FOR CONTRACT NO.: **01-476204**

INFORMATION HANDOUT

WATER QUALITY

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD - 401 PERMIT

(NORTH COAST REGION)

PERMITS

UNITED STATES ARMY CORPS OF ENGINEERS 404 PERMIT

MATERIALS INFORMATION

FOUNDATION REPORT

Foundation Report for Storm Damage Repair at HUM 253, PM 7.6
Foundation Report Addendum for Bridge No. 10E0022
Foundation Report for Storm Damage Repair at HUM 253, PM 7.75
Foundation Report Addendum for Bridge No. 10E0023

ROUTE: 01-MEN-253 - 7.6,7.8

WATER QUALITY

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD- 401 PERMIT
(NORTH COAST REGION)

California Regional Water Quality Control Board
North Coast Region
Geoffrey M. Hales, Chairman

www.waterboards.ca.gov/northcoast
5550 Skylane Boulevard, Suite A, Santa Rosa, California 95403
Phone: (877) 721-9203 (toll free) • Office: (707) 576-2220 • FAX: (707) 523-0135

Linda S. Adams
Acting Secretary for Environmental Protection

Edmund G. Brown Jr.
Governor

May 24, 2011

In the Matter of

Water Quality Certification

for the

California Department of Transportation
Highway 253 - Mendocino Storm Damage Repair
WDID No. 1B10028WNME

APPLICANT:	California Department of Transportation
RECEIVING WATER:	Wetlands and Unnamed tributaries to the Russian River
HYDROLOGIC AREA:	Russian River Hydrologic Unit No. 114.00
COUNTY:	Mendocino
FILE NAME:	CDOT - HWY 253, Mendocino Storm Damage Repair

BY THE EXECUTIVE OFFICER:

1. On March 25, 2010, the North Coast Regional Water Quality Control Board (Regional Water Board) received an application from the California Department of Transportation (Caltrans), requesting Federal Clean Water Act (CWA), section 401, Water Quality Certification for activities related to the proposed Mendocino County Highway 253, PM 7.60 and 7.75- Storm Damage Repair Project (project). Additional information was submitted on April 15, 2010 and March 21, 2011. The proposed project will cause disturbances to waters of the United States (U.S.) and waters of the State associated with wetlands and unnamed ephemeral tributaries to Russian River located within the Russian River Hydrologic Unit (HU) No.114.00 (Ukiah Hydrologic Sub-Area 114.31). The Regional Water Board provided public notice of the application pursuant to title 23, California Code of Regulations, section 3858 on April 27, 2011, and posted information describing the project on the Regional Water Board's website. No comments were received.

2. The proposed project is located on Highway 253 at post mile (PM) 7.60 and PM 7.75, in Mendocino County. The purpose of the proposed project is to repair the embankment and shoulder and upgrade drainage items along a section of Highway 253. The repairs are needed to restore the integrity of the highway, which has begun to fail. Soldier pile tieback walls were chosen to repair the road at these locations despite their high cost because they had the smallest footprint and the least amount of impacts to jurisdictional features.

3. At location 1 (PM 7.60), 193 linear feet of 8-inch underdrain will be replaced in kind on the upslope side of the road, roughly opposite the soldier pile tie back wall, and connected to the existing 18 inch cross culvert (approximately 75 linear feet). At location 2 the existing 8 inch by 250 foot damaged underdrain will be replaced in kind. The existing 8 inch and 18 inch cross culverts (approximately 50 linear feet each) will remain in place. Both culverts will have 25 foot downdrains attached at their outlets which will channel water to a 40 foot by 18 inch diameter perforated pipe. This pipe will run perpendicular to the culvert in order to distribute water evenly through the wetland area. Caltrans has determined that the project will result in 0.97 acres (443 linear feet) of temporary impacts to waters of the state (drainages). In addition, the project will result in 0.08 acres of temporary impacts to wetlands (0.01 acres waters of the U.S and 0.07 acres Waters of the State).

4. Caltrans' contractor will be required to implement Best Management Practices (BMPs) for construction and post-construction phases of the project. Caltrans will utilize BMPs to provide erosion and sediment control and pollution prevention throughout the project area during construction. All graded areas within the project affected by the construction activities will be appropriately stabilized and BMPs will be implemented to ensure erosion is minimized and controlled.

5. The project is tentatively scheduled for the period March 15th to October 15$^{th;}$ however, work within the drainages will only be conducted in the dry season (May 15 to October 15th). Caltrans has applied for authorization from the Unites States Army Corps of Engineers to perform the project under their Nationwide Permits No. 18 Non-Reporting (minor discharges) pursuant to Clean Water Act, section 404. In order to comply with California Environmental Quality Act, Caltrans has certified Mitigated Negative Declaration in June of 2009 (State Clearing House No. 2009052093). The Regional Water Board has considered the environmental documents and any proposed changes incorporated into the project or required as a condition of approval to avoid significant effects to the environment.

6. The Russian River watershed is listed on the Clean Water Act section 303(d) list as impaired for sediment and temperature. Roads are a significant source of sediment in the watershed (directly, from surface erosion, and, indirectly, by

triggering landslides). In addition, activities that impact the riparian zone and reduce riparian vegetation are identified as sources contributing to increased stream temperatures. A focus on measures to reduce sediment discharges to surface waters from roads in the watershed, and measures to avoid, minimize, and mitigate impacts on riparian zones is essential for achieving TMDL compliance. In accordance with the conditions of this Water Quality Certification Caltrans will be required to conduct surface water monitoring and erosion and sediment control monitoring and reporting.

7. Pursuant to Regional Water Board Resolution R1-2004-0087, *Total Maximum Daily Load Implementation Policy Statement for Sediment-Impaired Receiving Waters within the North Coast Region* (Sediment TMDL Implementation Policy), the Executive Officer is directed to "rely on the use of all available authorities, including existing regulatory standards, and permitting and enforcement tools to more effectively and efficaciously pursue compliance with sediment-related standards by all dischargers of sediment waste."

8. To ensure compliance with sediment, temperature and other related Water Quality Objectives within the Basin Plan, adequate wetland and riparian protection and stringent requirements to avoid, minimize, and mitigate the sediment and temperature impacts associated with the proposed project will be incorporated as enforceable conditions this Water Quality Certification. In addition, Caltrans will be required to conduct surface water monitoring, sampling, and analysis in accordance with the conditions of the Water Quality Certification. Additionally, storm water runoff monitoring, sampling, and analysis will be conducted as required by the State Water Resources Control Board (SWRCB) National Pollutant Discharge Elimination System (NPDES) Permit for Storm Water Discharges from the State of California, Department of Transportation (Caltrans) Properties, Facilities and Activities Order No. 99 – 06 - DWQ. The surface water data collected will be utilized to assess the adequacy of BMPs during construction as well as site specific mitigation measures proposed to minimize impacts to the environment, including sediment and temperature impacts.

9. The federal antidegradation policy requires that state water quality standards include an antidegradation policy consistent with the federal policy. The State Water Board established California's antidegradation policy in State Water Board Resolution No. 68-16. Resolution No. 68-16 incorporates the federal antidegradation policy where the federal policy applies under federal law. Resolution No. 68-16 requires that existing quality of waters be maintained unless degradation is justified based on specific findings. The Regional Water Board's Basin Plan implements, and incorporates by reference, both the State and federal antidegradation policies. This Order is consistent with applicable federal and State

antidegradation policies, as it does not authorize the discharge of increased concentrations of pollutants or increased volumes of treated wastewater, and does not otherwise authorize degradation of the waters affected by this project.

Receiving Waters:	Unnamed Tributaries to the Russian River and Wetlands Russian River Hydrologic Unit No. 114.00, Ukiah Hydrologic Sub-Area No. 114.31.
Filled or Excavated Areas:	Temporary – wetlands (Waters of U.S.): 0.01 acres Temporary – wetlands (Waters of State): 0.07 acres Temporary – streams (Waters of State): 0.97 acres
Total Linear Impacts:	Temporary - streams (Waters of U.S.): 443 linear ft
Dredge Volume :	None
Latitude/Longitude:	39.3531 N / 123.2542 W

ACCORDINGLY, BASED ON ITS INDEPENDENT REVIEW OF THE RECORD, THE REGIONAL WATER BOARD CERTIFIES THAT THE CALTRANS HIGHWAY 253 STORM DAMAGE REPAIR PROJECT (FACILITY NO. 1B10028WNME), as described in the application will comply with sections 301, 302, 303, 306 and 307 of the Clean Water Act, and with applicable provisions of state law, provided that the Caltrans complies with the following terms and conditions:

All conditions of this order apply to Caltrans (and all its employees) and all contractors (and their employees), sub-contractors (and their employees), and any other entity or agency that performs activities or work on the project (including the off-site mitigation lands) as related to this Water Quality Certification.

1. This certification action is subject to modification or revocation upon administrative or judicial review; including review and amendment pursuant to Water Code section 13330 and title 23, California Code of Regulations, section 3867.

2. This certification action is not intended and shall not be construed to apply to any discharge from any activity involving a hydroelectric facility requiring a Federal Energy Regulatory Commission (FERC) license or an amendment to a FERC license unless the pertinent certification application was filed pursuant to title 23, California Code of Regulations, section 3855, subdivision (b) and the application specifically identified that a FERC license or amendment to a FERC license for a hydroelectric facility was being sought.

3. The validity this certification is conditioned upon total payment of any fee required under title 23, California Code of Regulations, section 3833, and owed by the applicant.

4. Except as may be modified by any preceding conditions, all certification actions are contingent on: a) the discharge being limited, and all proposed revegetation, avoidance, minimization, and mitigation measures being completed, in strict compliance with the applicant's project description and CEQA documentation, as approved herein, and b) compliance with all applicable water quality requirements and water quality control plans including the requirements of the Basin Plan, and amendments thereto.

5. All conditions required by this Order shall be included in the Plans and Specifications prepared by Caltrans for the Contractor. In addition, Caltrans shall require compliance with all conditions included in this Order in the bid contract for this project.

6. Caltrans shall construct the project in accordance with the project described in the application and the findings above, and shall comply with all applicable water quality standards as detailed in the Basin Plan.

7. Any change in the design or implementation of the project that would have a significant or material effect on the findings, conclusions, or conditions of this Order must be submitted to the Executive Officer of the Regional Water Board for prior review, consideration, and written concurrence.

8. Caltrans shall provide a copy of this Order and State Water Resources Control Board (SWRCB) Order No. 2003-0017-DWQ to the contractor, all subcontractors, and all utility companies conducting the work, and require that copies remain in their possession at the work site. Caltrans shall be responsible for work conducted by its contractor, subcontractors, or utility companies.

9. The Regional Water Board shall be notified in writing each year at least five working days (working days are Monday – Friday) prior to the commencement of channel, vegetation or ground disturbing activities, dewatering activities, major concrete pours, deck grinding or water diversion activities with details regarding the construction schedule, in order to allow Regional Water Board staff to be present on-site during installation and removal activities, and to answer any public inquiries that may arise regarding the project. Caltrans shall provide Regional Water Board staff access to the project site to document compliance with this order.

10. The Resident Engineer (or appropriately authorized agent) shall hold on-site water quality permit compliance meetings (similar to tailgate safety meetings) to discuss permit compliance, including instructions on how to avoid violations and procedures for reporting violations. The meetings shall be held at least every other week, before forecasted storm events, and when a new contractor or subcontractor arrives to begin work at the site. The contractors, subcontractors and their employees, as well as any inspectors or monitors assigned to the project, shall be present at the meetings. Caltrans shall maintain dated sign-in sheets for attendees at these meetings, and shall make them available to the Regional Water Board on request.

11. All activities and best management practices (BMPs) shall be implemented according to the submitted application and the conditions in this certification. BMPs for erosion, sediment, turbidity and pollutant control shall be implemented and in place at commencement of, during, and after any ground clearing activities, construction activities, or any other project activities that could result in erosion, sediment, or other pollutant discharges to waters of the State. The BMPs shall be implemented in accordance with the Caltrans Construction Site Best Management Practice Manual (CCSBMPM) and all contractors and subcontractors shall comply with the CCSBMPM. In addition, BMPs for erosion and sediment control shall be utilized year round, regardless of season or time of year. Caltrans shall stage erosion and sediment control materials at the work site. All BMPs shall be installed properly and in accordance with the manufacturer's specifications. If the project Resident Engineer elects to install alternative BMPs for use on the project, Caltrans shall submit a proposal to Regional Water Board staff for review and concurrence.

12. Caltrans shall prioritize the use of wildlife-friendly biodegradable (not photo-degradable) erosion control products wherever feasible. Caltrans shall not use or allow the use of erosion control products that contain synthetic netting for permanent erosion control (i.e. erosion control materials to be left in place for two years or after the completion date of the project). If Caltrans finds that erosion control netting or products have entrapped or harmed wildlife, personnel shall remove the netting or product and replace it with wildlife-friendly biodegradable products. Caltrans shall not use or allow the use of erosion control products that contain synthetic materials within waters of the United States or waters of the State at any time. Caltrans shall request approval from the Regional Water Board if an exception from this requirement is needed for a specific location.

13. Work in flowing or standing surface waters, unless otherwise proposed in the project description and approved by the Regional Water Board, is prohibited. If

construction dewatering of groundwater is found to be necessary, Caltrans shall use a method of water disposal other than disposal to surface waters (such as land disposal) or Caltrans shall apply for coverage under the Low Threat Discharge Permit or an individual National Pollutant Discharge Elimination System (NPDES) Permit and receive notification of coverage to discharge to surface waters, prior to the discharge.

14. Caltrans is prohibited from discharging waste to waters of the State, unless explicitly authorized by this Order. For example, no debris, soil, silt, sand, bark, slash, sawdust, rubbish, cement or concrete or concrete washings, welding slag, oil or petroleum products, or other organic or earthen material from any construction or associated activity of whatever nature, other than that authorized by this Order, shall be allowed to enter into waters of the State. In addition, none of the materials listed above shall be placed within 150 linear feet of waters of the State or where the materials may be washed by rainfall into waters of the State.

15. If, at any time, an unauthorized discharge to surface water (including wetlands, rivers or streams) occurs, or any water quality problem arises, the associated project activities shall cease immediately until adequate BMPs are implemented. The Regional Water Board shall be notified promptly and in no case more than 24 hours after the unauthorized discharge or water quality problem arises.

16. Caltrans and their contractor are not authorized to discharge wastewater (e.g., water that has contacted uncured concrete or cement, or asphalt) to surface waters, ground waters, or land. Wastewater may only be disposed of to a sanitary waste water collection system/facility (with authorization from the facility's owner or operator) or a properly-licensed disposal or reuse facility. If Caltrans or their contractor proposes an alternate disposal method, Caltrans or their contractor shall apply for a permit from the Regional Water Board. Plans to reuse or recycle wastewater require written approval from Regional Water Board staff.

17. Caltrans shall submit, subject to approval by the Regional Water Board staff, a dewatering and/or diversion plan that appropriately describe the dewatered or diverted areas and how those areas will be handled during construction. The diversion/dewatering plans shall be submitted no later than 30 days prior to conducting the proposed activity. Information submitted shall include the area or work to be diverted or dewatered and method of the proposed activity. All diversion or dewatering activities shall be designed to minimize the impact to waters of the State and maintain natural flows upstream and downstream. All dewatering or diversion structures shall be installed in a manner that does not cause sedimentation, siltation or erosion upstream or downstream. All dewatering or diversion structures shall be removed immediately upon completion of project

activities. The in-channel work will only be conducted between May 15th and October 15th. This Water Quality Certification does not authorize Caltrans to draft surface waters.

18. Fueling, lubrication, maintenance, storage and staging of vehicles and equipment shall be outside of waters of the U.S. and the State. Fueling, lubrication, maintenance, storage and staging of vehicles and equipment shall not result in a discharge or a threatened discharge to any waters of the State or the U.S. At no time shall Caltrans use any vehicle or equipment which leaks any substance that may impact water quality.

19. Caltrans shall provide analysis and verification that placing non-hazardous waste or inert materials (which may include discarded product or recycled materials) will not result in degradation of water quality, human health, or the environment. All project-generated waste shall be handled, transported, and disposed in strict compliance with all applicable State and Federal laws and regulations. When operations are complete, any excess material or debris shall be removed from the work area and disposed of properly and in accordance with the Special Provisions for the project and/or Standard Specification 7-1.13, Disposal of Material Outside the Highway Right of Way. Caltrans shall submit to the Regional Water Board the satisfactory evidence provided to the Caltrans Engineer by the Contractor referenced in Standard Specification 7-1.13. In accordance with State and Federal laws and regulations, Caltrans is liable and responsible for the proper disposal of waste generated by their project.

20. Surface water monitoring shall be conducted whenever a project activity is conducted within waters of the State (e.g. demolition, pier construction, stream diversions). Surface water monitoring shall be conducted when any project activity has, or has the potential to, mobilize sediment and/or alter background conditions within waters of the State. In order to demonstrate compliance with receiving water limitations and applicable water quality standards, field measurements shall be collected whenever a project activity may alter background conditions.

21. Caltrans shall establish effluent, upstream (background) and downstream monitoring locations to demonstrate compliance with all applicable water quality objectives as detailed in the Basin Plan. The downstream location shall be no more than 50 feet from the effluent location. Field measurements shall be taken from each location four times daily for flow, pH, temperature, dissolved oxygen, total dissolved solids, turbidity and specific conductance. In addition, visual observations shall be made four times daily and include the appearance of the discharge including color, turbidity, floating or suspended matter or debris, appearance of the receiving water at the point of discharge (occurrence of erosion

and scouring, turbidity, solids deposition, unusual aquatic growth, etc), and observations about the receiving water, such as the presence of aquatic life. Measurements shall be collected from each sampling location four times daily while work is being conducted within waters of the State.

22. Whenever, as a result of project activities, downstream measurements exceed the following water quality objectives, appropriate measurements shall be collected from all monitoring locations every hour during the period of increase, and shall continue until measurements demonstrate compliance with receiving water limitations and the water quality parameters are no longer increasing as a result of project activities.

pH	<6.5 or >8.5 (any changes >0.5 units)
temperature	>0.5^{o}F above background
dissolved oxygen	<7 milligrams per liter (mg/L)
turbidity	20% above natural background
total dissolved solids	>150 mg/L
specific conductance	>250 micromhos @ 77^{o}F

If any measurements are beyond the water quality objectives 50 feet downstream of the source(s), all necessary steps shall be taken to install, repair, and/or modify BMPs to control the source(s). In addition, the overall distance from the source(s) to the downstream extent of the exceedance shall be measured.

Monitoring results shall be reported to appropriate Regional Water Board staff person by telephone within one hour of taking any measurements that exceed the limits detailed above (turbidity only if it is higher than 20 NTU as well). Upstream and downstream pictures within the working and/or disturbed area shall be taken and submitted to the appropriate Regional Water Board staff via e-mail or fax within 24 hours of the incident. All other monitoring data shall be reported on a monthly basis and is due to the Regional Water Board by the 15th of the following month.

23. Rainy Day Reports: Caltrans shall take photos of all areas disturbed by project activities, including all excess materials disposal areas, after rainfall events that generate visible runoff from these areas in order to demonstrate that erosion control and revegetation measures are present and have been installed appropriately and successfully. A brief report containing these photos shall be submitted within 30 days of the rainfall event that generated runoff from the disturbed areas. Once the site has demonstrated appropriate and effective erosion

and sediment control, Caltrans may request a reprieve from this condition from the Regional Water Board.

24. Caltrans proposes to reduce the project impacts by implementing on-site restoration and revegetation activities. The on-site restoration will encompass approximately 0.11 acres of wetland restoration. The on-site restoration will be conducted in accordance with Caltrans-prepared *Mitigation and Monitoring Proposal, Mendocino County, Highway 253 Storm Damage Project PM 7.60/7.75*, dated March 8, 2010. Monitoring reports for the mitigation project shall be submitted to the Regional Water Board on December 31, yearly for five years after the initial restoration actions are completed.

25. In the event of any violation or threatened violation of the conditions of this Order, the violation or threatened violation shall be subject to any remedies, penalties, process or sanctions as provided for under applicable state or federal law. For the purposes of section 401(d) of the Clean Water Act, the applicability of any state law authorizing remedies, penalties, process or sanctions for the violation or threatened violation constitutes a limitation necessary to assure compliance with the water quality standards and other pertinent requirements incorporated into this Order. In response to a suspected violation of any condition of this certification, the State Water Board may require the holder of any federal permit or license subject to this Order to furnish, under penalty of perjury, any technical or monitoring reports the State Water Board deems appropriate, provided that the burden, including costs, of the reports shall bear a reasonable relationship to the need for the reports and the benefits to be obtained from the reports. In response to any violation of the conditions of this Order, the Regional Water Board may add to or modify the conditions of this Order as appropriate to ensure compliance.

26. The Regional Water Board may add to or modify the conditions of this Order, as appropriate, and to implement any new or revised water quality standards and implementation plans adopted or approved pursuant to the Porter-Cologne Water Quality Control Act or section 303 of the Clean Water Act.

27. This Order is not transferable. In the event of any change in control of ownership of land presently owned or controlled by Caltrans, Caltrans shall notify the successor-in-interest of the existence of this Order by letter and shall forward a copy of the letter to the Regional Water Board. The successor-in-interest must send to the Regional Water Board Executive Officer a written request for transfer of this Order to discharge dredged or fill material under this Order. The request must contain the following:
    a. requesting entity's full legal name
    b. the state of incorporation, if a corporation

c. address and phone number of contact person
d. description of any changes to the project or confirmation that the successor-in-interest intends to implement the project as described in this Order.

28. The authorization of this certification for any dredge and fill activities expires on May 24, 2016. Conditions and monitoring requirements outlined in this Order are not subject to the expiration date outlined above, and remain in full effect and are enforceable.

29. Please contact our staff Environmental Specialist / Caltrans Liaison Jeremiah Puget of at (707) 576-2835 or jpuget@waterboards.ca.gov if you have any questions.

_____

Catherine Kuhlman
Executive Officer

110524_CDOT_Hwy253_StormDamageRepair_401cert

Weblink: State Water Resources Control Board Order No. 2003-0017 -DWQ, General Waste Discharge Requirements for Dredge and Fill Discharges That Have Received State Water Quality Certification can be found at: http://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2003/wqo/wqo2003-0017.pdf

Original sent to: Ms. Sandra Rosas, California Department of Transportation, P.O. 911, Marysville, CA 95901

Copies sent to: Mr. Alfred Kannely, California Department of Transportation, P.O. 911, Marysville, CA 95901

Ms. Jane Hicks, U.S. Army Corps of Engineers, Regulatory Functions, 1455 Market Street, San Francisco, CA 94103-1398

U.S. Army Corps of Engineers, District Engineer, 601 Startare Drive, Box 14, Eureka, CA 95501

PERMITS

UNITED STATES ARMY CORPS OF ENGINEERS 404 PERMIT

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, U.S. ARMY CORPS OF ENGINEERS
1455 MARKET STREET
SAN FRANCISCO, CALIFORNIA 94103-1398

JUN 03 2010

Regulatory Division

SUBJECT: File Number SPN-2010-00145 N

Ms. Lupe Jimenez
Office of Environmental Management
California Department of Transportation, District 3
P.O. Box 911
Marysville, California 95901

Dear Ms. Jimenez:

This letter is written in response to your submittal of March 25, 2010, concerning Department of the Army authorization for the State Route 253 Storm Damage Repair Project between Post Mile 7.60 and 7.75, in Mendocino County, California. The project is located on State Route 253 between Ukiah and Boonville

Winter storms in 2006 destabilized the soil slope along State Route 253 at post mile 7.60 and 7.75. The roadway embankment slid away from the highway at these locations. The length of slope failure at post mile 7.60 is 175 feet (Location 1) and the length of slope failure at post mile 7.75 is 225 feet (Location 2). Caltrans is proposing to restore the highway to prior conditions by reconstructing the failed shoulder and installing a solder pile wall at post mile 7.75.

Work to temporarily stabilize the slopes and to perform geotechnical work for a permanent fix at post mile 7.75 last year resulted in discharges of fill material into 0.06 acres of waters of the U.S. This work was done without a Corps permit or a Clean Water Act Section 401 Water Quality Certification from the North Coast Regional Water Quality Control Board. The violation is currently being resolved with the North Coast Regional Water Quality Control Board (Water Board).

At Location 1 (post mile 7.60), the underdrain will be replaced along the north side of the roadway in kind and will connect the new underdrain to the existing cross culvert. A soldier pile wall will be constructed to stabilize the roadway slope. No impacts to waters of the U.S. would occur from the work in this location.

At Location 2 (post mile 7.75), the underdrain on the north side of the road will be replaced. It will connect the new underdrain with a series of existing cross culverts. New downdrains will be attached at the culvert outlets which will channel water into a perforated pipe that will be placed perpendicular to the wetland at post mile 7.75. The perforated pipe will promote the expansion of the wetland habitat. A soldier pile wall will be constructed to stabilize the roadway

slope. The 0.06 acres of fill around the wetland from the geotechnical surveys, will be removed and those areas contoured to match the existing wetland.

Based on a review of the information you submitted and an inspection of the project site conducted by Corps personnel on May 17, 2010 , your project qualifies for authorization under Department of the Army Nationwide Permit 18 for Minor Discharges (72 Fed. Reg. 11092, March 12, 2007), pursuant to Section 404 of the Clean Water Act (33 U.S.C. Section 1344). See Enclosure 1. All work shall be completed in accordance with the plans and drawings titled "State Route 253 Storm Damage Repair Project at Post Mile 7.60 and 7.75, Grading Plans" drawings 1 and 2, dated May 27, 2010.

The project must be in compliance with the General Conditions cited in Enclosure 2 for this Nationwide Permit authorization to remain valid. Non-compliance with any condition could result in the suspension, modification or revocation of the authorization for your project, thereby requiring you to obtain an Individual Permit from the Corps. This Nationwide Permit authorization does not obviate the need to obtain other State or local approvals required by law.

This verification is valid until the NWP is modified, reissued, or revoked. All of the existing NWPs are scheduled to be modified, reissued, or revoked prior to March 18, 2012. It is incumbent upon you to remain informed of changes to the NWPs. We will issue a public notice when the NWPs are reissued. Furthermore, if you commence or are under contract to commence this activity before the date that the relevant nationwide permit is modified or revoked, you will have twelve months from the date of the modification or revocation of the NWP to complete the activity under the present terms and conditions of this nationwide permit. Upon completion of the project and all associated mitigation requirements, you shall sign and return the Certification of Compliance, Enclosure 3, verifying that you have complied with the terms and conditions of the permit.

This authorization will not be effective until you have obtained a Section 401 water quality certification from the North Coast Regional Water Quality Control Board (RWQCB). If the RWQCB fails to act on a valid request for certification within two months after receipt of a complete application, the Corps will presume a waiver of water quality certification has been obtained. You shall submit a copy of the certification to the Corps prior to the commencement of work.

To ensure compliance with this Nationwide Permit authorization, the following special conditions shall be implemented:

1. You shall notify the Corps in writing of the anticipated start and stop dates of construction, at least 5 days prior to the initiation of construction.

2. If there are any changes in the project design, materials, or construction methods prior to construction, those modifications must be approved by the Corps in writing.

3. Environmentally sensitive areas shall be clearly delineated on the construction plans and demarcated in the field with high-visibility fencing prior to commencement of construction activities. ESA fencing shall be properly maintained throughout the duration of the project. The ESA shall be off limits to construction activity and personnel at all times.

4. During construction, erosion control materials, including silt fences, erosion control blankets/mats, and sandbags will be on hand and utilized as deemed necessary.

5. No debris, oil, petroleum products or other organic material resulting from construction activities shall be allowed to enter or be placed where it may be washed by rainfall or runoff into areas subject to the jurisdiction of the Corps.

6. Following project construction, disturbed areas including access points, staging and equipment storage areas, etc. shall be returned to pre-project conditions. This shall include, but is not necessarily limited to, grading to establish pre-project contours, removal of debris and seeding or planting disturbed areas with vegetation adapted to local conditions.

7. In the event of any unanticipated discoveries of potential cultural/historic resources, you shall immediately halt work in the vicinity of the discovery and contact the appropriate regulatory authorities. You shall complete consultation pursuant to 36 CFR 800 to the satisfaction of the State Historic Preservation Officer prior to resuming work.

Should you have any questions regarding this matter, please call Andrea Meier of our Regulatory Division at 415-503-6798 or email her at andrea.j.meier@usace.army.mil. Please address all correspondence to the Regulatory Division and refer to the File Number at the head of this letter. If you would like to provide comments on our permit review process, please complete the Customer Survey Form available online at http://per2.nwp.usace.army.mil/survey.html.

Sincerely,

for

Jane M. Hicks
Chief, Regulatory Division

Enclosures

Copy furnished without enclosures:

CA RWQCB, Santa Rosa, CA

Enclosure 1.

18. *Minor Discharges.* Minor discharges of dredged or fill material into all waters of the United States, provided the activity meets all of the following criteria: (a) The quantity of discharged material and the volume of area excavated do not exceed 25 cubic yards below the plane of the ordinary high water mark or the high tide line; (b) The discharge will not cause the loss of more than 1/10 acre of waters of the United States; and (c) The discharge is not placed for the purpose of a stream diversion.

Notification: The permittee must submit a pre-construction notification to the district engineer prior to commencing the activity if: (1) The discharge or the volume of area excavated exceeds 10 cubic yards below the plane of the ordinary high water mark or the high tide line, or (2) the discharge is in a special aquatic site, including wetlands. (See general condition 27.) (Sections 10 and 404)

MATERIALS INFORMATION

FOUNDATION REPORT

Foundation Report for Storm Damage Repair at HUM 253, PM 7.6

KLEINFELDER
Bright People. Right Solutions.

TECHNICAL MEMORANDUM

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

Date: April 29, 2010

To: Charlie Narwold, Sr. Engineering Geologist
Division of Engineering Services
Office of Geotechnical Design North
Branch B

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

Kleinfelder Project: 93276/22REP

SUBJECT: FOUNDATION REPORT
STORM DAMAGE REPAIR
HUM 253 PM 7.6
EA: 01-476201
MENDOCINO COUNTY, CA

1 PROJECT DESCRIPTION

An active landslide is located on the east (downhill) side of Highway 253, near mile post 7.6 between the cities of Boonville and Ukiah, in Mendocino County, California. The location of the site is shown on Plate 1, Site Location. As shown on the Site Plan, Plate 2, the active landslide scarp is approximately 285 feet long. The landslide mass extends approximately 205 feet down slope to the east (see Plate 3, Section A-A'). Ground surface elevations that are shown on the cross sections are based on a hand level survey by Kleinfelder and may differ from the surface contours shown on the Site Plan. Between stations 103+00 and 104+25, the landslide scarp extends to within two to six feet of the edge of pavement of the eastbound lane. A 32-foot-long Styrofoam retaining wall is located within the landslide scarp between stations 103+79 and 104+11, and is located approximately six feet east of the edge of pavement for the eastbound lane.

There are several zones of landslide activity at this site. As directed by Caltrans, the purpose of this project is to provide geotechnical design parameters for a retaining structure to protect the road from currently active landslide related movement. This currently active movement has been estimated at a depth of approximately 11 feet based on slope inclinometer measurements in Boring R-08-003. The currently active landslide is underlain by additional landslide deposits that are classified as "recently active," reflecting probable movement within the past 50 years (see Plate 3). Stabilization of these deeper, recently active landslide deposits is not proposed at this time.

The lateral limits of the wall were selected to retain the major, central portion of the currently active landslide (the portion that is closest to the road). The portion of the

currently active landslide that is located down slope of the proposed retaining wall, and the portions that are beyond the north and south ends of the wall, may continue to move after the retaining wall is constructed. In addition, the shallow landslides on the uphill (west) side of the road are not addressed in this proposed repair.

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 (4) exploratory borings.
- Installation of one inclinometer/piezometer at one boring location.
- Installation of one piezometer at one boring location.
- Periodic site visits to take piezometers and inclinometer readings.
- Laboratory testing of selected samples from the borings.
- Global stability analyses.
- Preparation of Log of Test Borings (LOTBs).
- Consultation with Caltrans staff.
- Preparation of this memorandum.

3 PERTINENT REPORTS AND INVESTIGATIONS

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

1960, Jennings and Strand, California Division of Mines and Geology, Geologic Map of California, Ukiah Sheet

1982, Wagner and Bortugno, California Division of Mines and Geology, Regional Geologic Map Series, Map No. 2A, Geologic Map of the Santa Rosa Quadrangle, California

Caltrans Seismic Hazard Map and Report, Mualchin, 1996 with errata dated March 2006.

4 PROPOSED STRUCTURE DESCRIPTION

It is proposed to construct a retaining structure on the east 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, portions of which will be restrained by tiebacks. At the direction of Caltrans, the wall will be located approximately twenty-one feet east of the existing road centerline. The lateral limits of the wall established by Caltrans are illustrated on Plate 2.

5 SITE DESCRIPTION AND TOPOGRAPHY

At Post Mile 7.6, the two-lane Highway 253 rises gently to the north at approximately 40H:1V (Horizontal:Vertical). Slope gradients east (down slope) of the roadway range from between 1.4H:1V to 1.8H:1V at the landslide scarp to 2.8H:1V within the landslide mass. Cut slopes west (upslope) of the roadway range from 1.4H:1V to 1H:1V. Native slopes above the cut slopes range from approximately 1.6H:1V to 2H:1V.

The landslide movement currently impacting the roadway is a slump-flow complex. The maximum estimated thickness of the currently active landslide is approximately 11 feet, the estimated maximum total thickness of landslide deposits is approximately 20 feet. The arcuate headscarp of the landslide extends to within 2 feet of the east pavement edge. The toe of the currently active slide is estimated to be located laterally approximately 95 feet east of the pavement edge, and the recently active slide identified during our field mapping is located laterally approximately 210 feet east of the pavement edge, terminating within a swale. Three small active debris slides/flows are located above the roadway in the northwest portion of the site.

An access road was constructed from the southern edge of the landslide scarp (approximately 15 feet east of the edge of the roadway at station 102+45) to provide access for drilling borings R-08-002, R-08-003, and R-08-004. The access road extends through the mass of the slide terminating, approximately 20 feet east of the edge of the roadway at station 104+35. A 32-foot-long by 4- to 5-foot-tall Styrofoam retaining wall is located within the landslide scarp between stations 103+79 and 104+11, and is located approximately six feet east of the edge of pavement at the eastbound lane[1].

Sheet flow from the cut slopes and the westbound lane of the roadway are collected within a V-ditch adjacent to the west edge of the roadway and captured within a 1.5-foot-diameter corrugated metal culvert which extends below the roadway and outfalls downslope to the east. Drainage from the eastbound lane within the landslide currently flows down over the slope face of the fill prism. The cut slopes are vegetated with a moderate growth of wild grasses. The areas east of the fill slope support a tall growth of wild grasses, poison oak, manzanita and oak trees.

6 SUBSURFACE EXPLORATION AND LAB TESTING

SUBSURFACE INVESTIGATION

Four (4) exploration borings, designated R-08-001 through R-08-004, were drilled at this site by Caltrans Office of Drilling Services using rotary-wash drilling methods. Drilling was performed on May 13, 2008, through June 5, 2008. Drilling and sampling operations were observed and logged by Kleinfelder staff. Test borings were performed using a truck-mounted Acker MPCA drill rig (Equipment number 1974) utilizing 102-mm diameter and 93-mm (HXB) casing equipped with a tungsten carbide Geo Barrel and #8 diamond impregnated core bit, respectively.

Boring R-08-001 was advanced from the Highway 253 pavement level in the westbound traffic lane, up slope of the landslide, to a maximum depth of approximately 55 feet. Borings R-08-002, R-08-003, and R-08-004 were drilled on the access road, within the

[1] Eastbound lane and westbound lane pertain to average orientation along Highway 253. At the project site the eastbound lane is principally oriented to the north.

landslide mass, to maximum depths of between 70 and 75 feet. 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 each 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 Soil and Rock Legend. The results of the exploration are summarized on the attached Log of Test Borings (LOTBs), in Appendix A.

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-08-003. One piezometer was installed to approximately 55 feet below the ground surface within Boring R-08-001. The inclinometer casing was perforated for its full length except for the upper 5 to10 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 5 to 10 feet was backfilled with bentonite. The inclinometer was completed at the surface with a stovepipe outer casing. The piezometer consisted of 2-inch-diameter slotted PVC pipe with a solid PVC pipe section in the upper 5 to 10 feet. The piezometer was completed at the road surface with a 3-inch-diameter traffic rated well access box. Inclinometer readings were obtained by Kleinfelder on June 12, August 21, and November 4, 2008, March 5 and September 11, 2009. Results, presented as cumulative displacement profile plots, 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:

Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass (ASTM D2216).

Density of Soil in Place by the Drive-Cylinder Method (ASTM D2937).

Particle-Size Analysis of Soils (ASTM D422).

Liquid Limit, Plastic Limit, and Plasticity Index of Soils (ASTM D4318).

Unconsolidated Undrained Triaxial Compression Test for Cohesive Soils (ASTM D2850).

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

The results of the laboratory tests, together with a summary sheet, are provided in Appendix B.

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7 SITE GEOLOGY AND SUBSURFACE CONDITIONS

REGIONAL GEOLOGY

The site is located atop the northwest trending ridgeline separating Anderson Valley and Ukiah Valley within the Coast Range Geomorphic Province of Northern California. This province is generally characterized by northwest-trending mountain ranges and intervening valleys, which are a reflection of the dominant northwest structural trend of the bedrock in the region. As shown on Plate 4, Regional Geology, the basement rock in the northern portion of this province is presumed to consist of the Franciscan Complex, a diverse group of igneous, sedimentary, and metamorphic rocks of early Tertiary to Cretaceous age (approximately 38 to 100 million years old [Coastal Belt]) up to Upper Jurassic to Cretaceous age (140 to 65 million years old). 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 20 miles southwest of the site (Plate 5). In the site vicinity, the Franciscan Complex rocks are unconformably overlain by Tertiary age continental and marine sedimentary and volcanic rocks. These Tertiary age rocks are locally overlain by younger Quaternary alluvial, colluvial, and landslide deposits.

SITE GEOLOGY

The site geology, as mapped by Kleinfelder, is presented on Plate 2. The site and surrounding vicinity has been mapped by Jennings and Strand (1960, California Division of Mines and Geology Geologic Map of California, Ukiah Sheet). They indicate the site is underlain by undivided Cretaceous Marine sedimentary and meta-sedimentary rocks. A more recent publication by Wagner and Bortugno (1982, California Division of Mines and Geology, Regional Geologic Map Series, Map No. 2A, Geologic Map of the Santa Rosa Quadrangle, California) mapped the area adjacent to the south of the Jennings and Strand (1960) publication. Wagner and Bortugno (1982) indicate the unit which Jennings and Strand (1960) mapped as undivided Cretaceous Marine sedimentary and meta-sedimentary rocks as the Tertiary-Cretaceous age Coastal Belt member of the Franciscan Complex. This unit contains marine sandstone, shale, conglomerate, minor limestone and rare greenstone.

Jennings and Strand (1960) did not identify any landslide features at the site or within the immediate 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 Bedrock (ft)
R-08-001	103+72	9 feet left	55.0	2105+/-	5/13/08	8.5[2]
R-08-002	103+08	43 feet right	70.0	2093+/-	6/5/08	21.5
R-08-003	103+71	43 feet right	75.0	2089+/-	6/3/08	18
R-08-004	104+35	40 feet right	70.0	2092+/-	5/28/08	20.5

[1] Approximate distance from highway centerline, facing in direction of increasing stationing.
[2] Depth to top of Weak Surficial Bedrock.

Boring R-08-001 was drilled on the west side (westbound lane) of the roadway outside the limits of the active landslide mass. Sandy clay with gravel to silty clay fill extended to 5 feet below ground surface (bgs) in this boring. Beneath the fill, colluvium extended to a depth of 8.5 feet bgs, where weak surficial bedrock (disaggregated meta-sandstone) was encountered to approximately 22 feet bgs. Beneath the weak surficial bedrock, more competent bedrock (meta-shale and meta-sandstone) was encountered.

Borings R-08-002, R-08-003, and R-08-004 were drilled within the main landslide mass approximately 30 feet east of the east edge of the roadway. These borings were drilled on a temporary access road Caltrans constructed after the landslide occurred. Landslide deposits (layers of sandy clay, clayey gravel, and clayey sand) were encountered in these borings to depths of 16.5, 18, and 20.5 feet bgs, respectively. In boring R-08-002 colluvium/ decomposed bedrock was encountered beneath the landslide deposits up to a depth of 21.5 feet, where bedrock was encountered. Borings R-08-003 and R-08-004 encountered bedrock beneath the landslide deposits.

Upon completion of drilling, inclinometer casing was installed in Boring R-08-003 to facilitate the monitoring of the landslide. The most current survey (9/11/09) of the inclinometer installation indicates approximately 0.14 inches of down slope displacement since its initialization (6/12/08). Movement occurred along a relatively concise plane at approximately 11 feet below the ground surface. While the signature of movement on the cumulative displacement plot is consistent with typical landslide movement, it should be noted the magnitude of displacement is within tolerance for instrument accuracy (0.3 inches/100 feet of casing). This movement corresponds to a landslide failure surface that was noted in Boring R-08-003 at a depth of 10.8 feet. A second landslide failure surface was identified in the boring at 12.5 feet bgs, and landslide deposits were encountered as deep as 18 feet bgs. As such, continued monitoring of the inclinometer installation is recommended to confirm the displacement at 11 feet, and to assess potential future movement at greater depths.

The bedrock encountered in the borings primarily consisted of meta-shale and meta-sandstone, varying from very soft and disaggregated to moderately hard and slightly weathered, very intensely fractured to moderately fractured. Due to the large range of bedrock strength and weathering, transitions should be considered approximate and the depth of active sliding should continue to be monitored by inclinometer readings.

This is a summary of conditions encountered in the four borings. More detailed information is presented on the log of test borings. Variations in conditions between the borings should be expected.

Our interpretation of the surface and subsurface geologic conditions is presented on Plates 2 and 3.

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 6 feet were saturated or nearly saturated at the time of drilling. Seepage noted at the ground surface near the center of the landslide mass shown on Plate 2 is implied based on review of aerial photographs and the presence of phreatophytic vegetation. At the time of our investigation however, free water at the surface was not identified.

Water levels in the piezometer and slotted inclinometer were measured by Kleinfelder staff. On December 9, 2008, March 5 and September 11, 2009 the groundwater level was measured in the piezometer that was installed in Boring R-08-001. On June 12, August 21, and November 4, 2008, March 5 and September 11, 2009 groundwater levels were measured from the slotted slope inclinometer that was installed in Boring R-08-003. Results are tabulated below. For design purposes we recommend groundwater should be assumed to rise to approximately elevation 2091 feet. Please refer to "Design Forces" in section 11 for a more detailed discussion of design groundwater levels.

Water depth measured from ground surface (feet)		
Date	**R-08-001**	**R-08-003**
(Ground Elevation)	(2105')	(2089')
6/12/2008	---------	8.7
8/21/2008	---------	9.1
11/4/2008	---------	7.6
12/9/2008	12.1	---------
3/5/2009	7.1	7.3
9/11/2009	12.7	10.5

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 presented 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 March 2006), the nearest fault is the Maacama-Brush fault, which is

located approximately 7 miles east of the site. The Maacama-Brush fault is capable of generating earthquakes with a maximum credible earthquake (MCE) magnitude of 7.25. The Caltrans Seismic Hazard Map and Report (1996) locates the site between the 0.3g and 0.4g Peak Bedrock Acceleration (PBA) contours associated with the Maacama-Brush fault. We recommend a PBA value of 0.4g and corresponding Peak Ground Acceleration (PGA) of 0.4g for the use at this site. The PGA is estimated based on site soil class C. A portion of the Caltrans Seismic Hazard 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.

