INFORMATION HANDOUT

For Contract No. 01-0B27U4
At 01-DN-101-14.9/15.3

Identified by
Project ID 0115000111

PERMITS

County of Del Norte

Grading Permit Application

MATERIALS INFORMATION

South Last Chance Wall

Foundation Report for the Soldier Pile Ground Anchor Wall at DN 101 PM 15.0

Last Chance Wall

Foundation Report for the Soil Nail Wall at DN 101 PM 15.15

California Department of Industrial Relations

Division of Occupational Safety & Health \ Mining & Tunneling Unit \ Underground Classification

01-0B27U4
01-Del Norte-101-14.9/15.3
Project ID 0115000111

COUNTY OF DEL NORTE
Grading Permit

Engineering Division
Grading Permit Application

981 H Street, Suite 110
Crescent City, CA 95531
707-464-7229

Today's Date:	1-26-15		
APN:	Highway 101 R/W		
Property Owner's Name(s):	California Department of Transportation (and California State Parks, see cover letter)		
Site Address:	US Highway 101 Post Mile 14.9 to 15.15		
Mailing Address:	PO Box 3700		
	Eureka, CA 95502		
Landline/Cell/Fax:			
Applicant/Agent's Name:	Talitha Hodgson, Caltrans Project Manager		
Mailing Address:	P.O. Box 3700		
	Eureka, CA 95502		
Landline/Cell/Fax:	707.441.2097		
Brief Project Description:	Roadway Storm Damage Repair: construct soil nail wall and soldier pile wall		

Vegetation Removal:	■ Yes	☐ No	
Tree Removal [1]:	■ Yes	☐ No	[1] A form of Vegetation Removal.
Cut/Fill:	■ Structural	☐ Non-Structural	☐ Neither
Depth of Cut:	☐ Less than 5 ft	■ 5 ft or Greater	
Slope of Cut:	☐ 2:1 (x:y) or Less	■ Greater than 2:1 (x:y)	
Depth of Fill:	☐ Less than 1 ft	☐ 1ft to Less than 3 ft	■ 3 ft or Greater
Slope of Fill:	☐ 5:1 (x:y) or Less	■ Greater than 5:1 (x:y)	
Volume of Material:	☐ Less than 500 cy	■ 500 cy or Greater	
Surface Area to be Graded:	19,000	■ sf	☐ acres
Supporting Materials:	■ Plot Plan	■ Assessor's Parcel Map	☐ Deed
	☐ Biological Assessment	☐ Wetland Delineation	■ Detailed Project Description

* Plot Plan: A scaled drawing showing all property lines, grading areas, roads, structures, ditches, culverts, swales, fences, septic tanks, leach fields, etc.
* Assessor's Parcel Map: A copy on 11" x 17" paper or as provided to the applicant by the Del Norte County Assessor's Office.
* Deed: A copy of the recorded document available to the applicant in the Del Norte County Recorder's Office.

I declare under penalty of perjury that this application and all the foregoing are true and correct.

Property Owner or Applicant/Agent

1/26/15
Date

PERMIT #: GP 2015-03C

PLANNING DIVISION:

Zoning: ☑ Consistent ☐ Inconsistent

* Provide Zoning designation in this area of this form if it is not located on another form in the file.

General Plan Land Use: ☑ Consistent ☐ Inconsistent

* Provide General Plan Land Use designation in this area of this form if it is not located on another form in the file.

Coastal Zone: ☑ Yes ☐ No

CCC Coastal Zone Map: ☐ Local Jurisdiction ☑ Local Appeals Jurisdiction ☐ State Jurisdiction

CEQA Exemption: ☑ Yes ☐ No

Division Comments:

Recommendation: ☑ Project with conditions is consistent with the Codes/Policies of the Planning Division.

☐ Project as proposed is inconsistent with Codes/Policies of the Planning Division.

ENGINEERING DIVISION:

Division Comments:

Recommendation: ☑ Project with conditions is consistent with the Codes/Policies of the Engineering Division.

☐ Project as proposed is inconsistent with Codes/Policies of the Engineering Division.

DECISIONS:

Permit Approval Process: ☑ Planning Commission ☐ Over the Counter ☐ Not Required

Final Permit Status: ☑ Approved Locally: 4/1/15 ☐ Denied: ☐ Withdrawn:

☐ Appealed to CCC: No ☐ Approved by CCC: ☐ Denied by CCC:

Engineering Division		Plannning Division	
Reviewer's Initials:	Date:	Reviewer's Initials:	Date:
KB	4/1/15	LH	7/20/15
	Receipt #:	Date:	Fee:
Engineering Division:			
Plan Check Fee:			
Inspection Fee:			
Issuance Fee:	330060	2/10/15	$380.00
Planning Division:			
CEQA Fee:			
Application Fee:			
Issued By:	Issuance Date:	Expiration Date:	Total Fee:
RB	8/6/15	8/6/17	$380.00

PERMIT #: GP 2015-03 C

Engineering Division
Grading Permit Conditions

981 H Street, Suite 110
Crescent City, CA 95531
707-464-7229

RECEIVED

JUL 29 2015

DN COUNTY BUILDING INSPECTION

Today's Date: July 20, 2015
Permit Number: GP2015-03C
Property Owner's Name: Caltrans
Applicant's Name: Caltrans – Steve Croteau
APN: US Highway 101 Right-of-Way
Site Address: US Highway 101 Right-of-Way

1) Development shall be pursued in a diligent manner and completed in a reasonable period of time. This project shall be completed within two years from the date of final approval (not the date of issuance). The applicant may request a permit extension from the County Engineer prior to the expiration of the permit. The County Engineer, at their discretion, may extend the permit if substantial progress has been made in an attempt to meet the above timelines;
2) Prior to the ~~issuance of the Grading Permit~~ start of work, the applicant shall submit a copy of the Water Pollution Control Plan prepared for the project to the Engineering Division for review and acceptance;
3) Prior to the issuance of the Grading Permit, the applicant shall submit a complete set of plans to the Engineering Division for review and acceptance;
4) All improvements shall be constructed per the approved plans;
5) It is the applicant's responsibility to determine if permits are required from additional agencies, to obtain said permits, and to provide the County with a copy said permits;
6) All activities associated with the project shall be completed in strict accord with the Minimization Measures listed in *Natural Environment Study 01-DN-101 PM 15.1 01-OB270* prepared by Caltrans and dated February 2014 and *Natural Environment Study 01-DN-101 PM 14.9-15.0 01-OC241* prepared by Caltrans and dated June 2014;
7) The applicant shall abide by the Best Management Practices listed in the *Visual Impact Assessment* prepared for each location; and
8) This entitlement is specifically conditioned on the applicant agreeing to indemnify and hold harmless the County of Del Norte, the Planning Commission of the County of Del Norte, the Board of Supervisors of the County of Del Norte, their officers, employees and agents against any and all claims arising out of the issuance of the entitlement and specifically against any expense arising from defending any legal action challenging the issuance of the entitlement, including but not limited to the value of time devoted to such defense by County officers, employees and agents and the amount of any judgment, including costs of suit and attorney fees, recovered against the County or any of its officers, employees or agent in such legal action. The County of Del Norte reserves the option to either undertake the defense of any such legal action or to tender such defense to the applicant. Should the County tender such defense to the applicant and the applicant fail or neglect to diligently defend such legal action, the County may consider such failure or neglect to be a material breach of this conditions and forthwith revoke this entitlement.

County

Initial

General Provisions:

- All work shall be complete before requesting a final inspection from the Engineering Division.
- If a re-inspection is required, an additional fee will be due prior to the issuance of the Certificate of Occupancy or the Certificate of Completion.
- Please contact the Engineering Division at 707-464-7229 to request an inspection or inquire about the permit conditions listed above.
- If this permit is for a governmental agency, then a representative of the governmental agency shall sign as the responsible party agreeing to satisfy the conditions of this permit. If the governmental agency chooses to hire a contractor, the contractor shall also sign this permit agreeing to adhere to these conditions.

The Property Owner, not a Contractor/Agent, shall sign for all Engineering Division permits and/or conditions on or associated with the property owner's private property.

Acceptance of Conditions: X _____ X _____
Property Owner Date

OR

A Contractor or Agency Representative, not an Agent, may sign for Engineering Division permits and/or conditions not associated with private property.

Acceptance of Conditions: _____ 7/28/15
Contractor or Agency Representative Date

Conditions Reviewed By: _____ 8/6/15
Engineering Division Date

Conditions Drafted By: ☒ JB ☒ RB ☐ MP ☐ EL ☐ MJD ☐ JD (Roads)
☐ TMc ☐ City ☒ Other: PC

01-0B27U4
01-Del Norte-101-14.9/15.3
Project ID 0115000111

SOUTH LAST CHANCE WALL

01-DN-101-PM 14.88/15.0

State of California
DEPARMENT OF TRANSPORTATION

California State Transportation Agency

M e m o r a n d u m

Serious drought.
Help Save Water!

To: JEFF SIMS

Division of Structure Design
Office of Bridge Design North/Central
Branch 1

Date: August 12, 2015

File: 01-DN-101-PM 14.88/15.0
EFIS ID: 0115000111
EA: 01-0B27U1
South Last Chance Grade Wall
Bridge No:01E0021

Attn: VADIM SHOSTAK

From: DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES – OGDN

Subject: Foundation Report for the Soldier Pile Ground Anchor Wall at DN 101 PM 15.0

1. INTRODUCTION

This Foundation Report summarizes the results of the geotechnical investigation and provides geotechnical recommendations for the proposed Solider Pile Ground Anchor (SPGA) wall on Route 101 at post mile (PM) 15.0 in Del Norte County, CA (Figure 1- Vicinity Map).

2. PROJECT DESCRIPTION

The 2011/2012 storm season destabilized the slope below the project location and caused the loss of the southbound shoulder. A 12-foot high temporary Soil Nail Wall was constructed in May 2012 to prevent further retreat and to stabilize the existing travelled way.

A SPGA wall is proposed at this location to restore the shoulder and maintain the stability of the existing travel way.

The proposed SPGA wall details are shown in Table 1.

Table 1- Description of the Proposed SPGA

BEGIN			END			LENGTH (ft)	DESIGN HEIGHT (ft)	
Sta.	Latitude	Longitude	Sta.	Latitude	Longitude		Min.	Max.
482+75.00	41°38'00.42"	-124°06'55.29"	486+10.82	41°38'03.65"	-124°06'56.84	335	10	16

The layout line of the SPGA wall is shown on Figure 2- Site Plan and Landslide Map.

3. SCOPE OF WORK

The recommendations contained in this report are based on a review of geotechnical and geologic literature, a subsurface investigation, field observations, laboratory testing of soil samples, and geotechnical calculations. The SPGA wall is not intended to stabilize the large landslide that extends beyond the Project Limits, but to restore the southbound shoulder. Subsurface conditions were evaluated only at the boring locations and may deviate elsewhere within the Project Limits. The elevations reported in this memorandum are with respect to Mean Sea Level (MSL).

4. PERTINENT REPORTS AND INVESTIGATIONS

<u>FHWA Publications</u>

1. Sabatini, P. J. et. al. 1999, “Geotechnical Engineering Circular No. 4 - Ground Anchors and Anchored Systems” FHWA Report No. FHWA-IF-99-015.

<u>Caltrans Reports</u>

1. Additional Investigation of Last Chance Grade Landslide (File 01-DN-101-KP 23.1/24.7 01-32470K) dated April 20, 1999
2. Wills, C. J., “Landslides in the Highway 101 corridor between Wilson Creek and Crescent City, Del Norte County, California,” California Geological Society, 2000
3. Caltrans Soil and Rock Logging, Classification, and Presentation Manual, 2010 Edition.
4. Caltrans Corrosion Guidelines Version 2.0, 11/2012
5. Memo to Designers 5-12 “Earth Retaining Systems Using Ground Anchors”, July 2012

<u>Other Publications</u>

6. Stark, Timothy D. et. al., “Drained Shear Strength Parameters for Analysis of Landslides” Journal of Geotechnical and Geoenvironmental Engineering ASCE May 2005
7. Kleinfelder,Foundation Report Retaining Wall #1 “Last Chance Grade” Minor Roadway Realignment (EA 01-324700) Del Norte County, California. November 2007

5. FIELD INVESTIGATION AND TESTING PROGRAM

Three vertical mud-rotary borings were drilled between February 11, 2014 and March 5, 2014 for the purpose of characterizing the subsurface conditions. The boreholes was advanced using a truck mounted Acker MPCA drill rig using a 94-mm HXB casing equipped with a diamond impregnated core bit. Soil and rock samples were logged in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual 2010 Edition. The boring information will be provided in the Log of Test Borings (LOTBs) in the Project Plans.

Slope Inclinometers (SIs) with 2.75– inch diameter casings were installed in all the borings and backfilled with coarse sand and sealed with bentonite. The lower 20 feet of the casing was perforated to permit monitoring of water levels within the casing. Inclinometer readings were obtained between March 2014 and September 2014.

A summary of the borings and the depth of movement are provided in Table 2. The SI data are included in Appendix A-Slope Inclinometer Data.

Table 2 - Summary of Geotechnical Borings

BORING I.D.	STATION AND OFFSET FROM "A" ALIGNMENT	DEPTH OF BORING (ft, bgs)	SURFACE ELEVATION (ft, MSL)	DEPTH TO BEDROCK[1] (ft, bgs)	BEDROCK ELEVATION[1] (ft, MSL)	DEPTH TO FAILURE SURFACE (ft, MSL)
RC-14-001	485+38.07' 9.73' LT	100	691	38.5	652.5	82.5
RC-14-002	486+4.4' 15.72' LT	105	694	65	629	62.5
RC-14-003	483+39.68' 8.85' LT	110	683	42.5	640.5	80

[1] Bedrock was identified as depth that required drilling using a diamond core bit.

6. SITE GEOLOGY AND SUBSURFACE CONDITIONS

6.1. Site Description

The project site is located along Highway 101 in a rural area bordered by a state park. At the project location Highway 101 is a two-lane conventional highway that traverses coastal mountainous terrain.

The 2011/2012 storm season destabilized the slope below the project location and caused the loss of the southbound shoulder. A 12-foot high temporary Soil Nail Wall was constructed in May 2012 to prevent further

retreat and to stabilize the existing travelled way. The As-Built Plans for the Soil Nail wall are included in Appendix B.

During the Spring of 2014, linear depressions developed in the travelled way, presumably due to the movement of the large landslide that exists at this location (Figure 2).

6.2. Site Geology

The project site is located within the 2.5 mile segment of Highway 101 between Wilson Creek and Crescent City known as Last Chance Grade. Last Chance Grade crosses several active deep bedrock slides on the western flank of a 1,000+ foot ridge adjacent to the Pacific Ocean (Figure 3-Project Geologic Map). The project is located at the end of the southern section of the Last Chance Grade slide (map unit Qlss- Figure 3) that extends between post miles 15.20 and 14.85 with a depth of movement measured at 260 feet near post mile 15.1.
Bedrock within the project site is composed of the “Broken Formation” unit of the Franciscan complex and is composed mainly of thickly bedded sandstone with siltstone and shale interbeds (Ref. 2). Landslides in the Broken Formation are mainly translational and tend to have large masses of rock that slide on narrow zones of weaknesses.

Historically the movement of the southern portion has been episodic and is assumed to be triggered by heavy rainfall.

6.3. Subsurface conditions

The borings drilled for this investigation encountered 4.5 to 5 feet of asphalt, which indicates the extent of settlement and maintenance required to maintain the profile at this location. This was corroborated by personal communication with the Crescent City Maintenance Supervisor Jamie Camden (October 8, 2014).

Decomposed rock encountered beneath the asphalt ranged in thickness between approximately 30 and 85 feet in borings RC-14-001 and RC-14-002. A 13-foot thick layer of fill was encountered in Borehole RC-13-003 between the asphalt and decomposed rock. The decomposed bedrock consists of Graywacke Sandstone.

Slope Inclinometer data from RC-14-001 identified the landslide failure surface at approximately 82.5 feet below ground surface (bgs) at the interface of the decomposed rock and the intensely fractured bedrock.

The movement recorded in the inclinometer in RC-14-002 shows compression between 15 to 62.5 feet bgs. Within this range the bedrock was decomposed to a medium dense Clayey Sand and Silty Sand.

The inclinometer at RC-14-003 recorded movement between 75 and 80 feet bgs within the bedrock decomposed to a dense, Well-graded Gravel with Clay and Sand.

Index tests were performed on soil samples from boreholes RC-14-001 and RC-14-002. The results are included in Appendix C - Laboratory Data. Testing was performed by the Sacramento Materials Laboratory.

6.4 Groundwater conditions

Four groundwater measurements were taken at the project site between March 5 and September 17, 2014. Groundwater was only encountered in borehole RC-14-003 on March 5, 2014 at an elevation of 576.05.

7. CORROSION EVALUATION

Chemical analyses were performed on samples collected from borings to evaluate corrosion potential of the on-site soils. Testing was performed by the Caltrans Geotechnical Laboratory in Sacramento, CA. Table 3 summarizes the test results. The results of the corrosion tests are attached in Appendix C.

Table 3 -Summary of Soil Corrosion Tests

BOREHOLE ID	DEPTH (ft, bgs)	pH	CHLORIDE CONTENT (ppm)	SULFATE CONTENT (ppm)
RC-14-001	15-20	5.61	4	32
RC-13-002	35 - 40	6.71	--	--

For structural elements, the Department considers a site to be 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 or greater, sulfate concentration is 2000 ppm or greater, or the pH is 5.5 or less.

Based on the Caltrans Corrosion Guidelines (2012 version 2.0) and the laboratory test results, the site soils may be considered non-corrosive to steel and concrete.

As per Section 6.2 of the Guidelines (Survey of Site Conditions), it is noted that the project is located on a cliff within approximately a thousand feet from the Pacific Ocean.

8. GEOTECHNICAL AND FOUNDATION RECOMMENDATIONS

8.1. Wall Location and Height

The wall layout line is shown on Figure 2 and the subsurface geology along the wall layout line is shown on Figure 4- Subsurface Geology along Wall Layout Line. The proposed wall is approximately 335 feet in length with a maximum height of 16 feet.

8.2. Slope Stability analysis and Design Parameters

The stability analysis was constrained to analyze the landslide for a shallower intermediate failure plane because the intent of this wall is only to restore the shoulder width and maintain the travel way. The proposed wall is not intended to stabilize the existing landslide. The existing soil nail wall was ignored in the back analysis calculations.

For purposes of the slope stability model the intermediate failure surface was assumed to be within the decomposed bedrock is was interpreted to be landslide debris.

The soil strength parameters for the design were initially determined by using the standard penetration test (SPT) N values obtained from the vertical boreholes, published correlations and laboratory data.

These initial values were used in the slope stability program SLOPE-W 2012 on critical cross section A-A' (Figures 5- Design Cross-Section). A factor of safety of approximately 1.0 was assumed for the existing slope. The Morgenstern and Price Method of limit equilibrium that satisfies both force and moment equilibrium was used to compute the factor of safety (Figure 6 - Stability Analysis for Existing Conditions).

The recommended soil and rock parameters for the retaining wall design are provided in Table 5.

Table 5 - Soil Design Parameters

LAYER	APPROXIMATE THICKNESS (ft)[1]	MOIST UNIT WEIGHT (pcf)	ANGLE OF INTERNAL FRICTION (degrees)	COHESION (c, psf)
(1) Wall Backfill	12	120	34	0
(2) Landslide Debris	55	115	33.5	75
(3) Bedrock	100[2]	130	38	500

[1] – At wall layout line

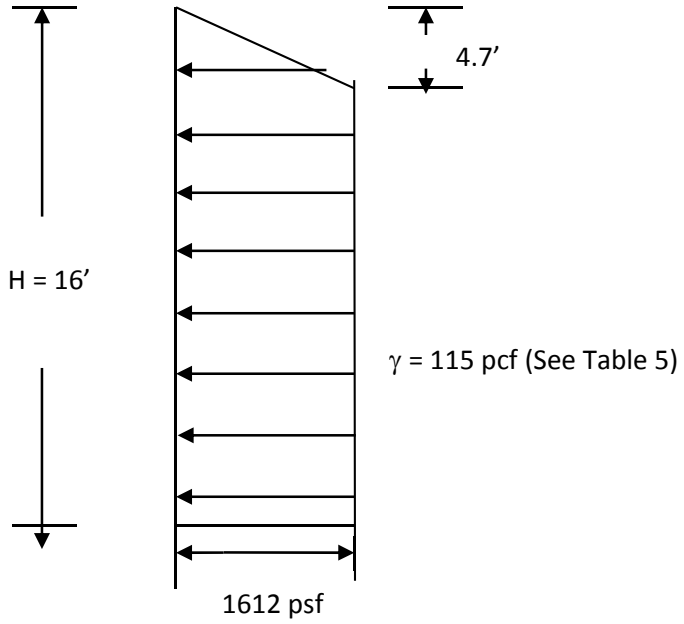
[2] – A thickness of 100 feet was chosen arbitrarily for the stability analysis

8.3. Hydrostatic Forces

The recommended design groundwater surface elevation is below the base of the wall.

8.4. Lateral Earth Pressures

The following apparent earth pressure distribution diagram was developed based on a soldier pile wall with a wall height of 16 feet and one row of ground anchors for landslide loading. The apparent pressure envelope assumes that negligible restraint would be provided by the toe of the wall.



Recommended Lateral Earth Pressure Distribution for P_{TOTAL} for a FOS=1.5

8.5. Seismic Recommendations

The shear wave velocity of 258 m/s (847 ft/s) was determined from soil types and corrected SPT numbers. Utilizing the Caltrans ARS online tool (V2.3.06), we recommend using the USGS 5% in 50 years hazard (2008) curve, which yields a spectral acceleration of 0.48g at period T = 0 seconds. The horizontal seismic coefficient (Kh) is typically taken as 1/3 to ½ of the Peak Ground Acceleration (PGA). We recommend using Kh = 0.16 for LRFD Extreme Event analysis. We recommend a value for vertical seismic coefficient Kv = 0.

The ARS online data sheet utilized is attached to this report in Appendix D – Seismic Data.

8.6. Recommendations for Ground Anchors

The ground anchor forces (lateral force) required to resist the landslide force was evaluated using SLOPE/W 2012. The existing soil nail wall, a proposed wall height of 16 feet and a fully specified shallow landslide surface was used in the model. The traffic surcharge was not included. A concentrated horizontal force (P_{TOTAL}) was applied at the wall face at the mid-point of the wall height. P_{TOTAL} was increased until a factor of safety of 1.5 was obtained. The results of the stability analysis indicate that a total horizontal force of 22 kips per foot is required to stabilize the slope (Figure 7- P_{TOTAL} Stability Analysis).

Table 6- Tieback Design Parameters

Recommended Tieback Inclination	15º
Minimum Tie-back Unbonded Length (feet)	
Row 1	30
Presumptive nominal unit bond stress (psi)	15

The recommended finished grade elevation on the down slope side of the wall at approximately roadway “A” Sta. 484+50 is approximately 675 feet.

The maximum pile lengths should be limited to 40 feet to prevent the piles from intersecting the presumed failure surface.

9. EARTH WORK AND WALL BACKFILL RECOMMENDATIONS

The wall will be constructed from the bottom up. The placement of approximately 120 cubic yards of Class 1 B permeable material will be required prior to tieback installation. Due to the marginal stability of the existing slope below, the wall should not be buried.

10. CONSTRUCTION CONSIDERATIONS

10.1. Excavation and Drilling Difficulties

The ground anchors will have be drilled through an 8”-thick shotcrete layer of the temporary soil nail wall. The nails are spaced at 4-foot horizontal intervals. The first row of nails are spaced at 2-feet below the top of the wall and the subsequent rows are spaced at 4-foot vertical intervals (See As-Builts – Appendix B).

The soldier piles will also intersect the toe of the existing soil nail wall.

Caving conditions will likely be encountered during drilling for the piles and tiebacks due to the intensely fractured nature of the rock. Temporary casing may be required to control caving and should be installed in conformance with the provisions in Section 49-4.03B “Drilled Holes,” of the Standard Specifications.

Drill fluid circulation was lost during drilling two of the three exploratory borings and is interpreted to indicate the presence of cracks and voids in the subsurface materials. The potential for the loss of concrete and grout into voids should be expected. Controlling measures such as the use of a “grout sock,” could greatly reduce the potential for grout loss.

10.2. Hazardous Materials

The fill deposits and bedrock within the Project Limits do not contain Naturally Occuring Asbestos (NOA).

11. PROJECT INFORMATION

Standard Special Provisions S5-280, “Project Information”, discloses to bidders and contractors a list of pertinent information available for their inspection prior to bed opening. The following is an excerpt for SSP-280 disclosing information originating from Geotechnical Services. Items listed to be included in the information Handout will be provided in Acrobat (pdf) format to addressee(s) of this report via electronic mail.

Data and information attached with the project plans are:

Log of Test Borings for South Last Chance Grade Wall

Data and information included in the Information Handout provided to the bidders and contractors are:

Foundation Report for South Last Chance Grade Wall – 01-DN-101-PM 14.88/15.0 dated August 12, 2015

Data and Information available for observation at the Eureka Drilling Annex:

A. Borehole Core Samples

If you have any questions or require additional information, please contact June James at (707) 441-4692 or Charlie Narwold at (707) 445-6036.

JUNE JAMES
Transportation Engineer
Office of Geotechnical Design North
Branch B

CHARLES NARWOLD
Senior Engineering Geologist
Office of Geotechnical Design North
Branch B

List of Figures:

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Figure 2 - Site Plan and Landslide Map
Figure 3 - Project Geologic Map
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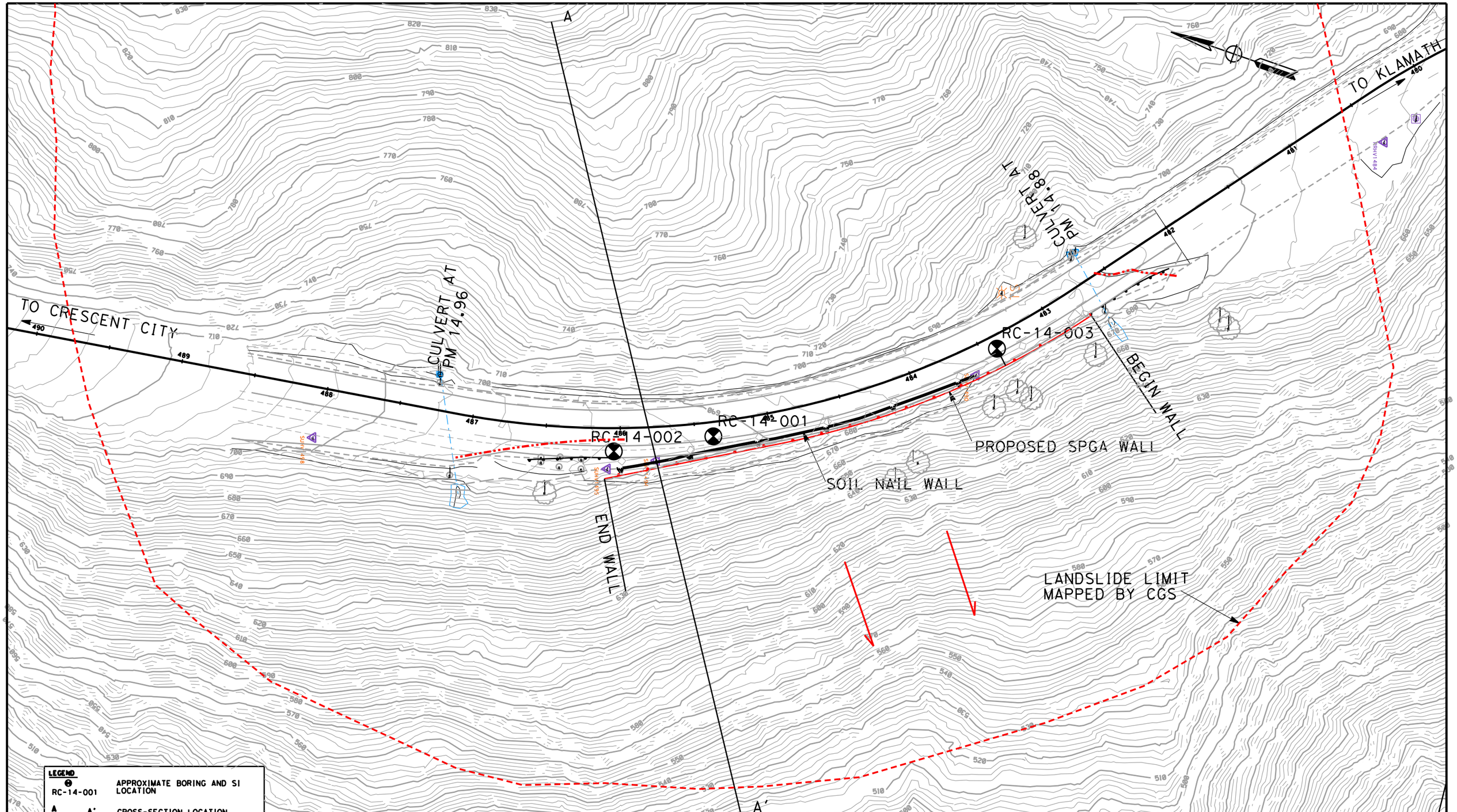
Figure 5- Design Cross-section
Figure 6- Stability Analysis for Existing Conditions
Figure 7- P_{TOTAL} Stability Analysis

List of Appendices

Appendix A – Slope Inclinometer Data
Appendix B – Temporary Soil Nail Wall As-Builts
Appendix C – Laboratory Data
Appendix D – Seismic Data

C: Traci Menard – GS
Talitha Hodgson – District 01

Department of Transportation Division of Engineering Services Geotechnical Services Office of Geotechnical Design North Branch B	EFIS: 0115000111 DATE:AUGUST 2015	**VICINITY MAP**
	SOUTH LAST CHANCE GRADE WALL 01- DN 101 PM 14.88/15.0	**FIGURE 1**



Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design North
Branch B

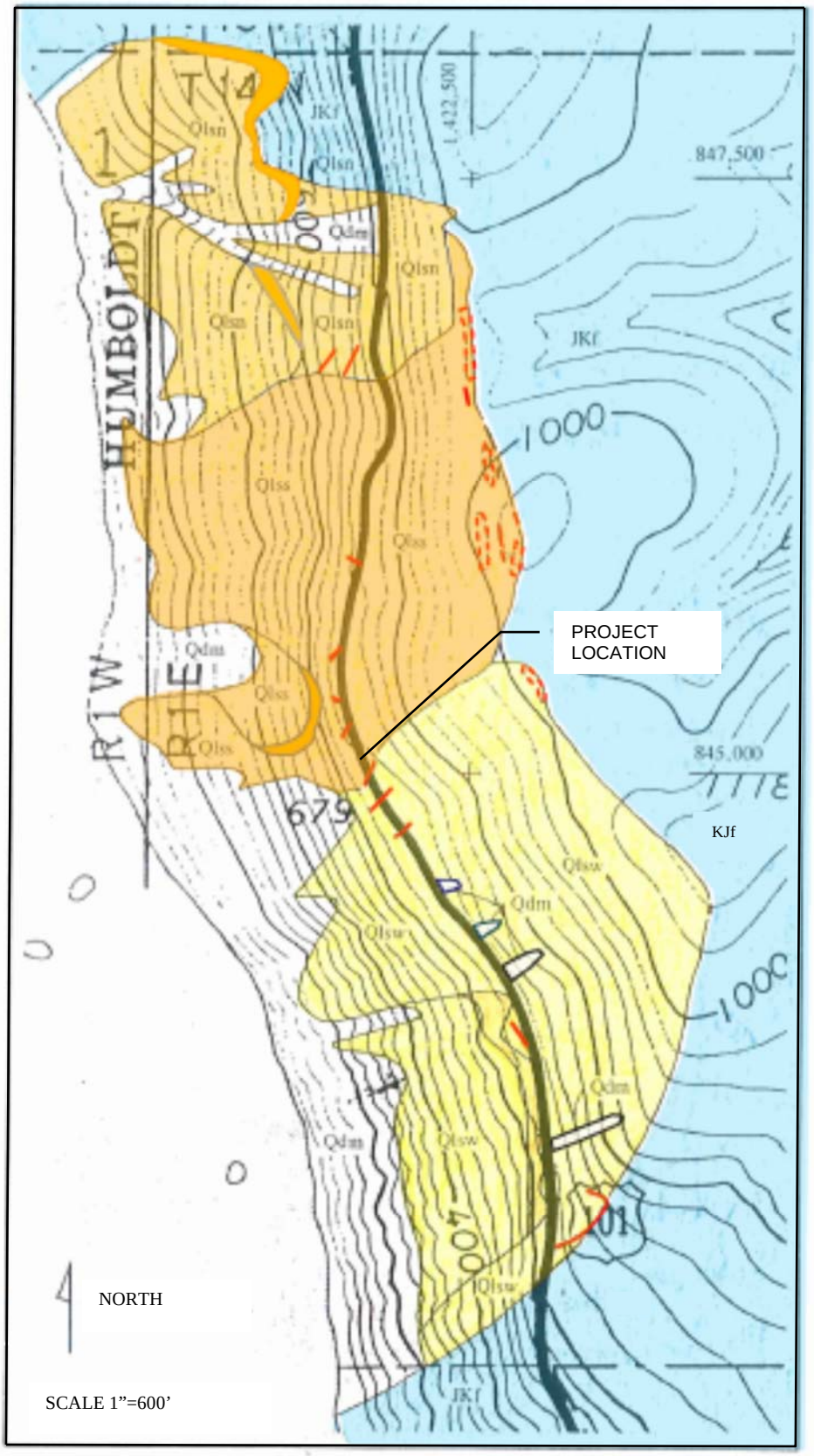
EFIS: 0115000111

DATE: AUGUST 2015

SITE PLAN AND LANDSLIDE MAP

SOUTH LAST CHANCE GRADE WALL
01-DN-101-PM-14.88/15.0

FIGURE 2



LEGEND

Qlsn	Holocene Age Last Chance Grade Landslide very active northern portion
Qlss	Holocene Age Last Chance Grade Landslide very active southern portion
Qlsw	Holocene Age Wilson Creek Wall Landslide
Qdm	Holocene Age debris flows, shallow landslides, and mass wasting
KJf	Cretaceous/ Jurassic Age Franciscan Complex mélange

SYMBOL

- Closed Depression
- Tension Cracks
- Landslide Scarp

GEOLOGIC MAP

Additional Investigation of Last Chance Grade Landslide

01-DN-101-KP 23.1/24.7

01-32470K

Tim Beck 2/9/99

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

EFIS ID: 0115000111

DATE: AUGUST 2015

PROJECT GEOLOGIC MAP

SOUTH LAST CHANCE WALL
01-DN-101-PM 14.88/15.0

FIGURE 3

TO KLAMATH

TO CRESCENT CITY

BEGIN WALL
"A" STA 482+75.00

END WALL
"A" STA 486+10.82

ORIGINAL GROUND SURFACE

BOREHOLE RC-14-003

BOREHOLE RC-14-001

BOREHOLE RC-14-002

TOP OF WALL

WALL BACKFILL

FILL

LANDSLIDE DEBRIS

BEDROCK

SLIDE SURFACE

700 690 680 670 660 650 640 640 630 620 610 600 590

483+00 484+00 485+00 486+00

"A" STATIONING

LEGEND

GEOLOGIC CONTACT, SOLID WHERE CERTAIN, DASHED WHERE APPROXIMATELY LOCATED AND QUERIED WHERE EXISTENCE IS UNCERTAIN

LANDSLIDE FAILURE SURFACE

Caltrans

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

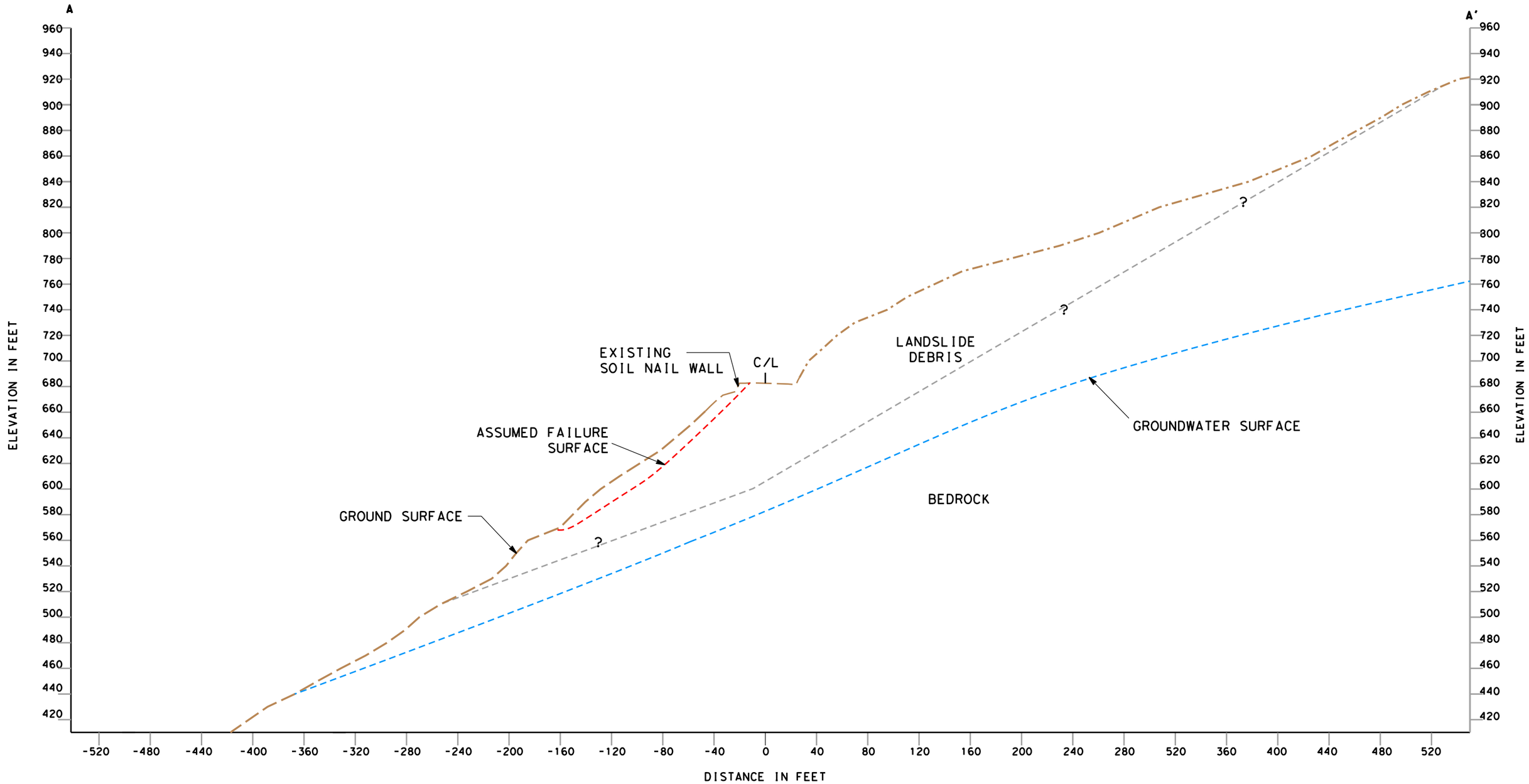
EFIS: 0115000111

DATE: AUGUST 2015

SUBSURFACE GEOLOGY
ALONG WALL LAYOUT LINE

SOUTH LAST CHANCE GRADE WALL
01-DN-101 PM 14.88/15.0

FIGURE 4



EXPLANATION

? GEOLOGIC CONTACT, SOLID WHERE CERTAIN, DASHED WHERE APPROXIMATELY LOCATED AND QUERIED WHERE EXISTENCE IS UNCERTAIN

? LANDSLIDE FAILURE SURFACE, SOLID WHERE CERTAIN, DASHED WHERE APPROXIMATELY LOCATED AND QUERIED WHERE EXISTENCE IS UNCERTAIN

Caltrans

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

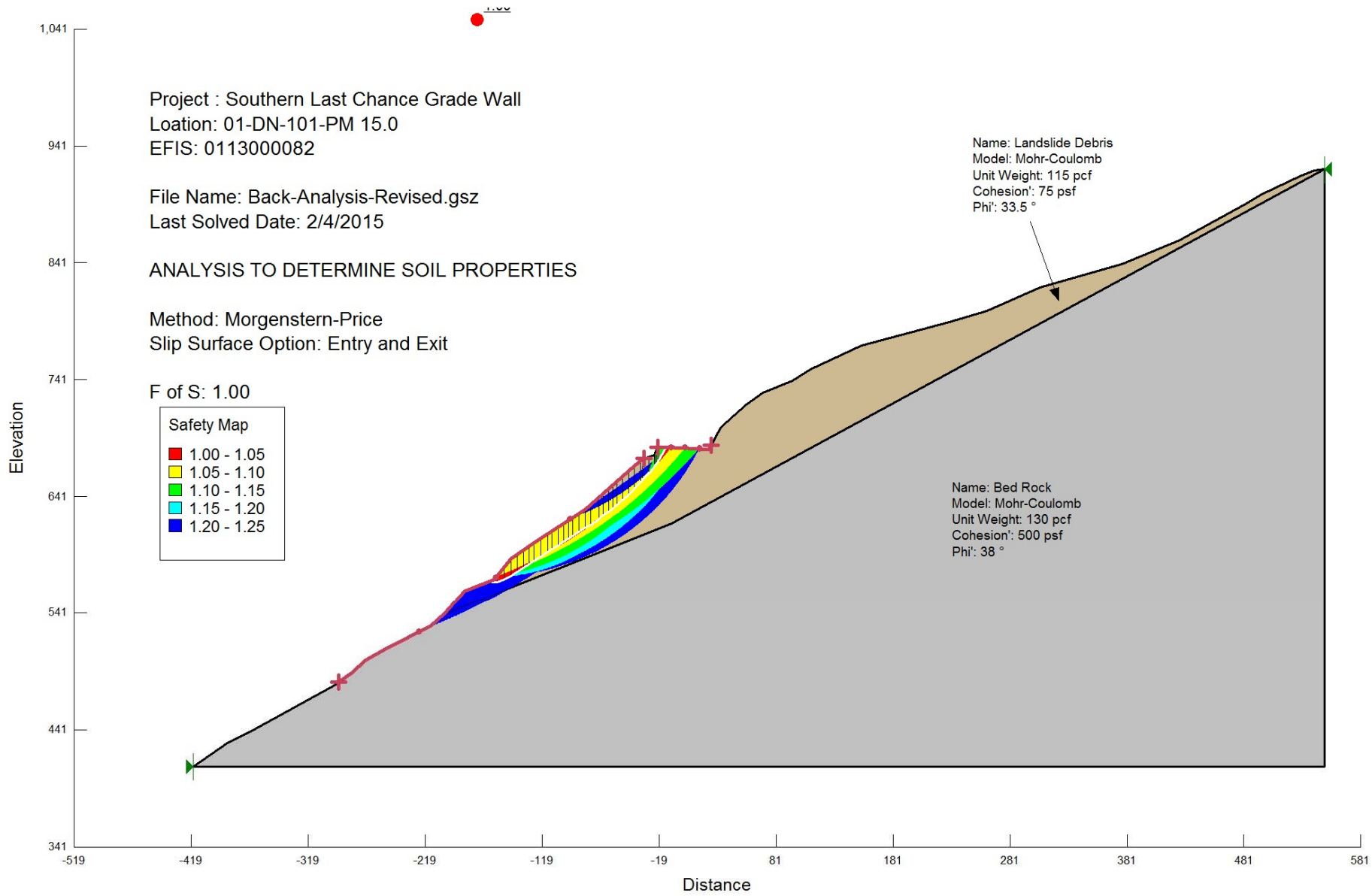
EFIS: 0115000111

DATE: AUGUST 2015

DESIGN CROSS-SECTION

SOUTH LAST CHANCE GRADE WALL
01-DN-101 PM-14.88/15.0

FIGURE 5



Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design North
Branch B

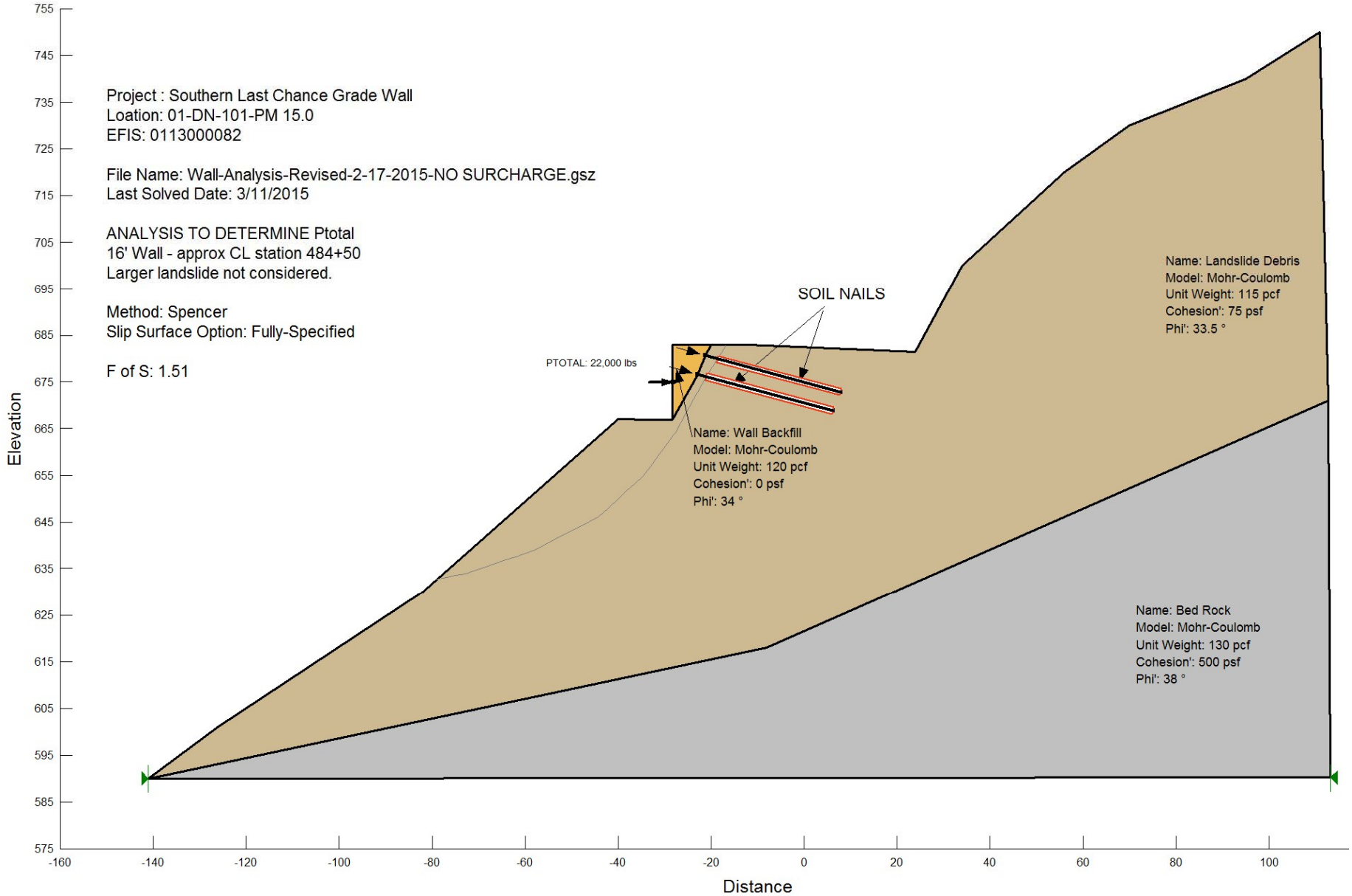
EFIS: 0115000111

Date: AUGUST 2015

STABILITY ANALYSIS FOR EXISTING CONDITIONS

SOUTH LAST CHANCE GRADE WALL
01-DN-101 PM 14.88/15.0

Figure 6



Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design North
Branch B

EFIS: 0115000111

Date: AUGUST 2015

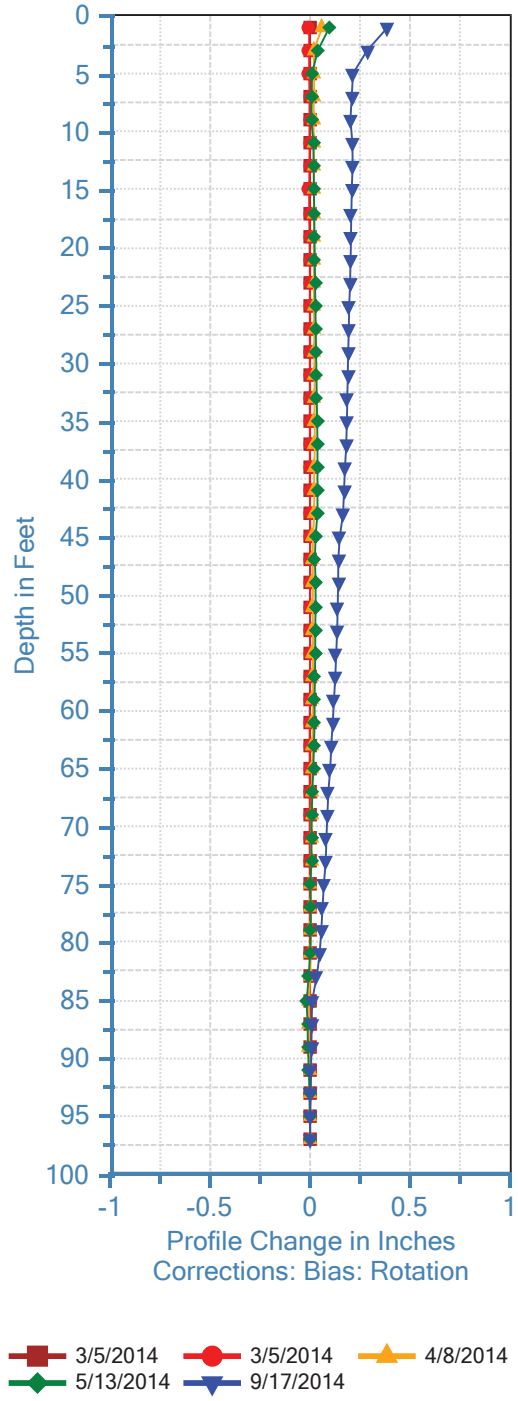
P_{TOTAL} STABILITY ANALYSIS

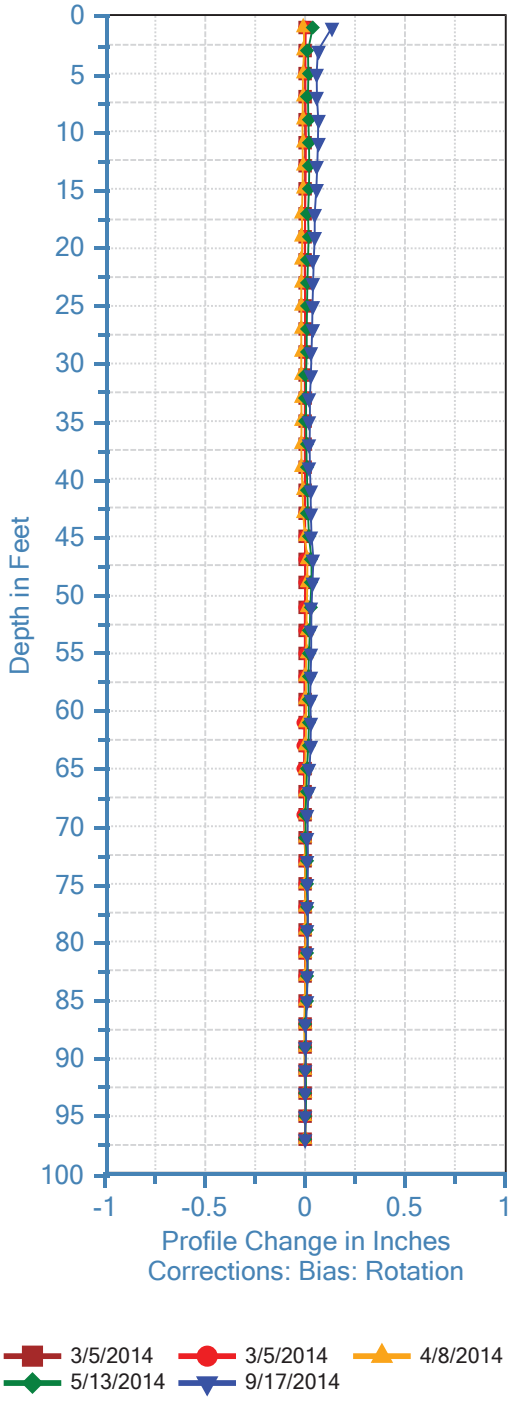
SOUTH LAST CHANCE GRADE WALL
01-DN-101 PM 14.88/15.0

Figure 7

APPENDIX A

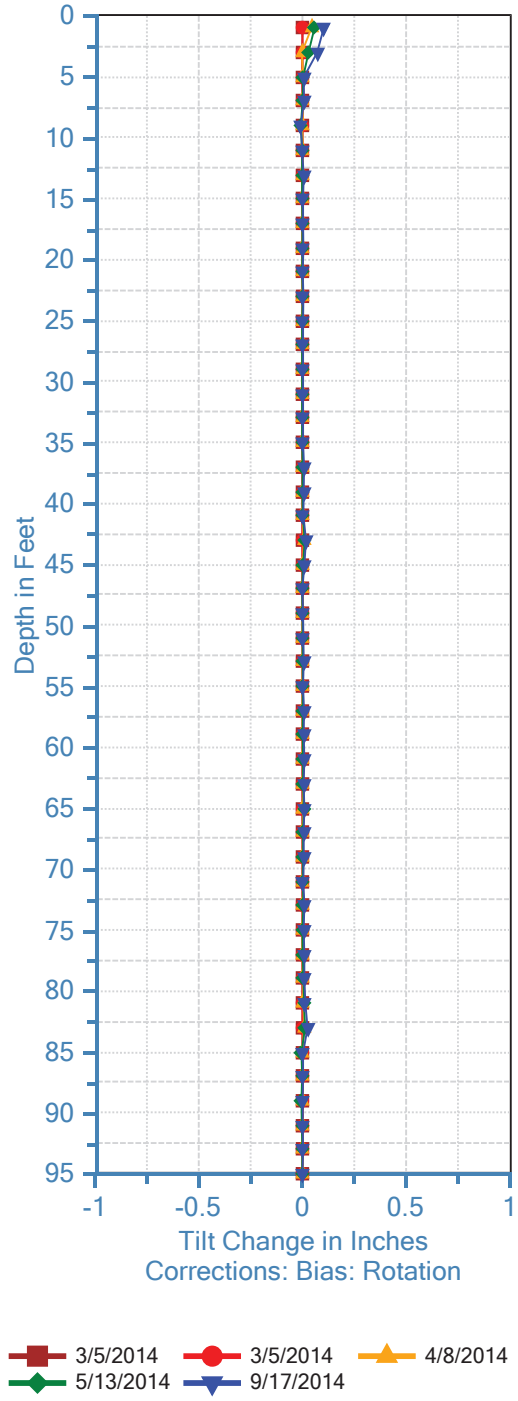
SLOPE INCLINOMETER DATA

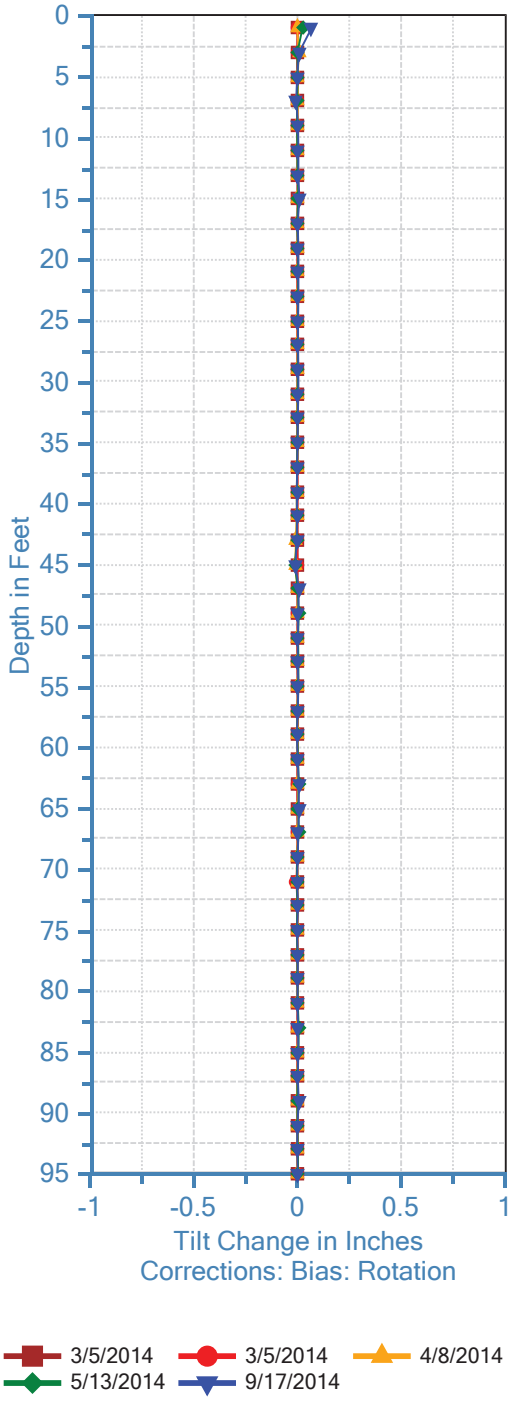




INCLINOMETER RESULTS
01-DN-101-P.M 15
SO. LCG WALL
E.A. No: 0113000082

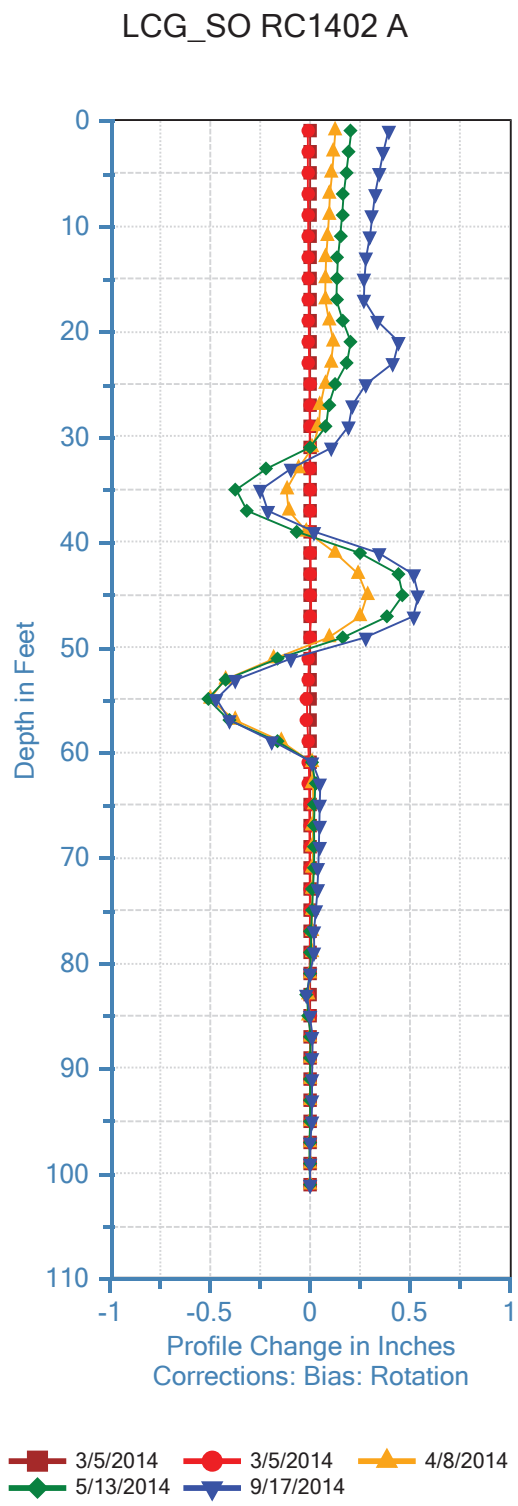
DEPTH OF INCLINOMETER CASING: 97'
Ao DIRECTION: 230* (MAGNETIC NORTH)
LOCATION (WGS-84): N41*38.025' W124*06.943'

