FOR CONTRACT NO.: 01-475104

INFORMATION HANDOUT

MATERIALS INFORMATION

FOUNDATION REPORTS

UNDERGROUND CLASSIFICATION NO. C107-023-09T

EQUIPMENT STAGING AREA PLANS

ROUTE: 01-Hum-254-5.1/5.6

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TECHNICAL MEMORANDUM

Geotechnical Engineering
Materials Testing & Inspection
Environmental Science & Engineering
Water Resources
Earthquake Engineering
Air Quality

Date: June 27, 2008

To: Charlie Narwold, Senior Engineering Geologist
State of California, Department of Transportation
Division of Engineering Services
Office of Geotechnical Design North
Branch B

From: Terry Craven, G.E.
William V. McCormick, C.E.G.

Kleinfelder Project: 85401/1 (Revised)

Subject: Preliminary Foundation Report
Storm Damage Repair
01 HUM 254 PM 5.10
EA: 01-475101
Humboldt County, CA

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1 PROJECT DESCRIPTION

During the winter of 2005/2006, a landslide occurred on the southwest (downhill) side of Highway 254, near milepost 5.10, south of Miranda, in Humboldt County, California. The location of the site is shown on Plate 1, Site Location. As shown on the Site Plan, Plate 2, the main landslide scarp is approximately 200 feet long and the landslide mass extends greater than 200 feet down slope to the southwest (see Plate 3, Section A-A'). The landslide scarp is located partly within the southwest shoulder and extends into the pavement, crossing the southbound lane and extending into the northbound lane up to approximately 8 feet. No existing retaining structures are located within the limits of this project.

The purpose of this project is to provide geotechnical design parameters for a retaining structure to protect the road from landslide related movement. Stabilization of the landslide as a whole is not part of this project and the main mass of the landslide may continue to move down slope of the proposed wall after the retaining structure is constructed.

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2 GEOTECHNICAL SCOPE OF WORK

The scope of our work for this project included the following:

- Review of available geologic information addressing this area.
- Geologic mapping of the landslide and immediate vicinity.
- Drilling, logging, and sampling of four exploratory borings.
- Installation of two Slope Inclinometer casings.
- Laboratory testing of selected samples from the borings.
- Global stability analyses.
- Preparation of this summary report.

3 PERTINENT REPORTS AND INVESTIGATIONS

In preparation of this memorandum, the following documents/reports were reviewed:

United States Department of Transportation, Federal Highway Administration-California Division, Damage Assessment Form (DAF) – Title 23, Humboldt County, Highway 254, Post Mile 5.10 to 5.15, dated 1-10-06.

State of California, Department of Transportation, Project Plans for Construction on State Highway in Humboldt County North of Garberville on Route 101 at 0.2 km North of Alderpoint Road Overcrossing and at 1.1 km South of South Fork Eel River Bridge and on Route 254 at 2.0 km South of Miranda Post Office (As-Built Plans), Contract 01-3933U4, Plans Approval June 28, 1999.

1983, Spittler, T.E., California Geological Survey [formerly the Division of Mines and Geology] Open File Report 83-25, Geology and Geomorphic Features Related to Landsliding, Miranda 7.5' Quadrangle, Humboldt County, California

2000, McLaughlin, R. J. et al., United States Geological Survey Miscellaneous Field Studies MF-2336, Version 1.0, Geology of the Cape Mendocino, Eureka, Garberville, and Southwestern part of the Hayfork 30X60 Minute Quadrangles and Adjacent Offshore Area, Northern California)

Caltrans Seismic Hazard Map and Report, Mualchin, 1996 with errata dated November 2004.

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4 PROPOSED STRUCTURE DESCRIPTION

It is proposed to construct a retaining structure on the southwest side of the existing roadway, to protect the road surface and supporting prism from landslide related damage. As proposed, the retaining structure will be a soldier pile and lagging wall, which may be partially restrained by one or more rows of tiebacks. In accordance with Caltrans standard practice, the wall will be located approximately four feet outside of the fog line. Our recommendations for the lateral limits of the wall are illustrated on Plate 2.

5 SITE DESCRIPTION AND TOPOGRAPHY

At Post Mile 5.1, the two lane Highway 254 roadway is relatively flat. Slope gradients southwest (down slope) of the roadway range from approximately 1.5H:1V (Horizontal: Vertical) to 2H:1V on the existing fill prism to as flat as 3H: 1V further down slope within the landslide mass. The cut slopes bordering the northeast edge of the roadway were constructed at a gradient of approximately 1.3H:1V in the vicinity of the landslide feature. Gradients above the cut slope flatten to between approximately 2H and 4H:1V.

The landslide movement currently impacting the roadway is generally translational, with an estimated mass thickness of 45 to 50 feet. The arcuate headscarp of the landslide extends up to eight (8) feet northeast (up slope) of the roadway centerline. The location of the headscarp was clearly visible during our field exploration in the form of a semi-continuous tension crack approximately one (1) inch wide, even after recent roadway resurfacing. A secondary landslide scarp is located approximately 180 feet southwest (down slope) of the roadway within the main landslide mass. Hummocky topography and minimal mature vegetation observed above the roadway cut slope suggests possible landslide activity. As the roadway outside of the active headscarp appears unaffected by upslope movement, the landslide is either dormant, or the adverse topography was generated as a result of a prior logging operation. In addition, a shallow, localized cut slope failure was noted directly above the main landslide feature. Exploration of this area upslope of Highway 254 was beyond the scope of our investigation.

Sheet flow from the cut slopes and the northeast lane roadway are collected within a roadside v-ditch and captured within a corrugated metal culvert which extends below the roadway and outfalls down slope to the southwest within the existing landslide area. The culvert is damaged and will require repair, replacement, or relocation outside the retaining wall limits. Drainage from the southwest lane within the landslide currently flows down over the slope face of the fill prism.

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Due to recent grading, the fill prism slope face is denuded of any form of vegetation. The area southwest of the fill slope supports a tall growth of wild grasses, blackberry vines, and mature oak, redwood and fir trees. The cut slope and area above is sparsely vegetated with a low to moderate growth of wild grasses.

6 SUBSURFACE EXPLORATION AND LAB TESTING

SUBSURFACE INVESTIGATION

Four (4) exploration borings, designated R-07-001 through R-07-004, were drilled at this site by Caltrans Office of Drilling Services and Woodward Drilling using rotary wash drilling methods. Drilling was performed on August 15, 2007 through August 28, 2007. All drilling and sampling operations were supervised by Kleinfelder staff. Borings R-07-001 and R-07-003 were advanced with a truck-mounted Mobile B-57 drill rig utilizing 114mm (HWT) and 96mm (HQ) casing, equipped with a tri-cone mill tooth bit and a #8 diamond impregnated core bit, respectively. Borings R-07-002 and R-07-004 were performed using truck-mounted Mobile B-47 drill rig utilizing 102-mm diameter and 96-mm (HQ) casing equipped with a tungsten carbide Geo Barrel and #8 diamond impregnated core bit, respectively. Borings R-07-001 through R-07-003 were advanced from the Highway 254 pavement level in the southeast-bound traffic lane to a maximum depth of approximately 100 feet. Boring R-07-004 was advanced from the gravel shoulder adjacent to the northbound lane of 254, also to a maximum depth of approximately 100 feet. The approximate locations of the borings are shown on Plate 2.

Samples of the soil and in-place bedrock were obtained by coring, using equipment as described above, and using 2-inch (inside diameter) Modified California and 1.4-inch (inside diameter) Standard Penetrometer Test samplers each driven with an automatic 140-pound hammer dropped 30 inches. The blows required to drive the Modified California and Standard Penetrometer Test samplers were recorded for each 6 inches of penetration or fraction thereof. Visual classifications were made in accordance with the attached Boring Record Legend. The results of the exploration are summarized on the attached Boring Records and Logs of Test Borings.

As part of this work, two slope inclinometer casings were installed to approximately 99 feet below the ground surface within the bore hole for Boring R-07-002 and to approximately 92 feet below the ground surface within the bore hole for R-07-004. The casings were perforated for their full lengths except for the upper 10 feet to permit possible monitoring of future water levels within the casings. The annular space around the perforated portion of the casings was backfilled with sand and the upper 10 feet was backfilled with bentonite. The inclinometers were completed at the surface with traffic rated access boxes.

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Inclinometer readings were obtained by Caltrans on January 16, February 6, February 10, March 6, April 17, and June 11 of 2008. The inclinometer in Boring R-07-002 was sheared off at a depth of 46 feet at the time of initialization on January 16, 2008. The casing was later sheared off at 17.4 feet when a reading was attempted on March 6, 2008. Inclinometer monitoring results are presented in Appendix C.

LABORATORY TESTING

Laboratory testing of selected soil samples obtained from the test borings was performed at Kleinfelder's Geotechnical Laboratory in Santa Rosa, California. The purpose of the testing was to verify the field descriptions and identifications, and obtain information for subsequent engineering evaluations. Tests performed included:

- Natural moisture content (ASTM D2216).
- Unit weight (ASTM D2937).
- Mechanical analyses (ASTM D422) for classification.
- Atterberg Limits tests (ASTM D4318).
- Consolidated undrained triaxial strength test (ASTM D4767).

Corrosivity tests were performed by an independent testing laboratory (AP Engineering & Testing, Inc. in Pomona, California) in accordance with Caltrans Test Methods 532 – pH, 643 – resistivity, 417 – sulfate content, and 422 – chloride content.

A summary of laboratory test results is attached in Appendix B.

7 SITE GEOLOGY AND SUBSURFACE CONDITIONS

REGIONAL GEOLOGY

The site is located on the eastern edge of the Eel River Drainage within the northern Coast Ranges Geomorphic Province, a dynamic region of California characterized by complex folding and faulting. The province is generally characterized by northwest-trending mountain ranges and intervening valleys that are a reflection of the dominant northwest structural trend of the bedrock in the region. The basement rock in the region is presumed to consist of the Franciscan Complex, a diverse group of igneous, sedimentary, and metamorphic rocks. The Franciscan Complex is part of a northwest trending belt of material immediately adjacent to the eastern edge of the San Andreas Fault system, which is located approximately 18 miles southwest of the site. The site is located approximately 29 miles east of the Mendocino Triple

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Junction where the Gorda, North American, and the Pacific plates meet. Regional Geology is shown on Plate 4.

SITE GEOLOGY

Site geology, as mapped by Kleinfelder for this investigation, is shown on Plate 2. The geology of the site and vicinity has been mapped by McLaughlin et al. (2000, United States Geological Survey Miscellaneous Field Studies MF-2336, Geology of the Cape Mendocino, Eureka, Garberville, and Southwestern part of the Hayfork 30 X 60 Minute Quadrangles and Adjacent Offshore Area, Northern California). McLaughlin et al. (2000) indicate the project site is underlain by the Jurassic-Cretaceous age Broken Formation of the Central Belt Franciscan Complex bedrock, which typically consists of conglomeratic meta-sandstone and meta-argillite. The areas north of the site and west/southwest of the Eel River are mapped as being underlain by Yager Terrane bedrock of the Coastal Belt Franciscan complex. This Eocene to Paleocene age bedrock is comprised of sheared and highly folded mudstone with minor sandstone and conglomerate interbeds. A bedrock thrust fault, located approximately 300 feet southwest of the proposed retaining wall at its closest point, separates the two Franciscan Complex units. Bedrock faults are common features within the Franciscan Complex and likely occurred during the formation of the geologic units. The features are not considered to be active. The Eel River bed located southwest (down slope) of the site is shown to be underlain by Quaternary age alluvial deposits consisting of clay, silt, sand, and gravel.

The site has also been mapped by Spittler (1983, California Geological Survey [formerly the Division of Mines and Geology] Open File Report 83-25, Geology and Geomorphic Features Related to Landsliding, Miranda 7.5' Quadrangle, Humboldt County, California). Spittler (1983) indicates the site and surrounding vicinity is underlain by Tertiary to Cretaceous age Yager Formation, with the Eel River bed underlain by Quaternary age stream channel deposits.

Neither publication identified any landslide features at the site or within the site vicinity.

SUBSURFACE CONDITIONS

The following table summarizes the drilling program performed for this investigation.

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Table 1: Boring Summary

I.D.	Approx. Station	Location (1)	Depth of Boring (ft)	Surface Elev. (ft)	Date Completed	Depth to In-Place(2) Bedrock (ft)
R-07-001	11+18	12 feet left	75.0	350+/-	8-15-07	32.5
R-07-002	11+86	7 feet left	100.0	350+/-	8-28-07	46.5
R-07-003	12+36	7 feet left	80.0	350+/-	8-16-07	29.5
R-07-004	11+80	18 feet right	100.0	350+/-	8-20-07	33.0

(1) Approximate distance from highway centerline, facing in direction of increasing stationing.

(2) Landsliding has occurred within the bedrock formation. This column designates the depth to the top of in-place bedrock, below the identified landslide material.

Borings R-07-001 through R-07-003 drilled for this investigation encountered multiple layers of asphaltic concrete and aggregate base to depths of approximately 7 to 21 feet indicative of past efforts to maintain the roadway grade during on-going movement of the slide zone within the paved area. These borings also encountered fill to depths of approximately 20 to 22 feet and landslide debris to depths of 29.5 to 46.5 feet. Then, the borings encountered moderately weathered in-place meta-sandstone and meta-shale to the termination depths of 75 to 100 feet.

Boring R-07-004, drilled in the shoulder on the north side of the pavement, encountered a 2-foot layer of aggregate base rock underlain by fill consisting of sandy silty clay with gravel to a depth of 8 feet over apparently dormant clayey gravel landslide debris to a depth of about 29 feet. An approximately 2-inch-thick, clay-lined shear was encountered at the base of the debris. The shear is underlain by intensely fractured, disaggregated dormant landslide blocks derived from meta-sandstone and meta-shale bedrock to a depth of 33 feet. The blocks are underlain by in-place metamorphic bedrock consisting of meta-sandstone, meta-shale, and argillite to the termination depth of 100 feet.

Triaxial (unconsolidated, undrained "TXUU") tests were performed on three samples of the landslide debris to aid in the evaluation of subsurface conditions. The range of shear strength ranged from 578 to 813 pounds per square foot (psf) and averaged 696 psf. A single triaxial TXUU was performed on a sample of the sandstone bedrock; however, the low value of 426 psf for shear strength is attributable to the gravelly nature of the sample and the probability that the sample was disturbed during sampling.

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8 GROUNDWATER

Due to the use of drilling fluid, it was not possible to record groundwater depths at the time of drilling. Moisture/density test results indicate that most samples below a depth of approximately 10 feet were saturated or nearly saturated. Piezometers (perforated SI casings) were installed in Borings R-07-002 and R-07-004 to allow future groundwater monitoring. Results of groundwater monitoring to date are tabulated below.

WATER LEVEL MONITORING		
	Depth from top of casing to water level (feet)	
Date	R-07-004	R-07-002
1/16/2008	16.6	38
1/29/2008	16.8	NMW
2/6/2008	NMW	NMW
3/6/2008	41.5	41.2
4/17/2008	42.9	NMW
6/11/2008	43.6	NMW

*NMW water level not measured.

9 CORROSION POTENTIAL

Chemical analyses were performed on two (2) samples collected from the borings to evaluate corrosion potential of the on-site soils. Testing was performed by AP Engineering & Testing, Inc. in Pomona, California. The results of the corrosion tests are attached in Appendix B.

Based on the Caltrans Corrosion Guidelines (2003 version 1.0), a site is considered corrosive if one or more of the following conditions exist for the representative soil and/or water samples taken at the site: Chloride concentration is 500 ppm (0.05%) or greater, sulfate concentration is 2000 ppm (0.2%) or greater, or the pH is 5.5 or less. Based on these Guidelines and the laboratory test results, the site may be considered non-corrosive to steel and concrete.

10 EARTHQUAKE FAULTS AND SEISMICITY

According to the Caltrans Seismic Hazard Map and Report (CSHM, Mualchin, 1996 with errata dated November 2004), the nearest fault is the Russ fault, which is located approximately 6.8 miles north of the site. The Russ fault is a fault of unknown mechanism (style) capable of generating earthquakes with a maximum credible earthquake (MCE) magnitude of 7.50. The Caltrans Seismic Hazard Map (CSHM) and Report (1996) locates the site on or immediately

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adjacent to the 0.4g Peak Bedrock Acceleration (PBA) contour associated with the Russ fault. We recommend a PBA value of 0.4g and corresponding Peak Ground Acceleration (PGA) of 0.4g for the analysis and design of the proposed retaining wall. The PGA is estimated based on site soil class C. A portion of the CSHM map is shown on Plate 5.

The site does not lie within an Alquist-Priolo Special Studies Zone (CDMG, 1997). No active faults are mapped crossing the project site nor do any project towards the site. The bedrock fault contact identified by McLaughlin et al. (2000), located approximately 300 feet southwest of the proposed retaining wall, is a common feature within the Franciscan Complex and likely occurred during the formation of the geologic units. The features are not considered to be active. As such, the possibility of primary surface rupture or deformation at the site is considered low.

11 GEOTECHNICAL AND FOUNDATION RECOMMENDATIONS

WALL LOCATION & DEPTH

Based on the field and laboratory data, it is our opinion that, without remediation, the material designated as active landslide deposits will continue to translate down slope. We recommend that a wall be designed to retain the landslide deposits that are located beneath the roadway prism. The proposed wall location is shown on Plate 2. In accordance with Caltrans standard practice, the wall is located approximately four feet outside of the highway fog line. Both ends of the proposed wall terminate approximately 10 feet outside the limits of the active landslide (as presently mapped), for a total length of approximately 184 feet.

The landslide appears to be 45 to 50 feet deep, with the bottom of the landslide occurring within the bedrock formation. Over time it is probable that the existing landslide deposits will continue to translate down slope and we recommend that the wall be designed to retain all soil and rock that is located above the in-place bedrock surface. Plate 6 illustrates the approximate elevation of in-place bedrock along the length of the wall.

We point out that the active landslide appears to be part of a much larger dormant landslide which extends far upslope of the road as well as beyond the lateral limits of the active landslide. The subsurface exploration did not explore the limits of the dormant landslide. The proposed wall is not designed to restrain this much larger landslide and reactivation of the dormant landslide could undermine and seriously damage the proposed retaining wall.

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SOIL AND ROCK PARAMETERS

Based on the results of our subsurface investigation and laboratory testing, subsurface materials within the retained height of the proposed retaining wall (approximately 45 to 50 feet) consist of fill and landslide debris overlying intensely fractured and moderately weathered bedrock mainly comprised of meta-sandstone and meta-shale. A cross section along the length of the proposed wall depicting our interpretation of the subsurface geologic conditions is presented on Plate 6. Based on our review of available data, we recommend that the following parameters be used for retaining wall design. These values represent our best estimate of actual soil properties and **do not contain a factor of safety**. Appropriate factors of safety must be applied during wall design. A surcharge pressure of 270 psf should be applied to the roadway surface behind the wall in accordance with Caltrans standard procedures.

Table 2: Soil/Rock Parameters for Retaining Wall Design

Type	Approximate Depth to Bottom of Layer, at Retaining Wall Location (ft)[1]	Total Unit Weight (pcf)	Angle of Internal Friction, ϕ (degrees)	Cohesion, c (psf)	K_a	K_p
Fill (Qaf)	14 to 23	135	35[2]	0[2]	0.27[5]	0[6]
Active Landslide Deposits (1163)	0 to 48	120	25[3]	0[3]	0.41[5]	0[6]
Dormant Landslide Deposits (2113)	0 to 34	120	32[2]	0[2]	0.31[5]	0[5,6]
Fractured Bedrock (Js)	NA	145	38[4]	0[4]	0.24[5]	4.2[5]

[1] See Plate 6 for anticipated thickness along wall.

[2] Estimated based on correlations with blowcounts and soil type.

[3] Estimated based on correlations with blowcounts and soil type, back-checked by assuming existing landslide has a factor of safety of ~1.0.

[4] Bedrock was too highly fractured to perform triaxial testing. Strength was estimated based on correlations with field blowcounts and material type.

[5] Coulomb method of analysis with $\delta = 0$.

[6] Slope stability analyses indicate that materials overlying bedrock (down slope from the wall) possess a factor of safety against sliding that is less than 1.3; hence, we recommend that no passive resistance be assumed from these materials.

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We understand that seismic wall loads will not be used in design since this is not a "critical" structure.

Tieback Anchors

Due to differences in strain compatibility between soil and bedrock, we recommend that tiebacks derive their support solely from the bedrock formation. The tieback unbonded length will depend on the tieback inclination, elevation, and the overall wall height.

In general, the no-load zone should be determined by the longest of the following values:

1) The distance from the back of the wall to a point that is 5 feet beyond the critical failure surface (in this case the critical failure surface is the surface of the bedrock formation).
2) The distance from the back of the wall to a point that is a distance of H/5 (H = wall height) beyond the critical failure surface.
3) 15 feet beyond the back of the wall.

The location of the unbonded zone for Section A-A' is shown on Plate 7. This section is approximately a worst case condition. For tiebacks that are located 8 feet from the top of the wall and are inclined at 20^0, the unbonded zone may be taken as 70 feet. For tiebacks that are located at other depths or inclinations, the unbonded zone should be estimated from Plate 7, with a minimum length of 15 feet behind the wall.

Soldier Piles

Soldier piles should gain their vertical resistance from friction in the in-place bedrock. Because of the fractured nature of the rock and the difficulty in removing slough from drilled holes, end bearing resistance should be neglected. Bedrock quality varies widely. We recommend that soldier piles be designed for a skin friction in bedrock of 1000 psf. This value is intended for use in a working stress analysis and contains a factor of safety of approximately 2.0.

We recommend that all soldier piling have a minimum embedment of 5 feet into in-place bedrock, deeper penetrations may be required to satisfy wall vertical or lateral loading conditions. As discussed in Section 12 of this memorandum, an embedment of 5 feet is expected to be adequate to force a landslide failure below the existing failure plane and into in-place bedrock.

The depth to in-place bedrock will be variable. The three borings closest to the wall encountered in-place bedrock at depths of 29.5 to 46.5 feet with the greatest depth near the center of the slide zone in the vicinity of Boring R-07-002. A sketch of estimated in-place bedrock depth along the length of the wall is provided on Plate 6.

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Lagging

The purpose of the proposed wall is to protect the road from landslide related movements, not to stabilize the active landslide mass below the wall. As discussed in Section 12, and as shown on Plate 11, the factor of safety against landsliding below the wall is very low, even if the upper 20 feet of soil is removed from below the wall (maximum allowable excavation based on right-of-way and environmental constraints). It should be assumed that the landslide mass below the wall will continue to move and will eventually pull away from the downhill side of the wall. This could result in the loss of material between the piling. To protect against loss of material, lateral earth support should be provided extending down to the in-place bedrock surface (see Plate 6). If support is provided by lagging, this would require temporary excavation to a depth of up to approximately 50 feet below existing grade, which is probably not practical within the project budget. If soldier pilings are spaced at three pile diameters or closer (center to center), soil arching should occur between the pilings to limit the internal loss of soil without the use of lagging. However, over time or in the presence of groundwater, loss of soil could still be significant and future maintenance may be necessary.

Wall Backfill

If required, backfill material behind the wall should be Class 1, Type B Permeable Material (Caltrans Standard Specifications 68-1.025). To prevent internal soil erosion, we recommend that a filter fabric (Caltrans Standard Specification 88-1.03) be placed between the Permeable fill and native soil. To prevent the accumulation of hydrostatic pressures behind the wall, we recommend that HDPE shims be installed between the lagging members.

To reduce backfill pressures, we recommend that any backfill placed within five feet of the wall (measured horizontally) be compacted with lightweight, hand-operated compaction equipment. Over-compaction of this fill can greatly increase wall pressures and/or deflections.

12 SLOPE STABILITY REVIEW

Kleinfelder performed slope stability analyses for the project using "Slide" version 5.03 by Rocscience. Plate 8 presents the results of analyses of the existing (active) landslide. This analysis was performed to back calculate the residual soil strength at the identified failure surface. For this analysis we used the geometry of cross section A-A' (Plate 3). The internal angle of soil friction that produced a factor of safety equal to one was 25^0, which agrees well with empirical correlations to field blow counts and soil type.

We then added the proposed retaining wall to this section and ran the model again. The wall was modeled as a rigid block so that the analysis was independent of the type of wall to be constructed. A 270 psf surcharge pressure was applied to the roadway area above the wall. The result of this analysis is summarized on Plate 9. The wall was modeled as a series of rigid

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piling with sufficient shear strength to force the landslide below the tips of the piling. Based on this analysis, with the wall socketed a minimum of 5 feet into bedrock, the calculated factor of safety against global stability was in the range of 1.5 (a minimum of 1.3 is required).

We then checked wall design pressures by modeling a 49 foot wall with a triangular load applied to the face of the wall, see Plate 10. The force necessary to provide a factor of safety of 1.3 was calculated to be equivalent to that exerted by a fluid with a unit weight of 67 pcf, or a total load of 81,000 pounds per lineal foot of wall. This calculated force is approximately 4% to 5% less than the design load calculated using the coefficients in Table 2 (including the roadway surcharge and a factor of safety of 1.3); thus, we recommend designing the wall in accordance with the parameters in Table 2.

Finally, we checked the slope stability of material below the wall, to see if removal of 20 feet of soil would improve stability of the material below the wall. Twenty feet is the maximum allowed excavation depth due to right-of-way and environmental limitations. A result of this analysis is shown on Plate11. Removal of this material had no significant effect on down slope stability. If should be assumed that the active landslide deposits below the proposed wall will continue to move.

13 CONSTRUCTION CONSIDERATIONS

- Caving conditions will likely be encountered during drilling for piles and tiebacks due to the granular nature of the fill and landslide deposits, and the intensely fractured nature of the bedrock. Temporary casing, drilling under slurry, or placement of slurry cement backfill or concrete and redrilling may be required to control caving and should be performed in conformance with the provisions in Section 49-4.03 "Drilled Holes'" of Caltrans Standard Specifications.

- Groundwater will likely be encountered in the pile and tieback holes. Pile and tieback installations may require dewatering or the placement of concrete and grout underwater. If water is present and the holes are not dewatered, displacement of the water by means of a closed system using a concrete pump or tremie tube to place concrete and grout at the bottom of the holes will be required in conformance with the provisions in Section 51-1.10 "Concrete Deposited Under Water," of Caltrans Standard Specifications.

- Vertical cut sections should not be deeper than five feet without shoring or sloping in accordance with Cal-OSHA Standards.

- Sufficient and timely observation during construction should be performed to correlate findings of the investigation with actual subsurface conditions exposed during construction.

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- The contractor should research utility locations and take necessary precautions to protect-in-place or relocate utilities as applicable, prior to excavation.

- Ponding of water adjacent to the structure should be avoided. During and after construction, positive drainage should be provided to direct surface water away from landslides and retaining structures. In particular, it is extremely important to collect the drainage from the south side of the road that currently flows over the face of the active landslide. Surface drainage should be collected into pipelines that are routed to suitable disposal areas away from the landslides. In addition, as discussed in Section 5, the damaged culvert on the north side of the roadway will require repair, replacement, or relocation outside the retaining wall limits.

14 CLOSURE

A Final Foundation Report can be provided once we receive the preliminary wall design. If you have any questions, please contact us at 707.571.1883

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15 ATTACHMENTS

Plate 1 Site Location
Plate 2 Site Plan
Plate 3 Section A-A'
Plate 4 Regional Geology
Plate 5 California Seismic Hazard Map
Plate 6 Approximate Bedrock Profile Along Proposed Retaining Wall
Plate 7 Tieback Unbonded Zone
Plate 8 Slope Stability: Cross Section A-A'
Plate 9 Slope Stability: Cross Section A-A' With Wall
Plate 10 Slope Stability: Cross Section A-A' Lateral Pressure
Plate 11 Slope Stability: Cross Section A-A' Downslope

Appendix A
Log of Test Borings (LOTBs, 6 pages)
Boring Record Legend
Boring Records R-07-001 through R-07-004 (14 pages)

Appendix B
Laboratory Test Summary
Laboratory Test Data Plates B-1 through B-3
Corrosion Test Results (AP Engineering and Testing, Inc.)

Appendix C
Slope Inclinometer Monitoring Results

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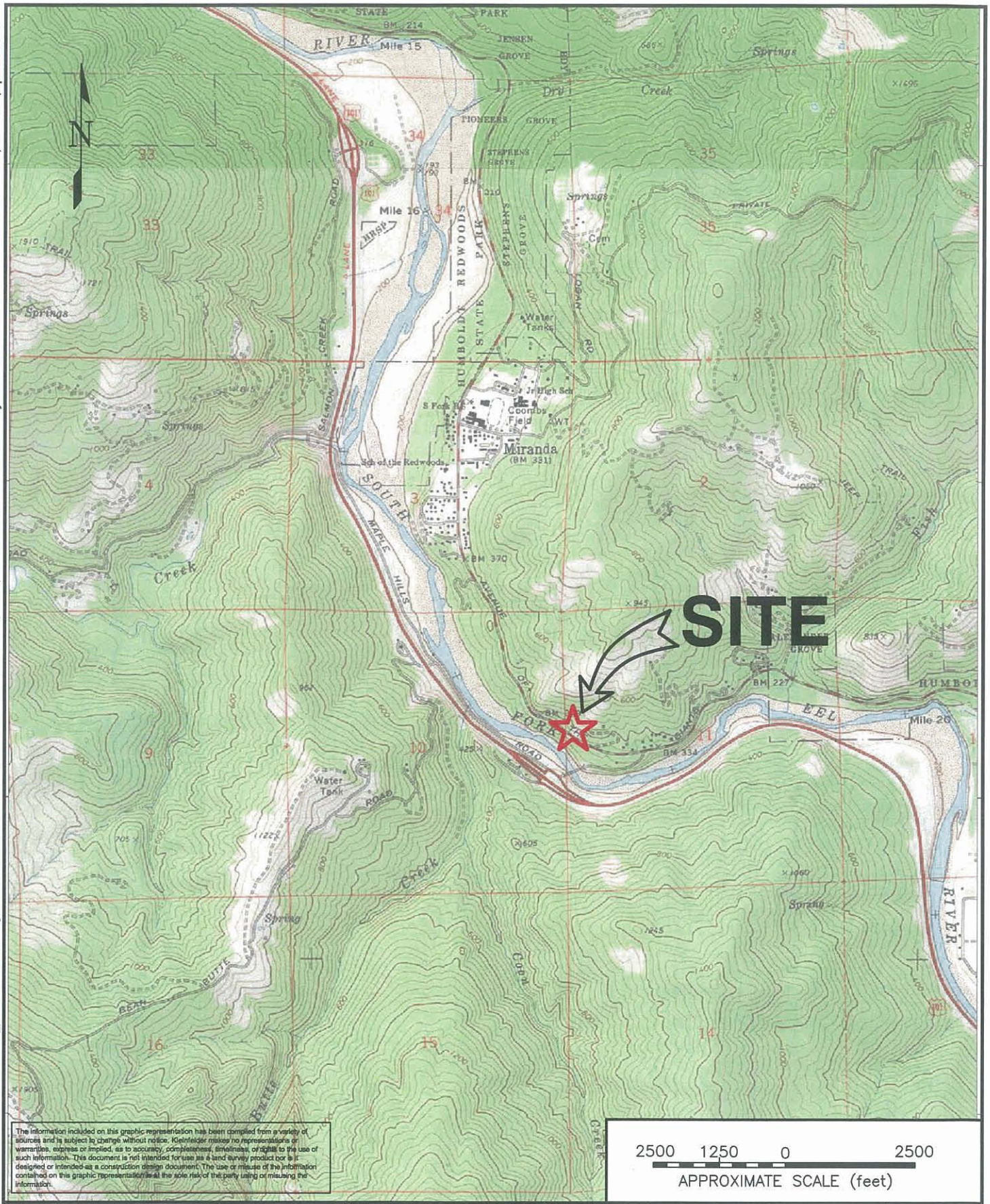
2240 Northpoint Parkway
Santa Rosa, CA 95407
Tel. 707-571-1883
Fax. 707-571-7813



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2500 1250 0 2500

APPROXIMATE SCALE (feet)

ATTACHED IMAGES: Images: Hum254pm5-80-loc.jpg
ATTACHED XREFS:
PLEASANTON, CA CAD FILE: U:\GEOTECH_PROJECTS\Projects\Active\85401 Caltrans HWY 254 PM 5.10, 5.58, 5.8\CAD\ LAYOUT: Layout1 PLOTTED: 27 Jun 2008, 8:12am, phubbard

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PROJECT NO.	85401-1
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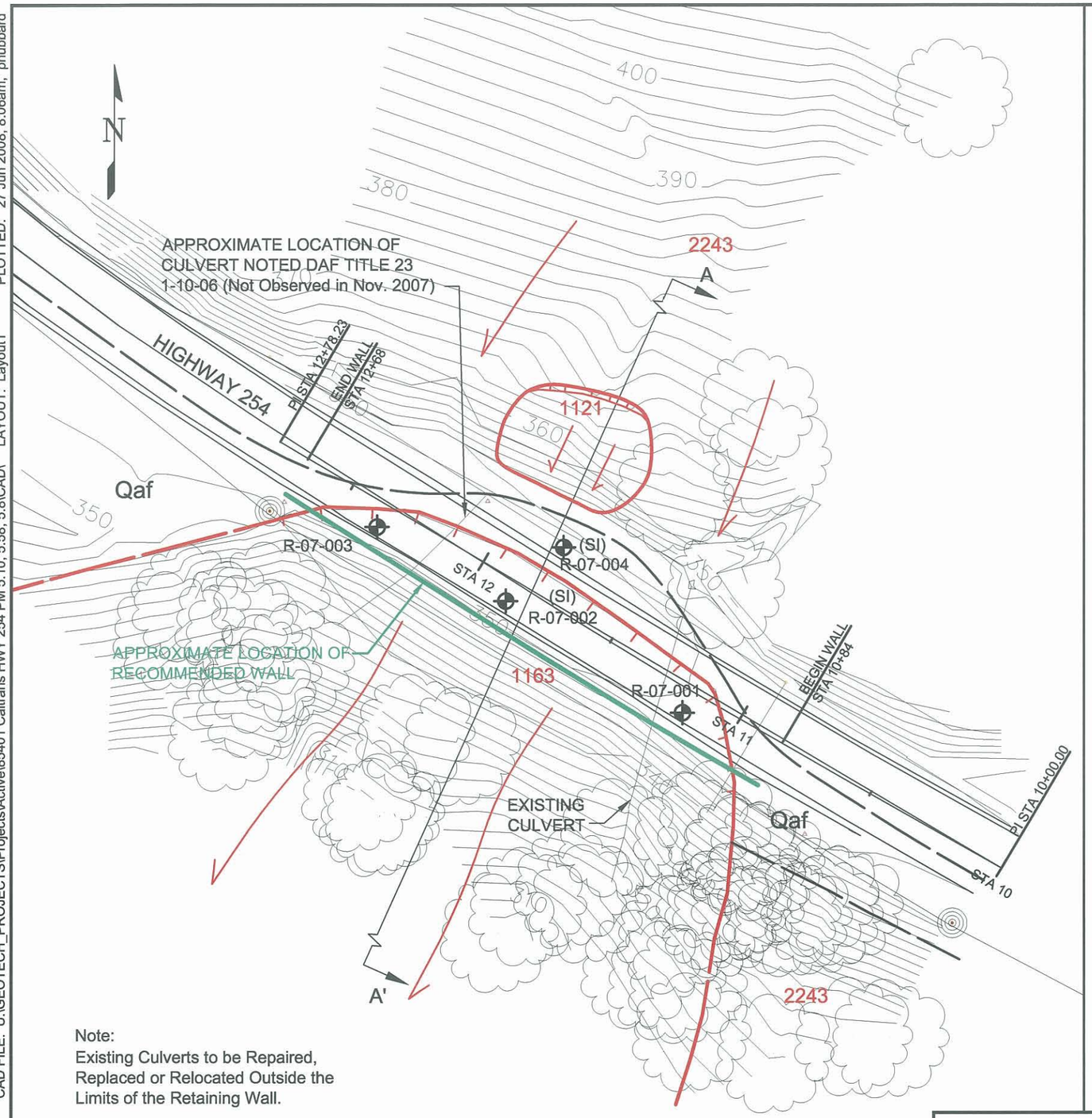
CHECKED BY:	JR
FILE NAME:	Hum254pm5-10-1.dwg

SITE LOCATION

STORM DAMAGE LOCATION
EA: 01-475101
HIGHWAY 254 P.M. 5.10
HUMBOLDT COUNTY, CALIFORNIA

PLATE

1



Note:
Existing Culverts to be Repaired, Replaced or Relocated Outside the Limits of the Retaining Wall.

40 20 0 40
APPROXIMATE SCALE (feet)

EXPLANATION

Qaf	Artificial Fill
1163	Landslide: Hatchures Indicate Scarp Area; Arrows Indicate Direction of Movement
1163	Landslide Identification Number (see landslide chart)
	Geologic Contact (dashed where approximate)
	Landslide Contact (dashed where approximate)
R-07-004	Boring Location
(SI)	Slope Inclinometer
A' A	Section Location

LANDSLIDE IDENTIFICATION CHART

STATE OF ACTIVITY

1=Active or Recently Active
(areas of unstable ground with relatively recent/"fresh" geomorphic features such as ground cracks, hummocky topography, exposed soils, abrupt gradient breaks and/or disrupted vegetation, typically recent to 50 years old)

2=Dormant
(areas of quasi-stable ground, with eroded and subdued geomorphic features, no exposed soils, somewhat re-vegetated but typically with different type or density, typically >50 to several hundreds of years old)

3=Ancient
(areas of relatively stable ground, typically characterized by large, broad and deep landslides with highly eroded and subdued geomorphic features, re-vegetated with similar type and density, typically several hundreds to several thousands of years old)

CERTAINTY OF IDENTIFICATION

1=Definite
2=Probable
3=Questionable

DOMINANT TYPE OF MOVEMENT

1=Slump Flow Complex
2=Debris Slide
3=Debris Flow
4=Earth Flow
5=Slump
6=Translational

THICKNESS OF DEPOSIT

1=Less Than 5 Feet
2=5 to 15 Feet
3=15 to 50 Feet
4=Greater Than 50 Feet

1 2 3 4

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SITE PLAN

STORM DAMAGE LOCATION
EA: 01-475101
HIGHWAY 254 P.M. 5.10
HUMBOLDT COUNTY, CALIFORNIA

PLATE
2

ATTACHED IMAGES: Images: DC_2502922.jpg
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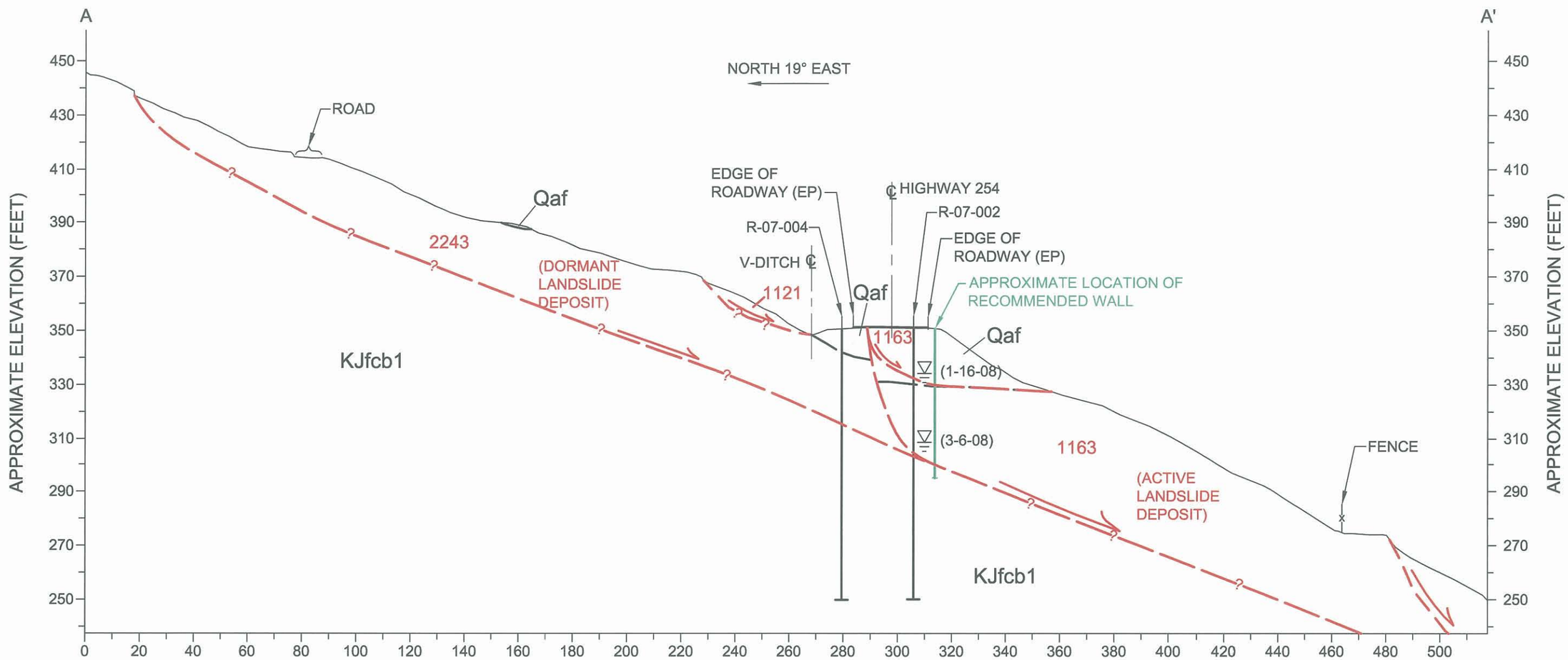

EXPLANATION

Qaf	Artificial Fill
KJfcb1	Franciscan Complex: Broken Formation
1163	Landslide Identification Number (see landslide chart plate 2)
(date) ▽	Caltrans Measured Water Level
	Geologic Contact (dashed where approximate)
	Landslide Contact (dashed where approximate, queried where additional uncertainty)

40 20 0 40
APPROXIMATE SCALE (feet)

NOTE:
SECTION A-A' WAS HAND LEVEL FIELD SURVEYED IN AUGUST 2007 AND MAY DIFFER FROM THE TOPOGRAPHY AND MAPPING AS SHOWN ON THE SITE PLAN, PLATE 2.