11 GEOTECHNICAL AND FOUNDATION RECOMMENDATIONS

WALL LOCATION & DEPTH

Based on the field and laboratory data and our slope stability analyses, it is our opinion that, without remediation, the material designated as currently active landslide deposits will continue to move downslope, and this will remove lateral support for the roadway. We recommend that a wall be designed to retain the roadway together with underlying soils. The proposed wall location is shown on Plate 2. At the direction of Caltrans, the wall is located approximately twenty-one feet east of the highway center line. The lateral limits designated by Caltrans for the proposed wall are approximately between stations 102+75 and 104+50, within the central portion of the currently active landslide, for a total wall length of approximately 175 feet. The proposed wall location is located at the top of the headscarp. At the direction of Caltrans, the finished grade at the base of the retaining wall will be approximately elevation 2091 feet, resulting in an exposed wall face of approximately 10 to 14 feet.

The currently active landslide appears to be approximately 11-feet-thick immediately down slope of the proposed wall location, with the bottom of the currently active landslide occurring at the top of older, but still recently active landslide deposits (estimated movement within the past 50 years). Over time it is likely that the currently active 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 surface of the weak surficial bedrock. Plate 6 illustrates the approximate elevation of in-place bedrock along the length of the wall. At the proposed wall location the depth to the weak surficial bedrock is estimated as 16 to 20 feet.

SOIL & ROCK PARAMETERS

Based on the results of our subsurface investigation and laboratory testing, subsurface materials within the retained height of the proposed retaining wall consist of fill, colluvium, and weak surficial bedrock overlying variably fractured and primarily slightly to moderately weathered bedrock, mainly comprised of meta-shale and meta-sandstone. 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 Bridge Design Specifications.

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)	Buoyant Unit Weight (pcf)	Angle of Internal Friction ϕ (degrees)	Cohesion c (psf)	K_a	K_p
Fill (Qaf) and Colluvium (Qc)	16 to 20	137	75	30[2]	0[2]	0.33[4]	0[5]
Surficial Weak Bedrock (KJf)	22 to 31	147	85	40[2]	0[2]	0.22[4]	4.60[4,6]
Bedrock (KJf)	NA	147	85	45[3]	0[3]	0.17[4]	5.82[4]

[1] See Plate 6 for anticipated thickness along wall, depths were estimated based on interpolation and extrapolation between borings which are offset from the proposed wall location. The depths should be considered approximate and variations should be expected.
[2] Based on correlations with field penetration test data and soil type.
[3] Strength was estimated based on TXUU tests, correlations with field penetration test data, and material type.
[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] Material in front of the wall has a very low factor of safety and should not be used in determining passive pressures.
[6] This value assumes that wall construction will result in a horizontal bench, at least 10 feet wide, at the toe of the wall.

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

DESIGN FORCES

Based on our discussions with Caltrans, it is recommended that the wall be designed assuming that all fill and colluvium below the wall may slide and pull away from the wall face. Therefore, no passive resistance should be assumed from material overlying the weak surficial bedrock. This is indicated in Table 2. In addition, because drainage may occur slowly following a landslide, it should be assumed that the water level behind the wall may not drop as quickly as the water level on the down slope side of the wall, resulting in an excess hydrostatic head on the back of the wall.

As discussed previously in this memorandum, we recommend that the wall be designed for a groundwater level that is approximately elevation 2091 feet. The wall should be provided with adequate drainage to prevent the build-up of hydrostatic pressures above this level. However, the critical design case discussed in the previous section assumes that material in front of the wall may slide and pull away from the wall down to the elevation of the weak surficial bedrock (this approximate elevation is shown on Plate 6). As this material pulls away, the water level immediately down slope of the wall will necessarily drop to the top of the weak, surficial bedrock (the bottom of the currently active landslide). However, the water level behind the wall may respond much more slowly. As a result, we recommend that the wall design assume a differential hydraulic head across the wall. The water level behind the wall should be assumed at elevation 2091, but the water level immediately down slope of the wall should be assumed at the

top of the weak surficial bedrock. Design pressures (both active and passive) should be based on total unit weights above the water table and buoyant unit weights below the water table. Design water levels are illustrated on Plate 7, Design Cross Section.

TIEBACK ANCHORS

We recommend that tiebacks derive their support solely from the relatively competent bedrock formation below fill, colluvium and the zone of weak surficial bedrock. The tieback unbonded length is the distance from the back of the wall to a point that is 5 feet beyond the surface of the relatively competent bedrock and is based on the elevation and inclination of the tiebacks provided in the unchecked details dated April 19, 2010 from Caltrans Structures Department. The tieback details show tiebacks located 8 feet from the top of the wall at an inclination of 20^0, based on this the unbonded zone may be taken as approximately 45 feet.

SOLDIER PILES

Soldier piles should gain their vertical resistance from friction in the bedrock, below any fill or colluvium. Based on our stability analyses, terminating the piles with their tips in the weak surficial bedrock yielded a factor of safety that was less than 1.3. Embedding the tips a foot into the competent bedrock resulted in a calculated factor of safety of 1.6. Due to the uncertainty in the depth of the contact between the weak and competent bedrock, we recommend that soldier piles be designed to penetrate a minimum of five feet into relatively competent bedrock (five feet below the bottom of the weak surficial bedrock). Deeper penetrations may be required to satisfy wall vertical or lateral loading conditions. If, during construction, competent bedrock is encountered at depths that are significantly shallower than shown on Plate 6, Caltrans Office of Geotechnical Design North should be notified for it may be possible to reduce the length of some soldier piling. No piles shall be shortened until personnel from the office of Geotechnical Design North have evaluated the bedrock encountered during drilling.

Bedrock quality varies widely. We recommend that soldier piles be designed for a skin friction in bedrock of 750 psf. This value applies to both the weak surficial bedrock and the underlying more competent bedrock. It is intended for use in a working stress analysis and contains a factor of safety of approximately 2.0. Because of the fractured nature of the rock and the difficulty in removing slough from drilled holes, end bearing resistance should be neglected.

The depth to in-place bedrock varies. A sketch of estimated bedrock depth along the length of the wall is provided on Plate 6. We estimate that the depth to weak surficial bedrock will vary from approximately 16 feet to 20 feet at the proposed wall location. The depth to relatively competent bedrock is estimated to vary from approximately 22 to 32 feet.

LAGGING

To protect against loss of material, lagging between piles should be provided extending through fill and colluvium to the surface of the weak surficial bedrock, approximately 16 to 20 feet below the top of the retaining wall. This will require temporary excavation up to approximately 8 feet below finished grade on the downhill side of the wall.

WALL BACKFILL

We recommend a one-foot-wide layer of Class 1, Type B Permeable Material be placed behind the back of the retaining wall face. To prevent internal soil erosion, we recommend that filter fabric be placed between the permeable material 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 an analysis of the recently active landslide. This analysis was performed to back calculate the residual soil strength within the landslide deposits. Plate 8 presents the results of an analysis along 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 approximately 30^0, which was used in our subsequent analyses. A similar analysis was performed for the currently active landslide and yielded similar results (factor of safety = 1.08).

We then added the proposed retaining wall to this section and ran the model again. A 270 psf surcharge pressure was applied to the roadway area above the wall. The wall was modeled as a series of rigid piling with sufficient shear strength to force the landslide below the tips of the piling. The result of this analysis is summarized on Plate 9. Based on this analysis, with the wall socketed a minimum of 1 foot into the bedrock underlying the weak surficial zone, the calculated factor of safety against global instability was approximately 1.6.

Finally, we checked the slope stability of material below the wall to see if removal of the specified 12 feet of soil would improve stability of the remaining landslide deposits down slope of the wall. Based on the general plan provided to us by Caltrans, we have used 12 feet as the approximate excavation (finished grade = elevation 2091 feet). A result of this analysis is shown on Plate 11. Removal of this material did not increase the slope stability factor of safety, which is approximately 1.0.

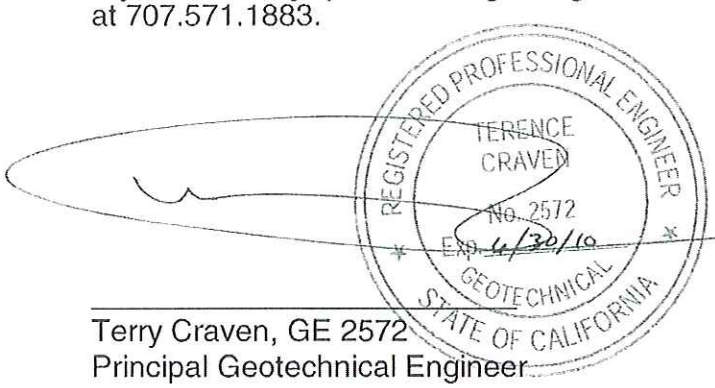
13 CONSTRUCTION CONSIDERATIONS

- Materials to be excavated will consist of fill, colluvium, and landslide deposits. We expect groundwater will be encountered at shallow depth. Depending on the time of year, caving conditions may 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 Caltrans Standard Specifications.

- We expect groundwater will 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 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 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.
- 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 the landslide and retaining structure. In particular, it is extremely important to collect the drainage from the east side of the road that currently flows over the face of the landslide. Surface drainage should be routed to suitable disposal areas away from the landslide.

14 CLOSURE

If you have any questions regarding the information provided herein, please contact us at 707.571.1883.



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15 ATTACHMENTS

Plates

Plate 1.....Site Location
Plate 2.....Site Plan
Plate 3.....Cross Section A-A'
Plate 4.....Regional Geology
Plate 5.....California Seismic Hazard Map
Plate 6.....Approximate Subsurface Geology Along Proposed Retaining Wall
Plate 7.....Design Cross Section
Plate 8.....Slope Stability: Back-Calculation
Plate 9.....Slope Stability: With Wall 1' Into Bedrock
Plate 10.....Slope Stability: Slope Stability: Down Slope

Appendix A

Log of Test Borings (LOTBs, 6 pages)

Appendix B

Laboratory Test Summary
Laboratory Test Data Plates B-1 through B-5
Corrosion Test Results (AP Engineering and Testing, Inc.)

Appendix C

Slope Inclinometer Monitoring Results (1 page)

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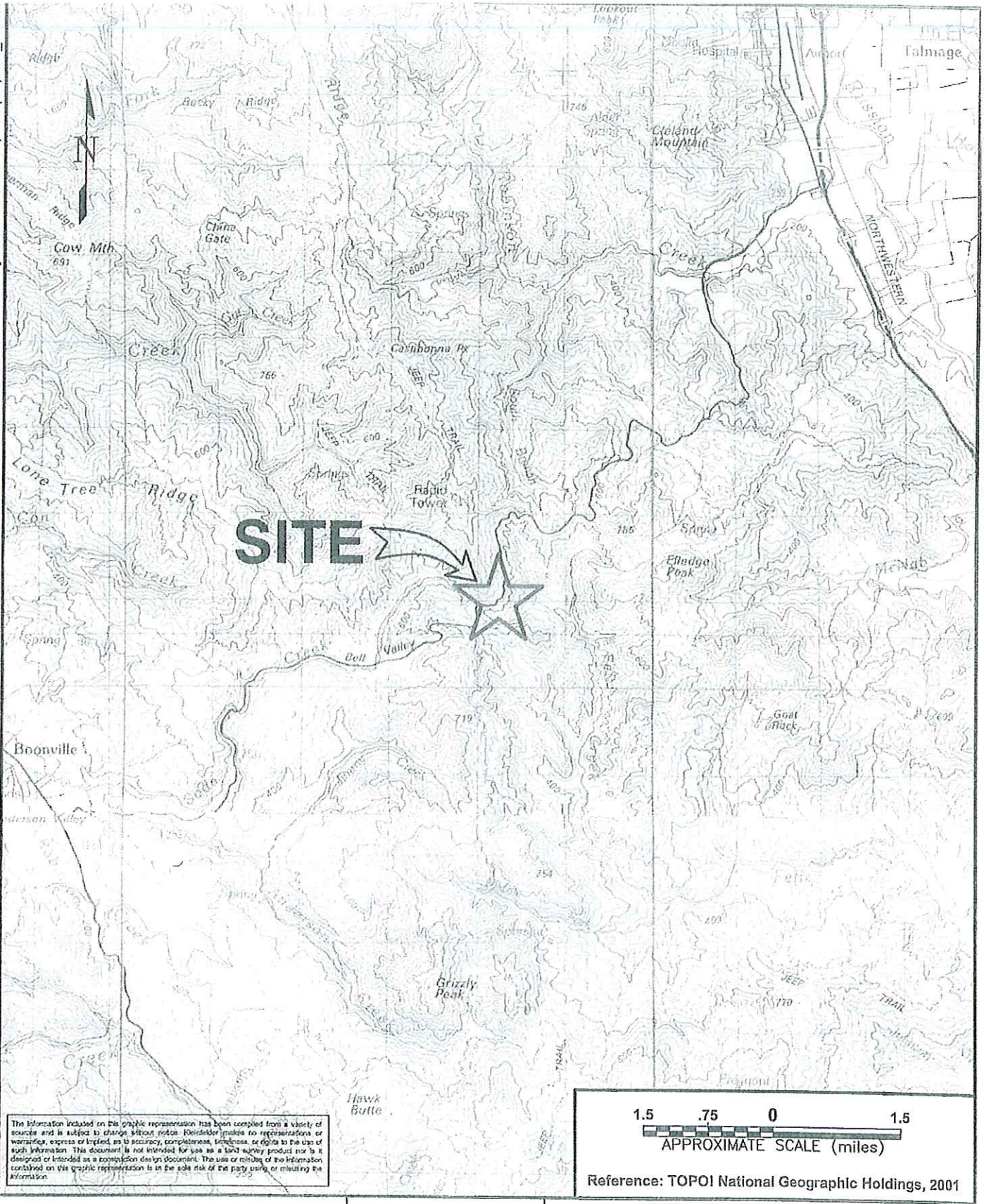
PLATES



Reference: TOPOI National Geographic Holdings, 2001

ATTACHED IMAGES: Images: 93276-LOC.jpg
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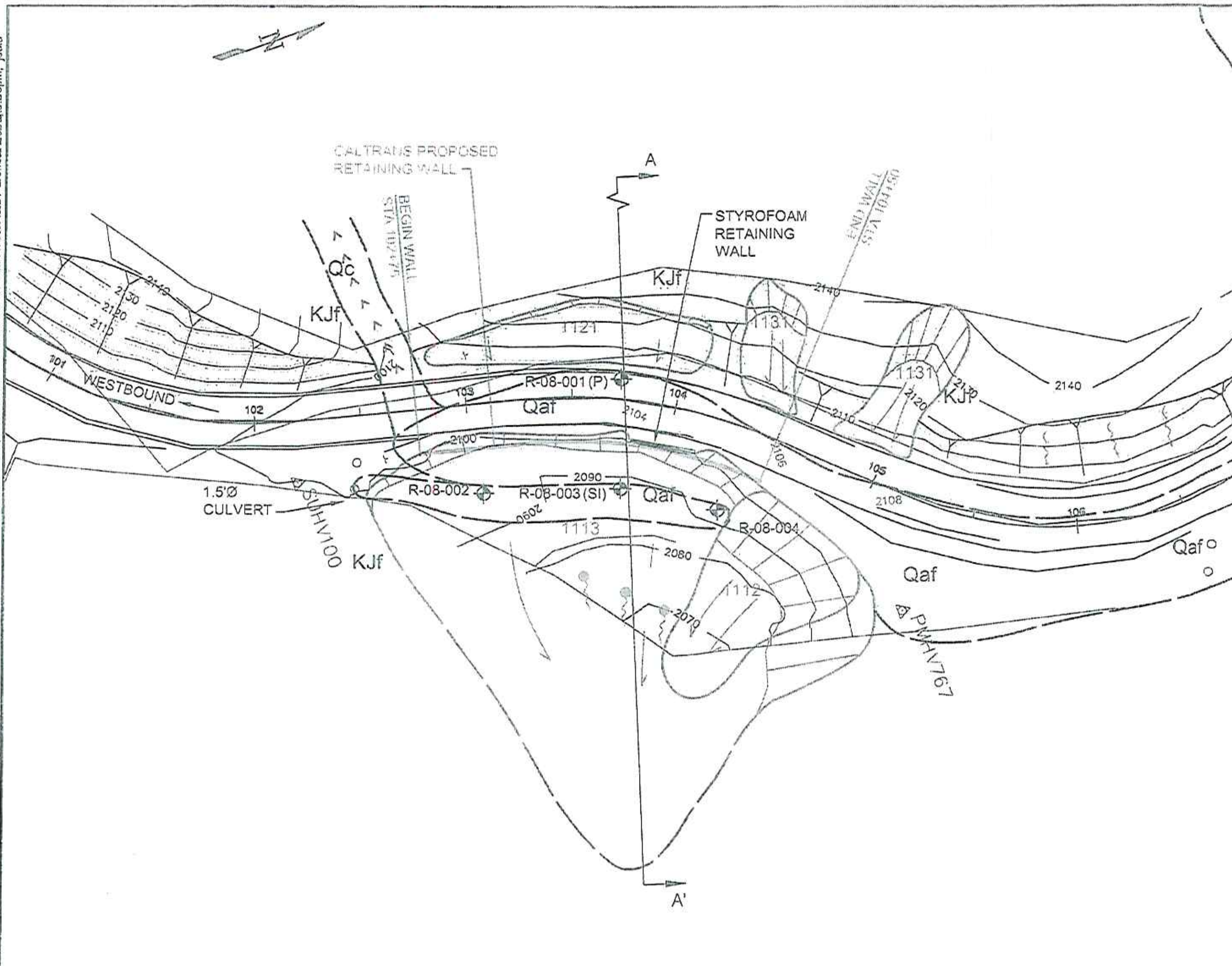
PROJECT NO.	93276
DRAWN:	NOV 2009
DRAWN BY:	PH
CHECKED BY:	JR
FILE NAME:	93276-3.dwg

SITE LOCATION

EA 01-476201
HIGHWAY 253 P.M. 7.6
MENDOCINO COUNTY, CALIFORNIA

PLATE
1



Base Map:Topography Map from Caltrans, 8-2009_Updated Topo Showing Temp Roads.dwg

50 25 0 50
APPROXIMATE SCALE (feet)

EXPLANATION

Symbol	Description
Qaf	Artificial Fill
Qc	Colluvium
KJf	Franciscan Complex Bedrock
	Geologic Contact (dashed where approximate)
A A'	Approximate Cross Section Location
	Landslide Contact (dashed where approximate)
1112	Landslide: Arrows Indicate Direction of Movement, Hatchures Indicate Scarp Area
R-08-001	Approximate Boring Location
(SI)	Slope Inclinometer Installed
(P)	Piezometer Installed
1112	Landslide Identification Number (reference landslide identification chart)
	Soil Creep
	Erosion Rilling
	Cutslope
	Seepage

LANDSLIDE IDENTIFICATION CHART

1 — 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)

2 — CERTAINTY OF IDENTIFICATION
- 1=Definite
- 2=Probable
- 3=Questionable

3 — DOMINANT TYPE OF MOVEMENT
- 1=Slump Flow Complex
- 2=Debris Slide
- 3=Debris Flow
- 4=Earth Flow
- 5=Slump
- 6=Translational

4 — 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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PROJECT NO.	93276
DRAWN:	NOV 2009
DRAWN BY:	PH/JDS
CHECKED BY:	JR
FILE NAME: 93276-1.dwg	

SITE PLAN

EA 01-476201
HIGHWAY 253 P.M. 7.6
MENDOCINO COUNTY, CALIFORNIA

PLATE
2

ATTACHED IMAGES: Images: DC_2506073.jpg Images: SITEPLAN_Page_1.jpg Images: SITEPLAN_Page_2.jpg
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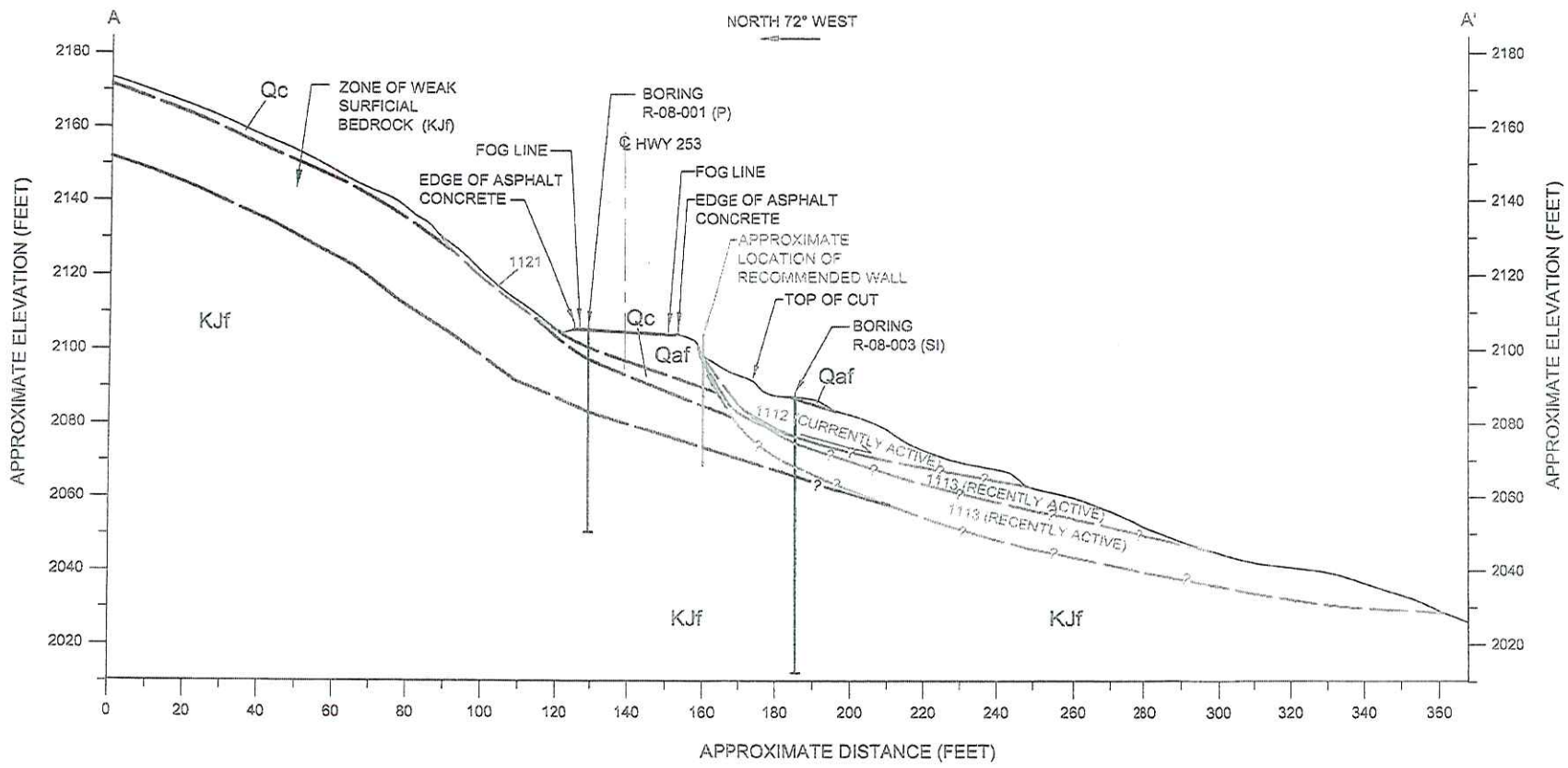

EXPLANATION

(P)	Piezometer Installed	Qc	Colluvium
(SI)	Slope Inclinometer Installed	Qaf	Artificial Fill
	Landslide Contact (dashed where approximate)	KJf	Franciscan Complex Bedrock
1113	Landslide Identification Number (reference landslide identification chart)		Geologic Contact (dashed where approximate)

NOTE:
SECTION A-A' WAS HAND LEVEL FIELD SURVEYED IN JULY 2008 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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PROJECT NO.	93276
DRAWN:	NOV 2009
DRAWN BY:	PH/JDS
CHECKED BY:	JR
FILE NAME:	93276-2.dwg

CROSS SECTION A - A'

EA 01-476201
HIGHWAY 253 P.M. 7.6
MENDOCINO COUNTY, CALIFORNIA

PLATE 3

ATTACHED IMAGES: Images: DC_2507865.jpg
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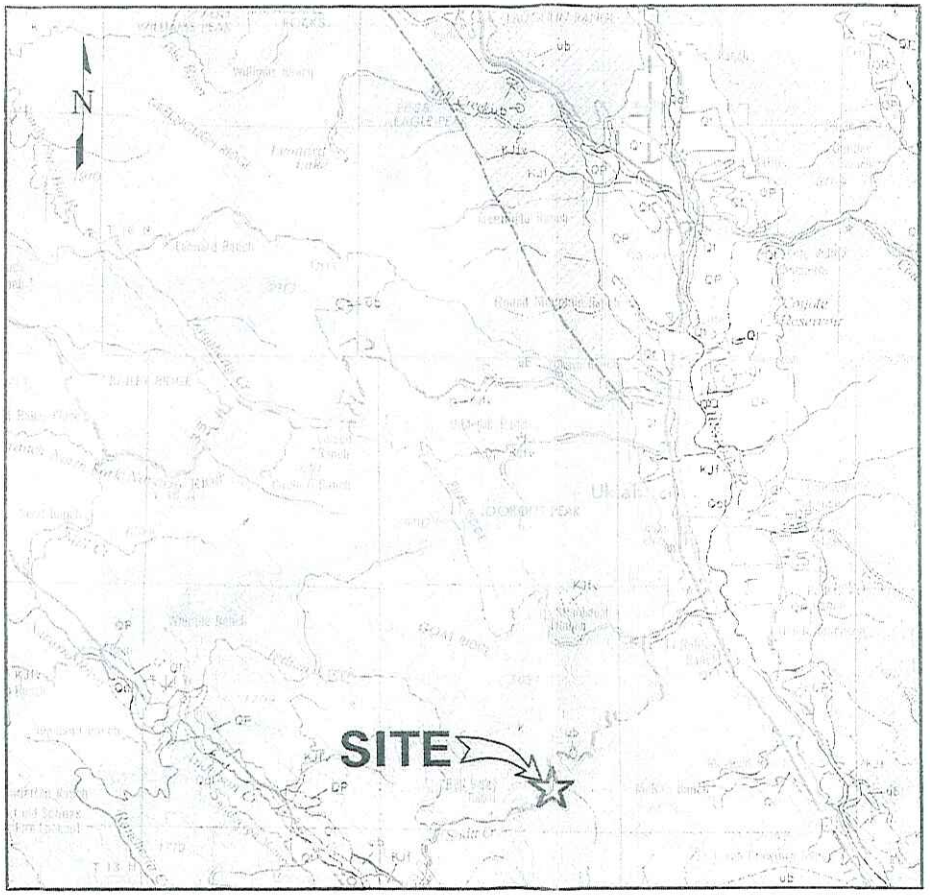
EXPLANATION

Contact
(Dashed where approximately located; gradational or inferred)

Fault
(Dashed where approximately located)

Qal	Alluvium
Qt	Quaternary nonmarine terrace deposits
QP	Plio-Pleistocene nonmarine
K	Undivided Cretaceous marine
KJf	Franciscan Formation
KJfv	Franciscan volcanic and metavolcanic rocks
ub	Mesozoic ultrabasic intrusive rocks



3 1.5 0 3
APPROXIMATE SCALE (miles)

Reference:
Geologic Map of California, Ukiah Sheet, Olaf P. Jenkins Edition
Charles W. Jennings and Rudolph G.Strand, 1960

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PROJECT NO.	93276
DRAWN:	NOV 2009
DRAWN BY:	PH
CHECKED BY:	JR
FILE NAME:	93276-6.dwg

REGIONAL GEOLOGY

EA 01-476201
HIGHWAY 253 P.M. 7.6
MENDOCINO COUNTY, CALIFORNIA

PLATE 4

ATTACHED IMAGES: Images: DC_2506193.jpg Images: DC_2506194.jpg Images: DC_2506195.jpg Images: DC_2506200.jpg
ATTACHED XREFS:
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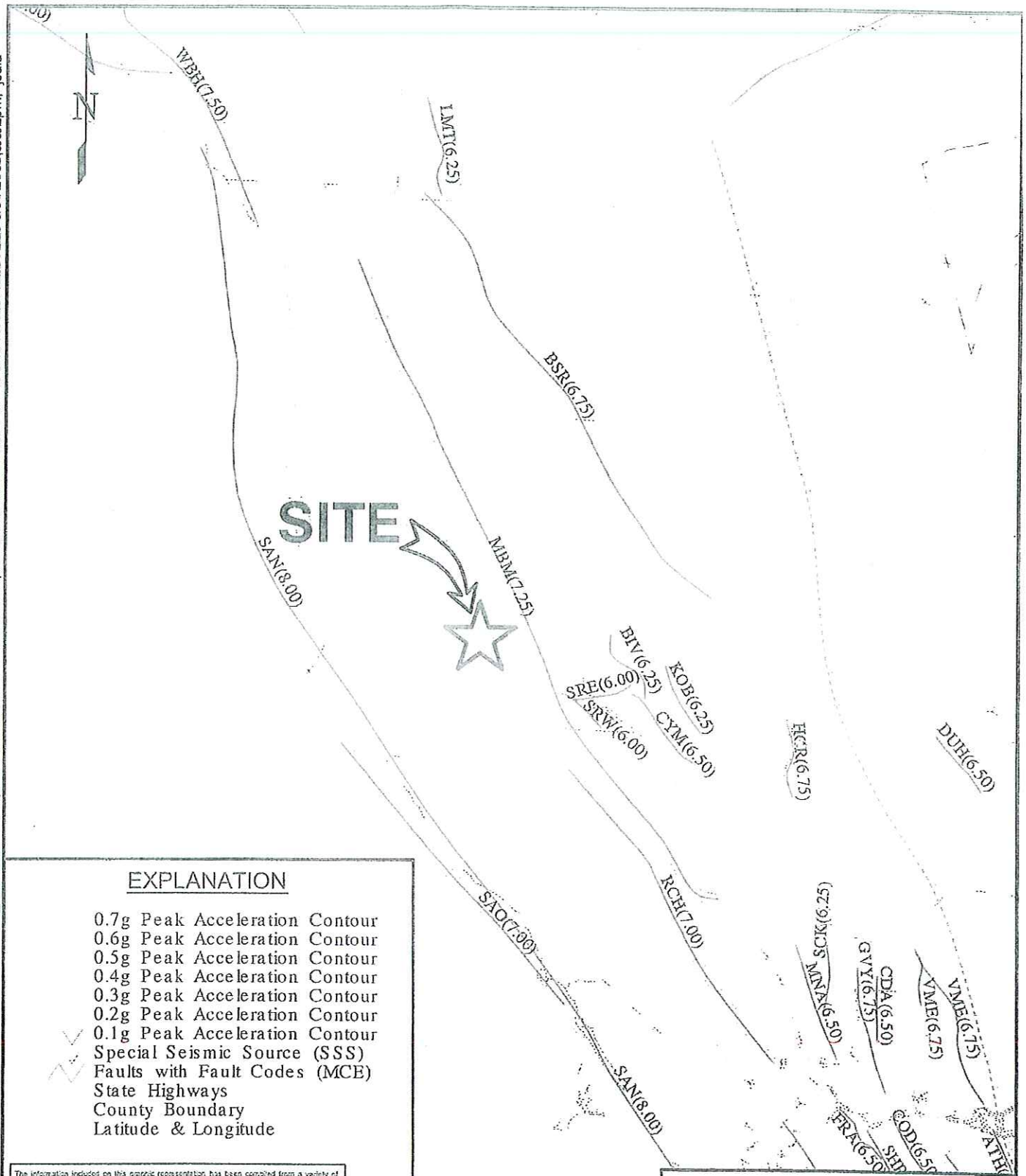

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PROJECT NO.	93276
DRAWN:	NOV 2009
DRAWN BY:	PH
CHECKED BY:	JR
FILE NAME:	93276-7.dwg

CALIFORNIA SEISMIC HAZARD MAP (MUALCHIN 1996)

EA 01-476201
HIGHWAY 253 P.M. 7.6
MENDOCINO COUNTY, CALIFORNIA

PLATE 5

ATTACHED IMAGES: Images: HzrdMap96 copy.jpg
ATTACHED XREFS:
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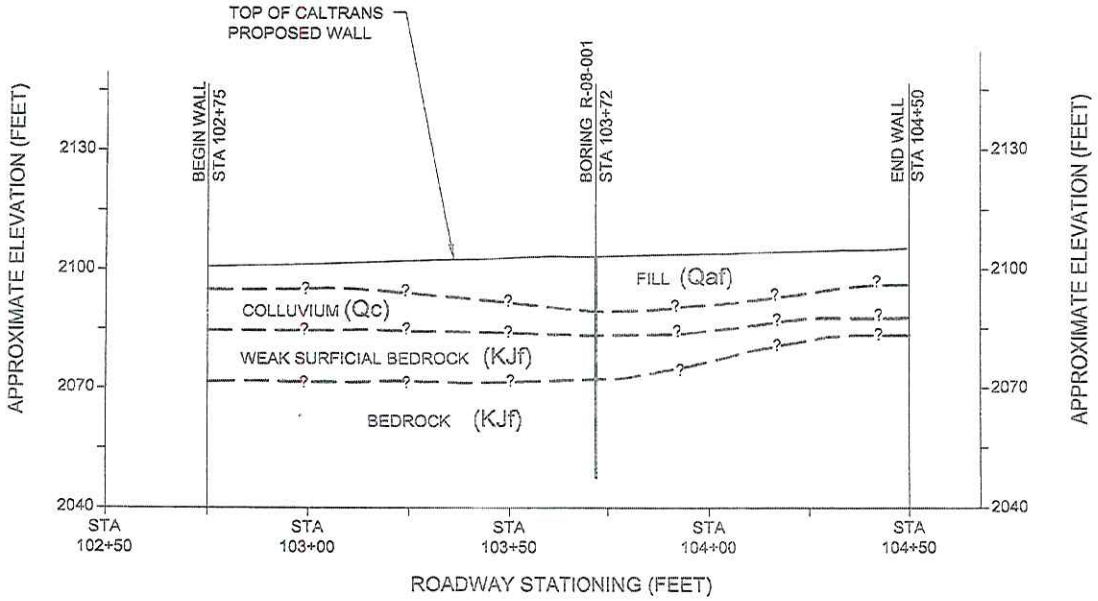

EXPLANATION

(Qaf)	Artificial Fill
(Qc)	Colluvium
(KJf)	Franciscan Complex Bedrock
	Geologic Contact: Dashed Where Approximate

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

Along the location of the profile, no landslide deposits are shown. Landslide deposits exist downslope of the section location.

30 15 0 30
APPROXIMATE SCALE (feet)

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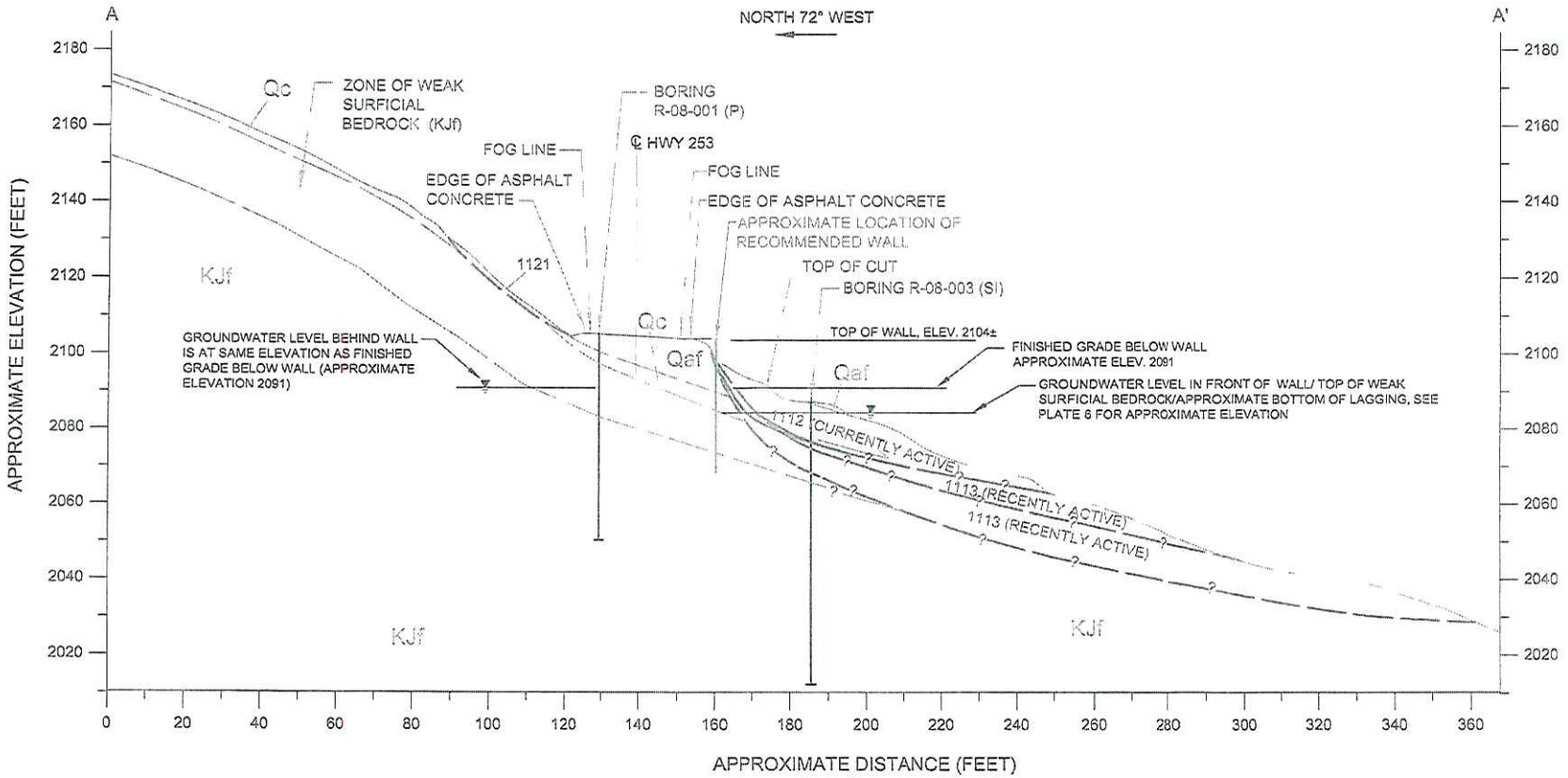
PROJECT NO.	93276
DRAWN:	NOV 2009
DRAWN BY:	JDS
CHECKED BY:	JR
FILE NAME:	93276-9.dwg

APPROXIMATE SUBSURFACE GEOLOGY ALONG PROPOSED RETAINING WALL

STORM DAMAGE LOCATION
EA: 01-476201
HIGHWAY 253 P.M. 7.6
MENDOCINO COUNTY, CALIFORNIA

PLATE 6



EXPLANATION

(P)	Piezometer Installed	Qc	Colluvium
(SI)	Slope Inclinometer Installed	Qaf	Artificial Fill
	Landslide Contact (dashed where approximate)	KJf	Franciscan Complex Bedrock
1113	Landslide Identification Number (reference landslide identification chart)		Geologic Contact (dashed where approximate)

NOTE:

SECTION A-A' WAS HAND LEVEL FIELD SURVEYED IN JULY 2008 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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PROJECT NO.	93276
DRAWN:	JAN 2010
DRAWN BY:	PH/JDS
CHECKED BY:	JR
FILE NAME:	93276-7A.dwg

DESIGN CROSS SECTION

EA 01-476201
HIGHWAY 253 P.M. 7.6
MENDOCINO COUNTY, CALIFORNIA

PLATE 7

ATTACHED IMAGES: Images: DC_2507865.jpg Images: Plate 7A.jpg
ATTACHED XREFS:
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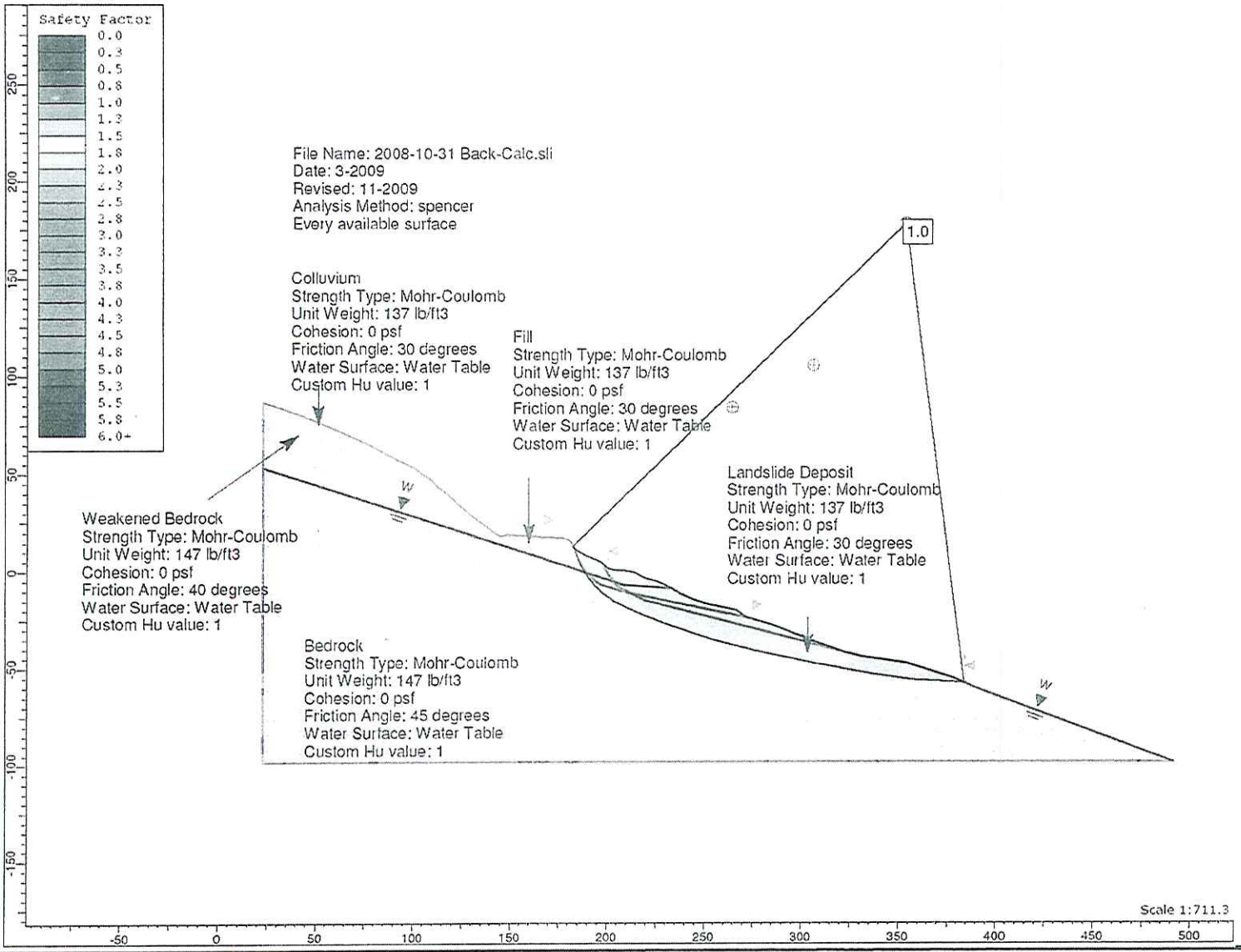