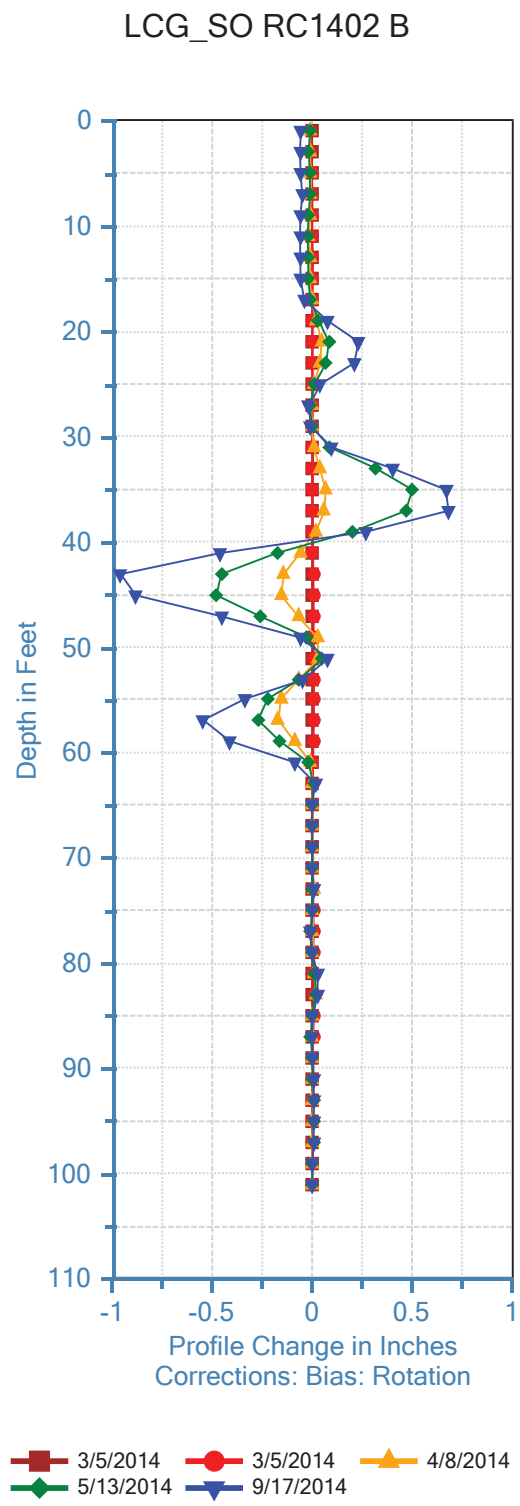




INCLINOMETER RESULTS
01-DN-101-P.M 15
SO. LCG WALL
E.A. No: 0113000082

DEPTH OF INCLINOMETER CASING: 97'
Ao DIRECTION: 230* (MAGNETIC NORTH)
LOCATION (WGS-84): N41*38.025' W124*06.943'

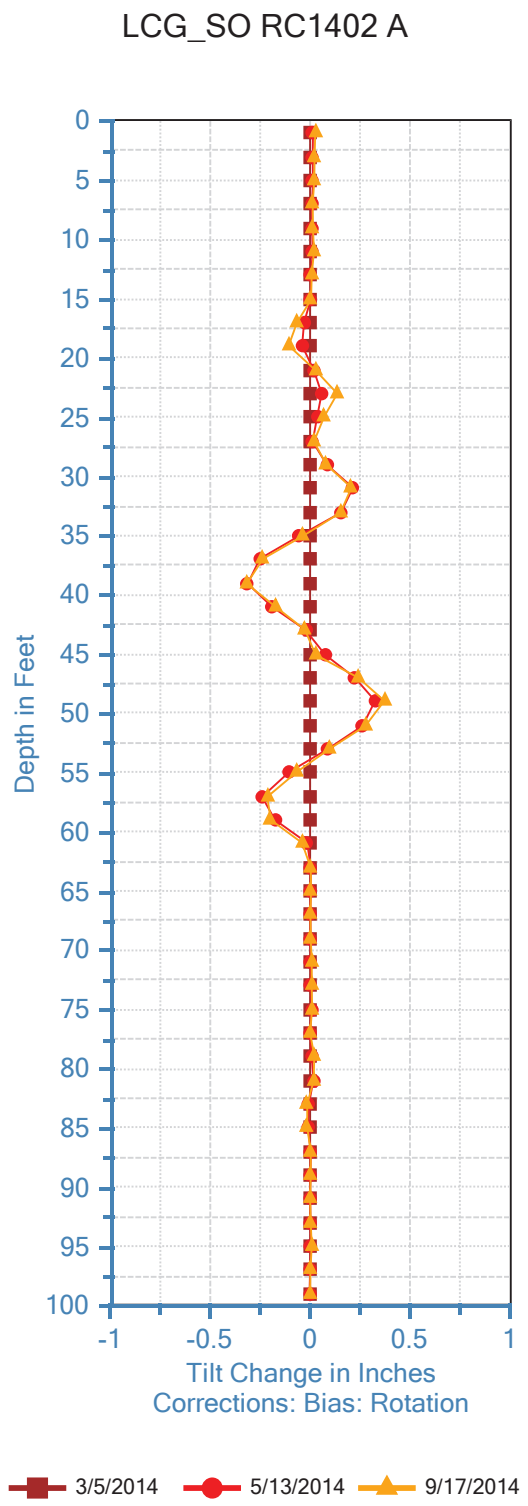


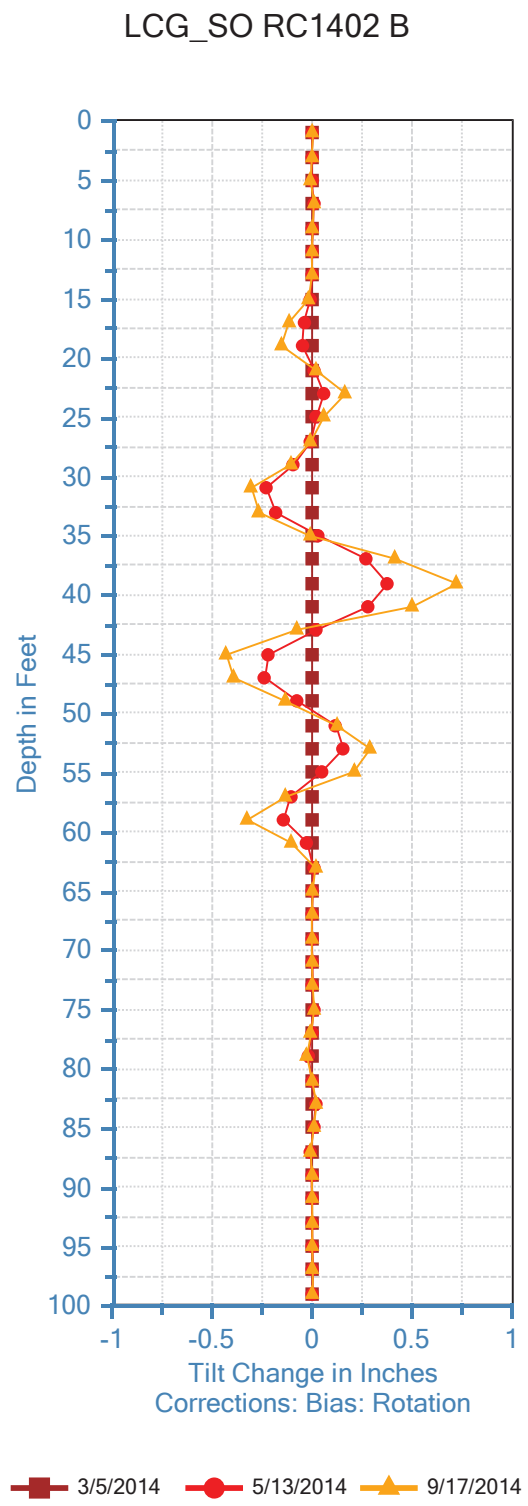


Caltrans

INCLINOMETER RESULTS
01-DN-101-P.M 15
SO. LCG WALL
E.A. No: 0113000082

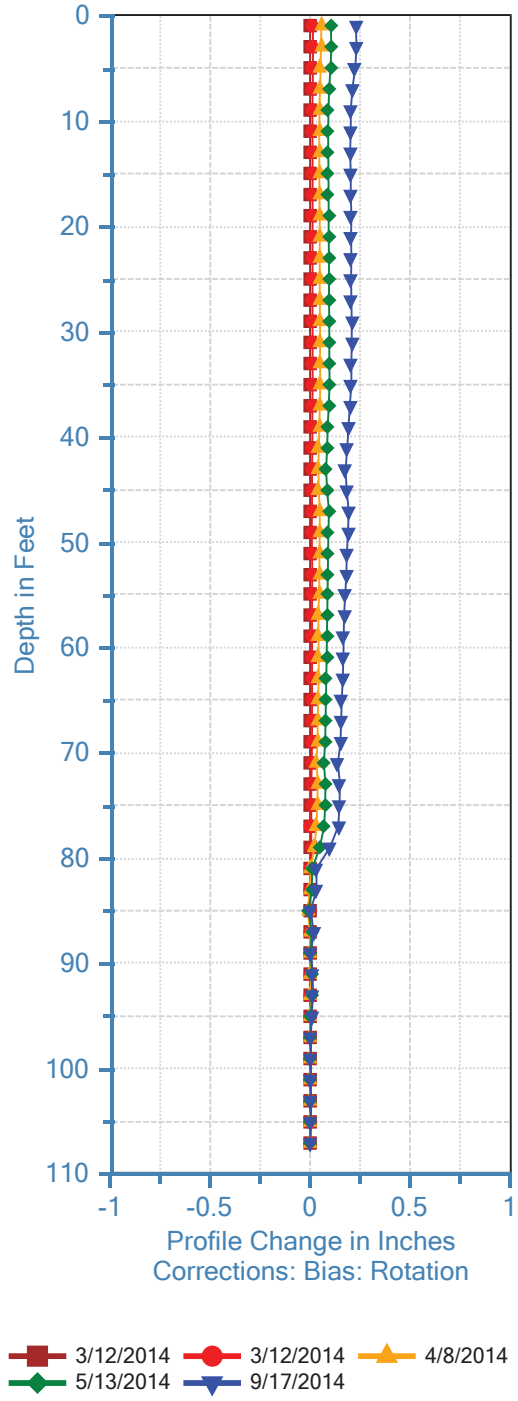
DEPTH OF INCLINOMETER CASING: 101'
Ao DIRECTION: 245 * (MAGNETIC NORTH)
LOCATION (WGS-84): N41*38.057' W124*06.950'

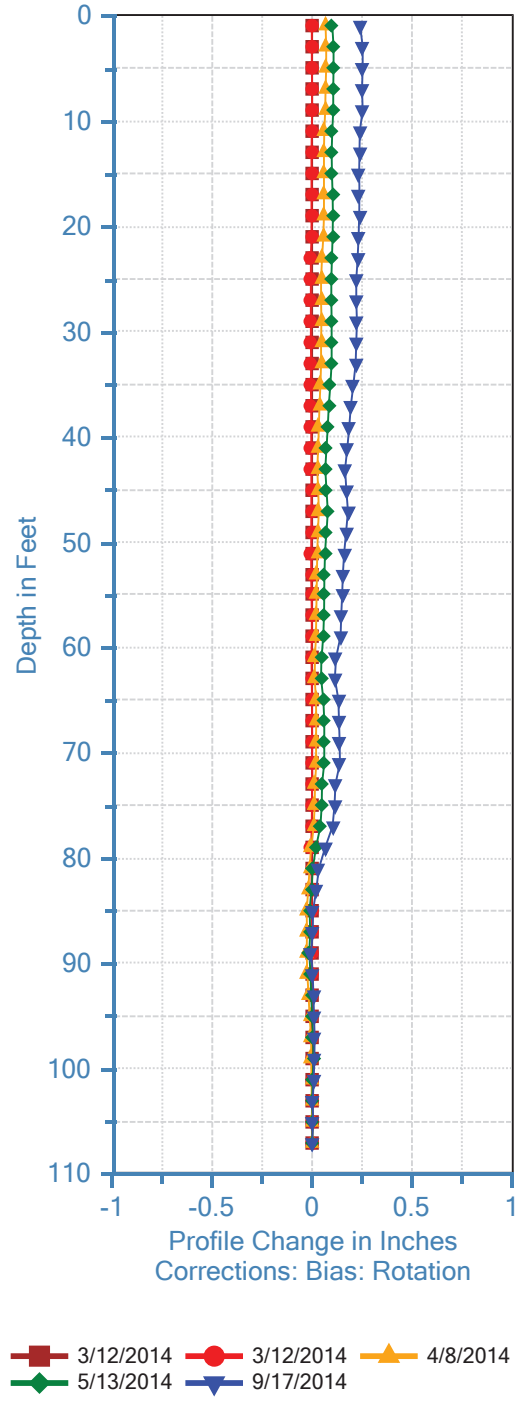




INCLINOMETER RESULTS
01-DN-101-P.M 15
SO. LCG WALL
E.A. No: 0113000082

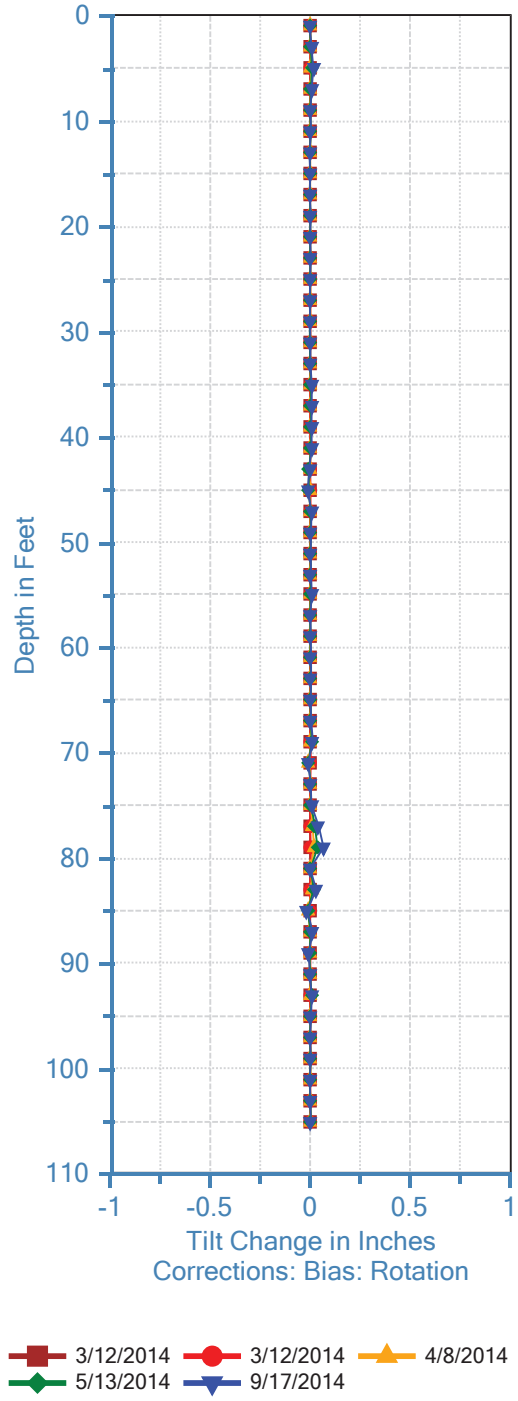
DEPTH OF INCLINOMETER CASING: 101'
Ao DIRECTION: 245 * (MAGNETIC NORTH)
LOCATION (WGS-84): N41*38.057' W124*06.950'

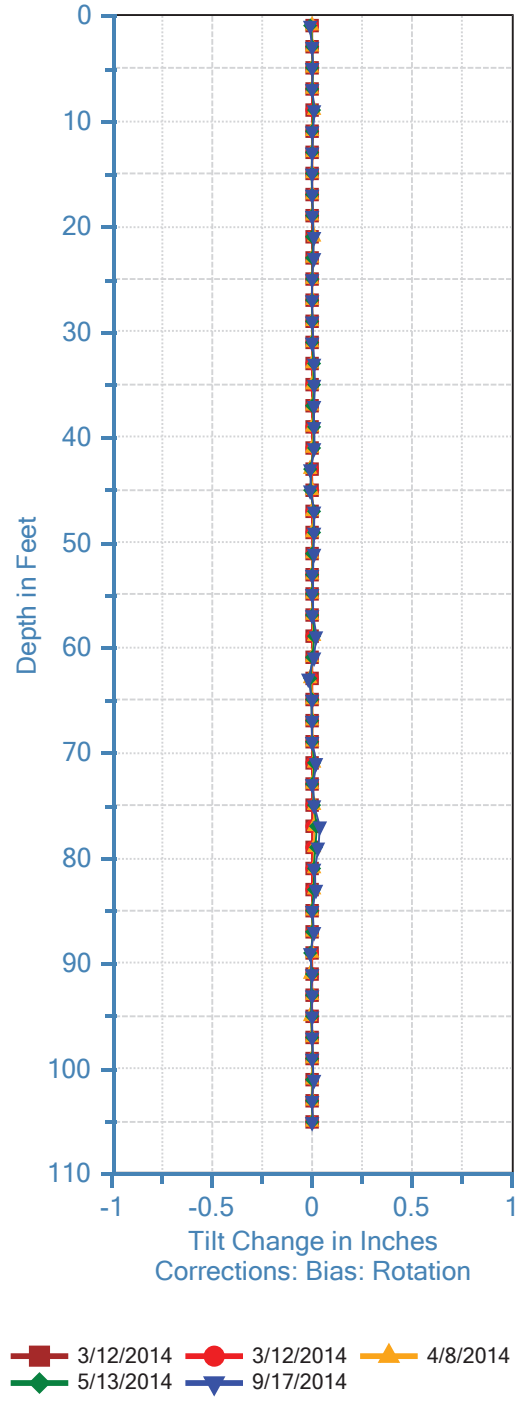




INCLINOMETER RESULTS
01-DN-101-P.M 15
SO. LCG WALL
E.A. No: 0113000082

DEPTH OF INCLINOMETER CASING: 107'
Ao DIRECTION: 199 * (MAGNETIC NORTH)
LOCATION (WGS-84): N41*38.026' W124*06.931'



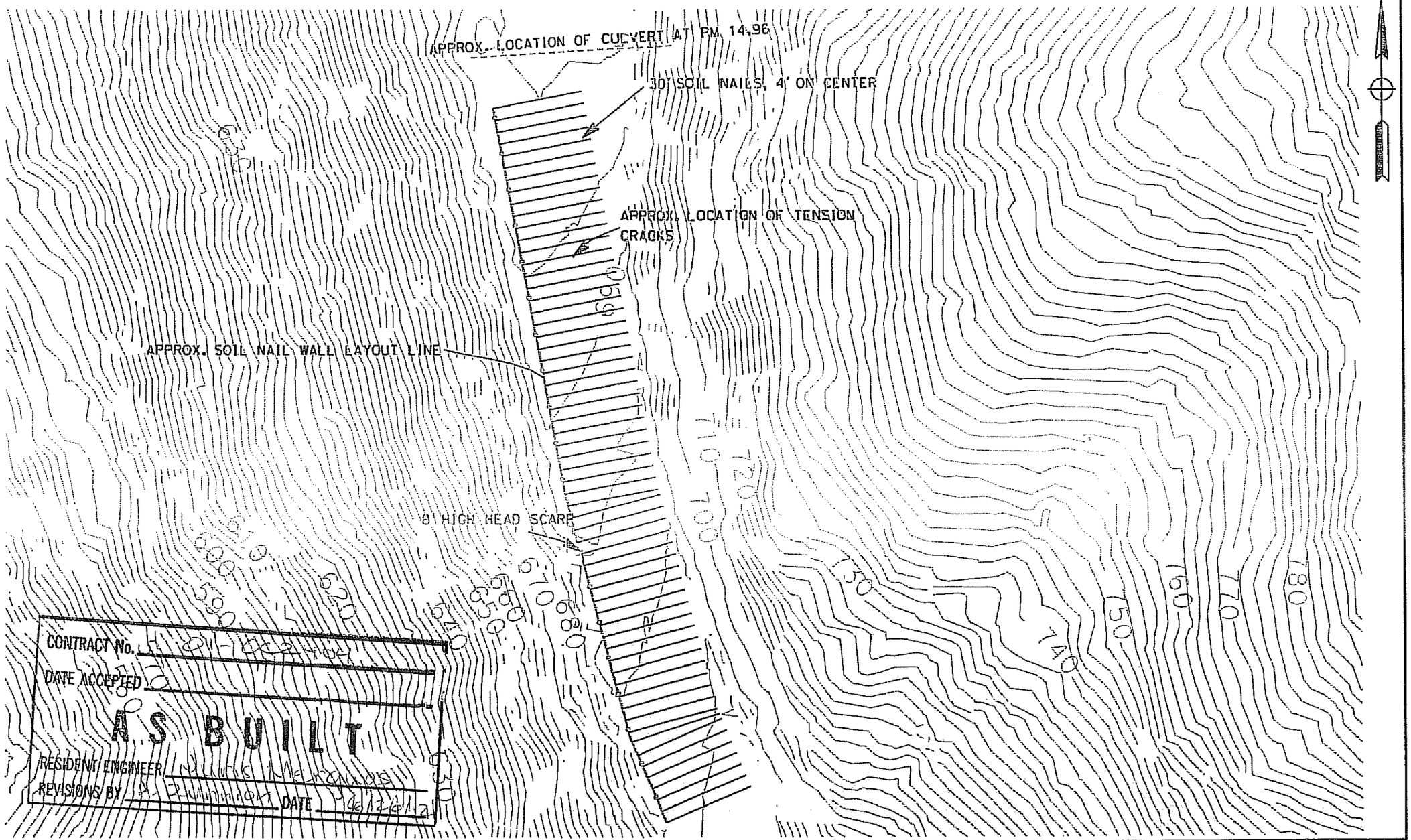


INCLINOMETER RESULTS
01-DN-101-P.M 15
SO. LCG WALL
E.A. No: 0113000082

DEPTH OF INCLINOMETER CASING: 107'
Ao DIRECTION: 199 * (MAGNETIC NORTH)
LOCATION (WGS-84): N41*38.026' W124*06.931'

APPENDIX B

TEMPORARY SOIL NAIL WALL AS-BUILTS



Caltrans

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design North
Branch B

EFIS: 0112000242

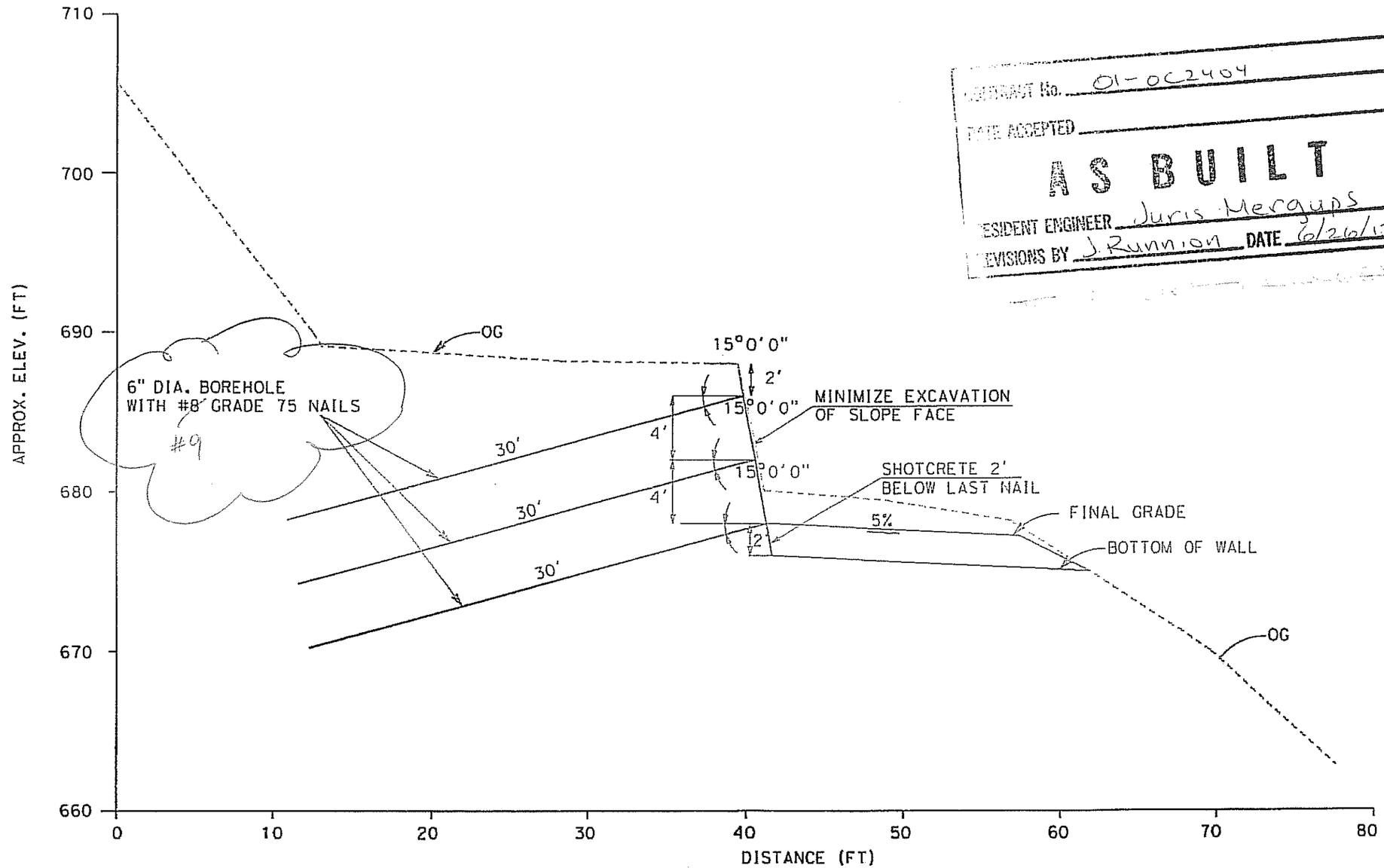
DATE: MAY 2, 2012

APPROXIMATE LAYOUT LINE
FOR SOIL NAIL REINFORCEMENT

SLIDE AT LAST CHANCE GRADE
01-DN-101-PM 14.96

FIGURE
1

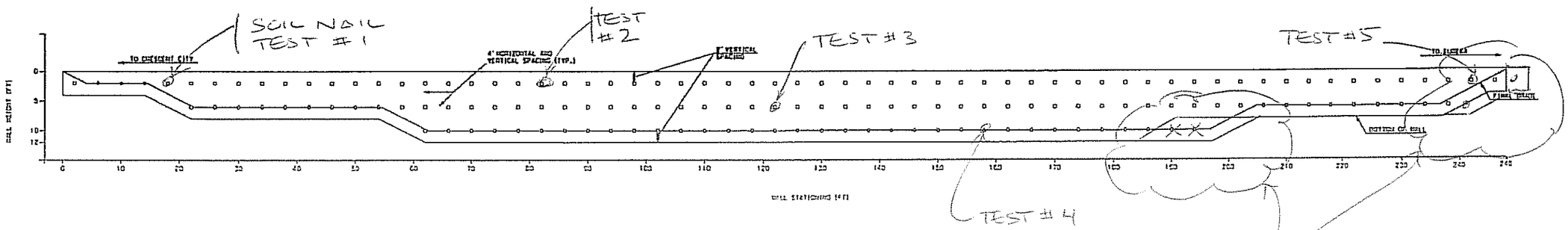
CONTRACT No. 01-0C2404
DATE ACCEPTED
AS BUILT
RESIDENT ENGINEER Juris Mergups
REVISIONS BY J. Runnion DATE 6/26/12



NOTES:

NUMBER OF ROWS VARY. SEE PROFILE SHEET.

Caltrans — Department of Transportation, Division of Engineering Services, Geotechnical Services, Office of Geotechnical Design North, Branch B	EFIS: 0112000242 DATE: MAY 2, 2012	TYPICAL SECTION
	SOIL NAIL WALL 01-DN-101-PM 15	FIGURE 2



TEST #4

SOIL NAILS FROM TIER 3 USED TO EXTEND TIER 1 AND 2.

LEGEND:

- 30' LONG SOIL NAIL (TYP.) LOCATION

30' SOIL NAIL TO BE PLACED IN THE FIELD TO MATCH THE TRANSITIONS WITH THE FINISH GRADE AS NEEDED.

NOTES:

TOTAL PLAN WALL FACE AREA = 8,455 SF

FINISH GRADE IS APPROXIMATELY 2 FEET ABOVE DESIGN GRADE.

