveyed on March 30, 2006. Top of casing elevation data and the depth to groundwater in each monitoring well was used to calculate the groundwater elevation.

The survey data is included in Appendix B for the monitoring wells. The survey was conducted to comply with EDF requests for electronic reporting of data to the State Water Resources Control Board (SWRCB) Database.

Purging and Field Measurements

Prior to collecting samples, each well was purged using a battery operated 2-inch diameter pump (Model ES-60 DC). During the purging activities, in order to obtain accurate measurements of groundwater parameters and especially to avoid the intrusion of oxygen from ambient air into the groundwater samples, field measurements were conducted in-situ (i.e., down-hole inside each monitoring well). The groundwater parameters such as DO, pH, temperature, EC,

turbidity, and the ORP were measured in-situ using a Horiba, Model U-22 multi-parameter instrument. The equipment was calibrated at the Site using standard solutions and procedures provided by the manufacturer.

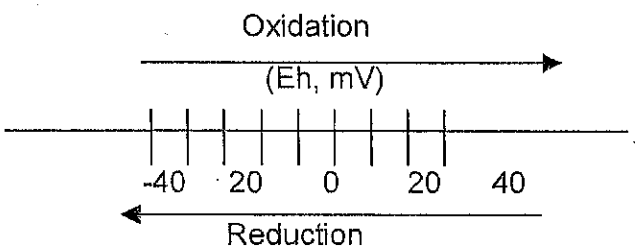
The field notes in Appendix B shows the details of the field measurements.

The pH of groundwater has an effect on the activity of microbial populations in the groundwater. The groundwater temperature affects the metabolic activity of bacteria. The groundwater conductivity (EC) is directly related to the concentration of ions in solution.

There is a strong correlation between the turbidity level and the biological oxygen demand of natural water bodies. The main purpose for checking the turbidity level is to provide a general overview of the extent of the suspended solids in the groundwater.

ORP (oxidation reduction potential) is the measure of the potential for an oxidation or reduction process to occur. In the oxidation process a molecule or ion loses one or several electrons. In the reduction process a molecule or ion gains one or several electrons. The unit of the redox potential is the Volt or m-Volt. The most important redox reaction in petroleum contaminated groundwater is the oxidation of petroleum hydrocarbons in the presence of bacteria and free molecular oxygen. Because the solubility of O_2 in water is low (9 mg/L at 25 °C and 11 mg/L at 5 °C), and because the rate of O_2 replenishment in subsurface environments is limited, DO can be entirely consumed, when the oxidation of only a small amount of petroleum hydrocarbons occurs.

Oxidation of petroleum hydrocarbons can still occur, when all the dissolved O_2 in the groundwater is consumed, however, the oxidizing agents (i.e., the constituents that undergo reduction) now become NO^-_3, MnO_2, Fe $(OH)_3$, SO_4^{2-} and others (Freeze and Cherry, 1979). As these oxidizing agents are consumed, the groundwater environment becomes more and more reduced. If the process proceeds far enough, the environment may become so strongly reduced that the petroleum hydrocarbons may undergo anaerobic degradation, resulting in the production of methane and carbon dioxide. The concept of oxidation and reduction in terms of changes in oxidation states is illustrated below.



The purging of the wells continued until the parameters for DO, pH, temperature, EC, turbidity, and redox stabilized or three casing volumes were purged. Once stabilization occurred, the groundwater samples were also tested on-site for ferrous iron (Fe^{+2}), nitrate (NO_3^-), and sulfate (SO_4^{-2}) concentrations.

Fe^{+2}, NO_3^-, and SO_4^{-2} were measured colorimetrically using the Hach Colorimeter Model 890. The Hach Model 890 Colorimeter is a microprocessor-controlled photometer suitable for colorimetric testing in the laboratory or the field. The required reagents for each specific test are provided in AccuVac ampuls.

- **Sampling**

On May 23 and 24, 2006, for sampling purposes, after purging, a disposable polyethylene bailer was used to collect sufficient samples from each monitoring well for laboratory analyses.

The groundwater sample was transferred to four 40-mL VOA vials and preserved with hydrochloric acid. The vials were then sealed to prevent the development of air bubbles within the headspace. The groundwater sample was also transferred into a one-liter non-preserved amber glass container. After the groundwater samples were collected they were placed on ice in an ice chest along with a chain of custody (COC) form. SOMA's field crew delivered the groundwater samples to Pacific Analytical Laboratory in Alameda, California on both May 23 and 24, 2006.

- **Laboratory Analysis**

The groundwater samples were analyzed, by Pacific Analytical Laboratory, a state certified laboratory, for TPH-g, TPH-d, BTEX, MtBE, gasoline oxygenates, lead scavengers, and ethanol. Samples for TPH-g, BTEX, MtBE, gasoline oxygenates, lead scavengers, and ethanol measurements were prepared using EPA Method 5030B and analyzed using EPA Method 8260B.

Samples for TPH-d measurements were analyzed using EPA Method 8015 modified. To reduce matrix interference, during TPH-d testing, the sample extract has undergone silica gel clean-up method 3630, which is specific to polar compound contamination.

Appendix B

Table of Elevations & Coordinates on Monitoring Wells
Measured by Harrington Surveys, Inc.,
and
Field Measurements of Physical, Chemical, &
Biodegradation Parameters of the Groundwater Samples
at Time of Sampling

734-6801

Harrington Surveys Inc.
Land Surveying & Mapping
2278 Larkey Lane, Walnut Creek, Ca. 94597 Phone (925)935-7228 Fax (925)935-5118
Cell (925)788-7359 E-Mail (ben5132@pacbell.net)

MAR. 30, 2006

SOMA ENVIRONMENTAL ENGINEERING
6620 OWENS DR. # A
PLEASANTON, CA. 994588

ATTN: ELENA

2610 CONTRA LOMA BLVD.
ANTIOCH CA.

SURVEY REPORT

CONTROLING POINTS FRON SURVEY BY HARRINGTON SURVEYS INC. DATED 11-23-04

WP-1 SET PK, CALIFORNIA COORDINATE SYSTEM, ZONE 3. NAD 83.
NORTH 2,188,672.57 - EAST 6,180,595.27, LAT. N37°59'54.00779"
W121°49'21.03092".
ELEVATION 38.76, NAVD 88,

WP-2 SET PK, CALIFORNIA COORDINATE SYSTEM, ZONE 3, NAD 83.
NORTH 2,188,922.98 - EAST 6,180,733.27, LAT N37°59'56.50245",
W121°49'19.35120".
ELEVATION 40.60, NAVD 88,

INSTRUMENTATION:
TRIMBLE GPS, MODEL 5800 AND LEICA TCA 1800, 1" HORZ. & VERT.
OBSERVATION: EPOCH = 180.

FIELD SURVEY: MAR. 24, 2006.

BEN HARRINGTON
PLS 5132

LICENSED LAND SURVEYOR
BENNY L. HARRINGTON
5132
6-30-07
STATE OF CALIFORNIA

2610 CONTRA LOMA BLVD.
ANTIOCH CA.
WELL UPDATE

HARRINGTON SURVEYS INC.
2278 LARKEY LANE
WALNUT CREEK, CA. 94597

JOB # 2456R
MARCH 30,2006

PT #	NORTH	EAST	LATITUDE ° ' "	LONGITUDE ° ' "	LATITUDE DEC.	LONGITUDE DEC.	ELEV	REMARKS
				CONTROL				
6	2188672.57	6180595.27	37°59'54.00779"N	121°49'21.03092"W	37.998335497N	121.822508589W	38.76	wp-1 set pk
7	2188922.98	6180733.27	37°59'56.50245"N	121°49'19.35120"W	37.999028458N	121.822042000W	40.60	wp-2 set pk
				WELL UPDATE				
51	2188773.79	6180673.04	37°59'55.01922"N	121°49'20.07723"W	37.998616450N	121.822243675W	37.32	PUNCH MW-12L
52	2188773.30	6180672.99	37°59'55.01434"N	121°49'20.07777"W	37.998615094N	121.822243825W	36.83	NOTCH MW-12L
53	2188774.12	6180673.14	37°59'55.02256"N	121°49'20.07604"W	37.998617378N	121.822243344W	37.30	PAV MW-12L
54	2188876.02	6180742.13	37°59'56.03948"N	121°49'19.23215"W	37.998899856N	121.822008931W	39.97	PUNCH MW-11L
55	2188875.84	6180742.11	37°59'56.03771"N	121°49'19.23238"W	37.998899364N	121.822008994W	39.63	NOTCH MW-11L
56	2188876.32	6180742.22	37°59'56.04243"N	121°49'19.23111"W	37.998900675N	121.822008642W	39.94	PAV MW-11L
57	2188943.55	6180744.32	37°59'56.70731"N	121°49'19.21679"W	37.999085364N	121.822004581W	36.15	PUNCH MW-10U
58	2188943.10	6180743.92	37°59'56.70281"N	121°49'19.22163"W	37.999111892N	121.822006008W	35.89	NOTCH MW-10U
59	2188943.72	6180744.48	37°59'56.70904"N	121°49'19.21471"W	37.999085844N	121.822004086W	36.16	PAV MW-10U

LICENSED LAND SURVEYOR
BENJAMIN J. HARRINGTON
5132
EX
6-30-07
STATE OF CALIFORNIA

04-2285E4

INFORMATION HANDOUT

Harrington Surveys Inc.

Land Surveying & Mapping

2278 Larkey Lane, Walnut Creek, Ca. 94596 Phone (925)935-7228 Fax (925)935-5118
Cell (925)788-7359 E-Mail (ben5132@pacbell.net)

Nov. 23, 2004
2610 Contra Loma Blvd.
Antioch, Ca.

Survey Report

Basis of Survey:
Coordinates are California State Plane, Zone 3, NAD 1983, NAVD 1988, Geoid Model GEOID99 (conus), WGS1984. Surveyed by GPS Observations using Monument Network as noted.

Contra Costa County GPS Control Point 59, PID # DE8508. Horz. Order ""B", Vert. Order; Fourth, Class 1, N2,183,539.01 E6,174,653.68, Lat. 37°59'02.42420"N Long. 121°50'34.33358"W, Epoch Date 2000.86. Elev. 170.28.

NGS Monument Designated as Lake Alhambra, PID # JS4835, Horz. Order ""B", Vert. Order; Fourth, Class 1, N2,191,193.79 E6,189,008.22, Lát.38°00'20.09339"N Long.121°47'36.36998"W, Epoch Date 2000.86, Elev. 15.35.

NOTE:

MW-4 is not accessible. The lid is welded or requires a special tool. Will non budge with a 10 pound sledge hammer.

MW-1 & MW-5 have been replaced with concrete plug.

MW-3 has damage to the rim, the rim has been broken and forced down below the paving surface. The well is full of dirt and debris but the PVC and CAP are OK, there is no lock.

The other monitoring wells have master locks or no lock at all.

Ben Harrington
PLS 5132

LICENSED LAND SURVEYOR
BENNY I. HARRINGTON
5132
C-30-07
STATE OF CALIFORNIA

2610 CONTRA COSTA B.VD.
ANTIOCH CA.

MONITORING WELLS

HARRINGTON SURVEYS INC.
2278 LARKEY LANE
WALNUT CREEK CA. 94597
925-903-7228 FAX. 925-935-5118

JOB # 2456
NOV. 23, 2004

PT. #	NORTH	EAST	ELEV.	LATITUDE	LONGITUDE	DESCRIPTION
10	2188888.99	6180690.89	40.15	37ø59'56.17439"N	121ø49'19.91442"W	FD. PK NAIL KW-714
6	2188672.57	6180595.27	38.76	37ø59'54.02185"N	121ø49'21.07081"W	SET PK NAIL
7	2188922.98	6180733.27	40.60	37ø59'56.51621"N	121ø49'19.39109"W	SET PK NAIL
8	2191193.79	6189008.22	15.35	38ø00'20.09339"N	121ø47'36.36998"W	FD. MON. STAMPED LS 4802\1993
9	2183539.01	6174653.68	170.27	37ø59'02.4242"N	121ø50'34.33358"W	FD. MON. STAMPED CCCO-9
31	2188912.63	6180720.21	40.43	37ø59'56.41211"N	121ø49'19.55234"W	MW-6A PAV
32	2188911.77	6180719.86	40.38	37ø59'56.40353"N	121ø49'19.55653"W	MW-6A PUNCH N. RIM
33	2188911.44	6180719.71	39.89	37ø59'56.40028"N	121ø49'19.55835"W	MW-6A NOTCH ON TOP 2" PVD
34	2188943.35	6180710.73	41.23	37ø59'56.71440"N	121ø49'19.67618"W	MW-9U PAV
35	2188942.85	6180710.39	41.22	37ø59'56.70941"N	121ø49'19.68039"W	MW-9U PUNCH N. RIM
36	2188942.60	6180710.29	40.57	37ø59'56.70690"N	121ø49'19.68152"W	MW-9U NOTCH ON TOP 2" PVC
37	2188949.37	6180701.96	41.44	37ø59'56.77269"N	121ø49'19.78678"W	MW-10L PAV
38	2188948.74	6180701.62	41.48	37ø59'56.76639"N	121ø49'19.79096"W	MW-10L PUNCH N. RIM
39	2188948.36	6180701.53	41.26	37ø59'56.76271"N	121ø49'19.79197"W	MW-10L NOTCH ON TOP 2" PVC
40	2188954.07	6180674.01	41.85	37ø59'56.81527"N	121ø49'20.13674"W	MW-7A PAV
41	2188953.25	6180673.57	41.82	37ø59'56.80711"N	121ø49'20.14209"W	MW-7A PUNCH N. RIM
42	2188953.02	6180673.17	41.29	37ø59'56.80479"N	121ø49'20.14705"W	MW-7A NOTCH ON TOP 2" PVC
43	2188832.86	6180657.48	37.47	37ø59'55.61487"N	121ø49'20.32191"W	MW-3 PAV
44	2188831.88	6180657.14	37.10	37ø59'55.60513"N	121ø49'20.32591"W	MW-3 NOTCH ON TOP 2" PVC
45	2188756.53	6180667.27	37.37	37ø59'54.86177"N	121ø49'20.18614"W	MW-2 PAV
46	2188755.62	6180667.04	37.39	37ø59'54.85272"N	121ø49'20.18891"W	MW-2 PUNCH N. RIM
47	2188755.42	6180666.92	37.06	37ø59'54.85069"N	121ø49'20.19042"W	MW-2 NOTCH ON TOP 2" PVC
48	2188672.02	6180604.42	38.56	37ø59'54.01768"N	121ø49'20.95637"W	MW-8U PAV
49	2188671.40	6180604.01	38.55	37ø59'54.01150"N	121ø49'20.96134"W	MW-8U PUNCH N. RIM
50	2188671.13	6180603.87	38.16	37ø59'54.00878"N	121ø49'20.96304"W	MW-8U NOTCH ON TOP 2" PVC

LICENSED LAND SURVEYOR
BENNY T. HARRINGTON
5132
6-30-07
STATE OF CALIFORNIA

ENVIRONMENTAL ENGINEERING, INC

Well No.: MW-2
Casing Diameter: 2 inch
Depth of Well: 29.80 ft
Top of Casing Elevation: 37.06 ft
Depth to Groundwater: 16.56 ft
Groundwater Elevation: 20.50 ft
Water Column Height: 13.24 ft
Purged Volume: 16 gallons

Project No.: 2701
Address: Bhalla's Service Station
2610 Contra Loma Blvd, Antioch
Date: May 23, 2006
Sampler: Tony Perini
Eric Jennings

Purging Method: Bailer ☐ Pump ☑

Sampling Method: Bailer ☑ Pump ☐

Color: No ☐ Yes ☑ **Describe** cloudy

Sheen: No ☑ Yes ☐ **Describe**

Odor: No ☐ Yes ☑ **Describe** slight petro odor

Field Measurements:

Time	Volume (gallons)	D.O. mg/L	pH	Temp °C	E.C. (µS/cm)	Turb. NTU	ORP	Fe^{+2} mg/L	NO_3 mg/L	SO_4^{-2} mg/L
11:34 AM	Started purging well									
11:36 AM	1.0	7.96	6.86	21.58	1920	20.4	-63			
11:38 AM	4	6.09	6.88	21.32	1410	0	-67			
11:41 AM	8	5.33	6.89	21.49	1610	0	-82			
11:45 AM	12	5.48	7.00	21.55	1640	0	-89			
11:48 AM	16	4.90	7.00	21.59	1640	0	-96			
11:50 AM	Sampled							0.83	0	80

Notes:

ENVIRONMENTAL ENGINEERING, INC

Well No.:	MW-3	**Project No.:**	2701
Casing Diameter:	2 inch	**Address:**	Bhalla's Service Station
Depth of Well:	31.10 ft		2610 Contra Loma Blvd, Antioch
Top of Casing Elevation:	37.10 ft	**Date:**	May 23, 2006
Depth to Groundwater:	17.00 ft	**Sampler:**	Tony Perini
Groundwater Elevation:	20.10 ft		~~Eric Jennings~~ Brian Timms
Water Column Height:	14.10 ft		
Purged Volume:	13 gallons		

Purging Method: Bailer ☐ Pump ☑

Sampling Method: Bailer ☑ Pump ☐

Color: No ☐ Yes ☐ Describe

Sheen: No ☐ Yes ☐ Describe

Odor: No ☐ Yes ☐ Describe

Field Measurements:

Time	Volume (gallons)	D.O. mg/L	pH	Temp °C	E.C. (µS/cm)	Turb. NTU	ORP	Fe^{+2} mg/L	NO_3^- mg/L	SO_4^{-2} mg/L
12:10 PM	Starting pumping well									
12:12 PM	1.0	7.56	6.84	20.97	1510	121	-63			
12:14 PM	4	6.29	6.80	20.78	1520	68	-65			
12:16 PM	7	5.34	6.78	20.91	1540	0	-61			
12:20 PM	13	4.79	6.79	20.93	1540	0	-76			
12:23 PM	Samples							3.30	0	80

Notes:

ENVIRONMENTAL ENGINEERING, INC

Well No.: MW-4A
Casing Diameter: 4 inch
Depth of Well: 32.25 ft
Top of Casing Elevation: 39.89 ft
Depth to Groundwater: 20.07 ft
Groundwater Elevation: 19.82 ft
Water Column Height: 12.18 ft
Purged Volume: 19 gallons

Project No.: 2701
Address: Bhalla's Service Station
2610 Contra Loma Blvd, Antioch
Date: May 23, 2006
Sampler: Tony Perini
Eric Jennings

Purging Method: Bailer ☐ Pump ☑

Sampling Method: Bailer ☑ Pump ☐

Color: No ☑ Yes ☐ Describe

Sheen: No ☑ Yes ☐ Describe

Odor: No ☑ Yes ☐ Describe

Field Measurements:

Time	Volume (gallons)	D.O. mg/L	pH	Temp °C	E.C. (µS/cm)	Turb. NTU	ORP	Fe^{+2} mg/L	NO_3^- mg/L	SO_4^{-2} mg/L
11:13 Am	started		purging	well						
11:15 Am	1.0	4.40	6.58	23.51	1840	219	139			
11:17 Am	4.0	3.49	6.54	23.62	1560	164	137			
11:20 Am	7	3.21	6.48	23.64	1390	146	137			
11:25 Am	14	2.82	6.42	23.65	1580	123	134			
11:29 Am	19	2.60	6.43	23.65	1610	120	132			
11:32 Am	sampled							0.25	6.3	27

Notes:

ENVIRONMENTAL ENGINEERING, INC

Well No.:	MW-7A	**Project No.:**	2701
Casing Diameter:	4 inch	**Address:**	Bhalla's Service Station
Depth of Well:	39.20 ft		2610 Contra Loma Blvd, Antioch
Top of Casing Elevation:	41.29 ft	**Date:**	May 23, 2006
Depth to Groundwater:	21.46 ft	**Sampler:**	Tony Perini
Groundwater Elevation:	19.83 ft		Eric Jennings
Water Column Height:	17.74 ft		
Purged Volume:	15 gallons		

Purging Method: Bailer ☐ Pump ☑

Sampling Method: Bailer ☑ Pump ☐

Color: No ☑ Yes ☐ Describe _____

Sheen: No ☑ Yes ☐ Describe _____

Odor: No ☑ Yes ☐ Describe _____

Field Measurements:

Time	Volume (gallons)	D.O. mg/L	pH	Temp °C	E.C. (µS/cm)	Turb. NTU	ORP	Fe^{+2} mg/L	NO_3^- mg/L	SO_4^{-2} mg/L
11:41 Am	started purging well									
11:43 Am	1.0	3.83	6.81	21.65	2030	405	126			
11:45 Am	4	3.09	6.74	21.65	2030	320	127			
11:47 Am	7	2.72	6.70	21.66	2030	281	127			
11:52 Am	15	2.20	6.67	21.66	2030	201	126			
11:55 Am	Sampled							0.20	5.8	80

Notes:

ENVIRONMENTAL ENGINEERING, INC

Well No.:	MW-8U	**Project No.:**	2701
Casing Diameter:	2 inch	**Address:**	Bhalla's Service Station
Depth of Well:	28.30 ft		2610 Contra Loma Blvd, Antioch
Top of Casing Elevation:	38.16 ft	**Date:**	May 24, 2006
Depth to Groundwater:	16.85 ft	**Sampler:**	Tony Perini
Groundwater Elevation:	21.31 ft		~~Eric Jennings~~ Brian Toms
Water Column Height:	11.45 ft		
Purged Volume:	7 gallons		

Purging Method: Bailer ☐ Pump ☑

Sampling Method: Bailer ☑ Pump ☐

Color: No ☑ Yes ☐ Describe

Sheen: No ☑ Yes ☐ Describe

Odor: No ☑ Yes ☐ Describe

Field Measurements:

Time	Volume (gallons)	D.O. mg/L	pH	Temp °C	E.C. (µS/cm)	Turb. NTU	ORP	Fe^{+2} mg/L	NO_3^- mg/L	SO_4^{-2} mg/L
11:05 Am	Started purging well									
11:07 Am	1.0	9.90	6.05	21.55	1930	22.9	212			
11:09 Am	4	8.74	6.53	21.47	1920	394	188			
11:10 Am	5	DRIED								
11:12 Am	6	8.58	6.80	21.82	1920	999	104			
11:14 Am	7	DRIED								
11:15 Am	Sampled							0.23	4.2	80

Notes:

ENVIRONMENTAL ENGINEERING, INC

Well No.:	MW-9U	**Project No.:**	2701
Casing Diameter:	2 inch	**Address:**	Bhalla's Service Station
Depth of Well:	42.05 ft		2610 Contra Loma Blvd, Antioch
Top of Casing Elevation:	40.57 ft	**Date:**	May 23, 2006
Depth to Groundwater:	20.78 ft	**Sampler:**	Tony Perini
Groundwater Elevation:	19.79 ft		Eric Jennings
Water Column Height:	21.27 ft		
Purged Volume:	12 gallons		

Purging Method: Bailer ☐ Pump ☑

Sampling Method: Bailer ☑ Pump ☐

Color: No ☑ Yes ☐ Describe

Sheen: No ☑ Yes ☐ Describe

Odor: No ☑ Yes ☐ Describe

Field Measurements:

Time	Volume (gallons)	D.O. mg/L	pH	Temp °C	E.C. (µS/cm)	Turb. NTU	ORP	Fe^{+2} mg/L	NO_3^- mg/L	SO_4^{-2} mg/L
1:16 PM	started pumping well									
1:18 PM	1.0	4.57	6.90	22.43	1980	999	128			
1:20 PM	4	3.02	6.83	22.33	1980	438	129			
1:23 PM	8	2.41	6.77	22.31	1980	336	129			
1:26 PM	12	2.17	6.75	22.32	1980	276	129			
1:30 PM	Sampled							0	5.7	80

Notes:

ENVIRONMENTAL ENGINEERING, INC

Well No.:	MW-1Dw	**Project No.:**	2701
Casing Diameter:	2 inch	**Address:**	Bhalla's Service Station 2610 Contra Loma Blvd, Antioch
Depth of Well:	25.70 ft	**Date:**	May 23, 2006
Top of Casing Elevation:	35.89 ft	**Sampler:**	Tony Perini Eric Jennings
Depth to Groundwater:	16.19 ft		
Groundwater Elevation:	19.70 ft		
Water Column Height:	9.51 ft		
Purged Volume:	10 gallons		

Purging Method: Bailer ☐ Pump ☑

Sampling Method: Bailer ☑ Pump ☐

Color: No ☐ Yes ☑ Describe cloudy

Sheen: No ☑ Yes ☐ Describe

Odor: No ☑ Yes ☐ Describe

Field Measurements:

Time	Volume (gallons)	D.O. mg/L	pH	Temp °C	E.C. (µS/cm)	Turb. NTU	ORP	Fe^{+2} mg/L	NO_3 mg/L	SO_4^{-2} mg/L
10:54 AM	started purging well									
10:56 AM	1.0	6.60	5.75	21.22	1880	999	175			
10:58 AM	4.0	5.79	6.11	21.18	1890	331	167			
11 AM	7	5.08	6.20	21.20	1890	197	161			
11:02 AM	10	4.53	6.24	21.20	1890	144	155			
11:05 AM	sampled							1.08	14.3	80

Notes:

ENVIRONMENTAL ENGINEERING, INC

Well No.:	MW-10L	**Project No.:**	2701
Casing Diameter:	2 inch	**Address:**	Bhalla's Service Station
Depth of Well:	52.68 ft		2610 Contra Loma Blvd, Antioch
Top of Casing Elevation:	41.26 ft	**Date:**	May 23, 2006
Depth to Groundwater:	21.50 ft	**Sampler:**	Tony Perini
Groundwater Elevation:	19.76 ft		Eric Jennings
Water Column Height:	31.18 ft		
Purged Volume:	28 gallons		

Purging Method: Bailer ☐ Pump ☑

Sampling Method: Bailer ☑ Pump ☐

Color: No ☑ Yes ☐ Describe

Sheen: No ☑ Yes ☐ Describe

Odor: No ☑ Yes ☐ Describe

Field Measurements:

Time	Volume (gallons)	D.O. mg/L	pH	Temp °C	E.C. (µS/cm)	Turb. NTU	ORP	Fe^{+2} mg/L	NO_3 mg/L	SO_4^{-2} mg/L
12:40 PM	Started purging well									
12:41	1	7.52	7.11	21.53	1890	999	126			
12:46	7	3.91	6.89	21.47	1900	582	112			
12:50	12	3.14	6.85	21.46	1910	446	130			
12:56	20	2.49	6.76	21.46	1920	298	129			
~~1:00~~ 1:02 PM	28	2.40	6.75	21.47	1920	321	129			
1:05 PM	Sampled							0	35	80

Notes:

ENVIRONMENTAL ENGINEERING, INC

Well No.:	MW-11L	**Project No.:**	2701
Casing Diameter:	2 inch	**Address:**	Bhalla's Service Station
Depth of Well:	47.20 ft		2610 Contra Loma Blvd, Antioch
Top of Casing Elevation:	39.63 ft	**Date:**	May 23, 2006
Depth to Groundwater:	19.78 ft	**Sampler:**	Tony Perini
Groundwater Elevation:	19.85 ft		Eric Jennings
Water Column Height:	27.42 ft		
Purged Volume:	19 gallons		

Purging Method: Bailer ☐ Pump ☑

Sampling Method: Bailer ☑ Pump ☐

Color: No ☑ Yes ☐ Describe

Sheen: No ☑ Yes ☐ Describe

Odor: No ☑ Yes ☐ Describe

Field Measurements:

Time	Volume (gallons)	D.O. mg/L	pH	Temp °C	E.C. (µS/cm)	Turb. NTU	ORP	Fe^{+2} mg/L	NO_3 mg/L	SO_4^{-2} mg/L
1:41 PM	Starting purging well									
1:43 PM	1.0	4.25	7.01	22.38	2100	999	121			
1:48 pm	7	3.14	6.90	22.29	2100	433	123			
1:53 pm	14	2.80	6.84	22.31	2100	347	122			
1:56 PM	19	2.64	6.83	22.30	2100	313	121			
2:00 PM	SAMPLED							0	35	80

Notes:

ENVIRONMENTAL ENGINEERING, INC

Well No.:	MW-12L	**Project No.:**	2701
Casing Diameter:	2 inch	**Address:**	Bhalla's Service Station
Depth of Well:	44.58 ft		2610 Contra Loma Blvd, Antioch
Top of Casing Elevation:	36.83 ft	**Date:**	May 23, 2006
Depth to Groundwater:	16.56 ft	**Sampler:**	Tony Perini
Groundwater Elevation:	20.27 ft		Eric Jennings
Water Column Height:	28.02 ft		
Purged Volume:	9 gallons		

Purging Method: Bailer ☐ Pump ☑

Sampling Method: Bailer ☑ Pump ☐

Color: No ☑ Yes ☐ Describe

Sheen: No ☑ Yes ☐ Describe

Odor: No ☑ Yes ☐ Describe

Field Measurements:

Time	Volume (gallons)	D.O. mg/L	pH	Temp °C	E.C. (µS/cm)	Turb. NTU	ORP	Fe^{+2} mg/L	NO_3 mg/L	SO_4^{-2} mg/L
2:10 PM	started purging well									
2:12 PM	1.0	3.56	7.15	22.26	2010	473	114			
2:16 PM	6	DRIED								
2:20 PM	8	5.60	7.19	22.83	2000	785	109			
2:22 PM	9	DRIED								
2:25 PM	sampled							.74	∅	80

Notes:

ENVIRONMENTAL ENGINEERING, INC

Well No.: EW-101
Casing Diameter: _____ inch
Depth of Well: _____ ft
Top of Casing Elevation: 36.08 ft
Depth to Groundwater: 21.45 ft
Groundwater Elevation: 14.63 ft
Water Column Height: _____ ft
Purged Volume: _____ gallons
not purged

Project No.: 2701
Address: Bhalla's Service Station
2610 Contra Loma Blvd, Antioch
Date: May 23, 2006
Sampler: Tony Perini
Eric Jennings

Purging Method: Bailer ☐ Pump ☐

Sampling Method: Bailer ☐ Pump ☐

Color: No ☐ Yes ☐ Describe _____

Sheen: No ☐ Yes ☐ Describe _____

Odor: No ☐ Yes ☐ Describe _____

Field Measurements:

Time	Volume (gallons)	D.O. mg/L	pH	Temp °C	E.C. (µS/cm)	Turb. NTU	ORP	Fe^{+2} mg/L	NO_3^- mg/L	SO_4^{-2} mg/L
No field measurements were taken (recorded)										
only depth to groundwater.										

Notes:

Appendix C

Laboratory Reports and Chain of Custody Forms

for the

Second Quarter 2006 Monitoring Event

CHAIN OF CUSTODY FORM

PAL Pacific Analytical Laboratory
851 West Midway Ave., Suite 201B
Alameda, CA 94501
510-864-0364 Telephone
510-864-0365 Fax

PAL Login# 6050014

Project No: 2701

Sampler: Tony Perini / Brian Times

Project Name: 2610 Contra Loma Blvd, Antioch

Report To: Tony Perini

Company: SOMA Environmental Engineering, Inc.

Turnaround Time: Standard

Tel: 925-734-6400
Fax: 925-734-6401

Analyses/Method

Lab No.	Sample ID	Sampling Date/Time: Date	Time	Matrix: Soil	Water	Waste	# of Containers	Preservatives: HCL	H_2SO_4	HNO_3	ICE	Field Notes	TPH-g, BTEX, MtBE 8260B	TPH-d 8015	Gasoline Oxygenates & Lead Scavengers	Ethanol
	MW-2	5/24/06	11:50 AM		X		4 VOAs 1-1L Amber	X			X	Grab Sample	X	X	X	X
	MW-3	5/24/06	12:28 PM		X			X			X		X	X	X	X
	MW-8U	5/24/06	11:15 AM		X			X			X		X	X	X	X

Sampler Remarks:

EDF OUTPUT REQUIRED
Silica Gel Cleanup Method

Relinquished by:	Date/Time:	Received by:	Date/Time:
[signature]	4:00 pm 5/24/06	James Zinger	5/24/06 4:00 PM

04-2285E4

INFORMATION HANDOUT

PAL Pacific Analytical Laboratory
851 West Midway Ave. Suite 201
Alameda, CA 94501 Phone (510) 864-0364

09 June 2006

Mansour Sepehr
SOMA Environmental Engineering Inc.
6620 Owens Drive, Suite A
Pleasanton, CA 94588

RE: 2610 Contra Loma Blvd, Antioch

Work Order Number: 6050014

This Laboratory report has been reviewed for technical correctness and completeness. This entire report was reviewed and approved by the Laboratory Director or the Director's designee, as verified by the following signature.

Sincerely,

Majid Akhavan
Laboratory Director

PAL

SOMA Environmental Engineering Inc.	Project: 2610 Contra Loma Blvd, Antioch	
6620 Owens Drive, Suite A	Project Number: 2701	**Reported:**
Pleasanton CA, 94588	Project Manager: Mansour Sepehr	09-Jun-06 15:26

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
MW-2	6050014-01	Water	24-May-06 11:50	24-May-06 16:08
MW-3	6050014-02	Water	24-May-06 12:23	24-May-06 16:08
MW-8U	6050014-03	Water	24-May-06 11:15	24-May-06 16:08

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

PAL

SOMA Environmental Engineering Inc. 6620 Owens Drive, Suite A Pleasanton CA, 94588	Project: 2610 Contra Loma Blvd, Antioch Project Number: 2701 Project Manager: Mansour Sepehr	**Reported:** 09-Jun-06 15:26

Extractable Petroleum Hydrocarbons by 8015 DRO

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-2 (6050014-01) Water Sampled: 24-May-06 11:50 Received: 24-May-06 16:08									
Diesel (C10-C24)	**939**	50.0	ug/l	1	BE63101	24-May-06	26-May-06	EPA 8015M	C-03, D-06, D-30
Surrogate: Pentacosane		*103 %*	*50-140*		"	"	"	"	
MW-3 (6050014-02) Water Sampled: 24-May-06 12:23 Received: 24-May-06 16:08									
Diesel (C10-C24)	**257**	50.0	ug/l	1	BE63101	24-May-06	26-May-06	EPA 8015M	C-03, D-06, D-30
Surrogate: Pentacosane		*71.6 %*	*50-140*		"	"	"	"	
MW-8U (6050014-03) Water Sampled: 24-May-06 11:15 Received: 24-May-06 16:08									
Diesel (C10-C24)	ND	50.0	ug/l	1	BE63101	24-May-06	26-May-06	EPA 8015M	C-03
Surrogate: Pentacosane		*86.6 %*	*50-140*		"	"	"	"	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

PAL

SOMA Environmental Engineering Inc.	Project: 2610 Contra Loma Blvd, Antioch	
6620 Owens Drive, Suite A	Project Number: 2701	Reported:
Pleasanton CA, 94588	Project Manager: Mansour Sepehr	09-Jun-06 15:26

Volatile Organic Compounds by EPA Method 8260B

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-2 (6050014-01) Water Sampled: 24-May-06 11:50 Received: 24-May-06 16:08									
Gasoline (C6-C12)	**5860**	50.0	ug/l	1	BE63001	24-May-06	26-May-06	EPA 8260B	
Benzene	ND	0.500	"	"	"	"	"	"	
Ethylbenzene	**45.1**	0.500	"	"	"	"	"	"	
m&p-Xylene	ND	1.00	"	"	"	"	"	"	
o-xylene	ND	0.500	"	"	"	"	"	"	
Toluene	ND	2.00	"	"	"	"	"	"	
MTBE	ND	0.500	"	"	"	"	"	"	
DIPE	ND	0.500	"	"	"	"	"	"	
ETBE	ND	0.500	"	"	"	"	"	"	
TAME	ND	2.00	"	"	"	"	"	"	
TBA	ND	10.0	"	"	"	"	"	"	
1,2-dichloroethane	ND	0.500	"	"	"	"	"	"	
1,2-Dibromoethane (EDB)	ND	0.500	"	"	"	"	"	"	
Ethanol	ND	1000	"	"	"	"	"	"	
Surrogate: 4-Bromofluorobenzene		*134 %*	*70-130*		"	"	"	"	*S-GC*
Surrogate: Dibromofluoromethane		*97.0 %*	*70-130*		"	"	"	"	
Surrogate: Perdeuterotoluene		*107 %*	*70-130*		"	"	"	"	
MW-3 (6050014-02RE1) Water Sampled: 24-May-06 12:23 Received: 24-May-06 16:08									
Gasoline (C6-C12)	ND	1080	ug/l	21.5	BE63001	24-May-06	30-May-06	EPA 8260B	
Benzene	ND	10.8	"	"	"	"	"	"	
Ethylbenzene	ND	10.8	"	"	"	"	"	"	
m&p-Xylene	ND	21.5	"	"	"	"	"	"	
o-xylene	ND	10.8	"	"	"	"	"	"	
Toluene	ND	43.0	"	"	"	"	"	"	
MTBE	ND	10.8	"	"	"	"	"	"	
DIPE	ND	10.8	"	"	"	"	"	"	
ETBE	ND	10.8	"	"	"	"	"	"	
TAME	ND	43.0	"	"	"	"	"	"	
TBA	**7090**	215	"	"	"	"	"	"	
1,2-dichloroethane	ND	10.8	"	"	"	"	"	"	
1,2-Dibromoethane (EDB)	ND	10.8	"	"	"	"	"	"	
Ethanol	ND	21500	"	"	"	"	"	"	
Surrogate: 4-Bromofluorobenzene		*114 %*	*70-130*		"	"	"	"	
Surrogate: Dibromofluoromethane		*112 %*	*70-130*		"	"	"	"	
Surrogate: Perdeuterotoluene		*106 %*	*70-130*		"	"	"	"	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

PAL

SOMA Environmental Engineering Inc.	Project: 2610 Contra Loma Blvd, Antioch	
6620 Owens Drive, Suite A	Project Number: 2701	**Reported:**
Pleasanton CA, 94588	Project Manager: Mansour Sepehr	09-Jun-06 15:26

Volatile Organic Compounds by EPA Method 8260B

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-8U (6050014-03) Water Sampled: 24-May-06 11:15 Received: 24-May-06 16:08									
Gasoline (C6-C12)	ND	50.0	ug/l	1	BE63001	24-May-06	26-May-06	EPA 8260B	
Benzene	ND	0.500	"	"	"	"	"	"	
Ethylbenzene	ND	0.500	"	"	"	"	"	"	
m&p-Xylene	ND	1.00	"	"	"	"	"	"	
o-xylene	ND	0.500	"	"	"	"	"	"	
Toluene	ND	2.00	"	"	"	"	"	"	
MTBE	ND	0.500	"	"	"	"	"	"	
DIPE	ND	0.500	"	"	"	"	"	"	
ETBE	ND	0.500	"	"	"	"	"	"	
TAME	ND	2.00	"	"	"	"	"	"	
TBA	**16.7**	10.0	"	"	"	"	"	"	
1,2-dichloroethane	ND	0.500	"	"	"	"	"	"	
1,2-Dibromoethane (EDB)	ND	0.500	"	"	"	"	"	"	
Ethanol	ND	1000	"	"	"	"	"	"	
Surrogate: 4-Bromofluorobenzene		*107 %*		*70-130*	"	"	"	"	
Surrogate: Dibromofluoromethane		*108 %*		*70-130*	"	"	"	"	
Surrogate: Perdeuterotoluene		*99.8 %*		*70-130*	"	"	"	"	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

PAL

SOMA Environmental Engineering Inc.	Project: 2610 Contra Loma Blvd, Antioch	
6620 Owens Drive, Suite A	Project Number: 2701	**Reported:**
Pleasanton CA, 94588	Project Manager: Mansour Sepehr	09-Jun-06 15:26

Extractable Petroleum Hydrocarbons by 8015 DRO - Quality Control

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch BE63101 - EPA 3510B										
Blank (BE63101-BLK1)				Prepared & Analyzed: 31-May-06						
Surrogate: Pentacosane	*44.1*		*ug/l*	*50.0*		*88.2*	*50-140*			
Diesel (C10-C24)	ND	50.0	"							
LCS (BE63101-BS1)				Prepared & Analyzed: 31-May-06						
Surrogate: Pentacosane	*44.4*		*ug/l*	*50.0*		*88.8*	*50-140*			
Diesel (C10-C24)	753	50.0	"	1000		75.3	50-130			
LCS Dup (BE63101-BSD1)				Prepared & Analyzed: 31-May-06						
Surrogate: Pentacosane	*48.9*		*ug/l*	*50.0*		*97.8*	*50-140*			
Diesel (C10-C24)	796	50.0	"	1000		79.6	50-130	5.55	40	

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PAL

SOMA Environmental Engineering Inc.	Project: 2610 Contra Loma Blvd, Antioch	
6620 Owens Drive, Suite A	Project Number: 2701	**Reported:**
Pleasanton CA, 94588	Project Manager: Mansour Sepehr	09-Jun-06 15:26

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch BE63001 - EPA 5030 Water MS										
Blank (BE63001-BLK1)				Prepared & Analyzed: 30-May-06						
Surrogate: 4-Bromofluorobenzene	*51.8*		*ug/l*	*50.0*		*104*	*70-130*			
Surrogate: Dibromofluoromethane	*56.0*		*"*	*50.0*		*112*	*70-130*			
Surrogate: Perdeuterotoluene	*50.6*		*"*	*50.0*		*101*	*70-130*			
MTBE	ND	0.500	"							
DIPE	ND	0.500	"							
ETBE	ND	0.500	"							
TAME	ND	2.00	"							
Gasoline (C6-C12)	ND	50.0	"							
TBA	ND	10.0	"							
1,2-dichloroethane	ND	0.500	"							
1,2-Dibromoethane (EDB)	ND	0.500	"							
Ethanol	ND	1000	"							
Benzene	ND	0.500	"							
Ethylbenzene	ND	0.500	"							
m&p-Xylene	ND	1.00	"							
o-xylene	ND	0.500	"							
Toluene	ND	2.00	"							
LCS (BE63001-BS1)				Prepared & Analyzed: 30-May-06						
Surrogate: 4-Bromofluorobenzene	*53.9*		*ug/l*	*50.0*		*108*	*70-130*			
Surrogate: Dibromofluoromethane	*48.2*		*"*	*50.0*		*96.4*	*70-130*			
Surrogate: Perdeuterotoluene	*48.0*		*"*	*50.0*		*96.0*	*70-130*			
MTBE	104	0.500	"	100		104	70-130			
ETBE	100	0.500	"	100		100	70-130			
TAME	96.2	2.00	"	100		96.2	70-130			
TBA	496	10.0	"	500		99.2	70-130			
Gasoline (C6-C12)	1780	50.0	"	2000		89.0	70-130			
Benzene	107	0.500	"	100		107	70-130			
Toluene	106	2.00	"	100		106	70-130			

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

PAL

SOMA Environmental Engineering Inc.	Project: 2610 Contra Loma Blvd, Antioch	
6620 Owens Drive, Suite A	Project Number: 2701	**Reported:**
Pleasanton CA, 94588	Project Manager: Mansour Sepehr	09-Jun-06 15:26

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch BE63001 - EPA 5030 Water MS										
LCS Dup (BE63001-BSD1)				Prepared & Analyzed: 30-May-06						
Surrogate: 4-Bromofluorobenzene	*52.9*		*ug/l*	*50.0*		*106*	*70-130*			
Surrogate: Dibromofluoromethane	*48.4*		*"*	*50.0*		*96.8*	*70-130*			
Surrogate: Perdeuterotoluene	*48.2*		*"*	*50.0*		*96.4*	*70-130*			
MTBE	107	0.500	"	100		107	70-130	2.84	20	
ETBE	104	0.500	"	100		104	70-130	3.92	20	
TAME	102	2.00	"	100		102	70-130	5.85	20	
Gasoline (C6-C12)	2030	50.0	"	2000		102	70-130	13.1	20	
TBA	517	10.0	"	500		103	70-130	4.15	20	
Benzene	112	0.500	"	100		112	70-130	4.57	20	
Toluene	110	2.00	"	100		110	70-130	3.70	20	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

PAL

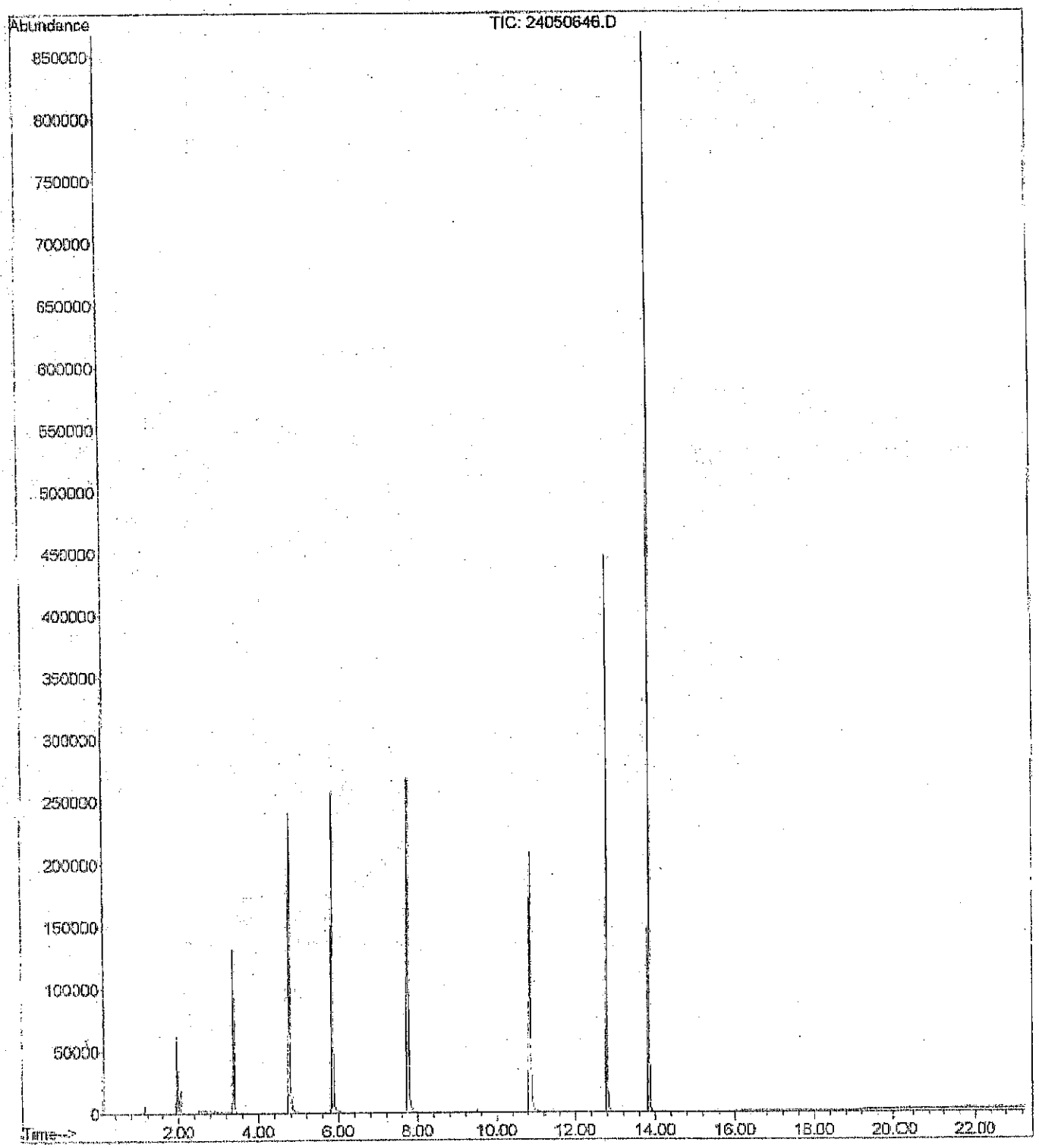
SOMA Environmental Engineering Inc.	Project: 2610 Contra Loma Blvd, Antioch	
6620 Owens Drive, Suite A	Project Number: 2701	Reported:
Pleasanton CA, 94588	Project Manager: Mansour Sepehr	09-Jun-06 15:26

Notes and Definitions

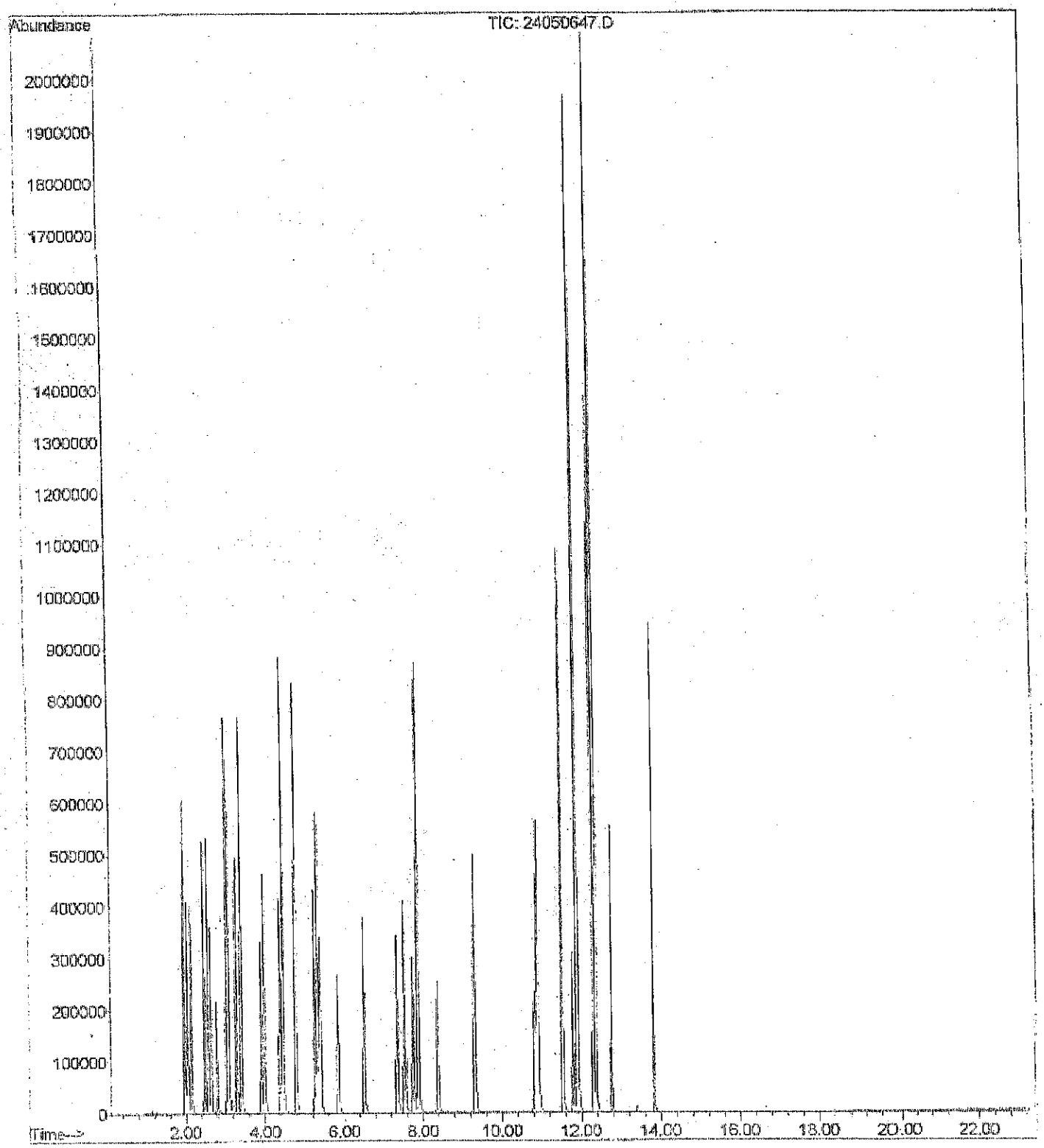
S-GC	Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the remaining surrogate.
D-30	Unidentified hydrocarbons C9-C16.
D-06	The sample chromatographic pattern does not resemble the fuel standard used for quantitation.
C-03	To reduce matrix interference, the sample extract has undergone silica-gel clean-up, method 3630, which is specific to polar compound contamination.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

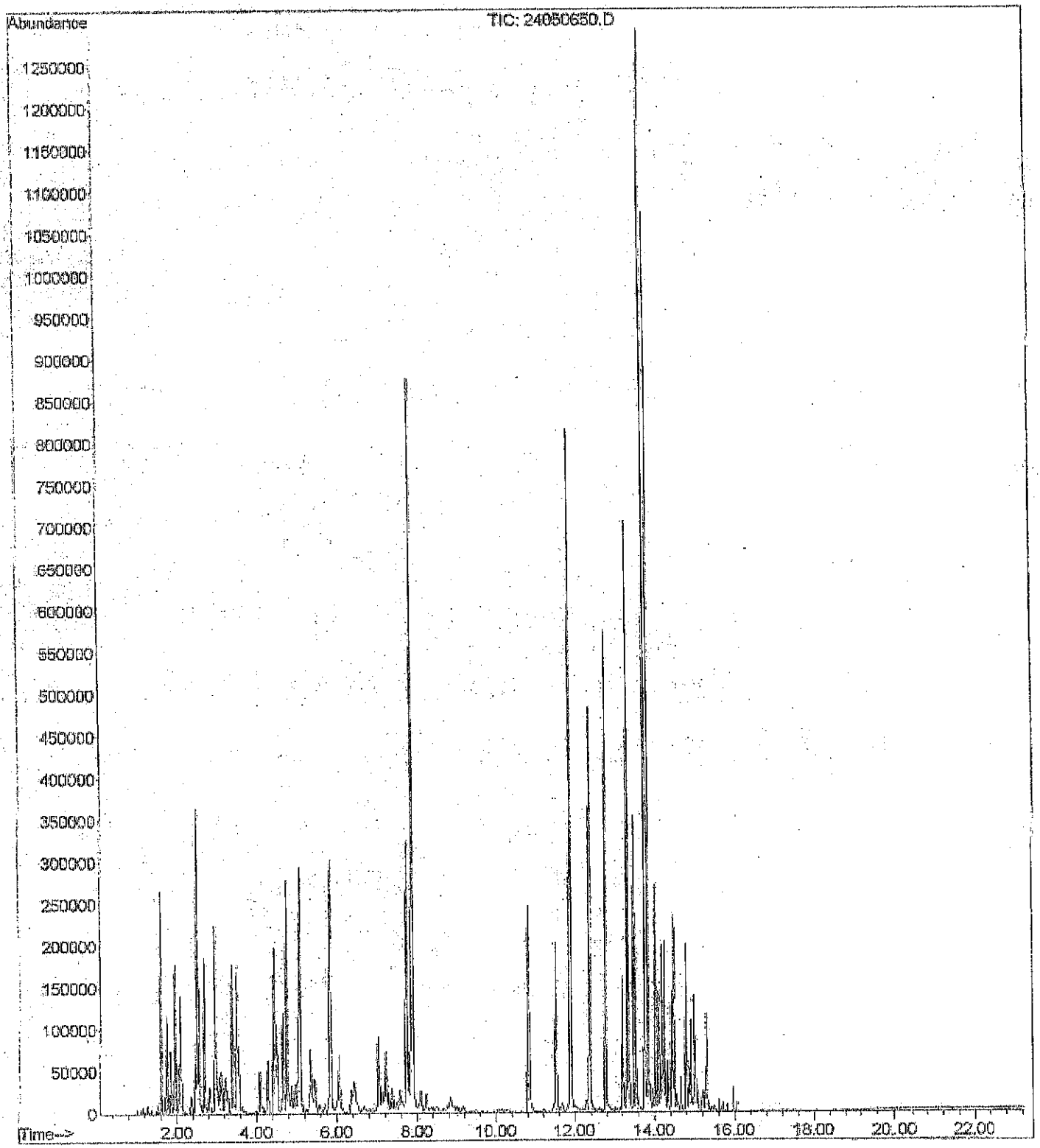
File :C:\MSDChem\1\DATA\2006-May-24-1502.b\24050646.D
Operator :
Acquired : 26 May 2006 12:41 am using AcqMethod OXY21506.M
Instrument : PAL GCMS
Sample Name: BE63001-BLK1
Misc Info :
Vial Number: 46



File :C:\MSDChem\1\DATA\2006-May-24-1502.b\Snapshot\24050647.D
Operator :
Acquired : 26 May 2006 1:23 am using AcqMethod OXY21506.M
Instrument : PAL GCMS
Sample Name: BE63001-BS1@voc
Misc Info :
Vial Number: 47



File :C:\MSDChem\1\DATA\2006-May-24-1502.b\24050650.D
Operator :
Acquired : 26 May 2006 3:30 am using AcqMethod OXY21506.M
Instrument : PAL GCMS
Sample Name: BE63001-BS1@gas
Misc Info :
Vial Number: 50

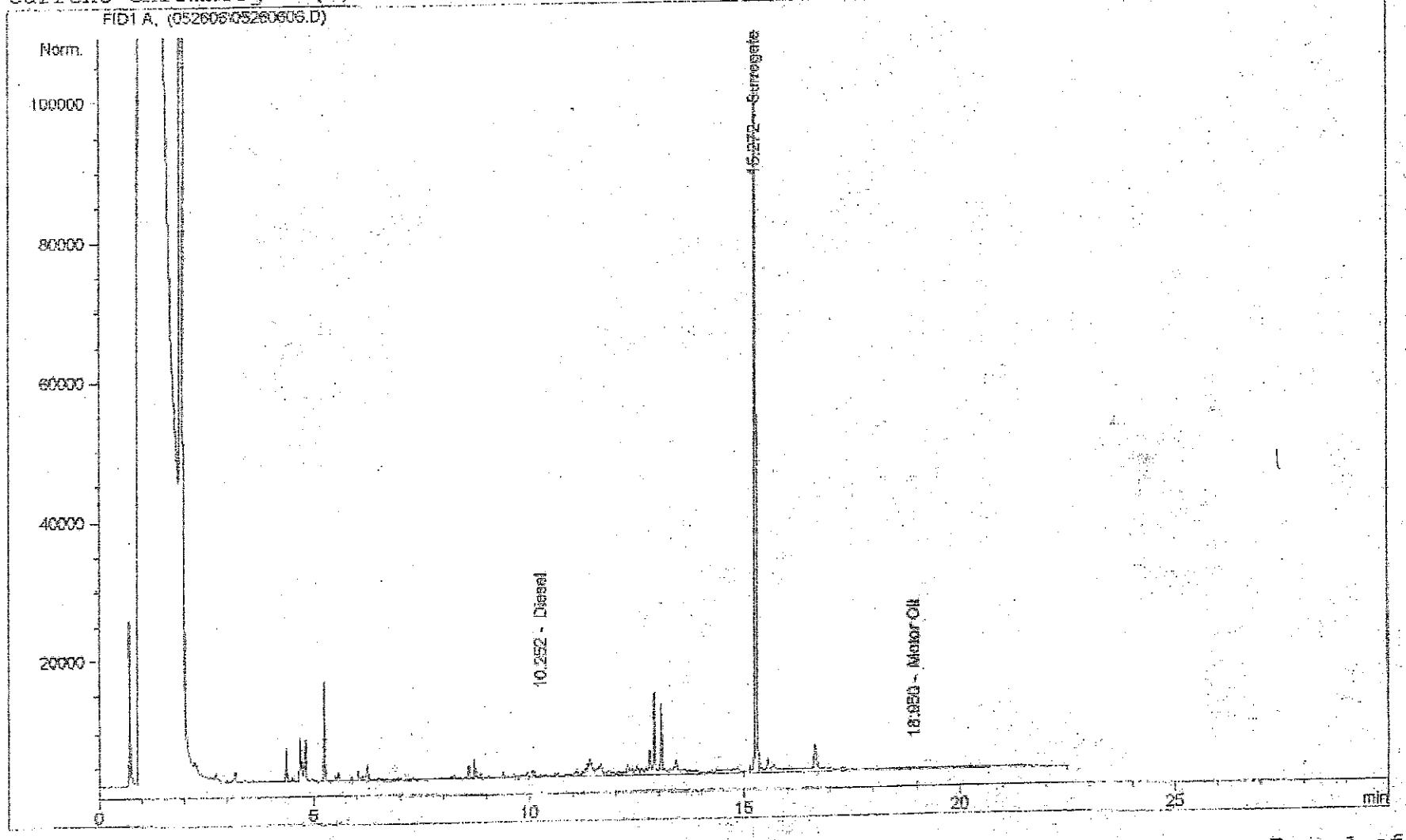


Injection Date : 5/26/06 3:22:20 PM
Sample Name : ~~MB058604~~ BE63101-BLK1
Acq. Operator : jz

Seq. Line : 1
Vial : 3
Inj : 1
Inj Volume : 2 ul

Acq. Method : C:\HPCHEM\1\METHODS\GC052306.M
Last changed : 5/24/06 10:25:47 AM by jz
Analysis Method : C:\HPCHEM\1\METHODS\GC052306.M
Last changed : 6/5/06 4:04:10 PM by jz
(modified after loading)

Current Chromatogram(s)



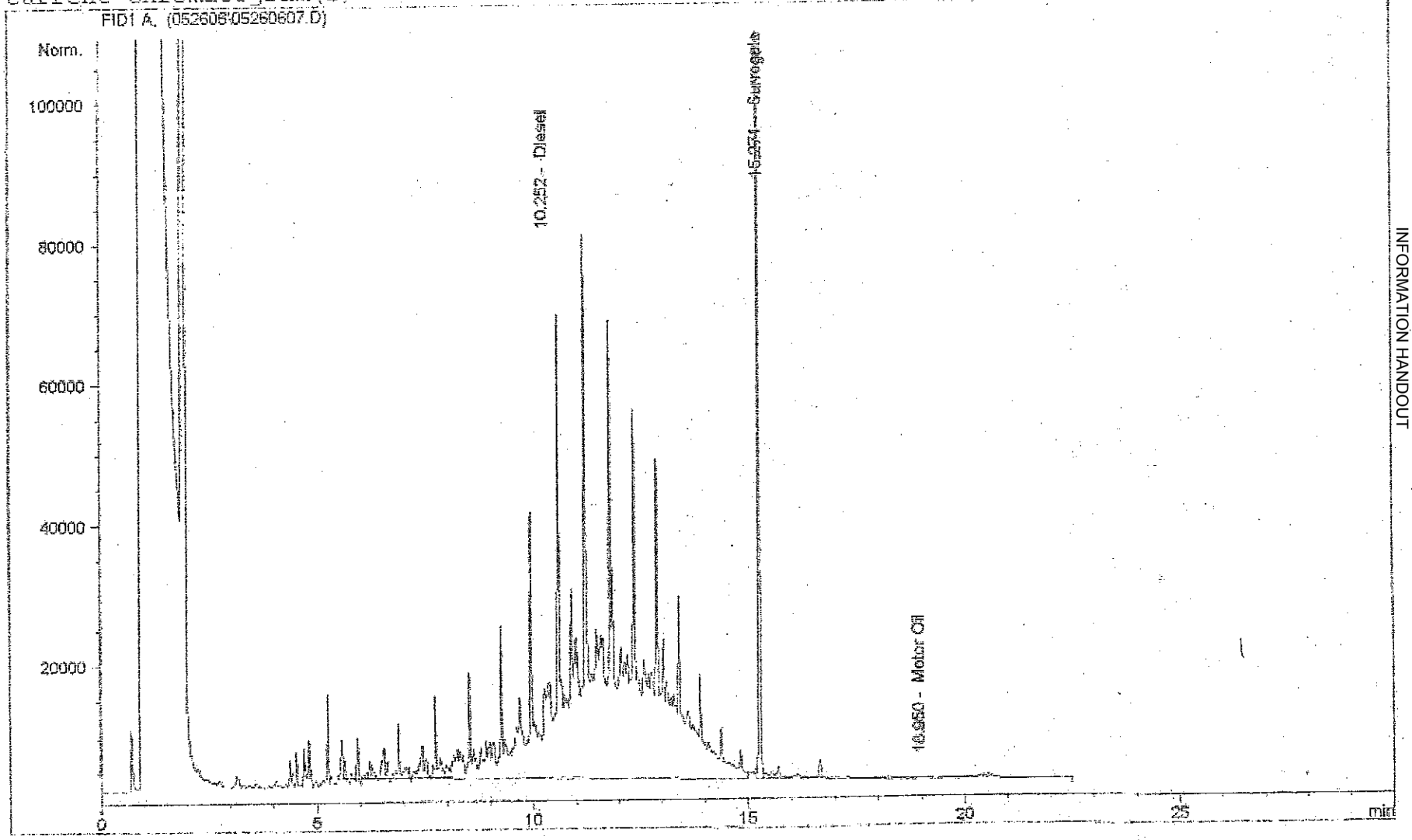
Instrument 1 6/9/06 2:28:55 PM jz

Injection Date : 5/26/06 3:55:00 PM
Sample Name : ~~LC3052604~~ BE63101-BS1
Acq. Operator : jz

Seq. Line : 2
Vial : 4
Inj : 1
Inj Volume : 2 ul

Acq. Method : C:\HPCHEM\1\METHODS\GC052306.M
Last changed : 5/24/06 10:25:47 AM by jz
Analysis Method : C:\HPCHEM\1\METHODS\GC052306.M
Last changed : 6/5/06 4:04:10 PM by jz
(modified after loading)

Current Chromatogram(s)



Instrument 1 6/9/06 2:29:12 PM jz

04-2285E4
INFORMATION HANDOUT

CHAIN OF CUSTODY FORM

PAL Pacific Analytical Laboratory
851 West Midway Ave., Suite 201B
Alameda, CA 94501
510-864-0364 Telephone
510-864-0365 Fax

PAL
Login# 6050013

Project No: 2701

Sampler: TONY PERINI / ERIC JENNINGS

Project Name: 2610 Contra Loma Blvd, Antioch

Report To: Tony Perini

Company: SOMA Environmental Engineering, Inc.

Turnaround Time: Standard

Tel: 925-734-6400
Fax: 925-734-6401

Analyses/Method

Lab No.	Sample ID	Sampling Date	Sampling Time	Soil	Water	Waste	# of Containers	HCL	H_2SO_4	HNO_3	ICE	Field Notes	TPH-g, BTEX, MtBE 8260B	TPH-d 8015	Gasoline Oxygenates & Lead Scavengers	Ethanol			
							4 VOAs 1-1L Amber												
	MW-6A	5/23/06	11:32 AM		X		X	X			X	Grab SAMPLE	X	X	X	X			
	MW-7A	5/23/06	11:55 AM		X		X	X			X		X	X	X	X			
	MW-9U	5/23/06	1:30 PM		X			X			X		X	X	X	X			
	MW-10U	5/23/06	11:05 AM		X			X			X		X	X	X	X			
	MW-10L	5/23/06	1:05 PM		X			X			X		X	X	X	X			
	MW-11L	5/23/06	2 PM		X			X			X		X	X	X	X			
	MW-12L	5/23/06	2:25 PM		X			X			X		X	X	X	X			

Sampler Remarks:

EDF OUTPUT REQUIRED
Silica Gel Cleanup Method

Relinquished by:	Date/Time:	Received by:	Date/Time:
Eric Jennings	MAY 23 2006 5:15 PM	[illegible]	5/23/06 5:15 PM

04-2285E4

INFORMATION HANDOUT

PAL Pacific Analytical Laboratory
851 West Midway Ave. Suite 201
Alameda, CA 94501 Phone (510) 864-0364

09 June 2006

Mansour Sepehr
SOMA Environmental Engineering Inc.
6620 Owens Drive, Suite A
Pleasanton, CA 94588

RE: 2610 Contra Loma Blvd, Antioch

Work Order Number: 6050013

This Laboratory report has been reviewed for technical correctness and completeness. This entire report was reviewed and approved by the Laboratory Director or the Director's designee, as verified by the following signature.

Sincerely,

Majid Akhavan
Laboratory Director

PAL

SOMA Environmental Engineering Inc.	Project: 2610 Contra Loma Blvd, Antioch	
6620 Owens Drive, Suite A	Project Number: 2701	**Reported:**
Pleasanton CA, 94588	Project Manager: Mansour Sepehr	09-Jun-06 14:38

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
MW-6A	6050013-01	Water	23-May-06 11:32	23-May-06 17:15
MW-7A	6050013-02	Water	23-May-06 11:55	23-May-06 17:15
MW-9U	6050013-03	Water	23-May-06 13:30	23-May-06 17:15
MW-10U	6050013-04	Water	23-May-06 11:05	23-May-06 17:15
MW-10L	6050013-05	Water	23-May-06 13:05	23-May-06 17:15
MW-11L	6050013-06	Water	23-May-06 14:00	23-May-06 17:15
MW-12L	6050013-07	Water	23-May-06 14:25	23-May-06 17:15

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

PAL

SOMA Environmental Engineering Inc.	Project: 2610 Contra Loma Blvd, Antioch	
6620 Owens Drive, Suite A	Project Number: 2701	**Reported:**
Pleasanton CA, 94588	Project Manager: Mansour Sepehr	09-Jun-06 14:38

Extractable Petroleum Hydrocarbons by 8015 DRO

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-6A (6050013-01) Water Sampled: 23-May-06 11:32 Received: 23-May-06 17:15									
Diesel (C10-C24)	**134**	50.0	ug/l	1	BE63101	24-May-06	26-May-06	EPA 8015M	C-03, D-06, D-09
Surrogate: Pentacosane		*85.8 %*	*50-140*		"	"	"	"	
MW-7A (6050013-02) Water Sampled: 23-May-06 11:55 Received: 23-May-06 17:15									
Diesel (C10-C24)	ND	50.0	ug/l	1	BE63101	24-May-06	26-May-06	EPA 8015M	C-03
Surrogate: Pentacosane		*98.2 %*	*50-140*		"	"	"	"	
MW-9U (6050013-03) Water Sampled: 23-May-06 13:30 Received: 23-May-06 17:15									
Diesel (C10-C24)	ND	50.0	ug/l	1	BE63101	24-May-06	26-May-06	EPA 8015M	C-03
Surrogate: Pentacosane		*92.0 %*	*50-140*		"	"	"	"	
MW-10U (6050013-04) Water Sampled: 23-May-06 11:05 Received: 23-May-06 17:15									
Diesel (C10-C24)	ND	50.0	ug/l	1	BE63101	24-May-06	26-May-06	EPA 8015M	C-03
Surrogate: Pentacosane		*89.6 %*	*50-140*		"	"	"	"	
MW-10L (6050013-05) Water Sampled: 23-May-06 13:05 Received: 23-May-06 17:15									
Diesel (C10-C24)	**102**	50.0	ug/l	1	BE63101	24-May-06	26-May-06	EPA 8015M	C-03, D-35
Surrogate: Pentacosane		*96.6 %*	*50-140*		"	"	"	"	
MW-11L (6050013-06) Water Sampled: 23-May-06 14:00 Received: 23-May-06 17:15									
Diesel (C10-C24)	ND	50.0	ug/l	1	BE63101	24-May-06	26-May-06	EPA 8015M	C-03
Surrogate: Pentacosane		*91.4 %*	*50-140*		"	"	"	"	
MW-12L (6050013-07) Water Sampled: 23-May-06 14:25 Received: 23-May-06 17:15									
Diesel (C10-C24)	**75.1**	50.0	ug/l	1	BE63101	24-May-06	26-May-06	EPA 8015M	C-03, D-06, D-30
Surrogate: Pentacosane		*103 %*	*50-140*		"	"	"	"	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

PAL

SOMA Environmental Engineering Inc.	Project: 2610 Contra Loma Blvd, Antioch	
6620 Owens Drive, Suite A	Project Number: 2701	**Reported:**
Pleasanton CA, 94588	Project Manager: Mansour Sepehr	09-Jun-06 14:38

Volatile Organic Compounds by EPA Method 8260B

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-6A (6050013-01RE1) Water Sampled: 23-May-06 11:32 Received: 23-May-06 17:15									
Gasoline (C6-C12)	ND	1080	ug/l	21.5	BE63001	24-May-06	30-May-06	EPA 8260B	
Benzene	ND	10.8	"	"	"	"	"	"	
Ethylbenzene	ND	10.8	"	"	"	"	"	"	
m&p-Xylene	ND	21.5	"	"	"	"	"	"	
o-xylene	ND	10.8	"	"	"	"	"	"	
Toluene	ND	43.0	"	"	"	"	"	"	
MTBE	**1380**	10.8	"	"	"	"	"	"	
DIPE	ND	10.8	"	"	"	"	"	"	
ETBE	ND	10.8	"	"	"	"	"	"	
TAME	ND	43.0	"	"	"	"	"	"	
TBA	**3090**	215	"	"	"	"	"	"	
1,2-dichloroethane	ND	10.8	"	"	"	"	"	"	
1,2-Dibromoethane (EDB)	ND	10.8	"	"	"	"	"	"	
Ethanol	ND	21500	"	"	"	"	"	"	
Surrogate: 4-Bromofluorobenzene		*112 %*		*70-130*		"	"	"	
Surrogate: Dibromofluoromethane		*110 %*		*70-130*		"	"	"	
Surrogate: Perdeuterotoluene		*104 %*		*70-130*		"	"	"	
MW-7A (6050013-02) Water Sampled: 23-May-06 11:55 Received: 23-May-06 17:15									
Gasoline (C6-C12)	ND	50.0	ug/l	1	BE63001	24-May-06	26-May-06	EPA 8260B	
Benzene	ND	0.500	"	"	"	"	"	"	
Ethylbenzene	ND	0.500	"	"	"	"	"	"	
m&p-Xylene	ND	1.00	"	"	"	"	"	"	
o-xylene	ND	0.500	"	"	"	"	"	"	
Toluene	ND	2.00	"	"	"	"	"	"	
MTBE	**1.20**	0.500	"	"	"	"	"	"	
DIPE	ND	0.500	"	"	"	"	"	"	
ETBE	ND	0.500	"	"	"	"	"	"	
TAME	ND	2.00	"	"	"	"	"	"	
TBA	ND	10.0	"	"	"	"	"	"	
1,2-dichloroethane	ND	0.500	"	"	"	"	"	"	
1,2-Dibromoethane (EDB)	ND	0.500	"	"	"	"	"	"	
Ethanol	ND	1000	"	"	"	"	"	"	
Surrogate: 4-Bromofluorobenzene		*103 %*		*70-130*		"	"	"	
Surrogate: Dibromofluoromethane		*111 %*		*70-130*		"	"	"	
Surrogate: Perdeuterotoluene		*101 %*		*70-130*		"	"	"	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

PAL

SOMA Environmental Engineering Inc.	Project: 2610 Contra Loma Blvd, Antioch	
6620 Owens Drive, Suite A	Project Number: 2701	**Reported:**
Pleasanton CA, 94588	Project Manager: Mansour Sepehr	09-Jun-06 14:38

Volatile Organic Compounds by EPA Method 8260B

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-9U (6050013-03) Water Sampled: 23-May-06 13:30 Received: 23-May-06 17:15									
Gasoline (C6-C12)	ND	50.0	ug/l	1	BE63001	24-May-06	26-May-06	EPA 8260B	
Benzene	ND	0.500	"	"	"	"	"	"	
Ethylbenzene	ND	0.500	"	"	"	"	"	"	
m&p-Xylene	ND	1.00	"	"	"	"	"	"	
o-xylene	ND	0.500	"	"	"	"	"	"	
Toluene	ND	2.00	"	"	"	"	"	"	
MTBE	**1.54**	0.500	"	"	"	"	"	"	
DIPE	ND	0.500	"	"	"	"	"	"	
ETBE	ND	0.500	"	"	"	"	"	"	
TAME	ND	2.00	"	"	"	"	"	"	
TBA	ND	10.0	"	"	"	"	"	"	
1,2-dichloroethane	ND	0.500	"	"	"	"	"	"	
1,2-Dibromoethane (EDB)	ND	0.500	"	"	"	"	"	"	
Ethanol	ND	1000	"	"	"	"	"	"	
Surrogate: 4-Bromofluorobenzene		*105 %*		*70-130*	"	"	"	"	
Surrogate: Dibromofluoromethane		*112 %*		*70-130*	"	"	"	"	
Surrogate: Perdeuterotoluene		*102 %*		*70-130*	"	"	"	"	
MW-10U (6050013-04) Water Sampled: 23-May-06 11:05 Received: 23-May-06 17:15									
Gasoline (C6-C12)	ND	50.0	ug/l	1	BE63001	24-May-06	26-May-06	EPA 8260B	
Benzene	ND	0.500	"	"	"	"	"	"	
Ethylbenzene	ND	0.500	"	"	"	"	"	"	
m&p-Xylene	ND	1.00	"	"	"	"	"	"	
o-xylene	ND	0.500	"	"	"	"	"	"	
Toluene	ND	2.00	"	"	"	"	"	"	
MTBE	**176**	0.500	"	"	"	"	"	"	
DIPE	ND	0.500	"	"	"	"	"	"	
ETBE	ND	0.500	"	"	"	"	"	"	
TAME	ND	2.00	"	"	"	"	"	"	
TBA	ND	10.0	"	"	"	"	"	"	
1,2-dichloroethane	ND	0.500	"	"	"	"	"	"	
1,2-Dibromoethane (EDB)	ND	0.500	"	"	"	"	"	"	
Ethanol	ND	1000	"	"	"	"	"	"	
Surrogate: 4-Bromofluorobenzene		*105 %*		*70-130*	"	"	"	"	
Surrogate: Dibromofluoromethane		*112 %*		*70-130*	"	"	"	"	
Surrogate: Perdeuterotoluene		*103 %*		*70-130*	"	"	"	"	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

PAL

SOMA Environmental Engineering Inc.	Project: 2610 Contra Loma Blvd, Antioch	
6620 Owens Drive, Suite A	Project Number: 2701	Reported:
Pleasanton CA, 94588	Project Manager: Mansour Sepehr	09-Jun-06 14:38

Volatile Organic Compounds by EPA Method 8260B

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-10L (6050013-05) Water Sampled: 23-May-06 13:05 Received: 23-May-06 17:15									
Gasoline (C6-C12)	ND	50.0	ug/l	1	BE63001	24-May-06	26-May-06	EPA 8260B	
Benzene	ND	0.500	"	"	"	"	"	"	
Ethylbenzene	ND	0.500	"	"	"	"	"	"	
m&p-Xylene	ND	1.00	"	"	"	"	"	"	
o-xylene	ND	0.500	"	"	"	"	"	"	
Toluene	ND	2.00	"	"	"	"	"	"	
MTBE	**0.950**	0.500	"	"	"	"	"	"	
DIPE	ND	0.500	"	"	"	"	"	"	
ETBE	ND	0.500	"	"	"	"	"	"	
TAME	ND	2.00	"	"	"	"	"	"	
TBA	ND	10.0	"	"	"	"	"	"	
1,2-dichloroethane	ND	0.500	"	"	"	"	"	"	
1,2-Dibromoethane (EDB)	ND	0.500	"	"	"	"	"	"	
Ethanol	ND	1000	"	"	"	"	"	"	
Surrogate: 4-Bromofluorobenzene		*105 %*		*70-130*	"	"	"	"	
Surrogate: Dibromofluoromethane		*112 %*		*70-130*	"	"	"	"	
Surrogate: Perdeuterotoluene		*102 %*		*70-130*	"	"	"	"	
MW-11L (6050013-06) Water Sampled: 23-May-06 14:00 Received: 23-May-06 17:15									
Gasoline (C6-C12)	ND	50.0	ug/l	1	BE63001	24-May-06	26-May-06	EPA 8260B	
Benzene	ND	0.500	"	"	"	"	"	"	
Ethylbenzene	ND	0.500	"	"	"	"	"	"	
m&p-Xylene	ND	1.00	"	"	"	"	"	"	
o-xylene	ND	0.500	"	"	"	"	"	"	
Toluene	ND	2.00	"	"	"	"	"	"	
MTBE	**0.890**	0.500	"	"	"	"	"	"	
DIPE	ND	0.500	"	"	"	"	"	"	
ETBE	ND	0.500	"	"	"	"	"	"	
TAME	ND	2.00	"	"	"	"	"	"	
TBA	ND	10.0	"	"	"	"	"	"	
1,2-dichloroethane	ND	0.500	"	"	"	"	"	"	
1,2-Dibromoethane (EDB)	ND	0.500	"	"	"	"	"	"	
Ethanol	ND	1000	"	"	"	"	"	"	
Surrogate: 4-Bromofluorobenzene		*104 %*		*70-130*	"	"	"	"	
Surrogate: Dibromofluoromethane		*114 %*		*70-130*	"	"	"	"	
Surrogate: Perdeuterotoluene		*103 %*		*70-130*	"	"	"	"	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

PAL

SOMA Environmental Engineering Inc.	Project: 2610 Contra Loma Blvd, Antioch	
6620 Owens Drive, Suite A	Project Number: 2701	**Reported:**
Pleasanton CA, 94588	Project Manager: Mansour Sepehr	09-Jun-06 14:38

Volatile Organic Compounds by EPA Method 8260B

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-12L (6050013-07) Water Sampled: 23-May-06 14:25 Received: 23-May-06 17:15									
Gasoline (C6-C12)	**55.9**	50.0	ug/l	1	BE63001	24-May-06	26-May-06	EPA 8260B	
Benzene	ND	0.500	"	"	"	"	"	"	
Ethylbenzene	ND	0.500	"	"	"	"	"	"	
m&p-Xylene	ND	1.00	"	"	"	"	"	"	
o-xylene	ND	0.500	"	"	"	"	"	"	
Toluene	ND	2.00	"	"	"	"	"	"	
MTBE	**1.86**	0.500	"	"	"	"	"	"	
DIPE	ND	0.500	"	"	"	"	"	"	
ETBE	ND	0.500	"	"	"	"	"	"	
TAME	ND	2.00	"	"	"	"	"	"	
TBA	ND	10.0	"	"	"	"	"	"	
1,2-dichloroethane	ND	0.500	"	"	"	"	"	"	
1,2-Dibromoethane (EDB)	ND	0.500	"	"	"	"	"	"	
Ethanol	ND	1000	"	"	"	"	"	"	
Surrogate: 4-Bromofluorobenzene		*108 %*		*70-130*	"	"	"	"	
Surrogate: Dibromofluoromethane		*114 %*		*70-130*	"	"	"	"	
Surrogate: Perdeuterotoluene		*104 %*		*70-130*	"	"	"	"	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

PAL

SOMA Environmental Engineering Inc.	Project: 2610 Contra Loma Blvd, Antioch	
6620 Owens Drive, Suite A	Project Number: 2701	**Reported:**
Pleasanton CA, 94588	Project Manager: Mansour Sepehr	09-Jun-06 14:38

Extractable Petroleum Hydrocarbons by 8015 DRO - Quality Control

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch BE63101 - EPA 3510B										
Blank (BE63101-BLK1)				Prepared & Analyzed: 31-May-06						
Surrogate: Pentacosane	*44.1*		*ug/l*	*50.0*		*88.2*	*50-140*			
Diesel (C10-C24)	ND	50.0	"							
LCS (BE63101-BS1)				Prepared & Analyzed: 31-May-06						
Surrogate: Pentacosane	*44.4*		*ug/l*	*50.0*		*88.8*	*50-140*			
Diesel (C10-C24)	753	50.0	"	1000		75.3	50-130			
LCS Dup (BE63101-BSD1)				Prepared & Analyzed: 31-May-06						
Surrogate: Pentacosane	*48.9*		*ug/l*	*50.0*		*97.8*	*50-140*			
Diesel (C10-C24)	796	50.0	"	1000		79.6	50-130	5.55	40	

The results in this report apply to the samples analyzed in accordance wi th the chain of custody document. This analytical report must be reproduced in its entire ty.

