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22 September 2016

Brandon Woods, P.E.
Facilities Engineering
Zone 7 Water Agency
100 N. Canyons Parkway
Livermore, CA 94551

RE: Preliminary Distress Evaluation / Emergency Stabilization Measures
Zone 7 Water Agency - Cope Lake Well House #1
Pleasanton, Alameda County, California

Dear Mr. Woods:

At your request, we have completed a preliminary evaluation of distress observed at the Cope Lake Well House #1 site in Pleasanton, California (Figure 1). Our work has included:

- Evaluation of historical documents (maps, figures, reports) provided by Zone 7;
- Site visits to observe distress in the Well House immediate vicinity;
- Review of survey data provided by Zone 7;
- Completion of a cone penetration test;
- Completion of two slope inclinometer readings, and data analysis;
- Engineering evaluation of existing data;
- Meeting with Zone 7 staff;
- Preparation of this letter to summarize our preliminary findings and provide recommendations for emergency measures that can be undertaken by Zone 7.

1.0 PROJECT DESCRIPTION

The Cope Lake Well House #1 (Well House) was constructed around 2009. In late 2013, Zone 7 noticed pavement cracking and separations significant enough to begin periodic surveying of the site and to retain Miller Pacific Engineering Group (Miller Pacific) to complete an evaluation and install a slope inclinometer. Due to ongoing distress, Zone 7 (District) approved a task order for CE&G to complete additional work. During a meeting on September 1st, the District asked CE&G to evaluate emergency response measure which have the potential to reduce the extent and rate of further distress to the Well House site and improvements. This letter and the attached plans are intended to summarize our preliminary opinions and provide plans for emergency stabilization measures which have the potential to reduce the rate of distress.

2.0 SITE HISTORY

Cope Lake Well House is located between Cope Lake (south of the building) and Lake H (north of the building). The lakes are reclaimed from gravel mining activities. Based on a 2004 Stetson Engineers report titled *Management Plan for Lakes H, I, and Cope Lake*, Lake H is one of at least 7 reclaimed quarry lakes to be included in a “chain of lakes” project for groundwater recharge and storage. Cope Lake is owned by Zone 7 but is not used for groundwater recharge.

The gravel quarries consisted of pit mining excavations in excess of 100 feet deep below natural grade. Relatively thin embankments were left between the quarried areas, each of which is now a lake. The embankment on which the Well House site is located is thought to have been widened using material similar to the mining fill used to backfill the quarry excavation pits. This is also depicted in a cross section provided in the 2004 Stetson Engineers report (see Figure 4).

Processing of the excavated alluvial soils (see Figure 3) materials involved separating out the desired gravelly materials, and disposal of “mining fill” waste into parts of the quarry pits. Cope Lake in particular was used as a disposal area for the mining fill and other fill. Based on a map of fill thickness and a cross section contained in the Stetson report, a second generation of fill was placed above the mining fill (see Figure 4). Using aerial images and the mining fill thickness figure, CE&G overlaid the Well House site onto the Stetson map. Additionally, CE&G used existing geotechnical data and a CPT completed for this project to create a preliminary geologic plan and section through the Well House (see Figure 5). Figures 4 and 5 suggest that differential fill conditions exist below the Well House with the fill thickening towards Cope Lake.

The 2014 Miller Pacific investigation and report included 4 geotechnical borings, laboratory testing, and the installation of a slope inclinometer (see Appendix B). Based upon the Miller

Pacific report and a CPT completed for this project, the Well House is supported on soft (second generation) fill in the upper 35-40 feet and marginally better mining fill below a depth of 40 feet. Based on findings of our CPT sounding (see Appendix A), and on blow counts and test data from previous borings, the upper soft fill appears to be of lower strength. The mining fill and subsequent upper (second generation) fill are made up primarily of clayey soils which likely yield an inadequate factor of safety for the permanent slope of approximately 1.5:1 (H:V).

The inclinometer reading for the 2014 slope inclinometer shows some “B” axis deformation which appears to be minor buckling suggestive of a higher rate of settlement within the newer second generation fill (upper 30-40 feet) than within the older mining fill in the basin. In addition to settlement, there are some irregular displacements in the A-axis which could be early landslide movement. The distress pattern is not definitive, and subsequent readings will help clarify the nature of movement.

Previous reports (e.g. Kleinfelder, Inc., Dec. 2007) also describe wave erosion as locally oversteepening the north shore/bank of Cope Lake, and areas of arcuate cracking, sloughing, and slumping similar to what is occurring now. Previous reports also describe locally extensive piping in the area east of the Well House, involving an upper interval of about 40 feet consisting of finer grained “overburden” (native material), with piping features reaching 4 feet in dimension.