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SECTION A - A'

STORM DAMAGE LOCATION
EA: 01-475101
HIGHWAY 254 P.M. 5.10
HUMBOLDT COUNTY, CALIFORNIA

PLATE
3

ATTACHED IMAGES: Images: DC_2504866.jpg
ATTACHED XREFS:
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ATTACHED IMAGES: Images: Geology_Explan.jpg Images: Hum254pm5-80-Geology.jpg
ATTACHED XREFS:
SANTA ROSA, CA CAD FILE: U:\GEOTECH_PROJECTS\Projects\Active\85401 Caltrans HWY 254 PM 5.10, 5.58, 5.8\CAD\ LAYOUT: Layout1 PLOTTED: 27 Jun 2008, 8:10am, phubbard

EXPLANATION

MAP SYMBOLS

Contact-Dashed where approximate, dotted where concealed, queried where uncertain

Fault-Dashed where approximate, dotted where concealed, queried where uncertain

Thrust fault-Barbs on upper plate, dashed where approximate, dotted where concealed, queried where uncertain

Strike and dip of bedding:

Inclined-Ball denotes top of beds is known from sedimentary features

Vertical-Ball denotes top of beds is known from sedimentary features

Horizontal

Overturned-Ball denotes that top of beds is known from sedimentary features

Approximate-Based on photo interpretation or estimated dip in field

Joint-Strike and dip of joint

Strike and dip of cleavage-Ball denotes that top of flow is known from sedimentary or volcanic features

Shear foliation:

Inclined

Vertical

Folds:

Synclinal or synformal axis-showing direction of plunge

Anticlinal or antiformal axis-showing direction of plunge

Overturned syncline

Qls **Landslide**-Arrows indicate direction of movement

Melange Blocks:

Serpentinite

Chert

Blueschist

Greenstone

10 **Fossil locality and number**

Qal **Alluvial deposits (Holocene and late Pleistocene?)**-Clay, silt, sand, gravel, and boulders, deposited in stream beds, alluvial fans, terraces, flood plains and ponds; and soils formed on these deposits. Includes largely Holocene deposits in modern stream channels and on flood plains

Qt **Undifferentiated nonmarine terrace deposits (Holocene and Pleistocene)**-Dissected and (or) uplifted gravel, sand, silt, and clay, deposited in fluvial settings. In western Eureka quadrangle (Sheet 1) unit includes minor shallow marine intertongues and warped and tilted beds of late Pleistocene Hookton and Rohnerville Formations of Ogle (1953), in addition to younger late Pleistocene and Holocene fluvial terrace units a few feet to a few tens of feet higher than normal modern high-water level

y1 **Sheared and highly folded mudstone**-Includes minor rhythmically interbedded sandstone, locally with lenses of conglomerate. Exhibits irregular topography lacking a well-incised system of sidehill drainages

cm1 **Melange**-Predominantly penetratively sheared, locally tuffaceous, scaly meta-argillite and less abundant blocks of metasandstone. Exhibits rounded, poorly incised, lumpy and irregular topography

cb1 **Broken formation**-Consists of bedded to massive, locally folded, rarely conglomeratic metasandstone and meta-argillite, with only minor amounts of highly sheared rocks. Exhibits sharp-crested topography with regular, well-incised sidehill drainages

cwr **White Rock metasandstone of Jayko and others (1989) (Paleogene and (or) Late Cretaceous)**-Arkosic metasandstone and minor meta-argillite, thick bedded to massive, shattered and sheared; commonly extensively veined with laumontite and calcite; metasandstone has 1 to 25 percent detrital K-feldspar and prominent detrital biotite. Unit occurs as slabs and blocks up to several kilometers long, mostly along west side of the Central belt. Unit is named for similar metasandstone described in the Covelo 1:100,000 quadrangle (Jayko and others, 1989) that contains dinoflagellates of late Cretaceous age. Some blocks of the White Rock metasandstone possibly have been tectonically incorporated into the Central belt from the structurally underlying Coastal belt, and thus could be Paleocene or Eocene in age. A carbonate concretion from melange adjacent to the White Rock metasandstone along the western side of the Central belt in the Covelo quadrangle was found to contain Paleocene dinoflagellates (A. Jayko, oral commun., 1993)

dpb **Basaltic flows and keratophyric tuff (Jurassic?)**-Uralitic and intruded locally by mylonitic quartz keratophyre dike rocks, present locally along west boundary of Central belt of Franciscan Complex near Benbow (Sheet 3) **Diabase (Jurassic?)**-Dikes and sills, fine to coarse grained, with ophitic texture, present below basalt flows near Benbow and forms Bear Buttes north of Garberville (Sheet 3). Lower part of diabase unit of Bear Buttes locally includes minor cumulate gabbro. Lower diabase contact considered to be an attenuation fault

dpsp **Serpentinite melange (Jurassic?)**-Partially to completely serpentinized ultramafic rocks (harzburgite, dunite), locally highly sheared, and includes minor masses of cumulate gabbro, diabase or basalt. Present beneath diabase and (or) basalt of the Benbow and Bear Buttes areas (Sheet 3). Contact with overlying ophiolitic rocks probably is an attenuation fault. Unit is partially equivalent to some serpentinite interspersed with and assigned to Central belt of Franciscan Complex

5000 2500 0 5000
APPROXIMATE SCALE (feet)

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Reference: R. J. Mclaughlin et al., 2000

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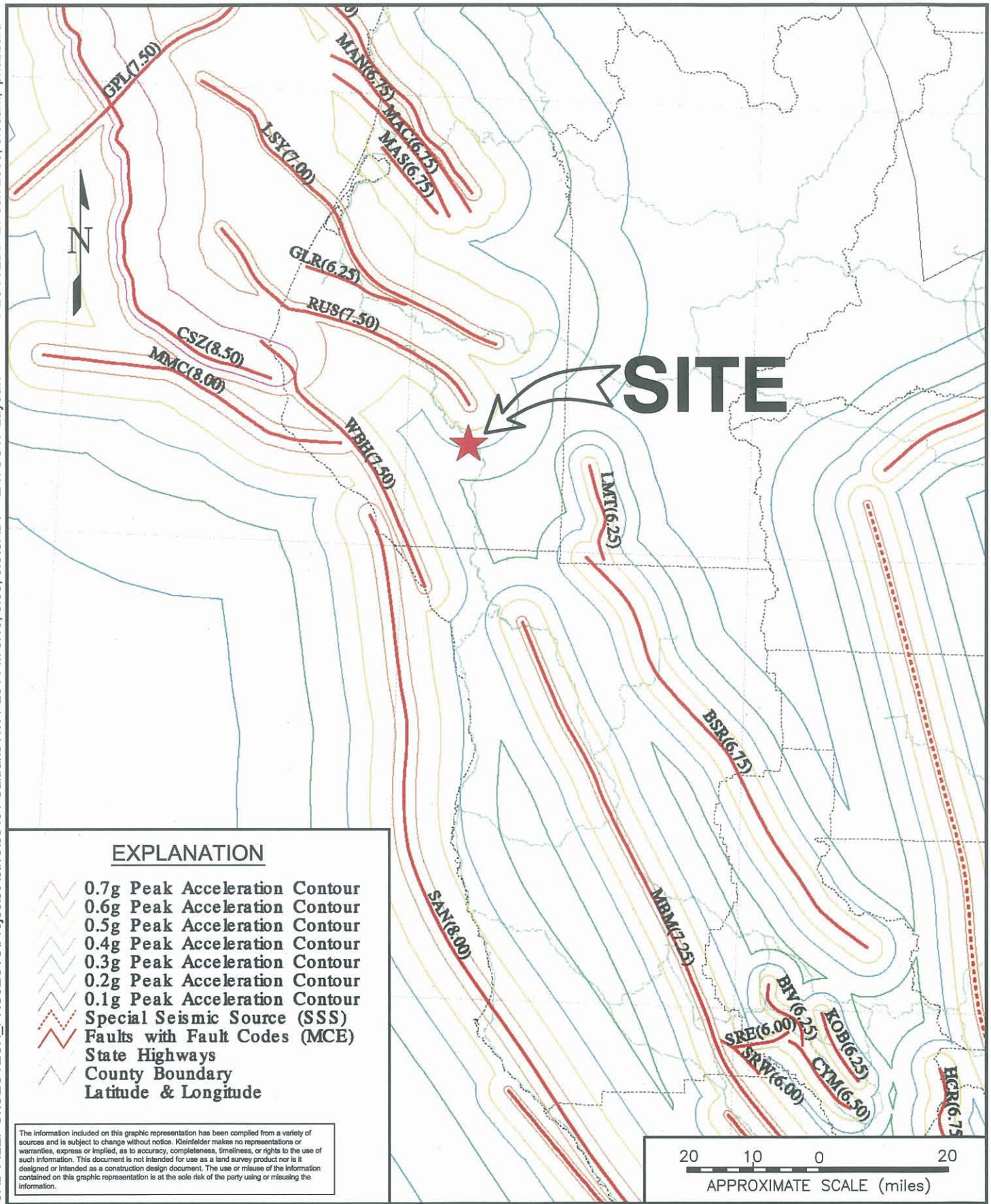
FILE NAME:	Hum254pm5-10-2.dwg

REGIONAL GEOLOGY

STORM DAMAGE LOCATION
EA: 01-475101
HIGHWAY 254 P.M. 5.10
HUMBOLDT COUNTY, CALIFORNIA

PLATE
4



EXPLANATION

- 0.7g Peak Acceleration Contour
- 0.6g Peak Acceleration Contour
- 0.5g Peak Acceleration Contour
- 0.4g Peak Acceleration Contour
- 0.3g Peak Acceleration Contour
- 0.2g Peak Acceleration Contour
- 0.1g Peak Acceleration Contour
- Special Seismic Source (SSS)
- Faults with Fault Codes (MCE)
- State Highways
- County Boundary
- Latitude & Longitude

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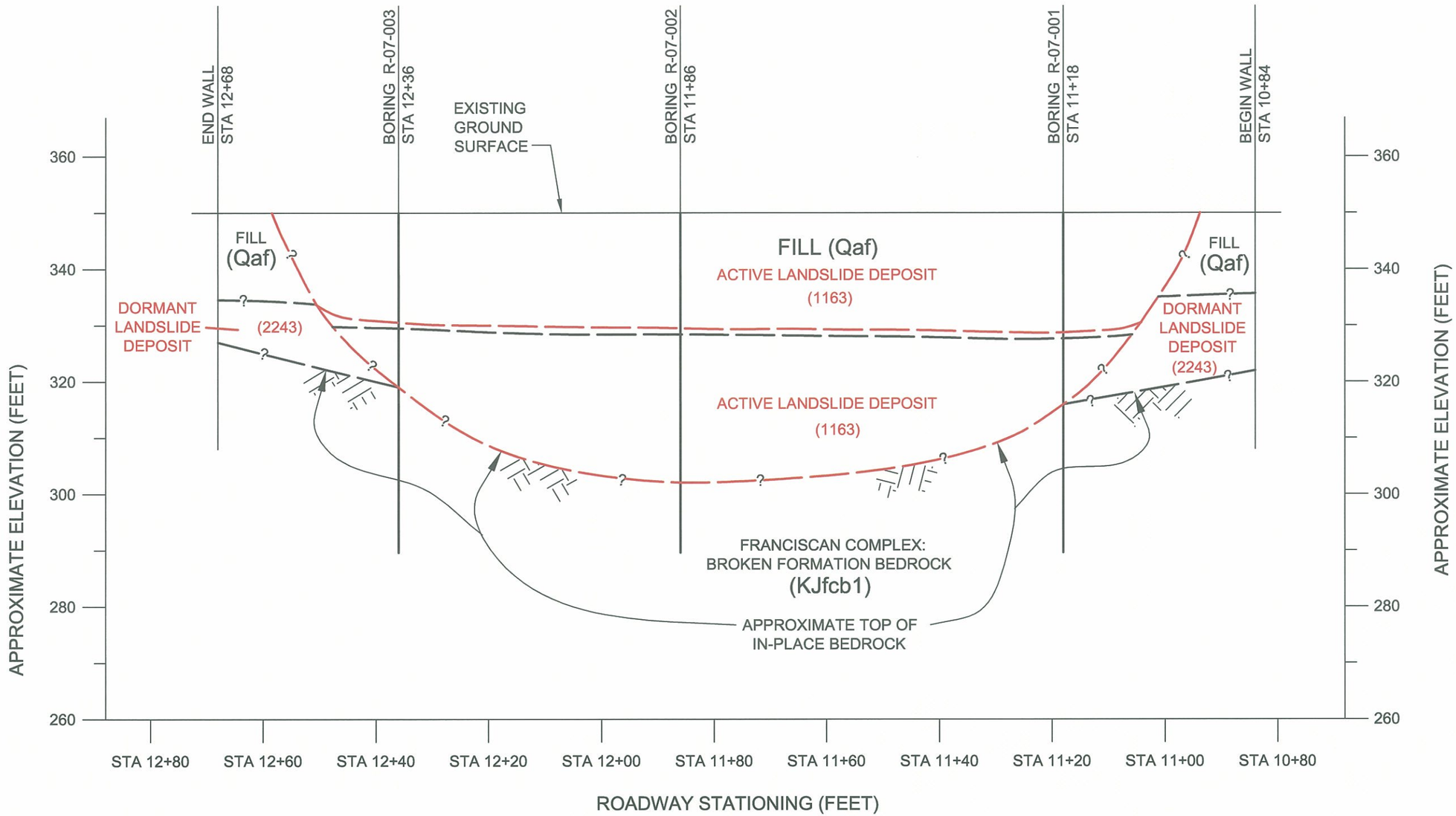
FILE NAME:	Hum254pm5-10-3.dwg

CALIFORNIA SEISMIC HAZARD MAP (MUALCHIN 1996)

STORM DAMAGE LOCATION
EA: 01-475101
HIGHWAY 254 P.M. 5.10
HUMBOLDT COUNTY, CALIFORNIA

PLATE **5**

PLOTTED: 27 Jun 2008, 8:08am, phubbard
LAYOUT: Layout1
CAD FILE: U:\GEOTECH_PROJECTS\Projects\Active\85401 Caltrans HWY 254 PM 5.10, 5.58, 5.8\CAD\
Images: EarthquakeHzrdMap96.jpg
ATTACHED IMAGES:
ATTACHED XREFS:
PLEASANTON, CA



NOTE:
The depth of bedrock indicated on this plate was generalized by interpolation and extrapolation between widely spaced borings. Information on bedrock depth exists only at the specific boring locations, which are offset from the proposed wall location. Bedrock depths shown should be considered approximate and variations should be expected.

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20 10 0 20
APPROXIMATE SCALE (feet)

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DRAWN BY:	PH
CHECKED BY:	JR
FILE NAME:	Hum254pm5-10-6.dwg

APPROXIMATE BEDROCK PROFILE ALONG WALL

STORM DAMAGE LOCATION
EA: 01-475101
HIGHWAY 254 P.M. 5.10
HUMBOLDT COUNTY, CALIFORNIA

PLATE
6

PLOTTED: 27 Jun 2008, 8:19am, phubbard
LAYOUT: Layout1
CAD FILE: U:\GEOTECH_PROJECTS\Projects\Active\85401 Caltrans HWY 254 PM 5.10, 5.58, 5.8\CAD\
ATTACHED IMAGES: Images: DC_2504876.jpg
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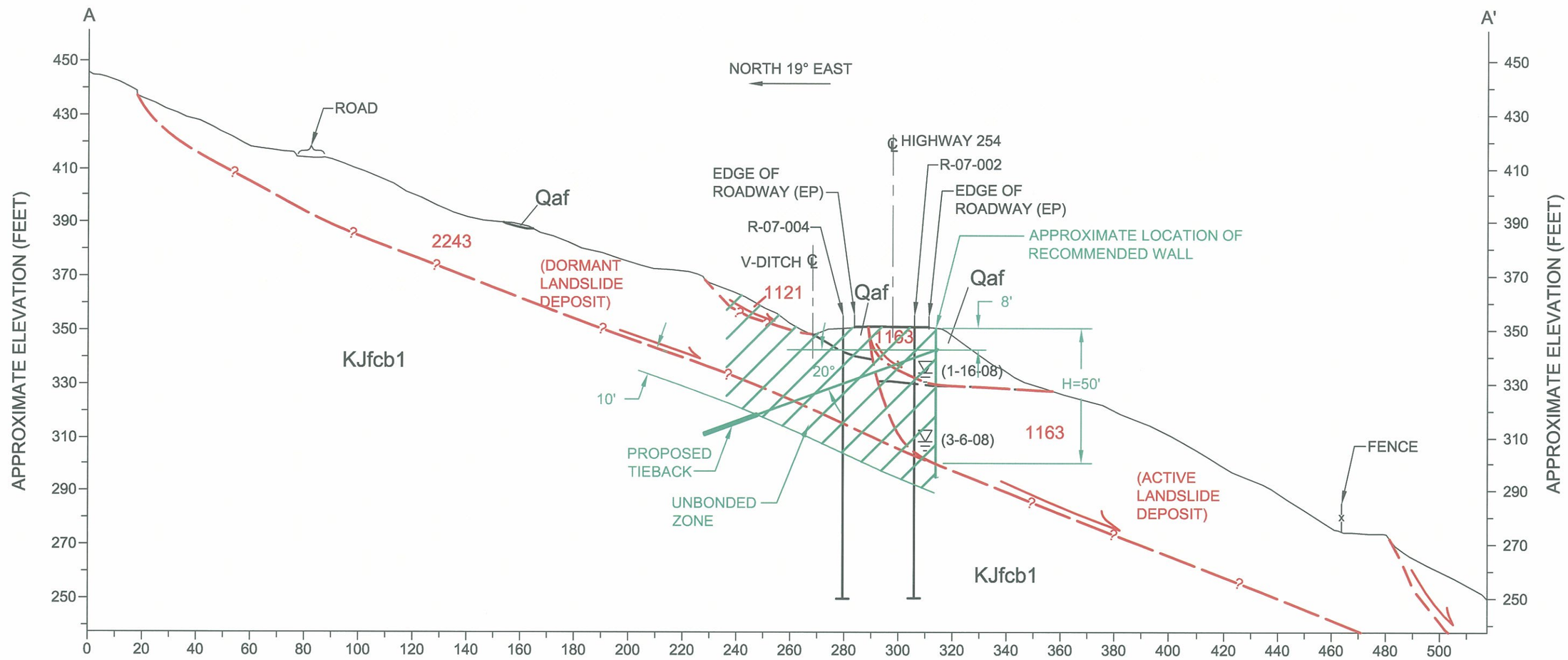
SANTA ROSA, CA



EXPLANATION

Qaf	Artificial Fill
KJfcb1	Franciscan Complex: Broken Formation
1163	Landslide Identification Number (see landslide chart plate 2)
(date) ▽	Caltrans Measured Water Level
	Geologic Contact (dashed where approximate)
	Landslide Contact (dashed where approximate, queried where additional uncertainty)

40 20 0 40
APPROXIMATE SCALE (feet)

NOTE:
SECTION A-A' WAS HAND LEVEL FIELD SURVEYED IN AUGUST 2007 AND MAY DIFFER FROM THE TOPOGRAPHY AND MAPPING AS SHOWN ON THE SITE PLAN, PLATE 2.

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TIEBACK UNBONDED ZONE

STORM DAMAGE LOCATION
EA: 01-475101
HIGHWAY 254 P.M. 5.10
HUMBOLDT COUNTY, CALIFORNIA

PLATE 7

ATTACHED IMAGES: Images: DC_2504866.jpg
ATTACHED XREFS:
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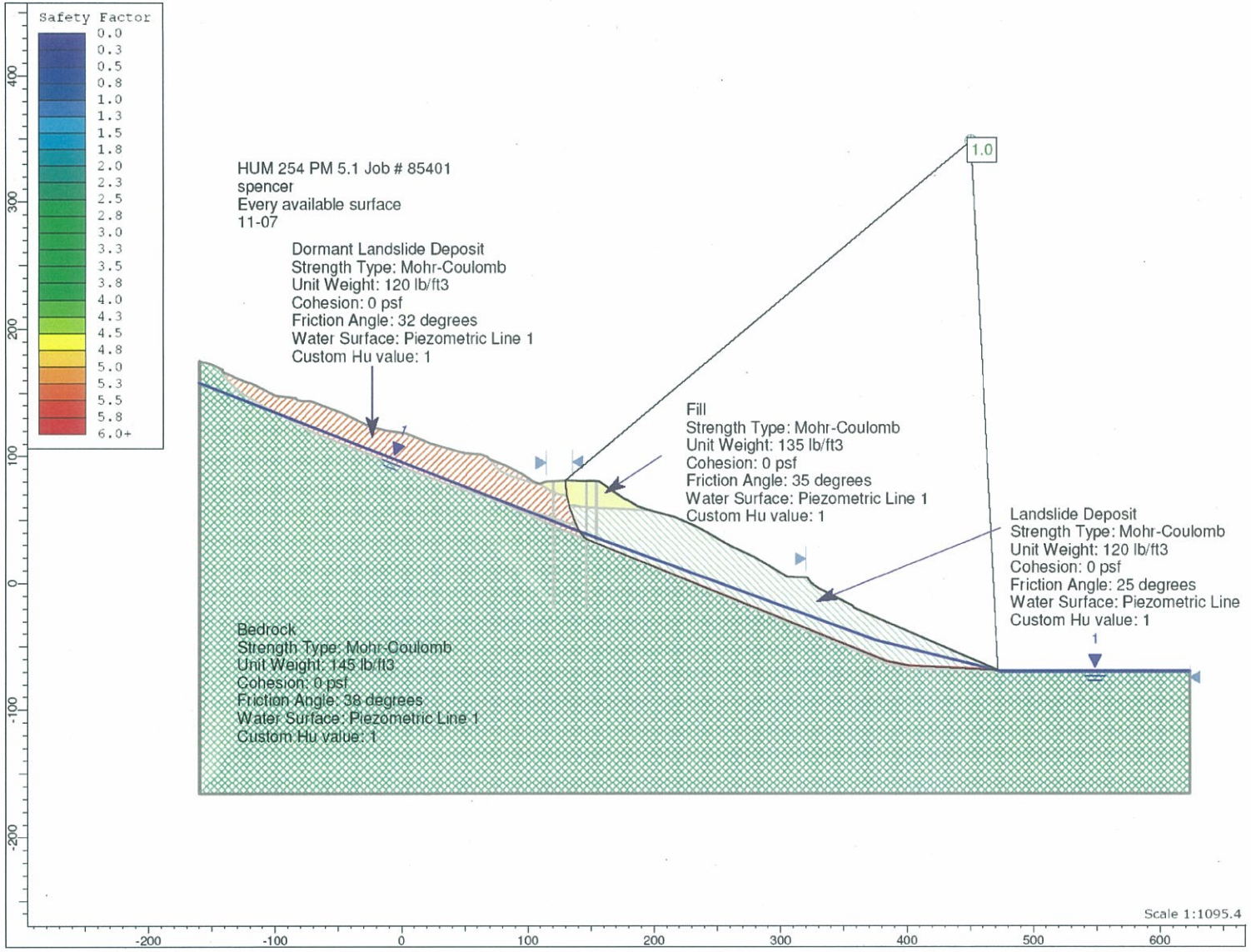

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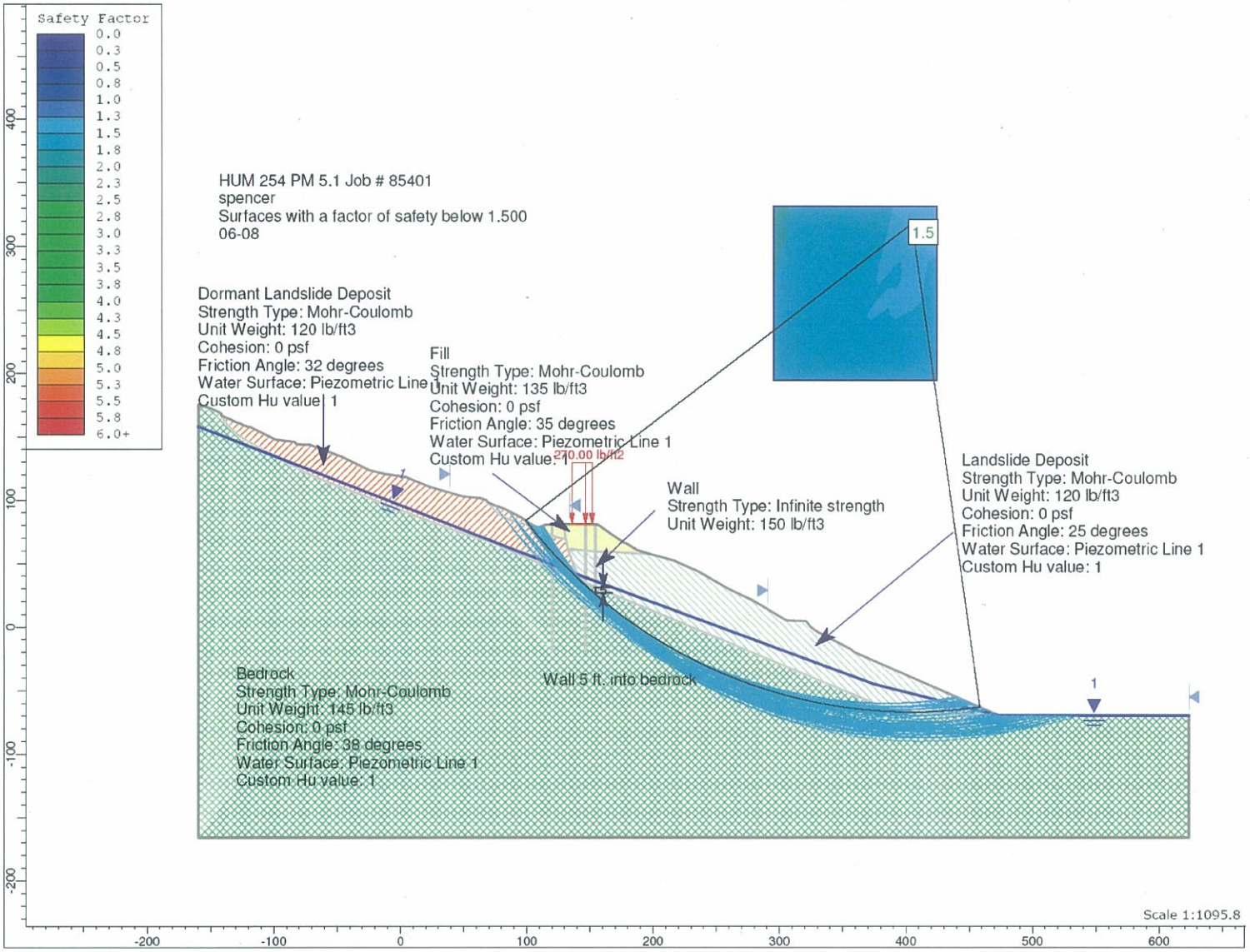
DATE:	JUNE 08
BY:	CMG
CHECKED BY:	TC

SLOPE STABILITY: CROSS SECTION A-A

EXISTING CONDITIONS, STATIC ANALYSIS
EA # 475101
01-HUM-254-5.1
HIGHWAY 254 P.M. 5.1
HUMBOLDT COUNTY, CALIFORNIA

PLATE
8



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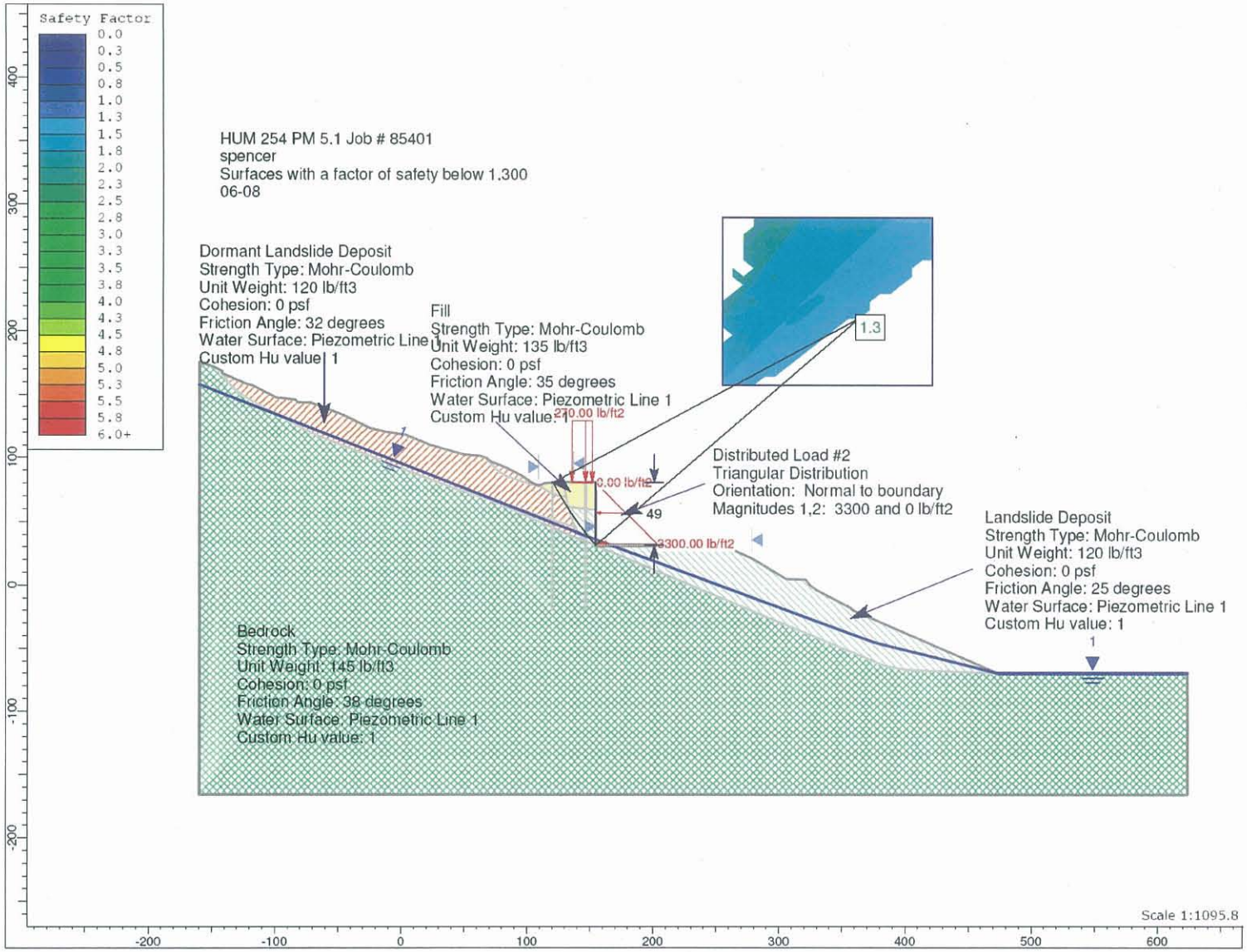
DATE:	JUNE 08
BY:	CMG
CHECKED BY:	TC

SLOPE STABILITY: CROSS SECTION A-A WITH WALL

IMPROVED CONDITIONS, STATIC ANALYSIS
EA # 475101
01-HUM-254-5.1
HIGHWAY 254 P.M. 5.1
HUMBOLDT COUNTY, CALIFORNIA

PLATE
9



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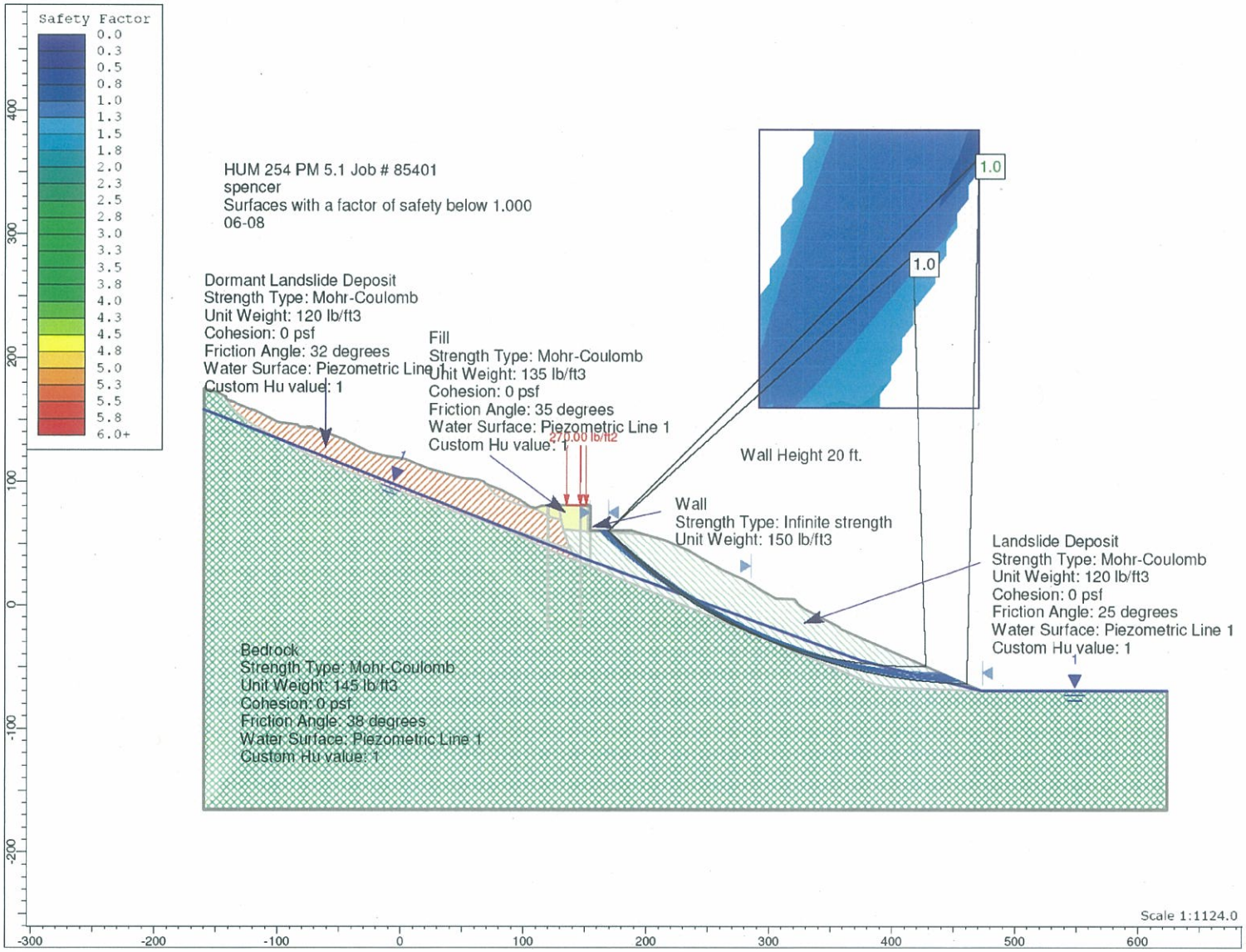
DATE:	JUNE 08
BY:	CMG
CHECKED BY:	TC

SLOPE STABILITY: CROSS SECTION A-A LATERAL PRESSURE

IMPROVED CONDITIONS, STATIC ANALYSIS
EA # 475101
01-HUM-254-5.1
HIGHWAY 254 P.M. 5.1
HUMBOLDT COUNTY, CALIFORNIA

PLATE
10



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DATE:	JUNE 08
BY:	CMG
CHECKED BY:	TC

SLOPE STABILITY: CROSS SECTION A-A DOWNSLOPE

IMPROVED CONDITIONS, STATIC ANALYSIS
EA # 475101
01-HUM-254-5.1
HIGHWAY 254 P.M. 5.1
HUMBOLDT COUNTY, CALIFORNIA

PLATE
11

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APPENDIX A

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
01	Hum	254	5.10		

GEOTECHNICAL PROFESSIONAL 6/27/08 DATE

PLANS APPROVAL DATE

REGISTERED GEOLOGIST WILLIAM V. McCORMICK III No. 1673 Exp. 11-30-08 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

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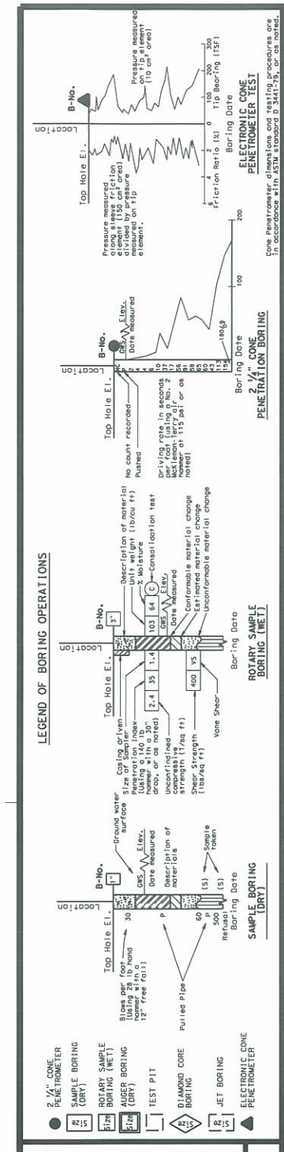
LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

GRAVEL, SAND, SILT, CLAY, CLAYEY SILT, PEAT and/or ORGANIC MATTER, FILL MATERIAL, IGNEOUS ROCK, SEDIMENTARY ROCK, METAMORPHIC, SANDY CLAY or CLAYEY SAND, SANDY SILT or SILTY SAND, SILTY CLAY

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

SPT N-Value (Blows/foot)	Granular	SPT N-Value (Blows/foot)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very Stiff
		>31	Hard

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

WEATHERING DESCRIPTORS

Modified from United States Bureau of Reclamation, Engineering Geology Field Manual.

Descriptors		Diagnostic features					General characteristics (strength, excavation, etc.)§
		Chemical weathering-Discoloration and/or oxidation		Mechanical weathering-Grain boundary conditions (disaggregation) primarily for granitics and some coarse-grained sediments	Texture and solutioning		
Alphanumeric descriptor	Descriptive term	Body of rock	Fracture surfaces †		Texture	Solutioning	
W1	Fresh	No discoloration, not oxidized.	No discoloration or oxidation.	No separation, intact (tight).	No change.	No solutioning.	Hammer rings when crystalline rocks are struck. Almost always rock excavation except for naturally weak or weakly cemented rocks such as siltstones or shales.
W2	Slightly weathered to fresh°						
W3	Slightly weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull.	Minor to complete discoloration or oxidation of most surfaces.	No visible separation, intact (tight).	Preserved.	Minor leaching of some soluble minerals may be noted.	Hammer rings when crystalline rocks are struck. Body of rock not weakened. With few exceptions, such as siltstones or shales, classified as rock excavation.
W4	Moderately to slightly weathered°						
W5	Moderately weathered	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are "rusty," feldspar crystals are "cloudy."	All fracture surfaces are discolored or oxidized.	Partial separation of boundaries visible.	Generally preserved.	Soluble minerals may be mostly leached.	Hammer does not ring when rock is struck. Body of rock is slightly weakened. Depending on fracturing, usually is rock excavation except in naturally weak rocks such as siltstones or shales.
W6	Intensely to moderately weathered°						
W7	Intensely weathered	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in-situ disaggregation, see grain boundary conditions.	All fracture surfaces are discolored or oxidized, surfaces friable.	Partial separation, rock is friable; in semiarid conditions granitics are disaggregated.	Texture altered by chemical disintegration (hydration, argillation).	Leaching of soluble minerals may be complete.	Dull sound when struck with hammer, usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures, or veinlets. Rock is significantly weakened. Usually common excavation.
W8	Very intensely weathered						
W9	Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay.		Complete separation of grain boundaries (disaggregated).	Resembles a soil, partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete.		Can be granulated by hand. Always common excavation. Resistant minerals such as quartz may be present as "stringers" or "dikes."

Note: This chart and its horizontal categories are more readily applied to rocks with feldspars and mafic minerals. Weathering in various sedimentary rocks, particularly limestones and poorly indurated sediments, will not always fit the categories established. This chart and weathering categories may have to be modified for particular site conditions or alteration such as hydrothermal effects; however, the basic framework and similar descriptors are to be used.

° Combination descriptors are permissible where equal distribution of both weathering characteristics are present over significant intervals or where characteristics present are "in between" the diagnostic feature. However, dual descriptors should not be used where significant, identifiable zones can be delineated. When given as a range, only two adjacent terms may be combined. "Decomposed to slightly weathered," or "moderately weathered to fresh" are not acceptable.

† Does not include directional weathering along shears or faults and their associated features. For example, a shear zone that carried weathering to great depths into a fresh rock mass would not require the rock mass to be classified as weathered.

§ These are generalizations and should not be used as diagnostic features for weathering or excavation classification. These characteristics vary to a large extent based on naturally weak materials or cementation and type of excavation.

BEDDING, FOLIATION, OR FLOW TEXTURE DESCRIPTORS

Descriptors	Thickness / Spacing
Massive	Greater than 10 ft
Very thickly (bedded, foliated, or banded)	3 to 10 ft
Thickly	1 to 3 ft
Moderately	0.3 to 1 ft
Thinly	0.1 to 0.3 ft
Very thinly	0.03 (3/8 in) to 0.1 ft
Laminated (intensely foliated or banded)	Less than 0.03 ft (3/8 in)

Modified from United States Bureau of Reclamation, Engineering Geology Field Manual.

FRACTURE DENSITY

Modified from United States Bureau of Reclamation, Engineering Geology Field Manual.

FRACTURE DENSITY- Based on the spacing of all natural fractures in an exposure or core recovery lengths in boreholes; excludes mechanical breaks, shears, and shear zones; however, shear-disturbed zones (fracturing outside the shear) are included. Descriptors for fracture density apply to all rock exposures such as tunnel walls, dozer trenches, outcrops, or foundation cut slopes and inverts, as well as boreholes. Descriptive criteria presented below are based on borehole cores where lengths are measured along the core axis, for other exposures the criteria is distance measured between fractures (size of blocks).

UNFRACTURED (FDØ): No fractures.

VERY SLIGHTLY FRACTURED (FD1): Core recovered mostly in lengths greater than 3 ft.

SLIGHTLY TO VERY SLIGHTLY FRACTURED (FD2)*

SLIGHTLY FRACTURED (FD3): Core recovered mostly in lengths from 1 to 3 ft. with few scattered lengths less than 1 ft or greater than 3 ft.

MODERATELY TO SLIGHTLY FRACTURED (FD4)*

MODERATELY FRACTURED (FD5): Core recovered mostly in 0.3 to 1.0 ft lengths with most lengths about 0.6 ft.

INTENSELY TO MODERATELY FRACTURED (FD6)*

INTENSELY FRACTURED (FD7): Lengths average from 0.1 to 0.3 ft with scattered fragmented intervals. Core recovered mostly in lengths less than 0.3 ft.

VERY INTENSELY TO INTENSELY FRACTURED (FD8)*

VERY INTENSELY FRACTURED (FD9): Core recovered mostly as chips and fragments with a few scattered short core lengths.

* Combinations of fracture densities (e.g. very intensely to intensely fractured, or moderately to slightly fractured) are used where equal distribution of both fracture density characteristics are present over a significant interval or exposure, or where characteristics are "in between" the descriptor definitions.

ROCK HARDNESS DESCRIPTORS

Alphanumeric Descriptor	Descriptor	Criteria
H1	Extremely hard	Core, fragment, or exposure cannot be scratched with knife or sharp pick; can only be chipped with repeated heavy hammer blows.
H2	Very hard	Cannot be scratched with knife on sharp pick. Core or fragment breaks with repeated heavy hammer blows.
H3	Hard	Can be scratched with knife or sharp pick with difficulty (heavy pressure). Heavy hammer blow required to break specimen.
H4	Moderately hard	Can be scratched with knife or sharp pick with light or moderate pressure. Core or fragment breaks with moderate hammer blow.
H5	Moderately soft	Can be grooved 1/16 inch deep by knife or sharp pick with moderate or heavy pressure. Core or fragment breaks with light hammer blow or heavy manual pressure.
H6	Soft	Can be grooved or gouged easily by knife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
H7	Very soft	Can be readily indented, grooved or gouged with fingernail, or carved with a knife. Breaks with light manual pressure.

Any bedrock unit softer than H7, very soft, is to be described using ASTM D-2488 consistency descriptors.

Note: Although "sharp pick" is included in these definitions, descriptions of ability to be scratched, grooved or gouged by a knife is the preferred criteria.

Modified from United States Bureau of Reclamation, Engineering Geology Field Manual.

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY A. Sanchez

CHECKED BY J. Richmond, C.E.G

KLEINFELDER
FIELD INVESTIGATION BY:
DATE: August 2007

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

X
PROJECT ENGINEER

BRIDGE NO. X
POST MILE 5.10

STORM DAMAGE LOCATION

LOG OF TEST BORINGS 1 OF 6

OSF GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 01
EA 475101

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 11-1-07 6-20-08

SHEET X OF X

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
01	Hum	254	5.10		

GEOTECHNICAL PROFESSIONAL DATE 6/27/08

REGISTERED GEOLOGIST WILLIAM V. McCORMICK III No. 1673 Exp. 11-30-08 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

PLANS APPROVAL DATE

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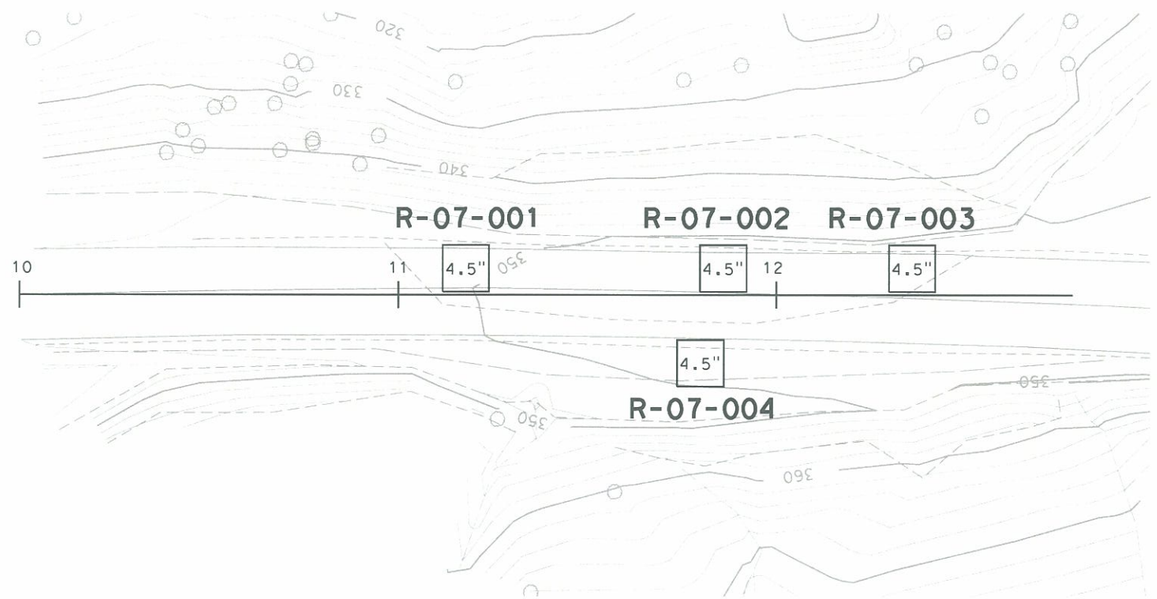
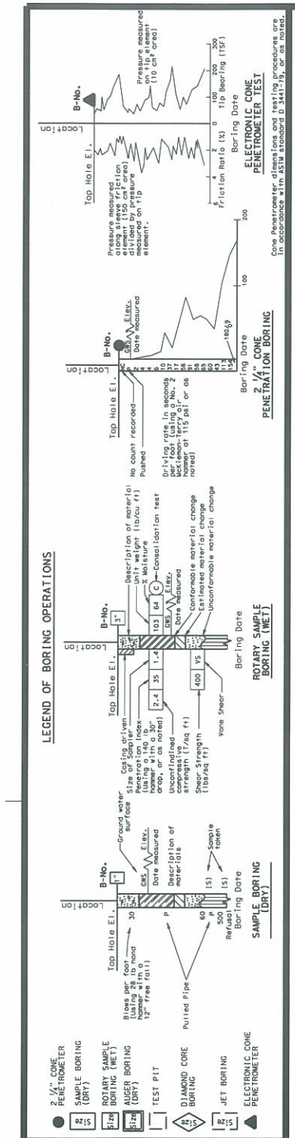
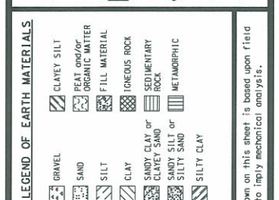
KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407



PLAN
1"=20'





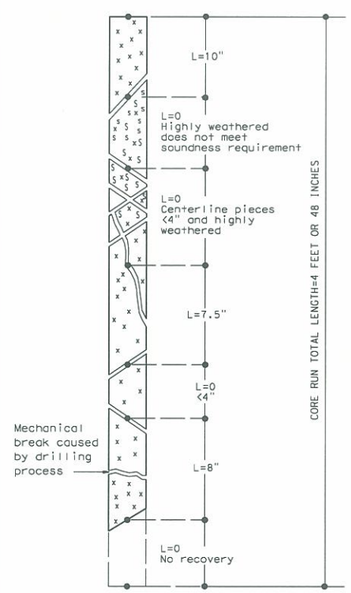
CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

SPT N-Value (Blows/foot)	Granular	SPT N-Value (Blows/foot)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very Stiff
		>31	Hard

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

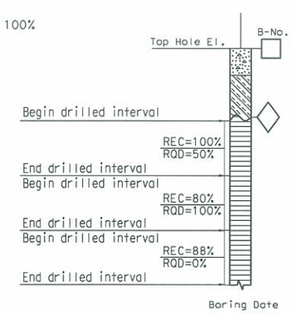
ROCK QUALITY DESIGNATION (RQD) & PERCENT RECOVERY (REC) LOGGING



$$RQD = \frac{\sum \text{Length of sound core} \geq 4 \text{ inches pieces}}{\text{Total core run length}}$$

$$RQD = \frac{10 + 7.5 + 8}{48} \times 100\%$$

RQD = 53% (fair)



RQD (ROCK QUALITY DESIGNATION)	DESCRIPTION OF ROCK QUALITY
0 - 25%	VERY POOR
25 - 50%	POOR
50 - 75%	FAIR
75 - 90%	GOOD
90 - 100%	EXCELLENT

After Deere & Deere, 1989

Notes:

1. Samples were taken using a California and modified California split-barrel sampler with an inside diameter (I.D.) of 2.5 in. and 2 in. and an outside diameter (O.D.) of 3 in. and 2.5 in. respectively.
2. A safety semi-automatic hammer (140 lb) with a 30 inch drop was used to advance the sampler.
3. Blowcounts noted for boring are field blowcounts and have not been corrected.
4. Samples were taken using a SPT split-barrel sampler with an inside diameter (I.D.) of 1.4 in. and an outside diameter (O.D.) of 2 in.
5. Core samples were taken using an HQ core sampler with a 2.5 in. inside diameter (I.D.) and 3.7 in. outside diameter (O.D.) core barrel.
6. Blowcounts 50/4 means 50 blows per 4 in. penetration.
7. Horizontal Borings were started approximately 5.5 to 6.0 ft. above existing pavement grade and inclined downward at approximately a 10 degree angle.