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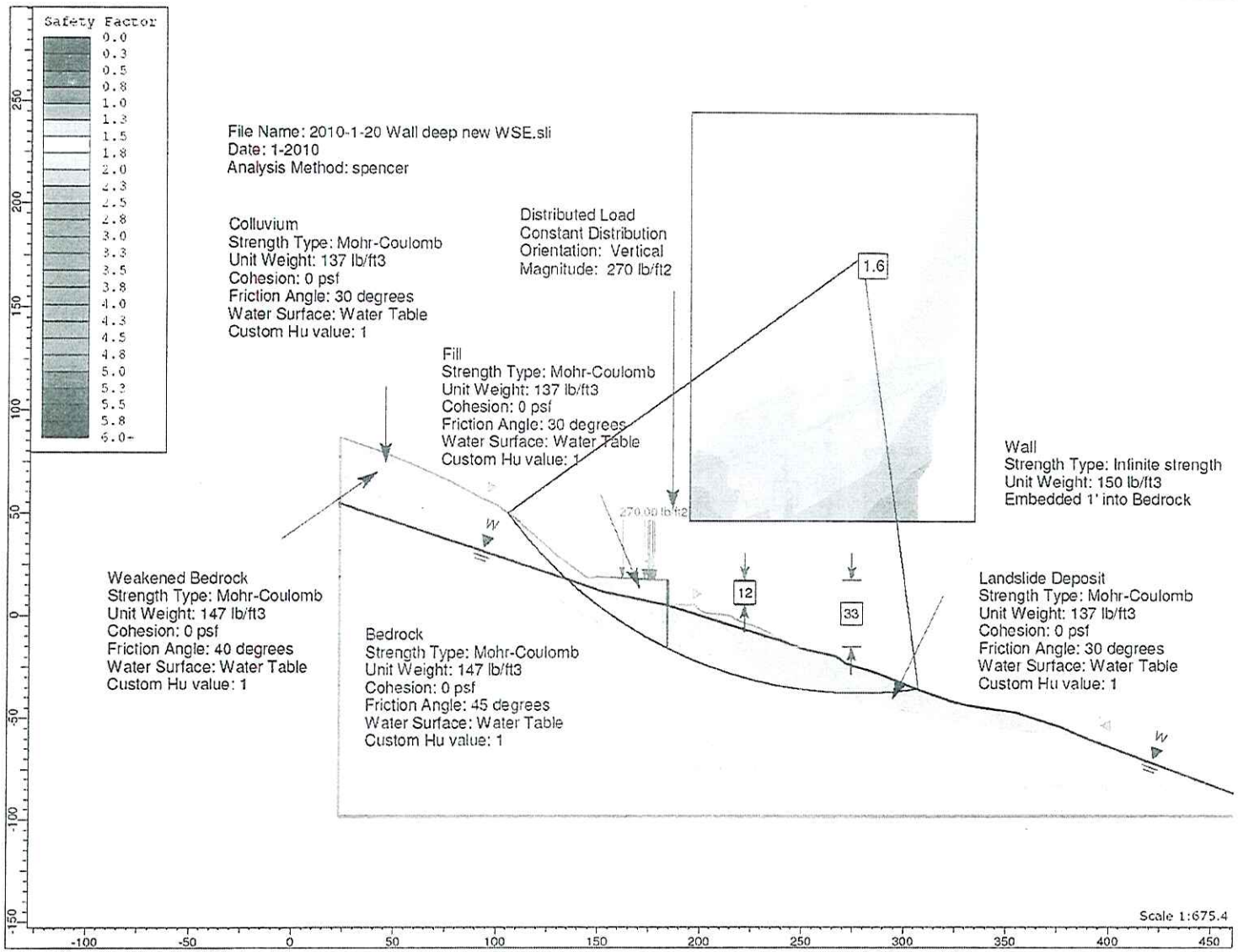
PROJECT NO.:	93276
DATE:	NOVEMBER 2009
BY:	CMG
CHECKED BY:	TC

SLOPE STABILITY: CROSS SECTION A-A': BACK-CALCULATION

EXISTING CONDITIONS, STATIC ANALYSIS
EA # 476201
HIGHWAY 253 P.M. 7.6 01-MEN-253-7.6
MENDOCINO COUNTY, CALIFORNIA

PLATE
8



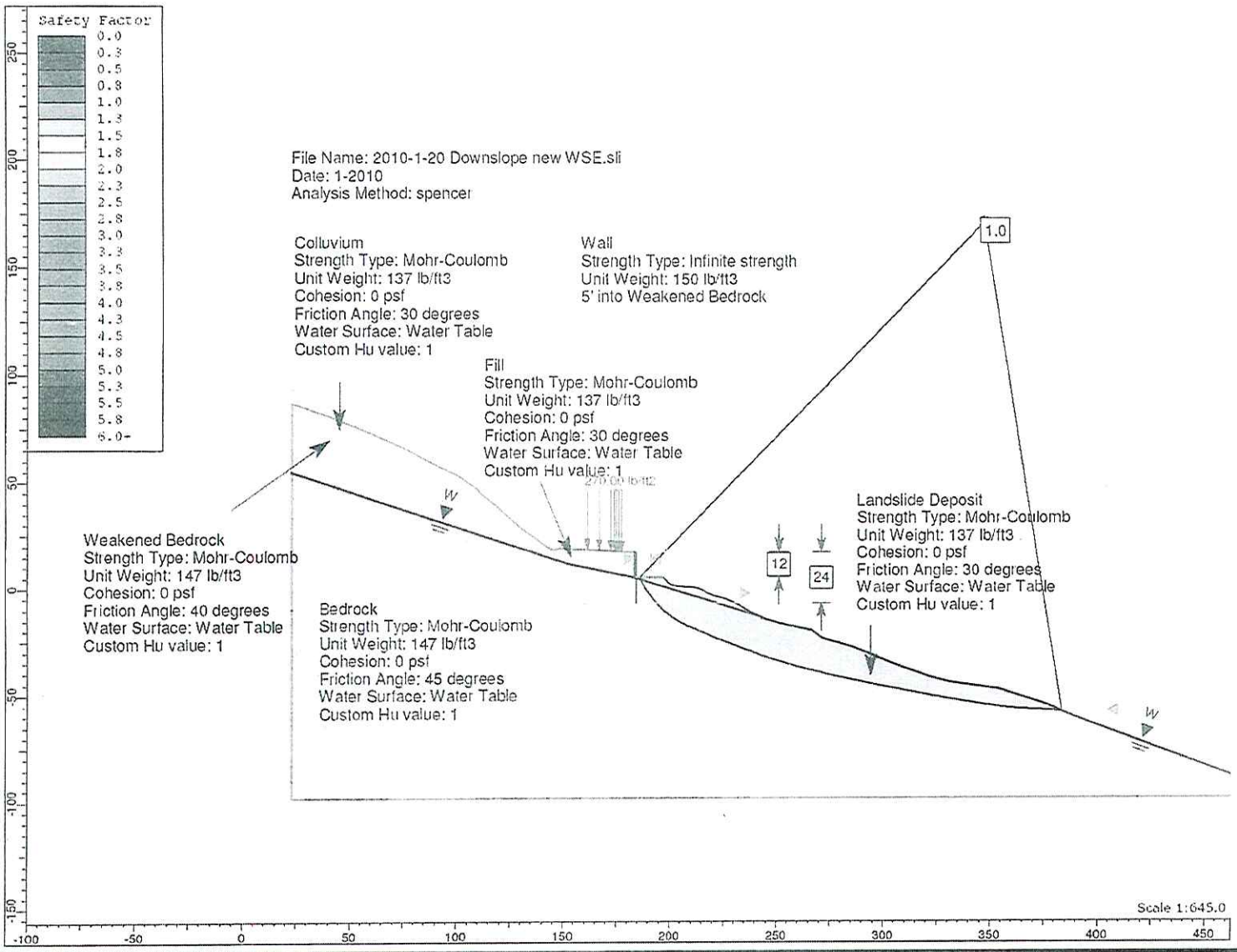
KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	93276
DATE:	JANUARY 2010
BY:	CMG
CHECKED BY:	TC

SLOPE STABILITY: SECTION A-A': WALL EMBEDDED 1' INTO BEDROCK

IMPROVED CONDITIONS, STATIC ANALYSIS
EA # 476201
HIGHWAY 253 P.M. 7.6 01-MEN-253-7.6
MENDOCINO COUNTY, CALIFORNIA

PLATE
9



KLEINFELDER
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PROJECT NO.:	93276
DATE:	JANUARY 2010
BY:	CMG
CHECKED BY:	TC

SLOPE STABILITY: CROSS SECTION A-A': DOWNSLOPE

IMPROVED CONDITIONS, STATIC ANALYSIS
EA # 476201
HIGHWAY 253 P.M. 7.6 01-MEN-253-7.6
MENDOCINO COUNTY, CALIFORNIA

PLATE
10

KLEINFELDER
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APPENDIX A

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	Men	253	7.6		

12-08
REGISTERED GEOLOGIST DATE

WILLIAM V. McCORMICK III
No. 1613
Exp. 11-30-10
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

PLANS APPROVAL DATE

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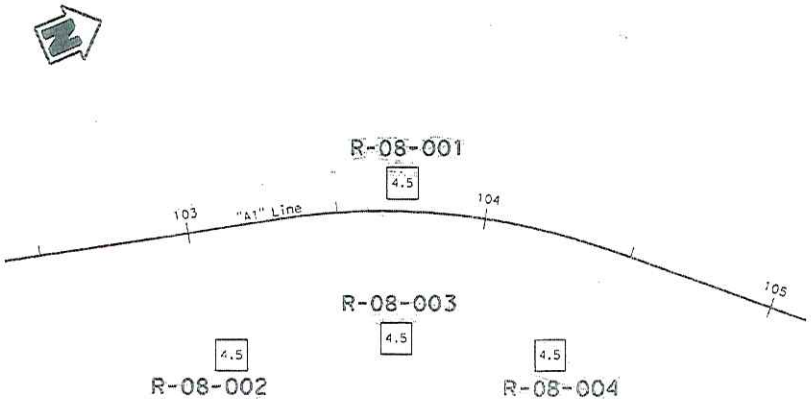
KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407



PLAN
1"=20'

Notes:

1. 2" samples were taken using a modified California split-barrel sampler with an inside diameter (I.D.) of 2" and an outside diameter (O.D.) of 2½".
2. 1.4" samples were taken using a SPT split-barrel sampler with an inside diameter (I.D.) of 1.4" and an outside diameter (O.D.) of 2".
3. An automatic hammer (140 lb) with a 30" drop was used to advance the sampler.
4. Blowcounts noted for boring are field blowcounts and have not been corrected.
5. Blowcounts 50/5 means 50 blows per 5" penetration.
6. This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2007)

BENCHMARKS

STATION	N	E	ELEV (FT)	DESCRIPTION

SURVEY CONTROL
1. Coordinates bearing and distances are based on the California State Plane Coordinate system of NAD 83 (1986). Elevations are based on NAVD88.

DESIGN OVERSIGHT ENGINEER:	SIGN OFF DATE:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION		BRIDGE NO.	RETAINING WALL @ PM 7.6
FUNCTIONAL SUPERVISOR	DRAWN BY: A. Sanchez	FIELD INVESTIGATION BY:	PROJECT ENGINEER	POST MILES 7.6	LOG OF TEST BORINGS 1 of 6
NAME:	CHECKED BY: W. McCormick	Kleinfelder May, June 2008			
DGS CIVIL LOG OF TEST BORINGS SHEET	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3		CU 03247 EA 476201	DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES: 5-09 11-2-09

DATE PLOTTED: 25-MAR-2009 TIME PLOTTED: 09:58

NOTE: This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2007)

FOR PLAN VIEW AND ADDITIONAL NOTES, SEE "LOG OF TEST BORINGS" SHEET 1 OF 6

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
01	Men	253	7.6		

REGISTERED GEOLOGIST — DATE 12-08

PLANS APPROVAL DATE

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REGISTERED GEOLOGIST WILLIAM V. McCORMICK III No. 1673 Exp. 11-30-10 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

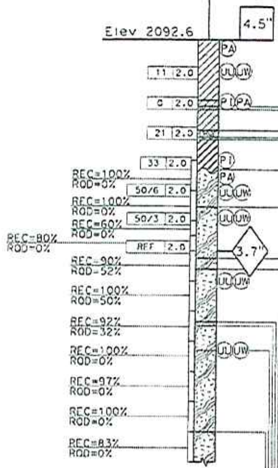
KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407

ELEVATION: 2110, 2100, 2090, 2080, 2070, 2060, 2050, 2040, 2030, 2020, 2010, 2000, 1990, 1980, 1970, 1960

R-08-002

43.0' Rt Sta. 103+08.0
"A1" Line

Elev 2092.6



SANDY lean CLAY (CL); soft to medium stiff; brown with orange mottles, light brown; dry to moist; fine to coarse SAND; [LANDSLIDE DEPOSIT].

CLAYEY SAND (SC); very loose; gray, greenish gray; few subangular GRAVEL; fine to coarse SAND; [LANDSLIDE DEPOSIT].

CLAYEY GRAVEL with SAND (GC); loose; light reddish brown; wet; subangular GRAVEL, max. 1 in. dia.; little fine to coarse SAND; little fines; [LANDSLIDE DEPOSIT].

CLAYEY SAND (SC); medium dense; gray blue; moist; trace subangular GRAVEL, max. 1 in. dia.; some fines; [LANDSLIDE DEPOSIT].

CLAYEY GRAVEL with SAND (GC); loose; olive gray brown; moist; [LANDSLIDE DEPOSIT].

Fat CLAY (CH); medium stiff; light brown; moist; trace fine SAND; [SLIDE PLANE].

Fat CLAY with GRAVEL (CH); stiff; brown with orange and gray mottles; moist; little subangular GRAVEL, max. 1 in. dia.; little SAND; [COLLUVIUM/DECOMPOSED BEDROCK].

METAMORPHIC ROCK (Clayey Meta-Sandstone), brown, orange brown, gray, fine-grained to medium-grained, intensely weathered, very soft, very intensely fractured, clay infill, pervasively sheared, multiple discontinuous orientations.

-Grades to dark gray blue, moderately to slightly weathered, occasional chlorite blebs, meta-sandstone corestones to 0.5 in.; at 27 ft.

METAMORPHIC ROCK (Argillite), dark gray, slightly weathered, very soft, very intensely fractured, moderately hard corestones locally, light olive gray blebs, striations within fracture faces locally, pervasively sheared.

-Becomes soft; at 35 ft.

METAMORPHIC ROCK (Meta-Sandstone), gray, fine-grained to medium-grained, slightly weathered, moderately hard.

-2 in. disaggregated zone; at 37.5 ft.

METAMORPHIC ROCK (Meta-Shale), gray to dark gray, slightly weathered, moderately soft, very intensely fractured, striations within fracture faces locally, potential for slaking.

-Multiple orientations, calcite infill; at 40 ft.

-General shearing fabric 80° to vertical; at 42 ft.

METAMORPHIC ROCK (Meta-Sandstone), gray to dark gray, fine-grained, slightly weathered, moderately hard, intensely fractured.

METAMORPHIC ROCK (Meta-Shale), dark gray, slightly weathered, very soft, very intensely fractured, pervasively sheared.

-Becomes moderately soft to moderately hard, sandstone interbeds; at 50 ft.

METAMORPHIC ROCK (Meta-Shale), gray to dark gray, fine-grained, very thinly bedded, slightly weathered, moderately soft, very intensely fractured, meta-sandstone interbeds, visible displacement of interbeds along fractures.

-Becomes very soft, plastic zone; from 56.4 to 56.6 ft.

-Bedding 55°; at 59.5 ft.

-Becomes very soft to soft, moderately to slightly weathered, abundant clay infill, pervasively sheared; at 60 ft.

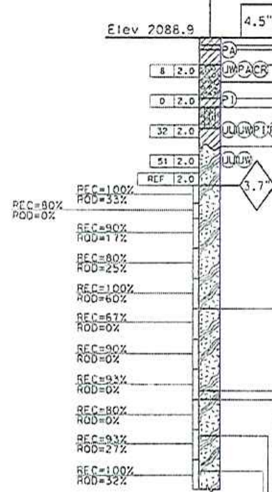
METAMORPHIC ROCK (Meta-Sandstone), gray to dark gray, fine-grained, moderately to slightly weathered, moderately soft to moderately hard, very intensely fractured, clay infill, calcite mineralization.

6-5-08
Terminated at Elev 2022.6
ER_i = 83%
Groundwater surface elevation not determined

R-08-003

42.9' Rt Sta. 103+71.4
"A1" Line

Elev 2088.9



CLAYEY SAND (SC); loose; gray brown with trace orange mottles; moist; fine to medium SAND; little fines; [LANDSLIDE DEPOSIT].

CLAYEY SAND (SC); loose; reddish brown with orange mottles; moist; fine to medium SAND; little fines; rootlets; [LANDSLIDE DEPOSIT].

SANDY lean CLAY (CL); medium stiff; dark gray; moist; about 6% subangular GRAVEL, max. 1.0 in. dia.; about 42% fine to coarse SAND; [LANDSLIDE DEPOSIT].

CLAYEY GRAVEL with SAND (GC); loose; dark brown; moist; about 51% angular to subangular GRAVEL, max. 1.0 in. dia.; about 26% fine to coarse SAND; about 23% fines; gravel derived from meta-sandstone; [LANDSLIDE DEPOSIT].

GWS Elev 2081.6
3-5-09

Lean CLAY (CL); very soft; brown to gray brown; moist; trace angular to subangular GRAVEL; some fine to medium SAND; [LANDSLIDE DEPOSIT].

-INTERMEDIATE SLIDE PLANE at 10.8 ft.

SILTY GRAVEL (GM); loose; red brown; moist; angular to subangular GRAVEL, max. 1.0 in. dia.; some fines; gravel derived from meta-sandstone; [LANDSLIDE DEPOSIT].

-INTERMEDIATE SLIDE PLANE at 12.5 ft.

SILTY CLAY with SAND (CL); stiff; olive brown, dark gray, reddish brown; moist; little fine SAND; [LANDSLIDE DEPOSIT/COLLUVIUM].

METAMORPHIC ROCK (Meta-Shale), dark gray, moderately to slightly weathered, very soft, very intensely fractured, pervasively sheared, clay infill, calcite mineralization, localized meta-sandstone interbed remnants.

-Increased meta-sandstone interbed remnants; at 23 ft.

METAMORPHIC ROCK (Meta-Sandstone), gray, light reddish brown, moderately weathered, moderately soft, very intensely fractured, iron oxide and calcite mineralization present.

-Becomes moderately hard; at 28 ft.

-Intensely weathered, very soft, intensely weathered; very soft; abundant iron oxide mineralization; from 30 to 30.6 ft.

-Becomes gray; at 31 ft.

-Joint 35°, planar, slightly open, calcite infill; at 31.7 ft.

-Joint 65°, planar, tight, minor clay infill; at 33 ft.

-Joints 55-70°, planar to slightly undulating, slightly open, minor calcite infill; at 35 ft.

-Remnant shale interbed; from 39.9 to 40.3 ft.

-Joint 55°, planar, slightly open, calcite infill; at 41.2 ft.

-Remnant shale interbed; from 42.3 to 43 ft.

METAMORPHIC ROCK (Meta-Shale), gray to dark gray, moderately to slightly weathered, very soft, very intensely fractured, clay infill, pervasively sheared.

-General shearing fabric 45-55°, occasional calcite veinlets.

METAMORPHIC ROCK (Meta-Sandstone), gray, fine-grained to medium-grained, moderately to slightly weathered, moderately hard, intensely fractured.

METAMORPHIC ROCK (Meta-Shale), dark gray, slightly weathered, very soft, very intensely fractured, pervasively sheared.

-Thin meta-sandstone interbed remnants; at 65 ft.

METAMORPHIC ROCK (Meta-Sandstone), gray, fine-grained to medium-grained, slightly weathered, moderately hard to hard, intensely fractured, calcite healed fractures.

-Thin meta-shale interbed; at 68.5 ft.

-Joint 35-70°, planar to slightly undulating, slightly open, locally silty clay, calcite mineralization; at 69 ft.

METAMORPHIC ROCK (Meta-Shale), gray to dark gray, slightly weathered, soft, intensely fractured, pervasively sheared, general shearing fabric 35°.

6-3-08
Terminated at Elev 2013.9
ER_i = 83%
Groundwater surface elevation not determined

103+00 — 104+00 — 105+00

PROFILE

HOR. 1"=10'
VER. 1"=10'

DESIGN OVERSIGHT ENGINEER:	SIGN OFF DATE:		
FUNCTIONAL SUPERVISOR	DRAWN BY: A. Sanchez	FIELD INVESTIGATION BY:	
NAME:	CHECKED BY: W. McCormick	E. Johnson	May, June 2008

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

BRIDGE NO.

POST MILES 7.6

RETAINING WALL @ PM 7.6

LOG OF TEST BORINGS 2 of 6

CU 03247
EA 476201

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

DISREGARD PRINTS BEARING EARLIER REVISION DATES

NOTE: This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2007)

FOR PLAN VIEW AND ADDITIONAL NOTES, SEE "LOG OF TEST BORINGS" SHEET 1 OF 6

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
01	Men	253	7.6		

REGISTERED GEOLOGIST — DATE 9-12-08

PLANS APPROVAL DATE

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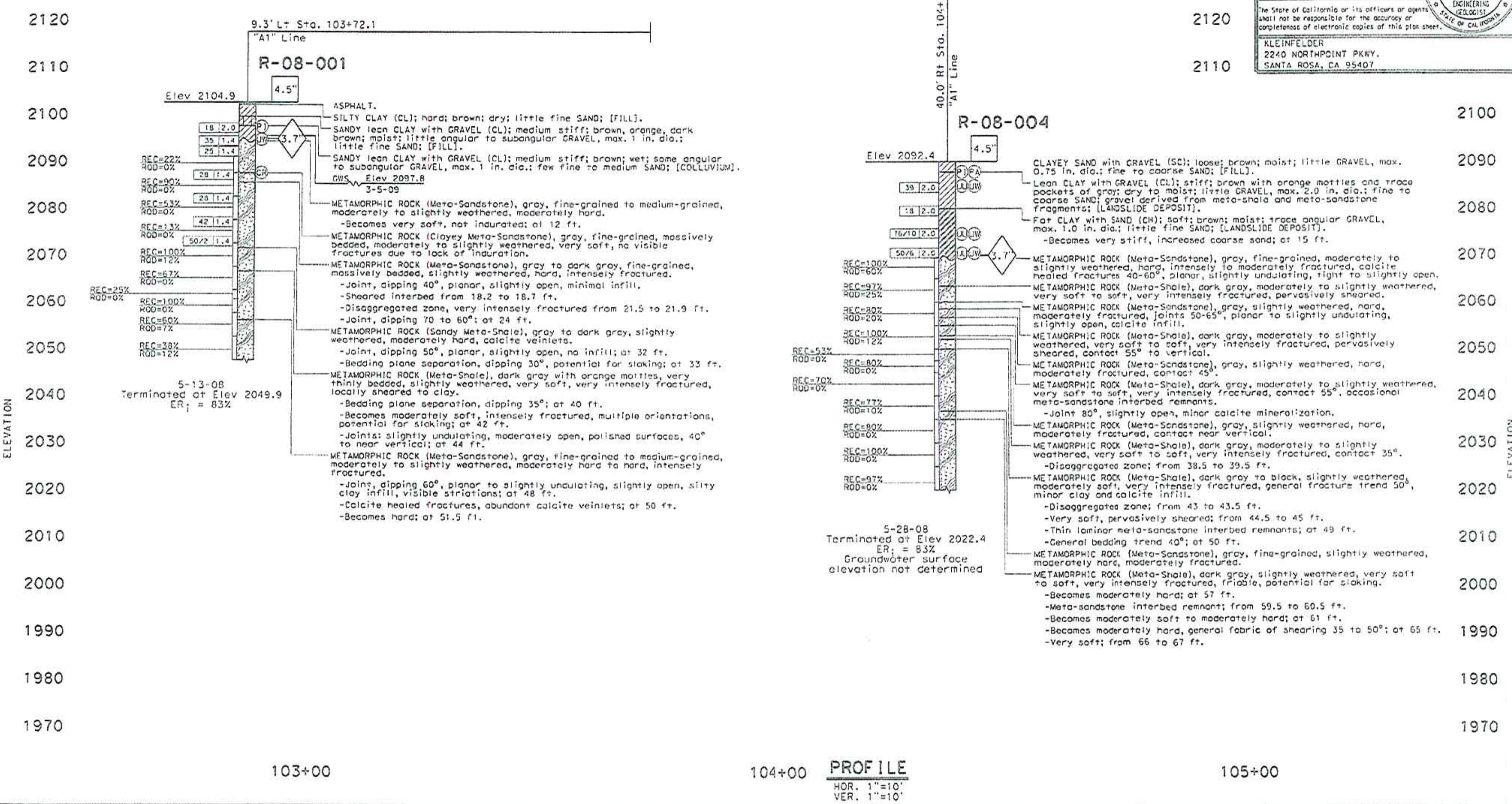
REGISTERED GEOLOGIST WILLIAM V. McCORMICK III No. 1673 Exp. 11-30-10 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407



PROFILE
HOR. 1"=10'
VER. 1"=10'

DESIGN OVERSIGHT ENGINEER:	SIGN OFF DATE:		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION		BRIDGE NO.	RETAINING WALL @ PM 7.6
FUNCTIONAL SUPERVISOR	DRAWN BY: A. Sanchez	FIELD INVESTIGATION BY:		PROJECT ENGINEER	POST MILES 7.6	LOG OF TEST BORINGS 3 of 6
NAME:	CHECKED BY: W. McCormick	E. Johnson May, June 2008				

DES CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

CU 03247
EA 476201

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
01	Men	253	7.6		

REGISTERED GEOLOGIST — DATE 9-12-08

PLANS APPROVAL DATE

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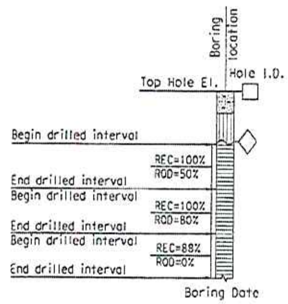
REGISTERED GEOLOGIST WILLIAM T. McCORMICK III No. 1673 Exp. 11-30-10 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407

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

$$REC = \frac{\Sigma \text{ Length of the recovered core pieces (inches)}}{\text{Total length of core run (inches)}} \times 100\%$$

$$RQD = \frac{\Sigma \text{ Length of intact core pieces} \geq 4"}{\text{Total length of core run (inches)}} \times 100\%$$



RELATIVE STRENGTH OF INTACT ROCK

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

BEDDING SPACING

Description	Thickness / Spacing
Massive	Greater than 10 ft
Very thickly bedded	3 to 10 ft
Thickly bedded	1 to 3 ft
Moderately bedded	3-5/8" to 1 ft
Thinly bedded	1-1/4" to 3-5/8"
Very thinly bedded	3/8" to 1-1/4"
Laminated	Less than 3/8"

LEGEND OF ROCK MATERIALS

- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

ROCK HARDNESS

Description	Criteria
Extremely Hard	Specimen cannot be scratched with a pocket knife or sharp pick; can only be chipped with repeated heavy hammer blows.
Very Hard	Specimen cannot be scratched with a pocket knife or sharp pick. Breaks with repeated heavy hammer blows.
Hard	Specimen can be scratched with a pocket knife or sharp pick with difficulty (heavy pressure). Heavy hammer blows required to break specimen.
Moderately Hard	Specimen can be scratched with pocket knife or sharp pick with light or moderate pressure. Core breaks with moderate hammer pressure.
Moderately Soft	Specimen can be grooved 1/6" deep with a pocket knife or sharp pick with moderate or heavy pressure. Breaks with light hammer blow or heavy manual pressure.
Soft	Specimen can be grooved or gouged easily by a pocket knife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
Very Soft	Specimen can be readily indented, grooved or gouged with fingernail, or carved with a pocket knife. Breaks with light manual pressure.

FRACTURE DENSITY

Description	Observed Fracture Density
Unfractured	No fractures.
Very slightly fractured	Lengths greater than 3 feet.
Slightly fractured	Lengths from 1 to 3 feet with few lengths less than 1 foot or greater than 3 feet.
Moderately fractured	Lengths mostly in 4" to 1 foot range with most lengths about 8"
Intensely fractured	Lengths average from 1 to 4" with scattered fragmented intervals with lengths less than 4"
Very intensely fractured	Mostly chips and fragments with a few scattered short core lengths.

Combination descriptors (such as "Very intensely to intensely fractured") are used where equal distribution of both fracture density characteristics is present over a significant interval or exposure, or where characteristics are "in between" the descriptor definitions. Only two adjacent descriptors may be combined.

WEATHERING DESCRIPTORS FOR INTACT ROCK

Description	Diagnostic features: Chemical Weathering-Discoloration and/or oxidation — Body of Rock	Chemical Weathering — Fracture Surfaces	Mechanical Weathering-Grain boundary conditions (disaggregation) primarily for granitics and some coarse-grained sediments	Texture and Solutioning — Texture	Texture and Solutioning — 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, see grain boundary conditions.	All fracture surfaces are discolored or oxidized, surfaces friable.	Partial separation, rock is friable; in semiarid conditions granitics are disaggregated.	Texture altered by chemical disintegration (hydration, argillation).	Leaching of soluble minerals may be complete.	Dull sound when struck with hammer, usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures, or veinlets. Rock is significantly weakened.
Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay.		Complete separation of grain boundaries (disaggregated).	Resembles a soil, partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete.		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes."

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

DESIGN OVERSIGHT ENGINEER: SIGN OFF DATE:
PREPARED BY A. Sanchez
CHECKED BY W. McCormick

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

BRIDGE NO.
POST MILE 7.6

ROCK LEGEND

LOG OF TEST BORINGS 4 of 6

GS LOTB ROCK LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 03247
EA 476201

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 11-02-07

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
01	Men	253	7.6		

REGISTERED GEOLOGIST 12-08 DATE

REGISTERED GEOLOGIST WILLIAM V. MCCORMICK III No. 1673 Exp. 11-30-10 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

PLANS APPROVAL DATE

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KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407

CEMENTATION

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

CONSISTENCY OF COHESIVE SOILS

Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

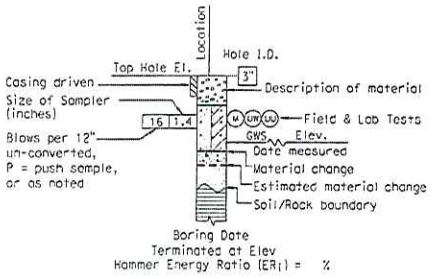
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
	D	Dynamic Cone Penetration Boring
	CPT	Cone Penetration Test (ASTM D 5778-95)
	O	Other

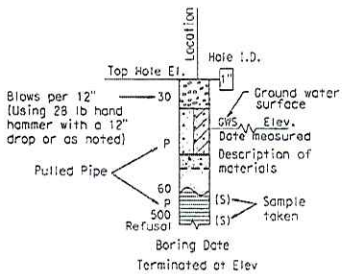
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

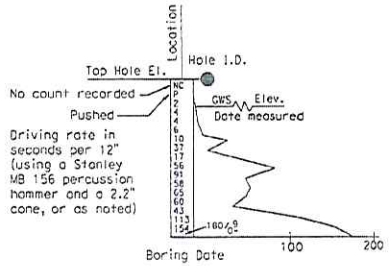
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be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



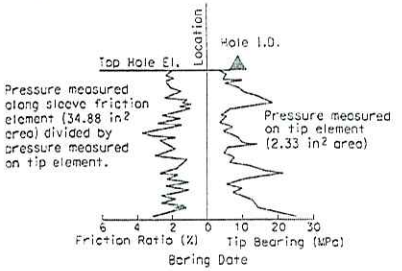
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

DESIGN OVERSIGHT ENGINEER:	SIGN OFF DATE:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION		BRIDGE NO.	SOIL LEGEND
PREPARED BY: A. Sanchez			PROJECT ENGINEER	POST MILE 7.6	LOG OF TEST BORINGS 5 OF 6
CHECKED BY: W. McCormick					
CS LOTB SOIL LEGEND	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS: 0 1 2 3	CU 03247 EA 476201		DISREGARD PRINTS DATED BEFORE: EARLIER REVISION DATES: 3/14 11-08	REVISION DATES: SHEET NO.

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

GROUP SYMBOLS AND NAMES

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

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

FIELD AND LABORATORY TESTING

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

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
01	Men	253	7.6		

REGISTERED GEOLOGIST — DATE 12-08

PLANS APPROVAL DATE

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REGISTERED GEOLOGIST — WILLIAM V. McCORMICK III — No. 1675 — Exp. 11-30-10 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

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

PERCENT OR PROPORTION OF SOILS

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

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

DESIGN OVERSIGHT ENGINEER: — SIGN OFF DATE:
PREPARED BY: A. Sanchez
CHECKED BY: W. McCormick

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

BRIDGE NO.
POST MILE: 7.6

CU 03247
EA 476201

SOIL LEGEND
LOG OF TEST BORINGS 6 of 6

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES — DATE: 11-2-08

SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS: 0 1 2 3

CS LOTB SOIL LEGEND

DATE PLOTTED = 23-NOV-08

KLEINFELDER
Bright People. Right Solutions.

APPENDIX B

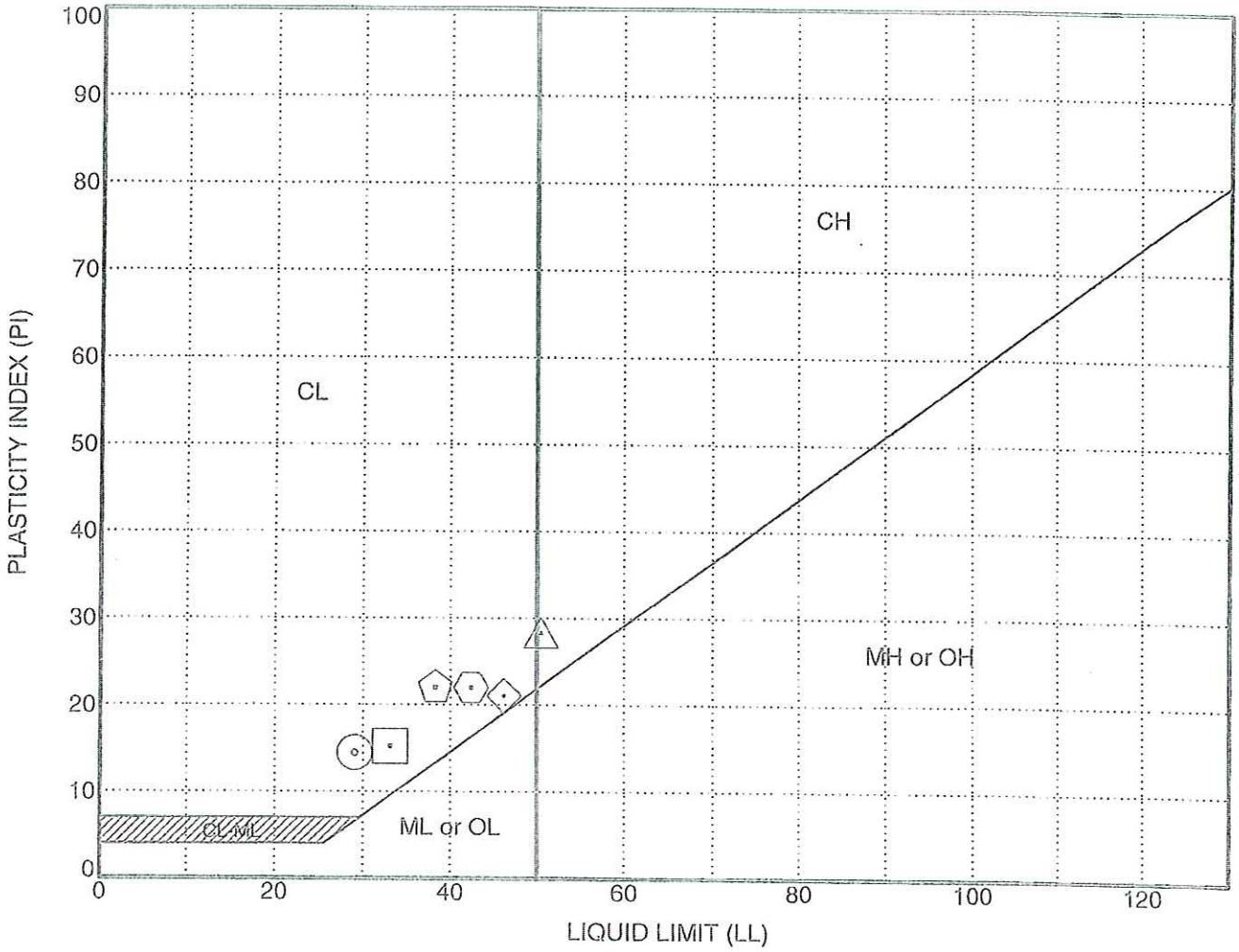
Highway 253 PM 7.6
EA # 01-476201
93276

Laboratory Summary Sheet

Soil/Rock Type	Boring	Depth (ft)	Dry density (pcf)	Moisture content (%)	Total density (pcf)	LL	PI	-200 (%)	TXUU (psf)	TXUU (tsf)	Confining Pressure (psf)	Other
FILL (CL)	R-08-001	4				29	14					
COLLUVIUM (CL)	R-08-001	6.5	122	12.5	137							
SURFICIAL META-SS	R-08-001	15										CR
LANDSLIDE (CL)	R-08-002	0.5						57				
LANDSLIDE (CL)	R-08-002	6	115	12.7	130				2999	1.5	706	
LANDSLIDE (SC)	R-08-002	10				33	15	39				
COLLUVIUM/DBR (CH)	R-08-002	20				50	28					
META-SANDSTONE	R-08-002	23						78				
META-SANDSTONE	R-08-002	25.5	125	13.3	142				4812	2.4	3298	
ARGILLITE	R-08-002	30.5	132	10.5	146				4345	2.2	4003	
META-SHALE	R-08-002	40	139	6.5	148				16063	8.0	5198	
META-SHALE	R-08-002	51.5	146	8	158				11530	5.8	6797	
LANDSLIDE (CL)	R-08-003	2						52				
LANDSLIDE (GC)	R-08-003	5.5										CR
LANDSLIDE (GC)	R-08-003	6	123	9.2	134			23				
LANDSLIDE (CL)	R-08-003	10				46	21					
LANDSLIDE/COLLUVIUM (CL)	R-08-003	15				42	22	76				
LANDSLIDE/COLLUVIUM (CL)	R-08-003	16	111	19	132				2484	1.2	2002	
META-SHALE	R-08-003	21	125	12.3	140				4881	2.4	2707	
LANDSLIDE (CL)	R-08-004	2.5				38	22	54				
LANDSLIDE (CL)	R-08-004	6	134	8	145				4460	2.2	806	
LANDSLIDE (CH)	R-08-004	16	120	15.1	138				5600	2.8	2002	
LANDSLIDE (CH)	R-08-004	20	132	9.9	145				9262	4.6	2606	

TXUU Triaxial Unconsolidated Undrained Strength
PI Plasticity Index
LL Liquid Limit
-200 Percent Passing 200 Sieve
CR Corrosivity

tsf tons per square foot
psf Pounds per square foot
SS Sandstone
DBR Decomposed Bedrock



SAMPLE SOURCE	CLASSIFICATION	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
⊙ R-08-001 @ 4.0'	Sandy Silty Clay (CL)	29	15	14	
⊡ R-08-002 @ 10.0'	Clayey Sand (SC)	33	18	15	39
△ R-08-002 @ 20.0'	Sandy Clay (CH)	50	22	28	
◇ R-08-003 @ 10.0'	Sandy Lean Clay (CL)	46	25	21	
⊙ R-08-003 @ 15.0'	Lean Clay with Sand (CL)	42	20	22	76
⬠ R-08-004 @ 2.5'	Sandy Lean Clay (CL)	38	16	22	54

KLEINFELDER
Bright People. Right Solutions.

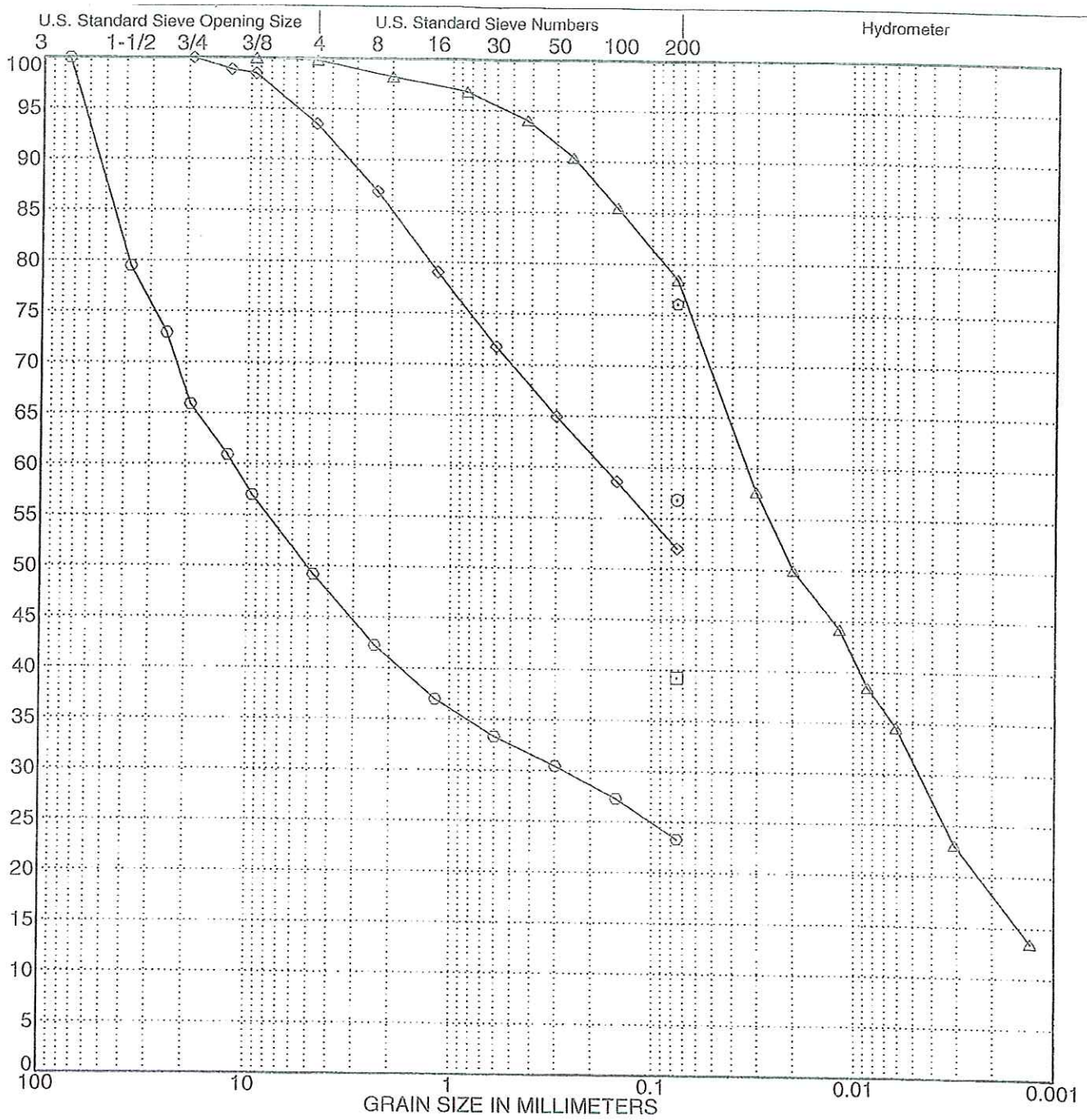
PROJECT NUMBER 93276 DATE 12/8/2009

ATTERBERG LIMITS (ASTM D4318)

EA 01-476201
HIGHWAY 253 P.M. 7.6
MENDOCINO COUNTY, CALIFORNIA

PLATE
B-1

Data Template: PI - KLEINFELDER SANTA ROSA 5-8-08 .GDT - 12/8/09 13:40 - U:\NEW GINT PROJECTS\93276 CALTRANS MULTIPLE JOBS\MEN 253 PM 7.6\01-MEN-253-7.6 LAB TESTS.GPJ



Cobbles	GRAVEL		SAND			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE		

SYMBOL	SAMPLE SOURCE	CLASSIFICATION
⊙	R-08-002 @ 0.5'	Sandy Lean Clay (CL)
⊡	R-08-002 @ 10.0'	Clayey Sand (SC)
△	R-08-002 @ 23.0'	Meta-Sandstone
◇	R-08-003 @ 2.0'	Sandy Lean Clay (CL)
⊙	R-08-003 @ 6.0'	Clayey Gravel with Sand (GC)
⬠	R-08-003 @ 15.0'	Lean Clay with Sand (CL)

KLEINFELDER
Bright People. Right Solutions.