PAL

SOMA Environmental Engineering Inc.	Project: 2610 Contra Loma Blvd, Antioch	
6620 Owens Drive, Suite A	Project Number: 2701	**Reported:**
Pleasanton CA, 94588	Project Manager: Mansour Sepehr	09-Jun-06 14:38

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch BE63001 - EPA 5030 Water MS										
Blank (BE63001-BLK1)				Prepared & Analyzed: 30-May-06						
Surrogate: 4-Bromofluorobenzene	*51.8*		*ug/l*	*50.0*		*104*	*70-130*			
Surrogate: Dibromofluoromethane	*56.0*		"	*50.0*		*112*	*70-130*			
Surrogate: Perdeuterotoluene	*50.6*		"	*50.0*		*101*	*70-130*			
MTBE	ND	0.500	"							
DIPE	ND	0.500	"							
ETBE	ND	0.500	"							
TAME	ND	2.00	"							
Gasoline (C6-C12)	ND	50.0	"							
TBA	ND	10.0	"							
1,2-dichloroethane	ND	0.500	"							
1,2-Dibromoethane (EDB)	ND	0.500	"							
Ethanol	ND	1000	"							
Benzene	ND	0.500	"							
Ethylbenzene	ND	0.500	"							
m&p-Xylene	ND	1.00	"							
o-xylene	ND	0.500	"							
Toluene	ND	2.00	"							
LCS (BE63001-BS1)				Prepared & Analyzed: 30-May-06						
Surrogate: 4-Bromofluorobenzene	*53.9*		*ug/l*	*50.0*		*108*	*70-130*			
Surrogate: Dibromofluoromethane	*48.2*		"	*50.0*		*96.4*	*70-130*			
Surrogate: Perdeuterotoluene	*48.0*		"	*50.0*		*96.0*	*70-130*			
MTBE	104	0.500	"	100		104	70-130			
ETBE	100	0.500	"	100		100	70-130			
TAME	96.2	2.00	"	100		96.2	70-130			
TBA	496	10.0	"	500		99.2	70-130			
Gasoline (C6-C12)	1780	50.0	"	2000		89.0	70-130			
Benzene	107	0.500	"	100		107	70-130			
Toluene	106	2.00	"	100		106	70-130			

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entire ty.

PAL

SOMA Environmental Engineering Inc.	Project: 2610 Contra Loma Blvd, Antioch	
6620 Owens Drive, Suite A	Project Number: 2701	**Reported:**
Pleasanton CA, 94588	Project Manager: Mansour Sepehr	09-Jun-06 14:38

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch BE63001 - EPA 5030 Water MS										
LCS Dup (BE63001-BSD1)				Prepared & Analyzed: 30-May-06						
Surrogate: 4-Bromofluorobenzene	*52.9*		*ug/l*	*50.0*		*106*	*70-130*			
Surrogate: Dibromofluoromethane	*48.4*		*"*	*50.0*		*96.8*	*70-130*			
Surrogate: Perdeuterotoluene	*48.2*		*"*	*50.0*		*96.4*	*70-130*			
MTBE	107	0.500	"	100		107	70-130	2.84	20	
ETBE	104	0.500	"	100		104	70-130	3.92	20	
TAME	102	2.00	"	100		102	70-130	5.85	20	
Gasoline (C6-C12)	2030	50.0	"	2000		102	70-130	13.1	20	
TBA	517	10.0	"	500		103	70-130	4.15	20	
Benzene	112	0.500	"	100		112	70-130	4.57	20	
Toluene	110	2.00	"	100		110	70-130	3.70	20	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

PAL

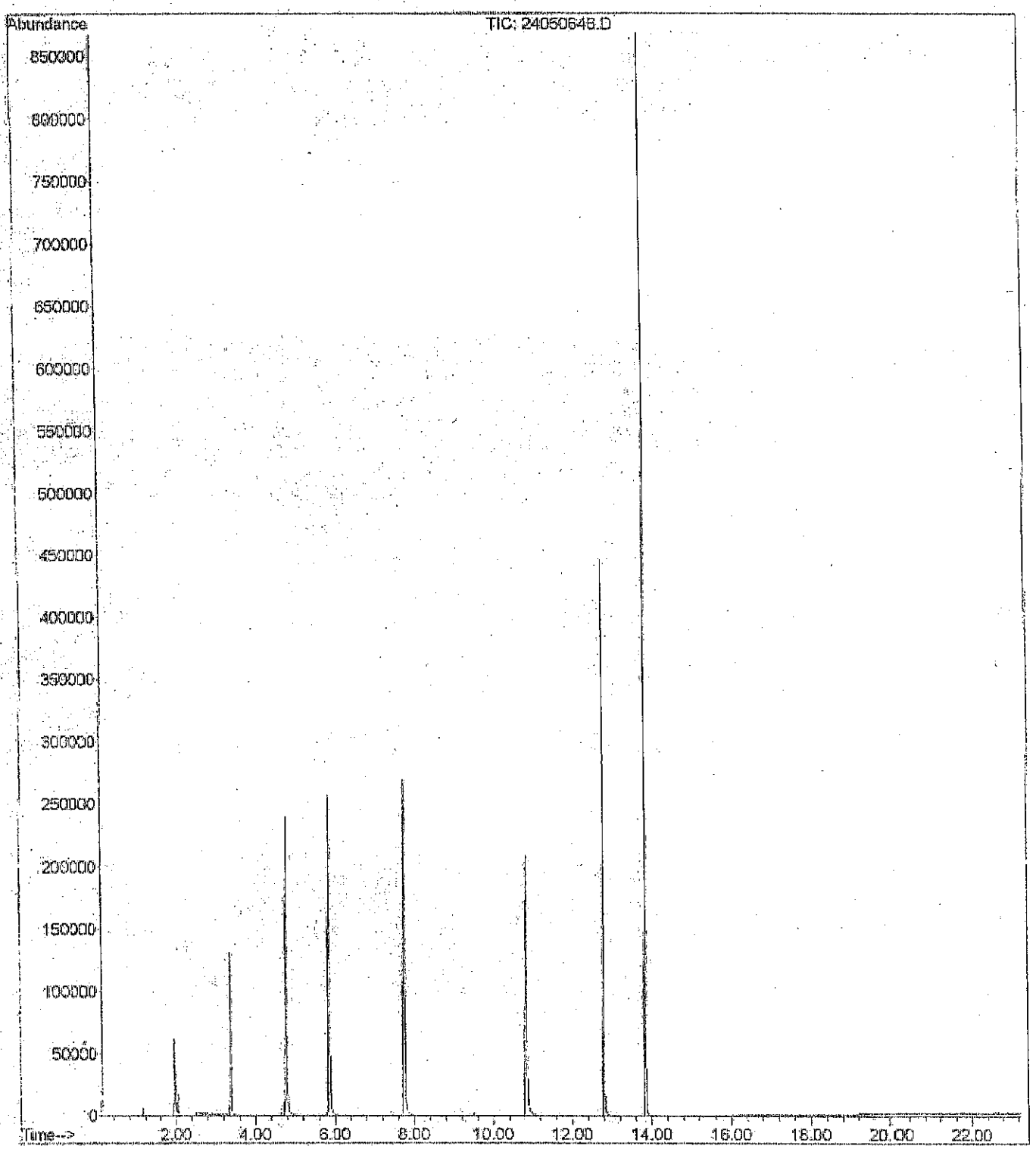
SOMA Environmental Engineering Inc.	Project: 2610 Contra Loma Blvd, Antioch	
6620 Owens Drive, Suite A	Project Number: 2701	**Reported:**
Pleasanton CA, 94588	Project Manager: Mansour Sepehr	09-Jun-06 14:38

Notes and Definitions

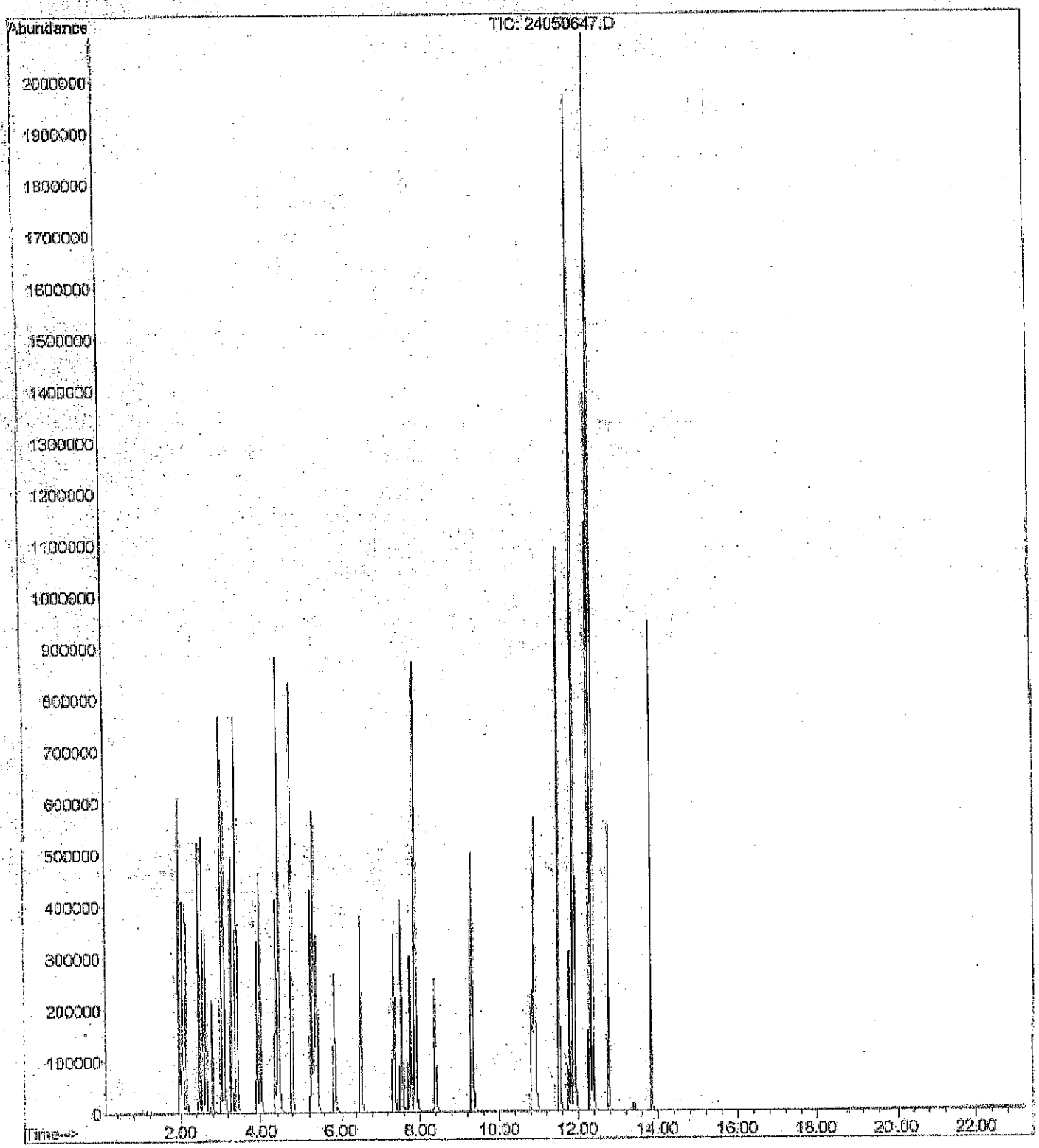
D-35	Sample does not display a fuel pattern. Sample contains several discreet peaks.
D-30	Unidentified hydrocarbons C9-C16.
D-09	Results in the diesel organics range are primarily due to overlap from a heavy oil range product.
D-06	The sample chromatographic pattern does not resemble the fuel standard used for quantitation.
C-03	To reduce matrix interference, the sample extract has undergone silica-gel clean-up, method 3630, which is specific to polar compound contamination.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

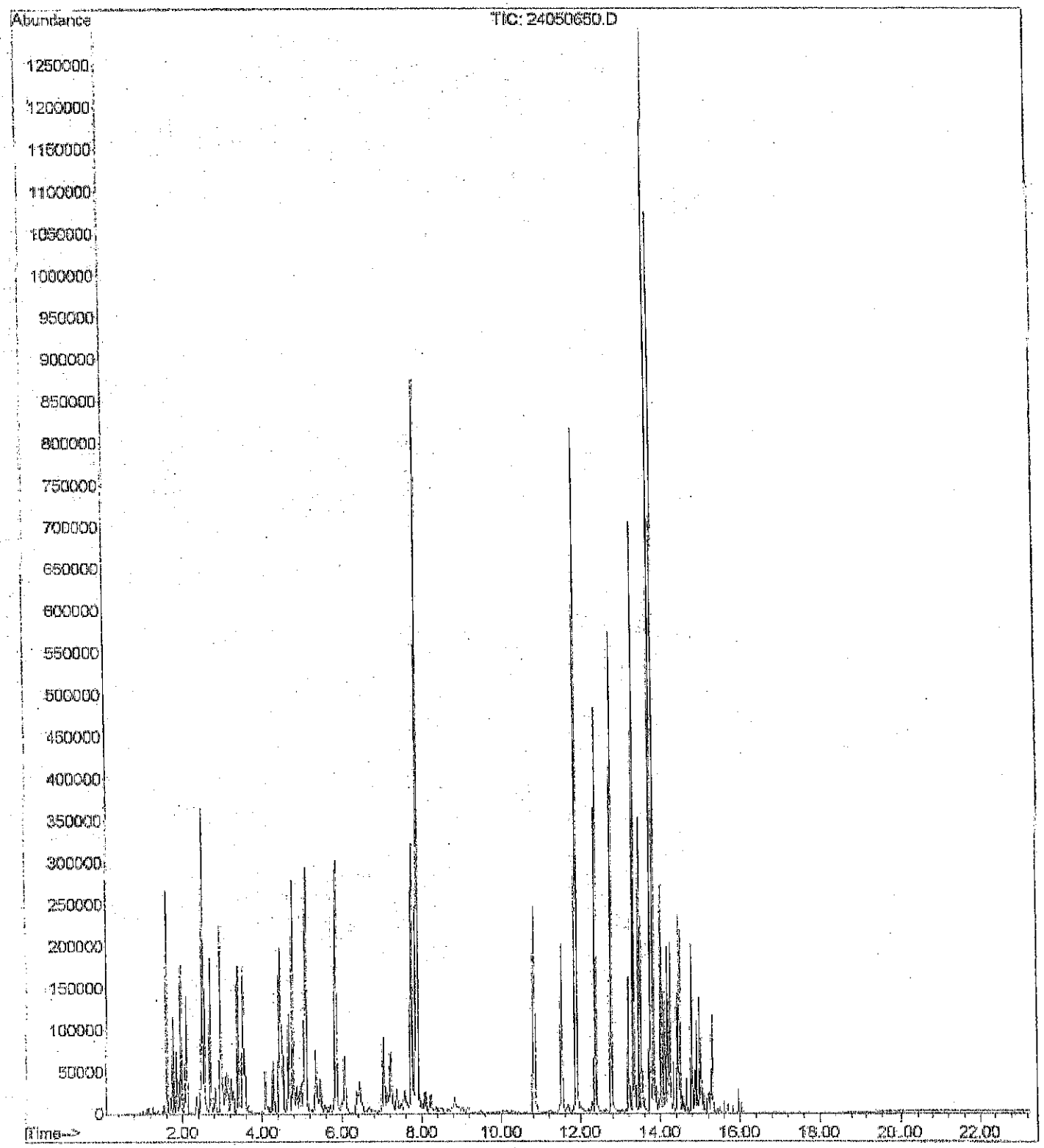
File :C:\MSDChem\1\DATA\2006-May-24-1502.b\24050646.D
Operator :
Acquired : 26 May 2006 12:41 am using AcqMethod OXY21506.M
Instrument : PAL GCMS
Sample Name: BE63001-BLK1
Misc Info :
Vial Number: 46



File :C:\MSDChem\1\DATA\2006-May-24-1502.b\Snapshot\24050647.D
Operator :
Acquired : 26 May 2006 1:23 am using AcqMethod OXY21506.M
Instrument : PAL GCMS
Sample Name: BE63001-BS1@voc
Misc Info :
Vial Number: 47



File :C:\MSDChem\1\DATA\2006-May-24-1502.b\24050650.D
Operator :
Acquired : 26 May 2006 3:30 am using AcqMethod OXY21506.M
Instrument : PAL GCMS
Sample Name: BE63001-BS1@gas
Misc Info :
Vial Number: 50

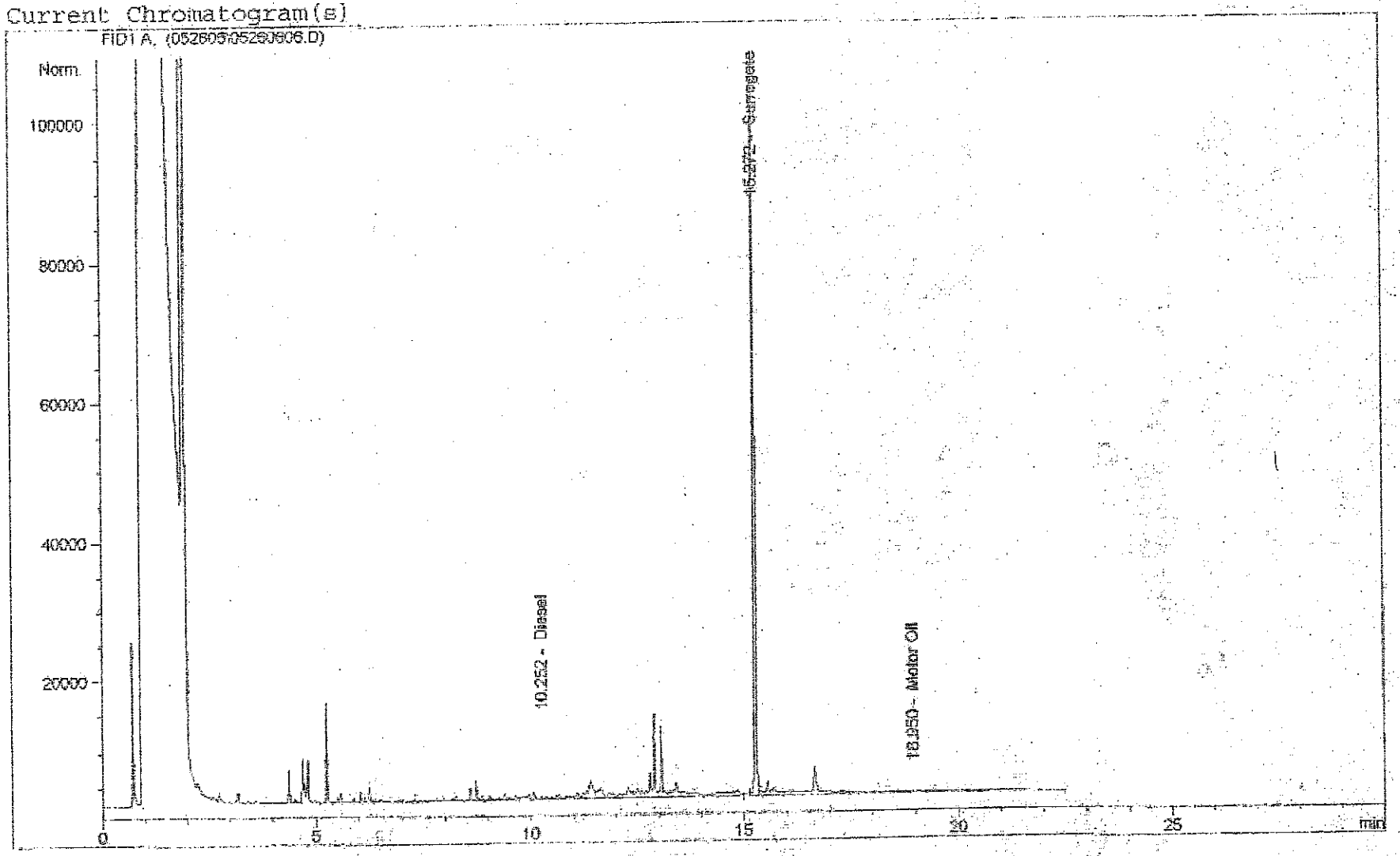


Injection Date : 5/26/06 3:22:20 PM
Sample Name : ~~MB052604~~ BE63101-BLK1
Acq. Operator : jz

Seq. Line : 1
Vial : 3
Inj : 1
Inj Volume : 2 ul

Acq. Method : C:\HPCHEM\1\METHODS\GC052306.M
Last changed : 5/24/06 10:25:47 AM by jz
Analysis Method : C:\HPCHEM\1\METHODS\GC052306.M
Last changed : 6/5/06 4:04:10 PM by jz
(modified after loading)

Current Chromatogram(s)



Instrument 1 6/9/06 2:28:55 PM jz

Page 1 of 1

04-2285E4

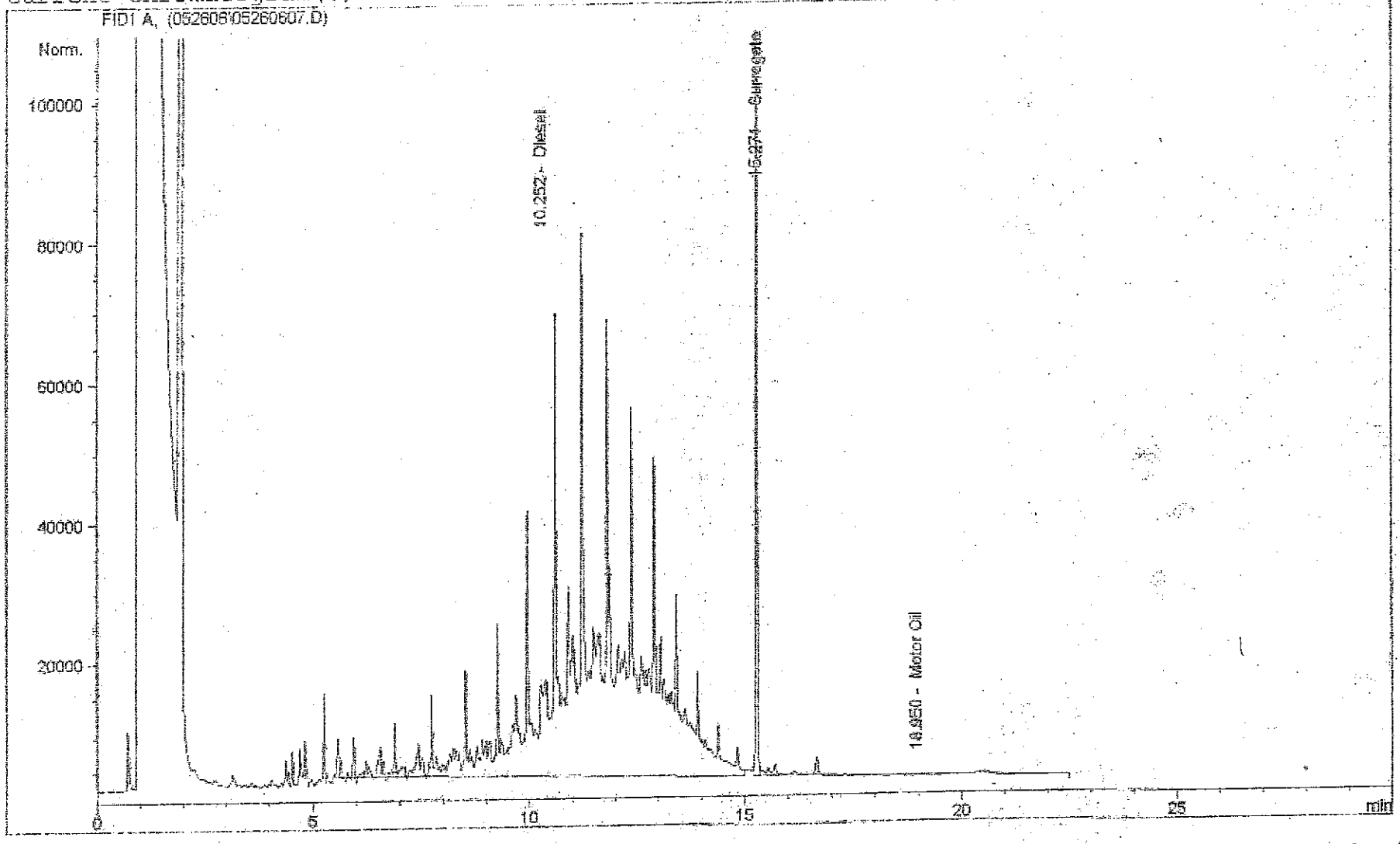
INFORMATION HANDOUT

Injection Date : 5/26/06 3:55:00 PM
Sample Name : ~~LCS052604~~ BE63101-BS1
Acq. Operator : jz

Seq. Line : 2
Vial : 4
Inj : 1
Inj Volume : 2 ul

Acq. Method : C:\HPCHEM\1\METHODS\GC052306.M
Last changed : 5/24/06 10:25:47 AM by jz
Analysis Method : C:\HPCHEM\1\METHODS\GC052306.M
Last changed : 6/5/06 4:04:10 PM by jz
(modified after loading)

Current Chromatogram(s)



Instrument 1 6/9/06 2:29:12 PM jz

Page 1 of 1

04-2285E4

INFORMATION HANDOUT

Appendix D

Laboratory Report and Chain of Custody Form

for the

Groundwater Treatment System Samples

CHAIN OF CUSTODY

PAL Pacific Analytical Laboratory
851 West Midway Ave., Suite 201
Alameda, CA 94501
(510)864-0364 Phone
(510) 864-0365 Fax

PAL LOGIN #6060008

Sampler: Brian Timms

Report To: Tony Perini

Company: SOMA Environmental

Telephone: 925-734-6400

Fax: 925-734-6401

Project No: 2703

Project Name: 2610 Contra Loma Blvd, Antioch

Turnaround Time: Standard

Lab No.	Sample ID.	Sampling Date Time	Matrix: Soil	Matrix: Water	Matrix: Waste	# of Containers	Preservative: HCL	Preservative: H_2SO_4	Preservative: HNO_3	Preservative: ICE	Analyses: BTEX/MtBE/TPH-g 8260B	Analyses: TPHd 8015B
	Effluent	6/8/06 / 2:15 PM		*		3 VOAs 1 L-Amber	*			*	*	*
	GAC-1	6/8/06 / 2:20 PM		*		3 VOAs 1 L-Amber	*			*	*	*
	Influent	6/8/06 / 2:15 PM		*		3 VOAs 1 L-Amber	*			*	*	*

Notes: **EDF OUTPUT REQUIRED**
Silica Gel Cleanup Method

RELINQUISHED BY:	RECEIVED BY:
6/8/06 4:00 P.M. DATE/TIME	6/8/06 4:01 PM DATE/TIME
DATE/TIME	DATE/TIME
DATE/TIME	DATE/TIME

04-2285E4

INFORMATION HANDOUT

PAL Pacific Analytical Laboratory
851 West Midway Ave. Suite 201
Alameda, CA 94501
Phone (510) 864-0364

23 June 2006

Mansour Sepehr
SOMA Environmental Engineering Inc.
6620 Owens Drive, Suite A
Pleasanton, CA 94588

RE: 2610 Contra Loma Blvd, Antioch

Work Order Number: 6060008

This Laboratory report has been reviewed for technical correctness and completeness. This entire report was reviewed and approved by the Laboratory Director or the Director's designee, as verified by the following signature.

Sincerely,

Majid Akhavan
Laboratorv Director

PAL

SOMA Environmental Engineering Inc. 6620 Owens Drive, Suite A Pleasanton CA, 94588	Project: 2610 Contra Loma Blvd, Antioch Project Number: 2703 Project Manager: Mansour Sepehr	**Reported:** 23-Jun-06 13:38

Extractable Petroleum Hydrocarbons by 8015 DRO

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Effluent (6060008-01) Water Sampled: 08-Jun-06 14:25 Received: 08-Jun-06 16:00									
Diesel (C10-C24)	ND	50.0	ug/l	1	BF61901	09-Jun-06	09-Jun-06	EPA 8015M	C-03
Surrogate: Pentacosane		*108 %*	*50-140*		"	"	"	"	
GAC-1 (6060008-02) Water Sampled: 08-Jun-06 14:20 Received: 08-Jun-06 16:00									
Diesel (C10-C24)	ND	50.0	ug/l	1	BF61901	09-Jun-06	09-Jun-06	EPA 8015M	C-03
Surrogate: Pentacosane		*103 %*	*50-140*		"	"	"	"	
Influent (6060008-03) Water Sampled: 08-Jun-06 14:15 Received: 08-Jun-06 16:00									
Diesel (C10-C24)	**143**	50.0	ug/l	1	BF61901	09-Jun-06	09-Jun-06	EPA 8015M	C-03, D-06, D-30
Surrogate: Pentacosane		*103 %*	*50-140*		"	"	"	"	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

PAL

SOMA Environmental Engineering Inc. 6620 Owens Drive, Suite A Pleasanton CA, 94588	Project: 2610 Contra Loma Blvd, Antioch Project Number: 2703 Project Manager: Mansour Sepehr	Reported: 23-Jun-06 13:38

Volatile Organic Compounds by EPA Method 8260B

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Effluent (6060008-01) Water Sampled: 08-Jun-06 14:25 Received: 08-Jun-06 16:00									
Gasoline (C6-C12)	ND	50.0	ug/l	1	BF61301	09-Jun-06	09-Jun-06	EPA 8260B	
Benzene	ND	0.500	"	"	"	"	"	"	
Ethylbenzene	ND	0.500	"	"	"	"	"	"	
m&p-Xylene	ND	1.00	"	"	"	"	"	"	
o-xylene	ND	0.500	"	"	"	"	"	"	
Toluene	ND	2.00	"	"	"	"	"	"	
MTBE	ND	0.500	"	"	"	"	"	"	
DIPE	ND	0.500	"	"	"	"	"	"	
ETBE	ND	0.500	"	"	"	"	"	"	
TAME	ND	2.00	"	"	"	"	"	"	
TBA	**1390**	10.0	"	"	"	"	"	"	
1,2-Dibromoethan	ND	0.500	"	"	"	"	"	"	
1,2-dichloroethane	ND	0.500	"	"	"	"	"	"	
Surrogate: 4-Bromofluorobenzene		*87.4 %*		*70-130*	"	"	"	"	
Surrogate: Dibromofluoromethane		*101 %*		*70-130*	"	"	"	"	
Surrogate: Perdeuterotoluene		*86.6 %*		*70-130*	"	"	"	"	
GAC-1 (6060008-02RE1) Water Sampled: 08-Jun-06 14:20 Received: 08-Jun-06 16:00									
Gasoline (C6-C12)	ND	100	ug/l	2	BF61301	09-Jun-06	12-Jun-06	EPA 8260B	
Benzene	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	
m&p-Xylene	ND	2.00	"	"	"	"	"	"	
o-xylene	ND	1.00	"	"	"	"	"	"	
Toluene	ND	4.00	"	"	"	"	"	"	
MTBE	ND	1.00	"	"	"	"	"	"	
DIPE	ND	1.00	"	"	"	"	"	"	
ETBE	ND	1.00	"	"	"	"	"	"	
TAME	ND	4.00	"	"	"	"	"	"	
TBA	**1770**	20.0	"	"	"	"	"	"	
1,2-Dibromoethan	ND	1.00	"	"	"	"	"	"	
1,2-dichloroethane	ND	1.00	"	"	"	"	"	"	
Surrogate: 4-Bromofluorobenzene		*87.2 %*		*70-130*	"	"	"	"	
Surrogate: Dibromofluoromethane		*101 %*		*70-130*	"	"	"	"	
Surrogate: Perdeuterotoluene		*88.0 %*		*70-130*	"	"	"	"	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

PAL

SOMA Environmental Engineering Inc. 6620 Owens Drive, Suite A Pleasanton CA, 94588	Project: 2610 Contra Loma Blvd, Antioch Project Number: 2703 Project Manager: Mansour Sepehr	**Reported:** 23-Jun-06 13:38

Volatile Organic Compounds by EPA Method 8260B

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Influent (6060008-03RE1) Water Sampled: 08-Jun-06 14:15 Received: 08-Jun-06 16:00									
Gasoline (C6-C12)	**2100**	50.0	ug/l	1	BF61301	09-Jun-06	12-Jun-06	EPA 8260B	
Benzene	ND	21.5	"	43	"	"	"	"	
Ethylbenzene	ND	21.5	"	"	"	"	"	"	
m&p-Xylene	ND	43.0	"	"	"	"	"	"	
o-xylene	**22.4**	21.5	"	"	"	"	"	"	
Toluene	ND	86.0	"	"	"	"	"	"	
MTBE	ND	21.5	"	"	"	"	"	"	
DIPE	ND	21.5	"	"	"	"	"	"	
ETBE	ND	21.5	"	"	"	"	"	"	
TAME	ND	86.0	"	"	"	"	"	"	
TBA	**7780**	430	"	"	"	"	"	"	
1,2-Dibromoethan	ND	21.5	"	"	"	"	"	"	
1,2-dichloroethane	ND	21.5	"	"	"	"	"	"	
Surrogate: 4-Bromofluorobenzene		*91.8 %*		*70-130*	"	"	"	"	
Surrogate: Dibromofluoromethane		*102 %*		*70-130*	"	"	"	"	
Surrogate: Perdeuterotoluene		*87.8 %*		*70-130*	"	"	"	"	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

PAL

SOMA Environmental Engineering Inc. 6620 Owens Drive, Suite A Pleasanton CA, 94588	Project: 2610 Contra Loma Blvd, Antioch Project Number: 2703 Project Manager: Mansour Sepehr	**Reported:** 23-Jun-06 13:38

Extractable Petroleum Hydrocarbons by 8015 DRO - Quality Control

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch BF61901 - EPA 3510B										
Blank (BF61901-BLK1)				Prepared & Analyzed: 19-Jun-06						
Surrogate: Pentacosane	*49.5*		*ug/l*	*50.0*		*99.0*	*50-140*			
Diesel (C10-C24)	ND	50.0	"							
LCS (BF61901-BS1)				Prepared & Analyzed: 19-Jun-06						
Surrogate: Pentacosane	*50.3*		*ug/l*	*50.0*		*101*	*50-140*			
Diesel (C10-C24)	736	50.0	"	1000		73.6	50-130			
LCS Dup (BF61901-BSD1)				Prepared & Analyzed: 19-Jun-06						
Surrogate: Pentacosane	*44.5*		*ug/l*	*50.0*		*89.0*	*50-140*			
Diesel (C10-C24)	705	50.0	"	1000		70.5	50-130	4.30	40	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

PAL

SOMA Environmental Engineering Inc. 6620 Owens Drive, Suite A Pleasanton CA, 94588	Project: 2610 Contra Loma Blvd, Antioch Project Number: 2703 Project Manager: Mansour Sepehr	Reported: 23-Jun-06 13:38

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch BF61301 - EPA 5030 Water MS										
Blank (BF61301-BLK1)				Prepared & Analyzed: 13-Jun-06						
Surrogate: 4-Bromofluorobenzene	*45.0*		*ug/l*	*50.0*		*90.0*	*70-130*			
Surrogate: Dibromofluoromethane	*48.4*		*"*	*50.0*		*96.8*	*70-130*			
Surrogate: Perdeuterotoluene	*43.7*		*"*	*50.0*		*87.4*	*70-130*			
MTBE	ND	0.500	"							
DIPE	ND	0.500	"							
ETBE	ND	0.500	"							
TAME	ND	2.00	"							
TBA	ND	10.0	"							
Gasoline (C6-C12)	ND	50.0	"							
1,2-Dibromoethan	ND	0.500	"							
1,2-dichloroethane	ND	0.500	"							
Benzene	ND	0.500	"							
Ethylbenzene	ND	0.500	"							
m&p-Xylene	ND	1.00	"							
o-xylene	ND	0.500	"							
Toluene	ND	2.00	"							
LCS (BF61301-BS1)				Prepared & Analyzed: 13-Jun-06						
Surrogate: 4-Bromofluorobenzene	*48.2*		*ug/l*	*50.0*		*96.4*	*70-130*			
Surrogate: Dibromofluoromethane	*45.6*		*"*	*50.0*		*91.2*	*70-130*			
Surrogate: Perdeuterotoluene	*44.3*		*"*	*50.0*		*88.6*	*70-130*			
MTBE	87.0	0.500	"	100		87.0	70-130			
ETBE	80.8	0.500	"	100		80.8	70-130			
Gasoline (C6-C12)	1880	50.0	"	2000		94.0	70-130			
TBA	602	10.0	"	500		120	70-130			
Benzene	90.0	0.500	"	100		90.0	70-130			
Toluene	91.4	2.00	"	100		91.4	70-130			

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

PAL

SOMA Environmental Engineering Inc. 6620 Owens Drive, Suite A Pleasanton CA, 94588	Project: 2610 Contra Loma Blvd, Antioch Project Number: 2703 Project Manager: Mansour Sepehr	**Reported:** 23-Jun-06 13:38

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Pacific Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch BF61301 - EPA 5030 Water MS										
LCS Dup (BF61301-BSD1)				Prepared & Analyzed: 13-Jun-06						
Surrogate: 4-Bromofluorobenzene	*49.0*		*ug/l*	*50.0*		*98.0*	*70-130*			
Surrogate: Dibromofluoromethane	*44.9*		*"*	*50.0*		*89.8*	*70-130*			
Surrogate: Perdeuterotoluene	*43.1*		*"*	*50.0*		*86.2*	*70-130*			
MTBE	85.8	0.500	"	100		85.8	70-130	1.39	20	
ETBE	83.5	0.500	"	100		83.5	70-130	3.29	20	
Gasoline (C6-C12)	1990	50.0	"	2000		99.5	70-130	5.68	20	
TBA	541	10.0	"	500		108	70-130	10.7	20	
Benzene	89.6	0.500	"	100		89.6	70-130	0.445	20	
Toluene	88.0	2.00	"	100		88.0	70-130	3.79	20	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

PAL

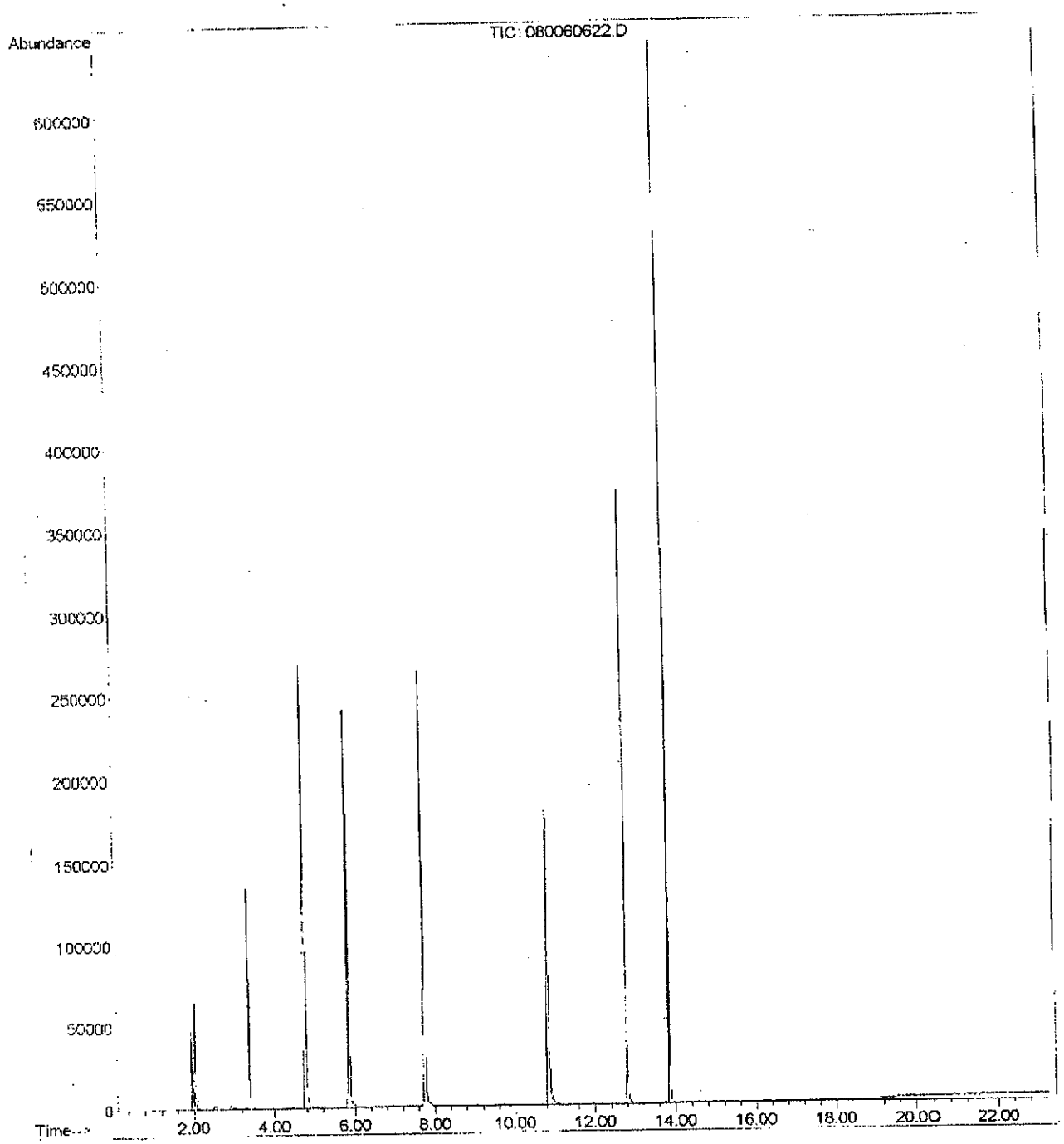
SOMA Environmental Engineering Inc. 6620 Owens Drive, Suite A Pleasanton CA, 94588	Project: 2610 Contra Loma Blvd, Antioch Project Number: 2703 Project Manager: Mansour Sepehr	**Reported:** 23-Jun-06 13:38

Notes and Definitions

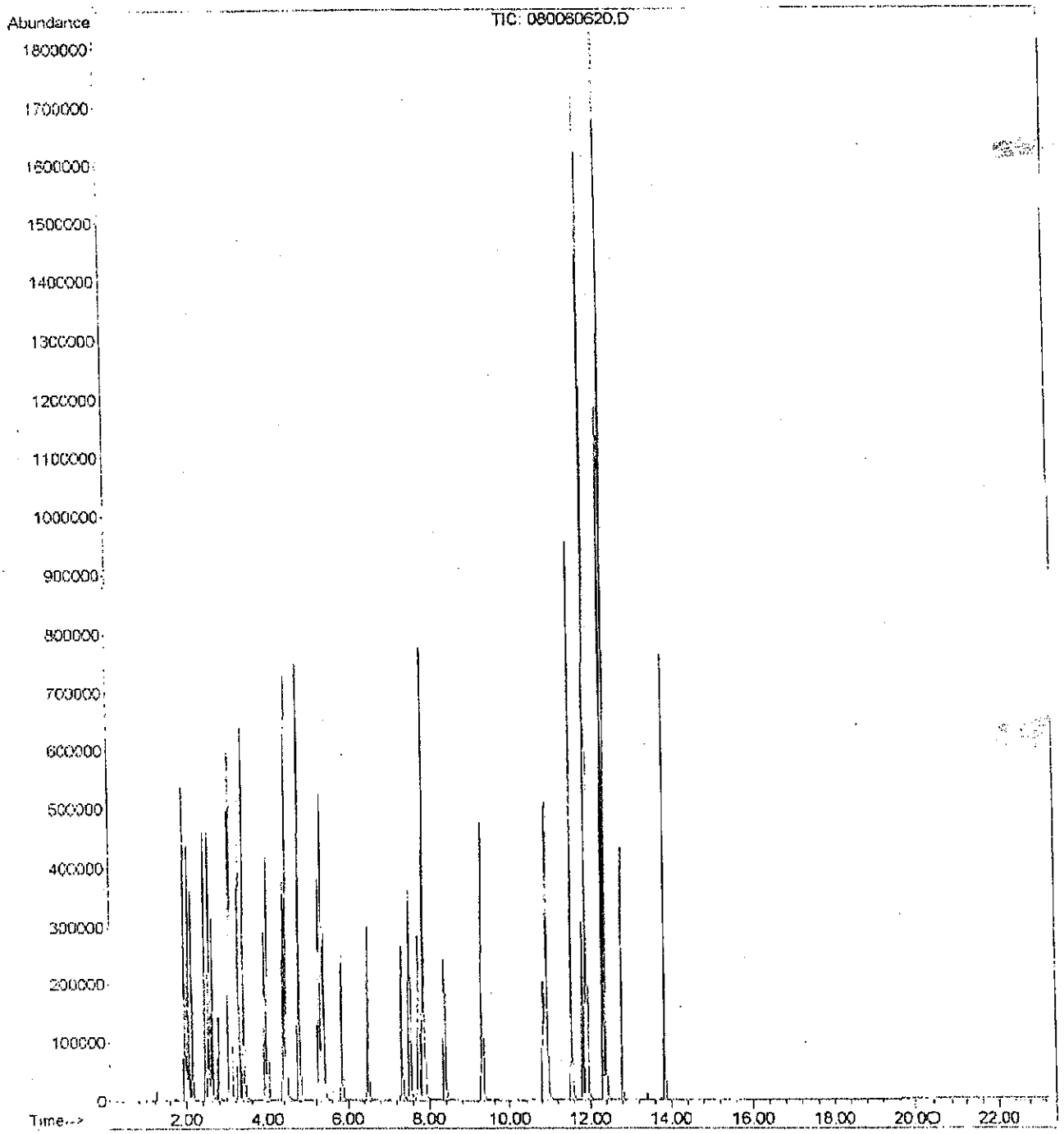
D-30	Unidentified hydrocarbons C9-C16.
D-06	The sample chromatographic pattern does not resemble the fuel standard used for quantitation.
C-03	To reduce matrix interference, the sample extract has undergone silica-gel clean-up, method 3630, which is specific to polar compound contamination.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

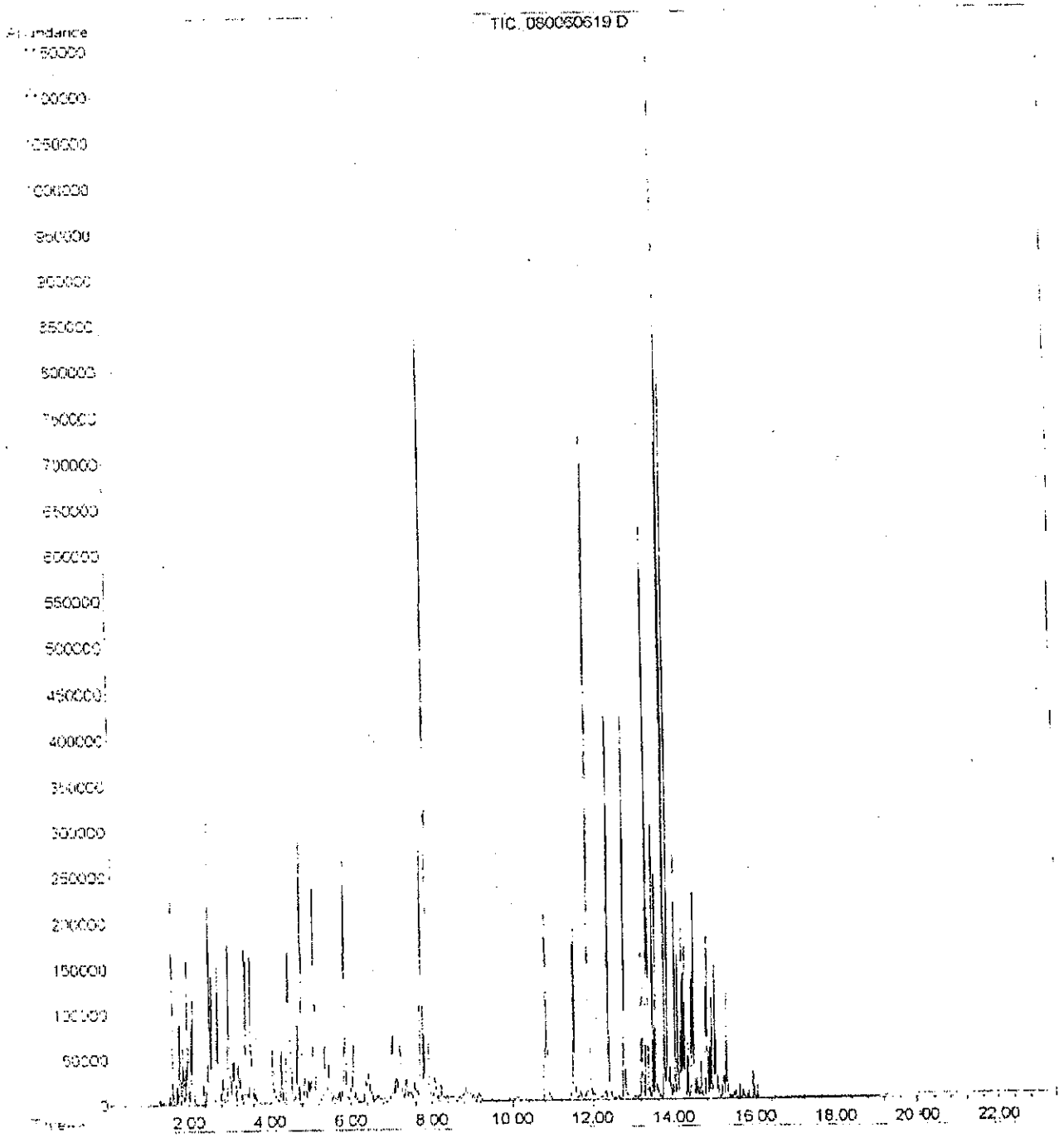
File :C:\MSDChem\1\DATA\2006-Jun-08-1552.b\080060622.D
Operator :
Acquired : 9 Jun 2006 1:36 pm using AcqMethod OXY21506.M
Instrument : PAL GCMS
Sample Name: BF61301-BLK1
Misc Info :
Vial Number: 22



File :C:\MSDChem\1\DATA\2006-Jun-08-1552.b\080060620.D
Operator :
Acquired : 9 Jun 2006 12:10 pm using AcqMethod OXY21506.M
Instrument : PAL GCMS
Sample Name: BF61301-BS1@voc
Misc Info :
Vial Number: 20



File :C:\MSDChem\1\DATA\2006-Jun-08-1552.b\080060619.D
Operator :
Acquired : 9 Jun 2006 11:28 am using AcqMethod OXY21506.M
Instrument : PAL GCMS
Sample Name: B761301-BS1ägas
Misc Info :
Vial Number: 19



Print of Window 38: Current Chromatogram(s)

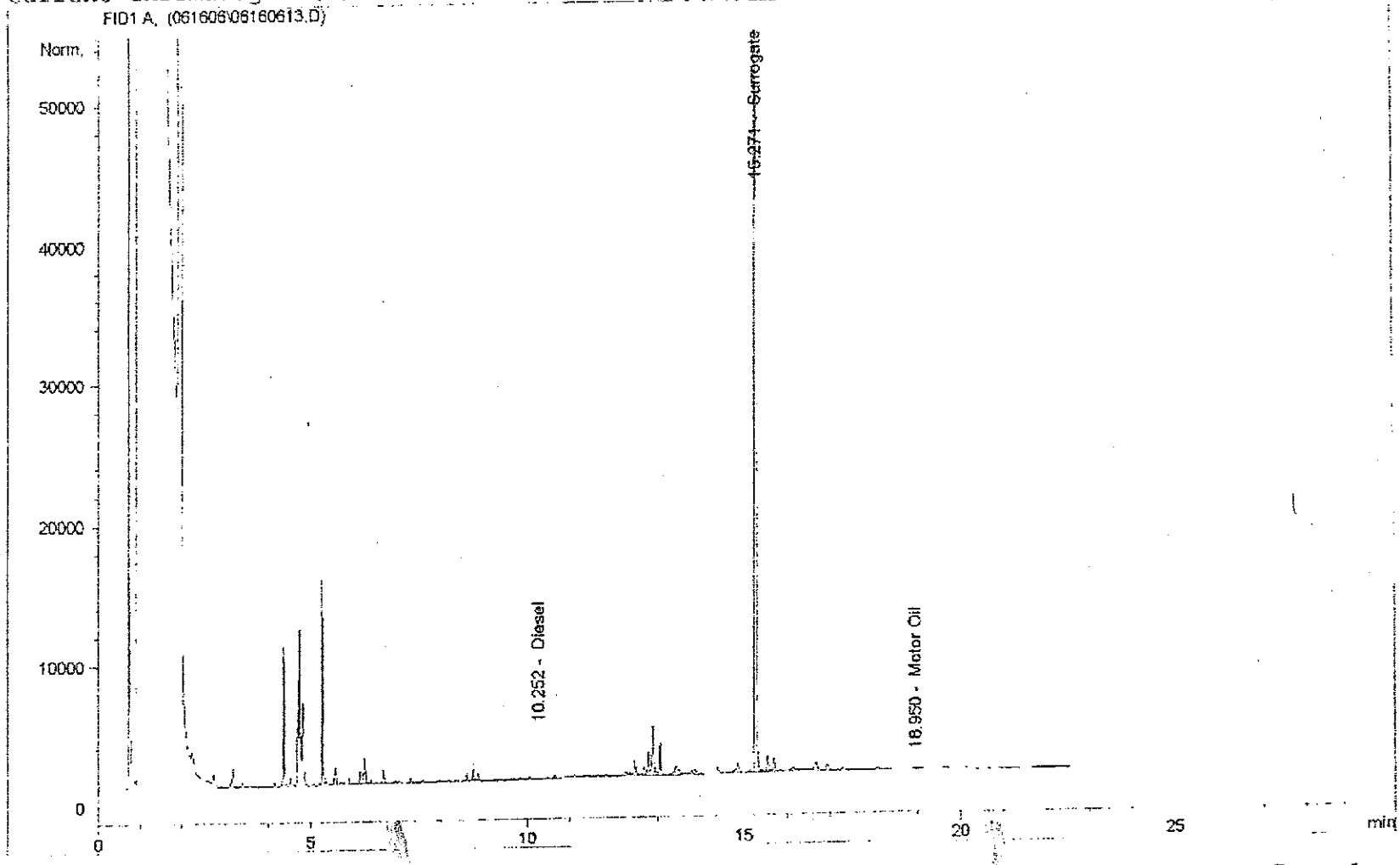
==========

Injection Date : 6/16/06 6:33:24 PM
Sample Name : ~~MB060806~~ BF061901-BLK1
Acq. Operator : jz

Seq. Line : 2
Vial : 4
Inj : 1
Inj Volume : 2 ul

Acq. Method : C:\HPCHEM\1\METHODS\GC052306.M
Last changed : 5/24/06 10:25:47 AM by jz
Analysis Method : C:\HPCHEM\1\METHODS\GC052306.M
Last changed : 6/22/06 4:21:35 PM by jz
(modified after loading)

Current Chromatogram(s)



Instrument 1 6/22/06 4:21:44 PM jz

Page 1 of 1

04-2285E4

INFORMATION HANDOUT

File of window 30: Current Chromatogram(s)

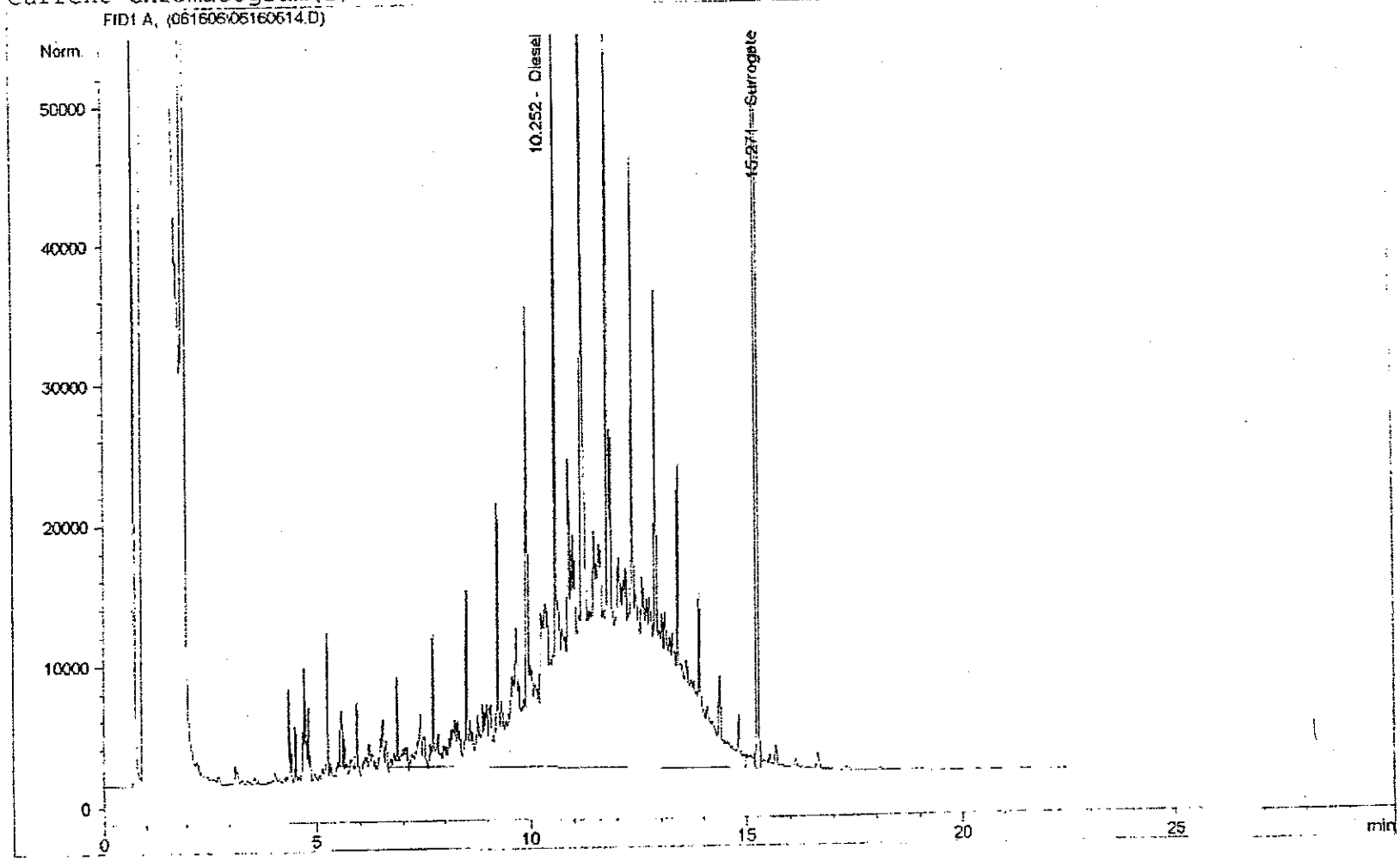
==========

Injection Date : 6/16/06 7:07:36 PM
Sample Name : ~~LC2066806~~ 8F61901-BS1
Acq. Operator : jz

Seq. Line : 3
Vial : 5
Inj : 1
Inj Volume : 2 ul

Acq. Method : C:\HPCHEM\1\METHODS\GC052306.M
Last changed : 5/24/06 10:25:47 AM by jz
Analysis Method : C:\HPCHEM\1\METHODS\GC052306.M
Last changed : 6/22/06 4:21:35 PM by jz
(modified after loading)

Current Chromatogram(s)



Instrument 1 6/22/06 4:22:05 PM jz

Page 1 of 1

04-2285E4

INFORMATION HANDOUT

APPENDIX B

February 08, 2007

Rick Day
Geocon Consultants, Inc.
2356 Research Drive
Livermore, CA 94550
TEL: (925) 371-5900
FAX: (925) 371-5915

ELAP No.: 1838
NELAP No.: 02107CA
NEVADA.: CA-401
Arizona: AZ0689
CSDLAC No.: 10196
Workorder No.: 089424

RE: SR4 WIDENING, E8328-06-01

Attention: Rick Day

Enclosed are the results for sample(s) received on January 31, 2007 by Advanced Technology Laboratories . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

Thank you for the opportunity to service the needs of your company.

Please feel free to call me at (562)989-4045 if I can be of further assistance to your company.

Sincerely,

Eddie F. Rodriguez
Laboratory Director

The cover letter and the case narrative are an integral part of this analytical report and cannot be reproduced in part or in its entirety without written permission from the client and Advanced Technology Laboratories.

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-001

Client Sample ID: DPB-1-5
Collection Date: 1/30/2007 9:45:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B				EPA 6010B		
RunID: ICP6_070207E	QC Batch: 33222			PrepDate:		2/6/2007 Analyst: RQ
Antimony	ND	2.0		mg/Kg	1	2/7/2007 3:08:15 PM
Arsenic	4.0	1.0		mg/Kg	1	2/7/2007 3:08:15 PM
Barium	130	1.0		mg/Kg	1	2/7/2007 3:08:15 PM
Beryllium	ND	1.0		mg/Kg	1	2/7/2007 3:08:15 PM
Cadmium	ND	1.0		mg/Kg	1	2/7/2007 3:08:15 PM
Chromium	18	1.0		mg/Kg	1	2/7/2007 3:08:15 PM
Cobalt	8.6	1.0		mg/Kg	1	2/7/2007 3:08:15 PM
Copper	18	2.0		mg/Kg	1	2/7/2007 3:08:15 PM
Lead	4.8	1.0		mg/Kg	1	2/7/2007 3:08:15 PM
Molybdenum	ND	1.0		mg/Kg	1	2/7/2007 3:08:15 PM
Nickel	17	1.0		mg/Kg	1	2/7/2007 3:08:15 PM
Selenium	ND	1.0		mg/Kg	1	2/7/2007 3:08:15 PM
Silver	ND	1.0		mg/Kg	1	2/7/2007 3:08:15 PM
Thallium	ND	1.0		mg/Kg	1	2/7/2007 3:08:15 PM
Vanadium	42	1.0		mg/Kg	1	2/7/2007 3:08:15 PM
Zinc	40	1.0		mg/Kg	1	2/7/2007 3:08:15 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				EPA 8015B(M)		
RunID: GC7_BACK_070202A	QC Batch: 33181			PrepDate:		2/1/2007 Analyst: CBR
DRO	2.3	1.0		mg/Kg	1	2/2/2007 12:38:00 PM
ORO	10	1.0		mg/Kg	1	2/2/2007 12:38:00 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_070202A	QC Batch: E07VS040			PrepDate:		Analyst: ML
GRO	ND	1.0		mg/Kg	1	2/2/2007 11:14:00 AM
MERCURY BY COLD VAPOR TECHNIQUE						
EPA 7471				EPA 7471A		
RunID: AA5_070206H	QC Batch: 33224			PrepDate:		2/6/2007 Analyst: EKS
Mercury	ND	0.10		mg/Kg	1	2/6/2007
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201A	QC Batch: R07VS028			PrepDate:		Analyst: DMP
1,1,1,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-001

Client Sample ID: DPB-1-5
Collection Date: 1/30/2007 9:45:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201A	QC Batch: R07VS028			PrepDate:		Analyst: **DMP**
1,1,1-Trichloroethane	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
1,1,2,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
1,1,2-Trichloroethane	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
1,1-Dichloroethane	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
1,1-Dichloroethene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
1,1-Dichloropropene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
1,2,3-Trichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
1,2,3-Trichloropropane	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
1,2,4-Trichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
1,2,4-Trimethylbenzene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
1,2-Dibromo-3-chloropropane	ND	10		µg/Kg	1	2/1/2007 6:16:00 PM
1,2-Dibromoethane	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
1,2-Dichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
1,2-Dichloroethane	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
1,2-Dichloropropane	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
1,3,5-Trimethylbenzene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
1,3-Dichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
1,3-Dichloropropane	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
1,4-Dichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
2,2-Dichloropropane	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
2-Chlorotoluene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
4-Chlorotoluene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
4-Isopropyltoluene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Benzene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Bromobenzene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Bromodichloromethane	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Bromoform	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Bromomethane	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Carbon tetrachloride	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Chlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Chloroethane	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Chloroform	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Chloromethane	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
cis-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Dibromochloromethane	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Dibromomethane	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-001

Client Sample ID: DPB-1-5
Collection Date: 1/30/2007 9:45:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201A	QC Batch: R07VS028			PrepDate:		Analyst: DMP
Dichlorodifluoromethane	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Ethyl Tert-butyl ether	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Ethylbenzene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Hexachlorobutadiene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Isopropylbenzene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
m,p-Xylene	ND	10		µg/Kg	1	2/1/2007 6:16:00 PM
Methylene chloride	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
MTBE	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
n-Butylbenzene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
n-Propylbenzene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Naphthalene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
o-Xylene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
sec-Butylbenzene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Styrene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
tert-Butylbenzene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Tetrachloroethene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Toluene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
trans-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Trichloroethene	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Trichlorofluoromethane	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM
Vinyl chloride	ND	5.0		µg/Kg	1	2/1/2007 6:16:00 PM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-002

Client Sample ID: DPB-1-10
Collection Date: 1/30/2007 9:50:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP6_070207E	QC Batch: 33222			PrepDate:		2/6/2007 Analyst: RQ
Antimony	ND	2.0		mg/Kg	1	2/7/2007 3:14:48 PM
Arsenic	4.1	1.0		mg/Kg	1	2/7/2007 3:14:48 PM
Barium	180	1.0		mg/Kg	1	2/7/2007 3:14:48 PM
Beryllium	ND	1.0		mg/Kg	1	2/7/2007 3:14:48 PM
Cadmium	ND	1.0		mg/Kg	1	2/7/2007 3:14:48 PM
Chromium	20	1.0		mg/Kg	1	2/7/2007 3:14:48 PM
Cobalt	9.1	1.0		mg/Kg	1	2/7/2007 3:14:48 PM
Copper	21	2.0		mg/Kg	1	2/7/2007 3:14:48 PM
Lead	6.5	1.0		mg/Kg	1	2/7/2007 3:14:48 PM
Molybdenum	ND	1.0		mg/Kg	1	2/7/2007 3:14:48 PM
Nickel	17	1.0		mg/Kg	1	2/7/2007 3:14:48 PM
Selenium	ND	1.0		mg/Kg	1	2/7/2007 3:14:48 PM
Silver	ND	1.0		mg/Kg	1	2/7/2007 3:14:48 PM
Thallium	ND	1.0		mg/Kg	1	2/7/2007 3:14:48 PM
Vanadium	47	1.0		mg/Kg	1	2/7/2007 3:14:48 PM
Zinc	43	1.0		mg/Kg	1	2/7/2007 3:14:48 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
	EPA 3550B			**EPA 8015B(M)**		
RunID: GC7_BACK_070202A	QC Batch: 33181			PrepDate:		2/1/2007 Analyst: CBR
DRO	5.5	1.0		mg/Kg	1	2/2/2007 1:29:00 PM
ORO	30	1.0		mg/Kg	1	2/2/2007 1:29:00 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_070201B	QC Batch: E07VS039			PrepDate:		Analyst: ML
GRO	ND	1.0		mg/Kg	1	2/1/2007 9:56:00 PM
MERCURY BY COLD VAPOR TECHNIQUE						
	EPA 7471			**EPA 7471A**		
RunID: AA5_070206H	QC Batch: 33224			PrepDate:		2/6/2007 Analyst: EKS
Mercury	ND	0.10		mg/Kg	1	2/6/2007
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201A	QC Batch: R07VS028			PrepDate:		Analyst: DMP
1,1,1,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-002

Client Sample ID: DPB-1-10
Collection Date: 1/30/2007 9:50:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201A	QC Batch: R07VS028				PrepDate:	Analyst: **DMP**
1,1,1-Trichloroethane	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
1,1,2,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
1,1,2-Trichloroethane	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
1,1-Dichloroethane	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
1,1-Dichloroethene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
1,1-Dichloropropene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
1,2,3-Trichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
1,2,3-Trichloropropane	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
1,2,4-Trichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
1,2,4-Trimethylbenzene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
1,2-Dibromo-3-chloropropane	ND	10		µg/Kg	1	2/1/2007 6:43:00 PM
1,2-Dibromoethane	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
1,2-Dichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
1,2-Dichloroethane	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
1,2-Dichloropropane	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
1,3,5-Trimethylbenzene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
1,3-Dichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
1,3-Dichloropropane	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
1,4-Dichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
2,2-Dichloropropane	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
2-Chlorotoluene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
4-Chlorotoluene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
4-Isopropyltoluene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Benzene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Bromobenzene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Bromodichloromethane	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Bromoform	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Bromomethane	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Carbon tetrachloride	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Chlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Chloroethane	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Chloroform	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Chloromethane	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
cis-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Dibromochloromethane	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Dibromomethane	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-002

Client Sample ID: DPB-1-10
Collection Date: 1/30/2007 9:50:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201A	QC Batch: R07VS028				PrepDate:	Analyst: **DMP**
Dichlorodifluoromethane	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Ethyl Tert-butyl ether	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Ethylbenzene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Hexachlorobutadiene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Isopropylbenzene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
m,p-Xylene	ND	10		µg/Kg	1	2/1/2007 6:43:00 PM
Methylene chloride	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
MTBE	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
n-Butylbenzene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
n-Propylbenzene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Naphthalene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
o-Xylene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
sec-Butylbenzene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Styrene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
tert-Butylbenzene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Tetrachloroethene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Toluene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
trans-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Trichloroethene	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Trichlorofluoromethane	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM
Vinyl chloride	ND	5.0		µg/Kg	1	2/1/2007 6:43:00 PM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-003

Client Sample ID: DPB-2-5
Collection Date: 1/30/2007 9:20:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B / EPA 6010B						
RunID: ICP6_070207E QC Batch: 33222 PrepDate: 2/6/2007 Analyst: RQ						
Antimony	ND	2.0		mg/Kg	1	2/7/2007 3:21:15 PM
Arsenic	3.6	1.0		mg/Kg	1	2/7/2007 3:21:15 PM
Barium	120	1.0		mg/Kg	1	2/7/2007 3:21:15 PM
Beryllium	ND	1.0		mg/Kg	1	2/7/2007 3:21:15 PM
Cadmium	ND	1.0		mg/Kg	1	2/7/2007 3:21:15 PM
Chromium	18	1.0		mg/Kg	1	2/7/2007 3:21:15 PM
Cobalt	8.3	1.0		mg/Kg	1	2/7/2007 3:21:15 PM
Copper	18	2.0		mg/Kg	1	2/7/2007 3:21:15 PM
Lead	4.7	1.0		mg/Kg	1	2/7/2007 3:21:15 PM
Molybdenum	ND	1.0		mg/Kg	1	2/7/2007 3:21:15 PM
Nickel	16	1.0		mg/Kg	1	2/7/2007 3:21:15 PM
Selenium	ND	1.0		mg/Kg	1	2/7/2007 3:21:15 PM
Silver	ND	1.0		mg/Kg	1	2/7/2007 3:21:15 PM
Thallium	ND	1.0		mg/Kg	1	2/7/2007 3:21:15 PM
Vanadium	40	1.0		mg/Kg	1	2/7/2007 3:21:15 PM
Zinc	36	1.0		mg/Kg	1	2/7/2007 3:21:15 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B / EPA 8015B(M)						
RunID: GC7_BACK_070202A QC Batch: 33181 PrepDate: 2/1/2007 Analyst: CBR						
DRO	74	10		mg/Kg	10	2/2/2007 2:44:00 PM
ORO	370	10		mg/Kg	10	2/2/2007 2:44:00 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_070201B QC Batch: E07VS039 PrepDate: Analyst: ML						
GRO	ND	1.0		mg/Kg	1	2/1/2007 10:20:00 PM
MERCURY BY COLD VAPOR TECHNIQUE						
EPA 7471 / EPA 7471A						
RunID: AA5_070206H QC Batch: 33224 PrepDate: 2/6/2007 Analyst: EKS						
Mercury	ND	0.10		mg/Kg	1	2/6/2007
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
EPA 8260B						
RunID: MS3_070201A QC Batch: R07VS028 PrepDate: Analyst: DMP						
1,1,1,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-003

Client Sample ID: DPB-2-5
Collection Date: 1/30/2007 9:20:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201A	QC Batch: R07VS028			PrepDate:		Analyst: DMP
1,1,1-Trichloroethane	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
1,1,2,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
1,1,2-Trichloroethane	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
1,1-Dichloroethane	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
1,1-Dichloroethene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
1,1-Dichloropropene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
1,2,3-Trichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
1,2,3-Trichloropropane	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
1,2,4-Trichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
1,2,4-Trimethylbenzene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
1,2-Dibromo-3-chloropropane	ND	10		µg/Kg	1	2/1/2007 7:10:00 PM
1,2-Dibromoethane	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
1,2-Dichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
1,2-Dichloroethane	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
1,2-Dichloropropane	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
1,3,5-Trimethylbenzene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
1,3-Dichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
1,3-Dichloropropane	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
1,4-Dichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
2,2-Dichloropropane	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
2-Chlorotoluene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
4-Chlorotoluene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
4-Isopropyltoluene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Benzene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Bromobenzene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Bromodichloromethane	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Bromoform	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Bromomethane	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Carbon tetrachloride	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Chlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Chloroethane	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Chloroform	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Chloromethane	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
cis-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Dibromochloromethane	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Dibromomethane	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-003

Client Sample ID: DPB-2-5
Collection Date: 1/30/2007 9:20:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201A	QC Batch: R07VS028			PrepDate:		Analyst: **DMP**
Dichlorodifluoromethane	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Ethyl Tert-butyl ether	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Ethylbenzene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Hexachlorobutadiene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Isopropylbenzene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
m,p-Xylene	ND	10		µg/Kg	1	2/1/2007 7:10:00 PM
Methylene chloride	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
MTBE	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
n-Butylbenzene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
n-Propylbenzene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Naphthalene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
o-Xylene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
sec-Butylbenzene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Styrene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
tert-Butylbenzene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Tetrachloroethene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Toluene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
trans-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Trichloroethene	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Trichlorofluoromethane	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM
Vinyl chloride	ND	5.0		µg/Kg	1	2/1/2007 7:10:00 PM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-004

Client Sample ID: DPB-2-10
Collection Date: 1/30/2007 9:25:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B / EPA 6010B						
RunID: ICP6_070207E QC Batch: 33222 PrepDate: 2/6/2007 Analyst: RQ						
Antimony	ND	2.0		mg/Kg	1	2/7/2007 3:27:32 PM
Arsenic	3.0	1.0		mg/Kg	1	2/7/2007 3:27:32 PM
Barium	140	1.0		mg/Kg	1	2/7/2007 3:27:32 PM
Beryllium	ND	1.0		mg/Kg	1	2/7/2007 3:27:32 PM
Cadmium	ND	1.0		mg/Kg	1	2/7/2007 3:27:32 PM
Chromium	17	1.0		mg/Kg	1	2/7/2007 3:27:32 PM
Cobalt	7.8	1.0		mg/Kg	1	2/7/2007 3:27:32 PM
Copper	18	2.0		mg/Kg	1	2/7/2007 3:27:32 PM
Lead	11	1.0		mg/Kg	1	2/7/2007 3:27:32 PM
Molybdenum	ND	1.0		mg/Kg	1	2/7/2007 3:27:32 PM
Nickel	15	1.0		mg/Kg	1	2/7/2007 3:27:32 PM
Selenium	ND	1.0		mg/Kg	1	2/7/2007 3:27:32 PM
Silver	ND	1.0		mg/Kg	1	2/7/2007 3:27:32 PM
Thallium	ND	1.0		mg/Kg	1	2/7/2007 3:27:32 PM
Vanadium	36	1.0		mg/Kg	1	2/7/2007 3:27:32 PM
Zinc	40	1.0		mg/Kg	1	2/7/2007 3:27:32 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B / EPA 8015B(M)						
RunID: GC7_BACK_070202A QC Batch: 33181 PrepDate: 2/1/2007 Analyst: CBR						
DRO	4.7	1.0		mg/Kg	1	2/2/2007 1:54:00 PM
ORO	25	1.0		mg/Kg	1	2/2/2007 1:54:00 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_070202A QC Batch: E07VS040 PrepDate: Analyst: ML						
GRO	ND	1.0		mg/Kg	1	2/2/2007 2:53:00 PM
MERCURY BY COLD VAPOR TECHNIQUE						
EPA 7471 / EPA 7471A						
RunID: AA5_070206H QC Batch: 33224 PrepDate: 2/6/2007 Analyst: EKS						
Mercury	ND	0.10		mg/Kg	1	2/6/2007
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
EPA 8260B						
RunID: MS3_070202A QC Batch: R07VS030 PrepDate: Analyst: DMP						
1,1,1,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-004

Client Sample ID: DPB-2-10
Collection Date: 1/30/2007 9:25:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070202A	QC Batch: R07VS030				PrepDate:	Analyst: **DMP**
1,1,1-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
1,1,2,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
1,1,2-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
1,1-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
1,1-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
1,1-Dichloropropene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
1,2,3-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
1,2,3-Trichloropropane	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
1,2,4-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
1,2,4-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
1,2-Dibromo-3-chloropropane	ND	10		µg/Kg	1	2/2/2007 10:17:00 AM
1,2-Dibromoethane	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
1,2-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
1,2-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
1,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
1,3,5-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
1,3-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
1,3-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
1,4-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
2,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
2-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
4-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
4-Isopropyltoluene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Benzene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Bromobenzene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Bromodichloromethane	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Bromoform	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Bromomethane	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Carbon tetrachloride	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Chlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Chloroethane	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Chloroform	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Chloromethane	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
cis-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Dibromochloromethane	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Dibromomethane	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-004

Client Sample ID: DPB-2-10
Collection Date: 1/30/2007 9:25:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070202A	QC Batch: R07VS030			PrepDate:		Analyst: **DMP**
Dichlorodifluoromethane	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Ethyl Tert-butyl ether	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Ethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Hexachlorobutadiene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Isopropylbenzene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
m,p-Xylene	ND	10		µg/Kg	1	2/2/2007 10:17:00 AM
Methylene chloride	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
MTBE	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
n-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
n-Propylbenzene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Naphthalene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
o-Xylene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
sec-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Styrene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
tert-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Tetrachloroethene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Toluene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
trans-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Trichloroethene	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Trichlorofluoromethane	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM
Vinyl chloride	ND	5.0		µg/Kg	1	2/2/2007 10:17:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-005

Client Sample ID: DPB-3-5
Collection Date: 1/30/2007 9:00:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B / EPA 6010B						
RunID: ICP6_070207E QC Batch: 33222 PrepDate: 2/6/2007 Analyst: RQ						
Antimony	ND	2.0		mg/Kg	1	2/7/2007 3:33:39 PM
Arsenic	2.5	1.0		mg/Kg	1	2/7/2007 3:33:39 PM
Barium	99	1.0		mg/Kg	1	2/7/2007 3:33:39 PM
Beryllium	ND	1.0		mg/Kg	1	2/7/2007 3:33:39 PM
Cadmium	ND	1.0		mg/Kg	1	2/7/2007 3:33:39 PM
Chromium	29	1.0		mg/Kg	1	2/7/2007 3:33:39 PM
Cobalt	12	1.0		mg/Kg	1	2/7/2007 3:33:39 PM
Copper	54	2.0		mg/Kg	1	2/7/2007 3:33:39 PM
Lead	6.9	1.0		mg/Kg	1	2/7/2007 3:33:39 PM
Molybdenum	ND	1.0		mg/Kg	1	2/7/2007 3:33:39 PM
Nickel	26	1.0		mg/Kg	1	2/7/2007 3:33:39 PM
Selenium	ND	1.0		mg/Kg	1	2/7/2007 3:33:39 PM
Silver	ND	1.0		mg/Kg	1	2/7/2007 3:33:39 PM
Thallium	ND	1.0		mg/Kg	1	2/7/2007 3:33:39 PM
Vanadium	50	1.0		mg/Kg	1	2/7/2007 3:33:39 PM
Zinc	40	1.0		mg/Kg	1	2/7/2007 3:33:39 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B / EPA 8015B(M)						
RunID: GC7_BACK_070202A QC Batch: 33181 PrepDate: 2/1/2007 Analyst: CBR						
DRO	37	5.0		mg/Kg	5	2/2/2007 2:19:00 PM
ORO	160	5.0		mg/Kg	5	2/2/2007 2:19:00 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_070202A QC Batch: E07VS040 PrepDate: Analyst: ML						
GRO	ND	1.0		mg/Kg	1	2/2/2007 12:03:00 PM
MERCURY BY COLD VAPOR TECHNIQUE						
EPA 7471 / EPA 7471A						
RunID: AA5_070206H QC Batch: 33224 PrepDate: 2/6/2007 Analyst: EKS						
Mercury	0.52	0.10		mg/Kg	1	2/6/2007
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
EPA 8260B						
RunID: MS3_070201A QC Batch: R07VS028 PrepDate: Analyst: DMP						
1,1,1,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-005