3.0 FIELD RECONNAISSANCE AND VISUAL ASSESSMENT

During our site visit with the District, the District pointed out distress at the site located primarily south of the Well House. The distress consisted of uneven and cracked pavement, separations between pavement, concrete slabs-on-grade, and the Well House building, and distress to the fire line on the south side of the Well House. On the southwest side of the Well House site, arcuate cracking is evident in the asphalt pavement adjacent to the chain link fence and east of the above-ground fire line valve. Approximately 4-inch separations are observed between the pump house building foundation and adjacent concrete walkway; and between the concrete walkway and concrete chemical spill containment area. An additional separation is evident between the back-up generator concrete pad on the west side of the Well House building and surrounding asphalt pavement.



Photo 1: View of an approximate 4-inch separation between south wall of Well House and concrete pad. Note the red fire protection line is also separated from the building at the bottom.

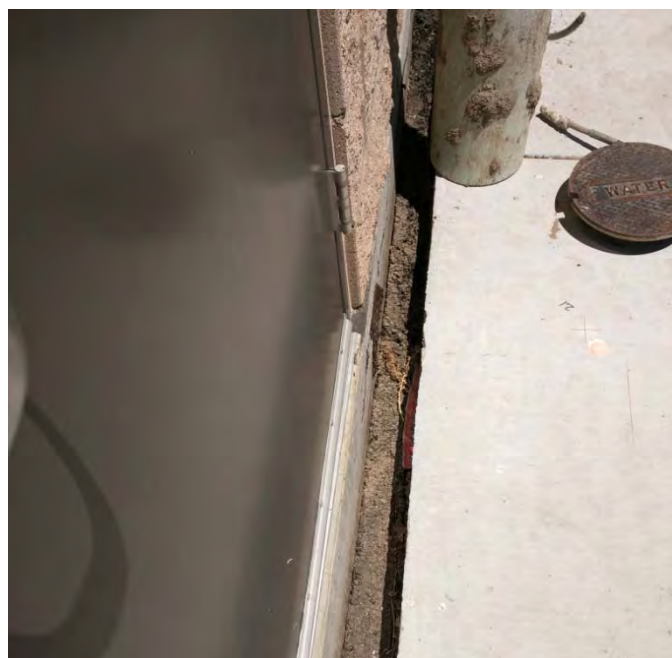


Photo #2: Closer view of separation in Photo #1.



Photo #3: View of separation between the asphalt and concrete pad northwest of the building.



Photo #4: View looking west. Note the arcuate cracks in the asphalt pavement (left of car in the middle of the photo).

4.0 SUBSURFACE INVESTIGATION

CE&G completed a single Cone Penetration Test (CPT) to a depth of 94 feet, at which depth refusal was encountered. The CPT was advanced by California Push Technologies on 09 August 2016. The location of the CPT is shown in Figures 2 and Figure 5. Based on the data recovered, silty clays and clays underlie the CPT location to a depth of 84 feet. This clayey material is underlain by sandy gravels and gravels to the depth explored. The CPT log is included in Appendix A.

5.0 DISTRESS MONITORING

In November 2013, the District retained Kier and Wright Civil Engineers and Surveyors (Kier and Wright) to establish a series of monitoring survey points. The horizontal and vertical displacements of each point were obtained based on subsequent measurements of these monitoring points in July 2014 and May 2016. Based on elevations recorded by Kier and Wright, the survey points measured up to about 4 inches (0.33 feet) of vertical settlement between November 2013 and May 2016 (2.5 years). CE&G used the vertical elevation data to create a preliminary contour map (Figure 6) to provide a graphical representation of the settlement measured at the site.

6.0 EXISTING SUBSURFACE EXPLORATION

6.1 GEOTECHNICAL BORINGS

In their 2014 study of the Well House site, Miller Pacific drilled 4 exploratory borings to varying depths at locations shown in Figure 2. In January 2014, Miller Pacific installed a slope inclinometer in Boring B-1 to observe movement within the fill that underlies the Well House site. The corresponding boring logs and inclinometer readings are included in Appendix B.

6.2 CONSOLIDATION/SETTLEMENT

The laboratory testing program completed by Miller Pacific in 2014 included a single consolidation test on a sample retrieved at 26 feet from Boring B-3. CE&G used the results from this test to evaluate whether consolidation is occurring at that depth, and to evaluate the potential for further consolidation. Based on our preliminary analysis (see Appendix A), the underlying soil is indeed currently undergoing consolidation, and further settlement of the ground surface is expected.

For approximating the total settlement expected, CE&G's model considered only the consolidation that is underway for the top 35 feet (second generation of fill). Based on this, the total settlement since the time of the 2014 laboratory testing is expected to be approximately 11 inches. Based on Kier and Wright monitoring survey points, a total of approximately 4 inches of vertical settlement has occurred following the time at which Miller Pacific sampled soil for consolidation testing. Therefore, we would expect an additional 7 inches of settlement based on our preliminary analysis. We note that this settlement estimate considers consolidation of only the upper 35 feet of fill, and does not address the deeper fill interval. As noted in Section 8.2, additional geotechnical sampling, testing, and analyses are required to further evaluate the conditions at the Well House site in greater detail.