CONTRACT No. 01-0C2404

DATE ACCEPTED

AS BUILT

RESIDENT ENGINEER Juris Margulis

REVISIONS BY J. Runnion DATE 10/26/12

Caltrans

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design North
Branch B

EFIS: 0112000242

DATE: MAY 2, 2012

SOIL NAIL WALL PROFILE

SOIL NAIL WALL
01-DN-101-PM 15

FIGURE 3

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
01	DN	101			

REGISTERED CIVIL ENGINEER X DATE

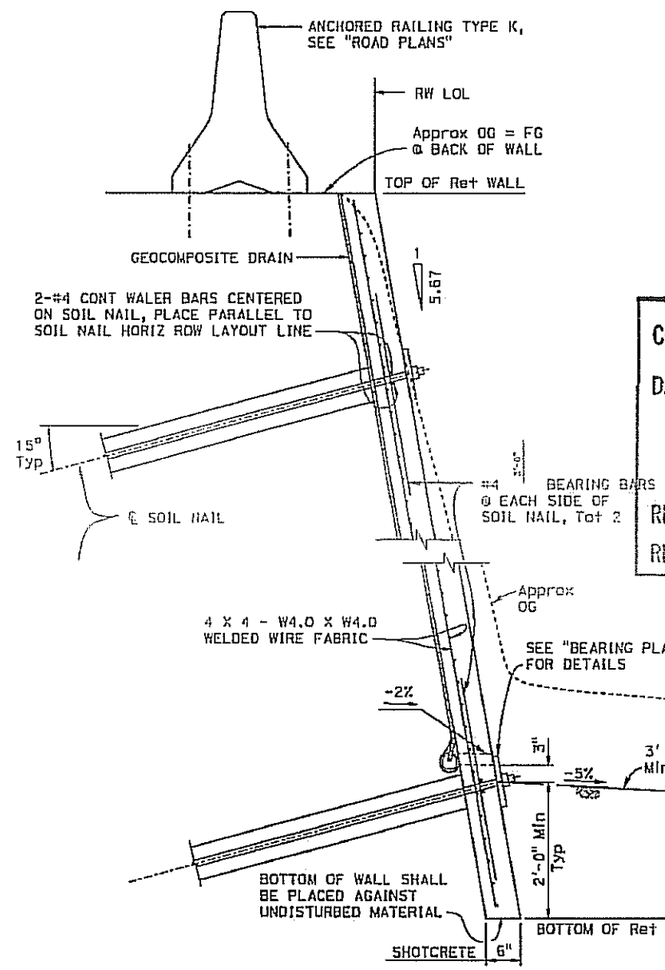
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Vadim Shostak No. 78424 Exp. (09-30-13) CIVIL STATE OF CALIFORNIA

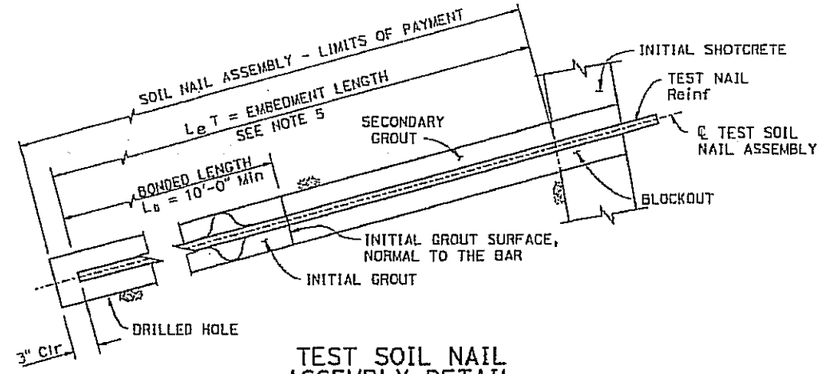
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

NOTES:

1. Max spacing between soil nails is 4'-0" vertically and horizontally.
2. The Max distance between top of retaining wall and the first row of nails is 2'-0".
3. The Max distance between bottom of retaining wall and the bottom row of nails is 2'-6".
4. See "SOIL NAIL WALL MIRROR ELEVATION VIEW" for embedment length.
5. The LeT embedment length of test nails shall be equal to the embedment length of adjacent soil nail assemblies.



TYPICAL SECTION
1" = 1'-0"



TEST SOIL NAIL ASSEMBLY DETAIL
NO SCALE

CONTRACT No. 01-0C2404

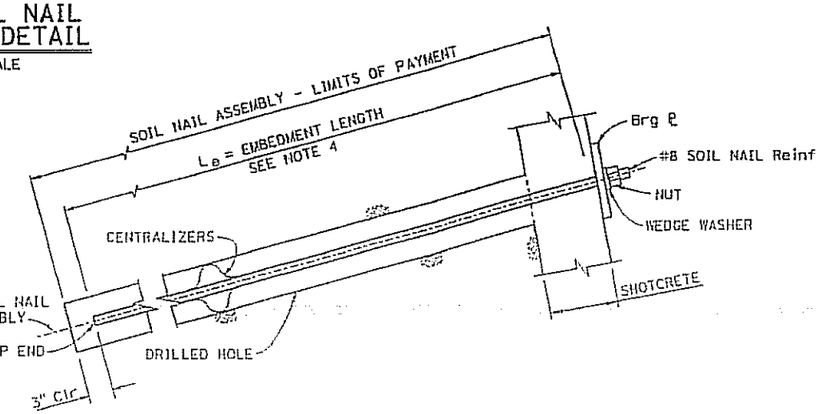
DATE ACCEPTED

AS BUILT

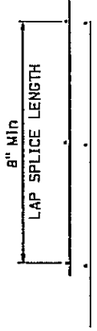
RESIDENT ENGINEER Chris Mercado

REVISIONS BY J. Rimmon DATE 6/26/12

NO ASBUILT CHANGES



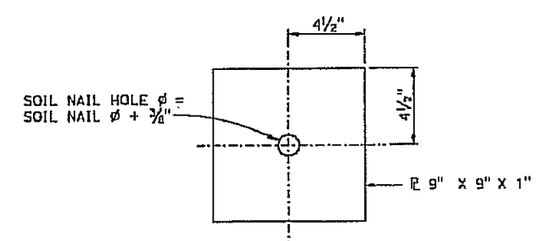
SOIL NAIL ASSEMBLY DETAIL
NO SCALE



NOTE:

Splices in primary wall reinforcement and waiers require Min clr 3 times the Max aggregate size around each bar.

LAP SPLICE
NO SCALE



BEARING PLATE
3" = 1'-0"

DESIGN	BY Vadim Shostak	CHECKED Eric Watson	
DETAILS	BY Jia Tang	CHECKED Eric Watson	
QUANTITIES	BY	CHECKED	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH 1

BRIDGE NO. X
POST MILE 15

RETAINING WALL @ PM 15
TYPICAL SECTION

STRUCTURES DESIGN DETAIL SHEET (ENGLISH) (REV. 09-01-10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 3576
PROJECT NUMBER & PHASE: 0112000242G
CONTRACT NO.: 01-0C240

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET X | OF X

FILE => rwpm15-ts.dgn

DISPLAY TIME PLOTTED => 10:42 DATE PLOTTED => 02-MAY-2012 DATE SAVED => 6/26/2012

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
01	DN	101			

REGISTERED CIVIL ENGINEER X DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Vadim Shastak No. 78424 Exp. 09-30-13 CIVIL STATE OF CALIFORNIA

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

GENERAL NOTES

DESIGN: Caltrans Bridge Design Specifications - April 2000 (LFD)
(1996 AASHTO with Interims and Revisions by Caltrans)

SOIL PARAMETERS

For determination of design lateral earth load

γ = 125 pcf
ϕ = 33.5°
c = 0 psf

SHOTCRETE

f'c = 3600 psi

DESIGN PULLOUT RESISTANCE

Qd = 3400 lb/lf

SOIL NAIL

fy = 75 ksi

STRUCTURAL STEEL

Bearing plate

fy = 36 ksi, ASTM A36

DESIGN LIFE

2 Years

CONTRACT No. 01-0C2404

DATE ACCEPTED

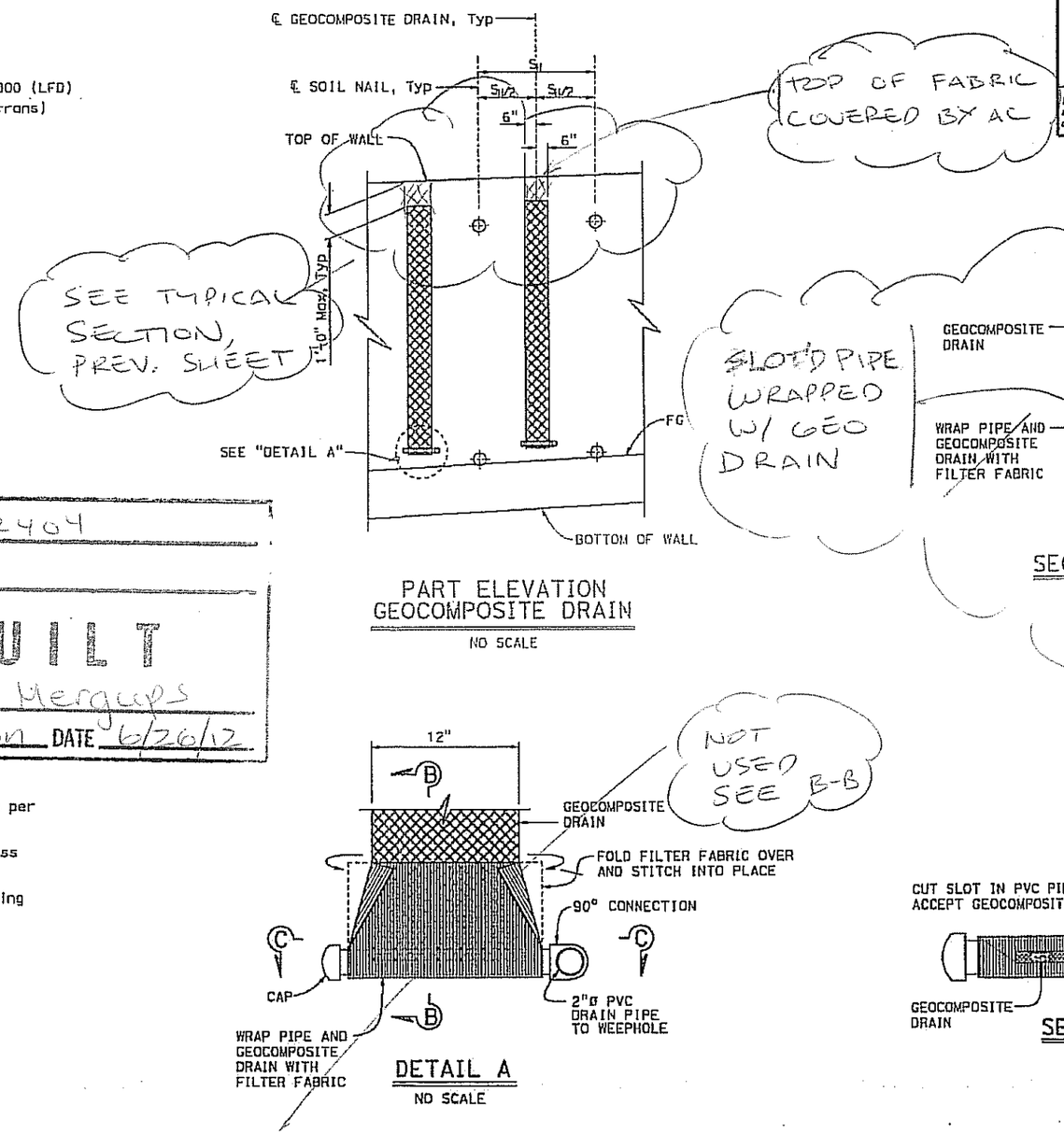
AS BUILT

RESIDENT ENGINEER Juris Mergups

REVISIONS BY J Runnion DATE 6/26/12

NOTES:

1. End treatment and splicing for geocomposite drain per manufacturer recommendations.
2. Geocomposite drain not required for wall height less than 6 feet.
3. Geocomposite drain shall be adjusted when conflicting with test soil nails.
4. Install weep hole at every geocomposite drain.



PART ELEVATION GEOCOMPOSITE DRAIN
NO SCALE

SECTION B-B
NO SCALE

DETAIL A
NO SCALE

SECTION C-C
NO SCALE

DESIGN	BY Vadim Shastak	CHECKED Eric Watson	
DETAILS	BY Jie Tang	CHECKED Eric Watson	
QUANTITIES	BY	CHECKED	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH 1

BRIDGE NO. X
POST MILE 15

RETAINING WALL @ PM 15
WALL DETAILS

STRUCTURES DESIGN DETAIL SHEET (ENGLISH) (REV. 09-01-10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 3576
PROJECT NUMBER & PHASE: 01120002423
CONTRACT NO.: 01-0C240

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET X | OF X

FILE =\ rw2ds15-wldet.dgn

USERNAME = s13482 DATE PLOTTED = 02-MAY-2012 TIME PLOTTED = 10:42

SUB 1B

SHEET 6 OF 6

NO ASBUILT CHANGES

CONTRACT No. 01-0C2404

DATE ACCEPTED

AS BUILT

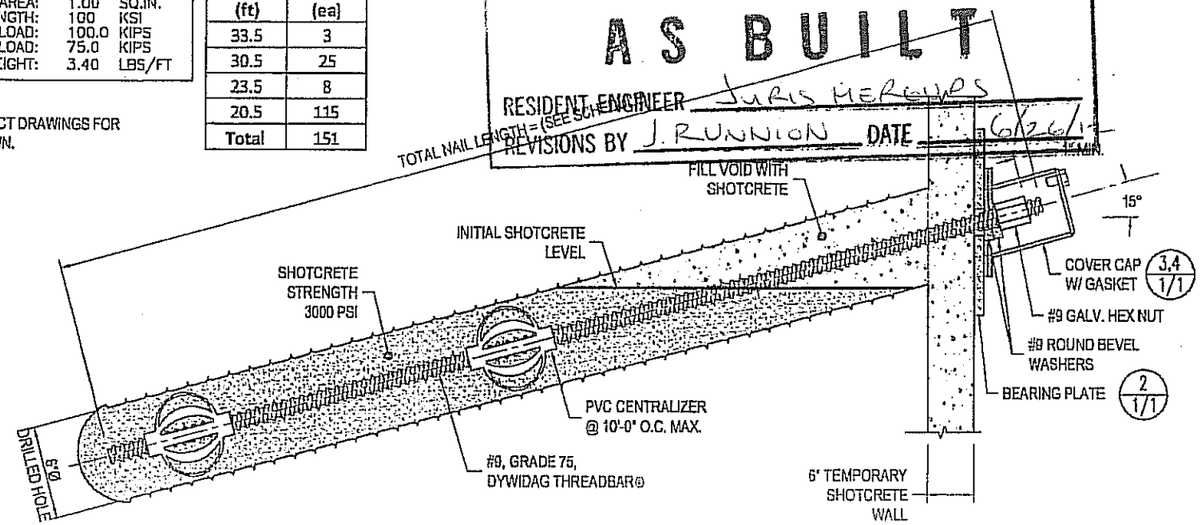
RESIDENT ENGINEER JURIS MERGUPS

REVISIONS BY J. RUNNION DATE 6/26/12

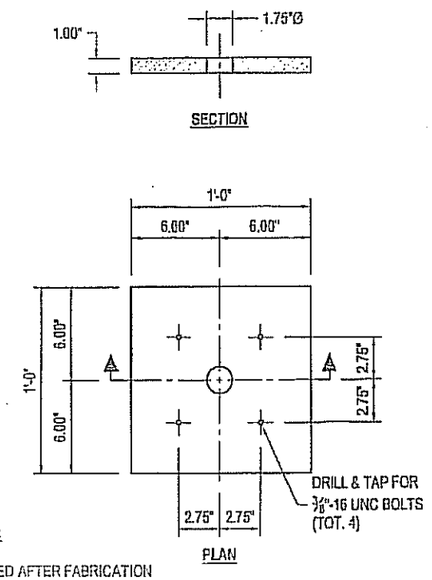
PHYSICAL PROPERTIES OF ASTM A615 #9 GR. 75 DYWIDAG THREADBAR		
EFFECTIVE AREA:	1.00	SQ.IN.
ULTIMATE STRENGTH:	100	KSI
ULTIMATE LOAD:	100.0	KIPS
YIELD LOAD:	75.0	KIPS
WEIGHT:	3.40	LBS/FT

NOTE:
REFER TO CONTRACT DRAWINGS FOR DETAILS NOT SHOWN.

Nail Length (ft)	Quantity (ea)
33.5	3
30.5	25
23.5	8
20.5	115
Total	151

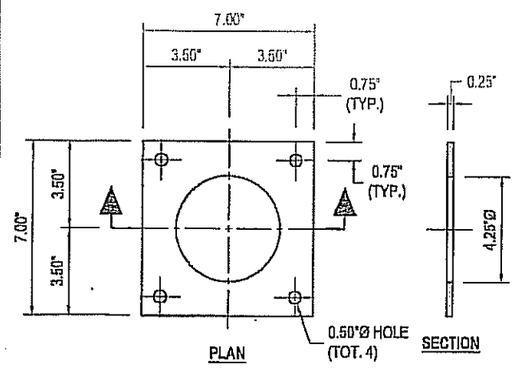


1 TYPICAL SOIL NAIL LONGITUDINAL SECTION



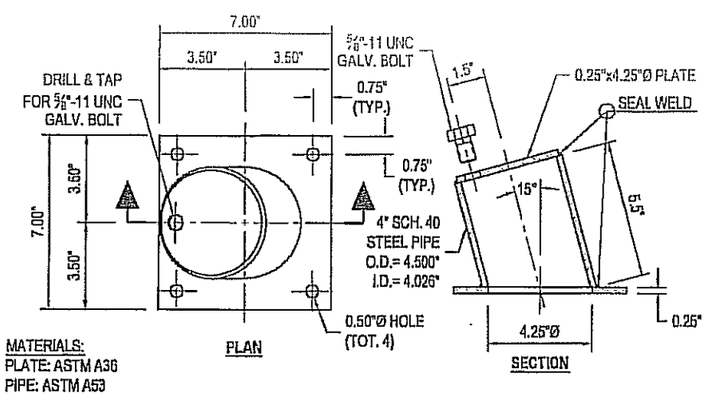
MATERIAL:
ASTM A36
GALVANIZED AFTER FABRICATION

2 BEARING PLATE DETAIL



MATERIAL:
NEOPRENE RUBBER

4 COVER CAP GASKET DETAIL



MATERIALS:
PLATE: ASTM A36
PIPE: ASTM A53
GALVANIZED AFTER FABRICATION

3 COVER CAP DETAIL

APPROVED
Pursuant to Section 5-1.02
of the Standard Specifications
State of California
DEPARTMENT OF TRANSPORTATION
Division of Engineering Services
Offices of Structure Construction

Signed
Structure Representative
Reg. Civil Engr. No. 70282
Date 5/1/12

REGISTERED PROFESSIONAL ENGINEER LUCIANO V. ROSARIO C 48932 EXP. 9.30.2012 CIVIL STATE OF CALIFORNIA

Reviewed 5.01.2012

Dist	County	Route	Post Mile	Bridge No.	Caltrans-Contract No.
			14.5		01-0C2404

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REV.	DATE	ISSUE DESCRIPTION	NAME	CHKD.

DWG TITLE: DYWIDAG SOIL NAIL DETAILS

DRAWN: L.BRION 04.25.12 SCALE: N.T.S.

CHKD.

PROJECT: HIGHWAY 101
PM 14.5 DEL NORTE COUNTY

LOCATION: DEL NORTE COUNTY, CALIFORNIA
CONTRACTOR: PACIFIC COAST DRILLING

DYWIDAG Systems International, USA, Inc.

DSI

JOB NO. J089093
DWG NO. 1 of 1

\\Dsi-sw03\geotech\#DWG\J089093-Hwy 101 PM 14.5 Del Norte County\J089093D1.DWG

APPENDIX C

LABORATORY DATA

Results sent to: MARIETTA JAMES

Division of Engineering Services
Materials Engineering and Testing Services
Corrosion and Structural Concrete Field Investigation Branch

Report Date: 9/3/2014
Reported by Michael Mifkovic

CORROSION TEST SUMMARY REPORT - SOIL

EFIS: **0113000082**

Dist/Co/Rte/PM **01 / DN /101/ / 15 PM**

CORROSION LAB #	TL101 #	BORE #	DEPTH (FT) START	DEPTH (FT) END	MINIMUM RESISTIVITY[1] (ohm-cm)	pH[1]	CHLORIDE CONTENT[2] (ppm)	SULFATE CONTENT[3] (ppm)	IS SAMPLE CORROSIVE?
SOIL SAMPLE FROM:									
CR20140237	**C898782**	RC-14-001	15	20	16380	5.61	4	32	NO
CR20140238	**C898784**	RC-14-002	35	40	11608	6.71			NO

This site is not corrosive to foundation elements (see note below).

Note: For Structural Elements, the Department considers a site corrosive if one or more of the following conditions exist: pH is 5.5 or less, chloride concentration is 500 ppm or greater, sulfate concentration is 2000 ppm or greater. Resistivity is not considered for Structural Elements. MSE backfill shall conform to the requirements of section 47-2.02C Structure Backfill in the 2010 Standard Specifications.

[1]CT 643, [2]CT 422, [3]CT 417

BORING SAMPLE RECORD

GL TRACKING NO. 14-047
TESTING DUE:

PROJECT NAME: South Last Chance Grade Slips
DIST-CO-RTE-PM: 01-DN-101-15-
DIST-EA: 01-0C2410
SUB JOB:
CLIENT: Marietta James

FA: ACT. CODE: 160
SPECIAL DESG:

BR. NO:
MSA CODE:

PHONE: 707-441-4692

Boring ID	Sample No.	Tube No.	Depth	Test Type															Remarks
				Unit Weight	Moisture Content	Specific Gravity	Mechanical Analysis	Atterberg	Consolidation	Triaxial UU	Triaxial CU	Unconfined Compression	Point Load	Direct Shear	Permeability	Compaction	Corrosion	Other	
RC-14-001	2		58-60		X		X												
RC-14-001	3		15-20		X		X	X											
RC-14-002	1		35-40		X		X	X											
RC-14-002	4		25-30		X		X												

CALIFORNIA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL LABORATORY

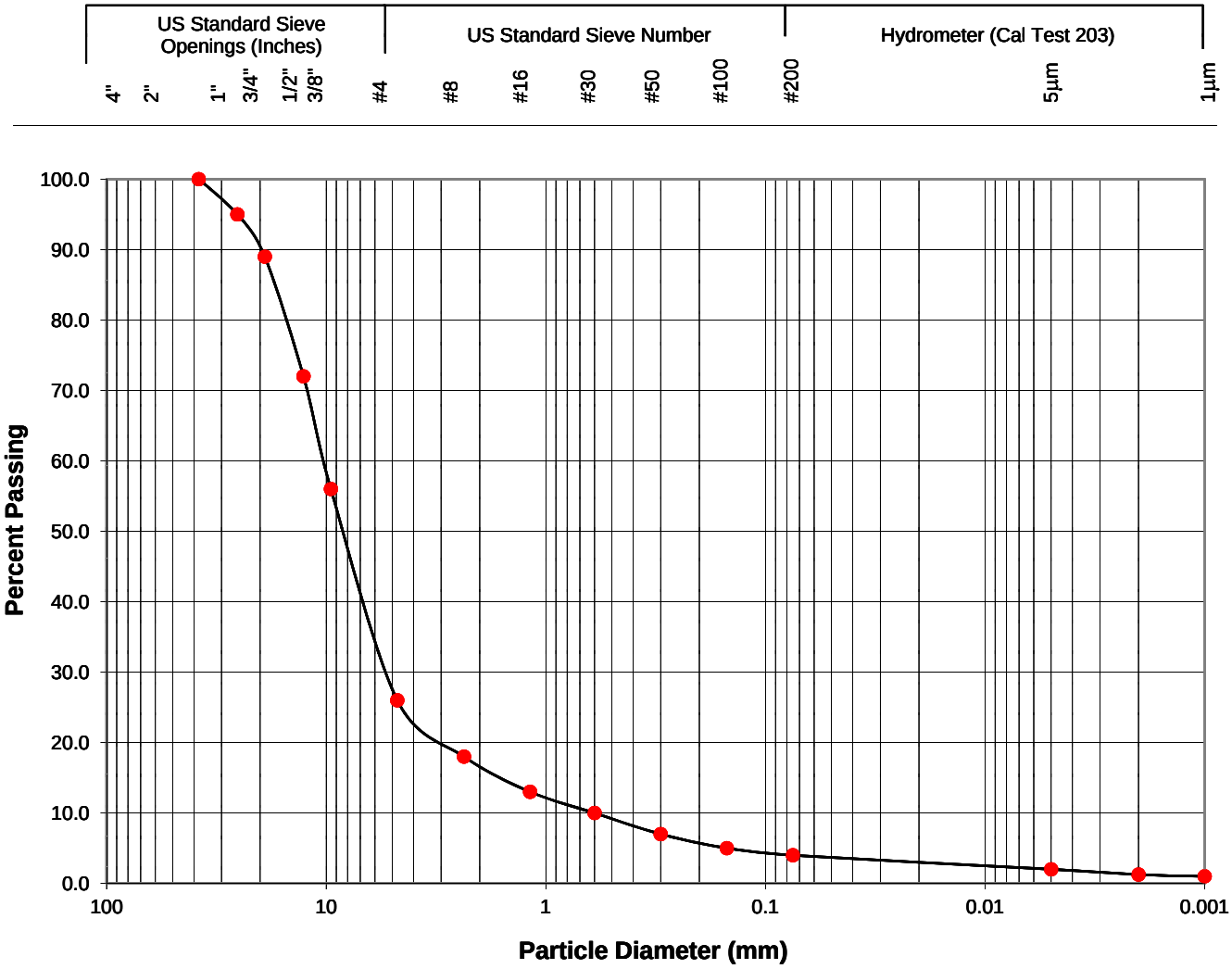
GL TRACKING NO : 14-047
Dist - EA: 01-0C2410
Report Date: September 30, 2014
Page: 1/1

CLASSIFICATION TEST SUMMARY

SAMPLE ID	% FINER THAN																	ATTERBERG LIMITS		AS RECEIVED		Gs
	3"	2 1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	5μ	1μ	LL	PI	γd (pcf)	%m	
RC-14-001_2				100	95	89	72	56	26	18	13	10	7	5	4	2	1				6.8	
RC-14-001_3								100	99	97	93	89	79	61	45	18	10		NP			
RC-14-002_1									100	95	88	83	71	55	41	18	9		NP			
RC-14-002_4					100	98	86	77	57	49	43	40	34	26	20	8	4				14.5	

SUMMARY OF PARTICLE ANALYSIS AND ATTERBERG LIMIT TESTS						
Boring ID	Depth (ft, bgs)	USCS	Description	ASTM Atterberg Limits		
				LL	PL	PI
RC-14-001	58 - 60	GP	Poorly Graded GRAVEL with SAND	--	--	--
RC-14-001	15 - 20	SP	Silty SAND	--	--	--
RC-14-002	35 - 40	SP	Silty SAND	--	--	--
RC-14-002	25-30	GM	Silty GRAVEL with SAND	--	--	--

Gradation Analysis Test Results



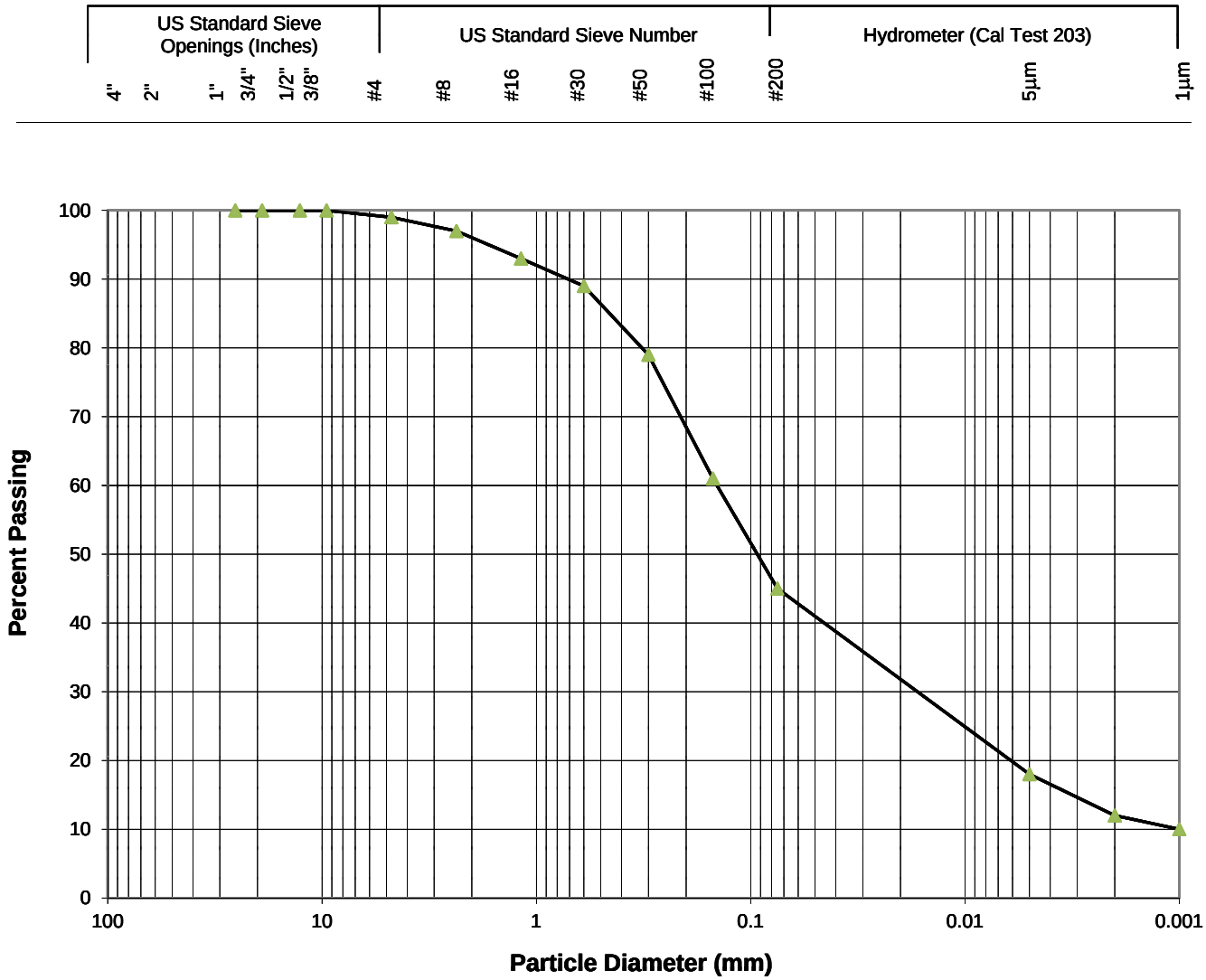
GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