Client Sample ID: DPB-3-5
Collection Date: 1/30/2007 9:00:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201A	QC Batch: R07VS028			PrepDate:		Analyst: DMP
1,1,1-Trichloroethane	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
1,1,2,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
1,1,2-Trichloroethane	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
1,1-Dichloroethane	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
1,1-Dichloroethene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
1,1-Dichloropropene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
1,2,3-Trichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
1,2,3-Trichloropropane	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
1,2,4-Trichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
1,2,4-Trimethylbenzene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
1,2-Dibromo-3-chloropropane	ND	10		µg/Kg	1	2/1/2007 8:04:00 PM
1,2-Dibromoethane	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
1,2-Dichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
1,2-Dichloroethane	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
1,2-Dichloropropane	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
1,3,5-Trimethylbenzene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
1,3-Dichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
1,3-Dichloropropane	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
1,4-Dichlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
2,2-Dichloropropane	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
2-Chlorotoluene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
4-Chlorotoluene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
4-Isopropyltoluene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Benzene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Bromobenzene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Bromodichloromethane	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Bromoform	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Bromomethane	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Carbon tetrachloride	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Chlorobenzene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Chloroethane	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Chloroform	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Chloromethane	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
cis-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Dibromochloromethane	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Dibromomethane	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-005

Client Sample ID: DPB-3-5
Collection Date: 1/30/2007 9:00:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201A	QC Batch: R07VS028				PrepDate:	Analyst: DMP
Dichlorodifluoromethane	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Ethyl Tert-butyl ether	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Ethylbenzene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Hexachlorobutadiene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Isopropylbenzene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
m,p-Xylene	ND	10		µg/Kg	1	2/1/2007 8:04:00 PM
Methylene chloride	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
MTBE	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
n-Butylbenzene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
n-Propylbenzene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Naphthalene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
o-Xylene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
sec-Butylbenzene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Styrene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
tert-Butylbenzene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Tetrachloroethene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Toluene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
trans-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Trichloroethene	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Trichlorofluoromethane	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM
Vinyl chloride	ND	5.0		µg/Kg	1	2/1/2007 8:04:00 PM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-006

Client Sample ID: DPB-3-10
Collection Date: 1/30/2007 9:05:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B				EPA 6010B		
RunID: ICP6_070207E	QC Batch: 33222			PrepDate:		2/6/2007 Analyst: RQ
Antimony	ND	2.0		mg/Kg	1	2/7/2007 3:40:25 PM
Arsenic	3.5	1.0		mg/Kg	1	2/7/2007 3:40:25 PM
Barium	120	1.0		mg/Kg	1	2/7/2007 3:40:25 PM
Beryllium	ND	1.0		mg/Kg	1	2/7/2007 3:40:25 PM
Cadmium	ND	1.0		mg/Kg	1	2/7/2007 3:40:25 PM
Chromium	15	1.0		mg/Kg	1	2/7/2007 3:40:25 PM
Cobalt	8.1	1.0		mg/Kg	1	2/7/2007 3:40:25 PM
Copper	15	2.0		mg/Kg	1	2/7/2007 3:40:25 PM
Lead	4.3	1.0		mg/Kg	1	2/7/2007 3:40:25 PM
Molybdenum	ND	1.0		mg/Kg	1	2/7/2007 3:40:25 PM
Nickel	14	1.0		mg/Kg	1	2/7/2007 3:40:25 PM
Selenium	ND	1.0		mg/Kg	1	2/7/2007 3:40:25 PM
Silver	ND	1.0		mg/Kg	1	2/7/2007 3:40:25 PM
Thallium	ND	1.0		mg/Kg	1	2/7/2007 3:40:25 PM
Vanadium	41	1.0		mg/Kg	1	2/7/2007 3:40:25 PM
Zinc	32	1.0		mg/Kg	1	2/7/2007 3:40:25 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				EPA 8015B(M)		
RunID: GC7_BACK_070202A	QC Batch: 33181			PrepDate:		2/1/2007 Analyst: CBR
DRO	5.3	1.0		mg/Kg	1	2/2/2007 1:03:00 PM
ORO	18	1.0		mg/Kg	1	2/2/2007 1:03:00 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_070202A	QC Batch: E07VS040			PrepDate:		Analyst: ML
GRO	ND	1.0		mg/Kg	1	2/2/2007 12:27:00 PM
MERCURY BY COLD VAPOR TECHNIQUE						
EPA 7471				EPA 7471A		
RunID: AA5_070206H	QC Batch: 33224			PrepDate:		2/6/2007 Analyst: EKS
Mercury	ND	0.10		mg/Kg	1	2/6/2007
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: DMP
1,1,1,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-006

Client Sample ID: DPB-3-10
Collection Date: 1/30/2007 9:05:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: **DMP**
1,1,1-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
1,1,2,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
1,1,2-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
1,1-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
1,1-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
1,1-Dichloropropene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
1,2,3-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
1,2,3-Trichloropropane	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
1,2,4-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
1,2,4-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
1,2-Dibromo-3-chloropropane	ND	10		µg/Kg	1	2/2/2007 1:24:00 AM
1,2-Dibromoethane	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
1,2-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
1,2-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
1,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
1,3,5-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
1,3-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
1,3-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
1,4-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
2,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
2-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
4-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
4-Isopropyltoluene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Benzene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Bromobenzene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Bromodichloromethane	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Bromoform	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Bromomethane	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Carbon tetrachloride	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Chlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Chloroethane	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Chloroform	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Chloromethane	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
cis-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Dibromochloromethane	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Dibromomethane	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-006

Client Sample ID: DPB-3-10
Collection Date: 1/30/2007 9:05:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: **DMP**
Dichlorodifluoromethane	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Ethyl Tert-butyl ether	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Ethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Hexachlorobutadiene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Isopropylbenzene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
m,p-Xylene	ND	10		µg/Kg	1	2/2/2007 1:24:00 AM
Methylene chloride	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
MTBE	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
n-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
n-Propylbenzene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Naphthalene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
o-Xylene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
sec-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Styrene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
tert-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Tetrachloroethene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Toluene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
trans-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Trichloroethene	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Trichlorofluoromethane	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM
Vinyl chloride	ND	5.0		µg/Kg	1	2/2/2007 1:24:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-007

Client Sample ID: DPB-4-5
Collection Date: 1/30/2007 10:00:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B				EPA 6010B		
RunID: ICP6_070207E	QC Batch: 33222			PrepDate:		2/6/2007 Analyst: RQ
Antimony	ND	2.0		mg/Kg	1	2/7/2007 3:46:43 PM
Arsenic	3.3	1.0		mg/Kg	1	2/7/2007 3:46:43 PM
Barium	120	1.0		mg/Kg	1	2/7/2007 3:46:43 PM
Beryllium	ND	1.0		mg/Kg	1	2/7/2007 3:46:43 PM
Cadmium	ND	1.0		mg/Kg	1	2/7/2007 3:46:43 PM
Chromium	16	1.0		mg/Kg	1	2/7/2007 3:46:43 PM
Cobalt	7.7	1.0		mg/Kg	1	2/7/2007 3:46:43 PM
Copper	15	2.0		mg/Kg	1	2/7/2007 3:46:43 PM
Lead	4.2	1.0		mg/Kg	1	2/7/2007 3:46:43 PM
Molybdenum	ND	1.0		mg/Kg	1	2/7/2007 3:46:43 PM
Nickel	15	1.0		mg/Kg	1	2/7/2007 3:46:43 PM
Selenium	ND	1.0		mg/Kg	1	2/7/2007 3:46:43 PM
Silver	ND	1.0		mg/Kg	1	2/7/2007 3:46:43 PM
Thallium	ND	1.0		mg/Kg	1	2/7/2007 3:46:43 PM
Vanadium	41	1.0		mg/Kg	1	2/7/2007 3:46:43 PM
Zinc	34	1.0		mg/Kg	1	2/7/2007 3:46:43 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				EPA 8015B(M)		
RunID: GC7_BACK_070202C	QC Batch: 33186			PrepDate:		2/2/2007 Analyst: CBR
DRO	2.4	1.0		mg/Kg	1	2/2/2007 6:34:00 PM
ORO	14	1.0		mg/Kg	1	2/2/2007 6:34:00 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_070202A	QC Batch: E07VS040			PrepDate:		Analyst: ML
GRO	ND	1.0		mg/Kg	1	2/2/2007 12:51:00 PM
MERCURY BY COLD VAPOR TECHNIQUE						
EPA 7471				EPA 7471A		
RunID: AA5_070206H	QC Batch: 33224			PrepDate:		2/6/2007 Analyst: EKS
Mercury	ND	0.10		mg/Kg	1	2/6/2007
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: DMP
1,1,1,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-007

Client Sample ID: DPB-4-5
Collection Date: 1/30/2007 10:00:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: **DMP**
1,1,1-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
1,1,2,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
1,1,2-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
1,1-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
1,1-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
1,1-Dichloropropene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
1,2,3-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
1,2,3-Trichloropropane	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
1,2,4-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
1,2,4-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
1,2-Dibromo-3-chloropropane	ND	10		µg/Kg	1	2/2/2007 1:51:00 AM
1,2-Dibromoethane	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
1,2-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
1,2-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
1,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
1,3,5-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
1,3-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
1,3-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
1,4-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
2,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
2-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
4-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
4-Isopropyltoluene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Benzene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Bromobenzene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Bromodichloromethane	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Bromoform	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Bromomethane	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Carbon tetrachloride	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Chlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Chloroethane	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Chloroform	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Chloromethane	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
cis-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Dibromochloromethane	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Dibromomethane	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-007

Client Sample ID: DPB-4-5
Collection Date: 1/30/2007 10:00:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: DMP
Dichlorodifluoromethane	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Ethyl Tert-butyl ether	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Ethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Hexachlorobutadiene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Isopropylbenzene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
m,p-Xylene	ND	10		µg/Kg	1	2/2/2007 1:51:00 AM
Methylene chloride	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
MTBE	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
n-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
n-Propylbenzene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Naphthalene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
o-Xylene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
sec-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Styrene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
tert-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Tetrachloroethene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Toluene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
trans-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Trichloroethene	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Trichlorofluoromethane	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM
Vinyl chloride	ND	5.0		µg/Kg	1	2/2/2007 1:51:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-008

Client Sample ID: DPB-4-10
Collection Date: 1/30/2007 10:05:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B / EPA 6010B						
RunID: ICP6_070207E	QC Batch: 33222			PrepDate:		2/6/2007 Analyst: RQ
Antimony	ND	2.0		mg/Kg	1	2/7/2007 3:52:58 PM
Arsenic	4.4	1.0		mg/Kg	1	2/7/2007 3:52:58 PM
Barium	140	1.0		mg/Kg	1	2/7/2007 3:52:58 PM
Beryllium	ND	1.0		mg/Kg	1	2/7/2007 3:52:58 PM
Cadmium	ND	1.0		mg/Kg	1	2/7/2007 3:52:58 PM
Chromium	20	1.0		mg/Kg	1	2/7/2007 3:52:58 PM
Cobalt	10	1.0		mg/Kg	1	2/7/2007 3:52:58 PM
Copper	18	2.0		mg/Kg	1	2/7/2007 3:52:58 PM
Lead	6.5	1.0		mg/Kg	1	2/7/2007 3:52:58 PM
Molybdenum	ND	1.0		mg/Kg	1	2/7/2007 3:52:58 PM
Nickel	20	1.0		mg/Kg	1	2/7/2007 3:52:58 PM
Selenium	ND	1.0		mg/Kg	1	2/7/2007 3:52:58 PM
Silver	ND	1.0		mg/Kg	1	2/7/2007 3:52:58 PM
Thallium	ND	1.0		mg/Kg	1	2/7/2007 3:52:58 PM
Vanadium	41	1.0		mg/Kg	1	2/7/2007 3:52:58 PM
Zinc	44	1.0		mg/Kg	1	2/7/2007 3:52:58 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B / EPA 8015B(M)						
RunID: GC7_BACK_070202C	QC Batch: 33186			PrepDate:		2/2/2007 Analyst: CBR
DRO	5.6	1.0		mg/Kg	1	2/2/2007 8:14:00 PM
ORO	32	1.0		mg/Kg	1	2/2/2007 8:14:00 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_070202A	QC Batch: E07VS040			PrepDate:		Analyst: ML
GRO	ND	1.0		mg/Kg	1	2/2/2007 2:29:00 PM
MERCURY BY COLD VAPOR TECHNIQUE						
EPA 7471 / EPA 7471A						
RunID: AA5_070206H	QC Batch: 33224			PrepDate:		2/6/2007 Analyst: EKS
Mercury	ND	0.10		mg/Kg	1	2/7/2007
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
EPA 8260B						
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: DMP
1,1,1,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-008

Client Sample ID: DPB-4-10
Collection Date: 1/30/2007 10:05:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029				PrepDate:	Analyst: DMP
1,1,1-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
1,1,2,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
1,1,2-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
1,1-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
1,1-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
1,1-Dichloropropene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
1,2,3-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
1,2,3-Trichloropropane	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
1,2,4-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
1,2,4-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
1,2-Dibromo-3-chloropropane	ND	10		µg/Kg	1	2/2/2007 2:44:00 AM
1,2-Dibromoethane	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
1,2-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
1,2-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
1,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
1,3,5-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
1,3-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
1,3-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
1,4-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
2,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
2-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
4-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
4-Isopropyltoluene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Benzene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Bromobenzene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Bromodichloromethane	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Bromoform	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Bromomethane	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Carbon tetrachloride	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Chlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Chloroethane	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Chloroform	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Chloromethane	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
cis-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Dibromochloromethane	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Dibromomethane	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-008

Client Sample ID: DPB-4-10
Collection Date: 1/30/2007 10:05:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: DMP
Dichlorodifluoromethane	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Ethyl Tert-butyl ether	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Ethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Hexachlorobutadiene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Isopropylbenzene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
m,p-Xylene	ND	10		µg/Kg	1	2/2/2007 2:44:00 AM
Methylene chloride	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
MTBE	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
n-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
n-Propylbenzene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Naphthalene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
o-Xylene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
sec-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Styrene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
tert-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Tetrachloroethene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Toluene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
trans-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Trichloroethene	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Trichlorofluoromethane	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM
Vinyl chloride	ND	5.0		µg/Kg	1	2/2/2007 2:44:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-009

Client Sample ID: DPB-4-15
Collection Date: 1/30/2007 10:10:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B				EPA 6010B		
RunID: ICP6_070207E	QC Batch: 33222			PrepDate:		2/6/2007 Analyst: RQ
Antimony	ND	2.0		mg/Kg	1	2/7/2007 3:59:09 PM
Arsenic	3.3	1.0		mg/Kg	1	2/7/2007 3:59:09 PM
Barium	160	1.0		mg/Kg	1	2/7/2007 3:59:09 PM
Beryllium	ND	1.0		mg/Kg	1	2/7/2007 3:59:09 PM
Cadmium	ND	1.0		mg/Kg	1	2/7/2007 3:59:09 PM
Chromium	22	1.0		mg/Kg	1	2/7/2007 3:59:09 PM
Cobalt	8.4	1.0		mg/Kg	1	2/7/2007 3:59:09 PM
Copper	24	2.0		mg/Kg	1	2/7/2007 3:59:09 PM
Lead	6.0	1.0		mg/Kg	1	2/7/2007 3:59:09 PM
Molybdenum	ND	1.0		mg/Kg	1	2/7/2007 3:59:09 PM
Nickel	17	1.0		mg/Kg	1	2/7/2007 3:59:09 PM
Selenium	ND	1.0		mg/Kg	1	2/7/2007 3:59:09 PM
Silver	ND	1.0		mg/Kg	1	2/7/2007 3:59:09 PM
Thallium	ND	1.0		mg/Kg	1	2/7/2007 3:59:09 PM
Vanadium	39	1.0		mg/Kg	1	2/7/2007 3:59:09 PM
Zinc	49	1.0		mg/Kg	1	2/7/2007 3:59:09 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				EPA 8015B(M)		
RunID: GC7_BACK_070202C	QC Batch: 33186			PrepDate:		2/2/2007 Analyst: CBR
DRO	6.3	1.0		mg/Kg	1	2/2/2007 8:40:00 PM
ORO	36	1.0		mg/Kg	1	2/2/2007 8:40:00 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_070202A	QC Batch: E07VS040			PrepDate:		Analyst: ML
GRO	ND	1.0		mg/Kg	1	2/2/2007 1:40:00 PM
MERCURY BY COLD VAPOR TECHNIQUE						
EPA 7471				EPA 7471A		
RunID: AA5_070206H	QC Batch: 33224			PrepDate:		2/6/2007 Analyst: EKS
Mercury	0.16	0.10		mg/Kg	1	2/7/2007
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: DMP
1,1,1,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-009

Client Sample ID: DPB-4-15
Collection Date: 1/30/2007 10:10:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: DMP
1,1,1-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
1,1,2,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
1,1,2-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
1,1-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
1,1-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
1,1-Dichloropropene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
1,2,3-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
1,2,3-Trichloropropane	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
1,2,4-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
1,2,4-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
1,2-Dibromo-3-chloropropane	ND	10		µg/Kg	1	2/2/2007 3:11:00 AM
1,2-Dibromoethane	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
1,2-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
1,2-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
1,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
1,3,5-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
1,3-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
1,3-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
1,4-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
2,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
2-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
4-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
4-Isopropyltoluene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Benzene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Bromobenzene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Bromodichloromethane	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Bromoform	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Bromomethane	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Carbon tetrachloride	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Chlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Chloroethane	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Chloroform	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Chloromethane	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
cis-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Dibromochloromethane	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Dibromomethane	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-009

Client Sample ID: DPB-4-15
Collection Date: 1/30/2007 10:10:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029				PrepDate:	Analyst: DMP
Dichlorodifluoromethane	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Ethyl Tert-butyl ether	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Ethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Hexachlorobutadiene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Isopropylbenzene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
m,p-Xylene	ND	10		µg/Kg	1	2/2/2007 3:11:00 AM
Methylene chloride	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
MTBE	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
n-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
n-Propylbenzene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Naphthalene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
o-Xylene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
sec-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Styrene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
tert-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Tetrachloroethene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Toluene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
trans-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Trichloroethene	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Trichlorofluoromethane	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM
Vinyl chloride	ND	5.0		µg/Kg	1	2/2/2007 3:11:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-010

Client Sample ID: DPB-5-5
Collection Date: 1/30/2007 10:28:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B				EPA 6010B		
RunID: ICP6_070207E	QC Batch: 33222			PrepDate:		2/6/2007 Analyst: RQ
Antimony	ND	2.0		mg/Kg	1	2/7/2007 4:05:21 PM
Arsenic	3.6	1.0		mg/Kg	1	2/7/2007 4:05:21 PM
Barium	110	1.0		mg/Kg	1	2/7/2007 4:05:21 PM
Beryllium	ND	1.0		mg/Kg	1	2/7/2007 4:05:21 PM
Cadmium	ND	1.0		mg/Kg	1	2/7/2007 4:05:21 PM
Chromium	20	1.0		mg/Kg	1	2/7/2007 4:05:21 PM
Cobalt	8.4	1.0		mg/Kg	1	2/7/2007 4:05:21 PM
Copper	18	2.0		mg/Kg	1	2/7/2007 4:05:21 PM
Lead	4.7	1.0		mg/Kg	1	2/7/2007 4:05:21 PM
Molybdenum	ND	1.0		mg/Kg	1	2/7/2007 4:05:21 PM
Nickel	20	1.0		mg/Kg	1	2/7/2007 4:05:21 PM
Selenium	ND	1.0		mg/Kg	1	2/7/2007 4:05:21 PM
Silver	ND	1.0		mg/Kg	1	2/7/2007 4:05:21 PM
Thallium	ND	1.0		mg/Kg	1	2/7/2007 4:05:21 PM
Vanadium	41	1.0		mg/Kg	1	2/7/2007 4:05:21 PM
Zinc	38	1.0		mg/Kg	1	2/7/2007 4:05:21 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				EPA 8015B(M)		
RunID: GC7_BACK_070202C	QC Batch: 33186			PrepDate:		2/2/2007 Analyst: CBR
DRO	5.7	1.0		mg/Kg	1	2/2/2007 9:05:00 PM
ORO	23	1.0		mg/Kg	1	2/2/2007 9:05:00 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_070202A	QC Batch: E07VS040			PrepDate:		Analyst: ML
GRO	ND	1.0		mg/Kg	1	2/2/2007 2:04:00 PM
MERCURY BY COLD VAPOR TECHNIQUE						
EPA 7471				EPA 7471A		
RunID: AA5_070206H	QC Batch: 33224			PrepDate:		2/6/2007 Analyst: EKS
Mercury	ND	0.10		mg/Kg	1	2/6/2007
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: DMP
1,1,1,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-010

Client Sample ID: DPB-5-5
Collection Date: 1/30/2007 10:28:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS				**EPA 8260B**		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: DMP
1,1,1-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
1,1,2,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
1,1,2-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
1,1-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
1,1-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
1,1-Dichloropropene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
1,2,3-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
1,2,3-Trichloropropane	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
1,2,4-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
1,2,4-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
1,2-Dibromo-3-chloropropane	ND	10		µg/Kg	1	2/2/2007 3:38:00 AM
1,2-Dibromoethane	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
1,2-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
1,2-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
1,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
1,3,5-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
1,3-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
1,3-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
1,4-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
2,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
2-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
4-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
4-Isopropyltoluene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Benzene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Bromobenzene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Bromodichloromethane	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Bromoform	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Bromomethane	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Carbon tetrachloride	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Chlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Chloroethane	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Chloroform	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Chloromethane	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
cis-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Dibromochloromethane	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Dibromomethane	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-010

Client Sample ID: DPB-5-5
Collection Date: 1/30/2007 10:28:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: DMP
Dichlorodifluoromethane	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Ethyl Tert-butyl ether	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Ethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Hexachlorobutadiene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Isopropylbenzene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
m,p-Xylene	ND	10		µg/Kg	1	2/2/2007 3:38:00 AM
Methylene chloride	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
MTBE	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
n-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
n-Propylbenzene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Naphthalene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
o-Xylene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
sec-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Styrene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
tert-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Tetrachloroethene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Toluene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
trans-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Trichloroethene	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Trichlorofluoromethane	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM
Vinyl chloride	ND	5.0		µg/Kg	1	2/2/2007 3:38:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-011

Client Sample ID: DPB-5-10
Collection Date: 1/30/2007 10:30:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			EPA 6010B			
RunID: ICP6_070206G	QC Batch: 33223			PrepDate:		2/6/2007 Analyst: RQ
Antimony	ND	2.0		mg/Kg	1	2/6/2007 6:33:31 PM
Arsenic	3.0	1.0		mg/Kg	1	2/6/2007 6:33:31 PM
Barium	210	1.0		mg/Kg	1	2/6/2007 6:33:31 PM
Beryllium	ND	1.0		mg/Kg	1	2/6/2007 6:33:31 PM
Cadmium	ND	1.0		mg/Kg	1	2/6/2007 6:33:31 PM
Chromium	20	1.0		mg/Kg	1	2/6/2007 6:33:31 PM
Cobalt	8.1	1.0		mg/Kg	1	2/6/2007 6:33:31 PM
Copper	16	2.0		mg/Kg	1	2/6/2007 6:33:31 PM
Lead	4.8	1.0		mg/Kg	1	2/6/2007 6:33:31 PM
Molybdenum	ND	1.0		mg/Kg	1	2/6/2007 6:33:31 PM
Nickel	17	1.0		mg/Kg	1	2/6/2007 6:33:31 PM
Selenium	ND	1.0		mg/Kg	1	2/6/2007 6:33:31 PM
Silver	ND	1.0		mg/Kg	1	2/6/2007 6:33:31 PM
Thallium	ND	1.0		mg/Kg	1	2/6/2007 6:33:31 PM
Vanadium	41	1.0		mg/Kg	1	2/6/2007 6:33:31 PM
Zinc	33	1.0		mg/Kg	1	2/6/2007 6:33:31 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			EPA 8015B(M)			
RunID: GC7_BACK_070202C	QC Batch: 33186			PrepDate:		2/2/2007 Analyst: CBR
DRO	3.8	1.0		mg/Kg	1	2/2/2007 5:44:00 PM
ORO	9.1	1.0		mg/Kg	1	2/2/2007 5:44:00 PM
GASOLINE RANGE ORGANICS BY GC/FID						
			EPA 8015B(M)			
RunID: GC2_070202A	QC Batch: E07VS040			PrepDate:		Analyst: ML
GRO	ND	1.0		mg/Kg	1	2/2/2007 4:06:00 PM
MERCURY BY COLD VAPOR TECHNIQUE						
EPA 7471			EPA 7471A			
RunID: AA5_070206G	QC Batch: 33225			PrepDate:		2/6/2007 Analyst: EKS
Mercury	ND	0.10		mg/Kg	1	2/6/2007
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
			EPA 8260B			
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: DMP
1,1,1,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-011

Client Sample ID: DPB-5-10
Collection Date: 1/30/2007 10:30:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: **DMP**
1,1,1-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
1,1,2,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
1,1,2-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
1,1-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
1,1-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
1,1-Dichloropropene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
1,2,3-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
1,2,3-Trichloropropane	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
1,2,4-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
1,2,4-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
1,2-Dibromo-3-chloropropane	ND	10		µg/Kg	1	2/2/2007 4:04:00 AM
1,2-Dibromoethane	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
1,2-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
1,2-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
1,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
1,3,5-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
1,3-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
1,3-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
1,4-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
2,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
2-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
4-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
4-Isopropyltoluene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Benzene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Bromobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Bromodichloromethane	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Bromoform	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Bromomethane	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Carbon tetrachloride	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Chlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Chloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Chloroform	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Chloromethane	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
cis-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Dibromochloromethane	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Dibromomethane	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-011

Client Sample ID: DPB-5-10
Collection Date: 1/30/2007 10:30:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: DMP
Dichlorodifluoromethane	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Ethyl Tert-butyl ether	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Ethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Hexachlorobutadiene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Isopropylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
m,p-Xylene	ND	10		µg/Kg	1	2/2/2007 4:04:00 AM
Methylene chloride	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
MTBE	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
n-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
n-Propylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Naphthalene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
o-Xylene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
sec-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Styrene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
tert-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Tetrachloroethene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Toluene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
trans-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Trichloroethene	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Trichlorofluoromethane	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM
Vinyl chloride	ND	5.0		µg/Kg	1	2/2/2007 4:04:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-012

Client Sample ID: DPB-5-15
Collection Date: 1/30/2007 10:35:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B				EPA 6010B		
RunID: ICP6_070206G	QC Batch: 33223			PrepDate:		2/6/2007 Analyst: RQ
Antimony	ND	2.0		mg/Kg	1	2/6/2007 6:39:45 PM
Arsenic	3.4	1.0		mg/Kg	1	2/6/2007 6:39:45 PM
Barium	140	1.0		mg/Kg	1	2/6/2007 6:39:45 PM
Beryllium	ND	1.0		mg/Kg	1	2/6/2007 6:39:45 PM
Cadmium	ND	1.0		mg/Kg	1	2/6/2007 6:39:45 PM
Chromium	19	1.0		mg/Kg	1	2/6/2007 6:39:45 PM
Cobalt	8.6	1.0		mg/Kg	1	2/6/2007 6:39:45 PM
Copper	21	2.0		mg/Kg	1	2/6/2007 6:39:45 PM
Lead	4.5	1.0		mg/Kg	1	2/6/2007 6:39:45 PM
Molybdenum	ND	1.0		mg/Kg	1	2/6/2007 6:39:45 PM
Nickel	17	1.0		mg/Kg	1	2/6/2007 6:39:45 PM
Selenium	ND	1.0		mg/Kg	1	2/6/2007 6:39:45 PM
Silver	ND	1.0		mg/Kg	1	2/6/2007 6:39:45 PM
Thallium	ND	1.0		mg/Kg	1	2/6/2007 6:39:45 PM
Vanadium	44	1.0		mg/Kg	1	2/6/2007 6:39:45 PM
Zinc	41	1.0		mg/Kg	1	2/6/2007 6:39:45 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				EPA 8015B(M)		
RunID: GC7_BACK_070202C	QC Batch: 33186			PrepDate:		2/2/2007 Analyst: CBR
DRO	96	20		mg/Kg	10	2/2/2007 9:31:00 PM
ORO	560	20		mg/Kg	10	2/2/2007 9:31:00 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_070202A	QC Batch: E07VS040			PrepDate:		Analyst: ML
GRO	ND	1.0		mg/Kg	1	2/2/2007 4:30:00 PM
MERCURY BY COLD VAPOR TECHNIQUE						
EPA 7471				EPA 7471A		
RunID: AA5_070206G	QC Batch: 33225			PrepDate:		2/6/2007 Analyst: EKS
Mercury	ND	0.10		mg/Kg	1	2/6/2007
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: DMP
1,1,1,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	DPB-5-15
Lab Order:	089424	**Collection Date:**	1/30/2007 10:35:00 AM
Project:	SR4 WIDENING, E8328-06-01	**Matrix:**	SOIL
Lab ID:	089424-012		

VOLATILE ORGANIC COMPOUNDS BY GC/MS

EPA 8260B

RunID: MS3_070201B QC Batch: R07VS029 PrepDate: Analyst: DMP

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
1,1,1-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
1,1,2,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
1,1,2-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
1,1-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
1,1-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
1,1-Dichloropropene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
1,2,3-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
1,2,3-Trichloropropane	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
1,2,4-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
1,2,4-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
1,2-Dibromo-3-chloropropane	ND	10		µg/Kg	1	2/2/2007 4:31:00 AM
1,2-Dibromoethane	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
1,2-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
1,2-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
1,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
1,3,5-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
1,3-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
1,3-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
1,4-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
2,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
2-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
4-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
4-Isopropyltoluene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Benzene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Bromobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Bromodichloromethane	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Bromoform	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Bromomethane	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Carbon tetrachloride	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Chlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Chloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Chloroform	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Chloromethane	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
cis-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Dibromochloromethane	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Dibromomethane	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-012

Client Sample ID: DPB-5-15
Collection Date: 1/30/2007 10:35:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: DMP
Dichlorodifluoromethane	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Ethyl Tert-butyl ether	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Ethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Hexachlorobutadiene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Isopropylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
m,p-Xylene	ND	10		µg/Kg	1	2/2/2007 4:31:00 AM
Methylene chloride	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
MTBE	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
n-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
n-Propylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Naphthalene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
o-Xylene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
sec-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Styrene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
tert-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Tetrachloroethene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Toluene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
trans-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Trichloroethene	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Trichlorofluoromethane	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM
Vinyl chloride	ND	5.0		µg/Kg	1	2/2/2007 4:31:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-013

Client Sample ID: DPB-6-5
Collection Date: 1/30/2007 11:00:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			EPA 6010B			
RunID: ICP6_070206G	QC Batch: 33223			PrepDate:		2/6/2007 Analyst: RQ
Antimony	ND	2.0		mg/Kg	1	2/6/2007 6:46:07 PM
Arsenic	3.3	1.0		mg/Kg	1	2/6/2007 6:46:07 PM
Barium	120	1.0		mg/Kg	1	2/6/2007 6:46:07 PM
Beryllium	ND	1.0		mg/Kg	1	2/6/2007 6:46:07 PM
Cadmium	ND	1.0		mg/Kg	1	2/6/2007 6:46:07 PM
Chromium	17	1.0		mg/Kg	1	2/6/2007 6:46:07 PM
Cobalt	8.3	1.0		mg/Kg	1	2/6/2007 6:46:07 PM
Copper	16	2.0		mg/Kg	1	2/6/2007 6:46:07 PM
Lead	4.4	1.0		mg/Kg	1	2/6/2007 6:46:07 PM
Molybdenum	ND	1.0		mg/Kg	1	2/6/2007 6:46:07 PM
Nickel	15	1.0		mg/Kg	1	2/6/2007 6:46:07 PM
Selenium	ND	1.0		mg/Kg	1	2/6/2007 6:46:07 PM
Silver	ND	1.0		mg/Kg	1	2/6/2007 6:46:07 PM
Thallium	ND	1.0		mg/Kg	1	2/6/2007 6:46:07 PM
Vanadium	40	1.0		mg/Kg	1	2/6/2007 6:46:07 PM
Zinc	33	1.0		mg/Kg	1	2/6/2007 6:46:07 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			EPA 8015B(M)			
RunID: GC7_BACK_070202C	QC Batch: 33186			PrepDate:		2/2/2007 Analyst: CBR
DRO	5.4	1.0		mg/Kg	1	2/2/2007 6:09:00 PM
ORO	25	1.0		mg/Kg	1	2/2/2007 6:09:00 PM
GASOLINE RANGE ORGANICS BY GC/FID						
			EPA 8015B(M)			
RunID: GC1_070207A	QC Batch: D07VS023			PrepDate:		Analyst: ML
GRO	ND	1.0		mg/Kg	1	2/7/2007 7:11:00 PM
MERCURY BY COLD VAPOR TECHNIQUE						
EPA 7471			EPA 7471A			
RunID: AA5_070206G	QC Batch: 33225			PrepDate:		2/6/2007 Analyst: EKS
Mercury	ND	0.10		mg/Kg	1	2/6/2007
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
			EPA 8260B			
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: DMP
1,1,1,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-013

Client Sample ID: DPB-6-5
Collection Date: 1/30/2007 11:00:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: DMP
1,1,1-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
1,1,2,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
1,1,2-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
1,1-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
1,1-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
1,1-Dichloropropene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
1,2,3-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
1,2,3-Trichloropropane	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
1,2,4-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
1,2,4-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
1,2-Dibromo-3-chloropropane	ND	10		µg/Kg	1	2/2/2007 4:58:00 AM
1,2-Dibromoethane	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
1,2-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
1,2-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
1,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
1,3,5-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
1,3-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
1,3-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
1,4-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
2,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
2-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
4-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
4-Isopropyltoluene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Benzene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Bromobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Bromodichloromethane	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Bromoform	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Bromomethane	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Carbon tetrachloride	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Chlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Chloroethane	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Chloroform	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Chloromethane	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
cis-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Dibromochloromethane	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Dibromomethane	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-013

Client Sample ID: DPB-6-5
Collection Date: 1/30/2007 11:00:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
			EPA 8260B			
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: **DMP**
Dichlorodifluoromethane	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Ethyl Tert-butyl ether	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Ethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Hexachlorobutadiene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Isopropylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
m,p-Xylene	ND	10		µg/Kg	1	2/2/2007 4:58:00 AM
Methylene chloride	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
MTBE	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
n-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
n-Propylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Naphthalene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
o-Xylene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
sec-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Styrene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
tert-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Tetrachloroethene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Toluene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
trans-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Trichloroethene	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Trichlorofluoromethane	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM
Vinyl chloride	ND	5.0		µg/Kg	1	2/2/2007 4:58:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-014

Client Sample ID: DPB-6-10
Collection Date: 1/30/2007 11:05:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B / EPA 6010B						
RunID: ICP6_070206G QC Batch: 33223 PrepDate: 2/6/2007 Analyst: RQ						
Antimony	ND	2.0		mg/Kg	1	2/6/2007 6:52:24 PM
Arsenic	3.5	1.0		mg/Kg	1	2/6/2007 6:52:24 PM
Barium	110	1.0		mg/Kg	1	2/6/2007 6:52:24 PM
Beryllium	ND	1.0		mg/Kg	1	2/6/2007 6:52:24 PM
Cadmium	ND	1.0		mg/Kg	1	2/6/2007 6:52:24 PM
Chromium	14	1.0		mg/Kg	1	2/6/2007 6:52:24 PM
Cobalt	6.7	1.0		mg/Kg	1	2/6/2007 6:52:24 PM
Copper	13	2.0		mg/Kg	1	2/6/2007 6:52:24 PM
Lead	4.0	1.0		mg/Kg	1	2/6/2007 6:52:24 PM
Molybdenum	ND	1.0		mg/Kg	1	2/6/2007 6:52:24 PM
Nickel	12	1.0		mg/Kg	1	2/6/2007 6:52:24 PM
Selenium	ND	1.0		mg/Kg	1	2/6/2007 6:52:24 PM
Silver	ND	1.0		mg/Kg	1	2/6/2007 6:52:24 PM
Thallium	ND	1.0		mg/Kg	1	2/6/2007 6:52:24 PM
Vanadium	35	1.0		mg/Kg	1	2/6/2007 6:52:24 PM
Zinc	31	1.0		mg/Kg	1	2/6/2007 6:52:24 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B / EPA 8015B(M)						
RunID: GC7_BACK_070202C QC Batch: 33186 PrepDate: 2/2/2007 Analyst: CBR						
DRO	3.8	1.0		mg/Kg	1	2/2/2007 5:18:00 PM
ORO	10	1.0		mg/Kg	1	2/2/2007 5:18:00 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC1_070207A QC Batch: D07VS023 PrepDate: Analyst: ML						
GRO	ND	1.0		mg/Kg	1	2/7/2007 7:37:00 PM
MERCURY BY COLD VAPOR TECHNIQUE						
EPA 7471 / EPA 7471A						
RunID: AA5_070206G QC Batch: 33225 PrepDate: 2/6/2007 Analyst: EKS						
Mercury	ND	0.10		mg/Kg	1	2/6/2007
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
EPA 8260B						
RunID: MS3_070201B QC Batch: R07VS029 PrepDate: Analyst: DMP						
1,1,1,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

ANALYTICAL RESULTS

Advanced Technology Laboratories

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-014

Client Sample ID: DPB-6-10
Collection Date: 1/30/2007 11:05:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029				PrepDate:	Analyst: DMP
1,1,1-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
1,1,2,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
1,1,2-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
1,1-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
1,1-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
1,1-Dichloropropene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
1,2,3-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
1,2,3-Trichloropropane	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
1,2,4-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
1,2,4-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
1,2-Dibromo-3-chloropropane	ND	10		µg/Kg	1	2/2/2007 5:25:00 AM
1,2-Dibromoethane	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
1,2-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
1,2-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
1,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
1,3,5-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
1,3-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
1,3-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
1,4-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
2,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
2-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
4-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
4-Isopropyltoluene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Benzene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Bromobenzene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Bromodichloromethane	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Bromoform	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Bromomethane	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Carbon tetrachloride	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Chlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Chloroethane	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Chloroform	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Chloromethane	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
cis-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Dibromochloromethane	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Dibromomethane	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-014

Client Sample ID: DPB-6-10
Collection Date: 1/30/2007 11:05:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: DMP
Dichlorodifluoromethane	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Ethyl Tert-butyl ether	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Ethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Hexachlorobutadiene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Isopropylbenzene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
m,p-Xylene	ND	10		µg/Kg	1	2/2/2007 5:25:00 AM
Methylene chloride	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
MTBE	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
n-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
n-Propylbenzene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Naphthalene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
o-Xylene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
sec-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Styrene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
tert-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Tetrachloroethene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Toluene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
trans-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Trichloroethene	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Trichlorofluoromethane	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM
Vinyl chloride	ND	5.0		µg/Kg	1	2/2/2007 5:25:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-015

Client Sample ID: DPB-6-15
Collection Date: 1/30/2007 11:10:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP6_070206G	QC Batch: 33223			PrepDate:		2/6/2007 Analyst: RQ
Antimony	ND	2.0		mg/Kg	1	2/6/2007 6:58:34 PM
Arsenic	4.9	1.0		mg/Kg	1	2/6/2007 6:58:34 PM
Barium	140	1.0		mg/Kg	1	2/6/2007 6:58:34 PM
Beryllium	ND	1.0		mg/Kg	1	2/6/2007 6:58:34 PM
Cadmium	ND	1.0		mg/Kg	1	2/6/2007 6:58:34 PM
Chromium	13	1.0		mg/Kg	1	2/6/2007 6:58:34 PM
Cobalt	5.9	1.0		mg/Kg	1	2/6/2007 6:58:34 PM
Copper	14	2.0		mg/Kg	1	2/6/2007 6:58:34 PM
Lead	5.0	1.0		mg/Kg	1	2/6/2007 6:58:34 PM
Molybdenum	ND	1.0		mg/Kg	1	2/6/2007 6:58:34 PM
Nickel	11	1.0		mg/Kg	1	2/6/2007 6:58:34 PM
Selenium	ND	1.0		mg/Kg	1	2/6/2007 6:58:34 PM
Silver	ND	1.0		mg/Kg	1	2/6/2007 6:58:34 PM
Thallium	ND	1.0		mg/Kg	1	2/6/2007 6:58:34 PM
Vanadium	35	1.0		mg/Kg	1	2/6/2007 6:58:34 PM
Zinc	32	1.0		mg/Kg	1	2/6/2007 6:58:34 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
	EPA 3550B			**EPA 8015B(M)**		
RunID: GC7_BACK_070202C	QC Batch: 33186			PrepDate:		2/2/2007 Analyst: CBR
DRO	ND	1.0		mg/Kg	1	2/2/2007 4:52:00 PM
ORO	2.5	1.0		mg/Kg	1	2/2/2007 4:52:00 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_070201B	QC Batch: E07VS039			PrepDate:		Analyst: ML
GRO	ND	1.0		mg/Kg	1	2/1/2007 8:19:00 PM
MERCURY BY COLD VAPOR TECHNIQUE						
	EPA 7471			**EPA 7471A**		
RunID: AA5_070206G	QC Batch: 33225			PrepDate:		2/6/2007 Analyst: EKS
Mercury	ND	0.10		mg/Kg	1	2/6/2007
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: DMP
1,1,1,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-015

Client Sample ID: DPB-6-15
Collection Date: 1/30/2007 11:10:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029				PrepDate:	Analyst: DMP
1,1,1-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
1,1,2,2-Tetrachloroethane	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
1,1,2-Trichloroethane	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
1,1-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
1,1-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
1,1-Dichloropropene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
1,2,3-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
1,2,3-Trichloropropane	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
1,2,4-Trichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
1,2,4-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
1,2-Dibromo-3-chloropropane	ND	10		µg/Kg	1	2/2/2007 5:51:00 AM
1,2-Dibromoethane	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
1,2-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
1,2-Dichloroethane	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
1,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
1,3,5-Trimethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
1,3-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
1,3-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
1,4-Dichlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
2,2-Dichloropropane	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
2-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
4-Chlorotoluene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
4-Isopropyltoluene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Benzene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Bromobenzene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Bromodichloromethane	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Bromoform	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Bromomethane	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Carbon tetrachloride	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Chlorobenzene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Chloroethane	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Chloroform	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Chloromethane	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
cis-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Dibromochloromethane	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Dibromomethane	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Lab Order: 089424
Project: SR4 WIDENING, E8328-06-01
Lab ID: 089424-015

Client Sample ID: DPB-6-15
Collection Date: 1/30/2007 11:10:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS3_070201B	QC Batch: R07VS029			PrepDate:		Analyst: DMP
Dichlorodifluoromethane	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Ethyl Tert-butyl ether	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Ethylbenzene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Hexachlorobutadiene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Isopropylbenzene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
m,p-Xylene	ND	10		µg/Kg	1	2/2/2007 5:51:00 AM
Methylene chloride	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
MTBE	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
n-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
n-Propylbenzene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Naphthalene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
o-Xylene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
sec-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Styrene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
tert-Butylbenzene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Tetrachloroethene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Toluene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
trans-1,2-Dichloroethene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Trichloroethene	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Trichlorofluoromethane	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM
Vinyl chloride	ND	5.0		µg/Kg	1	2/2/2007 5:51:00 AM

Qualifiers:
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference
- DO Surrogate Diluted Out
- E Value above quantitation range
- ND Not Detected at the Reporting Limit

Results are wet unless otherwise specified

Advanced Technology Laboratories

Date: *08-Feb-07*

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: MB-33222 SampType: MBLK TestCode: 6010_S Units: mg/Kg Prep Date: 2/6/2007 RunNo: 74149
Client ID: PBS Batch ID: 33222 TestNo: EPA 6010B EPA 3050B Analysis Date: 2/7/2007 SeqNo: 1112450

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	ND	2.0									
Arsenic	ND	1.0									
Barium	ND	1.0									
Beryllium	ND	1.0									
Cadmium	ND	1.0									
Chromium	ND	1.0									
Cobalt	ND	1.0									
Copper	ND	2.0									
Lead	ND	1.0									
Molybdenum	ND	1.0									
Nickel	ND	1.0									
Selenium	ND	1.0									
Silver	0.050	1.0									
Thallium	ND	1.0									
Vanadium	ND	1.0									
Zinc	ND	1.0									

Sample ID: LCS-33222 SampType: LCS TestCode: 6010_S Units: mg/Kg Prep Date: 2/6/2007 RunNo: 74149
Client ID: LCSS Batch ID: 33222 TestNo: EPA 6010B EPA 3050B Analysis Date: 2/7/2007 SeqNo: 1112451

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	48.919	2.0	50.00	0	97.8	80	120				
Arsenic	46.748	1.0	50.00	0	93.5	80	120				
Barium	49.858	1.0	50.00	0	99.7	80	120				
Beryllium	48.261	1.0	50.00	0	96.5	80	120				
Cadmium	48.802	1.0	50.00	0	97.6	80	120				
Chromium	51.344	1.0	50.00	0	103	80	120				
Cobalt	49.373	1.0	50.00	0	98.7	80	120				

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

INFORMATION HANDOUT

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: LCS-33222 | SampType: LCS | TestCode: 6010_S | Units: mg/Kg | Prep Date: 2/6/2007 | RunNo: 74149
Client ID: LCSS | Batch ID: 33222 | TestNo: EPA 6010B EPA 3050B | Analysis Date: 2/7/2007 | SeqNo: 1112451

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Copper	50.717	2.0	50.00	0	101	80	120				
Lead	49.427	1.0	50.00	0	98.9	80	120				
Molybdenum	50.088	1.0	50.00	0	100	80	120				
Nickel	48.764	1.0	50.00	0	97.5	80	120				
Selenium	48.163	1.0	50.00	0	96.3	80	120				
Silver	50.286	1.0	50.00	0.05000	100	80	120				
Thallium	50.119	1.0	50.00	0	100	80	120				
Vanadium	50.697	1.0	50.00	0	101	80	120				
Zinc	48.678	1.0	50.00	0	97.4	80	120				

Sample ID: 089424-010ADUP | SampType: DUP | TestCode: 6010_S | Units: mg/Kg | Prep Date: 2/6/2007 | RunNo: 74149
Client ID: DPB-5-5 | Batch ID: 33222 | TestNo: EPA 6010B EPA 3050B | Analysis Date: 2/7/2007 | SeqNo: 1112462

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	ND	2.0						0	0	20	
Arsenic	3.661	1.0						3.636	0.685	20	
Barium	122.288	1.0						111.7	9.01	20	
Beryllium	0.274	1.0						0.2780	0	20	
Cadmium	0.156	1.0						0.1543	0	20	
Chromium	18.367	1.0						19.94	8.22	20	
Cobalt	8.426	1.0						8.433	0.0797	20	
Copper	16.855	2.0						17.70	4.90	20	
Lead	4.624	1.0						4.689	1.39	20	
Molybdenum	0.140	1.0						0.1267	0	20	
Nickel	19.153	1.0						20.13	4.98	20	
Selenium	ND	1.0						0	0	20	
Silver	ND	1.0						0	0	20	
Thallium	ND	1.0						0	0	20	
Vanadium	39.132	1.0						41.41	5.66	20	
Zinc	36.534	1.0						38.35	4.85	20	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

INFORMATION HANDOUT

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: 089424-010AMS	SampType: MS	TestCode: 6010_S	Units: mg/Kg	Prep Date: 2/6/2007	RunNo: 74149
Client ID: DPB-5-5	Batch ID: 33222	TestNo: EPA 6010B	EPA 3050B	Analysis Date: 2/7/2007	SeqNo: 1112463

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	78.207	2.0	125.0	0	62.6	24	110				
Arsenic	93.991	1.0	125.0	3.636	72.3	61	104				
Barium	210.444	1.0	125.0	111.7	79.0	35	135				
Beryllium	94.952	1.0	125.0	0.2780	75.7	64	104				
Cadmium	97.486	1.0	125.0	0.1543	77.9	65	106				
Chromium	116.279	1.0	125.0	19.94	77.1	47	122				
Cobalt	103.864	1.0	125.0	8.433	76.3	55	111				
Copper	118.970	2.0	125.0	17.70	81.0	52	132				
Lead	96.971	1.0	125.0	4.689	73.8	37	128				
Molybdenum	90.567	1.0	125.0	0.1267	72.4	58	108				
Nickel	111.593	1.0	125.0	20.13	73.2	48	120				
Selenium	91.038	1.0	125.0	0	72.8	57	105				
Silver	8.804	1.0	125.0	0	7.04	44	116				S
Thallium	91.193	1.0	125.0	0	73.0	55	103				
Vanadium	140.484	1.0	125.0	41.41	79.3	57	116				
Zinc	129.467	1.0	125.0	38.35	72.9	41	120				

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: MB-33223 | SampType: MBLK | TestCode: 6010_S | Units: mg/Kg | Prep Date: 2/6/2007 | RunNo: 74063
Client ID: PBS | Batch ID: 33223 | TestNo: EPA 6010B | EPA 3050B | Analysis Date: 2/6/2007 | SeqNo: 1111084

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	ND	2.0									
Arsenic	ND	1.0									
Barium	ND	1.0									
Beryllium	ND	1.0									
Cadmium	ND	1.0									
Chromium	ND	1.0									
Cobalt	ND	1.0									
Copper	ND	2.0									
Lead	ND	1.0									
Molybdenum	ND	1.0									
Nickel	ND	1.0									
Selenium	ND	1.0									
Silver	ND	1.0									
Thallium	ND	1.0									
Vanadium	ND	1.0									
Zinc	ND	1.0									

Sample ID: LCS-33223 | SampType: LCS | TestCode: 6010_S | Units: mg/Kg | Prep Date: 2/6/2007 | RunNo: 74063
Client ID: LCSS | Batch ID: 33223 | TestNo: EPA 6010B | EPA 3050B | Analysis Date: 2/6/2007 | SeqNo: 1111085

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	48.679	2.0	50.00	0	97.4	80	120				
Arsenic	46.940	1.0	50.00	0	93.9	80	120				
Barium	49.926	1.0	50.00	0	99.9	80	120				
Beryllium	47.415	1.0	50.00	0	94.8	80	120				
Cadmium	49.646	1.0	50.00	0	99.3	80	120				
Chromium	51.756	1.0	50.00	0	104	80	120				
Cobalt	49.350	1.0	50.00	0	98.7	80	120				
Copper	50.365	2.0	50.00	0	101	80	120				
Lead	49.649	1.0	50.00	0	99.3	80	120				

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: LCS-33223 | SampType: LCS | TestCode: 6010_S | Units: mg/Kg | Prep Date: 2/6/2007 | RunNo: 74063
Client ID: LCSS | Batch ID: 33223 | TestNo: EPA 6010B EPA 3050B | Analysis Date: 2/6/2007 | SeqNo: 1111085

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Molybdenum	49.876	1.0	50.00	0	99.8	80	120				
Nickel	48.958	1.0	50.00	0	97.9	80	120				
Selenium	47.823	1.0	50.00	0	95.6	80	120				
Silver	45.246	1.0	50.00	0	90.5	80	120				
Thallium	49.637	1.0	50.00	0	99.3	80	120				
Vanadium	51.008	1.0	50.00	0	102	80	120				
Zinc	49.060	1.0	50.00	0	98.1	80	120				

Sample ID: 089424-015ADUP | SampType: DUP | TestCode: 6010_S | Units: mg/Kg | Prep Date: 2/6/2007 | RunNo: 74063
Client ID: DPB-6-15 | Batch ID: 33223 | TestNo: EPA 6010B EPA 3050B | Analysis Date: 2/6/2007 | SeqNo: 1111092

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	ND	2.0						0	0	20	
Arsenic	6.210	1.0						4.913	23.3	20	R
Barium	143.435	1.0						142.5	0.682	20	
Beryllium	0.358	1.0						0.3644	0	20	
Cadmium	0.959	1.0						0.3677	0	20	
Chromium	13.281	1.0						12.88	3.06	20	
Cobalt	6.018	1.0						5.858	2.70	20	
Copper	17.515	2.0						14.07	21.8	20	R
Lead	4.383	1.0						4.987	12.9	20	
Molybdenum	0.333	1.0						0.1493	0	20	
Nickel	11.660	1.0						10.95	6.32	20	
Selenium	ND	1.0						0	0	20	
Silver	ND	1.0						0	0	20	
Thallium	ND	1.0						0	0	20	
Vanadium	55.313	1.0						35.45	43.8	20	R
Zinc	30.172	1.0						31.88	5.52	20	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

INFORMATION HANDOUT

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: MB-33223 | SampType: MBLK | TestCode: 6010_S | Units: mg/Kg | Prep Date: 2/6/2007 | RunNo: 74126
Client ID: PBS | Batch ID: 33223 | TestNo: EPA 6010B EPA 3050B | Analysis Date: 2/7/2007 | SeqNo: 1112097

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	ND	2.0									
Arsenic	ND	1.0									
Barium	ND	1.0									
Beryllium	ND	1.0									
Cadmium	ND	1.0									
Chromium	ND	1.0									
Cobalt	ND	1.0									
Copper	ND	2.0									
Lead	ND	1.0									
Molybdenum	ND	1.0									
Nickel	ND	1.0									
Selenium	ND	1.0									
Silver	ND	1.0									
Thallium	ND	1.0									
Vanadium	ND	1.0									
Zinc	ND	1.0									

Sample ID: 089424-015AMS | SampType: MS | TestCode: 6010_S | Units: mg/Kg | Prep Date: 2/6/2007 | RunNo: 74126
Client ID: DPB-6-15 | Batch ID: 33223 | TestNo: EPA 6010B EPA 3050B | Analysis Date: 2/7/2007 | SeqNo: 1112101

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	91.819	2.0	125.0	0	73.5	24	110				
Arsenic	110.956	1.0	125.0	5.511	84.4	61	104				
Barium	292.307	1.0	125.0	142.8	120	35	135				
Beryllium	110.274	1.0	125.0	0.3796	87.9	64	104				
Cadmium	113.188	1.0	125.0	0.6492	90.0	65	106				
Chromium	127.055	1.0	125.0	13.26	91.0	47	122				
Cobalt	113.514	1.0	125.0	5.894	86.1	55	111				
Copper	140.118	2.0	125.0	16.20	99.1	52	132				
Lead	109.351	1.0	125.0	4.675	83.7	37	128				

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: 089424-015AMS | SampType: MS | TestCode: 6010_S | Units: mg/Kg | Prep Date: 2/6/2007 | RunNo: 74126
Client ID: DPB-6-15 | Batch ID: 33223 | TestNo: EPA 6010B EPA 3050B | Analysis Date: 2/7/2007 | SeqNo: 1112101

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Molybdenum	102.574	1.0	125.0	0.2575	81.9	58	108				
Nickel	115.459	1.0	125.0	11.26	83.4	48	120				
Selenium	104.616	1.0	125.0	0	83.7	57	105				
Silver	16.149	1.0	125.0	0	12.9	44	116				S
Thallium	100.617	1.0	125.0	0	80.5	55	103				
Vanadium	165.098	1.0	125.0	46.24	95.1	57	116				
Zinc	139.845	1.0	125.0	31.00	87.1	41	120				

Sample ID: LCS-33223 | SampType: LCS | TestCode: 6010_S | Units: mg/Kg | Prep Date: 2/6/2007 | RunNo: 74126
Client ID: LCSS | Batch ID: 33223 | TestNo: EPA 6010B EPA 3050B | Analysis Date: 2/7/2007 | SeqNo: 1112162

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	51.008	2.0	50.00	0	102	80	120				
Arsenic	49.338	1.0	50.00	0	98.7	80	120				
Barium	52.437	1.0	50.00	0	105	80	120				
Beryllium	51.119	1.0	50.00	0	102	80	120				
Cadmium	51.199	1.0	50.00	0	102	80	120				
Chromium	54.007	1.0	50.00	0	108	80	120				
Cobalt	51.981	1.0	50.00	0	104	80	120				
Copper	53.905	2.0	50.00	0	108	80	120				
Lead	52.156	1.0	50.00	0	104	80	120				
Molybdenum	53.052	1.0	50.00	0	106	80	120				
Nickel	51.221	1.0	50.00	0	102	80	120				
Selenium	50.868	1.0	50.00	0	102	80	120				
Silver	53.251	1.0	50.00	0	107	80	120				
Thallium	52.688	1.0	50.00	0	105	80	120				
Vanadium	53.450	1.0	50.00	0	107	80	120				
Zinc	51.255	1.0	50.00	0	103	80	120				

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: 089424-010A-DUP SampType: DUP TestCode: 7471_S Units: mg/Kg Prep Date: 2/6/2007 RunNo: 74108
Client ID: DPB-5-5 Batch ID: 33224 TestNo: EPA 7471A EPA 7471 Analysis Date: 2/6/2007 SeqNo: 1111948

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10						0	0	20	

Sample ID: 089424-010A-MS SampType: MS TestCode: 7471_S Units: mg/Kg Prep Date: 2/6/2007 RunNo: 74108
Client ID: DPB-5-5 Batch ID: 33224 TestNo: EPA 7471A EPA 7471 Analysis Date: 2/6/2007 SeqNo: 1111949

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	1.037	0.10	0.8300	0	125	67	160				

Sample ID: LCS-33224 SampType: LCS TestCode: 7471_S Units: mg/Kg Prep Date: 2/6/2007 RunNo: 74108
Client ID: LCSS Batch ID: 33224 TestNo: EPA 7471A EPA 7471 Analysis Date: 2/6/2007 SeqNo: 1111951

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.980	0.10	0.8300	0	118	80	120				

Sample ID: MB-33224 SampType: MBLK TestCode: 7471_S Units: mg/Kg Prep Date: 2/6/2007 RunNo: 74108
Client ID: PBS Batch ID: 33224 TestNo: EPA 7471A EPA 7471 Analysis Date: 2/6/2007 SeqNo: 1111952

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10									

Qualifiers:

- B Analyte detected in the associated Method Blank
- ND Not Detected at the Reporting Limit
- DO Surrogate Diluted Out
- E Value above quantitation range
- R RPD outside accepted recovery limits
- Calculations are based on raw values
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference

INFORMATION HANDOUT

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: 089424-015A-DUP | SampType: DUP | TestCode: 7471_S | Units: mg/Kg | Prep Date: 2/6/2007 | RunNo: 74066
Client ID: DPB-6-15 | Batch ID: 33225 | TestNo: EPA 7471A | EPA 7471 | Analysis Date: 2/6/2007 | SeqNo: 1111127

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.040	0.10						0.05280	0	20	

Sample ID: 089424-015A-MS | SampType: MS | TestCode: 7471_S | Units: mg/Kg | Prep Date: 2/6/2007 | RunNo: 74066
Client ID: DPB-6-15 | Batch ID: 33225 | TestNo: EPA 7471A | EPA 7471 | Analysis Date: 2/6/2007 | SeqNo: 1111128

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	1.019	0.10	0.8300	0.05280	116	67	160				

Sample ID: LCS-33225 | SampType: LCS | TestCode: 7471_S | Units: mg/Kg | Prep Date: 2/6/2007 | RunNo: 74066
Client ID: LCSS | Batch ID: 33225 | TestNo: EPA 7471A | EPA 7471 | Analysis Date: 2/6/2007 | SeqNo: 1111135

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.950	0.10	0.8300	0	114	80	120				

Sample ID: MB-33225 | SampType: MBLK | TestCode: 7471_S | Units: mg/Kg | Prep Date: 2/6/2007 | RunNo: 74066
Client ID: PBS | Batch ID: 33225 | TestNo: EPA 7471A | EPA 7471 | Analysis Date: 2/6/2007 | SeqNo: 1111136

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10									

Qualifiers:

- B Analyte detected in the associated Method Blank
- ND Not Detected at the Reporting Limit
- DO Surrogate Diluted Out
- E Value above quantitation range
- R RPD outside accepted recovery limits
  Calculations are based on raw values
- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: LCS-33181 | SampType: LCS | TestCode: 8015_S_DM L | Units: mg/Kg | Prep Date: 2/1/2007 | RunNo: 73857
Client ID: LCSS | Batch ID: 33181 | TestNo: EPA 8015B(M EPA 3550B | Analysis Date: 2/2/2007 | SeqNo: 1107812

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	16.882	1.0	33.00	0	51.2	38	112				

Sample ID: MB-33181 | SampType: MBLK | TestCode: 8015_S_DM L | Units: mg/Kg | Prep Date: 2/1/2007 | RunNo: 73857
Client ID: PBS | Batch ID: 33181 | TestNo: EPA 8015B(M EPA 3550B | Analysis Date: 2/2/2007 | SeqNo: 1107813

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	ND	1.0									
ORO	ND	1.0									

Sample ID: 089465-013AMS | SampType: MS | TestCode: 8015_S_DM L | Units: mg/Kg | Prep Date: 2/1/2007 | RunNo: 73857
Client ID: ZZZZZZ | Batch ID: 33181 | TestNo: EPA 8015B(M EPA 3550B | Analysis Date: 2/2/2007 | SeqNo: 1107814

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	21.734	1.0	33.00	2.642	57.9	25	109				

Sample ID: 089465-013ADUP | SampType: DUP | TestCode: 8015_S_DM L | Units: mg/Kg | Prep Date: 2/1/2007 | RunNo: 73857
Client ID: ZZZZZZ | Batch ID: 33181 | TestNo: EPA 8015B(M EPA 3550B | Analysis Date: 2/2/2007 | SeqNo: 1107816

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	6.137	1.0						2.642	79.6	30	R
ORO	7.617	1.0						4.215	57.5	30	R

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

INFORMATION HANDOUT

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: MB-33186 SampType: MBLK TestCode: 8015_S_DM L Units: mg/Kg Prep Date: 2/2/2007 RunNo: 73956
Client ID: PBS Batch ID: 33186 TestNo: EPA 8015B(M EPA 3550B Analysis Date: 2/2/2007 SeqNo: 1109465

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	ND	1.0									
ORO	ND	1.0									

Sample ID: LCS-33186 SampType: LCS TestCode: 8015_S_DM L Units: mg/Kg Prep Date: 2/2/2007 RunNo: 73956
Client ID: LCSS Batch ID: 33186 TestNo: EPA 8015B(M EPA 3550B Analysis Date: 2/2/2007 SeqNo: 1109466

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	14.245	1.0	33.00	0	43.2	38	112				

Sample ID: 089424-008AMS SampType: MS TestCode: 8015_S_DM L Units: mg/Kg Prep Date: 2/2/2007 RunNo: 73956
Client ID: DPB-4-10 Batch ID: 33186 TestNo: EPA 8015B(M EPA 3550B Analysis Date: 2/2/2007 SeqNo: 1109472

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	13.993	1.0	33.00	5.640	25.3	25	109				

Sample ID: 089424-008ADUP SampType: DUP TestCode: 8015_S_DM L Units: mg/Kg Prep Date: 2/2/2007 RunNo: 73956
Client ID: DPB-4-10 Batch ID: 33186 TestNo: EPA 8015B(M EPA 3550B Analysis Date: 2/2/2007 SeqNo: 1109474

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	4.089	1.0						5.640	31.9	30	R
ORO	25.164	1.0						32.20	24.5	30	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

INFORMATION HANDOUT

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: D020707MB1 SampType: MBLK TestCode: 8015_S_GAS Units: mg/Kg Prep Date: RunNo: 74127
Client ID: PBS Batch ID: D07VS023 TestNo: EPA 8015B(M Analysis Date: 2/7/2007 SeqNo: 1112126

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0									

Sample ID: D020707MB1MS SampType: MS TestCode: 8015_S_GAS Units: mg/Kg Prep Date: RunNo: 74127
Client ID: ZZZZZZ Batch ID: D07VS023 TestNo: EPA 8015B(M Analysis Date: 2/7/2007 SeqNo: 1112127

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.752	1.0	5.000	0	95.0	34	150				

Sample ID: 089524-007ADUP SampType: DUP TestCode: 8015_S_GAS Units: mg/Kg Prep Date: RunNo: 74127
Client ID: ZZZZZZ Batch ID: D07VS023 TestNo: EPA 8015B(M Analysis Date: 2/7/2007 SeqNo: 1112134

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0						0	0	30	

Sample ID: D020707LCS1 SampType: LCS TestCode: 8015_S_GAS Units: mg/Kg Prep Date: RunNo: 74127
Client ID: LCSS Batch ID: D07VS023 TestNo: EPA 8015B(M Analysis Date: 2/7/2007 SeqNo: 1112200

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.403	1.0	5.000	0	88.1	74	113				

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: E020107MB3 SampType: MBLK TestCode: 8015_S_GAS Units: mg/Kg Prep Date: RunNo: 73844
Client ID: PBS Batch ID: E07VS039 TestNo: EPA 8015B(M Analysis Date: 2/1/2007 SeqNo: 1107585

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0									

Sample ID: 089424-015A SampType: DUP TestCode: 8015_S_GAS Units: mg/Kg Prep Date: RunNo: 73844
Client ID: DPB-6-15 Batch ID: E07VS039 TestNo: EPA 8015B(M Analysis Date: 2/1/2007 SeqNo: 1107587

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0						0.2200	0	30	

Sample ID: 089424-015AMS SampType: MS TestCode: 8015_S_GAS Units: mg/Kg Prep Date: RunNo: 73844
Client ID: DPB-6-15 Batch ID: E07VS039 TestNo: EPA 8015B(M Analysis Date: 2/1/2007 SeqNo: 1107588

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.306	1.0	5.000	0.2200	81.7	34	150				

Sample ID: E020107LCS3 SampType: LCS TestCode: 8015_S_GAS Units: mg/Kg Prep Date: RunNo: 73844
Client ID: LCSS Batch ID: E07VS039 TestNo: EPA 8015B(M Analysis Date: 2/2/2007 SeqNo: 1107592

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.547	1.0	5.000	0	90.9	74	113				

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

INFORMATION HANDOUT

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: E020207MB1 SampType: MBLK TestCode: 8015_S_GAS Units: mg/Kg Prep Date: RunNo: 73896
Client ID: PBS Batch ID: E07VS040 TestNo: EPA 8015B(M Analysis Date: 2/2/2007 SeqNo: 1108407

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	0.214	1.0									

Sample ID: E020207MB1MS SampType: MS TestCode: 8015_S_GAS Units: mg/Kg Prep Date: RunNo: 73896
Client ID: ZZZZZZ Batch ID: E07VS040 TestNo: EPA 8015B(M Analysis Date: 2/2/2007 SeqNo: 1108408

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.903	1.0	5.000	0.2140	93.8	34	150				

Sample ID: 089424-001A SampType: DUP TestCode: 8015_S_GAS Units: mg/Kg Prep Date: RunNo: 73896
Client ID: DPB-1-5 Batch ID: E07VS040 TestNo: EPA 8015B(M Analysis Date: 2/2/2007 SeqNo: 1108411

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0						0	0	30	

Sample ID: E020207LCS1 SampType: LCS TestCode: 8015_S_GAS Units: mg/Kg Prep Date: RunNo: 73896
Client ID: LCSS Batch ID: E07VS040 TestNo: EPA 8015B(M Analysis Date: 2/2/2007 SeqNo: 1108419

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.755	1.0	5.000	0.2140	90.8	74	113				

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

INFORMATION HANDOUT

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: R020107LCS1 SampType: LCS TestCode: 8260_S Units: µg/Kg Prep Date: RunNo: 73795
Client ID: LCSS Batch ID: R07VS028 TestNo: EPA 8260B Analysis Date: 2/1/2007 SeqNo: 1106760

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1-Dichloroethene	93.830	5.0	100.0	0	93.8	79	127				
Benzene	101.180	5.0	100.0	0	101	85	122				
Chlorobenzene	95.230	5.0	100.0	0	95.2	81	129				
MTBE	89.930	5.0	100.0	0	89.9	67	134				
Toluene	92.590	5.0	100.0	0	92.6	83	122				
Trichloroethene	103.190	5.0	100.0	0	103	84	128				

Sample ID: R020107MB SampType: MBLK TestCode: 8260_S Units: µg/Kg Prep Date: RunNo: 73795
Client ID: PBS Batch ID: R07VS028 TestNo: EPA 8260B Analysis Date: 2/1/2007 SeqNo: 1106761

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1,1,2-Tetrachloroethane	ND	5.0									
1,1,1-Trichloroethane	ND	5.0									
1,1,2,2-Tetrachloroethane	ND	5.0									
1,1,2-Trichloroethane	ND	5.0									
1,1-Dichloroethane	ND	5.0									
1,1-Dichloroethene	ND	5.0									
1,1-Dichloropropene	ND	5.0									
1,2,3-Trichlorobenzene	ND	5.0									
1,2,3-Trichloropropane	ND	5.0									
1,2,4-Trichlorobenzene	ND	5.0									
1,2,4-Trimethylbenzene	ND	5.0									
1,2-Dibromo-3-chloropropane	ND	10									
1,2-Dibromoethane	ND	5.0									
1,2-Dichlorobenzene	ND	5.0									
1,2-Dichloroethane	ND	5.0									
1,2-Dichloropropane	ND	5.0									
1,3,5-Trimethylbenzene	ND	5.0									
1,3-Dichlorobenzene	ND	5.0									
1,3-Dichloropropane	ND	5.0									

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: R020107MB | SampType: MBLK | TestCode: 8260_S | Units: µg/Kg | Prep Date: | RunNo: 73795
Client ID: PBS | Batch ID: R07VS028 | TestNo: EPA 8260B | Analysis Date: 2/1/2007 | SeqNo: 1106761

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,4-Dichlorobenzene	ND	5.0									
2,2-Dichloropropane	ND	5.0									
2-Chlorotoluene	ND	5.0									
4-Chlorotoluene	ND	5.0									
4-Isopropyltoluene	ND	5.0									
Benzene	ND	5.0									
Bromobenzene	ND	5.0									
Bromodichloromethane	ND	5.0									
Bromoform	ND	5.0									
Bromomethane	ND	5.0									
Carbon tetrachloride	ND	5.0									
Chlorobenzene	ND	5.0									
Chloroethane	ND	5.0									
Chloroform	ND	5.0									
Chloromethane	ND	5.0									
cis-1,2-Dichloroethene	ND	5.0									
Dibromochloromethane	ND	5.0									
Dibromomethane	ND	5.0									
Dichlorodifluoromethane	ND	5.0									
Ethyl Tert-butyl ether	ND	5.0									
Ethylbenzene	ND	5.0									
Hexachlorobutadiene	ND	5.0									
Isopropylbenzene	ND	5.0									
m,p-Xylene	ND	10									
Methylene chloride	ND	5.0									
MTBE	ND	5.0									
n-Butylbenzene	ND	5.0									
n-Propylbenzene	ND	5.0									
Naphthalene	ND	5.0									
o-Xylene	ND	5.0									

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: R020107MB | SampType: MBLK | TestCode: 8260_S | Units: µg/Kg | Prep Date: | RunNo: 73795
Client ID: PBS | Batch ID: R07VS028 | TestNo: EPA 8260B | Analysis Date: 2/1/2007 | SeqNo: 1106761

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
sec-Butylbenzene	ND	5.0									
Styrene	ND	5.0									
tert-Butylbenzene	ND	5.0									
Tetrachloroethene	ND	5.0									
Toluene	ND	5.0									
trans-1,2-Dichloroethene	ND	5.0									
Trichloroethene	ND	5.0									
Trichlorofluoromethane	ND	5.0									
Vinyl chloride	ND	5.0									

Sample ID: 089437-001AMS | SampType: MS | TestCode: 8260_S | Units: µg/Kg | Prep Date: | RunNo: 73795
Client ID: ZZZZZZ | Batch ID: R07VS028 | TestNo: EPA 8260B | Analysis Date: 2/1/2007 | SeqNo: 1106762

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1-Dichloroethene	91.330	5.0	100.0	0	91.3	54	146				
Benzene	99.800	5.0	100.0	0	99.8	57	144				
Chlorobenzene	95.170	5.0	100.0	0	95.2	51	153				
MTBE	82.810	5.0	100.0	0	82.8	47	147				
Toluene	94.550	5.0	100.0	0	94.6	54	144				
Trichloroethene	103.380	5.0	100.0	0	103	55	151				

Sample ID: 089465-008ADUP | SampType: DUP | TestCode: 8260_S | Units: µg/Kg | Prep Date: | RunNo: 73795
Client ID: ZZZZZZ | Batch ID: R07VS028 | TestNo: EPA 8260B | Analysis Date: 2/1/2007 | SeqNo: 1107481

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1,1,2-Tetrachloroethane	ND	5.0						0	0	30	
1,1,1-Trichloroethane	ND	5.0						0	0	30	
1,1,2,2-Tetrachloroethane	ND	5.0						0	0	30	
1,1,2-Trichloroethane	ND	5.0						0	0	30	
1,1-Dichloroethane	ND	5.0						0	0	30	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: 089465-008ADUP | SampType: DUP | TestCode: 8260_S | Units: µg/Kg | Prep Date: | RunNo: 73795
Client ID: ZZZZZZ | Batch ID: R07VS028 | TestNo: EPA 8260B | Analysis Date: 2/1/2007 | SeqNo: 1107481

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1-Dichloroethene	ND	5.0						0	0	30	
1,1-Dichloropropene	ND	5.0						0	0	30	
1,2,3-Trichlorobenzene	ND	5.0						0	0	30	
1,2,3-Trichloropropane	ND	5.0						0	0	30	
1,2,4-Trichlorobenzene	ND	5.0						0	0	30	
1,2,4-Trimethylbenzene	ND	5.0						0	0	30	
1,2-Dibromo-3-chloropropane	ND	10						0	0	30	
1,2-Dibromoethane	ND	5.0						0	0	30	
1,2-Dichlorobenzene	ND	5.0						0	0	30	
1,2-Dichloroethane	ND	5.0						0	0	30	
1,2-Dichloropropane	ND	5.0						0	0	30	
1,3,5-Trimethylbenzene	ND	5.0						0	0	30	
1,3-Dichlorobenzene	ND	5.0						0	0	30	
1,3-Dichloropropane	ND	5.0						0	0	30	
1,4-Dichlorobenzene	ND	5.0						0	0	30	
2,2-Dichloropropane	ND	5.0						0	0	30	
2-Chlorotoluene	ND	5.0						0	0	30	
4-Chlorotoluene	ND	5.0						0	0	30	
4-Isopropyltoluene	ND	5.0						0	0	30	
Benzene	ND	5.0						0	0	30	
Bromobenzene	ND	5.0						0	0	30	
Bromodichloromethane	ND	5.0						0	0	30	
Bromoform	ND	5.0						0	0	30	
Bromomethane	ND	5.0						0	0	30	
Carbon tetrachloride	ND	5.0						0	0	30	
Chlorobenzene	ND	5.0						0	0	30	
Chloroethane	ND	5.0						0	0	30	
Chloroform	ND	5.0						0	0	30	
Chloromethane	ND	5.0						0	0	30	
cis-1,2-Dichloroethene	ND	5.0						0	0	30	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: 089465-008ADUP SampType: DUP TestCode: 8260_S Units: µg/Kg Prep Date: RunNo: 73795
Client ID: ZZZZZZ Batch ID: R07VS028 TestNo: EPA 8260B Analysis Date: 2/1/2007 SeqNo: 1107481

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dibromochloromethane	ND	5.0						0	0	30	
Dibromomethane	ND	5.0						0	0	30	
Dichlorodifluoromethane	ND	5.0						0	0	30	
Ethyl Tert-butyl ether	ND	5.0						0	0	30	
Ethylbenzene	ND	5.0						0	0	30	
Hexachlorobutadiene	ND	5.0						0	0	30	
Isopropylbenzene	ND	5.0						0	0	30	
m,p-Xylene	ND	10						0	0	30	
Methylene chloride	ND	5.0						0	0	30	
MTBE	ND	5.0						0	0	30	
n-Butylbenzene	ND	5.0						0	0	30	
n-Propylbenzene	ND	5.0						0	0	30	
Naphthalene	ND	5.0						0	0	30	
o-Xylene	ND	5.0						0	0	30	
sec-Butylbenzene	ND	5.0						0	0	30	
Styrene	ND	5.0						0	0	30	
tert-Butylbenzene	ND	5.0						0	0	30	
Tetrachloroethene	ND	5.0						0	0	30	
Toluene	ND	5.0						0	0	30	
trans-1,2-Dichloroethene	ND	5.0						0	0	30	
Trichloroethene	ND	5.0						0	0	30	
Trichlorofluoromethane	ND	5.0						0	0	30	
Vinyl chloride	ND	5.0						0	0	30	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: R020107LCS2 | SampType: LCS | TestCode: 8260_S | Units: µg/Kg | Prep Date: | RunNo: 73861
Client ID: LCSS | Batch ID: R07VS029 | TestNo: EPA 8260B | Analysis Date: 2/1/2007 | SeqNo: 1107890

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1-Dichloroethene	96.910	5.0	100.0	0	96.9	79	127				
Benzene	100.320	5.0	100.0	0	100	85	122				
Chlorobenzene	95.340	5.0	100.0	0	95.3	81	129				
MTBE	85.810	5.0	100.0	0	85.8	67	134				
Toluene	92.700	5.0	100.0	0	92.7	83	122				
Trichloroethene	99.000	5.0	100.0	0	99.0	84	128				

Sample ID: 089424-007AMS | SampType: MS | TestCode: 8260_S | Units: µg/Kg | Prep Date: | RunNo: 73861
Client ID: DPB-4-5 | Batch ID: R07VS029 | TestNo: EPA 8260B | Analysis Date: 2/1/2007 | SeqNo: 1107891

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1-Dichloroethene	96.840	5.0	100.0	0	96.8	54	146				
Benzene	99.550	5.0	100.0	0	99.6	57	144				
Chlorobenzene	94.320	5.0	100.0	0	94.3	51	153				
MTBE	78.300	5.0	100.0	0	78.3	47	147				
Toluene	95.640	5.0	100.0	0	95.6	54	144				
Trichloroethene	106.080	5.0	100.0	0	106	55	151				

Sample ID: R020107MB2 | SampType: MBLK | TestCode: 8260_S | Units: µg/Kg | Prep Date: | RunNo: 73861
Client ID: PBS | Batch ID: R07VS029 | TestNo: EPA 8260B | Analysis Date: 2/2/2007 | SeqNo: 1107893

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1,1,2-Tetrachloroethane	ND	5.0									
1,1,1-Trichloroethane	ND	5.0									
1,1,2,2-Tetrachloroethane	ND	5.0									
1,1,2-Trichloroethane	ND	5.0									
1,1-Dichloroethane	ND	5.0									
1,1-Dichloroethene	ND	5.0									
1,1-Dichloropropene	ND	5.0									
1,2,3-Trichlorobenzene	ND	5.0									

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: R020107MB2 | SampType: MBLK | TestCode: 8260_S | Units: µg/Kg | Prep Date: | RunNo: 73861
Client ID: PBS | Batch ID: R07VS029 | TestNo: EPA 8260B | Analysis Date: 2/2/2007 | SeqNo: 1107893

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,2,3-Trichloropropane	ND	5.0									
1,2,4-Trichlorobenzene	ND	5.0									
1,2,4-Trimethylbenzene	ND	5.0									
1,2-Dibromo-3-chloropropane	ND	10									
1,2-Dibromoethane	ND	5.0									
1,2-Dichlorobenzene	ND	5.0									
1,2-Dichloroethane	ND	5.0									
1,2-Dichloropropane	ND	5.0									
1,3,5-Trimethylbenzene	ND	5.0									
1,3-Dichlorobenzene	ND	5.0									
1,3-Dichloropropane	ND	5.0									
1,4-Dichlorobenzene	ND	5.0									
2,2-Dichloropropane	ND	5.0									
2-Chlorotoluene	ND	5.0									
4-Chlorotoluene	ND	5.0									
4-Isopropyltoluene	ND	5.0									
Benzene	ND	5.0									
Bromobenzene	ND	5.0									
Bromodichloromethane	ND	5.0									
Bromoform	ND	5.0									
Bromomethane	ND	5.0									
Carbon tetrachloride	ND	5.0									
Chlorobenzene	ND	5.0									
Chloroethane	ND	5.0									
Chloroform	ND	5.0									
Chloromethane	ND	5.0									
cis-1,2-Dichloroethene	ND	5.0									
Dibromochloromethane	ND	5.0									
Dibromomethane	ND	5.0									
Dichlorodifluoromethane	ND	5.0									

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: R020107MB2 | SampType: MBLK | TestCode: 8260_S | Units: µg/Kg | Prep Date: | RunNo: 73861
Client ID: PBS | Batch ID: R07VS029 | TestNo: EPA 8260B | Analysis Date: 2/2/2007 | SeqNo: 1107893

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Ethyl Tert-butyl ether	ND	5.0									
Ethylbenzene	ND	5.0									
Hexachlorobutadiene	ND	5.0									
Isopropylbenzene	ND	5.0									
m,p-Xylene	ND	10									
Methylene chloride	ND	5.0									
MTBE	ND	5.0									
n-Butylbenzene	ND	5.0									
n-Propylbenzene	ND	5.0									
Naphthalene	ND	5.0									
o-Xylene	ND	5.0									
sec-Butylbenzene	ND	5.0									
Styrene	ND	5.0									
tert-Butylbenzene	ND	5.0									
Tetrachloroethene	ND	5.0									
Toluene	ND	5.0									
trans-1,2-Dichloroethene	ND	5.0									
Trichloroethene	ND	5.0									
Trichlorofluoromethane	ND	5.0									
Vinyl chloride	ND	5.0									