6.3 STABILITY

CE&G reviewed the previous stability analyses by Miller Pacific which suggested the existing slopes are stable. CE&G, however, also noted that none of the analyses accounted for the possible presence of elevated pore pressure within the embankment; as a result the slope's factor of safety is lower than previously reported. As noted in section 6.2, the consolidation test results from the 2014 Miller Pacific report suggests that substantial consolidation settlement is ongoing. As consolidation settlement takes place, elevated pore pressure is dissipated. Since the existing consolidation test shows the embankment to be under-consolidated, excess pore pressures are present; the presence of excess pore pressures results in a lower calculated factor of safety (FS) for the slope.

For our independent slope stability analysis, CE&G used soil strengths that are consistent with the direct shear results presented in the Miller Pacific report (Appendix B). We also varied the soil parameters and the potential landslide geometry to perform a sensitivity analysis and to develop a range of calculated factors of safety for the existing slope.

We then developed various grading mitigation geometries and evaluated their FS to determine their effectiveness in improving overall slope stability. We considered the elevated pore pressures (incorporated into our model in the form of R_u values, which model excess pore pressures) in our examination of alternatives.

One of the grading mitigation concepts we considered involves trimming of the berm located along the top-of-slope, and flattening the overall slope gradient between the Well House and Cope Lake. Taking into account the elevated pore pressures, grading to reduce the height of the berm at the top of slope and flattening the overall slope gradient has the potential to improve the stability of the slope by 10 to 30%. Graphical output from some of our slope stability analyses are included in Appendix A. The wide range of results is due to variations we considered in soil

strength, pore pressure assumptions, and failure geometry. At this time, insufficient data exists to provide a more accurate estimate of the improvement in stability.

7.0 CONCLUSIONS

Based upon our evaluation of the existing data, site observations, and the CPT sounding we performed, we have the following conclusions:

- The Cope Lake Well House site is underlain by fill of variable thickness that appears to range up to about 100 feet deep and which was not placed as a conventional compacted earth fill;
- Below the Cope Lake Well House, the fill thickness increases from the roadway southward towards Cope Lake. This results in the Well House building and site being underlain by fill with differential thickness;
- The basal contacts of both the upper fill and the mining fill may be steeply dipping toward Cope Lake, and are likely not benched;
- An existing slope inclinometer suggests settlement and some lateral movement;
- It is unclear if the lateral movement suggested by the slope inclinometer is due to differential settlement and/or early landslide movement;
- Preliminary evaluation of a single consolidation test suggest that the Well House site may potentially settle an additional 7 inches, and even greater settlement is possible at the south end of the site due to increasing depths of fill.
- In the time since the consolidation test was performed, some areas of the site have settled as much as 4 inches;
- Additional geotechnical work is required to further evaluate the differential fill conditions at the site, the settlement characteristics of the fill, and the possible existence of a landslide;
- Emergency measures can be undertaken to improve the slope stability.

8.0 RECOMMENDATIONS

8.1 SHORT-TERM EMERGENCY

Emergency grading can be completed to improve the stability of the slope by 10-30%. If a landslide exists, a 10-30% improvement will reduce the rate of landslide related movement, and has the potential to stop landslide related movement. Appendix C includes plans for lowering the berm and flattening the slope to improve slope stability.

In addition to emergency grading, improvements at the site can be implemented to reduce the level and impacts of distress, and to improve the performance of the improvements subjected to differential movement. For examples, retrofitting pipelines and joints to better accommodate ground deformation would improve survivability of improvements. Relocating improvements such as pipelines farther from the slope face will place them in areas experiencing substantially less movement and distress.

8.2 FURTHER EVALUATION

As noted in Section 7, additional field exploration, laboratory testing and monitoring is required to evaluate the significant geotechnical issues which exist at the Cope Lake Well House site. The geotechnical concerns which need to be evaluated include determining: the distribution of fill underlying the Well House building and site, the consolidation properties of the fill(s) underlying the Well House building and site, the strength parameters of the fill(s) underlying the Well House building and site, and if additional inclinometers show landslide movement. This can be accomplished by completion of a series of borings and/or CPT soundings along with laboratory testing and the installation of additional slope inclinometers.

We recommend continued survey measurement and inclinometer reading while additional geotechnical work is being completed. The area considered by the surveys should be expanded, and the long-term stability of the reference benchmark for those surveys should be examined and confirmed.

As part of monitoring, we recommend installation of crack gauges (crack monitors) across selected cracks and separations at the site, and tracking of measured separations over time.

8.3 LONG TERM OPTIONS

Since additional evaluation is needed, it is premature to make long-term recommendations for the site. It is not, however, too early to indicate that there will be a wide range of options which could vary between, continued monitoring and ongoing maintenance at the site to relocation of the well.

The emergency grading recommended in section 8.1 has the potential to reduce or stop landslide related movement. The emergency grading, however, will not stop ongoing differential settlement at the site. As part of the project and alternative evaluation, Zone 7 will also need to determine the sensitivity of their improvements to differential settlement.