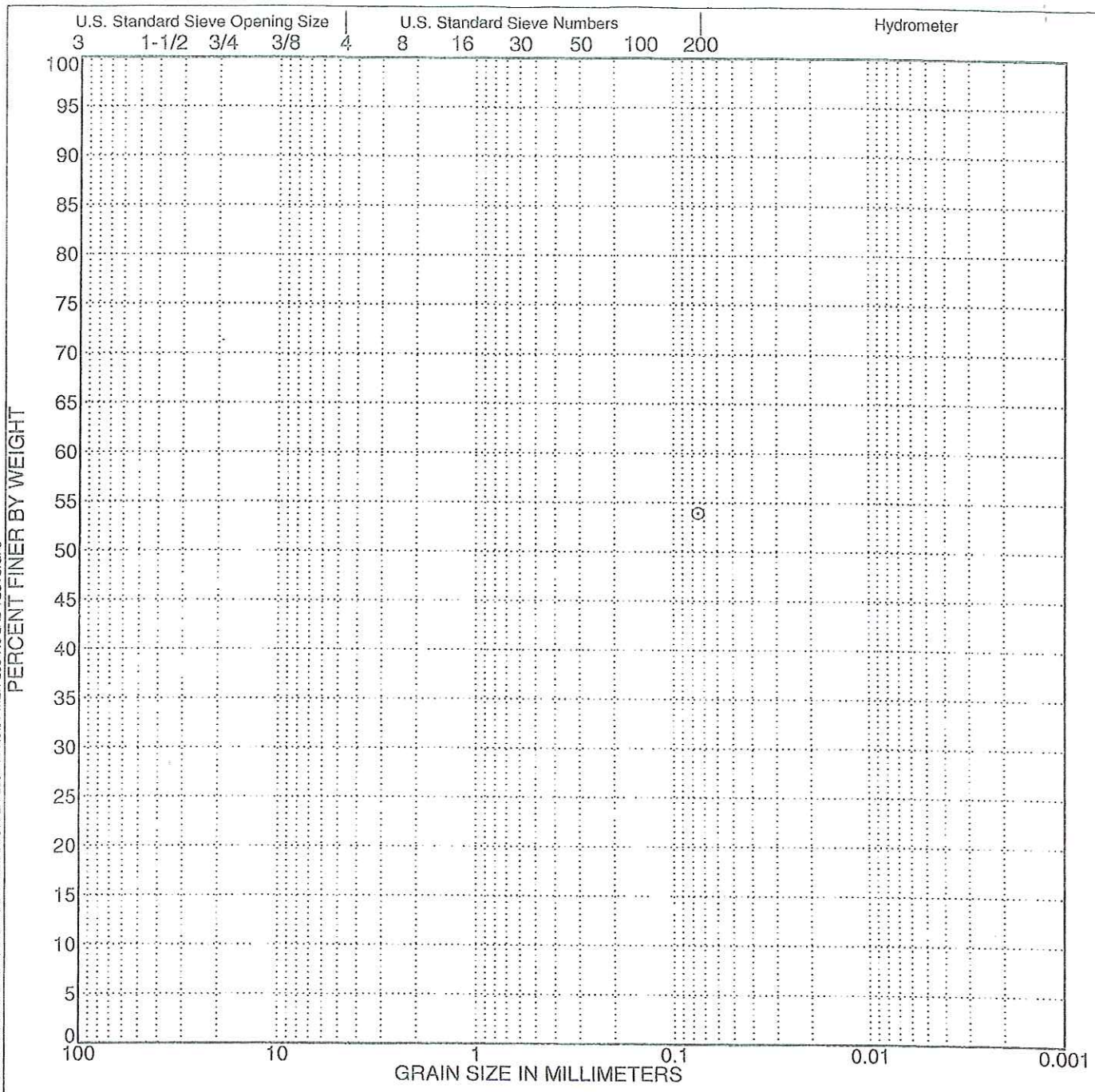
PROJECT NUMBER 93276 DATE 12/8/2009

PARTICLE SIZE ANALYSIS (ASTM C136)

EA 01-476201
HIGHWAY 253 P.M. 7.6
MENDOCINO COUNTY, CALIFORNIA

PLATE
B-2

Data Template:
SA - KLEINFELDER SANTA ROSA 5-8-08 .GDT - 12/8/09 13:41 - U:\NEW GINT PROJECTS\93276 CALTRANS MULTIPLE JOBS\MEN 253 PM 7.6\01-MEN-253-7.6 LAB TESTS.GPJ



Cobbles	GRAVEL		SAND			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE		

SYMBOL	SAMPLE SOURCE	CLASSIFICATION
⊙	R-08-004 @ 2.5'	Sandy Lean Clay (CL)

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PROJECT NUMBER 93276 DATE 12/8/2009

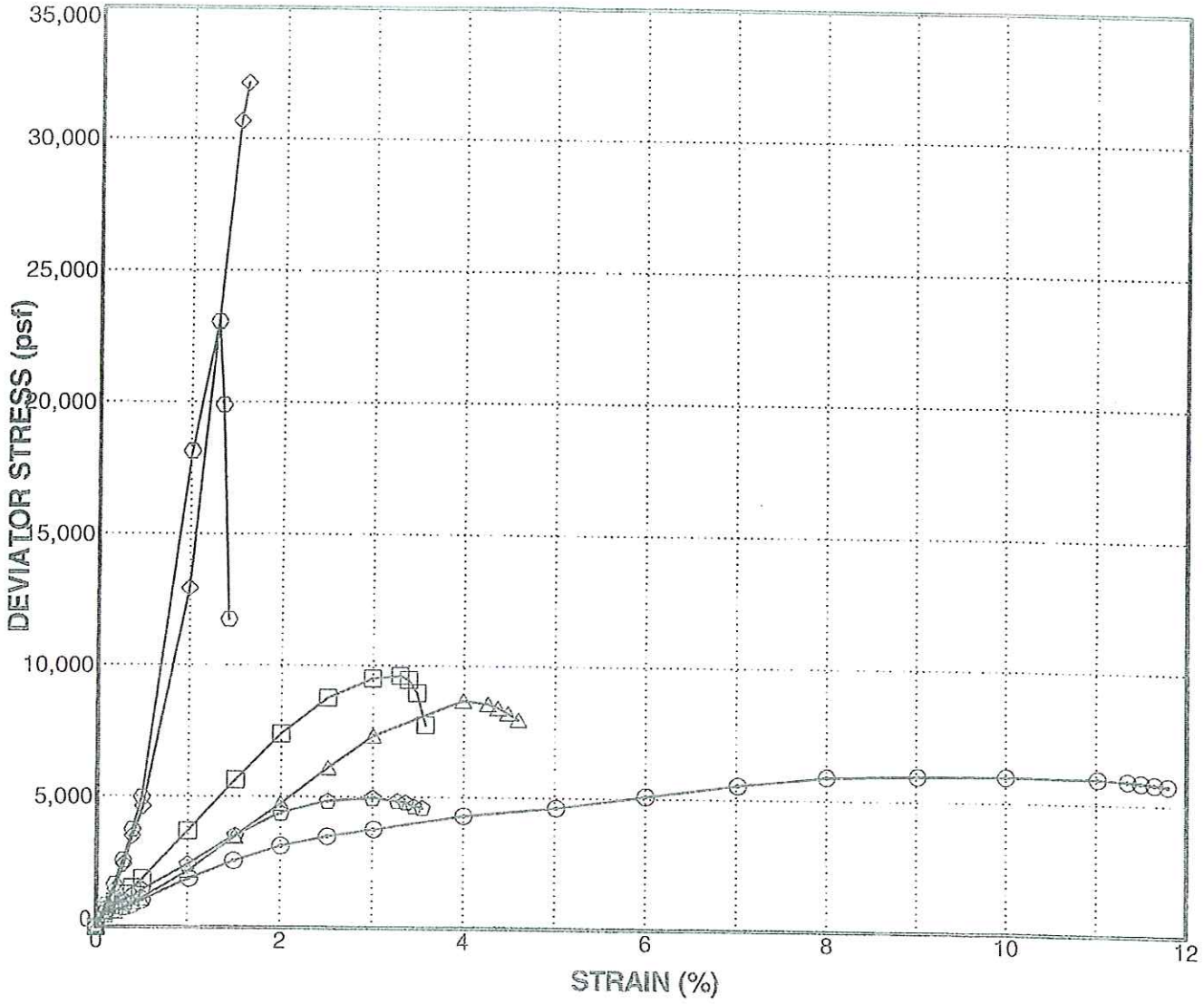
PARTICLE SIZE ANALYSIS (ASTM C136)

EA 01-476201
HIGHWAY 253 P.M. 7.6
MENDOCINO COUNTY, CALIFORNIA

PLATE

B-3

Data Template:
SA - KLEINFELDER SANTA ROSA 5-8-08 .GDT - 12/8/09 13:41 - U:\NEW GINT PROJECTS\93276 CALTRANS MULTIPLE JOBS\MEN 253 PM 7.6\01-MEN-253-7.6 LAB TESTS.GPJ



Sample Source	Classification	Type of Test	Confinement Pressure (psf)	Shear Strength (psf)	Strain (%)	Dry Density (pcf)	Moisture Content (%)
⊙ R-08-002 @ 6.0'	Sandy Lean Clay (CL)	TXUU	706	2999	10	115	12.7
⊡ R-08-002 @ 25.5'	Clayey Meta-Sandstone	TXUU	3298	4812	3	125	13.3
△ R-08-002 @ 30.5'	Argillite	TXUU	4003	4345	4	132	10.5
◇ R-08-002 @ 40.0'	Meta-Shale	TXUU	5198	16063	2	139	6.5
⊙ R-08-002 @ 51.5'	Meta-Shale	TXUU	6797	11530	1	146	8.0
⬠ R-08-003 @ 16.0'	Lean Clay with Sand (CL)	TXUU	2002	2484	3	111	19.0

UC = Unconfined Compression

TX/UU = Unconsolidated Undrained Triaxial

KLEINFELDER
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PROJECT NUMBER 93276 DATE 12/8/2009

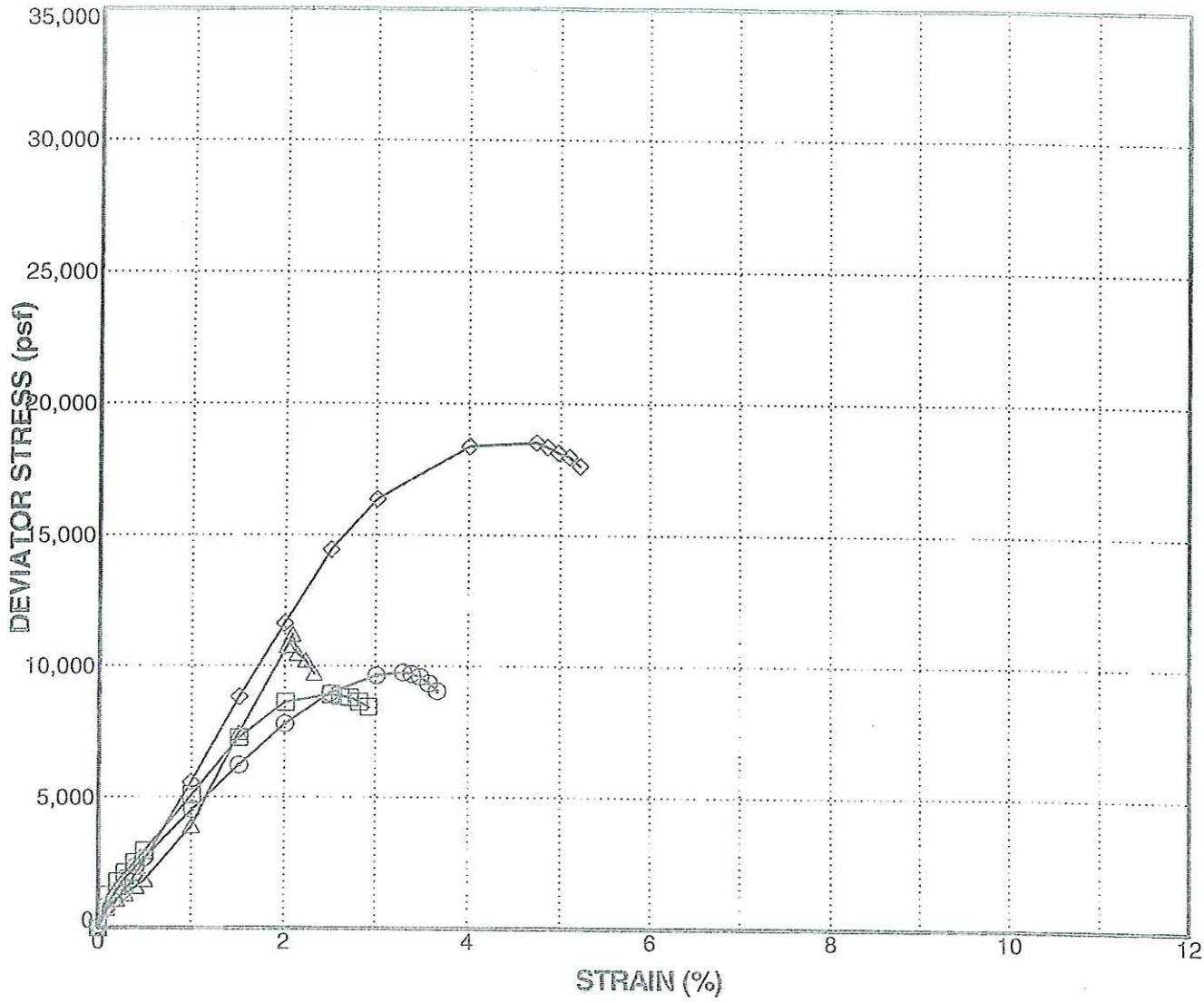
STRENGTH TEST DATA

EA 01-476201
HIGHWAY 253 P.M. 7.6
MENDOCINO COUNTY, CALIFORNIA

PLATE

B-4

Data Template:
NEW TXUU - KLEINFELDER SANTA ROSA 5-8-08 .GDT - 12/8/09 13:41 - U:\NEW GINT PROJECTS\93276 CALTRANS MULTIPLE JOBS\MEN 253 PM 7.6\01-MEN-253-7.6 LAB TESTS.GPJ



Sample Source	Classification	Type of Test	Confinement Pressure (psf)	Shear Strength (psf)	Strain (%)	Dry Density (pcf)	Moisture Content (%)
⊙ R-08-003 @ 21.0'	Meta-Shale	TXUU	2707	4881	3	125	12.3
⊡ R-08-004 @ 6.0'	Clay with Gravel (CL)	TXUU	806	4460	3	134	8.0
△ R-08-004 @ 16.0'	Clay with Sand (CH)	TXUU	2002	5600	2	120	15.1
◇ R-08-004 @ 20.0'	Clay with Sand (CH)	TXUU	2606	9262	5	132	9.9

UC = Unconfined Compression

TX/UU = Unconsolidated Undrained Triaxial

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PROJECT NUMBER 93276 DATE 12/8/2009

STRENGTH TEST DATA

EA 01-476201
HIGHWAY 253 P.M. 7.6
MENDOCINO COUNTY, CALIFORNIA

PLATE

B-5

Data Template:
NEW TXUU - KLEINFELDER SANTA ROSA 5-8-08 .GDT - 12/8/09 13:41 - U:\NEW GINT PROJECTS\93276 CALTRANS MULTIPLE JOBS\MEN 253 PM 7.6\01-MEN-253-7.6 LAB TESTS.GPJ

AP Engineering & Testing, Inc.

CORROSION TEST RESULTS

Client Name: Kleinfelder
Project Name: MEN253PM7.6
Project No.: 93276
Caltrans EA#: 01-476201

AP Job No.: 28-0758
Date 07/31/08

Sample ID.	Boring No.	Depth (ft)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
R-08-001	Core-15	15	CL	1000	6.8	64	69
R-08-003	Core-5.5	5.5	CL	2300	7.2	19	65

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

KLEINFELDER
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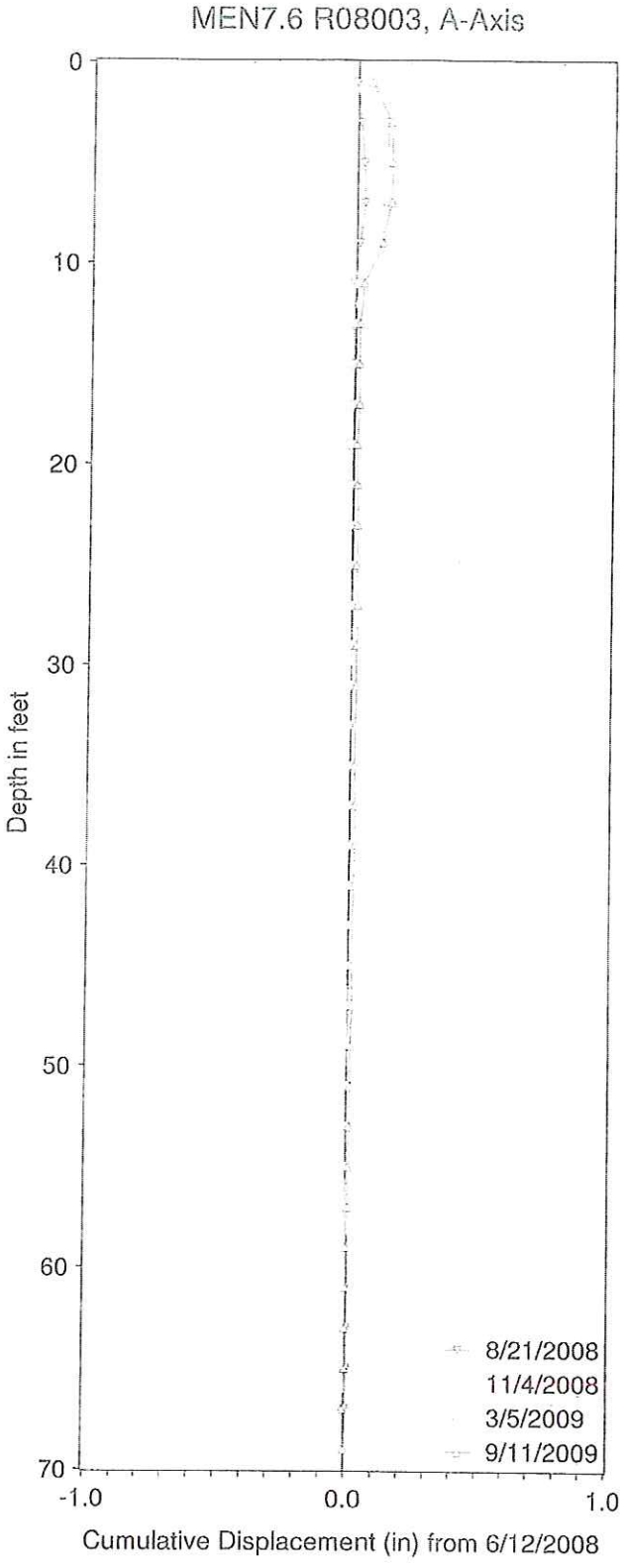
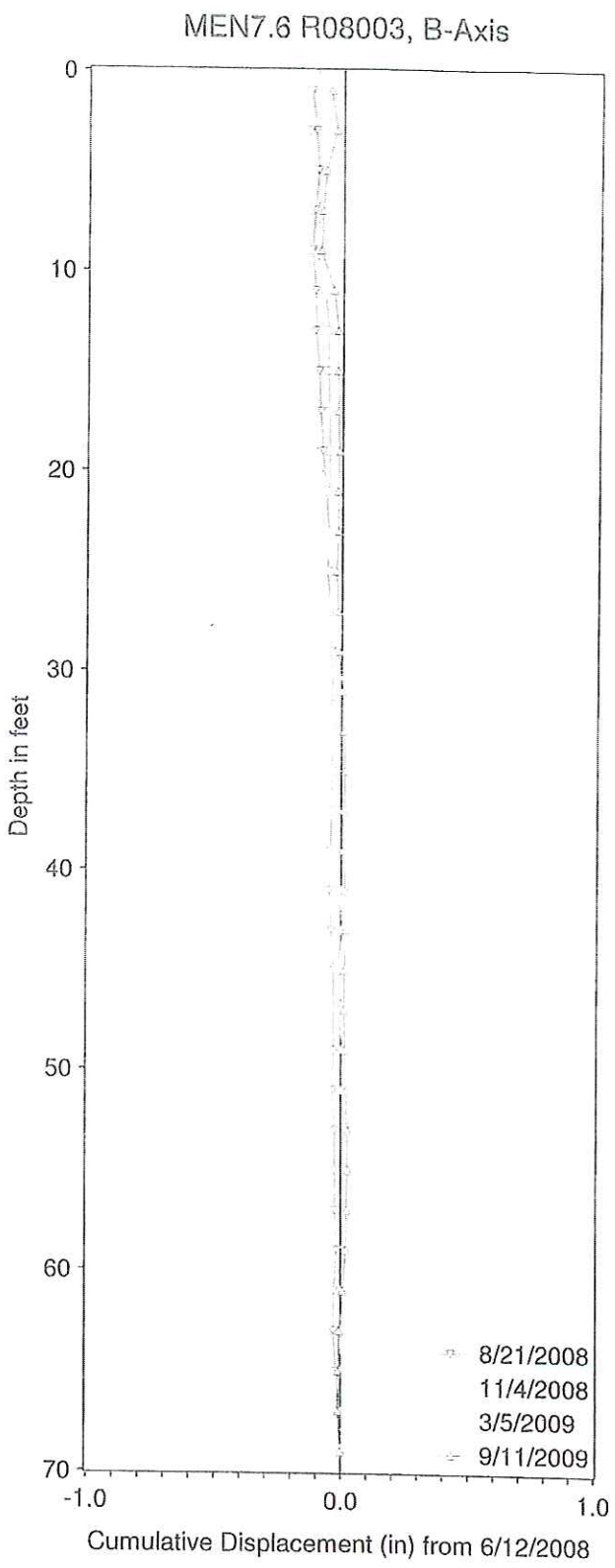
APPENDIX C


MEN7.6 R08003, A-Axis
Depth in feet
0
10
20
30
40
50
60
70
-1.0
0.0
1.0
Cumulative Displacement (in) from 6/12/2008
8/21/2008
11/4/2008
3/5/2009
9/11/2009


MEN7.6 R08003, B-Axis
Depth in feet
0
10
20
30
40
50
60
70
-1.0
0.0
1.0
Cumulative Displacement (in) from 6/12/2008
8/21/2008
11/4/2008
3/5/2009
9/11/2009

MATERIALS INFORMATION

FOUNDATION REPORT

Foundation Report Addendum for Bridge No. 10E0022

State of California
Department of Transportation

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: JEFF SIMS
Design Branch 1
Office of Bridge Design North

Date: December 15, 2010

File: 01-MEN-253 PM 7.6
EA: 01-476201
Bridge No. 10E0022

Attn: Kyoung-Hyeog Lee

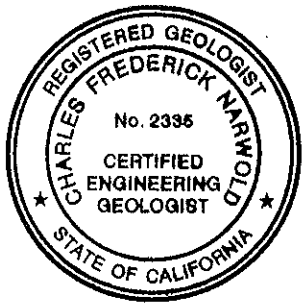
From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN NORTH
BRANCH B

Subject: Foundation Report Addendum

This Foundation Report Addendum provides revised recommendations for the above referenced structure. The recommendations contained herein supersede the recommendations in the Foundation Report prepared by Kleinfelder dated April 29, 2010. The Foundation Report recommends "a one-foot-wide layer of Class 1, Type B Permeable Material be placed behind the back of the retaining wall face." We do not recommend placing Class 1, Type B permeable material behind the timber lagging. Filter fabric should be placed on the backside of the wall between the timber lagging and the native material and fill.

If you have any questions or require further assistance, please call me at (707) 445-6036.

CHARLIE NARWOLD, CEG #2335
Senior Engineering Geologist
Office of Geotechnical Design - North
Branch B



c: OGDN Project Folder

MATERIALS INFORMATION

FOUNDATION REPORT

Foundation Report for Storm Damage Repair at HUM 253, PM 7.75

KLEINFELDER
Bright People. Right Solutions.

TECHNICAL MEMORANDUM

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

Date: April 29, 2010

To: Charlie Narwold, Sr. Engineering Geologist
Division of Engineering Services
Office of Geotechnical Design North
Branch B

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

Kleinfelder Project: 93276/22REP

SUBJECT : FOUNDATION REPORT
STORM DAMAGE REPAIR
HUM 253 PM 7.75
EA: 01-476201
MENDOCINO COUNTY, CA

---

1 PROJECT DESCRIPTION

An active landslide is located on the east (downhill) side of Highway 253, near mile post 7.75 between the cities of Boonville and Ukiah, in Mendocino County, California. The location of the site is shown on Plate 1, Site Location. As shown on the Site Plan, Plate 2, the active landslide scarp is approximately 400 feet long. The landslide mass extends approximately 375 feet down slope to the east (see Plate 3, Section A-A'). Ground surface elevations that are shown on the cross sections A-A' and B-B' are based on a hand level survey by Kleinfelder and may differ from the surface contours shown on the Site Plan. Between approximate Stations 107+28 through 108+00 and 109+65 through 110+40, the landslide scarp extends within six feet of the edge of pavement of the eastbound lane.

The purpose of this project is to provide geotechnical design parameters for a retaining structure to protect the road from active landslide related movement between Stations 106+75 and 109+00. Stabilization of the portion of the landslide that is north of the wall (i.e. Station 109+00 to approximately Station 111+00) is not intended at this time, however the wall should be designed so that it can be extended to protect this area in the future. The portion of the landslide that is located down slope (east) of the proposed wall will not be stabilized by this design and the main mass of the active landslide may continue to move away from the wall after construction. Remediation of the shallow landslides on the uphill (west) side of the road are not addressed in this report.

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 eight (8) exploratory borings.
- Installation of three (3) inclinometers/piezometers at boring locations.
- Installation of two (2) piezometers at boring locations.
- Periodic site visits to take piezometer and inclinometer readings.
- Laboratory testing of selected samples from the borings.
- Global stability analyses.
- Preparation of Log of Test Borings (LOTBs).
- Consultation with Caltrans staff.
- Preparation of this memorandum.

3 PERTINENT REPORTS AND INVESTIGATIONS

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

- Jennings, C.W. and R.G. Strand,1960, California Division of Mines and Geology, Geologic Map of California, Ukiah Sheet.
- Wagner, D.L. and E.J. Bortugno, 1982, California Division of Mines and Geology, Regional Geologic Map Series, Map No. 2A, Geologic Map of the Santa Rosa Quadrangle, California.
- Caltrans Seismic Hazard Map and Report, Mualchin, 1996 with errata dated March 2006.

4 PROPOSED STRUCTURE DESCRIPTION

It is proposed to construct a retaining structure on the east side of the existing roadway to protect the road surface and supporting prism from landslide-related damage between Stations 106+75 and 109+00. As proposed, the retaining structure will be a soldier pile and lagging wall, portions of which will be restrained by tiebacks. At the direction of Caltrans, the wall will be located approximately twenty-one feet east of the existing centerline. The lateral limits of the wall, as directed by Caltrans, are illustrated on Plate 2. The wall should be designed so that, if desired, it can be extended to the north at a future time.

5 SITE DESCRIPTION AND TOPOGRAPHY

At Post Mile 7.75, the two-lane Highway 253 rises gently to the south at a grade of 3% to 5%. Slope gradients east (down slope) of the roadway range from 1H:1V (Horizontal:Vertical) to 2.1H:1V along the landslide scarp and from 2.1H:1V to 3H:1V within the landslide mass. Cut slopes west (upslope) of the roadway range from

1.2H:1V to 2.2H:1V. Native slopes above the cut slopes range from approximately 1.5H:1V to 2.7H:1V.

The landslide movement currently impacting the roadway is translational, with an estimated mass thickness of approximately 15 to 23 feet. The arcuate headscarp of the landslide extends up to the east pavement edge in some areas of the landslide. The toe of the slide is located laterally approximately 375 feet east of the pavement edge in section A-A'. A small active slump landslide is located within the northern edge of the main landslide scarp. Four small active debris slides are located above the roadway within the cut slopes. A dormant debris flow is located above the roadway within the central portion of the site. A large dormant translational landslide is located within the northwestern portion of the site (above the road) terminating at the western edge of the roadway.

An area designated as wetlands by Caltrans has been delineated approximately between Stations 108+00 and 109+00 approximately 35 feet east of the eastern roadway edge within the landslide mass, as shown on the Site Plan, Plate 2. The wetland area is fed by a spring which emanates from the apparent toe of the fill prism, as indicated on Plate 2. Flow rate of the spring could not be estimated; phreatophytic vegetation within the wetland area would suggest the spring flows (at least marginally) throughout the year, however. We understand that the wetland is to be protected and will limit the boundaries of the proposed construction.

An access road was constructed by Caltrans from the southern edge of the landslide scarp (approximately 10 feet east of the edge of the roadway at Station 107+00) to provide access for drilling of the borings R-08-003 and R-08-004. The road extends through the mass of the slide terminating approximately 30 feet east of the edge of the roadway at Station 108+15. A second access road was constructed from the road shoulder at Station 111+50 to provide access for drilling of the borings R-08-005 through R-08-008. This access road extends through the mass of the slide terminating approximately 120 feet east of the edge of the roadway at Station 109+10.

Sheet flow from the cut slopes and the westbound lane of the roadway are collected within a V-ditch adjacent to the west edge of the roadway and captured within a 1.5-foot-diameter corrugated metal culvert which extends below the roadway and outfalls downslope to the east. Drainage from the eastbound lane within the landslide currently flows down over the slope face of the fill prism. The cut slopes are vegetated with a moderate growth of wild grasses. The areas east of the fill slope support a tall growth of wild grasses, poison oak, manzanita and oak trees.

It is our understanding that a 7.5 foot deep under drain exists underneath the v-ditch on the west edge of the roadway but has been destroyed or damaged. We understand that the under drain will be restored as part of this project.

6 SUBSURFACE EXPLORATION AND LAB TESTING

SUBSURFACE INVESTIGATION

Eight (8) exploration borings, designated R-08-001 through R-08-008, were drilled at this site by Caltrans Office of Drilling Services using rotary-wash drilling methods. Drilling was performed on May 14, 2008, through June 26, 2008. All drilling and

sampling operations were observed by Kleinfelder staff. Test borings were performed using a truck-mounted Acker MPCA drill rig (Equipment number 1974) utilizing 102-mm diameter and 93-mm (HXB) casing equipped with a tungsten carbide Geo Barrel and #8 diamond impregnated core bit, respectively. Borings R-08-001 and R-08-002 were advanced from the Highway 253 pavement level in the westbound traffic lane to maximum depths of 75 and 50 feet, respectively. Borings R-08-003 through R-08-008 were drilled on constructed access roads within the landslide mass, to depths between 50 and 75 feet. 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 each 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 Soil and Rock Legend. The results of the exploration are summarized on the attached Log of Test Borings (LOTBs), in Appendix A.

As part of this work, slope inclinometer casing was installed to approximately 75 feet below the ground surface within the bore hole for Borings R-08-004, R-08-005, and R-08-008. 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 approximately the upper 5 to 7 feet was backfilled with bentonite. The inclinometers were completed at the surface with a stovepipe outer casing. Two piezometers were installed to approximately 75 and 50 feet below the ground surface within Boring R-08-001 and R-08-002, respectively. The piezometers were completed at the surface with a 3-inch-diameter traffic rated access box. Inclinometer readings were obtained by Kleinfelder on June 12, August 21, and November 4, 2008 and March 5 and September 11, 2009. 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 check the field descriptions/identifications and to obtain information for subsequent engineering evaluations. Tests performed included:

Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass (ASTM D2216).

Density of Soil in Place by the Drive-Cylinder Method (ASTM D2937).

Particle-Size Analysis of Soils (ASTM D422).

Liquid Limit, Plastic Limit, and Plasticity Index of Soils (ASTM D4318).

Unconsolidated Undrained Triaxial Compression Test for Cohesive Soils (ASTM D2850).

Unconfined Compression Test for Cohesive Soils (ASTM D2166).

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

The results of the laboratory tests, together with a summary sheet, are provided in Appendix B.

7 SITE GEOLOGY AND SUBSURFACE CONDITIONS

REGIONAL GEOLOGY

The site is located atop the northwest trending ridgeline separating Anderson Valley and Ukiah Valley within the Coast Range Geomorphic Province of Northern California. This province is generally characterized by northwest-trending mountain ranges and intervening valleys, which are a reflection of the dominant northwest structural trend of the bedrock in the region. As shown on Plate 6, Regional Geology, the basement rock in the northern portion of this province is presumed to consist of the Franciscan Complex, a diverse group of igneous, sedimentary, and metamorphic rocks of early Tertiary to Cretaceous age (approximately 38 to 100 million years old [Coastal Belt]) up to Upper Jurassic to Cretaceous age (140 to 65 million years old). 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 20 miles southwest of the site (Plate 7). In the site vicinity, the Franciscan Complex rocks are unconformably overlain by Tertiary age continental and marine sedimentary and volcanic rocks. These Tertiary age rocks are locally overlain by younger Quaternary alluvial, colluvial, and landslide deposits.

SITE GEOLOGY

The site geology, as mapped by Kleinfelder, is presented on Plate 2. The site and surrounding vicinity has been mapped by Jennings and Strand (1960, California Division of Mines and Geology Geologic Map of California, Ukiah Sheet). They indicate the site is underlain by undivided Cretaceous Marine sedimentary and meta-sedimentary rocks. A more recent publication by Wagner and Bortugno (1982, California Division of Mines and Geology, Regional Geologic Map Series, Map No. 2A, Geologic Map of the Santa Rosa Quadrangle, California) mapped the area adjacent to the south of the Jennings and Strand (1960) publication. Wagner and Bortugno (1982) indicate the unit which Jennings and Strand (1960) mapped as undivided Cretaceous Marine sedimentary and meta-sedimentary rocks as the Tertiary-Cretaceous age Coastal Belt member of the Franciscan Complex. This unit contains marine sandstone, shale, conglomerate, minor limestone and rare greenstone.

Jennings and Strand (1960) did not identify any landslide features at the site or within the immediate site vicinity.

SUBSURFACE CONDITIONS

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

Table 1: Boring Summary

I.D.	Approx. Station	Location [1]	Depth of Boring (ft)	Surface Elev. (ft)	Date Completed	Depth to Bedrock (ft)
R-08-001	108+38	12 feet left	75	2096	5/14/08	16
R-08-002	109+42	11 feet left	50	2091	5/20/08	5
R-08-003	107+31	44 feet right	75	2086	6/10/08	15
R-08-004	107+95	47 feet right	74	2078	6/4/08	13.5
R-08-005	109+18	70 feet right	75	2068	6/25/08	10
R-08-006	109+80	66 feet right	75	2067	6/11/08	15
R-08-007	110+38	59 feet right	50	2069	6/12/08	17
R-08-008	109+30	123 feet right	75	2053	6/26/08	15

[1] Approximate distance from highway centerline, facing in direction of increasing stationing.

Borings R-08-001 and R-08-002 were drilled on the west side (south bound lane) of the roadway outside the limits of the active landslide mass. Boring R-08-001 encountered, colluvium comprised of stiff/medium dense layers of sandy lean clay, clayey sand, clayey gravel, and fat clay to 16 feet below ground surface (bgs). Beneath the colluvium, bedrock (primarily meta-shale with meta-sandstone interbeds) was encountered. In boring R-08-002, clayey gravel with sand fill extended to 2.5 feet. Beneath the fill, colluvium (clay with sand and clayey sand) extended to a depth of 5 feet bgs, where bedrock (meta-sandstone) was encountered.

Borings R-08-003 through R-08-007 were drilled within the main landslide mass approximately 30 to 50 feet east of the east edge of the roadway. These borings were drilled on a temporary access road Caltrans constructed after the landslide occurred for the purpose of drilling access. Landslide deposits mostly comprised of sandy clay (layers of clay with varying amounts of sand, gravel with silt and sand, clay with gravel, and clayey sand) were encountered in these borings to depths of 15, 13.5, 10, 15, and 16.9 feet bgs, respectively. Borings R-08-003 through R-08-007 encountered bedrock (meta-shale and meta-sandstone) beneath the landslide deposits.

Boring R-08-008 was drilled within the main landslide mass approximately 110 feet east of the east edge of the roadway, on the lower temporary access road Caltrans constructed after the landslide occurred. Boring R-08-008 encountered approximately 4 feet of access road fill (sand and gravel). Beneath the fill, landslide deposits (clayey sand, sandy clay) extended to a depth of 8.5 feet bgs, where possible landslide blocks (meta-sandstone and meta-shale) were encountered to a depth of 15 feet bgs. Beneath the possible landslide blocks, bedrock (meta-shale and meta-sandstone) was encountered.

Upon completion of drilling, inclinometer casing was installed in Borings R-08-004, R-08-005 and R-08-008 to facilitate the monitoring of the landslide. The most current survey (9/11/09) of the inclinometer installation indicates approximately two inches of down slope displacement at R-08-004 since its initialization (6/9/08). Movement occurred at a depth of 6 to 10 feet below the ground surface. Inclinometers at R-08-005 and R-08-008 did not show significant displacement between initial readings on 6/27/08

and the last reading taken on 9/11/09. Continued monitoring of the inclinometer installations is recommended to confirm the depths of landslide displacement.

Our interpretation of the subsurface geologic conditions is presented on cross sections A-A', B-B' and C-C', Plates 3 through 5. On cross sections B-B' and C-C', two queried depths of landslide activity are shown near the location of boring R-08-004. The upper failure plane, at a depth of approximately 9 feet, is based on inclinometer readings. The deeper failure plane, at a depth of approximately 15 feet, is based on an examination of samples from the boring. At other locations and on cross section A-A' the approximate bottom of the landslide was estimated from examination of soil/rock samples and from surface manifestations of possible landslide activity.

The bedrock encountered in the borings primarily consisted of very intensely to intensely fractured meta-shale and meta-sandstone, varying from very soft and disaggregated to moderately soft to moderately hard and slightly weathered, very intensely fractured to moderately fractured. Due to the large range of bedrock strength and weathering, transitions should be considered approximate and the depth of active sliding should continue to be monitored by inclinometer readings.

This is a summary of conditions encountered in the eight borings. More detailed information is presented on the boring logs. Variations in conditions between the borings should be expected.

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 all soil samples below a depth of 4 to 5 feet were saturated or nearly saturated at the time of drilling.

On June 12, August 21, November 4, 2008, March 5 and September 11, 2009 groundwater measurements were obtained in the piezometers installed in borings R-08-001 and R-08-002 and from the slotted slope inclinometers that were installed in borings R-08-004, R-08-005, and R-08-008. Results are tabulated below.

Table 2: Groundwater Level Measurements

Water depth measured from ground surface (feet)					
Date	**R-08-001**	**R-08-002**	**R-08-004**	**R-08-005**	**R-08-008**
(Ground Elevation)	(2096')	(2091')	(2078')	(2068')	(2053')
6/12/2008	N/A*	N/A*	19.9	N/A*	N/A*
8/21/2008	27	37	25.6	16.4	12.1
11/4/2008	27.8	31.2	24.4	18.6	12.4
3/5/2009	N/A*	16.6	15	12.2	5
9/11/2009	27.5	37.8	19	17.5	12.8

* Not accessible, no reading taken.

The large increase in groundwater levels on the March 5, 2009 readings can most likely be attributed to the heavy rainfall in February and early March 2009.

Significantly, the recorded water levels are all considerably below the elevation of the spring that feeds the wetland area shown on Plate 2. Although water for the wetland

could be supplied by flow through a bedrock fracture, it seems more likely that it originates in a perched water table within the fill and colluvium that overlie the bedrock.

In our analyses to back calculate soil strength parameters we assumed a groundwater table that is located within the landslide mass, but not at the highest levels recorded on 3/5/09. Back calculations should reflect the actual groundwater condition at the time the landslide occurred, but assuming an overly high groundwater table could overestimate soil properties and be unconservative.

For wall design purposes we recommend groundwater be assumed to rise to approximately elevation 2080 feet. Please refer to "Design Forces" in section 11 for a more detailed discussion of design groundwater levels.

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 presented 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 March 2006), the nearest fault is the Maacama-Brush fault, which is located approximately 7 miles east of the site. The Maacama-Brush fault is capable of generating earthquakes with a maximum credible earthquake (MCE) magnitude of 7.25. The Caltrans Seismic Hazard Map and Report (1996) locates the site between the 0.3g and 0.4g Peak Bedrock Acceleration (PBA) contours associated with the Maacama-Brush fault. We recommend a PBA value of 0.4g and corresponding Peak Ground Acceleration (PGA) of 0.4g for the use at this site. The PGA is estimated based on site soil class C. A portion of the Caltrans Seismic Hazard map is shown on Plate 7.

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.