Sample ID: 089424-007ADUP | SampType: DUP | TestCode: 8260_S | Units: µg/Kg | Prep Date: | RunNo: 73861
Client ID: DPB-4-5 | Batch ID: R07VS029 | TestNo: EPA 8260B | Analysis Date: 2/2/2007 | SeqNo: 1107896

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1,1,2-Tetrachloroethane	ND	5.0						0	0	30	
1,1,1-Trichloroethane	ND	5.0						0	0	30	
1,1,2,2-Tetrachloroethane	ND	5.0						0	0	30	
1,1,2-Trichloroethane	ND	5.0						0	0	30	
1,1-Dichloroethane	ND	5.0						0	0	30	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: 089424-007ADUP SampType: DUP TestCode: 8260_S Units: µg/Kg Prep Date: RunNo: 73861
Client ID: DPB-4-5 Batch ID: R07VS029 TestNo: EPA 8260B Analysis Date: 2/2/2007 SeqNo: 1107896

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1-Dichloroethene	ND	5.0						0	0	30	
1,1-Dichloropropene	ND	5.0						0	0	30	
1,2,3-Trichlorobenzene	ND	5.0						0	0	30	
1,2,3-Trichloropropane	ND	5.0						0	0	30	
1,2,4-Trichlorobenzene	ND	5.0						0	0	30	
1,2,4-Trimethylbenzene	ND	5.0						0	0	30	
1,2-Dibromo-3-chloropropane	ND	10						0	0	30	
1,2-Dibromoethane	ND	5.0						0	0	30	
1,2-Dichlorobenzene	ND	5.0						0	0	30	
1,2-Dichloroethane	ND	5.0						0	0	30	
1,2-Dichloropropane	ND	5.0						0	0	30	
1,3,5-Trimethylbenzene	ND	5.0						0	0	30	
1,3-Dichlorobenzene	ND	5.0						0	0	30	
1,3-Dichloropropane	ND	5.0						0	0	30	
1,4-Dichlorobenzene	ND	5.0						0	0	30	
2,2-Dichloropropane	ND	5.0						0	0	30	
2-Chlorotoluene	ND	5.0						0	0	30	
4-Chlorotoluene	ND	5.0						0	0	30	
4-Isopropyltoluene	ND	5.0						0	0	30	
Benzene	ND	5.0						0	0	30	
Bromobenzene	ND	5.0						0	0	30	
Bromodichloromethane	ND	5.0						0	0	30	
Bromoform	ND	5.0						0	0	30	
Bromomethane	ND	5.0						0	0	30	
Carbon tetrachloride	ND	5.0						0	0	30	
Chlorobenzene	ND	5.0						0	0	30	
Chloroethane	ND	5.0						0	0	30	
Chloroform	ND	5.0						0	0	30	
Chloromethane	ND	5.0						0	0	30	
cis-1,2-Dichloroethene	ND	5.0						0	0	30	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

INFORMATION HANDOUT

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: 089424-007ADUP SampType: DUP TestCode: 8260_S Units: µg/Kg Prep Date: RunNo: 73861
Client ID: DPB-4-5 Batch ID: R07VS029 TestNo: EPA 8260B Analysis Date: 2/2/2007 SeqNo: 1107896

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dibromochloromethane	ND	5.0						0	0	30	
Dibromomethane	ND	5.0						0	0	30	
Dichlorodifluoromethane	ND	5.0						0	0	30	
Ethyl Tert-butyl ether	ND	5.0						0	0	30	
Ethylbenzene	ND	5.0						0	0	30	
Hexachlorobutadiene	ND	5.0						0	0	30	
Isopropylbenzene	ND	5.0						0	0	30	
m,p-Xylene	ND	10						0	0	30	
Methylene chloride	ND	5.0						0	0	30	
MTBE	ND	5.0						0	0	30	
n-Butylbenzene	ND	5.0						0	0	30	
n-Propylbenzene	ND	5.0						0	0	30	
Naphthalene	ND	5.0						0	0	30	
o-Xylene	ND	5.0						0	0	30	
sec-Butylbenzene	ND	5.0						0	0	30	
Styrene	ND	5.0						0	0	30	
tert-Butylbenzene	ND	5.0						0	0	30	
Tetrachloroethene	ND	5.0						0	0	30	
Toluene	ND	5.0						0	0	30	
trans-1,2-Dichloroethene	ND	5.0						0	0	30	
Trichloroethene	ND	5.0						0	0	30	
Trichlorofluoromethane	ND	5.0						0	0	30	
Vinyl chloride	ND	5.0						0	0	30	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: R020207MB | SampType: MBLK | TestCode: 8260_S | Units: µg/Kg | Prep Date: | RunNo: 73865
Client ID: PBS | Batch ID: R07VS030 | TestNo: EPA 8260B | Analysis Date: 2/2/2007 | SeqNo: 1107967

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1,1,2-Tetrachloroethane	ND	5.0									
1,1,1-Trichloroethane	ND	5.0									
1,1,2,2-Tetrachloroethane	ND	5.0									
1,1,2-Trichloroethane	ND	5.0									
1,1-Dichloroethane	ND	5.0									
1,1-Dichloroethene	ND	5.0									
1,1-Dichloropropene	ND	5.0									
1,2,3-Trichlorobenzene	ND	5.0									
1,2,3-Trichloropropane	ND	5.0									
1,2,4-Trichlorobenzene	ND	5.0									
1,2,4-Trimethylbenzene	ND	5.0									
1,2-Dibromo-3-chloropropane	ND	10									
1,2-Dibromoethane	ND	5.0									
1,2-Dichlorobenzene	ND	5.0									
1,2-Dichloroethane	ND	5.0									
1,2-Dichloropropane	ND	5.0									
1,3,5-Trimethylbenzene	ND	5.0									
1,3-Dichlorobenzene	ND	5.0									
1,3-Dichloropropane	ND	5.0									
1,4-Dichlorobenzene	ND	5.0									
2,2-Dichloropropane	ND	5.0									
2-Chlorotoluene	ND	5.0									
4-Chlorotoluene	ND	5.0									
4-Isopropyltoluene	ND	5.0									
Benzene	ND	5.0									
Bromobenzene	ND	5.0									
Bromodichloromethane	ND	5.0									
Bromoform	ND	5.0									
Bromomethane	ND	5.0									
Carbon tetrachloride	ND	5.0									

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: R020207MB | SampType: MBLK | TestCode: 8260_S | Units: µg/Kg | Prep Date: | RunNo: 73865
Client ID: PBS | Batch ID: R07VS030 | TestNo: EPA 8260B | Analysis Date: 2/2/2007 | SeqNo: 1107967

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chlorobenzene	ND	5.0									
Chloroethane	ND	5.0									
Chloroform	ND	5.0									
Chloromethane	ND	5.0									
cis-1,2-Dichloroethene	ND	5.0									
Dibromochloromethane	ND	5.0									
Dibromomethane	ND	5.0									
Dichlorodifluoromethane	ND	5.0									
Ethyl Tert-butyl ether	ND	5.0									
Ethylbenzene	ND	5.0									
Hexachlorobutadiene	ND	5.0									
Isopropylbenzene	ND	5.0									
m,p-Xylene	ND	10									
Methylene chloride	ND	5.0									
MTBE	ND	5.0									
n-Butylbenzene	ND	5.0									
n-Propylbenzene	ND	5.0									
Naphthalene	ND	5.0									
o-Xylene	ND	5.0									
sec-Butylbenzene	ND	5.0									
Styrene	ND	5.0									
tert-Butylbenzene	ND	5.0									
Tetrachloroethene	ND	5.0									
Toluene	ND	5.0									
trans-1,2-Dichloroethene	ND	5.0									
Trichloroethene	ND	5.0									
Trichlorofluoromethane	ND	5.0									
Vinyl chloride	ND	5.0									

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

INFORMATION HANDOUT

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: 089424-004ADUP SampType: DUP TestCode: 8260_S Units: µg/Kg Prep Date: RunNo: 73865
Client ID: DPB-2-10 Batch ID: R07VS030 TestNo: EPA 8260B Analysis Date: 2/2/2007 SeqNo: 1107969

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1,1,2-Tetrachloroethane	ND	5.0						0	0	30	
1,1,1-Trichloroethane	ND	5.0						0	0	30	
1,1,2,2-Tetrachloroethane	ND	5.0						0	0	30	
1,1,2-Trichloroethane	ND	5.0						0	0	30	
1,1-Dichloroethane	ND	5.0						0	0	30	
1,1-Dichloroethene	ND	5.0						0	0	30	
1,1-Dichloropropene	ND	5.0						0	0	30	
1,2,3-Trichlorobenzene	ND	5.0						0	0	30	
1,2,3-Trichloropropane	ND	5.0						0	0	30	
1,2,4-Trichlorobenzene	ND	5.0						0	0	30	
1,2,4-Trimethylbenzene	ND	5.0						0	0	30	
1,2-Dibromo-3-chloropropane	ND	10						0	0	30	
1,2-Dibromoethane	ND	5.0						0	0	30	
1,2-Dichlorobenzene	ND	5.0						0	0	30	
1,2-Dichloroethane	ND	5.0						0	0	30	
1,2-Dichloropropane	ND	5.0						0	0	30	
1,3,5-Trimethylbenzene	ND	5.0						0	0	30	
1,3-Dichlorobenzene	ND	5.0						0	0	30	
1,3-Dichloropropane	ND	5.0						0	0	30	
1,4-Dichlorobenzene	ND	5.0						0	0	30	
2,2-Dichloropropane	ND	5.0						0	0	30	
2-Chlorotoluene	ND	5.0						0	0	30	
4-Chlorotoluene	ND	5.0						0	0	30	
4-Isopropyltoluene	ND	5.0						0	0	30	
Benzene	ND	5.0						0	0	30	
Bromobenzene	ND	5.0						0	0	30	
Bromodichloromethane	ND	5.0						0	0	30	
Bromoform	ND	5.0						0	0	30	
Bromomethane	ND	5.0						0	0	30	
Carbon tetrachloride	ND	5.0						0	0	30	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: 089424-004ADUP SampType: DUP TestCode: 8260_S Units: µg/Kg Prep Date: RunNo: 73865
Client ID: DPB-2-10 Batch ID: R07VS030 TestNo: EPA 8260B Analysis Date: 2/2/2007 SeqNo: 1107969

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chlorobenzene	ND	5.0						0	0	30	
Chloroethane	ND	5.0						0	0	30	
Chloroform	ND	5.0						0	0	30	
Chloromethane	ND	5.0						0	0	30	
cis-1,2-Dichloroethene	ND	5.0						0	0	30	
Dibromochloromethane	ND	5.0						0	0	30	
Dibromomethane	ND	5.0						0	0	30	
Dichlorodifluoromethane	ND	5.0						0	0	30	
Ethyl Tert-butyl ether	ND	5.0						0	0	30	
Ethylbenzene	ND	5.0						0	0	30	
Hexachlorobutadiene	ND	5.0						0	0	30	
Isopropylbenzene	ND	5.0						0	0	30	
m,p-Xylene	ND	10						0	0	30	
Methylene chloride	ND	5.0						0	0	30	
MTBE	ND	5.0						0	0	30	
n-Butylbenzene	ND	5.0						0	0	30	
n-Propylbenzene	ND	5.0						0	0	30	
Naphthalene	ND	5.0						0	0	30	
o-Xylene	ND	5.0						0	0	30	
sec-Butylbenzene	ND	5.0						0	0	30	
Styrene	ND	5.0						0	0	30	
tert-Butylbenzene	ND	5.0						0	0	30	
Tetrachloroethene	ND	5.0						0	0	30	
Toluene	ND	5.0						0	0	30	
trans-1,2-Dichloroethene	ND	5.0						0	0	30	
Trichloroethene	ND	5.0						0	0	30	
Trichlorofluoromethane	ND	5.0						0	0	30	
Vinyl chloride	ND	5.0						0	0	30	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

INFORMATION HANDOUT

CLIENT: Geocon Consultants, Inc.
Work Order: 089424
Project: SR4 WIDENING, E8328-06-01

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: 089424-004AMS SampType: MS TestCode: 8260_S Units: µg/Kg Prep Date: RunNo: 73865
Client ID: DPB-2-10 Batch ID: R07VS030 TestNo: EPA 8260B Analysis Date: 2/2/2007 SeqNo: 1107970

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1-Dichloroethene	91.720	5.0	100.0	0	91.7	54	146				
Benzene	91.070	5.0	100.0	0	91.1	57	144				
Chlorobenzene	87.800	5.0	100.0	0	87.8	51	153				
MTBE	72.180	5.0	100.0	0	72.2	47	147				
Toluene	85.790	5.0	100.0	0	85.8	54	144				
Trichloroethene	88.870	5.0	100.0	0	88.9	55	151				

Sample ID: R020207LCS1 SampType: LCS TestCode: 8260_S Units: µg/Kg Prep Date: RunNo: 73865
Client ID: LCSS Batch ID: R07VS030 TestNo: EPA 8260B Analysis Date: 2/2/2007 SeqNo: 1107973

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1-Dichloroethene	93.140	5.0	100.0	0	93.1	79	127				
Benzene	97.770	5.0	100.0	0	97.8	85	122				
Chlorobenzene	92.190	5.0	100.0	0	92.2	81	129				
MTBE	80.350	5.0	100.0	0	80.4	67	134				
Toluene	91.730	5.0	100.0	0	91.7	83	122				
Trichloroethene	96.610	5.0	100.0	0	96.6	84	128				

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
(562) 989-4045 • Fax (562) 989-4040

FOR LABORATORY USE ONLY:

P.O.#:

Logged By: MP Date: 1/31/07

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FEDEX ☐ Other: GSO

Sample Condition Upon Receipt: 1. CHILLED 5-6 Y☐ N☐ 2. HEADSPACE (VOA) Y☐ N☐ 3. CONTAINER INTACT Y☐ N☐ 4. SEALED Y☐ N☐ 5. # OF SPLS MATCH COC Y☐ N☐ 6. PRESERVED Y☐ N☐

Client: GEOCON
Attn: RICK DAY
Address: 2356 RESEARCH DR
City: LIVERMORE State: CA Zip Code: 94550
TEL: (925) 371-5900
FAX: (925) 371-5915

Project Name: SR4 WIDENING
Project #: E8328-06-01
Sampler: (Printed Name) C GIUNTOLI (Signature)

Relinquished by: (Signature and Printed Name) Date: 1/30/07 Time: 1730
Received by: (Signature and Printed Name) MARP Date: 1/31/07 Time: 8:50
Relinquished by: (Signature and Printed Name) Date: Time:
Received by: (Signature and Printed Name) Date: Time:
Relinquished by: (Signature and Printed Name) Date: Time:
Received by: (Signature and Printed Name) Date: Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: C GIUNTOLI 1/30/07
Print Name Date
Signature

Send Report To: Attn: SEE ABOVE Co: Address: City State Zip

Bill To: Attn: SAME Co: Address: City State Zip

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested: 8081A (Pesticides), 8082 (PCB), 8260B (Volatiles) + 1,4-DIOXANE, 8270C (BNA), 6010B (Total Metal), 8015B (GRO), 8020 (BTEX), 8015B (DRO) + 1,4-D, 8021 (BTEX), TITLE 22 / CAM 17 (6010/7000)

SPECIFY APPROPRIATE MATRIX: SOIL, WATER, GROUND WATER, WASTEWATER

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	8081A	8082	8260B	8270C	6010B	8015B (GRO)	8015B (DRO)	8020	8021	TITLE 22	SOIL	WATER	GROUND WATER	WASTEWATER	TAT	Container(s) #	Type	PRESERVATION	REMARKS
	0894134-001	DPB-1-5	1/30/07	945		X			X	X		X			X				E	1	T	C	
	2	DPB-1-10		950																			
	3	DPB-2-5		920																			
	4	DPB-2-10		925																			
	5	DPB-3-5		930																			
	6	DPB-3-10		935																			
	7	DPB-4-5		1000																			
	8	DPB-4-10		1005																			
	9	DPB-4-15		1010																			

QA/QC: RTNE ☐ CT ☒ SWRCB ☐ Logcode ___ OTHER ___

• TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: A= Overnight ≤ 24 hr B= Emergency Next workday C= Critical 2 Workdays D= Urgent 3 Workdays E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: White with report; Yellow to folder, Pink to submitter.

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
(562) 989-4045 • Fax (562) 989-4040

FOR LABORATORY USE ONLY:

P.O.#:

Logged By: MP Date: 1/31/07

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FEDEX ☐ Other: GSO

Sample Condition Upon Receipt:
1. CHILLED Y☐ N☐ 4. SEALED Y☐ N☐
2. HEADSPACE (VOA) Y☐ N☐ 5. # OF SPLS MATCH COC Y☐ N☐
3. CONTAINER INTACT Y☐ N☐ 6. PRESERVED Y☐ N☐

Client: GEOCON
Attn: RICK DAY
Address: 2356 RESEARCH DR.
City: LIVERMORE State: CA Zip Code: 94550
TEL: (925) 371-5900
FAX: (925) 371-5915

Project Name: SR4 WIDENING
Project #: E8328-06-01
Sampler: (Printed Name) C GIUNTOLI (Signature)

Relinquished by: (Signature and Printed Name) Date: 1/30/07 Time: 1230
Received by: (Signature and Printed Name) Date: 1/31/07 Time: 8:50
Relinquished by: (Signature and Printed Name) Date: Time:
Received by: (Signature and Printed Name) Date: Time:
Relinquished by: (Signature and Printed Name) Date: Time:
Received by: (Signature and Printed Name) Date: Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: CHRIS GIUNTOLI 1/30/07
Print Name Date
Signature

Send Report To:
Attn: SEE ABOVE
Co:
Address
City State Zip

Bill To:
Attn: SAME
Co:
Address
City State Zip

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX

Q A / Q C: RTNE ☐ CT ☒ SWRCB ☐ Logcode ____ OTHER ____

ITEM	LAB USE ONLY: Batch #: Lab No.	Sample Description: Sample I.D. / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal)	8015B (GRO)	8015B (DRO)	8021 (BTEX)	TITLE 22 / CAM 17 (6010 / 7000)	SOIL	WATER	GROUND WATER	WASTEWATER	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	089404-10	DPB-5-5	1/30/07	1025			X		X	X		X		X				E	1	TP	C	
	11	DPB-5-10		1030																		
	12	DPB-5-15		1035																		
	13	DPB-6-5		1100																		
	14	DPB-6-10		1105																		
	15	DPB-6-15		1110																		

• TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: A= Overnight ≤ 24 hr B= Emergency Next workday C= Critical 2 Workdays D= Urgent 3 Workdays E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=Hcl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: White with report, Yellow to folder, Pink to submitter.

04-2285E4

INFORMATION HANDOUT

Kenneth Forward
Project Manager

(Office) 925-674-6477
(Fax) 925-674-4546
KTF3@PGE.COM

May 13, 2011

Caltrans
Attn: Bijan Sartipi
District Director 4
111 Grand Avenue 94612
P.O. Box 23440
Oakland, CA 94623-0440

Re: EA 04-2285E1; G Street Overcrossing (Replace) Bridge No 28-0400 (Caltrans Reference) PM # 30690454; SR4 - 999 G St (Bridge Project), Antioch (PG&E Reference)

Dear Mr. Sartipi:

This letter is in response to the e-mail request by Anthony Gugino of Caltrans dated April 13th, 2011. Per that request PG&E is providing written confirmation and approval of the Caltrans construction guidelines for the G St Bridge Project. The G St Bridge project is part of Segment 2 of the Hwy-4 Widening Project. Below are the responses to the three PG&E bullet items from the April 13th e-mail that required a PG&E response.

Email Response:

- PG&E has reviewed the G St Bridge infrastructure specifications provided by Caltrans. This includes casing pipe specifications, installation details, concrete pipe supports etc. PG&E confirms that all PG&E requirements and standards for the installation of the G St Bridge infrastructure have been met. PG&E approves the G St Bridge infrastructure specifications provided by Caltrans.
- PG&E will coordinate with the Caltrans contractor and inspect the installation of the gas pipe casing and gas pipe bridge supports installed in the G St Bridge. Once the gas pipe infrastructure have been approved by the PG&E inspector. PG&E will schedule the installation of the gas pipe, casing vents, and clearance to pressurize the new gas main.
- PG&E will coordinate with the Caltrans contractor and inspect and approve the pressure testing of the gas casing.

PG&E will install their gas pipe facilities through the new G St Bridge per their current standards. PG&E will coordinate with the Caltrans contractor concerning the construction staging and schedule necessary to install the new gas pipe facilities. PG&E will abandon existing gas main in place and remove existing gas pipe in the existing G St Bridge structure. PG&E to perform all necessary backfill and project restoration associate with the installation and tie-in of new distribution gas pipe.

PG&E will contact and coordinated with all impacted utilities and agencies as necessary.

General & Emergency Contacts:

PG&E Project Manager: Kenneth Forward (925-674-6477) (510-385-6254) cell
Gas Supervisor: Jim Pope (925-779-7794)
Gas Foreman: Gary Rieb (925-445-7795) cell
Immediate Emergency Response: 1-800-PGE (743)-5000

If there are any questions or concerns about the information provided in this letter please feel free to contact the PG&E project manager Kenneth Forward.

Sincerely,

Pacific Gas & Electric Company
Kenneth Forward
Project Manager

cc: Overcomer Y. Hor
Senior Liaison Engineer / District 4
Caltrans
Division of Engineering Services Office Special Funded Projects
MS 9-2/7G
1801 30th Street
Sacramento, CA 95816

Laurie Lau
Regional Project Manager, Contra Costa County Project Management East
Caltrans
111 Grand Avenue 94612
P.O. Box 23440
Oakland, CA 94623-0440

Andrew Baskerville
Caltrans
2625 Crow Ct.,
Antioch, CA, 94509

Natalina Bernardi
BKF Engineers
4670 Willow Road, Suite 250
Pleasanton, CA 94588

Pacific Gas and Electric Company™

UTILITY OPERATIONS (UO)

UO Standard S4450

ISSUING DEPARTMENT:	**GD&TS**	EFFECTIVE DATE:	**4-01**
UO SPONSOR:	**VP – E&P**	REVIEW DATE:	**4-04**
	VP – CGT	PAGE NO.:	**1 OF 2**

TITLE: Operator Qualification Program

Purpose

This standard establishes the Company's written operator qualification program in accordance with 49 CFR §192.805, which requires that gas personnel performing covered tasks are qualified. The qualification of personnel performing covered tasks must be completed by October 28, 2002.

This standard supports UO Policy 3-7, "Gas & Electric Maintenance and Operations."

Safety

The procedures and requirements of this standard are intended to preserve public and employee safety by ensuring a qualified work force and reducing the probability and consequence of incidents caused by human error.

Implementation Responsibilities

The vice president of Engineering and Planning (E&P) and the vice president of California Gas Transmission (CGT) are responsible for approving, revising and distributing this standard.

Utility Operations (UO) directors, managers and supervisors are responsible for implementing this standard within their respective organizations.

The responsibility for evaluating an employee's ability to perform covered tasks on pipeline facilities and to recognize and react to abnormal operating conditions on those facilities shall rest with the operating department supervisor with the assistance, as needed, from Human Resources Learning Services or others.

Employees are responsible for carrying out their assigned tasks. For their own safety and that of the general public, employees are responsible for performing only the tasks for which they are trained, knowledgeable and qualified. When necessary, they shall notify their supervisor of any additional training, equipment or resources needed to perform their assigned tasks.

Revision

The director of Gas Distribution and Technical Services (GD&TS) or the director of Gas System Maintenance & Technical Support (GSM&TS) may revise and issue updates to Attachments 1 and 2 and the *Operator Qualification Manual*.

Compliance

Internal Company departments may conduct periodic audits. The California Public Utilities Commission also conducts compliance reviews on the requirements in this standard.

Definition of Terms

Abnormal Operating Condition: A condition that may indicate a malfunction of a component or deviation from normal operations that may: 1) indicate a condition exceeding design limits; or 2) result in a hazard to people, property or the environment.

Covered Task: An activity, determined by the Company, that: 1) is performed on a pipeline facility; 2) is an operations or maintenance task; 3) is performed as a requirement of 49 CFR Part 192; and 4) affects the operation or integrity of the pipeline.

"Directed and Observed": In the context of performing work while being directed and observed by a qualified individual, "directed and observed" means the qualified individual is in the immediate area and provides direct oversight as the covered task is being performed.

Pipeline: All parts of those physical facilities, owned and operated by the Company, through which gas moves in transportation, including distribution, transmission and gathering lines.

Date Issued/Updated

Effective: 4-01
Review Date: 4-04

Signed,

Shan Bhattacharya
Vice President
Engineering & Planning

Signed,

Michael A. Katz
Vice President
California Gas Transmission

Reference Documents

49 CFR 192 Subpart N

UO/GTS Standard D-S0355, "CPUC and DOT Reportable Incidents, Curtailments and Conditions and Low Pressure System Problem Reporting"

Operator Qualification Manual

Attachment 1

Detailed Procedures

I. Identification of Covered Tasks

The Company has compared its tasks with the definition of Covered Tasks and identified those tasks meeting the four-part criteria. The Company's covered tasks are listed in Attachment 2.

II. Qualification

A. All personnel performing covered tasks as of October 28, 2002, will receive their qualification through an appropriate method to ensure they are qualified to perform the covered tasks assigned. Appropriate methods include:

1. written or oral examination,
2. observation during performance on the job, on-the-job training or simulations,
3. other forms of assessment,
4. training history review,
5. work performance history review.

B. For individuals who were performing a covered task prior to August 27, 1999, the Work Performance History Review may be used as the sole evaluation method for qualification of individuals before October 28, 2002.

C. Subsequent requalification must include written, oral or hands-on testing and must be performed at least once each five calendar years.

D. As a part of the training and qualification process, personnel performing covered tasks are instructed on the normal operating criteria for each task and the appropriate actions to take when an abnormal operating condition is identified. The appropriate actions to take may include:

1. making the necessary adjustments to bring the equipment or settings back to normal operating conditions,
2. replacing the component(s),
3. immediately notifying the appropriate personnel of the abnormal operating condition and initiating emergency response procedures,
4. completing the appropriate paperwork to initiate the necessary corrective action.

III. Non-Qualified Personnel

Personnel that are not qualified to perform a covered task may do so if directed and observed by a qualified individual.

IV. Unsatisfactory Performance

A. When an employee has performed a covered task that may have contributed to a Department of Transportation reportable incident, as defined by 49 CFR §191.3, the individual's performance of the task must be re-evaluated as part of the incident review.

B. If at any time there is reason to believe that an individual is no longer qualified to perform a covered task, the employee must not perform the covered task until a re-evaluation has been conducted, except as noted in Paragraph III A. Non-Qualified Personnel.

C. Re-evaluation may be accomplished through methods prescribed in Paragraph II, Qualification.

V. Changes to Policies/Procedures

A. Changes in Company or local operating methods or the use of new equipment are evaluated to determine the impact on covered tasks. At a minimum, the evaluation will determine:

1. if a current covered task is affected,
2. if a new covered task is created,
3. what changes are necessary to the qualification materials, and,
4. the method for communicating the change to the appropriate employees.

B. When a gas-related Utility Operations standard, procedure or guideline or a *Gas Standards and Specifications* document is being revised, the author must evaluate whether there are changes to a covered task. If there are changes, the changes must be communicated. Methods for communicating changes may include, but are not limited to:

1. a review of revisions to field manuals,
2. group or individual training and testing,
3. formal training and testing.

VI. Recordkeeping

A. Qualification records may be hard copy or electronic and must include:

1. identification of the qualified individual,
2. identification of the covered tasks the individual is qualified to perform,
3. date(s) of current qualification, and
4. qualification method(s).

B. For individuals currently performing covered tasks, their current qualification records and previous five years' qualification records must be maintained.

C. Records of prior qualification(s) and records of individuals no longer performing covered tasks must be retained for a period of five years.

VII. Contractors and Mutual Assistance

The Company may accept qualifications obtained under the programs of other operators or contractors when the following conditions have been met:

1. the program complies with all provisions of 49 CFR Subpart N,
2. the standards used for qualification are acceptable to the Company, or
3. documented training is conducted on Company-specific procedures before initiating work activities.

The Company may accept certifications (qualification) of individuals received from nationally recognized agencies, such as, but not limited to:

1. American Society of Non-destructive Testing (ASND)
2. NACE International (formerly National Association of Corrosion Engineers)

Attachment 2

Covered Task List

Task Code	Task	Subtask Code	Subtask	DOT Reference	Gas Standards and Specifications
01-00.00	**Cast Iron Repair**	01-01.00	Bell Joints and Spigot Seals	192.753	GSS B-50
		01-02.00	Protect Cast Iron Pipeline	192.755	GSS A-39/C-37
		01-03.00	Operations and Maintenance	192.489	GSS C-37, B53/ 54.1
02-00.00	**Repair/Replace Distribution Pipeline**	02-01.00	Mechanical Repairs	192.703	GSS B-53/54
		02-02.00	Weld Repairs	192.703	GSS A-60
		02-03.00	Pipe Squeezing Steel	192.703	GSS M23
		02-04.00	Pipe Squeezing - Plastic	192.703	GSS M23/23.1
		02-05.00	Pipe Squeezing - Plastic (1/2” and 1”)	192.703	GSS M23/23.1
		02-06.00	Abandonment or Deactivation Pipeline Facilities	192.727	GSS C-30, A93.2
		02-07.00	Pipeline Replacement	192.703	GSS A-34/ A 93.1
03-00.00	**Corrosion Control**	03-01.00	Distribution Pipe Coatings – Tape/Paint	192.461	GSS E-10
		03-02.00	Transmission Pipe Coatings – All	192.461	GSS E-10
		03-03.00	Rectifier Reads	192.461	GSS E-10
		03-04.00	Atmospheric Corrosion / Monitor	192.479 / 481	GSS O-16
		03-05.00	Pipe Inspection	192.459	GSS O-16
		03-06.00	Pipe-to-Soil Reads	192.465	GSS O-16
		03-07.00	Cathodic Protection Maintenance	192.473	GSS O-11.1, 13/

Task Code	Task	Subtask Code	Subtask	DOT Reference	Gas Standards and Specifications
					13.1-3, 16
		03-08.00	Galvanic Anode Maintenance	192.473	GSS O-13.1
		03-09.00	Internal Corrosion/Monitor	192.475/ 477	GSS O-16
04-00.00	**Leak Test**	04-01.00	Soap Test/Stand-up Test	192.725	GSS A-34
05-00.00	**Locate Facilities**	05-01.00	Mark and Locate Facilities	192.614 (a) / (5)	UO Std - S0214/S4412 and G-1000
		05-02.00	Standby Pipeline	192.614 (6 C)	UO Std - S0214/ S4412 and G-1000
06-00.00	**Tapping Pipelines Under Pressure**	06-01.00	Operate Service Tee Tapping/Plugging Equipment (3/4" to 2")	192.627	GSS C-10/11 30, 31, 33 - 35 & 36.1,
		06-02.00	Operate Top Tapping/Plugging Equipment (3/4" to 4")	192.627	GSS C-16.3 & 16.5
		06-03.00	Operate Split Control Tapping/ Plugging Equipment (3/4" to 2")	192.627	GSS C-15.2
		06-04.00	Operate Split Control Tapping/ Plugging Equipment (3" to 8")	192.627	GSS C-15.3 & C-32 thru 32.3
		06-05.00	Operate Split Control Tapping/ Plugging Equipment (10" to 12")	192.627	GSS C-15.3
		06-06.00	Perform Hot Tapping/Branch Connection	192.627	GSS A-52
		06-07.00	TDW/Stopple 6" and Greater	192.627	GSS C-60
		06-08.00	Low Pressure/Semi-High Bagging Operations	192.627	GSS C-37
		06-09.00	Low Pressure Drilling/Threading Operations	192.627	GSS C-37
		06-10.00	Operate Riser Valve Changer	192.627	C-54.3

Task Code	Task	Subtask Code	Subtask	DOT Reference	Gas Standards and Specifications
			Equipment		
		06-11.00	Low Pressure Foaming Operations	192.627	GGS A-38.2, A-39 and A-36.2
07-00.00	**Purging of Pipelines**	07-01.00	Air Purging	192.629 (a)	GSS A-38
		07-02.00	Gas Purging	192.629 (b)	GSS A-38
		07-03.00	Inert Purging	192.629 (b)	GSS A-38
		07-04.00	Air Mover Operations	192.629 (b)	GSS A-38
08-00.00	**Patrolling**	08-01.00	Inspect and Maintain Transmission Line	192.613	UO Std. S0352
		08-02.00	Inspect and Maintain Distribution Line	192.705	UO Std. S0352
		08-03.00	Maintain Line Markers	192.707	UO Std. S0352/ 4122
09-00.00	**Leak Survey/ Investigation**	09-01.00	Conduct Surveys	192.706, 723	UO/GTS Std. S0350/S4411
		09-02.00	Leak Investigation	192.706, 723	GSS M–53/ 53.1
10-00.00	**Transmission Line Repairs**	10-01.00	Repair Procedures	192.713	GSS A-65
		10-02.00	Testing Welds	192.719 (b)	GSS A-65
		10-03.00	In-Service Welding	192.715 (b)	GSS A-65

Task Code	Task	Subtask Code	Subtask	DOT Reference	Gas Standards and Specifications
11-00.00	**Inspect and Test Remote Control Shutdown Devices**	11-01.00	Inspect/Test/Compressor Remote Shutdown Devices	192.731 (c)	CGT S-4431/S4432
		11-02.00	Test Remote Control Devices	192.731 (c)	CGT S-4431/ S4432
12-00.00	**Starting, Operating and Shutdown Compressor Units**	12-01.00	Start/Operate/Shutdown Turbine - Local	192.605 (b)(7)	CGT S-4431/ S4432
		12-02.00	Start/Operate Turbine Motor Remote	192.605 (b)(7)	CGT S-4431/ S4432
		12-03.00	Start/Operate/Shutdown - Recip/ Local	192.605 (b)(7)	CGT S-4431/ S4432
13-00.00	**Maintaining Gas Detection and Alarms Systems**	13-01.00	Inspect/Test/Maintain Gas Detection/Alarms	192.736 (c)	CGT S-4291
		13-02.00	Remote System Monitoring	192.736 (b), (c)	CGT S-4291
14-00.00	**Inspect and Test Pressure Regulating and Limiting Devices**	14-01.00	Maintain/Operate Regulators (includes valves operating as regulators regardless of service)	192.739	S-S0351 Form 62-6321 Section A1A-A5 CGT S4432 Section B3D
15-00.00	**Monitor Telemetering and/or Pressure Recording Devices**	15-01.00	Monitor System Conditions (SCADA)	192.741	CGT S-4432
		15-02.00	Monitor Distribution Recording	192.741	GSS J-62

Task Code	Task	Subtask Code	Subtask	DOT Reference	Gas Standards and Specifications
			Devices		
16-00.00	**Inspect and Test Relief Devices**	16-01.00	Test/Maintain Relief Devices	192.739/ 743	GSS H-70 CGT S-4432
17-00.00	**Valve Maintenance**	17-01.00	Inspect/Maintain Emergency Valves	192.745/ 747	GSS F-11
		17-02.00	Remote Valve Operations (SCADA)	192.745/ 747	GSS F-11
18-00.00	**Vault Maintenance**	18-01.00	Inspect Vault	192.749	UO Stds. S0446, S0213

Anthony Gugino/HQ/Caltrans/CAGov
04/13/2011 12:13 PM

To Alfonso Gonzalez/D04/Caltrans/CAGov@DOT, Bonnita Chow/D04/Caltrans/CAGov@DOT, Craig Whitten/HQ/Caltrans/CAGov@DOT, John
cc Kevin Keady/HQ/Caltrans/CAGov@DOT
bcc
Subject gas line installation agreement

History: This message has been forwarded.

Attached are some documents that we developed with the major natural gas utility companies. The intent of these documents was to have all the utility companies submit standardized natural gas utility installation drawings that included provisions for seismic displacements. It was not the intent that these be used on our contract drawings.

1. Standard gas line drawings to be used by the gas utility companies to develop site specific utility installation plans.
2. Guidelines for Natural Gas Pipelines on Caltrans Bridges (edits in blue are changes that we will soon adopt at the request of the gas utility companies)
3. Letter of Approval from me to the utility companies

The casing pipe is part of the utility not part of the bridge and there are specific design and testing requirements that the utility companies have for the casing pipe. The obstacles that I see with including the gas line on the contract plans are as follows:

- PG&E would need to review casing pipe specifications, installation details, including concrete supports, and state in writing that it meets their requirements
- PG &E would need to inspect and approve the casing pipe welding and installation and certify in writing that the welding met their requirements
- PG &E would need to conduct or witness the pressure testing and state, in writing, that it meets their requirements
- Structure OE would be reluctant to use non-standard specifications that would need to be resolved. SOE can speak to that issue
- I suppose the Engineer of record has no problem stamping the plans??

Caltrans Box Girder Bridge.TIF Guidelines Caltrans Bridges 5 29 2009 Color.pdf Anthony Gugino 3 15 1996 Letter.doc

STATE OF CALIFORNIA-BUSINESS, TRANSPORTATION AND HOUSING AGENCY PETE WILSON, Governor

DEPARTMENT OF TRANSPORTATION
OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS
P.O. BOX 942874
SACRAMENTO, CA 94274-0001

FAX (916) 227-8357
TDD (916) 654-4014
(916) 227-8866

March 15, 1996

Mr. Chih-Hung Lee
Pacific Gas and Electric Company
P. O. Box 770000
Mail Code H9A
San Francisco, CA 94177

Dear Mr. Lee:

This is to inform you that the "Guidelines for Natural Gas Pipelines on Caltrans Bridges" and the standard installation details provided in the typical drawings, "Natural Gas Pipeline Installation in Box Girder Bridge", developed by the Subcommittee on Natural Gas Pipeline Bridge Crossings, have been approved by Caltrans, Division of Structures.

Attached for your information, is a memo from the Chief, Division of Structures, informing other divisions in Caltrans of our approval.

I have also included the approved copy of the guidelines with revision date 12/1/95 and a copy of the details without a revision date, signed by the committee members in 12/95.

I would like to thank you and the other committee members for their hard work. I look forward to working with the committee to develop additional standard details.

Sincerely,

ANTHONY M. GUGINO, Section Chief
Office of Structure Maintenance
and Investigations

Attachments

cc: Dave Reistetter w/attach.
Richard Gailing, w/attach.

State of California Business, Transportation and Housing Agency

Memorandum

To: JIM BORDEN
Program Manager
Traffic Operation

DENNY SHIELDS
Program Manager
Right of Way & Asset Management

Date: March 5, 1996
File:

From: DEPARTMENT OF TRANSPORTATION
ENGINEERING SERVICE CENTER
DIVISION OF STRUCTURES

Subject: Utility Agreement

Attached are two documents entitled "Guidelines For Natural Gas Pipelines On Caltrans Bridges" and "Standard Installation Details for Natural Gas Pipeline in Box Girder Bridges". Natural gas utility installations on Caltrans bridges must meet the requirements in the guidelines. Plans submitted by utility companies for installation of natural gas lines in box girder bridges must conform to the standard installation details to the maximum extent possible.

These guidelines and plans were jointly developed by the Subcommittee on Natural Gas Pipeline Bridge Crossings. The participants in this committee include representatives from Caltrans, Division of Structures, Pacific Gas and Electric, Southern California Gas and San Diego Gas and Electric.

To conform with the requirements in the guidelines, a modification to Section 13.03.05.02 of the Right of Way Manual is required. Item B.3 under this section (attached) should be deleted. This item restricts the size of gas carrier lines in bridges. It does not appear that changes are required in the Encroachment Manual.

Requests for copies of these guidelines and plans, or any questions regarding these documents should be directed to the Division of Structures Utility Committee Chairman. Currently the chairman is Anthony Gugino. He may be reached at Calnet 8-498-8866 or public number (916) 227-8866.

ORIGINAL SIGNED BY

JOHN ALLISON, Chief
Division of Structures

Attachments
cc: Structures Utility Committee Members
bcc: JAllison, AGugino/AG/jh

GUIDELINES FOR NATURAL GAS PIPELINES ON CALTRANS BRIDGES

Prepared by the Subcommittee on Natural Gas Pipeline Bridge Crossings

The following guidelines were originally proposed by Caltrans Division of Structures (Caltrans DOS) and subsequently reviewed, revised, and adopted by the gas utilities. These guidelines have been developed to improve the seismic safety of gas pipelines on bridges. They apply to new and existing bridges; however, for gas pipeline installations on existing structures, a special review may be required based on the design.

1. Pipeline Installation Plans:

The following items shall be shown on utility installation plans, when applicable:

A. Carrier pipe size and material
B. Casing pipe size and material
C. Supports
D. Details at abutments, bents, hinges, and diaphragms
E. Casing vents
F. Corrosion protection
G. Operating pressure
H. Shutoff valves and their locations (if located within Caltrans right-of-way). Otherwise, a note should indicate the location of the nearest shutoff valve in either direction from the bridge.

2. Location on Bridges:

Gas pipelines shall be located within cells in box girder bridges or between girders on other type bridges. Medium density polyethylene (MDPE) carrier pipe installed in a steel casing between girders on other types of bridges must not be over traffic. MDPE carrier pipe installed in a steel casing is allowed on curved bridges provided the clearance requirements of paragraph 5.4.2 are met. Gas utilities typically cannot be accommodated on existing slab bridges. Exception to pipeline installations on new slab bridges may be approved by Caltrans on a case-by-case basis and will require special design coordination with Caltrans.

3. Pipeline Pressure:

Pipeline design pressure shall be in accordance with CPUC General Order No. 112, DOT 49 CFR, and accepted industry design criteria. For pipelines operating at pressures higher than 200 psig, or in a Class 4 location, the pipe hoop stress shall not exceed 40% of SMYS (Specified Minimum Yield Strength). For pipelines operating at 200 psig or lower, the pipe hoop stress shall not exceed 50% of SMYS in Class 2 and 3 locations or 60% of SMYS in a Class 1 location. The combined stresses, including pressure, temperature, and seismic related stresses, shall not exceed 90% SMYS (steel pipe) or 90% Yield Strength (plastic pipe) at MAOP (Maximum Allowable Operating Pressure) when calculated using a generally accepted yield failure criterion, such as the von Mises method. Maximum allowable operating pressure of MDPE carrier pipe shall not exceed 60 psig.

4. Pipe Size:

Maximum carrier or casing pipe size shall be limited only by the bridge design configuration. Caltrans, the architect and engineering firm for Caltrans, and the local utility shall discuss the design specifications of a new bridge in its planning phase before proceeding with the bridge design. Nominal diameter of MDPE carrier pipe shall not exceed 8 inches.

GUIDELINES FOR NATURAL GAS PIPELINES ON CALTRANS BRIDGES

Prepared by the Subcommittee on Natural Gas Pipeline Bridge Crossings

5. Carrier Pipe:

5.1 The carrier line shall be made of welded steel pipe or medium density polyethylene pipe designated as PE 2406/2708 CE per ASTM D2513 and D3350.The MDPE pipe shall have a minimum Long Term Hydrostatic Design Basis of 1000 psi at 140 F.

5.2 MDPE carrier pipe wall thickness shall be SDR 11.5 pipe or thicker.

5.3 MDPE carrier pipe shall be one continuous length or butt fused straight lengths with no fittings inside the casing.

5.4 Carrier pipe spacers

5.4.1 Install spacers a maximum of 12" from end of casing.

5.4.2 MDPE carrier pipe
Install carrier pipe spacers in accordance with the following table:
Spacers to provide a minimum of 0.333 inches clearance between carrier pipe and casing.

Nominal Pipe Size (inches)	Maximum Spacing (feet)
2	2
3	3
4	4
6	5
8	5

5.5 Install rubber end seals to prevent debris from entering the casing.

5.6 Push MDPE carrier pipe into casing or use approved breakaway device to protect MDPE carrier pipe when pulling.

5.7 Minimum temperature of MDPE carrier pipe at installation/tie-in shall be 40 F to ensure buckling stress is less than critical and a minimum 0.333 inches clearance between carrier pipe and casing when maximum pipe operating temperature is 140 F. Maximum MDPE carrier pipe installation temperature shall be120 F.

5.8 Tie-in MDPE carrier pipe a minimum of two hours after inserting MDPE carrier pipe into bridge steel casing to minimize tensile stresses.

GUIDELINES FOR NATURAL GAS PIPELINES ON CALTRANS BRIDGES

Prepared by the Subcommittee on Natural Gas Pipeline Bridge Crossings

6. Casing Pipe:
Carrier pipe in box girder bridges or between girders on other type bridges shall be cased the entire length of the bridge, plus a minimum of 5 feet beyond the approach slabs, or beyond the abutments, whichever is greater. Casing to be designed and installed per the utility's specifications. Ownership and maintenance of the casing shall be the responsibility of the utility. Casing shall be welded steel pipe and its girth welds shall develop the structural strength of the casing pipe. Install MDPE carrier pipe in a welded steel casing a minimum of two nominal diameters greater.

7. Casing Vents:
Casing vents shall be located at each end of the bridge structure. Vent pipes shall be located within Caltrans right-of-way to prevent vandalism and as directed by the Caltrans field engineer.

8. Seismic Design of Gas Pipelines:
Gas pipeline installations shall be based on designs that accommodate anticipated transverse seismic displacements across bridge abutment joints. The minimum displacement shall be 4 inches on new bridges and 6 inches on existing bridges. Also, pipeline supports shall be designed to allow longitudinal movement between the pipeline and the bridge superstructure. Seismic displacement information on new bridges will be provided by the bridge designer. On new bridges, designed with abutment backwalls, Caltrans will size end diaphragm utility openings to provide 4 inches minimum clearance or clearance equal to calculated seismic displacements. The minimum length of laterally unrestrained encased steel carrier pipe required to accommodate a given lateral bridge displacement is shown in Table 1. For encased MDPE carrier pipe, use the minimum unrestrained length of a Grade B steel carrier pipe shown in Table 1. (The use of Table 1 for MDPE carrier pipe is conservative since the MDPE bending stresses are less than a steel carrier pipe as submitted in the 4/23/2009 Calculations for Medium Density Polyethylene Pipe on Caltrans Bridges.)

9. Pipe Supports:
Pipe supports shall be concrete or steel. The supports shall be designed to accommodate pipeline seismic design displacements and to restrain the pipeline subjected to 0.5 g acceleration in any direction. Support spacing shall be based on the capacity of the pipe support, pipeline stresses, and bridge slab capacity. Support spacing shall be shown on the utility installation drawings and shall not exceed 20 feet.

GUIDELINES FOR NATURAL GAS PIPELINES ON CALTRANS BRIDGES

Prepared by the Subcommittee on Natural Gas Pipeline Bridge Crossings

10. Shutoff Valves:

10.1 The locations and installations of the shutoff valves shall be designed to comply with requirements of the CPUC and DOT. In addition, each bridge shall be evaluated on a case-by-case basis for the purpose of providing the quickest response time in case of an emergency, consistent with emergency response plans developed in accordance with the applicable state and local codes. Shutoff valves (or vaults to pinch the line) shall be installed on new 8-inch diameter and smaller pipelines, within 600 feet from each end of the bridge, at the nearest accessible street intersection. As an alternative, the existing area isolation system may be used if it can be shown that the system would provide a similar level of protection to the bridge as would be provided by the dedicated shutoff valves (or pinch vaults).

10.2 Between the bridge and the MDPE valve, install the following lateral offset length (horizontal or vertical) [a] of MDPE carrier pipe buried in the soil perpendicular to the bridge to attain a resistance force, or install a length of MDPE carrier pipe in the horizontal axial direction [b] in line with the bridge to attain a friction force, or a combination of both to resist tensile and compressive forces.

MDPE Carrier Pipe Nominal Diameter (inches)	Lateral Offset Length [a] (feet)	Axial Length [b] (feet)
2	2.5	60
3	3.5	90
4	4.5	120
6	6.5	160
8	8.5	220

11. Isolation:

The carrier pipeline shall be electrically isolated from the bridge structure or the casing pipe. Isolation between the casing pipe and the bridge structure is optional.

12. Pipe Coating:

The steel carrier pipeline shall be coated according to CPUC General Order No. 112 and DOT 49 CFR, Section 192.461.

13. Depth of Cover at Bridge Approaches:

Gas pipelines over 6 inches nominal pipe diameter or operating over 60 psig shall be installed at a minimum depth of 42 inches within Caltrans rights-of-way. Pipelines 6 inches nominal and smaller shall be installed a minimum 36 inches below finished grade. Pipelines may be installed with less cover if they are provided with additional protection to withstand anticipated external loads, in accordance with CPUC General Order No. 112 and DOT 49 CFR, Section 192.327. Also, the effects of wheel loads on buried casing pipe shall be investigated when minimum depth requirements are not met.

GUIDELINES FOR NATURAL GAS PIPELINES ON CALTRANS BRIDGES

Prepared by the Subcommittee on Natural Gas Pipeline Bridge Crossings

14. Electrical Lines:
High voltage electrical lines and gas pipelines shall not share the same bridge cell or area between girders.

15. Cathodic Corrosion Protection:
The utility plan shall show installed cathodic protection devices if the devices are within Caltrans right-of-way. Cathodic protection will be provided in accordance with CPUC General Order No. 112 and DOT 49 CFR, Section 192.463.

16. Testing:
The carrier pipe shall be leak or strength tested as required by CPUC General Order No. 112 and DOT 49 CFR. The test pressure and test medium shall be noted on the installation drawing. In addition, for pipelines operating at pressures higher than 200 psig, the pipe shall be tested to a minimum of 1.5 the MAOP and all girth welds shall be nondestructively tested.

17. Typical Drawings:
The standard installation details provided in the typical drawings, "Natural Gas Pipeline Installation in Box Girder Bridge" and "Natural Gas Pipeline Installation in Open Girder Bridge," mutually developed by Caltrans DOS and the gas utilities, shall be used to the maximum extent possible.

18. Procedures and Approvals:

- Caltrans shall notify the local gas utility of its intent to construct a bridge, providing the opportunity to plan a gas pipeline on the bridge as early in the design phase as possible.
- Variances or exceptions to these guidelines shall be reviewed and approved by Caltrans DOS.
- Revision of these guidelines shall be reviewed and approved by the Subcommittee on Natural Gas Pipeline Bridge Crossings.

The Subcommittee is composed of representatives from:
Caltrans Division of Structures
Pacific Gas & Electric Company
San Diego Gas & Electric Company
Southern California Gas Company

GUIDELINES FOR NATURAL GAS PIPELINES ON CALTRANS BRIDGES

TABLE 1

Unrestrained length required to accommodate a predicated bridge seismic displacement

(using von Mises failure criterion for biaxial stresses)

Pipe Hoop Stress at 40% of SMYS**

Combined stress design factor: 0.90

ENCASED STEEL CARRIER PIPE

E = 30,000 ksi															
Carrier pipe: (in)		4	6	8	10	12	14	16	18	20	22	24	26	28	30
Min. pipe wall: (in)		0.188	0.188	0.188	0.219	0.250	0.250	0.250	0.281	0.281	0.312	0.312	0.344	0.375	0.375
Casing size: (in)		8	10	12	16	18	20	22	24	26	28	30	32	34	36
Min. pipe wall: (in)		0.188	0.219	0.250	0.250	0.281	0.281	0.312	0.312	0.344	0.375	0.375	0.375	0.375	0.375
Steel Grade* (ksi)	Bridge Displ. (in)	Minimum unrestrained length (ft) (Distance from abutment to the first restraining support)													
Grade B	2.5	16	20	23	25	27	29	31	33	34	36	37	39	40	42
" "	4.0	21	25	28	32	34	36	39	41	43	45	47	49	51	53
" "	6.0	25	30	35	39	42	44	47	50	53	55	58	60	62	65
" "	8.0	29	35	40	45	49	51	55	58	61	64	67	69	72	75
" "	10.0	32	39	45	50	54	57	61	65	68	71	75	78	81	83
X42	2.5	15	18	21	23	25	26	28	30	31	33	34	36	37	38
" "	4.0	19	23	26	29	32	33	35	37	40	41	43	45	46	48
" "	6.0	23	28	32	35	39	40	43	46	48	51	53	55	57	59
" "	8.0	27	32	37	41	44	47	50	53	56	58	61	63	66	68
" "	10.0	30	36	41	45	50	52	56	59	62	65	68	71	74	76
X52	2.5	13	16	19	20	22	24	25	27	28	29	31	32	33	34
" "	4.0	17	20	23	26	28	30	32	34	35	37	39	40	42	43
" "	6.0	21	25	29	32	35	36	39	41	43	45	47	49	51	53
" "	8.0	24	29	33	37	40	42	45	47	50	52	55	57	59	61
" "	10.0	27	32	37	41	45	47	50	53	56	59	61	64	66	68

* For grades of steel higher than X52, use the table values for X52.

** The unrestrained length is calculated based on carrier pipe hoop stress at 40% of SMYS. If the hoop stress is higher, the unrestrained length might be longer and shall be calculated using the following equation:

TABLE 1 (continued)

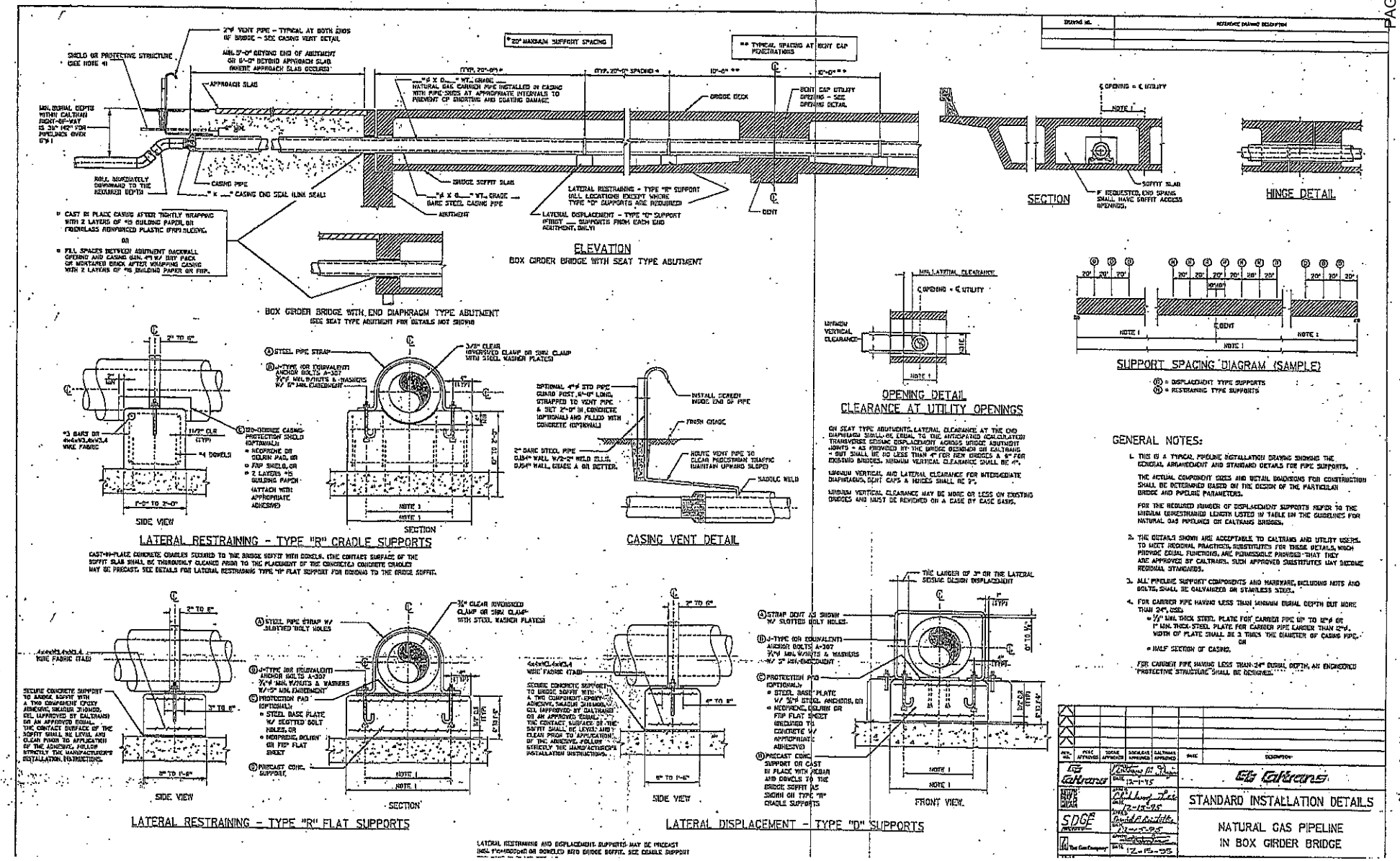
$$L = \left(\frac{3\Delta DE}{|S_b|} \right)^{0.5}$$

$$S_b = 0.2S_h - (0.81F_y^2 - 0.75S_h^2)^{0.5}$$

$$S_h = \frac{PD}{2t}$$

L = *Unrestrained length*
Δ = *Bridge seismic displacement*
D = *Pipe outside diameter*
E = *Young's Modulus* (30×10^6 *psi*)
t = *Pipe wall thickness*
F_y = *Pipe yield stress (SMYS)*

INFORMATION HANDOUT



GENERAL NOTES:

1. THIS IS A TYPICAL PIPELINE INSTALLATION DRAWING SHOWING THE GENERAL ARRANGEMENT AND STANDARD DETAILS FOR PIPE SUPPORTS.

   THE ACTUAL COMPONENT SIZES AND DETAIL DIMENSIONS FOR CONSTRUCTION SHALL BE DETERMINED BASED ON THE DESIGN OF THE PARTICULAR BRIDGE AND PIPELINE PARAMETERS.

   FOR THE REQUIRED NUMBER OF DISPLACEMENT SUPPORTS REFER TO THE MINIMUM UNRESTRAINED LENGTH LISTED IN TABLE IM THE GUIDELINES FOR NATURAL GAS PIPELINES ON CALTRANS BRIDGES.

2. THE DETAILS SHOWN ARE ACCEPTABLE TO CALTRANS AND UTILITY USERS. TO MEET REGIONAL PRACTICES, SUBSTITUTES FOR THESE DETAILS, WHICH PROVIDE EQUAL FUNCTIONS, ARE PERMISSIBLE PROVIDED THAT THEY ARE APPROVED BY CALTRANS. SUCH APPROVED SUBSTITUTES MAY BECOME REGIONAL STANDARDS.

3. ALL PIPELINE SUPPORT COMPONENTS AND HARDWARE, INCLUDING NUTS AND BOLTS, SHALL BE GALVANIZED OR STAINLESS STEEL.

4. FOR CARRIER PIPE HAVING LESS THAN MINIMUM BURIAL DEPTH BUT MORE THAN 24", USE:
   - 1/2" MIN. THICK STEEL PLATE FOR CARRIER PIPE UP TO 12"Ø OR 1" MIN. THICK STEEL PLATE FOR CARRIER PIPE LARGER THAN 12"Ø. WIDTH OF PLATE SHALL BE 3 TIMES THE DIAMETER OF CASING PIPE.

     OR
   - HALF SECTION OF CASING.

   FOR CARRIER PIPE HAVING LESS THAN 24" BURIAL DEPTH, AN ENGINEERED "PROTECTIVE STRUCTURE" SHALL BE DESIGNED.

REV. NO.	MAT. APPROVED	DESIGN APPROVED	SIGNALS & LIGHTING APPROVED	CALTRANS APPROVED	DATE	DESCRIPTION

Caltrans — Caltrans

STANDARD INSTALLATION DETAILS

NATURAL GAS PIPELINE IN BOX GIRDER BRIDGE

SDGE

04-2285E4

INFORMATION HANDOUT

URS

SR4 (East) - Loveridge To Somersville

LETTER OF TRANSMITTAL

TO: **Amna Hawatky, Environmental Scientist**
401 Certification & Wetlands Unit
Division of Water Quality
CA State Water Resources Control Board
1001 I Street, 15th floor
Sacramento, CA 95814

DATE:	**30-Apr-09**
PROJECT NO.:	**26814907**
RE:	**SWRCB 401 Permit Application**

WE ARE SENDING YOU ☑ **Attached** ☐ **Under separate cover via** _____ **THE FOLLOWING ITEMS:**

☐ Shop Drawing Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of Letter ☐ Change Order ☐ Other _____

COPIES	DATE	NO.	DESCRIPTION	
1	4/30/2009		SWRCB 401 Permit Application	
1	4/29/2009		$347.00 Check incl. Supporting Documentation (Fee Calc. Spreadsheet, Impact Summary Table, Figures)	
1	4/29/2009		CD with Supporting Documents:	
			• SR4e Loveridge Hydromod Report	• Mitigation & Monitoring Plan (Updated)
			• SR4e Loveridge SWDR	• Wetland Delineation
			• SR4 Somersville to 160 Hydromod	• Wetland Reverification
			• SR4 Somersville to 160 SWDR	• USFWS Biological Opinion
			• Neg Dec Environmental Document	• USFWS Biological Opinion Amendment
			• ACOE 404 Permit Application	• SR4e Loveridge CDFG Lake & Streambed Alt. Agmt

THESE ARE TRANSMITTED as checked below:

☑ For Approval ☐ Approved as Submitted ☐ Resubmit _____ Copies for Approval
☐ For Your Use ☐ Approved as Noted ☐ Submit _____ Copies for Distribution
☑ As Requested ☐ Returned for Corrections ☐ Return _____ Corrected Prints
☐ For Review and Comment ☐ Prints Returned to _____ After Loan to Us
☐ For Bids Due _____, _____ ☐ Other_____

REMARKS Please complete your review of these documents and process the 401 permit. If you have any questions regarding this information, please contact us. A Draft of the CDFG Lake & Streambed Alteration Agreement will follow under separate cover.

COPY TO: Susan Miller, CCTA
Laurie Lau, Caltrans
Trudy Presser, Gray Bowen
File

SIGNED Scott C. Kelsey

Scott C. Kelsey, P.E.

URS Corporation
3440 Vincent Road
Pleasant Hill, CA 94523
925-256-1250 (fax)
925-974-1550

File: C:_ Scott's\SR4e Loveridge\Correspondence\Amna Hawatky Trans 4-29-09.xls

State Water Resources Control Board

Division of Water Quality, Water Quality Certification Unit

1001 I Street, 15th Floor, Sacramento, CA 95814

Terry Tamminen
Secretary for Environmental Protection

Arnold Schwarzenegger
Governor

Introduction

This application is for the State Route (SR) 4 (East) Widening Project - Loveridge Road to SR 160, which will result in impacts to wetlands and other waters of the U.S. and the State that are within the boundaries of multiple Regional Water Quality Control Boards. As a result, the activites associated with this project are being permitted through the State Water Resources Control Board. The proposed project will be implemented in 2 phases, the Loveridge Segment will be implemented first, followed by the Somersville to SR 160 Segment.

Enclosed with this Application is a Compact Disc (CD) that contains electronic copies of the following supporting documents:

- 404 Permit Application for the Army Corps of Enginners (ACOE)
- Hydromodification Report and Memo for the Loveridge Segment
- Hydromodification Report for the Somersville to SR 160 Segment
- Lake and Streambed Alteration Agreements for the California Department of Fish and Game (CDFG)
- Mitigation and Monitoring Plan for the SR4 Project
- SR 4 Widening Negative Declaration (Neg Dec)
- Stormwater Data Report for the Loveridge Segment
- Stormwater Data Report for the Somersville to SR 160 Segment
- United States Fish and Wildlife (USFWS) Biological Opinion and Amendment
- Wetland Delineation for SR 4
- Wetland Reverification for SR 4

CLEAN WATER ACT §401 WATER QUALITY CERTIFICATION APPLICATION FORM

(Use only for multi-regional projects, otherwise use the appropriate Regional Board application form)

1. APPLICANT/AGENT INFORMATION

a) Applicant: Contra Costa Transportation Authority ATTN: Susan Miller	b) Agent[1]: URS Corporation ATTN: Jan Novak
Address: 3478 Buskirk Avenue, Suite 100	Address: 1333 Broadway, Suite 800
Pleasant Hill, CA 94523	Oakland, CA 94612
Phone No. (925) 256-4736	Phone No. (510) 874-1733
Fax No. (925)-256-4701	Fax No. (510) 874-3268
E-mail Address: smiller@ccta.net	E-mail Address: jan_novak@urscorp.com

Have you previously contacted the Regional Board staff regarding this project? If 'yes' provide information on date, person, and brief summary of subject matter.

Contra Costa Transportation Authority (CCTA) previously consulted with the San Francisco Regional Water Quality Control Board. The contact person was Brendan Thompson, Environmental Specialist - (510) 622-2506, bthompson@waterboards.ca.gov. The determination made by the San Francisco Regional Board required that the project be permitted by the State Water Resources Control Board, as the impacts of the project are within multiple Regional Water Quality Control Board regions.

STATEMENT OF AUTHORIZATION

I hereby authorize Jan Novak to act in my behalf as my agent in the processing of this application, and to furnish upon request, supplemental information in support of this permit application.

Applicant's Signature

4/30/2009
Date

[1]Complete only if applicable

2. PROJECT DESCRIPTION

a) Project Title:

State Route (SR) 4 (East) Widening Project - Loveridge Road to SR 160

b) Project Purpose:

The purpose of the proposed SR 4 (East) Widening Project – Loveridge Road to SR 160 project is to reduce existing congestion, improve traffic operations, encourage use of high occupancy vehicles (HOVs), and accommodate anticipated travel demand through the year 2030 by providing additional capacity and sufficient right-of-way to accommodate multi-modal transportation. The project would widen this portion of SR 4 from the existing four lane roadway to an eight-lane roadway. This project is part of the Contra Costa Transportation Authority's overall plan to continue to widen SR 4 further into the eastern portion of the county and is consistent with the Phase 1 Implementation Plan recommendation made in the SR 4 (east) Railroad Ave. to SR 160 Major Investment Study (MIS). Correcting conditions on SR 4 is a necessary component of the overall program to improve transportation through northern Contra Costa County.

continued on next page...

State Water Resources Control Board

INFORMATION HANDOUT

Division of Water Quality, Water Quality Certification Unit

1001 I Street, 15th Floor, Sacramento, CA 95814

c) Project Activities:

The California Department of Transportation (Caltrans), in cooperation with the Federal Highway Administration (FHWA) and CCTA, proposes to widen SR4, its interchanges, and affected local roadways from approximately 0.8 mile west of Loveridge Road to approximately 0.7 mile east of Hillcrest Avenue (Figure 1). The project will require reconstruction of all interchanges within the project limits and would include the addition of auxiliary lanes between interchanges to facilitate on and off traffic movements.

This project has been separated into 2 phases: The Loveridge Segment (PM 23.7 to 25.8), and the Somersville to SR 160 Segment(PM 25.8 to 29.6).

Project activities for both segments are described below:

- Widen SR4 from the existing four lanes to eight lanes. The widened freeway would consist of an HOV lane and three mixed-flow lanes in each direction.
- Preserve sufficient width in the SR 4 median through the Loveridge Road Interchange to accommodate the possibility of future public transit improvements.
- Eliminate partial interchange at G Street and reconstruct the overcrossing.
- Add auxiliary lanes on SR 4 between interchanges from the on-ramps to the off-ramps.
- Provide capability to create ramp metering facilities, including HOV preferential lanes and California Highway Patrol (CHP) enforcement areas, where feasible.
- Widen Roosevelt Lane pedestrian undercrossing and the Cavallo Road undercrossing.
- Extend drainage facilities that cross SR4 in the project area.
- Reconstruct SR4 interchanges to accommodate the freeway widening at:
  - Loveridge Road
  - Somersville Road
  - Contra Loma Boulevard- L Street
  - Lone Tree Way –A Street
  - Hillcrest Avenue
- The proposed project would conform to improvements currently being constructed to the west of the project area as part of the Route 4/ Railroad Avenue Interchange Project (by others) as well as improvements proposed to the east of the project as part of the SR4 Bypass Project (by others).
- Within the Loveridge Segment, Existing drainage culverts (Kirker Creek, Old Kirker Creek, Los Medanos Waste Way) will be modified to accommodate the freeway widening.
- Within the Somersville to SR 160 Segment, Existing drainange culverts that transmit the waters of West Antioch Creek will be modified to accommodate freeway widening.

d) Proposed Schedule (start-up, duration, and completion dates):

Construction of the Loveridge segment will begin in the summer of 2009 and is expected to be completed in the winter of 2012. Construction of the other 3 segments are planned to begin in 2010 and will continue for 5 years, ending in 2015.

State Water Resources Control Board

Division of Water Quality, Water Quality Certification Unit

1001 I Street, 15th Floor, Sacramento, CA 95814

3. FEDERAL LICENSES/PERMITS

a) Federal Agency(ies)/File Number(s):

U.S. Army Corps of Engineers____X__ Other_____

File No.(s) (if known) This permit is pending approval.

b) Permit Type(s) (please provide permit number(s) if known):

Nationwide Permit No.(s)_____ Regional General Permit No.(s) _____

Individual Permit____X Other_____

c) Does the project require any Federal Application(s), Notification(s) or Correspondence?

Yes __X___ (attach copy[ies], see below) No _____ (attach detailed explanation)

d) Provide copies of the license/permit/application.

A copy of the ACOE Section 404 Permit Application has been included on the enclosed CD.

4. OTHER LICENSES/PERMITS/AGREEMENTS

a) Please list all other required, including local regulatory approvals (submit final or draft copy if available). Include information on any De-watering, NPDES, and Storm Water permits.

Agency	License/Permit/Agreement	Permit No.	Approval Date
CDFG	Lake and Streambed Alteration Agreement for the Loveridge Segment	1600-2008-0217-3	November 8, 2008
CDFG	Lake and Streambed Alteration Agreement for the Somersville To 160 Segment		Pending
SWQCB	Storm Water Pollution Prevention Plan (SWPPP), to be developed by the construction contractor		Approval will be sought prior to construction

Copies of the Lake and Streambed Alteration Agreements have been included on the enclosed CD.

b) Does the project require a Federal Energy Regulatory Commission (FERC) license or amendment to a FERC license?

No__X Yes_____ (attach application copy)

State Water Resources Control Board

Division of Water Quality, Water Quality Certification Unit

1001 I Street, 15th Floor, Sacramento, CA 95814

5. CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

Indicate CEQA Document (submit final or draft copy if available*):

Type of CEQA Document	Date of filing of Notice of Exemption/ Preparation and Name of Lead Agency
Statutory Exemption/Class Title	NA
Categorical Exemption/Class Title	NA
Negative Declaration	August 26, 2004/Caltrans*
Mitigated Negative Declaration	NA
Environmental Impact Report	NA

*A copy of the Final Negative Declaration is provided on the enclosed CD.

Note: Ample time must be provided to the certifying agency to properly review a final copy of valid CEQA documentation before certification can occur.

6. APPLICATION FEE

Provide an initial deposit of $NA* for the application. Please write a check made out to the State Water Resources Control Board.

Is a check enclosed? Yes X No. _____ Check Number 36296 Amount **$ 347.00**

***An initial deposit of $640, with an additional application fee of $303 has already been submitted for the Loveridge Segment. Included with this application is a check for the fees associated with the additional impacts of the Somersville to SR 160 Segment (a total of $347). For questions on this matter, please contact the agent listed in Section 1.**

7. PROJECT SITE DESCRIPTION – GENERAL (Include areas outside of US waters)

a) Project Location (attach map of suitable quality and detail):

City or Area The Cities of Pittsburg and Antioch County Contra Costa

Longitude/Latitude: Western Extent: 38.015422 Lat, -121.881019 Long

Eastern Extent: 37.990297 Lat, -121.762241 Long

b) **Total Project Size:** 435.21 acres 32,200 linear feet (if appropriate)

c) Site description of the entire project area (including areas outside of jurisdictional water of the US):

The project site is located along SR4 between 0.8 mile west of Loveridge Road to 0.7 mile east of Hillcrest Avenue (Figure 1). The project will be constructed in two phases. The first phase will widen the Loveridge Segment (0.8 mile west of Loveridge Road to the Somersville Interchange), while the second phase will widen the Somersville to SR 160 Segment (Somersville Interchange to approximately 0.7 mile east of Hillcrest Avenue. The project area is predominately bordered by developed and ruderal areas, with some annual grasslands. The project crosses four channalized urban draianges.

State Water Resources Control Board

INFORMATION HANDOUT

Division of Water Quality, Water Quality Certification Unit

1001 I Street, 15th Floor, Sacramento, CA 95814

8. WATER BODY IMPACT

a) **Water Body Name(s)**[2]:

Clearly indicate on a published map of suitable detail, quality, and scale (1:24K) to allow the certifying agency to easily identify the area(s) and water body(ies) receiving any discharge.

Receiving waters include Kirker Creek, Old Kirker Creek, Los Medanos Wasteway, West Antioch Creek

See Impacts Sheets 1 through 5 for maps of all water bodies affected by the project. These maps identify only those areas with impacts to wetlands and waters within the project limits and are summarized below*.

b) **Fill and Excavation:** Indicate in ACRES and/or LINEAR FEET the proposed waters to be impacted, and identify the impacts(s) as permanent and/or temporary for each water body type listed below*:

Water Body Type	**Post Mile**	Sheet No.	Permanent Impact		Temporary Impact		
			Acres	Linear Feet	Acres	Linear Feet	
Wetlands:[3]							
wl/wus 1	23.8	1			0.048	98.4	
wl/wus 2	24.4	2	0.010	10.0			
wl/wus 3	24.4	2	0.021	66.0			
wl/wus 5a	26.8	4	0.008	65.0			
wl/wus 5b	26.9	4	0.013	90.0			
wl/wus 6	26.8	4	0.011	44.0			
wl/wus 7	26.9	4	0.003	24.0			
wl/wus 8	26.9	4	0.005	72.0			
wl/wus 9a	27.0	5	0.002	20.0			
wl/wus 9b	27.0	5	0.007	30.0			
wl/wus 10	27.0	5	0.002	20.0			
wl/wus 11	27.2	5	0.009	40.0			
Wetland Totals:			**0.091**	**481**	**0.048**	**98.4**	
continued on next page…							

*Culverted Waters of the US (cwus) are shown on the Impact Sheets generated for the ACOE, but are not summarized on the above table, as the state does not require reporting of these impacts.

Streambed/Canal:							
ws 1	23.8	1	0.008	698.0			
owus 1	23.8	1			0.005	82.0	
owus 4	24.4	2	0.005	66.0			
owus 5	25.5	3	0.011	51.3	0.004	10.0	
owus 6	25.5	3	0.007	13.5			
owus 7a	26.8	4	0.015	85.0			
owus 7b	26.9	4	0.031	295.0			
owus 8	26.8	4	0.004	44.0			
owus 9	26.9	4	0.004	80.0			
owus 10a	27.0	5	0.002	20.0			
owus 10b	27.0	5	0.007	100.0			
owus 11	27.2	5	0.003	10.0			
Streambed/Canal Total:			**0.097**	**1462.8**	**0.009**	**92.0**	
Lake/Reservoir:			None		None		
Ocean/Estuary/Bay:			None		None		
Riparian:			None		None		
Isolated Waters:[4]			None		None		

Provide the name, title, and affiliation of person that carried out wetland delineation.

Parsons Transportation Group, Inc. performed the wetland delineation, which was verified by ACOE in 2002. A reverification of this delineation was performed by URS Corp. in 2008, and approved by the ACOE in January of 2009 (File No. 2002-26746S). Copies of these reports are included on the attached CD.

c) **Dredging:** Volume (cubic yards) of dredged material to be discharged in waters of the United States.
NA

e) **SWANCC:** Is the water body isolated (SWANCC-relater)? Yes _ No X

d) Provide information on the Q_2, Q_{10}, Q_{100} for pre- and post-project implementation.

Existing drainage culverts (Kirker Creek, Old Kirker Creek, Los Medanos Waste Way, and West Antioch Creek) will be modified to accommodate the freeway widening:

- Kirker Creek (Sheet 1) currently crosses SR4 in a 72" Reinforced Concrete Pipe combined with a twin 10'x8' Reinforced Concrete Box (RCB). This project proposes to extend these culverts in-kind to accommodate the roadway widening. The system is capable of handling an ultimate Q50 (2880 CFS) as determined by the Contra Costa Flood Control District.
- The existing box culvert at Old Kirker Creek (Sheet 2) will be replaced to accommodate the freeway widening. It will be replaced with a double 12' x 4' Reinforced Concrete Box capable of passing a Q100 (1060 CFS) as determined by the Contra Costa Flood Control District.

continued on next page…

- The Los Medanos Wasteway (Sheet 3) crosses SR 4 in an 8'x7' RCB. The project proposes to extend this culvert in-kind to accommodate the roadway widening. The Contra Costa County Water District currently transports raw water through this channel, which is owned by the U.S. Bureau of Reclamation.
- West Antioch Creek (Sheets 4 and 5) crosses SR 4 in a 120-inch diameter concrete pipe which eventually transitions to a 10" x 8' RCB at the downstream outfall. This project proposes to install an additional 120-inch concrete pipe which, when combined with the original culvert, can pass a Q100 (2100 CFS Undeveloped Condition) as determined by Contra Costa County Flood Control District. Improvements to the L Street/Contra Loma Interchange will require the partial removal of an existing triple 5' x 3' RCB and installation of a new 10' x 5' RCB on one of the laterals feeding the Creek. Another major lateral to West Antioch Creek slightly west of this interchange consists of a 42" and a 72" RCP which will need to be extended in-kind to accommodate the widening.

The Stormwater Data Reports and Hydromodification Studies of the Loveridge Segment and the Somersville to SR 160 Segment,are provided on the enclosed CD.

e) Indicate type(s) of material proposed to be discharged in waters of the United States:

1,008 yd.^{3} Roadway Fill
1,048 yd.^{3} RSP
569 yd.^{3} Concrete
4 yd.^{3} Concrete FES
640 yd.^{3} Concrete Box
150 yd.^{3} Grading
240 yd.^{3}Gravel (temporary fill)
12 yd.^{3} Sand Bags (temporary fill)
8 yd.^{3} Water Filled Cofferdam (temporary fill)

[2]Both US Army Corps of Engineer's jurisdictional- and non-jurisdictional or isolated waters (SWANCC).

[3]Per US Army Corps of Engineer's wetland delineation protocol.

[4]SWANCC-related (isolated) water body.

State Water Resources Control Board

INFORMATION HANDOUT

Division of Water Quality, Water Quality Certification Unit

1001 I Street, 15th Floor, Sacramento, CA 95814

9. COMPENSATORY MITIGATION (Please complete attached Mitigation Checklist)

a) Is compensatory mitigation proposed? Yes X No

b) Indicate in ACRES and LINEAR FEET (where appropriate) the total quantity of **waters of the United States** proposed to be Created, Restored and/or Enhanced for purposes of providing Compensatory Mitigation:

Water Body Type	Created	Restored	Enhanced	Set Aside for Protection
Wetland	0.940			
Streambed				
Lake/Reservoir				
Ocean/Estuary/Bay				
Riparian				
Isolated Waters				

c) If contributing to a Mitigation Bank provide the following:

Mitigation Bank Name: Elsie Gridley Mitigation Bank

Name of Mitigation Bank Operator: Michael A. Gridley

Office Address of Operator/Phone Number: 3223 Webster Street,
San Francisco, CA 94123

Mitigation Bank Location (Latitude/Longitude, County, and City): Latitude121W 49'15", Longitude38N 16'22", Solano County, South of the city of Dixon.

Mitigation Bank Water Body Type(s): Perennial Marsh, Vernal Marsh, Seasonal Wetland, Alkali Playa Pools, Vernal Pools, Agricultural Drainage Ditch

Mitigation Area (acres or linear feet) and cost (dollar): 0.940 acres of wetlands at a cost of $140,000 per acre, for a total cost of $131,600.

d) Provide/attach a map with suitable detail, quality, and scale (1:24K) that will easily provide information as to the location(s) and water body(ies) of the mitigation area.

See Figure 2: Elsie Gridley Mitigation Bank Service Area.

10. THREATENED/ENDANGERED SPECIES

a) Does the project require coordination with the US Fish and Wildlife Service or National Marine Fisheries Service under the Federal Endangered Species Act?

Yes X (provide copies of Biological Report) No ____ (provide basis of determination)

A copy of the Biological Opinion issued by the USFWS is included on the enclosed CD.

b) Does the project require coordination with the State of California Department of Fish and Game under the California Endangered Species Act?

Yes X (provide copies of Biological Report) No ____ (provide basis of determination)

Potential effects to special status species are addressed in the Streambed Alteration Agreements issued by CDFG.

State Water Resources Control Board

Division of Water Quality, Water Quality Certification Unit

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11. OTHER ACTIONS/BEST MANAGEMENT PRACTICES (BMPs)

Briefly describe other actions/BMPs to be implemented to Avoid and/or Minimize impacts to waters of the United States, including preservation of habitats, erosion control measures, project scheduling, flow diversions, etc.

Work within the stream/riparian corridors shall be done during periods of no/low flow.

When work in a flowing stream is unavoidable, the entire flow will be diverted around the construction area until work is complete. Normal flows will be restored as soon as work is complete at that location.

Equipment shall not be operated in wetted areas.

No hazardous materials or construction waste shall be allowed to enter such waters.

Staging and storage areas for construction materials and equipment will be located outside of stream channels and banks.

Refueling of equipment will occur away from water bodies so that accidental spills do not enter such waters.

Temporarily impacted areas will be restored as per Mitigation and Monitoring Plan (on the enclosed CD).

A SWPPP will be developed and implemented as a part of the proposed project.

Permanent Impacts to water features will be compensated for though the purchase of credits at a mitigation bank, as described above in Section 9.