Along with long-term monitoring, in-situ ground improvement methods may be appropriate to reduce differential settlement at the site to a level tolerable by the improvements. The

improvement level could be limited to portion of the site to reduce cost, if other less sensitive portions of the site can accommodate the anticipated settlement.

9.0 LIMITATIONS

The conclusions and recommendations of this report are based upon information provided to us regarding the project, subsurface conditions encountered at the CPT locations, our geologic reconnaissance, the results of the laboratory testing program, and professional judgment. We have employed accepted geotechnical engineering and engineering geologic procedures, and our professional opinions and conclusions are made in accordance with generally accepted geotechnical engineering and engineering geologic principles and practices. This standard is in lieu of all warranties, either expressed or implied.

The locations of the borings were taken from the Miller Pacific report and the CPT location was determined by using tape and compass methods from established site features and are considered to be approximate. Site conditions described in the text of this report are those existing at the time of our last field exploration and reconnaissance in August 2016 and are not necessarily representative of the site conditions at other times or locations.

Unanticipated soil conditions are frequently encountered during construction and cannot be fully determined by drilling and sampling a limited number of exploratory borings. Additional expenditures may be required during the construction phases of the project as conditions vary. It is recommended that a contingency fund be established to cover potential adverse soil and groundwater conditions which may be encountered during site development. If it is found during construction that subsurface conditions differ from those described on the boring logs, then the conclusions and recommendations in this report shall be considered invalid, unless the changes are reviewed and the conclusions and recommendations modified and approved in writing by Cal Engineering & Geology, Inc.

Field observation and testing services are essential parts of the project. It is important that Cal Engineering & Geology, Inc. be retained to observe and test the earthwork, excavations, and other relevant construction operations. The recommendations of this report are contingent upon this stipulation.

The evaluation or identification of the potential presence of hazardous materials at the site was not requested and is beyond the scope of this project. If you have any questions regarding this report, or if we may be of further service, please contact us.

Yours truly,

CAL ENGINEERING & GEOLOGY, INC.



Mark W. Myers, P.E., G.E.
Associate Engineer



Mehal Vitthal, E.I.T.
Project Engineer



G. Reid Fisher, Ph.D., P.G., E.G.
Principal Geologist

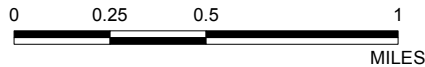
10.0 REFERENCES

- California Department of Conservation Division of Mines and Geology, 1997, Guidelines for Evaluating and Mitigating Seismic Hazards in California, Special Publication 117, 70p.
- California Building Code, 2010, California Code of Regulations, Title 24, Part 2, Volume 2, California Building Standards Commission, effective date 1 January 2011.
- Dibblee, T. W. Jr., 1980, Preliminary geologic map of the Las Trampas Ridge Quadrangle, Alameda and Contra Costa Counties: U.S. Geological Survey Open File Report 80-545 map scale 1:24,000.
- Geocon Consultants, Inc., “Preliminary Geotechnical Engineering and Geologic Investigation, Cope Lake Tertiary Water Storage Project, Alameda County, California”, Geocon Project No. E8106-06-01, dated October 8, 2002.
- Kleinfelder Inc., “Summary of Field Reconnaissance Observations Performed along Slopes Bordering Lake I and Cope Lake within Chain-of-Lakes Complex in Pleasanton, California”, File No. 64584/PWRCON, dated February 1, 2006.
- Kleinfelder Inc., “Geotechnical Investigation Report, Proposed Zone 7 Well Master Plan and Pipelines, Alameda County, California”, File No. 83398, dated September 13, 2007.
- Kleinfelder Inc., “Second Field Reconnaissance Observations Performed along Slopes Bordering Lake I and Cope Lake within Chain-of-Lakes Complex in Pleasanton, California”, File No. 64584/PWRCON, dated December 11, 2007.
- Miller Pacific Engineering Group, “Preliminary Report, Geotechnical Investigation, Zone 7 – Lakes H, I, and Cope, Pleasanton, California”, Project No. 960.01, dated February 13, 2004.
- Miller Pacific Engineering Group, “Phase 1 Geotechnical Investigation / Data Report, Cope Lake Well House (Chain of Lakes Well No. 1), 3655 El Charro Road, Pleasanton, California”, File: 1492.03 rpt.doc, dated March 18, 2014.
- Stetson Engineers Inc., “Management Plan for Lakes H, I, and Cope Lake”, dated June 2004.