Sample ID: RC-14-001 58'-60'

CALTRANS
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Engineering North - Branch B

Project:	South Last Chance Grade Wall
EA:	113000082
D.-Co.-Rt.-:	01-DN-101-PM 15.0
	9/30/2014

Gradation Analysis Test Results



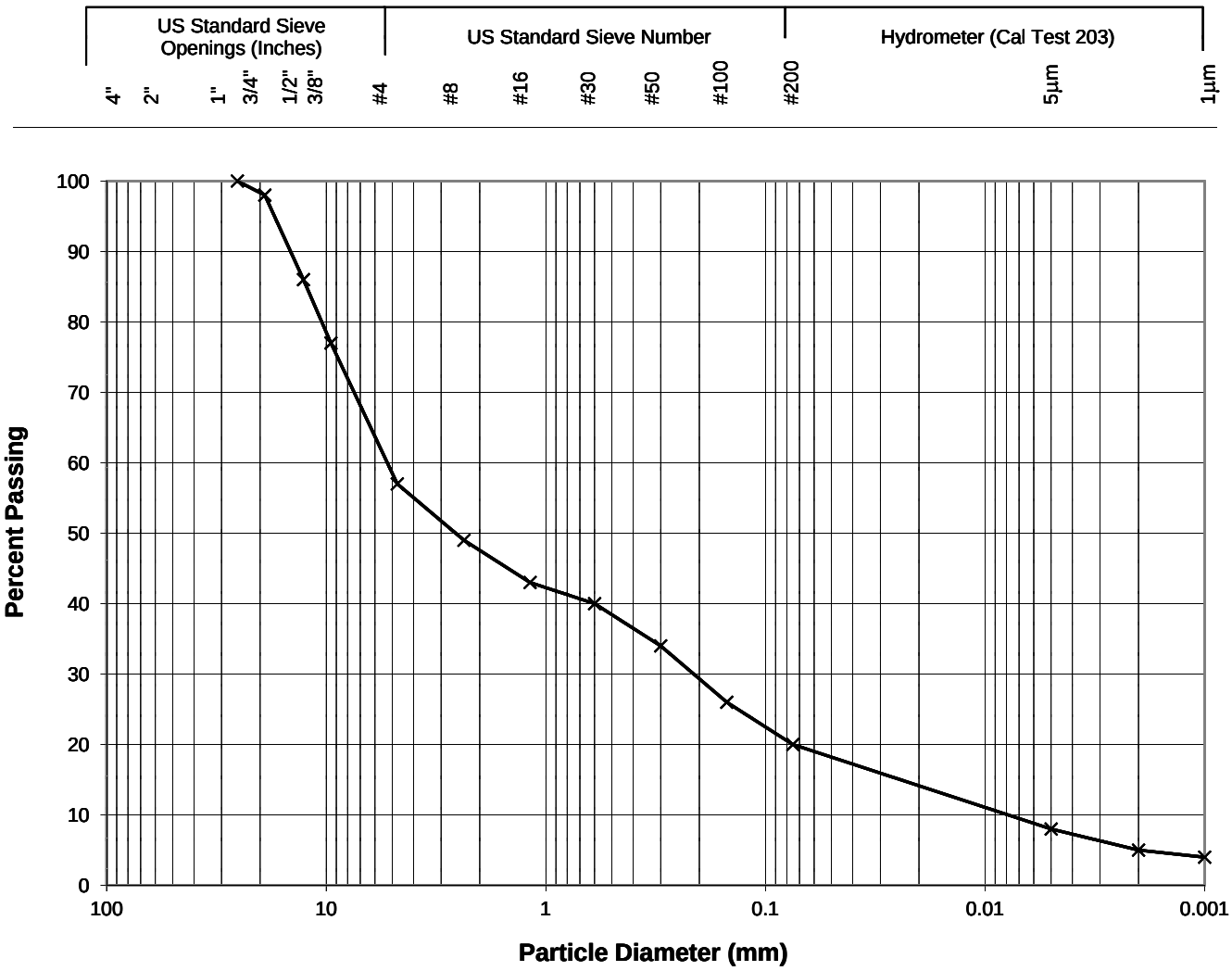
GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

Sample ID: RC-14-001 15'-20'

CALTRANS
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Engineering North - Branch B

Project:	South Last Chance Grade Wall
EA:	113000082
D.-Co.-Rt.-:	01-DN-101-PM 15.0
	9/30/2014

Gradation Analysis Test Results



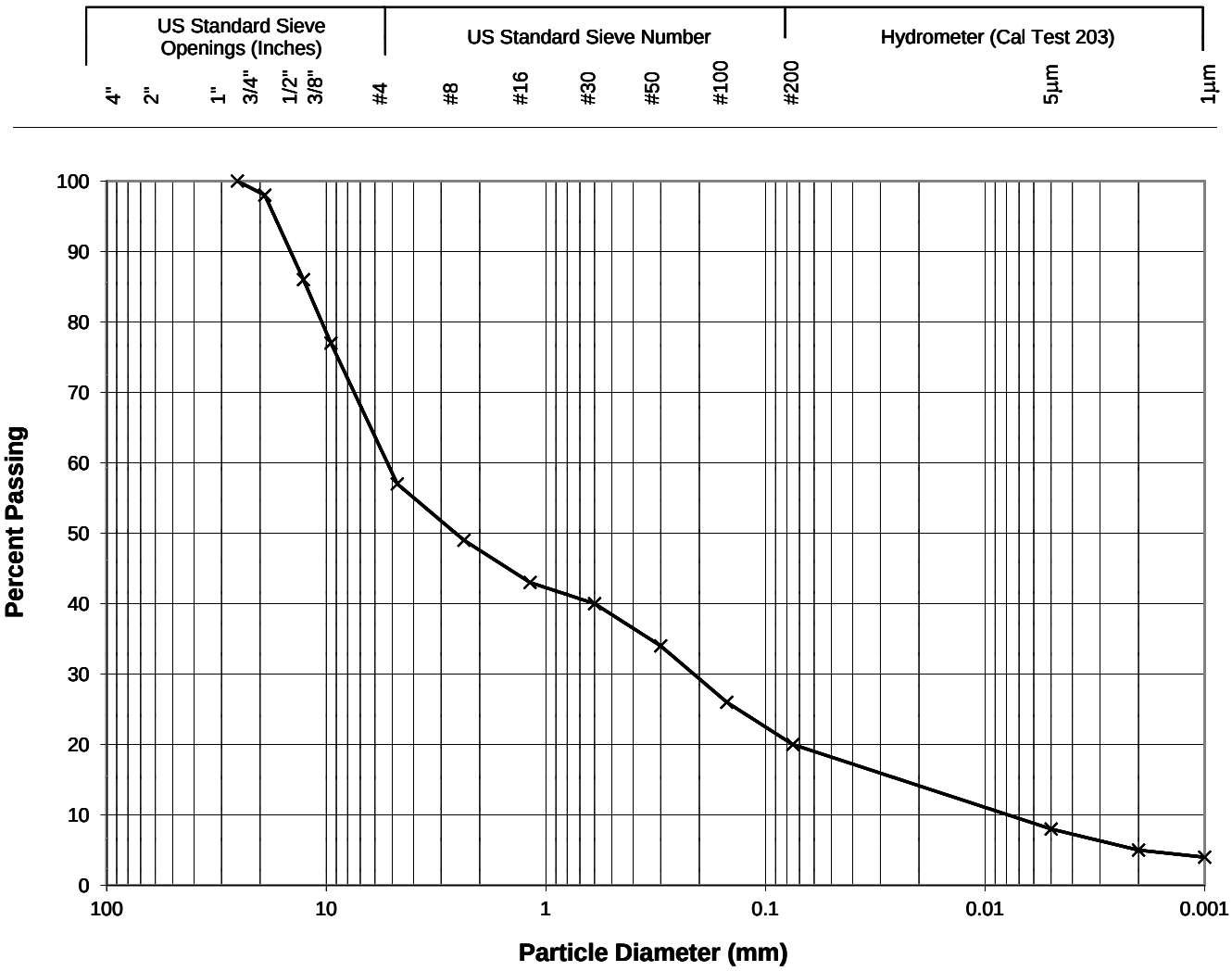
GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

Sample ID: RC-14-002 25'-30'

CALTRANS
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Engineering North - Branch B

Project:	South Last Chance Grade Wall
EA:	113000082
D.-Co.-Rt.-:	01-DN-101-PM 15.0
	9/30/2014

Gradation Analysis Test Results



GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

Sample ID: RC-12-001 25'-30'

CALTRANS
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Engineering North - Branch B

Project:	South Last Chance Grade Wall
EA:	113000082
D.-Co.-Rt.-:	01-DN-101-PM 15.0
	9/30/2014

APPENDIX D

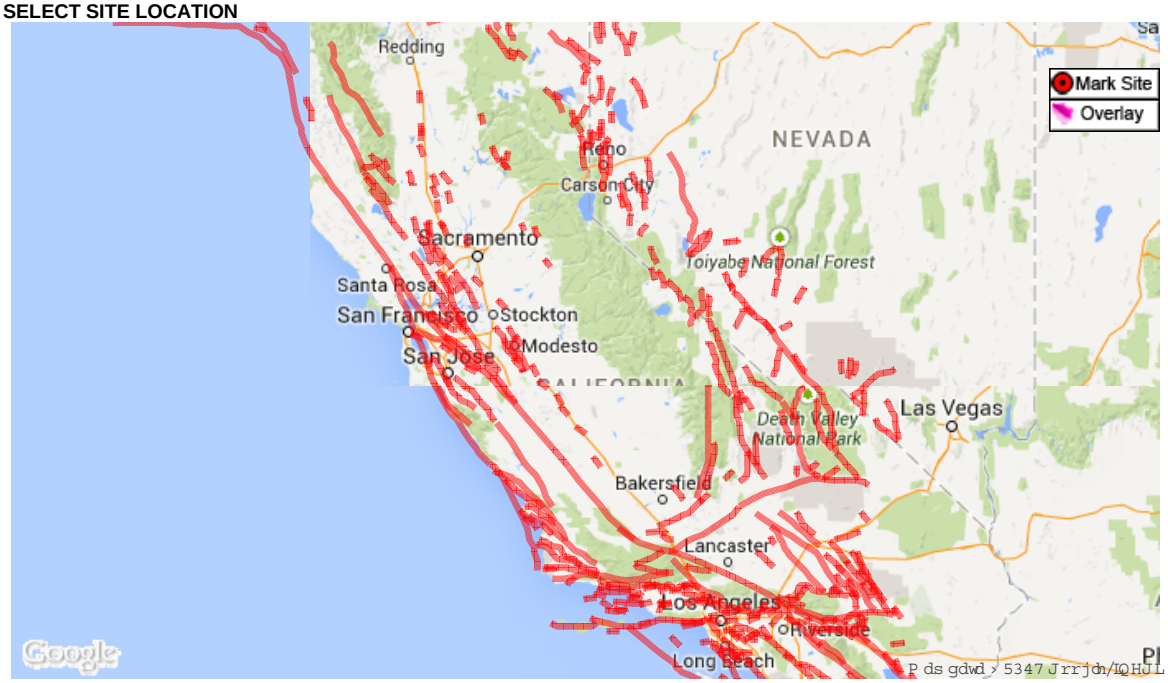
SEISMIC DATA

CALIFORNIA DEPARTMENT OF
TRANSPORTATION

Caltrans ARS Online (v2.3.06)

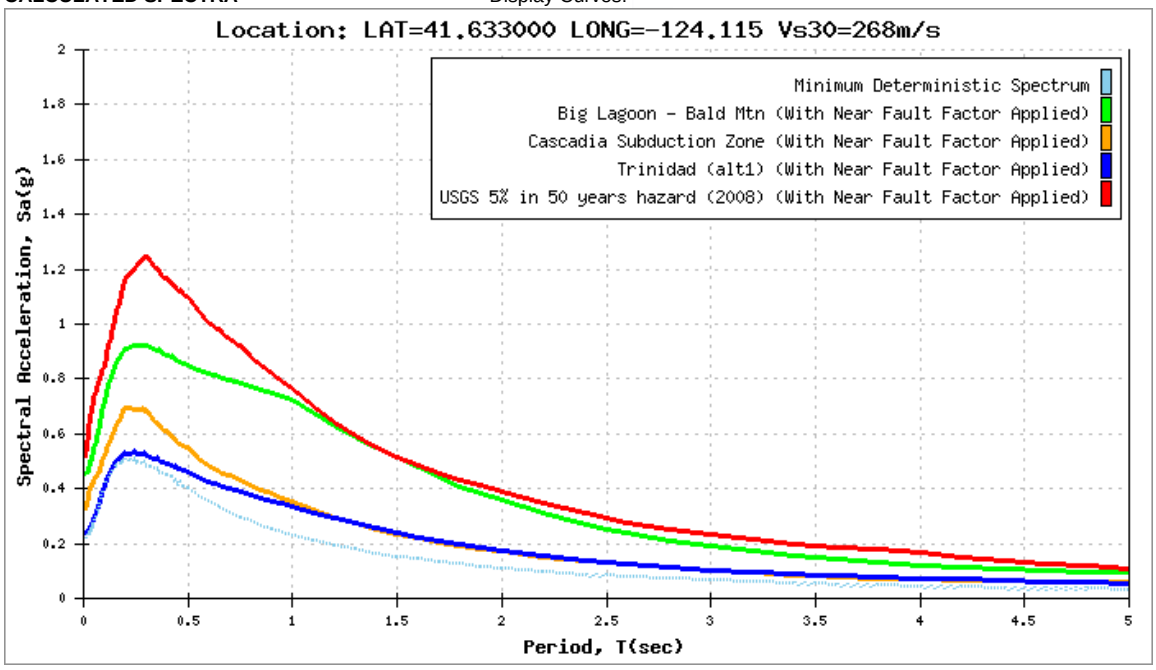
This web-based tool calculates both deterministic and probabilistic acceleration response spectra for any location in California based on criteria provided in *Appendix B of Caltrans Seismic Design Criteria*. More...

SELECT SITE LOCATION



Latitude: 41.633 **Longitude:** -124.115 ***Vs30*:** 268 m/s Calculate

CALCULATED SPECTRA Display Curves: 3



01-0B27U4
01-Del Norte-101-14.9/15.3
Project ID 0115000111

LAST CHANCE WALL

01-DN-101-PM 15.15

State of California
DEPARMENT OF TRANSPORTATION

California State Transportation Agency

M e m o r a n d u m

Serious drought.
Help Save Water!

To: BARTT GUNTER

Division of Structure Design
Office of Bridge Design South
Branch 19

Date: August 12, 2015

File: 01-DN-101-PM 15.15
EFIS ID: 0115000111
EA: 01-0B27U1
Last Chance Soil Nail Wall
Bridge No:01E0020

Attn: MAMUNUR RAHMAN

From: DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES – OGDN

Subject: Foundation Report for the Soil Nail Wall at DN 101 PM 15.15

1. INTRODUCTION

This Foundation Report summarizes the results of the geotechnical investigation and provides geotechnical recommendations for the proposed soil nail wall on Route 101 at post mile (PM) 15.15 in Del Norte County, CA (Figure 1- Vicinity Map). A 25 foot high soil nail wall is proposed at this location in order to prevent further retreat of a landslide head scarp into the existing roadway prism.

2. PROJECT DESCRIPTION

Winter rains in 2011 activated a shallow translational landslide below the roadway between PM 15.10 and 15.14 (Figure 2- Landslide Map and Plan View). This landslide destabilized a section of the southbound roadway prism. A soil nail wall was proposed to prevent further retreat of the head scarp into the roadway prism.
The proposed wall is approximately 225 feet long and has a maximum design height of 25 feet. The design life of the soil nail wall will be dependent upon the rate and magnitude of future landslide movement in this area.

The details of the proposed Soil Nail Wall are shown in Table 1.

Table 1- Description of the Proposed Soil Nail Wall

BEGIN			END			LENGTH (ft)	DESIGN HEIGHT (ft)	
Sta.	Latitude	Longitude	Sta.	Latitude	Longitude		Min.	Max.
496+0.00	41° 38' 13.319"	-124° 06' 54.88"	498+25.02	41° 38' 15.322"	-124° 06' 54.24"	225	5	25

3. SCOPE OF WORK

The recommendations contained in this report are based on a review of geotechnical/geologic literature, a subsurface investigation, field observations, laboratory testing of soil samples, and geotechnical calculations. Subsurface conditions were evaluated only at the boring locations and may deviate elsewhere within the Project Limits. The elevations reported in this memorandum are with respect to Mean Sea Level (MSL).

4. PERTINENT REPORTS AND INVESTIGATIONS

<u>Kleinfelder Reports</u>

1. Foundation Report Retaining Wall #2 "Last Chance Grade" Minor Roadway Realignment (EA 01-324700), Del Norte County, California dated November 9, 2007

<u>FHWA Publications</u>

2. Lazarte, Carlos A et.al. "Geotechnical Engineering Circular No. 7 Soil Nail Walls," Publication FHWA0-IF-03-017, Federal Highway Administration, Washington, D.C.

<u>Caltrans Reports</u>

3. Preliminary Investigation of Last Chance Grade Landslide (File 01-DN-101-15.0/15.5 01-32470K) dated 01-18-1994

4. Additional Investigation of Last Chance Grade Landslide (File 01-DN-101-KP 23.1/24.7 01-32470K) dated 04-20-1999

5. Wills, C. J., "Landslides in the Highway 101 corridor between Wilson Creek and Crescent City, Del Norte County, California," California Geological Society, 2000

6. Preliminary Geotechnical Report, Last Chance Grade Correction and Tunnel Study 01-DN-101-KM24.1/25.1(PM 15.0/15.6) work performed under EA 01-324700 dated 05-31-2001

7. Caltrans Corrosion Guidelines Version 2.0, 11/2012

8. Caltrans Bridge Design Specifications, Sections 4 and 5, August 2004

9. Last Chance Grade Retaining Wall #2 Structure Plans, dated 11-10-2008

10. Caltrans Soil and Rock Logging, Classification, and Presentation Manual, 2010 Edition.

11. Geotechnical Design Recommendations for the Repair at DN 101 PM 15.27 (EFIS ID: 011200259) dated 08-08-2012

5. FIELD INVESTIGATION AND TESTING PROGRAM

The approximate limits of the shallow translational landslide located below the roadway were mapped on April 30, 2013 in order to determine the down slope stability of the proposed wall (Figure 2).

One mud-rotary boring (RC-12-001) was drilled in January 2012 for the purpose of characterizing the subsurface conditions for the soil nails and determine if any landslide movement is occurring inboard of the existing landslide head scarp. The borehole was advanced using a truck mounted Acker MPCA and a CME 750 drill rig using a 94-mm HXB casing equipped with a diamond impregnated core bit. Soil and rock samples were logged in accordance to the Caltrans Soil and Rock Logging, Classification, and Presentation Manual 2010 Edition. The boring information will be provided in the Log of Test Borings (LOTBs).

A 2.75 inch SI casing was installed in the boring and backfilled with coarse sand and sealed with bentonite. The lower 20 feet of the casing was perforated to permit monitoring of water levels within the casing. Inclinometer readings were obtained between March 2012 and April 2013.

Two vertical boreholes (B-9 and B-11) and one horizontal borehole B-10(H) were drilled within the project limits in March 2007 by Kleinfelder as part of the foundation investigation for Retaining Wall #2 located within the project limits (References 1 and 9). All boring locations are shown on Figure 2.

A summary of the borings are provided in Table 1. The SI data are included in Appendix B.

Table 2 –Boring and Inclinometer Data Summary

BORING I.D.	STATION AND OFFSET	DEPTH OF BORING (ft, bgs)	SURFACE ELEVATION (ft, MSL)	DEPTH TO BEDROCK (ft, bgs)	BEDROCK ELEVATION (ft, MSL)
RC-12-001	496+31.3 LT 25.7'	50	760	8	752
B-9[1]	496+49.4 RT 1.2'	64	762.5	4	758.5
B-10(H)[1,2]	496+60.20 RT 14.5'	55	--	-	-
B-11[1]	497+5.4 RT 0.6'	100	767	23.3	743.7

[1] – Borings drilled by Kleinfelder, March 15-21, 2007. Station and offset are approximate.

[2] – Horizontal Boring

6. SITE GEOLOGY AND SUBSURFACE CONDITIONS

6.1. Site Description

The shallow translational landslide that initiated this project was triggered during the 2011/2012 storm season. This slide over-steepened a section of the fill slope adjacent to the roadway prism denuding the lightly forested area. The existing 1H:1V and steeper side slopes not affected by the slide are vegetated lightly with young Douglas fir (Pseudotsuga menziesii), Redwood (Sequoia sempervirens) and Red Alder (Alnus rubra) along with an understory associated with a coastal Redwood forest.

The northbound lane within the project limits is bordered by a 181- foot long soldier pile ground anchor wall (Retaining Wall #2) and a 1H:1V or steeper cut slope dominated by a second-growth Redwood forest (Figure 2).

Surface water within the project limits drains through an 18 inch culvert at PM 15.15.

6.2. Site Geology

The project site is located within the 2.5 mile segment of Highway 101 between Wilson Creek and Crescent City known as Last Chance Grade. Last Chance Grade crosses several active deep bedrock landslides on the western flank of a 1,000+ foot ridge adjacent to the Pacific Ocean (Figure 3-Project Geologic Map). The project is located within the southern section of the Last Chance Grade slide (map unit Qlss- Figure 3) that extends between post miles 15.20 and 14.85 with a depth of movement measured at 260 feet near post mile 15.1.

Bedrock within the project site is composed of the “Broken Formation” unit of the Franciscan complex and is composed mainly of thickly bedded sandstone with siltstone and shale interbeds (Ref. 5). Landslides in the Broken Formation are mainly translational and tend to have large masses of rock that slide on narrow zones of weakness.

Historically the movement of the southern portion has been episodic and is assumed to be triggered by heavy rainfall.

6.3. Subsurface conditions

The site is underlain by a mix of fill and asphalt with approximate thickness ranging between 5 and 9 feet. The fill is composed of dense, Silty Sand with Gravel (SM) and Well-graded Gravel with Silt and Sand (GW-GM) Underlying the fill is approximately 7 to 14 feet of landslide debris. The landslide debris was composed of Sandstone decomposed to poorly graded Gravel with Sand (GP) and poorly graded Gravel (GP). Beneath the landslide debris is a shear zone ranging in thickness between 9 and 17 feet. The shear zone was composed of loose Well-graded Gravel with Clay and Sand (GW-GC), loose to medium dense Poorly-graded Gravel with Sand (GP), and medium dense Well-graded Gravel interspersed with seams of loose Clayey Sands (SC). The Sandstone below the shear zone was slightly weathered to decomposed and very intensely fractured (Figure 4- Subsurface Geology along Wall Layout Line).

Landslide movement in the project area is currently being monitored via a surface monitoring network extending from PM 14.3 to approximately PM 15.3. Between July 2012 and April 2015, Retaining Wall #2, upslope of the proposed soil nail wall, has experienced a maximum total horizontal displacement of 10 inches to the west and a maximum vertical displacement of 4.2 inches. Based on the data from the monitoring network the entire project site is moving, presumably as a block, along the deeper failure surface identified at a depth of 260 feet below ground surface in SI P1450 (Appendix B).

In 2007 two tension cracks were mapped in the travelled way near the north end of Retaining Wall #2 and were determined to be due to the down dropping of a western rock mass (Ref.1 and Figure 3). During the Summer of 2014, the tension cracks have started to become visible again along with some distortion along the center line. A 5 to 15 feet deep shallow translational slide was also mapped above the roadway in 2007 (Ref. 1 and Figure 3).

The concrete safety shape at Retaining Wall #2, is exhibiting parallel cracks along its entire length due the horizontal and vertical movement from the slide.

The upper 40 feet of the slope inclinometer (SI) RC-12-001 shows a small deflection or tilting to the west which is likely due to the relaxation of the slope adjacent to the head scarp. SI P1450 which was installed in 2013 to monitor the larger landslide indicates movement at a depth of 260 feet below ground surface.

6.4 Groundwater conditions

Groundwater was measured in borehole RC-12-001 at a depth of 49.6 feet on March 11, 2013. It is assumed that the groundwater is fracture controlled and hence highly variable. The soil nails may encounter perched groundwater based on the hydrophytic vegetation observed downslope of the wall.

7. CORROSION EVALUATION

Corrosivity testing was not conducted at this site. The corrosivity testing from the two projects in the vicinity (Refs. 1 and 11) indicate that the soil has a minimum resistivity ranging between 3800 to 5038 ohms-cm and a pH between 6.12 and 8.14.

For structural elements, the Department considers a site to be 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 or greater, sulfate concentration is 2000 ppm or greater, or the pH is 5.5 or less.

Based on the Caltrans Corrosion Guidelines (2012 version 2.0) and the laboratory test results, the site soils may be considered non-corrosive to steel and concrete.

As per Section 6.2 of the Guidelines (Survey of Site Conditions), it is noted that the project is located on a cliff that is within 0.2 miles of the Pacific Ocean.

8. GEOTECHNICAL AND FOUNDATION RECOMMENDATIONS

8.1. Wall Location and Height

The wall layout line is shown on Figure 2 - Landslide Map and Plan View. The proposed Soil Nail Wall is approximately 225 feet in length with a maximum design height of 25 feet with 5 levels of soil nails. The recommended finished grade elevation on the down slope side of the wall at roadway station “A” 496+31.3 is at approximate elevation 736 feet. Nail lengths of 50 feet are recommended to aid in stabilizing the roadway prism.

8.2. Slope Stability Analysis and Design Parameters

The recommended soil and rock parameters for the retaining wall design are provided in Table 3. The design cross-section is shown in Figure 5 – Design Cross Section A-A’ Sta. 496+31.3.

Table 3 – Soil and Rock Design Parameters

LAYER	APPROXIMATE THICKNESS (ft)[1]	TOTAL UNIT WEIGHT (pcf)	ANGLE OF INTERNAL FRICTION (degrees)	COHESION (c, psf)
(1) Fill	5-9	135	32	0
(2) Landslide Debris	7-14	135	40	75
(3) Shear Zone	9-17	125	33	0
(4) Sandstone	230[2]	138	38	500

[1] – At wall layout line
[2] – Thickness was chosen arbitrarily for the stability analysis.

These design parameters were determined from the slope stability program SLOPE/W 2012 using Design Cross Section A-A' (Figure 5). Observed ground surface features and previous geologic mapping were used to fix the entry, depth and exit points of the failure surface. A factor of safety of 1.0 was assumed for the existing slope in order to back calculate the strength parameters. The Morgenstern and Price Method of limit equilibrium that satisfies both force and moment equilibrium was used for this analysis. The graphic results are presented in Figure 6 – Stability Analysis for Existing Conditions.

8.3. Hydrostatic Forces

The recommended design groundwater surface elevation is 16 feet below top of the wall (Figure 7 - Soil Nail Wall Stability Analysis). Provisions for drainage will be required at the back of the wall face.

8.4. Seismic Recommendations

The shear wave velocity of 269 m/s (883 ft/s) was determined from soil types and corrected SPT numbers. Utilizing the Caltrans ARS online tool (V2.3.06), we recommend using the USGS 5% in 50 years hazard (2008) curve, which yields a spectral acceleration of 0.49 g at period T = 0 seconds. The horizontal seismic coefficient (Kh) is typically taken as 1/3 to

½ of the Peak Ground Acceleration (PGA). We recommend using Kh = 0.16 for LRFD Extreme Event analysis. We recommend a value for vertical seismic coefficient Kv = 0.

The ARS online data sheet utilized is attached to this report in Appendix C – Seismic Data.

9. DESIGN CRITERIA FOR SOIL NAIL WALL

The Caltrans' Soil Reinforcement Computer Program SNAIL version 1.3 was used to design the proposed soil nail wall. The minimum internal factor of safety for the wall was 1.65. The graphic results are shown in Figure 7 – Soil Nail Wall Stability Analysis. The wall was designed conservatively using the design groundwater surface elevation which is higher than measured.

The global stability for the wall was calculated using the criteria used for the back analysis because this wall is not intended to stabilize the landslide. A minimum factor of safety of 1.34 was obtained for the external (or global) stability of the wall. The graphic results are shown in Figure 8 – Soil Nail Wall Global Stability Analysis.

The following limiting criteria were used in the design of the proposed soil nail portion of the wall.

1. The minimum factor of safety for static loading, FOS static = 1.65
2. Maximum design soil nail wall height = 25 feet
3. Maximum horizontal spacing = 4.0 feet
4. Maximum vertical spacing = 5.0 feet
5. Traffic Surcharge = 270 psf
6. External Load (facing) = 19 kips per 4 feet of horizontal spacing
7. Maximum vertical distance between top of cut and the top most row of soil nails = 3 feet
8. The inclination angle of the nails to the horizontal = 15 degrees
9. The maximum vertical distance from bottom row of the soil nails to the bottom the soil wall = 3 feet.
10. A single zone is recommended for soil nail testing using the following parameters:
    a. Friction angle, φ = 33 degrees
    b. Cohesion, c = 0 psf
    c. Total unit weight = 125 pcf
11. The recommended minimum nail length is 50 feet.