11 GEOTECHNICAL AND FOUNDATION RECOMMENDATIONS

WALL LOCATION & DEPTH

Based on the field and laboratory data and our slope stability analyses, it is our opinion that, without remediation, the material designated as active landslide deposits will continue to move down slope and this will remove lateral support for the roadway. We recommend that a wall be designed to retain the roadway together with underlying soils. The proposed wall location is shown on Plate 2. At the direction of Caltrans, the wall is

located approximately twenty-one feet east of the highway center line. The lateral limits designated by Caltrans for the proposed wall are approximately between Stations 106+75 and 109+00, within the southern half of the active landslide, for a total wall length of approximately 225 feet. Currently, the roadway above the northern half of the landslide (Stations 109+00 through 111+00) has an intact shoulder and a retaining wall is not proposed at this time. It is possible that Caltrans will extend the proposed retaining wall to the north in the future and the wall should be designed to allow this possible extension. Based on discussions with Caltrans we understand at Station 108+50 lagging will extend down to approximately elevation 2069 feet and the finished grade at the base of the retaining wall will be approximately elevation 2080 feet, resulting in an exposed wall face of approximately 14 feet. The finished grade elevation around Station 108+50 is constrained by the wetland.

The active landslide appears to be 10 to 15 feet thick immediately down slope of the proposed wall location, with the bottom of the landslide occurring near the bedrock surface. Over time it is likely that the landslide deposits will continue to translate down slope and we recommend that the wall be designed to retain all soil that is located above the surface of the bedrock. Plate 8 illustrates the approximate elevation of bedrock along the length of the wall. At the proposed wall location the depth to the bedrock surface is estimated as 16 to 30 feet.

SOIL & ROCK PARAMETERS

Based on the results of our subsurface investigation and laboratory testing, subsurface materials within the retained height of the proposed retaining wall consist of fill, colluvium, and bedrock mainly comprised of meta-shale and meta-sandstone. A cross section along the length of the proposed wall depicting our interpretation of the subsurface geologic conditions is presented on Plate 8. Because the wall location was modified after the field investigation was completed we have limited subsurface information at the wall location and this plate should be considered approximate.

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 Bridge Design Specifications.

Fill was only encountered in one boring on the west side of the road, but greater thicknesses of fill may be encountered at the wall location. Fill properties were assumed to be the same as the landslide and colluvium.

Table 3: Soil/Rock Parameters for Retaining Wall Design

Type	Approximate Depth to Bottom of Layer, at Retaining Wall Location (ft)[1]	Total Unit Weight (pcf)	Buoyant Unit Weight (pcf)	Angle of Internal Friction ϕ (degrees)	Cohesion c (psf)	K_a	K_p
Fill (Qaf)	8 to 16	134	72	30[2]	0[2]	0.33[4]	0[5]
Colluvium (Qc)	16 to 30	134	72	30[2]	0[2]	0.33[4]	0[5]
Bedrock (KJf)	NA	146	84	40[3]	0[3]	0.22[4]	4.60[4,6]

[1] See Plate 8 for anticipated thickness along wall, depths were estimated based on interpolation and extrapolation between borings which are offset from the proposed wall location. The depths should be considered approximate and variations should be expected.

[2] Based on correlations with field penetration, laboratory test data and soil type, as well as with results from the previous geotechnical explorations at Post Mile 7.6. Properties were checked by assuming a factor of safety of 1.0 for the existing landslide mass and back calculating soil properties; see Section 12 of this Memorandum.

[3] Strength was estimated based on TXUU tests, correlations with field penetration test data, and material type.

[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] Soil and colluvium in front of the wall have a very low factor of safety and should not be used in determining passive pressures.

[6] This value assumes that wall construction will result in a horizontal bench, at least 10 feet wide, at the base of the lagging.

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

DESIGN FORCES

We understand from Caltrans that although lagging will extend to the top of the bedrock formation (approximately elevation 2069), the finished grade below the wall will be no lower than elevation 2080 to protect the existing wetland. Wall drainage will also be limited to the portion of the wall that is above elevation 2080.

Based on our discussions with Caltrans, it is recommended that the wall be designed assuming that all fill and colluvium below the wall may slide and pull away from the wall face. Therefore, no passive resistance should be assumed from material overlying the bedrock. This is indicated in Table 3. In addition, because drainage may occur slowly following a landslide, it should be assumed that the water level behind the wall may not drop as quickly as the water level on the down slope side of the wall, resulting in an excess hydrostatic head on the back of the wall.

As discussed previously in this memorandum, we recommend that the wall be designed for a groundwater level that is approximately elevation 2080 feet. The wall should be provided with adequate drainage to prevent the build-up of hydrostatic pressures above this level. However, the critical design case discussed in the previous section assumes that material in front of the wall may slide and pull away from the wall down to the

elevation of the bedrock (this approximate elevation is shown on Plate 8). As this material pulls away, the water level immediately down slope of the wall will necessarily drop to the top of the bedrock (the bottom of the currently active landslide). However, the water level behind the wall may respond much more slowly. As a result, we recommend that the wall design assume a differential hydraulic head across the wall. The water level behind the wall should be assumed at elevation 2080, but the water level immediately down slope of the wall should be assumed at the top of the bedrock. Design pressures (both active and passive) should be based on total unit weights above the water table and buoyant unit weights below the water table. Design water levels are illustrated on Plate 9, Design Cross Section.

In addition, there is the potential for high perched groundwater flow at the time of construction and this should be anticipated by the contractor.

TIEBACK ANCHORS

We recommend that tiebacks derive their support solely from the relatively competent bedrock formation below the fill and colluvium. The tieback unbonded length is the distance from the back of the wall to a point that is 5 feet beyond the surface of the relatively competent bedrock and is based on the elevation and inclination of the tiebacks provided in the unchecked details dated April 23, 2010 from Caltrans Structures Department. The tieback details show tiebacks located 10 feet from the top of the wall at an inclination of 20^0, based on this the unbonded zone may be taken as approximately 35 feet.

SOLDIER PILES

Soldier piles should gain their vertical resistance from friction in the bedrock below any fill or colluvium. As discussed in Section 12, a minimum penetration of 10 feet into the bedrock is necessary to obtain a design slope stability factor of safety of approximately 1.3. Deeper penetrations may be required to satisfy wall vertical or lateral loading conditions.

Bedrock quality varies widely. We recommend that soldier piles be designed for a skin friction in bedrock of 750 psf. It is intended for use in a working stress analysis and contains a factor of safety of approximately 2.0. Because of the fractured nature of the rock and the difficulty in removing slough from drilled holes, end bearing resistance should be neglected.

The depth to bedrock varies. We estimate that the depth will vary from approximately 16 feet to 30 feet at the proposed wall location. A sketch of estimated bedrock depth along the length of the wall is provided on Plate 8.

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 14, even if the downslope grade is excavated to elevation 2080, the slope factor of safety below the wall is unchanged, at approximately 1.0. The factor of safety drops slightly below 1.0 when we add the assumption of perched water to our model.

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 through fill and colluvium to the bedrock surface, approximately 16 to 30 feet below the top of the retaining wall. If support is provided by lagging, this would require temporary excavation up to approximately 11 feet below finished grade on the downhill side of the wall.

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 10 and 11 present the results of analyses of the active landslide. These analyses were performed to back calculate the residual soil strength within the landslide deposits. For these analyses we used the geometry of cross sections A-A' (Plate 3) and C-C' (Plate 5). Analysis of block failure surfaces as well as analysis along an identified failure surface were performed. The internal angle of soil friction that produced a factor of safety equal to one was approximately 30^0, which was used in our subsequent analyses. Selection of a groundwater surface is discussed in Section 8 of this Memorandum. Analysis of the landslide soil strength yielded essentially the same soil parameters as were determined for the adjacent landslide at post mile 7.6.

We then added the proposed retaining wall to sections A-A' and C-C' and ran the models again. A 270 psf traffic surcharge pressure was applied to the roadway area above the wall. The wall was modeled as a series of rigid piling with sufficient shear strength to force the landslide below the tips of the piling. The results of these analyses are summarized on Plates 12 and 13. For section A-A', the calculated factor of safety against global instability was approximately 1.3 with the piling embedded a minimum of 5 feet into bedrock. For section C-C', the factor of safety was 1.1 with 5 feet of embedment. Increasing the embedment to 10 feet resulted in a calculated factor of safety against global instability of approximately 1.2. However, the failure mode with 10 feet of embedment is along an extremely deep failure surface that is not consistent with observed failures. Although we do not have sufficient subsurface information to verify it, it seems highly probable that bedrock strength increases with depth and will prevent this mode of failure. Based on this we consider the calculated factor of safety of 1.2 to be acceptable for this condition and as discussed in Section 11 we recommend soldier piles penetrate a minimum of 10 feet into bedrock.

Finally, we checked the slope stability of material below the wall for section C-C' to see if excavation below the wall to elevation 2080 would improve stability of the remaining landslide deposits down slope of the wall. For this model we included a perched water table that daylights at the base of the wall (in an attempt to protect the wetland that is located within the landslide mass, wall drainage will not extend below the finished grade at the bottom of the wall). The perched zone of water was modeled within the upper zone of the colluvium and has a bottom elevation of 2069 feet (approximate elevation of bedrock at the wall location). The result of this analysis is shown on Plate 14. Removal of this material did not increase the slope stability factor of safety, which is approximately 1.0. The addition of the perched water decreased the slope stability factor of safety to 0.9. This low calculated factor of safety is the basis for our recommendation (in Table 3) that material above the surface of the bedrock should not be assumed to provide lateral support for the proposed wall.

13 CONSTRUCTION CONSIDERATIONS

- Materials to be excavated will consist of fill, colluvium, and landslide deposits. High perched groundwater and/or seepage should be anticipated by the contractor in wall excavations and in drilled holes for piling and tiebacks. Depending on the time of year, caving conditions may 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 Caltrans Standard Specifications.
- We expect groundwater will 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 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 Caltrans Standard Specifications.
- Vertical cut sections should not be deeper than five feet without shoring or sloping in accordance with CAL/OSHA Standards. The potential for ground water flow and/or seepage into excavations should be anticipated. Where groundwater flow is encountered sloping or shoring may be required in excavations that are less than five feet deep.
- 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 east side of the road that currently flows over the face of the landslide. Surface drainage should be collected into pipelines that are routed to suitable disposal areas away from the landslide.

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14 CLOSURE

If you have any questions regarding the information provided herein, please contact us at 707.571.1883.

Terry Craven, GE 2572
Principal Geotechnical Engineer

William V. McCormick, CEG 1673
Principal Engineering Geologist

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15 ATTACHMENTS

Plates

Plate 1.....Site Location
Plate 2.....Site Plan
Plate 3.....Section A-A'
Plate 4.....Section B-B'
Plate 5.....Section C-C'
Plate 6.....Regional Geology
Plate 7.....California Seismic Hazard Map
Plate 8.....Approximate Geologic Profile Along Proposed Retaining Wall
Plate 9.....Design Cross Section
Plate 10.....Slope Stability: Section A-A' Back-Calculation
Plate 11.....Slope Stability: Section C-C' Back-Calculation
Plate 12.....Slope Stability: Section A-A' Wall
Plate 13.....Slope Stability: Section C-C' Wall
Plate 14.....Slope Stability: Section C-C' Downslope

Appendix A

Log of Test Borings (LOTBs, 11 pages)

Appendix B

Laboratory Test Summary
Laboratory Test Data Plates B-1 through B-7
Corrosion Test Results (AP Engineering and Testing, Inc.)

Appendix C

Slope Inclinometer Monitoring Results (3 pages)

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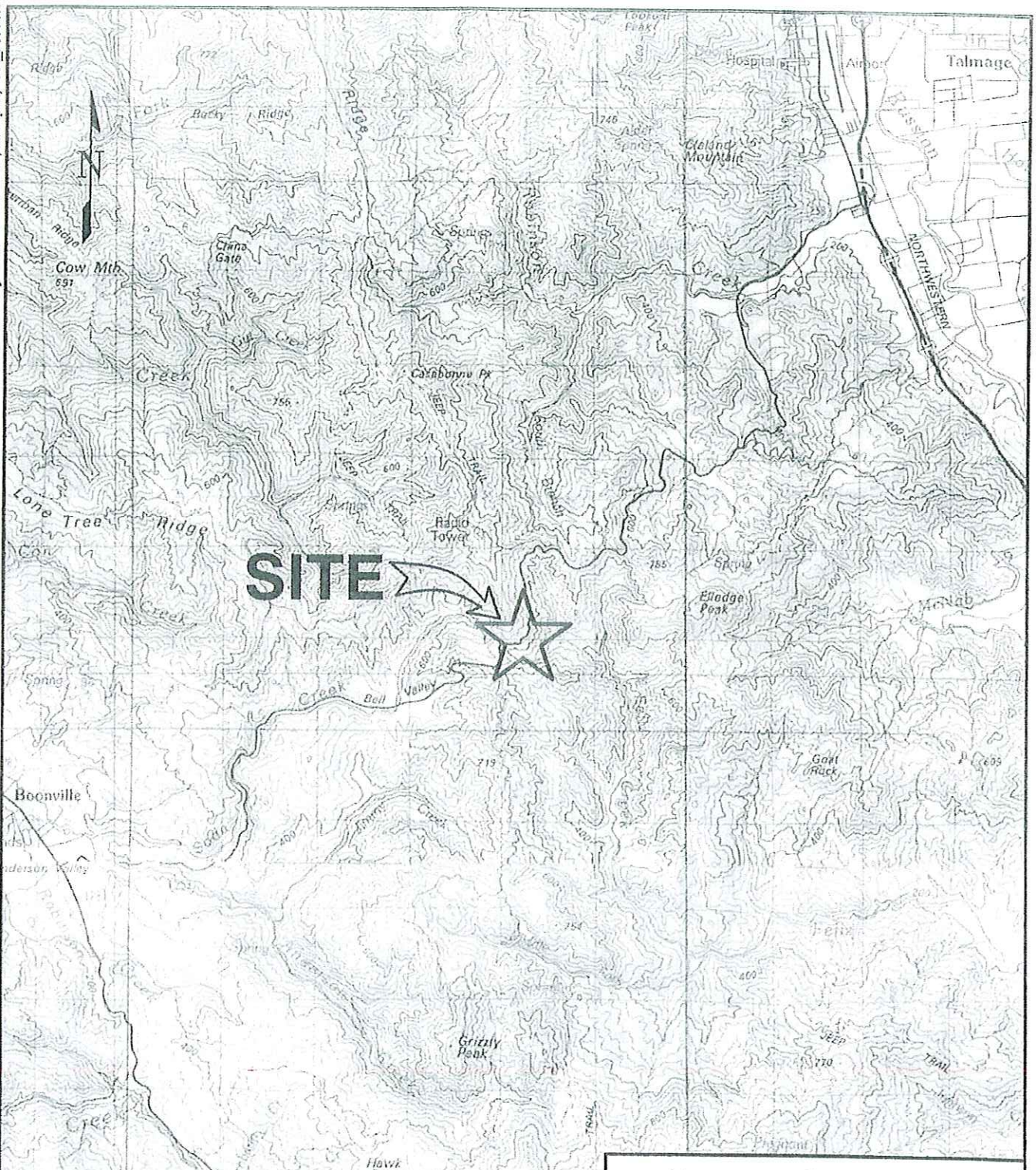
PLATES



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Reference: TOPO! National Geographic Holdings, 2001

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DRAWN BY:	PH
CHECKED BY:	JR
FILE NAME:	93276-3.dwg

SITE LOCATION

EA 01-476201
HIGHWAY 253 P.M. 7.75
MENDOCINO COUNTY, CALIFORNIA

PLATE 1

ATTACHED IMAGES: Images: 93276-LOC.jpg
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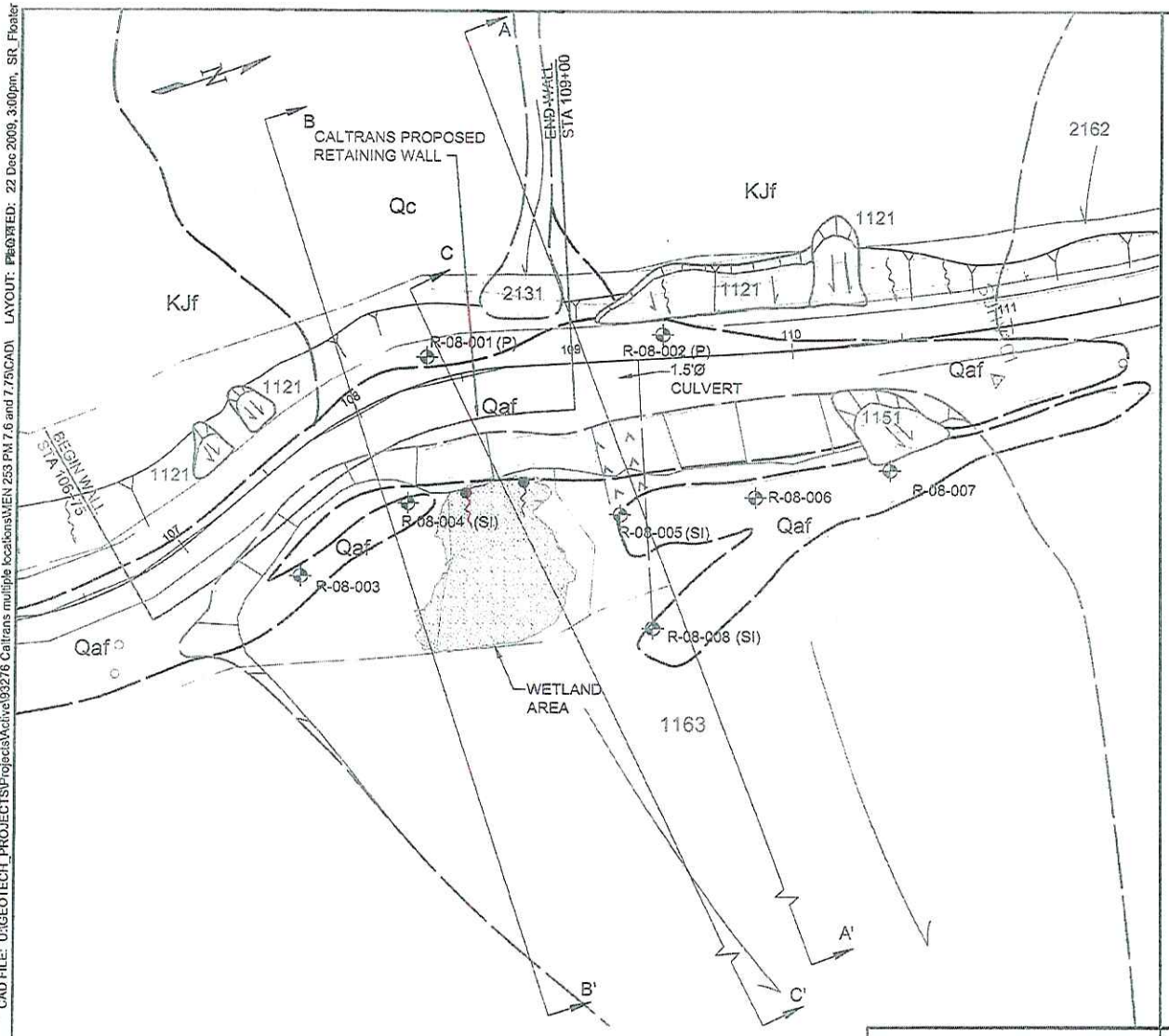

EXPLANATION

- Qaf — Artificial Fill
- Qc — Colluvium
- KJf — Franciscan Complex Bedrock
- Geologic Contact (dashed where approximate)
- A — A' — Approximate Cross Section Location
- Landslide Contact (dashed where approximate)
- 1112 — Landslide: Arrows Indicate Direction of Movement, Hatchures Indicate Scarp Area
- R-08-001 — Approximate Boring Location
- (SI) — Slope Inclinometer Installed
- (P) — Piezometer Installed
- 1112 — Landslide Identification Number (reference Landslide Identification Chart)
- Soil Creep
- Erosion Rilling
- Cutslope
- Seepage

LANDSLIDE IDENTIFICATION CHART

STATE OF ACTIVITY

1=Active or Recently Active
(areas of unstable ground with relatively identifiable 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

Base Map:Topography Map from Caltrans, 8-2009_Updated Topo Showing Temp Roads.dwg

50 25 0 50
APPROXIMATE SCALE (feet)

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FILE NAME:	93276-1.dwg

SITE PLAN

EA 01-476201
HIGHWAY 253 P.M. 7.75
MENDOCINO COUNTY, CALIFORNIA

PLATE 2

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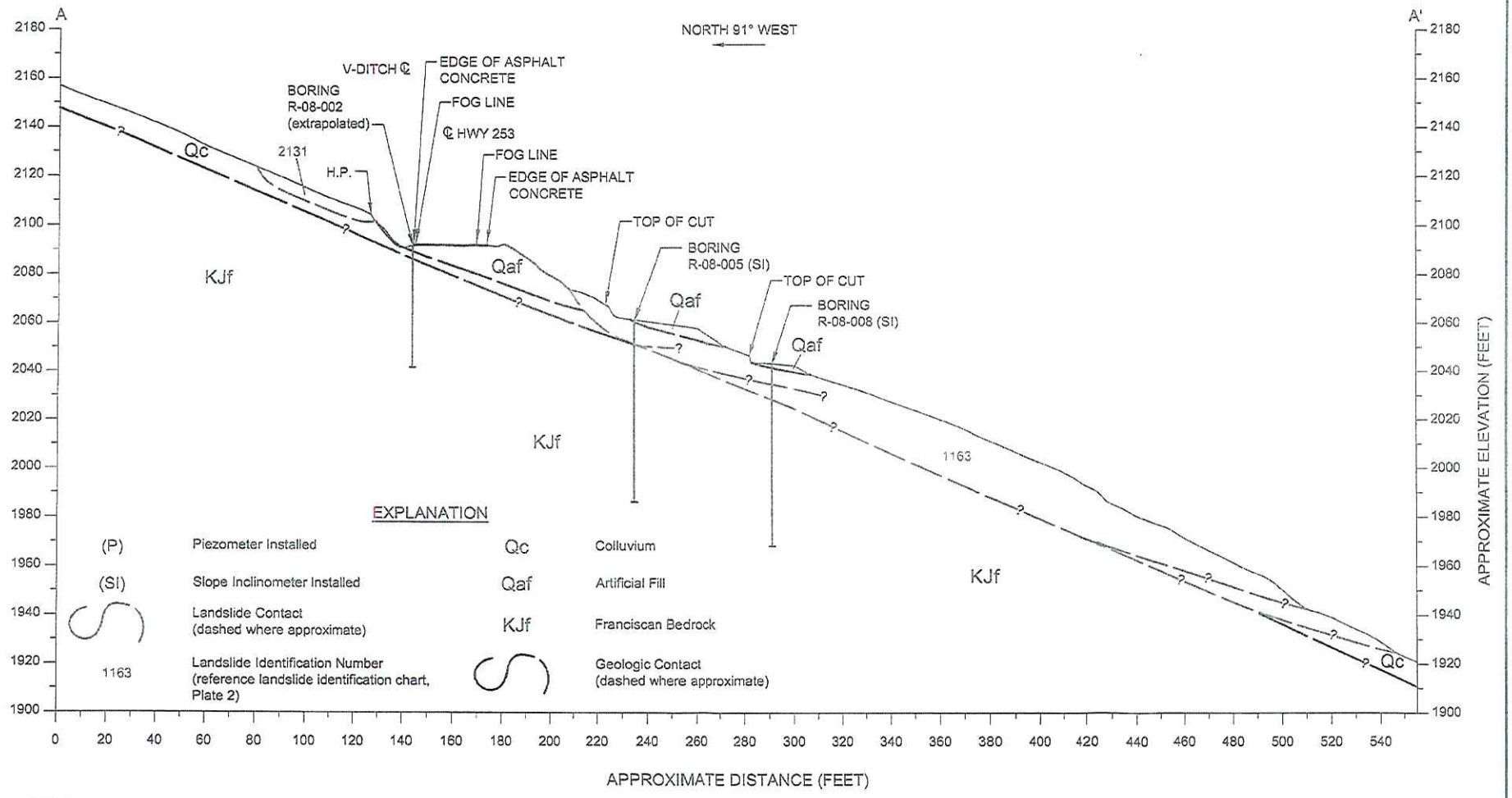

EXPLANATION

(P)	Piezometer Installed	Qc	Colluvium
(SI)	Slope Inclinometer Installed	Qaf	Artificial Fill
	Landslide Contact (dashed where approximate)	KJf	Franciscan Bedrock
1163	Landslide Identification Number (reference landslide identification chart, Plate 2)		Geologic Contact (dashed where approximate)

NOTE:
SECTION A-A' WAS HAND LEVEL FIELD SURVEYED IN JULY 2008 AND MAY DIFFER FROM THE TOPOGRAPHY AND MAPPING AS SHOWN ON THE SITE PLAN, PLATE 2.

40 20 0 40
APPROXIMATE SCALE (feet)

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CROSS SECTION A - A'

EA 01-476201
HIGHWAY 253 P.M. 7.75
MENDOCINO COUNTY, CALIFORNIA

PLATE 3

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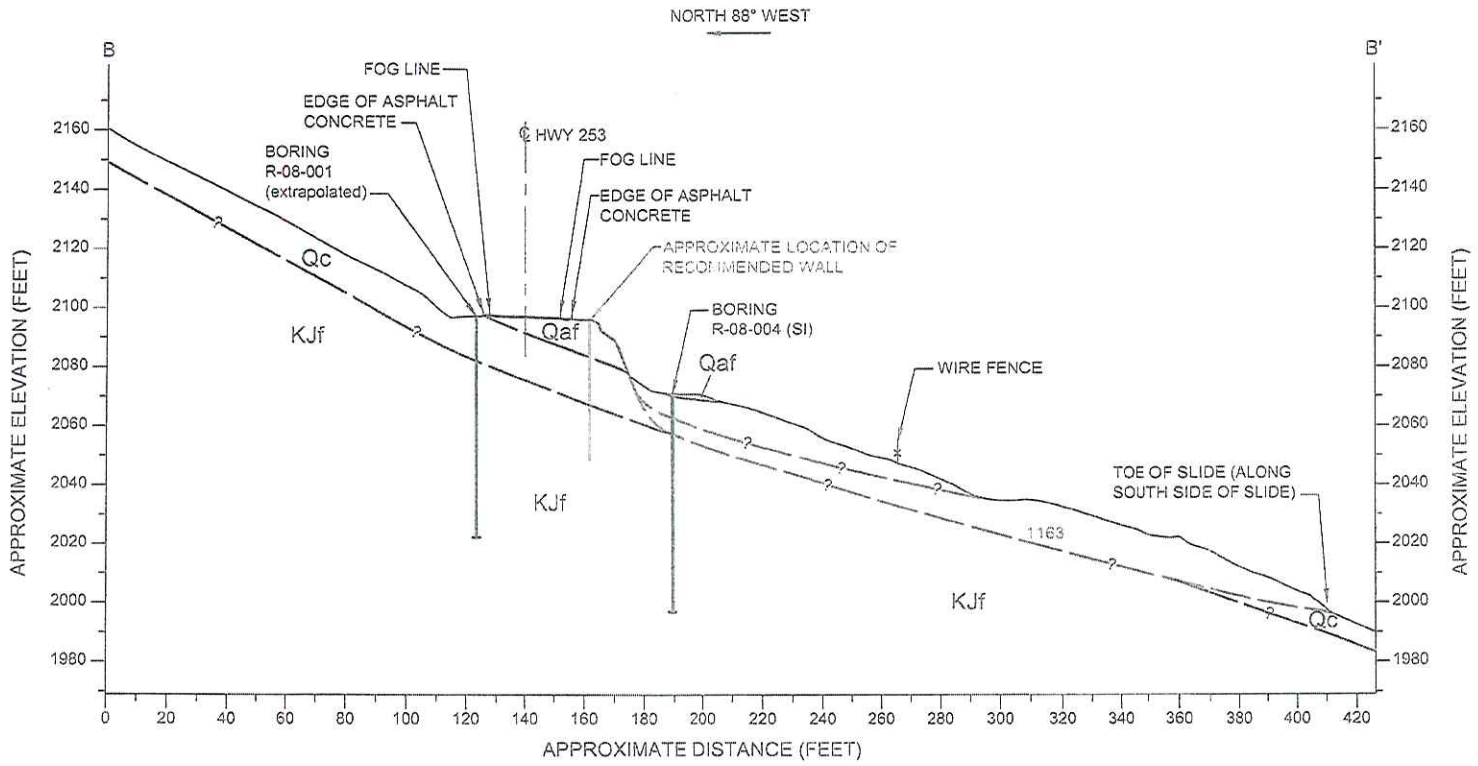

EXPLANATION

(P)	Piezometer Installed	Qc	Colluvium
(SI)	Slope Inclinometer Installed	Qaf	Artificial Fill
	Landslide Contact (dashed where approximate)	KJf	Franciscan Bedrock
1163	Landslide Identification Number (reference landslide identification chart, Plate 2)		Geologic Contact (dashed where approximate)

NOTE:
SECTION B-B' WAS HAND LEVEL FIELD SURVEYED IN JULY 2008 AND MAY DIFFER FROM THE TOPOGRAPHY AND MAPPING AS SHOWN ON THE SITE PLAN, PLATE 2.

40 20 0 40
APPROXIMATE SCALE (feet)

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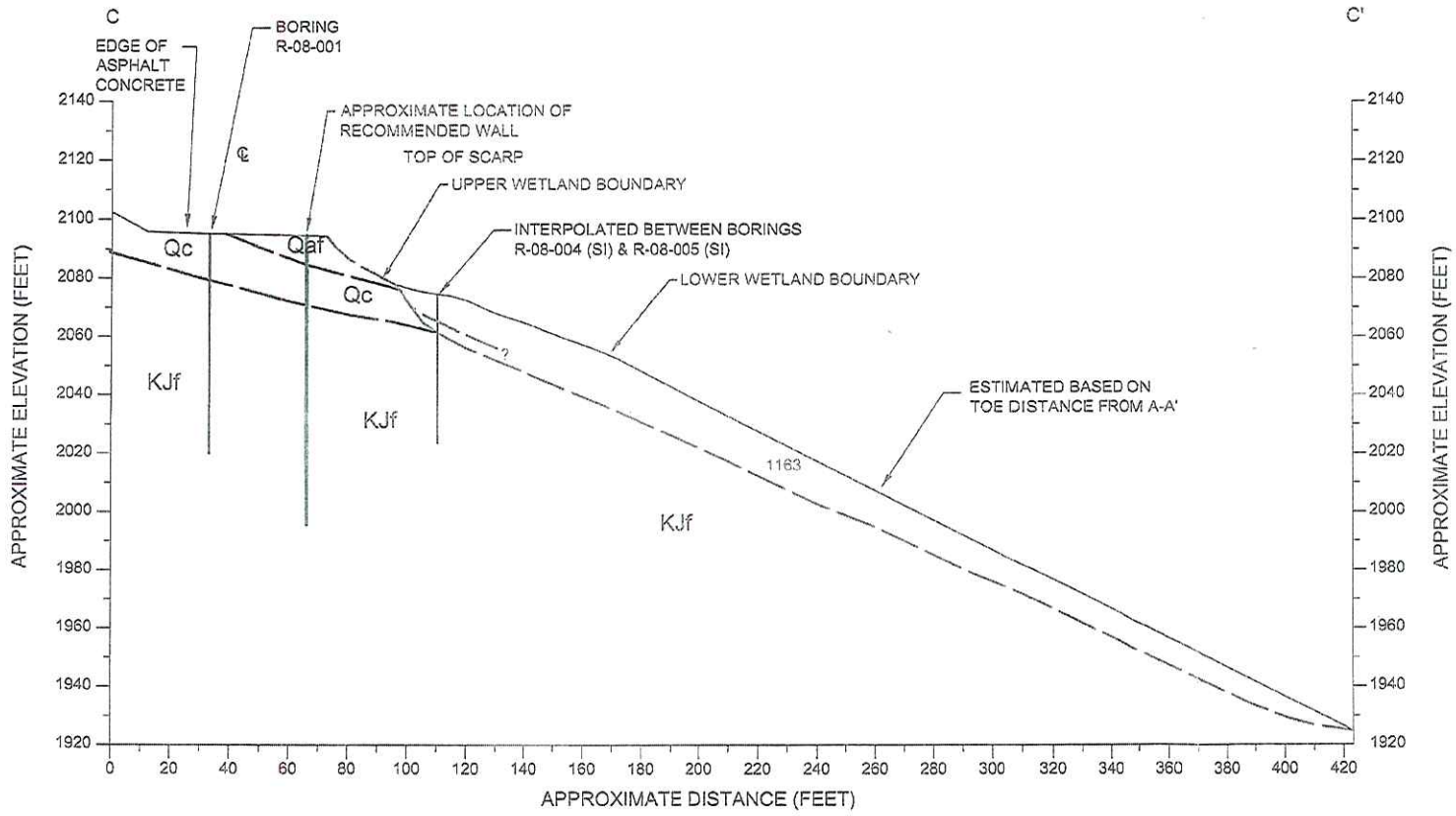
CROSS SECTION B - B'

EA 01-476201
HIGHWAY 253 P.M. 7.75
MENDOCINO COUNTY, CALIFORNIA

PLATE 4



EXPLANATION

(P)	Piezometer Installed	Qc	Colluvium
(SI)	Slope Inclinometer Installed	Qaf	Artificial Fill
	Landslide Contact (dashed where approximate)	KJf	Franciscan Bedrock
1163	Landslide Identification Number (reference landslide identification chart, Plate 2)		Geologic Contact (dashed where approximate)

NOTE:
SECTION C-C' WAS DRAWN FROM THE TOPOGRAPHY PROVIDED BY CALTRANS IN 2009 AND MAPPING SHOWN ON THE SITE PLAN, PLATE 2.

40 20 0 40
APPROXIMATE SCALE (feet)

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CROSS SECTION C - C'

EA 01-476201
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MENDOCINO COUNTY, CALIFORNIA

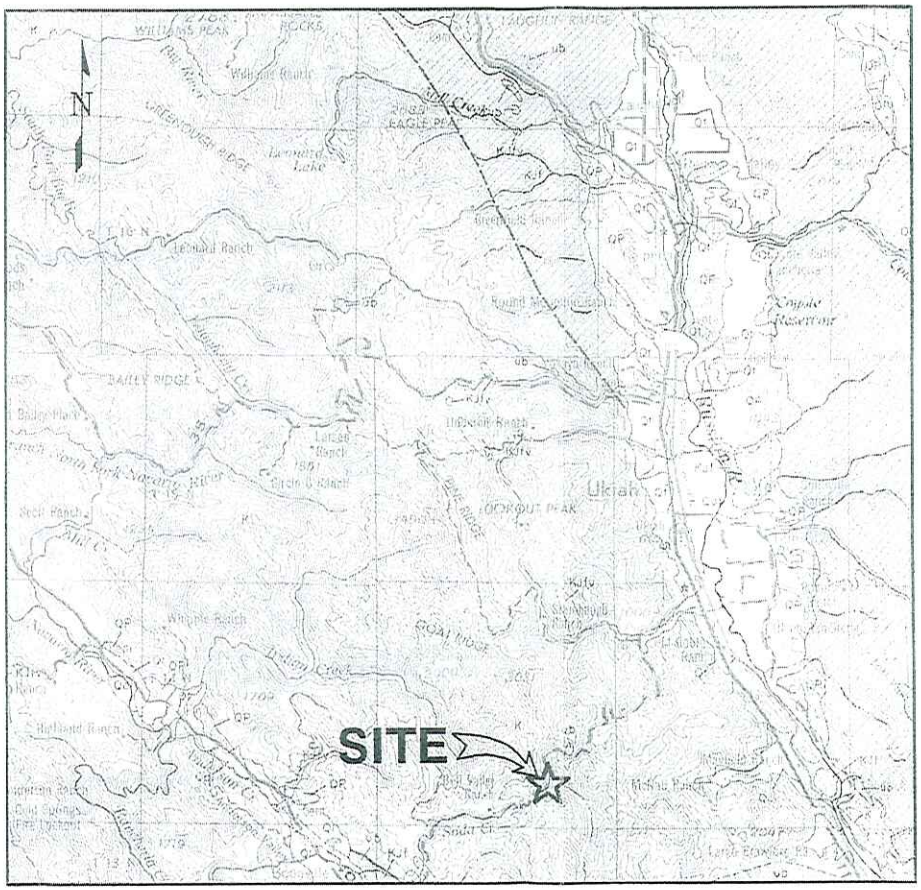
PLATE 5

EXPLANATION

Contact
(Dashed where approximately located; gradational or inferred)

Fault
(Dashed where approximately located)

Qal	Alluvium
Qt	Quaternary nonmarine terrace deposits
QP	Plio-Pleistocene nonmarine
K	Undivided Cretaceous marine
KJf	Franciscan Formation
KJfv	Franciscan volcanic and metavolcanic rocks
ub	Mesozoic ultramafic intrusive rocks



3 1.5 0 3
APPROXIMATE SCALE (miles)

Reference:
Geologic Map of California, Ukiah Sheet, Olaf P. Jenkins Edition
Charles W. Jennings and Rudolph G.Strand, 1960

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REGIONAL GEOLOGY

EA 01-476201
HIGHWAY 253 P.M. 7.75
MENDOCINO COUNTY, CALIFORNIA

PLATE
6

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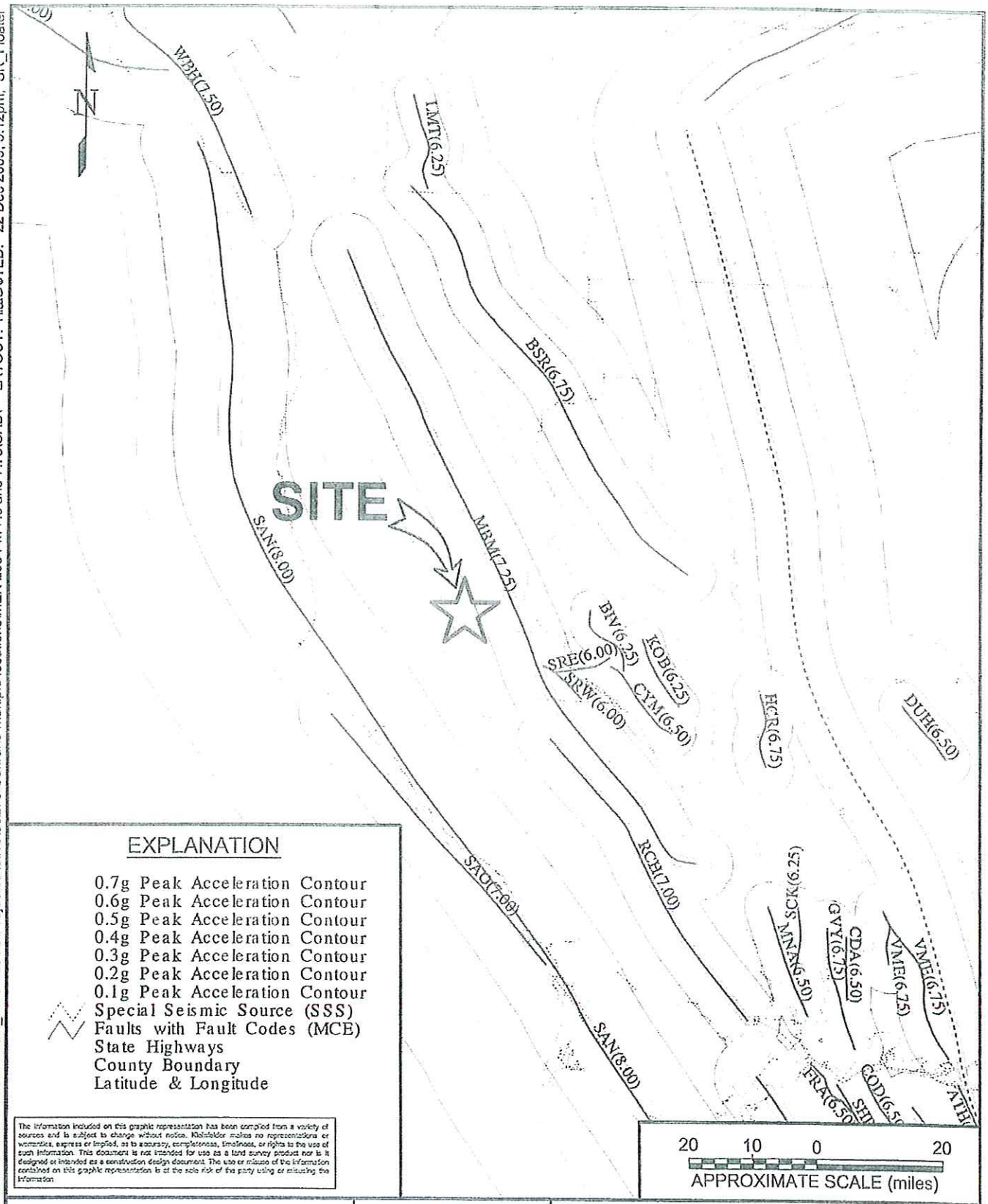

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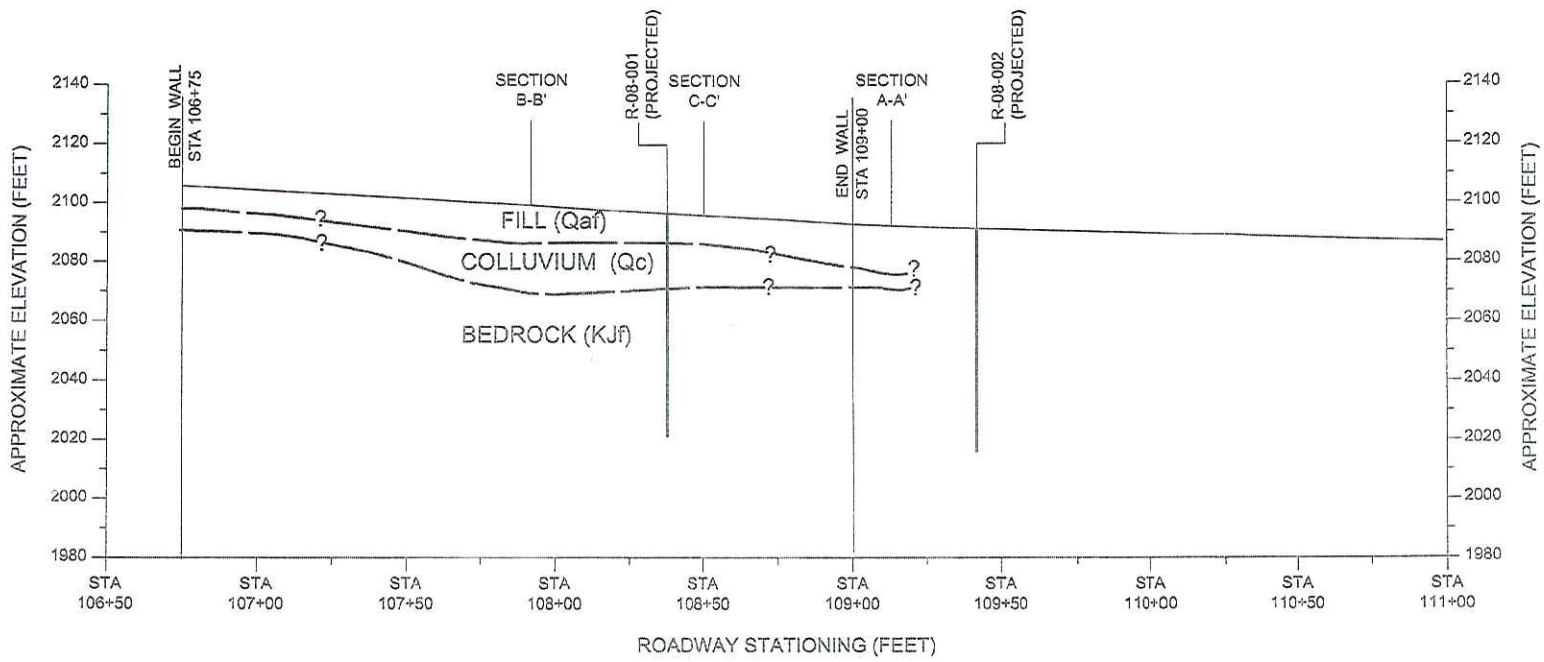
CALIFORNIA SEISMIC HAZARD MAP (MUALCHIN 1996)

EA 01-476201
HIGHWAY 253 P.M. 7.75
MENDOCINO COUNTY, CALIFORNIA

PLATE 7



EXPLANATION

Geologic Contact (dashed where approximate)

Landslide Contact (dashed where approximate)

(Qc)	Colluvium
(Qaf)	Artificial Fill
(KJf)	Franciscan Bedrock

NOTE:
The soil layers and depth of bedrock indicated on this plate were generalized by interpolation and extrapolation between widely spaced borings. Surface information exists only at the specific boring locations, which are offset from the proposed wall location. The profile shown should be considered approximate and variations should be expected.
Along the location of the profile, no landslide deposits are shown. Landslide deposits exist downslope of the section location.