IN-SITU, LAB & FIELD TEST DESIGNATIONS

AL	ATTERBERG LIMITS
CA	CHEMICAL ANALYSIS
CN	CONSOLIDATION
CU	CONSOLIDATED UNDRAINED TRIAXIAL
DS	DIRECT SHEAR
MD	MAX. DRY DENSITY
PL	POINT LOAD
PP	POCKET PENETROMETER
SA	SIEVE ANALYSIS
TV	TORVANE
UC	UNCONFINED COMPRESSION
UU	UNCONSOLIDATED UNDRAINED TRIAXIAL
VS	VANE SHEAR
WC	MOISTURE CONTENT

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY A. Sanchez

CHECKED BY J. Richmond, C.E.G

KLEINFELDER
FIELD INVESTIGATION BY:
DATE: August 2007

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

X
PROJECT ENGINEER

BRIDGE NO. X
POST MILE 5.10

STORM DAMAGE LOCATION
LOG OF TEST BORINGS 2 OF 6

OSF GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 01
EA 475101

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 11-1-07 6-20-08

SHEET X OF X

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

CONSISTENCY CLASSIFICATION FOR SOILS

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		>31	Hard

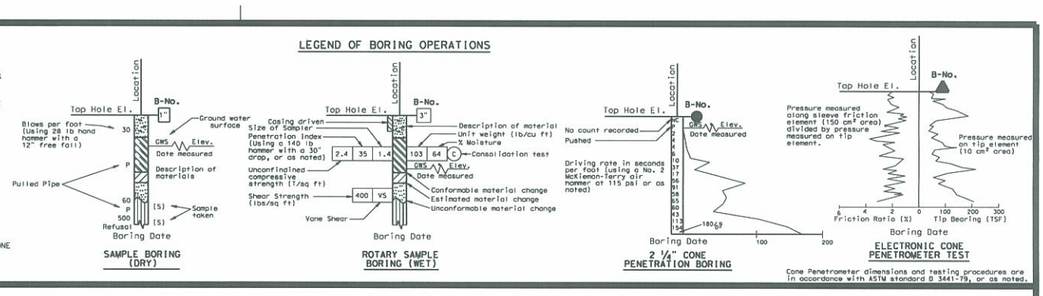
NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

LEGEND OF EARTH MATERIALS

GRAVEL, SAND, SILT, CLAY, SANDY CLAY or CLAYEY SAND, SANDY SILT or SILTY SAND, SILTY CLAY, CLAYEY SILT, PEAT and/or ORGANIC MATTER, FILL MATERIAL, IGNEOUS ROCK, SEDIMENTARY ROCK, METAMORPHIC

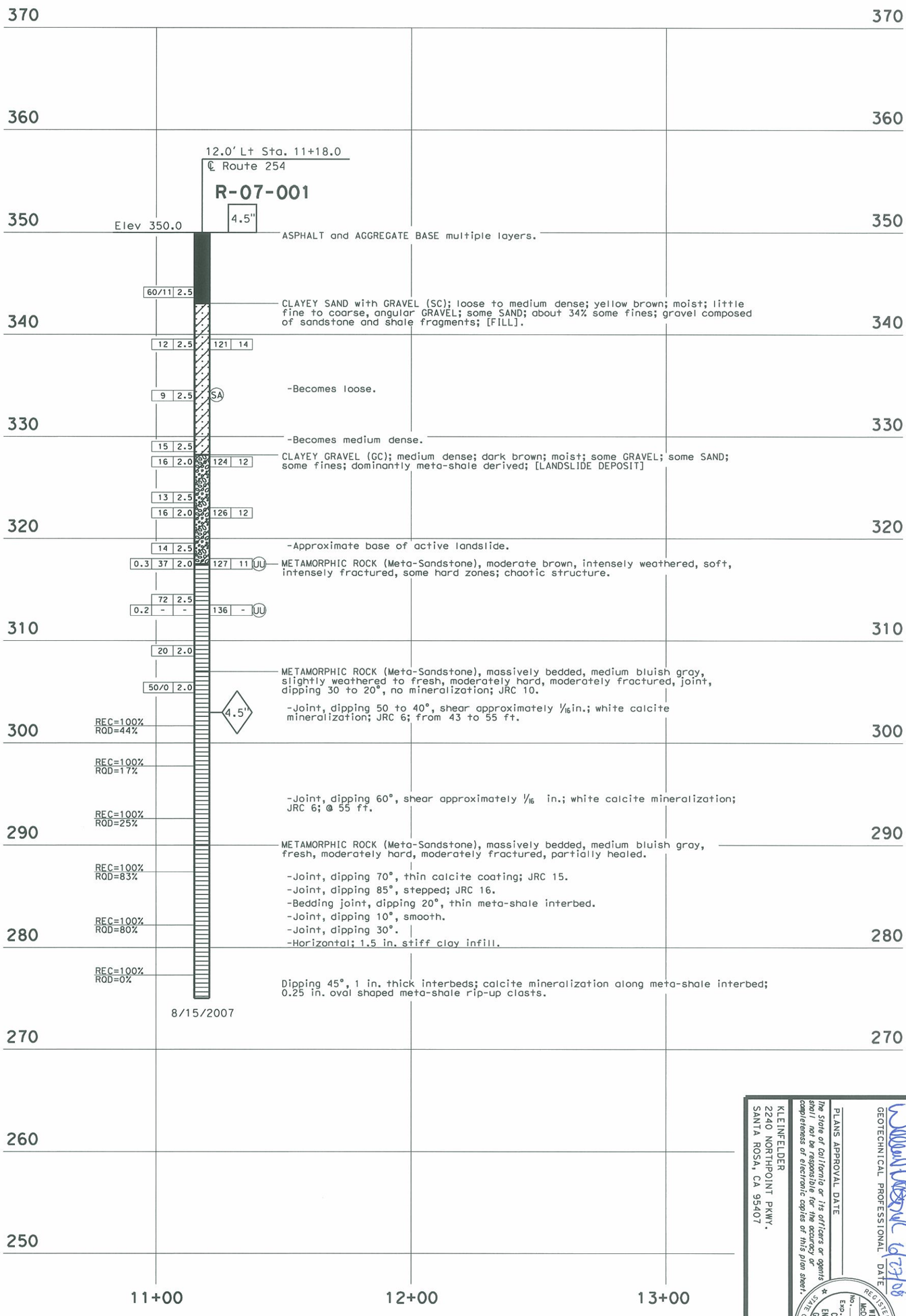
LEGEND OF BORING OPERATIONS

2 1/4" CONE PENETROMETER; SAMPLE BORING (DRY); ROTARY SAMPLE BORING (WET); AUGER BORING (DRY); TEST PIT; DIAMOND CORE BORING; JET BORING; ELECTRONIC CONE PENETROMETER



Cone Penetrometer dimensions and testing procedures are in accordance with ASTM standard D 3441-79, or as noted.

FOR PLAN VIEW AND ADDITIONAL NOTES, SEE "LOG OF TEST BORINGS" SHEET 2 OF 8



PROFILE

HOR. 1"=20'
VER. 1"=5'

KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407

PLANS APPROVAL DATE

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REGISTERED GEOLOGIST — WILLIAM V. MCCORMICK III — No. 1623 — Exp. 11-30-08 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

GEOTECHNICAL PROFESSIONAL DATE 6/27/08

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET TOTAL SHEETS
01	Hum	254	5.10	

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY A. Sanchez

CHECKED BY J. Richmond, C.E.G

KLEINFELDER FIELD INVESTIGATION BY:

DATE: August 2007

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

X PROJECT ENGINEER

CU 01
EA 475101

BRIDGE NO. X

POST MILE 5.10

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET X OF X

STORM DAMAGE LOCATION

LOG OF TEST BORINGS 3 OF 6

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

GSF GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 2/25/05)

FILE => $REQUEST

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
01	Hum	254	5.10		

GEOTECHNICAL PROFESSIONAL 6/27/08 DATE

REGISTERED GEOLOGIST WILLIAM V. McCORMICK III No. 1673 Exp. 11-30-08 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

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KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407

FOR PLAN VIEW AND ADDITIONAL NOTES, SEE "LOG OF TEST BORINGS" SHEET 2 OF 8

R-07-004

18.0' Rt Sta. 11+80.0
℄ Route 254
Elev 350.0
4.5"

ELEVATION

- SILTY GRAVEL with SAND (GM); loose; gray to gray brown; dry; about 50% mostly subangular GRAVEL, max. 1.5 in. dia.; about 35% some SAND; [AGGREGATE BASE].
- SANDY SILTY CLAY with GRAVEL (CL); stiff; brown; moist; subrounded GRAVEL, max. 0.5 in. dia.; about 35% fine to coarse SAND; [FILL].
- -Increased gravel content, very stiff.
- CLAYEY GRAVEL with SAND (GC); loose to medium dense; gray and yellow brown; moist to wet; about 50% mostly subangular GRAVEL, max. 1.5 in. dia.; about 30% fine to coarse SAND; sandstone gravel; [DORMANT LANDSLIDE DEPOSIT].
- -Meta-shale fragments in debris.
- -Possible slide plane @ 18 ft.
- -Dipping 20°, faint clay lined shear.
- -Meta-sandstone and meta-shale derived debris.
- -becomes dark gray and moderate olive brown.
- -approximately 2 in. thick shear, (possible slip plane) @ 29 ft.
- METAMORPHIC ROCK (Meta-Sandstone), fine-grained to medium-grained, dark gray and moderate brown, moderately weathered, medium strong, very intensely fractured, shear, dipping 5°, clay lined; [DORMANT LANDSLIDE DEPOSIT].
- METAMORPHIC ROCK (Meta-Shale), fine-grained, dark gray to black, moderately weathered, soft, very intensely fractured, fracture zone, brecciated, pervasively sheared, abundant clay infill, moderate structure remains; [DORMANT LANDSLIDE DEPOSIT].
- METAMORPHIC ROCK (Meta-Sandstone), fine-grained to medium-grained, dark gray, moderately to slightly weathered, moderately hard, intensely fractured, bedding joint, dipping 15°, minimal infill.
- -Joint, dipping 5°, planar, slightly open, minimal infill, polished, JRC 2-4.
- -Joint, dipping 50°, planar, slightly open, FeO and calcite mineralization, JRC 8-10 @ 34.6 ft.
- -Joint, dipping 60°, planar, slightly open, FeO and calcite mineralization, JRC 8-10 @ 35 ft.
- METAMORPHIC ROCK (Meta-Sandstone), fine-grained to medium-grained, dark gray, slightly weathered, moderately hard to hard, intensely to moderately fractured, FeO infill.
- -Joint, dipping 72°, planar to slightly undulating, slightly open, FeO mineralization, JRC 10-12 @ 36.6 ft.
- -Intensely fractured, fracture zone, from 36.7 to 38 ft.
- -Joint, dipping 50°.
- -Joint, dipping 20 to 90°, planar, slightly open, FeO, faint calcite mineralization, JRC 4-6 @ 39.4 to 39.8 ft.
- -Dipping 30°, weathered clay lined seam, 2 in. thick, no shearing, polished faces @ 40 ft.
- -Joint, dipping 25 to 40°, planar, slightly open, minimal infill, JRC 4-6 @ 40.8 ft.
- -Joint, dipping 50 to 60°, planar, slightly open, calcite mineralization, JRC 8-10 @ 41.5 ft.
- METAMORPHIC ROCK (Meta-Sandstone), with Meta-shale interbeds, fine-grained, dark gray to black, slightly weathered, hard, intensely to moderately fractured, local clay infill, meta-shale is moderately soft.
- -Meta-shale interbed, bedding plane separation, dipping 30°.
- -Joint, dipping 40°, planar, slightly open, sandy clay infill, JRC 8-10 @ 46 ft.
- -Meta-shale interbed, dipping 65°.
- -Joint, dipping 25°, planar, stepped, slightly open, sandy clay infill; @ 49 ft.
- -Bedding plane separation, dipping 25°, on meta-shale interbed @ 50 ft.
- -Joint, dipping 30°, planar, slightly open, minimal infill, JRC 6-8; @ 49 ft.
- METAMORPHIC ROCK (Meta-Sandstone), with Meta-shale interbeds, fine-grained, dark gray to black, slightly weathered, hard, moderately to slightly fractured, abundant calcite healed fractures.
- -Bedding plane separation, dipping 50°, @ meta-shale interbed, approximately 3 in. thick, very intensely fractured @ 54.5 ft.
- -Fracture zone, very intensely fractured, minimal infill; from 55 to 56.1 ft.
- METAMORPHIC ROCK (Meta-Sandstone), with Meta-shale interbeds, fine-grained, dark gray to black, slightly weathered, moderately hard, intensely fractured, local clay infill.
- -Joint, dipping 40°, planar, slightly open, minimal infill, JRC 4-6; @ 56.5 ft.
- -Fracture zone, on meta-shale interbed, abundant clay infill; from 56.7 to 57.1 ft.
- -Joint, dipping 20 to 60°, planar, slightly open, minimal infill, polished, JRC 4-6; from 57.5 to 58.5 ft.
- -Bedding plane separation, dipping 30°, on meta-shale interbed; @ 59 and 59.8 ft.
- -Bedding plane separation, dipping 43°, on meta-shale interbed; @ 60.2 ft.
- -Bedding plane separation, dipping 40°, on meta-shale interbed; @ 61.7 ft.
- -Fracture zone, dipping 90°, weak, brecciated, meta-shale interbed with clay infill, from 62.4 to 63 ft.
- -Fracture zone, dipping 20°, weak, brecciated, meta-shale interbed with clay infill, from 63.5 to 64.2 ft.
- -Joint, dipping 80°@ 67 ft.
- -Bedding plane separation, dipping 55°, on meta-shale interbed @ 69 ft.
- -Bedding plane separation, dipping 60°, on meta-shale interbed @ 69.5 ft.
- -Joint, dipping 55°@ 71 ft.
- -Joint, dipping 5°@ 72 ft.
- -Bedding plane separation, dipping 60°, on meta-shale interbed @ 73.5 ft.
- -Brecciated meta-shale bed remnant @ 74 and 75 ft. Joint, dipping 55°.
- METAMORPHIC ROCK (Meta-Sandstone), with Meta-shale interbeds, fine-grained, dark gray to black, slightly weathered, moderately fractured, meta-sandstone is hard, argillitic beds are soft, minimal infill, abundant local calcite healed fractures. Joint, dipping 30°, @ 76 ft.
- -Dipping 30°@ 79 ft.
- -Bedding plane separation, dipping 35°, on argillite interbed @ 79.5 ft.
- -Fracture zone, dipping 45°, abundant clay infill; from 80 to 80.4 ft.
- METAMORPHIC ROCK (Argillite), slightly weathered, soft, very intensely fractured, bedding joint, dipping 40 to 45°, approximately parallel bedding, pervasively sheared to clay; from 82 to 83 ft.
- METAMORPHIC ROCK (Meta-Sandstone), fine-grained to medium-grained, dark gray to grayish blue, slightly weathered, hard, moderately fractured, local calcite healing.
- -Joint, dipping 50°, calcite healed; from 83.5 to 84.2 ft.
- -Joint, dipping 47°, planar, slightly open, minimal calcite, JRC 2-4; @ 87.8 ft.
- -Joint, dipping 60°, planar, slightly open, minimal calcite, JRC 2-4; @ 88.5 ft.
- -Joint, dipping 52°, planar, slightly open, calcite, JRC 2-4; @ 89.3 ft.
- -Joint, dipping 55°, planar, slightly open, calcite, JRC 2-4; @ 89.7 ft.
- -Joint, dipping 50°, planar, slightly open, minimal infill, JRC 8-10; @ 90.2 ft.
- -Joint, dipping 55°, planar, slightly open, minimal infill, JRC 8-10; @ 91.3 ft.
- -Joint, dipping 55°, planar, slightly open, calcite, JRC 2-4; @ 92.5 ft.
- -Occasional totally healed calcite fractures.
- -Joint, dipping 60°, planar, slightly open, calcite, JRC 2-4; @ 93 ft.
- -Joint, dipping 60°, planar to slightly undulating, open, sandy clay infill; @ 93.8 ft.
- -Abundant fractures at multiple orientations.
- -Joint, dipping 55°, minor calcite mineralization, JRC 2-4; @ 95 ft.
- -Joint, dipping 52°, minor calcite mineralization, JRC 6-8; @ 96 ft.
- -Joint, dipping 52°, minor clayey sand infill, JRC 4-6; @ 97 ft.
- -Joint, dipping 30°, minor calcite mineralization, JRC 8-10; @ 97.3 ft.
- -Fracture zone, thick layers of calcite on some fractures; from 97.7 to 98.8 ft.
- -Joint, dipping 62°, some calcite mineralization, JRC 4-6; @ 99 and 99.5 ft.

Sample data along boring: 22 | 2.5 | 104 | 13; 23 | 2.5 | 136 | 9; 0.3 | 24 | 2.5 | 131 | 10 (AL)(UU); 25 | 2.5 (SA); 50/6 | 2.5 (4.5"); 69 | 2.0 | 110 | 12 (SA); 138 | 7

REC=75% RQD=0%; REC=80% RQD=0%; REC=100% RQD=0%; REC=100% RQD=14%; REC=17% RQD=0%; REC=100% RQD=85%; REC=100% RQD=17%; REC=90% RQD=0%; REC=100% RQD=48%; REC=100% RQD=50%; REC=100% RQD=60%; REC=100% RQD=38%; REC=100% RQD=72%; REC=100% RQD=33%; REC=100% RQD=27%

8/20/2007

Elevations: 350, 340, 330, 320, 310, 300, 290, 280, 270, 260, 250, 240, 230

11+00 12+00 13+00

ELEVATION

PROFILE
HOR. 1"=20'
VER. 1"=5'

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

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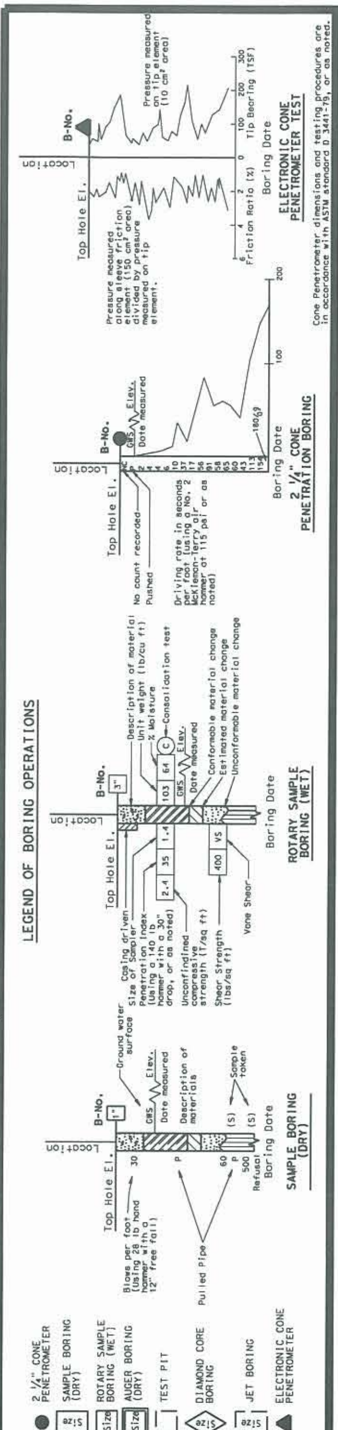
LEGEND OF BORING OPERATIONS



DESIGN OVERSIGHT / SIGN OFF DATE	DRAWN BY: A. Sanchez	CHECKED BY: J. Richmond, C.E.G	KLEINFELDER FIELD INVESTIGATION BY: DATE: August 2007	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	X PROJECT ENGINEER	BRIDGE NO. X / POST MILE 5.10

STORM DAMAGE LOCATION

LOG OF TEST BORINGS 4 OF 6

GSF GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 2/25/05)

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

SPT N-Value (Blows/foot)	Granular	SPT N-Value (Blows/foot)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very Stiff
		>31	Hard

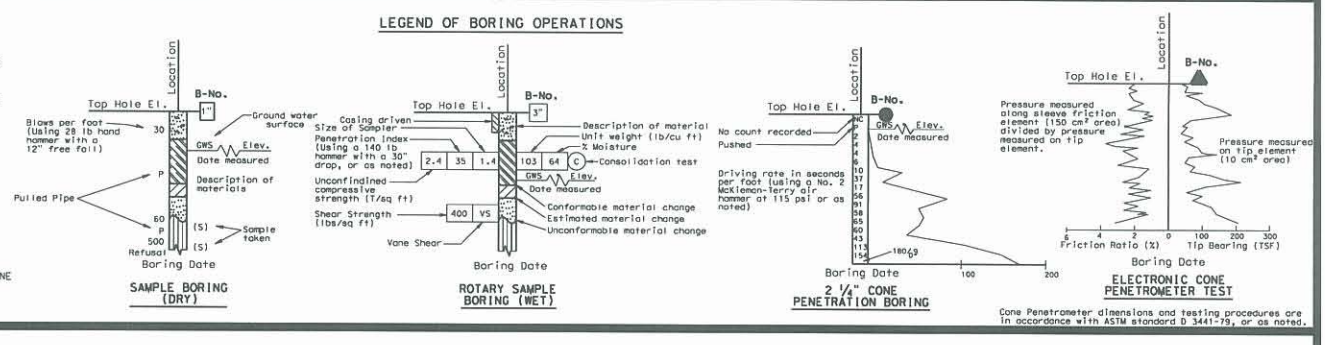
NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

LEGEND OF EARTH MATERIALS

GRAVEL, SAND, SILT, CLAY, SANDY CLAY or CLAYEY SAND, SANDY SILT or SILTY SAND, SILTY CLAY, CLAYEY SILT, PEAT and/or ORGANIC MATTER, FILL MATERIAL, IGNEOUS ROCK, SEDIMENTARY ROCK, METAMORPHIC

LEGEND OF BORING OPERATIONS

2 1/4" CONE PENETROMETER; SAMPLE BORING (DRY); ROTARY SAMPLE BORING (WET); AUGER BORING (DRY); TEST PIT; DIAMOND CORE BORING; JET BORING; ELECTRONIC CONE PENETROMETER



Cone Penetrometer dimensions and testing procedures are in accordance with ASTM standard D 3441-79, or as noted.

FOR PLAN VIEW AND ADDITIONAL NOTES, SEE "LOG OF TEST BORINGS" SHEET 2 OF 8

7.0' Lt Sta. 11+86.0
℄ Route 254

R-07-002

4.5"

Elev 350.0

ELEVATION

Elevation	Sample	Description
350		ASPHALT.
	82 / 2.5	Poorly graded GRAVEL with CLAY and SAND (GP-GC); very dense; olive gray; dry; mostly fine, angular GRAVEL; some fine to coarse SAND; little fines; [FILL].
	50/3.5 / 2.5	SILTY SAND (SM); medium dense; dark brown; dry; fine to medium SAND [FILL].
		CLAYEY SAND with GRAVEL (SC); medium dense; olive gray; moist; little fine to coarse GRAVEL; fine to coarse SAND; [FILL].
340		ASPHALT.
	12 / 2.0	Poorly graded GRAVEL with SAND medium dense; mixed with brown gravelly soil; old yellow roadway centerline in asphalt debris, asphaltic; [FILL].
	50/5.5 / 2.0	ASPHALT.
		-Slide plane at 17.4 ft. from slope inclinometer profile FHS02
330		SANDY lean CLAY (CL); stiff; dark brown; moist; few GRAVEL; fine to coarse SAND; some meta-sandstone fragments; [LANDSLIDE DEPOSIT].
	21 / 2.0	- / 15 (AL)
	22 / 2.5	125 / 13
320		CLAYEY SAND with GRAVEL (SC-SM); medium dense; moderate olive brown; moist; fine to coarse SAND; some angular meta-shale and meta-sandstone fragments; [LANDSLIDE DEPOSIT].
	50/6 / 2.5	
	39 / 2.0	118 / 11
	50/6 / 2.0	128 / 10 (SA)
310	REC=95% ROD=38%	4.5" METAMORPHIC ROCK (Meta-Sandstone Landslide Block), thinly bedded, medium bluish gray, moderately weathered, moderately hard, moderately fractured, calcite veining; [LANDSLIDE DEPOSIT].
	REC=45% ROD=12%	-Joint, dipping 60°, smooth; calcite.
		-Slide plane at 46 ft. from slope inclinometer profile FHS02
		-possible rounded gravel infill from caving after rod removal.
	2 / 2.0	METAMORPHIC ROCK (Meta-Sandstone), thinly bedded, medium bluish gray, moderately weathered, moderately hard, moderately fractured, calcite veining.
300		-Joint, dipping 60°, smooth.
		-Bedding joint, dipping 20°.
		-Fracture zone, from 51 to 53 ft.
	REC=90% ROD=17%	METAMORPHIC ROCK (Meta-Sandstone), thickly bedded, medium bluish gray, moderately weathered, moderately hard, intensely fractured, joint, dipping 60 to 0°.
	REC=80% ROD=67%	-Joint, dipping 40°, from 54 to 60 ft.
290	REC=93% ROD=17%	METAMORPHIC ROCK (Meta-Conglomerate), thinly bedded, medium bluish gray, moderately to slightly weathered, moderately hard, joint, clast types: red chert, quartzite, meta-volcanics, phyllite.
	REC=95% ROD=87%	METAMORPHIC ROCK (Meta-Sandstone), medium-grained, medium bluish gray, moderately to slightly weathered, moderately hard, joint, dipping 60°.
		-Massively bedded, joint, dipping 60 to 0°, from 66 to 95 ft.
	REC=93% ROD=90%	-Dipping 70°, calcite veining; from 66 to 95 ft.
		-Occasional soft sediment deformation.
280		-Brecciated meta-shale bed from 70.5 to 70.8 ft.
	REC=93% ROD=33%	
	REC=100% ROD=0%	-Becomes fine-grained.
		-Fracture zone, from 74 to 74.5 ft.
		-Intensely fractured, medium-grained.
	REC=80% ROD=47%	-Moderately fractured.
270		-Fracture zone, from 78.5 to 79 ft.
	REC=94% ROD=33%	
		-Intensely fractured @ 84 ft.
	REC=92% ROD=75%	
	REC=100% ROD=0%	METAMORPHIC ROCK (Meta-Shale), laminated, black, moderately weathered, moderately hard, moderately fractured, bedding joint, dipping 60°.
260	REC=100% ROD=63%	METAMORPHIC ROCK (Meta-Sandstone), fine-grained to medium-grained, medium bluish gray, moderately to slightly weathered, moderately hard.
		-Pyrite trace from 91 to 95 ft.
		-Joint, dipping 60°.
	REC=93% ROD=63%	-Bedding joint, dipping 90 to 60°.
250	REC=100% ROD=75% / REC=0% ROD=0%	
240		

8/28/2007

12+00 13+00

PROFILE
HOR. 1"=20'
VER. 1"=5'

KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407

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 GEOLOGIST WILLIAM V. McCORMICK III No. 1673 Exp. 11-30-08 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

GEOTECHNICAL PROFESSIONAL DATE 6/27/08

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET TOTAL SHEETS
01	Hum	254	5.10	

DESIGN OVERSIGHT
SIGN OFF DATE
CHECKED BY J. Richmond, C.E.G
DRAWN BY A. Sanchez
KLEINFELDER FIELD INVESTIGATION BY:
DATE: August 2007
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS
PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
X PROJECT ENGINEER
CU 01 EA 475101
FILE => $REQUEST
DISREGARD PRINTS BEARING EARLIER REVISION DATES
BRIDGE NO. X
POST MILE 5.10
STORM DAMAGE LOCATION
LOG OF TEST BORINGS 5 OF 6
10-25-07 6-20-08 REVISION DATES (PRELIMINARY STAGE ONLY)
SHEET X OF X

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

CONSISTENCY CLASSIFICATION FOR SOILS			
According to the Standard Penetration Test			
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		>31	Hard

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

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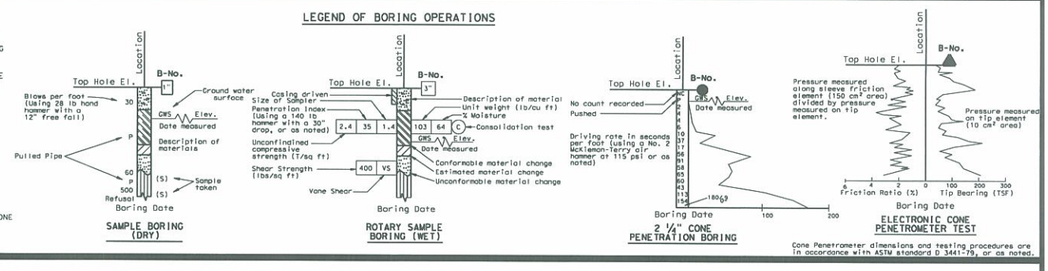
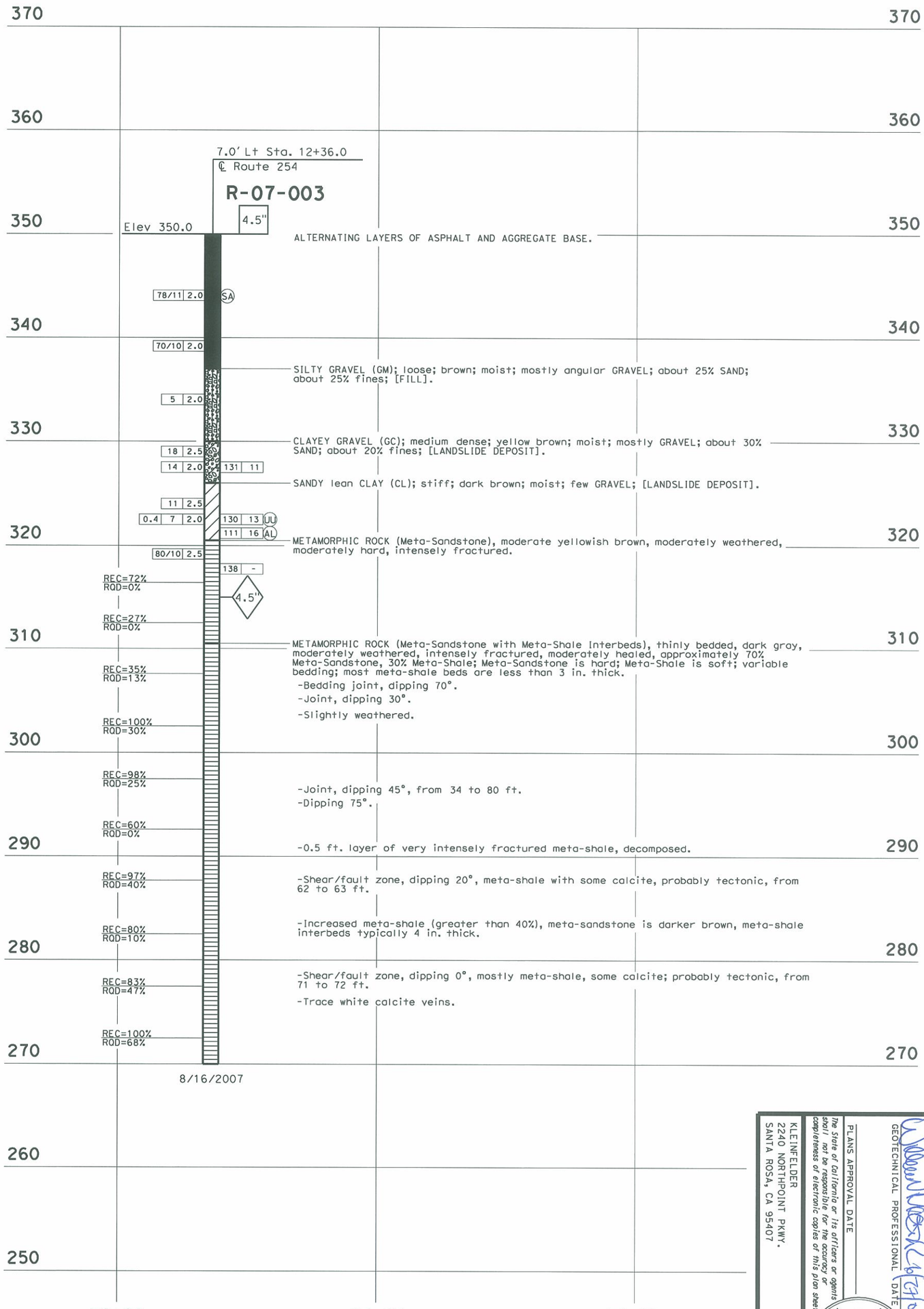


Cone Penetrometer dimensions and testing procedures are in accordance with ASTM standard D 3441-79, or as noted.

FOR PLAN VIEW AND ADDITIONAL NOTES, SEE "LOG OF TEST BORINGS" SHEET 2 OF 8



PROFILE
HOR. 1"=20'
VER. 1"=5'

DESIGN OVERSIGHT
SIGN OFF DATE
DRAWN BY A. Sanchez
CHECKED BY J. Richmond, C.E.G
KLEINFELDER FIELD INVESTIGATION BY:
DATE: August 2007

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

X PROJECT ENGINEER

CU 01
EA 475101

BRIDGE NO. X
POST MILE 5.10

DISREGARD PRINTS BEARING EARLIER REVISION DATES

STORM DAMAGE LOCATION

LOG OF TEST BORINGS 6 OF 6

REVISION DATES (PRELIMINARY STAGE ONLY)
10-24-07
6-20-08

SHEET X OF X

KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407

PLANS APPROVAL DATE

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REGISTERED GEOLOGIST WILLIAM V. McCORMICK III No. 1673 Exp. 11-30-08 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

GEOTECHNICAL PROFESSIONAL DATE 6/27/08

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	Hum	254	5.10		

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

OSF GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 2/23/05)

GROUP SYMBOLS AND NAMES

Graphic / Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic / Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY elastic ELASTIC SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTS

C	Consolidation (ASTM D 2435-04)
CL	Collapse Potential (ASTM D 5333-03)
CP	Compaction Curve (CTM 216 - 06)
CR	Corrosion, Sulfates, Chlorides (CTM 643 - 99; CTM 417 - 06; CTM 422 - 06)
CU	Consolidated Undrained Triaxial (ASTM D 4767-02)
DS	Direct Shear (ASTM D 3080-04)
EI	Expansion Index (ASTM D 4829-03)
M	Moisture Content (ASTM D 2216-05)
OC	Organic Content (ASTM D 2974-07)
P	Permeability (CTM 220 - 05)
PA	Particle Size Analysis (ASTM D 422-63 [2002])
PI	Liquid Limit, Plastic Limit, Plasticity Index (AASHTO T 89-02, AASHTO T 90-00)
PL	Point Load Index (ASTM D 5731-05)
PM	Pressure Meter
PP	Pocket Penetrometer
R	R-Value (CTM 301 - 00)
SE	Sand Equivalent (CTM 217 - 99)
SG	Specific Gravity (AASHTO T 100-06)
SL	Shrinkage Limit (ASTM D 427-04)
SW	Swell Potential (ASTM D 4546-03)
TV	Pocket Torvane
UC	Unconfined Compression - Soil (ASTM D 2166-06) Unconfined Compression - Rock (ASTM D 2938-95)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850-03)
UW	Unit Weight (ASTM D 4767-04)
VS	Vane Shear (AASHTO T 223-96 [2004])

SAMPLER GRAPHIC SYMBOLS

- Standard Penetration Test (SPT)
- Standard California Sampler
- Modified California Sampler
- Shelby Tube
- Piston Sampler
- NX Rock Core
- HQ Rock Core
- Bulk Sample
- Other (see remarks)

DRILLING METHOD SYMBOLS

- Auger Drilling
- Rotary Drilling
- Dynamic Cone or Hand Driven
- Diamond Core

WATER LEVEL SYMBOLS

- First Water Level Reading (during drilling)
- Static Water Level Reading (short-term)
- Static Water Level Reading (long-term)

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - North

REPORT TITLE
BORING RECORD LEGEND

DIST.	COUNTY	ROUTE	POSTMILE	EA
01	Humboldt	254	5.1	01-475101

PROJECT OR BRIDGE NAME
Storm Damage Location: Highway 254 P.M. 5.10

BRIDGE NUMBER	PREPARED BY	DATE	SHEET
	C. Goitein	6-27-08	1 of 3

CONSISTENCY OF COHESIVE SOILS

Descriptor	Unconfined Compressive Strength (tsf)	Pocket Penetrometer (tsf)	Torvane (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 - 0.50	0.25 - 0.50	0.12 - 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 - 1.0	0.50 - 1.0	0.25 - 0.50	Can be penetrated several inches by thumb with moderate effort
Stiff	1.0 - 2.0	1.0 - 2.0	0.50 - 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2.0 - 4.0	2.0 - 4.0	1.0 - 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

APPARENT DENSITY OF COHESIONLESS SOILS

Descriptor	SPT N_{60} - Value (blows / foot)
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Descriptor	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Descriptor	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

SOIL PARTICLE SIZE

Descriptor		Size
Boulder		> 12 inches
Cobble		3 to 12 inches
Gravel	Coarse	3/4 inch to 3 inches
	Fine	No. 4 Sieve to 3/4 inch
Sand	Coarse	No. 10 Sieve to No. 4 Sieve
	Medium	No. 40 Sieve to No. 10 Sieve
	Fine	No. 200 Sieve to No. 40 Sieve
Silt and Clay		Passing No. 200 Sieve

PLASTICITY OF FINE-GRAINED SOILS

Descriptor	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled, and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll, and not much time is required to reach the plastic limit; it cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

CEMENTATION

Descriptor	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

NOTE: This legend sheet provides descriptors and associated criteria for required soil description components only. Refer to Caltrans Soil and Rock Logging, Classification, and Presentation Manual (July 2007), Section 2, for tables of additional soil description components and discussion of soil description and identification.

ROCK GRAPHIC SYMBOLS

IGNEOUS ROCK

SEDIMENTARY ROCK

METAMORPHIC ROCK

BEDDING SPACING

Descriptor	Thickness or Spacing
Massive	> 10 ft
Very thickly bedded	3 to 10 ft
Thickly bedded	1 to 3 ft
Moderately bedded	3-5/8 inches to 1 ft
Thinly bedded	1-1/4 to 3-5/8 inches
Very thinly bedded	3/8 inch to 1-1/4 inches
Laminated	< 3/8 inch

WEATHERING DESCRIPTORS FOR INTACT ROCK

	Diagnostic Features					
	Chemical Weathering-Discoloration-Oxidation		Mechanical Weathering and Grain Boundary Conditions	Texture and Solutioning		
Descriptor	Body of Rock	Fracture Surfaces		Texture	Solutioning	General Characteristics
Fresh	No discoloration, not oxidized	No discoloration or oxidation	No separation, intact (tight)	No change	No solutioning	Hammer rings when crystalline rocks are struck.
Slightly Weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull	Minor to complete discoloration or oxidation of most surfaces	No visible separation, intact (tight)	Preserved	Minor leaching of some soluble minerals may be noted	Hammer rings when crystalline rocks are struck. Body of rock not weakened.
Moderately Weathered	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are "rusty"; feldspar crystals are "cloudy"	All fracture surfaces are discolored or oxidized	Partial separation of boundaries visible	Generally preserved	Soluble minerals may be mostly leached	Hammer does not ring when rock is struck. Body of rock is slightly weakened.
Intensely Weathered	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in situ disaggregation (refer to grain boundary conditions)	All fracture surfaces are discolored or oxidized; surfaces are friable	Partial separation, rock is friable; in semi-arid conditions, granitics are disaggregated	Altered by chemical disintegration such as via hydration or argillation	Leaching of soluble minerals may be complete	Dull sound when struck with hammer; usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures or veinlets. Rock is significantly weakened.
Decomposed	Discolored of oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay		Complete separation of grain boundaries (disaggregated)	Resembles a soil; partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes".

Note: Combination descriptors (such as "slightly weathered to fresh") are used where equal distribution of both weathering characteristics is present over significant intervals or where characteristics present are "in between" the diagnostic feature. However, combination descriptors should not be used where significant identifiable zones can be delineated. Only two adjacent descriptors shall be combined. "Very intensely weathered" is the combination descriptor for "decomposed to intensely weathered".

RELATIVE STRENGTH OF INTACT ROCK

Descriptor	Uniaxial Compressive Strength (psi)
Extremely Strong	> 30,000
Very Strong	14,500 - 30,000
Strong	7,000 - 14,500
Medium Strong	3,500 - 7,000
Weak	700 - 3,500
Very Weak	150 - 700
Extremely Weak	< 150

ROCK HARDNESS

Descriptor	Criteria
Extremely Hard	Specimen cannot be scratched with pocket knife or sharp pick; can only be chipped with repeated heavy hammer blows
Very hard	Specimen cannot be scratched with pocket knife or sharp pick; breaks with repeated heavy hammer blows
Hard	Specimen can be scratched with pocket knife or sharp pick with heavy pressure; heavy hammer blows required to break specimen
Moderately Hard	Specimen can be scratched with pocket knife or sharp pick with light or moderate pressure; breaks with moderate hammer blows
Moderately Soft	Specimen can be grooved 1/6 in. with pocket knife or sharp pick with moderate or heavy pressure; breaks with light hammer blow or heavy hand pressure
Soft	Specimen can be grooved or gouged with pocket knife or sharp pick with light pressure, breaks with light to moderate hand pressure
Very Soft	Specimen can be readily indented, grooved, or gouged with fingernail, or carved with pocket knife; breaks with light hand pressure

CORE RECOVERY CALCULATION (%)

$$\frac{\Sigma \text{ Length of the recovered core pieces (in.)}}{\text{Total length of core run (in.)}} \times 100$$

RQD CALCULATION (%)

$$\frac{\Sigma \text{ Length of intact core pieces > 4 in.}}{\text{Total length of core run (in.)}} \times 100$$

FRACTURE DENSITY

Descriptor	Criteria
Unfractured	No fractures
Very Slightly Fractured	Lengths greater 3 ft
Slightly Fractured	Lengths from 1 to 3 ft, few lengths outside that range
Moderately Fractured	Lengths mostly in range of 4 in. to 1 ft, with most lengths about 8 in.
Intensely Fractured	Lengths average from 1 in. to 4 in. with scattered fragmented intervals with lengths less than 4 in.
Very Intensely Fractured	Mostly chips and fragments with few scattered short core lengths

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
P. Holland	8-15-07	8-15-07		R-07-001
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
Woodward			Sta ~ Offset ~12L 11+18	350 +- ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Rotary Wash			Mobile B57	4.5 in.
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified California, SPT, Coring			Safety semi-automatic, 140 lb, 30-inch drop	
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement Grout				75.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT and AGGREGATE BASE multiple layers.												
	1														
	2														
	3														
	4														
	5				1	1 10 50/5		82							
	6														
	7		CLAYEY SAND with GRAVEL (SC); loose to medium dense; yellow brown; moist; little fine to coarse, angular GRAVEL; some SAND; about 34% some fines; gravel composed of sandstone and shale fragments [FILL].												Circulation loss from 7 to 9 ft.
	8														
	9														
	10				2	4 4 8	12	83							
	11														
	12									14	121				
	13														
	14														
	15		Becomes loose.		3	3 4 5	9	67							
	16														
	17														-200 = 34%
	18														
	19														
	20		Becomes medium dense.		4	7 7 8	15	67							
	21														
	22		CLAYEY GRAVEL (GC); medium dense; dark brown; moist; some GRAVEL; some SAND; some fines; dominantly meta-shale derived; [LANDSLIDE DEPOSIT].		5	3 9 7	16	78		12	124				
	23														
	24														
	25														

(continued)

Department of Transportation
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REPORT TITLE				HOLE ID
BORING RECORD				R-07-001
DIST. 01	COUNTY Humboldt	ROUTE 254	POSTMILE 5.1	EA 01-475101
PROJECT OR BRIDGE NAME: Storm Damage Location: Highway 254 P.M. 5.10				
BRIDGE NUMBER	PREPARED BY C. Goitein	DATE 8-29-07	SHEET 1 of 3	

CALTRANS BORING RECORD 052007 HUM 254 PM 5.10.GPJ CT SACTO 053107.GDT 6/26/08

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25		CLAYEY GRAVEL (GC) *(continued)*.		6	4 5 8	13								
	26														
	27				7	3 7 9	16			12	126				
	28														
	29														
	30				8	5 6 8	14								
	31														
	32		Approximate base of active landslide.		9	5 5 32	37			11	127	UU =0.3			
	33		METAMORPHIC ROCK (Meta-Sandstone), moderate brown, intensely weathered, soft, intensely fractured, some hard zones; chaotic structure.												Circulation lost
	34														
	35				10	36 38 34	72								
	36														
	37										136	UU =0.2			
	38														
	39														
	40				11	10 9 11	20	72							
	41														
	42														
	43		METAMORPHIC ROCK (Meta-Sandstone), massively bedded, medium bluish gray, slightly weathered to fresh, moderately hard, moderately fractured, joint, dipping 30 to 20°, no mineralization; JRC 10.												
	44														
	45		Joint, dipping 50 to 40°, shear approximately 1/16 in.; white calcite mineralization; JRC 6; from 43 to 55 ft.		12	50/0		0							
	46														
	47				C1			100	44						Advanced HW outercasing to 47 ft. Switched to HQ # 8 impreg diamond bit
	48														
	49														
	50				C2			100	17						
	51														
	52														
	53														
	54														
	55														

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				**R-07-001**
DIST. **01**	COUNTY **Humboldt**	ROUTE **254**	POSTMILE **5.1**	EA **01-475101**
PROJECT OR BRIDGE NAME **Storm Damage Location: Highway 254 P.M. 5.10**				
BRIDGE NUMBER	PREPARED BY **C. Goitein**	DATE **8-29-07**	SHEET **2 of 3**	

CALTRANS BORING RECORD 052007 HUM 254 PM 5.10.GPJ CT SACTO 053107.GDT 6/26/08

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55		Joint, dipping 60°, shear approximately 1/16 in.; white calcite mineralization; JRC 6; @ 55 ft. METAMORPHIC ROCK (Meta-Sandstone) *(continued)*.		C3			100	25						
	56														
	57														
	58														
	59														
	60		METAMORPHIC ROCK (Meta-Sandstone), massively bedded, medium bluish gray, fresh, moderately hard, moderately fractured, partially healed.		C4			100	83						Continued circulation loss
	61														
	62		Joint, dipping 70°, thin calcite coating; JRC 15.												
	63														
	64														
	65		Joint, dipping 85°, stepped; JRC 16. Bedding joint, dipping 20°, thin meta-shale interbed.		C5			100	80						
	66		Joint, dipping 10°, smooth.												
	67		Joint, dipping 30°.												
	68		Horizontal; 1.5 in. stiff clay infill.												
	69														
	70				C6			100							
	71														
	72														
	73		Dipping 45°, 1 in. thick interbeds; calcite mineralization along meta-shale interbed; 0.25 in. oval shaped meta-shale rip-up clasts.												
	74														
	75		Bottom of Borehole at 75.0 ft.												
	76														
	77														
	78														
	79														
	80														
	81														
	82														
	83														
	84														
	85														

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REPORT TITLE				HOLE ID
BORING RECORD				**R-07-001**
DIST. **01**	COUNTY **Humboldt**	ROUTE **254**	POSTMILE **5.1**	EA **01-475101**
PROJECT OR BRIDGE NAME **Storm Damage Location: Highway 254 P.M. 5.10**				
BRIDGE NUMBER	PREPARED BY **C. Goitein**	DATE **8-29-07**	SHEET **3 of 3**	

CALTRANS BORING RECORD 052007 HUM 254 PM 5.10.GPJ CT SACTO 053107.GDT 6/26/08

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C. Goitein/J. Walker	8-23-07	8-28-07		R-07-002
DRILLING CONTRACTOR: Caltrans			BOREHOLE LOCATION (Station, Offset, Line): Sta ~ Offset ~7L 11+86	SURFACE ELEVATION: 350 +- ft
DRILLING METHOD: Rotary Wash			DRILL RIG: Mobile B47	BOREHOLE DIAMETER: 4.5 in.
SAMPLER TYPE(S) AND SIZE(S) (ID): Modified California, SPT, Coring			SPT HAMMER TYPE: Safety semi-automatic, 140 lb, 30-inch drop	HAMMER EFFICIENCY, ERi
BOREHOLE BACKFILL AND COMPLETION: Slope Inclonometer Installed			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING: 100.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT.												
	1														
	2				1	44	82	83							Begin Punch Core @ 2 ft.
	3				2	47									
					3	35									
	4		Poorly graded GRAVEL with CLAY and SAND (GP-GC); very dense; olive gray; dry; mostly fine, angular GRAVEL; some fine to coarse SAND; little fines [FILL].		C1										
	5														
	6		SILTY SAND (SM); medium dense; dark brown; dry; fine to medium SAND [FILL].			50/3.5		44							
	7		CLAYEY SAND with GRAVEL (SC); medium dense; olive gray; moist; little fine to coarse GRAVEL; fine to coarse SAND [FILL].		C2										
	8		ASPHALT.												Punch core refusal, use drill head from 7.5 to 11 ft., fluid loss @ 9 ft.
	9		Poorly graded GRAVEL with SAND medium dense; mixed with brown gravelly soil; old yellow roadway centerline in asphalt debris, asphaltic [FILL].												
	10														
	11					10	12	75							fluid loss, no circulation
	12					6									
						6									
	13				C3										
	14														
	15		ASPHALT.												
	16					50/5.5									Punch core refusal, use drill head from 16 to 21 ft.
	17														
	18		SLIDE PLANE at 17.4 ft. from slope inclinometer profile FHS02.												
	19														
	20														
	21		SANDY lean CLAY (CL); stiff; dark brown; moist; few GRAVEL; fine to coarse SAND; some meta-sandstone fragments; [LANDSLIDE DEPOSIT].		4	7	21	40							PI
	22					7									
						14									
	23				C4										
	24														
	25														

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				R-07-002
DIST. 01	COUNTY Humboldt	ROUTE 254	POSTMILE 5.1	EA 01-475101
PROJECT OR BRIDGE NAME: Storm Damage Location: Highway 254 P.M. 5.10				
BRIDGE NUMBER	PREPARED BY C. Goitein	DATE 9-5-07	SHEET 1 of 4	

CALTRANS BORING RECORD 052007 HUM 254 PM 5.10.GPJ CT SACTO 053107.GDT 6/26/08

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25		SANDY lean CLAY (CL) *(continued)*.					40							
	26					8	22	8							
	27				5	11 11				13	125				
	28				C5										
	29		CLAYEY SAND with GRAVEL (SC-SM); medium dense; moderate olive brown; moist; fine to coarse SAND; some angular meta-shale and meta-sandstone fragments; [LANDSLIDE DEPOSIT].												
	30					50/6									Punch core refusal, use drill head from 30 to 31 ft.
	31				6	15 20 19	39	40		11	118				
	32														
	33				C6										
	34				C7			33			128				-200 = 12 %
	35														
	36				7	50/6		95	38	10					
	37		METAMORPHIC ROCK (Meta-Sandstone Landslide Block), thinly bedded, medium bluish gray, moderately weathered, moderately hard, moderately fractured, calcite veining, [LANDSLIDE DEPOSIT].		C8										End drilling for day, Resume drilling 8-27-07 Switch to HQ # 8 impreg diamond bit @ 36 ft.
	38														
	39														
	40				C9			45	12						
	41		Joint, dipping 60°, smooth; calcite.												
	42														
	43														
	44														
	45		SLIDE PLANE at 46 ft. from slope inclinometer profile FHS02.			1 1 1	2								
	46														possible rounded gravel infill from caving after rod removal
	47		METAMORPHIC ROCK (Meta-Sandstone), thinly bedded, medium bluish gray, moderately weathered, moderately hard, moderately fractured, calcite veining.		C10										
	48														
	49		Joint, dipping 60°, smooth.												
	50		Bedding joint, dipping 20°.		C11			90	17						
	51		Fracture zone, from 51 to 53 ft.												drilling tightened up
	52														
	53		METAMORPHIC ROCK (Meta-Sandstone), thickly bedded, medium bluish gray, moderately weathered, moderately hard, intensely fractured, joint, dipping 60 to 0°.												
	54		Joint, dipping 40°, from 54 to 60 ft.												
	55														