12. PAST/FUTURE PROPOSALS BY THE APPLICANT

Briefly list/describe any projects carried out in the last 5 years or planned for implementation in the next 5 years that are in any way related to the proposed activity or may impact the same receiving body of water. Include estimated adverse impacts.

Completed Projects:
Loveridge Road Pump Plant
SR 4 East Widening: Bailey to Railroad (2005).
SR 4 Widening: Railroad to Loveridge (2006).

Proposed Projects:

East County Rail Extension - eBART

Applicant's Signature (or Agent)

4/30/2009
Date

For further information please
email: wqcert@swrcb.ca.gov

California Environmental Protection Agency

Recycled Paper

Our mission is to preserve and enhance the quality of California's water resources for the benefit of present and future generations.

04-2285E4

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URS CORPORATION
1333 BROADWAY, SUITE 800
OAKLAND, CA 94612

36296

11-35/1210 CA

DATE April 29, 2009

PAY TO THE ORDER OF CA State Water Resources Control Board $ *347.00******

Three Hundred Forty Seven & 00/100******* DOLLARS

Bank of America
San Francisco, California

VOID AFTER 120 DAYS

Lennie Simpson

⑈036296⑈ ⑆121000358⑆ 12336⑈01250⑈

Details on Back. Security Features Included

URS CORPORATION
OAKLAND, CA 94612

DETACH AND RETAIN THIS STATEMENT
THE ATTACHED CHECK IS IN PAYMENT OF ITEMS DESCRIBED BELOW
IF NOT CORRECT, PLEASE NOTIFY US PROMPTLY. NO RECEIPT DESIRED

DATE	DESCRIPTION	AMOUNT
4/29/09	Impacts to Waters of the State Fee 26814914.54420.62000	$347.00

A2

DREDGE AND FILL FEE CALCULATOR[1] v8 10/07/2008

This fee schedule is based on California Code of Regulations, Division 3, Chapter 9, Article 1, section 2200(a)(3). TO CALCULATE FEE: Enter the "Discharge Size" in Section A or, if the project qualifies, check the check-box in Section B according to the applicable Flat Fee category. If the project involves multiple discharges, then both Section A and Section B fee charges may apply (see footnote 1(a) below). The project fee owed will appear in the "Total Fee For All Categories" box at the bottom of the Fee Calculator. In any case, dredge and fill operation fees shall not exceed $40,000, plus any applicable surcharge(s).

A. FEES BASED ON DISCHARGE SIZE

	FEE CATEGORY	RATE	DISCHARGE SIZE		FEE	
(i)	**Fill & Excavation[2] Discharges.** Size of the discharge area as expressed in hundredths of acres (0.01 acre; 436 square feet) rounded up.	**$640 base fee plus Discharge Area Acres x** $2752	0.126		**$347**	
	To Non-Federal Waters (per fee cat. iv)	**$640 base fee plus Discharge Area Acres x** $2752 x 2			**$0**	
(ii)	**Dredging Discharges (except Sand Mining-see (v) below)[3]** Dredge volume expressed in Cubic Yards.	**$640 base fee plus Dredge Volume CY** x $0.102			**$0**	
	To Non-Federal Waters (per fee cat. iv)	**$640 base fee plus Dredge Volume CY** x $0.102 x 2			**$0**	**Categories (i) (iii) will be charged an additional Base Fee amount of $640 which is included in the total below.**
(iii)	**Channel and Shoreline Discharges**. Discharge length shall be reported in Linear Feet. Includes linear discharges to drainage features and shorelines, e.g., bank stabilization, revetment, and channelization projects. (Note): The fee for channel and shoreline linear discharges will be assessed under the "Fill and Excavation" or "Channel and Shoreline" schedules, whichever results in the higher fee.	**$640 base fee plus Discharge Length Feet x** $6.40		**$0**	**$0**	
		$640 base fee plus Discharge Area Acres x $2752		**$0**		
	To Non-Federal Waters (per fee cat. iv)	**$640 base fee plus Discharge Length Feet x** $6.40 x 2		**$0**	**$0**	
		$640 base fee plus Discharge Area Acres x $2752 x 2		**$0**		
(iv)	**Discharges to Non-federal (e.g. "Isolated") Waters.** Discharges to waters or portions of waterbodies not regulated as "waters of the United States", including waters determined to be "isolated" pursuant to the findings of *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers* (2001) 121 S. Ct. 675. **Double the otherwise applicable fee except restoration projects, which shall be charged the normal fee.**					

B. FEES BASED ON FLAT FEE CATEGORIES

(v)	**Sand Mining Dredging Discharges.** Aggregate extraction in marine waters where the source material is free of pollutants and the dredging operation will not violate any Basin Plan Provisions.	$1,024 Flat fee	Check if Applicable	☐	**$0**
(vi)	**Low Impact Discharges.** Projects may be classified as low impact discharges if they meet the following criteria: 1. The discharge affects less than (a) 0.1 acre, (b) 200 linear feet, and (c) 25 cubic yards. 2. Demonstrate that the discharger: (a) has taken all practicable measures to avoid impacts, (b) for unavoidable temporary impacts the discharger will restore waters and vegetation to pre-project conditions as quickly as practicable, (c) for unavoidable permanent impacts the discharger will ensure that there is no net loss of wetland, riparian area, or headwater functions, including onsite habitat, habitat connectivity, floodwater retention, and pollutant removal. 3. The discharge will not: (a) directly or indirectly destabilize a bed of a receiving water, (b) contribute to significant cumulative effects, (c) cause pollution, contamination, or nuisance, (d) adversely affect candidate, threatened, or endangered species, (e) degrade water quality or beneficial uses, (f) be toxic, or (g) include "hazardous" or "designated" material. 4. Discharge is to waterbody regulated as "waters of the United States".	$640 Flat fee.	Check if Applicable	☐	**$0**

(vii)	**Restoration Projects.** Projects undertaken for the sole purpose of restoring or enhancing the beneficial uses of water. This schedule does not apply to projects required under a regulatory mandate or to projects that include a non-restorative component, e.g., land development, property protection, or flood management..	$640 Flat fee	Check if Applicable	☐	$0
(viii)	**General Orders.** Projects which are required to submit notification of a proposed discharge to the State and/or Regional Board pursuant to a general water quality certification permitting discharges authorized by a federal general permit or license, (e.g., a U.S. Army Corps of Engineers nationwide permit). Applies ONLY if general water quality certification was previously granted.	$77 Flat Fee	Check if Applicable	☐	$0
	TOTAL FEE FOR ALL CATEGORIES **Includes $640 Base Price for Catagories (i)-(iii) as applicable. Total fee due is limited to a maximum of $40,000.**				$987
	Amended Orders. Amendments of WDR's or water quality certifications previoulsy issued for one-time discharges not subject to annual billings. Fees charged as follows:				$0
	(a) Minor project changes, not requiring technical anlysis and involving only minimal processing time.	No fee required			$0
	(b) Changes to projects eligible for flat fees (fee categories v. - viii. above) where technical analysis is needed to assure continuing eligibility for flat fee and that beneficial uses are still protected.	Appropriate flat fee			$0
	(c) Project changes not involving an increased discharge amount, but requiring some technical analysis to assure that beneficial uses are still protected and that original conditions are still valid, or need to be modified	$640 flat fee			$0
	(d) Project changes involving an increased discharge amount and requiring some technical analysis to assure that beneficial uses are still protected and that original conditions are still valid, or need to be modified.	Additional fee assessed per increased amount of discharge(s) per this dredge and fill fee schedule [Section 2200 (a)(3)] (plus $640 base fee)			$0
	(e) Major project changes requiring an essentially new analysis and re-issuance of WDR's or water quality certification.	New fee assessed per this dredge and fill fee schedule (Section 2200 (a)(3)).			$0

1(a) When a single project includes multiple discharges within a single dredge and fill category, the fee for that category shall be assessed based on the total area, volume, or length of discharge (as applicable) of the multiple discharges. When a single project includes discharges that are assessed under multiple fee categories, the total fee shall be the sum of the fees assessed under each applicable fee category; however a $640 base fee, if required, shall be charged only once. Fees shall be based on the largest discharge size specified in the original or revised report of waste discharge or Clean Water Act (CWA) section 401 water quality certification application, or as reduced by the applicant without any State or Regional Board intervention. If water quality certification is issued in conjunction with waste discharge requirements (WDRs) or is issued for a discharge regulated under preexisting WDRs, the current annual WDR fee as derived from this dredge and fill fee schedule shall be paid in advance during the application for water quality certification, and shall comprise the fee for water quality certification.

1(b) Discharges requiring water quality certification and regulated under a federal permit or license other than a US Army Corps of Engineers CWA section 404 permit or a Federal Energy Regulatory Commission License shall be assessed a fee determined from the table in CCR 23, Section 2200(a).

2 "Excavation" refers to moving sediment or soil in shallow waters or under no-flow conditions where impacts to beneficial uses are best described by the area of discharge. It typically is done for purposes other than navigation. Example includes trenching for utility lines, other earthwork preliminary to construction, and removing sediment to increase channel capacity.

3 "Dredging" generally refers to removing sediment in deeper water to increase depth. The impacts to benficial uses are best described by the volume of the discharge and typically occur to facilitate navigation. For fee purposes it also includes aggregate extraction within stream channels where the substrate is composed of course sediment (e.g., gravel) and is reshaped by normal winter flows (e.g., point bars), where natural flood disturbance precludes establishment of significant riparian vegetation, and where extraction timing, location and volume will not cause changes in channel structure (except as required by regulatory agencies for habitat improvement) or impair the ability of the channel to support beneficial uses.

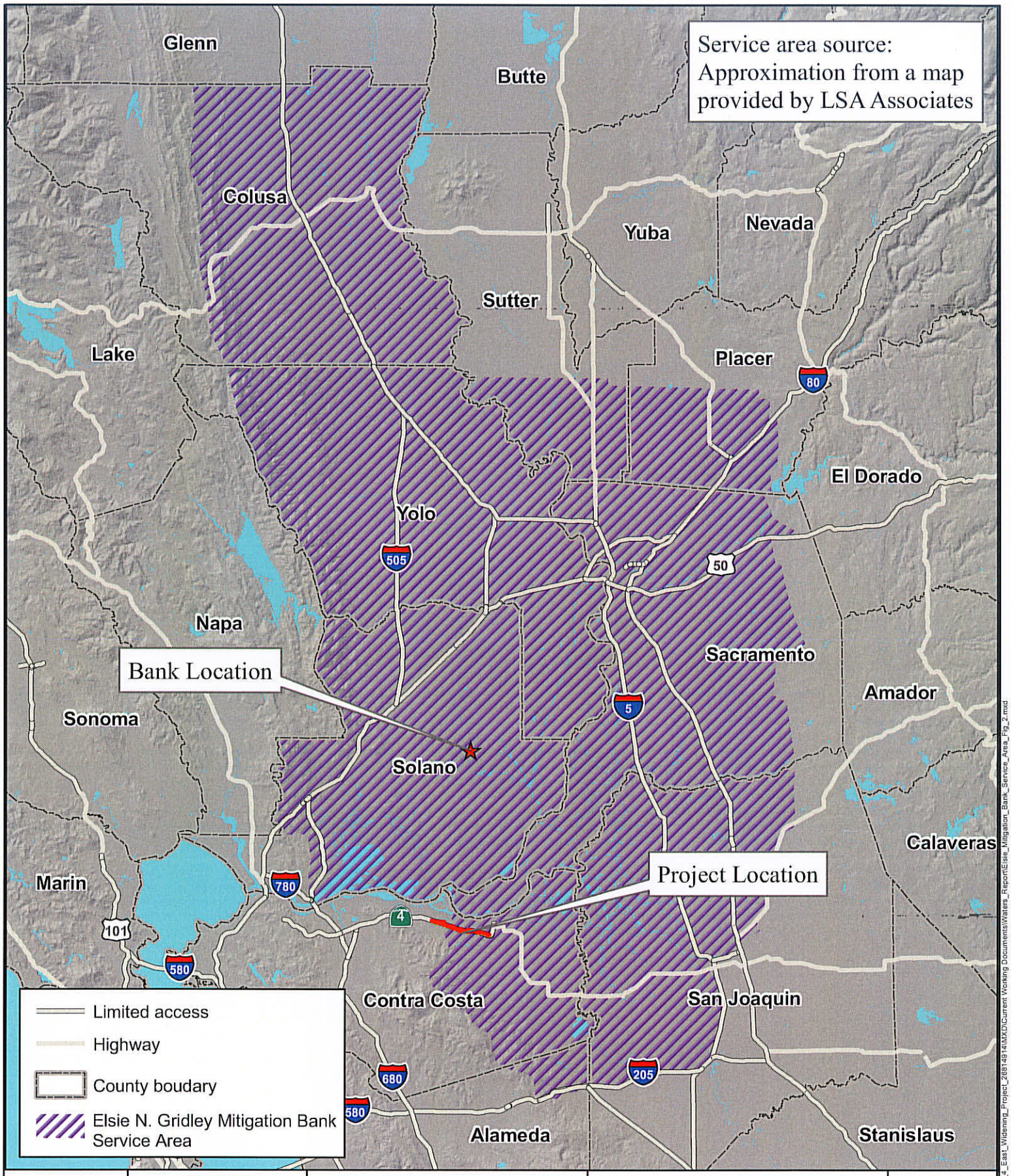
Name	Impact	Type	Impact Page	Acres	Linear Feet
owus 1	Temporary	Other Waters of the U.S.	1	0.005	82.00
wl/wus 1	Temporary	Wetland/Waters of the U.S.	1	0.048	98.40
ws 1	**Permanent**	**Waters of the State**	**1**	**0.008**	**698.00**
owus 4	**Permanent**	**Other Waters of the U.S.**	**2**	**0.005**	**66.00**
wl/wus 2	**Permanent**	**Wetland/Waters of the U.S.**	**2**	**0.010**	**10.00**
wl/wus 3	**Permanent**	**Wetland/Waters of the U.S.**	**2**	**0.021**	**66.00**
owus 5	**Permanent**	**Other Waters of the U.S.**	**3**	**0.011**	**51.30**
owus 5	Temporary	Other Waters of the U.S.	3	0.004	10.00
owus 6	**Permanent**	**Other Waters of the U.S.**	**3**	**0.007**	**13.50**
owus 7a	**Permanent**	Other Waters of the U.S.	4	0.015	85.00
owus 7b	**Permanent**	**Other Waters of the U.S.**	**4**	**0.027**	**225.00**
owus 7b	**Permanent**	Other Waters of the U.S.	4	0.004	70.00
owus 8	**Permanent**	**Other Waters of the U.S.**	**4**	**0.004**	**44.00**
owus 9	**Permanent**	**Other Waters of the U.S.**	**4**	**0.003**	**60.00**
owus 9	**Permanent**	Other Waters of the U.S.	4	0.001	20.00
wl/wus 5a	**Permanent**	Wetland/Waters of the U.S.	4	0.008	65.00
wl/wus 5b	**Permanent**	**Wetland/Waters of the U.S.**	**4**	**0.011**	**70.00**
wl/wus 5b	**Permanent**	Wetland/Waters of the U.S.	4	0.002	20.00
wl/wus 6	**Permanent**	**Wetland/Waters of the U.S.**	**4**	**0.011**	**44.00**
wl/wus 7	**Permanent**	**Wetland/Waters of the U.S.**	**4**	**0.003**	**24.00**
wl/wus 8	**Permanent**	**Wetland/Waters of the U.S.**	**4**	**0.004**	**60.00**
wl/wus 8	**Permanent**	Wetland/Waters of the U.S.	4	0.001	12.00
owus 10a	**Permanent**	**Other Waters of the U.S.**	**5**	**0.002**	**20.00**
owus 10b	**Permanent**	**Other Waters of the U.S.**	**5**	**0.005**	**80.00**
owus 10b	**Permanent**	Other Waters of the U.S.	5	0.002	20.00
owus 11	**Permanent**	Other Waters of the U.S.	5	0.003	10.00
wl/wus 9a	**Permanent**	**Wetland/Waters of the U.S.**	**5**	**0.002**	**20.00**
wl/wus 9b	**Permanent**	**Wetland/Waters of the U.S.**	**5**	**0.005**	**10.00**
wl/wus 9b	**Permanent**	Wetland/Waters of the U.S.	5	0.002	20.00
wl/wus 10	**Permanent**	**Wetland/Waters of the U.S.**	**5**	**0.002**	**20.00**
wl/wus 11	**Permanent**	Wetland/Waters of the U.S.	5	0.009	40.00

	Temporary	Permanent	Totat impact
Total ws	0.000	0.008	0.008
Total owus	0.009	0.089	0.098
Total wl/wus	0.048	0.091	0.139
Grand Total	0.057	0.188	0.245

N	Caltrans	State Route 4 (East) Widening Project Loveridge Road to State Route 160 0 1 2 Miles	Project Location Map

Figure 1

URS Corporation L:\Projects\State_Route_4_East_Widening_Project_26814914\MXD\Current Working Documents\Project Location_Map_Figure_1.mxd



N

Caltrans

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

0 5 10 15 20 Miles

Elsie N Gridley Mitigation Bank Service Area

Figure 2

L:\Projects\State_Route_4_East_Widening_Project_26814814\MXD\Current Working Documents\Waters_Report\Elsie_Mitigation_Bank_Service_Area_Fig_2.mxd

N

0 200 400 800

Feet

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

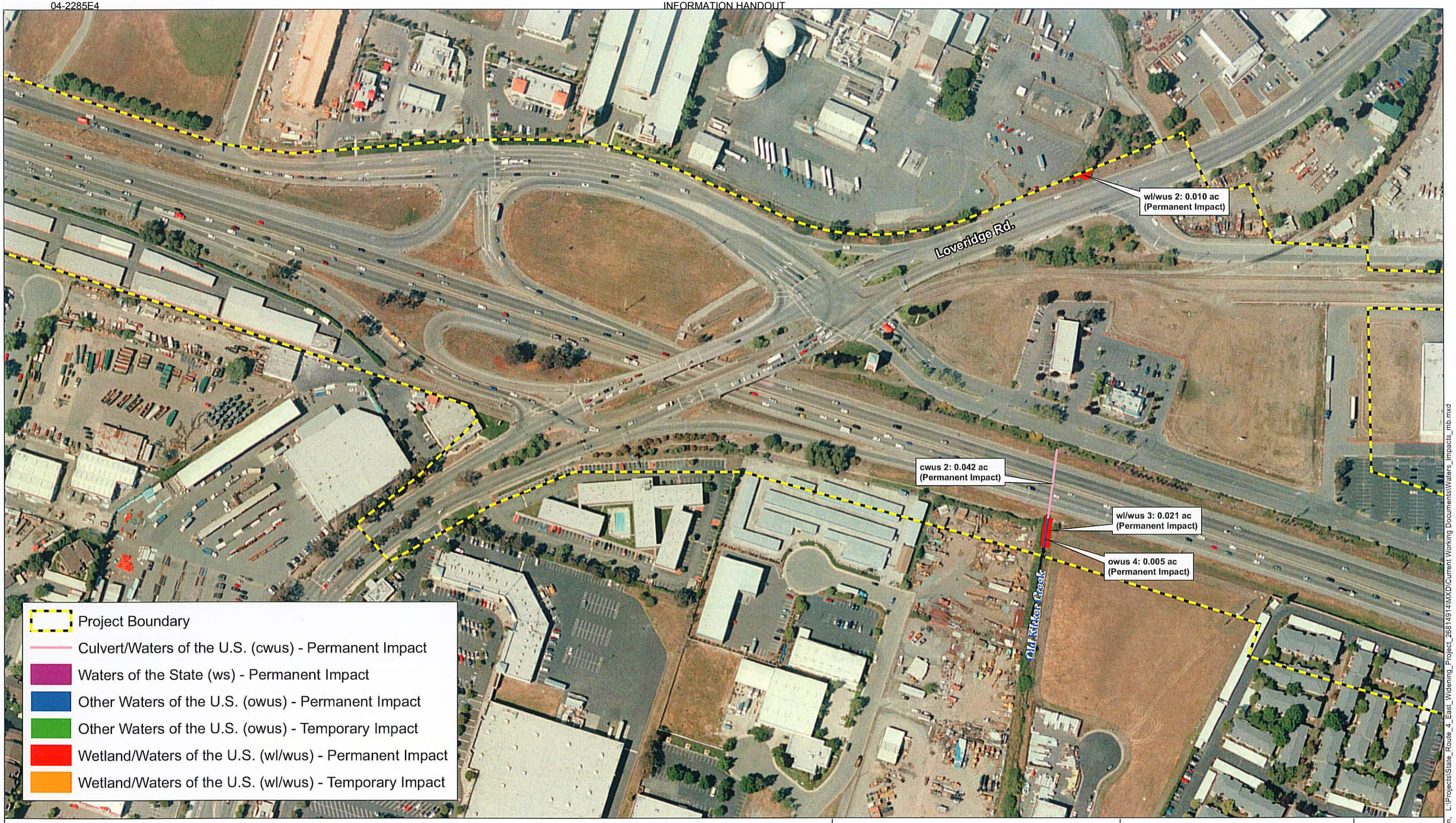
26814914

Impacts to
Jurisdictional Waters
(Rapanos Reach 1)

Sheet 1
of 5

December
2008

URS Corporation, J. Owen, L:\Projects\State_Route_4_East_Widening_Project_26814914\MXD\Current Working Documents\Waters_Impacts_mb.mxd



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0 200 400 800

Feet

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Impacts to
Jurisdictional Waters
(Rapanos Reach 2)

Sheet 2
of 5

December
2008

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N

0 200 400 800

Feet

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Impacts to Jurisdictional Waters (Rapanos Reach 3)

Sheet 3 of 5

December 2008

URS Corporation, J. Owen, L:\Projects\State_Route_4_East_Widening_Project_26814914\MXD\Current Working Documents\Waters_Impacts_mb.mxd

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0 200 400 800

Feet

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Impacts to Jurisdictional Waters (Rapanos Reach 4)

Sheet 4 of 5

December 2008

URS Corporation, J. Owen, L:\Projects\State_Route_4_East_Widening_Project_26814914\MXD\Current Working Documents\Waters_Impacts_mb.mxd

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0 200 400 800

Feet

State Route 4 (East) Widening Project Loveridge Road to State Route 160	Impacts to Jurisdictional Waters (Rapanos Reach 5)	Sheet 5 of 5
26814914		December 2008

URS Corporation, J. Owen, L:\Projects\State_Route_4_East_Widening_Project_26814914\MXD\Current Working Documents\Waters_Impacts_mb.mxd

STATE OF CALIFORNIA
ARNOLD SCHWARZENEGGER, Governor
04-2285E4
INFORMATION HANDOUT
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, 2010

BKF Engineers/Surveyors/Planners
4670 Willow Road, Suite 250
Pleasanton, California 94588

RECEIVED
JAN 22 2010
BkF ENGINEERS

Attention: Michael Poon

Subject: Underground Classification Nos. C080-013-10T thru C082-013-10T
State Route 4 Widening Project – Segment 2

Owner: Contra Costa Transportation Authority
3478 Buskirk Avenue, Suite 100
Pleasant Hill, California 94523

Mr. Poon:

The information provided to this office relative to the above project has been reviewed. On the basis of this analysis, Underground Classifications of "Potentially Gassy with Special Conditions" have been assigned to the tunnels identified on your submittal. Please forward the original Classifications to the Owner and retain true and correct copies of these Classifications for your records.

When the contractor who will be performing the work is selected, please deliver to them a true and correct copy of the Classification for posting at the job site and advise them to notify this office to schedule the mandated Prejob Conferences with the Division prior to commencing any activity associated with construction of the tunnels.

Please be informed that whenever an employee enters any bore or shaft being constructed under 30 inches in diameter, the Mining and Tunneling Unit then has immediate jurisdiction over that job. Please contact the Mining and Tunneling Unit prior to entering such spaces.

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

Sincerely,

John R. Leahy

John R. Leahy
Senior Engineer

cc: Richard Brockman
File

INFORMATION HANDOUT

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Underground Classification

C080-013-10T

CONTRA COSTA TRANSPORTATION AUTHORITY

(NAME OF TUNNEL OR MINE AND COMPANY NAME)

of 3478 Buskirk Avenue, Suite 100, Pleasant Hill, California 94523

(MAILING ADDRESS)

at STATE ROUTE 4 WIDENING PROJECT – SEGMENT 2

(LOCATION)

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

(CLASSIFICATION)

as required by the California Labor Code Section 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.

The 30-inch diameter by 112 feet long tunnel project located under Route 4 approximately 1,300 feet west of the intersection of Route 4 and Contra Loma Boulevard, Antioch, Contra Costa County.

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

Date January 20, 2010

(SENIOR ENGINEER)

John R. Leahy

 03 77089

INFORMATION HANDOUT

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Underground Classification

C081-013-10T

CONTRA COSTA TRANSPORTATION AUTHORITY
(NAME OF TUNNEL OR MINE AND COMPANY NAME)

of 3478 Buskirk Avenue, Suite 100, Pleasant Hill, California 94523
(MAILING ADDRESS)

at STATE ROUTE 4 WIDENING PROJECT – SEGMENT 2
(LOCATION)

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

as required by the California Labor Code Section 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.

The 144-inch diameter by 655 feet long tunnel project located under Route 4 approximately 750 feet east of the intersection of Route 4 and Contra Loma Boulevard, Antioch, Contra Costa County.

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

Date January 20, 2010

(SENIOR ENGINEER)

John R. Leahy

State of California INFORMATION HANDOUT

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Underground Classification

C082-013-10T

CONTRA COSTA TRANSPORTATION AUTHORITY

(NAME OF TUNNEL OR MINE AND COMPANY NAME)

of 3478 Buskirk Avenue, Suite 100, Pleasant Hill, California 94523

(MAILING ADDRESS)

at STATE ROUTE 4 WIDENING PROJECT – SEGMENT 2

(LOCATION)

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

(CLASSIFICATION)

as required by the California Labor Code Section 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.

The 30-inch diameter by 49 feet long tunnel project located under westbound Route 4 approximately 800 feet west of the intersection of Route 4 and Contra Loma Boulevard, Antioch, Contra Costa County.

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

Date January 20, 2010

(SENIOR ENGINEER)

John R. Leahy

INFORMATION HANDOUT

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Underground Classification

C061-013-11T

CONTRA COSTA TRANSPORTATION AUTHORITY
(NAME OF TUNNEL OR MINE AND COMPANY NAME)

of 3478 Buskirk Avenue, Suite 100, Pleasant Hill, CA 94523
(MAILING ADDRESS)

at STATE ROUTE 4 WIDENING PROJECT – SEGMENT 2
(LOCATION)

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

as required by the California Labor Code Section 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.

The 60-inch diameter by 25 feet deep drilled shaft located on the south side of Route 4, approximately 900 feet west of the intersection of Route 4 and Contra Loma Boulevard, Antioch, Contra Costa County.

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

Date January 12, 2011

Patterson
(SENIOR ENGINEER)
for John R. Leahy

INFORMATION HANDOUT

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Underground Classification

C062-013-11T

CONTRA COSTA TRANSPORTATION AUTHORITY
(NAME OF TUNNEL OR MINE AND COMPANY NAME)

of 3478 Buskirk Avenue, Suite 100, Pleasant Hill, CA 94523
(MAILING ADDRESS)

at STATE ROUTE 4 WIDENING PROJECT – SEGMENT 2
(LOCATION)

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

as required by the California Labor Code Section 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.

The 60-inch diameter by 25 feet deep drilled shaft located on the north side of Route 4, approximately 850 feet west of the intersection of Route 4 and Contra Loma Boulevard, Antioch, Contra Costa County.

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

Date January 12, 2011

Douglas Patterson
(SENIOR ENGINEER)
for John R. Leahy

INFORMATION HANDOUT

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Underground Classification

C063-013-11T

CONTRA COSTA TRANSPORTATION AUTHORITY

(NAME OF TUNNEL OR MINE AND COMPANY NAME)

of 3478 Buskirk Avenue, Suite 100, Pleasant Hill, CA 94523

(MAILING ADDRESS)

at STATE ROUTE 4 WIDENING PROJECT – SEGMENT 2

(LOCATION)

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

(CLASSIFICATION)

as required by the California Labor Code Section 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.

The two 90-inch diameter by 75 feet deep drilled shafts located in the median of Route 4, at the intersection of Route 4 and Contra Loma Boulevard, Antioch, Contra Costa County.

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

Date January 12, 2011

Daniel C. Patterson

(SENIOR ENGINEER)

for John R. Leahy

INFORMATION HANDOUT

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Underground Classification

C064-013-11T

CONTRA COSTA TRANSPORTATION AUTHORITY

(NAME OF TUNNEL OR MINE AND COMPANY NAME)

of 3478 Buskirk Avenue, Suite 100, Pleasant Hill, CA 94523

(MAILING ADDRESS)

at STATE ROUTE 4 WIDENING PROJECT – SEGMENT 2

(LOCATION)

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

(CLASSIFICATION)

as required by the California Labor Code Section 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.

The seven 78-inch diameter by 75 feet deep drilled shafts located in the median of Contra Loma Boulevard, at the intersection of Route 4 and Contra Loma Boulevard, Antioch, Contra Costa County.

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

Date January 12, 2011

Dorothea Patterson

(SENIOR ENGINEER)

for John R. Leahy

INFORMATION HANDOUT

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Underground Classification

C065-013-11T

CONTRA COSTA TRANSPORTATION AUTHORITY
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of 3478 Buskirk Avenue, Suite 100, Pleasant Hill, CA 94523
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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 thirteen 30-inch diameter by 30 feet deep drilled shafts located on the west side of Contra Loma Boulevard, approximately 850 feet south of the intersection of Route 4 and Contra Loma Boulevard, Antioch, Contra Costa County.

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

Date January 12, 2011

(SENIOR ENGINEER)

for John R. Leahy

INFORMATION HANDOUT

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Underground Classification

C066-013-11T (AMENDED)

CONTRA COSTA TRANSPORTATION AUTHORITY

(NAME OF TUNNEL OR MINE AND COMPANY NAME)

of 3478 Buskirk Avenue, Suite 100, Pleasant Hill, CA 94523

(MAILING ADDRESS)

at STATE ROUTE 4 WIDENING PROJECT – SEGMENT 2

(LOCATION)

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

(CLASSIFICATION)

as required by the California Labor Code Section 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.

The 60-inch diameter by 25 feet deep drilled shaft located on the north side of Route 4, approximately 1,150 feet east of the intersection of Route 4 and Contra Loma Boulevard, Antioch, Contra Costa County.

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

Date January 20, 2011

(SENIOR ENGINEER)

John R. Leahy

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, U.S. ARMY CORPS OF ENGINEERS
1455 MARKET STREET
SAN FRANCISCO, CALIFORNIA 94103-1398

Regulatory Division

SUBJECT: File Number 2002-26746S

JUL 24 2009

Ms. Susan Miller
Contra Costa Transportation Authority
3478 Buskirk Avenue, Suite 100
Pleasant Hill, California 94523

Dear Ms. Miller:

Enclosed is your signed copy of a Department of the Army permit (Enclosure 1) to widen and improve State Route 4 (SR-4) in the cities of Pittsburg and Antioch, Contra Costa County, California. The project would widen SR-4 from the existing four lanes to eight lanes with one High-Occupancy Vehicle lane (HOV) in each direction. The project also includes redesign and reconstruction of the interchanges within the project limits and the addition of auxiliary lanes between on-ramps and off-ramps.

Please complete the appropriate parts of "Project Status" form (Enclosure 2), and return it to this office as your work progresses. You are responsible for ensuring that the contractor or workers executing the activity authorized herein are knowledgeable of the terms and conditions of this authorization.

Should you have any questions regarding this matter, please call Hal Durio of our Regulatory Division at 415-503-6785. Please address all correspondence to the Regulatory Division and refer to the File Number at the head of this letter. If you would like to provide comments on our permit review process, please complete the Customer Survey Form available online at http://per2.nwp.usace.army.mil/survey.html.

Sincerely,

Jane M. Hicks

for Laurence M. Farrell
Lieutenant Colonel, U.S. Army
Commanding

Enclosures

Copies Furnished (w/encl 1 only):

US FWS, Sacramento, CA
CA DFG, Yountville, CA
CA RWQCB, Oakland, CA

PROJECT STATUS
INFORMATION HANDOUT

Please use the forms below to report the dates when you start and finish the work authorized by the enclosed permit. Also if you suspend work for an extended period of time, use the forms below to report the dates you suspended and resumedwork. The second copy is provided for your records. If you find that you cannot complete the work within the time granted by the permit, please apply for a time extension at least one month before your permit expires. If you materially change the plan or scope of the work, it will be necessary for you to submit new drawings and a request for a modification of your permit.

(cut as needed) ----------

Date:_____

NOTICE OF COMPLETION OF WORK under Department of the Army Permit No. 26746S
TO: District Engineer, US Army Corps of Engineers, RegulatoryDivision, 1455 Market Street, 16th Floor, San Francisco, CA 94103-1398

In compliance with the conditions of Permit No.26746S, this is to notify you that work was completed on _____.

Permittee: Ms. Susan Miller, Contra Costa Transportation Authority
Address: 3478 Buskirk Avenue, Suite 100, Pleasant Hill, CA 94523

(cut as needed) ----------

Date:_____

NOTICE OF RESUMPTION OF WORK under Department of the Army Permit No.26746S
TO: District Engineer, US Army Corps of Engineers, RegulatoryDivision, 1455 Market Street, 16th Floor, San Francisco, CA 94103-1398

In compliance with the conditions of Permit No.26746S, this is to notify you that work was completed on _____.

Permittee: Ms. Susan Miller, Contra Costa Transportation Authority
Address: 3478 Buskirk Avenue, Suite 100, Pleasant Hill, CA 94523

(cut as needed) ----------

Date:_____

NOTICE OF SUSPENSION OF WORK under Department of the Army Permit No.26746S
TO: District Engineer, US Army Corps of Engineers, RegulatoryDivision, 1455 Market Street, 16th Floor, San Francisco, CA 94103-1398

In compliance with the conditions of Permit No.26746S, this is to notify you that work was completed on _____.

Permittee: Ms. Susan Miller, Contra Costa Transportation Authority
Address: 3478 Buskirk Avenue, Suite 100, Pleasant Hill, CA 94523

(cut as needed) ----------

Date:_____

NOTICE OF COMMENCEMENT OF WORK under Department of the Army Permit No.26746S
TO: District Engineer, US Army Corps of Engineers, RegulatoryDivision, 1455 Market Street, 16th Floor, San Francisco, CA 94103-1398

In compliance with the conditions of Permit No.26746S, this is to notify you that work was completed on _____.

Permittee: Ms. Susan Miller, Contra Costa Transportation Authority
Address: 3478 Buskirk Avenue, Suite 100, Pleasant Hill, CA 94523

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, U.S. ARMY CORPS OF ENGINEERS
1455 MARKET STREET
SAN FRANCISCO, CALIFORNIA 94103-1398

DEPARTMENT OF THE ARMY PERMIT

PERMITTEE: Ms. Susan Miller, Contra Costa Transportation Authority

PERMIT NO.: 2002-26746S

ISSUING OFFICE: San Francisco District, U.S. Army Corps of Engineers

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 Contra Costa Transit Authority (CCTA) is authorized through this Department of the Army permit to perform the following work:

A. Fill 0.048 acre (100 lineal feet) of wetland supported by sediment within a concrete lined Kirker Creek located between the existing highway and some unused railroad tracks on the south side of SR-4.

B. Fill 0.021 acre of wetland and 0.005 acre of waters of the U.S. by placing approximately 66 lineal feet of Old Kirker Creek on the south side of SR-4 into a culvert.

C. Fill 0.010 acre of wetland on the north side of SR-4 at the northwest edge of Loveridge Road at Old Kirker Creek.

D. Fill 0.022 acre (75 lineal feet) of waters of U.S. to extend culverts on both the north and south side of SR-4 at the Los Medanos Wasteway.

E. Fill 0.060 acre of wetlands and 0.066 acre of waters of the U.S. at the West Antioch Creek Complex, which will place approximately 1040 lineal feet of waters and combined wetland into new culverts.

The project is approximately 6.1 miles long. The work will widen the highway from two lanes in each direction to four lanes in each direction, one HOV lane and three mixed flow lanes. Auxiliary lanes, which span between on ramps to off ramps, have been designed into the project to allow for longer distance and safer merging of traffic. Five main intersections, Loveridge Road, Somersville, Contra Loma Boulevard-L Street, Lone Tree Way-A Street and Hillcrest Avenue, will be redesigned to accommodate the highway widening and to improve traffic flow. The G Street interchange, which currently has an eastbound exit ramp and westbound entrance ramp will be reconstructed to remove highway access and accommodate highway widening. The Cavallo Road Undercrossing and the Roosevelt Lane Pedestrian Undercrossing will be widened. (Refer to "State Route 4 (East) Widening Project: Loveridge Road To State Route 160", dated November 10, 2003.)

Because of funding and construction restrictions, the project will be built in four segments and some of the segments will be divided into phases. The work is planned to be completed over the next 10 years, as funding becomes available. Segment 1 is scheduled to be constructed first, beginning in 2009. The timing and order of Segment 2, Segment 3, and Segment 4 will be determined as funding becomes available. The segments and phases of construction are described below.

Segment 1: The Loveridge Road segment, between PM 23.7 and PM 25.8, is scheduled to be constructed first. It will tie into the previously completed SR-4 project, which ended in Pittsburg at approximately PM

24.2 (where Kirker Creek passes under SR-4). The Loveridge Road segment ends at PM 25.8, slightly east of the Los Medanos Wasteway. (For details of Segment 1, refer to "Project Plans for Construction on State Highway in Contra Costa County, in Pittsburg and Antioch from 0.9 KM West of Loveridge Road Overcrossing to 0.3 KM West of Somersville Road Undercrossing", and dated September 17, 2008).

Segment 2: The second segment, the Somersville Road Undercrossing segment, extends eastward from where the Loveridge Road segment ends and is between PM R25.61 and PM R26.62. (For details of the Somersville Road Undercrossing phase, refer to "Project Plans for Construction on State Highway in Contra Costa County, in Antioch and Pittsburg from 0.7 Mile West of Somersville Road Undercrossing to 0.5 Mile East of Somersville Road Undercrossing", dated July 15, 2008).

Segment 3: Segment 3 begins at PM 26.5 and ends at PM 27.5. The Contra Loma Boulevard-L Street Interchange will be rebuilt to accommodate widening of Contra Loma Boulevard and L Street to a four lane facility with room for left turn lanes. SR-4 will be widened and elevated 3 feet to allow more overhead over Contra Loma Boulevard-L Street, and the on and off ramps will be redesigned, adjacent to where West Antioch Creek crosses under SR-4.

The G Street Overcrossing will be reconstructed along with some of the local street intersections to accommodate SR-4 widening, improve local traffic flow and remove the on and off ramps so there will be no SR-4 access from G Street. (For details of Segment 3, refer to the project plans entitled "Project Plans for Construction of State Highway in Contra Costa County, in Antioch from 0.3 Mile West of Contra Loma Boulevard Undercrossing to 0.2 Mile East of G Street Overcrossing" and dated April 22, 2009.)

Segment 4: Segment 4 begins at the end of Segment 3 and extends to PM 29.7, near the SR4/Route 160 Interchange. Segment 4 is divided into 2 phases, which CCTA refers to as Phase 4a and Phase 4b. Phase 4a will rebuild the SR-4/Lone Tree Way-A Street Interchange and the Cavallo Road Undercrossing. Phase 4b will reconfigure the SR-4/Hillcrest Avenue Interchange and widen the highway to the end of the project limits. (For details of Segment 4A, see the project plans entitled "Project Plans for Construction on State Highway in Contra Costa County, in Antioch from 0.61 Miles West of "A" Street Undercrossing to 0.10 Miles East of Hillcrest Avenue Overcrossing" and dated January 16, 2009. For details of Segment 4B, see the project plans entitled "Project Plans for Construction on State Highway in Contra Costa County, in Antioch from 0.33 Miles West of Hillcrest Avenue Overcrossing to 0.98 Miles East of Hillcrest Avenue Overcrossing" and dated April 17, 2009.)

PROJECT LOCATION: This project is located in Pittsburg and Antioch in Contra Costa County, California. The project is on State Route 4 (SR-4) starting 0.84 mile west of Loveridge Road (Post Mile 23.7) and ending approximately 0.7 mile east of Hillcrest Avenue (Post Mile 29.7).

PERMIT CONDITIONS

GENERAL CONDITIONS:

1. The time limit for completing the work authorized ends on July 15, 2019. 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. If 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 if it contains such conditions.

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 (FWS) BO dated June 13, 2005 (151422SWR04SR9275:ES) (as amended by Amendment to Biological Opinion for the State Route 4 Widening Project dated April 15, 2008 (Service File No. 1-1-05-F-0158)) contains mandatory terms and conditions to implement the reasonable and prudent measures that are associated with "incidental take" that is also specified in the BO. 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, 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, where a take of the listed species occurs, will constitute an unauthorized take and it will also constitute non-compliance with this Corps permit. The FWS is the appropriate authority to determine compliance with the terms and conditions of its BO and with the ESA.

2. CCTA will mitigate for the 0.139 acre of permanent wetland loss within the three segments of the project through the purchase of 0.14 acre of wetland credits from an approved wetland creation mitigation bank within the service area of the Contra Costa County SR-4 Widening Project.

3. CCTA may not begin construction on any part of the SR-4 project that will impact Corps jurisdiction until the Corps has received copies of receipts from the mitigation bank purchases (see Special Conditions 2 and above) and has approved these purchases in writing.

4. For permanent impact to 0.093 acre of other waters of the United States, CCTA shall use standard BMP (best management practices) erosion control standards on all disturbed ground associated with Corps jurisdiction, re-grade the soil surface to conform to existing grades, and plant the disturbed areas with an appropriate native species ground cover seed mix.

5. CCTA will provide the Corps with the final project plans for all project segments prior to start of work. CCTA will apply to the Corps for a permit modification before any work in waters of the U.S. if either of the following conditions arise: a) the final project plans for any segment are significantly different than the above permitted project description; or b) if impacts to waters of the U.S. are greater for any segment than described in the above permitted project description.

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.

Adam J. Miller 7/24/2009

(PERMITTEE) (DATE)

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

Jane M. Hicks 7/24/09

Cr Laurence M. Farrell (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)

04-2285E4

State Water Resources Control Board

INFORMATION HANDOUT

Executive Office

Linda S. Adams
Secretary for Environmental Protection

Charles R. Hoppin, Chairman
1001 I Street • Sacramento, California 95814 • (916) 341-5615
Mailing Address: P.O. Box 100 • Sacramento, California • 95812-0100
Fax (916) 341-5621 • http://www.waterboards.ca.gov

Arnold Schwarzenegger
Governor

JUL 0 6 2009

Ms. Susan Miller
Contra Costa Transportation Authority
3478 Buskirk Ave., Suite 100
Pleasant Hill, CA 94523

Dear Ms. Miller:

CLEAN WATER ACT (CWA) SECTION 401 WATER QUALITY CERTIFICATION FOR THE STATE ROUTE 4 WIDENING PROJECT (PROJECT), CITIES OF PITTSBURG AND ANTIOCH, CONTRA COSTA COUNTY (CORPS FILE #2002-26746N)

On April 11, 2008, the San Francisco Bay Regional Water Quality Control Board (San Francisco Bay Water Board) received an application from the Contra Costa Transportation Authority (Authority) for CWA section 401 Water Quality Certification (Certification) for Phase 1 of the Project. San Francisco Bay Water Board staff reviewed the information submitted by the Authority describing the project activities and the proposed water quality protection measures.

On February 11, 2009, the project file was forwarded to the State Water Resources Control Board (State Water Board) because the project was expanded to include Phase 2, which extends into the jurisdiction of the Central Valley Regional Water Quality Control Board (Central Valley Water Board). The State Water Board issues or denies certifications that affect waters within multiple Regional Water Boards. State Water Board staff consulted with the San Francisco Bay Water Board and Central Valley Water Board, as well as the U.S. Army Corps of Engineers.

Pursuant to Title 23, section 3838 of the California Code of Regulations, I hereby make the Certification determination described in the Enclosure for these projects. Attachments A through D to the Enclosure are also a part of this Certification.

If you require further assistance, please contact Amna Hawatky, the staff person most knowledgeable on the subject, at (916) 341-5483 (ahawatky@waterboards.ca.gov). You may also contact Bill Orme, Chief of the 401 Certification and Wetlands Protection Unit, at (916) 341-5464 (borme@waterboards.ca.gov).

Sincerely,

Dorothy Rice

Dorothy Rice
Executive Director

Enclosure

cc: (See next page)

cc: (all with Enclosure)

Mr. Jan Novak
U.R.S. Corporation
1333 Broadway, Suite 800
Oakland, CA 94612
Jan_Novak@URSCorp.com

Mr. David Smith
Wetlands Regulatory Office
U.S. Environmental Protection Agency, Region 9
75 Hawthorne St.
San Francisco, CA 94105
Smith.DavidW@epamail.epa.gov

Ms. Jane Hicks
Regulatory Branch
San Francisco District
U.S. Army Corps of Engineers
1455 Market Street
San Francisco, CA 94103-1398
jane.m.hicks@usace.army.mil

Mr. Bruce H. Wolfe
San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612
BWolfe@waterboards.ca.gov

Ms. Pamela Creedon
Central Valley Regional Water Quality Control Board
11020 Sun Center Drive, #200
Rancho Cordova, CA 95670-6114
PCreedon@waterboards.ca.gov

Ms. Melissa Escaron
California Department of Fish and Game
P.O. Box 47
Yountville, CA 94599
MESCARON@dfg.ca.gov

cc: (See continuation page)

cc: (all with Enclosure)

Mr. Hardeep Takhar
California Department of Transportation
111 Grand Avenue
Oakland, CA 94612
Hardeep_S_Takhar@dot.ca.gov

Mr. Ryan Olah
U.S. Fish and Wildlife Service
2800 Cottage Way, Room W-2605
Sacramento, CA 95825
ryan_olah@fws.gov

INFORMATION HANDOUT

State Water Resources Control Board

Executive Office

Charles R. Hoppin, Chairman
1001 I Street • Sacramento, California 95814 • (916) 341-5603
Mailing Address: P.O. Box 100 • Sacramento, California • 95812-0100
Fax (916) 341-5621 • http://www.waterboards.ca.gov

Linda S. Adams
Secretary for Environmental Protection

Arnold Schwarzenegger
Governor

ACTION ON REQUEST FOR CLEAN WATER ACT (CWA) SECTION 401 WATER QUALITY CERTIFICATION FOR THE STATE ROUTE 4 (SR4) WIDENING PROJECT, CONTRA COSTA COUNTY (Corps File No. 2002-26746N)

PROJECT: CWA Section 401 Certification SR4 Widening Project, Contra Costa County

APPLICANT: Ms. Susan Miller
Contra Costa Transportation Authority
3478 Buskirk Avenue, Suite 100
Pleasant Hill, CA 94523

This Order responds to your request for a 401 Water Quality Certification (Certification) for the Contra Costa County Transportation Authority's (Authority) SR4 Widening Project (Project). The Authority has applied for a U.S. Army Corps of Engineers (Corps) Individual Permit (Corps No. 2002-26746N) pursuant to section 404 of the CWA (33 U.S.C. 1344) for the proposed Project. The Authority has applied to the State Water Resources Control Board (State Water Board) for a Certification that the Project will not violate State water quality standards.

ACTION:

- ☒ Order for Standard Certification
- ☐ Order for Denial of Certification
- ☐ Order for an Amendment of a Technically Conditioned Certification
- ☐ Order for Waiver of Waste Discharge Requirements

PROJECT DESCRIPTION:

The Authority proposes to widen SR4 in the cities of Pittsburg and Antioch, through Contra Costa County. The Project is located 0.8 miles west of Loveridge Road, and approximately 0.7 miles east of Hillcrest Avenue. This Certification applies to the entirety of the Project from Loveridge Road to State Route 160.

The Project's purpose is to provide traffic congestion relief and meet future traffic demand through the year 2030. Widening activities consist of converting the existing four lane highway to an eight lane facility (three lanes plus a commuter lane). The Project has been designed with additional space within the SR4 median to accommodate the possibility of future public transit improvements.

The primary receiving waters in the Project area are Old Kirker Creek, Kirker Creek, the Los Medanos Wasteway, and West Antioch Creek. All drain to Suisun Bay, approximately four miles north of SR4. Work in jurisdictional waters includes:

- Replacement of a box culvert at Old Kirker Creek. The existing Old Kirker Creek concrete box culvert will be replaced with a higher capacity double box culvert and

extended approximately 38 feet upstream. Approximately 28 linear feet of riprap will be placed upstream of the new culvert;

- In-kind replacement and extension of box culverts at Kirker Creek and the Los Medanos Wasteway. Rock slope protection will be placed at the outlets and inlets of both culverts. Kirker Creek currently crosses beneath SR4 through a 72 inch concrete pipe and double box culvert, and daylights north of Loveridge Road; this system will be replaced in-kind and extended to the south by approximately 98 linear feet with an additional 82 linear feet of riprap; and
- Relocation of a 36 inch sanitary sewer line crossing Old Kirker Creek. The existing line crosses the creek south of the upstream end of the existing culvert and will be relocated south of the existing SR4 crossing.

Additional work includes:

- Widening of the Roosevelt Lane pedestrian undercrossing and the Cavallo Road undercrossings;
- Reconstruction of the Loveridge Road, Somersville Road, Contra Loma; Boulevard-L Street, Lone Tree Way- A Street, and Hillcrest Avenue interchanges. A sixth intersection at G street would be redesigned to accommodate a new SR4 overstructure;
- Replacement of the Century Boulevard undercrossing structure; and
- Shifting of SR4 frontage roads California Avenue and North Park Boulevard to the north to accommodate widening and interchange improvement activities.

STANDARD CONDITIONS:

1. 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 and Article 6 (commencing with section 3867) of Chapter 28, Title 23 of the California Code of Regulations.

2. This Certification action is not intended and shall not be construed to apply to 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 subsection 3855(b) of Chapter 28, Title 23 of the California Code of Regulations, and the application specifically identified that a FERC license or amendment to a FERC license for a hydroelectric facility was being sought.

3. This Certification is conditioned upon total payment of any fee required under Chapter 28, Title 23 of the California Code of Regulations and owed by the applicant.

ADDITIONAL CONDITIONS:

1. Best Management Practices (BMPs)

a. Appropriate BMPs shall be implemented throughout the project activities to help minimize sediment disturbance and suspension within the water. All BMP materials shall be on site and ready for use prior to project implementation. BMPs shall be in full compliance with all specifications governing the proper design, installation, operation, and maintenance of such management practices.

b. No equipment shall be operated in areas of flowing or standing water; no fueling, cleaning or maintenance of vehicles or equipment shall take place within jurisdictional waters or within any areas where an accidental discharge may occur.

c. Activities shall not cause turbidity increases in surface water to exceed:

(a) where natural turbidity is between 0 and 5 Nephelometric Turbidity Units (NTUs), increases shall not exceed 1 NTU;

(b) where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent;

(c) where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTUs;

(d) where natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent.

Except that these limits will be eased during in-water working periods to allow a turbidity increase of 15 NTU over background turbidity as measured in surface waters 300 feet downstream from the working area. In determining compliance with the above limits, appropriate averaging periods may be applied provided that beneficial uses will be fully protected.

d. Activities shall not cause settleable matter to exceed 0.1 ml/l in surface waters as measured in surface waters 300 feet downstream from the project.

e. In the event that project activities occur in surface waters, result in the deposition of soil materials, or create a visible plume, the following monitoring shall be conducted immediately upstream and 300 feet downstream of the work site and the results reported to the State Water Board:

Parameter	Unit	Type of Sample	Frequency of Sample
Turbidity	NTU	Grab	Every 4 hours during work in water
Settleable Material	ml/l	Grab	Same as above.

f. The Authority shall notify the State Water Board immediately if the above criteria are exceeded.

g. Dewatering and diversion activities shall be executed as described in the "Dewatering and Non-Storm Water Discharge Control Plan" revised May 9, 2009. Any deviation from the Project plans shall require State Water Board approval.

h. Stream diversion activities shall occur only between April 1st and October 15th.

i. Prior to dewatering and diversion activities, the Authority shall ensure a biologist is on site to ensure no sensitive aquatic species are stranded in areas of dewatering and diversion.

j. The Authority shall immediately remove stream diversion structures when diversion is no longer necessary. All diverted streams shall be returned to their original condition.

k. All on- and off-site biofiltration swales shall incorporate a soil amendment to enhance their infiltrative capacity and be maintained on a regular basis to ensure optimal treatment functionality.

l. The off-site stormwater treatment project shall be completed at or before Project completion.

m. No debris, soil, silt, sand, cement, concrete, or washings thereof, other construction related materials or wastes, oil or petroleum products or other organic or earthen material shall be allowed to enter into or be placed where it may be washed by rainfall or runoff into jurisdictional wetlands or waters. Upon completion of construction, all construction-related materials shall be removed from the work area and any areas adjacent to the work area.

n. Disturbance or removal of vegetation shall be minimized. The site shall be stabilized utilizing BMPs, including the successful reestablishment of native vegetation, to enhance wildlife habitat values, and to prevent and control erosion and sedimentation. Revegetation work is not confined to the period of April 1st to October 15, but must be completed in the same calendar year.

2. Monitoring Reports

a. Monitoring reports will be submitted by November 1st of each monitoring year to the 401 Program Managers of the State Water Board and the appropriate Regional Water Board(s) documenting work undertaken the previous year(s). The reports, at a minimum, shall include:

i. Names, titles, and affiliations of all persons who prepared the report and conducted field work;
ii. Copies of Corps permits, any special Conditions, and subsequent Letters of Memorandum;
iii. Analysis of all quantitative monitoring data;
iv. Electronic or color copies of all photo-documentation;
v. Maps showing the monitoring area, vegetation survey sites, and photo-documentation points; and
vi. Remedial action recommendations, as needed.

b. Monitoring reports shall be submitted for five years. Reports shall be directed to: Program Manager, Certification and Wetlands Program at the following State and appropriate Regional Water Board office(s):

State Water Resources Control Board
Division of Water Quality
1001 "I" Street, 15th Floor
Sacramento, CA 95814

San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

Central Valley Regional Water Quality Control Board
Sacramento Office
11020 Sun Center Drive, Suite 200
Rancho Cordova, CA 95670-6114

c. The Authority shall notify the State Water Board within 24 hours of any noncompliance that may impact the beneficial uses of waters of the State. The notification shall include the volume and type of materials discharged and recovered, measures used to contain the discharge, and measures used to prevent future discharges.

ADMINISTRATIVE CONDITIONS:

1. The Authority shall submit to the State Water Board a Bill of Sale of 0.944 acres of seasonal freshwater wetland mitigation credits from Elsie Gridley Mitigation Bank.

2. The Authority shall adhere to the conditions imposed by the Project Individual Permit, issued to the Authority by the Corps.

3. A copy of the Storm Water Pollution Prevention Plan (SWPPP) shall be provided to the State Water Board at least 30 days prior to the start of construction. 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.

4. The Authority shall maintain a copy of this Certification and supporting documentation (Attachments) at the Project site during construction for review by site personnel and agencies. All personnel (employees, contractors, and subcontractors) performing work on the proposed project shall be adequately informed and trained regarding the conditions of this Certification.

5. The Authority shall grant State Water Board and Regional Water Board staff, or an authorized representative, upon presentation of credentials and other documents as may be required by law, permission to enter the project site at reasonable times, to ensure compliance with the terms and conditions of this Certification and/or to determine the impacts the project may have on the waters of the State.

6. In the event of any violation or threatened violation of the conditions of this Certification, the violation or threatened violation must be subject to any remedies, penalties, processes, or sanctions as provided for under State law.

7. The State Water Board reserves the right to suspend, cancel, or modify and reissue this Certification, after providing notice to the Authority and/or responsible Project Site Supervisor, if the State Water Board determines that the project fails to comply with any of the terms or conditions of the Certification.

8. Designs and details for all post construction BMPs shall be submitted to the State Water Board for review and approval. Post construction BMPs shall not be constructed until State Water Board staff has approved the designs for the BMPs.

9. The activity(ies) described in the 401 Certification application shall not result in the taking of any State endangered species, threatened species, or candidate species, or the habitat of such a species unless the activity is authorized by the California Department of Fish and Game pursuant to a permit, memorandum of understanding, or other document or program in accordance with Fish and Game Code sections 2081, 2081.1, or 2086.

10. All protective measures included in the Biological Opinion (#1-1-05-F-0158 and amendment issued on April 15, 2008) issued by the United States Fish and Wildlife Service on June 13, 2005 and the 1602 Lake and Streambed Alteration Agreement (#1600-2008-0217-3) issued by the California Department of Fish and Game on November 6, 2008 for this project will be implemented. All protective measures included in the 1602 Lake and Streambed Alteration Agreement for the Somersville to State Route 160 segment will be implemented. A copy of the 1602 Lake and Streambed Alteration Agreement for the Somersville to State Route 160 shall be provided to the State Water Board prior to any discharge to waters of the State.

11. Any significant modifications to the Mitigation and Monitoring Report, June 2009 (Attachment D) must be approved by the State Water Board before implementation.

12. This Certification does not obviate the need to obtain other permits that may be required by federal, state, or local authorities.

13. Failure to comply with any condition of this Certification shall constitute a violation of the CWA and the Porter-Cologne Water Quality Control Act. Any such certification previously granted shall immediately be revoked, and any or all discharges shall cease. The permittee may then be subject to administrative and/or civil liability pursuant to Water Code section 13385.

14. Certification is conditioned upon total payment of the full fee required in State regulations (23 CCR section 3833). State Water Board staff received two checks one on March 1, 2009 ($943.00) and another April 4, 2009 ($347.00) for fees associated with this Project.

STATE WATER BOARD CONTACT PERSON:

If you have any questions, please contact State Water Board Environmental Scientist Amna Hawatky at (916) 341-5483 (**ahawatky@waterboards.ca.gov**). You may also contact Bill Orme, Chief of the 401 Certification and Wetlands Protection Unit, at (916) 341-5464 (**borme@waterboards.ca.gov**).

WATER QUALITY CERTIFICATION:

I hereby issue an order certifying that any discharge from the referenced project will comply with the applicable provisions of Clean Water Act 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), if all of the conditions listed in the certification action are met. This discharge is also regulated pursuant to State Water Board Quality Order No. 2003-0017-DWQ, which authorizes this certification to serve as Waste Discharge Requirements pursuant to the Porter-Cologne Water Quality Control Act (Wat. Code, § 13000 et seq.).

Except insofar as may be modified by any preceding conditions, all certification actions are contingent on: (a) the discharge being limited and all proposed mitigation being completed in strict compliance with the Mitigation and Monitoring Report for Jurisdictional Waters of the U.S, Project Information Sheet (Attachment B), and (b) compliance with all applicable requirements of the Regional Water Board's Water Quality Control Plan.

Dorothy Rice, Executive Director
State Water Resources Control Board

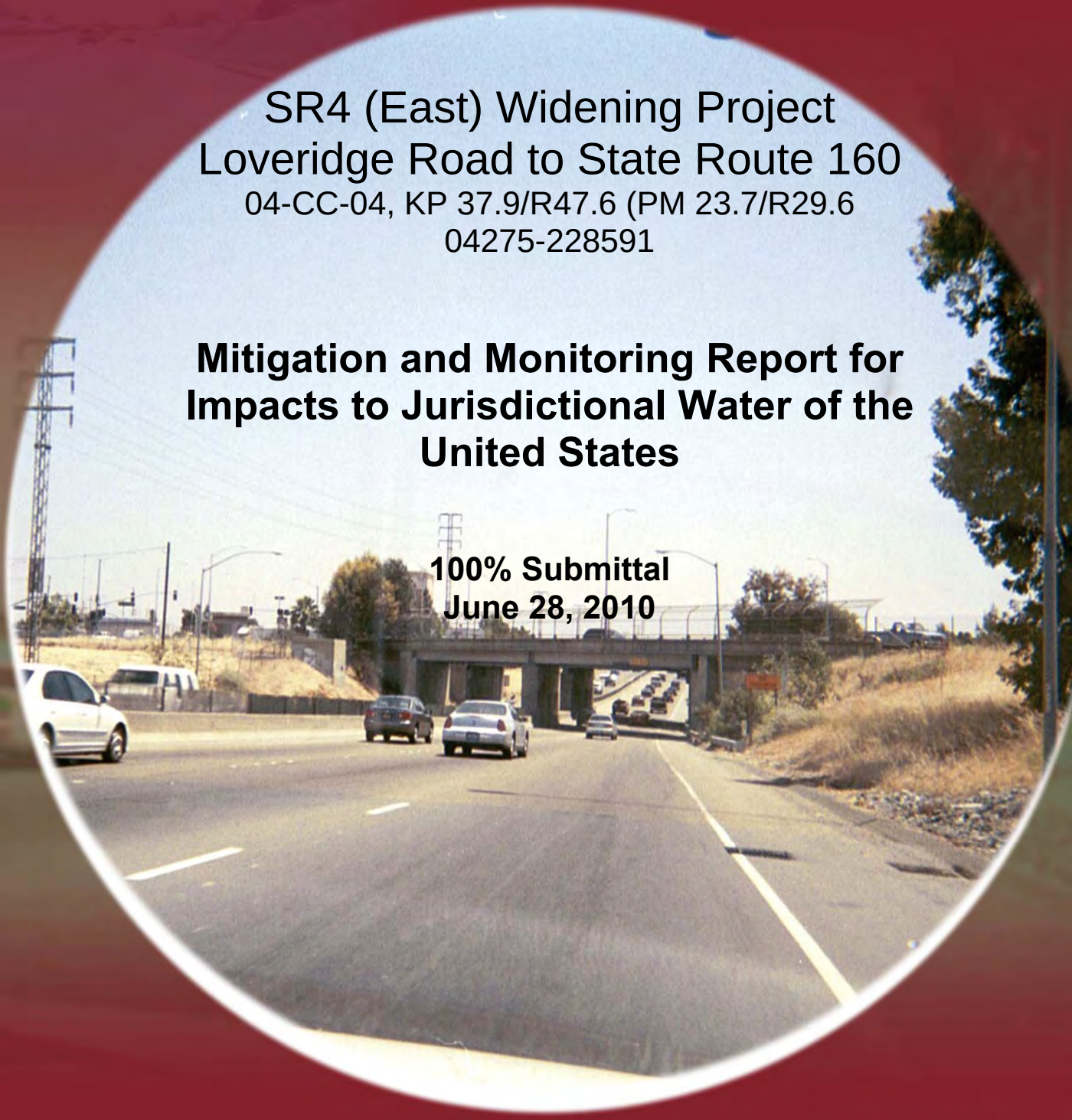
7.06.09
Date

Attachments:
A. Signatory Requirements
B. Project Information Sheet
C. Project Impacts and Mitigation
D. Mitigation and Monitoring Report

CONTRA COSTA TRANSPORTATION AUTHORITY

California Department of Transportation

Caltrans



SR4 (East) Widening Project
Loveridge Road to State Route 160

04-CC-04, KP 37.9/R47.6 (PM 23.7/R29.6
04275-228591

Mitigation and Monitoring Report for Impacts to Jurisdictional Water of the United States

100% Submittal
June 28, 2010

URS

TABLE OF CONTENTS

1. Section 1 Introduction 1-1

2. Section 2 Project Background 2-1

2.1 PROJECT DESCRIPTION 2-1
2.2 PROJECT AREA 2-2

3. Section 3 Environmental Setting 3-1

3.1 DESCRIPTION OF BIOLOGICAL COMMUNITIES 3-1
3.1.1 Freshwater Emergent Wetland 3-1
3.1.2 Non-Native Grassland 3-1
3.1.3 Ruderal/Disturbed and Croplands 3-1
3.1.4 Windrow 3-1

4. Section 4 Impacts 4-1

4.1 SUMMARY OF IMPACTS TO WETLANDS AND OTHER WATERS OF THE U.S. 4-1
4.1.1 Wetland Regulations 4-1
4.1.2 Affected Environment 4-1

5. Section 5 Avoidance and Minimization 5-1

5.1 WETLANDS AND OTHER WATERS OF THE U.S. and the state 5-1

6. Section 6 Mitigation Goals 6-1

6.1 Wetland Mitigation Goals 6-1
6.1.1 Avoidance and Minimization of Impacts to Wetlands and OWUS 6-1
6.1.2 Provide Compensation for Permanent Impacts to Jurisdictional Waters 6-1

7. Section 7 Proposed Off–Site Mitigation 7-1

7.1 SELECTION OF OFF-SITE MITIGATION 7-1
7.2 Proposed Off-Site Mitigation For Jurisdictional Waters 7-2

8. Section 8 Mitigation Implementation 8-1

8.1 PRESERVATION OF HABITAT AT ELSIE N. GRIDLEY MITIGATION BANK 8-1

9. Section 9 Monitoring 9-1

9.1 Off-Site Mitigation Monitoring 9-1

TABLE OF CONTENTS

10. Section 10 Contingency Plan 10-1

10.1 Jurisdictional Waters Contingency plans 10-1
10.1.1 Wildlands, Inc. Holland Tract Preserve 10-1

11. Section 11 References 11-1

Tables

4-1 Temporary Impacts to Wetlands and Other Waters of the U.S. from Proposed SR4 Widening Project

4-2 Permanent Impacts to Wetlands and Other Waters of the U.S. from Proposed SR4 Widening Project

8-1 Summary of Mitigation Opportunities Considered in Contra Costa County for the Proposed SR4 Widening Project

10-1 Performance Criteria for On-Site Wetland Restoration

Figures

1 Project Location Area Map

2 Elsie N. Gridley Mitigation Bank Service Area

3 Holland Tract Preserve Future Mitigation Bank Location

Sheets

1-5 Impacts to Jurisdictional Waters

Appendix A

Impacts to Jurisdictional Features

Appendix B

Drainage Plans for Kirker Creek

TABLE OF CONTENTS

Acronyms and Abbreviations

Caltrans	California Department of Transportation
CCTA	Contra Costa Transportation Authority
CHP	California Highway Patrol
CRLF	California Red-Legged Frog
CWUS	Culvert waters of the U.S.
ESA fencing	Environmentally Sensitive Area fencing
FHWA	Federal Highway Administration
HOV	High Occupancy Vehicle
Km	Kilometers
OWUS	Other waters of the U.S.
OWUS	Other Waters of the U.S.
SR4	State Route 4
USACE	U.S. Army Corps of Engineers
WL	Wetlands
WL/WUS	Wetland Waters
WS	Waters of the State (California)
WUS	Waters of the United States

SECTIONONE Introduction

This document describes the proposed off-site mitigation for impacts to jurisdictional wetlands and other waters of the U.S. from potential impacts of the proposed State Route 4 Widening Project. The purpose of the proposed project is to reduce existing congestion, improve traffic operations, encourage high occupancy vehicle (HOV) use, and accommodate anticipated travel demand through the year 2030 by providing sufficient right-of-way to accommodate multi-modal transportation.

The project is estimated to permanently impact 0.139 acre of wetlands/waters (WL/WUS), 0.089 acre of other waters of the U.S. (OWUS) and 0.008 acre of waters of the state (WS). In addition, there will be temporary impacts to 0.009 acre of OWUS, as well as to 0.140 acre of culvert waters of the U.S. (CWUS). This mitigation report provides the project background as well as compensation possibilities that are appropriate for the losses of jurisdictional WL/WUS, OWUS, and WS.

2.1 PROJECT DESCRIPTION

The California Department of Transportation (Caltrans), in cooperation with the Federal Highway Administration (FHWA) and Contra Costa Transportation Authority (CCTA), proposes to widen State Route 4 (SR4), its interchanges, and affected local roadways from approximately 0.84 mile west of Loveridge Road to approximately 0.70 mile east of Hillcrest Avenue. The SR4 corridor is currently facing severe problems which include traffic congestion and inefficient energy use, as well as deteriorating air quality and traffic safety. Correcting conditions on SR4 is a necessary component of the overall program to improve transportation through Contra Costa County. The project will require reconstruction of all interchanges within the project limits and would include the addition of auxiliary lanes between interchanges to facilitate on and off traffic movements.

The proposed project will consist of the following actions:

- Widen SR4 from the existing four lanes to eight lanes. The widened freeway would consist of an HOV lane and three mixed-flow lanes in each direction.
- Preserve sufficient width in the SR4 median through the Loveridge Road Interchange to accommodate the possibility of future public transit improvements.
- Eliminate partial interchange at G Street and reconstruct the overcrossing.
- Add auxiliary lanes on SR4 between interchanges from the on-ramps to the off-ramps.
- Provide capability to create ramp metering facilities, including high occupancy vehicle (HOV) preferential lanes and California Highway Patrol (CHP) enforcement areas, where feasible.
- Widen Roosevelt Lane pedestrian undercrossing and the Cavallo Road undercrossing.
- Extend drainage facilities that cross SR4 in the project area.
- Reconstruct SR4 interchanges to accommodate the freeway widening at:
    - Loveridge Road
    - Somersville Road
    - Contra Loma Boulevard- L Street
    - Lone Tree Way –A Street
    - Hillcrest Avenue

The proposed project would conform to improvements currently being constructed to the west of the project area as part of the Route 4/ Railroad Avenue Interchange Project (by others) as well as improvements proposed to the east of the project as part of the SR4 Bypass Project (by others).

Caltrans is undertaking final design of the first segment of the project, Loveridge Road to Somersville Road. Considerations for the remainder of the SR4 East corridor from Somersville Road to the eastern project limit (0.70 mile east of Hillcrest Avenue) is based on project design plans.

2.2 PROJECT AREA

The project area is defined as the area that may be disturbed during project construction, located on the Route 4 corridor in Contra Costa County, 0.84 mile west of Loveridge Road (PM 23.7) to approximately 0.7 mile east of Hillcrest Avenue (PM 29.7). The SR4 project area is slightly more than 6.1 miles in length (9.8 kilometers). The project area extends slightly beyond the anticipated 8-lane area of the proposed highway, to accommodate for construction equipment. The proposed project location is depicted in Figure 1.

N

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

0 0.5 1 1.5 2 Miles

Project Location Map

Figure 1

URS Corporation L:\Projects\State_Route_4_East_Widening_Project_26814914\WXD\Current Working Documents\Project Location_Map_Figure_1.mxd

3.1 DESCRIPTION OF BIOLOGICAL COMMUNITIES

The project corridor includes the SR4 roadway from approximately 1.33 kilometers (km) west of Loveridge Road to East Antioch in Contra Costa County. The project corridor encompasses approximately 6.1 miles (9.8 km) of highway and ranges in elevation from 12 feet (3.66 meters) to 35 feet (10.67 meters) above sea level. Current land use in the project area is primarily commercial, but also includes residential developments and some open agricultural fields.

The project corridor traverses four vegetation communities and a number of jurisdictional waters. Biological communities identified within the project corridor include freshwater emergent wetland, non-native grassland, ruderal/disturbed, and windrow. A brief description of each community and its associated wildlife assemblage is provided below.

3.1.1 Freshwater Emergent Wetland

Freshwater marshes are found throughout California and are among the most productive wildlife habitats within the state. These marshes are found in various land depressions or at the edges of rivers and lakes. They provide food, cover, and water for more than 160 species of birds, and a variety of mammals, reptiles, and amphibians. California Red Legged Frogs (*Rana aurora draytonii*) are among the species that could utilize these freshwater communities in the greater project area.

3.1.2 Non-Native Grassland

This community, primarily composed of non-native grasslands, occurs intermittently along SR4. It is typically found on fine-textured, usually clay soils, which may range from moist, possibly even waterlogged, during the rainy season to very dry during the dry season. Grasslands provide foraging and nesting habitat for a wide variety of wildlife species including raptors, small mammals, amphibians and reptiles.

3.1.3 Ruderal/Disturbed and Croplands

This community type encompasses urban development, highly disturbed vegetation communities, highly eroded/disturbed areas, and erosion control areas, and active or fallow croplands. The ruderal areas observed in the SR4 corridor occur intermittently and have a high incidence of exotic plant invasion. This is the most common community type found within this highly developed urban environment.

3.1.4 Windrow

Windrows occur in SR4 intermittently along the road, both within and adjacent to the project right-of-way. This community consists of various tree species that have been planted for ornamental or commercial purposes. Windrows may provide roost, perches, and nest sites for various bird species, particularly raptors. Its litter layer may provide cover for small vertebrate species.

4.1 SUMMARY OF IMPACTS TO WETLANDS AND OTHER WATERS OF THE U.S.

There are eight jurisdictional drainages found within the project corridor. These are primarily stream channels that cross underneath State Route 4. Because the project involves the widening of an existing roadway, opportunities to avoid wetlands that run along or cross the roadway are limited. Still, only four of these drainages are impacted by the SR4 widening project.

4.1.1 Wetland Regulations

As established in Section 404 of the Clean Water Act (33 U.S.C. 1344), the U.S. Army Corps of Engineers (USACE) has final authority over the identification of wetlands and other waters of the U.S. in the project vicinity, including their jurisdiction, determination of areas affected by the project, and the type of permits and conditions required. A “no net loss” of wetland acreage or value policy is established within both the state and federal executive branches.

The project area was originally delineated and approved by USACE in 2002. A wetland re-verification of the study area has been completed and was submitted to USACE on January 29, 2008, along with this mitigation report.

4.1.2 Affected Environment

Habitat values and functions of the wetland sites in the SR4 corridor are of low quality and limited value due to several factors such as fragmentation, small size, isolation from other wetland areas, and lack of ecotones or riparian vegetation. Plant and animal species observed in the project area are recorded as generalist species that inhabit a broad spectrum of habitats.

Based on the URS reverification of the existing wetland delineation, the sum of 2.216 acres of wetland and other waters of the U.S. (including 1.599 acres of CWUS) were delineated at the following locations along the project corridor:

- Kirker Creek
- Old Kirker Creek
- An unnamed drainage channel (tributary to Kirker Creek) located west of Loveridge Road and north of SR4.
- Los Medanos Wasteway
- West Antioch Creek

The project will permanently affect 0.236 acre of WL/WUS, OWUS, and WS. In addition, 0.009 acre of OWUS and 0.140 acre of CWUS will be temporarily impacted by the proposed project. A summary of permanent (construction phase) impacts are presented in Table 4-1, a detailed breakdown of impacts and mitigation is provided in Appendix A. These values were acquired from the Wetland Reverification for State Route 4 (East) Widening Project: Loveridge Road to State Route 160 (URS, 2007). This reverification was verified by USACE on January 5, 2009 (File Number: 2002-26746S) Impacts to wetlands and other jurisdictional waters are shown in Sheets 1-5.

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State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Impacts to Jurisdictional Waters (Rapanos Reach 4)

Sheet 4 of 5

December 2008

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State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Impacts to
Jurisdictional Waters
(Rapanos Reach 3)

Sheet 3
of 5

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2008

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State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Impacts to
Jurisdictional Waters
(Rapanos Reach 2)

Sheet 2
of 5

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State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Impacts to
Jurisdictional Waters
(Rapanos Reach 1)

Sheet 1
of 5

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State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Impacts to
Jurisdictional Waters
(Rapanos Reach 5)

Sheet 5
of 5

December
2008

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The project will temporarily impact 0.005 acre of other waters of the U.S. (OWUS 1) within Kirker Creek (Sheet 1), and 0.004 acre (OWUS 5) within the Los Medanos Wasteway (Sheet 3). These impacts will be caused by the restructuring of these engineered sections of the channels as a result of road widening. OWUS 1 will be slightly widened, and the concrete lined channel will be replaced with a rock-slope protection (RSP) lined channel, as shown in the Kirker Creek Drainage Plans (Appendix B). OWUS 5 will be temporarily impacted due to relocation of the existing culvert outfall apron as the roadway is widened. OWUS 5 is an unvegetated sandy channel that will be regraded to its original shape following construction. There will be no impacts to wetland vegetation as a result of either of these two temporary impacts. As a result, no mitigation, beyond regrading, will be necessary for these impacts. No other temporary impacts occur as a result of this project.

Table 4-1 Permanent Impacts to Wetlands and Other Waters of the U.S. and the State from Proposed SR4 Widening Project

Affected Features	Permanently Affected by Project (Acres)	Suggested Mitigation Ratio	Proposed Offsite Mitigation (Acres)
Kirker Creek, Old Kirker Creek, and Los Medanos Wasteway			
Wetland/ Waters of the U.S.	0.079	4:1	0.316
Other Waters of the U.S.	0.023	4:1	0.092
Waters of the State	0.008	4:1	0.032
West Antioch Creek			
Wetlands/ Waters of the U.S.	0.060	4:1	0.240
Other Waters of the U.S.	0.066	4:1	0.264
Waters of the State	NA	4:1	
Total	**0.236**		**0.944**

5.1 WETLANDS AND OTHER WATERS OF THE U.S. AND THE STATE

Impacts to wetland/waters, other waters of the U.S, culvert waters of the U.S., and waters of the State will be avoided and minimized during construction through the following on-site measures.

Water Quality Impact Avoidance Measures

Contractors will be required to implement a SWPPP as part of the NPDES General Construction Activity Storm Water Permit. Measures in the plan would include:

- Excessive siltation and sedimentation will be avoided by not working during the rainy season (October 16 – April 14 at the Contra Loma Interchange (West Antioch Creek); October 16 – March 31 at all other locations);
- Conducting all construction work according to site-specific construction plans that minimize the potential for sediment input to the aquatic system. Erosion control procedures will be implemented to prevent discharge of soil and backfill material into adjacent sensitive habitats, waterways, or wetlands. These measures will include:
    - silt fences;
    - biodegradable soil stabilization blankets;
    - mulching;
    - vegetated upland buffers;
    - hydroseeding with tackifiers; and
    - seeding with native species.

  All non-cultivated bare ground will be treated with appropriate erosion control measures according to the SWPPP;
- Minimizing the areas to be cleared, graded, and recontoured;
- Grading and shaping of disturbed areas to restore natural topography;
- Avoiding riparian and wetland vegetation outside the construction zone by installing Environmentally Sensitive Area fencing (ESA fencing);
- Covering bare areas with mulch and revegetating all cleared areas using native species;
- Providing areas located outside the OHWM for staging, refueling, and storing equipment, materials, fuels, lubricants, solvents, and other possible contaminants;
- Preventing raw cement, concrete or concrete washings, asphalt, paint or other coating material, oil or other petroleum products, or any other substances that could be hazardous to aquatic life from contaminating the soil or entering watercourses;
- Establishing a spill prevention and countermeasure plan before project construction that includes strict onsite handling rules to keep construction and maintenance materials out of drainages and waterways. This includes cleaning up all spills immediately according to the spill prevention and countermeasure plan; and
- Avoiding operation of equipment in flowing water.

Stream Diversion Limits

Caltrans proposes to implement the following stream diversion measures, in order to avoid impacts to stream channels during construction work:

- Temporary creek diversion systems will be established for all creek channels affected by the project. These creek channels are Kirker Creek, Old Kirker Creek, Los Medanos Wasteway, and West Antioch Creek (Contra Loma Interchange).
- A possible option that is being investigated at Contra Loma Interchange is to establish 2 separate temporary water diversion systems at West Antioch Creek. For the first system, a cofferdam will need to be placed upstream of the open 120-inch reinforced concrete pipe (RCP), underneath Fitzuren Road, southwest of the G Street interchange. Base flows traveling down West Antioch Creek toward the freeway would collect behind this cofferdam and eventually drain westerly along their historic path and eventually enter the upstream end of the triple 5 x 3 foot reinforced concrete box (RCB) at Contra Loma Boulevard. The triple 5 x 3 foot RCB outfalls into the open channel portion of West Antioch Creek further downstream. The second temporary water diversion system would have to be applied upstream of the triple 5 x 3 foot RCB while it is being replaced at its downstream end. A City of Antioch 6 x 3 foot RCB empties into this system which means there will be a significant base flow to contend with during the summer months. A water-filled cofferdam would be temporarily installed at this location to deal with these base flows.
- Corrugated steel pipe (CSP), sized at about 48 inches in diameter for dry-season flows, will be utilized wherever pipe is necessary. Clean gravel and filter fabric would also be installed. The cofferdams, filter fabric, and corrugated steel pipe will be removed from the creek bed after completion of the project.
- These creek diversion systems are only to be used between April 1st and October 15th for the Kirker Creek, Old Kirker Creek, and Los Medanos Wasteway creek diversion systems, and between April 15th and October 15th for the West Antioch Creek diversion system.
- Caltrans will ensure that a biologist is on site prior to dewatering to ensure no sensitive aquatic species are stranded.
- A gravel cofferdam wrapped with an impermeable plastic liner will be placed upstream of the work area to direct base flows through an appropriately sized diversion pipe. The diversion pipe will extend through the Contractor's work area and outlet through a sandbag dam at the downstream end.
- Once the temporary creek diversion systems are no longer required, the CSP, the sandbags, the gravel dam, and the impermeable plastic liner will all be removed and the creek returned to its natural condition.
- Constructing sediment catch basins across stream channels immediately below the project site will be implemented when performing in-channel construction to prevent silt- and

sediment-laden water from entering the main stream flow. Accumulated sediments will be periodically removed from the catch basins.

Revegetation of Upland Areas

Upland plant communities will be temporarily affected by construction. Revegetation of upland area in the vicinity of aquatic features will reduce erosion and sedimentation into receiving bodies. Non-native grassland and ruderal plant communities will be replaced with native plant species. Revegetation of the temporarily impacted areas outside of wetland habitats will be conducted with a commercially available native seed mix. To minimize erosion, seeding and planting activities will be completed by the end of December of the final construction year for each respective construction segment.

Caltrans proposes to implement off-site mitigation for permanent impacts to jurisdictional waters. This section describes the long-term goals of the proposed mitigation. These goals include the types of habitats to be restored, enhanced, or compensated.

6.1 WETLAND MITIGATION GOALS

The proposed wetland mitigation plan has two primary goals:

- Avoidance and minimization of impacts to wetlands and other jurisdictional waters; and
- Provide compensation for permanent losses of wetlands and other waters.