40 20 0 40
APPROXIMATE SCALE (feet)

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www.kleinfelder.com

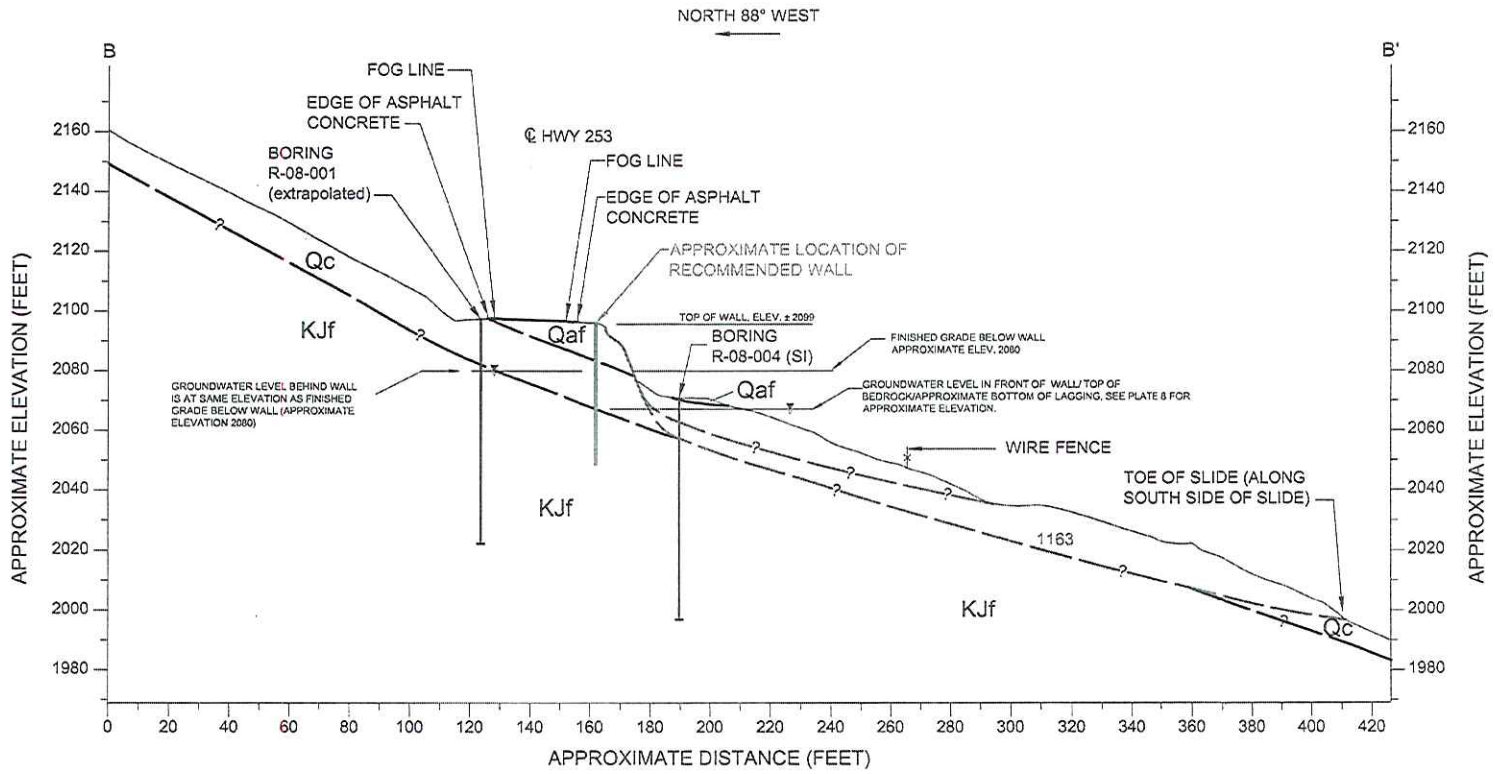
PROJECT NO.	93276
DRAWN:	DEC 2009
DRAWN BY:	JDS
CHECKED BY:	JR
FILE NAME:	93276-11.dwg

APPROXIMATE SUBSURFACE GEOLOGY ALONG PROPOSED RETAINING WALL

EA 01-476201
HIGHWAY 253 P.M. 7.75
MENDOCINO COUNTY, CALIFORNIA

PLATE 8

ATTACHED IMAGES: Images: bedrock profile along wall.jpg Images: DC_2506174.jpg Images: section C-C' .jpg
ATTACHED XREFS:
SANTA ROSA, CA CAD FILE: U:\GEOTECH_PROJECTS\Projects\Active\93276 Caltrans multiple locations\MEN 253 PM 7.6 and 7.75\CADD LAYOUT: SECTION 09 Dec 2009, 4:35pm, SR_Floater



EXPLANATION

(P)	Piezometer Installed	Qc	Colluvium
(SI)	Slope Inclinometer Installed	Qaf	Artificial Fill
	Landslide Contact (dashed where approximate)	KJf	Franciscan Bedrock
1163	Landslide Identification Number (reference landslide identification chart, Plate 2)		Geologic Contact (dashed where approximate)

NOTE:
SECTION B-B' WAS HAND LEVEL FIELD SURVEYED IN JULY 2008 AND MAY DIFFER FROM THE TOPOGRAPHY AND MAPPING AS SHOWN ON THE SITE PLAN, PLATE 2.

40 20 0 40
APPROXIMATE SCALE (feet)

KLEINFELDER
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www.kleinfelder.com

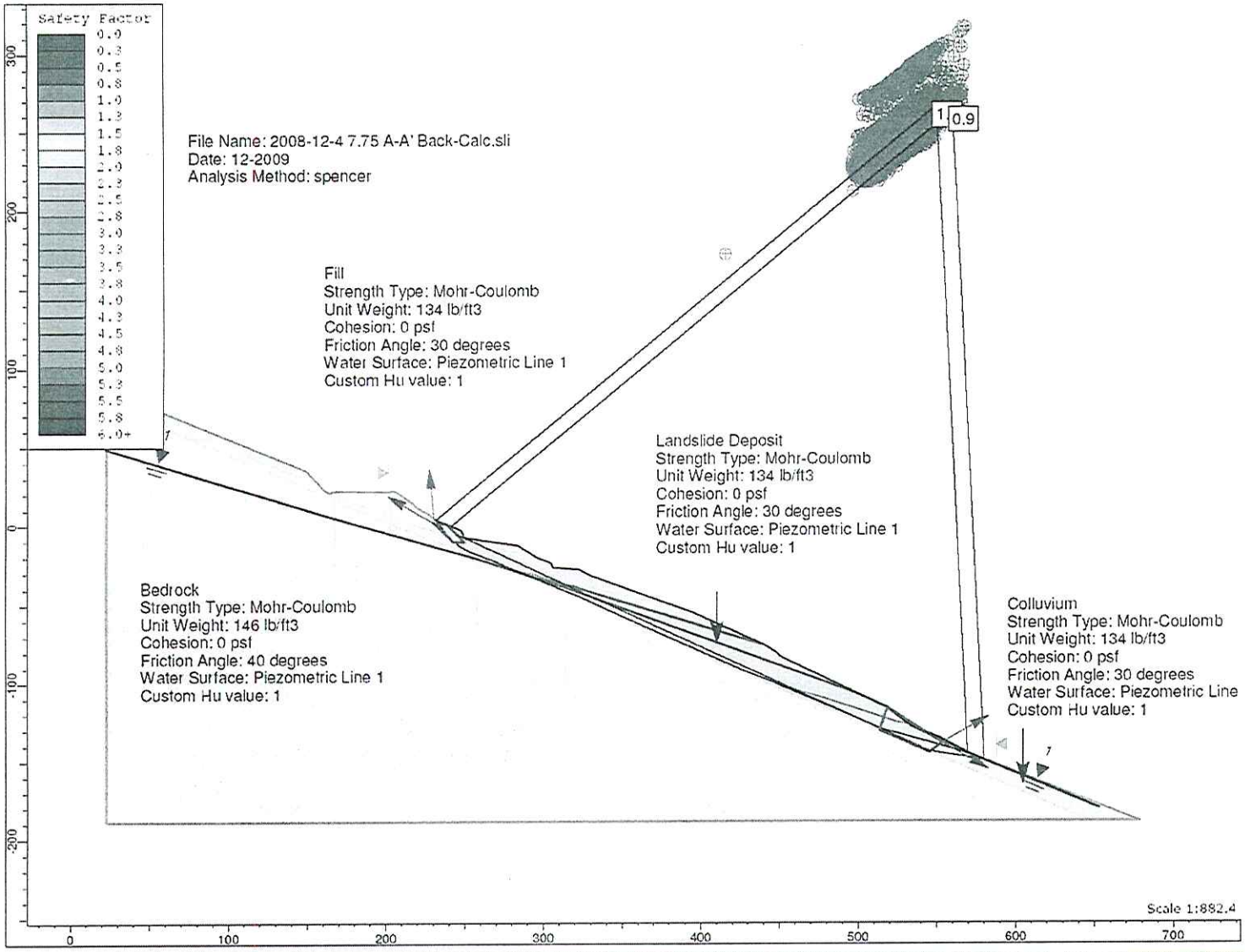
PROJECT NO.	93276
DRAWN:	DEC 2009
DRAWN BY:	PH/JDS
CHECKED BY:	JR
FILE NAME:	93276-5A.dwg

DESIGN CROSS SECTION

EA 01-476201
HIGHWAY 253 P.M. 7.75
MENDOCINO COUNTY, CALIFORNIA

PLATE 9

ATTACHED IMAGES: Images: DC_2506174.jpg
ATTACHED XREFS:
SANTA ROSA, CA CAD FILE: U:\GEOTECH_PROJECTS\Projects\Active\93276 Caltrans multiple locations\MEN 253 PM 7.6 and 7.75\CAD\ LAYOUT: B-B' MODIFIED: 30 Apr 2010, 9:26am, SR_Floater



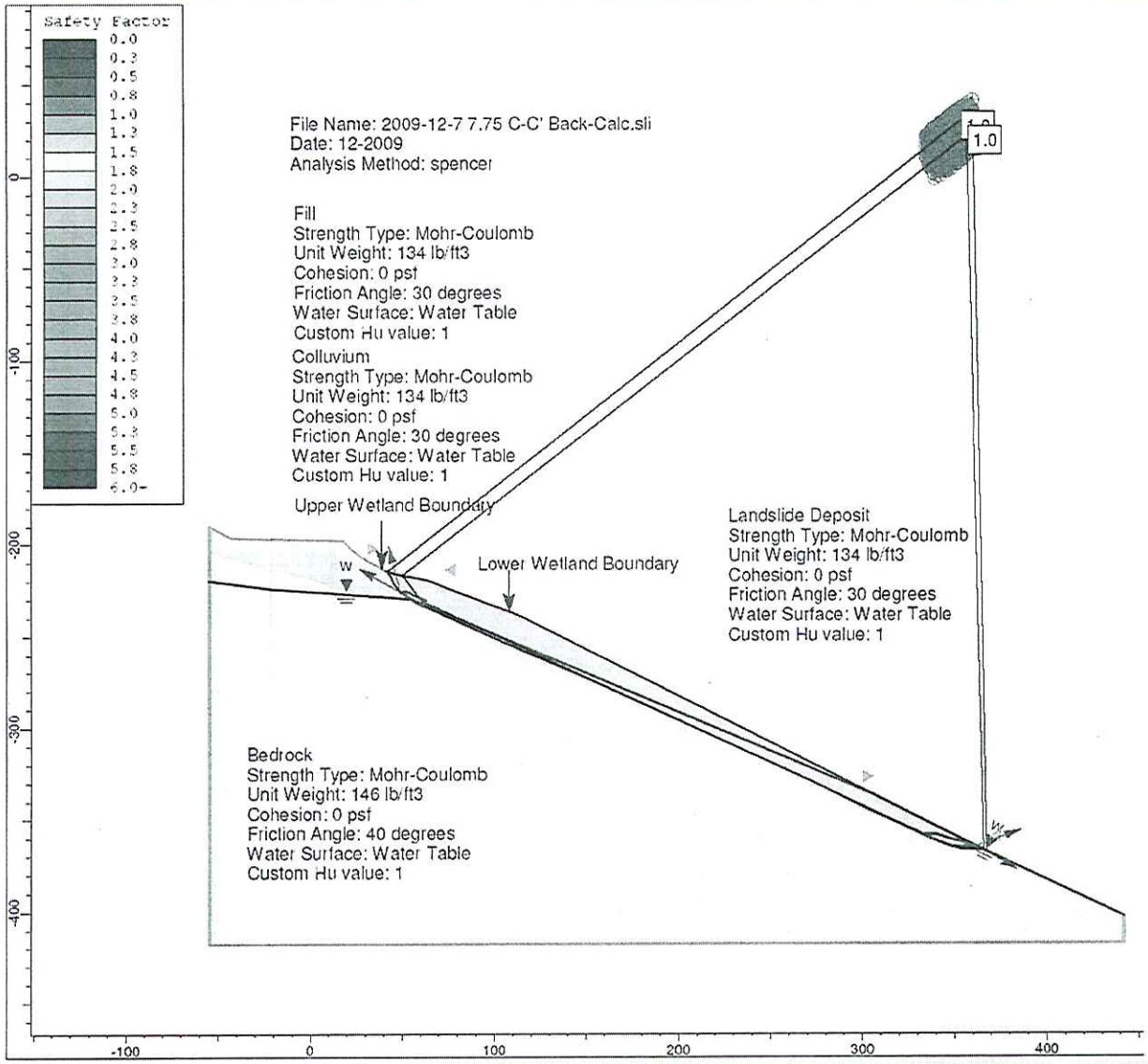
KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	93276
DATE:	DECEMBER 09
BY:	CMG
CHECKED BY:	TC

SLOPE STABILITY: CROSS SECTION A-A': BACK-CALCULATION

EXISTING CONDITIONS, STATIC ANALYSIS
EA # 467201
01-MEN-253-7.75
HIGHWAY 253 P.M. 7.75
MENDOCINO COUNTY, CALIFORNIA

PLATE
10



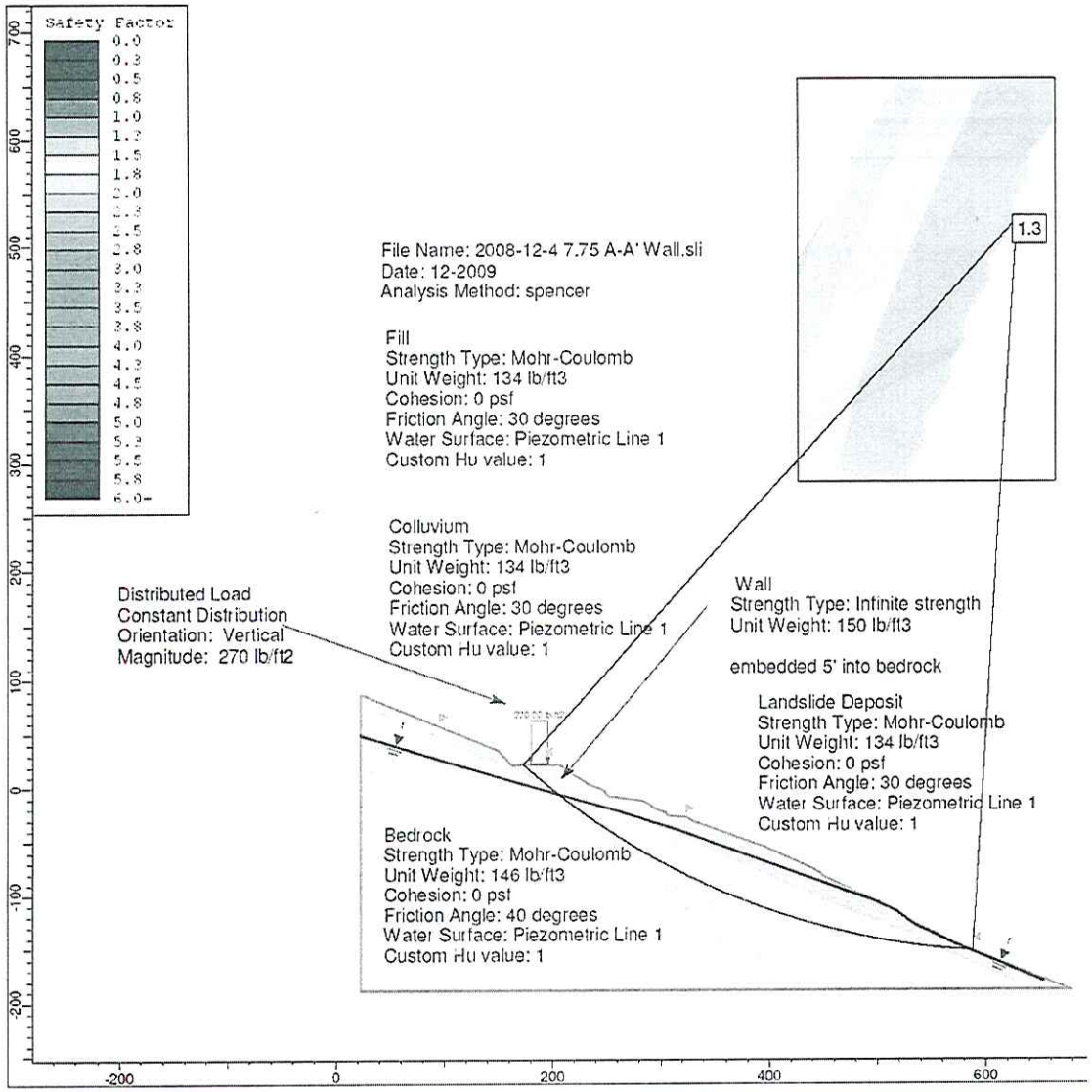
KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	93276
DATE:	DECEMBER 09
BY:	CMG
CHECKED BY:	TC

SLOPE STABILITY: CROSS SECTION C-C': BACK CALCULATION

EXISTING CONDITIONS, STATIC ANALYSIS
EA # 467201
01-MEN-253-7.75
HIGHWAY 253 P.M. 7.75
MENDOCINO COUNTY, CALIFORNIA

PLATE
11



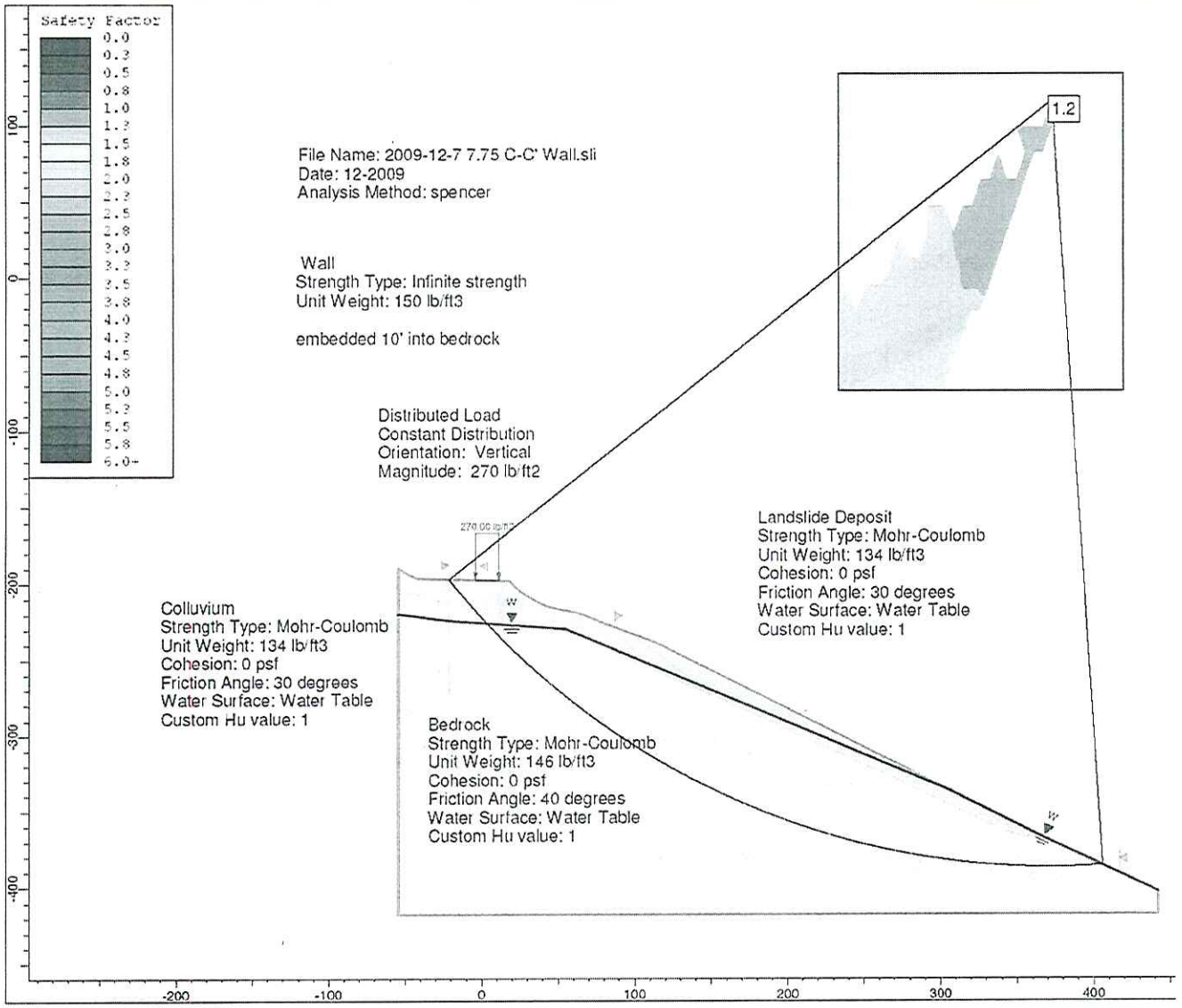
KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	93276
DATE:	DECEMBER 09
BY:	CMG
CHECKED BY:	TC

SLOPE STABILITY: CROSS SECTION A-A': WALL (EMBEDDED 5' INTO BEDROCK)

IMPROVED CONDITIONS, STATIC ANALYSIS
EA # 467201
01-MEN-253-7.75
HIGHWAY 253 P.M. 7.75
MENDOCINO COUNTY, CALIFORNIA

PLATE
12



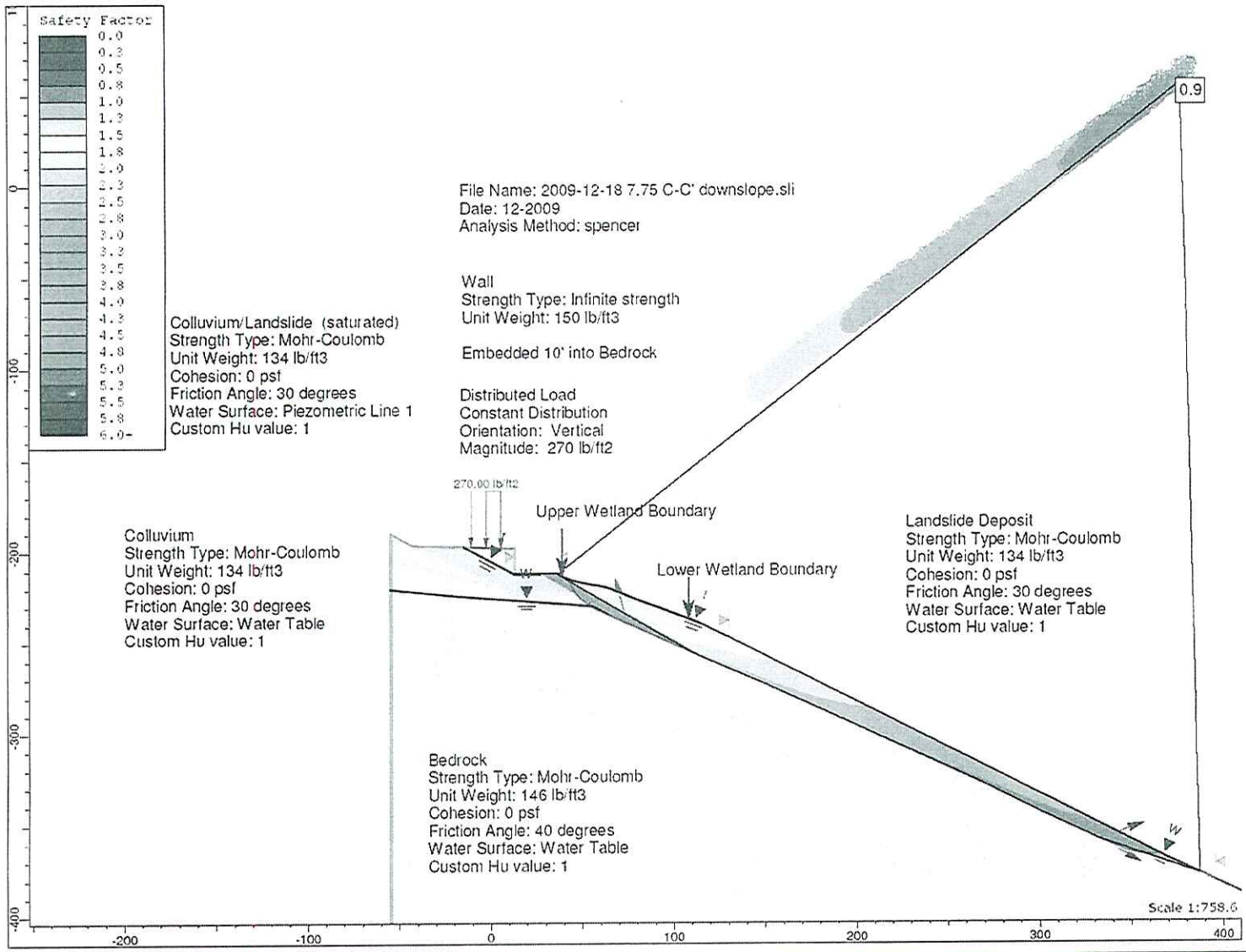
KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	93276
DATE:	DECEMBER 09
BY:	CMG
CHECKED BY:	TC

SLOPE STABILITY: CROSS SECTION C-C': WALL (EMBEDDED 10' INTO BEDROCK)

IMPROVED CONDITIONS, STATIC ANALYSIS
EA # 467201
01-MEN-253-7.75
HIGHWAY 253 P.M. 7.75
MENDOCINO COUNTY, CALIFORNIA

PLATE
13



KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	93276
DATE:	DECEMBER 09
BY:	CMG
CHECKED BY:	TC

SLOPE STABILITY: CROSS SECTION C-C': DOWNSLOPE

IMPROVED CONDITIONS, STATIC ANALYSIS
EA # 467201
01-MEN-253-7.75
HIGHWAY 253 P.M. 7.75
MENDOCINO COUNTY, CALIFORNIA

PLATE
14

KLEINFELDER
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APPENDIX A

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
01	Men	253	7.75		

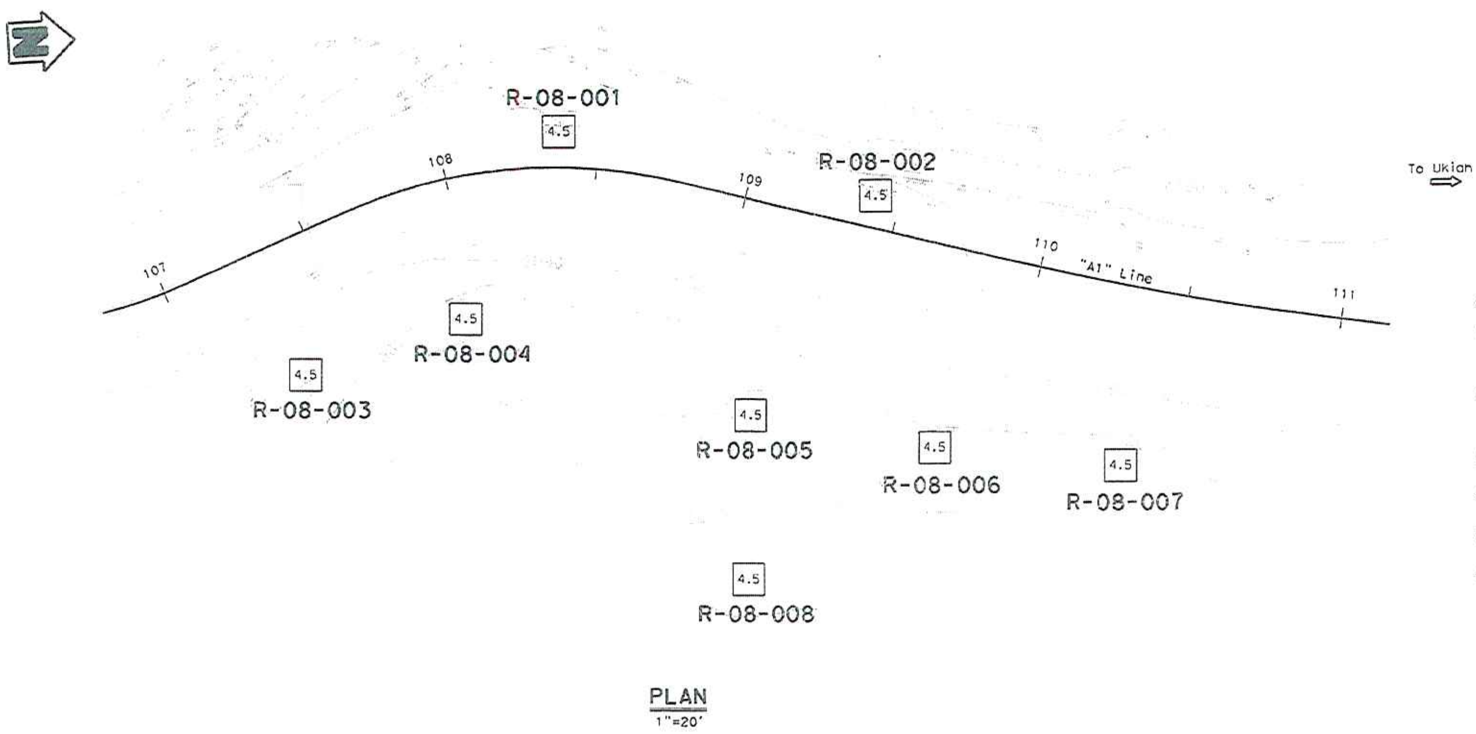
REGISTERED GEOLOGIST 9-24-08 DATE

PLANS APPROVAL DATE

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

REGISTERED GEOLOGIST WILLIAM V. McCORMICK III No. 1675 Exp. 11-30-10 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407



PLAN
1"=20'

Notes:

1. 2" samples were taken using a modified California split-barrel sampler with an inside diameter (I.D.) of 2" and an outside diameter (O.D.) of 2½".
2. 1.4" samples were taken using a SPT split-barrel sampler with an inside diameter (I.D.) of 1.4" and an outside diameter (O.D.) of 2".
3. An automatic hammer (140 lb) with a 30" drop was used to advance the sampler.
4. Blowcounts noted for boring are field blowcounts and have not been corrected.
5. Blowcounts 50/5 means 50 blows per 5" penetration.
6. This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2007)

BENCHMARKS

STATION	OFFSET	N	E	ELEV	DESCRIPTION
110+89.50	22.993' Rt	2,142,704.17	6,202,722.84	2086.64	SUHV101-100D SPIKE

SURVEY CONTROL
1. Coordinates bearing and distances are based on the California State Plane Coordinate system of NAD 83 (1986). Elevations are based on NAVD88.

DESIGN OVERSIGHT ENGINEER: SIGN OFF DATE:
FUNCTIONAL SUPERVISOR
NAME:
DRAWN BY: A. Sanchez
CHECKED BY: W. McCormick, C. Coitein
FIELD INVESTIGATION BY: Kleinfelder June 2008
PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
PROJECT ENGINEER
BRIDGE NO.
POST MILES 7.75
RETAINING WALL @ PM 7.75
LOG OF TEST BORINGS 1 of 11
CU 03247
EA 476201
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS
DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES
SHEET OF
OGS CIVIL LOG OF TEST BORINGS SHEET

NOTE: This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2007)

FOR PLAN VIEW AND ADDITIONAL NOTES, SEE "LOG OF TEST BORINGS" SHEET 1 OF 11

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
01	Men	253	7.75		

REGISTERED GEOLOGIST — DATE 12-24-08

WILLIAM V. MCCORMICK III, No. 1673, Exp. 11-30-10, CERTIFIED ENGINEERING GEOLOGIST, STATE OF CALIFORNIA

PLANS APPROVAL DATE

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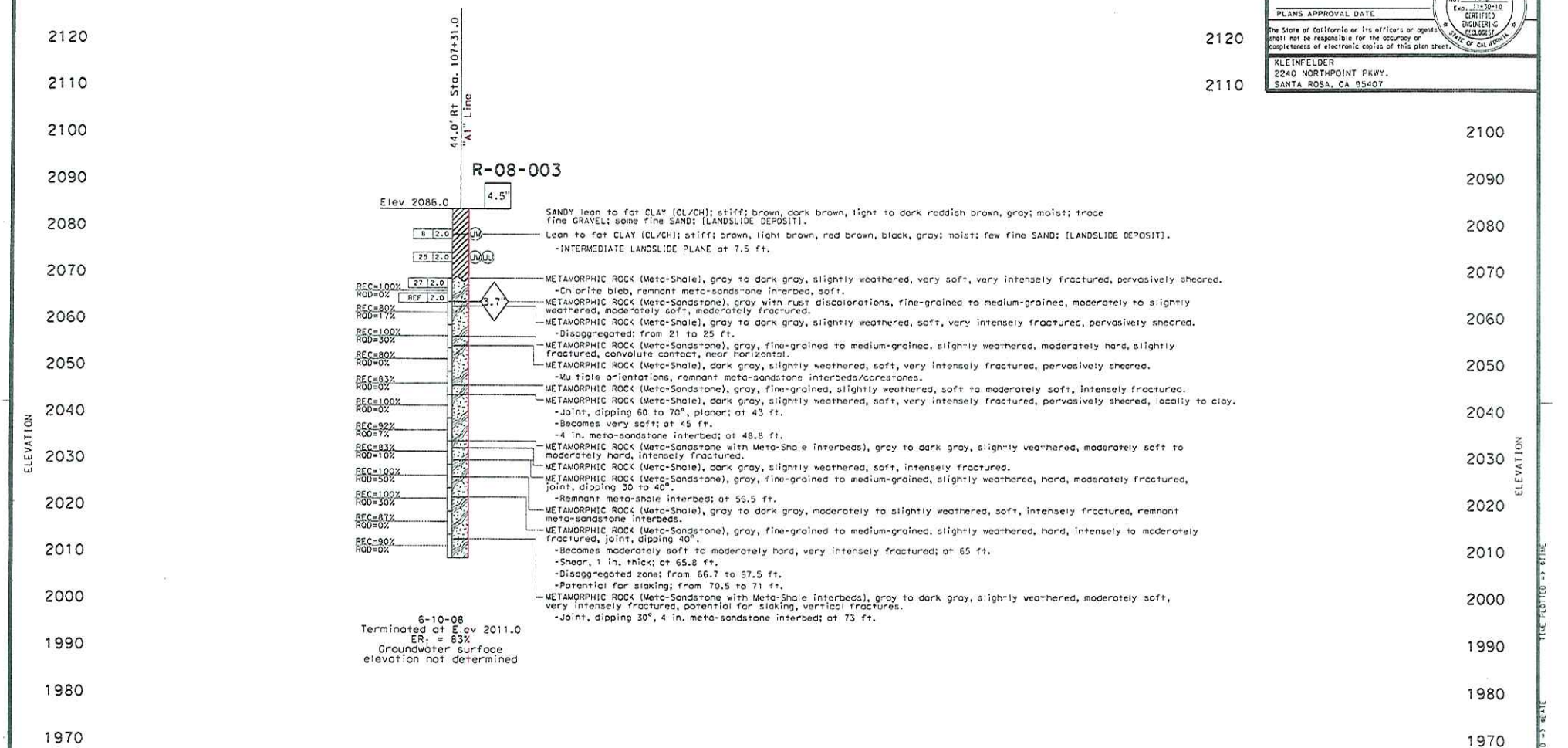
KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407



PROFILE
HOR. 1"=10'
VER. 1"=10'

DESIGN OVERSIGHT ENGINEER:	SIGN OFF DATE:		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	BRIDGE NO.	RETAINING WALL @ PM 7.75
FUNCTIONAL SUPERVISOR	DRAWN BY: A. Sanchez	FIELD INVESTIGATION BY:			
NAME:	CHECKED BY: W. McCormick, C. Goitein	E. Johnson June 2008	PROJECT ENGINEER	POST MILES 7.75	LOG OF TEST BORINGS 2 of 11
005 CIVIL LOG OF TEST BORINGS SHEET	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3		CU 03247 EA 476201	DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES: 9-24-08, 11-4-08, 5-11-10 — SHEET OF

TFILE => GREQUEST

USERNAME => RJOSEPH — DATE PLOTTED => 8-MAY-2010 — TIME PLOTTED => 07:16

NOTE: This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2007)

FOR PLAN VIEW AND ADDITIONAL NOTES, SEE "LOG OF TEST BORINGS" SHEET 1 OF 11

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
01	Men	253	7.75		

REGISTERED GEOLOGIST 9-24-08 DATE

PLANS APPROVAL DATE

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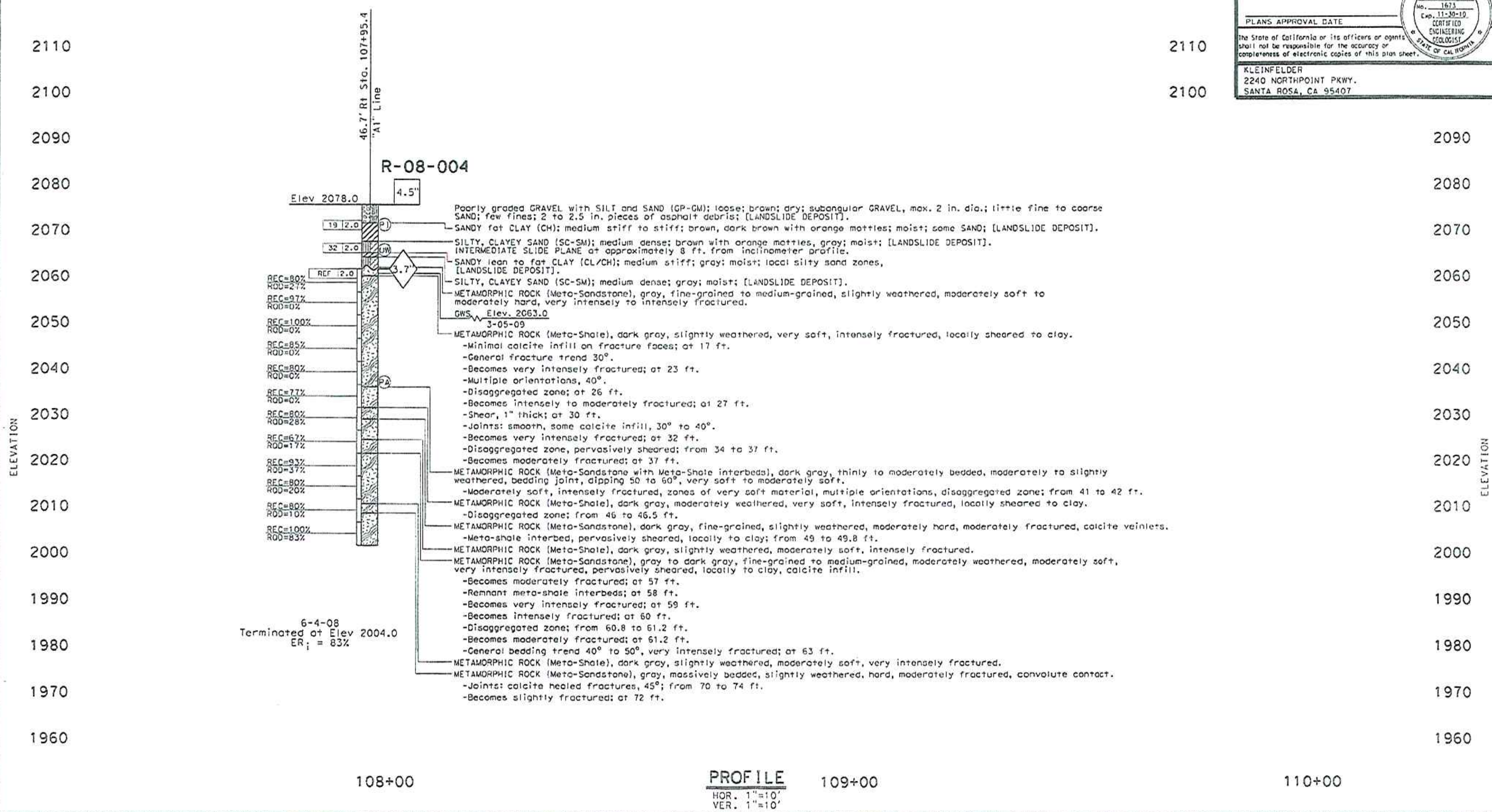
REGISTERED GEOLOGIST WILLIAM V. McCORMICK III No. 1673 Exp. 11-30-10 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407



PROFILE
HOR. 1"=10'
VER. 1"=10'

DESIGN OVERSIGHT ENGINEER:	SIGN OFF DATE:		
FUNCTIONAL SUPERVISOR	DRAWN BY: A. Sanchez	FIELD INVESTIGATION BY:	
NAME:	CHECKED BY: W. McCormick, C. Goltein	E. Johnson	June 2008

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

BRIDGE NO.