BASEMAP REFERENCE

1. ORTHOIMAGERY FROM ESRI, 2016.
2. STREET CENTERLINES FROM CALTRANS CALIFORNIA ROAD SYSTEM, DOWNLOADED ON 15 MAY 2016.



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PRELIMINARY DISTRESS EVALUATION
ZONE 7 WATER AGENCY – COPE LAKE WELL HOUSE #1
PLEASANTON, ALAMEDA COUNTY, CALIFORNIA

SITE LOCATION MAP

160820

SEPTEMBER 2016

FIGURE 1

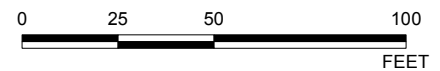


BASEMAP REFERENCE

1. ORTHOIMAGERY FROM ESRI, 2016.

MAP SYMBOLS DESCRIPTION

- ◆ INCLINOMETER LOCATION BY MILLER PACIFIC, 2014
- ▲ CPT LOCATION BY CE&G, 2016
- BORING LOCATION BY MILLER PACIFIC, 2014



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PRELIMINARY DISTRESS EVALUATION
ZONE 7 WATER AGENCY – COPE LAKE WELL HOUSE #1
PLEASANTON, ALAMEDA COUNTY, CALIFORNIA

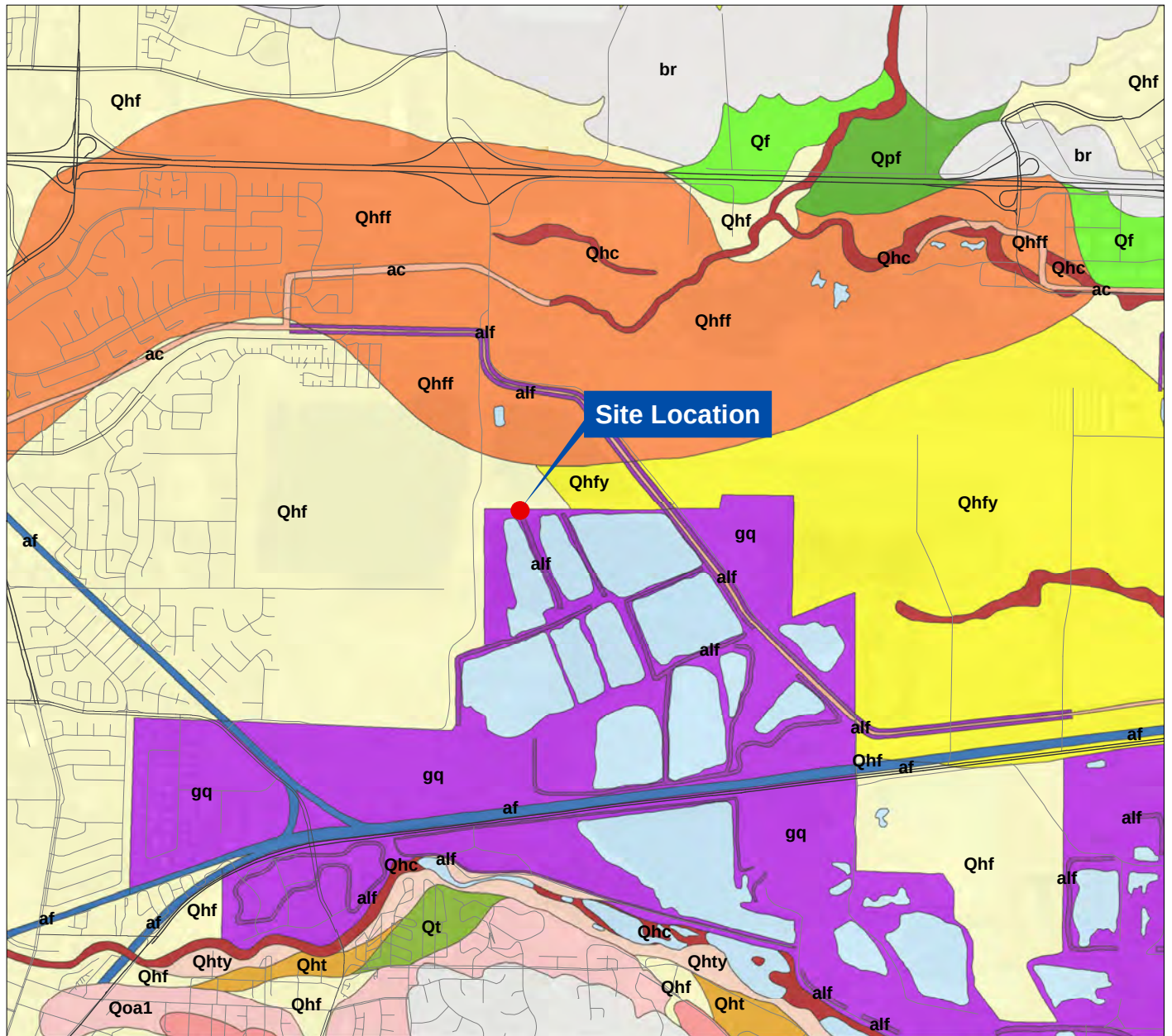
BORING LOCATION MAP

160820

SEPTEMBER 2016

FIGURE 2

M:\2016\160820 Zone 7 TOR1 Wellhouse Distress\GIS\160820_Fig3_Regional_Geology_Witter.mxd: 9/23/2016: kdrozynska



BASEMAP REFERENCE

1. QUATERNARY GEOLOGY FROM WITTER AND OTHERS, 2006.
2. STREET CENTERLINES FROM CALTRANS, 2016.

UNIT DESCRIPTION



WATER



ARTIFICIAL FILL (HISTORICAL)



ARTIFICIAL LEVEE FILL (HISTORICAL)



GRAVEL QUARRIES AND PERCOLATION PONDS (HISTOR.)