9.1. Stability Testing

For the purpose of stability and load testing, it is recommended that the entire wall be treated as a single zone.

9.2. Soil Nail Proof Testing

Approximately 19 soil nail proof tests are anticipated (8% of the production nails). Figure 9 - Location of Proof Test Nails shows the recommended locations of the proof tests.

9.3. Downslope Stability

The downslope stability was evaluated at the proposed finish grade elevation of approximately 736 ft. The factor of safety for a critical failure surface originating from the toe of the wall is 1.1. Geologic mapping below the limits of the proposed wall identified sandstone that is locally stable.

9.4. Bearing Capacity

The allowable bearing capacity at the base of the wall for a 2-foot wide footing is 733 pounds per square foot (psf). The bearing capacity assumes that the bearing pad will be placed on a surface that is approximately 15-20 feet from the wall face to the hinge point.

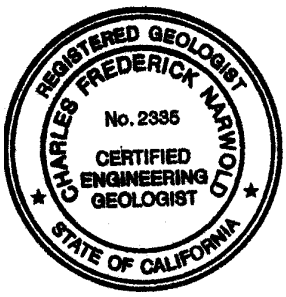
10. CONSTRUCTION CONSIDERATIONS

Backfill will be required along the soil nail wall alignment prior to construction due to the loss of the travel way. The Broken Formation may generally be excavated using standard excavation equipment. Due to the intensely fractured nature of the Broken Formation difficult drilling and caving conditions may be encountered.

The soil nails may encounter perched groundwater.

The deep SI P1450 that is located in the construction staging area will have to be protected during construction.

If you have any questions or require additional information, please contact June James at (707) 441-4692 or Charlie Narwold at (707) 445-6036.



JUNE JAMES
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CHARLES NARWOLD
Senior Engineering Geologist
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Branch B

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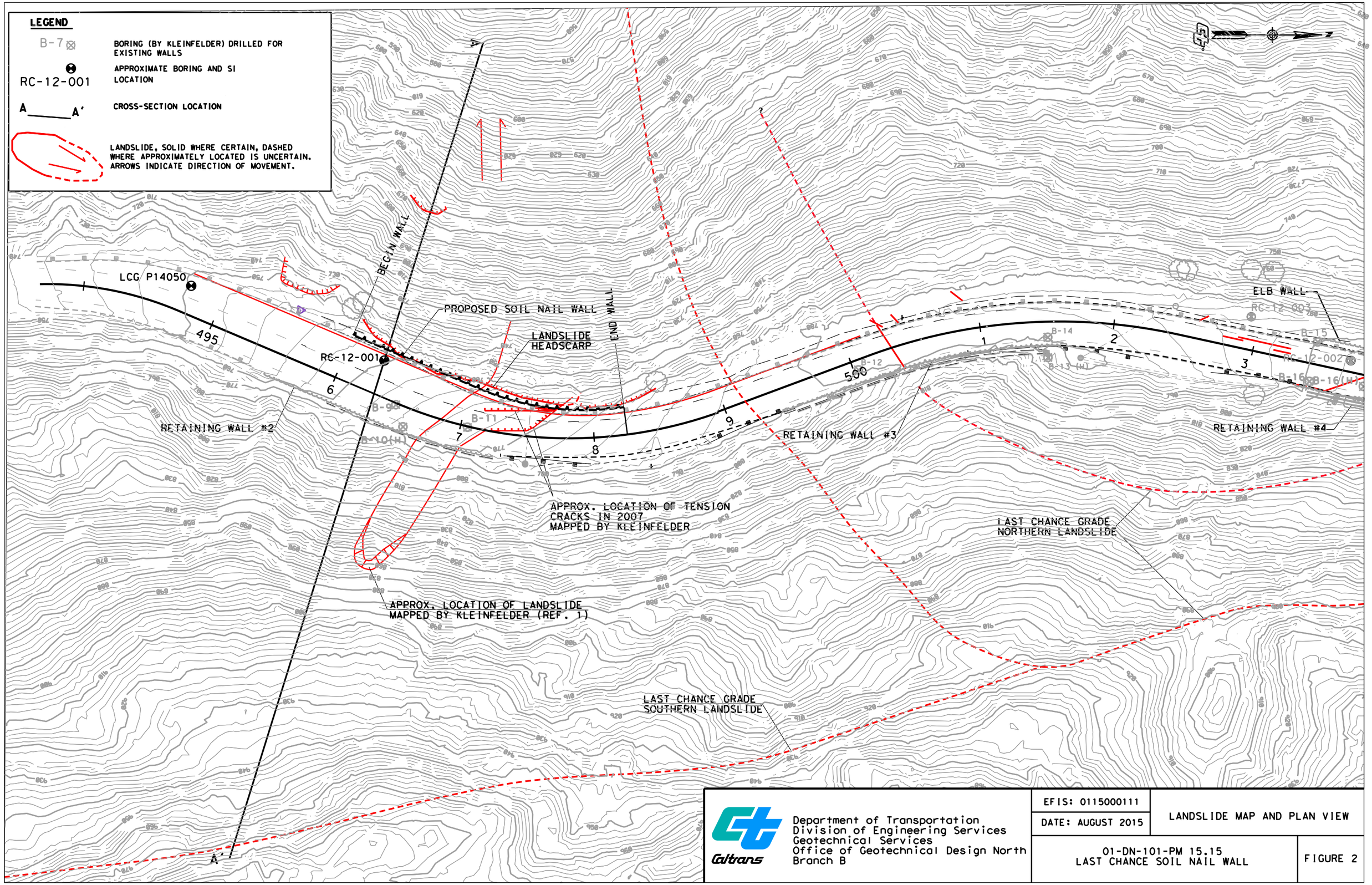
Appendix A – Kleinfelder Log of Test Borings
Appendix B – Slope Inclinometer Monitoring Results
Appendix C – Seismic Data

C: Traci Menard – GS
Talitha Hodgson – District 01

Department of Transportation Division of Engineering Services Geotechnical Services Office of Geotechnical Design North Branch B	EFIS: 0115000111 DATE: AUGUST 2015	**VICINITY MAP**
	01- DN 101 PM 15.15 LAST CHANCE SOIL NAIL WALL	**FIGURE 1**



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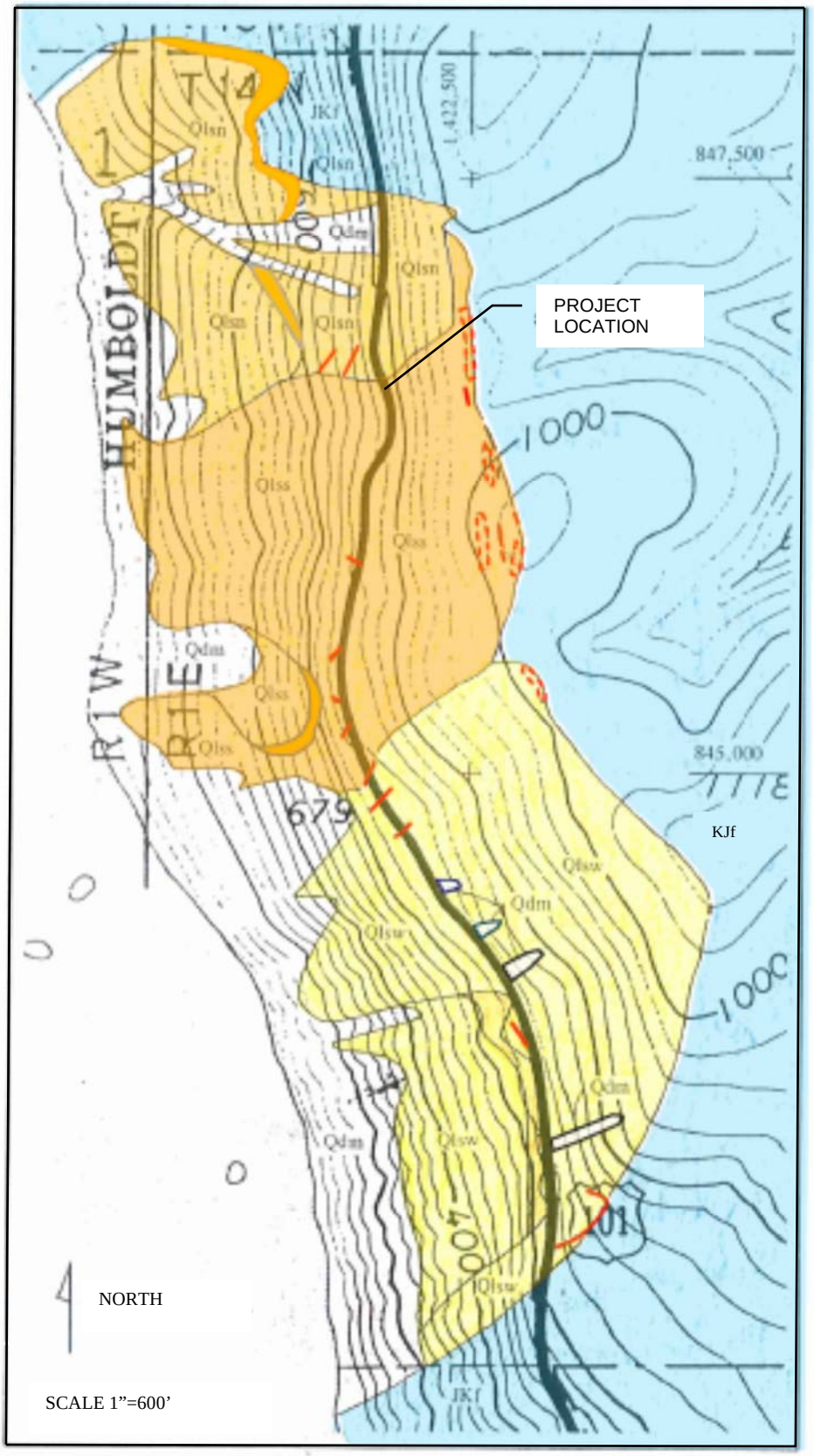
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design North
Branch B

EFIS: 0115000111	LANDSLIDE MAP AND PLAN VIEW
DATE: AUGUST 2015	
01-DN-101-PM 15.15 LAST CHANCE SOIL NAIL WALL	FIGURE 2



LEGEND

Qlsn	Holocene Age Last Chance Grade Landslide very active northern portion
Qlss	Holocene Age Last Chance Grade Landslide very active southern portion
Qlsw	Holocene Age Wilson Creek Wall Landslide
Qdm	Holocene Age debris flows, shallow landslides, and mass wasting
KJf	Cretaceous/ Jurassic Age Franciscan Complex mélange

SYMBOL

- Closed Depression
- Tension Cracks
- Landslide Scarp

GEOLOGIC MAP

Additional Investigation of Last Chance Grade Landslide

01-DN-101-KP 23.1/24.7

01-32470K

Tim Beck 2/9/99

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

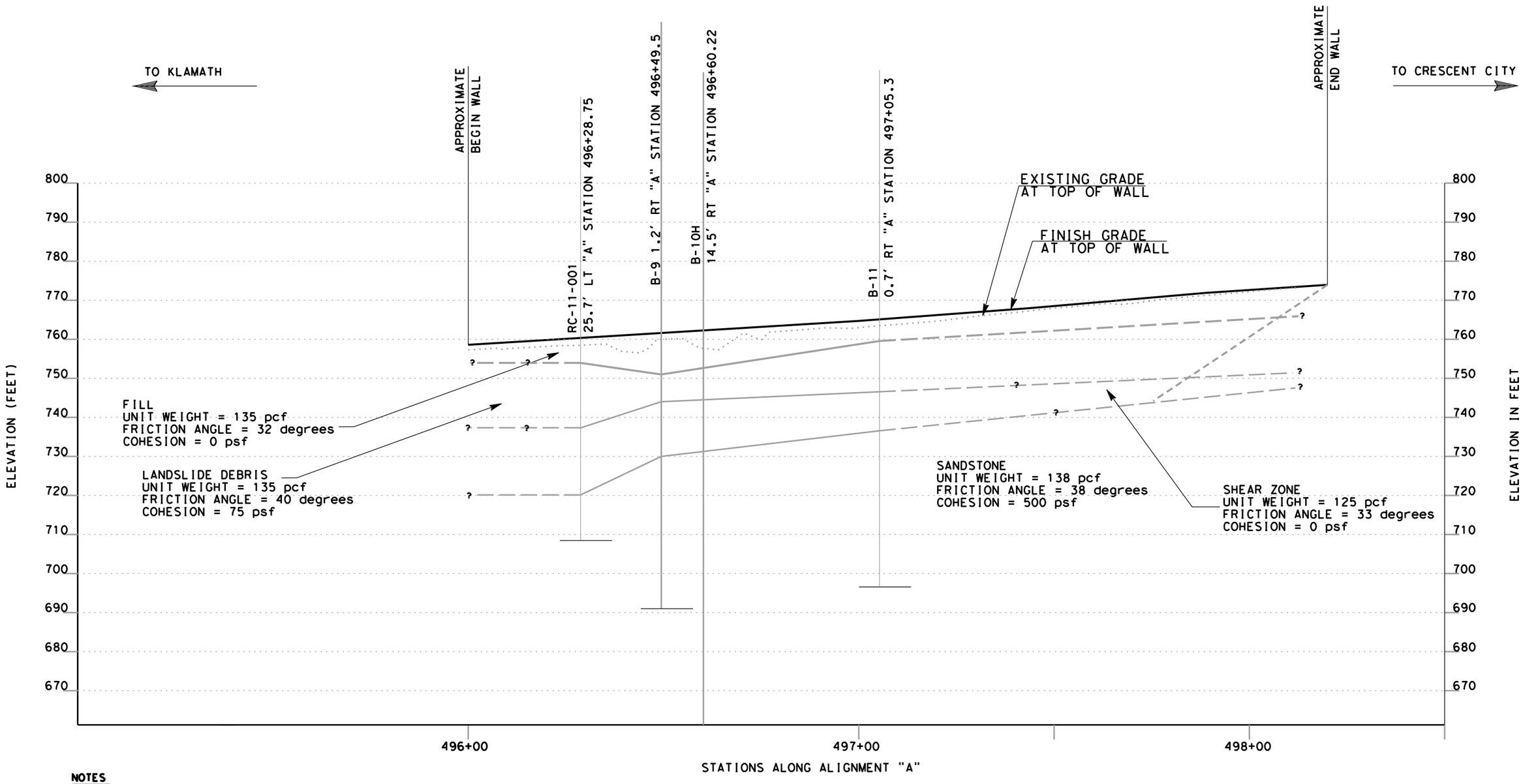
EFIS ID: 0115000111

DATE: AUGUST 2015

PROJECT GEOLOGIC MAP

01-DN-101-PM 15.15
LAST CHANCE SOIL NAIL WALL

FIGURE 3



NOTES

GEOLOGIC CONTACT, SOLID WHERE CERTAIN, DASHED WHERE APPROXIMATELY LOCATED AND QUERIED WHERE EXISTENCE IS UNCERTAIN

INFORMATION FROM BOREHOLES B-9 AND B-11 ARE PROJECTED

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Geotechnical Services
Office of Geotechnical Design - North

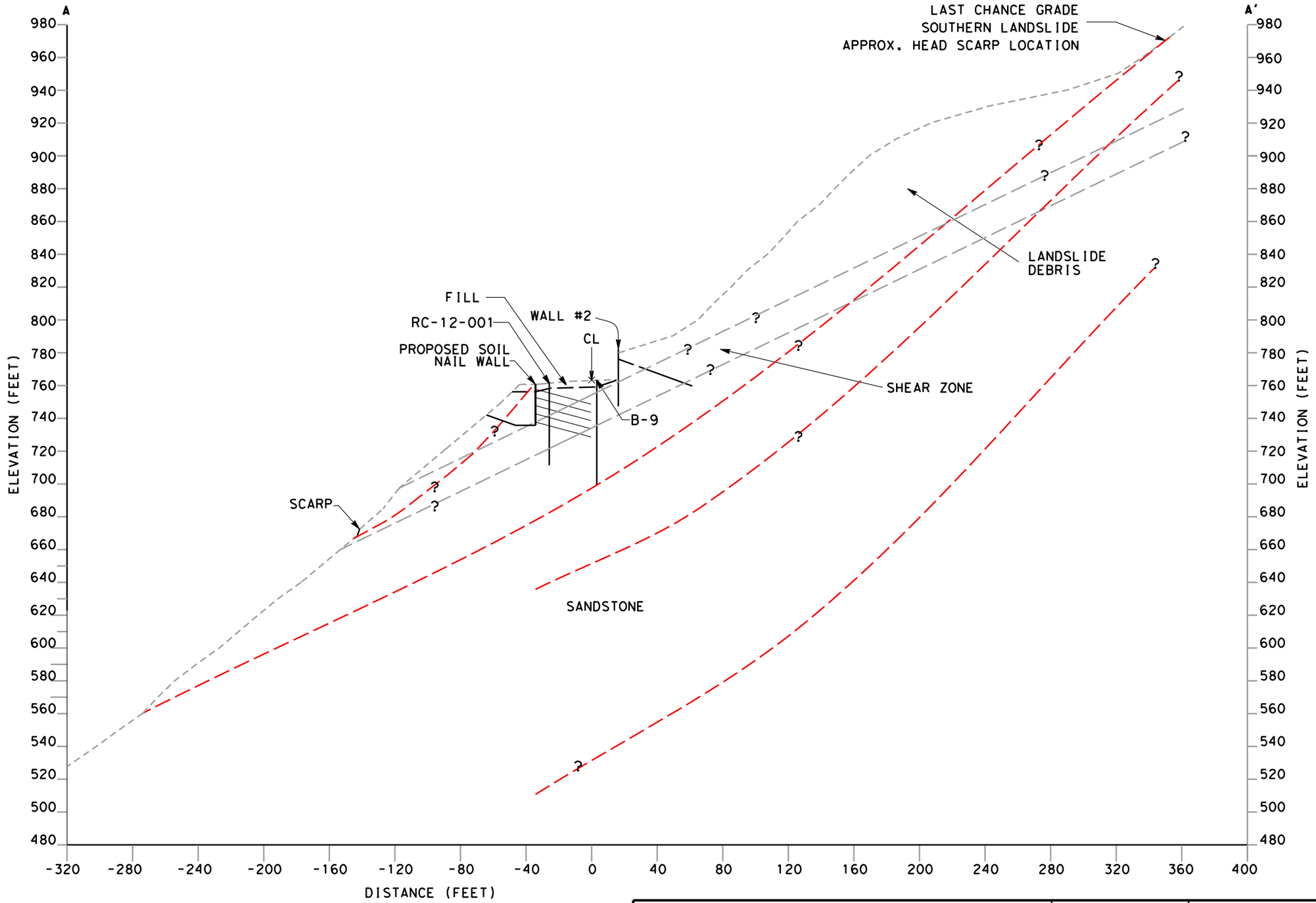
EFIS: 0115000111

DATE: AUGUST 2015

SUBSURFACE GEOLOGY ALONG WALL LAYOUT LINE

01-DN-101 PM-15.15
LAST CHANCE SOIL NAIL WALL

FIGURE 4



EXPLANATION

? GEOLOGIC CONTACT, SOLID WHERE CERTAIN, DASHED WHERE APPROXIMATELY LOCATED AND QUERIED WHERE EXISTENCE IS UNCERTAIN

? LANDSLIDE PLANE, SOLID WHERE CERTAIN, DASHED WHERE APPROXIMATELY LOCATED AND QUERIED WHERE EXISTENCE IS UNCERTAIN

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

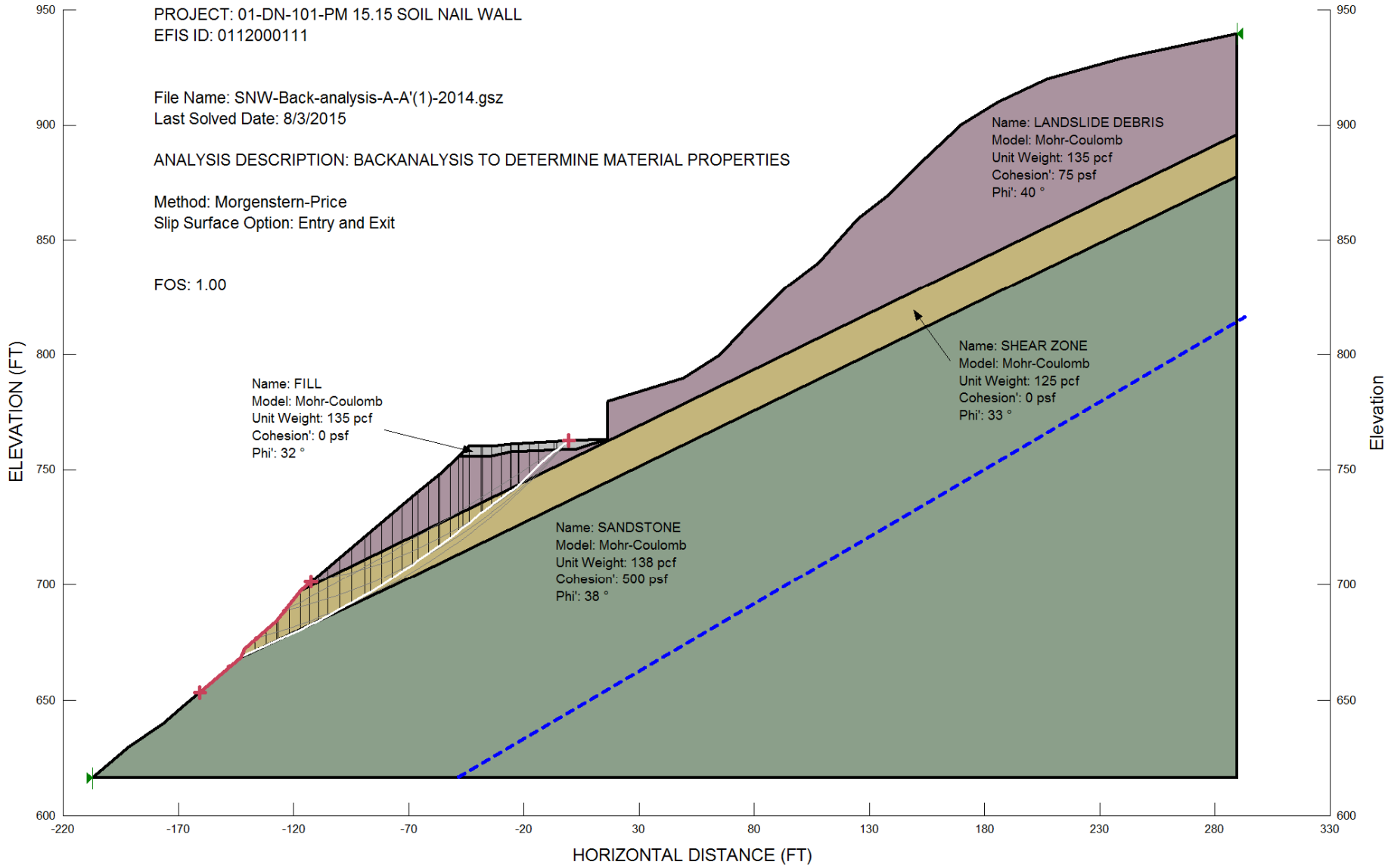
EFIS: 0115000111

DATE: AUGUST 2015

DESIGN CROSS SECTION A-A'
STA. 496+31.3

01-DN-101 PM-15.15
LAST CHANCE SOIL NAIL WALL

FIGURE 5



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Branch B

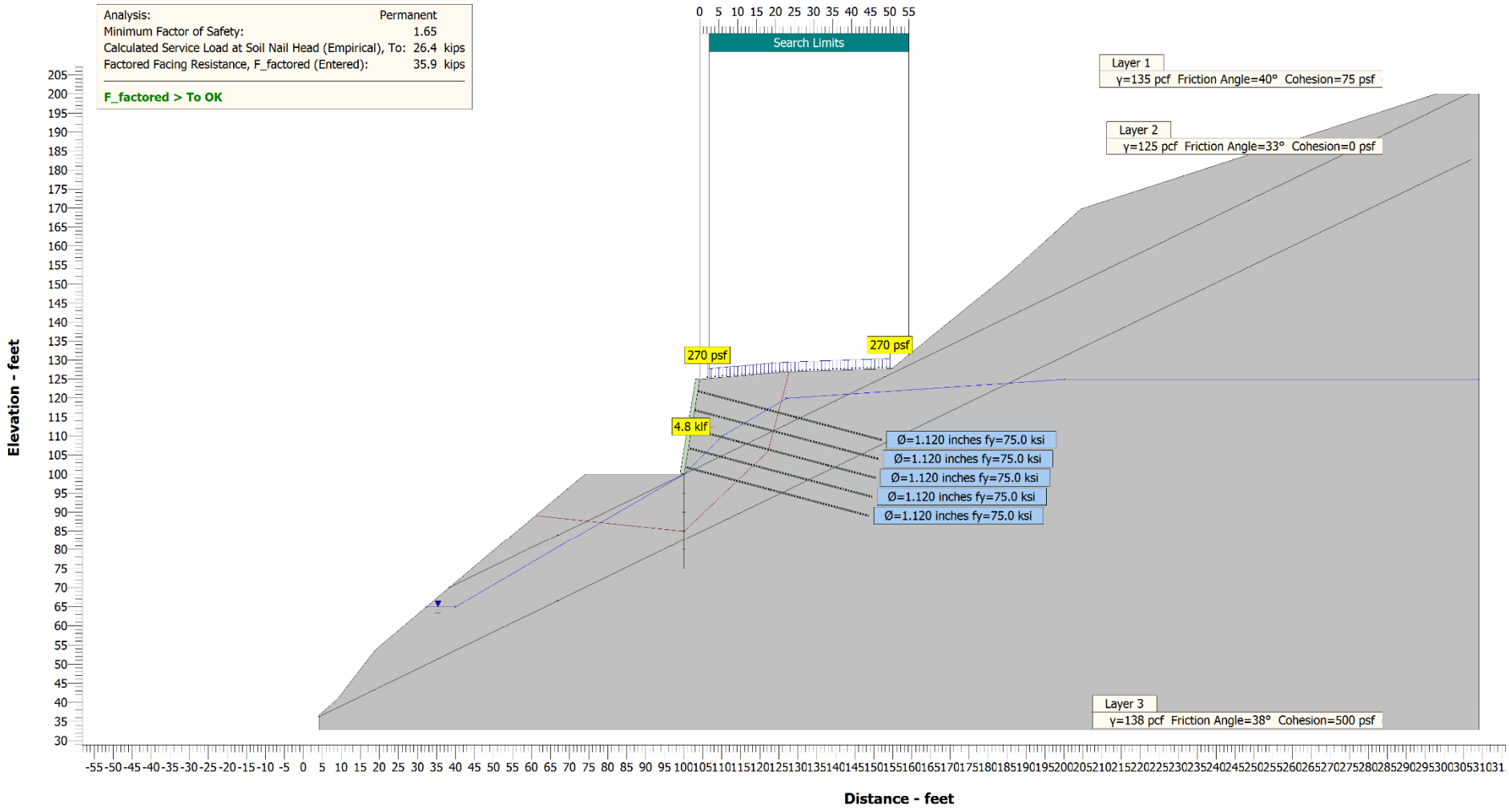
EFIS: 0115000111

Date: AUGUST 2015

STABILITY ANALYSIS FOR EXISTING CONDITIONS

01-DN-101 PM 15.15
LAST CHANCE SOIL NAIL WALL

Figure 6



Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design North
Branch B

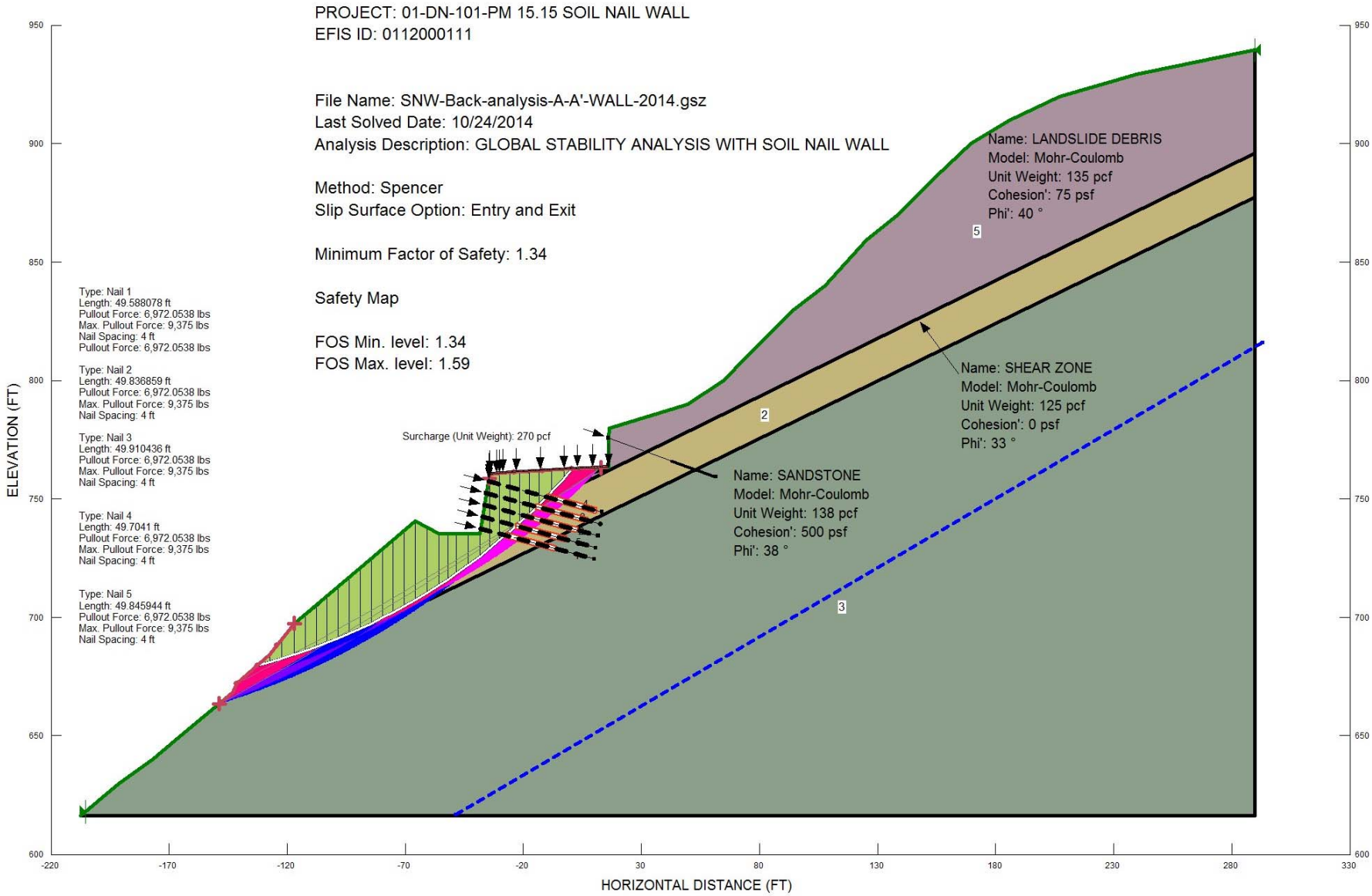
EFIS: 0115000111

Date: JULY 2015

SOIL NAIL WALL STABILITY ANALYSIS

01-DN-101 PM 15.15
LAST CHANCE SOIL NAIL WALL

Figure 7



Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design North
Branch B

EFIS: 0115000111

Date: AUGUST 2015

SOIL NAIL WALL GLOBAL STABILITY ANALYSIS

01-DN-101 PM 15.15
LAST CHANCE SOIL NAIL WALL

Figure 8

APPENDIX A

KLEINFELDER LOG OF TEST BORINGS

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
01	DN	101	14.8/15.6		

GEOTECHNICAL PROFESSIONAL — DATE 10-15-07

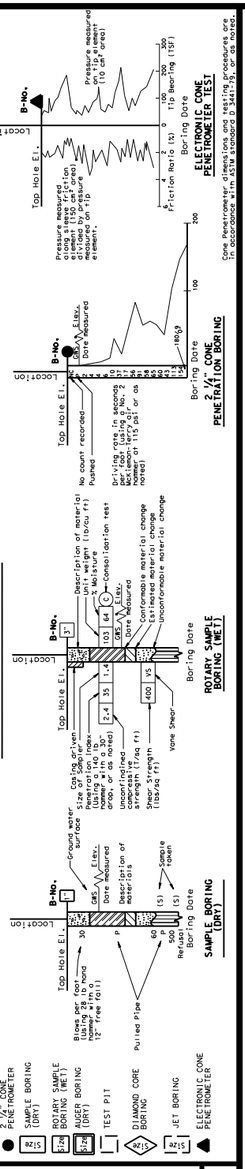
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — MARK H. STANLEY — No. G.E. 002397 — Exp. 9-30-08 — STATE OF CALIFORNIA

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

KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407

LEGEND OF BORING OPERATIONS



WEATHERING DESCRIPTORS

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

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

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

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

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

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

BEDDING, FOLIATION, OR FLOW TEXTURE DESCRIPTORS

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

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

FRACTURE DENSITY

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

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

UNFRACTURED (FD0): No fractures.