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REPORT TITLE				HOLE ID
BORING RECORD				**R-07-002**
DIST. **01**	COUNTY **Humboldt**	ROUTE **254**	POSTMILE **5.1**	EA **01-475101**
PROJECT OR BRIDGE NAME **Storm Damage Location: Highway 254 P.M. 5.10**				
BRIDGE NUMBER	PREPARED BY **C. Goitein**		DATE **9-5-07**	SHEET **2 of 4**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55		METAMORPHIC ROCK (Meta-Sandstone) *(continued)*.		C12			80	67						
	56														
	57														
	58				C13			93	17						
	59														
	60		METAMORPHIC ROCK (Meta-Conglomerate), thinly bedded, medium bluish gray, moderately to slightly weathered, moderately hard, joint, clast types: red chert, quartzite, meta-volcanics, phyllite.		C14			95	87						replace core bit
	61														
	62		METAMORPHIC ROCK (Meta-Sandstone), medium-grained, medium bluish gray, moderately to slightly weathered, moderately hard, joint, dipping 60°.												
	63														
	64														
	65		Massively bedded, joint, dipping 60 to 0°, from 66 to 95 ft.		C15			93	90						
	66														
	67		Dipping 70°, calcite veining; from 66 to 95 ft.												
	68														
	69		Occasional soft sediment deformation.												
	70				C16			93	33						
	71		Brecciated meta-shale bed from 70.5 to 70.8 ft.												
	72														chatter, core barrel stuck, cobble
	73		Becomes fine-grained.		C17			100	0						
	74		Fracture zone, from 74 to 74.5 ft.												
	75		Intensely fractured, medium-grained.		C18			80	47						
	76														
	77		Moderately fractured.												
	78														
	79		Fracture zone, from 78.5 to 79 ft.												
	80				C19			94	33						
	81														
	82														
	83				C20			92	75						
	84		Intensely fractured, @ 84 ft.												broken chuck, fixed chuck and resume drilling
	85														

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				**R-07-002**
DIST. **01**	COUNTY **Humboldt**	ROUTE **254**	POSTMILE **5.1**	EA **01-475101**
PROJECT OR BRIDGE NAME **Storm Damage Location: Highway 254 P.M. 5.10**				
BRIDGE NUMBER	PREPARED BY **C. Goitein**	DATE **9-5-07**	SHEET **3 of 4**	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	85		METAMORPHIC ROCK (Meta-Sandstone) *(continued)*.		C21			100	0						
	86		METAMORPHIC ROCK (Meta-Shale), laminated, black, moderately weathered, moderately hard, moderately fractured, bedding joint, dipping 60°.												
	87		METAMORPHIC ROCK (Meta-Sandstone), fine-grained to medium-grained, medium bluish gray, moderately to slightly weathered, moderately hard.		C22			100	63						
	88														
	89														
	90				C23										
	91		Pyrite trace from 91 to 95 ft.												
	92														
	93														
	94														
	95		Joint, dipping 60°.		C24			93	63						
	96		Bedding joint, dipping 90 to 60°.												
	97														
	98				C25			100	75						
	99				C26			0							
	100		Bottom of Borehole at 100.0 ft. Slope Inclonometer Installed to 99 ft.												
	101														
	102														
	103														
	104														
	105														
	106														
	107														
	108														
	109														
	110														
	111														
	112														
	113														
	114														
	115														

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REPORT TITLE				HOLE ID
BORING RECORD				**R-07-002**
DIST. **01**	COUNTY **Humboldt**	ROUTE **254**	POSTMILE **5.1**	EA **01-475101**
PROJECT OR BRIDGE NAME **Storm Damage Location: Highway 254 P.M. 5.10**				
BRIDGE NUMBER	PREPARED BY **C. Goitein**		DATE **9-5-07**	SHEET **4 of 4**

CALTRANS BORING RECORD 052007 HUM 254 PM 5.10.GPJ CT SACTO 053107.GDT 6/26/08

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
P. Holland	8-16-07	8-16-07		R-07-003
DRILLING CONTRACTOR: Woodward			BOREHOLE LOCATION (Station, Offset, Line): Sta ~ Offset ~7L 12+36	SURFACE ELEVATION: 350 +- ft
DRILLING METHOD: Rotary Wash			DRILL RIG: Mobile B57	BOREHOLE DIAMETER: 4.5 in.
SAMPLER TYPE(S) AND SIZE(S) (ID): Modified California, SPT, Coring			SPT HAMMER TYPE: Safety semi-automatic, 140 lb, 30-inch drop	HAMMER EFFICIENCY, ERi
BOREHOLE BACKFILL AND COMPLETION: Cement Grout			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING: 80.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		ALTERNATING LAYERS OF ASPHALT AND AGGREGATE BASE.												
	1														
	2														Advanced HWT Casing to 32 ft.
	3														
	4														
	5			X	1	18 28 50/5									-200 = 0 %
	6														
	7														
	8														
	9														
	10			X	2	6 20 50/4									
	11														
	12														
	13		SILTY GRAVEL (GM); loose; brown; moist; mostly angular GRAVEL; about 25% SAND; about 25% fines [FILL].												
	14														
	15			X	3	3 3 2	5								
	16														
	17														
	18														
	19														
	20		CLAYEY GRAVEL (GC); medium dense; yellow brown; moist; mostly GRAVEL; about 30% SAND; about 20% fines; [LANDSLIDE DEPOSIT].	X	4	8 9 9	18								
	21														
	22			X	5	5 6 8	14			11	131				
	23														
	24		SANDY lean CLAY (CL); stiff; dark brown; moist; few GRAVEL; [LANDSLIDE DEPOSIT].												
	25														

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REPORT TITLE				HOLE ID
BORING RECORD				R-07-003
DIST. 01	COUNTY Humboldt	ROUTE 254	POSTMILE 5.1	EA 01-475101
PROJECT OR BRIDGE NAME: Storm Damage Location: Highway 254 P.M. 5.10				
BRIDGE NUMBER	PREPARED BY C. Goitein	DATE 9-10-07	SHEET 1 of 3	

CALTRANS BORING RECORD 052007 HUM 254 PM 5.10.GPJ CT SACTO 053107.GDT 6/26/08

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25		SANDY lean CLAY (CL) *(continued)*. [LANDSLIDE DEPOSIT].			7	11								
	26				6	5 6									
	27				7	2 2 5	7			13 16	130 111	UU =0.4			PI
	28														
	29														
	30		METAMORPHIC ROCK (Meta-Sandstone), moderate yellowish brown, moderately weathered, moderately hard, intensely fractured.			18									
	31				8	30 50/4									
	32				C1			72			138				
	33														
	34														Advanced HQ to 80 ft.
	35				C2			27							
	36														
	37														
	38														
	39														
	40		METAMORPHIC ROCK (Meta-Sandstone with Meta-Shale Interbeds), thinly bedded, dark gray, moderately weathered, intensely fractured, moderately healed, approximately 70% Meta-Sandstone, 30% Meta-Shale; Meta-Sandstone is hard; Meta-Shale is soft; variable bedding; most meta-shale beds are less than 3 in. thick. Bedding joint, dipping 70°. Joint, dipping 30°.		C3			35	13						
	41														
	42														
	43														
	44														
	45				C4			100	30						
	46		Slightly weathered.												
	47														
	48														
	49														
	50				C5			98	25						
	51														
	52														
	53														
	54		Joint, dipping 45°, from 34 to 80 ft. Dipping 75°.												
	55														

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REPORT TITLE				HOLE ID
BORING RECORD				**R-07-003**
DIST. **01**	COUNTY **Humboldt**	ROUTE **254**	POSTMILE **5.1**	EA **01-475101**
PROJECT OR BRIDGE NAME **Storm Damage Location: Highway 254 P.M. 5.10**				
BRIDGE NUMBER	PREPARED BY **C. Goitein**	DATE **9-10-07**	SHEET **2 of 3**	

CALTRANS BORING RECORD 052007 HUM 254 PM 5.10.GPJ CT SACTO 053107.GDT 6/26/08

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55		METAMORPHIC ROCK (Meta-Sandstone with Meta-Shale Interbeds) *(continued)*.		C6			60	0						
	56														
	57														
	58														
	59		0.5 ft. layer of very intensely fractured meta-shale, decomposed.												
	60				C7			97	40						
	61														
	62		Shear/fault zone, dipping 20°, meta-shale with some calcite, probably tectonic from 62 to 63 ft.												
	63														
	64														
	65				C8			80	10						
	66		Increased meta-shale (greater than 40%), meta-sandstone is darker brown, meta-shale interbeds typically 4 in. thick.												
	67														
	68														
	69														
	70				C9			83	47						
	71		Shear/fault zone, dipping 0°, mostly meta-shale, some calcite; probably tectonic from 71 to 72 ft.												
	72														
	73		Trace white calcite veins.												
	74														
	75				C10			100	68						
	76														
	77														
	78														
	79														
	80		Bottom of Borehole at 80.0 ft.												
	81														
	82														
	83														
	84														
	85														

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REPORT TITLE				HOLE ID
BORING RECORD				**R-07-003**
DIST. **01**	COUNTY **Humboldt**	ROUTE **254**	POSTMILE **5.1**	EA **01-475101**
PROJECT OR BRIDGE NAME **Storm Damage Location: Highway 254 P.M. 5.10**				
BRIDGE NUMBER	PREPARED BY **C. Goitein**	DATE **9-10-07**	SHEET **3 of 3**	

CALTRANS BORING RECORD 052007 HUM 254 PM 5.10.GPJ CT SACTO 053107.GDT 6/26/08

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Richmond	8-16-07	8-20-07		R-07-004
DRILLING CONTRACTOR: Caltrans			BOREHOLE LOCATION (Station, Offset, Line): Sta ~ Offset ~18R 11+80	SURFACE ELEVATION: 350 +- ft
DRILLING METHOD: Rotary Wash			DRILL RIG: Mobile B47	BOREHOLE DIAMETER: 4.5 in.
SAMPLER TYPE(S) AND SIZE(S) (ID): Modified California, SPT, Coring			SPT HAMMER TYPE: Safety semi-automatic, 140 lb, 30-inch drop	HAMMER EFFICIENCY, ERi
BOREHOLE BACKFILL AND COMPLETION: Slope Inclonometer Installed			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING: 100.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SILTY GRAVEL with SAND (GM); loose; gray to gray brown; dry; about 50% mostly subangular GRAVEL, max. 1.5 in. dia.; about 35% SAND; [AGGREGATE BASE].		C1			17							Begin Punch Core
	1														
	2		SANDY SILTY CLAY with GRAVEL (CL); stiff; brown; moist; subrounded GRAVEL, max. 0.5 in. dia.; about 35% fine to coarse SAND [FILL].												
	3														
	4														
	5														
	6		Increased gravel content, very stiff.			13	22	60							
	7				1	10 12				13	104				
	8		CLAYEY GRAVEL with SAND (GC); loose to medium dense; gray and yellow brown; moist to wet; about 50% mostly subangular GRAVEL, max. 1.5 in. dia.; about 30% fine to coarse SAND; meta-sandstone gravel; [DORMANT LANDSLIDE DEPOSIT].		C2										
	9														
	10														
	11					14	23	15							
	12				2 3	8 15				9	136				
	13				C3										
	14														
	15														
	16					18	24	60							
	17		Meta-shale fragments in debris.		4	10 14				10	131	UU =0.3			PI
	18		Possible slide plane @ 18 ft. Dipping 20°, faint clay lined shear.		C4										
	19														
	20		Meta-sandstone and meta-shale derived debris.												minor circulation loss
	21					10	25								
	22				5 6	12 13									-200 = 29 %
	23				C5										
	24		Becomes dark gray and moderate olive brown.												Hard drilling from 24 to 25 ft.
	25				C6										

(continued)

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - North

REPORT TITLE				HOLE ID
BORING RECORD				R-07-004
DIST. 01	COUNTY Humboldt	ROUTE 254	POSTMILE 5.1	EA 01-475101
PROJECT OR BRIDGE NAME: Storm Damage Location: Highway 254 P.M. 5.10				
BRIDGE NUMBER	PREPARED BY C. Goitein	DATE 9-10-07	SHEET 1 of 4	

CALTRANS BORING RECORD 052007 HUM 254 PM 5.10.GPJ CT SACTO 053107.GDT 6/26/08

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25		CLAYEY GRAVEL with SAND (GC) *(continued)*. [DORMANT LANDSLIDE DEPOSIT].		C6										
	26				7	19 50		75	0						
	27														Switch to HQ # 8 impreg bit @ 27 ft.
	28				C7										circulation loss from 27 to 31.5 ft.
	29		Approximately 2 in. thick shear, (possible slip plane).												
	30		METAMORPHIC ROCK (Meta-Sandstone), fine-grained to medium-grained, dark gray and moderate brown, moderately weathered, medium strong, very intensely fractured, shear, dipping 5°, clay lined, [DORMANT LANDSLIDE DEPOSIT].		8	24 31 38	69	80	0	12	110				-200 = 32 %
	31														
	32		METAMORPHIC ROCK (Meta-Shale), fine-grained, dark gray to black, moderately weathered, soft, very intensely fractured, fracture zone, brecciated, pervasively sheared, abundant clay infill, moderate structure remains, [DORMANT LANDSLIDE DEPOSIT].		C8					7	138				
	33														
	34		METAMORPHIC ROCK (Meta-Sandstone), fine-grained to medium-grained, dark gray, moderately to slightly weathered, moderately hard, intensely fractured, bedding joint, dipping 15°, minimal infill.												
	35		Joint, dipping 5°, planar, slightly open, minimal infill, polished, JRC 2-4.		C9			100	0						
	36		Joint, dipping 50°, planar, slightly open, FeO and calcite mineralization, JRC 8-10 @ 34.6 ft.												
	37		Joint, dipping 60°, planar, slightly open, FeO and calcite mineralization, JRC 8-10 @ 35 ft.												
	38		METAMORPHIC ROCK (Meta-Sandstone), fine-grained to medium-grained, dark gray, slightly weathered, moderately hard to hard, intensely to moderately fractured, FeO infill.												
	39		Joint, dipping 72°, planar to slightly undulating, slightly open, FeO mineralization, JRC 10-12 @ 36.6 ft.		C10			100	14						
	40		Intensely fractured, fracture zone, from 36.7 to 38 ft. Joint, dipping 50°.												circulation loss from 40 to 45 ft.
	41		Joint, dipping 20 to 90°, planar, slightly open, FeO, faint calcite mineralization, JRC 4-6 @ 39.4 to 39.8 ft. Dipping 30°, weathered clay lined seam, 2 in. thick, no shearing, polished faces @ 40 ft.												
	42		Joint, dipping 25 to 40°, planar, slightly open, minimal infill, JRC 4-6 @ 40.8 ft.		C11			17	0						
	43		Joint, dipping 50 to 60°, planar, slightly open, calcite mineralization, JRC 8-10 @ 41.5 ft.												
	44														
	45		METAMORPHIC ROCK (Meta-Sandstone), with Meta-Shale interbeds, fine-grained, dark gray to black, slightly weathered, hard, intensely to moderately fractured, local clay infill, meta-shale is moderately soft.		C12			100	25						
	46														
	47		Meta-Shale interbed, bedding plane separation, dipping 30°.												
	48		Joint, dipping 40°, planar, slightly open, sandy clay infill, JRC 8-10 @ 46 ft. Meta-Shale interbed, dipping 65°.												
	49		Joint, dipping 25°, planar, stepped, slightly open, sandy clay infill; @ 49 ft.												
	50		Bedding plane separation, dipping 25°, on meta-shale interbed @ 50 ft.		C13			100	85						circulation lost
	51		Joint, dipping 30°, planar, slightly open, minimal infill, JRC 6-8; @ 49 ft.												
	52		METAMORPHIC ROCK (Meta-Sandstone), with Meta-Shale interbeds, fine-grained, dark gray to black, slightly weathered, hard, moderately to slightly fractured, abundant calcite healed fractures.												
	53														
	54		Bedding plane separation, dipping 50°, @ meta-shale interbed, approximately 3 in. thick, very intensely fractured @ 54.5 ft.												
	55														

(continued)

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - North

REPORT TITLE				HOLE ID
BORING RECORD				**R-07-004**
DIST. **01**	COUNTY **Humboldt**	ROUTE **254**	POSTMILE **5.1**	EA **01-475101**
PROJECT OR BRIDGE NAME **Storm Damage Location: Highway 254 P.M. 5.10**				
BRIDGE NUMBER	PREPARED BY **C. Goitein**	DATE **9-10-07**	SHEET **2 of 4**	

CALTRANS BORING RECORD 052007 HUM 254 PM 5.10.GPJ CT SACTO 053107.GDT 6/26/08

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55		METAMORPHIC ROCK (Meta-Sandstone) *(continued)*. Fracture zone, very intensely fractured, minimal infill; from 55 to 56.1 ft.		C14			100	17						
	56														
	57		METAMORPHIC ROCK (Meta-Sandstone), with Meta-Shale interbeds, fine-grained, dark gray to black, slightly weathered, moderately hard, intensely fractured, local clay infill.												
	58		Joint, dipping 40°, planar, slightly open, minimal infill, JRC 4-6; @ 56.5 ft.												
	59		Fracture zone, on meta-shale interbed, abundant clay infill; from 56.7 to 57.1 ft.												
	60		Joint, dipping 20 to 60°, planar, slightly open, minimal infill, polished, JRC 4-6; from 57.5 to 58.5 ft.		C15			90	0						
	61		Bedding plane separation, dipping 30°, on meta-shale interbed; @ 59 and 59.8 ft.												
	62		Bedding plane separation, dipping 43°, on meta-shale interbed; @ 60.2 ft.												
			Bedding plane separation, dipping 40°, on meta-shale interbed; @ 61.7 ft.												
	63		Fracture zone, dipping 90°, weak, brecciated, meta-shale interbeds with clay infill, from 62.4 to 63 ft.												
	64		Fracture zone, dipping 20°, weak, brecciated, meta-shale interbeds with clay infill, from 63.5 to 64.2 ft.												
	65				C16			100	48						
	66														
	67		Joint, dipping 80°, @ 67 ft.												
	68														
	69		Bedding plane separation, dipping 55°, on meta-shale interbed @ 69 ft.												
	70		Bedding plane separation, dipping 60°, on meta-shale interbed @ 69.5 ft.		C17			100	50						
	71		Joint, dipping 55°, @ 71 ft.												
	72		Joint, dipping 5°, @ 72 ft.												
	73														
	74		Bedding plane separation, dipping 60°, on meta-shale interbed @ 73.5 ft. Brecciated meta-shale bed remnant @ 74 and 75 ft.												
	75		Joint, dipping 55°.		C18			100	60						End drilling for day, Resume 8-20-07
	76		METAMORPHIC ROCK (Meta-Sandstone), with Meta-Shale interbeds, fine-grained, dark gray to black, slightly weathered, moderately fractured, meta-sandstone is hard, argillitic beds are soft, minimal infill, abundant local calcite healed fractures.												
	77														
	78		Joint, dipping 30°, @ 76 ft.												
	79		Dipping 30°, @ 79 ft.												
	80		Bedding plane separation, dipping 35°, on argillite interbed @ 79.5 ft. Fracture zone, dipping 45°, abundant clay infill; from 80 to 80.4 ft.		C19			100	38						
	81														
	82		METAMORPHIC ROCK (Argillite), slightly weathered, soft, very intensely fractured, bedding joint, dipping 40 to 45°, approximately parallel bedding, pervasively sheared to clay.												no circulation
	83														
	84		METAMORPHIC ROCK (Meta-Sandstone), fine-grained to medium-grained, dark gray to grayish blue, slightly weathered, hard, moderately fractured, local calcite												
	85														

(continued)

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - North

REPORT TITLE				HOLE ID
BORING RECORD				**R-07-004**
DIST. **01**	COUNTY **Humboldt**	ROUTE **254**	POSTMILE **5.1**	EA **01-475101**
PROJECT OR BRIDGE NAME **Storm Damage Location: Highway 254 P.M. 5.10**				
BRIDGE NUMBER	PREPARED BY **C. Goitein**	DATE **9-10-07**	SHEET **3 of 4**	

CALTRANS BORING RECORD 052007 HUM 254 PM 5.10.GPJ CT SACTO 053107.GDT 6/26/08

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	85		healing.		C20			100	72						
			Joint, dipping 50°, calcite healed; from 83.5 to 84.2 ft.												
	86		METAMORPHIC ROCK (Meta-Sandstone) *(continued)*.												
	87														
	88		Joint, dipping 47°, planar, slightly open, minimal calcite, JRC 2-4; @ 87.8 ft.												
	89		Joint, dipping 60°, planar, slightly open, minimal calcite, JRC 2-4; @ 88.5 ft.												
			Joint, dipping 52°, planar, slightly open, calcite, JRC 2-4; @ 89.3 ft.												
	90		Joint, dipping 55°, planar, slightly open, calcite, JRC 2-4; @ 89.7 ft.		C21			100	33						
	91		Joint, dipping 50°, planar, slightly open, minimal infill, JRC 8-10; @ 90.2 ft.												
	92		Joint, dipping 55°, planar, slightly open, minimal infill, JRC 8-10; @ 91.3 ft.												
	93		Joint, dipping 55°, planar, slightly open, calcite, JRC 2-4; @ 92.5 ft.												
			Occasional totally healed calcite fractures.												
	94		Joint, dipping 60°, planar, slightly open, calcite, JRC 2-4; @ 93 ft.												
			Joint, dipping 60°, planar to slightly undulating, open, sandy clay infill; @ 93.8 ft.												
	95		Abundant fractures at multiple orientations.		C22			100	27						
	96		Joint, dipping 55°, minor calcite mineralization, JRC 2-4; @ 95 ft.												
	97		Joint, dipping 52°, minor calcite mineralization, JRC 6-8; @ 96 ft.												
			Joint, dipping 52°, minor clayey sand infill, JRC 4-6; @ 97 ft.												
	98		Joint, dipping 30°, minor calcite mineralization, JRC 8-10; @ 97.3 ft.												
	99		Fracture zone, thick layers of calcite on some fractures; from 97.7 to 98.8 ft.												
			Joint, dipping 62°, some calcite mineralization, JRC 4-6; @ 99 and 99.5 ft.												
	100		Bottom of Borehole at 100.0 ft.												
			Slope Inclonometer Installed to 92 ft.												
	101														
	102														
	103														
	104														
	105														
	106														
	107														
	108														
	109														
	110														
	111														
	112														
	113														
	114														
	115														

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - North

REPORT TITLE				HOLE ID
BORING RECORD				**R-07-004**
DIST. **01**	COUNTY **Humboldt**	ROUTE **254**	POSTMILE **5.1**	EA **01-475101**
PROJECT OR BRIDGE NAME **Storm Damage Location: Highway 254 P.M. 5.10**				
BRIDGE NUMBER	PREPARED BY **C. Goitein**	DATE **9-10-07**	SHEET **4 of 4**	

CALTRANS BORING RECORD 052007 HUM 254 PM 5.10.GPJ CT SACTO 053107.GDT 6/26/08

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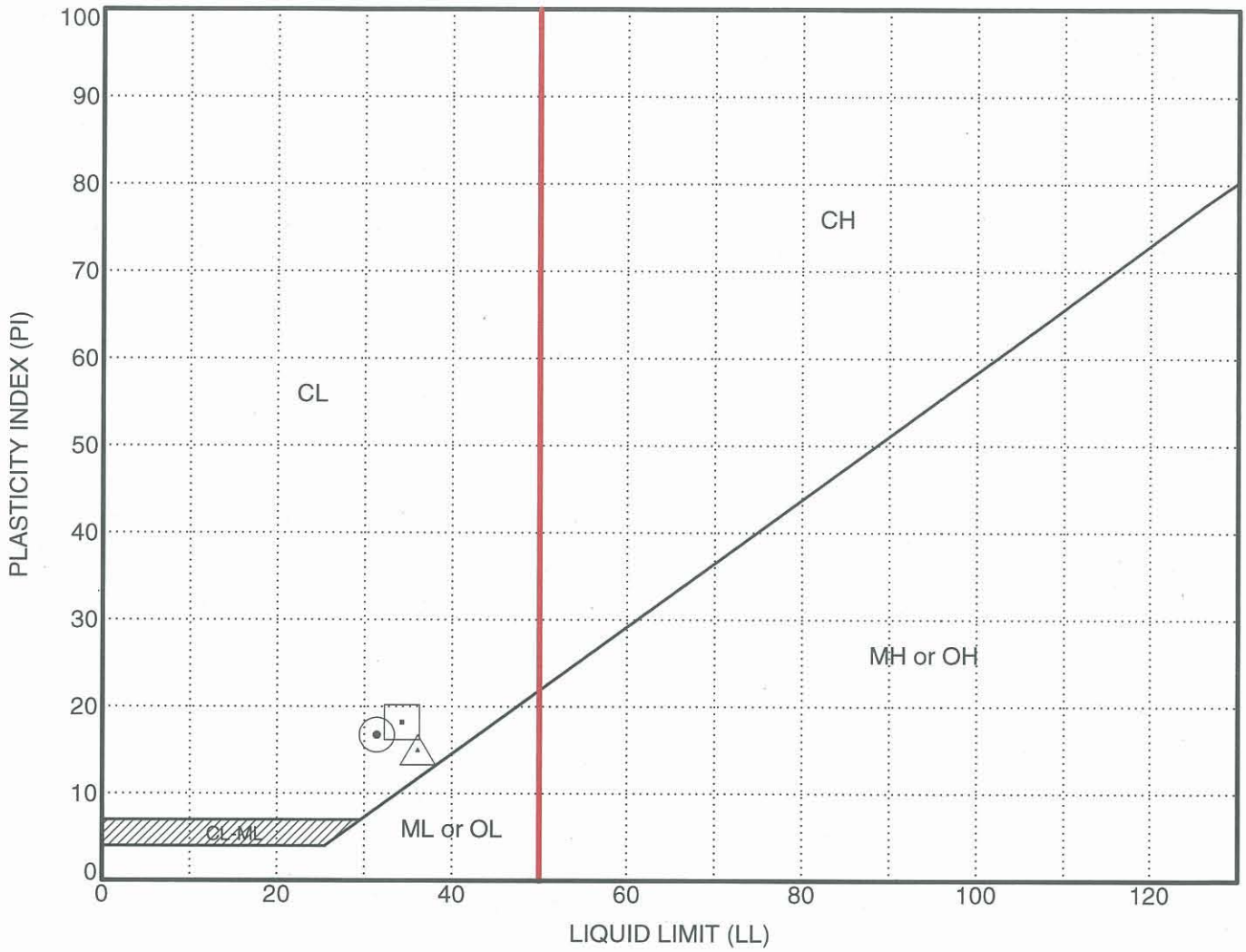
APPENDIX B

Lab Test Summary
Storm Damage Location: **Highway 254 P.M. 5.1 Job # 85401**

Soil/Rock Type	Boring	Depth (ft)	UU (psf)	UU (Tsf)	Confining Pressure (psf)	Dry density (pcf)	Moisture content (%)	Total density (pcf)	PI	LL	-200
FILL SC	R-07-001	11.5				121	14	138			
FILL SC	R-07-001	16.5									34
DEBRIS GC	R-07-001	21.5				124	12	139			
DEBRIS GC	R-07-001	26.5				126	12	141			
DEBRIS GC	R-07-001	31.5	696	0.3	4032	127	11	141			
META-SANDSTONE	R-07-001	36.5	426	0.2	4320	136		136			
DEBRIS CL	R-07-002	21					15		16	31	
DEBRIS CL	R-07-002	27				125	13	141			
DEBRIS SC	R-07-002	31				118	11	131			
DEBRIS SC	R-07-002	34				128		128			12
DEBRIS SC	R-07-002	36					10				
FILL AC	R-07-003	5									0
DEBRIS GC	R-07-003	21.5				131	11	145			
DEBRIS CL	R-07-003	26.5	813	0.4	3456	130	13	147			
DEBRIS CL	R-07-003	27				111	16	129	18	34	
META-SANDSTONE	R-07-003	31.5				138		138			
FILL CL	R-07-004	7				104	13	118			
DEBRIS GC	R-07-004	11.8				136	9	148			
DEBRIS GC	R-07-004	16.8	578	0.3	2016	131	10	144	15	36	
DEBRIS GC	R-07-004	21.7									29
META-SHALE	R-07-004	30				110	12	123			32
META-SHALE	R-07-004	31.5				138	7	148			

PI – PLASTICITY INDEX
LL - LIQUID LIMIT
UU – TRIAXIAL UNCONSOLIDATED UNDRAINED
TSF - TONS PER SQUARE FOOT



SAMPLE SOURCE	CLASSIFICATION	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
⊙ R-07-002 @ 21.0'	Sandy Clay (CL)	31	15	16	
⊡ R-07-003 @ 27.0'	Sandy Clay (CL)	34	16	18	
△ R-07-004 @ 16.8'	Clayey Gravel with Sand (GC)	36	21	15	

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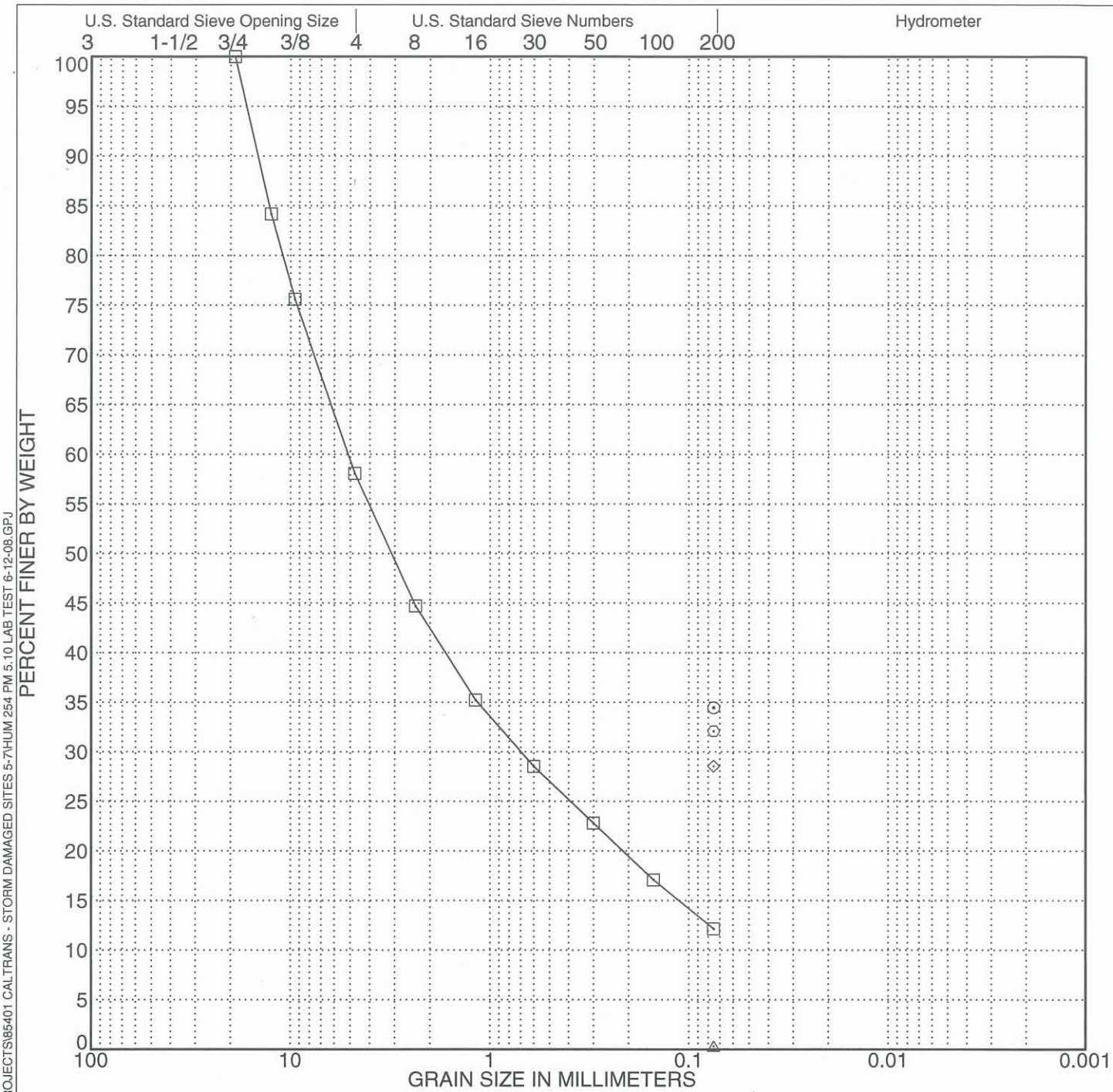
PROJECT NUMBER **85401** DATE **6/26/2008**

PLASTICITY CHART

HUM 254 PM 5.1
01-475101

PLATE
B-1

Data Template:
PI - KLEINFELDER SANTA ROSA 5-8-08 .GDT - 6/26/08 16:25 - U:\NEW GINT PROJECTS\85401 CALTRANS - STORM DAMAGED SITES 5-7\HUM 254 PM 5.10 LAB TEST 6-12-08.GPJ



Cobbles	GRAVEL		SAND			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE		

SYMBOL	SAMPLE SOURCE	CLASSIFICATION
⊙	R-07-001 @ 16.5'	Clayey Sand and Gravel (SC)
⊡	R-07-002 @ 34.0'	Clayey Sand with Gravel (SC-SM)
△	R-07-003 @ 5.0'	Sandy Gravelly Asphalt
◇	R-07-004 @ 21.7'	Clayey Gravel with Sand (GC)
⬡	R-07-004 @ 30.0'	Meta-Shale

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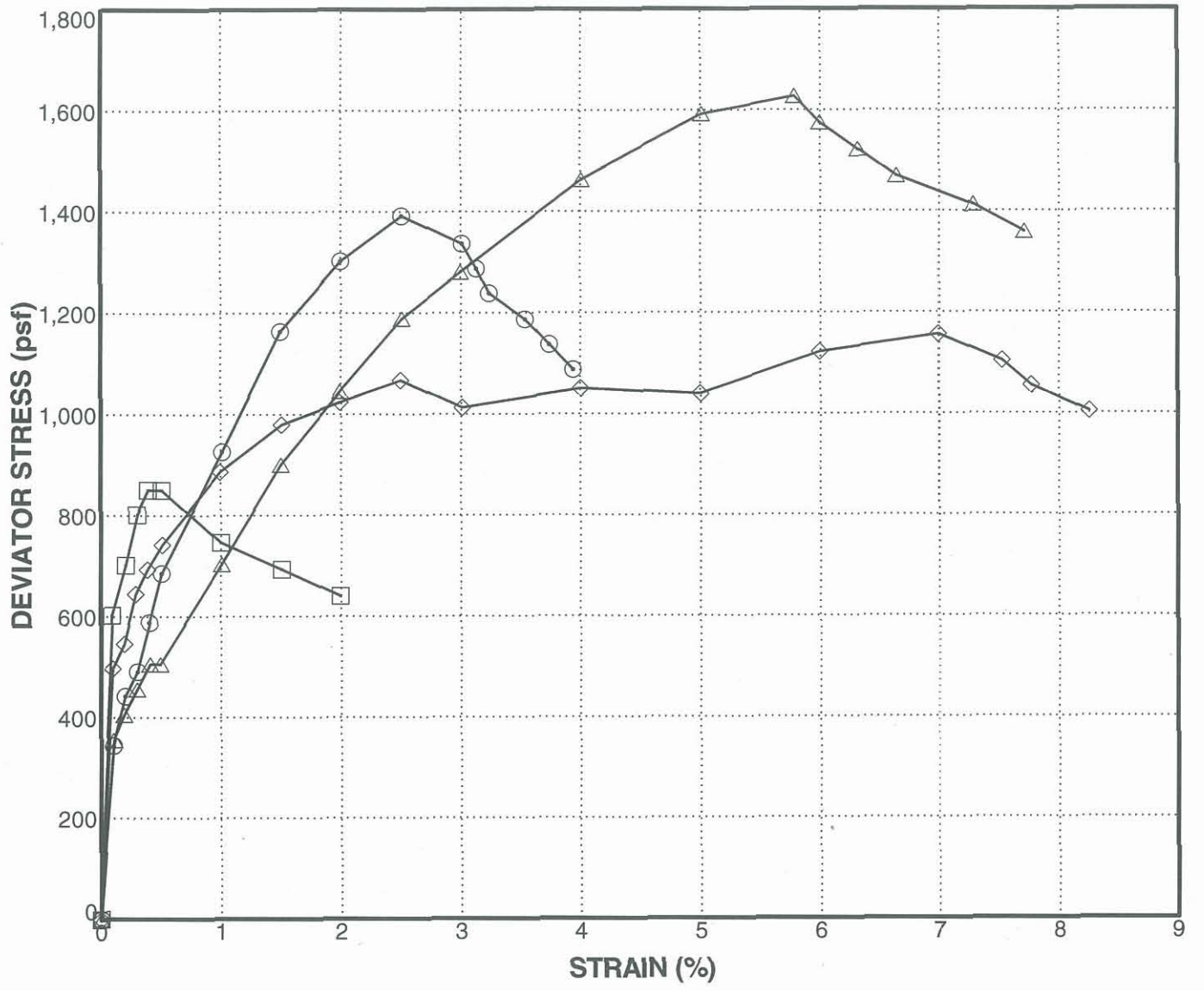
PROJECT NUMBER **85401** DATE **6/26/2008**

PARTICLE SIZE ANALYSIS

HUM 254 PM 5.1
01-475101

PLATE **B-2**

Data Template:
SA - KLEINFELDER SANTA ROSA 5-8-08 .GDT - 6/26/08 16:25 - U:\NEW GINT PROJECTS\85401 CALTRANS - STORM DAMAGED SITES 5-7\HUM 254 PM 5.10 LAB TEST 6-12-08.GPJ



Sample Source	Classification	Type of Test	Confinement Pressure (psf)	Shear Strength (psf)	Strain (%)	Dry Density (pcf)	Moisture Content (%)
⊙ R-07-001 @ 31.5'	Clayey Gravel (GC)	TXUU	4032	696	3	127	11.4
⊡ R-07-001 @ 36.5'	Meta-Sandstone	TXUU	4320	426	0	136	5.8
△ R-07-003 @ 26.5'	Sandy Clay (CL)	TXUU	3456	813	6	130	13.0
◇ R-07-004 @ 16.8'	Clayey Gravel with Sand (GC)	TXUU	2016	578	7	131	9.7

UC = Unconfined Compression

TX/UU = Unconsolidated Undrained Triaxial

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PROJECT NUMBER **85401** DATE **6/26/2008**

STRENGTH TEST DATA

HUM 254 PM 5.1
01-475101

PLATE

B-3

Data Template:
NEW TXUU - KLEINFELDER SANTA ROSA 5-8-08 .GDT - 6/26/08 16:26 - U:\NEW GINT PROJECTS\85401 CALTRANS - STORM DAMAGED SITES 5-7\HUM 254 PM 5.10 LAB TEST 6-12-08.GPJ

AP Engineering & Testing, Inc.

CORROSION TEST RESULTS

Client Name: Kleinfelder
Project Name: Caltrans
Project No.: 85401

AP Job No.: 27-0928
Date 09/19/07

EA # Highway & PM	Boring No.	Remarks	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (%)	Chloride Content (%)
EA01-475001 HUM 254 PM 5.8	R-07-004	13+15 ft	CL	2200	7.3	0.0005	0.0146
EA01-475001 HUM 254 PM 5.8	R-07-001	20 ft	CL	1800	7.4	0.0087	0.0070
EA01-475101 HUM 254 PM 5.58	R-07-004	10.5-15.5 ft	CL	1900	7.3	0.0004	0.0074
EA01-475101 HUM 254 PM 5.58	R-07-002	30 ft	CL	1700	7.4	0.0003	0.0135
EA01-475101 HUM 254 PM 5.1	R-07-004	13 ft	CL	1700	7.4	0.0043	0.0129
EA01-475101 HUM 254 PM 5.1	R-07-002	32 ft	CL	2200	7.6	0.0016	0.0127

NOTES:
Resistivity Test and pH: California Test Methods 532 and 643
Sulfate Content : California Test Method 417
Chloride Content : California Test Method 422
ND = Not Detectable
NA = Not Sufficient Sample
NR = Not Requested

2607 Pomona Boulevard, Pomona, CA 91768
Tel. (909) 869-6316 Fax. (909)869-6318

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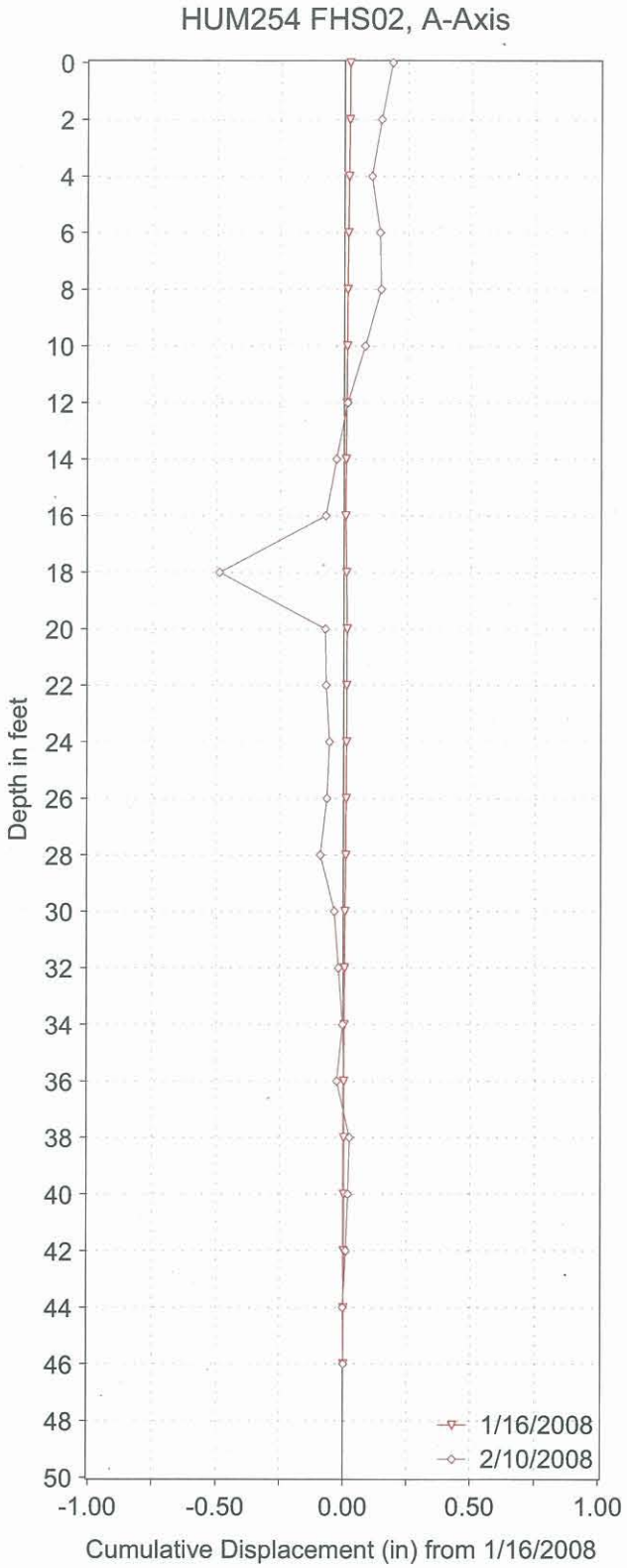
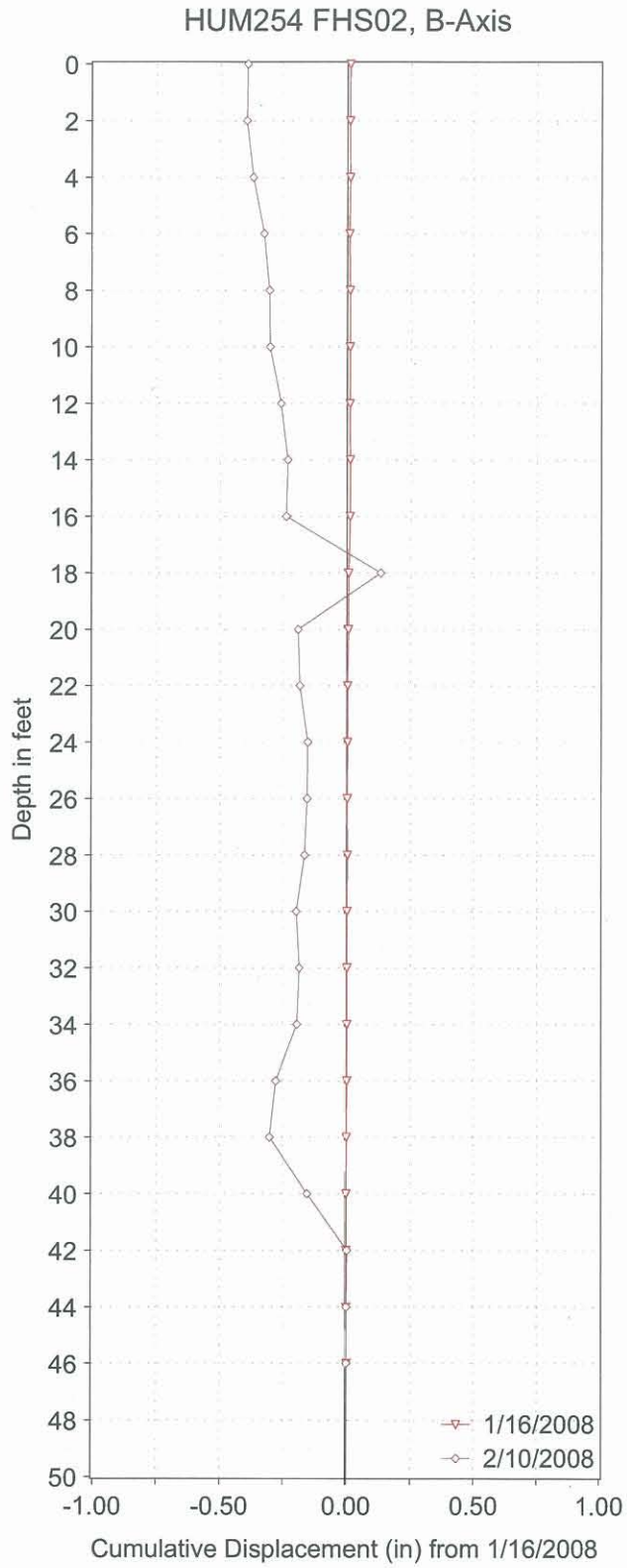
APPENDIX C

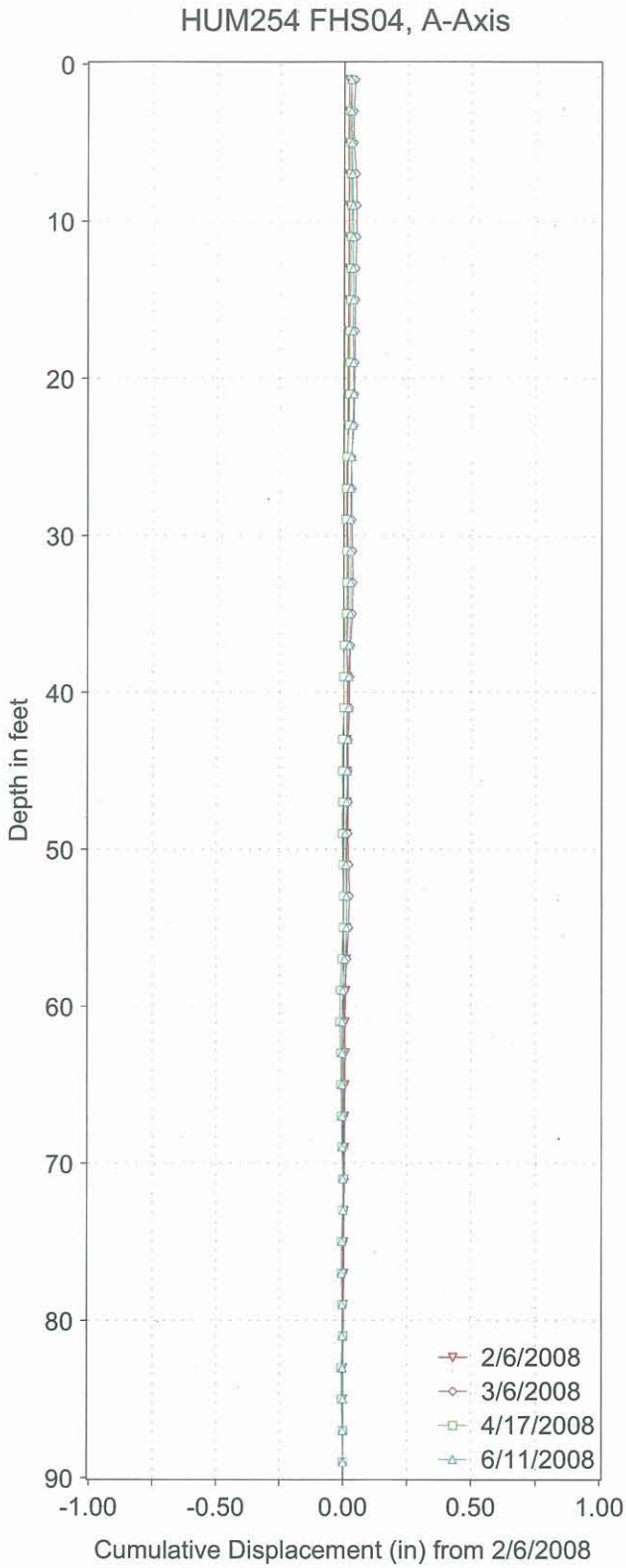


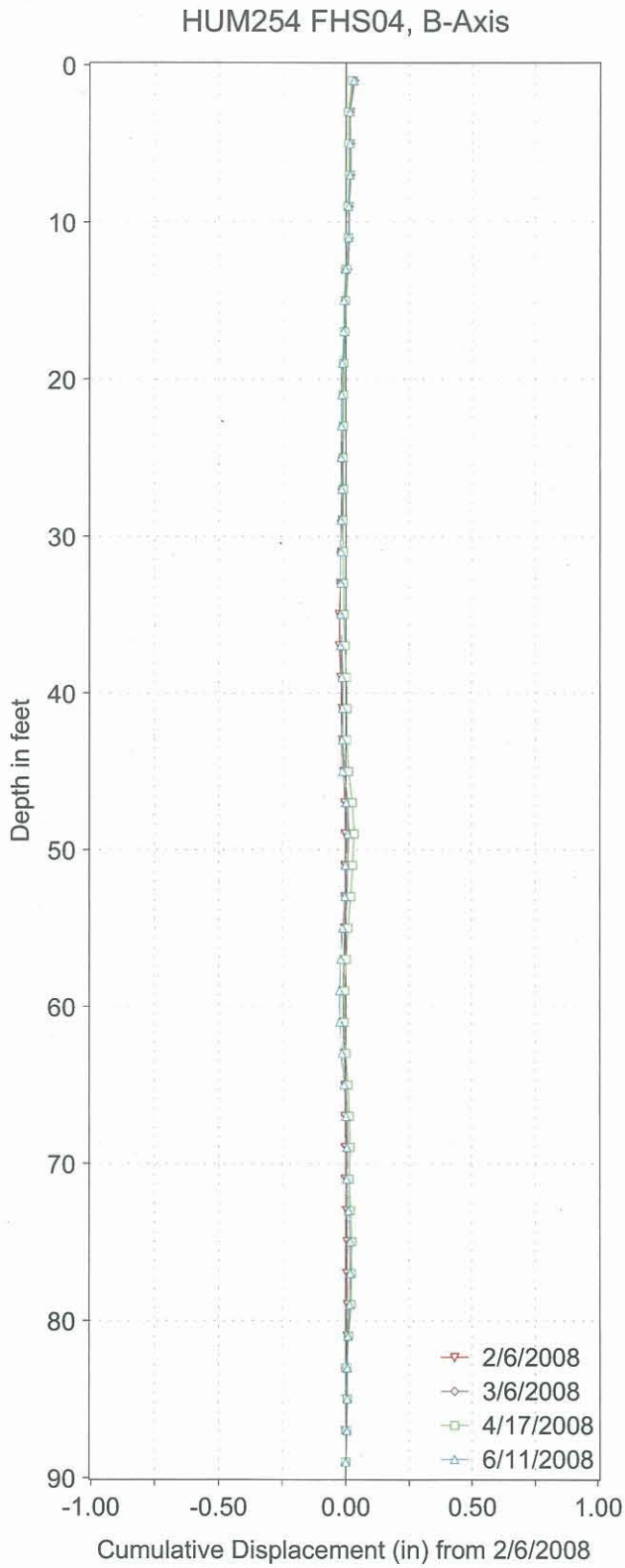


INCLINOMETER MONITORING RESULTS

01-HUM-254-PM 5.10/5.15
South Miranda Sink
E.A. No.: 01-475101

Depth of Inclinometer Casing: 46 feet
Ao Direction: N/A° (Magnetic North)
Location (WGS-84) : N/A





INCLINOMETER MONITORING RESULTS

01-HUM-254-PM 5.10/5.15
South Miranda Sink
E.A. No.: 01-475101

Depth of Inclinometer Casing: 89 feet
Ao Direction: N/A° (Magnetic North)
Location (WGS-84) : N/A

KLEINFELDER
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TECHNICAL MEMORANDUM

Geotechnical Engineering
Materials Testing & Inspection
Environmental Science & Engineering
Water Resources
Earthquake Engineering
Air Quality

Date: July 1, 2008

To: Charlie Narwold, Senior Engineering Geologist
State of California, Department of Transportation
Division of Engineering Services
Office of Geotechnical Design North
Branch B

From: Terry Craven, G.E.
William V. McCormick, C.E.G.