ARTIFICIAL STREAM CHANNEL (HISTORICAL)



HISTORICAL STREAM CHANNEL DEPOSITS (HISTORICAL)



ALLUVIAL FAN DEPOSITS (LATEST HOLOCENE)



STREAM TERRACE DEPOSITS (LATEST HOLOCENE)



BASIN DEPOSITS (HOLOCENE)



ALLUVIAL FAN DEPOSITS (HOLOCENE)



ALLUVIAL FAN DEPOSITS, FINE FACIES (HOLOCENE)



STREAM TERRACE DEPOSITS (HOLOCENE)



ALLUVIAL DEPOSITS, UNDIFFERENTIATED (HOLOCENE)



ALLUVIAL FAN DEPOSITS (HOLOCENE TO LATEST PLEISTOCENE)



STREAM TERRACE DEPOSITS (HOLOCENE TO LAT. PLEISTOCENE)



ALLUVIAL FAN DEPOSITS (LATEST PLEISTOCENE)



YOUNGER ALLUVIAL DEPOSITS, UNDIFFERENTIATED



OLDER ALLUVIAL DEPOSITS, UNDIFFERENTIATED



OLDER DEPOSITS AND BEDROCK (EARLY QUATERNARY AND OLDER)



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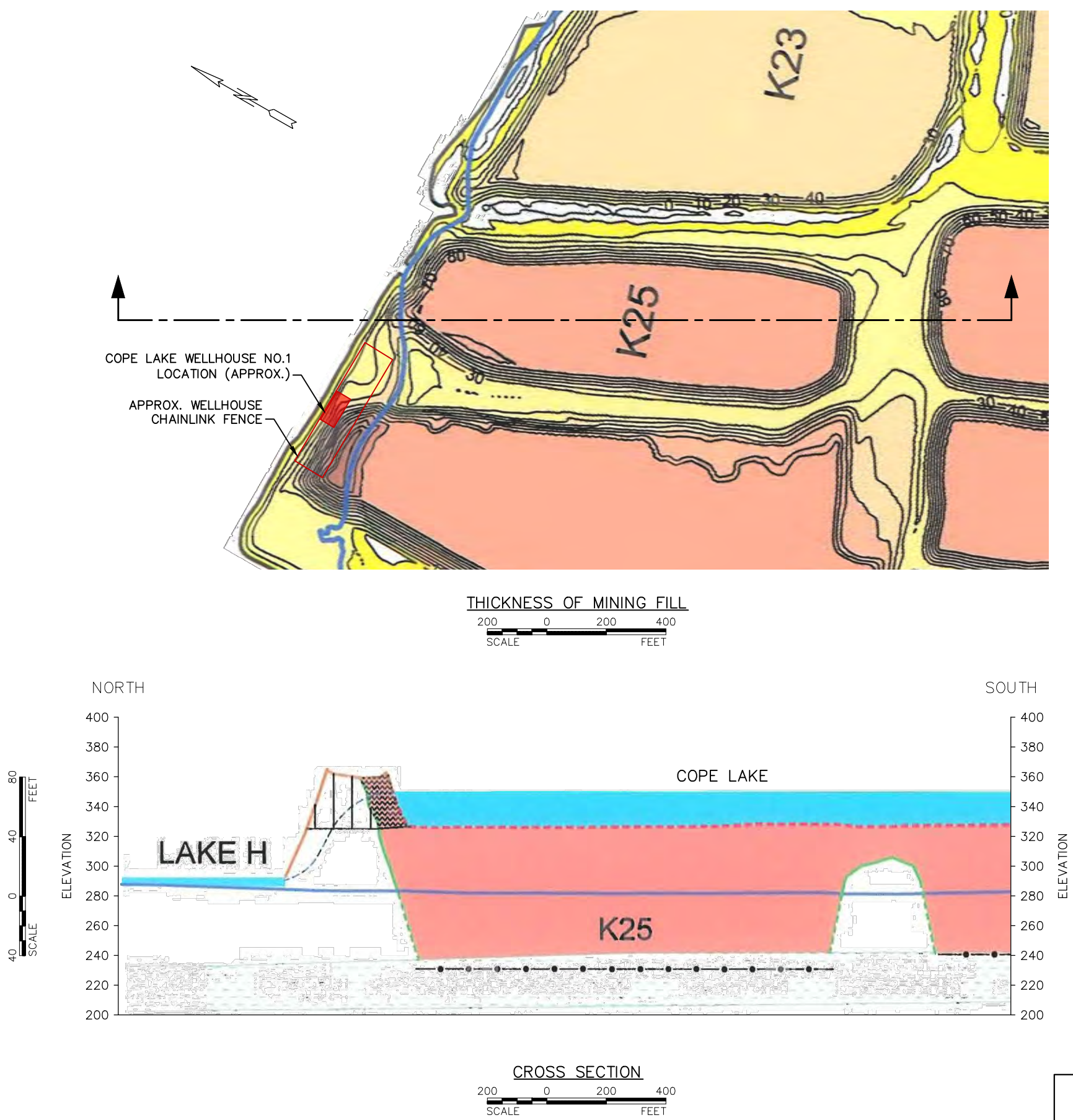
PRELIMINARY DISTRESS EVALUATION ZONE 7 WATER AGENCY – COPE LAKE WELL HOUSE #1 PLEASANTON, ALAMEDA COUNTY, CALIFORNIA QUATERNARY GEOLOGIC MAP