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

SLIGHTLY TO VERY SLIGHTLY FRACTURED (FD2)*

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

MODERATELY TO SLIGHTLY FRACTURED (FD4)*

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

INTENSELY TO MODERATELY FRACTURED (FD6)*

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

VERY INTENSELY TO INTENSELY FRACTURED (FD8)*

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

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

ROCK HARDNESS DESCRIPTORS

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

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

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

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

LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

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

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

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

BRIDGE NO. X — POST MILE 15.13/15.14

"LAST CHANCE GRADE" RETAINING WALL NO. 2

LOG OF TEST BORINGS 1 OF 5

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

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 01
EA 324700

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES (PRELIMINARY STAGE ONLY) 10-1-07 — SHEET X OF X

FILE => $REQUEST

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

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
01	DN	101	14.8/15.6		

GEOTECHNICAL PROFESSIONAL DATE 10-15-07

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — MARK H. STANLEY — No. G.E. 002397 — Exp. 9-30-08 — STATE OF CALIFORNIA

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KLEINFELDER
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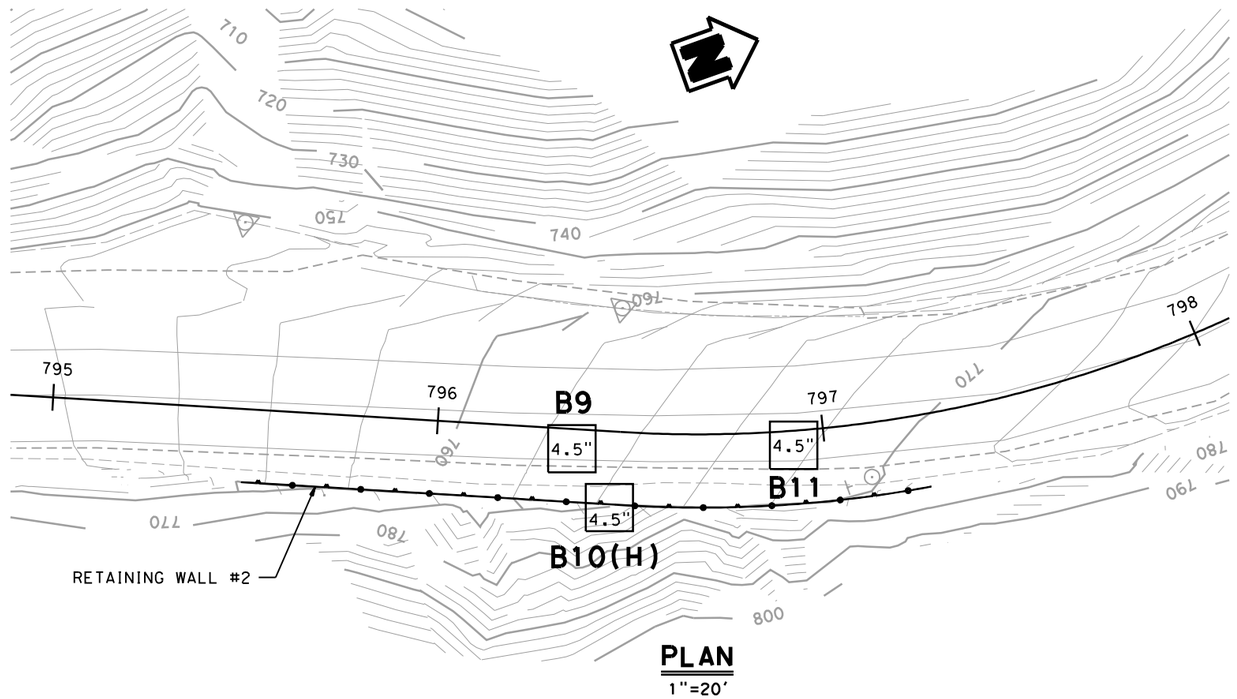
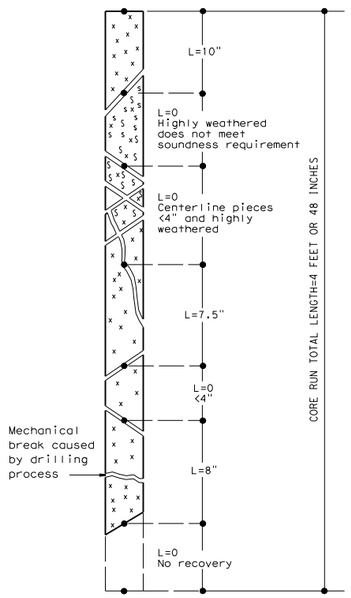


PLAN
1"=20'

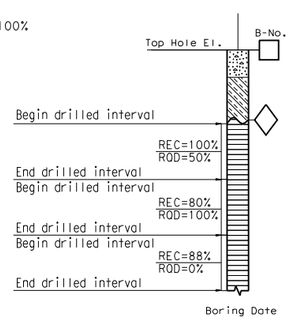
ROCK QUALITY DESIGNATION (RQD) & PERCENT RECOVERY (REC) LOGGING



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

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

RQD = 53% (fair)



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

After Deere & Deere, 1989

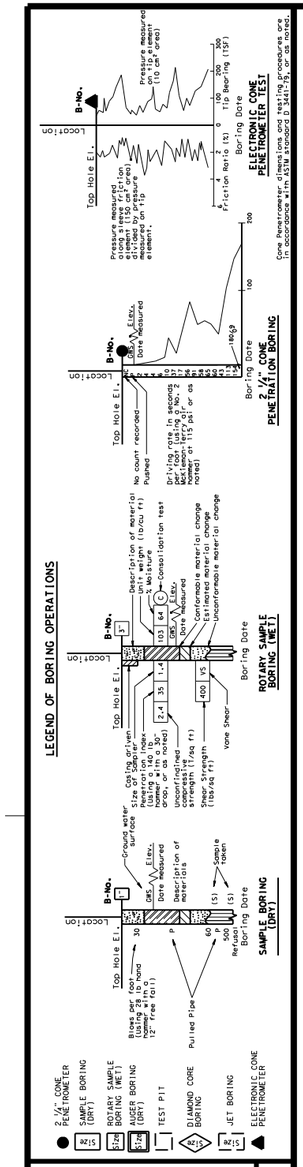
Notes:

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

IN-SITU, LAB & FIELD TEST DESIGNATIONS

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

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

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

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

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

BRIDGE NO. X
POST MILE 15.13/15.14

"LAST CHANCE GRADE" RETAINING WALL NO. 2

LOG OF TEST BORINGS 2 OF 5

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

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 01
EA 324700

DISREGARD PRINTS BEARING EARLIER REVISION DATES 10-1-07

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

FILE => $REQUEST

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

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

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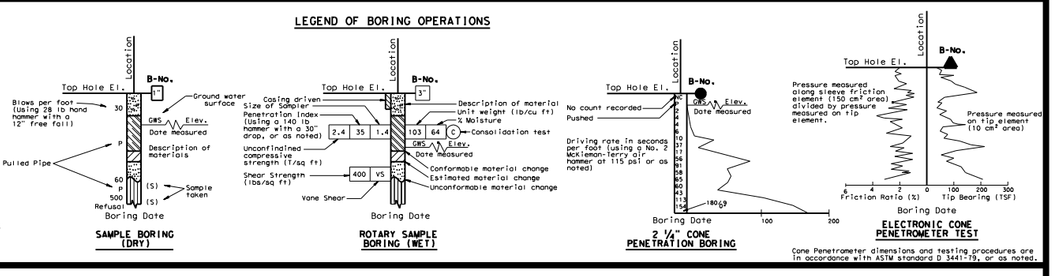
NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

LEGEND OF EARTH MATERIALS

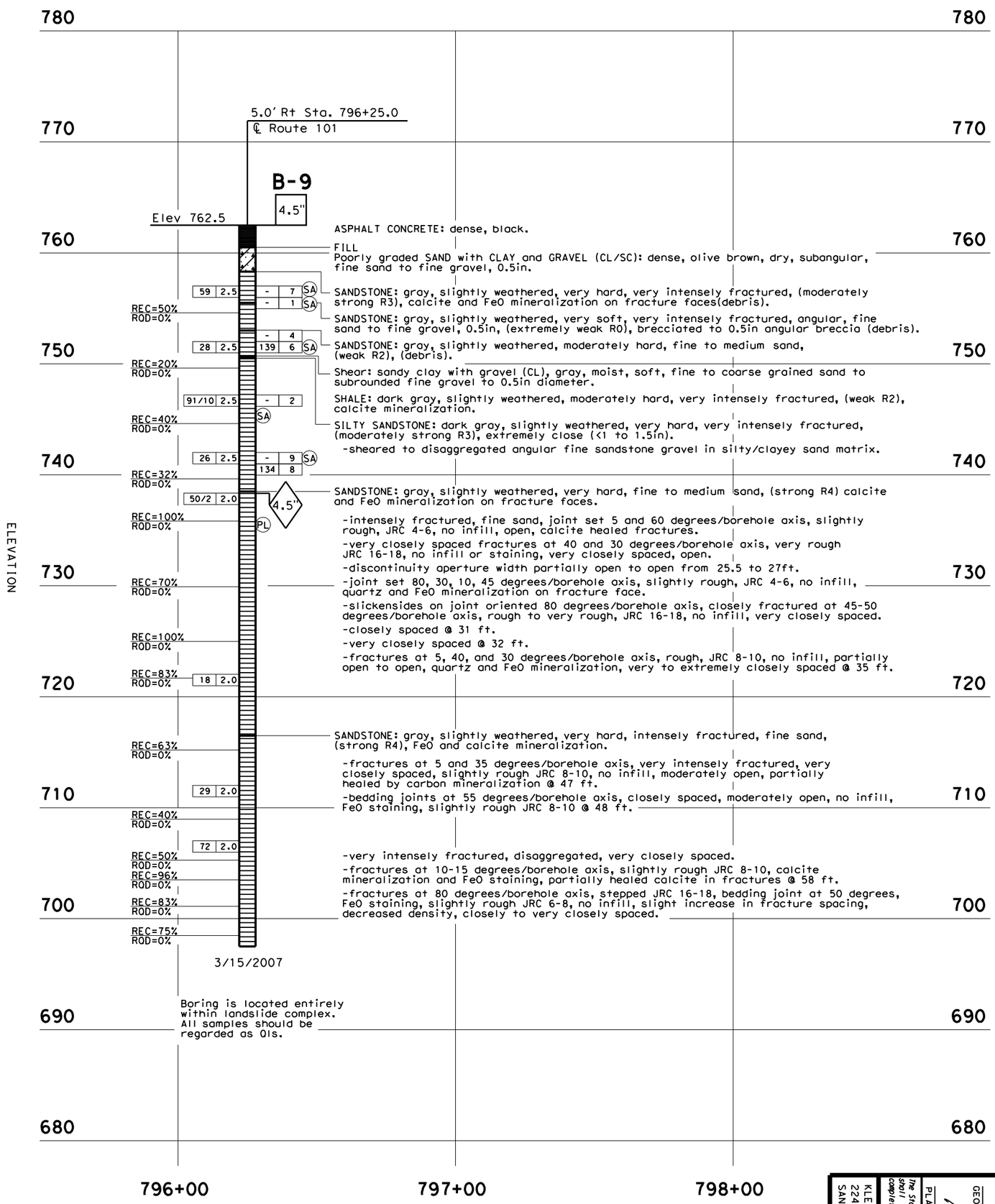
GRAVEL, SAND, SILT, CLAY, SANDY CLAY or CLAYEY SAND, SANDY SILT or SILTY SAND, SILTY CLAY, CLAYEY SILT, PEAT and/or ORGANIC MATTER, FILL MATERIAL, IGNEOUS ROCK, SEDIMENTARY ROCK, METAMORPHIC

LEGEND OF BORING OPERATIONS

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



FOR PLAN VIEW AND ADDITIONAL NOTES, SEE "LOG OF TEST BORINGS" SHEET 2 OF 5



ASPHALT CONCRETE: dense, black.

FILL
Poorly graded SAND with CLAY and GRAVEL (CL/SC): dense, olive brown, dry, subangular, fine sand to fine gravel, 0.5in.

SANDSTONE: gray, slightly weathered, very hard, very intensely fractured, (moderately strong R3), calcite and FeO mineralization on fracture faces(debris).

SANDSTONE: gray, slightly weathered, very soft, very intensely fractured, angular, fine sand to fine gravel, 0.5in, (extremely weak R0), brecciated to 0.5in angular breccia (debris).

SANDSTONE: gray, slightly weathered, moderately hard, fine to medium sand, (weak R2), (debris).

Shear: sandy clay with gravel (CL), gray, moist, soft, fine to coarse grained sand to subrounded fine gravel to 0.5in diameter.

SHALE: dark gray, slightly weathered, moderately hard, very intensely fractured, (weak R2), calcite mineralization.

SILTY SANDSTONE: dark gray, slightly weathered, very hard, very intensely fractured, (moderately strong R3), extremely close (<1 to 1.5in).
-sheared to disaggregated angular fine sandstone gravel in silty/clayey sand matrix.

SANDSTONE: gray, slightly weathered, very hard, fine to medium sand, (strong R4) calcite and FeO mineralization on fracture faces.
-intensely fractured, fine sand, joint set 5 and 60 degrees/borehole axis, slightly rough, JRC 4-6, no infill, open, calcite healed fractures.
-very closely spaced fractures at 40 and 30 degrees/borehole axis, very rough JRC 16-18, no infill or staining, very closely spaced, open.
-discontinuity aperture width partially open to open from 25.5 to 27ft.
-joint set 80, 30, 10, 45 degrees/borehole axis, slightly rough, JRC 4-6, no infill, quartz and FeO mineralization on fracture face.
-slickensides on joint oriented 80 degrees/borehole axis, closely fractured at 45-50 degrees/borehole axis, rough to very rough, JRC 16-18, no infill, very closely spaced.
-closely spaced @ 31 ft.
-very closely spaced @ 32 ft.
-fractures at 5, 40, and 30 degrees/borehole axis, rough, JRC 8-10, no infill, partially open to open, quartz and FeO mineralization, very to extremely closely spaced @ 35 ft.

SANDSTONE: gray, slightly weathered, very hard, intensely fractured, fine sand, (strong R4), FeO and calcite mineralization.
-fractures at 5 and 35 degrees/borehole axis, very intensely fractured, very closely spaced, slightly rough JRC 8-10, no infill, moderately open, partially healed by carbon mineralization @ 47 ft.
-bedding joints at 55 degrees/borehole axis, closely spaced, moderately open, no infill, FeO staining, slightly rough JRC 8-10 @ 48 ft.
-very intensely fractured, disaggregated, very closely spaced.
-fractures at 10-15 degrees/borehole axis, slightly rough JRC 8-10, calcite mineralization and FeO staining, partially healed calcite in fractures @ 58 ft.
-fractures at 80 degrees/borehole axis, stepped JRC 16-18, bedding joint at 50 degrees, FeO staining, slightly rough JRC 6-8, no infill, slight increase in fracture spacing, decreased density, closely to very closely spaced.

Boring is located entirely within landslide complex. All samples should be regarded as Qls.

PROFILE

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

KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER — MARK H. STANLEY — No. G.E. 002397 — Exp. 9-30-08 — STATE OF CALIFORNIA

GEOTECHNICAL PROFESSIONAL — DATE 10-15-07

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
01	DN	101	14.8/15.6		

DESIGN OVERSIGHT — SIGN OFF DATE

DRAWN BY: A. Sanchez

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

KLEINFELDER FIELD INVESTIGATION BY: DATE: March-May 2007

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

X PROJECT ENGINEER

CU 01 EA 324700

FILE => $REQUEST

BRIDGE NO. X — POST MILE 15.13/15.14

DISREGARD PRINTS BEARING EARLIER REVISION DATES

10-1-07

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET X OF X

"LAST CHANCE GRADE" RETAINING WALL NO. 2

LOG OF TEST BORINGS 3 OF 5

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

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

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

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

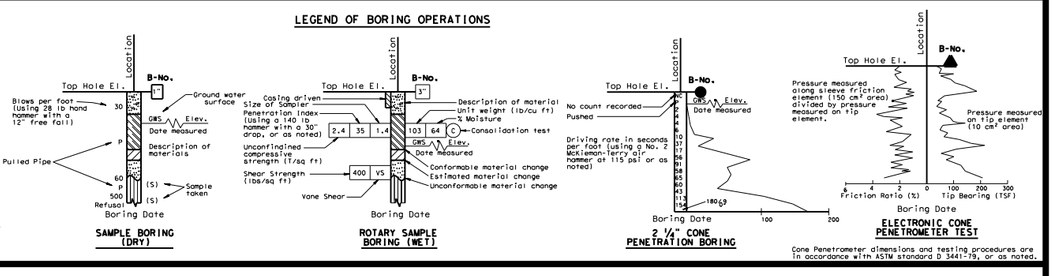
NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

LEGEND OF EARTH MATERIALS

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

LEGEND OF BORING OPERATIONS

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



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

FOR PLAN VIEW AND ADDITIONAL NOTES, SEE "LOG OF TEST BORINGS" SHEET 2 OF 5

20.0' Rt Sta. 796+45.0
℄ Route 101

B-10(H)

(HORIZONTAL BORING)

3.8"

Depth 55.0

Depth

20 / 10 / 0 / -10 / -20 / -30 / -40 / -50 / -60 / -70

REC=70% ROD=0%

- 0 SA

SANDSTONE: light gray, slightly weathered, moderately hard, fine to medium sand, (weak R2), FeO staining on fracture faces.

-Fractures at 0, 30, 60, 90 degrees/borehole axis, stepped, JRC 14-16, moderately open to moderately wide when healed, closely spaced, intensely fractured, thin to moderately thick infill, partially healed with calcite.

-Fracture zone: angular breccia up to 2in.

REC=20% ROD=0%

- 1

-Fracture zone: angular breccia up to 2in.

REC=57% ROD=0%

-Fractures at 0, 30, 60 degrees/borehole axis, stepped, JRC 12-14, moderately open, very closely to closely spaced, very intensely fractured, thin infill, partially calcite healed.

- 0 SA

SANDSTONE: gray, slightly weathered, very hard, fine to coarse sand, (very strong R5), FeO staining on fracture faces.

REC=80% ROD=0%

-Fracture zone: angular breccia up to 2 @ 16 ft.

-Fractures at 0, 30, 60, 90 degrees/borehole axis, stepped, JRC 12-14, moderately open, very closely to closely spaced, intensely to very intensely fractured, very thin to moderately thick infill, partially calcite healed fractures @ 16.5 ft.

REC=55% ROD=0%

-Fracture zone: angular breccia up to 2 in @ 18 ft.

-Fracture zone: angular breccia up to 3 in @ 21 ft.

- 1 SA

CONGLOMERATE: gray, slightly weathered, hard, (moderately strong R3), fine sand to fine rounded clasts up to 0.5in.

REC=47% ROD=0%

SANDY SHALE: dark gray, slightly weathered, moderately hard, (weak R2).

-Fracture zone: angular breccia up to 2 in @ 25 ft.

CONGLOMERATE: gray, slightly weathered, hard, (moderately strong R3), fine sand to finerounded clasts up to 0.5in.

REC=20% ROD=0%

SANDSTONE: gray, slightly weathered, hard, fine to medium sand, (strong R4), FeO staining on fracture faces.

-Fracture zone: angular breccia up to 3 in @ 32 ft.

REC=10% ROD=0%

SANDSTONE: gray, slightly weathered, moderately hard, fine sand, (weak R2), FeO staining on fracture faces, angular breccia up to 3in.

REC=40% ROD=0%

137 | 8

-Shear: 4in thick, sandy clay with silt (CL), dark gray, moist, medium stiff, fine to coarse sand.

REC=70% ROD=0%

-Fractures at 0, 30, 60, 90 degrees/borehole axis, stepped, JRC 12-14, slightly open, closely spaced, intensely to very intensely fractured, moderately thin infill, some partially calcite healed fractures @ 47 ft.

-Fracture zone: angular breccia up to 1.5 in @ 50 ft.

REC=60% ROD=0%

SANDSTONE: gray, slightly weathered, very hard, fine to medium sand, (strong R4), FeO staining on fracture faces.

-Fractures at 30, 60, 90 degrees/borehole axis, stepped, JRC 10-12, slightly open, closely spaced, intensely fractured, partially calcite healed fractures @ 52 ft.

5/3/2007

-Shear: 4in thick, sandy clay with gravel (CL), gray, moist, fine to coarse sand, shale derived @ 53.5 ft.

Boring is located entirely within landslide complex. All samples should be regarded as OIs.

796+00 / 797+00 / 798+00

PROFILE

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

KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407

PLANS APPROVAL DATE

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

GEOTECHNICAL PROFESSIONAL 10-15-07 DATE

REGISTERED PROFESSIONAL ENGINEER
MARK H. STANLEY
No. G.E. 002397
Exp. 9-30-08
STATE OF CALIFORNIA

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
01	DN	101	14.8/15.6		

DESIGN OVERSIGHT
SIGN OFF DATE

DRAWN BY A. Sanchez
CHECKED BY J. Richmond, C.E.G

KLEINFELDER
FIELD INVESTIGATION BY:
DATE: March-May 2007

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

X PROJECT ENGINEER

CU 01
EA 324700
FILE => SHEQUEST

BRIDGE NO. X
POST MILE 15.13/15.14

DISREGARD PRINTS BEARING EARLIER REVISION DATES

10-1-07

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET X OF X

"LAST CHANCE GRADE" RETAINING WALL NO. 2

LOG OF TEST BORINGS 4 OF 5

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

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

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

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

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

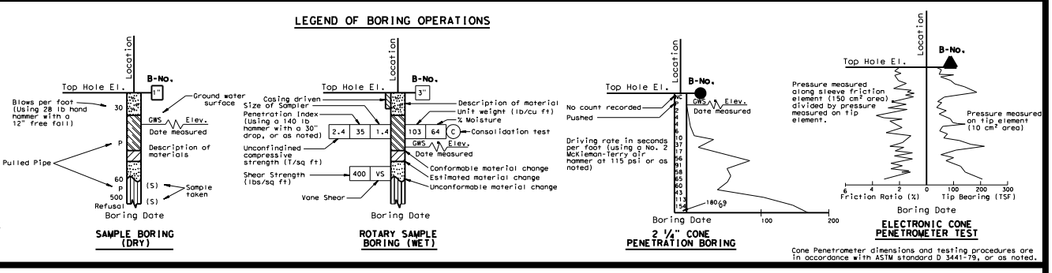
NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

LEGEND OF EARTH MATERIALS

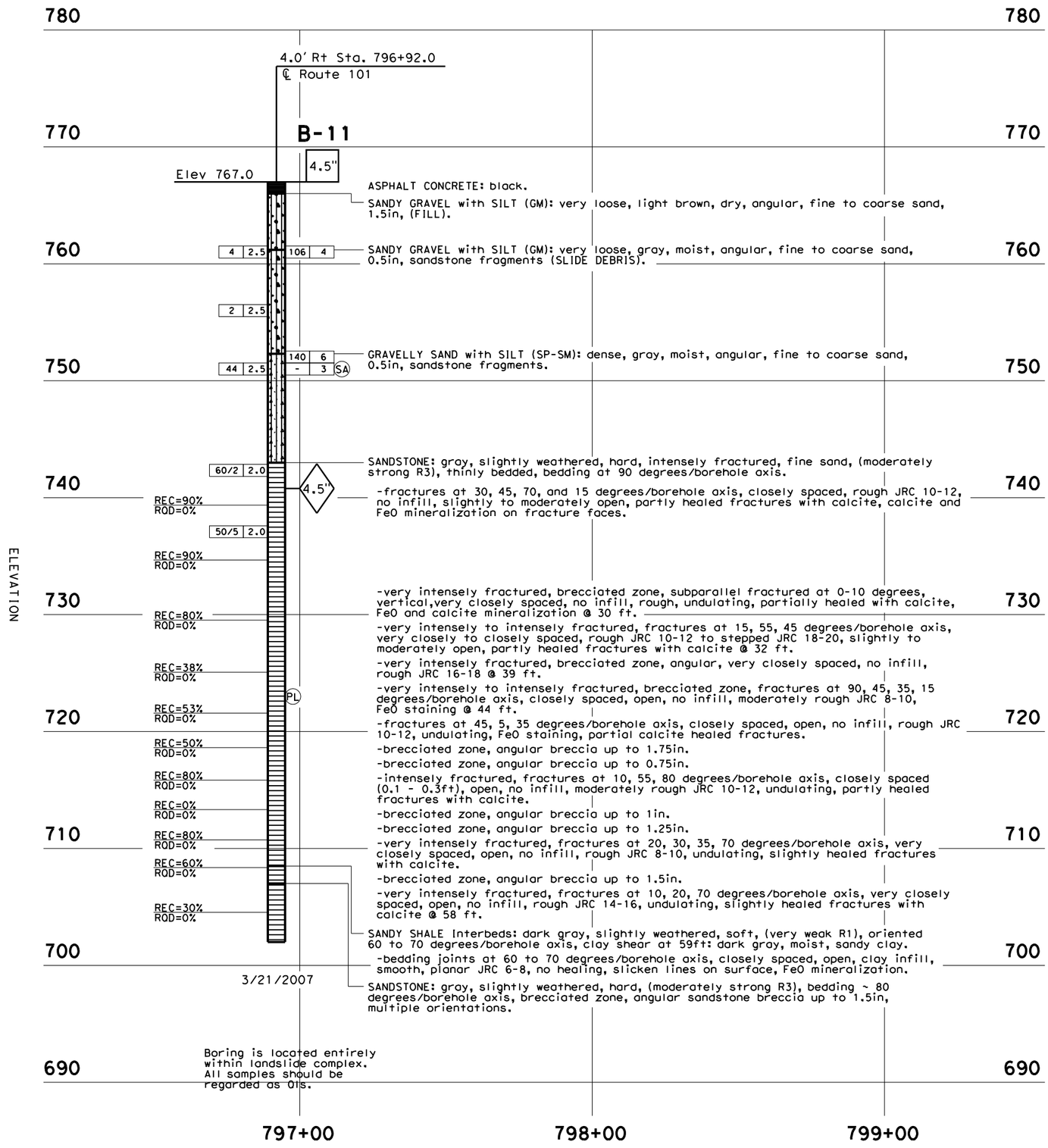
GRAVEL, SAND, SILT, CLAY, SANDY CLAY or CLAYEY SAND, SANDY SILT or SILTY SAND, SILTY CLAY, CLAYEY SILT, PEAT and/or ORGANIC MATTER, FILL MATERIAL, IGNEOUS ROCK, SEDIMENTARY ROCK, METAMORPHIC