Kleinfelder Project: 85401/1

Subject: Preliminary Foundation Report (Revised)
Storm Damage Repair
HUM 254 PM 5.58
EA01-475101
Humboldt County, CA

---

1 PROJECT DESCRIPTION

During the winter of 2005/2006, a landslide occurred on the west (downhill) side of Highway 254, near milepost 5.58, south of Miranda, in Humboldt County, California. The location of the site is shown on Plate 1, Site Location. As shown on the Site Plan, Plate 2, the main landslide scarp is approximately 390 feet long and the landslide mass extends more than 300 feet downslope to the west (see Plate 3, Section A-A'). The landslide scarp is located within the highway pavement, crossing the southbound lane and extending into the northbound lane up to approximately 10 feet. No existing retaining structures are located within the limits of this project.

The purpose of this project is to provide geotechnical design parameters for a retaining structure to protect the road from landslide-related movement. Stabilization of the landslide as a whole is not part of this project and the main mass of the landslide may continue to move downslope of the proposed wall after the retaining structure is constructed.

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2240 Northpoint Parkway
Santa Rosa, CA 95407
Tel. 707-571-1883
Fax. 707-571-7813

2 GEOTECHNICAL SCOPE OF WORK

The scope of our work for this project included the following:

- Review of available geologic information addressing this area.
- Geologic mapping of the landslide and immediate vicinity.
- Drilling, logging, and sampling of four exploratory borings.
- Installation of one Slope Inclinometer casing.
- Laboratory testing of selected samples from the borings.
- Global stability analyses.
- Preparation of this summary report.

3 PERTINENT REPORTS AND INVESTIGATIONS

In preparation of this memorandum, the following documents/reports were reviewed:

United States Department of Transportation, Federal Highway Administration-California Division, Damage Assessment Form (DAF) – Title 23, Humboldt County, Highway 254, Post Mile 5.58, dated 1-09-06.

1983, Spittler, T.E., California Geological Survey [formerly the Division of Mines and Geology] Open File Report 83-25, Geology and Geomorphic Features Related to Landsliding, Miranda 7.5' Quadrangle, Humboldt County, California

2000, McLaughlin, R. J. et al., United States Geological Survey Miscellaneous Field Studies MF-2336, Version 1.0, Geology of the Cape Mendocino, Eureka, Garberville, and Southwestern part of the Hayfork 30X60 Minute Quadrangles and Adjacent Offshore Area, Northern California)

Caltrans Seismic Hazard Map and Report, Mualchin, 1996 with errata dated November 2004.

4 PROPOSED STRUCTURE DESCRIPTION

It is proposed to construct a retaining structure on the west side of the existing roadway to protect the road surface and supporting prism from landslide-related damage. As proposed, the retaining structure will be a soldier pile and lagging wall, which may be partially restrained

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by one or more rows of tiebacks. In accordance with Caltrans standard practice, the wall will be located approximately four feet outside of the fog line. Our recommendations for the lateral limits of the wall are illustrated on Plate 2.

5 SITE DESCRIPTION AND TOPOGRAPHY

At Post Mile 5.58, the two lane Highway 254 roadway is relatively flat, rising gently to the north. Slope gradients west (downslope) of the roadway range from approximately 1.4H:1V (Horizontal:Vertical) on the existing fill prism to as flat as 4H:1V further downslope within the landslide mass. The cut slopes bordering the east edge of the roadway were constructed at gradients ranging between approximately 0.8H and 1.3H:1V in the vicinity of the landslide feature. Gradients above the cut slope flatten slightly to approximately 1.8H:1V.

The landslide movement currently impacting the roadway is rotational/translational, with an estimated mass thickness of 50 feet or more. The arcuate headscarp of the landslide extends up to ten (10) feet east (upslope) of the roadway centerline. The location of the headscarp was largely obscured during our field exploration by recent roadway resurfacing. Localized tension cracking and pavement distress/settlement along the scarp location indicated on the 2007 topographic survey provided by Caltrans was visible, however.

A second landslide feature was identified east of the main landslide affecting Highway 254. The feature was characterized as an earthflow with an estimated thickness between 15 and 25 feet. The earthflow is classified as active since hummocky topography within the mass upslope suggests recent surficial activity. The east side of the roadway, however, appears unaffected by upslope movement indicating dormancy of the lower (deeper) portion of this earthflow. In addition, shallow, localized raveling of the cut slopes was noted directly above the main landslide feature. Exploration of the area upslope of Highway 254 was beyond the scope of this investigation.

Sheet flow from the cut slopes and the east lane roadway are collected within a v-ditch adjacent to the gravel shoulder and captured within a corrugated metal culvert which extends below the roadway and outfalls downslope to the west. Drainage from the southwest lane within the landslide currently flows down over the slope face of the fill prism. Due to recent grading, the fill prism slope face is denuded of any form of vegetation. The cut slopes are sparsely vegetated with a low to moderate growth of wild grasses. The areas west of the fill slope and east of the cut slope support a tall growth of wild grasses, blackberry vines, poison oak, and mature oak and fir trees.

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6 SUBSURFACE EXPLORATION AND LAB TESTING

SUBSURFACE INVESTIGATION

Four (4) test borings, designated R-07-001 through R-07-004, were advanced using rotary wash drilling methods. Drilling was performed on August 20, 2007 through August 30, 2007, by Caltrans Office of Drilling Services, Spectrum Exploration, and Woodward Drilling. All drilling and sampling operations were supervised by Kleinfelder staff. Test boring R-07-001 was advanced with a truck-mounted Mobile B-57 drill rig utilizing 114mm (HWT) and 96mm (HQ) casing, equipped with a tri-cone mill tooth bit and a #8 diamond impregnated core bit, respectively. Test boring R-07-002 was performed using a truck-mounted Mobile B-47 drill rig utilizing 102-mm diameter and 96-mm (HQ) casing equipped with a tungsten carbide Geo Barrel and #8 diamond impregnated core bit, respectively. Borings R-07-003 and R-07-004 were advanced with a track-mounted Boart Longyear Delta Base drill rig utilizing 114mm (HWT) and 96mm (HQ) casing, equipped with a tri-cone mill tooth bit and a #8 diamond impregnated core bit, respectively.

Borings R-07-001 through R-07-003 were advanced from the Highway 254 gravel shoulder adjacent to the south bound traffic lane to depths of approximately 71.5 to 76.5 feet. Boring R-07-004 was advanced from the gravel shoulder adjacent to the north bound lane of 254 to approximately 76.0 feet below the ground surface. The approximate locations of the borings are shown on Plate 2.

Samples of the soil and bedrock were obtained by coring, using equipment as described above, and using 2-inch (inside diameter) Modified California and 1.4-inch (inside diameter) Standard Penetration Test samplers driven with an automatic 140-pound hammer dropped 30 inches. The blows required to drive the Modified California and Standard Penetration Test samplers were recorded for each 6 inches of penetration or fraction thereof. Visual classifications were made in accordance with the attached Boring Record Legend. The results of the exploration are summarized on the attached Boring Records.

As part of this work, one slope inclinometer casing was installed to approximately 75 feet below the ground surface within the bore hole for Boring R-07-002. The casing was perforated for its full length except for the upper 10 feet to permit possible monitoring of future water levels within the casing. The annular space around the perforated portion of the casing was backfilled with sand and the upper approximately 7 feet was grouted. The inclinometer was completed at the surface with a traffic-rated access box. No inclinometer readings or water level measurements were obtained at the time of installation. Inclinometer readings were obtained by Caltrans on February 6, March 6, April 17, and June 11, 2008. Inclinometer monitoring results are presented in Appendix C.

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LABORATORY TESTING

Laboratory testing of selected soil samples obtained from the test borings was performed at Kleinfelder's Geotechnical Laboratory in Santa Rosa, California. The purpose of the testing was to verify the field visual classifications and obtain information for subsequent engineering evaluations. Tests performed included:

Natural moisture content (ASTM D2216) and unit weight (ASTM D2937).

Mechanical analyses (ASTM D422).

Atterberg Limits tests (ASTM D4318)

Unconsolidated, undrained, triaxial strength test (ASTM D2850).

The results of the geotechnical laboratory testing are provided in the attached Lab Test Summary.

Corrosivity tests were performed by an independent testing laboratory (AP Engineering & Testing, Inc. in Pomona, California) in accordance with Caltrans Test Methods 532 – pH, 643 – resistivity, 417 – sulfate content, and 422 – chloride content.

A summary of laboratory test results is attached in Appendix B.

7 SITE GEOLOGY AND SUBSURFACE CONDITIONS

REGIONAL GEOLOGY

The site is located on the eastern edge of the Eel River Drainage within the northern Coast Ranges Geomorphic Province, a dynamic region of California characterized by complex folding and faulting. The province is generally characterized by northwest-trending mountain ranges and intervening valleys that are a reflection of the dominant northwest structural trend of the bedrock in the region. The basement rock in the region is presumed to consist of the Franciscan Complex, a diverse group of igneous, sedimentary, and metamorphic rocks. The Franciscan Complex is part of a northwest trending belt of material immediately adjacent to the eastern edge of the San Andreas fault system, which is located approximately 18 miles southwest of the site. The site is located approximately 28.5 miles east of the Mendocino Triple Junction where the Gorda, North American, and the Pacific plates meet. Regional Geology is shown on Plate 4.

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SITE GEOLOGY

Site geology, as mapped by Kleinfelder for this investigation, is shown on Plate 2. The geology of the site and vicinity has been mapped by McLaughlin et al. (2000, United States Geological Survey Miscellaneous Field Studies MF-2336, Geology of the Cape Mendocino, Eureka, Garberville, and Southwestern part of the Hayfork 30 X 60 Minute Quadrangles and Adjacent Offshore Area, Northern California). McLaughlin et al. (2000) indicate the project site is underlain by the Jurassic-Cretaceous age Broken Formation of the Central Belt Franciscan Complex bedrock, which typically consists of conglomeratic meta-sandstone and meta-argillite. The areas north of the site and west/southwest of the Eel River are mapped as being underlain by Yager Terrane bedrock of the Coastal Belt Franciscan complex. This Eocene to Paleocene age bedrock is comprised of sheared and highly folded mudstone with minor sandstone and conglomerate interbeds. A bedrock thrust fault, located approximately 300 feet southwest of the proposed retaining wall at its closest point, separates the two Franciscan Complex units in the site vicinity. Bedrock faults are common features within the Franciscan Complex and likely occurred during the formation of the geologic units. The features are not considered to be active. The Eel River bed located southwest (downslope) of the site is shown to be underlain by Quaternary age alluvial deposits consisting of clay, silt, sand, and gravel.

The site has also been mapped by Spittler (1983, California Geological Survey [formerly the Division of Mines and Geology] Open File Report 83-25, Geology and Geomorphic Features Related to Landsliding, Miranda 7.5' Quadrangle, Humboldt County, California). Spittler (1983) indicates the site and surrounding vicinity is underlain by Tertiary to Cretaceous age Yager Formation, with the Eel River bed underlain by Quaternary age stream channel deposits. In addition, Spittler (1983) identifies an area of "disturbed ground" located in the upper elevations east/northeast of the site.

Neither publication identified any landslide features at the site or within the site vicinity.

SUBSURFACE CONDITIONS

The following table summarizes the drilling program performed for this investigation.

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Table 1: Boring Summary

I.D.	Approx. Station	Location (1)	Depth of Boring (ft)	Surface Elev. (ft)	Date Completed	Depth to In-Place(2) Bedrock (ft)
R-07-001	102+21	20 feet left	71.5	363	8-20-07	19.5
R-07-002	103+13	15 feet left	75.0	366	8-30-07	45.0
R-07-003	103+81	22 feet left	76.5	366	8-21-07	35.0
R-07-004	103+17	22 feet right	76.0	369	8-23-07	25.0

(1) Approximate distance from highway centerline, facing in direction of increasing stationing.

(2) Landsliding has occurred within the bedrock formation. This column designates the depth to the top of in-place bedrock, below the identified landslide material.

Borings R-07-001 and R-07-003 drilled for this investigation encountered multiple layers of fill consisting of gravelly lean clay and sand with gravel (with asphalt fragments at R-07-003) to depths of 14 to 17 feet. Boring R-07-002 encountered asphaltic concrete with layers of sandy clayey gravel to a depth of 20 feet, indicative of past efforts to maintain the roadway grade during on-going movement of the slide zone within the paved area. Below the asphalt, Boring R-07-002 encountered layers of fill consisting of gravel and clayey sand with gravel, with occasional thin asphalt layers, to a depth of 31 feet. Below the asphalt and fill layers, Borings R-07-001 to R-07-003 encountered landslide debris consisting of clayey sand with gravel, clayey gravel with sand, and sandy lean clay with gravel to depths of 19.5 to 45 feet, underlain by moderately weathered, very soft to soft, meta-shale to the termination depths of 71.5 to 76.5 feet.

Boring R-07-004, drilled in the shoulder on the east side of the pavement, encountered a 2.5-foot layer of sandy clay fill overlying dormant landslide deposits of sandy to gravelly clay and meta-shale to a depth of approximately 25 feet. Below this depth the boring encountered in-place bedrock, consisting of very soft meta-shale, to the termination depth of 76.0 feet.

Triaxial (unconsolidated, undrained "TXUU") tests were performed on four samples of the landslide debris to aid in the evaluation of subsurface conditions. The range of shear strength was between 439 and 4621 pounds per square foot (psf) and averaged 2154 psf. A single triaxial test (TXUU) on a fill sample indicated a shear strength of 3968 psf and a single triaxial test (TXUU) performed on a sample of the meta-shale bedrock indicated a shear strength of 697 psf (the low value for this sample is probably attributable to sample disturbance due to the intensely fractured nature of the rock).

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8 GROUNDWATER

Due to the use of drilling fluid, it was not possible to record groundwater depths at the time of drilling. Moisture/density tests' results indicate that most samples below a depth of approximately 10 feet were saturated or nearly saturated. A piezometer (perforated SI casing) was installed in Boring R-07-002 to allow future groundwater monitoring. Results of groundwater monitoring to date are tabulated below. For design purposes we recommend that groundwater be assumed to rise to within 15 feet of the top of the wall, unless it is artificially lowered by wall drainage measures.

WATER LEVEL MONITORING (R-07-002)	
Date	Depth from top of casing to water level (feet)
1/16/2008	18.3
1/29/2008	NMW
2/6/2008	NMW
3/6/2008	21.4
4/17/2008	23
6/11/2008	25.8

*NMW water level not measured.

9 CORROSION POTENTIAL

Chemical analyses were performed on two (2) samples collected from the borings to evaluate corrosion potential of the on-site soils. Testing was performed by AP Engineering & Testing, Inc. in Pomona, California. The results of the corrosion tests are attached in Appendix B.

Based on the Caltrans Corrosion Guidelines (2003 version 1.0), a site is considered corrosive if one or more of the following conditions exist for the representative soil and/or water samples taken at the site: Chloride concentration is 500 ppm (0.05%) or greater, sulfate concentration is 2000 ppm (0.2%) or greater, or the pH is 5.5 or less. Based on these Guidelines and the laboratory test results, the site may be considered non-corrosive to steel and concrete.

10 EARTHQUAKE FAULTS AND SEISMICITY

According to the Caltrans Seismic Hazard Map and Report (CSHM, Mualchin, 1996 with errata dated November 2004), the nearest fault is the Russ fault, which is located approximately 6.5 miles north of the site. The Russ fault is a fault of unknown mechanism (style) capable of generating earthquakes with a maximum credible earthquake (MCE) magnitude of 7.50. The

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Caltrans Seismic Hazard Map and Report (1996), locates the site between the 0.4g and 0.5g Peak Bedrock Acceleration (PBA) contours associated with the Russ fault. We recommend a PBA value of 0.5g and corresponding Peak Ground Acceleration (PGA) of 0.5g for the analysis and design of the proposed Highway 254 retaining wall. The PGA is estimated based on site soil class C. The fault and PBA map is shown on Plate 5.

The site does not lie within an Alquist-Priolo Special Studies Zone (CDMG, 1997). No active faults are mapped crossing the project site nor do any faults project towards the site. The bedrock fault contact identified by McLaughlin et al. (2000), located approximately 300 feet southwest of the proposed retaining wall, is a common feature within the Franciscan Complex and likely occurred during the formation of the geologic units. The features are not considered to be active. As such, the possibility of primary surface rupture or deformation at the site is considered low.

11 GEOTECHNICAL AND FOUNDATION RECOMMENDATIONS

WALL LOCATION & DEPTH

Based on the field and laboratory data, it is our opinion that, without remediation, the material designated as active landslide deposits will continue to move downslope. We recommend that a wall be designed to retain the landslide deposits that are located beneath the roadway prism. The proposed wall location is shown on Plate 2. In accordance with Caltrans standard practice, the wall is located approximately four feet outside of the highway fog line. Both ends of the proposed wall terminate approximately 10 feet outside the limits of the active landslide (as presently mapped), for a total length of approximately 235 feet.

The landslide appears to be up to 50 feet or more in depth, with the bottom of the landslide occurring within the bedrock formation. Over time it is probable that the existing landslide deposits will continue to translate downslope and we recommend that the wall be designed to retain all soil and rock that is located above the in-place bedrock surface. Plate 6 illustrates the approximate elevation of in-place bedrock along the length of the wall.

We point out that a dormant landslide (earth flow) is present immediately upslope of the existing roadway. In addition, a portion of this landslide farther upslope is considered to be active. The subsurface exploration did not explore the limits of this dormant landslide. If this earth flow should become reactivated in the future, it could overload and damage a portion of the proposed retaining wall.

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SOIL AND ROCK PARAMETERS

Based on the results of our subsurface investigation and laboratory testing, subsurface materials within the retained height of the proposed retaining wall (approximately 50 feet) consist of fill and landslide deposits overlying intensely fractured and moderately weathered bedrock mainly comprised of meta-shale. A cross section along the length of the proposed wall depicting our interpretation of the subsurface geologic conditions is presented on Plate 6. Based on our review of available data, we recommend that the following parameters be used for retaining wall design. These values represent our best estimate of actual soil properties and **do not contain a factor of safety**. Appropriate factors of safety must be applied during wall design. A surcharge pressure of 270 psf should be applied to the roadway surface behind the wall in accordance with Caltrans standard procedures.

Table 2: Soil/Rock Parameters for Retaining Wall Design

Type	Approximate Depth to Bottom of Layer, at Retaining Wall Location (ft)[1]	Total Unit Weight (pcf)	Angle of Internal Friction, ϕ (degrees)	Cohesion, c (psf)	K_a	K_p
Fill (Qaf)	11 to 31	135	19[2]	0[2]	0.51[4]	0[5]
Active Landslide Deposits (1113) & Colluvium	17 to 45	135	19[2]	0[2]	0.51[4]	0[5]
Fractured Bedrock (KJfcb1)	NA	143	35[3]	0[3]	0.27[4]	3.7[4]

[1] See Plate 6 for anticipated thickness along wall.

[2] Back-checked by assuming existing landslide has a factor of safety of ~1.0.

[3] Bedrock was too highly fractured to perform triaxial testing. Strength was estimated based on correlations with field blowcounts and material type, as well as observations of existing bedrock slopes.

[4] Coulomb method of analysis with $\delta = 0$. The effective width to which the pressure is applied should be in accordance with Caltrans Bridge Design Specifications, Chapter 5.

[5] Slope stability analyses indicate that materials overlying bedrock (downslope from the wall) possess a factor of safety against sliding that is less than 1.3; hence, we recommend that no passive resistance be assumed from these materials.

We understand that seismic wall loads will not be used in design since this is not a "critical" structure.

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Tieback Anchors

Due to differences in strain compatibility between soil and bedrock, we recommend that tiebacks derive their support solely from the in-place bedrock formation. The tieback unbonded length will depend on the tieback inclination, elevation, and the overall wall height.

In general, the no-load zone should be determined by the longest of the following values:

1) The distance from the back of the wall to a point that is 5 feet beyond the critical failure surface (in this case the critical failure surface is the surface of the bedrock formation).
2) The distance from the back of the wall to a point that is a distance of H/5 (H = wall height) beyond the critical failure surface.
3) 15 feet beyond the back of the wall.

The location of the unbonded zone for Section A-A' is shown on Plate 7. This section is approximately a worst case condition. For tiebacks that are located 8 feet from the top of the wall and are inclined at 20^0, the unbonded zone may be taken as 50 feet. For tiebacks that are located at other depths or inclinations, the unbonded zone should be estimated from Plate 7, with a minimum length of 15 feet behind the wall.

Soldier Piles

Soldier piles should gain their vertical resistance from friction in the in-place bedrock. Because of the fractured nature of the rock and the difficulty in removing slough from drilled holes, end bearing resistance should be neglected. Bedrock quality varies widely. We recommend that soldier piles be designed for a skin friction in bedrock of 1000 psf. This value is intended for use in a working stress analysis and contains a factor of safety of approximately 2.0.

We recommend that all soldier piling have a minimum embedment of 5 feet into in-place bedrock, deeper penetrations may be required to satisfy wall vertical or lateral loading conditions. As discussed in Section 12 of this memorandum, an embedment of 5 feet is expected to be adequate to force a landslide failure below the existing failure plane and into in-place bedrock.

The depth to in-place bedrock will be variable. The three borings closest to the wall encountered in-place bedrock at depths of 19.5 to 45.0 feet with the greatest depth near the center of the slide zone in the vicinity of Boring R-07-002. A sketch of estimated in-place bedrock depth along the length of the wall is provided on Plate 6.

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Lagging

The purpose of the proposed wall is to protect the road from landslide related movements, not to stabilize the active landslide mass below the wall. As discussed in Section 12, and as shown on Plate 12, even if the upper 20 feet of soil is excavated below the wall (maximum allowable excavation based on right-of-way and environmental constraints), the slope factor of safety is increased to only 1.2. A minimum factor of safety of 1.3 is required by the Caltrans Design Specifications. To obtain a factor of safety of 1.3 for the slope below the wall, it would be necessary to excavate to a depth of approximately 30 feet (see Plate 13).

Based on the above considerations, it should be assumed that the landslide mass below the wall will continue to move and will eventually pull away from the downhill side of the wall. This could result in the loss of material between the piling. To protect against loss of material, lateral earth support should be provided extending down to the in-place bedrock surface (for the approximate depth of in-place bedrock refer to Plate 6). If support is provided by lagging, this would require temporary excavation to a depth of up to approximately 50 feet below existing grade, which is probably not practical within the project budget. If soldier pilings are spaced at three pile diameters or closer (center to center), soil arching should occur between the pilings to limit the internal loss of soil without the use of lagging (lagging should still be installed to at least five feet below the lowest tieback level). However, over time or in the presence of groundwater, loss of soil could still be significant between piling and future maintenance may be necessary.

Wall Backfill

If required, backfill material behind the wall should be Class 1, Type B Permeable Material (Caltrans Standard Specifications 68-1.025). To prevent internal soil erosion, we recommend that a filter fabric (Caltrans Standard Specification 88-1.03) be placed between the Permeable fill and native soil. To prevent the accumulation of hydrostatic pressures behind the wall, we recommend that HDPE shims be installed between the lagging members.

To reduce backfill pressures, we recommend that any backfill placed within five feet of the wall (measured horizontally) be compacted with lightweight, hand-operated compaction equipment. Over-compaction of this fill can greatly increase wall pressures and/or deflections.

12 SLOPE STABILITY REVIEW

Kleinfelder performed slope stability analyses for the project using "Slide" version 5.03 by Rocscience. Plates 8 and 9 present the results of analyses of the existing (active) landslide. These analyses were performed to back calculate the residual soil strength. Plate 8 presents the results of a standard circular failure surface analysis; Plate 9 presents the results of an analysis along the identified failure surface. For these analyses we used the geometry of

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cross section A-A' (Plate 3). The internal angle of soil friction that produced a factor of safety equal to one was approximately 19^0, which was used in our subsequent analyses.

We then added the proposed retaining wall to this section and ran the model again. The wall was modeled as a rigid block so that the analysis was independent of the type of wall to be constructed. A 270 psf surcharge pressure was applied to the roadway area above the wall. The result of this analysis is summarized on Plate 10. The wall was modeled as a series of rigid piling with sufficient shear strength to force the landslide below the tips of the piling. Based on this analysis, with the wall socketed a minimum of 5 feet into bedrock, the calculated factor of safety against global stability was in the range of 1.6 (a minimum of 1.3 is required).

We next checked wall design pressures by modeling a 47 foot wall (fully drained) with a triangular load applied to the face of the wall, see Plate 11. The force necessary to provide a factor of safety of 1.3 was calculated to be equivalent to that exerted by a fluid with a unit weight of 87 pcf, or a total load of 100,000 pounds per lineal foot of wall. This calculated force is approximately 7% less than the design load calculated using the coefficients in Table 2 (including the roadway surcharge and a factor of safety of 1.3); thus, we recommend designing the wall in accordance with the parameters in Table 2.

Finally, we checked the slope stability of material below the wall to see if removal of 20 feet of soil would improve stability of the material below the wall. Twenty feet is the maximum allowed excavation depth due to right-of-way and environmental limitations. A result of this analysis is shown on Plate 12. Removal of this material increased the slope stability factor of safety to 1.2, which is still below the Caltrans standard of 1.3. As shown on Plate 13, it would be necessary to excavate to approximately 30 feet to obtain a factor of safety of 1.3 below the wall. We understand that this depth of excavation is not permissible within right-of-way and environmental constraints.

13 CONSTRUCTION CONSIDERATIONS

- Materials to be excavated will consist of fill, slide debris, and fractured/weathered rock. Groundwater may be encountered at shallow depth. Caving conditions will likely be encountered during drilling for the piles and tiebacks due to the granular nature of portions of the fill and landslide debris, and the intensely fractured and weathered nature of the rock. Temporary casing, drilling under slurry, or placement of slurry cement backfill or concrete and redrilling may be required to control caving and should be performed in conformance with the provisions in Section 49-4.03 "Drilled Holes," of the Standard Specifications.

- Groundwater will likely be encountered in the pile and tieback holes. Pile and tieback installations may require dewatering or the placement of concrete and grout under water. If water is present and the holes are not dewatered, displacement of the water

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by means of a closed system using a concrete pump or tremie tube to place concrete and grout at the bottom of the holes will be required in conformance with the provisions in Section 51-1.10 "Concrete Deposited Under Water," of the Standard Specifications.

- Vertical cut sections should not be deeper than five feet without shoring or sloping in accordance with CAL/OSHA Standards.

- Sufficient and timely observation during construction should be performed to correlate findings of the investigation with actual subsurface conditions exposed during construction.

- The contractor should research utility locations and take necessary precautions to protect-in-place or relocate utilities as applicable, prior to excavation.

- Ponding of water adjacent to the structure should be avoided. During and after construction, positive drainage should be provided to direct surface water away from landslides and retaining structures. In particular, it is extremely important to collect the drainage from the west side of the road that currently flows over the face of the active landslide. Surface drainage should be collected into pipelines that are routed to suitable disposal areas away from the landslide.

14 CLOSURE

A Final Foundation Report can be provided once we receive the preliminary wall design. If you have any questions, please contact us at 707.571.1883

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15 ATTACHMENTS

Plate 1 Site Location
Plate 2 Site Plan
Plate 3 Section A-A'
Plate 4 Regional Geology
Plate 5 California Seismic Hazard Map
Plate 6 Approximate Bedrock Profile Along Proposed Retaining Wall
Plate 7 Tieback Unbonded Zone
Plate 8 Slope Stability: Back-Calculation
Plate 9 Slope Stability: Back-Calculation
Plate 10 Slope Stability: Wall
Plate 11 Slope Stability: Lateral Pressure
Plate 12 Slope Stability: Downslope
Plate 13 Slope Stability: Downslope

Appendix A
Log of Test Borings (LOTBs, 6 pages)
Boring Record Legend (3 pages)
Boring Records R-07-001 through R-07-004 (12 pages)

Appendix B
Laboratory Test Summary
Laboratory Test Data Plates B-1 through B-3
Corrosion Test Results (AP Engineering and Testing, Inc.)

Appendix C
Slope Inclinometer Monitoring Results

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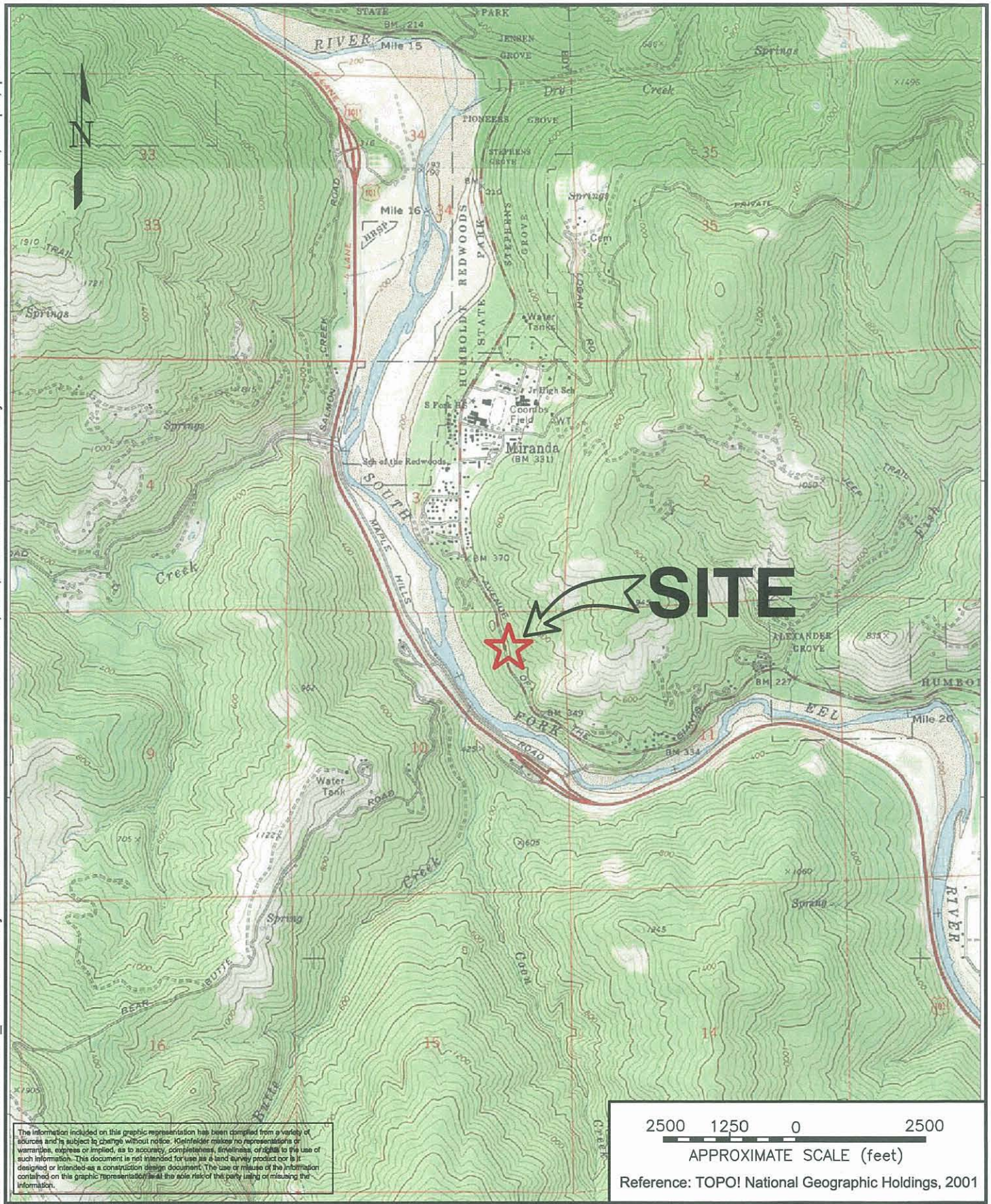
PLATES



Reference: TOPO! National Geographic Holdings, 2001

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ATTACHED IMAGES: Images: Hum254pm5-80-loc.jpg
ATTACHED XREFS:
PLEASANTON, CA
CAD FILE: U:\GEOTECH_PROJECTS\Projects\Active\85401 Caltrans HWY 254 PM 5.10, 5.58, 5.8\CAD\ LAYOUT: Layout1 PLOTTED: 17 Jun 2008, 3:01pm, phubbard

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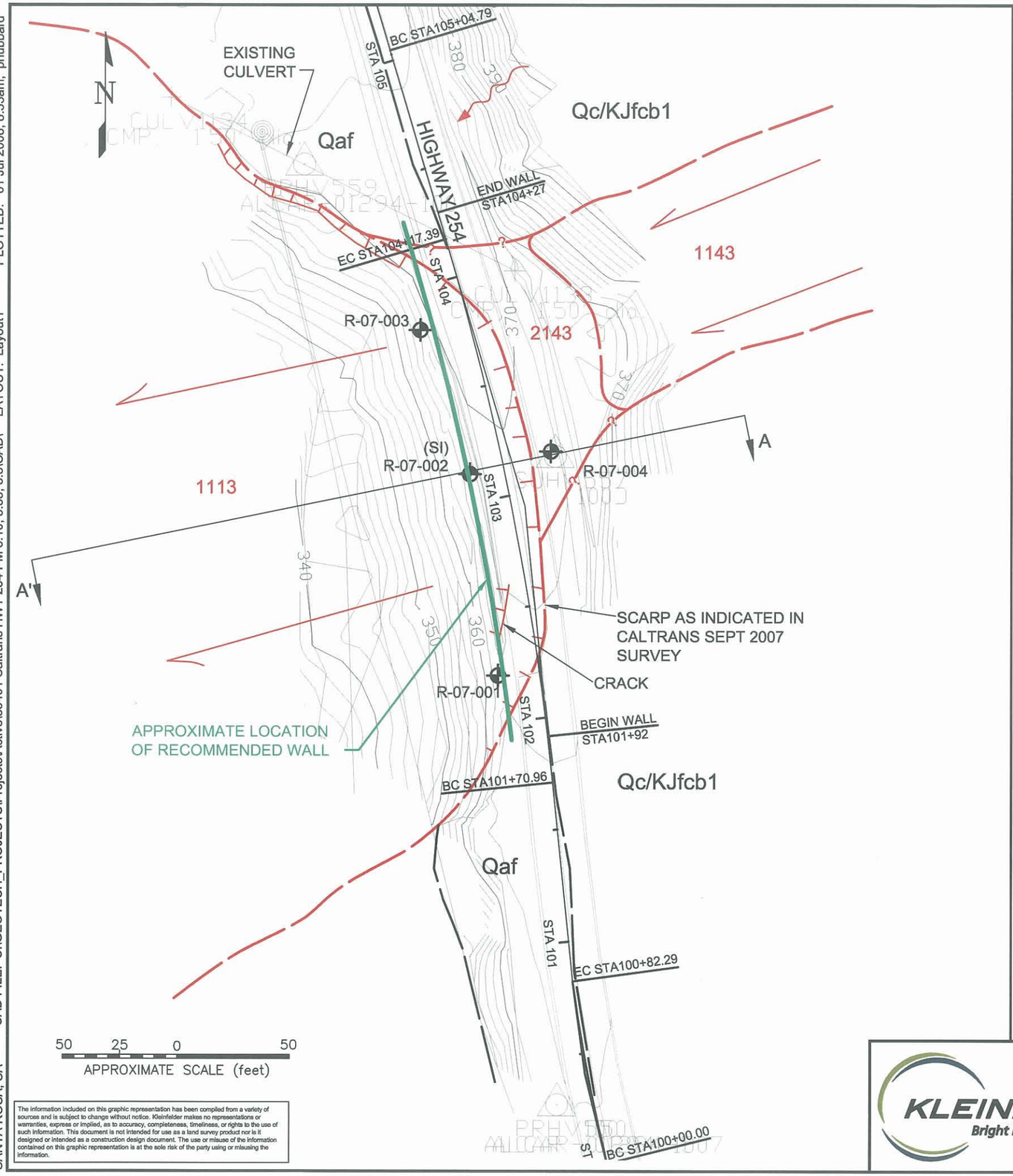
PROJECT NO.	85401-1
DRAWN:	JUNE 2008
DRAWN BY:	PH
CHECKED BY:	JR
FILE NAME:	Hum254pm5-58-5.dwg

SITE LOCATION

STORM DAMAGE LOCATION
EA: 01-475101
HIGHWAY 254 P.M. 5.58
HUMBOLDT COUNTY, CALIFORNIA

PLATE
1



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EXPLANATION

Qaf	Artificial Fill
Qc/KJfcb1	Colluvium over/Franciscan Complex: Broken Formation
1113	Landslide: Hatchures Indicate Scarp Area; Arrows Indicate Direction of Movement
1113	Landslide Identification Number (see landslide chart)
	Soil Creep/Ravelling
	Geologic Contact (dashed where approximate)
	Landslide Contact (dashed where approximate)
R-07-004	Boring Location
(SI)	Slope Inclinometer
A' A	Section Location

LANDSLIDE IDENTIFICATION CHART

STATE OF ACTIVITY

1=Active or Recently Active
(areas of unstable ground with relatively recent/"fresh" geomorphic features such as ground cracks, hummocky topography, exposed soils, abrupt gradient breaks and/or disrupted vegetation, typically recent to 50 years old)

2=Dormant
(areas of quasi-stable ground, with eroded and subdued geomorphic features, no exposed soils, somewhat re-vegetated but typically with different type or density, typically >50 to several hundreds of years old)

3=Ancient
(areas of relatively stable ground, typically characterized by large, broad and deep landslides with highly eroded and subdued geomorphic features, re-vegetated with similar type and density, typically several hundreds to several thousands of years old)

CERTAINTY OF IDENTIFICATION

1=Definite
2=Probable
3=Questionable

DOMINANT TYPE OF MOVEMENT

1=Slump Flow Complex
2=Debris Slide
3=Debris Flow
4=Earth Flow
5=Slump
6=Translational

THICKNESS OF DEPOSIT

1=Less Than 5 Feet
2=5 to 15 Feet
3=15 to 50 Feet
4=Greater Than 50 Feet

1 2 3 4

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FILE NAME:	Hum254pm5-58-2.dwg

SITE PLAN

STORM DAMAGE LOCATION
EA: 01-475101
HIGHWAY 254 P.M. 5.58
HUMBOLDT COUNTY, CALIFORNIA

PLATE **2**

ATTACHED IMAGES: Images: DC_2503036.jpg
ATTACHED XREFS: XRef: Hum254pm5-58-Backgrnd; XRef: Hum254pm5-58-Station
SANTA ROSA, CA CAD FILE: U:\GEOTECH_PROJECTS\Projects\Active\85401 Caltrans HWY 254 PM 5.10, 5.58, 5.8\CAD\ LAYOUT: Layout1 PLOTTED: 01 Jul 2008, 8:33am, phubbard

PLOTTED: 30 Jun 2008, 1:34pm, phubbard
LAYOUT: Layout1
CAD FILE: U:\GEOTECH_PROJECTS\Projects\Active\85401 Caltrans HWY 254 PM 5.10, 5.58, 5.8\CAD\
Images: DC_2504860.jpg
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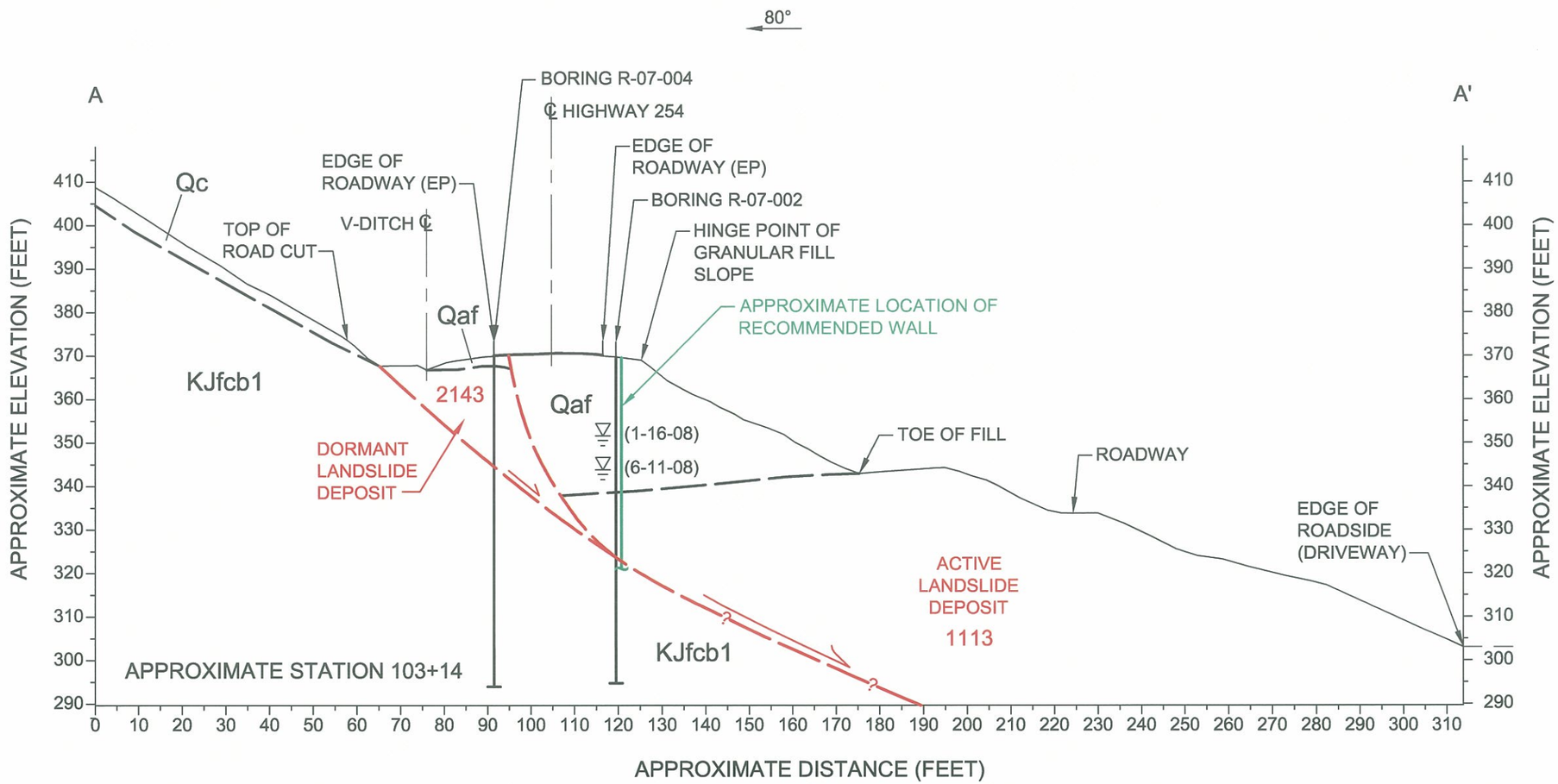
SANTA ROSA, CA



EXPLANATION

Qaf	Artificial Fill	(date)	Caltrans Measured Water Level
Qc	Colluvium		Geologic Contact (dashed where approximate)
KJfcb1	Franciscan Complex: Broken Formation		Landslide Contact (dashed where approximate)
1143	Landslide Identification Number (see landslide chart plate 2)		

NOTE:
SECTION A-A' WAS HAND LEVEL FIELD SURVEYED IN AUGUST 2007 AND MAY DIFFER FROM THE TOPOGRAPHY AND MAPPING AS SHOWN ON THE SITE PLAN, PLATE 2.