POST MILES 7.75

RETAINING WALL @ PM 7.75
LOG OF TEST BORINGS 3 of 11

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 03247
EA 476201

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET OF

NOTE: This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2007)

FOR PLAN VIEW AND ADDITIONAL NOTES, SEE "LOG OF TEST BORINGS" SHEET 1 OF 11

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
01	Men	253	7.75		

WILLIAM V. McCORMICK III
REGISTERED GEOLOGIST — DATE 4-24-08

PLANS APPROVAL DATE

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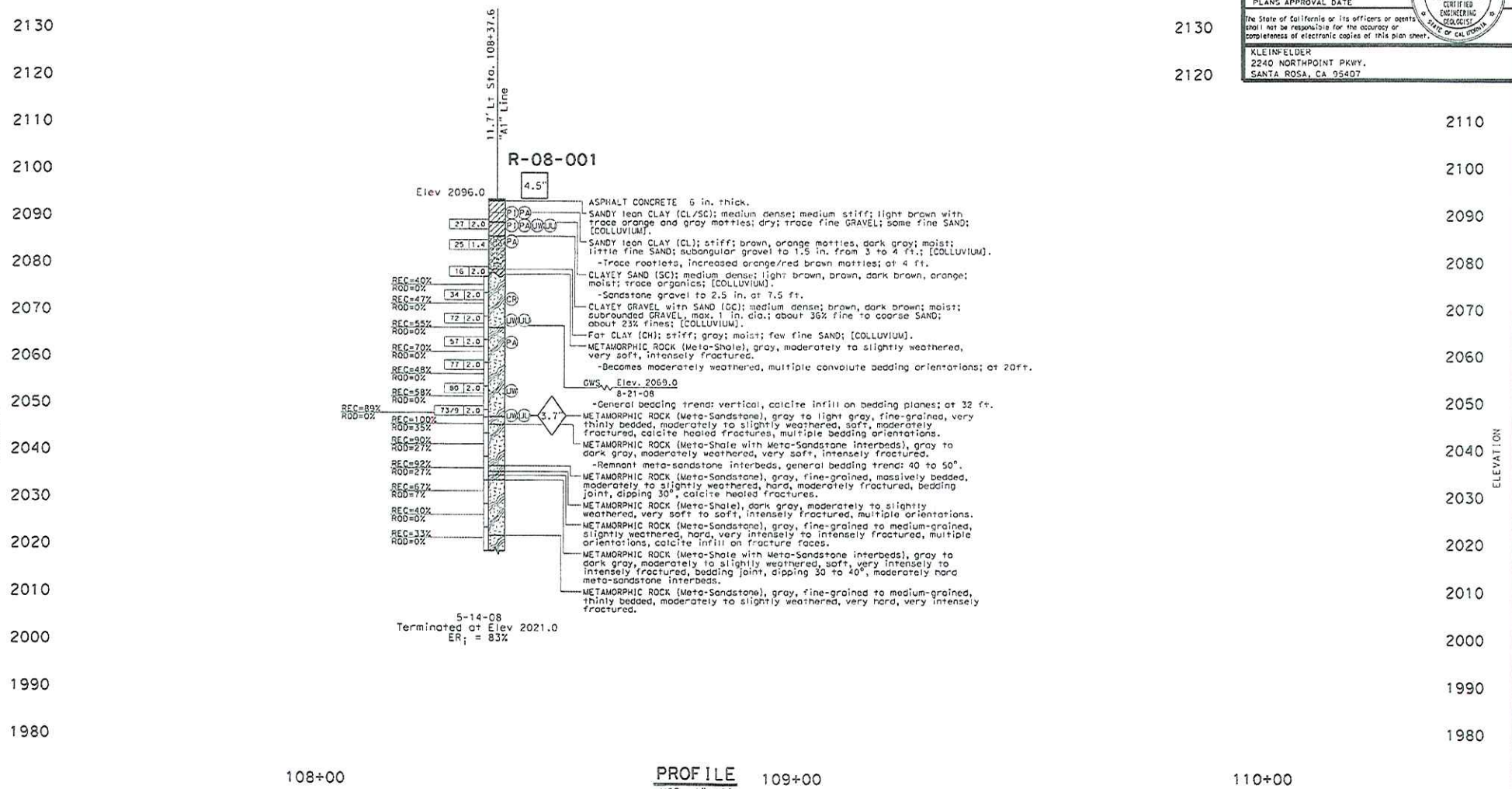
REGISTERED GEOLOGIST — WILLIAM V. McCORMICK III — No. 1673 — Exp. 11-30-10 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407



ELEVATION

2130 2120 2110 2100 2090 2080 2070 2060 2050 2040 2030 2020 2010 2000 1990 1980

108+00 109+00 110+00

PROFILE
HOR. 1"=10'
VER. 1"=10'

DESIGN OVERSIGHT ENGINEER:	SIGN OFF DATE:		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION		RETAINING WALL @ PM 7.75
FUNCTIONAL SUPERVISOR NAME:	DRAWN BY: A. Sanchez	FIELD INVESTIGATION BY: E. Johnson May 2008		PROJECT ENGINEER	POST MILES 7.75 — LOG OF TEST BORINGS 4 of 11
	CHECKED BY: W. McCormick, C. Coltein				
OGS CIVIL LOG OF TEST BORINGS SHEET	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3		CU 03247 EA 476201	DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES

DATE PLOTTED => 7/11/08
TIME PLOTTED => 11:08

NOTE: This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2007)

FOR PLAN VIEW AND ADDITIONAL NOTES, SEE "LOG OF TEST BORINGS" SHEET 1 OF 11

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
01	Men	253	7.75		

REGISTERED GEOLOGIST — DATE 5-24-08

PLANS APPROVAL DATE

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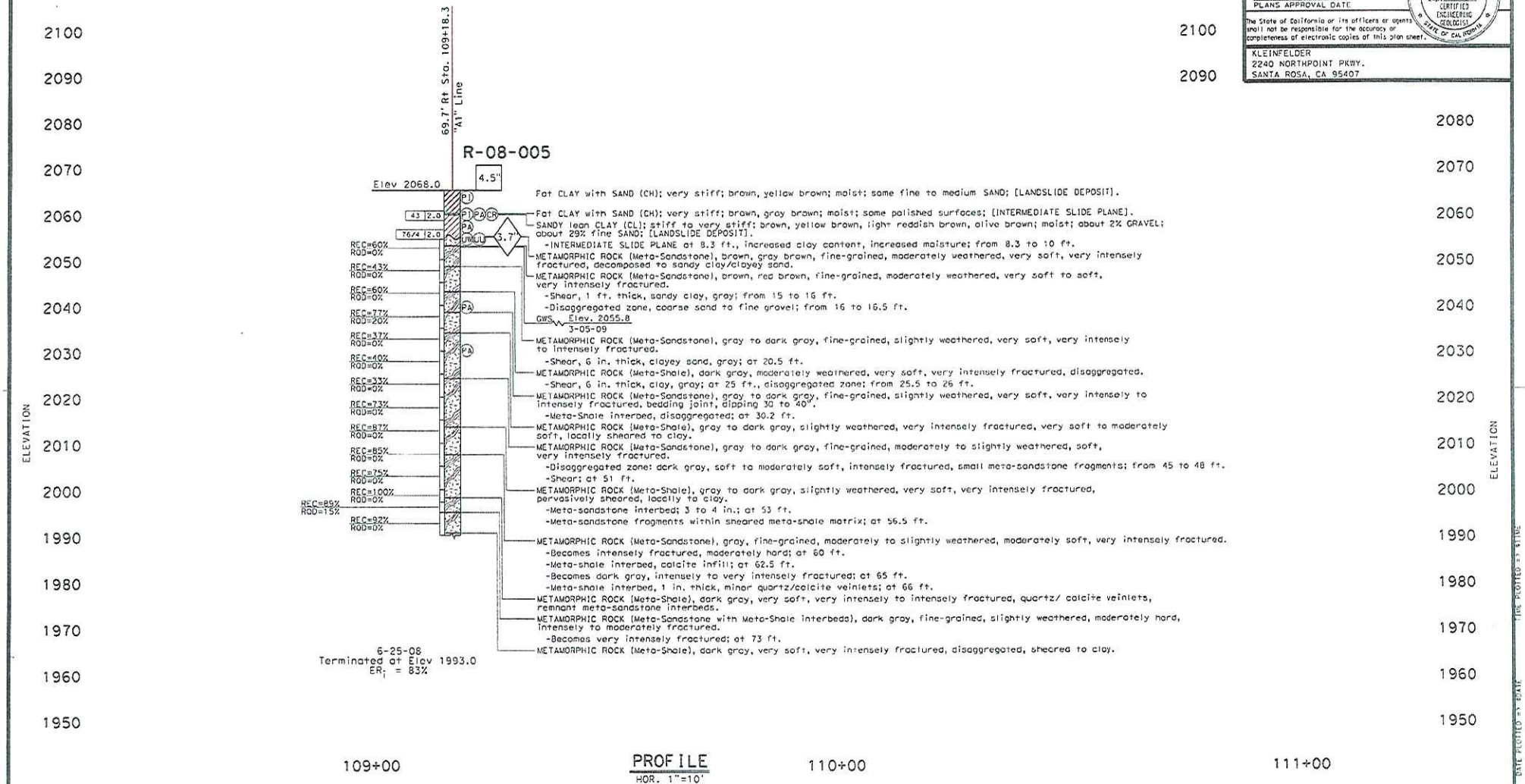
WILLIAM V. McCORMICK III, No. 1672, Exp. 11-30-10, CERTIFIED ENGINEERING GEOLOGIST, STATE OF CALIFORNIA

KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407



PROFILE
HOR. 1"=10'
VER. 1"=10'

DESIGN OVERSIGHT ENGINEER:	SIGN OFF DATE:		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION		BRIDGE NO.	RETAINING WALL @ PM 7.75
FUNCTIONAL SUPERVISOR	DRAWN BY: A. Sanchez	FIELD INVESTIGATION BY:		PROJECT ENGINEER	POST MILES 7.75	LOG OF TEST BORINGS 5 of 11
NAME:	CHECKED BY: W. McCormick, C. Goltein	E. Johnson June 2008				
OGS CIVIL LOG OF TEST BORINGS SHEET	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3		CU 03247 EA 476201		DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES / SHEET OF

DATE PLOTTED => 5-JUNE
USERNAME => bjuser

NOTE: This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2007)

FOR PLAN VIEW AND ADDITIONAL NOTES, SEE "LOG OF TEST BORINGS" SHEET 1 OF 11

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
01	Men	253	7.75		

REGISTERED GEOLOGIST — DATE 8-24-08

PLANS APPROVAL DATE

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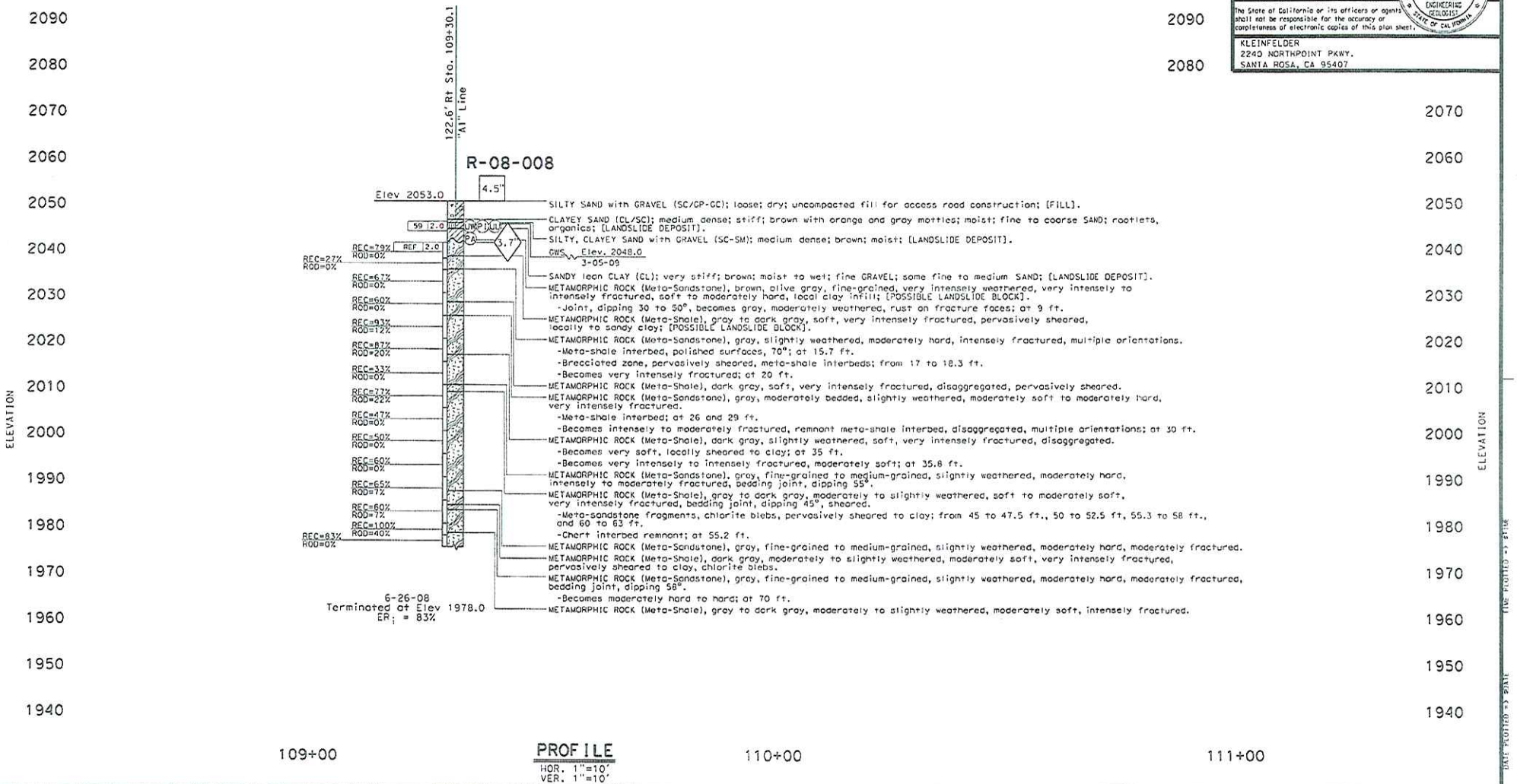
REGISTERED GEOLOGIST — WILLIAM V. McCORMICK III — No. 1973 — Exp. 11-30-10 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407



PROFILE
HOR. 1"=10'
VER. 1"=10'

DESIGN OVERSIGHT ENGINEER:	SIGN OFF DATE:		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION		BRIDGE NO.	RETAINING WALL @ PM 7.75
FUNCTIONAL SUPERVISOR	DRAWN BY: A. Sanchez	FIELD INVESTIGATION BY:		PROJECT ENGINEER	POST MILES 7.75	LOG OF TEST BORINGS 6 of 11
NAME:	CHECKED BY: W. McCormick, C. Goitein	E. Johnson June 2008				

DGS CIVIL LOG OF TEST BORINGS SHEET — ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 — CU 03247 EA 476201 — DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES — SHEET

(FILE => $REQUEST)

NOTE: This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2007)

FOR PLAN VIEW AND ADDITIONAL NOTES, SEE "LOG OF TEST BORINGS" SHEET 1 OF 11

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
01	Men	253	7.75		

REGISTERED GEOLOGIST — DATE 5-24-08

WILLIAM V. McCORMICK III, No. 1673, Exp. 11-30-10, CERTIFIED ENGINEERING GEOLOGIST, STATE OF CALIFORNIA

PLANS APPROVAL DATE

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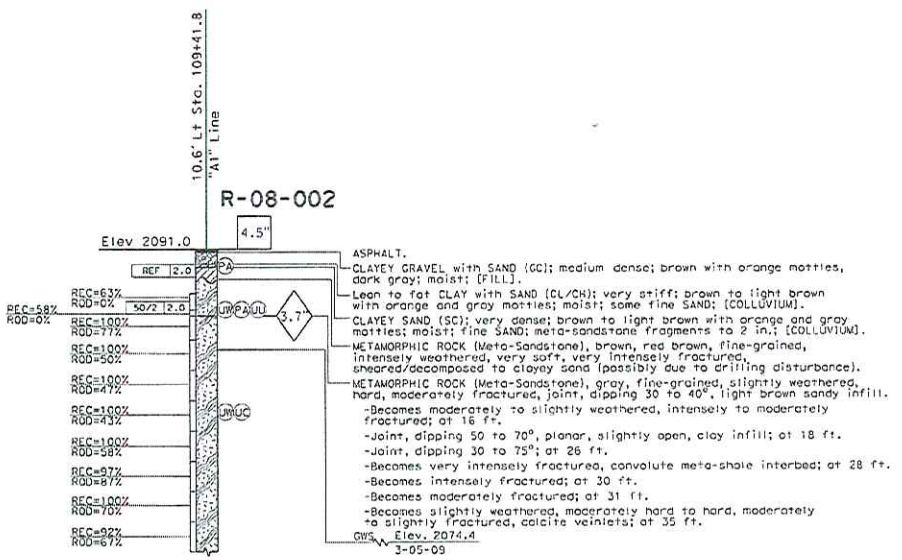
KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407



5-20-08
Terminated at Elev 2041.0
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ELEVATION: 2130, 2120, 2110, 2100, 2090, 2080, 2070, 2060, 2050, 2040, 2030, 2020, 2010, 2000, 1990, 1980

109+00 110+00 111+00

PROFILE
HOR. 1"=10'
VER. 1"=10'

DESIGN OVERSIGHT ENGINEER:	SIGN OFF DATE:		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION		RETAINING WALL @ PM 7.75
FUNCTIONAL SUPERVISOR	DRAWN BY: A. Sanchez	FIELD INVESTIGATION BY:		PROJECT ENGINEER	LOG OF TEST BORINGS 7 of 11
NAME:	CHECKED BY: W. McCormick, C. Goltein	E. Johnson May 2008			
DGS CIVIL LOG OF TEST BORINGS SHEET	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS		CU 03247 EA 476201	DISREGARD PRINTS BEARING EARLIER REVISION DATES	BRIDGE NO. / POST MILES 7.75

FILE =z SREQUES

NOTE: This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2007)

FOR PLAN VIEW AND ADDITIONAL NOTES, SEE "LOG OF TEST BORINGS" SHEET 1 OF 11

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
01	Men	253	7.75		

REGISTERED GEOLOGIST — DATE 6-24-08

WILLIAM T. McCORMICK III, No. 1611, Exp. 11-30-10, CERTIFIED ENGINEERING GEOLOGIST, STATE OF CALIFORNIA

PLANS APPROVAL DATE

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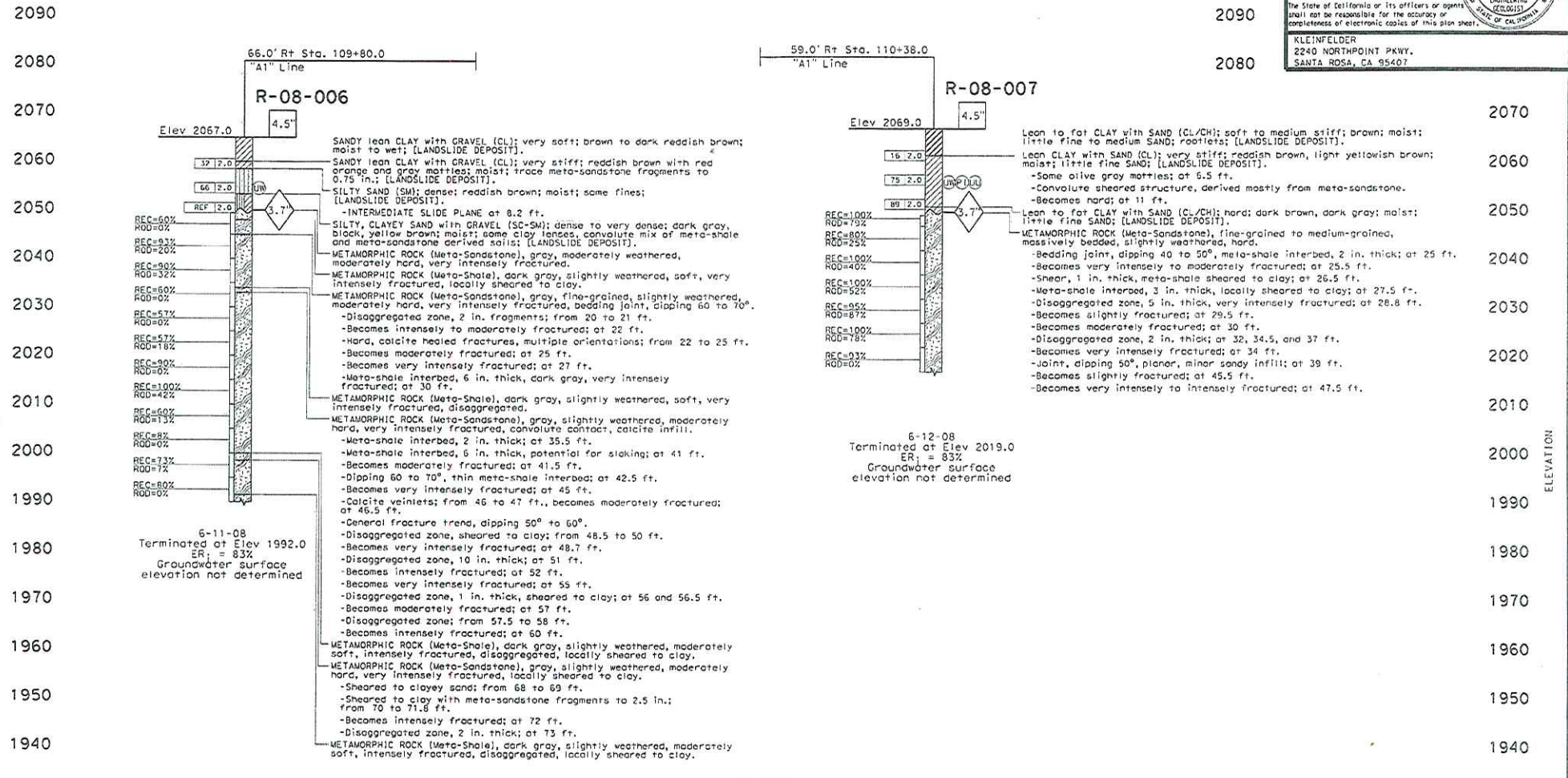
KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407



PROFILE
HOR. 1"=10'
VER. 1"=10'

DESIGN OVERSIGHT ENGINEER:	SIGN OFF DATE:		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION		BRIDGE NO. — RETAINING WALL @ PM 7.75
FUNCTIONAL SUPERVISOR	DRAWN BY: A. Sanchez	FIELD INVESTIGATION BY:		PROJECT ENGINEER	POST MILES 7.75 — LOG OF TEST BORINGS 8 of 11
NAME:	CHECKED BY: W. McCormick, C. Goltein	E. Jonnson June 2008			
DGS CIVIL LOG OF TEST BORINGS SHEET	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3		CU 03247 EA 476201	DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES — SHEET OF

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

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
01	Men	253	7.75		

REGISTERED GEOLOGIST DATE 9-24-08

PLANS APPROVAL DATE

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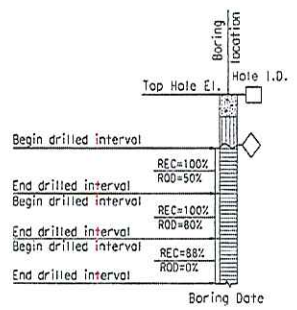
REGISTERED GEOLOGIST WILLIAM Y. MCCORMICK III No. 1673 Exp. 11-30-10 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407

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

$$REC = \frac{\sum \text{Length of the recovered core pieces (inches)}}{\text{Total length of core run (inches)}} \times 100\%$$

$$RQD = \frac{\sum \text{Length of intact core pieces} \geq 4"}{\text{Total length of core run (inches)}} \times 100\%$$



RELATIVE STRENGTH OF INTACT ROCK

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

BEDDING SPACING

Description	Thickness / Spacing
Massive	Greater than 10 ft
Very thickly bedded	3 to 10 ft
Thickly bedded	1 to 3 ft
Moderately bedded	3-5/8" to 1 ft
Thinly bedded	1-1/4" to 3-5/8"
Very thinly bedded	3/8" to 1-1/4"
Laminated	Less than 3/8"

LEGEND OF ROCK MATERIALS

- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

ROCK HARDNESS

Description	Criteria
Extremely Hard	Specimen cannot be scratched with a pocket knife or sharp pick; can only be chipped with repeated heavy hammer blows.
Very Hard	Specimen cannot be scratched with a pocket knife or sharp pick. Breaks with repeated heavy hammer blows.
Hard	Specimen can be scratched with a pocket knife or sharp pick with difficulty (heavy pressure). Heavy hammer blows required to break specimen.
Moderately Hard	Specimen can be scratched with pocket knife or sharp pick with light or moderate pressure. Core breaks with moderate hammer pressure.
Moderately Soft	Specimen can be grooved 1/6" deep with a pocket knife or sharp pick with moderate or heavy pressure. Breaks with light hammer blow or heavy manual pressure.
Soft	Specimen can be grooved or gouged easily by a pocket knife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
Very Soft	Specimen can be readily indented, grooved or gouged with fingernail, or carved with a pocket knife. Breaks with light manual pressure.

FRACTURE DENSITY

Description	Observed Fracture Density
Unfractured	No fractures.
Very slightly fractured	Lengths greater than 3 feet.
Slightly fractured	Lengths from 1 to 3 feet with few lengths less than 1 foot or greater than 3 feet.
Moderately fractured	Lengths mostly in 4" to 1 foot range with most lengths about 8"
Intensely fractured	Lengths average from 1 to 4" with scattered fragmented intervals with lengths less than 4"
Very intensely fractured	Mostly chips and fragments with a few scattered short core lengths.

Combination descriptors (such as "Very intensely to intensely fractured") are used where equal distribution of both fracture density characteristics is present over a significant interval or exposure, or where characteristics are "in between" the descriptor definitions. Only two adjacent descriptors may be combined.

WEATHERING DESCRIPTORS FOR INTACT ROCK

Description	Diagnostic features: Chemical Weathering-Discoloration and/or oxidation — Body of Rock	Diagnostic features: Chemical Weathering-Discoloration and/or oxidation — Fracture Surfaces	Diagnostic features: Mechanical Weathering-Grain boundary conditions (disaggregation) primarily for granitics and some coarse-grained sediments	Diagnostic features: Texture and Solutioning — Texture	Diagnostic features: Texture and Solutioning — 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, see grain boundary conditions.	All fracture surfaces are discolored or oxidized, surfaces friable.	Partial separation, rock is friable; in semiarid conditions granitics are disaggregated.	Texture altered by chemical disintegration (hydration, argillation).	Leaching of soluble minerals may be complete.	Dull sound when struck with hammer, usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures, or veinlets. Rock is significantly weakened.
Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay.		Complete separation of grain boundaries (disaggregated).	Resembles a soil, partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete.		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes."

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

DESIGN OVERSIGHT ENGINEER:	SIGN OFF DATE:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION		BRIDGE NO.	ROCK LEGEND
PREPARED BY	A. Sanchez		PROJECT ENGINEER	POST MILE 7.75	LOG OF TEST BORINGS 9 of 11
CHECKED BY	W. McCormick, C. Goitein				
05 LOTA ROCK LEGEND	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3	CU 03247 EA 476201		DISREGARD PRINTS BEARING EARLIER REVISION DATE	REVISION DATES

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
01	Men	253	7.75		

REGISTERED GEOLOGIST — DATE 24-08

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. 11-30-10 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

CEMENTATION

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

CONSISTENCY OF COHESIVE SOILS

Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

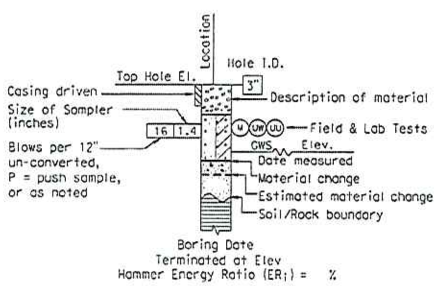
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
[ ]	O	Other

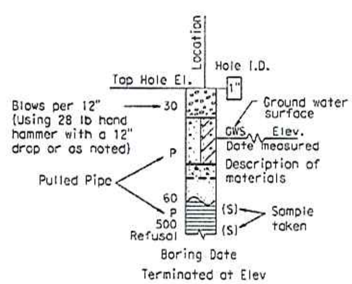
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

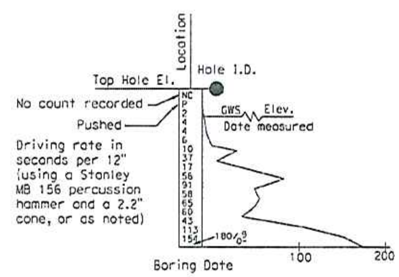
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be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



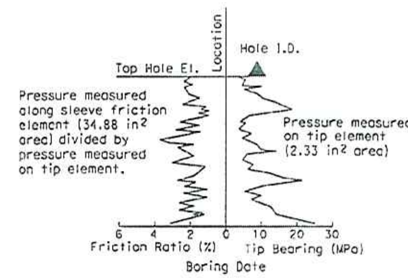
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

DESIGN OVERSIGHT ENGINEER:	SIGN OFF DATE:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	PROJECT ENGINEER	BRIDGE NO. / POST MILE 7.75	SOIL LEGEND
PREPARED BY	A. Sanchez				LOG OF TEST BORINGS 10 OF 11
CHECKED BY	W. McCormick, C. Goitein				

GS LOTB SOIL LEGEND — ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 — CU 03247 EA 476201 — DISREGARD PRINTS BEARING EARLIER REVISION DATES

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

GROUP SYMBOLS AND NAMES

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

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

FIELD AND LABORATORY TESTING

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

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
01	Men	253	7.75		

REGISTERED GEOLOGIST — DATE 24-08

REGISTERED GEOLOGIST WILLIAM V. MCCORMICK III No. 1673 EXP. 11-30-10 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

PLANS APPROVAL DATE

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KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

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

PERCENT OR PROPORTION OF SOILS

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

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

DESIGN OVERSIGHT ENGINEER: — SIGN OFF DATE:
PREPARED BY: A. Sanchez
CHECKED BY: W. McCormick, C. Goitein

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

BRIDGE NO.

POST MILE 7.75

SOIL LEGEND
LOG OF TEST BORINGS 11 of 11

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 03247
EA 476201

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET OF

USERNAME => $USER

DATE PLOTTED => $TIME

KLEINFELDER
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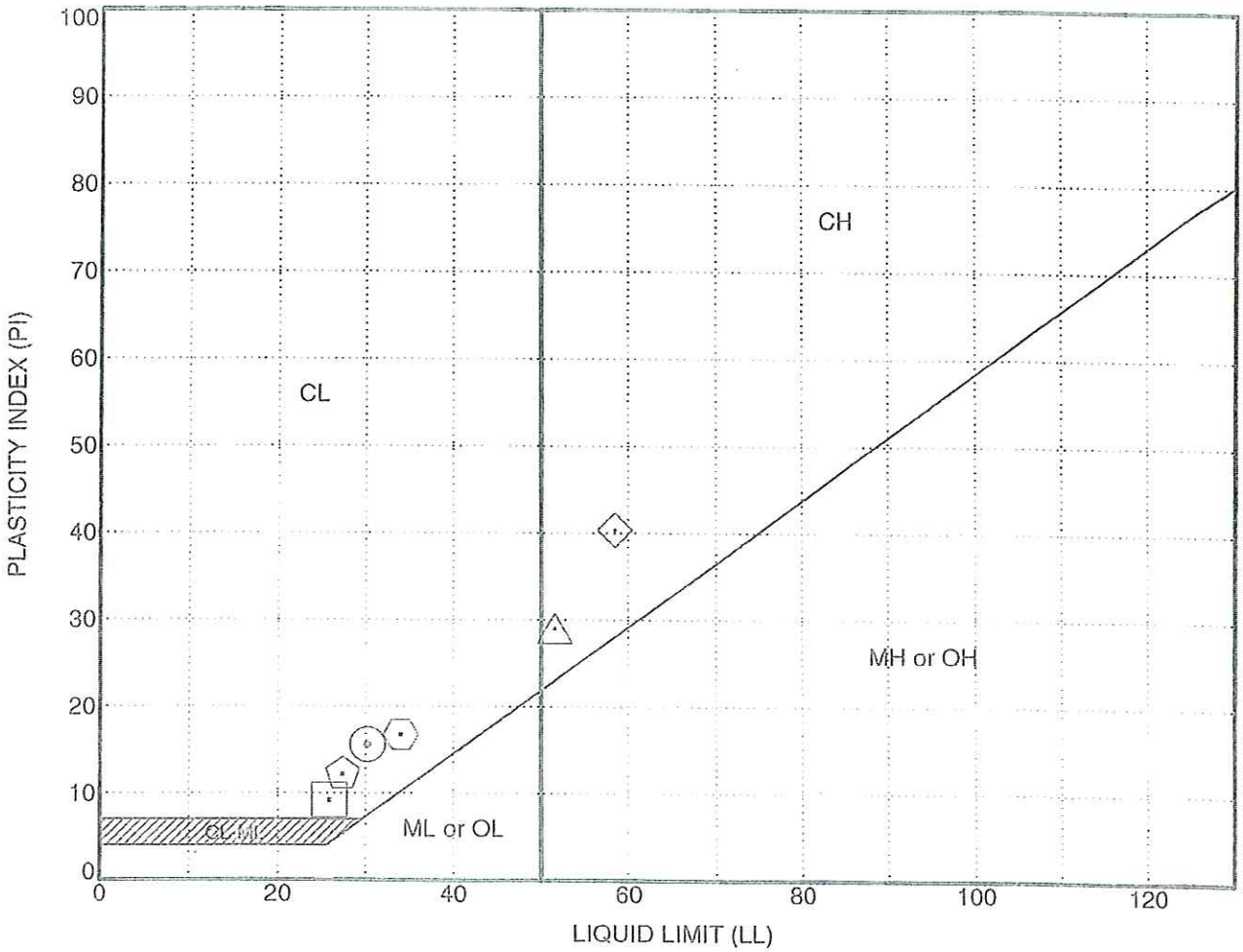
APPENDIX B

Highway 253 PM 7.75
Humboldt County, CA
EA # 01-476201

Laboratory Summary Sheet

Soil/Rock Type	Boring	Depth (ft)	TXUU (tsf)	TXUU (psf)	Confining Pressure (psf)	UC (psf)	Dry density (pcf)	Moisture content (%)	Total density (pcf)	PI	LL	-200	Other
LANDSLIDE (CH)	R08-005	1								40	58		
LANDSLIDE (CH)	R08-004	4.5								29	52		
LANDSLIDE (CL/CH)	R08-003	5.5					96	28.1	123				
LANDSLIDE (CL)	R08-005	5.5								17	34	69	
LANDSLIDE (CL)	R08-005	6	0.6	1281	1498		119	15.5	137				
LANDSLIDE (CL)	R08-005	6.5											CR
LANDSLIDE (CL)	R08-008	6.5	1.4	2868	850		124	12.5	140	19	34		
LANDSLIDE (CL)	R08-008	7.5										57	
LANDSLIDE (CL)	R08-005	8.5										56	
LANDSLIDE (CL/CH)	R08-003	10.5	0.4	893	1454		93	30.9	122				
LANDSLIDE (SM)	R08-006	10.5					128	11.3	142				
LANDSLIDE (SC-SM)	R08-004	10					121	14.3	138				
LANDSLIDE (CL)	R08-007	11	2.0	3952	1555		125	10	138	12	27		
COLLUVIUM (SC)	R08-002	3										23	
COLLUVIUM (CL)	R08-001	3.5								15	30	58	
COLLUVIUM (SC)	R08-001	5.5								9	26	46	
COLLUVIUM (SC)	R08-001	6					115	14.7	132				
COLLUVIUM (GC)	R08-001	9.3										23	
META-SHALE	R08-001	21											CR
META-SHALE	R08-005	25.5										43	
META-SHALE	R08-001	26	2.6	5167	3701		126	13.2	143				
META-SHALE	R08-001	31										83	
META-SHALE	R08-005	35										56	
META-SHALE	R08-004	38.5										56	
META-SHALE	R08-001	41					128	11.7	143				
META-SHALE	R08-001	46	2.5	5002	6394		132	9.9	145				
META-SANDSTONE	R08-002	10										41	
META-SANDSTONE	R08-002	10.5	1.2	2411	1397		130	9.6	142				
META-SANDSTONE	R08-005	10.5	1.7	3429	1454		132	8.2	143				
META-SANDSTONE	R08-002	27				357034	160	0.7	161				

TXUU Triaxial Unconsolidated Undrained Strength
UC Unconfined Compressive Strength
PI Plasticity Index
LL Liquid Limit
-200 Percent Passing 200 Sieve
CR Corrosivity
tsf tons per square foot
psf Pounds per square foot
BR Bedrock



SAMPLE SOURCE	CLASSIFICATION	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
⊙ R-08-001 @ 3.5'	Sandy Lean Clay with Gravel (CL)	30	15	15	58
⊡ R-08-001 @ 5.5'	Clayey Sand (SC)	26	17	9	46
△ R-08-004 @ 4.5'	Sandy Fat Clay (CH)	52	23	29	
◈ R-08-005 @ 1.0'	Fat Clay with Sand (CH)	58	18	40	
⊙ R-08-005 @ 5.5'	Sandy Lean Clay (CL)	34	17	17	69
⊙ R-08-007 @ 11.0'	Lean Clay with Sand (CL)	27	15	12	

KLEINFELDER
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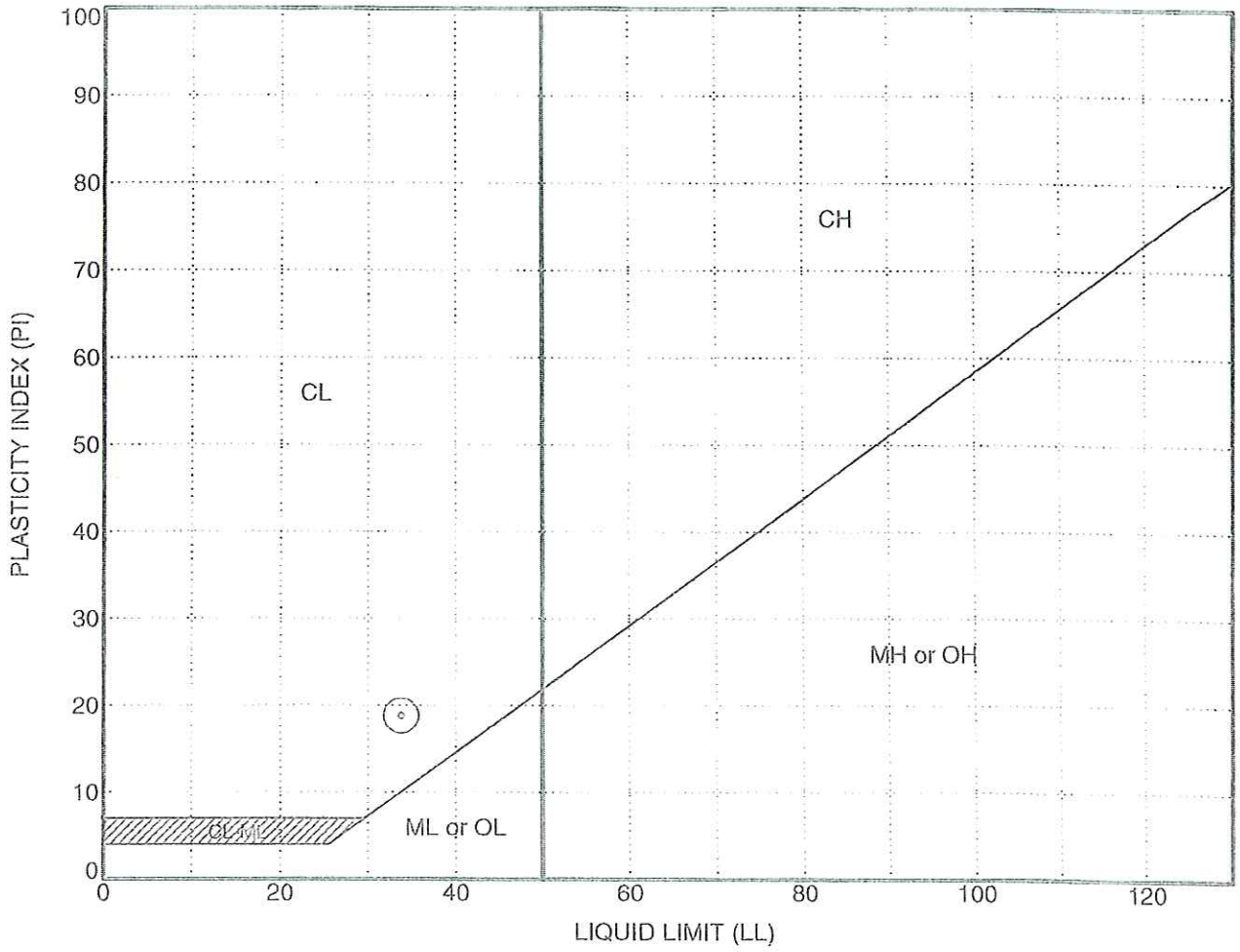
PROJECT NUMBER 93276 DATE 12/22/2009

ATTERBERG LIMITS (ASTM D4318)

EA 01-476201
HIGHWAY 253 P.M. 7.75
MENDOCINO, CALIFORNIA

PLATE B-1



SAMPLE SOURCE	CLASSIFICATION	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
⊙ R-08-008 @ 6.5'	Sandy Lean Clay (CL)	34	15	19	

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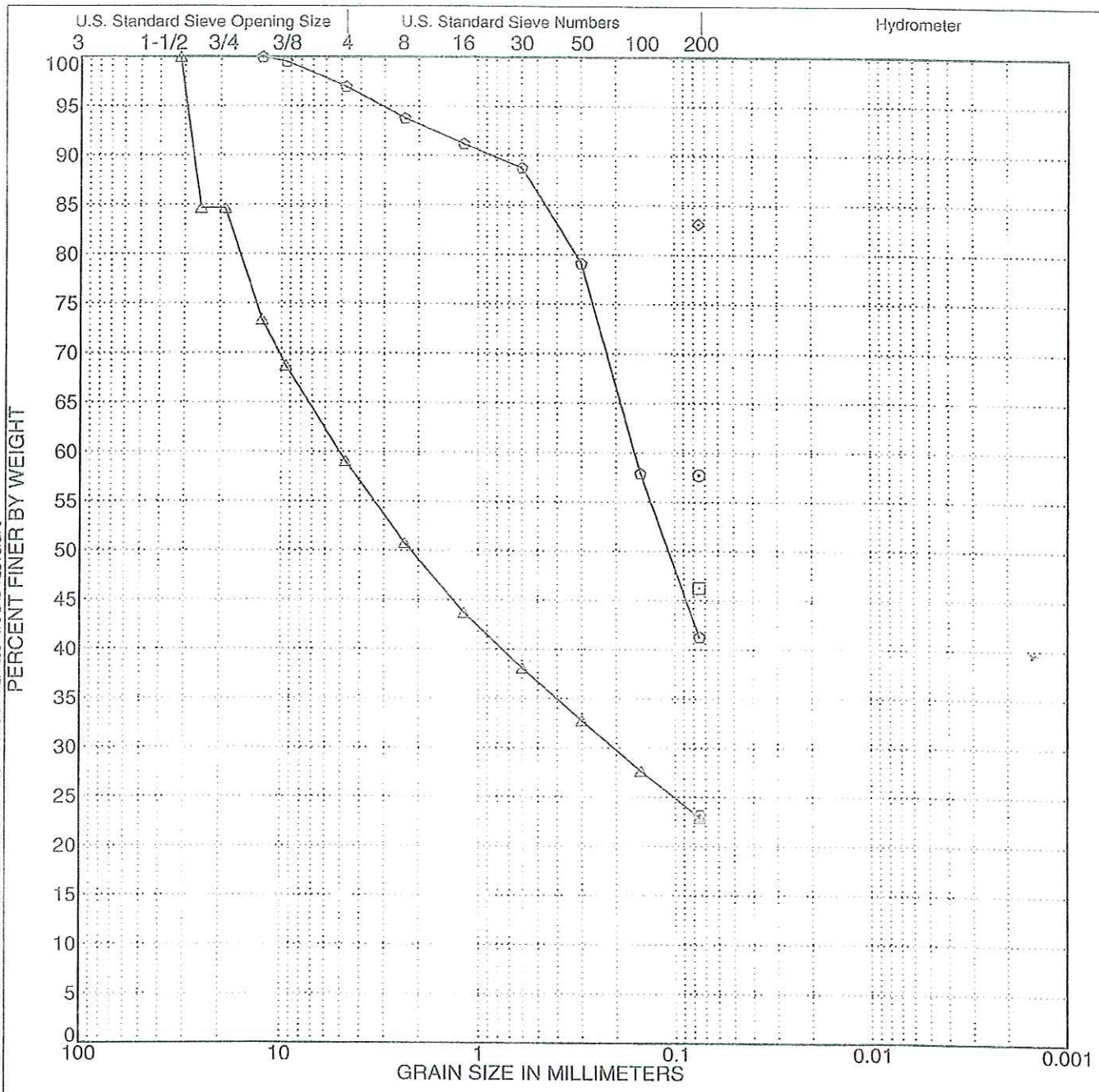
PROJECT NUMBER 93276 DATE 12/22/2009

ATTERBERG LIMITS (ASTM D4318)

EA 01-476201
HIGHWAY 253 P.M. 7.75
MENDOCINO, CALIFORNIA

PLATE
B-2



Cobbles	GRAVEL		SAND			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE		

SYMBOL	SAMPLE SOURCE	CLASSIFICATION
⊙	R-08-001 @ 3.5'	Sandy Lean Clay with Gravel (CL)
⊡	R-08-001 @ 5.5'	Clayey Sand (SC)
△	R-08-001 @ 9.3'	Clayey Gravel with Sand (GC)
◇	R-08-001 @ 31.0'	Meta-Shale (Clay with Sand)
⊙	R-08-002 @ 3.0'	Clayey Sand (SC)
⬠	R-08-002 @ 10.0'	Meta-Sandstone (Clayey Sand)

KLEINFELDER
Bright People. Right Solutions.