Specific goals related to performance of the wetland mitigation are referenced in the performance criteria associated with the off-site mitigation proposal.

6.1.1 Avoidance and Minimization of Impacts to Wetlands and OWUS

Whenever possible, impacts to jurisdictional waters will be avoided. The avoidance and minimization techniques described in Section 5 (Avoidance and Minimization) reduce negative impacts to WL/WUS and OWUS. This goal serves to reduce the amount of on-site restoration and off-site mitigation required.

6.1.2 Provide Compensation for Permanent Impacts to Jurisdictional Waters

Caltrans proposes to provide off-site compensation for the permanent loss of WL/WUS (0.139 acre of permanent impacts) as well as the permanent loss of OWUS (0.089 acre of permanent impacts). The goal of the proposed mitigation is to provide compensation for the loss of jurisdictional waters that will be appropriate ecologically (same wetland and/or ecosystem type) and geographically (in proximity to the project). As wetlands will be provided as compensation for impacts to OWUS, a mitigation ratio of 4:1 is proposed to compensate for out of kind replacement of jurisdictional aquatic features. Providing high-quality wetland compensation for the loss of low-quality OWUS areas is expected to satisfy mitigation requirements. Based on mitigation ratios provided in Table 4-1, 0.944 acre of jurisdictional waters will be obtained to complete off-site mitigation. The off-site mitigation will occur at the mitigation bank identified in Section 8 (Proposed Off-Site Mitigation).

7.1 SELECTION OF OFF-SITE MITIGATION

Locations for off-site mitigation were evaluated to acquire the most suitable habitat replacement based on the following criteria:

- Compatibility with target wetland types (freshwater emergent)
- Compatibility with sensitive species target habitat as well as habitat values
- Lands or projects available for enhancement, restoration, and/or creation of wetland or sensitive species habitat in close proximity to proposed project site, within Contra Costa County

All possible mitigation or conservation banks, as well as sites for habitat enhancement and/or creation, in the Contra Costa County region were investigated as possible mitigation opportunities for this project. Potential sites were found in listings from the USFWS and CDFG websites, web searches, and other potential sources. Table 7-1 presents the organizations and projects identified and contacted as potential options for the off-site mitigation project, as well as a description of their mitigation potential.

Table 7-1 Summary of Mitigation Opportunities Considered for the Proposed SR4 Widening Project

Site/Organization	Species/Habitat	Acres/Credits Available	Location	Description/Project Status
Elsie N. Gridley Mitigation Bank	WL	Yes	Contra Costa County	Several restoration projects available for wetlands.
Wildlands Inc. Holland Tract Preserve	WL	No*	Contra Costa County	Located 3 miles east of project site, potential for restoration and creation of freshwater marsh. Mitigation bank not yet operational.
Muir Heritage Land Trust	CRLF, WL	No*	Contra Costa County	Several potential projects available for restoration, protection and preservation purposes. Nothing concrete specified.
Life Garden	WL	No*	Contra Costa County	Iron Horse Corridor in Walnut Creek Watershed. Project is not currently established.
Nature Conservancy	WL	No*	California	No current projects available for mitigation or easements.
American Land Trust	WL	No*	Contra Costa County	Awaiting approval for land use as mitigation bank
French Camp	WL	No*	Contra Costa County	Not yet approved by USACE to sell mitigation credits
San Joaquin Valley Mitigation Bank	WL	No*	San Joaquin County	No current projects available for mitigation

Table 7-1 Summary of Mitigation Opportunities Considered for the Proposed SR4 Widening Project

Site/Organization	Species/Habitat	Acres/Credits Available	Location	Description/Project Status
California State Parks, Cowell Ranch	WL, CRLF	No*	Contra Costa County	No current projects available for mitigation
Trust for Public Lands	WL	No*	Contra Costa County	No current projects available for mitigation
TARC, Trails for Richmond	WL	No*	Contra Costa County	No current projects available for mitigation
Bryte Ranch Mitigation Bank	WL	No*	El Dorado, Placer, Sacramento Counties	No current projects available for mitigation near Contra Costa County
East Bay Regional Parks	WL, CRLF	No*	Contra Costa County	An HCP covers the restoration of a riparian channel near CRLF habitat.

CRLF = California Red-Legged Frogs
USFWS = US Fish and Wildlife Service
USACE = US Army Corps of Engineers
WL = Wetlands
HCP = Habitat Conservation Plan

*Denotes organizations which do not currently have available programs (As of Nov. 2007), but may become open in the future.

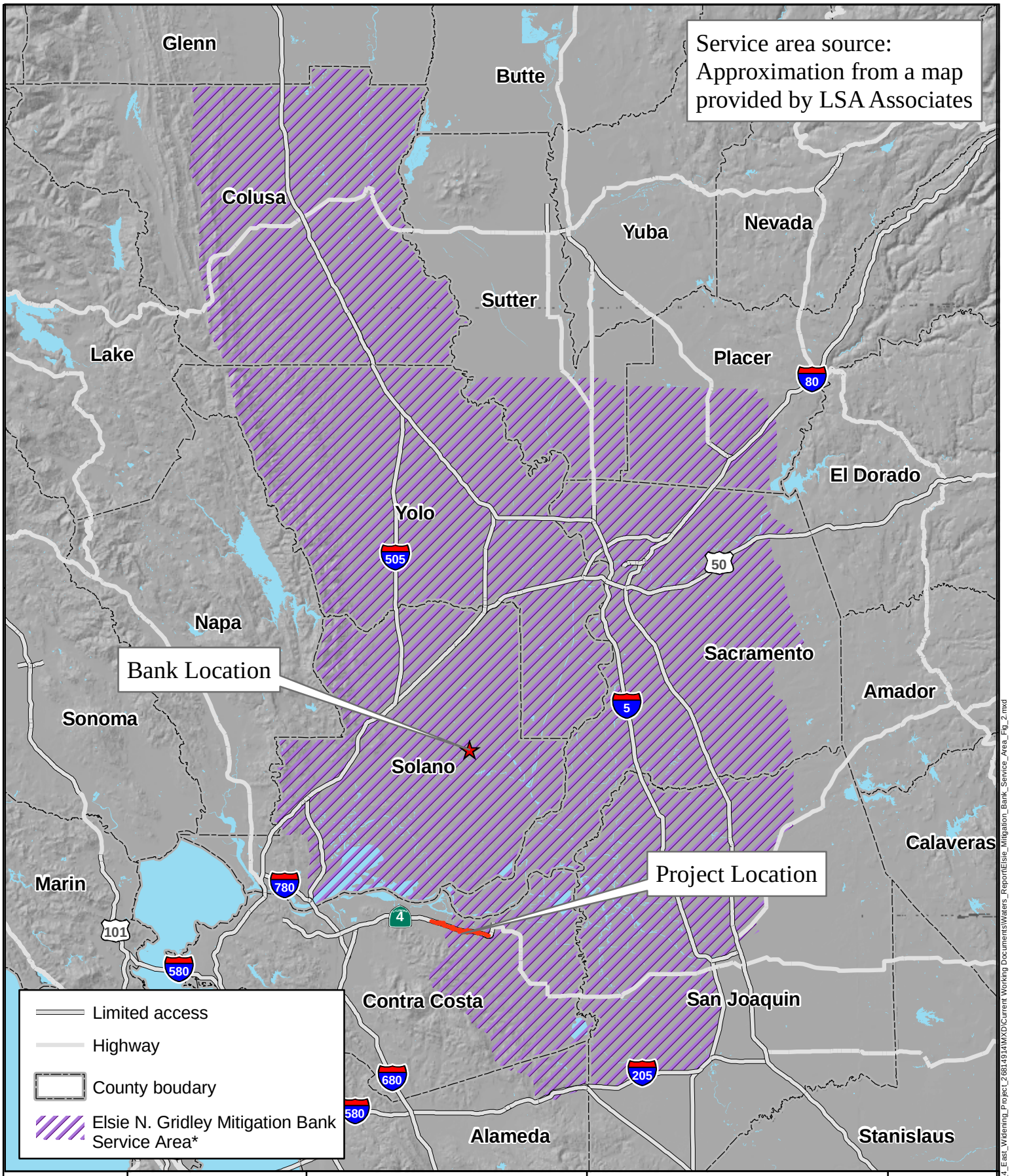
7.2 PROPOSED OFF-SITE MITIGATION FOR JURISDICTIONAL WATERS

Mitigation will take effect for both permanently and temporarily impacted jurisdictional waters following USACE 2002 no-net-loss guidelines. Although most jurisdictional waters onsite constitute poor habitat quality, wetlands will be mitigated at the ratios presented in Table 4-1 and discussed above in Section 6.1.2. Following these recommendations, Caltrans will purchase wetland credits equivalent to 0.944 acres.

7.2.1 Elsie N. Gridley Mitigation Bank

The Elsie N. Gridley Mitigation Bank (EGMB) is approved by USACE to sell wetlands and vernal pools for recreation, restoration, and preservation credits. This particular bank service area extends into eastern Contra Costa County, in close proximity to the SR4 project area. The purchase of mitigation credits at the Elsie N. Gridley Mitigation Bank would offer the best fit for project mitigation, since these are the best available high quality wetlands in the SR4 proximity.

The established habitat presented at EGMB offers the best potential mitigation within the Bay Area. The Elsie N. Gridley Bank has several projects, and serves the area in east Contra Costa County, as is outlined in Figure 2.



N

Caltrans

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

0 5 10 15 20 Miles

Elsie N Gridley Mitigation Bank Service Area

Figure 2

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8.1 PRESERVATION OF HABITAT AT ELSIE N. GRIDLEY MITIGATION BANK

Wetland preservation credits will be purchased at the Elsie N. Gridley Mitigation Bank (EGMB) to compensate for the project's permanent impacts to wetlands and other waters of the U.S. Documentation to USACE will need to be provided stating the correct number of credits allocated to the EGMB before the start of construction, scheduled for May 2009.

9.1 OFF-SITE MITIGATION MONITORING

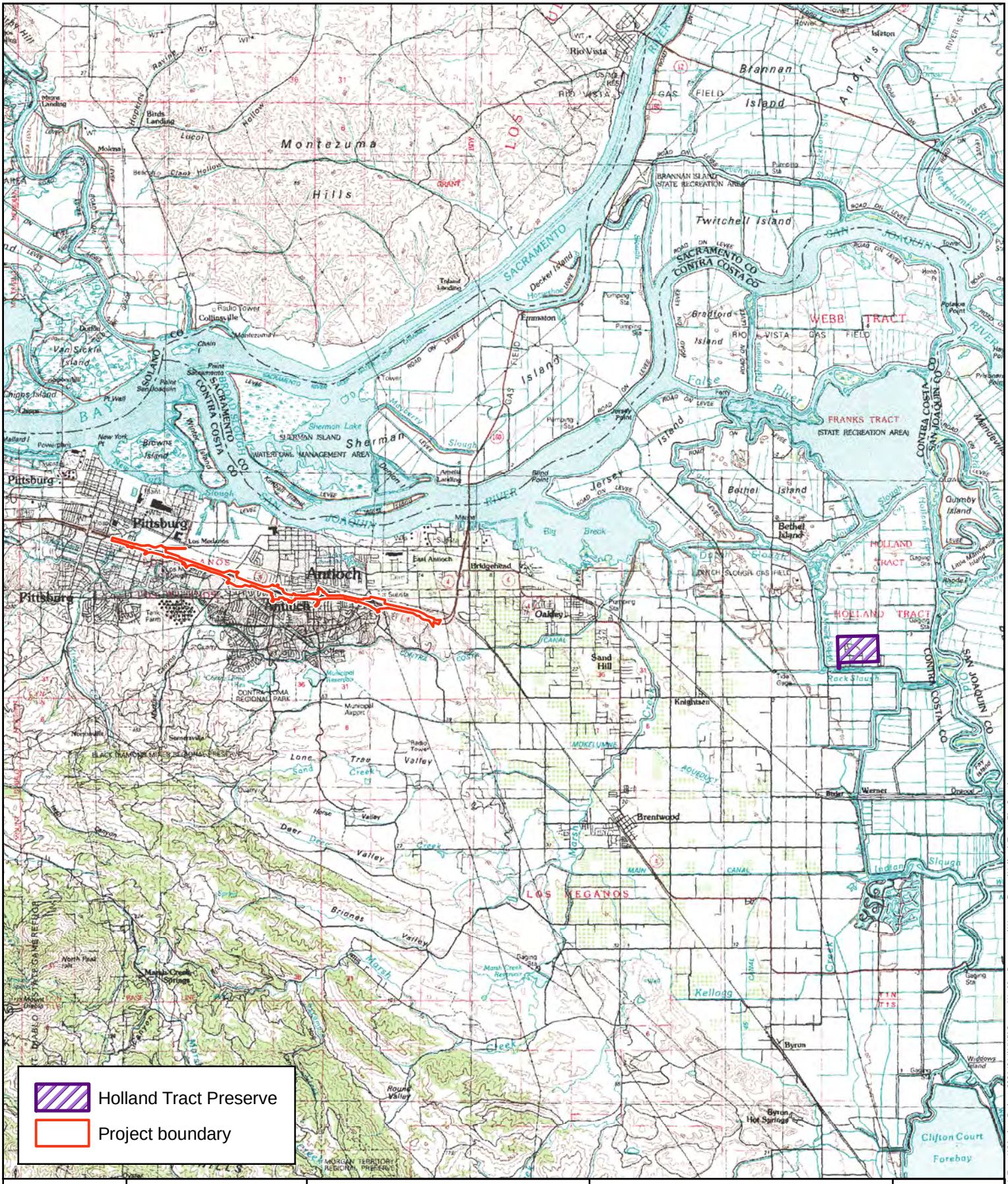
Purchased Mitigation Bank Credits and Conservation Easements

Prior to initiation of ground disturbing activities on the SR4 project, Caltrans shall provide evidence to USACE, CDFG, and RWQCB that the appropriate number of credits for jurisdictional waters have been dedicated at EGMB. All monitoring and performance standards shall be the responsibility of the mitigation bank, species fund, or conservation easement managers.

10.1 JURISDICTIONAL WATERS CONTINGENCY PLANS

10.1.1 Wildlands, Inc. Holland Tract Preserve

If it is not possible to purchase credits from the Elsie N. Gridley Mitigation Bank before the initial start of construction, credits will be pursued at Wildlands Inc. Holland Tract Preserve. Wildlands Inc. has recently purchased approximately 263 acres of land, known as the Holland Tract, located in East Contra Costa County near Oakley, about 16 miles east of the SR4 project. The preserve is bordered by sloughs and rivers feeding the Sacramento-San Joaquin Delta. The preserve plans on establishing or enhancing 107.5 acres of wetlands and open water habitat. These wetland environments will include both freshwater and tidally influenced wetlands. Although the Holland Tract Preserve is an excellent opportunity for SR4 mitigation purposes, as it provides credits for wetland habitat restoration and creation, this project is in the planning stages. The project site is outlined in Figure 3.



N

Caltrans

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

0 1 2 4 Miles

Wildlands Inc.
Holland Tract Preserve

Figure 3

L:\Projects\State_Route_4_East_Widening_Project_26814914\MXD\Current Working Documents\Waters_Report\Holland_Trust_Fig_3.mxd

SECTIONELEVEN References

California Department of Transportation (Caltrans) and Federal Highway Administration (FHWA). 2005. Initial Study/ Negative Declaration/Final Environmental Assessment. State Route 4 (East) Widening Project: Loveridge Road to State Route 160. August 2005.

Parsons. 2004. State Route 4 (East) Widening Project: Loveridge Road to State Route 160 – Natural Environment Study/ Biological Assessment. Prepared for Contra Costa Transportation Authority, State of California Department of Transportation and U.S. Department of Transportation Federal Highway Administration. May 2004.

Parsons. 2005. State Route 4 (East) Widening Project: Loveridge Road to State Route 160 – Addendum to the Natural Environment Study/ Biological Assessment. Prepared for Contra Costa Transportation Authority, State of California Department of Transportation and U.S. Department of Transportation Federal Highway Administration. June 2005.

URS Corporation. 2006. San Antonio Pipeline Relocation Project- Off-Site Compensatory Mitigation Plan for Federally Listed Species & Wetlands. Prepared for Chevron Pipe Line Company. September 2006.

URS Corporation. 2007. Greenwood Bridge Replacement- Conceptual Mitigation Plan. Prepared for Caltrans. May 2007.

URS Corporation. 2007. Wetland Reverification for SR4 (East) Widening Project Loveridge Road to Somersville Road - 04-CC-04, KP 37.9/41.3 (PM 23.7/25.8). Prepared for Caltrans/Contra Costa Transportation Authority. December 2007.

U.S. Army Corps of Engineers. 2002. Regulatory Guidance Letter No. 02, December 24,2004. Guidance Compensatory Mitigation Projects for Aquatic Resource Impacts Under the Corps Regulatory Program Pursuant to Section 407 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899.

Appendix A

Impacts to Jurisdictional Features

Appendix A: Impacts to Jurisdictional Features

Feature Name	Impact Sheet	Segment	Impact Type	Feature Type	Impact Acres	Linear Feet Impact	Mitigation Ratio
owus 1	1	Loveridge-Somersville	Temporary	Other Waters of the U.S.	0.005	82	NA
owus 4	**2**	**Loveridge-Somersville**	**Permanent**	**Other Waters of the U.S.**	**0.005**	**66**	**4:1**
owus 5	**3**	**Loveridge-Somersville**	**Permanent**	**Other Waters of the U.S.**	**0.011**	**51.3**	**4:1**
owus 5	3	Loveridge-Somersville	Temporary	Other Waters of the U.S.	0.004	10	NA
owus 6	**3**	**Loveridge-Somersville**	**Permanent**	**Other Waters of the U.S.**	**0.007**	**13.5**	**4:1**
		Loveridge-Somersville	**Total Temporary OWUS**		**0.009**		
		Loveridge-Somersville	**Total Permanent OWUS**		**0.023**		
owus 10a	**5**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.002**	**20**	**4:1**
owus 10b	**5**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.007**	**100**	**4:1**
owus 11	**5**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.003**	**10**	**4:1**
owus 7a	**4**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.015**	**85**	**4:1**
owus 7b	**4**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.031**	**295**	**4:1**
owus 8	**4**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.004**	**44**	**4:1**
owus 9	**4**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.004**	**80**	**4:1**
		Somersville- Route 160	**Total Permanent OWUS**		**0.066**		
ws 1	**1**	**Loveridge-Somersville**	**Permanent**	**Waters of the State**	**0.008**	**698**	**4:1**
		Loveridge-Somersville	**Total Permanent WS**		**0.008**		
wl/wus 1	**1**	**Loveridge-Somersville**	**Permanent**	**Wetland/Waters of the U.S.**	**0.048**	**98**	**4:1**
wl/wus 2	**2**	**Loveridge-Somersville**	**Permanent**	**Wetland/Waters of the U.S.**	**0.010**	**10**	**4:1**
wl/wus 3	**2**	**Loveridge-Somersville**	**Permanent**	**Wetland/Waters of the U.S.**	**0.021**	**66**	**4:1**
		Loveridge-Somersville	**Total Permanent WL/WUS**		**0.079**		

Appendix A: Impacts to Jurisdictional Features (continued)

Feature Name	Impact Sheet	Segment	Impact Type	Feature Type	Impact Acres	Linear Feet Impact	Mitigation Ratio
wl/wus 10	5	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.002	20	4:1
wl/wus 11	5	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.009	40	4:1
wl/wus 5a	4	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.008	65	4:1
wl/wus 5b	4	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.013	90	4:1
wl/wus 6	4	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.011	44	4:1
wl/wus 7	4	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.003	24	4:1
wl/wus 8	4	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.005	72	4:1
wl/wus 9a	5	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.002	20	4:1
wl/wus 9b	5	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.007	30	4:1
		Somersville- Route 160	Total Permanent WL/WUS		0.060		

	Temporary Impacts	Permanent Impacts	Total Impacts
Total ws	0.000	0.008	0.008
Total owus	0.009	0.089	0.098
Total wl/wus	0.000	0.139	0.139
Grand Total	0.009	0.236	0.245

Appendix B

Drainage Plans

04-228554

INFORMATION HANDOUT

NOTES:

FOR LEGEND, NOTES AND ABBREVIATIONS SEE SHEET D-1.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

REGISTERED PROFESSIONAL ENGINEER J.E. Peterson No. 42777 EXP. 3-31-08 CIVIL STATE OF CALIFORNIA

PLANS APPROVAL DATE

CONTRA COSTA
TRANSPORTATION AUTHORITY
3478 Buskirk Ave. Suite 100
Pleasant Hill, CA 94523

CALTRANS
111 Grand Avenue
Oakland, CA 94612

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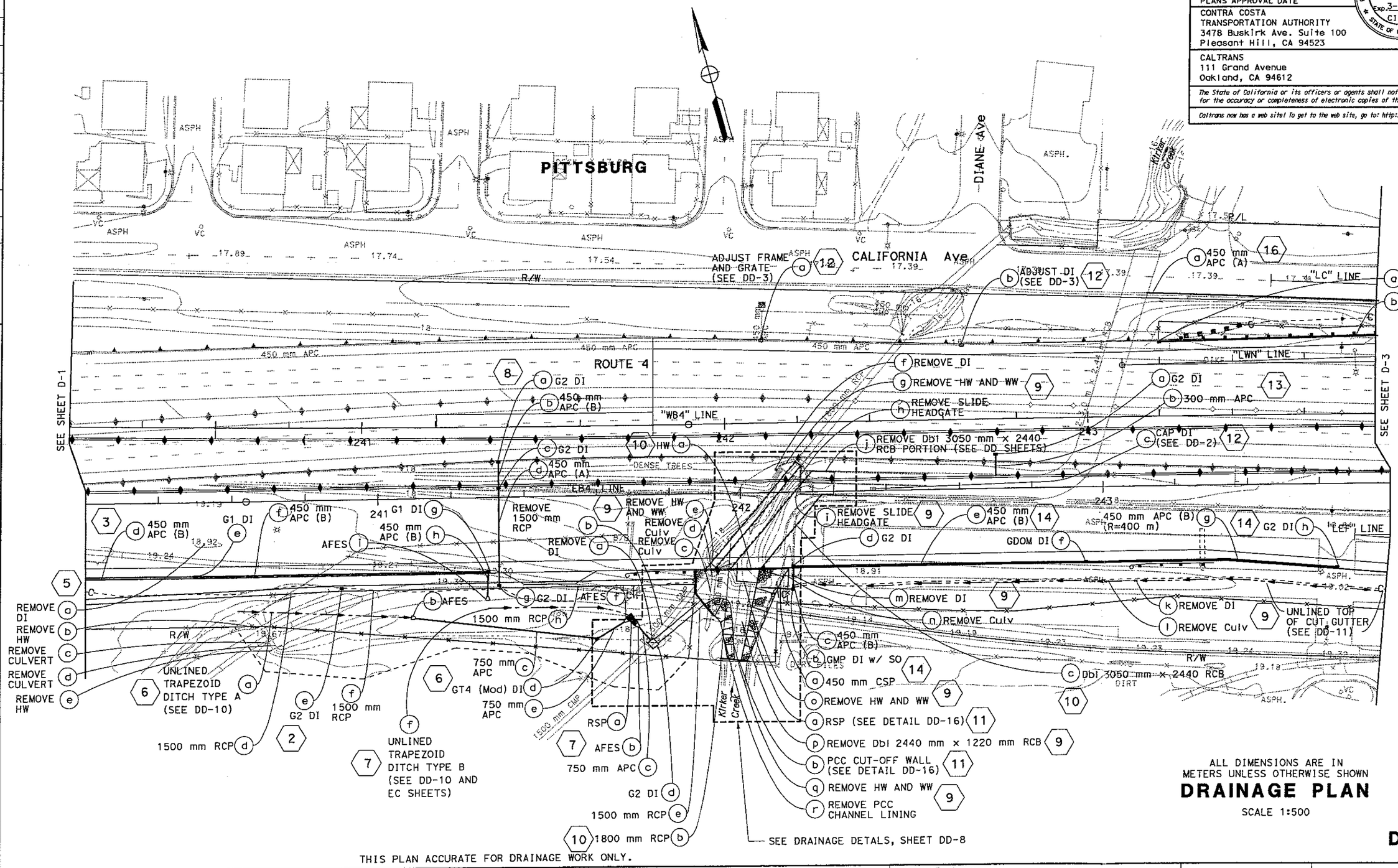

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DRAINAGE PLAN

SCALE 1:500

D-2

REVISED BY	DATE REVISED
KMR	11-07
SLP	11-07

CALCULATED/DESIGNED BY — CHECKED BY

DESIGN OVERSIGHT — JOSEPH PETERSON

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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Joseph E. Peterson
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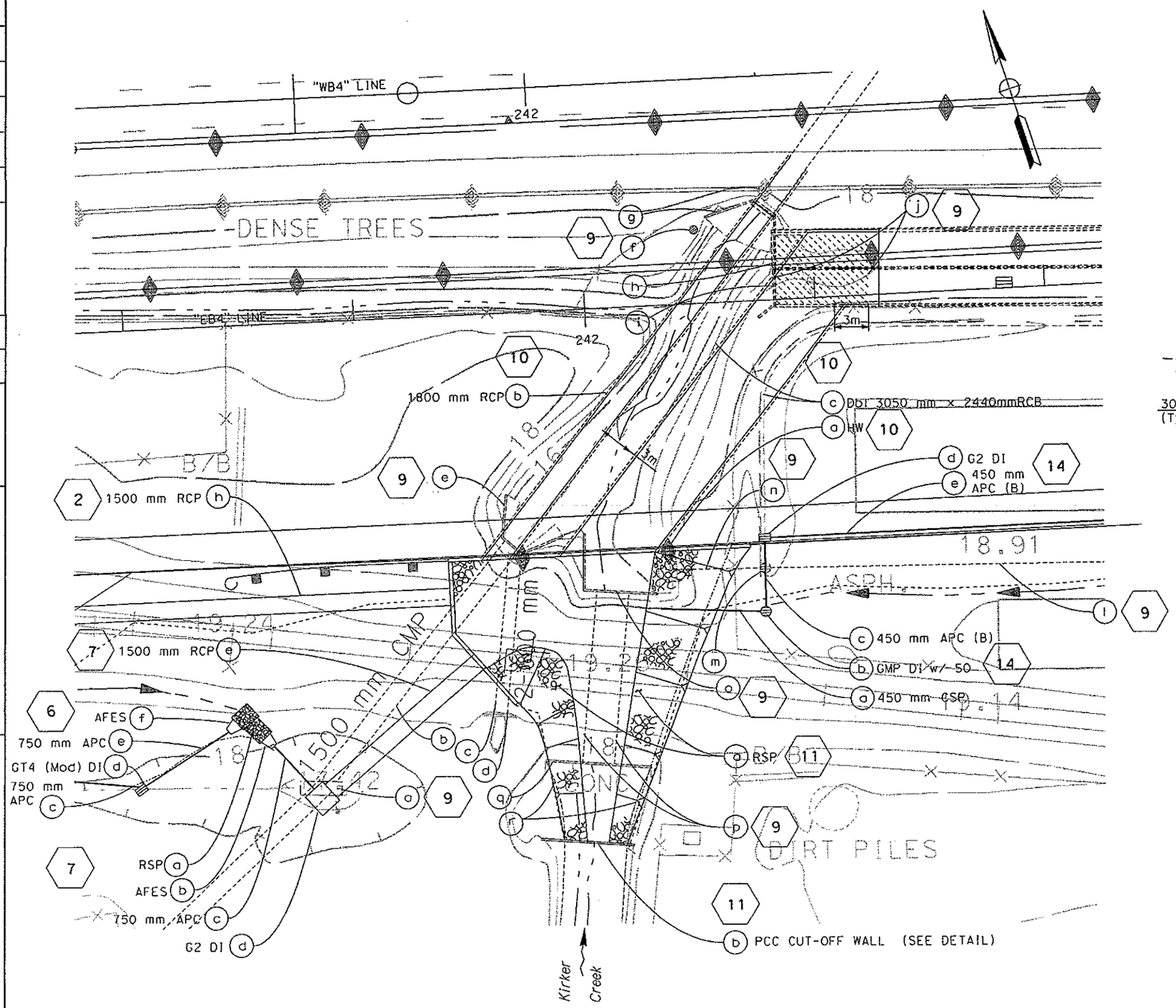

KIRKER CREEK MODIFICATION

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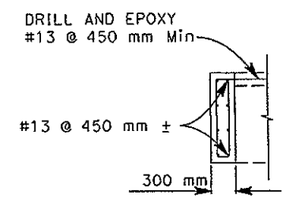
NOTE: FOR ADDITIONAL INFORMATION SEE DD-21



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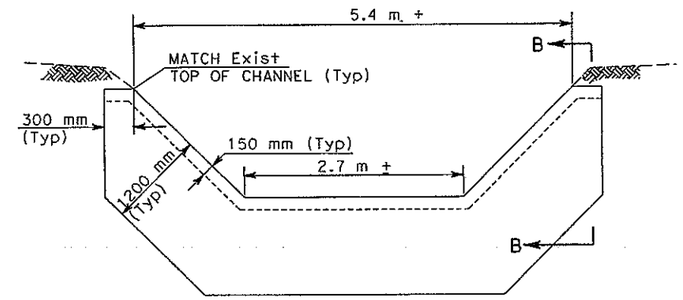

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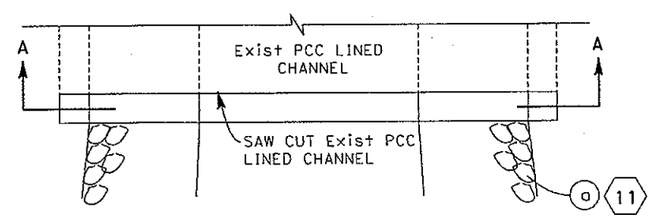

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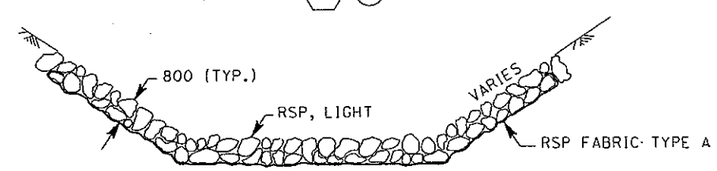

RSP DETAIL

NO SCALE

DRAINAGE DETAILS

SCALE AS SHOWN

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DD-16

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CU 04275

EA 228591

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	215	960

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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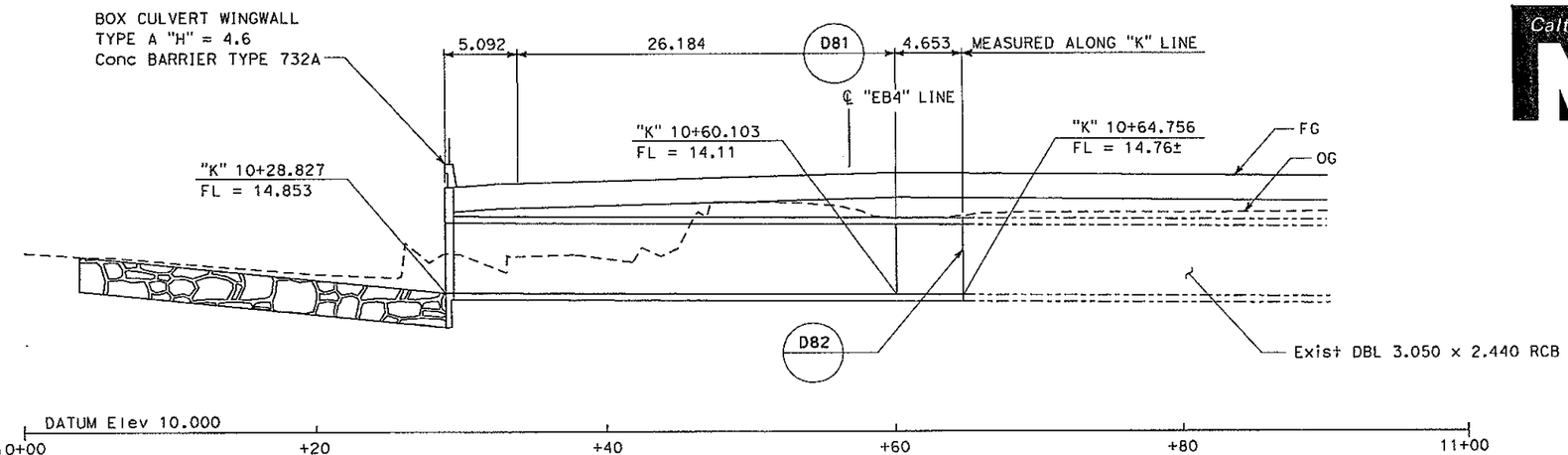

ELEVATION

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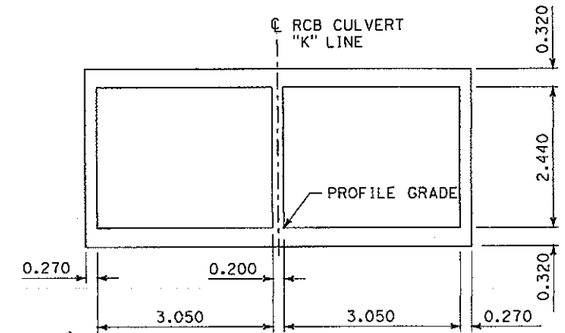
Vert 1:100



TYPICAL SECTION (D81)

SEE NOTE 5
1:40

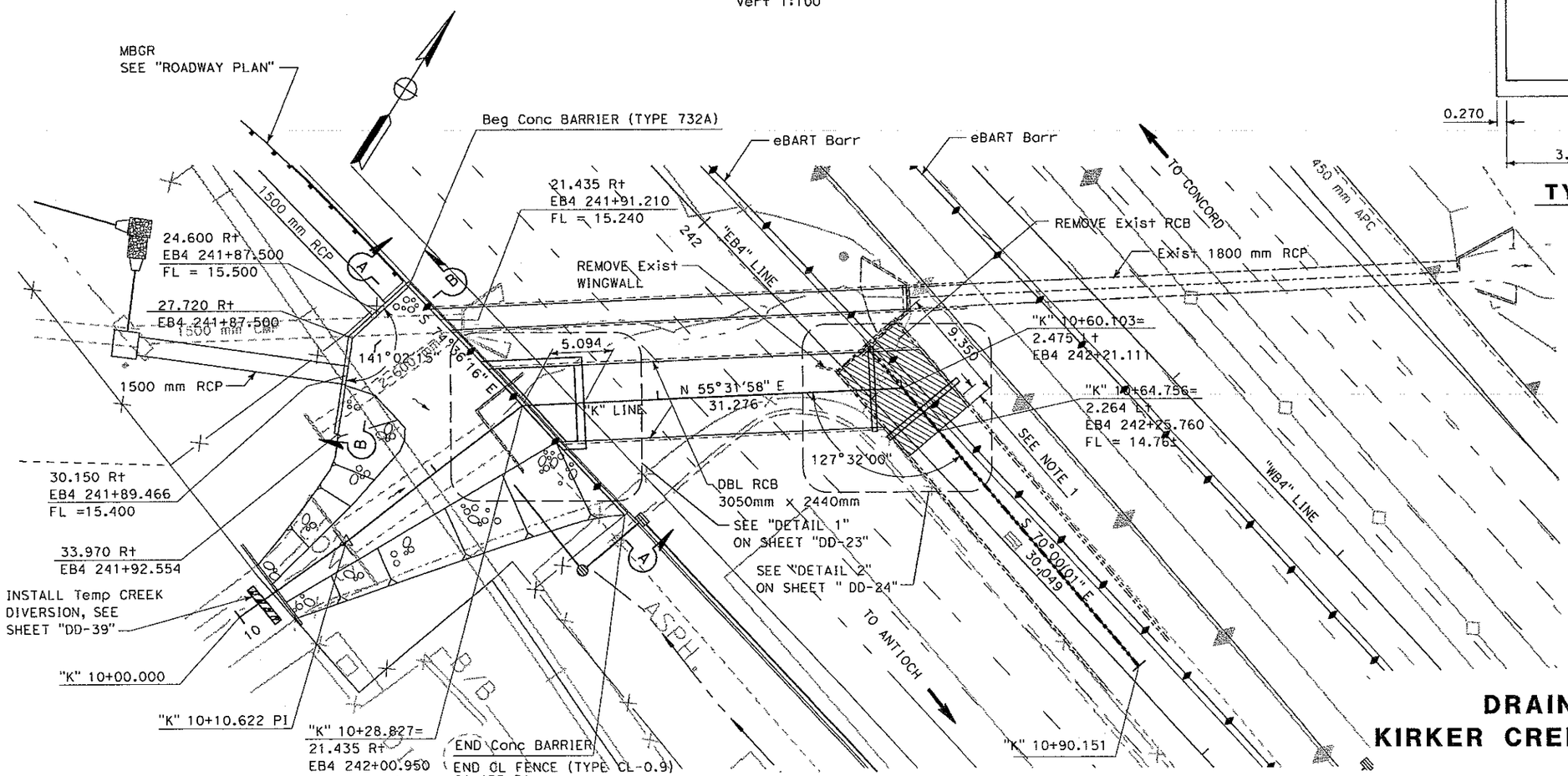
NOTES:

1. SEE (D82) FOR RCB EXTENSION DETAILS.
2. SEE "DD-22" SHEET FOR SECTION A-A AND SECTION B-B.
3. SEE "DD-23" SHEET FOR "DETAIL 1".
4. SEE "DD-24" SHEET FOR "DETAIL 2".
5. FOR REINFORCEMENT DETAILS SEE Std PLANS D81, BOX 3.050 x 2.440 WITH 6 m Max COVER

LEGEND:

REMOVE RCB (PARTIAL)

INDICATES EXISTING STRUCTURE



PLAN

1:200

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DRAINAGE DETAILS
KIRKER CREEK RCB EXTENSION

SCALE AS SHOWN

DD-21

PAGE-1024

CALCULATED/ DESIGNED BY	PH	DATE 03/05	REVISED BY	DATE REVISED
CHECKED BY	AM	03/05		

DESIGN OVERSIGHT
JOSEPH PETERSON

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

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Attachment A

SIGNATORY REQUIREMENTS

All Documents Submitted In Compliance With This Order Shall Meet The Following Signatory Requirements:

1. All applications, reports, or information submitted to the State Water Resources Control Board (State Water Board) must be signed and certified as follows

   (a) For a corporation, by a responsible corporate officer of at least the level of vice president.
   (b) For a partnership or sole proprietorship, by a general partner or proprietor, respectively.
   (c) For a municipality, or a state, federal, or other public agency, by either a principal executive officer or ranking elected official.

2. A duly authorized representative of a person designated in Items 1.a through 1.c above may sign documents if:

   (a) The authorization is made in writing by a person described in Items 1.a through 1.c above.
   (b) The authorization specifies either an individual or position having responsibility for the overall operation of the regulated activity.
   (c) The written authorization is submitted to the State Water Board Executive Director.

3. Any person signing a document under this section shall make the following certification:

   "I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

PROJECT INFORMATION SHEET

CWA Section 401 Water Quality Certification for the State Route 4 Widening Project, Contra Costa County (Corps File #2002-26746S)

1.	Applicant & Agent	Ms. Susan Miller Contra Costa Transportation Authority (Applicant) 3478 Buskirk Avenue, Suite 100 Pleasant Hill, CA 94523 Jan Novak, U.R.S. Corporation (Agent) Email: Jan_Novak@URSCorp.com 1333 Broadway, Suite 800 Oakland, CA 94612
2.	Project Purpose, and Description	**Purpose:** Reduce traffic congestion, improve traffic operations, encourage High-Occupancy Vehicle (HOV) use, and accommodate future anticipated traffic demand through the year 2030. **Description:** The Applicant, in conjunction with the California Department of Transportation (Caltrans) and the Federal Highway Administration (FHWA), will widen State Route 4 (SR4) from the existing four lanes to eight lanes (three mixed-flow and one HOV lane in each direction) from Loveridge Road Interchange to State Route 160. The project is proposed to be completed in two phases. The first phase will widen the Loveridge Segment (0.8 mile west of Loveridge Road to the Somersville Interchange). The second phase will widen the Somersville Interchange to SR 160 segment (Somersville Interchange to approximately 0.7 mile east of Hillcrest Avenue). Existing drainage culverts (Kirker Creek, Old Kirker Creek, Los Medanos Wasteway, and West Antioch Creek) will be modified during the freeway widening activities.
3.	Receiving Water(s)/ Hydrologic Unit(s)	**See Attachment C**
4.	Latitude/Longitude	**Western Extent**: Lat: 38.015422, Long: -121.881019 **Eastern Extent**: Lat: 37.990297, Long : -121.762241
5.	Dredge Volume (CY)	NA
6.	Water Body Type(s) & Area of Filled/Excavated Waters (Acres)	**Loveridge Segment**: Temporary Impacts Streambed: 0.009 acres Wetland: 0.000 acres Permanent Impacts Streambed: 0.031 acres Wetland: 0.079 acres

6. (Cont.)	Water Body Type(s) & Area of Filled/Excavated Waters (Acres)	**<u>Somersville to SR 160 Segment</u>**: <u>Temporary Impacts</u> Streambed: 0.000 acres Wetland: 0.000 acres <u>Permanent Impacts</u> Streambed: 0.066 acres Wetland: 0.060 acres
7.	Federal Agency Permit	U.S. Army Corps of Engineers, San Francisco District (File #2002-26746N)
8.	State Agency Permit (s)	California Department of Fish and Game (CDFG): Lake and Streambed Alteration Agreement for the Loveridge Segment (1600-2008-0217-3) Lake and Streambed Alteration Agreement for the Somersville to SR 160 Segment (Pending)
9.	Non-Compensatory Mitigation	A combination of avoidance and minimization measures is proposed to offset potential effects of project construction to wetlands and waters of the U.S./State. All feasible and practical measures will be undertaken to avoid and/or minimize impacts to waters during construction. These measures will conform to guidelines stated in the project's Mitigation and Monitoring Report (June 2009). **See Attachment D**
10.	Compensatory Mitigation	Compensatory mitigation shall be as described in the project's Mitigation and Monitoring Report (June 2009). The Applicant proposes to compensate for Temporary impacts at a ratio of 1:1 and Permanent impacts at a ratio of 4:1. **See Attachment D**
11.	Public Notice	In satisfaction of the public notice requirements of section 3858, Title 23, of the California Code of Regulations, which governs the State's Certification Program, a Public Notice of Application for Water Quality Certification for the subject project was posted on the State Water Board Web site on April 22, 2009.
12.	Fees	On March 1, 2009 a check from the Applicant in the amount of $943.00 was received. On April 4, 2009 a check from the Applicant in the amount of $347.00 was received. State Water Board received a total of $1290.00 in payment of required fees associated with this permit application.
13.	CEQA Compliance	**California Environmental Quality Act (CEQA) Compliance:** Mitigated Negative Declaration Lead Agency: Caltrans Date Completed: August 26, 2005

Attachment C

PROJECT IMPACTS AND MITIGATION

This attachment lists the Project impacts for both the Loveridge Road and Sommersville to State Route 160 segments. In addition, the mitigation requirements for temporary, permanent, and stormwater impacts are provided.

A. Project Impacts (Temporary, Permanent, and Stormwater):

1. Temporary impacts for the Loveridge Road segment are summarized below:

Table 1: Loveridge Road segment-Temporary Impacts

Hydrologic Unit Code (HUC)	Water Body	Project Impact Area (acres)	Impact Sheet No.	Post Mile
Suisun Bay 18050001	Kirker Creek	0.005	1	23.8
Suisun Bay 18050001	Los Medanos Wasteway	0.004	3	25.5
Total		**0.009**		

2. Permanent impacts for the Loveridge Road segment are summarized below:

Table 2: Loveridge Road segment-Permanent Impacts

Hydrologic Unit Code (HUC)	Water Body	Project Impact Area (acres)	Impact Sheet No.	Post Mile
Suisun Bay 18050001	Kirker Creek	0.048	1	23.8
Suisun Bay 18050001	Kirker Creek	0.008	1	23.8
Suisun Bay 18050001	Old Kirker Creek	0.005	1	23.8
Suisun Bay 18050001	Old Kirker Creek	0.010	2	24.4
Suisun Bay 18050001	Old Kirker Creek	0.021	2	24.4
Suisun Bay 1805001	Los Medanos Wasteway	0.011	3	25.5
Suisun Bay 1805001	Los Medanos Wasteway	0.007	3	25.5
Total		**0.11**		

3. Stormwater impacts for the Loveridge Road segment are summarized below:

Project implementation would result in 32.8 acres of added and reworked impervious area. As detailed in a memorandum dated October 27, 2008, the Authority evaluated susceptibility for hydromodification impacts to receiving waters and found that all receiving waters in the Project area, with the exception of Old Kirker Creek and the culverts under Century Boulevard, are at low risk for hydromodification impacts.

4. Permanent impacts for the Somersville to State Route 160 segment are summarized below:

Table 3: Somersville to State Route 160 segment-Permanent Impacts

Hydrologic Unit Code (HUC)	Water Body	Project Impact Area (acres)	Impact Sheet No.	Post Mile
San Joaquin Delta 18040003	West Antioch Creek	0.015	4	26.8
San Joaquin Delta 18040003	West Antioch Creek	0.031	4	26.9
San Joaquin Delta 18040003	West Antioch Creek	0.004	4	26.8
San Joaquin Delta 18040003	West Antioch Creek	0.004	4	26.9
San Joaquin Delta 18040003	West Antioch Creek	0.008	4	26.8
San Joaquin Delta 18040003	West Antioch Creek	0.013	4	26.9
San Joaquin Delta 18040003	West Antioch Creek	0.011	4	26.8
San Joaquin Delta 18040003	West Antioch Creek	0.003	4	26.9
San Joaquin Delta 18040003	West Antioch Creek	0.005	4	26.9
San Joaquin Delta 18040003	West Antioch Creek	0.002	4	27.0
San Joaquin Delta 18040003	West Antioch Creek	0.007	4	27.0
San Joaquin Delta 18040003	West Antioch Creek	0.003	4	27.2
San Joaquin Delta 18040003	West Antioch Creek	0.002	4	27.0
San Joaquin Delta 18040003	West Antioch Creek	0.007	5	27.0
San Joaquin Delta 18040003	West Antioch Creek	0.002	5	27.0
San Joaquin Delta 18040003	West Antioch Creek	0.009	5	27.2
Total		**0.126**		

5. Stormwater impacts for the Somersville to State Route 160 segment are summarized below:

Project implementation would result in 39.1 acres of added impervious area. As detailed in a memorandum dated May 26, 2009, the Authority evaluated susceptibility for hydromodification impacts to receiving waters and found that West Antioch Creek is at risk for hydromodification impacts.

B. <u>Mitigation</u>:

1. Mitigation for temporary impacts for the Project is summarized below:

   To mitigate for temporary impacts to jurisdictional wetlands and waters, the Authority shall re-vegetate all temporarily disturbed areas with appropriate native vegetation, restore disturbed areas to original or improved conditions, and follow stream diversion best management practices unless otherwise approved by the State Water Board.

2. Mitigation for permanent impacts for the Project is summarized below:

   The Authority shall mitigate for permanent impacts through the purchase of 0.944 acres of seasonal wetland mitigation credits from Elsie Gridley Mitigation Bank (Bank) in Solano County.

3. Mitigation for stormwater impacts for the Project is summarized below:

   a. Loveridge Road segment

   As mitigation for increased pollutant loads associated with impervious areas, the Authority shall provide on-site treatment of stormwater runoff. On-site stormwater treatment shall be constructed as described in the Best Management Practice (BMPs) as identified in the *Route 4 East Widening Project: Loveridge Road to Somersville Road Draft Storm Water Data Report.* The biofiltration swales and detention basin will mitigate water quality impacts from 23.0 acres of the required 32.8 acres of stormwater treatment, leaving a treatment deficit of 9.8 acres.

   To fulfill the 9.8 acre stormwater treatment deficit, the Authority shall implement an off-site stormwater treatment project. Details of the off-site stormwater treatment proposal were provided to Water Board staff in a Water Resources Engineering Company Project Memorandum dated June 17, 2008, and in a follow-up e-mail correspondence with the Authority dated August 6, 2008.

   The Authority prepared a *Hydromodification Report* (Report) dated September 2008, based on the Hydrograph Modification Management Plan of the Contra Costa Clean Water Program. An addendum was made to the Report in a Project Memorandum (Memo) dated October 27, 2008. As detailed in the Report and Memo, only Old Kirker Creek requires mitigation for potential hydromodification impacts. The above-mentioned detention basin shall mitigate for potential hydromodification impacts to Old Kirker Creek.

   b. Sommersville to State Route 160 segment

   As mitigation for increased pollutant loads associated with impervious areas, the Authority shall provide on site treatment of stormwater runoff. On-site stormwater treatment shall be constructed as described in the BMPs as identified in the Caltrans *Drainage Calculations and Exhibits for Storm Water Quality Treatment BMPs* dated April 2009. The biofiltration swales, biostrips, and an underground water quality detention pipe facility will mitigate water quality impacts from 40 acres of the required 39.1 acres of stormwater treatment.

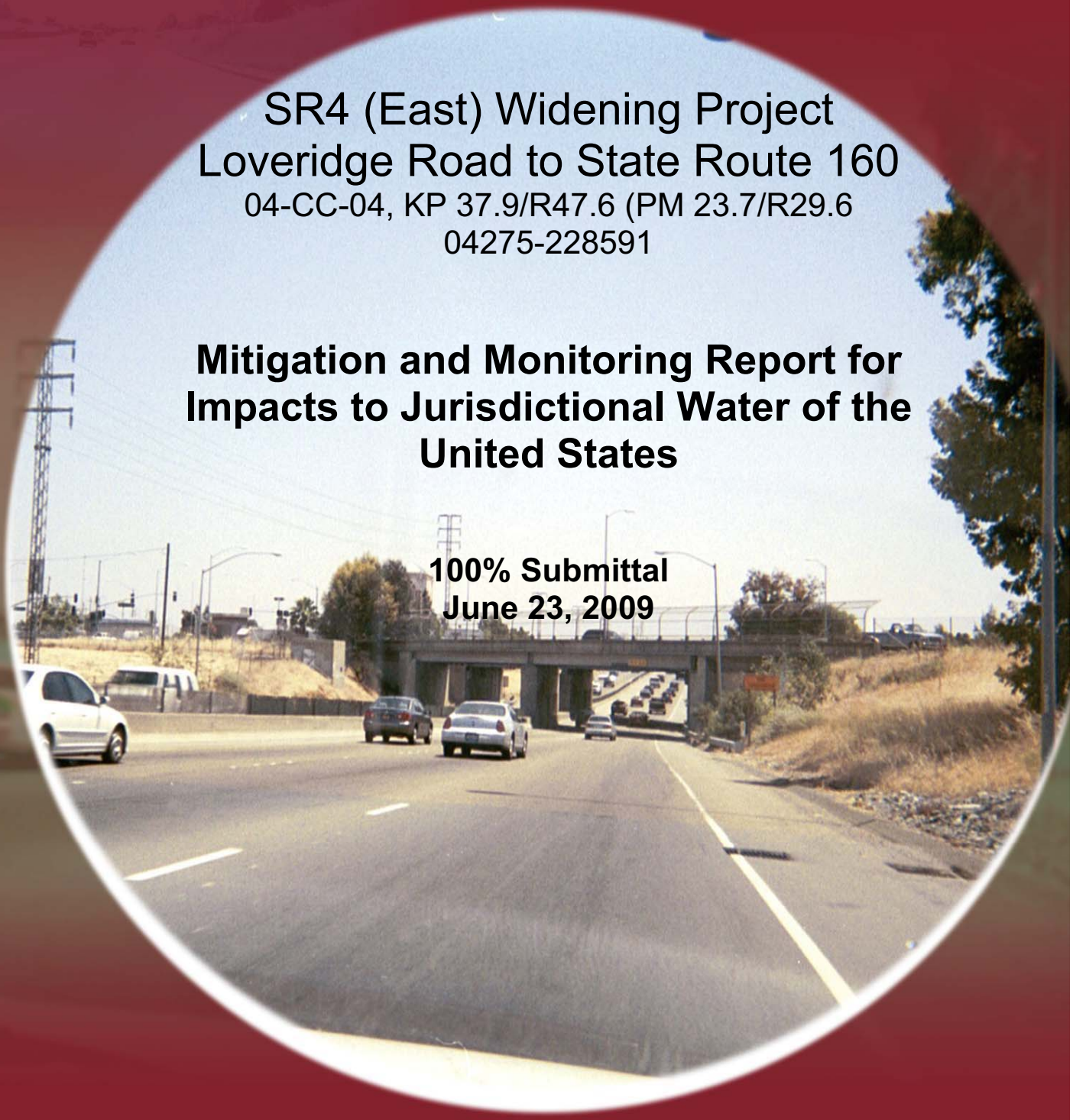
CONTRA COSTA TRANSPORTATION AUTHORITY

California Department of Transportation

Caltrans

SR4 (East) Widening Project
Loveridge Road to State Route 160

04-CC-04, KP 37.9/R47.6 (PM 23.7/R29.6
04275-228591



Mitigation and Monitoring Report for Impacts to Jurisdictional Water of the United States

100% Submittal
June 23, 2009

URS

TABLE OF CONTENTS

1. Section 1 Introduction 1-1

2. Section 2 Project Background 2-1

2.1 PROJECT DESCRIPTION 2-1
2.2 PROJECT AREA 2-2

3. Section 3 Environmental Setting 3-1

3.1 DESCRIPTION OF BIOLOGICAL COMMUNITIES 3-1
3.1.1 Freshwater Emergent Wetland 3-1
3.1.2 Non-Native Grassland 3-1
3.1.3 Ruderal/Disturbed and Croplands 3-1
3.1.4 Windrow 3-1

4. Section 4 Impacts 4-1

4.1 SUMMARY OF IMPACTS TO WETLANDS AND OTHER WATERS OF THE U.S. 4-1
4.1.1 Wetland Regulations 4-1
4.1.2 Affected Environment 4-1

5. Section 5 Avoidance and Minimization 5-1

5.1 WETLANDS AND OTHER WATERS OF THE U.S. and the state 5-1

6. Section 6 Mitigation Goals 6-1

6.1 Wetland Mitigation Goals 6-1
6.1.1 Avoidance and Minimization of Impacts to Wetlands and OWUS 6-1
6.1.2 Provide Compensation for Permanent Impacts to Jurisdictional Waters 6-1

7. Section 7 Proposed Off–Site Mitigation 7-1

7.1 SELECTION OF OFF-SITE MITIGATION 7-1
7.2 Proposed Off-Site Mitigation For Jurisdictional Waters 7-2

8. Section 8 Mitigation Implementation 8-1

8.1 PRESERVATION OF HABITAT AT ELSIE N. GRIDLEY MITIGATION BANK 8-1

9. Section 9 Monitoring 9-1

9.1 Off-Site Mitigation Monitoring 9-1

TABLE OF CONTENTS

10. Section 10 Contingency Plan 10-1

10.1 Jurisdictional Waters Contingency plans 10-1
10.1.1 Wildlands, Inc. Holland Tract Preserve 10-1

11. Section 11 References 11-1

Tables

4-1 Temporary Impacts to Wetlands and Other Waters of the U.S. from Proposed SR4 Widening Project

4-2 Permanent Impacts to Wetlands and Other Waters of the U.S. from Proposed SR4 Widening Project

8-1 Summary of Mitigation Opportunities Considered in Contra Costa County for the Proposed SR4 Widening Project

10-1 Performance Criteria for On-Site Wetland Restoration

Figures

1 Project Location Area Map

2 Elsie N. Gridley Mitigation Bank Service Area

3 Holland Tract Preserve Future Mitigation Bank Location

Sheets

1-5 Impacts to Jurisdictional Waters

Appendix A

Impacts to Jurisdictional Features

Appendix B

Drainage Plans for Kirker Creek

TABLE OF CONTENTS

Acronyms and Abbreviations

Caltrans	California Department of Transportation
CCTA	Contra Costa Transportation Authority
CHP	California Highway Patrol
CRLF	California Red-Legged Frog
CWUS	Culvert waters of the U.S.
ESA fencing	Environmentally Sensitive Area fencing
FHWA	Federal Highway Administration
HOV	High Occupancy Vehicle
Km	Kilometers
OWUS	Other waters of the U.S.
OWUS	Other Waters of the U.S.
SR4	State Route 4
USACE	U.S. Army Corps of Engineers
WL	Wetlands
WL/WUS	Wetland Waters
WS	Waters of the State (California)
WUS	Waters of the United States

SECTIONONE Introduction

This document describes the proposed off-site mitigation for impacts to jurisdictional wetlands and other waters of the U.S. from potential impacts of the proposed State Route 4 Widening Project. The purpose of the proposed project is to reduce existing congestion, improve traffic operations, encourage high occupancy vehicle (HOV) use, and accommodate anticipated travel demand through the year 2030 by providing sufficient right-of-way to accommodate multi-modal transportation.

The project is estimated to permanently impact 0.139 acre of wetlands/waters (WL/WUS), 0.089 acre of other waters of the U.S. (OWUS) and 0.008 acre of waters of the state (WS). In addition, there will be temporary impacts to 0.009 acre of OWUS, as well as to 0.140 acre of culvert waters of the U.S. (CWUS). This mitigation report provides the project background as well as compensation possibilities that are appropriate for the losses of jurisdictional WL/WUS, OWUS, and WS.

2.1 PROJECT DESCRIPTION

The California Department of Transportation (Caltrans), in cooperation with the Federal Highway Administration (FHWA) and Contra Costa Transportation Authority (CCTA), proposes to widen State Route 4 (SR4), its interchanges, and affected local roadways from approximately 0.84 mile west of Loveridge Road to approximately 0.70 mile east of Hillcrest Avenue. The SR4 corridor is currently facing severe problems which include traffic congestion and inefficient energy use, as well as deteriorating air quality and traffic safety. Correcting conditions on SR4 is a necessary component of the overall program to improve transportation through Contra Costa County. The project will require reconstruction of all interchanges within the project limits and would include the addition of auxiliary lanes between interchanges to facilitate on and off traffic movements.

The proposed project will consist of the following actions:

- Widen SR4 from the existing four lanes to eight lanes. The widened freeway would consist of an HOV lane and three mixed-flow lanes in each direction.
- Preserve sufficient width in the SR4 median through the Loveridge Road Interchange to accommodate the possibility of future public transit improvements.
- Eliminate partial interchange at G Street and reconstruct the overcrossing.
- Add auxiliary lanes on SR4 between interchanges from the on-ramps to the off-ramps.
- Provide capability to create ramp metering facilities, including high occupancy vehicle (HOV) preferential lanes and California Highway Patrol (CHP) enforcement areas, where feasible.
- Widen Roosevelt Lane pedestrian undercrossing and the Cavallo Road undercrossing.
- Extend drainage facilities that cross SR4 in the project area.
- Reconstruct SR4 interchanges to accommodate the freeway widening at:
    - Loveridge Road
    - Somersville Road
    - Contra Loma Boulevard- L Street
    - Lone Tree Way –A Street
    - Hillcrest Avenue

The proposed project would conform to improvements currently being constructed to the west of the project area as part of the Route 4/ Railroad Avenue Interchange Project (by others) as well as improvements proposed to the east of the project as part of the SR4 Bypass Project (by others).

Caltrans is undertaking final design of the first segment of the project, Loveridge Road to Somersville Road. Considerations for the remainder of the SR4 East corridor from Somersville Road to the eastern project limit (0.70 mile east of Hillcrest Avenue) is based on project design plans.

2.2 PROJECT AREA

The project area is defined as the area that may be disturbed during project construction, located on the Route 4 corridor in Contra Costa County, 0.84 mile west of Loveridge Road (PM 23.7) to approximately 0.7 mile east of Hillcrest Avenue (PM 29.7). The SR4 project area is slightly more than 6.1 miles in length (9.8 kilometers). The project area extends slightly beyond the anticipated 8-lane area of the proposed highway, to accommodate for construction equipment. The proposed project location is depicted in Figure 1.

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Caltrans

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

0 0.5 1 1.5 2 Miles

Project Location Map

Figure 1

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3.1 DESCRIPTION OF BIOLOGICAL COMMUNITIES

The project corridor includes the SR4 roadway from approximately 1.33 kilometers (km) west of Loveridge Road to East Antioch in Contra Costa County. The project corridor encompasses approximately 6.1 miles (9.8 km) of highway and ranges in elevation from 12 feet (3.66 meters) to 35 feet (10.67 meters) above sea level. Current land use in the project area is primarily commercial, but also includes residential developments and some open agricultural fields.

The project corridor traverses four vegetation communities and a number of jurisdictional waters. Biological communities identified within the project corridor include freshwater emergent wetland, non-native grassland, ruderal/disturbed, and windrow. A brief description of each community and its associated wildlife assemblage is provided below.

3.1.1 Freshwater Emergent Wetland

Freshwater marshes are found throughout California and are among the most productive wildlife habitats within the state. These marshes are found in various land depressions or at the edges of rivers and lakes. They provide food, cover, and water for more than 160 species of birds, and a variety of mammals, reptiles, and amphibians. California Red Legged Frogs (*Rana aurora draytonii*) are among the species that could utilize these freshwater communities in the greater project area.

3.1.2 Non-Native Grassland

This community, primarily composed of non-native grasslands, occurs intermittently along SR4. It is typically found on fine-textured, usually clay soils, which may range from moist, possibly even waterlogged, during the rainy season to very dry during the dry season. Grasslands provide foraging and nesting habitat for a wide variety of wildlife species including raptors, small mammals, amphibians and reptiles.

3.1.3 Ruderal/Disturbed and Croplands

This community type encompasses urban development, highly disturbed vegetation communities, highly eroded/disturbed areas, and erosion control areas, and active or fallow croplands. The ruderal areas observed in the SR4 corridor occur intermittently and have a high incidence of exotic plant invasion. This is the most common community type found within this highly developed urban environment.

3.1.4 Windrow

Windrows occur in SR4 intermittently along the road, both within and adjacent to the project right-of-way. This community consists of various tree species that have been planted for ornamental or commercial purposes. Windrows may provide roost, perches, and nest sites for various bird species, particularly raptors. Its litter layer may provide cover for small vertebrate species.

4.1 SUMMARY OF IMPACTS TO WETLANDS AND OTHER WATERS OF THE U.S.

There are eight jurisdictional drainages found within the project corridor. These are primarily stream channels that cross underneath State Route 4. Because the project involves the widening of an existing roadway, opportunities to avoid wetlands that run along or cross the roadway are limited. Still, only four of these drainages are impacted by the SR4 widening project.

4.1.1 Wetland Regulations

As established in Section 404 of the Clean Water Act (33 U.S.C. 1344), the U.S. Army Corps of Engineers (USACE) has final authority over the identification of wetlands and other waters of the U.S. in the project vicinity, including their jurisdiction, determination of areas affected by the project, and the type of permits and conditions required. A "no net loss" of wetland acreage or value policy is established within both the state and federal executive branches.

The project area was originally delineated and approved by USACE in 2002. A wetland re-verification of the study area has been completed and was submitted to USACE on January 29, 2008, along with this mitigation report.

4.1.2 Affected Environment

Habitat values and functions of the wetland sites in the SR4 corridor are of low quality and limited value due to several factors such as fragmentation, small size, isolation from other wetland areas, and lack of ecotones or riparian vegetation. Plant and animal species observed in the project area are recorded as generalist species that inhabit a broad spectrum of habitats.

Based on the URS reverification of the existing wetland delineation, the sum of 2.216 acres of wetland and other waters of the U.S. (including 1.599 acres of CWUS) were delineated at the following locations along the project corridor:

- Kirker Creek
- Old Kirker Creek
- An unnamed drainage channel (tributary to Kirker Creek) located west of Loveridge Road and north of SR4.
- Los Medanos Wasteway
- West Antioch Creek

The project will permanently affect 0.236 acre of WL/WUS, OWUS, and WS. In addition, 0.009 acre of OWUS and 0.140 acre of CWUS will be temporarily impacted by the proposed project. A summary of permanent (construction phase) impacts are presented in Table 4-1, a detailed breakdown of impacts and mitigation is provided in Appendix A. These values were acquired from the Wetland Reverification for State Route 4 (East) Widening Project: Loveridge Road to State Route 160 (URS, 2007). This reverification was verified by USACE on January 5, 2009 (File Number: 2002-26746S) Impacts to wetlands and other jurisdictional waters are shown in Sheets 1-5.

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Feet

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Impacts to Jurisdictional Waters (Rapanos Reach 4)

Sheet 4 of 5

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State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Impacts to
Jurisdictional Waters
(Rapanos Reach 3)

Sheet 3
of 5

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2008

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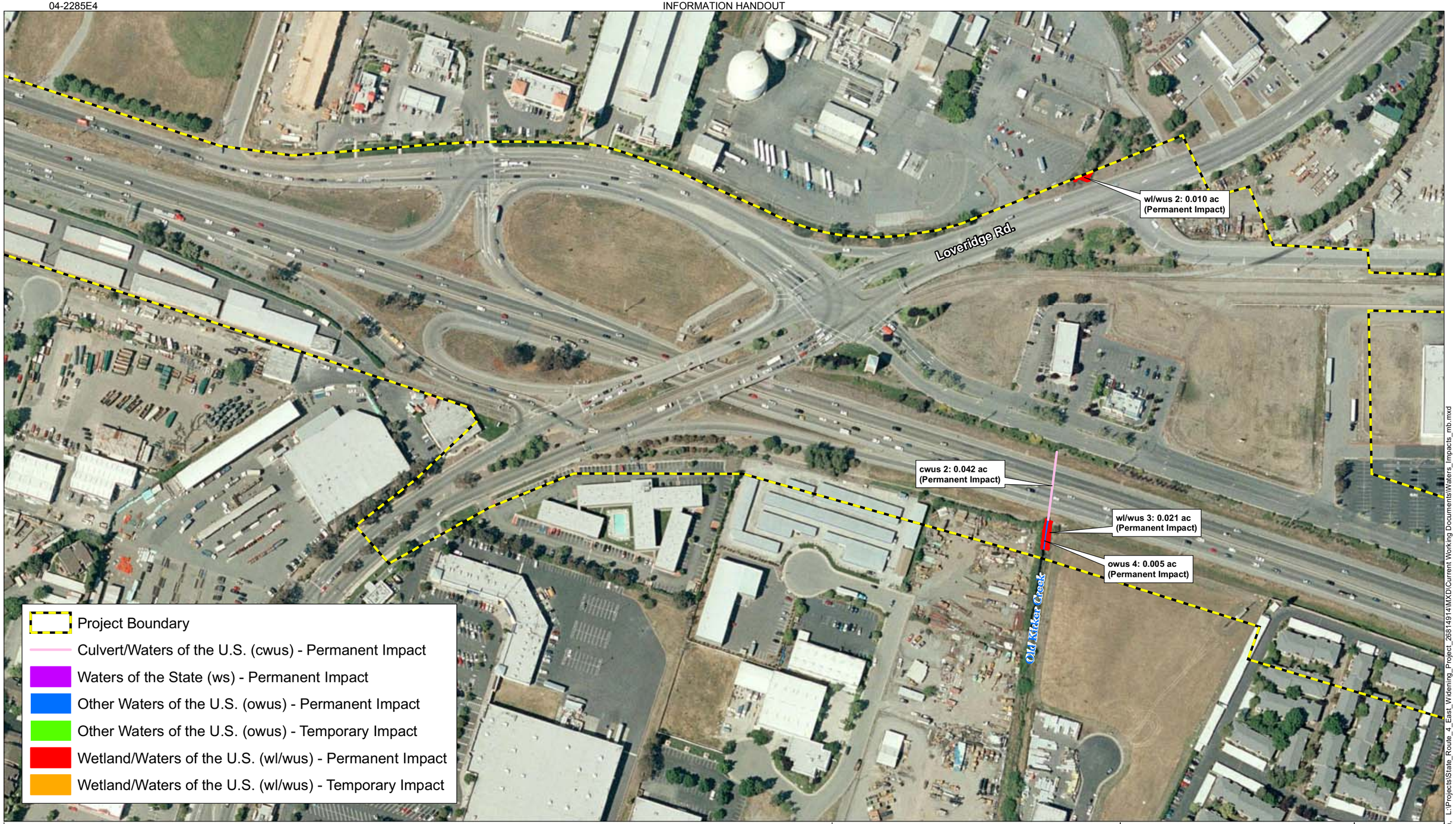

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State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Impacts to
Jurisdictional Waters
(Rapanos Reach 2)

Sheet 2
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State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Impacts to
Jurisdictional Waters
(Rapanos Reach 1)

Sheet 1
of 5

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State Route 4 (East) Widening Project
Loveridge Road to State Route 160

26814914

Impacts to
Jurisdictional Waters
(Rapanos Reach 5)

Sheet 5
of 5

December
2008

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The project will temporarily impact 0.005 acre of other waters of the U.S. (OWUS 1) within Kirker Creek (Sheet 1), and 0.004 acre (OWUS 5) within the Los Medanos Wasteway (Sheet 3). These impacts will be caused by the restructuring of these engineered sections of the channels as a result of road widening. OWUS 1 will be slightly widened, and the concrete lined channel will be replaced with a rock-slope protection (RSP) lined channel, as shown in the Kirker Creek Drainage Plans (Appendix B). OWUS 5 will be temporarily impacted due to relocation of the existing culvert outfall apron as the roadway is widened. OWUS 5 is an unvegetated sandy channel that will be regraded to its original shape following construction. There will be no impacts to wetland vegetation as a result of either of these two temporary impacts. As a result, no mitigation, beyond regrading, will be necessary for these impacts. No other temporary impacts occur as a result of this project.

Table 4-1 Permanent Impacts to Wetlands and Other Waters of the U.S. and the State from Proposed SR4 Widening Project

Affected Features	Permanently Affected by Project (Acres)	Suggested Mitigation Ratio	Proposed Offsite Mitigation (Acres)
Kirker Creek, Old Kirker Creek, and Los Medanos Wasteway			
Wetland/ Waters of the U.S.	0.079	4:1	0.316
Other Waters of the U.S.	0.023	4:1	0.092
Waters of the State	0.008	4:1	0.032
West Antioch Creek			
Wetlands/ Waters of the U.S.	0.060	4:1	0.240
Other Waters of the U.S.	0.066	4:1	0.264
Waters of the State	NA	4:1	
Total	**0.236**		**0.944**

5.1 WETLANDS AND OTHER WATERS OF THE U.S. AND THE STATE

Impacts to wetland/waters, other waters of the U.S, culvert waters of the U.S., and waters of the State will be avoided and minimized during construction through the following on-site measures.

Water Quality Impact Avoidance Measures

Contractors will be required to implement a SWPPP as part of the NPDES General Construction Activity Storm Water Permit. Measures in the plan would include:

- Excessive siltation and sedimentation will be avoided by not working during the rainy season (October 16 – May 31 at the Contra Loma Interchange (West Antioch Creek); October 16 – March 31 at all other locations);
- Conducting all construction work according to site-specific construction plans that minimize the potential for sediment input to the aquatic system. Erosion control procedures will be implemented to prevent discharge of soil and backfill material into adjacent sensitive habitats, waterways, or wetlands. These measures will include:
  - silt fences;
  - biodegradable soil stabilization blankets;
  - mulching;
  - vegetated upland buffers;
  - hydroseeding with tackifiers; and
  - seeding with native species.

  All non-cultivated bare ground will be treated with appropriate erosion control measures according to the SWPPP;
- Minimizing the areas to be cleared, graded, and recontoured;
- Grading and shaping of disturbed areas to restore natural topography;
- Avoiding riparian and wetland vegetation outside the construction zone by installing Environmentally Sensitive Area fencing (ESA fencing);
- Covering bare areas with mulch and revegetating all cleared areas using native species;
- Providing areas located outside the OHWM for staging, refueling, and storing equipment, materials, fuels, lubricants, solvents, and other possible contaminants;
- Preventing raw cement, concrete or concrete washings, asphalt, paint or other coating material, oil or other petroleum products, or any other substances that could be hazardous to aquatic life from contaminating the soil or entering watercourses;
- Establishing a spill prevention and countermeasure plan before project construction that includes strict onsite handling rules to keep construction and maintenance materials out of drainages and waterways. This includes cleaning up all spills immediately according to the spill prevention and countermeasure plan; and
- Avoiding operation of equipment in flowing water.

Stream Diversion Limits

Caltrans proposes to implement the following stream diversion measures, in order to avoid impacts to stream channels during construction work:

- Temporary creek diversion systems will be established for all creek channels affected by the project. These creek channels are Kirker Creek, Old Kirker Creek, Los Medanos Wasteway, and West Antioch Creek (Contra Loma Interchange).
- A possible option that is being investigated at Contra Loma Interchange is to establish 2 separate temporary water diversion systems at West Antioch Creek. For the first system, a cofferdam will need to be placed upstream of the open 120-inch reinforced concrete pipe (RCP), underneath Fitzuren Road, southwest of the G Street interchange. Base flows traveling down West Antioch Creek toward the freeway would collect behind this cofferdam and eventually drain westerly along their historic path and eventually enter the upstream end of the triple 5 x 3 foot reinforced concrete box (RCB) at Contra Loma Boulevard. The triple 5 x 3 foot RCB outfalls into the open channel portion of West Antioch Creek further downstream. The second temporary water diversion system would have to be applied upstream of the triple 5 x 3 foot RCB while it is being replaced at its downstream end. A City of Antioch 6 x 3 foot RCB empties into this system which means there will be a significant base flow to contend with during the summer months. A water-filled cofferdam would be temporarily installed at this location to deal with these base flows.
- Corrugated steel pipe (CSP), sized at about 48 inches in diameter for dry-season flows, will be utilized wherever pipe is necessary. Clean gravel and filter fabric would also be installed. The cofferdams, filter fabric, and corrugated steel pipe will be removed from the creek bed after completion of the project.
- These creek diversion systems are only to be used between April 1st and October 15th for the Kirker Creek, Old Kirker Creek, and Los Medanos Wasteway creek diversion systems, and between June 1st and October 15th for the West Antioch Creek diversion system.
- Caltrans will ensure that a biologist is on site prior to dewatering to ensure no sensitive aquatic species are stranded.
- A gravel cofferdam wrapped with an impermeable plastic liner will be placed upstream of the work area to direct base flows through an appropriately sized diversion pipe. The diversion pipe will extend through the Contractor's work area and outlet through a sandbag dam at the downstream end.
- Once the temporary creek diversion systems are no longer required, the CSP, the sandbags, the gravel dam, and the impermeable plastic liner will all be removed and the creek returned to its natural condition.
- Constructing sediment catch basins across stream channels immediately below the project site will be implemented when performing in-channel construction to prevent silt- and

sediment-laden water from entering the main stream flow. Accumulated sediments will be periodically removed from the catch basins.

Revegetation of Upland Areas

Upland plant communities will be temporarily affected by construction. Revegetation of upland area in the vicinity of aquatic features will reduce erosion and sedimentation into receiving bodies. Non-native grassland and ruderal plant communities will be replaced with native plant species. Revegetation of the temporarily impacted areas outside of wetland habitats will be conducted with a commercially available native seed mix. To minimize erosion, seeding and planting activities will be completed by the end of December of the final construction year for each respective construction segment.

Caltrans proposes to implement off-site mitigation for permanent impacts to jurisdictional waters. This section describes the long-term goals of the proposed mitigation. These goals include the types of habitats to be restored, enhanced, or compensated.

6.1 WETLAND MITIGATION GOALS

The proposed wetland mitigation plan has two primary goals:

- Avoidance and minimization of impacts to wetlands and other jurisdictional waters; and
- Provide compensation for permanent losses of wetlands and other waters.

Specific goals related to performance of the wetland mitigation are referenced in the performance criteria associated with the off-site mitigation proposal.

6.1.1 Avoidance and Minimization of Impacts to Wetlands and OWUS

Whenever possible, impacts to jurisdictional waters will be avoided. The avoidance and minimization techniques described in Section 5 (Avoidance and Minimization) reduce negative impacts to WL/WUS and OWUS. This goal serves to reduce the amount of on-site restoration and off-site mitigation required.

6.1.2 Provide Compensation for Permanent Impacts to Jurisdictional Waters

Caltrans proposes to provide off-site compensation for the permanent loss of WL/WUS (0.139 acre of permanent impacts) as well as the permanent loss of OWUS (0.089 acre of permanent impacts). The goal of the proposed mitigation is to provide compensation for the loss of jurisdictional waters that will be appropriate ecologically (same wetland and/or ecosystem type) and geographically (in proximity to the project). As wetlands will be provided as compensation for impacts to OWUS, a mitigation ratio of 4:1 is proposed to compensate for out of kind replacement of jurisdictional aquatic features. Providing high-quality wetland compensation for the loss of low-quality OWUS areas is expected to satisfy mitigation requirements. Based on mitigation ratios provided in Table 4-1, 0.944 acre of jurisdictional waters will be obtained to complete off-site mitigation. The off-site mitigation will occur at the mitigation bank identified in Section 8 (Proposed Off-Site Mitigation).

7.1 SELECTION OF OFF-SITE MITIGATION

Locations for off-site mitigation were evaluated to acquire the most suitable habitat replacement based on the following criteria:

- Compatibility with target wetland types (freshwater emergent)
- Compatibility with sensitive species target habitat as well as habitat values
- Lands or projects available for enhancement, restoration, and/or creation of wetland or sensitive species habitat in close proximity to proposed project site, within Contra Costa County

All possible mitigation or conservation banks, as well as sites for habitat enhancement and/or creation, in the Contra Costa County region were investigated as possible mitigation opportunities for this project. Potential sites were found in listings from the USFWS and CDFG websites, web searches, and other potential sources. Table 7-1 presents the organizations and projects identified and contacted as potential options for the off-site mitigation project, as well as a description of their mitigation potential.

Table 7-1 Summary of Mitigation Opportunities Considered for the Proposed SR4 Widening Project

Site/Organization	Species/Habitat	Acres/Credits Available	Location	Description/Project Status
Elsie N. Gridley Mitigation Bank	WL	Yes	Contra Costa County	Several restoration projects available for wetlands.
Wildlands Inc. Holland Tract Preserve	WL	No*	Contra Costa County	Located 3 miles east of project site, potential for restoration and creation of freshwater marsh. Mitigation bank not yet operational.
Muir Heritage Land Trust	CRLF, WL	No*	Contra Costa County	Several potential projects available for restoration, protection and preservation purposes. Nothing concrete specified.
Life Garden	WL	No*	Contra Costa County	Iron Horse Corridor in Walnut Creek Watershed. Project is not currently established.
Nature Conservancy	WL	No*	California	No current projects available for mitigation or easements.
American Land Trust	WL	No*	Contra Costa County	Awaiting approval for land use as mitigation bank
French Camp	WL	No*	Contra Costa County	Not yet approved by USACE to sell mitigation credits
San Joaquin Valley Mitigation Bank	WL	No*	San Joaquin County	No current projects available for mitigation

Table 7-1 Summary of Mitigation Opportunities Considered for the Proposed SR4 Widening Project

Site/Organization	Species/Habitat	Acres/Credits Available	Location	Description/Project Status
California State Parks, Cowell Ranch	WL, CRLF	No*	Contra Costa County	No current projects available for mitigation
Trust for Public Lands	WL	No*	Contra Costa County	No current projects available for mitigation
TARC, Trails for Richmond	WL	No*	Contra Costa County	No current projects available for mitigation
Bryte Ranch Mitigation Bank	WL	No*	El Dorado, Placer, Sacramento Counties	No current projects available for mitigation near Contra Costa County
East Bay Regional Parks	WL, CRLF	No*	Contra Costa County	An HCP covers the restoration of a riparian channel near CRLF habitat.

CRLF = California Red-Legged Frogs
USFWS = US Fish and Wildlife Service
USACE = US Army Corps of Engineers
WL = Wetlands
HCP = Habitat Conservation Plan

*Denotes organizations which do not currently have available programs (As of Nov. 2007), but may become open in the future.