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30 15 0 30
APPROXIMATE SCALE (feet)

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CHECKED BY:	JR
FILE NAME:	Hum254pm5-58-1.dwg

SECTION A - A'

STORM DAMAGE LOCATION
EA: 01-475101
HIGHWAY 254 P.M. 5.58
HUMBOLDT COUNTY, CALIFORNIA

PLATE
3

ATTACHED IMAGES: Images: Geology_Explan.jpg Images: Hum254pm5-80-Geology.jpg
ATTACHED XREFS:
SANTA ROSA, CA CAD FILE: U:\GEOTECH_PROJECTS\Projects\Active\85401 Caltrans HWY 254 PM 5.10, 5.58, 5.8\CAD\ LAYOUT: Layout1 PLOTTED: 17 Jun 2008, 3:22pm, phubbard

EXPLANATION

MAP SYMBOLS

Contact-Dashed where approximate, dotted where concealed, queried where uncertain

Fault-Dashed where approximate, dotted where concealed, queried where uncertain

Thrust fault-Barbs on upper plate, dashed where approximate, dotted where concealed, queried where uncertain

Trace of the San Andreas fault associated with 1906 earthquake rupture-Dashed where approximate, queried where uncertain

Strike and dip of bedding:

Inclined-Ball denotes top of beds is known from sedimentary features

Vertical-Ball denotes top of beds is known from sedimentary features

Horizontal

Overturned-Ball denotes that top of beds is known from sedimentary features

Approximate-Based on photo interpretation or estimated dip in field

Joint-Strike and dip of joint

Strike and dip of cleavage-Ball denotes that top of flow is known from sedimentary or volcanic features

Shear foliation:

Inclined

Vertical

Folds:

Synclinal or synformal axis-showing direction of plunge

Anticlinal or antiformal axis-showing direction of plunge

Overturned syncline

Landslide-Arrows indicate direction of movement

Melange Blocks:

Serpentinite

Chert

Blueschist

Greenstone

Fossil locality and number

Qal — **Alluvial deposits (Holocene and late Pleistocene?)**-Clay, silt, sand, gravel, and boulders, deposited in stream beds, alluvial fans, terraces, flood plains and ponds; and soils formed on these deposits. Includes largely Holocene deposits in modern stream channels and on flood plains

Qt — **Undifferentiated nonmarine terrace deposits (Holocene and Pleistocene)**-Dissected and (or) uplifted gravel, sand, silt, and clay, deposited in fluvial settings. In western Eureka quadrangle (Sheet 1) unit includes minor shallow marine intertongues and warped and tilted beds of late Pleistocene Hookton and Rohnerville Formations of Ogle (1953), in addition to younger late Pleistocene and Holocene fluvial terrace units a few feet to a few tens of feet higher than normal modern high-water level

y1 — **Sheared and highly folded mudstone**-Includes minor rhythmically interbedded sandstone, locally with lenses of conglomerate. Exhibits irregular topography lacking a well-incised system of sidehill drainages

cm1 — **Melange**-Predominantly penetratively sheared, locally tuffaceous, scaly meta-argillite and less abundant blocks of metasandstone. Exhibits rounded, poorly incised, lumpy and irregular topography

cb1 — **Broken formation**-Consists of bedded to massive, locally folded, rarely conglomeratic metasandstone and meta-argillite, with only minor amounts of highly sheared rocks. Exhibits sharp-crested topography with regular, well-incised sidehill drainages

cwr — **White Rock metasandstone of Jayko and others (1989) (Paleogene and (or) Late Cretaceous)**-Arkosic metasandstone and minor meta-argillite, thick bedded to massive, shattered and sheared; commonly extensively veined with laumontite and calcite; metasandstone has 1 to 25 percent detrital K-feldspar and prominent detrital biotite. Unit occurs as slabs and blocks up to several kilometers long, mostly along west side of the Central belt. Unit is named for similar metasandstone described in the Covelo 1:100,000 quadrangle (Jayko and others, 1989) that contains dinoflagellates of late Cretaceous age. Some blocks of the White Rock metasandstone possibly have been tectonically incorporated into the Central belt from the structurally underlying Coastal belt, and thus could be Paleocene or Eocene in age. A carbonate concretion from melange adjacent to the White Rock metasandstone along the western side of the Central belt in the Covelo quadrangle was found to contain Paleocene dinoflagellates (A. Jayko, oral commun., 1993)

dpb — **Basaltic flows and keratophyric tuff (Jurassic?)**-Uralitic and intruded locally by mylonitic quartz keratophyre dike rocks, present locally along west boundary of Central belt of Franciscan Complex near Benbow (Sheet 3) **Diabase (Jurassic?)**-Dikes and sills, fine to coarse grained, with ophitic texture, present below basalt flows near Benbow and forms Bear Buttes north of Garberville (Sheet 3). Lower part of diabase unit of Bear Buttes locally includes minor cumulate gabbro. Lower diabase contact considered to be an attenuation fault

dpsp — **Serpentinite melange (Jurassic?)**-Partially to completely serpentinized ultramafic rocks (harzburgite, dunite), locally highly sheared, and includes minor masses of cumulate gabbro, diabase or basalt. Present beneath diabase and (or) basalt of the Benbow and Bear Buttes areas (Sheet 3). Contact with overlying ophiolitic rocks probably is an attenuation fault. Unit is partially equivalent to some serpentinite interspersed with and assigned to Central belt of Franciscan Complex

5000 2500 0 5000
APPROXIMATE SCALE (feet)

Reference: R. J. Mclaughlin et al., 2000

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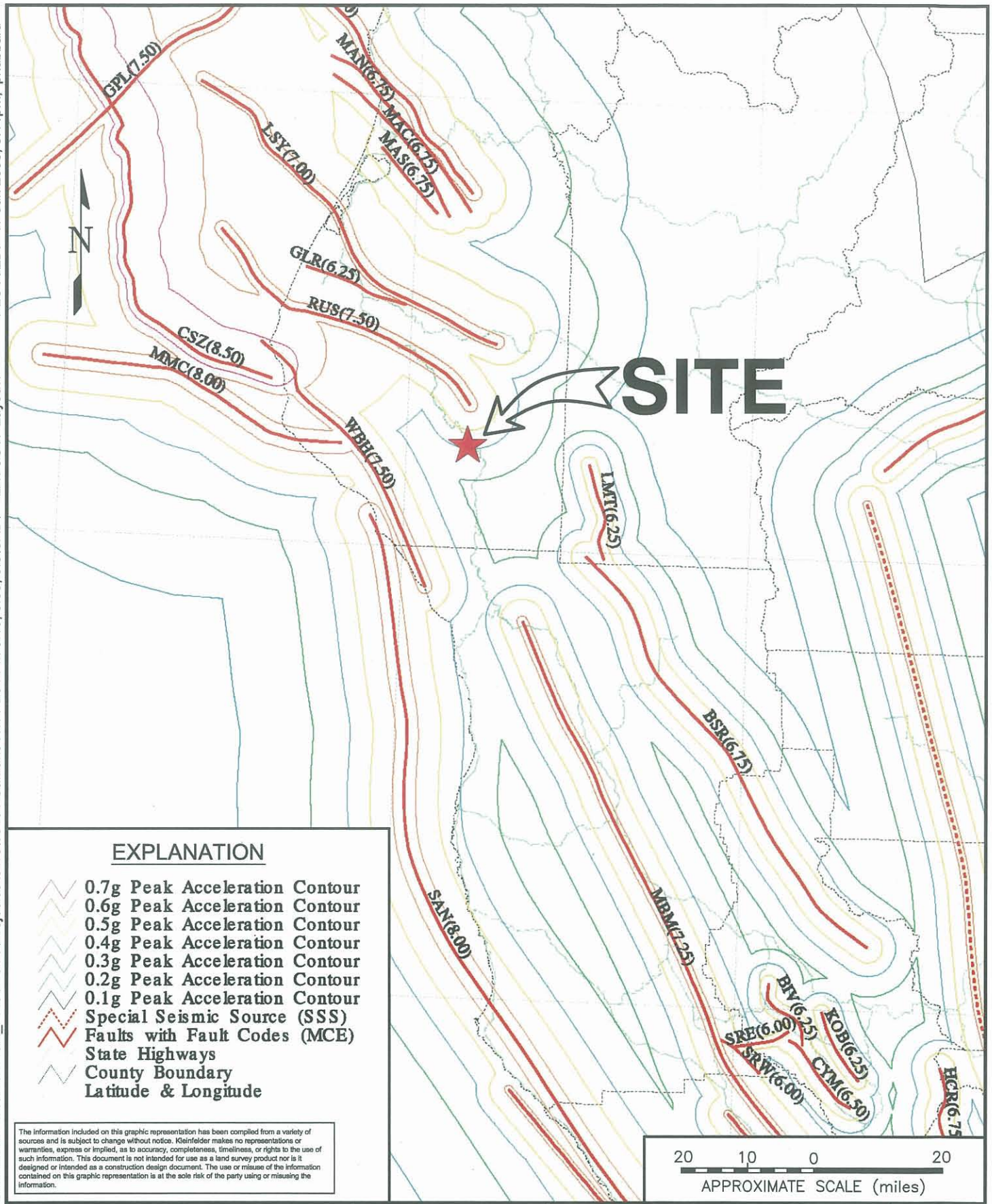
CHECKED BY:	JR
FILE NAME:	Hum254pm5-58-3.dwg

REGIONAL GEOLOGY

STORM DAMAGE LOCATION
EA: 01-475101
HIGHWAY 254 P.M. 5.58
HUMBOLDT COUNTY, CALIFORNIA

PLATE 4



EXPLANATION

- 0.7g Peak Acceleration Contour
- 0.6g Peak Acceleration Contour
- 0.5g Peak Acceleration Contour
- 0.4g Peak Acceleration Contour
- 0.3g Peak Acceleration Contour
- 0.2g Peak Acceleration Contour
- 0.1g Peak Acceleration Contour
- Special Seismic Source (SSS)
- Faults with Fault Codes (MCE)
- State Highways
- County Boundary
- Latitude & Longitude

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FILE NAME:	Hum254pm5-58-4.dwg

CALIFORNIA SEISMIC HAZARD MAP (MUALCHIN 1996)

STORM DAMAGE LOCATION
EA: 01-475101
HIGHWAY 254 P.M. 5.58
HUMBOLDT COUNTY, CALIFORNIA

PLATE **5**

PLOTTED: 17 Jun 2008, 3:11pm, phubbard
LAYOUT: Layout1
CAD FILE: U:\GEOTECH_PROJECTS\Projects\Active\85401 Caltrans HWY 254 PM 5.10, 5.58, 5.8\CAD\
Images: EarthquakeHzrdMap96.jpg
ATTACHED IMAGES:
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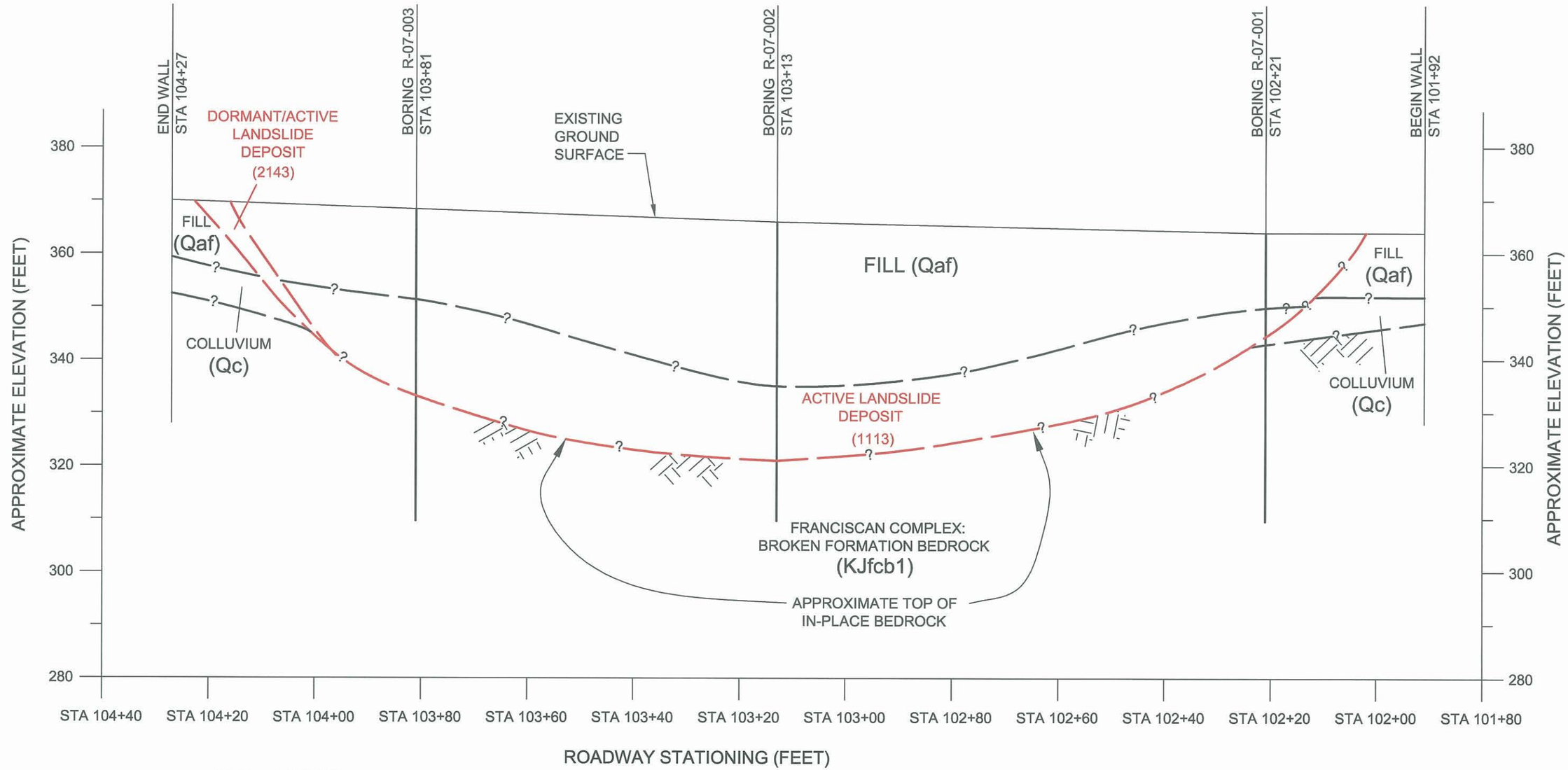
PLEASANTON, CA



EXPLANATION

Qaf	Artificial Fill		Geologic Contact (dashed where approximate)
Qc	Colluvium		Landslide Contact (dashed where approximate)
KJfcb1	Franciscan Complex: Broken Formation	1113	Landslide Identification Number (see landslide chart plate 2)

NOTE:
The depth of bedrock indicated on this plate was generalized by interpolation and extrapolation between widely spaced borings. Information on bedrock depth exists only at the specific boring locations, which are offset from the proposed wall location. Bedrock depths shown should be considered approximate and variations should be expected.

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20 10 0 20
APPROXIMATE SCALE (feet)

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DRAWN BY:	PH
CHECKED BY:	JR
FILE NAME:	Hum254pm5-58-6.dwg

APPROXIMATE BEDROCK PROFILE ALONG WALL

STORM DAMAGE SITE
EA: 01-475101
HIGHWAY 254 P.M. 5.58
HUMBOLDT COUNTY, CALIFORNIA

PLATE
6

ATTACHED IMAGES: Images: DC_2504882.jpg
ATTACHED XREFS:
SANTA ROSA, CA CAD FILE: U:\GEOTECH_PROJECTS\Projects\Active\85401 Caltrans HWY 254 PM 5.10, 5.58, 5.8\CAD\ LAYOUT: Layout1 PLOTTED: 01 Jul 2008, 3:56pm, phubbard

PLOTTED: 01 Jul 2008, 2:52pm, phubbard
LAYOUT: Layout1
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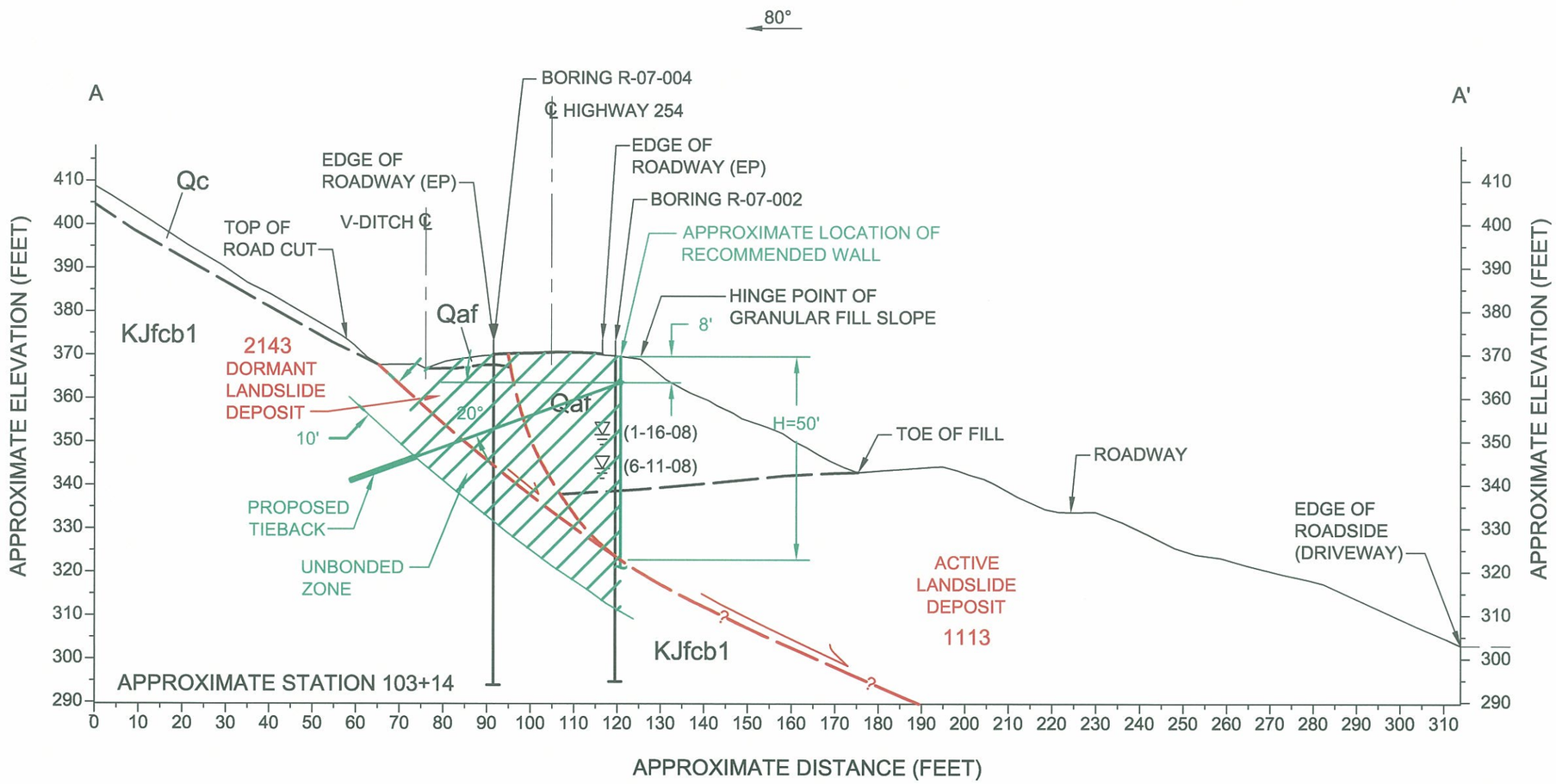
ATTACHED XREFS:
SANTA ROSA, CA



EXPLANATION

Qaf	Artificial Fill	(date) ▽	Caltrans Measured Water Level
Qc	Colluvium		Geologic Contact (dashed where approximate)
KJfcb1	Franciscan Complex: Broken Formation		Landslide Contact (dashed where approximate)
1143	Landslide Identification Number (see landslide chart plate 2)		

NOTE:
SECTION A-A' WAS HAND LEVEL FIELD SURVEYED IN AUGUST 2007 AND MAY DIFFER FROM THE TOPOGRAPHY AND MAPPING AS SHOWN ON THE SITE PLAN, PLATE 2.

30 15 0 30
APPROXIMATE SCALE (feet)

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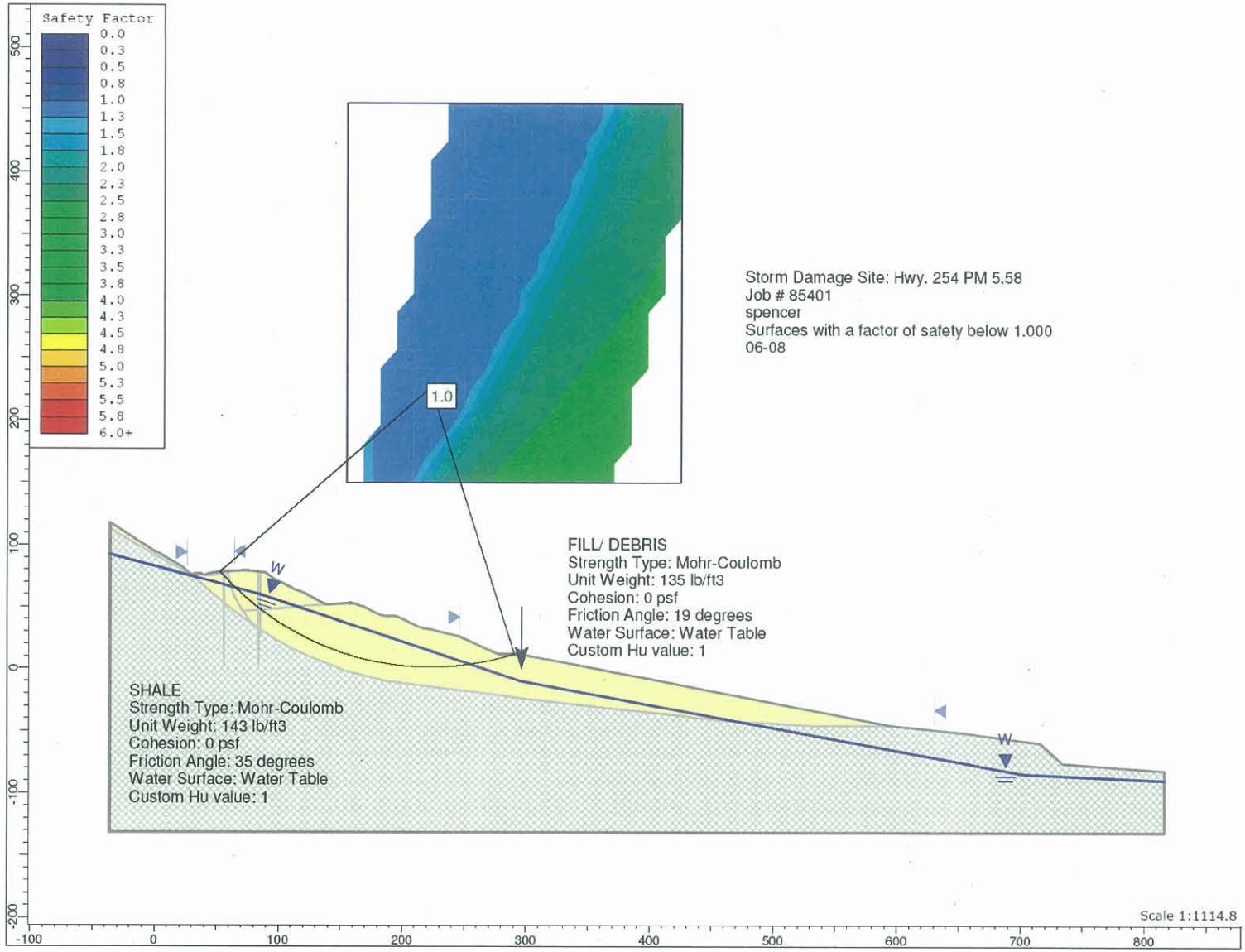
CHECKED BY:	JR
FILE NAME:	Hum254pm5-58-7.dwg

TIEBACK UNBONDED ZONE

STORM DAMAGE LOCATION
EA: 01-475101
HIGHWAY 254 P.M. 5.58
HUMBOLDT COUNTY, CALIFORNIA

PLATE
7



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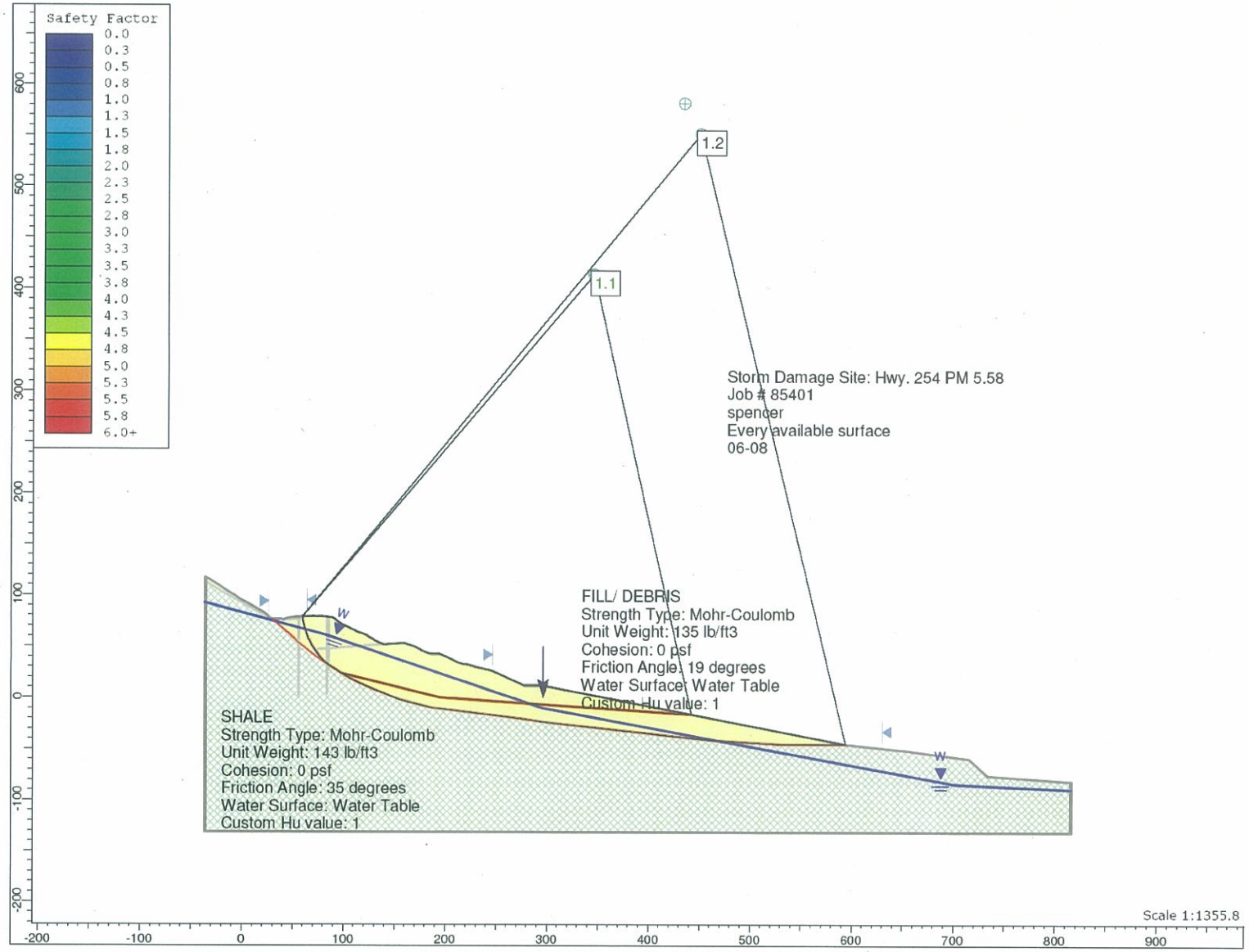
PROJECT NO.:	85401
DATE:	JULY 08
BY:	CMG
CHECKED BY:	TC

SLOPE STABILITY: BACK-CALCULATION

EXISTING CONDITIONS, STATIC ANALYSIS, CIRCULAR FAILURE
EA # 475101
01-HUM-254-5.58
HIGHWAY 254 P.M. 5.58
HUMBOLDT COUNTY, CALIFORNIA

PLATE
8



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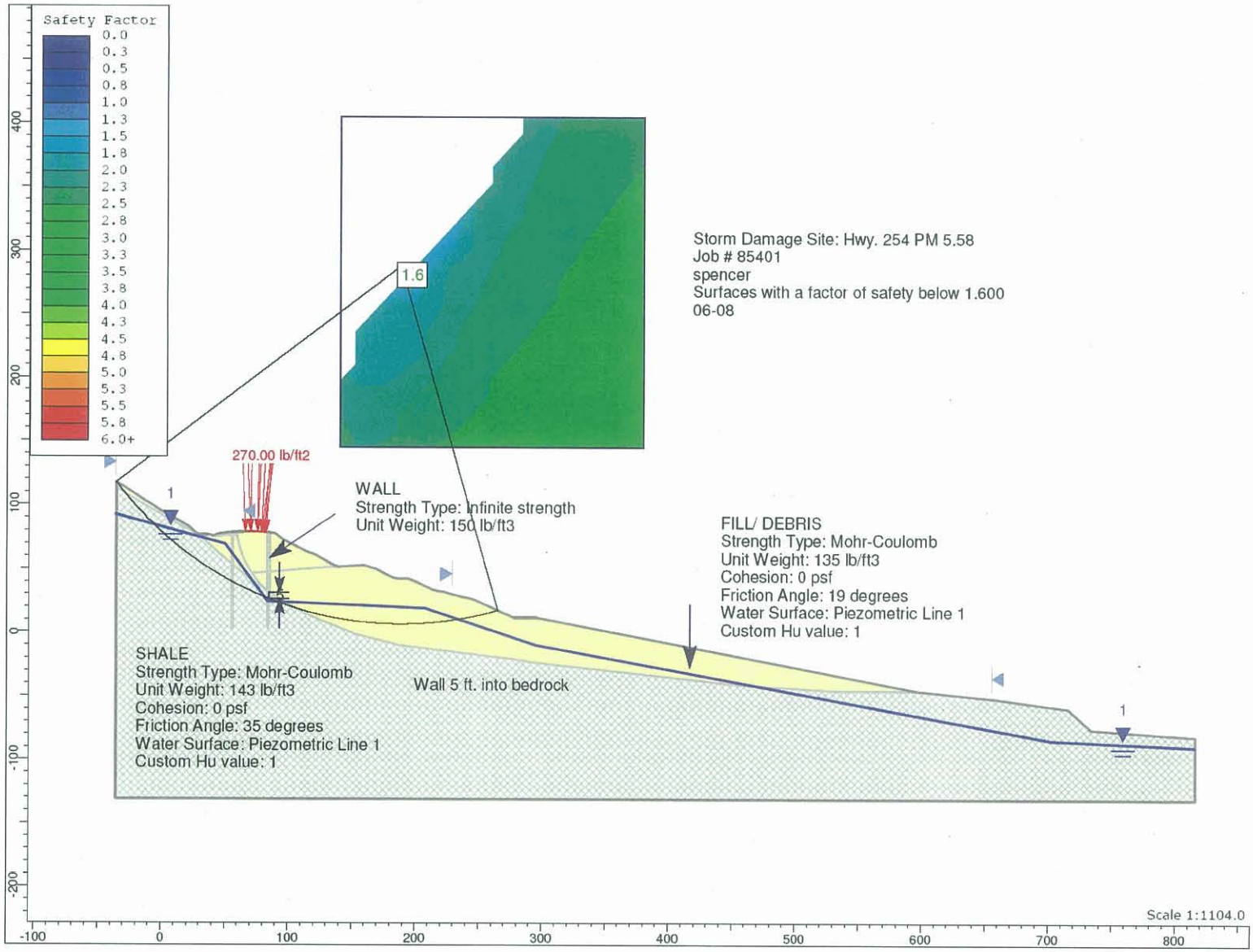
PROJECT NO.:	85401
DATE:	JULY 08
BY:	CMG
CHECKED BY:	TC

SLOPE STABILITY: BACK-CALCULATION

EXISTING CONDITIONS, STATIC ANALYSIS, BLOCK FAILURE
EA # 475101
01-HUM-254-5.58
HIGHWAY 254 P.M. 5.58
HUMBOLDT COUNTY, CALIFORNIA

PLATE
9



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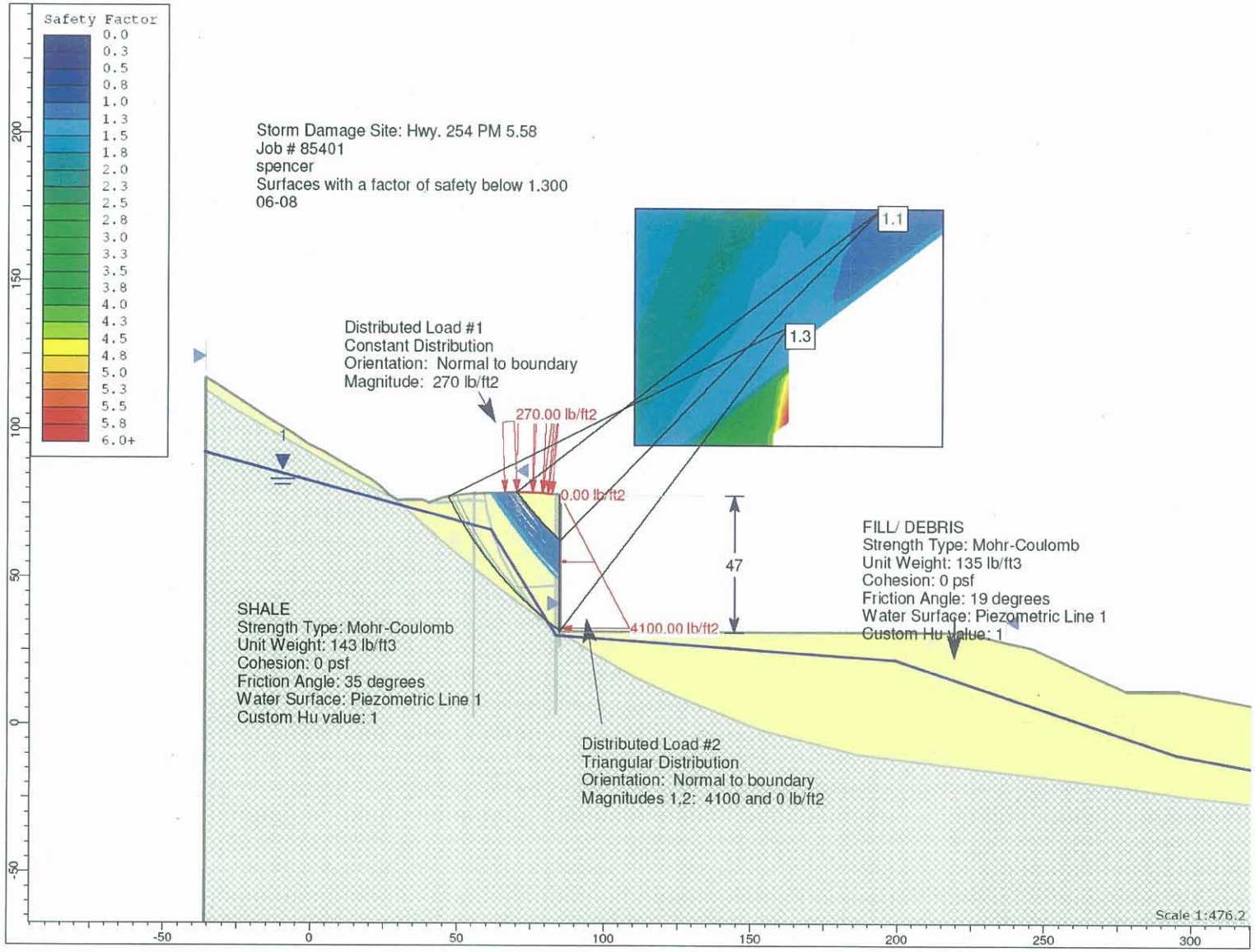
PROJECT NO.:	85401
DATE:	JULY 08
BY:	CMG
CHECKED BY:	TC

SLOPE STABILITY: WALL

IMPROVED CONDITIONS, STATIC ANALYSIS
EA # 475101
01-HUM-254-5.58
HIGHWAY 254 P.M. 5.58
HUMBOLDT COUNTY, CALIFORNIA

PLATE
10



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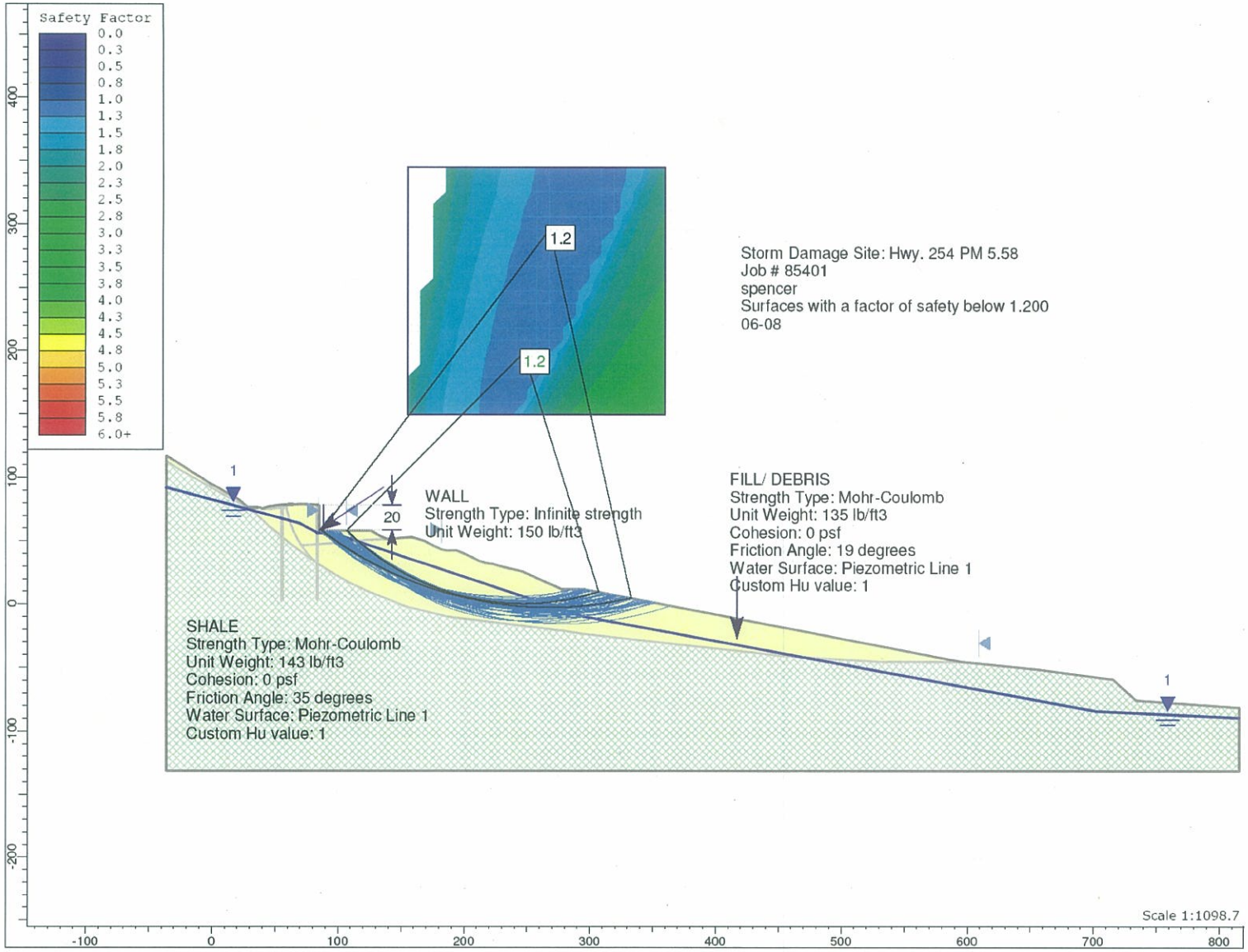
PROJECT NO.:	85401
DATE:	JULY 08
BY:	CMG
CHECKED BY:	TC

SLOPE STABILITY: LATERAL PRESSURE

IMPROVED CONDITIONS, STATIC ANALYSIS
EA # 475101
01-HUM-254-5.58
HIGHWAY 254 P.M. 5.58
HUMBOLDT COUNTY, CALIFORNIA

PLATE
11



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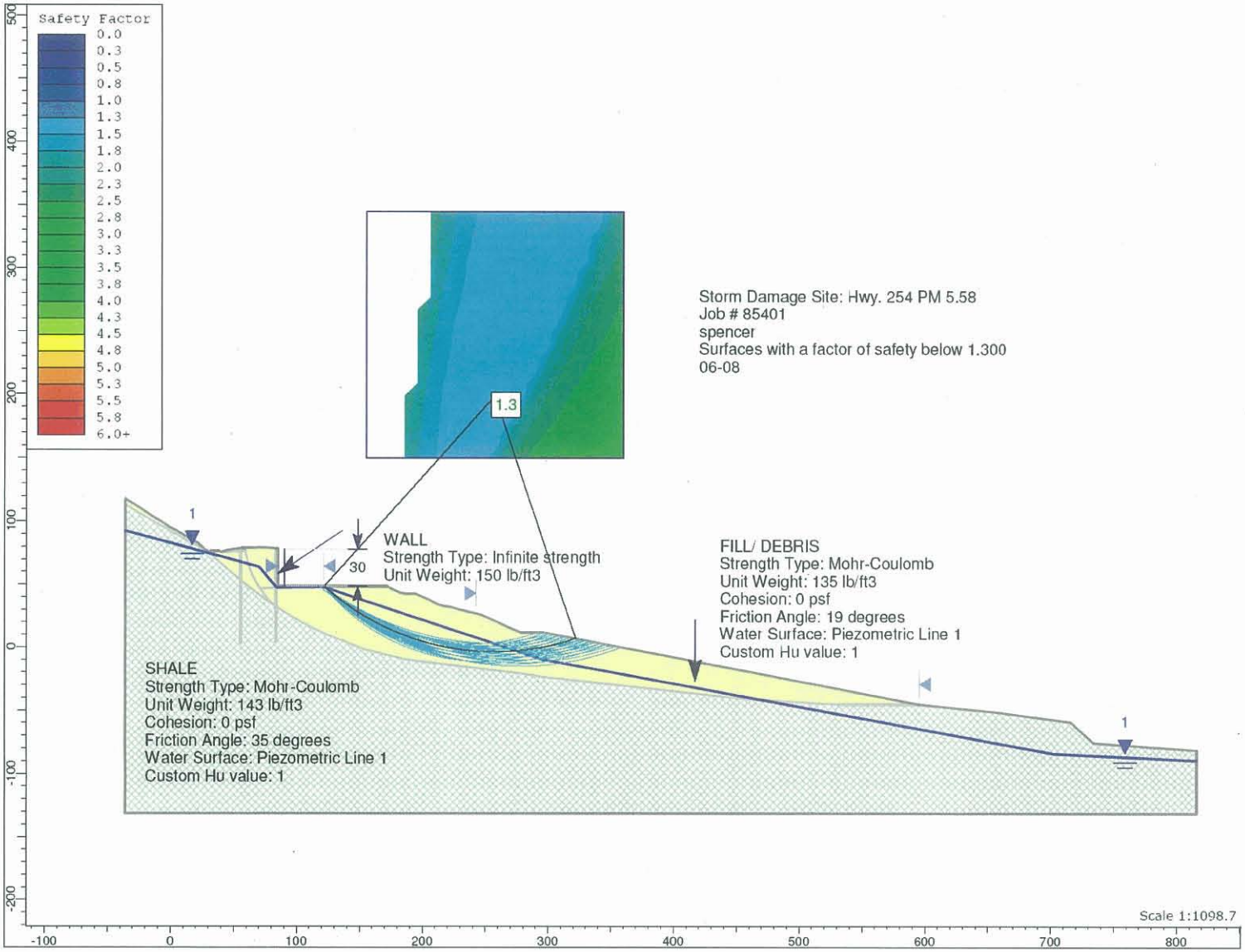
PROJECT NO.:	85401
DATE:	JULY 08
BY:	CMG
CHECKED BY:	TC

SLOPE STABILITY: DOWNSLOPE

IMPROVED CONDITIONS, STATIC ANALYSIS, LAGGING TO 20 FEET
EA # 475101
01-HUM-254-5.58
HIGHWAY 254 P.M. 5.58
HUMBOLDT COUNTY, CALIFORNIA

PLATE
12



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DATE:	JULY 08
BY:	CMG
CHECKED BY:	TC

SLOPE STABILITY: DOWNSLOPE

IMPROVED CONDITIONS, STATIC ANALYSIS, LAGGING TO 30 FEET
EA # 475101
01-HUM-254-5.58
HIGHWAY 254 P.M. 5.58
HUMBOLDT COUNTY, CALIFORNIA

PLATE
13

APPENDIX A

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
01	Hum	254	5.58		

GEOTECHNICAL PROFESSIONAL DATE 7/1/08

REGISTERED GEOLOGIST WILLIAM V. McCORMICK III No. 1673 Exp. 11-30-08 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

PLANS APPROVAL DATE

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SANTA ROSA, CA 95407

WEATHERING DESCRIPTORS

Modified from United States Bureau of Reclamation, Engineering Geology Field Manual.

Descriptors		Diagnostic features					
		Chemical weathering-Discoloration and/or oxidation		Mechanical weathering-Grain boundary conditions (disaggregation) primarily for granitics and some coarse-grained sediments	Texture and solutioning		General characteristics (strength, excavation, etc.)§
Alphanumeric descriptor	Descriptive term	Body of rock	Fracture surfaces †		Texture	Solutioning	
W1	Fresh	No discoloration, not oxidized.	No discoloration or oxidation.	No separation, intact (tight).	No change.	No solutioning.	Hammer rings when crystalline rocks are struck. Almost always rock excavation except for naturally weak or weakly cemented rocks such as siltstones or shales.
W2	Slightly weathered to fresh °						
W3	Slightly weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull.	Minor to complete discoloration or oxidation of most surfaces.	No visible separation, intact (tight).	Preserved.	Minor leaching of some soluble minerals may be noted.	Hammer rings when crystalline rocks are struck. Body of rock not weakened. With few exceptions, such as siltstones or shales, classified as rock excavation.
W4	Moderately to slightly weathered °						
W5	Moderately weathered	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are "rusty," feldspar crystals are "cloudy."	All fracture surfaces are discolored or oxidized.	Partial separation of boundaries visible.	Generally preserved.	Soluble minerals may be mostly leached.	Hammer does not ring when rock is struck. Body of rock is slightly weakened. Depending on fracturing, usually is rock excavation except in naturally weak rocks such as siltstones or shales.
W6	Intensely to moderately weathered °						
W7	Intensely weathered	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in-situ disaggregation, see grain boundary conditions.	All fracture surfaces are discolored or oxidized, surfaces friable.	Partial separation, rock is friable; in semiarid conditions granitics are disaggregated.	Texture altered by chemical disintegration (hydration, argillation).	Leaching of soluble minerals may be complete.	Dull sound when struck with hammer, usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures, or veinlets. Rock is significantly weakened. Usually common excavation.
W8	Very intensely weathered						
W9	Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay.		Complete separation of grain boundaries (disaggregated).	Resembles a soil, partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete.		Can be granulated by hand. Always common excavation. Resistant minerals such as quartz may be present as "stringers" or "dikes."

Note: This chart and its horizontal categories are more readily applied to rocks with feldspars and mafic minerals. Weathering in various sedimentary rocks, particularly limestones and poorly indurated sediments, will not always fit the categories established. This chart and weathering categories may have to be modified for particular site conditions or alteration such as hydrothermal effects; however, the basic framework and similar descriptors are to be used.