PROJECT NUMBER 93276 DATE 12/22/2009

PARTICLE SIZE ANALYSIS (ASTM C136)

EA 01-476201
HIGHWAY 253 P.M. 7.75
MENDOCINO, CALIFORNIA

PLATE
B-3

Data Template:
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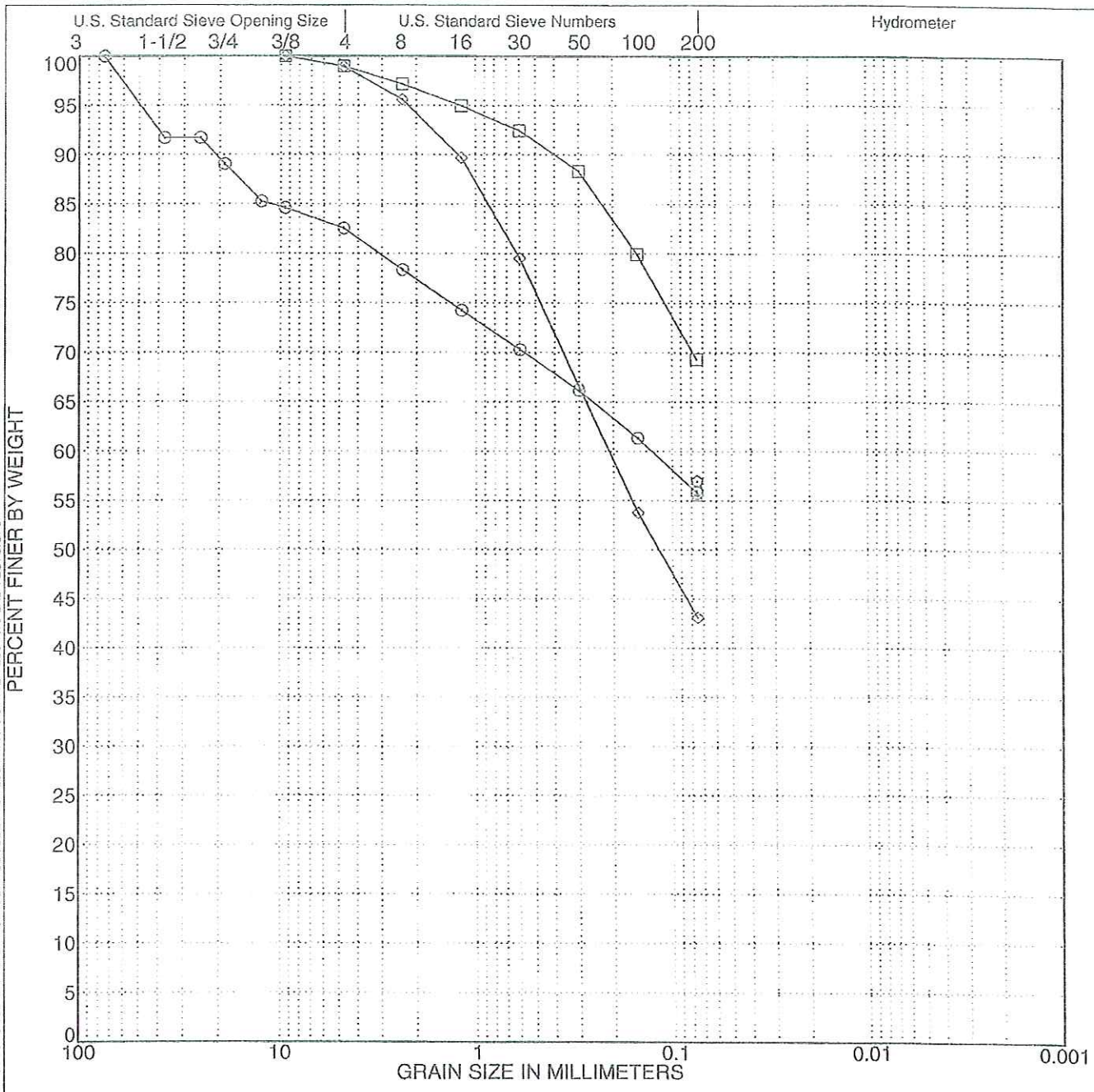

Cobbles	GRAVEL		SAND			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE		

SYMBOL	SAMPLE SOURCE	CLASSIFICATION
⊙	R-08-004 @ 38.5'	Meta-Shale (Sandy lean Clay with Gravel)
⊡	R-08-005 @ 5.5'	Sandy Lean Clay (CL)
△	R-08-005 @ 8.5'	Sandy Lean Clay (CL)
◇	R-08-005 @ 25.5'	Meta-Shale (Clayey Sand)
⊙	R-08-005 @ 35.0'	Meta-Shale (Sandy Clay)
⬠	R-08-008 @ 7.5'	Sandy Lean Clay (CL)

KLEINFELDER
Bright People. Right Solutions.

PROJECT NUMBER 93276 DATE 12/22/2009

PARTICLE SIZE ANALYSIS (ASTM C136)

EA 01-476201
HIGHWAY 253 P.M. 7.75
MENDOCINO, CALIFORNIA

PLATE
B-4

Data Template:
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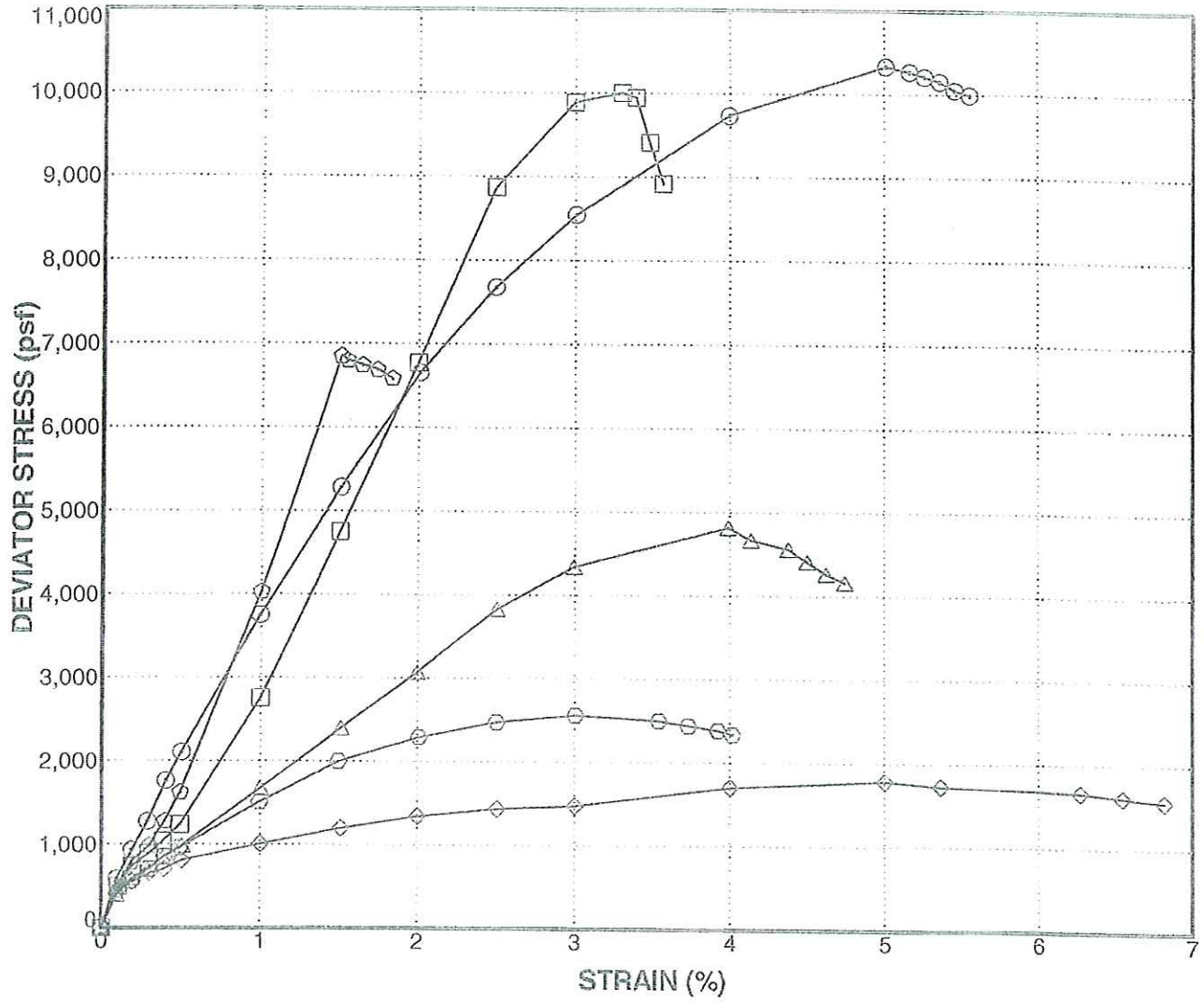


Sample Source	Classification	Type of Test	Confinement Pressure (psf)	Shear Strength (psf)	Strain (%)	Dry Density (pcf)	Moisture Content (%)
⊙ R-08-001 @ 26.0'	Meta-Shale	TXUU	3701	5167	5	126	13.2
⊡ R-08-001 @ 46.0'	Meta-Shale	TXUU	6394	5002	3	132	9.9
△ R-08-002 @ 10.5'	Meta-Sandstone (Clayey Sand)	TXUU	1397	2411	4	130	9.6
◇ R-08-003 @ 10.5'	Lean to Fat Clay (CL/CH)	TXUU	1454	893	5	93	30.9
⊙ R-08-005 @ 6.0'	Sandy Lean Clay (CL)	TXUU	1498	1281	3	119	15.5
⬠ R-08-005 @ 10.5'	Meta-Sandstone (Clayey Sand)	TXUU	1454	3429	2	132	8.2

UC = Unconfined Compression

TX/UU = Unconsolidated Undrained Triaxial

KLEINFELDER
Bright People. Right Solutions.

PROJECT NUMBER 93276 DATE 12/22/2009

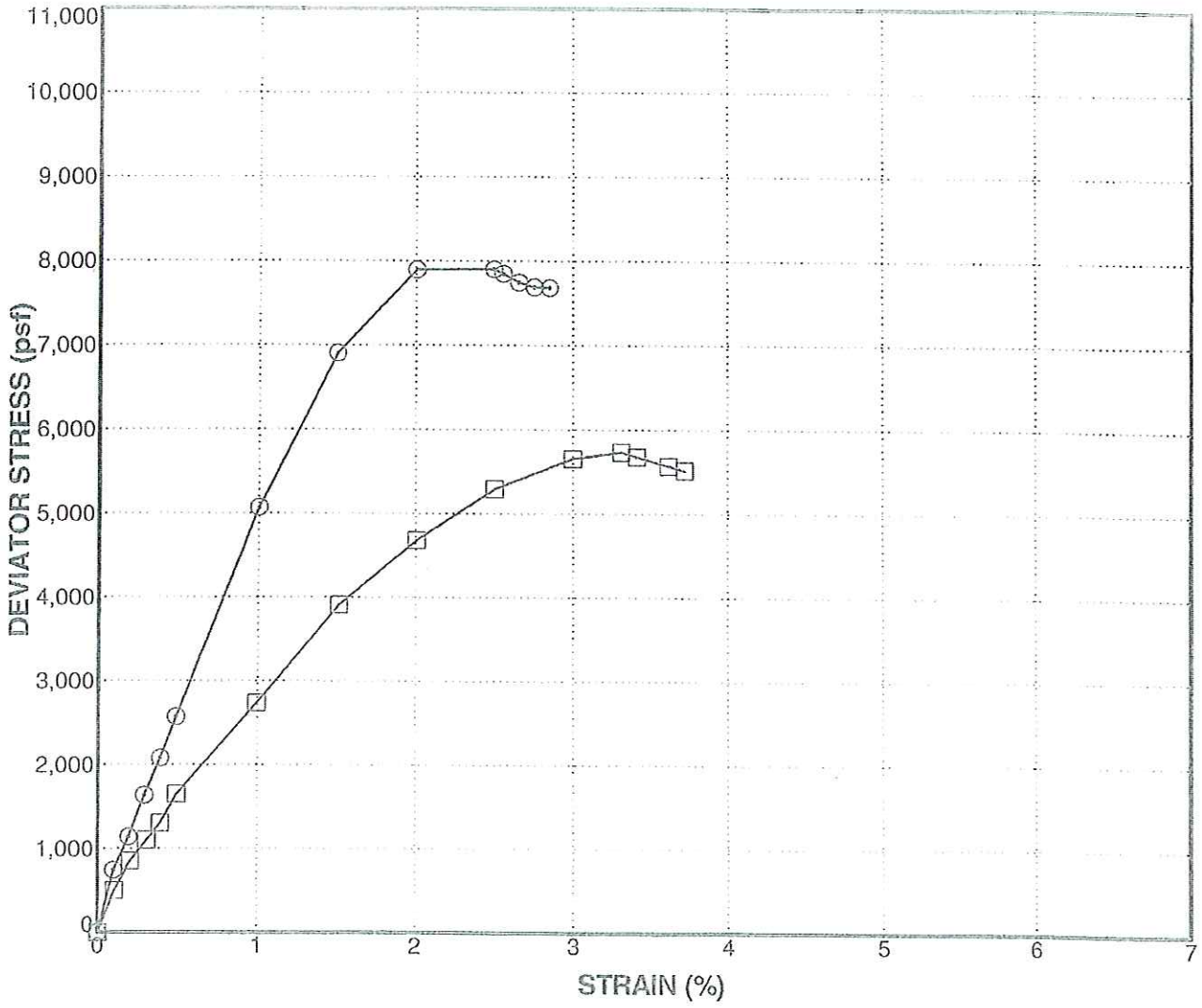
STRENGTH TEST DATA

EA 01-476201
HIGHWAY 253 P.M. 7.75
MENDOCINO, CALIFORNIA

PLATE

B-5

Data Template:
NEW TXUU - KLEINFELDER SANTA ROSA 5-8-08 .GDT - 12/22/09 15:17 - U:\NEW GINT PROJECTS\93276 CALTRANS MULTIPLE JOBS\MEN 253 PM 7.75\01-MEN-253-7.75 LAB TESTS.GPJ



Sample Source	Classification	Type of Test	Confinement Pressure (psf)	Shear Strength (psf)	Strain (%)	Dry Density (pcf)	Moisture Content (%)
⊙ R-08-007 @ 11.0'	Lean Clay with Sand (CL)	TXUU	1555	3952	2	125	10.0
⊡ R-08-008 @ 6.5'	Sandy Lean Clay (CL)	TXUU	850	2868	3	124	12.5

UC = Unconfined Compression

TX/UU = Unconsolidated Undrained Triaxial

KLEINFELDER
Bright People. Right Solutions.

PROJECT NUMBER 93276 DATE 12/22/2009

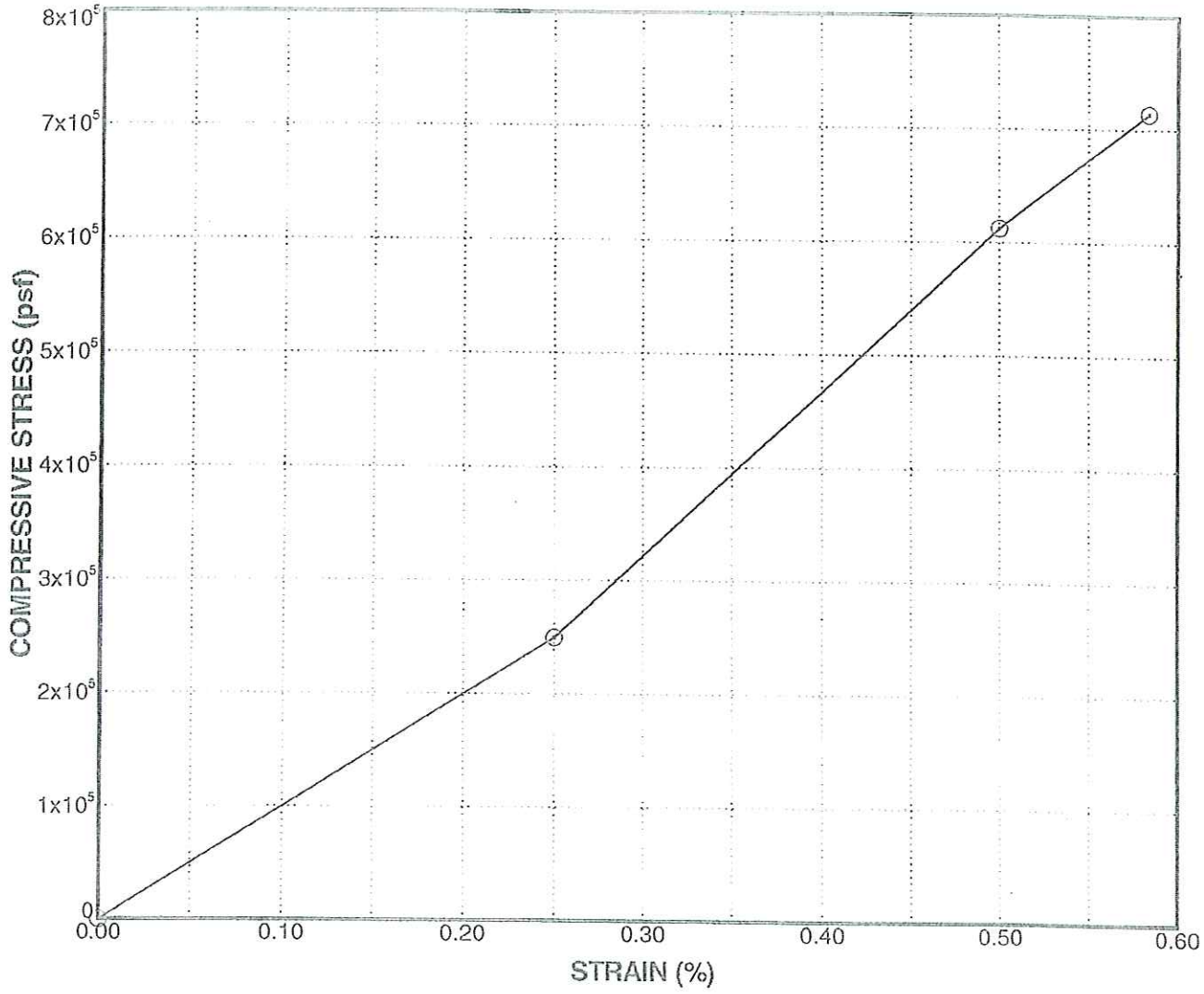
STRENGTH TEST DATA

EA 01-476201
HIGHWAY 253 P.M. 7.75
MENDOCINO, CALIFORNIA

PLATE

B-6

Data Template:
NEW TXUU - KLEINFELDER SANTA ROSA 5-8-08 .GDT - 12/22/09 15:17 - U:\NEW GINT PROJECTS\93276 CALTRANS MULTIPLE JOBS\MEN 253 PM 7.75\01-MEN-253-7.75 LAB TESTS.GPJ



Sample Source	Classification	Type of Test	Confinement Pressure (psf)	Shear Strength (psf)	Strain (%)	Dry Density (pcf)	Moisture Content (%)
⊙ R-08-002 @ 27.0'	Meta-Sandstone	UC	0	357034	1	160	0.7

UC = Unconfined Compression

TX/UU = Unconsolidated Undrained Triaxial

KLEINFELDER
Bright People. Right Solutions.

PROJECT NUMBER 93276 DATE 12/22/2009

STRENGTH TEST DATA

EA 01-476201
HIGHWAY 253 P.M. 7.75
MENDOCINO, CALIFORNIA

PLATE

B-7

Data Template:
NEW UC - KLEINFELDER SANTA ROSA 5-6-08 .GDT - 12/22/09 15:18 - U:\NEW GINT PROJECTS\93276 CALTRANS MULTIPLE JOBS\MEN 253 PM 7.75\01-MEN-253-7.75 LAB TESTS.GPJ

AP Engineering & Testing, Inc.

CORROSION TEST RESULTS

Client Name: Kleinfelder
Project Name: MEN253PM7.75
Project No.: 93276
Caltrans EA#: 01-476201

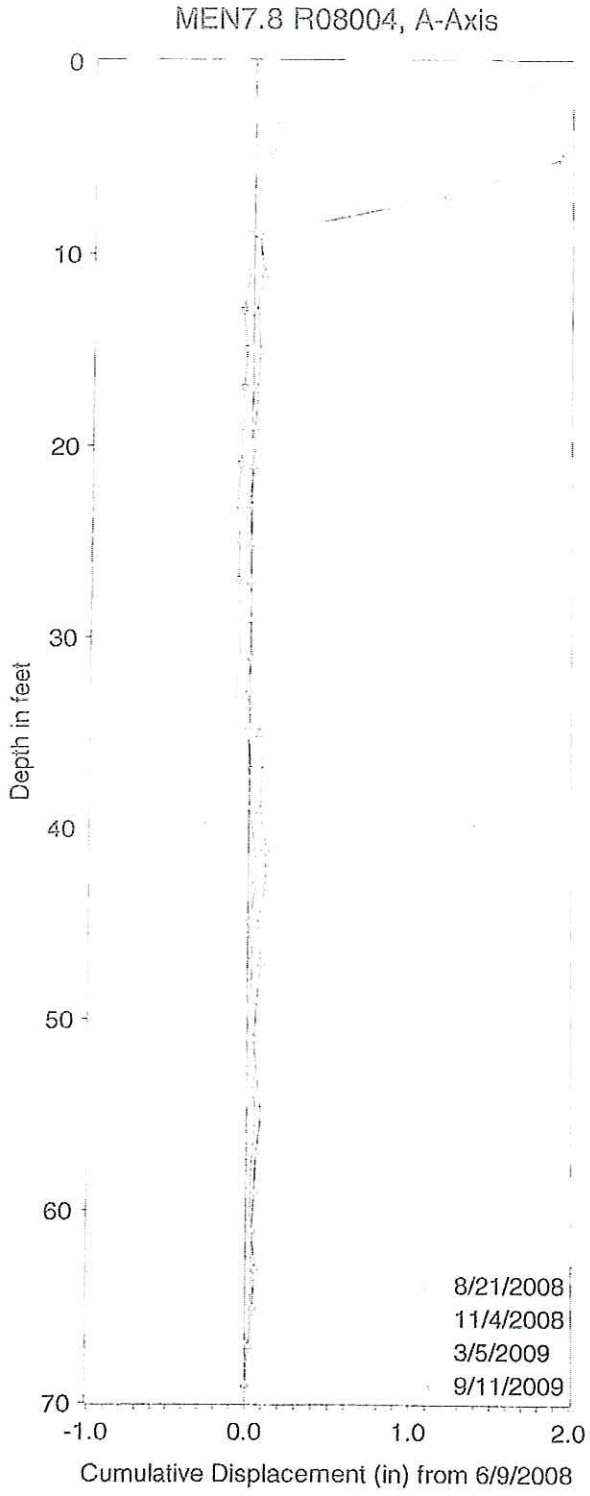
AP Job No.: 28-0758
Date 07/31/08

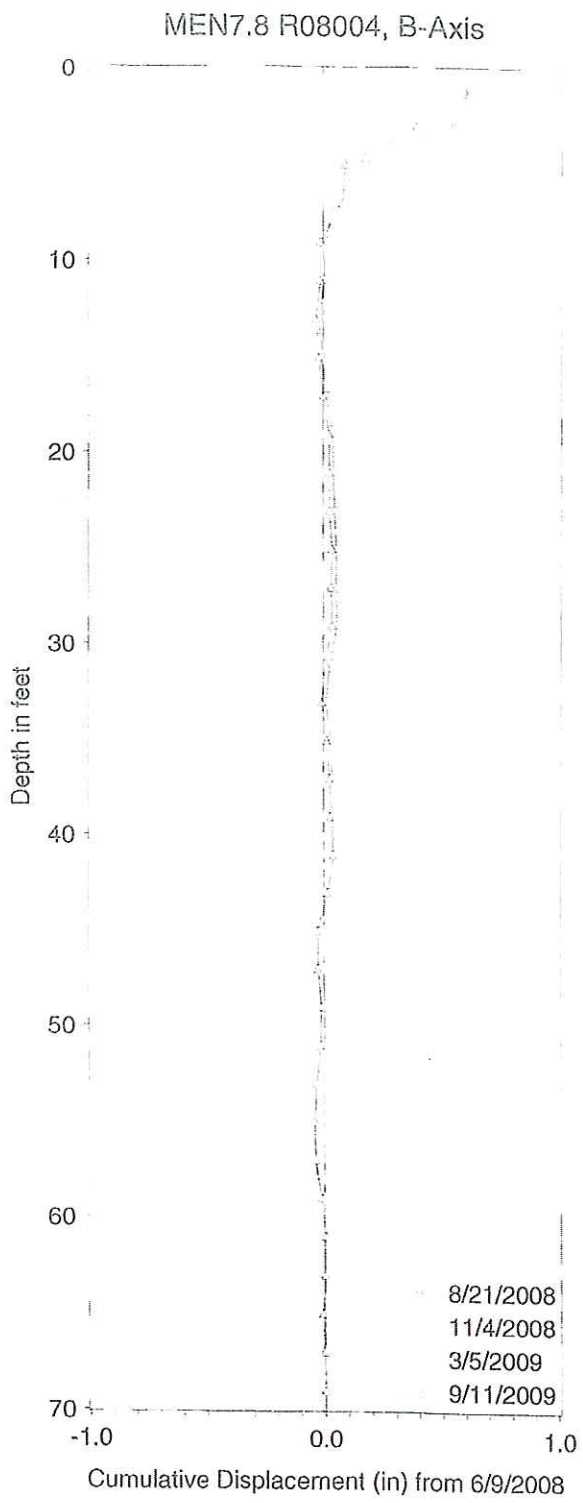
Sample ID.	Boring No.	Depth (ft)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
R-08-005	Core-6.5	6.5	CL	1700	6.8	7	145
R-08-001	Core-21.5	21.5	CL	820	7.1	298	134

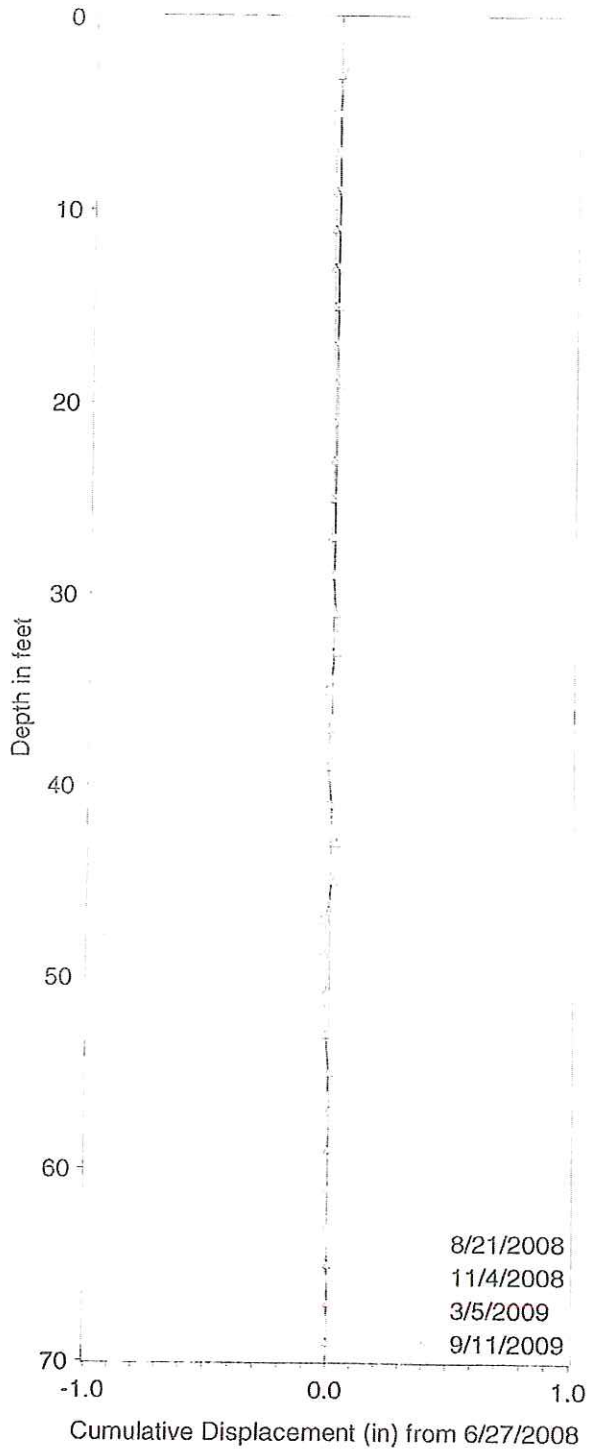
NOTES: Resistivity Test and pH: California Test Methods 532 and 643
Sulfate Content : California Test Method 417
Chloride Content : California Test Method 422
ND = Not Detectable
NA = Not Sufficient Sample
NR = Not Requested

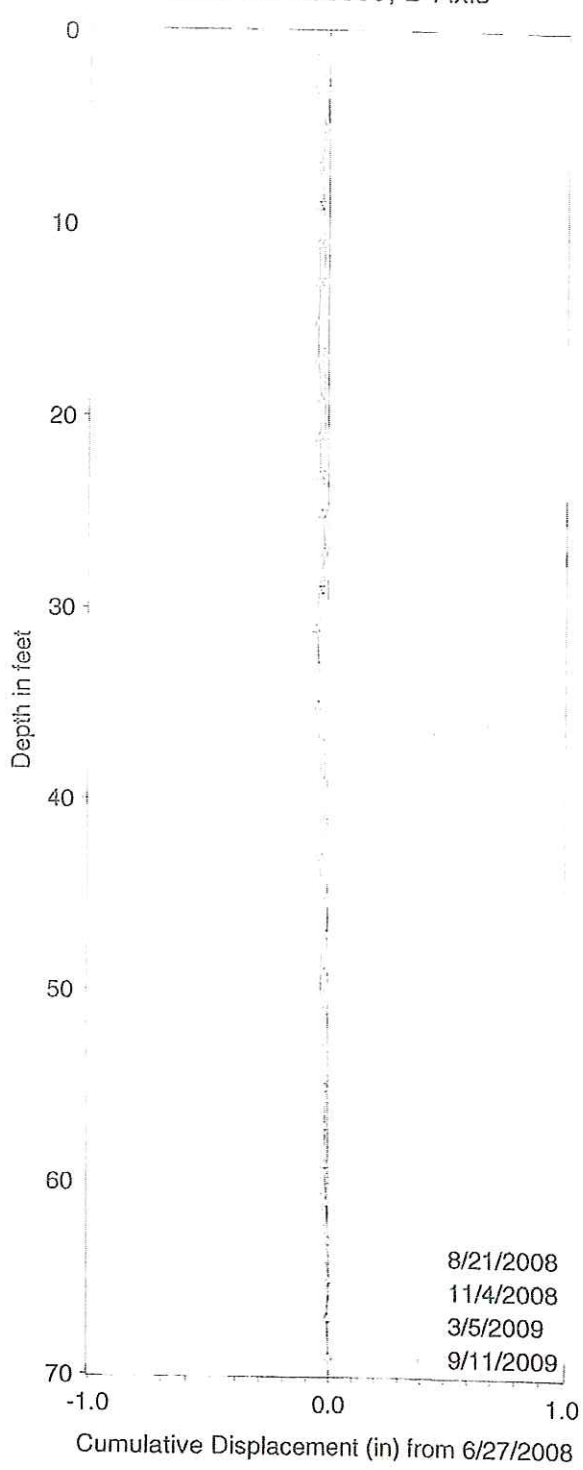
KLEINFELDER
Bright People. Right Solutions.

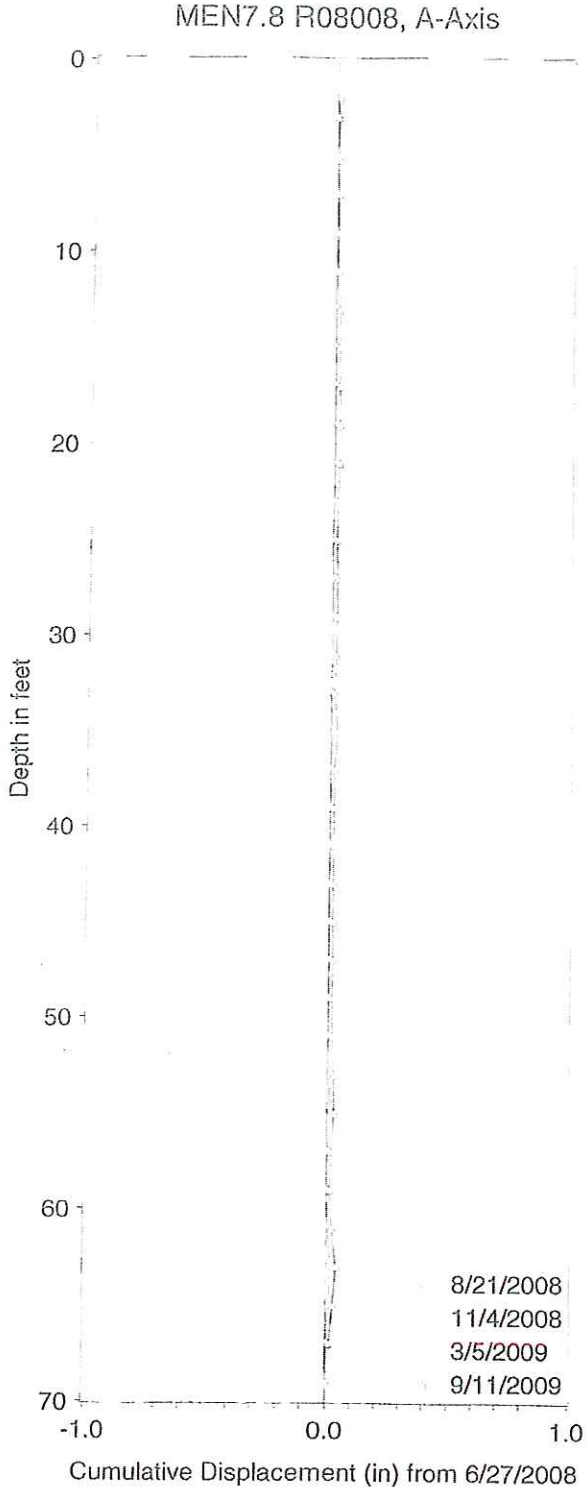
APPENDIX C


MEN7.8 R08004, A-Axis
0
10
20
30
40
50
60
70
Depth in feet
-1.0
0.0
1.0
2.0
Cumulative Displacement (in) from 6/9/2008
8/21/2008
11/4/2008
3/5/2009
9/11/2009


MEN7.8 R08004, B-Axis
0
10
20
30
40
50
60
70
Depth in feet
-1.0
0.0
1.0
Cumulative Displacement (in) from 6/9/2008
8/21/2008
11/4/2008
3/5/2009
9/11/2009


MEN7.8 R08005, A-Axis
0
10
20
30
40
50
60
70
Depth in feet
-1.0
0.0
1.0
Cumulative Displacement (in) from 6/27/2008
8/21/2008
11/4/2008
3/5/2009
9/11/2009


MEN7.8 R08005, B-Axis
0
10
20
30
40
50
60
70
Depth in feet
-1.0
0.0
1.0
Cumulative Displacement (in) from 6/27/2008
8/21/2008
11/4/2008
3/5/2009
9/11/2009


MEN7.8 R08008, A-Axis
0
10
20
30
40
50
60
70
Depth in feet
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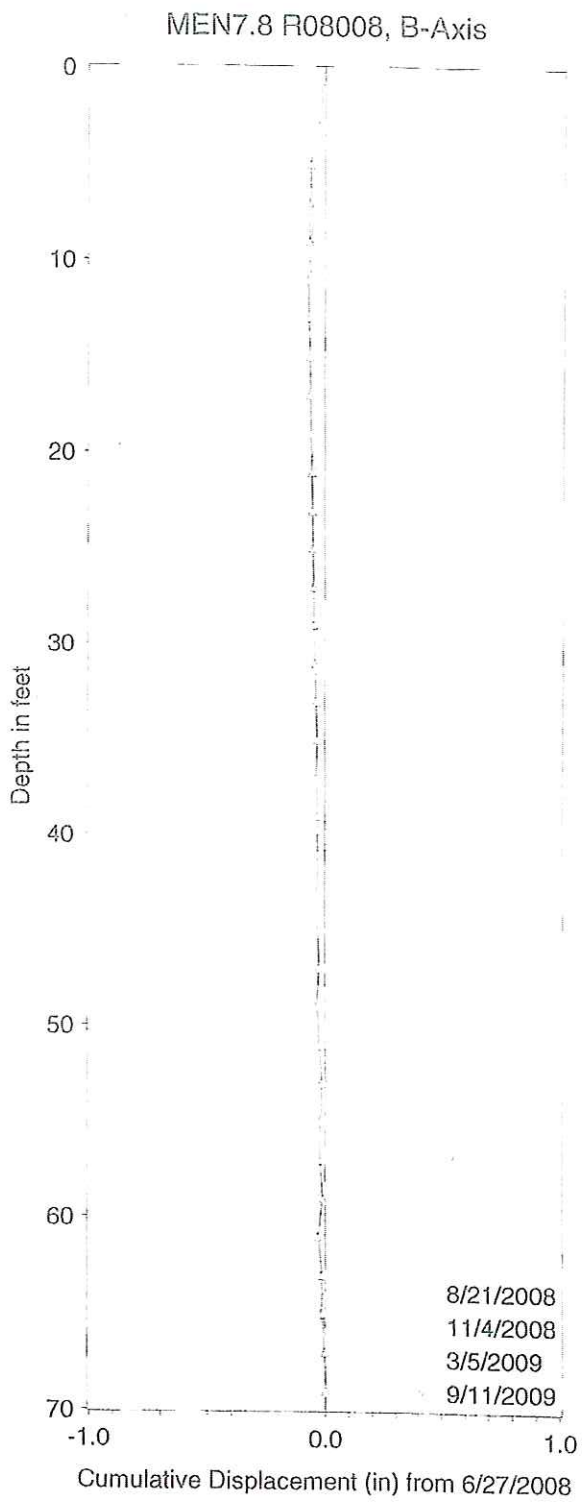
0.0
1.0
Cumulative Displacement (in) from 6/27/2008
8/21/2008
11/4/2008
3/5/2009
9/11/2009


MEN7.8 R08008, B-Axis
0
10
20
30
40
50
60
70
Depth in feet
-1.0
0.0
1.0
Cumulative Displacement (in) from 6/27/2008
8/21/2008
11/4/2008
3/5/2009
9/11/2009

MATERIALS INFORMATION

FOUNDATION REPORT

Foundation Report Addendum for Bridge No. 10E0023

State of California
Department of Transportation

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: JEFF SIMS
Design Branch 1
Office of Bridge Design North

Date: December 15, 2010

File: 01-MEN-253 PM 7.75
EA: 01-476201
Bridge No. 10E0023

Attn: Kyoung-Hyeog Lee

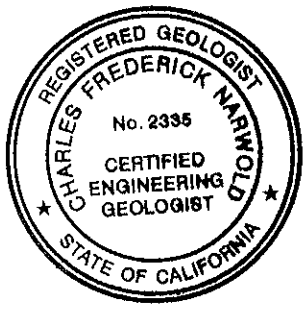
From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN NORTH
BRANCH B

Subject: Foundation Report Addendum

This Foundation Report Addendum provides revised recommendations for the above referenced structure. The recommendations contained herein supersede the recommendations in the Foundation Report prepared by Kleinfelder dated April 29, 2010. The Foundation Report states, "If required, backfill behind the wall should be Class 1, Type B Permeable Material…" We do not recommend placing Class 1, Type B permeable material behind the timber lagging. Filter fabric should be placed on the backside of the wall between the timber lagging and the native material and fill.

If you have any questions or require further assistance, please call me at (707) 445-6036.

CHARLIE NARWOLD, CEG #2335
Senior Engineering Geologist
Office of Geotechnical Design - North
Branch B



c: OGDN Project Folder

State of California
Department of Transportation

Business, Transportation and Housing Agency

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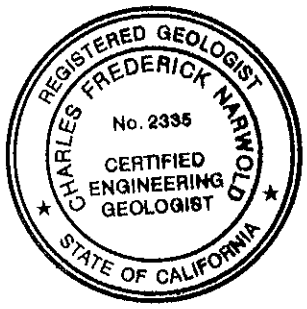
Senior Engineering Geologist
Office of Geotechnical Design - North
Branch B



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