LEGEND OF BORING OPERATIONS

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



FOR PLAN VIEW AND ADDITIONAL NOTES, SEE "LOG OF TEST BORINGS" SHEET 2 OF 5



PROFILE

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

KLEINFELDER
2240 NORTHPOINT PKWY.
SANTA ROSA, CA 95407

PLANS APPROVAL DATE

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

REGISTERED PROFESSIONAL ENGINEER — MARK H. STANLEY — No. G.E. 002397 — Exp. 9-30-08 — STATE OF CALIFORNIA

GEOTECHNICAL PROFESSIONAL — DATE 10-15-07

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
01	DN	101	14.8/15.6		

DESIGN OVERSIGHT — SIGN OFF DATE

DRAWN BY: A. Sanchez — CHECKED BY: J. Richmond, C.E.G

KLEINFELDER FIELD INVESTIGATION BY: — DATE: March-May 2007

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

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

X PROJECT ENGINEER

CU 01 EA 324700 FILE => $REQUEST

BRIDGE NO. X — POST MILE 15.13/15.14

DISREGARD PRINTS BEARING EARLIER REVISION DATES

10-1-07 — REVISION DATES (PRELIMINARY STAGE ONLY)

"LAST CHANCE GRADE" RETAINING WALL NO. 2

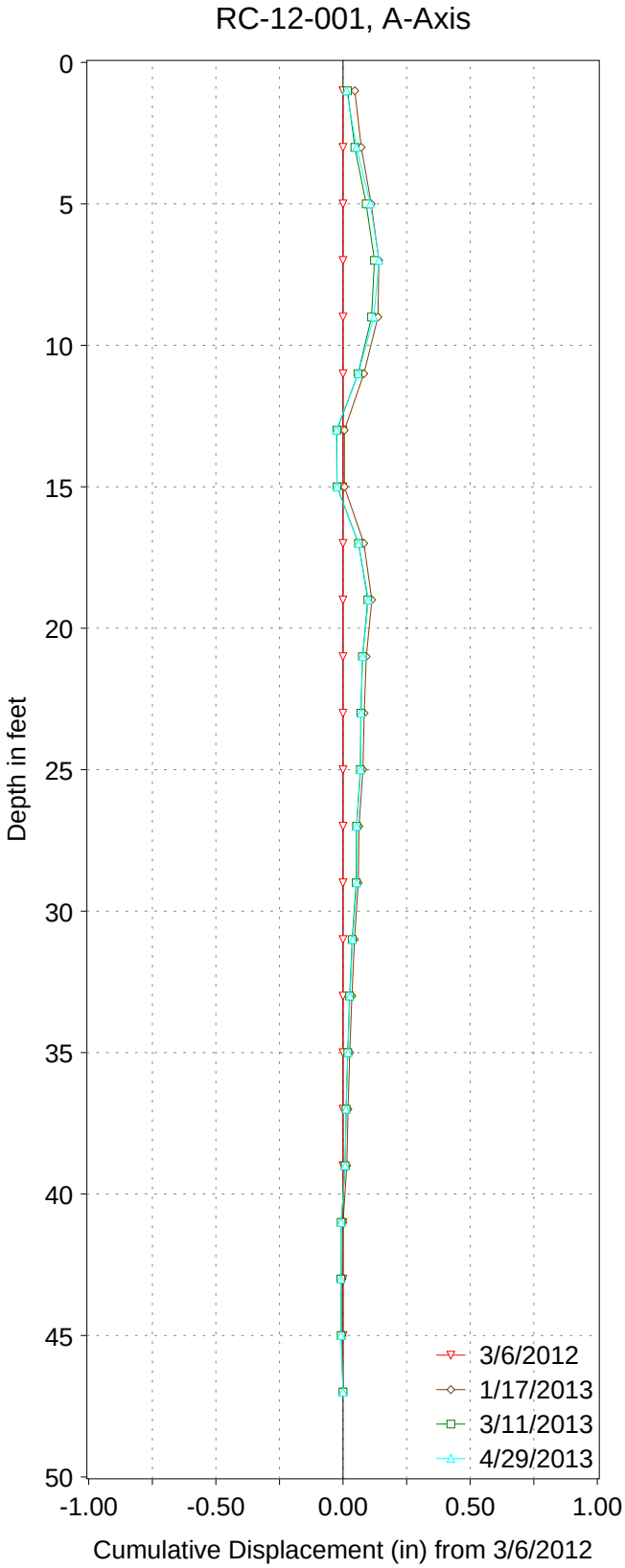
LOG OF TEST BORINGS 5 OF 5

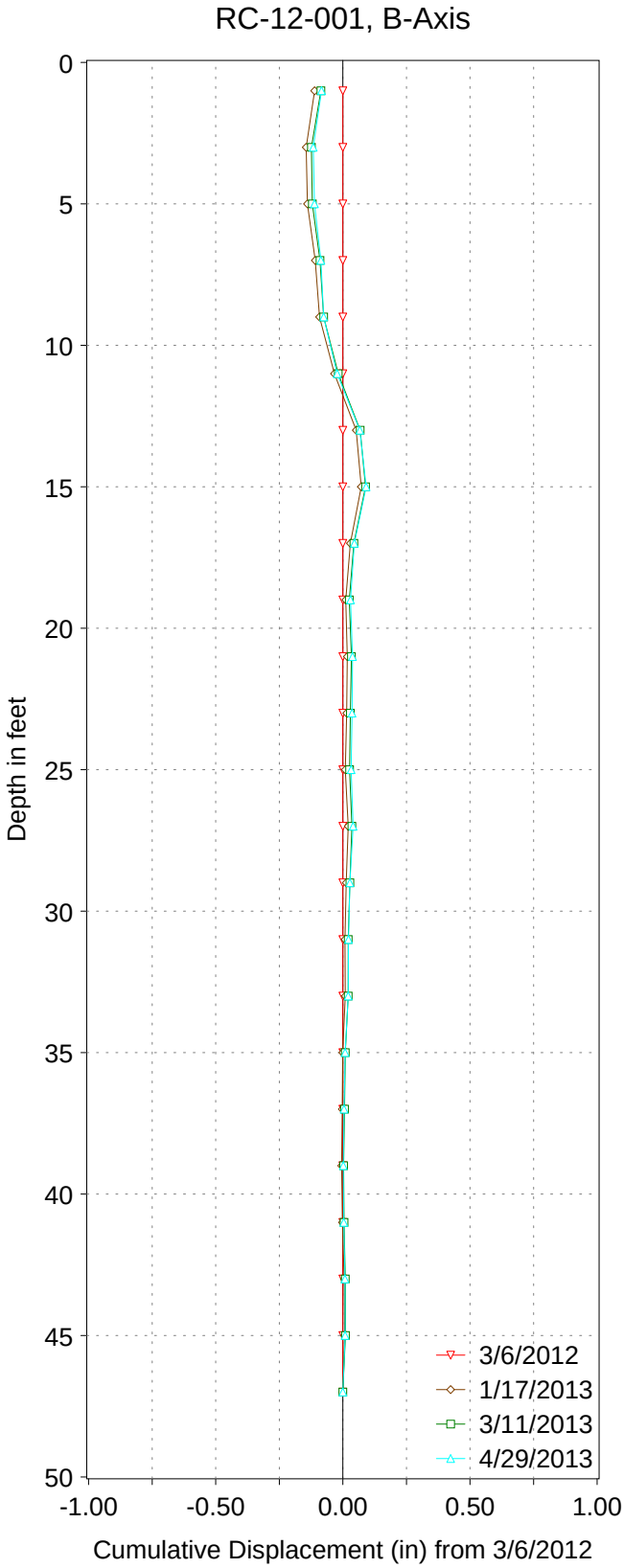
SHEET X OF X

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

APPENDIX B

SLOPE INCLINOMETER MONITORING RESULTS





RESULT OF SI MONITORING

01-DN-101-PM15.1

Site: Last Chance Slips RC-12-001

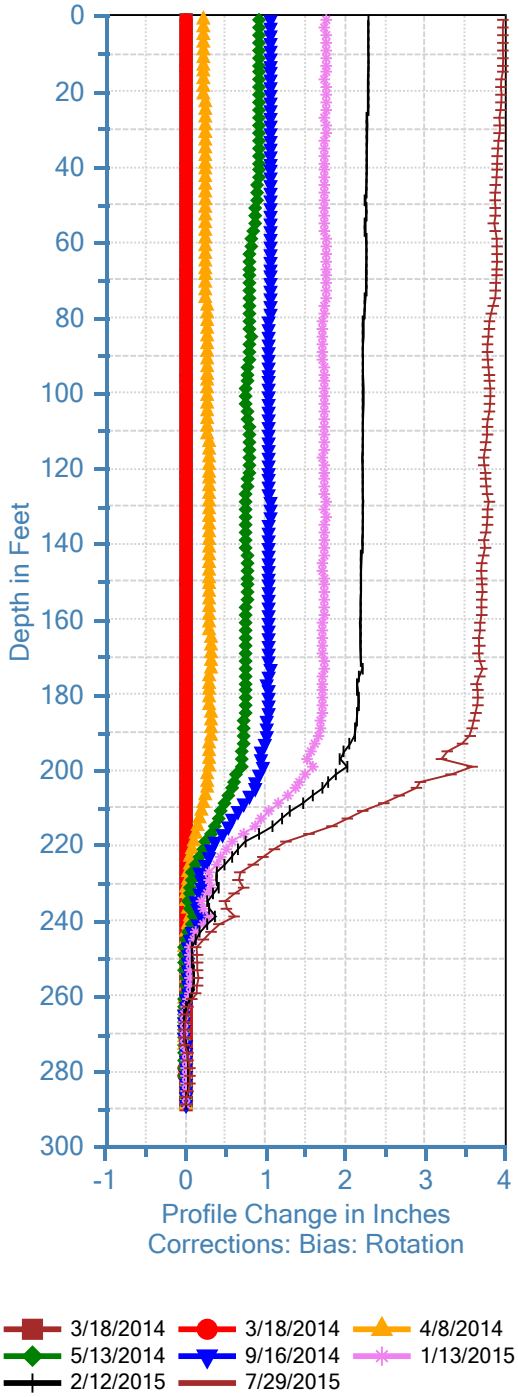
E.A.: 0112000111/230

Depth of Casing: 47 ft

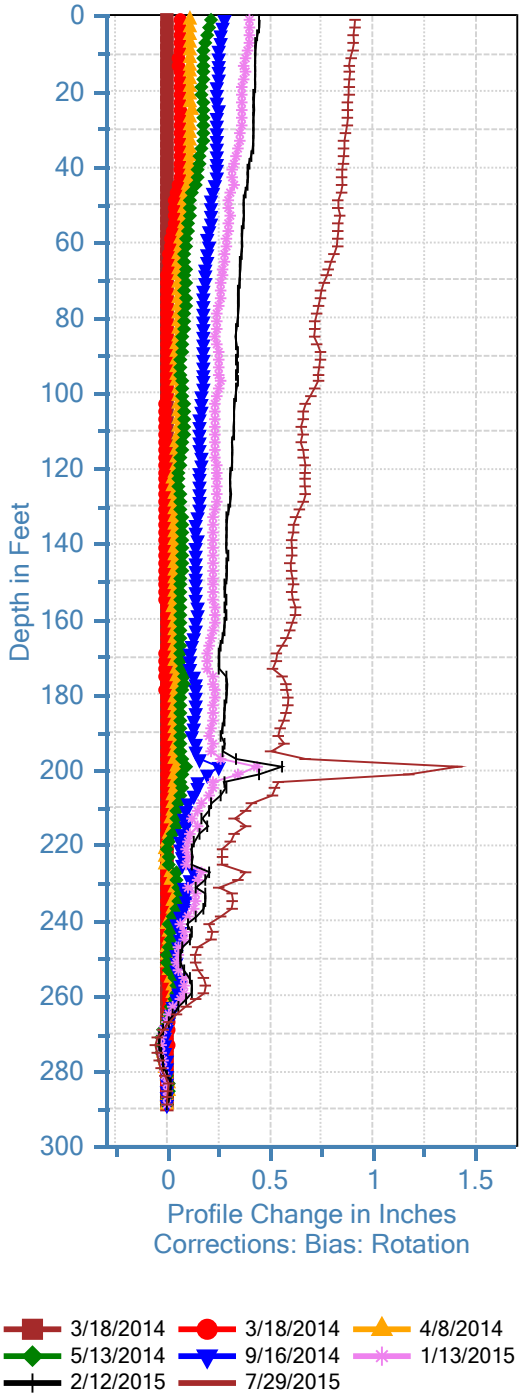
A0 direction:

Location:

LCGEFS P14050 A



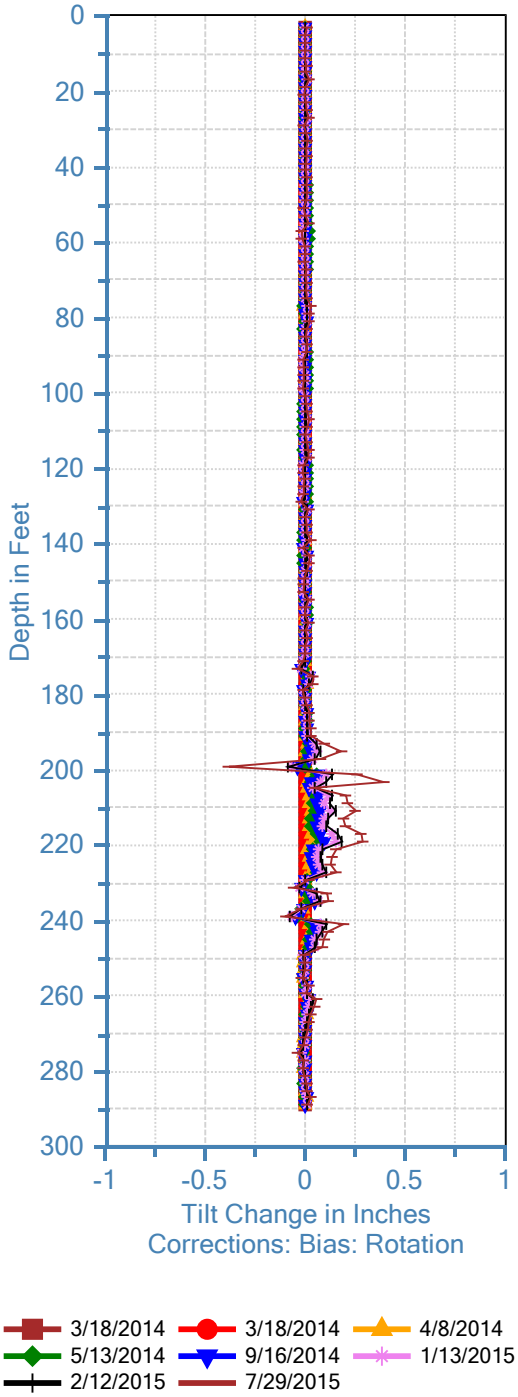
LCGEFS P14050 B



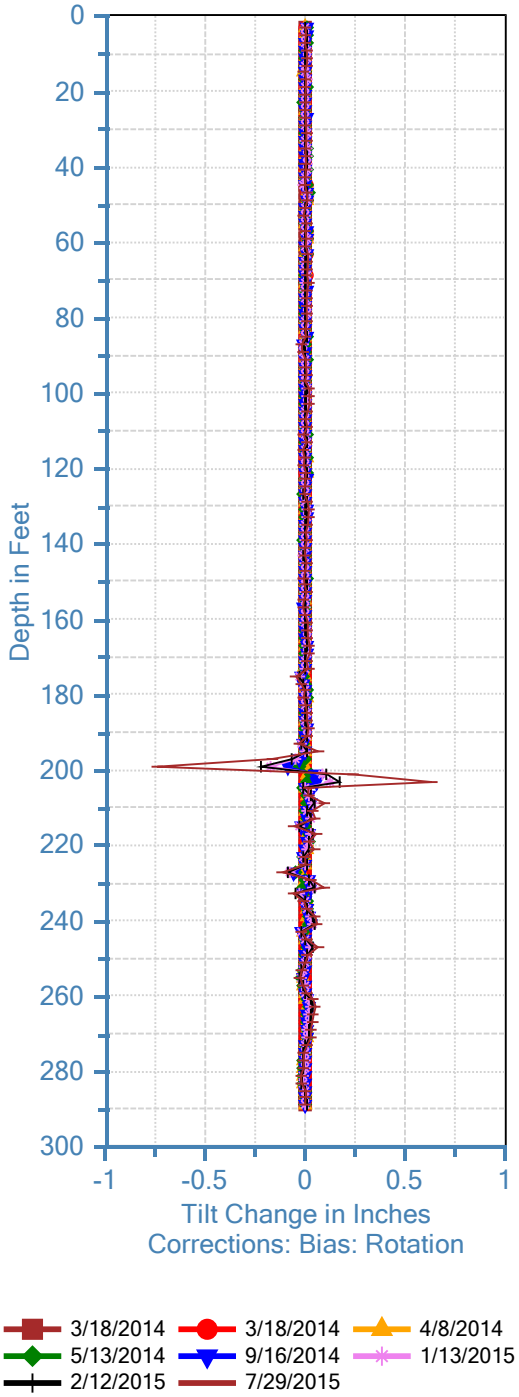
INCLINOMETER RESULTS
01-DN-101-P.M 15
LCG EFS-Last Change Grade
E.A. No: 0112000259
0114000066

DEPTH OF INCLINOMETER CASING: 289'
Ao DIRECTION: 248 * (MAGNETIC NORTH)
LOCATION (WGS-84): N41*38.198', W124*06.922'

LCGEFS P14050 A



LCGEFS P14050 B



INCLINOMETER RESULTS
01-DN-101-P.M 15
LCG EFS-Last Change Grade
E.A. No: 0112000259
0114000066

DEPTH OF INCLINOMETER CASING: 289'
Ao DIRECTION: 248 * (MAGNETIC NORTH)
LOCATION (WGS-84): N41*38.198', W124*06.922'

APPENDIX C

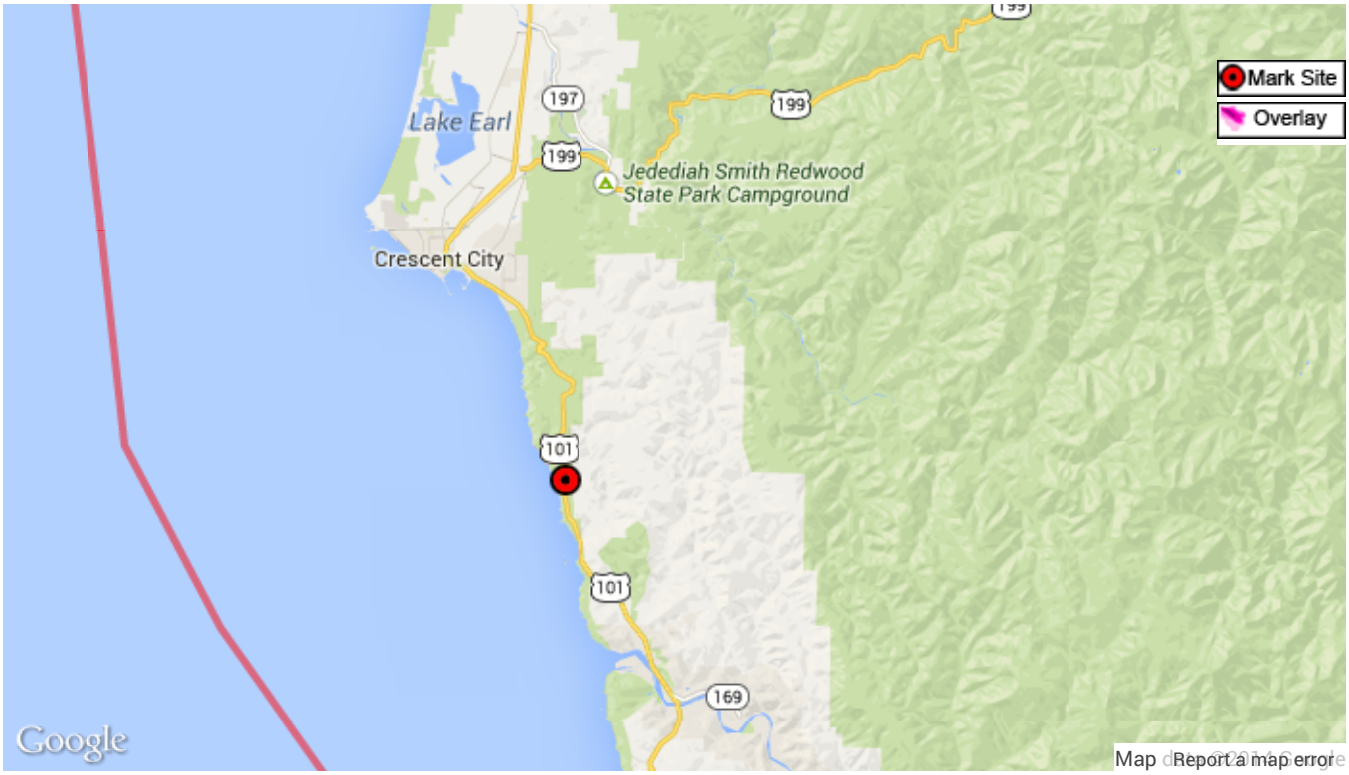
SEISMIC DATA

CALIFORNIA DEPARTMENT OF
TRANSPORTATION

Caltrans ARS Online (v2.3.06)

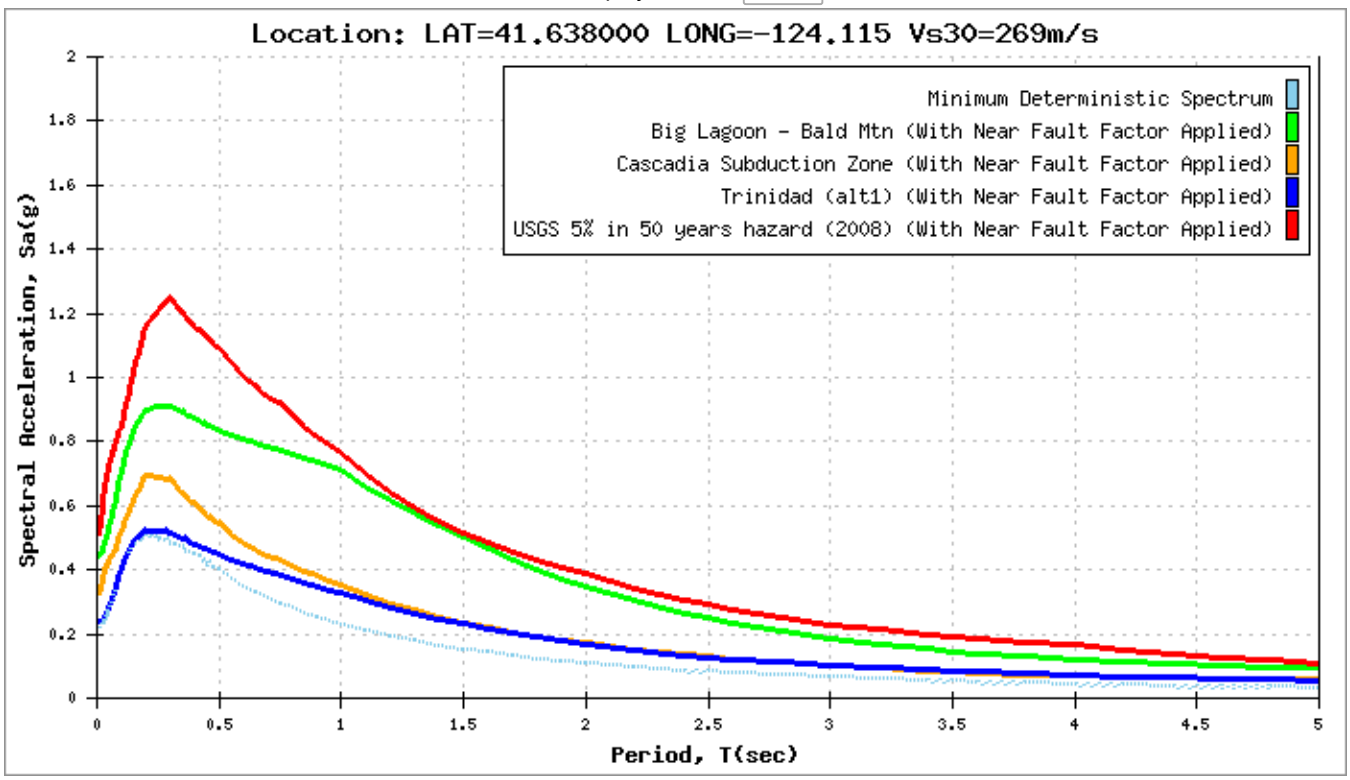
This web-based tool calculates both deterministic and probabilistic acceleration response spectra for any location in California based on criteria provided in *Appendix B of Caltrans Seismic Design Criteria*. More...

SELECT SITE LOCATION



Latitude: 41.638 **Longitude:** -124.115 ***Vs30*:** 269 m/s Calculate

CALCULATED SPECTRA Display Curves: 3



Tabular Data Envelope Only Hide Near Fault Axis Scale Show Basin

Apply Near Fault Adjustment To:
NOTE: Caltrans SDC requires application of a Near Fault Adjustment factor for sites less than 25 km (Rrup) from the causative fault.

☑ Deterministic Spectrum Using

12.40 Km Big Lagoon - Bald Mtn

37.17 Km Cascadia Subduction Zone

21.62 Km Trinidad (alt1)

☑ Probabilistic Spectrum Using

12.40 Km (Recommend Performing Deaggregation To Verify)

◉ Show Spectrum with Adjustment Only

○ Show Spectrum with and without near fault Adjustment

OK

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01-0B27U4
01-Del Norte-101-14.9/15.3
Project ID 0115000111

CALIFORNIA DEPARTMENT OF INDUSTRIAL RELATIONS

Underground Classifications

STATE OF CALIFORNIA

EDMUND G. BROWN, JR., Governor

DEPARTMENT OF INDUSTRIAL RELATIONS
DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT
2424 Arden Way, Suite 125
Sacramento, California 95825
doshM&Tsac@dir.ca.gov

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

January 20, 2015

State of Calif. Dept. of Transportation
District 1
PO Box 3700
Eureka, CA 95502

Attention: Todd Lark

Subject: Project: 15053 – South Last Chance Wall Project, Del Norte County
Classification: Potentially Gassy With Special Conditions
Number Attached: 1 (A)

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

When the contractor who will be performing the work is selected, please advise them to notify this office to schedule the mandated Pre-Job Conference with the Division prior to commencing any activity associated with boring of the tunnel. A Pre-Job Request Form is enclosed.

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

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

Sincerely,

Douglas Patterson
Senior Engineer

enc: Classification
Pre-Job Request Form

cc: jsnapp@dir.ca.gov

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Underground Classification

15053A015CT STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

of DISTRICT 1, PO BOX 3700; EUREKA, CA 95502

at SOUTH LAST CHANCE WALL PROJECT

has been classified as *** POTENTIALLY GASSY WITH SPECIAL CONDITIONS ***

as required by the California Labor Code § 7955.

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

SPECIAL CONDITIONS

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

The forty-six 30-inch-diameter 30-foot-deep drilled vertical shafts along southbound Route 101 located approximately 2.4 miles north of the Wilson Creek Road & Route 101 intersection in Crescent City, Del Norte County

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

Douglas Patterson, Senior Engineer

January 20, 2015

State of California
Department of Industrial Relations
Division of Occupational Safety & Health

REQUEST FOR PRE-JOB (TUNNEL)

ATTACH COPY OF CLASSIFICATION AND DIESEL PERMIT

Company Name:_____

Phone_____FAX:_____

DATE FAXED: _____

PLEASE NOTE: THE BORING CONTRACTOR SHOULD SCHEDULE THE PREJOB AS FAR IN ADVANCE AS POSSIBLE – AT LEAST 3-4 DAYS IN ADVANCE. THE DIVISION REQUIRES THE JOB TO BE SET UP WHEN THE FIELD ENGINEER ARRIVES FOR THE PREJOB. THIS MEANS THAT THE BORE PIT HAS BEEN DUG AND PROPERLY GUARDED, THE CRANE IS IN PLACE AND READY TO LIFT, THE BORING MACHINE IS IN THE PIT AND READY TO GO, AND THE CREW IS READY TO BEGIN BORING THE TUNNEL. IF THERE IS A DELAY IN SETTING UP THE JOB, THE BORING CONTRACTOR SHOULD CONTACT THE DIVISION IMMEDIATELY.

PRE-JOB REQUEST DATE & TIME: _____

ON-SITE SUPERVISOR & CELL NO.: _____

CLASSIFICATION #: _____ **DIESEL PERMIT #:** _____

BORE DIAMETER AND LENGTH: _____ _____
(Diameter) (Length)

IS BORE ENTRY ANTICIPATED? YES NO
(Circle One)

You MUST contact the Division if entry is planned, REGARDLESS of the bore diameter.

MANNER OF EXCAVATION: _____

_____

JOB-SITE LOCATION AND DIRECTIONS: _____

_____

_____

GENERAL CONTRACTOR: _____

SUBMITTED BY: _____

REVIEWED BY: _____ **DATE:** _____

☐ *Mining & Tunneling Unit, District 1*
2424 Arden Way, Suite 125
Sacramento, California 95825-2400
(916) 574-2540; ***FAX: (916) 574-2542***

☐ *Mining & Tunneling Unit, District 2*
6150 Van Nuys Blvd., Suite 310
Van Nuys, California 91401-3333
(818) 901-5420; ***FAX: (818) 901-5579***

☐ *Mining & Tunneling Unit, District 3*
464 West Fourth Street, Suite 354
San Bernardino, California 92401-1442
(909) 383-6782; ***FAX: (909) 388-7132***