° Combination descriptors are permissible where equal distribution of both weathering characteristics are present over significant intervals or where characteristics present are "in between" the diagnostic feature. However, dual descriptors should not be used where significant, identifiable zones can be delineated. When given as a range, only two adjacent terms may be combined. "Decomposed to slightly weathered," or "moderately weathered to fresh" are not acceptable.

† Does not include directional weathering along shears or faults and their associated features. For example, a shear zone that carried weathering to great depths into a fresh rock mass would not require the rock mass to be classified as weathered.

§ These are generalizations and should not be used as diagnostic features for weathering or excavation classification. These characteristics vary to a large extent based on naturally weak materials or cementation and type of excavation.

BEDDING, FOLIATION, OR FLOW TEXTURE DESCRIPTORS

Descriptors	Thickness / Spacing
Massive	Greater than 10 ft
Very thickly (bedded, foliated, or banded)	3 to 10 ft
Thickly	1 to 3 ft
Moderately	0.3 to 1 ft
Thinly	0.1 to 0.3 ft
Very thinly	0.03 (3/8 in) to 0.1 ft
Laminated (intensely foliated or banded)	Less than 0.03 ft (3/8 in)

Modified from United States Bureau of Reclamation, Engineering Geology Field Manual.

FRACTURE DENSITY

Modified from United States Bureau of Reclamation, Engineering Geology Field Manual.

FRACTURE DENSITY- Based on the spacing of all natural fractures in an exposure or core recovery lengths in boreholes; excludes mechanical breaks, shears, and shear zones; however, shear-disturbed zones (fracturing outside the shear) are included. Descriptors for fracture density apply to all rock exposures such as tunnel walls, dozer trenches, outcrops, or foundation cut slopes and inverts, as well as boreholes. Descriptive criteria presented below are based on borehole cores where lengths are measured along the core axis, for other exposures the criteria is distance measured between fractures (size of blocks).

UNFRACTURED (FDØ): No fractures.

VERY SLIGHTLY FRACTURED (FD1): Core recovered mostly in lengths greater than 3 ft.

SLIGHTLY TO VERY SLIGHTLY FRACTURED (FD2)*

SLIGHTLY FRACTURED (FD3): Core recovered mostly in lengths from 1 to 3 ft. with few scattered lengths less than 1 ft or greater than 3 ft.

MODERATELY TO SLIGHTLY FRACTURED (FD4)*

MODERATELY FRACTURED (FD5): Core recovered mostly in 0.3 to 1.0 ft lengths with most lengths about 0.6 ft.

INTENSELY TO MODERATELY FRACTURED (FD6)*

INTENSELY FRACTURED (FD7): Lengths average from 0.1 to 0.3 ft with scattered fragmented intervals. Core recovered mostly in lengths less than 0.3 ft.

VERY INTENSELY TO INTENSELY FRACTURED (FD8)*

VERY INTENSELY FRACTURED (FD9): Core recovered mostly as chips and fragments with a few scattered short core lengths.

* Combinations of fracture densities (e.g. very intensely to intensely fractured, or moderately to slightly fractured) are used where equal distribution of both fracture density characteristics are present over a significant interval or exposure, or where characteristics are "in between" the descriptor definitions.

ROCK HARDNESS DESCRIPTORS

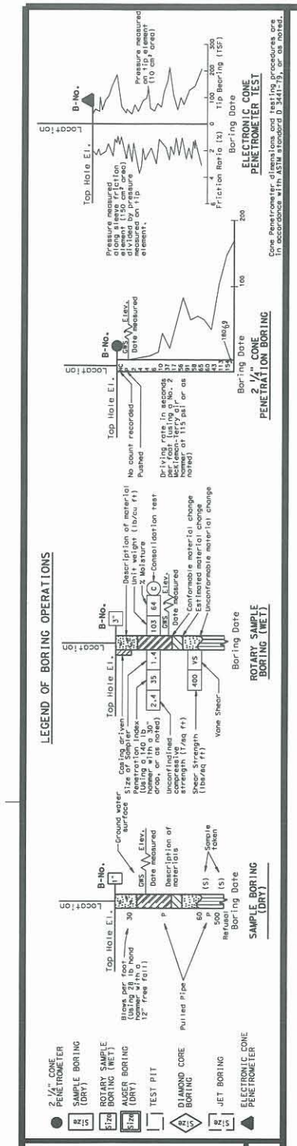
Alphanumeric Descriptor	Descriptor	Criteria
H1	Extremely hard	Core, fragment, or exposure cannot be scratched with knife or sharp pick; can only be chipped with repeated heavy hammer blows.
H2	Very hard	Cannot be scratched with knife on sharp pick. Core or fragment breaks with repeated heavy hammer blows.
H3	Hard	Can be scratched with knife or sharp pick with difficulty (heavy pressure). Heavy hammer blow required to break specimen.
H4	Moderately hard	Can be scratched with knife or sharp pick with light or moderate pressure. Core or fragment breaks with moderate hammer blow.
H5	Moderately soft	Can be grooved 1/16 inch deep by knife or sharp pick with moderate or heavy pressure. Core or fragment breaks with light hammer blow or heavy manual pressure.
H6	Soft	Can be grooved or gouged easily by knife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
H7	Very soft	Can be readily indented, grooved or gouged with fingernail, or carved with a knife. Breaks with light manual pressure.

Any bedrock unit softer than H7, very soft, is to be described using ASTM D-2488 consistency descriptors.

Note: Although "sharp pick" is included in these definitions, descriptions of ability to be scratched, grooved or gouged by a knife is the preferred criteria.

Modified from United States Bureau of Reclamation, Engineering Geology Field Manual.

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

SPT N-Value (Blows/foot)	Granular	SPT N-Value (Blows/foot)	Cohesive
0-4	Very Loose	<2	Very Soft
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31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very Stiff
		>31	Hard

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

DESIGN OVERSIGHT	DRAWN BY A. Sanchez	KLEINFELDER FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
SIGN OFF DATE	CHECKED BY J. Richmond, C.E.G	DATE: August 2007	X PROJECT ENGINEER

BRIDGE NO. X
POST MILE 5.58

STORM DAMAGE LOCATION
LOG OF TEST BORINGS 1 OF 6

OSF GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 01
EA 475101

DISREGARD PRINTS BEARING EARLIER REVISION DATES 11-1-07 6-20-08

REVISION DATES (PRELIMINARY STAGE ONLY) SHEET X OF X

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
01	Hum	254	5.58		

GEOTECHNICAL PROFESSIONAL DATE 7/1/08

PLANS APPROVAL DATE

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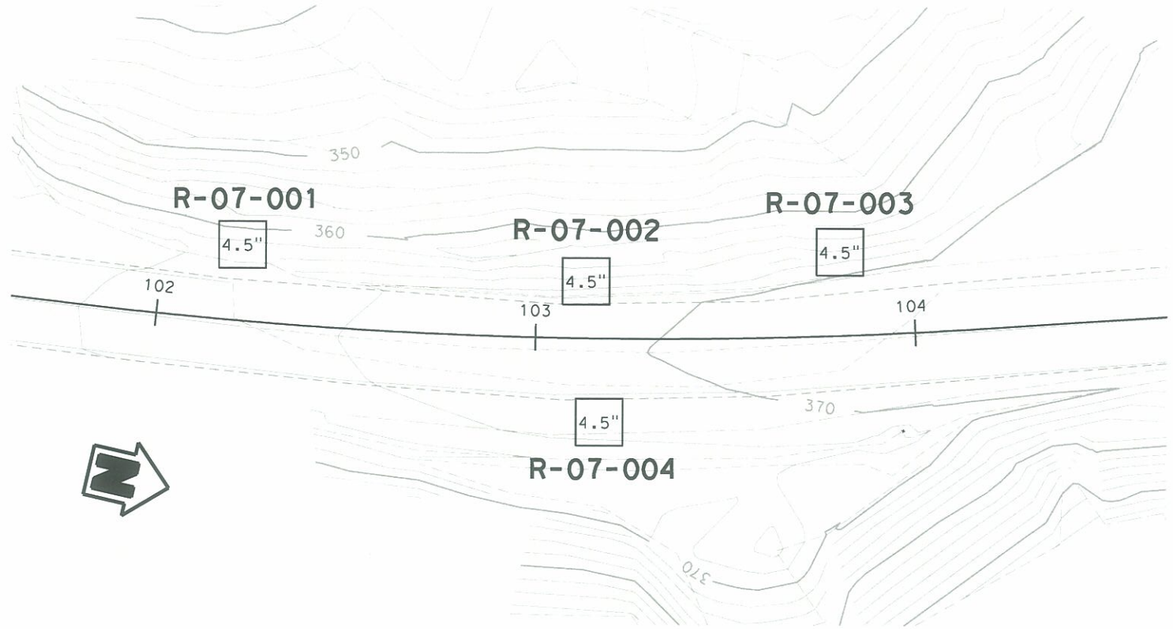
REGISTERED GEOLOGIST WILLIAM V. McCORMICK III No. 1673 Exp. 11-30-08 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

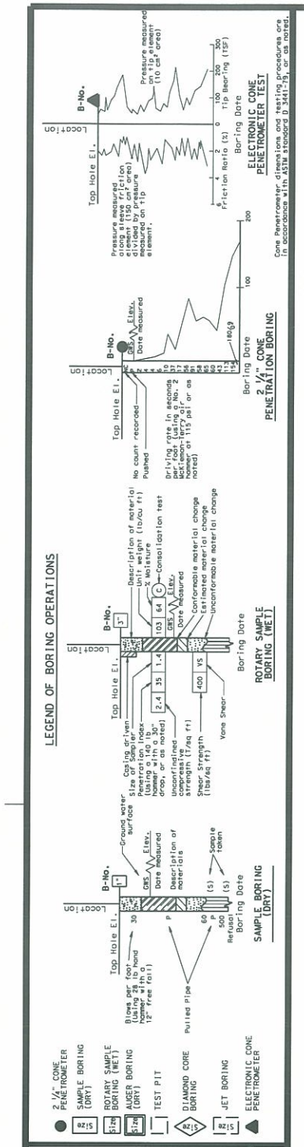
KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407



PLAN

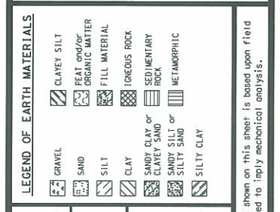
1"=20'

LEGEND OF BORING OPERATIONS



Cone Penetrometer dimensions and testing procedures are in accordance with ASTM standard D 3441-75, or as noted.

LEGEND OF EARTH MATERIALS



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		>31	Hard

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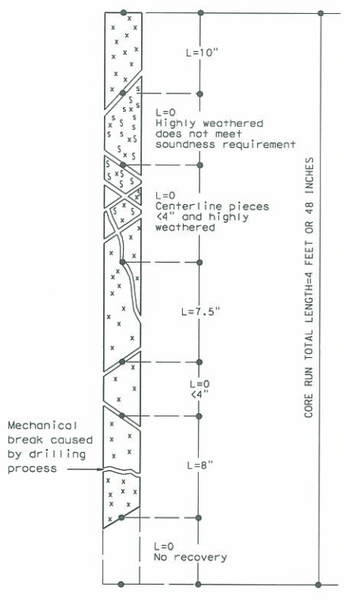
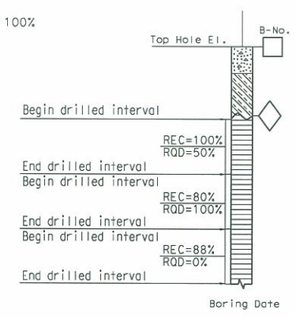
ROCK QUALITY DESIGNATION (RQD) & PERCENT RECOVERY (REC) LOGGING



$$RQD = \frac{\sum \text{Length of sound core} \geq 4 \text{ inches pieces}}{\text{Total core run length}}$$

$$RQD = \frac{10 + 7.5 + 8}{48} \times 100\%$$

RQD = 53% (fair)



RQD (ROCK QUALITY DESIGNATION)	DESCRIPTION OF ROCK QUALITY
0 - 25%	VERY POOR
25 - 50%	POOR
50 - 75%	FAIR
75 - 90%	GOOD
90 - 100%	EXCELLENT

After Deere & Deere, 1989

Notes:

1. Samples were taken using a California and modified California split-barrel sampler with an inside diameter (I.D.) of 2.5 in. and 2 in. and an outside diameter (O.D.) of 3 in. and 2.5 in. respectively.
2. A safety semi-automatic hammer (140 lb) with a 30 inch drop was used to advance the sampler.
3. Blowcounts noted for boring are field blowcounts and have not been corrected.
4. Samples were taken using a SPT split-barrel sampler with an inside diameter (I.D.) of 1.4 in. and an outside diameter (O.D.) of 2 in.
5. Core samples were taken using an HQ core sampler with a 2.5 in. inside diameter (I.D.) and 3.7 in. outside diameter (O.D.) core barrel.
6. Blowcounts 50/4 means 50 blows per 4 in. penetration.
7. Horizontal Borings were started approximately 5.5 to 6.0 ft. above existing pavement grade and inclined downward at approximately a 10 degree angle.

IN-SITU, LAB & FIELD TEST DESIGNATIONS

AL	ATTERBERG LIMITS
CA	CHEMICAL ANALYSIS
CN	CONSOLIDATION
CU	CONSOLIDATED UNDRAINED TRIAXIAL
DS	DIRECT SHEAR
MD	MAX. DRY DENSITY
PL	POINT LOAD
PP	POCKET PENETROMETER
SA	SIEVE ANALYSIS
TV	TORVANE
UC	UNCONFINED COMPRESSION
UU	UNCONSOLIDATED UNDRAINED TRIAXIAL
VS	VANE SHEAR
WC	MOISTURE CONTENT

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY A. Sanchez

CHECKED BY J. Richmond, C.E.G

KLEINFELDER
FIELD INVESTIGATION BY:
DATE: August 2007

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

X
PROJECT ENGINEER

BRIDGE NO. X
POST MILE 5.58

STORM DAMAGE LOCATION

LOG OF TEST BORINGS 2 OF 6

OSF GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 01
EA 475101

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 11-1-07 6-20-08

SHEET X OF X

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

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01	Hum	254	5.58		

GEOTECHNICAL PROFESSIONAL — DATE 7/1/08

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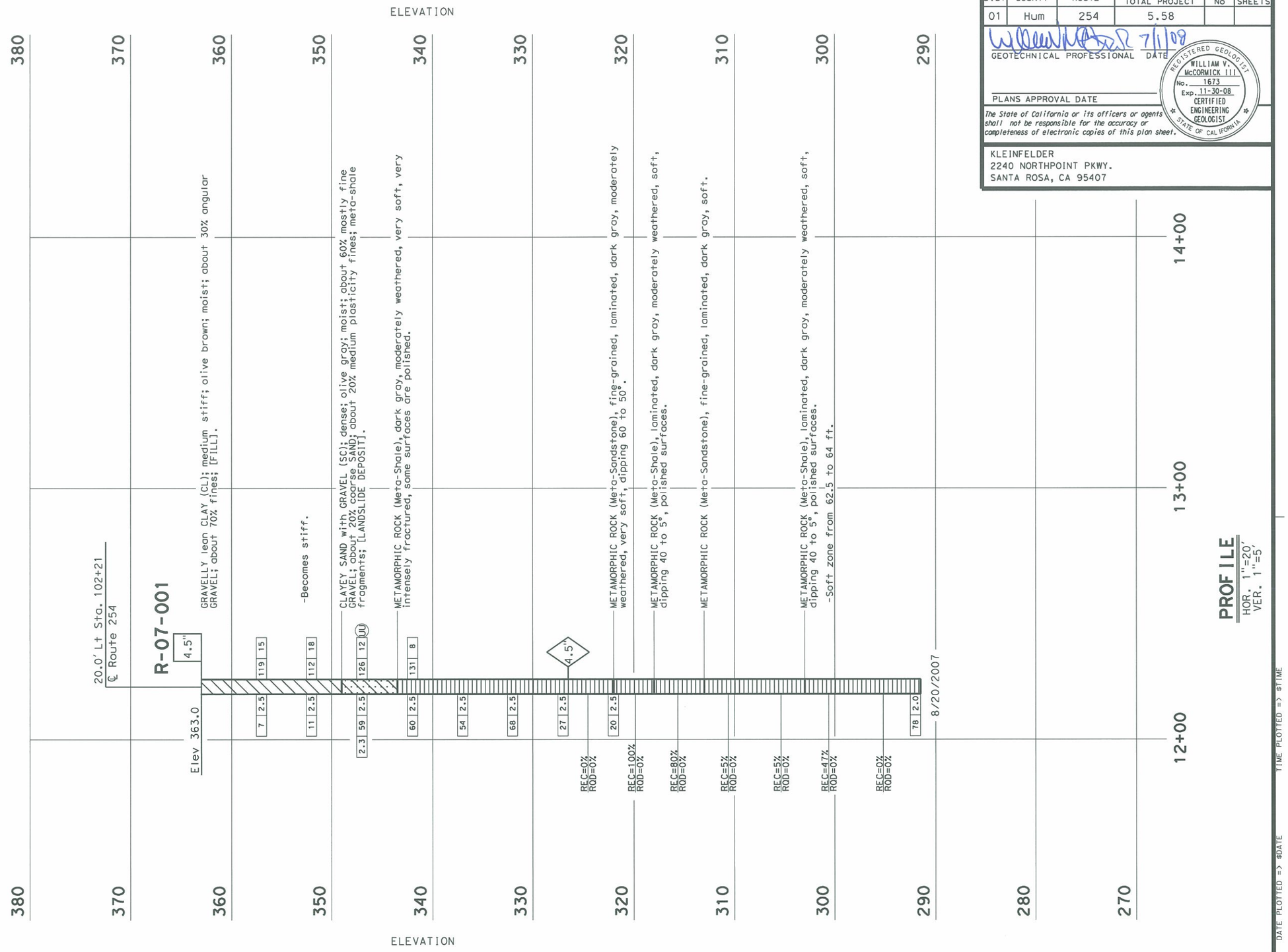
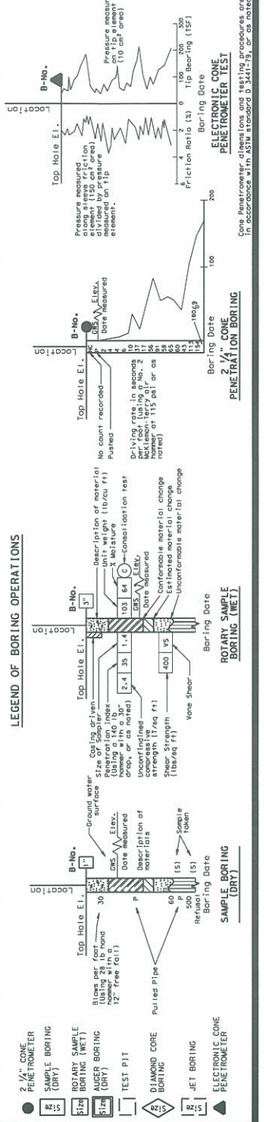
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407

FOR PLAN VIEW AND ADDITIONAL NOTES, SEE "LOG OF TEST BORINGS" SHEET 2 OF 6



LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

GRAVEL · SAND · SILT · CLAY · SANDY CLAY or CLAYEY SAND · SANDY SILT or SILTY SAND · SILTY CLAY · CLAYEY SILT · PEAT and/or ORGANIC MATTER · FILL MATERIAL · IGNEOUS ROCK · SEDIMENTARY ROCK · METAMORPHIC

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

SPT N-Value (Blows/foot)	Granular	SPT N-Value (Blows/foot)	Cohesive
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DESIGN OVERSIGHT	DRAWN BY: A. Sanchez	KLEINFELDER	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
SIGN OFF DATE	CHECKED BY: J. Richmond, C.E.G	FIELD INVESTIGATION BY: DATE: August 2007	X PROJECT ENGINEER

BRIDGE NO. X — POST MILE 5.58

STORM DAMAGE LOCATION
LOG OF TEST BORINGS 3 OF 6

CU 01
EA 475101

DISREGARD PRINTS BEARING EARLIER REVISION DATES 11-1-07 6-20-08

REVISION DATES (PRELIMINARY STAGE ONLY) — SHEET X OF X

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

FILE => $REQUEST

OSF GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 2/25/05)

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

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LEGEND OF EARTH MATERIALS

GRAVEL, SAND, SILT, CLAY, SANDY CLAY or CLAYEY SAND, SANDY SILT or SILTY SAND, SILTY CLAY, CLAYEY SILT, PEAT and/or ORGANIC MATTER, FILL MATERIAL, IGNEOUS ROCK, SEDIMENTARY ROCK, METAMORPHIC

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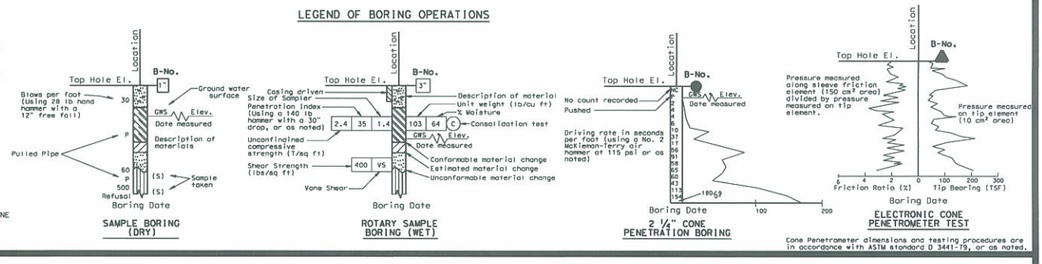
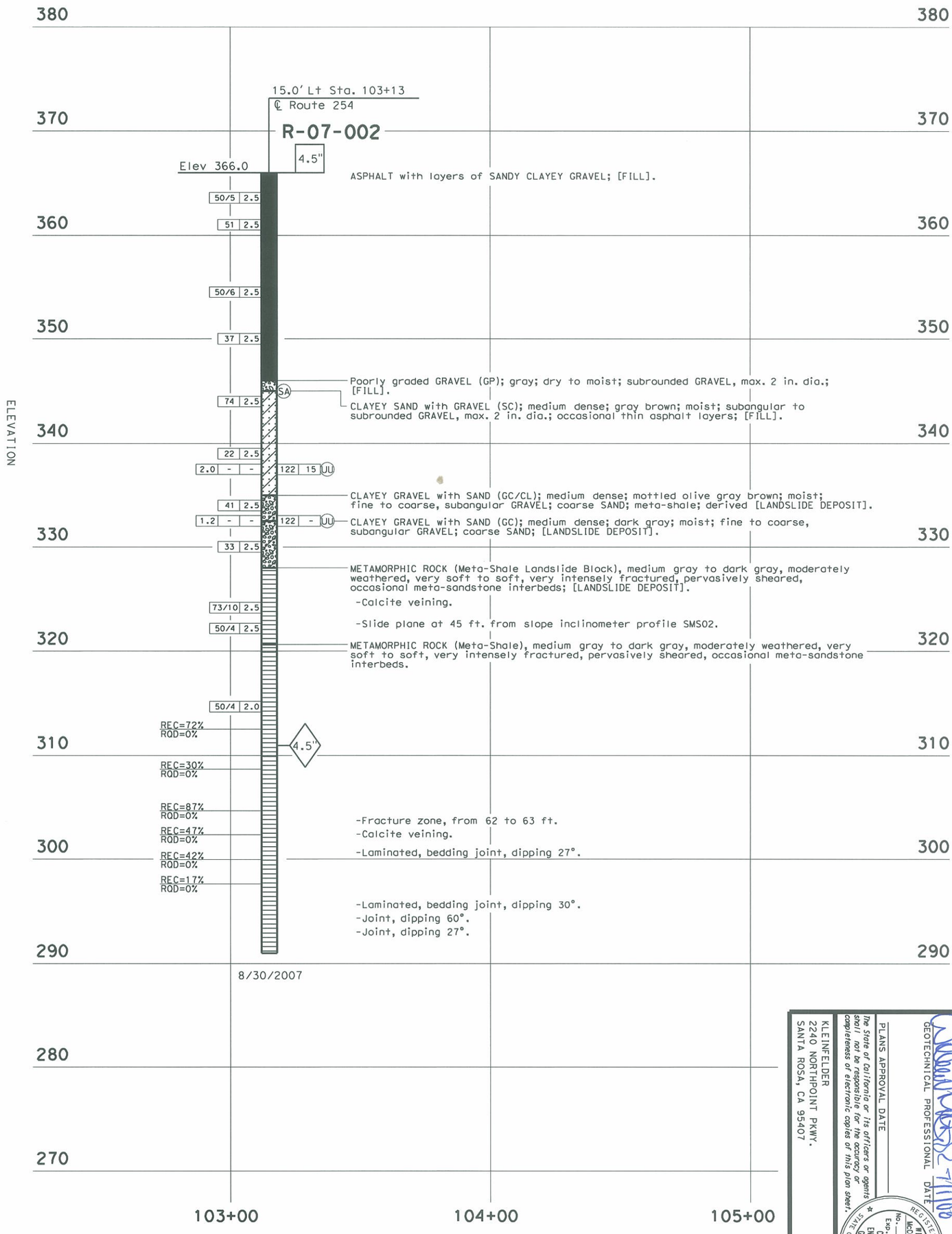
LEGEND OF BORING OPERATIONS

2 1/2" CONE PENETROMETER; SAMPLE BORING (DRY); ROTARY SAMPLE BORING (WET); AUGER BORING (DRY); TEST PIT; DIAMOND CORE BORING; JET BORING; ELECTRONIC CONE PENETROMETER



Cone Penetrometer dimensions and testing procedures are in accordance with ASTM standard D 3441-79, or as noted.

FOR PLAN VIEW AND ADDITIONAL NOTES, SEE "LOG OF TEST BORINGS" SHEET 2 OF 6



PROFILE

HOR. 1"=20'
VER. 1"=5'

KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407

PLANS APPROVAL DATE

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET TOTAL SHEETS
01	Hum	254	5.58	

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY: A. Sanchez

CHECKED BY: J. Richmond, C.E.G

KLEINFELDER FIELD INVESTIGATION BY:

DATE: August 2007

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

X PROJECT ENGINEER

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EA 475101

FILE => $REQUEST

BRIDGE NO. X

POST MILE 5.58

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

STORM DAMAGE LOCATION

LOG OF TEST BORINGS 4 OF 6

SHEET X OF X

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

OSF GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 2/25/05)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
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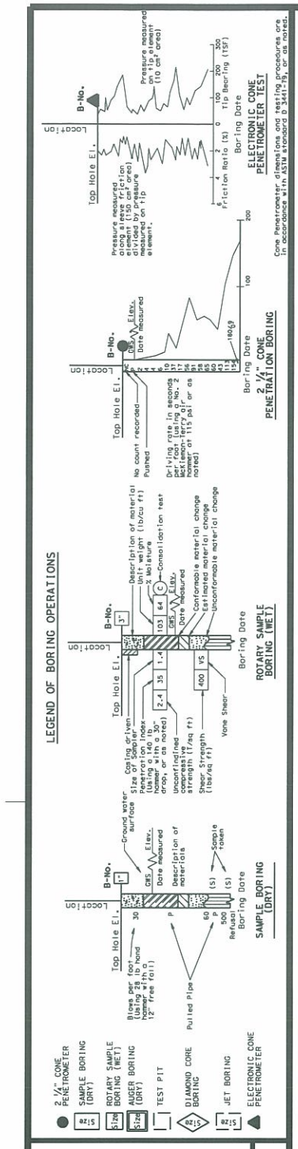

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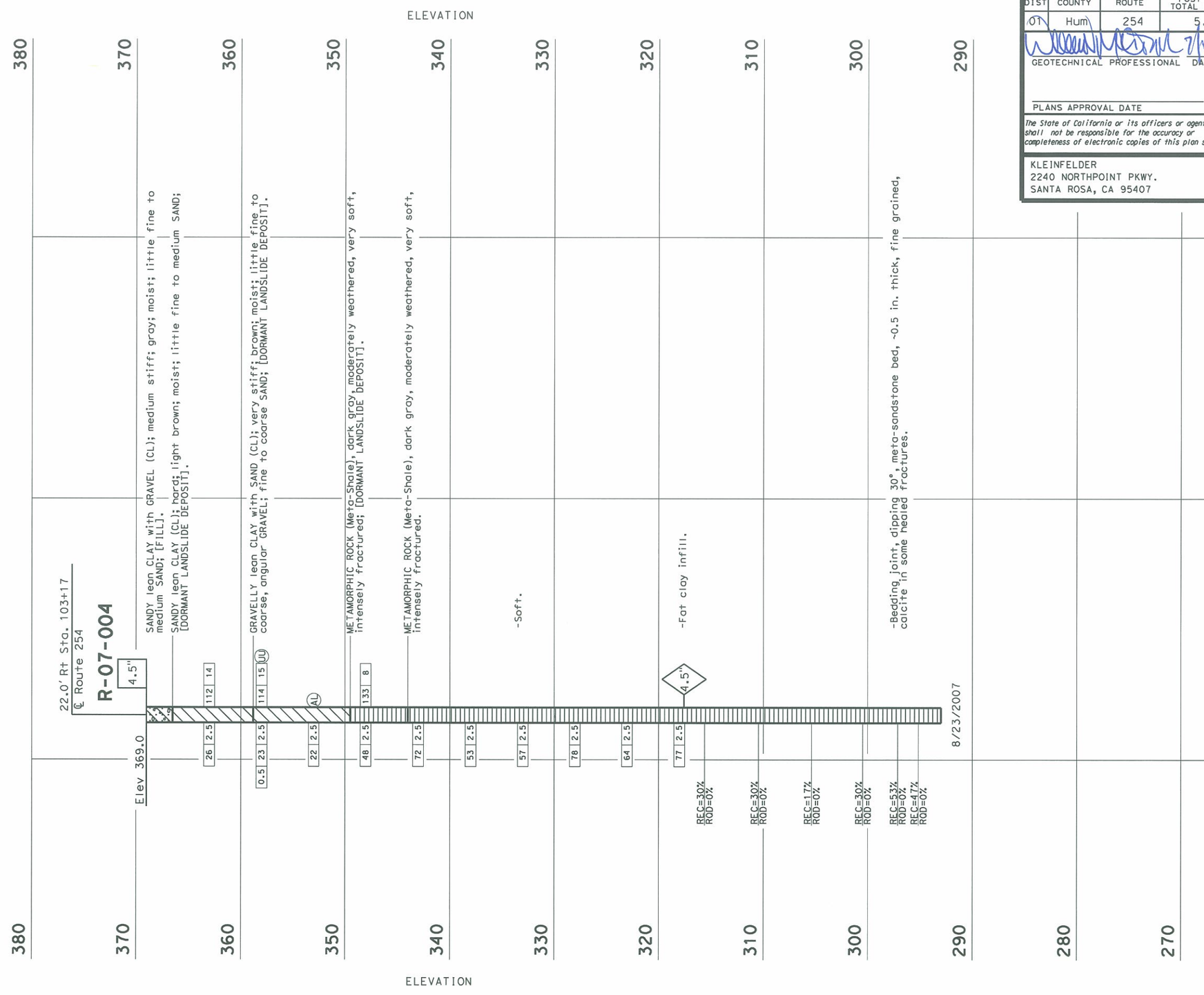

DESIGN OVERSIGHT	DRAWN BY	A. Sanchez	KLEINFELDER FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	J. Richmond, C.E.G	DATE: August 2007

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

X
PROJECT ENGINEER

BRIDGE NO. X
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STORM DAMAGE LOCATION
LOG OF TEST BORINGS 5 OF 6

OSF GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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SHEET X OF X

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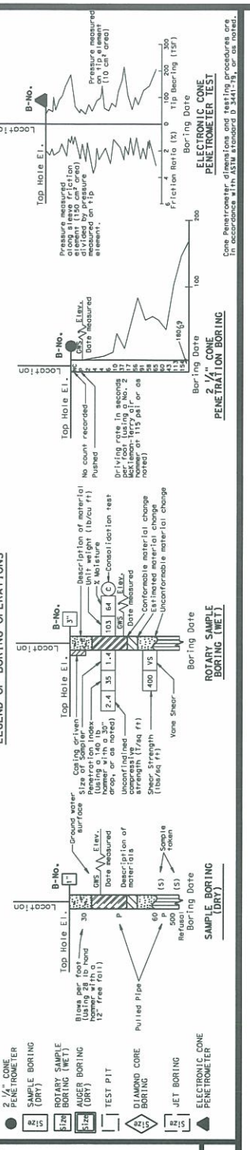
LEGEND OF BORING OPERATIONS



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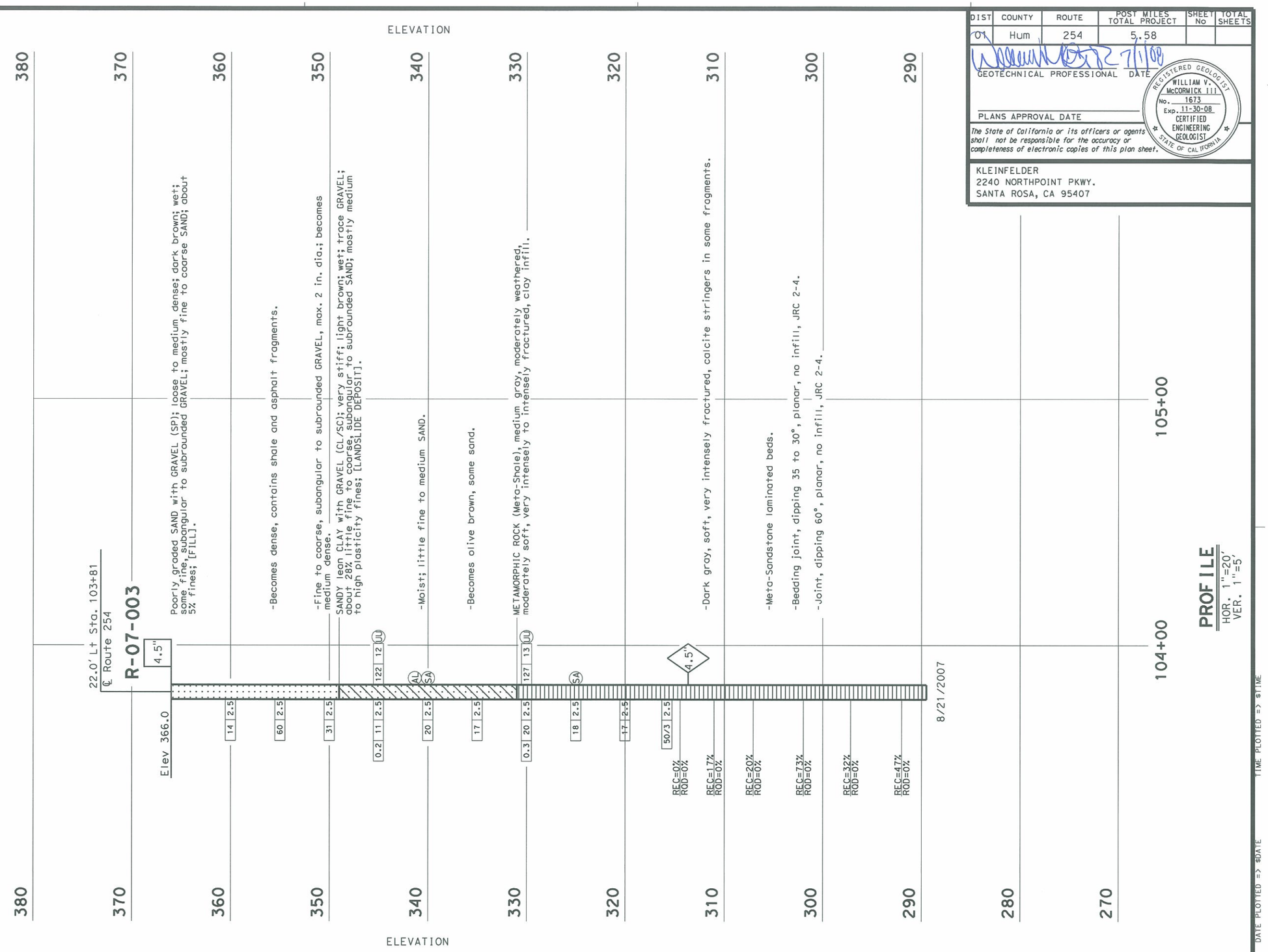

DESIGN OVERSIGHT	DRAWN BY	A. Sanchez	KLEINFELDER FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	J. Richmond, C.E.G	DATE: August 2007

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

X
PROJECT ENGINEER

BRIDGE NO. X
POST MILE 5.58

STORM DAMAGE LOCATION
LOG OF TEST BORINGS 6 OF 6

OSF GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 11-1-07 6-20-08

SHEET X OF X

FILE => $REQUEST

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GROUP SYMBOLS AND NAMES

Graphic / Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic / Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY elastic ELASTIC SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTS

C	Consolidation (ASTM D 2435-04)
CL	Collapse Potential (ASTM D 5333-03)
CP	Compaction Curve (CTM 216 - 06)
CR	Corrosion, Sulfates, Chlorides (CTM 643 - 99; CTM 417 - 06; CTM 422 - 06)
CU	Consolidated Undrained Triaxial (ASTM D 4767-02)
DS	Direct Shear (ASTM D 3080-04)
EI	Expansion Index (ASTM D 4829-03)
M	Moisture Content (ASTM D 2216-05)
OC	Organic Content (ASTM D 2974-07)
P	Permeability (CTM 220 - 05)
PA	Particle Size Analysis (ASTM D 422-63 [2002])
PI	Liquid Limit, Plastic Limit, Plasticity Index (AASHTO T 89-02, AASHTO T 90-00)
PL	Point Load Index (ASTM D 5731-05)
PM	Pressure Meter
PP	Pocket Penetrometer
R	R-Value (CTM 301 - 00)
SE	Sand Equivalent (CTM 217 - 99)
SG	Specific Gravity (AASHTO T 100-06)
SL	Shrinkage Limit (ASTM D 427-04)
SW	Swell Potential (ASTM D 4546-03)
TV	Pocket Torvane
UC	Unconfined Compression - Soil (ASTM D 2166-06) Unconfined Compression - Rock (ASTM D 2938-95)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850-03)
UW	Unit Weight (ASTM D 4767-04)
VS	Vane Shear (AASHTO T 223-96 [2004])

SAMPLER GRAPHIC SYMBOLS

- Standard Penetration Test (SPT)
- Standard California Sampler
- Modified California Sampler
- Shelby Tube
- Piston Sampler
- NX Rock Core
- HQ Rock Core
- Bulk Sample
- Other (see remarks)

DRILLING METHOD SYMBOLS

- Auger Drilling
- Rotary Drilling
- Dynamic Cone or Hand Driven
- Diamond Core

WATER LEVEL SYMBOLS

- First Water Level Reading (during drilling)
- Static Water Level Reading (short-term)
- Static Water Level Reading (long-term)

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REPORT TITLE
BORING RECORD LEGEND

DIST.	COUNTY	ROUTE	POSTMILE	EA
01	Humboldt	254	5.6	01-475101

PROJECT OR BRIDGE NAME
Storm Damage Location: Highway 254 P.M. 5.58

BRIDGE NUMBER	PREPARED BY	DATE	SHEET
	C. Goitein	6-26-08	1 of 3

CONSISTENCY OF COHESIVE SOILS

Descriptor	Unconfined Compressive Strength (tsf)	Pocket Penetrometer (tsf)	Torvane (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 - 0.50	0.25 - 0.50	0.12 - 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 - 1.0	0.50 - 1.0	0.25 - 0.50	Can be penetrated several inches by thumb with moderate effort
Stiff	1.0 - 2.0	1.0 - 2.0	0.50 - 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2.0 - 4.0	2.0 - 4.0	1.0 - 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

APPARENT DENSITY OF COHESIONLESS SOILS

Descriptor	SPT N_{60} - Value (blows / foot)
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Descriptor	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Descriptor	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

SOIL PARTICLE SIZE

Descriptor		Size
Boulder		> 12 inches
Cobble		3 to 12 inches
Gravel	Coarse	3/4 inch to 3 inches
	Fine	No. 4 Sieve to 3/4 inch
Sand	Coarse	No. 10 Sieve to No. 4 Sieve
	Medium	No. 40 Sieve to No. 10 Sieve
	Fine	No. 200 Sieve to No. 40 Sieve
Silt and Clay		Passing No. 200 Sieve

PLASTICITY OF FINE-GRAINED SOILS

Descriptor	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled, and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll, and not much time is required to reach the plastic limit; it cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

CEMENTATION

Descriptor	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

NOTE: This legend sheet provides descriptors and associated criteria for required soil description components only. Refer to Caltrans Soil and Rock Logging, Classification, and Presentation Manual (July 2007), Section 2, for tables of additional soil description components and discussion of soil description and identification.

ROCK GRAPHIC SYMBOLS

IGNEOUS ROCK

SEDIMENTARY ROCK

METAMORPHIC ROCK

BEDDING SPACING

Descriptor	Thickness or Spacing
Massive	> 10 ft
Very thickly bedded	3 to 10 ft
Thickly bedded	1 to 3 ft
Moderately bedded	3-5/8 inches to 1 ft
Thinly bedded	1-1/4 to 3-5/8 inches
Very thinly bedded	3/8 inch to 1-1/4 inches
Laminated	< 3/8 inch

WEATHERING DESCRIPTORS FOR INTACT ROCK

	Diagnostic Features					
	Chemical Weathering-Discoloration-Oxidation		Mechanical Weathering and Grain Boundary Conditions	Texture and Solutioning		
Descriptor	Body of Rock	Fracture Surfaces		Texture	Solutioning	General Characteristics
Fresh	No discoloration, not oxidized	No discoloration or oxidation	No separation, intact (tight)	No change	No solutioning	Hammer rings when crystalline rocks are struck.
Slightly Weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull	Minor to complete discoloration or oxidation of most surfaces	No visible separation, intact (tight)	Preserved	Minor leaching of some soluble minerals may be noted	Hammer rings when crystalline rocks are struck. Body of rock not weakened.
Moderately Weathered	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are "rusty"; feldspar crystals are "cloudy"	All fracture surfaces are discolored or oxidized	Partial separation of boundaries visible	Generally preserved	Soluble minerals may be mostly leached	Hammer does not ring when rock is struck. Body of rock is slightly weakened.
Intensely Weathered	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in situ disaggregation (refer to grain boundary conditions)	All fracture surfaces are discolored or oxidized; surfaces are friable	Partial separation, rock is friable; in semi-arid conditions, granitics are disaggregated	Altered by chemical disintegration such as via hydration or argillation	Leaching of soluble minerals may be complete	Dull sound when struck with hammer; usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures or veinlets. Rock is significantly weakened.
Decomposed	Discolored of oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay		Complete separation of grain boundaries (disaggregated)	Resembles a soil; partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes".

Note: Combination descriptors (such as "slightly weathered to fresh") are used where equal distribution of both weathering characteristics is present over significant intervals or where characteristics present are "in between" the diagnostic feature. However, combination descriptors should not be used where significant identifiable zones can be delineated. Only two adjacent descriptors shall be combined. "Very intensely weathered" is the combination descriptor for "decomposed to intensely weathered".