160820

SEPTEMBER 2016

FIGURE 3

M:\2016\160820 Zone 7 TO#1 Wellhouse Distress\AutoCAD Files\160820 Fig4 Stetson Data.dwg 9-23-16 08:21:57 AM mvthol



Thickness of Mining Fill			
Color	RANGE OF MINING FILL THICKNESS (FEET)	MINING FILL SURFACE AREA (ACRES)	% OF TOTAL MINING FILL SURFACE AREA
	0	7.7	2.6 %
	0 - 10	23.7	8.0 %
	10 - 20	15.8	5.3 %
	20 - 40	40.5	13.6 %
	40 - 60	70.9	23.9 %
	60 - 80	18.6	6.3 %
	80 - 100	67.7	22.8 %
	100 - 120	28.9	9.7 %
	120 - 140	21.9	7.4 %
	140 - 160	1.2	0.4 %
TOTAL :		297.0	

- LEGEND**
- PRESENT SURFACE
 - TOPOGRAPHIC SURVEY (2001)
 - BATHYMETRIC SURVEY (2001-2002)
 - MINED SURFACE
 - MINING BERM TOP SURFACE (KAISER, 1978)
 - BERM SIDE SLOPE ESTIMATED 1:1
 - DEEPEST MINED SURFACE (2000 MINING REPORT)
 - GROUND-WATER SURFACE
 - GROUND - WATER ELEVATION FALL 2002 (ZONE 7)
 - ESTIMATED GROUND - WATER ELEVATION TO ACCOUNT FOR LAKE LEVEL
 - NATIVE MATERIAL
 - OVERBURDEN
 - AQUIFER
 - CLAY UNIT
 - NON-NATIVE / OTHERS
 - WATER IN LAKE
 - MINING FILL
 - SHORELINE DEPOSIT
 - NON-NATIVE FILL MATERIAL

REFERENCE

1. THICKNESS OF MINING FILL AND CROSS SECTION FROM "MANAGEMENT PLAN FOR LAKES H, I, AND COPE LAKE", REPORT BY STETSON ENGINEERS INC., JUNE 2004.