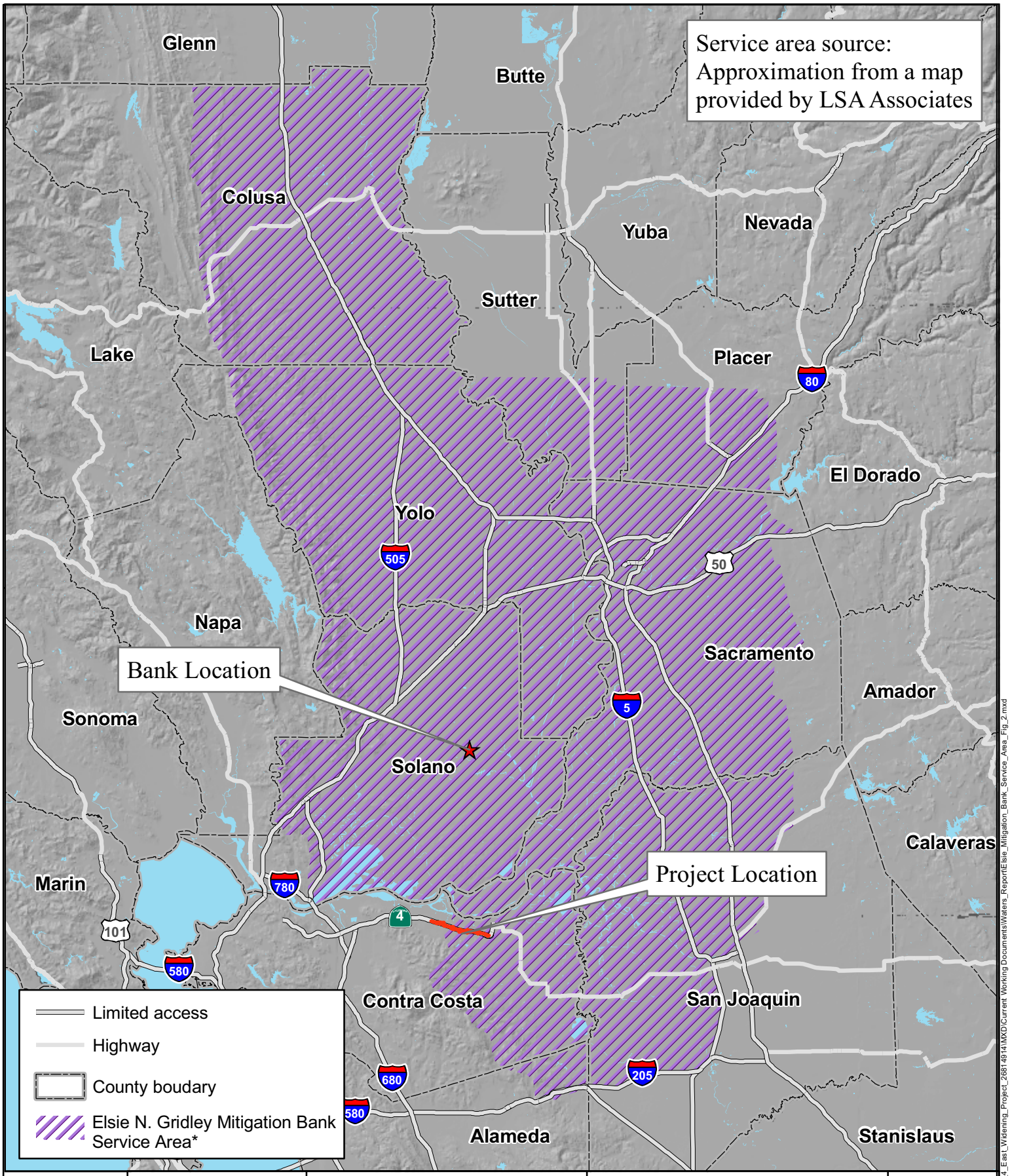
7.2 PROPOSED OFF-SITE MITIGATION FOR JURISDICTIONAL WATERS

Mitigation will take effect for both permanently and temporarily impacted jurisdictional waters following USACE 2002 no-net-loss guidelines. Although most jurisdictional waters onsite constitute poor habitat quality, wetlands will be mitigated at the ratios presented in Table 4-1 and discussed above in Section 6.1.2. Following these recommendations, Caltrans will purchase wetland credits equivalent to 0.944 acres.

7.2.1 Elsie N. Gridley Mitigation Bank

The Elsie N. Gridley Mitigation Bank (EGMB) is approved by USACE to sell wetlands and vernal pools for recreation, restoration, and preservation credits. This particular bank service area extends into eastern Contra Costa County, in close proximity to the SR4 project area. The purchase of mitigation credits at the Elsie N. Gridley Mitigation Bank would offer the best fit for project mitigation, since these are the best available high quality wetlands in the SR4 proximity.

The established habitat presented at EGMB offers the best potential mitigation within the Bay Area. The Elsie N. Gridley Bank has several projects, and serves the area in east Contra Costa County, as is outlined in Figure 2.



N

Caltrans

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

0 5 10 15 20 Miles

Elsie N Gridley Mitigation Bank Service Area

Figure 2

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8.1 PRESERVATION OF HABITAT AT ELSIE N. GRIDLEY MITIGATION BANK

Wetland preservation credits will be purchased at the Elsie N. Gridley Mitigation Bank (EGMB) to compensate for the project's permanent impacts to wetlands and other waters of the U.S. Documentation to USACE will need to be provided stating the correct number of credits allocated to the EGMB before the start of construction, scheduled for May 2009.

9.1 OFF-SITE MITIGATION MONITORING

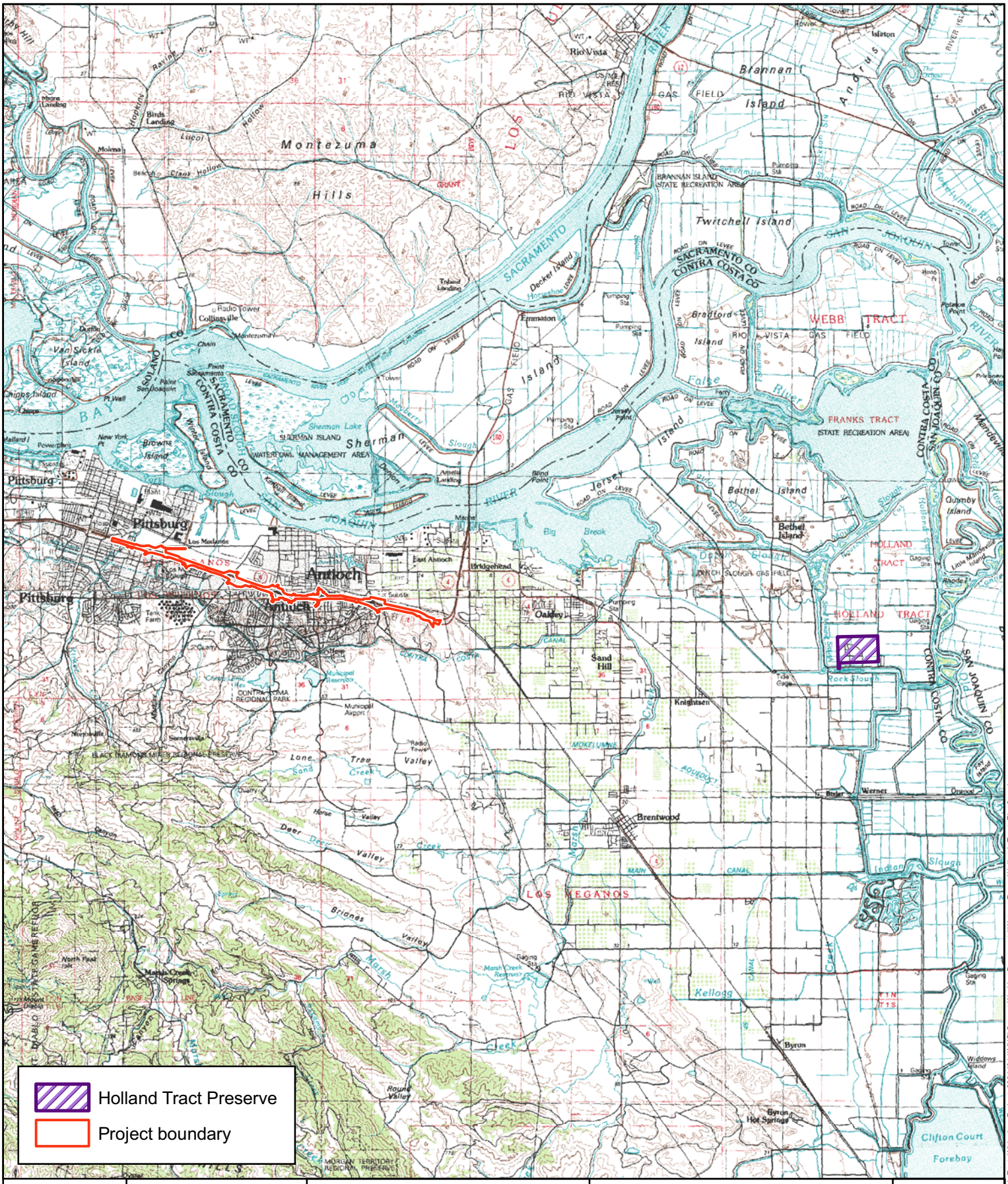
Purchased Mitigation Bank Credits and Conservation Easements

Prior to initiation of ground disturbing activities on the SR4 project, Caltrans shall provide evidence to USACE, CDFG, and RWQCB that the appropriate number of credits for jurisdictional waters have been dedicated at EGMB. All monitoring and performance standards shall be the responsibility of the mitigation bank, species fund, or conservation easement managers.

10.1 JURISDICTIONAL WATERS CONTINGENCY PLANS

10.1.1 Wildlands, Inc. Holland Tract Preserve

If it is not possible to purchase credits from the Elsie N. Gridley Mitigation Bank before the initial start of construction, credits will be pursued at Wildlands Inc. Holland Tract Preserve. Wildlands Inc. has recently purchased approximately 263 acres of land, known as the Holland Tract, located in East Contra Costa County near Oakley, about 16 miles east of the SR4 project. The preserve is bordered by sloughs and rivers feeding the Sacramento-San Joaquin Delta. The preserve plans on establishing or enhancing 107.5 acres of wetlands and open water habitat. These wetland environments will include both freshwater and tidally influenced wetlands. Although the Holland Tract Preserve is an excellent opportunity for SR4 mitigation purposes, as it provides credits for wetland habitat restoration and creation, this project is in the planning stages. The project site is outlined in Figure 3.



N

State Route 4 (East) Widening Project
Loveridge Road to State Route 160

0 1 2 4 Miles

Wildlands Inc.
Holland Tract Preserve

Figure 3

L:\Projects\State_Route_4_East_Widening_Project_26814914\MXD\Current Working Documents\Waters_Report\Holland_Trust_Fig_3.mxd

SECTIONELEVEN References

California Department of Transportation (Caltrans) and Federal Highway Administration (FHWA). 2005. Initial Study/ Negative Declaration/Final Environmental Assessment. State Route 4 (East) Widening Project: Loveridge Road to State Route 160. August 2005.

Parsons. 2004. State Route 4 (East) Widening Project: Loveridge Road to State Route 160 – Natural Environment Study/ Biological Assessment. Prepared for Contra Costa Transportation Authority, State of California Department of Transportation and U.S. Department of Transportation Federal Highway Administration. May 2004.

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URS Corporation. 2006. San Antonio Pipeline Relocation Project- Off-Site Compensatory Mitigation Plan for Federally Listed Species & Wetlands. Prepared for Chevron Pipe Line Company. September 2006.

URS Corporation. 2007. Greenwood Bridge Replacement- Conceptual Mitigation Plan. Prepared for Caltrans. May 2007.

URS Corporation. 2007. Wetland Reverification for SR4 (East) Widening Project Loveridge Road to Somersville Road - 04-CC-04, KP 37.9/41.3 (PM 23.7/25.8). Prepared for Caltrans/Contra Costa Transportation Authority. December 2007.

U.S. Army Corps of Engineers. 2002. Regulatory Guidance Letter No. 02, December 24,2004. Guidance Compensatory Mitigation Projects for Aquatic Resource Impacts Under the Corps Regulatory Program Pursuant to Section 407 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899.

Appendix A
Impacts to Jurisdictional Features

Appendix A: Impacts to Jurisdictional Features

Feature Name	Impact Sheet	Segment	Impact Type	Feature Type	Impact Acres	Linear Feet Impact	Mitigation Ratio
owus 1	1	Loveridge-Somersville	Temporary	Other Waters of the U.S.	0.005	82	NA
owus 4	**2**	**Loveridge-Somersville**	**Permanent**	**Other Waters of the U.S.**	**0.005**	**66**	**4:1**
owus 5	**3**	**Loveridge-Somersville**	**Permanent**	**Other Waters of the U.S.**	**0.011**	**51.3**	**4:1**
owus 5	3	Loveridge-Somersville	Temporary	Other Waters of the U.S.	0.004	10	NA
owus 6	**3**	**Loveridge-Somersville**	**Permanent**	**Other Waters of the U.S.**	**0.007**	**13.5**	**4:1**
		Loveridge-Somersville	**Total Temporary OWUS**		**0.009**		
		Loveridge-Somersville	**Total Permanent OWUS**		**0.023**		
owus 10a	**5**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.002**	**20**	**4:1**
owus 10b	**5**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.007**	**100**	**4:1**
owus 11	**5**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.003**	**10**	**4:1**
owus 7a	**4**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.015**	**85**	**4:1**
owus 7b	**4**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.031**	**295**	**4:1**
owus 8	**4**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.004**	**44**	**4:1**
owus 9	**4**	**Somersville- Route 160**	**Permanent**	**Other Waters of the U.S.**	**0.004**	**80**	**4:1**
		Somersville- Route 160	**Total Permanent OWUS**		**0.066**		
ws 1	**1**	**Loveridge-Somersville**	**Permanent**	**Waters of the State**	**0.008**	**698**	**4:1**
		Loveridge-Somersville	**Total Permanent WS**		**0.008**		
wl/wus 1	**1**	**Loveridge-Somersville**	**Permanent**	**Wetland/Waters of the U.S.**	**0.048**	**98**	**4:1**
wl/wus 2	**2**	**Loveridge-Somersville**	**Permanent**	**Wetland/Waters of the U.S.**	**0.010**	**10**	**4:1**
wl/wus 3	**2**	**Loveridge-Somersville**	**Permanent**	**Wetland/Waters of the U.S.**	**0.021**	**66**	**4:1**
		Loveridge-Somersville	**Total Permanent WL/WUS**		**0.079**		

Appendix A: Impacts to Jurisdictional Features (continued)

Feature Name	Impact Sheet	Segment	Impact Type	Feature Type	Impact Acres	Linear Feet Impact	Mitigation Ratio
wl/wus 10	5	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.002	20	4:1
wl/wus 11	5	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.009	40	4:1
wl/wus 5a	4	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.008	65	4:1
wl/wus 5b	4	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.013	90	4:1
wl/wus 6	4	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.011	44	4:1
wl/wus 7	4	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.003	24	4:1
wl/wus 8	4	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.005	72	4:1
wl/wus 9a	5	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.002	20	4:1
wl/wus 9b	5	Somersville- Route 160	Permanent	Wetland/Waters of the U.S.	0.007	30	4:1
		Somersville- Route 160	Total Permanent WL/WUS		0.060		

	Temporary Impacts	Permanent Impacts	Total Impacts
Total ws	0.000	0.008	0.008
Total owus	0.009	0.089	0.098
Total wl/wus	0.000	0.139	0.139
Grand Total	0.009	0.236	0.245

Appendix B
Drainage Plans

04-228554

INFORMATION HANDOUT

NOTES:

FOR LEGEND, NOTES AND ABBREVIATIONS SEE SHEET D-1.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER J.E. Peterson No. 42777 Exp. 3-31-08 CIVIL STATE OF CALIFORNIA

CONTRA COSTA
TRANSPORTATION AUTHORITY
3478 Buskirk Ave. Suite 100
Pleasant Hill, CA 94523

CALTRANS
111 Grand Avenue
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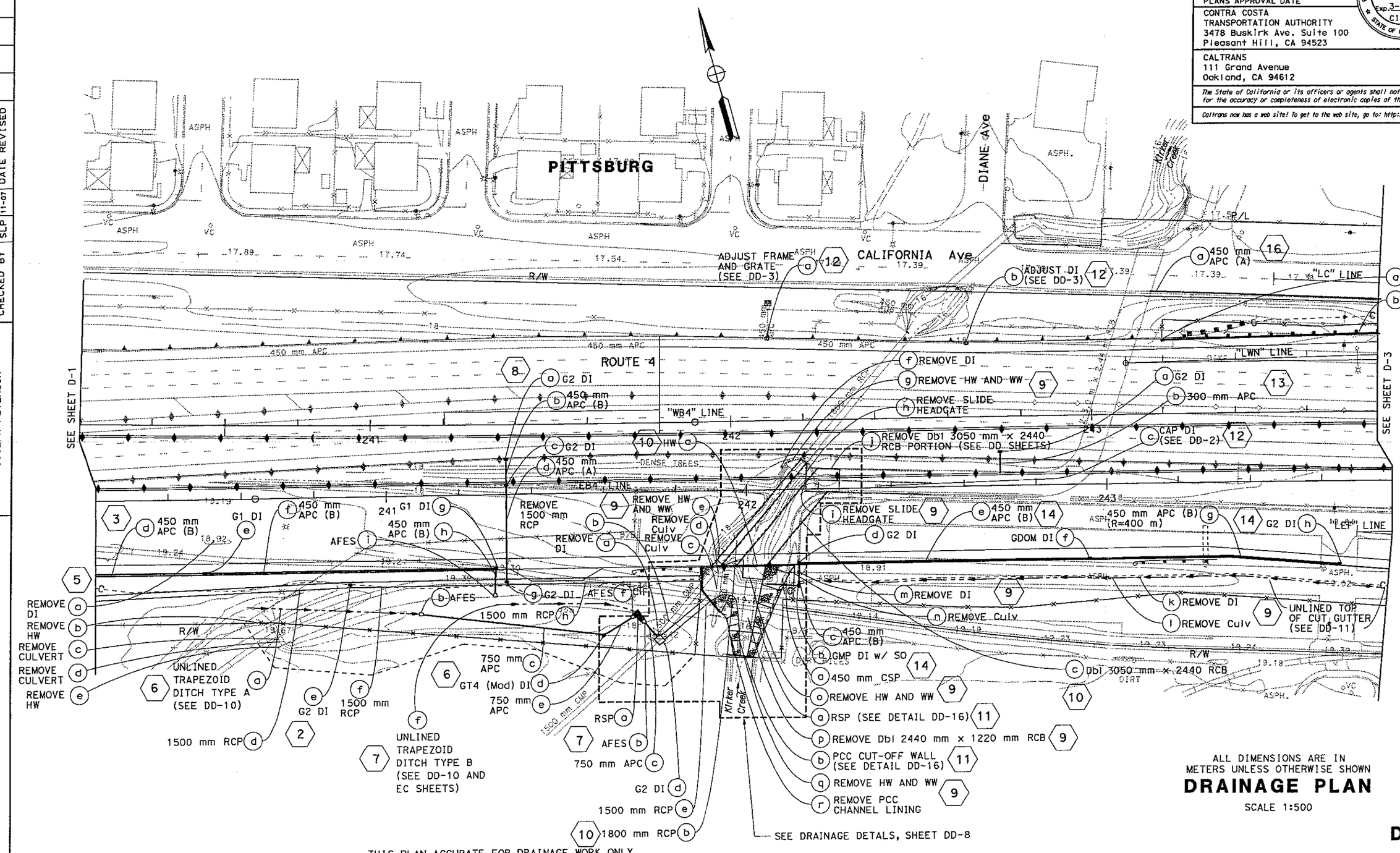

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DRAINAGE PLAN

SCALE 1:500

D-2

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DATE	REVISED BY	DATE REVISED
11-07	KMR	11-07

CALCULATED/DESIGNED BY: KMR
CHECKED BY: SLP

DESIGN OVERSIGHT: JOSEPH PETERSON

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No. 42777
Exp. 3-31-08
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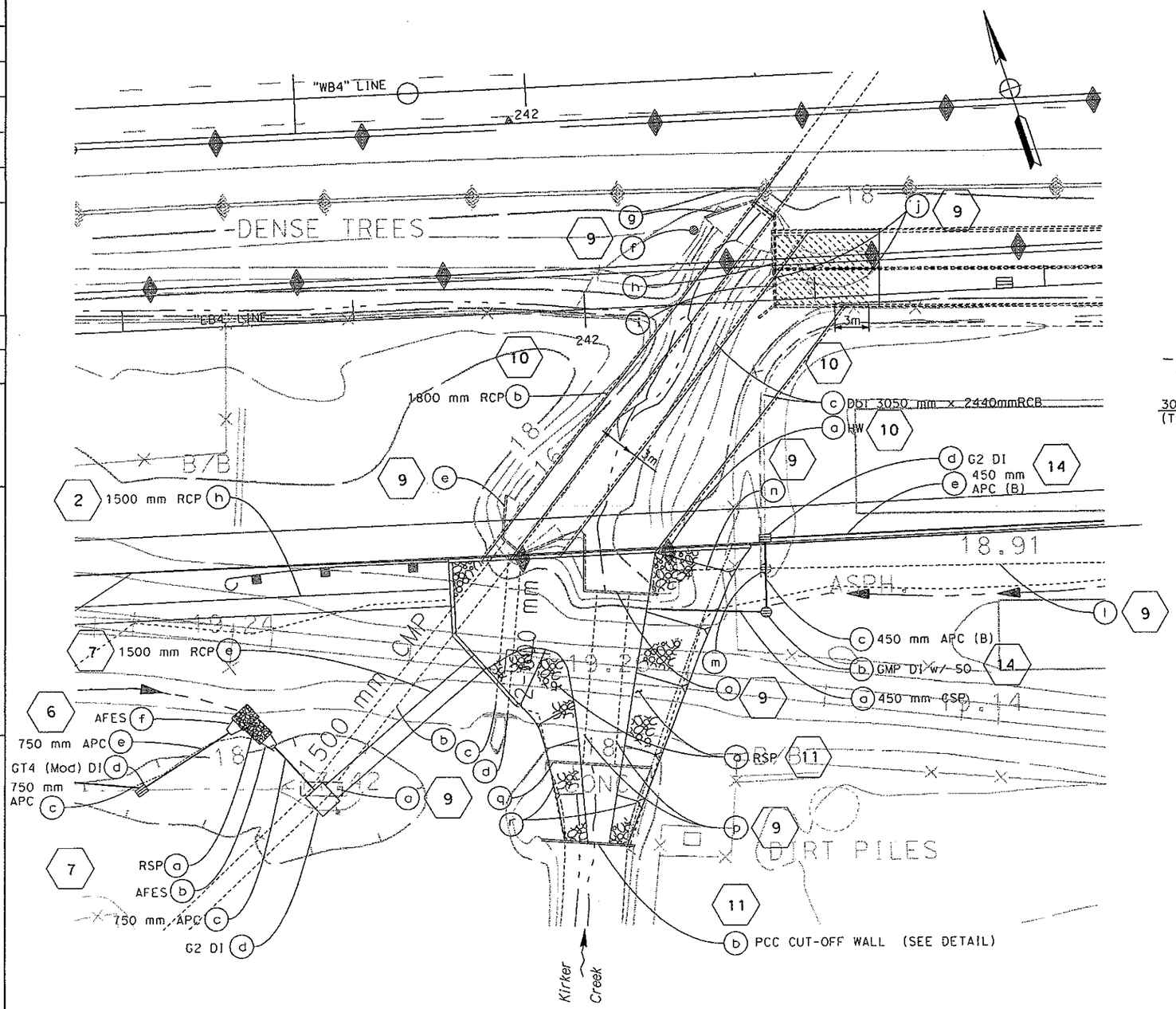

KIRKER CREEK MODIFICATION

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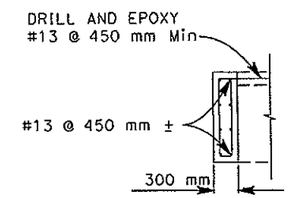
NOTE: FOR ADDITIONAL INFORMATION SEE DD-21



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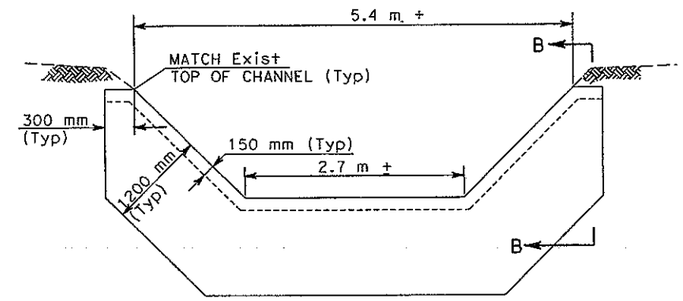

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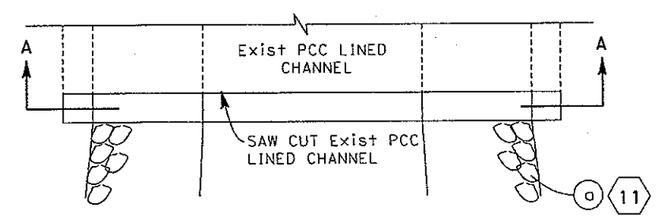

PCC CHANNEL CUT-OFF WALL

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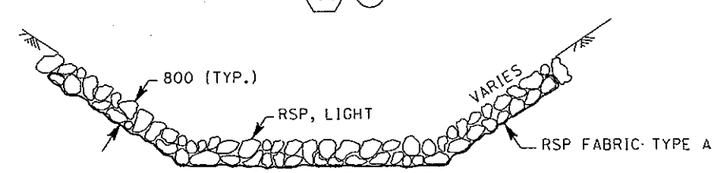

RSP DETAIL

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DRAINAGE DETAILS

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DD-16

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EA 228591

INFORMATION HANDOUT

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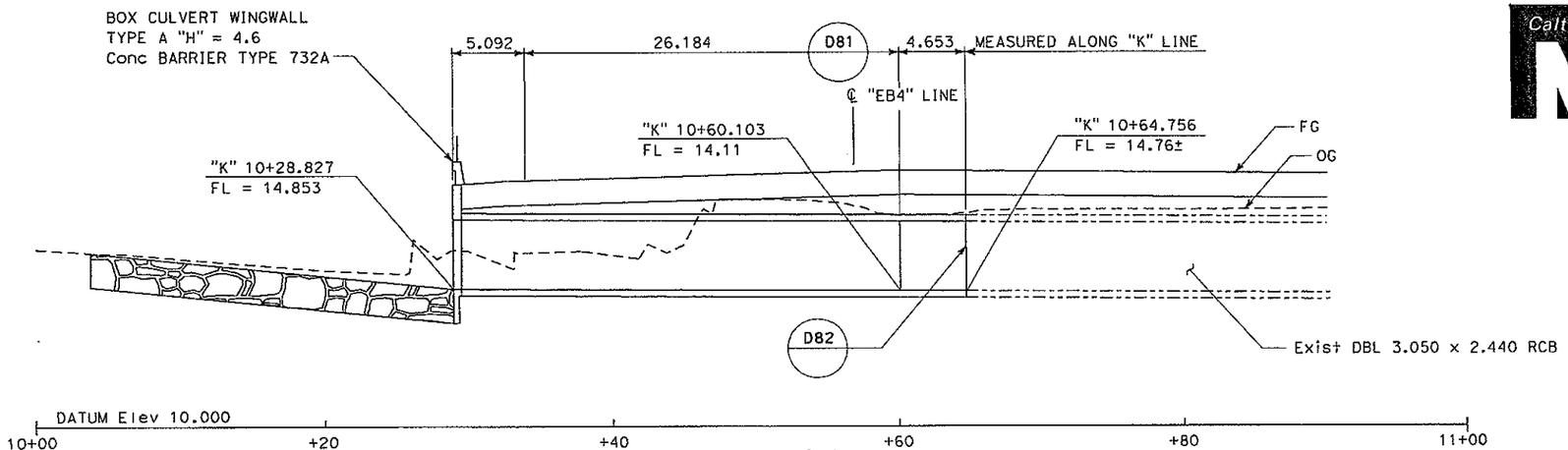

ELEVATION

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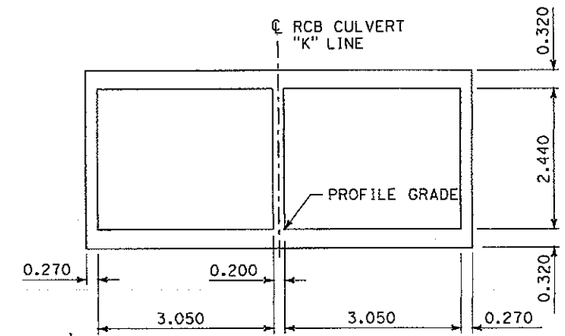
Vert 1:100



TYPICAL SECTION D81

SEE NOTE 5
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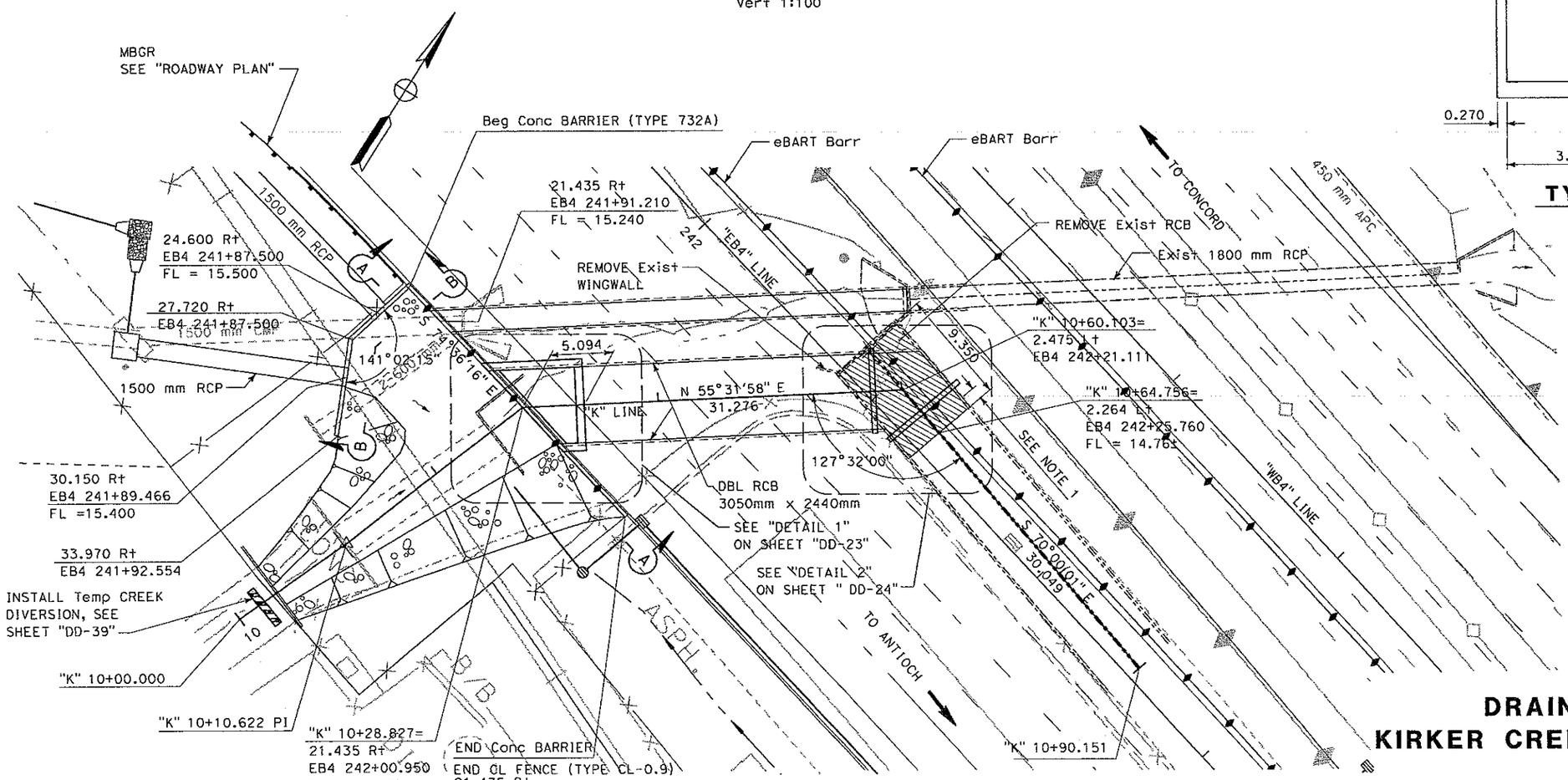

PLAN

1:200

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NOTES:

1. SEE D82 FOR RCB EXTENSION DETAILS.
2. SEE "DD-22" SHEET FOR SECTION A-A AND SECTION B-B.
3. SEE "DD-23" SHEET FOR "DETAIL 1".
4. SEE "DD-24" SHEET FOR "DETAIL 2".
5. FOR REINFORCEMENT DETAILS SEE Std PLANS D81, BOX 3.050 x 2.440 WITH 6 m Max COVER

LEGEND:

REMOVE RCB (PARTIAL)

INDICATES EXISTING STRUCTURE

DRAINAGE DETAILS
KIRKER CREEK RCB EXTENSION

SCALE AS SHOWN

DD-21

CALCULATED/ DESIGNED BY	PH	DATE 03/05	REVISED BY
CHECKED BY	AM	03/05	DATE REVISED

DESIGN OVERSIGHT
JOSEPH PETERSON

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

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DEPARTMENT OF TRANSPORTATION
111 GRAND AVENUE
P. O. BOX 23660
OAKLANE, CA 94623-0660
PHONE (510) 622-8729
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Flex your power!
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January 21, 2010

Ms. Susan Moore, Field Supervisor
U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, Ca 95825-1846

Attn: Jerry Roe

Subject: Request for Amendment to Biological Opinion for State Route 4 (East) Widening Project (USFWS File No. 1-1-05-F-0158; 1-1-05-F-0158-2)

Dear Ms. Moore:

The United States Fish and Wildlife Service (USFWS) issued a Biological Opinion (BO) on June 13, 2005 (1-1-05-F-0158) for the California Department of Transportation and Contra Costa Transportation Authority (Caltrans/CCTA) project to widen State Route 4 (SR-4) -- Loveridge Road to State Route 160 in Contra Costa County, California, from its current four lanes to an eight-lane facility providing, three mixed-flow and one high occupancy vehicle lane in each direction, to reconstruct interchanges and to provide auxiliary lanes between the interchanges. The SR-4 project will reduce existing traffic congestion, improve traffic operations, and encourage high occupancy vehicle use to accommodate travel demand. An amendment to the BO was approved and issued by USFWS on April 15, 2008 (1-1-05-F-0158-2).

Because of funding and construction restrictions, the project will be built in four segments and some of the segments will be further divided into phases.

In a best faith effort to provide USFWS with the most accurate description of design plans in the West Antioch Creek area (Segment 2, CRLF habitat), the request for the first BO amendment was sent to USFWS prior to the start of the first project segment. Since that point, a combination of significant factors has altered the affected CRLF habitat, as discussed below. Caltrans as the NEPA lead agency requests an amendment to the BO to include the recent changes in affected upland and aquatic CRLF habitat. Reasons for an amendment to the Biological Opinion are two-fold:

(1) Impact acreage changes based on Jurisdictional Delineation

The original jurisdictional delineation for waters of the U.S. was completed on July 10, 2002. Caltrans revised the jurisdictional delineation in 2007 and submitted the report to the United States Army Corps of Engineers (USACE) on January 29, 2008 for reverification. Meanwhile, the request for a BO amendment was submitted to USFWS prior to USACE verification of the jurisdictional delineation. USACE approved the wetland reverification in January 5, 2009, but determined that the acreages for aquatic areas were smaller than those submitted by Caltrans/CCTA. Since the impact numbers to CRLF habitat agreed upon in the BO are based on the USACE jurisdictional delineation, the reverification of the jurisdictional delineation has resulted in changes to the impact and mitigation acreages for CRLF aquatic and upland/aestivation habitat. The wetland reverification resulted in smaller impacts to aquatic habitat and therefore larger impacts to upland/aestivation habitat (impact areas once considered as aquatic became upland; Table 1, in section below).

(2) Engineering Design Plans are now at 95%

The impact acreages in the April 15, 2008 Amended BO were based on the 35% engineering design plans. The engineering design for the West Antioch Creek area is now at 95%. The likelihood of any further design changes affecting impact acreages is now minimal.

Summary of Impact and Mitigation Acreages

Based on the agreed-upon mitigation ratio from the April 15, 2008 Amended BO, the new mitigation acreages would be 2.308 acres of onsite restoration and 5.208 acres of offsite mitigation (Table 1 & 2).

Table 1. Original and Updated Impact Acreages at West Antioch Creek Area of the State Route 4 Widening Project.

Impact on Aquatic and Upland Habitat	2005 Biological Opinion Impacts (acre)	2008 BO Amendment Impacts (acre)	2009 Final Impacts (acre)
Permanent Aquatic	0.1518	0.221	0.143
Permanent Upland	1.4200	1.372	1.516
Temporary Aquatic	0.0208	0.112	0
Temporary Upland	1.0400	2.410	2.308

Table 2. Present Mitigation Acreages at West Antioch Creek Area of the State Route 4 Widening Project.

Impact on Aquatic and Upland Habitat	Impacts (acre)	Mitigation Ratio	On-Site Mitigation (acre)	Off-Site Mitigation (acre)
Permanent Aquatic	0.143	3:1	0	0.429
Permanent Upland	1.516	3:1	0	4.548
Temporary Aquatic	0	1.1:1*	0	0
Temporary Upland	2.308	1.1:1*	2.308	0.231
TOTAL			2.308	5.208

- Ratio includes 1:1 onsite restoration; 0.1:1 offsite mitigation

Based on the 2008 amended BO, Caltrans purchased 5.04 acres of mitigation credits at Ohlone Mitigation Bank on August 1, 2008 (USFWS approved bank) to mitigate for permanent and temporary impacts. Caltrans would purchase an additional 0.17 acre to satisfy its offsite mitigation requirements based on the revised impacts.

Amended Biological Opinion Text Revisions

Based on the above information, Caltrans requests the following changes to the June 13, 2005 Biological Opinion and April 15, 2008, Amended Biological Opinion (requested changes in **BOLD**):

1. Add the following to the Consultation History:

December 23, 2009, Email received from Caltrans/CCTA requesting an amendment to the amended Biological Opinion dated April 15, 2008.

January 5, 2010, Phone call to Jerry Roe from Caltrans requesting an amendment to the Amended Biological Opinion dated April 15, 2008 due to changes in the CRLF habitat impact resulting from USACE reverified wetland delineation (dated January 5, 2009) and updated (95%) engineering design plans.

2. Change Item 2 (**Avoidance and Conservation Measures** #21) on page 2 of the April 15, 2008 Amended Biological Opinion from:

According to the revised wetland delineation and jurisdictional determination, the request for an amendment to the June 13, 2005 Biological Opinion, and discussions between Caltrans, Contra Costa Transportation Authority and the Service, the Project will permanently effect 0.221-acre and will temporarily affect 0.112-acre of wetlands and Water of the United States.

To:
According to the revised wetland delineation and jurisdictional determination, the request for an amendment to the April 15, 2008 Amended Biological Opinion, and discussions between Caltrans, Contra Costa Transportation Authority and the Service, the Project will permanently effect **0.143**-acre of wetlands and Water of the United States.

3. Change Item 3 (**Avoidance and Conservation Measures** #22) on page 2 of the April 15, 2008 Amended Biological Opinion from:

According to the revised wetland delineation and jurisdictional determination, the request for an amendment to the June 14, 2005 Biological Opinion, and discussions between Caltrans, Contra Costa Transportation Authority and the Service, the Project will permanently affect 1.593 acres and temporarily affect 2.522 acres of California red-legged frog habitat. Permanent effects will be compensated at a 3:1 ratio totaling 4.779 acres, and temporary effects will be compensated at a 1.1:1 ratio totaling 2.774 acres (i.e. 1:1 ratio for onsite restoration; 0.1:1 ratio for offsite compensation).

To:
According to the revised wetland delineation and jurisdictional determination, the request for an amendment to the April 15, 2008 Amended Biological Opinion, and discussions between Caltrans, Contra Costa Transportation Authority and the Service, the Project will permanently affect **1.659 acres** and temporarily affect **2.308 acres** of California red-legged frog habitat. Permanent effects will be compensated at a 3:1 ratio totaling **4.977** acres, and temporary effects will be compensated at a 1.1:1 ratio totaling **2.539** acres (i.e. **2.308 acres** at 1:1 ratio for onsite restoration; **0.231 acre** at 0.1:1 ratio for offsite compensation).

4. Change Item 4 (the **Effects of the Proposed Action**) on page 2 of the April 15, 2008 Amended Biological Opinion from:

Temporary effects are project activities that temporarily remove one or more essential components of the habitat of a listed species, but can be restored to pre-project conditions of equal or greater habitat value. In order for the effects to be considered temporary, the affected habitat of the listed species must be totally restored within one year. Ground disturbance resulting from the proposed State Route 4 Project includes substantial grading, excavating, and fill. Caltrans is considering the adverse effects of a significant amount of cut and fill of earth, a maximum of 2.522 acres, to be of a temporary nature. These activities have potential to cause injury and mortality to individual California red-legged frogs occupying the action area. As part of the project description, Caltrans has stated upon completion of the project, they will restore temporary disturbed areas to promote restoration to pre-project conditions. The temporary effects will result in the permanent loss of the habitat utilized by the California red-legged frog unless the restoration implemented by Caltrans is adequately planned, utilizes native California plant species collected in the immediate area of the proposed project, and meets specific success criteria.

To:
Temporary effects are project activities that temporarily remove one or more essential components of the habitat of a listed species, but can be restored to pre-project conditions of equal or greater habitat value. In order for the effects to be considered temporary, the affected habitat of the listed species must be totally restored within one year. Ground disturbance resulting from the proposed State Route 4 Project includes substantial grading, excavating, and fill. Caltrans is considering the adverse effects of a significant amount of cut and fill of earth, a maximum of **2.308** acres, to be of a temporary nature. These activities have potential to cause injury and mortality to individual California red-legged frogs occupying the action area. As part of the project description, Caltrans has stated upon completion of the project, they will restore temporary disturbed areas to promote restoration to pre-project conditions. The temporary effects will result in the permanent loss of the habitat utilized by the California red-legged frog unless the restoration implemented by Caltrans is adequately planned, utilizes native California plant species collected in the immediate area of the proposed project, and meets specific success criteria.

5. Change Item 5 (**Effects of the Proposed Action**) on page 3 of the April 15, 2008 Amended Biological Opinion from:

The amount of wetlands and other Waters of the United States at West Antioch Creek that will be permanently affected is 0.221-acre and 0.112-acre will be temporarily affected by the proposed State Route 4 project; there will be permanent effects to 1.372 acres of upland habitat and 2.41 acres of temporary effects. The permanent effects to California red-legged frog habitat will be compensated for at a 3:1 ratio totaling 4.779 acres and temporary effects will be compensated at a 1.1:1 ratio totaling 2.774 acres.

To:
The amount of wetlands and other Waters of the United States at West Antioch Creek that will be permanently **affected by the proposed State Route 4 project is 0.143-acre;** there will be permanent effects to **1.516** acres of upland habitat and **2.308** acres of temporary effects **to upland habitat**. The permanent effects to California red-legged frog habitat will be compensated for at a 3:1 ratio totaling **4.977** acres and temporary effects will be compensated at a 1.1:1 ratio totaling **2.539** acres.

6. Change Item 6 (**Amount or Extent of Take**) on page 4 of the April 15, 2008 Amended Biological Opinion from:

The Service anticipates that incidental take of the California red-legged frog will be difficult to detect because when this amphibian is not in their breeding ponds, it inhabits the burrow of ground squirrels or other rodents, or may be difficult to locate due to their cryptic appearance and behavior; the sub-adult 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. Losses of this species also may 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. Therefore, the Service is estimating that all California red-legged frogs inhabiting 4.115 acres (permanent effects = 1.593 acres; temporary effects = 2.522 acres) of aquatic and upland habitat, based on the Biological Assessment, April 1, 2005, field meeting, the June 1, 2005, meeting with Caltrans, Addendum to the Biological Assessment, revised wetland delineation and jurisdictional determination, the request for an amendment to the June 13, 2005 Biological Opinion, and correspondence between Caltrans, Contra Costa Transportation Authority and U.S. Fish and Wildlife Service, will be subject to incidental take. Upon implementation of the Reasonable and Prudent Measures, incidental take associated with the State Route 4 Project in the form of harm, harassment, capture, injury, and death of the California red-legged frog caused by habitat loss and construction activities will become exempt from the prohibitions describe under section 9 of the Act.

To:
The Service anticipates that incidental take of the California red-legged frog will be difficult to detect because when this amphibian is not in their breeding ponds, it inhabits

the burrow of ground squirrels or other rodents, or may be difficult to locate due to their cryptic appearance and behavior; the sub-adult 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. Losses of this species also may 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. Therefore, the Service is estimating that all California red-legged frogs inhabiting **3.967** acres (permanent effects = **1.659** acres; temporary effects = **2.308** acres) of aquatic and upland habitat, based on the Biological Assessment, April 1, 2005, field meeting, the June 1, 2005, meeting with Caltrans, Addendum to the Biological Assessment, revised wetland delineation and jurisdictional determination, the request for an amendment to the June 13, 2005 Biological Opinion, **April 15, 2008 Amendment to the Biological Opinion, January 5, 2009 Jurisdictional Determination by the USACE, and recent** correspondence between Caltrans, Contra Costa Transportation Authority and U.S. Fish and Wildlife Service, will be subject to incidental take. Upon implementation of the Reasonable and Prudent Measures, incidental take associated with the State Route 4 Project in the form of harm, harassment, capture, injury, and death of the California red-legged frog caused by habitat loss and construction activities will become exempt from the prohibitions describe under section 9 of the Act.

7. Change Item 7 (**Terms and Conditions**, (A)(4)) on page 4 of the April 15, 2008 Amended Biological Opinion from:

As described in the June 1, 2005, meeting with Caltrans, and the Addendum to the Biological Assessment, 2.84 acres of upland habitat and 0.4 acre of aquatic habitat for the California red red-legged frog shall be permanently protected through (1) acquisition and management of appropriate off-site habitat, (2) purchase of an appropriate amount of credits at a Service-approved conservation bank; or (3) deposit of sufficient funds into a Caltrans account that will be used to purchase and manage appropriate habitat for the California red-legged frog as approved by the Service. The written approval of the Service shall be obtained by Caltrans prior to implementing the measure they have chosen for habitat compensation.

To:
As described in Caltrans' January 2010 request for an Amendment to the Biological Opinion, 5.208 acres of mitigation for the California red-legged frog shall be permanently protected through (1) acquisition and management of appropriate off-site habitat, (2) purchase of an appropriate amount of credits at a Service-approved conservation bank; or (3) deposit of sufficient funds into a Caltrans account that will be used to purchase and manage appropriate habitat for the California red-legged frog as approved by the Service. The written approval of the Service shall be obtained by Caltrans prior to implementing the measure they have chosen for habitat compensation.

8. Change Item 8 (**Terms and Conditions**, (A)(12)) on page 5 of the April 15, 2008 Amended Biological Opinion from:

As described in the June 1, 2005, meeting, Caltrans shall submit to the Service their draft proposal for the restoration of the 2.522 acres of California red-legged frog habitat that will be temporarily affected by the proposed project at least sixty (60) calendar days prior to initial ground breaking at the State Route 4 project; the final plan shall be submitted for approval by the Service prior to ground breaking at the proposed project. The plan shall include restoration and revegetation work associated with temporary effects using native California plant species from on-site or local sources (i.e., local ecotype). Plant materials from non-local sources shall be allowed only with written authorization from the Service. To the maximum extent practicable (i.e., presence of natural lands), topsoil shall be removed, cached, and returned to the site according to successful restoration protocols. Loss of soil from run-ff or erosion shall be prevented with straw bales, straw wattles, or similar means provided they do not entangle, block escape or dispersal routes of listed animal species. The draft and final plan shall contain specific quantifiable criteria to evaluate the success of the restoration.

To:
As described in the June 1, 2005, meeting, Caltrans shall submit to the Service their draft proposal for the restoration of the **2.308** acres of California red-legged frog habitat that will be temporarily affected by the proposed project at least sixty (60) calendar days prior to initial ground breaking at the State Route 4 project; the final plan shall be submitted for approval by the Service prior to ground breaking at the proposed project. The plan shall include restoration and revegetation work associated with temporary effects using native California plant species from on-site or local sources (i.e., local ecotype). Plant materials from non-local sources shall be allowed only with written authorization from the Service. To the maximum extent practicable (i.e., presence of natural lands), topsoil shall be removed, cached, and returned to the site according to successful restoration protocols. Loss of soil from run-ff or erosion shall be prevented with straw bales, straw wattles, or similar means provided they do not entangle, block escape or dispersal routes of listed animal species. The draft and final plan shall contain specific quantifiable criteria to evaluate the success of the restoration.

The remainder of the June 13, 2005 Biological Opinion and the April 15, 2008 Amendment is unchanged.

Once again, we appreciate your assistance with this important roadway improvement project. If you have any questions or need additional information, please feel free to contact Ahmad Hashemi, Senior Biologist, at 510.286.5961.

Sincerely,

for, JEFFREY G. JENSEN
District Office Chief
Office of Biological Sciences and Permits
Caltrans District 4, Oakland

cc: Susan Miller, CCTA

bc:	Jan Novak,	URS
	Scott Kelsey,	URS
	James B Richards	Deputy District Director, CT
	Laurie Lau,	Regional Project Manager, CT
	Bonnita Chow,	District Branch Chief, CT
	Howell Chan,	Senior Environmental Planner, CT
	Ahmad Hashemi,	Senior Biologist, CT

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:
1-1-05-F-0158

Mr. Gene Fong
Federal Highway Administration
Department of Transportation
650 Capital Mall, Suite 4-100
Sacramento, California 95814

JUN 13 2005

Subject: Biological Opinion on the Proposed State Route 4 (east) from Loveridge Road to State Route 160 Widening Project in Contra Costa County, California

Dear Mr. Fong:

This is in response to your June 7, 2005, request for formal consultation with the U.S. Fish and Wildlife Service (Service) on the proposed State Route 4 (east) widening from Loveridge Road to State Route 160 in Contra Costa County, California. Your request was received in this office on June 9, 2005. This document represents the Service's biological opinion on the effects of the action on the threatened California red-legged frog (*Rana aurora draytonii*). This document is issued pursuant to section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act).

The proposed State Route 4 project is not likely to adversely affect the endangered salt marsh harvest mouse (*Reithrodontomys raviventris*) and the threatened giant garter snake (*Thamnophis gigas*) due to an apparent lack of suitable habitat for these two listed animals in the action area.

This biological opinion is based on: (1) a letter from the Federal Highway Administration to the Service dated June 9, 2005; (2) *Natural Environmental Study/Biological Assessment State Route 4 (east) Widening Project Loveridge Road to State Route 160 04-CC-4 KP7.8/R47.6 (PM2.5/R29.6) EA 04275-228500* (Biological Assessment) dated March 2004 that was prepared by Parsons; (3) a visit to the project site on April 1, 2005, by Chris Nagano of the Service, John Cleckler detailee from the California Department of Transportation (Caltrans) to Service, and representatives from Caltrans, the County of Contra Costa, and Parsons; (4) An April 22, 2005, letter from the Service to the Federal Highway Administration; (5) Several telephone calls between the Service and Parsons regarding the location where a frog and suitable California red-legged frog habitat were observed at West Antioch Creek on the April 1, 2005, field meeting; (6) an electronic mail message from Kate Lewis of Parsons to David Yam of Caltrans dated May 1,

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2005, that contained the amount of permanent and temporary effects to the upland habitat of the California red-legged frog at West Antioch Creek; (7) a meeting between David Yam and Chris Nagano regarding the effects to the California red-legged frog and appropriate compensation for the proposed project; (8) Addendum to the Natural Environment Study/Biological Assessment prepared by Parsons and electronically mailed on June 3, 2005; and (9) other information available to the Service.

CONSULTATION HISTORY

May 3, 2004:	The Service received the *Natural Environmental Study/Biological Assessment State Route 4 (east) Widening Project Loveridge Road to State Route 160 04-CC-4 KP7.8/R47.6 (PM2.5/R29.6) EA 04275-228500.*
April 1, 2005:	Chris Nagano and John Cleckler, and representatives from Caltrans, the County of Contra Costa, and Parsons met at the proposed project site. Mr. Nagano observed a medium-sized frog in West Antioch Creek on the north side of State Route 4, and the Caltrans representative observed a frog in West Antioch Creek on the south side of State Route 4; suitable aquatic and upland habitat for the California red-legged frog was observed along West Antioch Creek on the north and south sides of State Route 4.
April 22, 2005:	The Service sent a letter to the Federal Highway Administration requesting additional information on the proposed project.
April 28, 2005 to May 23, 2005	Several telephone conversations between the Service and Parsons regarding the location where the frogs and the California red-legged frog habitat was observed at West Antioch Creek on the April 1, 2005, field meeting.
May 1, 2005:	Kate Lewis of Parsons sent an e-mail to David Yam of Caltrans dated May 1, 2005, that contained the amount of permanent and temporary effects to the upland habitat of the California red-legged frog at West Antioch Creek.
June 1, 2005:	Chris Nagano of the Service met with David Yam of Caltrans regarding the effects to the California red-legged frog and appropriate compensation for the proposed project.

BIOLOGICAL OPINION

Description of Proposed Action

It is our understanding, the proposed project is located on State Route 4 from approximately 0.81 mile west of the Loveridge Road interchange to 0.77 mile east of the Hillcrest Avenue interchange in the City of Antioch in Contra Costa County, California. The proposed action consists of the doubling of available lanes from four to eight, reconstruction of five interchanges;

widening the median for the entire project segment; widening of pedestrian undercrossings; extending box culverts at Kirker Creek, West Antioch Creek, and the Los Medanos; widening of a utility undercrossing at Century Boulevard; and the relocation of a pump station at Loveridge Road.

Construction of the proposed project is expected to begin in 2007 and extend to 2013. The construction primarily will take place during the daylight hours, but some nighttime work will occur to avoid interference with highway traffic.

Avoidance and Conservation Measures

According to the Biological Assessment, the June 1, 2005, meeting between the Service and David Yam of Caltrans, the Addendum to the Biological Assessment and other information available to the Service, Caltrans proposes to avoid, minimize, and compensate for effects to the California red-legged frog through the following measures (several of these measures are being implemented for effects to wetlands and other wildlife, but will serve as conservation measures for the listed amphibian):

1. Construction activities in streambeds will be restricted to the dry season.

2. Creek flow will not be impeded.

3. A high visibility construction fence outlining environmentally sensitive areas (ESA) will be installed as a first order of work and will remain until job completion. No work, storage, or other activities shall occur within an ESA.

4. The equipment staging area will be on State Route 4 or on the property outside of the U.S. Army Corps of Engineer's jurisdiction.

5. A coffer dam and corrugated steel pipe, sized at about 48 inches in diameter for dry-season flows, will be installed with clean gravel and filter fiber. The coffer dam, filter fiber, and corrugated steel pipe will be removed from the creek bed after completion of the project.

6. Landscape trees growing on top of the culvert will be cut down, rather than bulldozed or pulled out.

7. Excavated materials will be disposed of at an approved disposal site.

8. The Contractor shall furnish a permitted Biological Monitor. The permitted Biological Monitor shall be permitted by the Service to handle listed species, specifically the California red-legged frog. The permitted Biological Monitor shall also hold a California Department of Fish and Game Scientific Collection Permit for handling general wildlife species, common to coastal scrub and riparian habitats of the San Francisco Bay Area, that might be expected in the project vicinity and any additional written permits or

Mr. Gene Fong

Memorandum of Understanding (MOUs) from the California Department of Fish and Game for the 'Species of Special Concern'.

9. A general Biological Monitor may be used instead of the permitted Biological Monitor for onsite monitoring in certain instances as specified below. The general Biological Monitor shall possess a 4-year college degree in Biology or Environmental Sciences, a minimum of one year's experience in biological wildlife surveys or wildlife monitoring, and shall hold a California Department of Fish and Game Scientific Collection Permit for handling general wildlife species, common to coastal scrub and riparian habitats of the San Francisco Bay Area, that might be expected in the project vicinity. In addition, the general Biological Monitor shall also be able to identify the California red-legged frog.

10. The permitted Biological Monitor shall be on site during the installation of perimeter barriers (Type Frog) and temporary fence (Type ESA), and during any clearing and grubbing activities to ensure work areas are clear of listed species. During these activities, the permitted Biological Monitor shall conduct monitoring in the area where work is scheduled prior to the initiation of each construction work shift and visually survey the entire area, where fences are to be installed or removed, and where clearing and grubbing activities are to take place. The monitoring shall consist at a minimum of the following activities: (1) visual surveys of the entire area focusing on the immediate area where work is proposed for that shift; (2) inspecting under rocks, wood, or other debris; (3) inspecting under and in construction equipment and stored materials; (4) probing and shaking of vegetation to flush wildlife. Tools such as, but not limited to, a spotlight and a wooden stick for probing vegetation and litter may be used during the monitoring process. During the fencing and clearing and grubbing work shifts, the permitted Biological Monitor shall continue to monitor the area for the California red-legged frog. If any barrier or fence is found not to be in good condition, the permitted Biological Monitor shall immediately inform the Resident Engineer and Contractor, and corrective action shall be taken immediately by the Contractor. The permitted Biological Monitor shall make a final visual survey of all fences and barriers at the beginning of each work day during these phases of construction to ensure the integrity of the fence and barrier lines such that wildlife will not be able to enter the construction area between work shifts.

11. The general Biological Monitor shall conduct monitoring prior to the initiation of each construction work shift in active construction work areas at West Antioch Creek, routinely at the beginning of the work shift. This Biological Monitor shall perform the following tasks: (1) monitoring of ESAs, fencing, perimeter barriers, and silt fences throughout the entire project site, and (2) monitoring of active construction zones to ensure work areas are clear of listed species, species of special concern, and other general wildlife that might enter the construction zone. If any fence or barrier is found not to be in good condition, the Biological Monitor shall immediately inform the Resident Engineer and Contractor, and the Contractor shall take immediate corrective action.

12. A Biological Monitor must be on-call and capable of responding to the work site within

one (1) hour.

13. Biological Monitors shall maintain monitoring records that include: (1) the beginning and ending time of each day's monitoring effort; (2) a statement clearly stating whether specified species, or any other general wildlife species, were encountered, including the time and location when such species were found; (3) the time the specimen was identified and by whom and its condition; (5) condition of the barriers and fences; and (6) a description of any actions taken. The Biological Monitors shall maintain complete records in their possession while conducting monitoring activities and shall immediately surrender records to the Resident Engineer upon request. All monitoring records shall be provided to the Resident Engineer upon completion of the monitoring work.

14. When any frog is encountered by a Biological Monitor or Contractor's personnel, construction activities in the immediate area (within a 15-meter radius) of where the frog is found shall be immediately halted. If encountered by the Contractor's personnel, the Resident Engineer and onsite Biological Monitor shall be immediately notified. If encountered by the Biological Monitor, the Resident Engineer and Contractor shall be immediately notified. If the permitted Biological Monitor is not present when a frog is encountered, the general Biological Monitor shall immediately notify the permitted Biological Monitor.

15. If the general Biological Monitor is not authorized by the Service to handle the California red-legged frog, any individual frog encountered on the project site shall be protected, at the location where encountered, underneath an inverted 5-gallon white plastic bucket until the permitted Biological Monitor arrives at the site to identify the specimen to species. The bucket shall have a minimum of six (6) 15 mm holes drilled in the bottom for ventilation. The bucket shall be shaded and damp material inserted if necessary to ensure that the frog does not become overheated and dehydrated or desiccated. Under no circumstances shall the frog be left under the bucket for more than three (3) hours. The permitted Biological Monitor shall come immediately to the project site in order to confirm whether or not the specimen is a California red-legged frog. The permitted Biological Monitor, in accordance with Service guidelines, shall move any live California red-legged frog encountered within the construction zone a minimum of 100 meters from the construction zone. The relocation site shall be determined prior to commencement of conservation activities. Injured or dead California red-legged frogs shall be handled only by the permitted Biological Monitor as prescribed in the Service permit.

16. In addition, any injured or dead California red-legged frogs found or any unanticipated damage to the species habitat occurring due to construction activities, shall be reported immediately to the on-site Biological Monitor and the Resident Engineer. The Biological Monitor shall: (1) notify the Service within 24 hrs, and (2) prepare a written report (separate from monitoring report as described elsewhere in these special provisions) by the end of the work shift and submit the report to the Resident Engineer. The written report shall include the following information, as a minimum: the date, time, precise location of the specimen/incident, and any other pertinent information.

17. The permitted Biological Monitor shall conduct a pre-construction employee education program for Contractor and State personnel prior to the start of construction. All Contractor personnel working on the project shall attend the program. An education program shall also be provided for all new personnel and substitutes brought onto the job after the pre-construction employee education program who have not previously had the training. The employee education program shall include: (1) descriptions of the California red-legged frog, (2) photographs of all the frog species that might be found in the area, and (3) information regarding the duties of the permitted Biological Monitor and, if applicable, the general Biological Monitor. Contact information for each Biological Monitor shall be provided to all Contractor employees and shall direct the employees to immediately notify the on-site Biological Monitor should a Contractor employee encounter a California red-legged frog or species of similar appearance during the progress of the work.

18. California red-legged frog photo identification cards and information sheets shall be passed out to all workers. An 8.5-inch x 11-inch information fact sheet for the California red-legged frog and a laminated pocket-size California red-legged frog ID card shall be passed out to workers during the pre-construction education program. The information fact sheet shall contain descriptive species identification and habitat information including color photographs of the California red-legged frog, the common bullfrog, and the common tree frog. The frog ID card shall contain a color photo of the California red-legged frog on one side and California red legged frog identification information on the other side.

19. Activities shall cease until appropriate corrective measures have been completed.

20. All sightings of any incidental take shall be reported the Service immediately by telephone.

21. The Biological Assessment stated that the approximately 0.47 acres of wetlands that will be affected temporarily or permanently by the proposed project will be mitigated for at a 1:1 or 2:1 ratio. The preferred method of mitigation is through the purchase of credits from an established conservation bank.

22. According to the June 1, 2005, meeting, there will be permanent effects to 1.42 acres of upland habitat and 1.04 acres of temporary effects. The permanent effects will be compensated for at a 2:1 ratio (2.84 acres) and areas subject to temporary effects will be restored.

STATUS OF SPECIES/ENVIRONMENTAL BASELINE

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

This 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 1985). The abdomen and hind legs of adults are largely red; 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 light centers (Stebbins 1985), 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).

California red-legged frogs have paired vocal sacs and vocalize in air (Hayes and Krempels 1986). Female frogs deposit egg masses on emergent vegetation so that the egg mass floats on the surface of the water (Hayes and Miyamoto 1984). California 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 California Red-legged frog was historically documented with 46 counties but the taxa now remains in 238 streams or drainages within 23 counties, representing a loss of 70 percent of its former range (U.S. Fish and Wildlife 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. The species 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 2002).

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 California red-legged frogs currently are associated with deep pools with dense stands of overhanging willows (*Salix* spp.) and an intermixed fringe of cattails (*Typha latifolia*) (Jennings 1988). California red-legged frogs disperse upstream and downstream of their breeding habitat to forage and seek sheltering habitat.

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 Feller (2005), this includes coyote bush (*Baccharis pilularis*) California blackberry thickets (*Rubus ursinus*), and root masses associated with willow (*Salix* species) and California bay trees (*Umbellularis californica*). Sometimes the non-breeding habitat used by California red-legged frogs is extremely limited in size, for example, a 6-foot wide Coyote bush thicket growing along a tiny intermittent creek surrounded by heavily grazed grassland (Feller 2005). Sheltering habitat for California 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 ricks may also be used. Incised stream channels with portions narrower and depths greater than than 18 inches also may provide important summer sheltering habitat. Accessibility to sheltering habitat is essential for the survival of California red-legged frogs within a watershed, and can be a factor limiting frog population numbers and survival.

California 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, with 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 mile to more than 2 miles without apparent regard to topography, vegetation type, or riparian corridors (Bulger, unpublished data).

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* spp.) or cattails (Jennings *et al.* 1992). California 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). California red-legged frogs may live 8 to 10 years (Jennings *et al.* 1992). Populations of California red-legged frogs fluctuate from year to year. When conditions are favorable California 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, California red-legged frogs may temporarily disappear from an area when conditions are stressful (e.g., drought).

The diet of California red-legged frogs is highly variable. Hayes and Tennant (1985) found invertebrates to be the most common food items. Vertebrates, such as Pacific tree frogs (*Hyla regilla*) and California mice (*Peromyscus californious*), represented 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. Feeding activity probably occurs along the shoreline and on the surface of the water (Hayes and Tennant 1985). The diet of California red-legged frogs apparently has not been studied, but their diet probably is 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 (*Rana catesbeiana*) (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* spp.), goldfish (*Carassius auratus*), common carp (*Cyprinus carpio*), and mosquitofish (*Gambusia affinis*) (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 California red-legged frog throughout its range.

Several researchers in central California have noted the decline and eventual disappearance of California 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 both predation and competition. 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. In addition to predation, bullfrogs may have a competitive advantage over California red-legged frogs; bullfrogs are larger, possess more generalized food habits (Bury and Whelan 1984), have an extended breeding season (Storer 1933) during which an individual female can produce as many as 20,000 eggs (Emlen 1977), and larvae are unpalatable to predatory fish (Kruse and Francis 1977). In addition to competition, bullfrogs also interfere with California red-legged frog reproduction. Both California and northern red-legged frogs have been observed in amplexus with (mounted on) 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 California red-legged frogs, especially in sub-optimal habitat. The urbanization of land within and adjacent to California red-legged frog habitat has also impacted California red-legged frogs. These declines are attributed to channelization of riparian areas, enclosure of the channels by urban development that blocks California red-legged frog dispersal, and the introduction of predatory fishes and bullfrogs. This report further identifies the conversion and isolation of perennial pool habitats resulting from urbanization as an ongoing impact to California red-legged frogs.

Mao *et al.* (1999 cited in Fellers 2005) reported northern red-legged frog (*Rana aurora aurora*) infected with an iridovirus, which also was presented in sympatric three-spined sticklebacks (*Gastrucleatus aculeatus*) in northwestern California. Ingles (1932a, 1932b, and 1933 cited in Fellers 2005) reported four species of trematodes from California red-legged frogs, but he later synonomized two of them.

The recovery plan for the California red-legged frog identifies eight recovery units. Each recovery unit reflects areas with similar conservation needs. The strategy for recovery of California red-legged frogs includes promoting and protecting populations that are geographically distributed in a manner that allows for the continued existence of viable metapopulations. The California red-legged frog has been extirpated or nearly extirpated from over 70 percent of their former range. Historically, this species was found throughout the Central Valley and Sierra Nevada foothills. As of 1996, California red-legged frogs have been documented in approximately 240 streams or drainages from 23 counties, primarily in central coastal California. Monterey, San Luis Obispo, and Santa Barbara counties support the largest

extent of currently occupied habitat. The most secure aggregations of California red-legged frogs are found in aquatic sites that support substantial riparian and aquatic vegetation and lack non-native predators.

This project is located within the East San Francisco Bay Recovery Unit, which extends from the northernmost portion of Contra Costa County, includes a portion of San Joaquin County south to Santa Clara County, includes the eastern portion of San Mateo County, and all of San Francisco County (U. S. Fish and Wildlife Service 2002). Contra Costa and Alameda counties contain the majority of known California red-legged frog localities within the eastern San Francisco Bay area. Within this recovery unit, the listed amphibian seem to have been nearly eliminated from the western lowland areas near urbanization, they still occur in isolated populations in the East Bay Foothills (between Interstate 580 and Interstate 680), and are abundant in several areas in the eastern portions of Alameda and Contra Costa counties. This recovery unit is essential to the survival and recovery of California red-legged frogs, as it contains the largest number of occupied drainages in the northern portion of its range. There is a breeding population at Black Diamond Mines Regional Park (U.S. Fish and Wildlife Service 2002).

There are several recent sightings of the California red-legged frog in the vicinity of the action area and throughout the region south of Antioch and Pittsburg (California Department of Fish and Game 2004). Adult California red-legged frogs are highly mobile and may move considerable distances from their breeding ponds. Areas containing aquatic and upland habitat exist within and adjacent to the action area; and a medium sized frog of an unidentified species was observed at West Antioch Creek (Nagano pers. obs. April 2005). The action area contains components that can be used by the California red-legged frog for feeding, resting, mating, movement corridors, and other essential behaviors. Therefore, the Service believes that the California red-legged frog is reasonably certain to occur within the action area because of the biology and ecology of the animal, the presence of suitable habitat in and adjacent to the action area, as well as the nearby recent observations of this listed species.

Effects of the Proposed Action

The proposed State Route 4 Project likely will result in a number of adverse effects to California red-legged frog. There is a likelihood the animals may be affected by being crushed, entombed, hit and injured or killed by vehicle strikes, poisoned by chemical agents, trapped in erosion control netting, or harassed by noise and vibration. Individuals exposed during excavations likely will be crushed and killed or injured by construction-related activities. California red-legged frogs could fall into the trenches, pits, or other excavations, and then they could be directly killed or be unable to escape and be killed due to desiccation, entombment, or starvation. The amphibians could be subject to increased levels of harassment resulting from lights used during night time construction. Edible trash left during or after repair activities could attract predators, such as racoons (*Procyon lotor*) and crows (*Corvus corax*) to the sites, who could subsequently prey on the listed amphibian. California red-legged frogs may become trapped if plastic mono-filament netting is used for erosion control or other purposes where they would be subject to death by predation, starvation, or desiccation (Stuart *et al.* 2001). The increased width of the

road and higher levels of vehicle traffic will result in higher numbers of California red-legged frog killed during their movements between their upland habitat and breeding ponds.

Temporary effects are project activities that temporarily remove one or more essential components of the habitat of a listed species, but can be restored to pre-project conditions of equal or greater habitat value. In order for the effects to be considered temporary, the affected habitat of the listed species must be totally restored within two seasons. Ground disturbance resulting from the proposed State Route 4 Project includes substantial grading, excavating, and fill. The Caltrans is considering the adverse effects of a significant amount of cut and fill of earth, a maximum of 1.04 acres, to be of a temporary nature. These activities have potential to cause injury and mortality to individual California red-legged frogs occupying the action area. As part of the project description, the Caltrans has stated upon completion of the project, they will restore temporary disturbed areas to promote restoration to pre-project conditions. The temporary effects will result in the permanent loss of the habitat utilized by the California red-legged frog unless the restoration implemented by Caltrans is adequately planned, utilizes native California plant species collected in the immediate area of the proposed project, and meets specific success criteria.

[redacted] The permanent effects to the upland habitat will be compensated for at a 2:1 ratio (2.84 acres) and the areas subject to temporary effects will be restored.

Construction equipment that has been used in different areas and with different species of amphibians including the California red-legged frog may transmit diseases by introducing contaminated soil and other material on the 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.* 2000).

Construction related activities are likely to cause disruption of surface movement, disruption or complete loss of reproduction, harassment from increased human activity, and permanent and temporary loss of shelter. Because these animals are nocturnal, if construction is performed at night, associated lighting likely would increase all of the above effects. Wise and Buchanan (2002) reviewed the adverse effects that may result from night time illumination on salamander species. Artificial lighting used during night time construction may increase predation of the California red-legged frog, if it occurs during periods of fall, winter, or spring rains, because the amphibians will lose the cover of darkness for movement. Nocturnal foraging by this listed animal may be affected by artificial lighting.

The loss of ground squirrel burrows and other dry season retreats will reduce the amount of

available upland habitat within the action area. The loss of the portion of West Antioch Creek where the on and off ramps will be constructed will result in reduced breeding opportunities for the California red-legged frog. The addition of impermeable surfaces resulting from the two freeway ramps will be accompanied by an increase in chemical runoff, which would include gasoline and oil, as well as silt runoff, which will reduce water quality in the project site.

The effect of habitat fragmentation on the California red-legged frog is potentially significant. Fragmentation can have to effects: (1) reduction in access to habitat as well as habitat suitability, and (2) disruption of movements, dispersal, and gene flow. The construction of the freeway ramps through listed frog habitat may restrict or block movement between West Antioch Creek and upland habitat. The likelihood of this effect will increase with larger road size, higher traffic volume, and the presence of fences or median barriers. In addition to limiting access to West Antioch Creek or upland habitat, roads also may reduce the suitability of habitat for the California red-legged frog by fragmentation into patches too small for effective use by the animals. As a habitat patch decreases in size, the number of individuals of this threatened animal the patch can support also decreases. This increases the probability that the animals will be extirpated from each habitat patch. The possibility for recolonization will depend upon the nature of the factors, e.g., roads, canals, development, etc., that are causing the fragmentation.

Fragmentation factors that effectively isolate patches and limit access also constitute barriers to California red-legged frog dispersal, and gene flow. Movements and dispersal corridors between breeding and upland habitat are critical to this animal's population dynamics, particularly because the animals currently persist as metapopulations with multiple disjunct population centers. Movement and dispersal corridors likely are important for alleviating over-crowding during years when California red-legged frog abundance is high, 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.

Roads have been documented as barriers to movements by a diversity of species, and this effect varies with road size and traffic volume. The inhibition of animal movements caused by roads produces a significant effect by fragmenting habitats and populations (Joly and Morand 1997). Roads were found to be significant barriers to gene flow among common frogs (*Rana temporaria*) in Germany and this has resulted in genetic differentiation among populations separated by roads (Reh and Seitz 1990). Similarly, significant genetic subdivision was detected in bank voles (*Clethrionomys glarelous*) populations separated by a 164 foot wide highway in Germany (Gerlach and Musolf 2000).

California red-legged frog mortality and injury occurs when the animals attempt to cross roads and are hit by cars, trucks, or motorcycles. The majority of strikes occur when the animals are moving to their breeding habitat. Thus, vehicle strikes are a direct source of mortality for the California red-legged frog. If vehicle strikes are sufficiently frequent in a given locality, this could result in reduced abundance of this animal. Especially problematic is the death of females prior to the laying of their eggs because this could result in the loss of an entire cohort, and

therefore, reduced recruitment of new individuals into the population.

Vehicles constitute a consistent source of mortality for the animal, based on the frequency with which vehicle strikes occur. Vehicular usage on California roads is increasing rapidly and directly with human population and urban expansion. During November 2002, California's estimated total vehicular travel on State highway system roads alone was 14.27 billion miles (this figure and subsequent vehicular-use data from Caltrans' Internet website which was accessed on January 2, 2003). From 1972 to 2001, State highway system total vehicular usage rose steadily from 67.11 to 167.81 billion miles annually. For the 23 California counties in which the California red-legged frog may occur, State highway system total annual vehicular usage in 1999, 2000, and 2001 was 53.27, 55.85, and 57.21 billion miles, respectively. The steady increase of vehicular use is thus continuing. We believe such figures illustrate (1) the general increase in vehicular usage that has been, and is still, occurring in many parts of the California red-legged frog's range, and (2) that additional increments of road-kill losses, which are already a potentially serious problem for the species, are likely occurring.

Vehicle-related mortality has significantly affected other listed or rare species. Rudolph *et al.* (1999) estimated that road-associated mortality may have depressed populations of Louisiana pine snakes (*Pituophis ruthveni*) and timber rattlesnakes (*Crotalus horridus*) by over 50% in eastern Texas, and this mortality may be a primary factor in local extirpations of this species of rattlesnake (Rudolph *et al.* 1998). Mortality from vehicles also is contributing to the reduction in the status of the prairie garter snake (*Thamnophis radix radix*) in Ohio (Dalrymple and Reichenbach 1984), and was a limiting factor in the recovery of the endangered American crocodile (*Crocodylus acutus*) in Florida (Kushland 1998).

The presence of roads in an area could result in the introduction of chemical contaminants to the site. Contaminants could be introduced in several ways. Substances used in road building materials or to recondition roads can leach out or wash off roads adjacent habitat. Vehicle exhaust emissions can include hazardous substances which may concentrate in soils along roads. Heavy metals such as lead, aluminum, iron, cadmium, copper, manganese, titanium, nickel, zinc, and boron are all emitted in vehicle exhaust (Trombulak and Frissell 2000). Concentrations of organic pollutants (e. Dioxins, polychlorinated biphenyls) are higher in soils along roads (Benfenati *et al.* 1992). Ozone levels are higher in the air near roads (Trombulak and Frissell 2000). Vehicles may leak hazardous substances such as motor oil and antifreeze. Although the quantity leaked by a given vehicle may be minute, these substances can accumulate on roads and then get washed into the adjacent environment by runoff during rain storms. An immense variety of substances could be introduced during accidental spills of materials. Such spills can result from small containers falling off passing 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 areas adjacent to roads could be exposed to any contaminants that are present at the site. Exposure pathways could include inhalation, dermal contact, direct ingestion, ingestion of contaminated soil or plants, or consumption of contaminated prey. 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. Contaminants also may have the same effect on California red-legged frog prey species. This could result in reduced prey abundance and diminished local carrying capacity for this listed amphibian.

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

Construction of roads can facilitate the invasion and establishment by species not native to the area. 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. They could compete with California red-legged frogs for resources such as food or burrows, or directly injure or kill the threatened amphibian. Non-native plants and animals may reduce habitat quality for this frog species or their prey, and reduce the productivity or the local carrying capacity for the threatened animal.

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, does not appear to be used by California red-legged frog prey, exhibits dense growth, and may be difficult for the listed amphibian to move through due its large size (up to 3.3 feet tall), and numerous sharp spines. Other species that may disperse along roads and invade adjacent habitat include mustards (*Brassica* species) and Russian thistle (*Salsola tragus*) (Tellman 1997).

Negative effects to wildlife populations from roads may extend some distance from the actual road. The phenomenon can result from any of the effects already described in this biological opinion (e.g. vehicle-related mortality, habitat degradation, invasive exotic species, etc.). 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 sale, 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 1575-6560 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, and 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 has not been adequately investigated; however, it is possible it exists given the effects of roads on the animal.

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.

From 1995 to 2020, the human population is projected to increase by 18 percent for the San Francisco Bay hydrologic region, while at the same time agricultural crop land use in the region is projected to remain around 65,000 acres (California Department of Water Resources 998). According the California Department of Forestry, from 2000 to 2020, the human population within counties in the Bay Area region is expected to grow by 29 percent (5.3 million people to 6.8 million people), and by 60 percent from 2000 to 2040 (5.3 million people to 8.4 million people) (California Department of Forestry 1998). There will likely be many other development projects that occur during this timeframe due to increases in human population growth that will continue to imperil the California red-legged frog.

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. Numerous non-Federal activities continue to negatively impact the California red-legged frog in the action area. Habitats are lost or degraded as a result of urbanization, 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, ground squirrel reduction efforts, 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.

Within this region of Contra Costa County, there is a continued demand for new housing. Considering this, the remaining open space in the vicinity of the State Route 4 project likely is threatened by development. The development of 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.

CONCLUSION

After reviewing the current status of the California red-legged frog, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the State Route 4 Project is not likely to jeopardize the continued existence of this listed species. Critical habitat has been proposed for the California red-legged frog, however none is located in the action area, and therefore none will be affected by the proposed project.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, 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 the California Department of Transportation so they become binding conditions of project authorization for the exemption under 7(o)(2) to apply. Caltrans has a continuing duty to regulate the activity that is covered by this incidental take statement. If the California Department of Transportation (1) fails to adhere to the terms and conditions of the incidental take statement through enforceable terms, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of 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 this amphibian is not in their breeding ponds, it inhabits the burrows of ground squirrels or other rodents, or may be difficult to locate due to their cryptic appearance and behavior; the sub-adult 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. Losses of this species also may 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. Therefore, the Service is estimating that all California

red-legged frogs inhabiting 2.62 acres (permanent effects = 1.42 acres of upland and 0.15 acre of aquatic habitat; temporary effects = 0.02 acre of aquatic habitat and 1.04 of upland habitat), based on the Biological Assessment, April 1, 2005, field meeting, the June 1, 2005, meeting with Caltrans, and the Addendum to the Biological Assessment will be subject to incidental take. Upon implementation of the Reasonable and Prudent Measures, incidental take associated with the State Route 4 Project in the form of harm, harassment, capture, injury, and death of the California red-legged frog caused by habitat loss and construction activities will become exempt from the prohibitions described under section 9 of the Act.

Effect of the Take

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the California red-legged frog. Critical habitat for the California red-legged frog has been proposed, however none is located in the action area, and therefore will not be affected by the proposed project.

Reasonable and Prudent Measures

The following reasonable and prudent measures are necessary and appropriate to minimize the effects of the State Route 4 Project on the California red-legged frog:

1. Caltrans shall implement conservation measures for the California red-legged frog to minimize (1) the effects of the loss of habitat that will occur as a result of the project; (2) the potential for harassment, harm, injury, and mortality to this listed species; and (3) the potential for inadvertent capture or entrapment of federally listed wildlife species during construction activities.

2. Caltrans shall ensure their compliance with this biological opinion.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Federal Highway Administration shall ensure Caltrans complies with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.

A. The following Term and Conditions will implement Reasonable and Prudent Measure number one (1):

   1. Caltrans shall minimize the potential for incidental take of the California red-legged frog resulting from project related activities by implementation of the conservation measures as described in the Biological Assessment, the Addendum to the Biological Assessment, and appearing in the *Project Description* of this biological opinion.

2. Caltrans shall include Special Provisions that include the avoidance and minimization measures of this biological opinion in the solicitation for bid information. In addition, Caltrans will educate and inform contractors involved in the project as to the requirements of the biological opinion.

3. 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 State Route 4 Project. Their name and telephone number shall be provided to the Service at least thirty (30) calendar days prior to groundbreaking at the project.

4. As described in the June 1, 2005, meeting with Caltrans, and the Addendum to the Biological Assessment, 2.84 acres of upland habitat and 0.4 acre of aquatic habitat for the California red red-legged frog shall be permanently protected through (1) acquisition and management of appropriate off-site habitat, (2) purchase of an appropriate amount of credits at a Service-approved conservation bank; or (3) deposit of sufficient funds into a Caltrans account that will be used to purchase and manage appropriate habitat for the California red-legged frog as approved by the Service. The written approval of the Service shall be obtained by Caltrans prior to implementing the measure they have chosen for habitat compensation.

5. 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 Caltrans Resident Engineer, 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

6. Permanent and temporary construction disturbances and other types of project-related disturbance to California red-legged frog habitat shall be minimized to the maximum extent practicable. 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 preconstruction surveys and, to the maximum extent possible, should be established in locations disturbed by previous activities to prevent further adverse effects.

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

8. Prior to initiation of ground breaking, the Caltrans or a Service-approved biologist will conduct an education and training session for all construction personnel. All individuals who will be involved in the site preparation or construction shall be present, including the project representative(s) responsible for reporting take to

the Service and the California Department of Fish and Game. Training sessions shall be repeated for all new employees before they access the project site. Sign up sheets identifying attendees and the contractor/company they represent shall be provided to the Service with the post-construction compliance report. At a minimum, the training shall include a description of the natural history of the California red-legged frog affected by the State Route 4 Project and include information on this listed species and its habitats. The training shall include the general measures that are being implemented to conserve this species as they relate to the project, the penalties for non-compliance, and the boundaries (work area) of the project. To ensure that employees and contractors understand their roles and responsibilities, training shall be conducted in languages other than English, as appropriate.