RELATIVE STRENGTH OF INTACT ROCK

Descriptor	Uniaxial Compressive Strength (psi)
Extremely Strong	> 30,000
Very Strong	14,500 - 30,000
Strong	7,000 - 14,500
Medium Strong	3,500 - 7,000
Weak	700 - 3,500
Very Weak	150 - 700
Extremely Weak	< 150

ROCK HARDNESS

Descriptor	Criteria
Extremely Hard	Specimen cannot be scratched with pocket knife or sharp pick; can only be chipped with repeated heavy hammer blows
Very hard	Specimen cannot be scratched with pocket knife or sharp pick; breaks with repeated heavy hammer blows
Hard	Specimen can be scratched with pocket knife or sharp pick with heavy pressure; heavy hammer blows required to break specimen
Moderately Hard	Specimen can be scratched with pocket knife or sharp pick with light or moderate pressure; breaks with moderate hammer blows
Moderately Soft	Specimen can be grooved 1/6 in. with pocket knife or sharp pick with moderate or heavy pressure; breaks with light hammer blow or heavy hand pressure
Soft	Specimen can be grooved or gouged with pocket knife or sharp pick with light pressure, breaks with light to moderate hand pressure
Very Soft	Specimen can be readily indented, grooved, or gouged with fingernail, or carved with pocket knife; breaks with light hand pressure

CORE RECOVERY CALCULATION (%)

$$\frac{\Sigma \text{ Length of the recovered core pieces (in.)}}{\text{Total length of core run (in.)}} \times 100$$

RQD CALCULATION (%)

$$\frac{\Sigma \text{ Length of intact core pieces > 4 in.}}{\text{Total length of core run (in.)}} \times 100$$

FRACTURE DENSITY

Descriptor	Criteria
Unfractured	No fractures
Very Slightly Fractured	Lengths greater 3 ft
Slightly Fractured	Lengths from 1 to 3 ft, few lengths outside that range
Moderately Fractured	Lengths mostly in range of 4 in. to 1 ft, with most lengths about 8 in.
Intensely Fractured	Lengths average from 1 in. to 4 in. with scattered fragmented intervals with lengths less than 4 in.
Very Intensely Fractured	Mostly chips and fragments with few scattered short core lengths

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REPORT TITLE
BORING RECORD LEGEND

DIST.	COUNTY	ROUTE	POSTMILE	EA
01	Humboldt	254	5.6	01-475101

PROJECT OR BRIDGE NAME
Storm Damage Location: Highway 254 P.M. 5.58

BRIDGE NUMBER	PREPARED BY	DATE	SHEET
	C. Goitein	6-26-08	3 of 3

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Walker	8-20-07	8-20-07		R-07-001
DRILLING CONTRACTOR: Woodward			BOREHOLE LOCATION (Station, Offset, Line): Sta ~ Offset ~20L 102+21	SURFACE ELEVATION: 363 ft
DRILLING METHOD: Rotary Wash			DRILL RIG: Mobile B57	BOREHOLE DIAMETER: 4.5 in.
SAMPLER TYPE(S) AND SIZE(S) (ID): Modified California, SPT, Coring			SPT HAMMER TYPE: Safety semi-automatic, 140 lb, 30-inch drop	HAMMER EFFICIENCY, ERi
BOREHOLE BACKFILL AND COMPLETION: Cement Grout			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING: 71.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		GRAVELLY lean CLAY (CL); medium stiff; olive brown; moist; about 30% angular GRAVEL; about 70% fines [FILL].												
	1														
361.00	2														
	3														
359.00	4														
	5														
357.00	6				1	3 5 2	7			15	119				
	7														
355.00	8														
	9														
353.00	10		Becomes stiff.		2 3	4 5 6	11			18	112				
	11														
351.00	12														
	13														
349.00	14		CLAYEY SAND with GRAVEL (SC); dense; olive gray; moist; about 60% mostly fine GRAVEL; about 20% coarse SAND; about 20% medium plasticity fines; meta-shale fragments [LANDSLIDE DEPOSIT].												
	15				4 5	9 28 31	59			12	126	UU = 2.3			
347.00	16														
	17														
345.00	18														
	19														
343.00	20		METAMORPHIC ROCK (Meta-Shale), dark gray, moderately weathered, very soft, very intensely fractured, some surfaces are polished.		6 7	18 28 32	60			8	131				
	21														
341.00	22														
	23														
339.00	24														
	25														

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				R-07-001
DIST. 01	COUNTY Humboldt	ROUTE 254	POSTMILE 5.6	EA 01-475101
PROJECT OR BRIDGE NAME: Storm Damage Location: Highway 254 P.M. 5.58				
BRIDGE NUMBER	PREPARED BY C. Goitein	DATE 9-11-07	SHEET 1 of 3	

CALTRANS BORING RECORD 052007 HUM 254 PM 5.58.GPJ CT SACTO 053107.GDT 6/26/08

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25		METAMORPHIC ROCK (Meta-Shale) *(continued)*.			25	54								
337.00	26				8 9	25 29									
	27														
335.00	28														
	29														
333.00	30					28	68								
	31				10 11	32 36									
331.00	32														
	33														
329.00	34														
	35					17	27								
327.00	36				12 13	13 14									
	37				C1			0							Begin coring with HQ #8 impreg diamond bit
325.00	38														
	39														
323.00	40					3	20								
	41				14 15	7 13									
			METAMORPHIC ROCK (Meta-Sandstone), fine-grained, laminated, dark gray, moderately weathered, very soft, dipping 60 to 50°.												
321.00	42				C2			100	0						
	43														
319.00	44														
	45		METAMORPHIC ROCK (Meta-Shale), laminated, dark gray, moderately weathered, soft, dipping 40 to 5°, polished surfaces.		C3			80	0						
317.00	46														
	47														
315.00	48														
	49														
313.00	50		METAMORPHIC ROCK (Meta-Sandstone), fine-grained, laminated, dark gray, soft.		C4			5	0						
	51														
311.00	52														
	53														
309.00	54														
	55														

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				**R-07-001**
DIST. **01**	COUNTY **Humboldt**	ROUTE **254**	POSTMILE **5.6**	EA **01-475101**
PROJECT OR BRIDGE NAME **Storm Damage Location: Highway 254 P.M. 5.58**				
BRIDGE NUMBER	PREPARED BY **C. Goitein**		DATE **9-11-07**	SHEET **2 of 3**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55		METAMORPHIC ROCK (Meta-Sandstone) *(continued)*.		C5			5	0						lost circulation
307.00	56														
	57														
305.00	58														
	59														
303.00	60		METAMORPHIC ROCK (Meta-Shale), laminated, dark gray, moderately weathered, soft, dipping 40 to 5°, polished surfaces.		C6			47	0						
	61														
301.00	62														
	63		Soft zone from 62.5 to 64 ft.												
299.00	64														
	65				C7			0	0						
297.00	66														
	67														
295.00	68														
	69														
293.00	70					17	78								
	71					28 50									
291.00	72		Bottom of Borehole at 71.5 ft.												
	73														
289.00	74														
	75														
287.00	76														
	77														
285.00	78														
	79														
283.00	80														
	81														
281.00	82														
	83														
279.00	84														
	85														

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REPORT TITLE				HOLE ID
BORING RECORD				**R-07-001**
DIST. **01**	COUNTY **Humboldt**	ROUTE **254**	POSTMILE **5.6**	EA **01-475101**
PROJECT OR BRIDGE NAME **Storm Damage Location: Highway 254 P.M. 5.58**				
BRIDGE NUMBER	PREPARED BY **C. Goitein**	DATE **9-11-07**	SHEET **3 of 3**	

CALTRANS BORING RECORD 052007 HUM 254 PM 5.58.GPJ CT SACTO 053107.GDT 6/26/08

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Walker	8-29-07	8-30-07		R-07-002
DRILLING CONTRACTOR: Caltrans			BOREHOLE LOCATION (Station, Offset, Line): Sta ~ Offset ~15L 103+13	SURFACE ELEVATION: 366 ft
DRILLING METHOD: Rotary Wash			DRILL RIG: Mobile B47	BOREHOLE DIAMETER: 4.5 in.
SAMPLER TYPE(S) AND SIZE(S) (ID): Modified California, SPT, Coring			SPT HAMMER TYPE: Safety semi-automatic, 140 lb, 30-inch drop	HAMMER EFFICIENCY, ERi
BOREHOLE BACKFILL AND COMPLETION: Inclinometer Installed			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING: 75.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT with layers of SANDY CLAYEY GRAVEL [FILL].												
	1														
364.00	2				1	6									
	3				2	50/5									
362.00	4					25	51								
	5				3 4	23 28									
360.00	6				C1										Begin Punch core @ 6 ft.
	7														
358.00	8														
	9														
356.00	10														
	11				5	27									
354.00	12				6	50									
	13														
352.00	14														
	15					4	37								
350.00	16				7 8	14 23									
	17				C2										
348.00	18														
	19														
346.00	20		Poorly graded GRAVEL (GP); gray; dry to moist; subrounded GRAVEL, max. 2 in. dia. [FILL].												
	21		CLAYEY SAND with GRAVEL (SC); medium dense; gray brown; moist; subangular to subrounded GRAVEL, max. 2 in. dia.; occasional thin asphalt layers [FILL].		9	13	74								-200 = 33 %
344.00	22				10 11	30 44									
	23				C3			48							
342.00	24														
	25														

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REPORT TITLE				HOLE ID
BORING RECORD				R-07-002
DIST. 01	COUNTY Humboldt	ROUTE 254	POSTMILE 5.6	EA 01-475101
PROJECT OR BRIDGE NAME: Storm Damage Location: Highway 254 P.M. 5.58				
BRIDGE NUMBER -	PREPARED BY C. Goitein	DATE 9-11-07	SHEET 1 of 3	

CALTRANS BORING RECORD 052007 HUM 254 PM 5.58.GPJ CT SACTO 053107.GDT 6/26/08

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25	CLAYEY SAND with GRAVEL (SC) *(continued)*.		C3			48							
340.00	26				18	22								
	27				15									
					7									
338.00	28			C4										
	29								15	122	UU = 2			
336.00	30													
	31	CLAYEY GRAVEL with SAND (GC/CL); medium dense; mottled olive gray brown; moist; fine to coarse, subangular GRAVEL; coarse SAND; meta-shale derived [LANDSLIDE DEPOSIT].		12	12	41								
334.00	32			13	16									
				14	25									
	33			C5										
332.00	34	CLAYEY GRAVEL with SAND (GC); medium dense; dark gray; moist; fine to coarse, subangular GRAVEL; coarse SAND; [LANDSLIDE DEPOSIT].								122	UU = 1.2			
	35				15	33								
330.00	36			15	16									
				16	17									
	37			C6										
328.00	38	METAMORPHIC ROCK (Meta-Shale Landslide Block), medium gray to dark gray, moderately weathered, very soft to soft, very intensely fractured, pervasively sheared, occasional meta-sandstone interbeds, [LANDSLIDE DEPOSIT].												
	39			C7										
326.00	40													
	41	Calcite veining.			24									
324.00	42			17	23									
				18	50/4									
	43			C8										
322.00	44	SLIDE PLANE at 45 ft. from slope inclinometer profile SMS02.		C9	50/4									
	45	METAMORPHIC ROCK (Meta-Shale), medium gray to dark gray, moderately weathered, very soft to soft, very intensely fractured, pervasively sheared, occasional meta-sandstone interbeds.												
320.00	46			C10										
	47													
318.00	48													
	49													
316.00	50													
	51				16									
314.00	52				50/4									
				C11			72	0						
	53													
312.00	54													Begin coring with HQ #8 impreg diamond bit
	55													

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REPORT TITLE				HOLE ID
BORING RECORD				**R-07-002**
DIST. **01**	COUNTY **Humboldt**	ROUTE **254**	POSTMILE **5.6**	EA **01-475101**
PROJECT OR BRIDGE NAME **Storm Damage Location: Highway 254 P.M. 5.58**				
BRIDGE NUMBER	PREPARED BY **C. Goitein**	DATE **9-11-07**	SHEET **2 of 3**	

CALTRANS BORING RECORD 052007 HUM 254 PM 5.58.GPJ CT SACTO 053107.GDT 6/26/08

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55		METAMORPHIC ROCK (Meta-Shale) *(continued)*.		C12			30	0						
310.00	56														
	57														
308.00	58														
	59														
306.00	60				C13			87	0						
	61														
304.00	62		Fracture zone, from 62 to 63 ft.												
	63		Calcite veining.		C14			47	0						
302.00	64														
	65		Laminated, bedding joint, dipping 27°.		C15			42	0						Switch bit to stratapax
300.00	66														Slow drilling
	67				C16			17	0						
298.00	68														
	69														
296.00	70		Laminated, bedding joint, dipping 30°.		C17										
	71		Joint, dipping 60°.												
294.00	72		Joint, dipping 27°.												
	73				C18										
292.00	74														
	75		Bottom of Borehole at 75.0 ft. Inclinometer Installed to 75 ft.												
290.00	76														
	77														
288.00	78														
	79														
286.00	80														
	81														
284.00	82														
	83														
282.00	84														
	85														

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - North

REPORT TITLE				HOLE ID
BORING RECORD				**R-07-002**
DIST. **01**	COUNTY **Humboldt**	ROUTE **254**	POSTMILE **5.6**	EA **01-475101**
PROJECT OR BRIDGE NAME **Storm Damage Location: Highway 254 P.M. 5.58**				
BRIDGE NUMBER	PREPARED BY **C. Goitein**		DATE **9-11-07**	SHEET **3 of 3**

CALTRANS BORING RECORD 052007 HUM 254 PM 5.58.GPJ CT SACTO 053107.GDT 6/26/08

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
B. von Dessonneck	8-20-07	8-21-07		R-07-003
DRILLING CONTRACTOR: Spectrum			BOREHOLE LOCATION (Station, Offset, Line): Sta ~ Offset ~22L 103+81	SURFACE ELEVATION: 366 ft
DRILLING METHOD: Rotary Wash			DRILL RIG: Delta Base	BOREHOLE DIAMETER: 4.5 in.
SAMPLER TYPE(S) AND SIZE(S) (ID): Modified California, Coring			SPT HAMMER TYPE: Safety semi-automatic, 140 lb, 30-inch drop	HAMMER EFFICIENCY, ERi
BOREHOLE BACKFILL AND COMPLETION: Cement Grout			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING: 76.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		Poorly graded SAND with GRAVEL (SP); loose to medium dense; dark brown; wet; some fine, subangular to subrounded GRAVEL; mostly fine to coarse SAND; about 5% fines [FILL].												
	1														
364.00	2														
	3														
362.00	4														
	5														
360.00	6				1 2	3 7 7	14	72							
	7														
358.00	8														
	9														
356.00	10		Becomes dense, contains shale and asphalt fragments.		3 4	2 23 37	60	72							
	11														
354.00	12														
	13														
352.00	14														Circulation Loss
	15		Fine to coarse, subangular to subrounded GRAVEL, max. 2 in. dia.; becomes medium dense.		5 6	18 21 10	31	72							
350.00	16														
	17		SANDY lean CLAY with GRAVEL (CL/SC); very stiff; light brown; wet; trace GRAVEL; about 28% little fine to coarse, subangular to subrounded SAND; mostly medium to high plasticity fines; [LANDSLIDE DEPOSIT].												
348.00	18														
	19														
346.00	20				7 8	3 5 6	11	78		12	137	UU = 0.2			
	21														
344.00	22														
	23														
342.00	24														
	25														

(continued)

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - North

REPORT TITLE				HOLE ID
BORING RECORD				R-07-003
DIST. 01	COUNTY Humboldt	ROUTE 254	POSTMILE 5.6	EA 01-475101
PROJECT OR BRIDGE NAME: Storm Damage Location: Highway 254 P.M. 5.58				
BRIDGE NUMBER	PREPARED BY C. Goitein	DATE 9-11-07	SHEET 1 of 3	

CALTRANS BORING RECORD 052007 HUM 254 PM 5.58.GPJ CT SACTO 053107.GDT 6/26/08

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25		Moist; little fine to medium SAND. SANDY lean CLAY with GRAVEL (CL/SC) *(continued)*.			8	20	78							PI
340.00	26				9	8									-200 = 43 %
					10	12									
	27														
338.00	28														
	29														
336.00	30		Becomes olive brown, some sand.		11	3	17	11							
	31					8									
						9									
334.00	32														
	33														
332.00	34														
	35		METAMORPHIC ROCK (Meta-Shale), medium gray, moderately weathered, moderately soft, very intensely to intensely fractured, clay infill.			5	20	72							
330.00	36				12	9									
					13	11				13	127	UU = 0.3			
	37														
328.00	38														
	39														
326.00	40					6	18	83							
	41				14	11									
					15	7									-200 = 9 %
324.00	42														
	43														
322.00	44														
	45					6	17	78							
320.00	46				16	7									
					17	10									
	47														
318.00	48														
	49														
316.00	50				18	26		78							
	51					50/3									
314.00	52				C1			0							Begin Coring with HQ #8 diamond bit
	53														
312.00	54		Dark gray, soft, very intensely fractured, calcite stringers in some fragments.		C2			17	0						
	55														

(continued)

Department of Transportation
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Geotechnical Services
Office of Geotechnical Design - North

REPORT TITLE				HOLE ID
BORING RECORD				**R-07-003**
DIST. **01**	COUNTY **Humboldt**	ROUTE **254**	POSTMILE **5.6**	EA **01-475101**
PROJECT OR BRIDGE NAME **Storm Damage Location: Highway 254 P.M. 5.58**				
BRIDGE NUMBER	PREPARED BY **C. Goitein**	DATE **9-11-07**	SHEET **2 of 3**	

CALTRANS BORING RECORD 052007 HUM 254 PM 5.58.GPJ CT SACTO 053107.GDT 6/26/08

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55		METAMORPHIC ROCK (Meta-Shale) *(continued)*.		C2			17	0						
310.00	56														
	57				C3			20	0						
308.00	58														
	59														
306.00	60														
	61		Meta-sandstone laminated beds.												
304.00	62				C4			73	0						
	63		Bedding joint, dipping 35 to 30°, planar, no infill, JRC 2-4.												
302.00	64														
	65														
300.00	66		Joint, dipping 60°, planar, no infill, JRC 2-4.												
	67				C5			32	0						
298.00	68														
	69														
296.00	70														
	71														
294.00	72				C6			47	0						
	73														
292.00	74														
	75														
290.00	76														
	77		Bottom of Borehole at 76.5 ft.												
288.00	78														
	79														
286.00	80														
	81														
284.00	82														
	83														
282.00	84														
	85														

Department of Transportation
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Office of Geotechnical Design - North

REPORT TITLE				HOLE ID
BORING RECORD				**R-07-003**
DIST. **01**	COUNTY **Humboldt**	ROUTE **254**	POSTMILE **5.6**	EA **01-475101**
PROJECT OR BRIDGE NAME **Storm Damage Location: Highway 254 P.M. 5.58**				
BRIDGE NUMBER	PREPARED BY **C. Goitein**	DATE **9-11-07**	SHEET **3 of 3**	

CALTRANS BORING RECORD 052007 HUM 254 PM 5.58.GPJ CT SACTO 053107.GDT 6/26/08

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
B. von Dessonneck	8-22-07	8-23-07		R-07-004
DRILLING CONTRACTOR: Spectrum			BOREHOLE LOCATION (Station, Offset, Line): Sta ~ Offset ~22R 103+17	SURFACE ELEVATION: 369 ft
DRILLING METHOD: Rotary Wash			DRILL RIG: Delta Base	BOREHOLE DIAMETER: 4.5 in.
SAMPLER TYPE(S) AND SIZE(S) (ID): Modified California, Coring			SPT HAMMER TYPE: Safety semi-automatic, 140 lb, 30-inch drop	HAMMER EFFICIENCY, ERi
BOREHOLE BACKFILL AND COMPLETION: Cement Grout			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING: 76.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY with GRAVEL (CL); medium stiff; gray; moist; little fine to medium SAND [FILL].												
	1														
367.00	2														
	3		SANDY lean CLAY (CL); hard; light brown; moist; little fine to medium SAND; [DORMANT LANDSLIDE DEPOSIT].												
365.00	4														
	5														
363.00	6				1 2	10 14 12	26	61		14	112				
	7														
361.00	8														
	9														
359.00	10		GRAVELLY lean CLAY with SAND (CL); very stiff; brown; moist; little fine to coarse, angular GRAVEL; fine to coarse SAND; [DORMANT LANDSLIDE DEPOSIT].												
	11				3 4	7 11 12	23	56		15	114	UU =0.5			
357.00	12														
	13														
355.00	14														
	15														
353.00	16				5 6	8 9 13	22	50							PI
	17														
351.00	18														
	19														
349.00	20		METAMORPHIC ROCK (Meta-Shale), dark gray, moderately weathered, very soft, intensely fractured, [DORMANT LANDSLIDE DEPOSIT].												
	21				7 8	13 21 27	48	67		8	133				
347.00	22														
	23														
345.00	24														
	25		Approximate base of dormant landslide at 25 ft.												

(continued)

Department of Transportation
Division of Engineering Services
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Office of Geotechnical Design - North

REPORT TITLE				HOLE ID
BORING RECORD				R-07-004
DIST. 01	COUNTY Humboldt	ROUTE 254	POSTMILE 5.6	EA 01-475101
PROJECT OR BRIDGE NAME: Storm Damage Location: Highway 254 P.M. 5.58				
BRIDGE NUMBER	PREPARED BY C. Goitein	DATE 9-21-07	SHEET 1 of 3	

CALTRANS BORING RECORD 052007 HUM 254 PM 5.58.GPJ CT SACTO 053107.GDT 7/1/08

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25		METAMORPHIC ROCK (Meta-Shale), dark gray, moderately weathered, very soft, intensely fractured.			6	72	72							
343.00	26				9	22									
					10	50									
	27														
341.00	28														
	29														
339.00	30					18	53	61							
	31				11	22									
					12	31									
337.00	32														
	33														
335.00	34														
	35		Soft.			8	57	67							
333.00	36				13	28									
					14	29									
	37														
331.00	38														
	39														
329.00	40					19	78	61							
	41				15	33									
					16	45									
327.00	42														
	43														
325.00	44														
	45					14	64	61							
323.00	46				17	32									
					18	32									
	47														
321.00	48														
	49														
319.00	50					15	77	61							
	51		Fat clay infill.			27									
					C1	50		30	0						
317.00	52														Begin Coring with HQ #8 diamond bit Circulation Loss
	53														
315.00	54														
	55														

(continued)

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - North

REPORT TITLE				HOLE ID
BORING RECORD				**R-07-004**
DIST. **01**	COUNTY **Humboldt**	ROUTE **254**	POSTMILE **5.6**	EA **01-475101**
PROJECT OR BRIDGE NAME **Storm Damage Location: Highway 254 P.M. 5.58**				
BRIDGE NUMBER	PREPARED BY **C. Goitein**		DATE **9-21-07**	SHEET **2 of 3**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55		METAMORPHIC ROCK (Meta-Shale) *(continued)*.		C1			30	0						
313.00	56				C2			30	0						
	57														
311.00	58														
	59														
309.00	60														
	61				C3			17	0						
307.00	62														
	63														
305.00	64														
	65														
303.00	66				C4			30	0						
	67														
301.00	68														
	69														
299.00	70														
	71		Bedding joint, dipping 30°, meta-sandstone bed, ~0.5 in. thick, fine grained, calcite in some healed fractures.		C5			53	0						
297.00	72														
	73				C6			47	0						
295.00	74														
	75														
293.00	76		Bottom of Borehole at 76.0 ft.												
	77														
291.00	78														
	79														
289.00	80														
	81														
287.00	82														
	83														
285.00	84														
	85														

Department of Transportation
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Geotechnical Services
Office of Geotechnical Design - North

REPORT TITLE				HOLE ID
BORING RECORD				**R-07-004**
DIST. **01**	COUNTY **Humboldt**	ROUTE **254**	POSTMILE **5.6**	EA **01-475101**
PROJECT OR BRIDGE NAME **Storm Damage Location: Highway 254 P.M. 5.58**				
BRIDGE NUMBER	PREPARED BY **C. Goitein**		DATE **9-21-07**	SHEET **3 of 3**

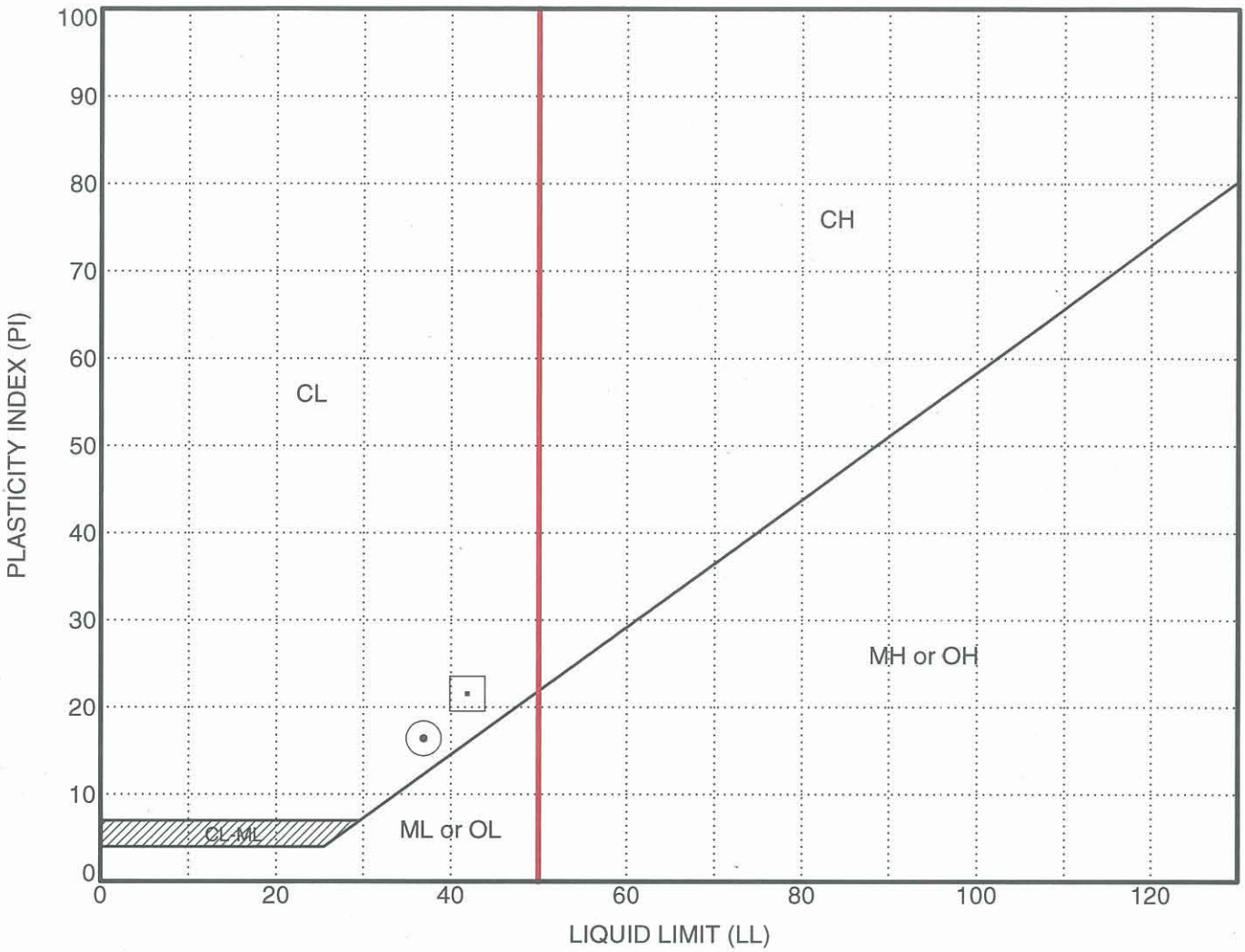
CALTRANS BORING RECORD 052007 HUM 254 PM 5.58.GPJ CT SACTO 053107.GDT 7/1/08

APPENDIX B

Lab Test Summary
Storm Damage Location: **Highway 254 P.M. 5.58 Job # 85401**

Soil/Rock Type	Boring	Depth (ft)	UU (tsf)	UU (psf)	Confining Pressure (psf)	Dry density (pcf)	Moisture content (%)	Total density (pcf)	PI	LL	PL	-200
Fill CL	R-07-001	6				119	15	137				
Fill CL	R-07-001	11				112	18	132				
Debris SC	R-07-001	16	2.3	4621	2016	126	12	141				
Meta-Shale	R-07-001	21				131	8	142				
Fill SC	R-07-002	21										33
Fill SC	R-07-002	29	2.0	3968	3888	122	15	140				
Debris GC	R-07-002	34	1.2	2460	4320	122	13	138				
Debris CL/SC	R-07-003	21	0.2	439	2736	122	12	137				
Debris CL/SC	R-07-003	25							17	37	20	
Debris CL/SC	R-07-003	26										43
Meta-Shale	R-07-003	36	0.3	697	4608	127	13	144				
Meta-Shale	R-07-003	41										9
Debris CL	R-07-004	6				112	14	127				
Debris CL	R-07-004	11	0.5	1096	1440	114	15	131				
Debris CL	R-07-004	16							22	42	20	
Meta-Shale	R-07-004	21				133	8	144				

LL – LIQUID LIMIT
PL - PLASTIC LIMIT
PI - PLASTICITY INDEX
UU - UNCONSOLIDATED UNDRAINED



SAMPLE SOURCE	CLASSIFICATION	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
⊙ R-07-003 @ 25.0'	Sandy Clay with Gravel (CL/SC)	37	20	17	
⊡ R-07-004 @ 16.0'	Gravelly Clay with Sand (CL)	42	20	22	

KLEINFELDER
Bright People. Right Solutions.

PROJECT NUMBER **85401** DATE **6/26/2008**

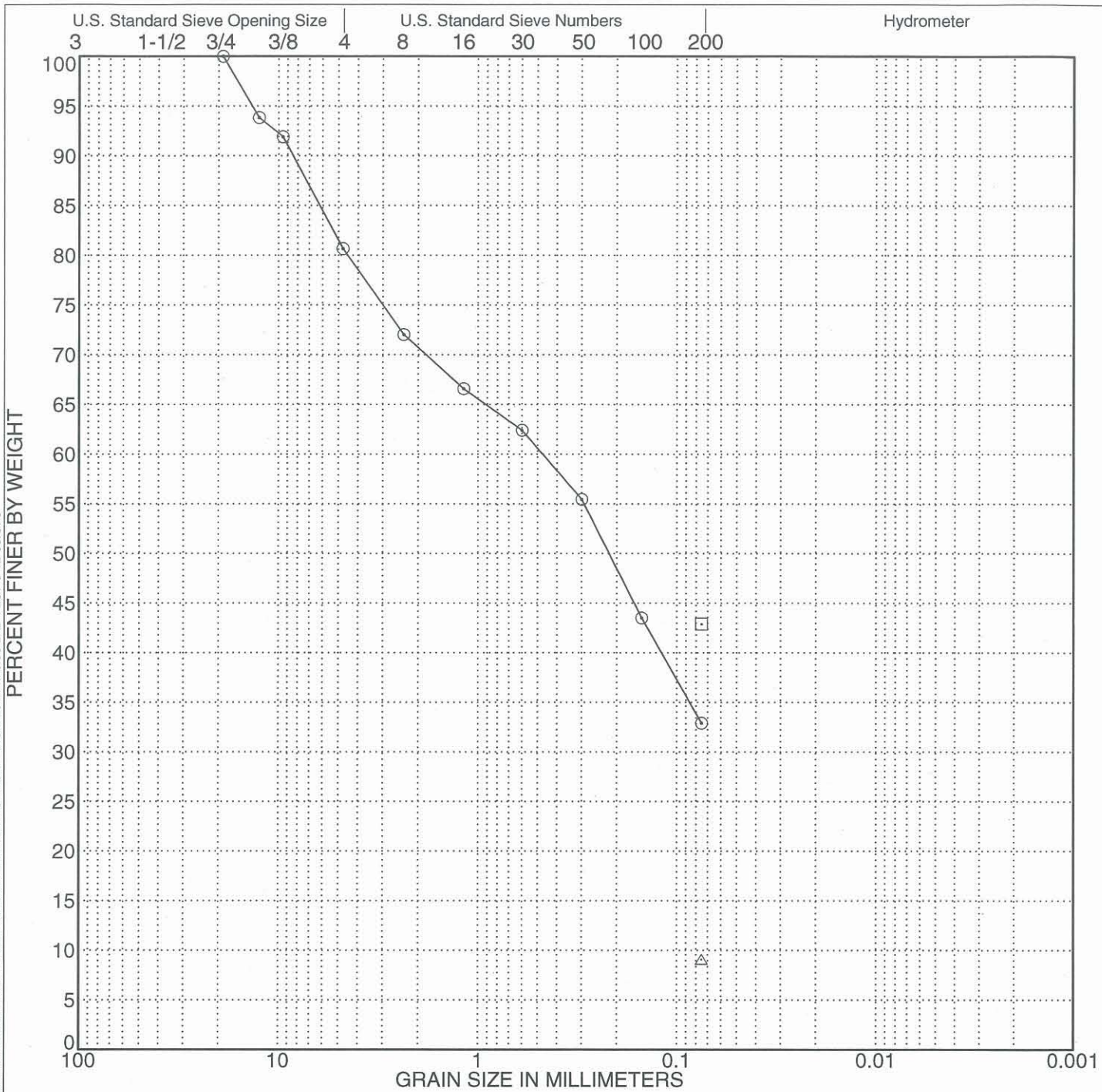
PLASTICITY CHART

HUM 254 PM 5.58
EA-01-475101

PLATE

B-1

Data Template:
PI - KLEINFELDER SANTA ROSA 5-8-08 .GDT - 6/26/08 15:43 - U:\NEW GINT PROJECTS\85401 CALTRANS - STORM DAMAGED SITES 5-7\HUM 254 PM 5.58 LAB TEST 6-12-08.GPJ



Cobbles	GRAVEL		SAND			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE		

SYMBOL	SAMPLE SOURCE	CLASSIFICATION
⊙	R-07-002 @ 21.0'	Clayey Sand with Gravel (SC)
⊡	R-07-003 @ 26.0'	Sandy Clay with Gravel (CL/SC)
△	R-07-003 @ 41.0'	Meta-Shale

KLEINFELDER
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PROJECT NUMBER **85401** DATE **6/26/2008**

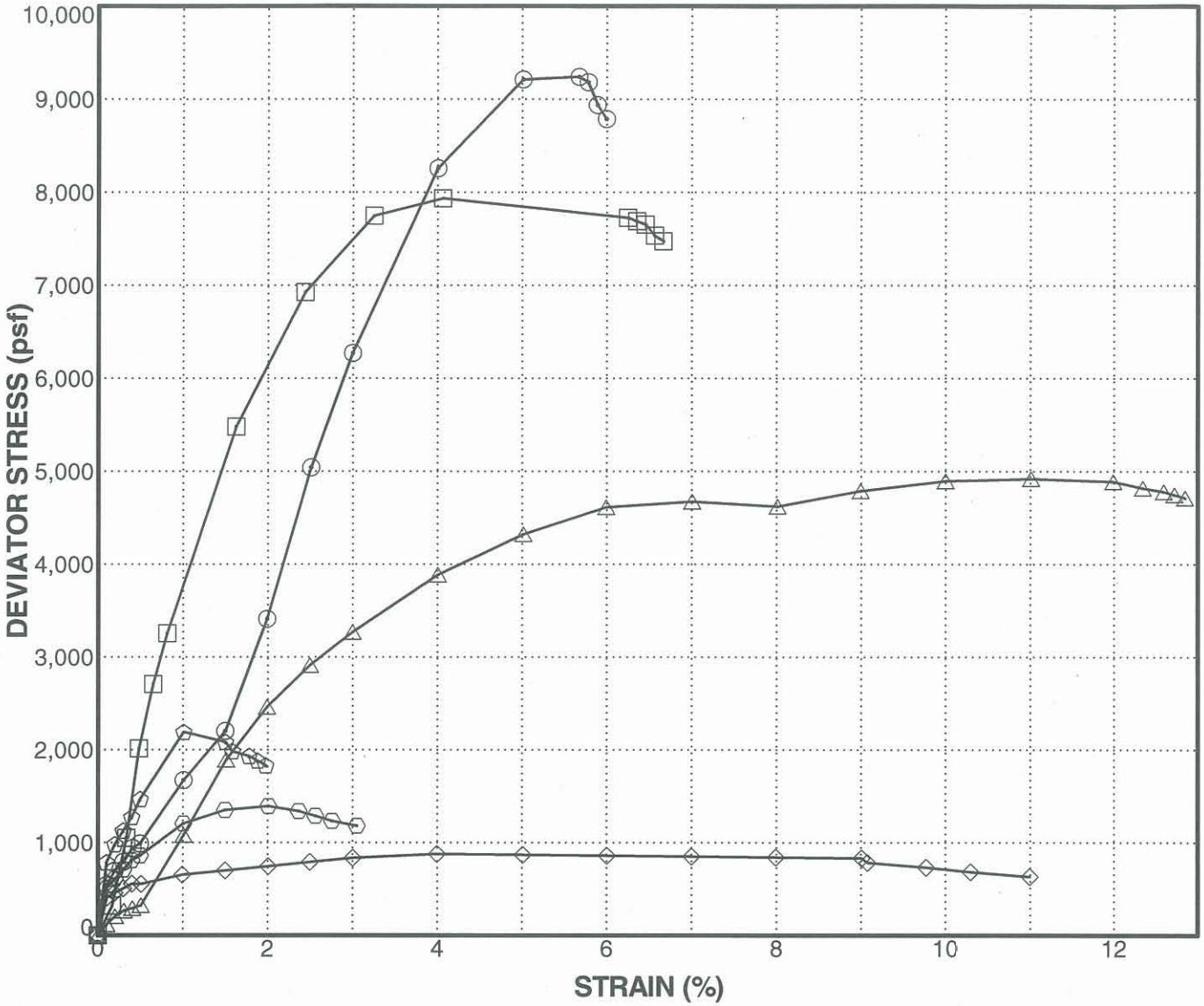
PARTICLE SIZE ANALYSIS

HUM 254 PM 5.58
EA-01-475101

PLATE

B-2

Data Template:
SA - KLEINFELDER SANTA ROSA 5-8-08 .GDT - 6/26/08 15:44 - U:\NEW GINT PROJECTS\85401 CALTRANS - STORM DAMAGED SITES 5-7\HUM 254 PM 5.58 LAB TEST 6-12-08.GPJ



Sample Source	Classification	Type of Test	Confinement Pressure (psf)	Shear Strength (psf)	Strain (%)	Dry Density (pcf)	Moisture Content (%)
⊙ R-07-001 @ 16.0'	Clayey Sand with Gravel (SC)	TXUU	2016	4621	6	126	11.7
⊡ R-07-002 @ 29.0'	Clayey Sand with Gravel (SC)	TXUU	3888	3968	4	122	14.6
△ R-07-002 @ 34.0'	Clayey Gravel with Sand (GC)	TXUU	4320	2460	11	122	13.4
◇ R-07-003 @ 21.0'	Sandy Clay with Gravel (CL/SC)	TXUU	2736	439	4	122	12.2
⊙ R-07-003 @ 36.0'	Meta-Shale	TXUU	4608	697	2	127	13.0
⬠ R-07-004 @ 11.0'	Gravelly Clay with Sand (CL)	TXUU	1440	1096	1	114	14.7

UC = Unconfined Compression

TX/UU = Unconsolidated Undrained Triaxial

KLEINFELDER
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PROJECT NUMBER **85401** DATE **6/26/2008**

STRENGTH TEST DATA

HUM 254 PM 5.58
EA-01-475101

PLATE

B-3

Data Template:
NEW TXUU - KLEINFELDER SANTA ROSA 5-8-08 .GDT - 6/26/08 15:44 - U:\NEW GINT PROJECTS\85401 CALTRANS - STORM DAMAGED SITES 5-7\HUM 254 PM 5.58 LAB TEST 6-12-08.GPJ

AP Engineering & Testing, Inc.

CORROSION TEST RESULTS

Client Name: Kleinfelder
Project Name: Caltrans
Project No.: 85401

AP Job No.: 27-0928
Date 09/19/07

EA # Highway & PM	Boring No.	Remarks	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (%)	Chloride Content (%)
EA01-475001 HUM 254 PM 5.8	R-07-004	13+15 ft	CL	2200	7.3	0.0005	0.0146
EA01-475001 HUM 254 PM 5.8	R-07-001	20 ft	CL	1800	7.4	0.0087	0.0070
EA01-475101 HUM 254 PM 5.58	R-07-004	10.5-15.5 ft	CL	1900	7.3	0.0004	0.0074
EA01-475101 HUM 254 PM 5.58	R-07-002	30 ft	CL	1700	7.4	0.0003	0.0135
EA01-475101 HUM 254 PM 5.1	R-07-004	13 ft	CL	1700	7.4	0.0043	0.0129
EA01-475101 HUM 254 PM 5.1	R-07-002	32 ft	CL	2200	7.6	0.0016	0.0127

NOTES:
Resistivity Test and pH: California Test Methods 532 and 643
Sulfate Content : California Test Method 417
Chloride Content : California Test Method 422
ND = Not Detectable
NA = Not Sufficient Sample
NR = Not Requested

2607 Pomona Boulevard, Pomona, CA 91768
Tel. (909) 869-6316 Fax. (909)869-6318

KLEINFELDER
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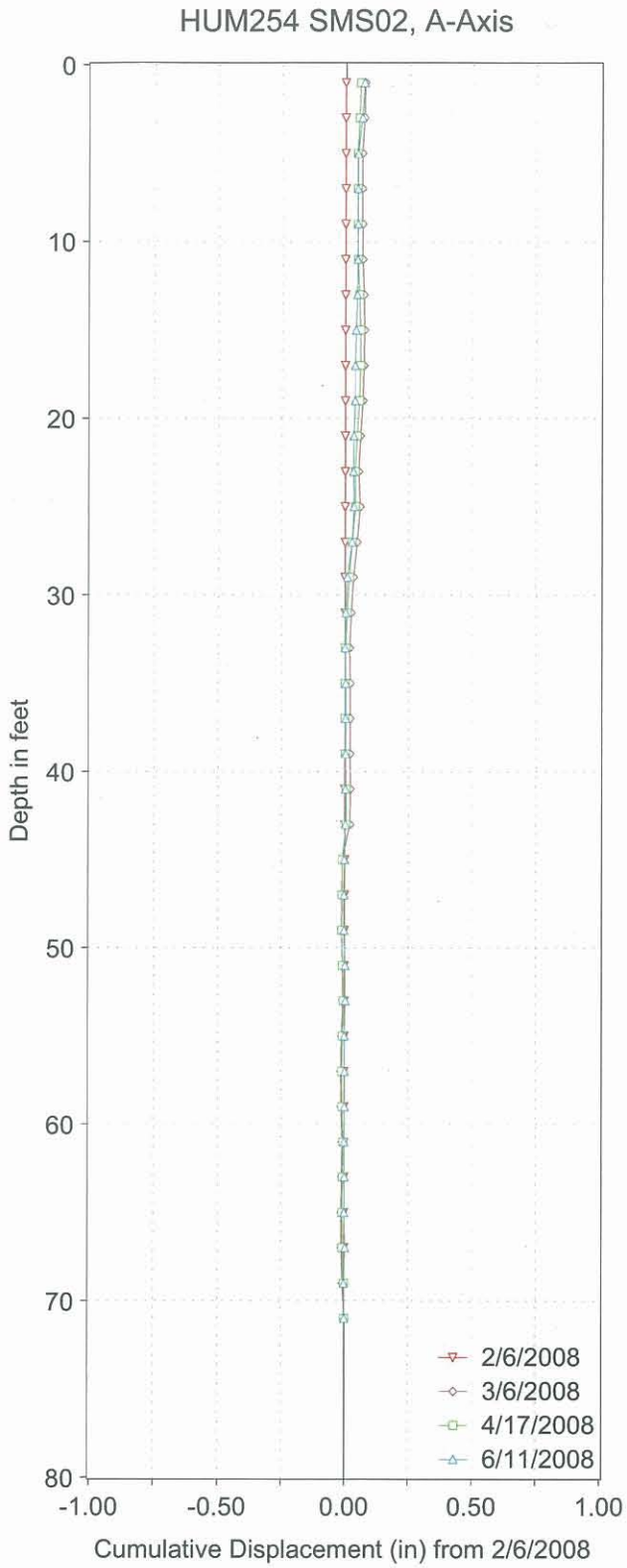
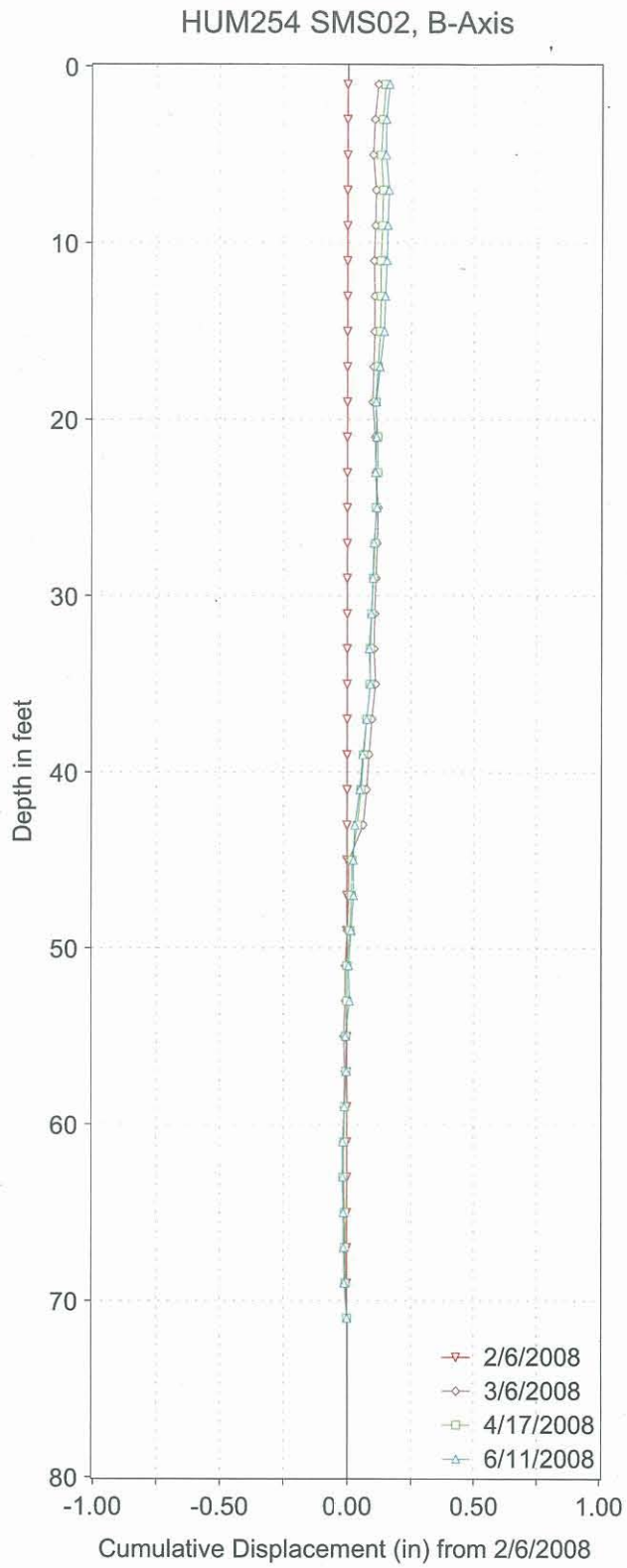
APPENDIX C





INCLINOMETER MONITORING RESULTS

01-HUM-254-PM 5.58
South Miranda Sink
E.A. No.: 01-475101

Depth of Inclinometer Casing: 71 feet
Ao Direction: N/A° (Magnetic North)
Location (WGS-84) : N/A

STATE OF CALIFORNIA ARNOLD SCHWARZENEGGER, Governor

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

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

July 18, 2008

Department of Transportation
North Region – Design East
703 B Street
Marysville, California 95901

Attention: Fermin Barriga, Branch Chief

Subject: Underground Classification No. C107-023-09T
Highway 254 Miranda Walls

Mr. Barriga

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

When the contractor who will be performing the work is selected, please advise them to notify this office to schedule the mandated Prejob Conference with the Division prior to commencing any activity associated with construction or rehabilitation of the tunnel.

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
Senior Engineer

cc: Richard Brockman
File

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Underground Classification

C107-023-09T

CALIFORNIA DEPARTMENT OF TRANSPORTATION

(NAME OF TUNNEL OR MINE AND COMPANY NAME)

of 1656 Union Street, Eureka, California 95501

(MAILING ADDRESS)

at HIGHWAY 254 MIRANDA WALLS

(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 fifty eight 36-inch diameter shafts of varying depths of 41 to 60 feel located at two sites alongside Highway 254, approximately 1.3 and 0.8 miles south of the Miranda Post Office, Humboldt County.

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

Date November 18, 2008

(SENIOR ENGINEER)

John R. Leahy

03 77089

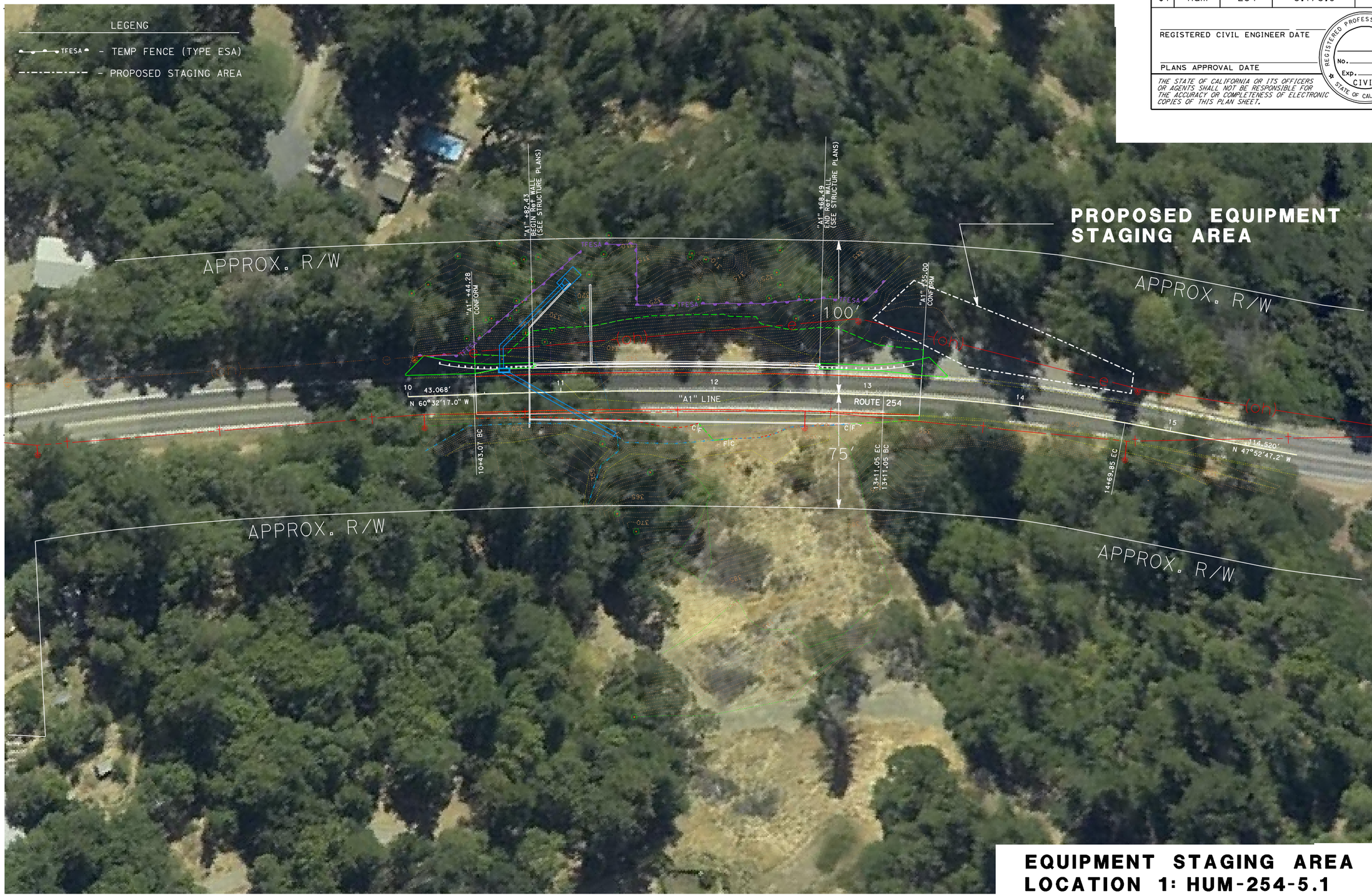
Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
01	Hum	254	5.1/5.6		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

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



EQUIPMENT STAGING AREA LOCATION 1: HUM-254-5.1

NO SCALE

SHEET-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans **DESIGN**

FUNCTIONAL SUPERVISOR: THOMAS P. WOOD

CALCULATED-DESIGNED BY: HORACIO PARAS JR

CHECKED BY: FERMIN BARRIGA

REVISED BY

DATE REVISED

LAST REVISION 04-08-09

DATE PLOTTED => 09-APR-2009

TIME PLOTTED => 14:49

BORDER LAST REVISED 3/1/2007

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME => s131585

DGN FILE => StagingArea5-1-2.dgn

CU 03224

EA 475101

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
01	Hum	254	5.1/5.6		

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EQUIPMENT STAGING AREA
LOCATION 2: HUM-254-5.6

NO SCALE

SHEET-2

REVISED BY	
DATE REVISED	
HORACIO PARAS JR	
FERMIN BARRIGA	
CALCULATED-DESIGNED BY	
CHECKED BY	
FUNCTIONAL SUPERVISOR	
THOMAS P. WOOD	

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans **DESIGN**

LAST REVISION 04-08-09 DATE PLOTTED => 09-APR-2009 TIME PLOTTED => 14:50