9. A litter control program shall be instituted at the State Route 4 project. All workers ensure their food scraps, paper wrappers, food containers, cans, bottles, and other trash from the project area are deposited in covered or closed trash containers. The trash containers shall be removed from the project area at the end of each working day.

10. All construction activity shall be confined within the State Route 4 project site, which may include temporary access roads, haul roads, and staging areas specifically designated and marked for these purposes, as described in Term and Condition 13 below. At no time shall equipment or personnel be allowed to adversely affect areas containing suitable California red-legged frog habitat outside the project site without authorization from the Service.

11. All grindings and asphaltic-concrete waste shall be stored within previously disturbed areas absent of habitat and at a minimum of 150 feet from any culvert, or stream.

12. As described at the June 1, 2005, meeting, Caltrans shall submit to the Service their draft proposal for the restoration of the 1.04 acre of California red-legged frog upland habitat that will be temporarily affected by the proposed project at least sixty (60) calendar days prior to initial ground breaking at the State Route 4 project; the final plan shall be submitted for approval by the Service prior to ground breaking at the proposed project. The plan shall include restoration and revegetation work associated with temporary effects using native California plant species from on-site or local sources (i.e., local ecotype). Plant materials from non-local sources shall be allowed only with written authorization from the Service. To the maximum extent practicable (i.e., presence of natural lands), topsoil shall be removed, cached, and returned to the site according to successful restoration protocols. Loss of soil from run-off or erosion shall be prevented with straw bales, straw wattles, or similar means provided they do not entangle, block escape or dispersal routes of listed animal species. The draft and final plan shall contain specific quantifiable criteria to evaluate the success of the restoration.

Mr. Gene Fong

13. The State Route 4 Project construction area shall be delineated with high visibility temporary fencing at least four (4) feet in height, flagging, or other barrier to prevent encroachment of construction personnel and equipment onto any sensitive areas during project work activities. Such fencing shall be inspected and maintained daily until completion of the project. The fencing will be removed only when all construction equipment is removed from the site. Actions within the project area shall be limited to vehicle and equipment operation on existing roads. No project activities will occur outside the delineated project construction area.

14. Prior to any ground disturbance, pre-construction surveys shall be conducted by a Service-approved biologist for the California red-legged frog. These surveys shall consist of walking surveys of the project limits and adjacent areas accessible to the public to determine presence of the species.

15. 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.

16. Maintenance and construction excavations greater than two (2) feet deep either shall be covered or filled in at the end of each working day. The trench or pit shall be surveyed in the morning and late afternoon hours to ascertain whether a California red-legged frog has fallen into the trench or pit. If at anytime, a trapped California red-legged frog is discovered trapped in a trench or pit, the animal shall be carefully captured by a Service-approved biologist and released at a Service-approved location which contains suitable habitat and is outside of the construction area. The Service shall be notified by telephone and electronic mail within one (1) working day of the incident.

17. Tightly woven fiber netting or similar material shall be used for erosion control or other purposes at the State Route 4 Project site to ensure that a California red-legged frog does not get trapped. Plastic mono-filament netting shall not be used at the project site. This limitation will be communicated to the contractor through use of Special Provisions included in the bid solicitation package.

18. The following Term and Condition shall be implemented for borrow sites associated with the State Route 4 Project:

    a. Caltrans shall require as part of the construction contract that all contractors comply with the Act in the performance of the work necessary for project completion performed inside and outside the project right-of-way.

    b. Caltrans shall require documentation from the contractor that aggregate, fill, or borrow material provided for each project was obtained in

compliance with the Act. Evidence of compliance with the Act shall be demonstrated by providing the Resident Engineer any one of the following:

i. a letter from the Service stating use of the borrow pit area will not result in the incidental take of listed species;
ii. an incidental take permit for contractor-related activities issued by the Service pursuant to section 10(a)(1)(B) of the Act;
iii. a biological opinion or a letter concurring with a "not likely to adversely affect" determination issued by the Service to the Federal agency having jurisdiction over contractor-related activities;
iv. letter from the Service concurring with the "no effect" determination for contractor-related activities; or
v. Contractor submittal of information to the Caltrans Resident Engineer indicating compliance with the State Mining and Reclamation Act (SMARA) and provide the County of Contra Costa land use permits and California Quality Act (CEQA) clearance.

c. If a borrow site that is in compliance with the Act is not available, Caltrans shall either:

i. identify/select a site that the Service has concurred with the "no effect" determination, or;
ii. request reinitiation of formal consultation on the action considered herein based on new information.

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

1. If requested, during or upon completion of construction activities, the on-site biologist, and/or a representative from Caltrans shall accompany Service or California Department of Fish and Game personnel on an on-site inspection of the site to review project effects to the California red-legged frog and its habitat.

2. The Federal Highway Administration shall ensure Caltrans complies with the *Reporting Requirements* of this biological opinion.

Reporting Requirements

Injured California red-legged frogs must be cared for by a licensed veterinarian or other qualified Service-approved person; dead individuals of this listed species must be preserved according to standard museum techniques and held in a secure location. The Service and the California Department of Fish and Game must 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 must 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, Chief of the Endangered Species Division at the Sacramento Fish and Wildlife Office (916/414-6600), and Scott Heard, Resident Agent-in-Charge of the Service's Law Enforcement Division at 916/414-6660.

Caltrans shall submit a post-construction compliance report prepared by the on-site biologist to the Sacramento Fish and Wildlife Office within sixty (60) calendar days of the date of the completion of construction activity. This report shall detail (i) dates that construction occurred; (ii) pertinent information concerning the success of the project in meeting compensation and other conservation measures; (iii) an explanation of failure to meet such measures, if any; (iv) known project effects on the California red-legged frog, if any; (v) occurrences of incidental take of this listed species, if any; and (vi) other pertinent information.

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 to implement recovery actions, to help implement recovery plans, to develop information, or otherwise further the purposes of the Act.

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

1. Caltrans should assist the Service in implementing recovery actions identified in the *Recovery Plan for the California red-legged Frog* (U.S. Fish and Wildlife Service 2002).

2. Caltrans should incorporate culverts, tunnels, or bridges on highways and other roadways that allow safe passage by California red-legged frogs, other listed animals, and wildlife. Caltrans should include photographs, plans, and other information in their biological assessments if they incorporate "wildlife friendly" crossings into their projects.

3. The Federal Highway Administration and Caltrans should consider participating in the planning for a regional habitat conservation plan for the California red-legged frog, other listed species, and sensitive species.

4. Caltrans should consider establishing functioning preservation and creation conservation banking systems to further the conservation of the California red-legged frog, and other appropriate species. Such banking systems also could possibly be utilized for other required mitigation (i.e., seasonal wetlands, riparian habitats, etc.) where appropriate.

5. 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. A copy of the reporting form and a topographic map clearly marked with the location the animals were observed also should be provided to the Service.

6. Caltrans should provide habitat for bats, including surfaces for bat roosts on the underside of bridges and other structures whenever possible.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation on the proposed State Route 4 (east) widening from Loveridge Road to State Route 160 in Contra Costa County, California. 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 maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) 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; (3) 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 (4) 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 any questions regarding this biological opinion on the State Route 4 Project, please contact the Chief of our Endangered Species Division at the letterhead address or at telephone 916/414-6600.

Sincerely,

for Cay C. Goude
Acting Field Supervisor

cc:
Susan Chang California Department of Transportation, Oakland, California
Dee Waremycia, California Department of Fish and Game, Sacramento, California
Janice Gan, California Department of Fish and Game, Yountville, California
Carl Wilcox, California Department of Fish and Game, Yountville, California
Scott Wilson, California Department of Fish and Game, Yountville, California
Warden Nicole Kozicki, California Department of Fish and Game, Yountville, California

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Canada. Comstock Publishing Company, Inc., Ithaca, New York. xii + 640 pp.

Stream Diversion Plans

- Temporary creek diversion systems will be established for all creek channels affected by the project. These creek channels are Kirker Creek, Old Kirker Creek, Los Medanos Wasteway, and West Antioch Creek (Contra Loma Interchange).
- These creek diversion systems are only to be used between April 1st and October 15th for the Kirker Creek, Old Kirker Creek, and Los Medanos Wasteway creek diversion systems, and between June 1st and October 15th for the West Antioch Creek diversion system.
- An upstream gravel dam is used to direct the base flows during the dry season through an appropriately sized diversion pipe (The pipe diameter varies from 700 – 900 mm, depending on the location). This plastic diversion pipe passes through the Contractor's work area and discharges flows through a downstream sandbag cofferdam wrapped with an impermeable polyethylene liner. The pipe will discharge 15-20 feet upstream from the construction area. Only clean gravel, sandbags, and filter fabric will be used.
- A possible option that is being investigated at Contra Loma Interchange is to establish 2 separate temporary water diversion systems at West Antioch Creek. For the first system, a cofferdam will need to be placed upstream of the open 120-inch reinforced concrete pipe (RCP), underneath Fitzuren Road, southwest of the G Street interchange. Base flows traveling down West Antioch Creek toward the freeway would collect behind this cofferdam and eventually drain westerly along their historic path and eventually enter the upstream end of the triple 5 x 3 foot reinforced concrete box (RCB) at Contra Loma Boulevard. The triple 5 x 3 foot RCB outfalls into the open channel portion of West Antioch Creek further downstream. The second temporary water diversion system would have to be applied upstream of the triple 5 x 3 foot RCB while it is being replaced at its downstream end. A City of Antioch 6 x 3 foot RCB empties into this system which means there will be a significant base flow to contend with during the summer months. A water-filled cofferdam would be temporarily installed at this location to deal with these base flows.
- The construction of sediment catch basins across stream channels immediately below the project site when performing in-channel construction to prevent silt- and sediment-laden water from entering the main streamflow (accumulated sediments would be periodically removed from the catch basin).
- Caltrans will ensure that a biologist is on site prior to dewatering to ensure no sensitive aquatic species are stranded.
- Once the temporary creek diversion systems are no longer required, the plastic pipe, the sandbags, the gravel dam, and the impermeable plastic liner will all be removed and the creek returned to its natural condition.
- The following figures are some representative plans of the proposed water diversion systems.

United States Army Corps of Engineers

Individual Permit Table of Contents

Section 404 Individual Permit Application .....

Section 1: .....Application

Attachments

Appendix A: ..... Project Location Map

Appendix B: ..... Plan View and Cross-Sectional Map

Appendix C: ..... USFWS Biological Opinion

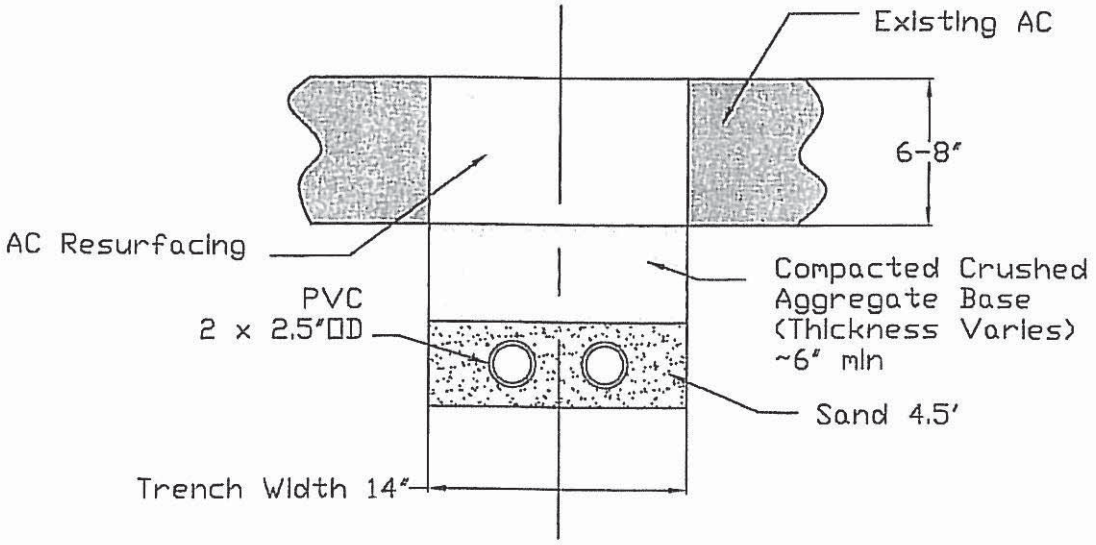
Appendix D: ..... NOAA Letter of Concurrance

Appendix E: .....Impacts to Jurisdictional Waters

Appendix F: .....Mitigation and Monitoring Plan for Wetlands and Other Waters of the U.S.

Appendix G: .....Stream Diversion Plans

For your reference, the Mitigation and Monitoring Plan for Wetlands and Other Waters of the U.S. included with this document.



Note: One PVC pipe for groundwater and one for electrical connection

Figure 3: Trench Backfill Schematic

ENVIRONMENTAL ENGINEERING, INC.

Pacific Gas and Electric Company™

UTILITY OPERATIONS (UO)

UO Standard S4110

ISSUING DEPARTMENT:	**Gas Distribution**	EFFECTIVE DATE:	**10-05**		
UO OFFICER:	**Senior Director E&P**	REVIEW DATE:	**10-10**		
CGT OFFICER:	**VP - CGT**	PAGE NO.:	**1**	OF	**5**

TITLE: Leak Survey and Repair of Gas Transmission and Distribution Facilities

Purpose

This standard establishes uniform minimum requirements for performing gas leak surveys of Pacific Gas and Electric Company (Company) pipelines, station piping, mains, and services in order to detect, report, and repair leaks. It also establishes requirements for developing and maintaining a system of records.

Recision

This standard supersedes UO Standard D-S0350/S4110, "Leak Survey and Repair of Gas Transmission and Distribution Facilities," issued 5-00.

Safety

Failure to perform leak survey and leak repair work effectively and efficiently can pose a risk to public safety and property.

All persons performing work under this standard shall comply with Utility Standard Practice (USP) 22, "Safety and Health Program."

Implementation Responsibilities

The senior director of Engineering and Planning (E&P) and the vice president of California Gas Transmission (CGT) are responsible for approving, revising, and distributing this standard.

Utility Operations (UO) and CGT directors are responsible for implementing this standard within their respective organizations.

The responsibility for performing gas leak surveys and completing gas leak survey and repair records for the transmission and distribution facilities shall rest with the operating department supervisor who directs the maintenance and operation of the facilities.

The responsibility for scheduling the leak survey and repair work and maintaining the associated records shall rest with the Operations, Maintenance and Construction (OM&C) superintendents in the UO divisions and the district superintendents in CGT or others as designated.

Compliance

Implementation and effectiveness are measured by the responsible directors/superintendents. In addition, internal Company departments will conduct periodic audits. The California Public Utilities Commission (CPUC) also conducts compliance reviews on the requirements in this standard.

Policy

Leak surveys shall be conducted at regular intervals throughout the gas transmission and distribution systems. The Company's policy is to search for, evaluate, and control gas leakage in the interests of safety and efficiency of operation.

Procedures

The directors of Gas Distribution and Technical Services (GD&TS) and Gas System Maintenance and Technical Support (GSM&TS) are authorized to modify these detailed procedures, forms, or instructions, as needed, or to approve variances from this procedure on an exception basis.

Reference Documents

49 Code of Federal Regulations 191, Sections 1, 7, 23, and 25

49 Code of Federal Regulations 192, Sections 605, 703, 706, 709, 711, 717, 723, and 935

California Public Utilities Commission General Order 112-E, Section 143.1

Gas Piping Technology Committee (GPTC) Guide for Gas Transmission and Distribution Piping Systems, ANSI/GPTC Z380.1-2003

Code of Safe Practices, Basic Safety Requirements, Sections 1, 2, 3, 13, and 15

IGIS User Guide

Utility Standard Practice 22, "Safety and Health Program"

Utility Operations Standards and Guidelines

D-S0213, "Work Procedures in Confined Spaces"

D-S0353/S4112, "Physical Inspection of Pipelines, Mains, and Services"

D-S0355/S4413, "CPUC and DOT Reportable Incidents, Curtailments and Conditions and Low Pressure System Problem Reporting"

D-S0430, "Maximum Allowable Operating Pressure, Requirements for Distribution Systems and Transmission Gathering Lines"

D-S0443, "Natural Gas Distribution Pipe Wrap Removal, Handling, and Disposal Procedure"

S4111, "Patrolling Pipelines and Mains"

S4129, "Deactivation of Gas Facilities"

S4133, "Corrosion Control of Gas Transmission Facilities"

S4134, "Selection of Steel Pipeline Repair Methods"

S4412, "Protection of Underground Infrastructure"

S4450, "Operator Qualification Program"

4711, "Natural Gas Pipe Wrap: Removal, Handling, and Disposal"

S6434, "Gas Leak and Odor Response"

S6435, "Establishing and Discontinuing Gas and Electric Service"

D-G0054, "Leak Survey Training"

D-G0055, "Leak Survey Auditing"

D-G0071, "Follow-up Leak Survey Procedures for Inaccessible Locations"

Gas Standards and Specifications Documents

A-34, "Piping Design and Test Requirements"

A-34.1, "General Requirements for Work Reportable to the CPUC"

A-34.2, "Low, Semi-High, and High Pressure Uprating Procedure"

A-60, "Gas Main Welding Sleeves (Type B Sleeves With Circumferential Welds"

A-61, "Low Pressure Gas Main Welding Sleeve Fabricating, Installing, and Purchasing Data"

A-63, "Gas Main Repair Can"

A-64, "Gas Line Patches and Half Soles"

A-66, "Repairing Cast Iron Pipeline Defects"

A-67, "Copper Pipeline Defects"

A-68, "Leak Repair Tapes"

A-69, "Economic Analysis of Gas Leak Recheck, Repair, or Replace Options"

A-93.1, "Plastic Gas Distribution System Construction and Maintenance"

B-50, "Bell Joint Leak Clamping Preparation Document"

B-50.1, "Cast Iron Repair Fittings"

B-51, "Procedure for Installing Dresser Style 60, 160, and Style 100 Adjustable Bell Joint Leak Clamps"

B-51.1, "Procedure for Installing Skinner Bell Joint Leak Clamps"

B-51.2, "Procedure for Installing Bell Joint Leak Seal"

B-52, "Bell Joint Leak Seal"

B-52.1, "Bell Joint Anaerobic Sealants"

B-53, "Skinner Leak Repair Clamps"

B-53.1, "Repair Clamps"

B-54, "Compression Couplings"

B-54.1, "Insulated Line Caps for Cast Iron Mains"

B-54.2, “Uninsulated Line Caps for Steel Mains”

B-56, “Installation Instructions for Heat-Shrinkable Gas Repair Sleeves (GRS) on Low-Pressure Mains”

B-57, “Installing Avonseal I Bell Joint Seals on Cast Iron Mains”

B-58, “Installation of Avonseal II Low-Pressure Bell Joint Seal”

B-91.4, “Cast Iron to Steel Insulated Transition Couplings”

B-91.5, “Cast Iron to Polyethylene Transition Fittings”

B-91.6, “Service Connection Fittings for Cast Iron”

B-91.7, “Steel Coupling Clamps”

M-53, “Portable Combustible Gas Indicator Specification”

M-53.1, “Portable Combustible Gas Indicator Operations and Maintenance Instructions”

M-53.2, “Portable Hydrogen Flame Ionization Gas Detector”

M-53.3, “Verifying the Calibration of Portable Combustible Gas Indicators, Hydrogen Flame Ionization Units, and OMDs”

M-53.4, “Mobile Leak Survey, Hydrogen Flame Ionization”

M-53.5, “Mobile Leak Survey - Optical Methane Detection”

O-16, “Corrosion Control of Gas Facilities”

Attachments

Attachment 1, “Leak Survey and Repair Procedures"

Attachment 2, Form 62-0612, “Leak Survey Log”

Attachment 3, “IGIS Survey Leak Log” (Sample)

Attachment 4, “IGIS Recheck Leak Log” (Sample)

Attachment 5, Form 62-4060, “Leak Survey Repair, Inspection, and Gas Quarterly Incident Report (“A” Form)”

Instructions for “A” Form

Attachment 6, Form 61-0548, “Gas Dig-In Leak Survey Repair, Inspection and Gas Quarterly Incident Report (“A1” Form)

Instructions for “A1”

Attachment 7, “CGT Leak Repair/Inspection Form”

Date Issued/Updated

Effective: **October 2005**

Review Date: **October 2010**

Signed,

Kevin J. Dasso
Senior Director
Engineering and Planning

Signed,

Robert T. Howard
Vice President
California Gas Transmission

For Further Information

For additional information on this standard, please contact the Gas Engineering and Planning section (223-8180) of the Gas Distribution and Technical Services department. Additional copies of this standard are available in the Technical Information Library of the Company's Intranet at the link below:

http://www/techlib/default.asp?body=manuals/uo_standards/all_uo_standards.asp

Leak Survey and Repair Procedures

Definition of Terms

Abnormal Operating Condition: A condition identified by the operator that may indicate a malfunction of a component or deviation from normal operations that may do either of the following:

- Indicate a condition exceeding design limits, or
- Result in a hazard(s) to persons, property, or the environment.

Anniversary Month: The month in which the leak was initially reported or the month that has been established in the Leak Survey Program as the month where the work will show as being scheduled.

Building: Any structure designed and used for human occupancy in which gas could accumulate.

Business Districts: The principal business areas in an urban community. In determining business districts, the following areas should be considered:

- Non-wall-to-wall areas, typically at least entire blocks, where the vast majority of the buildings on **both** sides of the street are used for commercial, industrial, religious, educational, health, and/or recreational purposes. Both the main and services should be leak surveyed in these areas annually.
- Wall-to-wall areas, typically an entire block, where the vast majority of the properties on **both** sides of the street have no lawns, green strips, or trees. There are instances of wall-to-wall areas in residential areas. Both the main and services should be leak surveyed in these areas annually.
- Areas, typically at least entire blocks, where the mains and services are in private property serving a shopping center from the roadway or parking lot. Both the main and services should be leak surveyed in these areas annually.
- Any other location or site, which in the judgment of a technically competent supervisor or a technically competent management employee, that should be leak surveyed annually. Business districts do not include small commercial areas (e.g., a small store or a strip mall) in residential areas where the mains are in the franchise area and the businesses are served from lateral services off of the mains. Strip malls in commercial areas should be included in "business districts."

CGI (Can't Get In): A location where there is no access to typically perform maintenance work.

CGT-Distribution: A pipeline operating over 60 pounds per square inch gauge (psig) that does not meet the definition of "Transmission" as defined in 49 CFR Part 192, Subpart 192.3.

CGT-Gathering Line: A pipeline that transports gas from a current production facility to a transmission line or distribution main.

CGT-Transmission: A pipeline operating over 60 psig that meets the definition of

Transmission as defined in 49 CFR Part 192, Subpart 192.3.

Class Locations: An area defined and classified by criteria set forth in 49 CFR 192.5, which reads as follows:

"(a) This section classifies pipeline locations for purposes of this part. The following criteria apply to classifications under this section.

(1) A "class location unit" is an onshore area that extends 220 yards on either side of the centerline of any continuous 1-mile length of pipeline.

(2) Each separate dwelling unit in a multiple dwelling unit building is counted as a separate building intended for human occupancy.

(b) Except as provided in paragraph (c) of this section, pipeline locations are classified as follows:

(1) A Class 1 location is:

(i) An offshore area; or

(ii) Any class location unit that has 10 or fewer buildings intended for human occupancy.

(2) A Class 2 location is any class location unit that has more than 10 but fewer than 46 buildings intended for human occupancy.

(3) A Class 3 location is:

(i) Any class location unit that has 46 or more buildings intended for human occupancy; or

(ii) An area where the pipeline lies within 100 yards of either a building or a small, well-defined outside area (such as a playground, recreation area, outdoor theater, or other place of public assembly) that is occupied by 20 or more persons on at least 5 days a week for 10 weeks in any 12-month period. (The days and weeks need not be consecutive.)

(4) A Class 4 location is any class location unit where buildings with four or more stories above ground are prevalent.

(c) The length of Class locations 2, 3, and 4 may be adjusted as follows:

(1) A Class 4 location ends 220 yards from the nearest building with four or more stories above ground.

(2) When a cluster of buildings intended for human occupancy requires a Class 2 or 3 location, the class location ends 220 yards from the nearest building in the cluster."

Clear a Leak: Validate through investigation that a leak is no longer present.

Combustible Material: A flammable, gaseous, or liquid material consisting of organic compounds, such as methane, benzene, etc.

Competent First Responder: A person who is qualified by training and experience concerning the nature, hazards, and properties of natural gas, e.g., a gas service representative.

Confined Space: A workspace defined by the concurrent existence of the following:

- Insufficient existing ventilation - Existing ventilation is insufficient to remove dangerous air contamination or an oxygen deficiency that may exist

or develop, and

- Limited access - Ready access or egress for the removal of a suddenly disabled employee is difficult due to the location or size of the openings.

Distribution Main: A pipeline that serves as a common source of supply for more than two service lines operating at 60 psig or less.

District Regulator Station: Facilities which contain pressure-control devices and their appurtenances, within the transmission and distribution system, that limit and control pressures in distribution mains that serve more than two services. This includes facilities from the upstream fire valve (inclusive) to the regulator station that may operate above 60 psig.

Electrical Survey: A close interval survey of electrical potential (voltage) between the buried pipe and its environment for the purpose of identifying areas of corrosive conditions.

Gas Facilities: All Company-operated gas lines and related appurtenances.

Leak: The unintentional escape of gas from containment.

Leakage Detection Instrument: An instrument capable of detecting a leak in or near a natural gas-carrying piping component or system. The leak survey instrument should be capable of detecting gas readings of 50 ppm of gas in air.

Leak Grade: A classification of a leak based on leak readings, public exposure, and location.

Leak Recheck: Any leak survey performed with a leakage detection instrument in the area of an existing Priority Grade 2, Grade 2, or Grade 3 leak.

Leak Repair: An action to restore a gas facility to sound condition by eliminating a gas leak.

Leak Survey: A search for possible gas leakage in any area where Company gas facilities exist, or where a gas leak is reported or suspected.

LEL: The "lower explosive limit" expressed as a percentage by volume of gas in air at standard conditions. For natural gas, the LEL is 5%.[1]

Nominal Month: All dates that fall within the respective month. Some call this a calendar month.

Operator Qualified: Employees evaluated and qualified in accordance with UO Standard S4450, "Operator Qualification Program."

PPM: "Parts per million" expressed by a volume of gas in a volume of gas-air mixture (1,000 ppm is equal to 0.1% gas.).

Public Assembly: All schools, hospitals, and readily identifiable churches. Other cases may include certain public assembly buildings occupied by 20 or more

[1] For this standard the LEL for natural gas is 5% and UEL is 15% as defined in the AGA Guide for American Transmission and Distribution Piping Systems, Guide Material Appendix G-192-11, "Gas Leakage Control Guidelines for Natural Gas Systems." Some manufacturers' models of combustible gas indicators list 4% as the LEL, which is their default setting.

persons, recreational areas, state-licensed daycare centers with licensed occupancies of 12 or more, or nursing homes with eight or more beds. At least the service lines for these facilities shall be surveyed annually.

Reading: A measurement of gas indicated on a gas detector.

Service: A distribution line that transports gas from a common source of supply to a customer meter.

SMYS: "Specified minimum yield strength."

Station Piping: For the purpose of leak surveying, this includes all transmission gas pipes and appurtenances within the property lines of CGT:

- Compressor stations.
- Terminals.
- Storage holder facilities.
- Transmission to transmission pressure regulator stations.
- Other gas operating installations.

Substructure: Any structure, tunnel, passageway, or other confined space below ground level where gas could accumulate.

Technically Competent Supervisor: A supervisor who has been trained concerning the nature, hazards, and properties of natural gas and this standard.

Tunnel: A subsurface passageway in which a person could enter and gas could accumulate. For purposes of this standard, "tunnel" also includes large sewers, storm drains, pipelines, conduits, etc.

UEL: The "upper explosive limit" expressed as a percentage by volume of gas in air at standard conditions. For the purposes of this standard, the UEL is 15%.

Vegetation Survey: A gas leakage survey conducted by observing the conditions of the soil and the vegetation along certain gas transmission or gas gathering pipelines.

Venting: Drilling a hole or holes, or excavating above and/or around a leak to allow the gas to dissipate or vent.

Leak Survey, General

The procedures outlined are intended as guidelines to be used as minimum standards wherever applicable. Although these procedures will be found to be applicable in the majority of cases, particular situations where they would not be applicable will still require sound judgment in carrying out an effective leak survey program. Distribution plats and/or distribution maps or CGT records used to perform the leak surveys shall be as current as practical, typically within 3 months of the scheduled leak survey.

Leaks from Non-Pacific Gas and Electric Company (Company) Sources

Odors or indications from non-Company sources should be investigated using the procedures listed in the "Volatile Combustible Material in Soil" section on Page 26 of this attachment. When leak indications are found to originate from a non-Company source or facility, such as gasoline vapors, sewer, or marsh gas, prompt action should be taken where necessary to protect life and property. Leaks that are potentially hazardous should be reported promptly to the operator of the facility and, where appropriate, to the police department, fire department, or other governmental agencies.

In the case where gas indications are being detected, but are suspected not to be Company gas, samples of the gas can be taken and analyzed, or field tests can be performed by using equipment that can determine whether or not it is Company gas determined by detecting the presence of ethane.

Leaks on Customer Premises

For leaks on customers' premises, refer to UO Standards S6434, "Gas Leak and Odor Response" and S6435, "Establishing and Discontinuing Gas and Electric Service."

Leak Survey and Leak Repair Roles and Responsibilities

The following are roles and responsibilities for leak survey and repair coordinators, the leak survey supervisor, leak survey coordinator's supervisor, leak surveyor, compliance lead, leak repair supervisor, and leak repair employees.

For gas transmission facilities maintained by Gas System Maintenance and Technical Services (GSM&TS) districts, the gas maintenance supervisors fulfill the roles of most of the employees listed above. Leak surveys conducted by GSM&TS are documented on the Pipeline Patrol Reports, Form 4111A, when vegetation survey is used. Plat sheets are not used for documenting transmission leak surveys conducted by GSM&TS.

1. **Leak survey and leak repair coordinator (typically gas mapping employee and/or CGT gas maintenance supervisor**

   A. The leak survey and leak repair coordinator has overall responsibility for:
   - Leak survey, recheck, and repair schedules.
   - Following up concerning due or past due leak information and work.
   - Coordination of Integrated Gas Information System (IGIS) information, leak, leak survey, and repair records.

B. Specific responsibilities

- Ensure that the scheduling of all leak-related activities, survey, rechecks, and repairs are timely, correct, and accurate.
- Clearly communicate the schedule to the work groups and/or to the respective supervisor of employees performing leak survey, leak investigation, and leak repair work.
- Assist the leak survey supervisor and the leak repair supervisor in ensuring the accuracy and timeliness of all leak surveys, leak investigations, and leak repairs.
    - Routine leak records should be returned to the coordinator no more than 7 calendar days following the day the respective survey for a respective map is completed.
    - Make changes that are compliant with the survey schedule and/or survey data as requested by the leak survey supervisor.
    - Rearrange leak repair schedules and/or survey data as requested by the Leak Survey supervisor.
    - Critically review the records and information returned from the field to identify potential conflicts, errors, and/or omissions.
    - Follow up concerning outstanding "no access" locations.
    - Follow up concerning any potential conflicts, errors, and/or omissions in records of information provided.
- Assist the appropriate supervisor in ensuring that all leaks are rechecked in a timely manner.
- Ensure that suspected copper service leaks are appropriately identified and graded as a Grade 1, Grade 2+, or Grade 2 leaks.
- Assist the appropriate supervisor in ensuring that all leaks are appropriately graded by evaluating the information or lack of information for each respective leak and comparing the information against the leak grading criteria in this standard.
- Assist the appropriate supervisor in ensuring that all downgrades and upgrades are justified and adequately documented.
- Assist the leak repair supervisor to ensure that all leaks are repaired in a timely manner by supplying the supervisor with leak information and by following up in an effective and efficient manner.
- Assist all work groups in ensuring accurate and timely communication of all leak-related information and schedules.
- Supply copies of leak documents, leak logs, survey logs, recheck reports, and plat sheets, as required, to survey and repair work groups.
- For the CGT-Gas Distribution Memorandum of Understanding (MOU), where plat sheets are being used to document the survey, and for all Gas Distribution leak surveys, supply a copy of the respective IGIS Survey Log for the surveyors to use. This will eliminate duplicate leak numbers from being issued and ensure the rechecks of existing leaks are appropriately documented with the survey.
  (**Note:** CGT facilities that are maintained by CGT use Pipeline Patrol Report, Form F4111-A, rather than leak survey maps/plats.)
- Update maps and/or records, as needed, to reflect discrepancies noted by leak surveyors or others.
- Supply other information as requested by the survey and repair work groups.

- Ensure timely input of information into IGIS.
- Organize, maintain, and retain leak survey and repair information.
- Inform the leak survey coordinator's supervisor of recurring and/or worsening trends concerning the quality of service from other work groups or individuals that are jeopardizing or may jeopardize the quality of the program.

2. Leak survey supervisor (typically a construction supervisor or a GSM&T gas maintenance supervisor)

A. The leak survey supervisor has overall responsibility for ensuring the following:

- Overall survey coordination.
- Critical data review.
- Supplying timely and accurate records.
- Supervise leak surveyors.
- Manage leak survey equipment, supplies and tools.

B. Specific responsibilities

- Ensure that for a CGT-Gas Distribution MOU, where plat sheets are being used to document the survey, and for all Gas Distribution leak surveys, the surveyors are being supplied a copy of the respective IGIS Survey Log for the surveyors to use and that the surveyors are using the Survey Log. This will eliminate duplicate leak numbers from being issued and ensure that the rechecks of existing leaks are appropriately documented with the survey. (Note: CGT facilities that are maintained by CGT use Pipeline Patrol Report, Form F4111-A, rather than leak survey maps/plats.)
- Return maps and records to the leak survey and repair coordinator no more than 7 calendar days following the day the respective survey for the respective map is completed.
- Critically review all Leak Survey Maps, "A" Forms, and Leak Logs for accuracy, proper grading, and completeness.
- Ensure that all downgrades and upgrades are justified and adequately documented.
- Forward any "A" Forms, "A1" Forms, survey logs, leak logs, and any completed leak survey maps to the leak survey coordinator on a daily basis.
- Notify the gas operating engineer of unusual survey findings.
- Ensure that all CGI locations are being followed up in a timely manner and resolved.
- Coordinate changes to survey schedules, frequencies, data, and techniques to all affected employees.
- Inform others to help resolve any recurring and/or worsening trends concerning the quality of service from other work groups or individuals that are jeopardizing or may jeopardize the quality of the program.
- *Supervise leak surveyors.*
    - Ensure that all survey employees are trained and Operator Qualified (OQd) to conduct leak survey activities.
    - Manage work group scheduling to ensure timely survey, leak investigation, and recheck work.
    - Monitor survey progress and resource needs.
    - Document monthly survey completion.

  - Ensure accuracy and completeness of all information provided by leak surveyors.
- *Manage leak survey equipment, supplies, and tools.*
  - Ensure that only approved and authorized equipment, tools, and procedures are used by leak surveyors.
  - Ensure that all leak detection equipment is calibrated and in proper working order.
  - Ensure that adequate equipment, supplies, and tools are readily available for the surveyors.

3. Leak survey coordinator's supervisor (typically the mapping supervisor or the GSM&TS gas maintenance supervisor)

A. The leak survey coordinator's supervisor is responsible for the following leak survey activities:

- Monitor procedures.
- Supervise leak survey coordinators.
- Follow up on reports of recurring and/or worsening trends concerning the quality of service from other work groups or individuals that are jeopardizing or may jeopardize the quality of the program.

B. Specific responsibilities

- Ensure that an adequate scheduling process is in place and is being used effectively.
- Ensure that an adequate monthly routine leak survey progress monitoring process is in place and is being used effectively. This report must at least indicate the percentage the leak survey is complete for the month to date based on hours scheduled for the month versus the scheduled hours completed for the month, or miles of facilities to be surveyed for the month versus the miles of facilities completed for the month.
- Lead the effort to work with the gas operations engineer and the leak survey supervisor to develop and implement action plans to:
  - Improve schedule effectiveness.
  - Implement new leak software.
  - Integrate new mapping and recordkeeping processes.
- Monitor survey and recheck completion.
- *Supervise leak survey and leak repair coordinators*
  - Ensure that mappers are adequately trained to manage survey records and computer software, such as Gas FM and Excel.
  - Ensure accurate and timely schedule implementation.
  - Ensure accurate IGIS information.
  - Ensure timely follow-up concerning any potential conflicts, errors, and/or omissions in records of information provided.
  - Reinforce with the leak survey coordinator, the leak survey coordinator's responsibility to report recurring and/or worsening trends concerning the quality of service from other work groups or individuals that are jeopardizing or may jeopardize the quality of the program.

4. Leak surveyor

A. The leak surveyor's general areas of responsibilities include:

- Route and schedule assigned survey work to ensure timely and efficient completion of the work.
- Conduct survey activities.
- Be ready and able to explain the leak grading and leak survey procedures to the public, as needed.
- Update survey and leak records and forward them to others for action.

B. Specific responsibilities

- *Route and schedule survey work.*
  - Review and evaluate assigned work, route the assigned work, and schedule accordingly.
  - Ensure that surveys are completed on time.
  - Update all appropriate records.
- *Conduct survey activities.*
  - Use only Company-approved techniques, tools, and equipment.
  - Accurately grade the leaks based on concentration, proximity to structures, public exposure, and likelihood of migration and/or future hazard. Consideration of the soil type (sand, clay, rock, etc.) and weather shall be made before clearing a leak. A Grade 2 or 2+ leak that was graded in a dry season in a clay soil area that is currently in a wet season should be evaluated carefully before downgrading or deleting a leak. Adequately document any leak downgrades and upgrades.
  - For a CGT-Gas Distribution MOU, where plat sheets are being used to document the survey, and for all Gas Distribution leak surveys, use the copy of the respective IGIS survey log. This will eliminate duplicate leak numbers from being issued and ensure that the rechecks of existing leaks are appropriately documented with the survey.
  - Consult with a supervisor when unusual conditions are encountered.
  - Be ready and able to explain the leak grading and leak survey procedures to the public, as needed.
  - Ensure that all detection equipment is calibrated and in proper working order.
  - Notify the supervisor of specific CGI follow-up requirements.
  - Recommend additions/deletions to annual leak survey locations as conditions warrant.
  - Recommend and document changes to and/or conflicts with facility records.
  - Conduct atmospheric corrosion inspections, evaluations, and reporting in the course of the leak survey.
  - Appropriately identify and grade suspected copper service leaks on the leak logs and/or "A" Form.
  - Report and/or correct any conditions found in the field concerning Company facilities needing corrective action.
  - Standby/make safe Grade 1 leak locations as required.

- *Update survey records and forward to others for action.*
  - Note the location and leak number of each leak on the leak map records.
  - Ensure that all survey and recheck logs are timely, accurate, and complete.

5. Compliance lead (typically the operations engineer for Gas Distribution and MOU CGT facilities, or for non-MOU CGT facilities the GSM&TS district supervisor or System Integrity representative.)

- Review/audit leak survey and repair activities in accordance with the current Gas Distribution and Technical Services Compliance Plan, Leak Survey and Repair Audit Protocol, and the Senior Gas Operations Engineers Review Protocol.
- Ensure that for CGT-Gas Distribution MOUs, where plat sheets are being used to document the survey, and for all Gas Distribution leak surveys, a copy of the respective IGIS Survey Log for the surveyors to use is being issued and used. This will eliminate duplicate leak numbers from being issued and ensure that the rechecks of existing leaks are appropriately documented with the survey.
- Help ensure that the proper replace versus repair decisions are being made.
- Review other leak survey and repair activities as requested.
- Review the IGIS Leak Downgrade and IGIS Leak Upgrade Reports to ensure that appropriate documentation and grading practices are in place.
- Work with other stakeholders to develop and implement process improvement initiatives.
- Work with program lead to revise/modify standards and guidelines.
- Evaluate leak data to identify, assess, and manage leak trends, and evaluate replace versus repair situations.
- Champion the authorization of identified replacement work based on condition and/or leak history.

6. Leak repair supervisor (typically a gas construction supervisor or the GSM&TS gas maintenance supervisor for CGT)

- *Responsibilities*
  - Manage and monitor the leak repair process.
  - Supervise leak repair employees.
  - Manage repair equipment, tools, and supplies.
  - Ensure that the proper accounting is being used by the repair employees.
- *Specific Responsibilities*
  - *Manage the leak repair process.*
    - Help ensure that the proper replace versus repair decisions are being made.
    - Ensure that all repairs are completed in a timely manner.
    - Critically review leaks before repair to ensure the leak should be repaired. Consider the soil type (sand, clay, rock, etc.) and weather before clearing a leak. A Grade 2 or 2+ leak that was graded in a dry season in a clay soil area that is currently in a wet season should be evaluated carefully before downgrading or deleting a leak.
    - Ensure that any special circumstance must be clearly noted on the “A” and “A1” forms.

        - Review all repaired leak "A" and "A1" forms to ensure accuracy and completeness.
        - Ensure that all repaired leak "A" and "A1" forms are returned to the leak survey and repair coordinator in a timely manner.
    - *Supervise leak repair employees.*
        - Ensure that all repair employees are OQd as required.
        - Provide training to all repair employees.
        - Ensure that only approved repair techniques/procedures are used.
        - Monitor individual leak repair progress and quality.
        - Monitor, evaluate, and manage leak repair costs and trends.
    - *Manage repair equipment, tools, and supplies.*
        - Provide sufficient tools and supplies for all likely local leak scenarios.
        - Ensure that all repair equipment and tools are approved, in proper working order, and calibrated as required.

7. Leak repair employees (typically a gas crew lead person)

A. The leak repair employees' general areas of responsibilities include:

- Critically evaluate the grade of the leak before repair to confirm the need for repair.
- Evaluate the situation and recommend either facility repair, deactivation, or replacement.
- Pinpoint and repair the leak.
- Fully document the leak repair work and inspection data in ink. Note that the crew leader whose crew repaired the leak shall sign-off the "A" or "A1" Form. They shall not be signed-off by a supervisor or anyone else on behalf of the crew leader.
- The respective leak number shall be included on the time record (time sheet) for the workers that worked on the respective leak repair.

B. Specific responsibilities

- *Route and schedule repair work.*
    - Review and evaluate assigned work, route the assigned work, and schedule it accordingly.
    - Ensure that repairs are completed on time.
    - Update and submit all appropriate records in a timely manner.
- *Conduct repair activities.*
    - Use only approved procedures, tools, and equipment.
    - Accurately grade the leaks based on concentration, proximity to structures, public awareness, and likelihood of migration and/or future hazard. Adequately document reasons for any leak downgrades and upgrades.
    - Consult with a supervisor when an unusual condition is encountered.
    - Ensure that all detection equipment is calibrated and in proper working order.
    - Ensure that all leak repair employees are appropriately trained and qualified.
    - Notify the supervisor of specific CGI follow-up requirements.
    - Fully document the work performed. Complete appropriate requests for additional information concerning leak records and activity in a timely manner.
    - Clearly report field-to-record discrepancies.

Table 1
Frequency of Periodic Required Gas Leak Surveys

Gas Facilities	Semi-annual	Annual	3 Years	5 Years	After Repairs (Note 1)	Acceptable Leak Survey Methods
Distribution Class 4 locations, in principal business districts, and in Class 3 locations covered by 49 CFR 192.5(b), (3), and (ii), and G.O. 112E Section 143.1 where, in the opinion of the supervisor, (see Note 2) conditions warrant survey.		X			X	Foot or Mobile Only
Distribution (Note 3) Buried metallic facilities not under cathodic protection, not already in an annual leak survey area.			X		X	Foot or Mobile Only
Distribution Balance of underground facilities.				X	X	Foot or Mobile Only
CGT-Distribution Class 4 locations, in principal business districts, and in Class 3 locations covered by 49 CFR 192.5(b), (3), and (ii), and G.O. 112E Section 143.1 where, in the opinion of the supervisor, (see Note 2) conditions warrant survey.		X			X	Foot or Mobile Only*
CGT-Distribution Class 1, 2, and 3 where an annual survey is not required.				X	X	Class 3: Foot or Mobile Only* Class 1 and 2: Foot, Mobile, Vegetation
CGT-Transmission Class 1 and 2		X			X	Foot, Mobile, or Vegetation
CGT-Transmission Class 3 and 4	X**				X	Foot or Mobile Only*
CGT Gathering Class 1, 2, 3, and 4		X			X	Class 3: Foot or Mobile Only* Class 1 and 2: Foot, Mobile or Vegetation
Station Piping Class 1, 2, 3, and 4		X			X	Foot or Mobile Only*
CGT-Transmission Transporting Unodorized Gas in Class 1 and 2		X			X	Foot, Mobile, or Vegetation
CGT-Transmission Transporting Unodorized Gas in Class 3	X				X	Foot or Mobile Only (No Exceptions)

* **Vegetation Leak Survey may only be performed on Class 3 facilities if specific permission is granted in writing from CGT. However, for semi-annually required leak survey in Class 3 areas, if vegetation exists, a vegetation leak survey may be used for one of the leak surveys.**

**** CGT-Transmission that will be integrity assessed under the Pipeline Integrity Management Program requires only an annual leak survey. The list of covered pipelines that will be integrity assessed is maintained by the Risk Management Section of GSM&TS.**

Notes:

1. The need for a follow-up survey/post-repair check should be determined by a qualified employee, under the direction of the supervisor in charge of maintenance and based on factors such as residual gas, leak history, age, and type of system.
2. All service lines to schools (www.greatschools.net), hospitals (http://neuro-www2.mgh.harvard.edu/hospitalwebusa.html), business districts, and churches (http://www.churchseek.net) must be surveyed annually (The websites provided may not be complete listings and may be used in conjunction with other records, such as historical records, phone book references, and other sources). Other cases may include certain public assembly buildings occupied by 20 or more persons, recreational areas, state licensed daycare centers with licensed occupancies of 12 or more (www.ccld.ca.gov/docs/ccld_search/ccld_search.aspx) or nursing homes with eight or more beds (www.healthgrades.com).
3. Three-year leak survey areas include buried metallic facilities, not cathodically protected. Also includes isolated copper services, not cathodically protected. This does not include isolated, stainless-steel metallic connector fittings that are part of the plastic system.
4. Frequency definitions: Semi-annual means twice each calendar year not to exceed 7-1/2 months. Annual means once per calendar year not to exceed 14 months; 3 years means once each three calendar year period, within the anniversary month, not to exceed 38 nominal months; 5 years means once each 5 calendar-year period, within the anniversary month not to exceed 62 nominal months. If a survey is performed outside of the prescribed time period to be compliant, the late survey date will not be used as a basis to reschedule the survey. Only surveys that are performed within compliant time periods will be allowed to be used as a basis for rescheduling.
5. Please note that any rescheduling that is performed by using the leak survey nominal month time windows shall be documented. Care shall be taken when rescheduling the work to not disrupt future months' leak survey workload.

Types of Special Leak Surveys

Special leak surveys shall be performed for the following situations:

1. Customer or third-party complaints of gas leakage.
2. Scheduled checks of previously identified leaks that are being checked outside of a routine leak survey.
3. Before and during maximum allowable operating pressure (MAOP) uprates of gas distribution facilities (Gas Standard A34.2, "Low, Semi-High, and High Pressure Uprating Procedure").

Special leak surveys should be considered for the following situations:

1. On susceptible gas facilities[1] ahead of street improvements or blasting work and before, during, and/or after major third-party construction projects that involve a large trench, chamber, or vault excavations (see 2.A. below). When disruptive construction is close to gas facilities making them more susceptible to damage, give extra consideration to conducting special leak surveys before, during, and after the construction.

   1. Typically the more susceptible facilities are cast iron facilities, steel facilities with mechanical joints, and/or 12" or larger distribution facilities with miter joints.

2. Determine whether a special leak survey should be conducted after evaluating the following areas:
   A. The most recent leak survey data.
   B. The degree of sub-grade disruption based on the type of work being performed, e.g., scarifying the street versus overlaying the street.
   C. The material type and age of the gas facilities involved, and after evaluating (as needed) the following supplemental areas:
      - Repaired leakage history.
      - Main and service inspection data, including cover where appropriate.
      - Active leakage data.
   D. Only after the prior steps are completed and the evaluation suggests that there is a reasonable risk of leakage in the scope of the proposed project shall a special leak survey be conducted.
   E. If the area is scheduled for replacement in the next ~3 years, then the division should request that the city, county, or state defer their work until the facilities are replaced.
3. After abnormal operating pressure conditions with the concurrence of the Gas Operations engineer, a GD&TS engineer, or a pipeline engineer for CGT facilities.
4. Following a substantial earthquake impacting the local division (Richter scale rating of greater than 5), landslide, flood, or other significant natural damage situation involving susceptible gas facilities[1].

   1. Typically the more susceptible facilities are cast iron facilities, steel facilities with mechanical joints, or 12" and/or larger distribution facilities with miter joints.

Leak Survey and Leak Investigation Follow-up Procedures to Inaccessible Locations

For a gas facility that cannot be accessed on the initial attempt to perform a leak survey, a follow-up method is required, such as in UO Guideline D-G0071, "Follow-Up Leak Survey Procedures for Inaccessible Locations."

Leak Survey Method for Leak Checks and Leak Investigations

An approved and authorized gas detection unit shall be used to conduct leak surveys (except for vegetation leak surveys) or any required leak checks (e.g., required 6-month scheduled leak checks of Grade 2 leaks).

Leak Survey and Leak Investigation Method to Downgrade or Clear a Leak

The same type of instrument, or a more sensitive instrument that was used to record an original leak indication, shall be used to subsequently clear that same leak indication on a leak survey, leak check, or leak recheck. Consider the soil type (sand, clay, rock, etc.) and weather before clearing a leak. A Grade 2 or 2+ leak that was graded in a dry season in a clay soil area that is currently in a wet season should be evaluated carefully before downgrading or deleting a leak. A gas leak identified by vegetation leak survey shall be verified by using an approved and authorized gas sensing unit or procedure. Company gas leakage instrument types in order of decreasing sensitivity are:

1. Walking hydrogen flame ionization unit (most sensitive).
2. Mobile optical methane detection or mobile hydrogen flame ionization unit.
3. Subsurface combustible gas indicator.

Leak Surveyor and/or Leak Detector Person Qualifications

Gas leakage surveys and leak investigations shall be performed by employees who are OQd in the type of survey work being performed, and who are familiar with the characteristics of the natural gas and leakage detection instruments being used.

Calibration of Leak Survey and Leak Investigation Equipment

All leak survey instruments that are used to perform the leak surveys required by this standard must be checked for calibration and calibrated (if necessary) according to the frequencies recommended by the manufacturer or the gas standards covering this equipment (M-53, "Portable Combustible Gas Indicator Specification," M-53.1, "Portable Combustible Gas Indicator Operation and Maintenance Specifications," M-53.2, "Portable Hydrogen Flame Ionization Gas Detector," M-53.3, Calibrating Portable Combustible Gas Indicators and Hydrogen Flame Ionization Units," M-53.4, "Mobile Leak Survey, Hydrogen Flame Ionization," and M-53.5, "Mobile Leak Survey, Optical Methane Detection").

If the leak detection and/or leak survey equipment has not been calibrated within the specified calibration time spans immediately before field use, the equipment shall be checked for calibration and calibrated (if necessary) before being used as required by the respective gas standard. Records of the calibration checks, calibrations, and when the equipment is in or out of service shall be kept in accordance with the applicable gas standard and retained for 7 years.

Leak Survey Methods

Following are the acceptable methods of gas leak survey.

1. Mobile-Type Survey

Only approved equipment and procedures shall be used to conduct a mobile-type survey, as detailed in M-53.4, "Mobile Leak Survey, Hydrogen Flame Ionization" and M-53.5, "Mobile Leak Survey, Optical Methane Detection."

2. Foot Survey

A. A foot survey shall be conducted by using an approved portable hydrogen flame ionization instrument (as listed in M-53.2, "Portable Hydrogen Flame Ionization Gas Detector"), or other combustible gas indicator (as listed in M-53, "Portable Combustible Gas Indicator Specification"). Exposed facilities such as meter sets and risers may be tested with leak detection fluid (e.g., soap).

B. The foot survey method may be used to leak survey mains in a street or other vehicular area where safe, effective, and efficient coverage is possible. Due to the demonstrated effectiveness and efficiency of the mobile leak survey equipment, the use of the mobile survey should be maximized where it is practical.

C. Survey procedures

(1) Survey at exposed piping, gas casing vents, surface openings, pavement cracks and joints, unpaved areas, casing vents, or other locations where gas may vent.

(2) Survey over all services and outside meter sets or meter enclosure vents (this includes services and mains in the street area).

(3) Survey house foundation vents in the proximity of the meter sets for under-the-structure meter sets.

(4) When leak indications are found in a wall-to-wall area or in the close proximity of a structure, the use of bar holing is recommended to better define the situation.

3. Vegetation Survey

A. A vegetation survey can be used as a leak survey method in conjunction with other methods. Vegetation leak survey may only be used as the sole leak survey method for gas transmission lines and gas gathering lines for Class 1 or 2 locations, provided gas detectors are used to verify suspected positive gas indication. For semiannually required leak surveys in Class 3 areas, if vegetation exists, a vegetation leak survey may be used for one of the semiannual leak surveys. However, the other semiannually required leak survey in Class 3 areas must be conducted by mobile-type or foot survey.

B. A vegetation survey may not be used on any gas distribution facilities.

C. A vegetation survey may not be used on any gas transmission lines or gathering lines in Class 3 or Class 4 locations*.

D. A vegetation survey may be performed by foot, vehicle, or aerial patrol.

***Vegetation Leak Survey may only be performed on Class 3 facilities if specific permission is granted in writing from CGT or is one of the semiannual leak surveys (see Paragraph 3A above).**

Surveillance and Repair Priorities

Response, surveillance, and repair priority shall be based on such factors as:

1. The volume, gas-air concentration, and type of escaping gas (for handling unknown gas sources, see the "Volatile Combustible Material in Soil" section on Page 26 of this attachment).
2. The size and occupancy of the area where leakage could occur, and the proximity to structures both above and below ground.
3. The presence of any type of channel or tunnel that could affect the migration or accumulation of gas underground.
4. Soil and surface conditions that influence Item 3 above.
5. The proximity to sources of ignition.
6. Public awareness and apprehension of the leak situation.
7. Soil movement caused by landslides, earthquakes, and so forth, where external stresses on the pipeline may cause leakage.

After considering such factors, grading and repair priority shall be in order of Grade 1, Priority Grade 2 (Grade 2+), Grade 2, and Grade 3 (see the "Leak Grading" section on Page 17 of this attachment).

Leak Response and Action for Suspected Leaks Reported By Others

Suspected leaks reported to the Company by other than Company employees

A gas leak reported by other than Company or Company-contracted employees shall be responded to immediately, and will be evaluated and/or graded by a competent first responder[1] or trained person.

- If the leak is not determined to be non-hazardous by a competent first responder, then OM&C or GSM&TS employees will be called upon to further evaluate, investigate, and/or grade the leak. The first responder should complete the "A" or "A1" form as completely as feasible.
- If the leak is determined to be non-hazardous by a competent first responder and not yet graded, the leak information is to be communicated to OM&C or GSM&TS by the next working day for further investigation and action via a multi-purpose tag or other formal documented method. Refer to the "Assigning Leak Numbers" section, Paragraph 2 on Page 23 of this attachment concerning leak grading. The first responder should complete the "A" or "A1" form as completely as feasible.

- For Gas Distribution, costs to investigate leaks found on or downstream of the service valve shall be charged to major work category, MWC, HY. Costs to investigate suspected leaks, where the service department has already investigated and found no physical evidence of a leak and forwarded the work to OM&C, where OM&C finds no leakage shall be charged to MWC DD.

1. A gas service representative is competent to determine if a gas leak is non-hazardous.

Leak Grading

Where readings are found in multiple locations, and the readings and conditions support that there is only one leak with gas migration, only one leak number shall be assigned and the most severe condition found shall be reported. For example, where only one leak exists and two readings are found, one would not report a 4% gas in the lawn as the leak reading or location, but rather would record a 1% gas reading at the foundation of the building, and would grade the leak based on the most severe condition found, noting the 4% reading in the lawn.

Grade 1

1. Criteria: A leak that represents an existing or probable hazard to persons or property requiring immediate repair or continuous action until conditions are no longer hazardous. This criteria includes:

   A. Any reading of 80% LEL (4.0% gas in air, 40,000 ppm) or greater where the gas would likely migrate to the outside wall of a building.

   B. Any gas reading in, at, or under a building or tunnel.

   C. Escaping gas that has ignited.

   D. Gas which can be seen, heard, or felt in a location where the presence of gas endangers the general public or property.

   E. A gas leak which falls outside of the above criteria and poses an immediate hazard in the judgment of either:

      - The surveyor and a technically competent supervisor, or
      - The leak detector person and a technically competent supervisor.

Please note that any leak that is suspected to be on a copper service shall be graded either as a Grade 1, Grade 2+, or Grade 2 leak. Leaks that are suspected to be on copper services shall not be graded as Grade 3 leaks or be deleted[1].

1. A leak that was previously suspected as being a copper service leak can be deleted or downgraded if it is determined that the leak is not associated with a copper service as previously reported. The division can propose the condition data be corrected, which would allow the leak to be downgraded. The request shall be submitted to the program lead for critical review and authorization. If authorized, the program lead will request the changes through the IGIS administrators. If the change in IGIS is made, then all relevant local leak records will be updated with the new leak data and will be initialed and dated by local Company employees.

2. Action

   A. Take immediate and continuous corrective action to eliminate the hazard. Such action may include (but is not limited to) one or more of the following:

      (1) Evacuate the premises.

(2) Vent the leakage. (Any Grade 1 leak that is downgraded by venting the gas will be required to be checked at 3-month, not to exceed 4-nominal-month intervals. This will verify that the ventilation is still adequate to support the current grade until the leak has been checked for at least an entire year without requiring additional ventilation work while maintaining the downgraded leak grade. It can be released from the 3-month- not to exceed 4- nominal month recheck interval requirement and be treated as a normal Grade 2 or Grade 3 leak).

(3) Remove the sources of ignition.

(4) If gas is burning, prevent the spread of fire, but do not necessarily extinguish the burning gas.

(5) Eliminate the source of gas.

(6) Restrict public access to the area.

B. Downgrade to a Grade 2+ leak if the leak is not hazardous to life or property, but the leak requires priority, scheduled repair based on a probable future hazard. Action taken or the reasoning behind the downgrade shall be noted on the leak record.

C. Downgrade to a Grade 2 leak if the leak is not hazardous to life or property, but the leak only requires scheduled repair based on a probable future hazard. Action taken or the reasoning behind the downgrade shall be noted on the leak record.

D. Downgrade to a Grade 3 leak if the leak is non-hazardous and can reasonably be expected to remain non-hazardous, and it was not previously downgraded to a Grade 3[2]. Action taken or the reasoning behind the downgrade shall be noted on the leak record.

E. Downgrade to a Grade 0 leak if the leak is not a valid leak or if no leakage is found. Action taken or the reasoning behind the downgrade shall be noted on the leak record. Note that any such downgrade on a suspected low pressure facility will be checked again within 6 months not to exceed the last day of the seven month.

F. Make continuous repair efforts until the leak is repaired or conditions are mitigated to a point where the leak can be downgraded.

G. If the leak meets the criteria for a reportable incident or a safety-related condition (per UO Standard D-S0355/S4413, "CPUC and DOT Reportable Incidents, Curtailments and Conditions and Low Pressure System Problem Reporting"), make the necessary reports.

2-See Grade 3 downgrade exceptions.

Priority Grade 2 (Grade 2+)

1. Any leak that falls below the Grade 1 leak criteria and above the Grade 2 leak criteria: A leak that is not hazardous to life or property, but requires a priority, scheduled repair based on a probable future hazard or requirements to meet the construction schedule of others, e.g., otherwise Grade 2 leaks within the scope of paving projects. This criteria includes:

   A. Any previous Grade 1 leak, based on leak readings and location, where the immediate hazard has been eliminated through any crew action (for example, ventilating the leak) other than a leak repair, but requires priority repair.

B. Any Grade 2 leak that requires priority, scheduled repair, based on a probable future hazard or requirements to meet the construction schedule of others, e.g., otherwise Grade 2 leaks within the scope of construction projects.

C. A gas leak which falls outside of the "A" or "B" criteria and is a Grade 2+ leak in the judgment of:

- The surveyor and a technically competent supervisor, or
- The leak detector person and a technically competent supervisor.

Please note that any leak that is suspected to be on a copper service shall be graded either as a Grade 1, Grade 2+, or Grade 2 leak. Leaks that are suspected to be on copper services shall not be graded as Grade 3 leaks or be deleted[1].

1. See Footnote 1 under Grade 1 Criteria.

2. Action

A. Repair or clear, as designated by the operating department, not to exceed 90 calendar days from the date reported), or ahead of ground freezing or other adverse changes in venting conditions.

B. Downgrade to a Grade 2 if the leak meets the following criteria:

1) It is not hazardous to life or property at the time of detection, but only requires the scheduled repair of a Grade 2 leak based on its probable future hazard. Action taken or the reasoning behind the downgrade shall be noted on the leak record.

C. Downgrade to a Grade 3 if the leak meets all of the following criteria[2]:

1) The leak is non-hazardous and can reasonably be expected to remain non-hazardous, and

2) It was not previously downgraded to a Grade 3 leak. Action taken or the reasoning behind the downgrade shall be noted on the leak record.

D. Downgrade to a Grade 0 leak if the leak is not a valid leak or if no leakage is found. Action taken or the reasoning behind the downgrade shall be noted on the leak record. Note that any such downgrade on a suspected low pressure facility will be checked again within 6 months not to exceed the last day of the seven month.

2. See Grade 3 downgrade exceptions.

Grade 2

1. Criteria: A leak that is not hazardous to life or property at the time of detection, but requires scheduled repair based on a probable future hazard. This criteria includes:

A. Any reading of 100% LEL (5% gas in air, 50,000 ppm) or greater in a Class 3 or 4 location that is in a well-ventilated area, such as a pipeline right-of-way, station yard, or a non-wall-to-wall paved area, which does not otherwise qualify as a Grade 1 or a Priority 2 (Grade 2+) leak.

B. Any reading greater than 40% LEL (2% gas in air, 20,000 ppm) in a wall-to-wall paved area which does not otherwise qualify as a Grade 1 or a Priority 2 (Grade 2+) leak.

C. Any reading between 20% LEL (1% gas in air, 10,000 ppm) and 80% LEL (4% in air, 40,000 ppm) in a substructure where gas would likely migrate creating a probable future hazard, or in a confined space.

D. A gas leak which falls outside of the above criteria and is a Grade 2 leak in the judgment of:

- The surveyor and a technically competent supervisor, or
- The leak detector person and a technically competent supervisor.

Please note that any leak that is suspected to be on a copper service shall be graded either as a Grade 1, Grade 2+, or Grade 2 leak. Leaks that are suspected to be on copper services shall not be graded as Grade 3 leaks or be deleted[1].

See Footnote 1 under Grade 1 criteria.

2. Action

A. Repair or clear no later than 18 months to the day from the date reported, or ahead of ground freezing or other adverse changes in venting conditions. Consider repairing when the leak is discovered if it is located in a hard-to-access location.

B. Copper services with Grade 1, 2+, and/or 2 leaks or that have become plugged shall be replaced in accordance with Gas Standard A-67, "Copper Pipeline Defects."

C. For other than copper services, services with Grade 1, 2+, and/or 2 leaks shall be repaired or replaced in accordance with Gas Standard A-69, "Economic Analysis of Gas Leak Recheck, Repair, or Replace Options" or other applicable Gas Distribution bulletins.

D. Maintain surveillance before repair at intervals not to exceed the last day of the 7th month after the anniversary month, or the month of the last leak check.

F. Downgrade to a Grade 3 if the leak is non-hazardous and can reasonably be expected to remain non-hazardous, and it was not previously downgraded to a Grade 3.[2] Action taken or the reasoning behind the downgrade shall be noted on the leak record.

G. Downgrade to a Grade 0 leak if the leak is not a valid leak or if no leakage is found. Action taken or the reasoning behind the downgrade shall be noted on the leak record. Note that any such downgrade on a suspected low pressure facility will be checked again within 6 months not to exceed the last day of the seven month.

2. See Grade 3 downgrade exceptions.

Grade 3

1. Criteria

Any reading of less than 100% LEL (5% gas in air, 50,000 ppm) in a Class 3 or 4 location that is in a well-ventilated area, such as a pipeline right-of-way, station yard, or a non-wall-to-wall paved area, which does not otherwise qualify as a Grade 1, Priority Grade 2, or Grade 2 leak. Please note that a leak is only allowed to be downgraded to a Grade 3 once[2].

A. Any reading equal to or less than 40% LEL (2% gas in air, 20,000 ppm) in a wall-to-wall paved area that does not otherwise qualify as a Grade 1, Grade 2+, or Grade 2 leak.

B. All other leaks which are non-hazardous and can reasonably be expected to remain non-hazardous, and were not previously downgraded to a Grade 3[2].

2. Recheck during the next scheduled survey or at an interval determined by the operating headquarters. This interval shall not be less than 6 months or greater than the next required scheduled leak survey.

3. Please note that any leak that is suspected to be on a copper service shall be graded either as a Grade 1, Grade 2+, or Grade 2 leak. Leaks that are suspected to be on copper services shall not be graded as Grade 3 leaks or be deleted[1].

4. Downgrade to a Grade 0 leak if the leak is not a valid leak or if no leakage is found. Action taken or the reasoning behind the downgrade shall be noted on the leak record.

1. See Footnote 1 under Grade 1 criteria.

2. -See Grade 3 downgrade exceptions.

Grade 3 Downgrade Exceptions

If there is an instance where a leak clearly should be downgraded to a Grade 3 leak and cannot be because the leak of record was previously downgraded to a Grade 3 leak, the leak's history should be critically reviewed to establish that the grading history supports the initial and subsequent upgrade of the leak from the initial downgrade to a Grade 3 leak. If the leak history reveals that the previous leak grading was incorrect to the point that the "proposed corrected" grades would allow the leak to be downgraded, then the request shall be submitted to the program lead for critical review and authorization. If authorized, the program lead will request the changes through the IGIS administrators. If the grade changes in IGIS are made, then all relevant local leak records will be updated with the new leak grade data and will be initialed and dated by local Company employees and will include the rationale behind the regrading activity.

Leak Repair Methods

The following are acceptable methods of gas leak repair.

1. Plastic Pipe or Fittings

Plastic pipe repair methods are listed in A-93.1, "Plastic Gas Distribution System Construction and Maintenance."

2. Steel Pipe or Fittings

Steel pipe repair methods are listed in UO Standard S4134, "Selection of Steel Gas Pipeline Repair Methods."

3. Cast Iron Pipe or Fittings

Cast iron pipe repair methods are listed in Gas Standard A-66, "Repairing Cast Iron Pipeline Defects."

4. Copper Pipe or Fittings

Copper pipe repair methods are listed in Gas Standard A-67, "Repair of Copper Pipeline Defects."

Corrosion Leak Repairs

Every corrosion external leak repair on a buried steel gas distribution facility and transmission facility must have a pipe-to-soil measurement taken in accordance with Gas Standard O-16, "Corrosion Control of Gas Facilities," and/or UO Standard-S4133, "Corrosion Control of Transmission Facilities."

Pressure Testing of Severed or Replaced Gas Facilities

Test data for repairs of gas facilities that have been replaced or reconnected shall be recorded on the associated "A" Form in accordance with Gas Standard A-34, "Piping Design and Test Requirements," and/or A-93.1, "Plastic Gas Distribution Construction and Maintenance."

A. Severed or disconnected gas services shall be tested from the point of the cut nearest to the main to the service riser.

B. Segments of main to be installed shall be tested before installation.

C. All fittings placed in service shall be soap tested.

Management Review of Leak Surveys and Repairs

1. Leak Survey Records Review

A. As the leak survey is in progress, a technically competent management person shall review the results. The OM&C or GSM&TS supervisor shall ensure that periodic leak surveys are scheduled and completed in the field on time so that any necessary corrective action can be taken.

B. All leak log forms shall be reviewed, signed (or initialed), and dated by a technically competent management person to ensure proper grading of leaks and proper completion of the form.

C. The scope of the leak survey will be reviewed annually to ensure that new facilities and/or facility maps are added to the scope of the survey within a compliant time period and surveyed within a compliant time period. It is recommended that this step take place in the third quarter of the year, so that the scope of the work can be identified and factored into any local resource planning goals.

D. The leak survey program shall be reviewed periodically (not to exceed 5 nominal years) by an operations engineer or other technically competent designee for regulatory compliance and operational efficiency so that long-range plans, replacement studies, or other action plans can be formulated.

2. Leak Repair Records Review

A. For construction, each Form "A" and Form "A1" shall be reviewed, signed (or initialed), and dated by a technically competent management person to ensure proper leak grading, leak repair, follow-up actions and documentation.

B. For mapping, each Form "A" and Form "A1" shall be reviewed by the Mapping department or CGT Records/Mapping section in GSM&TS to ensure proper facility information (cathodic protection area, type of gas facility, year installed) is recorded on the form and in the computer database as specified by Gas Distribution or in the local CGT/UO MOU.

C. As determined by the gas operations engineer or the CGT GSM Pipeline Engineering section, completed leak repair forms and/or data should be evaluated. The gas operations engineer or the CGT GSM Pipeline Engineering section shall ensure that any appropriate follow-up actions are taken, such as:

(1) Other investigations,

(2) Filing a material problem report,

(3) Incorporating into long-range capital plans, or

(4) Other actions.

D. Each external corrosion leak repair on a previously reported cathodically protected, buried metal facility shall be reviewed and evaluated by a qualified corrosion person to determine if any cathodic protection related corrective measures are needed.

(1) If it is discovered that the facility is not under cathodic protection and is not required to be under cathodic protection, the Form "A" CP "Yes" field should be changed to CP "No" and any needed IGIS changes shall be made. This information should be noted on the Form "A."

(2) If the cathodic protection facility was reported as "down" at the time of the leak repair, this investigation shall be documented in the facility's respective cathodic protection maintenance record. Any actions taken or findings related to a normally cathodically protected facility being down, less than 850-millivolts reading, shall be noted on the Form "A" or "A1" and on the respective facility's cathodic protection record.

Assigning Leak Numbers

1. Leak numbers are to be initially assigned or supplied by mapping employees in the UO organization and by Gas System Maintenance mapping employees in the CGT organization.
2. Leaks that are reported and determined to be non-hazardous by a Company employee that is competent in identifying a hazardous gas leak condition, but not trained and qualified in grading leaks shall submit the leak to OM&C or GSM&TS for further investigation and grading. The initial grade to be assigned by OM&C or GSM&TS to the subject leak shall be a 2+, unless there is clear and concise information supplied by the person that allows the leak to be graded otherwise. The initial date and time checked shall be based on the initial evaluation date and time. The gas reading will be recorded as 100% visual.
3. All leak indications shall be recorded on the appropriate forms ("Leak Survey, Repair, Gas Quarterly Incident Report"; "Leak Logs;" or "Survey Logs") and turned into the operating headquarters at least weekly. Leak indications requiring prompt action shall be transmitted to the designated operating supervisor.
4. Each initial leak indication must have a leak number assigned to it within 1 working day of the discovery of the leak.

5. A leak number shall be assigned for each different type of gas facility with a leak (e.g., if a gas service and a main are both leaking within the same bell hole, two different leak numbers should be assigned).
6. If a gas facility has multiple leaks, then one leak number should be assigned per each location that can be worked within a typical repair site (e.g., if a 4' x 4' bell hole has to be expanded to repair an additional leak, then a second leak number can be assigned).
7. Leak numbers shall not be assigned to aboveground meter set leaks (any leak above the bottom of the threads of the service valve excluding the service valve). Any such leaks found and reported to the service department will be documented via a Multipurpose Tag or by directly entering the information into FAS.

Computer Processing of Leak Numbers, Responses, and Repairs

1. Use the established computer system to automatically transfer the local leak information to the system database.
2. Enter all leaks into the leak recording computer system, including all Grade 3 leaks.
3. Ensure that each dig-in leak indication is entered into the leak recording computer system within 10 calendar days of the discovery of the leak.
4. Ensure that each non-dig-in leak indication is entered into the leak recording computer system within 14 calendar days of the discovery of the leak.
5. Ensure that each leak surveillance check and leak repair is entered into the leak recording computer system within 14 calendar days of those actions.

Approved Leak Survey and Repair Records, Forms, and Reports

The following are the records and reports to be completed in conjunction with leak survey procedures. Leak survey and findings on CGT facilities that are maintained by the CGT districts shall be documented on the "Pipeline Patrol Report" (Form F4111-A), or equivalent.

1. An approved records system made up of the appropriate records, indicating the established survey frequency, shall be prepared and maintained in each area, division, or headquarters.
2. Maps or survey records with the previous month surveyed for each respective type of survey identified for the month (1-year, 3-year, 5-year, foot, or mobile surveys). This process is to be handled within the CGT scheduling software for pipelines maintained by the CGT districts.
   A. The last surveyed field on the stamp will be the earliest month recorded for the previous respective survey for the respective plat map
   B. The miles or feet of main and the number of services associated with the each respective survey on the plat map record will be supplied with the record.
   C. The total number of assigned hours associated with each respective survey will be supplied with the record before the survey. See the sample "Stamp" in Figure 1 on the following page.:

Wall Map/Plat_____ Color Coding_____

Identify the Frequency & Type of Survey: **5 Year** **Mobile** / **3 Year** / **Annual** **Foot**

Last Performed _____

Name	Date	Hours	Feet/Miles of Main (Indicate Units)	Number of Services
TOTAL ACTUAL WORK				
FORECAST TOTAL WORK				

Figure 1. Survey Stamp

3. If the survey is being rescheduled, the intent to reschedule the survey and the targeted new scheduled month and year will be clearly identified, as well as the original scheduled survey month and year. This will be noted on the previous and current resurvey record. For CGT, this process is to be handled within the CGT scheduling software for pipelines maintained, PLM, by the CGT districts.
4. The leak survey records will have all of the facilities to be surveyed before the survey readily identified, and have all of the facilities surveyed after the survey readily identified. For CGT, this process is to be documented on the "Pipeline Patrol Report," Form F4111-A, for CGT pipelines maintained by the CGT districts.
5. Completed leak survey record copies shall be turned in to the operating headquarters with the following information. This process is to be documented on the "Pipeline Patrol Report," Form F4111-A, for pipelines maintained by the CGT districts.

   A. The scheduled month, frequency of the survey, date surveyed, miles or feet of main, number of the services surveyed, the survey method, and name or initials of the surveyor will be part of the final survey record.

   B. Evidence that all current mains and services have been surveyed is clearly indicated by marking over main and marking each service. Where there are a readily discernable number of distinct facilities that are scheduled for survey, the survey of these facilities can be noted on a list referenced to the map record where each facility is clearly noted.

   C. Facility record corrections required, as determined by inspection in the field.

6. A pre-numbered "Leak Log" will be supplied by mapping and shall be used by the surveyors to record leaks found on scheduled leak surveys. Pre-numbered leak logs will not be required to be used on CGT facilities maintained by the CGT districts due to the extremely small number of leaks normally found.
7. A "Survey Log" (a standard IGIS Report) that lists all open leaks on the respective plat will be supplied by mapping to the surveyor to allow the surveyor to conduct leak rechecks for leaks

within the scope of the leak survey and to prevent duplicate leak number assignments and entries.

8. For data input beyond the data included in the Survey Log, the current "Leak Survey, Repair, Inspection and Gas Quarterly Incident Report" (62-4060 or an approved equivalent), is to be used by UO employees to record computer input data, and all information relative to survey findings, main condition, and repair. CGT employees should use the most current form, as shown in the sample in Attachment 7, for this purpose. Pipeline, main and service inspection records are to be maintained in accordance with UO Standard D-S0353/GTS S4112, "Physical Inspection of Pipelines, Mains, and Services."

9. If the leak survey is performed after the anniversary month or a planned rescheduling month, but within a compliant time period, and there are valid extenuating circumstances, the circumstances must be documented and validated by a technically competent management employee. Examples of allowable extenuating circumstances are:

   A. Significantly more than the normal inclement weather days as compared to the "Farmers Almanac." References must be cited along with the number of days involved.

   B. Flame Pac and/or Optane Methane Detector (OMD) Unit down without backup. The efforts made to obtain resources to perform the survey shall be documented, initialed, and dated by a supervisor.

   C. Catastrophic event taxing labor and/or equipment resources.

   D. Sudden and unplanned loss of qualified leak surveyors, such as death, injury, or illness.

10. If the leak survey is performed outside of a compliant time period and there are extenuating circumstances, the circumstances must be documented and validated by a technically competent management employee. The extenuating circumstances will not justify the non-compliance, but will help explain it.

    Examples of extenuating circumstances are:

    A. Significantly more than the normal inclement weather days as compared to the "Farmers Almanac."

    B. Flame Pac and/or OMD Unit down without backup.

    C. Catastrophic event taxing labor and/or equipment resources.

    D. Sudden and unplanned loss of qualified leak surveyors.

Leak Survey, Special Leak Survey, and Repair Document Retention Requirements

1. Routine leak survey records shall be retained as follows:

   A. For transmission facilities, the leak survey records shall be kept for a minimum of 5 years with the exception of 5-year leak survey records, which shall be kept for 8 years.

   B. For all other lines, the leak survey records (e.g., plats, log books) shall be kept for the latest and immediately preceding survey, plus 3 years.

2. The "Leak Log," the "Survey Log," and the "Leak Check Log" shall be retained for the life of any gas facility, plus 1 year.

3. The "Leak Survey, Repair, Inspection, and Gas Quarterly Incident Report" shall be retained for the life of any gas facility, plus 1 year. The "Leak Survey, Repair, Inspection, and Gas Quarterly Incident Report" shall be retained for the life of any deactivated and not abandoned gas facility, plus 1 year.
4. Special leak survey records shall be retained as follows:
   A. For transmission facilities, the leak survey records shall be kept on file for a minimum of 5 years.
   B. For all other lines, the leak survey records (e.g., plats, log books) shall be kept for the latest and immediately preceding survey, plus 3 years.

Inspection records, in connection with leak repair or other pipe exposure, shall be maintained for the life of the facility per UO Standard D-S0353/GTS S4112, "Physical Inspection of Pipelines, Mains, and Services."

Entries to Leak Survey and Repair Documents

Any entries on the "Survey Log," recheck log, or "Leak Survey, Repair, Inspection and Gas Quarterly Incident, and Inspection Report" must be in ink. **Do not** make a change by erasing, obliterating, or using whiteout.

Changes to Leak Survey and Repair Documents

Any changes to the initial information recorded on the "Survey Log," recheck log, or "Leak Survey, Repair, Inspection and Gas Quarterly Incident, and Inspection Report" must be dated and initialed by the person making the change in ink. Any grade changes must be dated, initialed and have the reason for the grade change noted. **Do not** make a change by erasing, obliterating, or using whiteout.

Volatile Combustible Material in Soil

1. If the source of the gas leak cannot be found after a thorough field investigation by Company leak surveyors or gas leak crews, one potential cause that must be considered is the presence of combustible material in the soil. When such conditions exist:
   A. The local headquarters may use an appropriate chromatograph or other approved ethane-detection devise to determine the source of the gas and present the results to the facility or property owner, if appropriate.
   B. If the source of the unknown gas is not clear, the local headquarters shall request that the material be further analyzed by an authorized lab or Technical and Ecological Services, as mutually agreed upon by the Company and the third party.
   C. After the analyses are made, the ultimate decision concerning the source of the unknown gas shall include the opinion of the gas operations engineer and the local hazardous waste or environmental coordinator.
   D. If the combustible gas is not the Company's, the matter shall be immediately referred to the public agency, property owner, etc., having the jurisdiction and a record made of the notification.
   E. The situation shall be monitored to keep the Company informed about the eventual abatement of the hazard and to be cognizant of it when performing future leak surveys.

Michael Poon

From: Warren, Ken [KWarren@ci.antioch.ca.us]
Sent: Monday, November 29, 2010 11:36 AM
To: Luis Garcia
Cc: Brandt, Joe; Michael Poon; Saunders, Lisa
Subject: RE: SR 4 Widening - Segment 2 - Contract 04-2285E4

Luis: Please contact Lisa Saunders (925-779-6150) in the City Finance Department to discuss obtaining permits for fire hydrant meters for your project.

KEN WARREN
ASSISTANT ENGINEER

CITY OF ANTIOCH
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
200 'H' STREET - POB 5007
ANTIOCH CA 94531-5007

OFFICE ☎: (925) 779-7000 x 1-2066
FAX 🖷: (925) 779-7034
E-MAIL ✉: kwarren@ci.antioch.ca.us

Due to the ongoing economic crisis and its impact to the City's budget City offices are closed every Friday and the Community Development Department operating hours are:

8:00am – 11:30am: Full service counter hours
12:00pm – 1:00pm: Closed for lunch
1:00pm – 5:00pm: By appointment only

We thank you for your understanding.

From: Luis Garcia [mailto:lgarcia@BKF.com]
Sent: Monday, November 29, 2010 10:57 AM
To: Warren, Ken
Cc: Brandt, Joe; Michael Poon
Subject: SR 4 Widening - Segment 2 - Contract 04-2285E4

Ken:

The Contractor will require water for the construction operations on the subject project. Assuming the Contractor approaches the City and completes the necessary applications and meets the City requirements, etc, will the City water hydrants be an available water source to the Contractor??

Please let me know since we need to confirm we know of an available water source.

Thanks,

Luis Garcia

BKF Engineers
925.396.7769

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