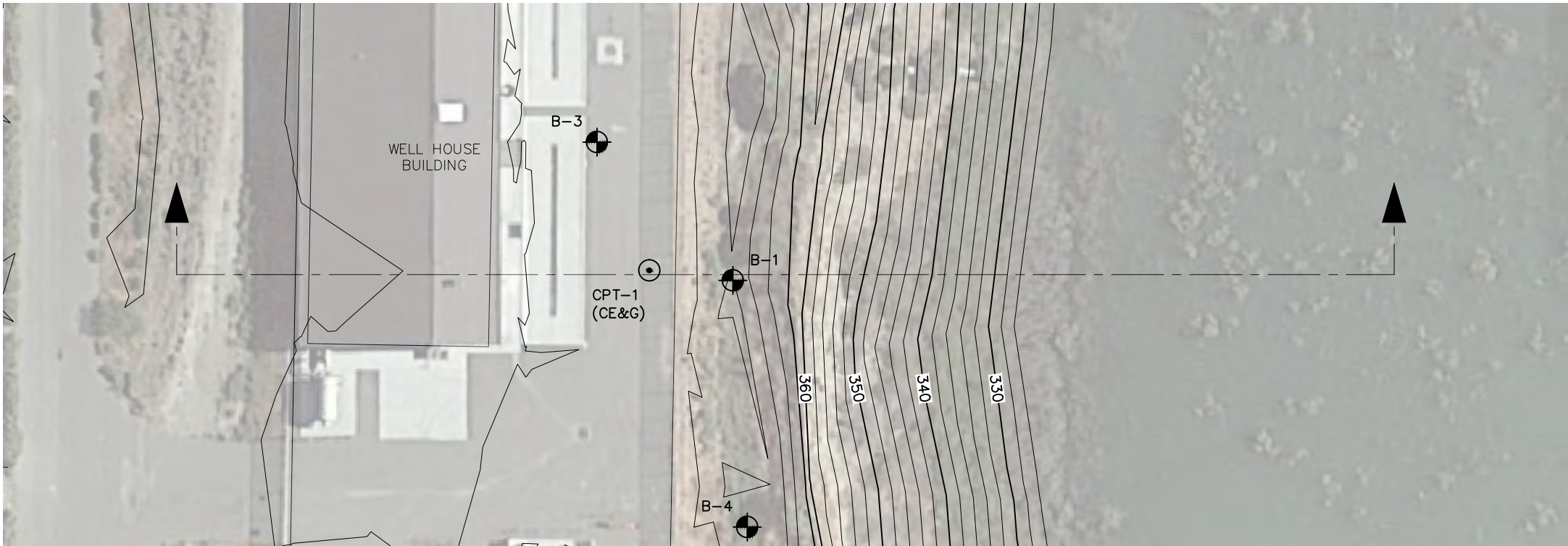
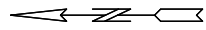
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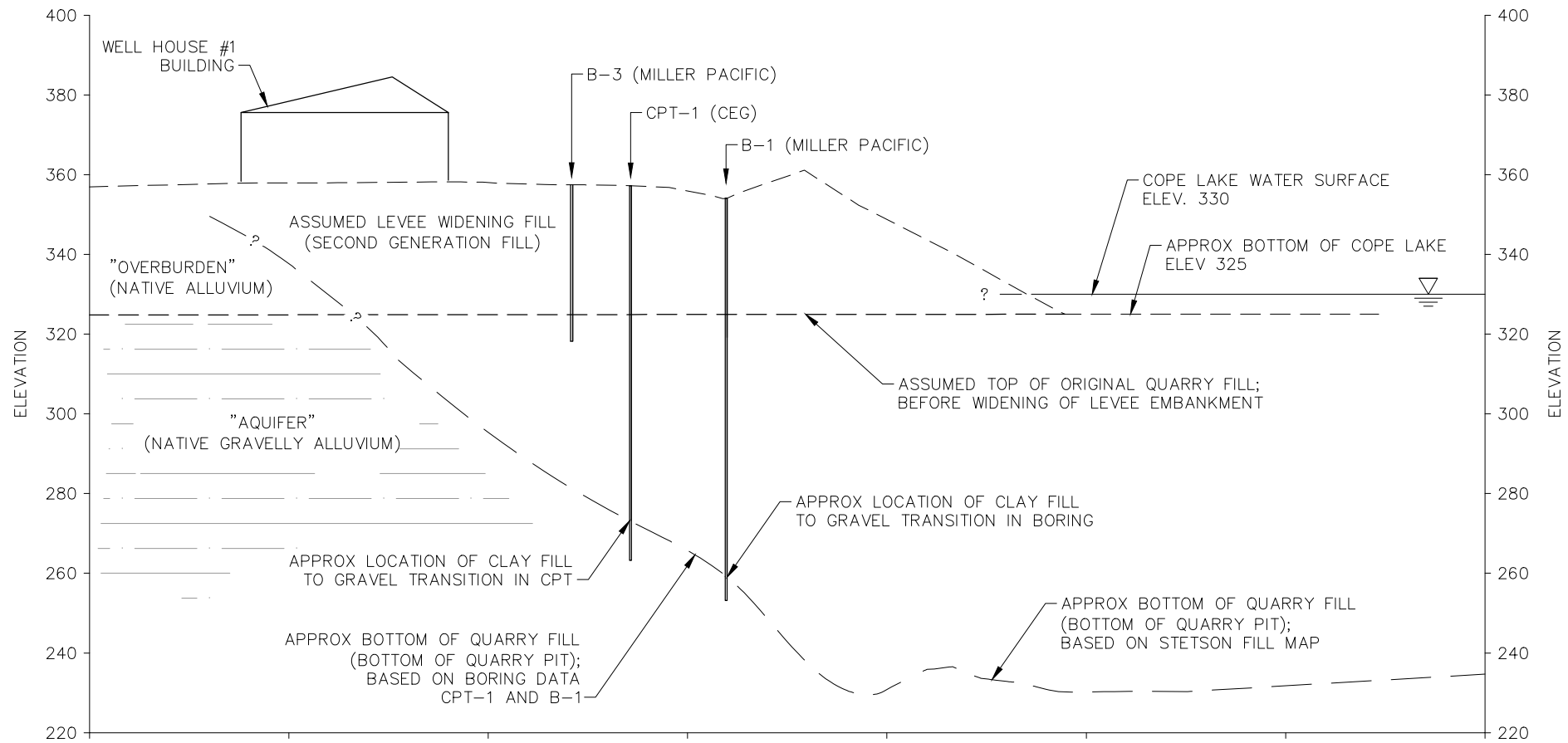
PRELIMINARY DISTRESS EVALUATION
ZONE 7 WATER AGENCY - COPE LAKE WELL HOUSE #1
PLEASANTON, ALAMEDA COUNTY, CALIFORNIA
CROSS SECTION FROM STETSON, 2004

160820	SEPTEMBER 2016	FIGURE 4
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M:\2016\160820 Zone 7 TO#1 Wellhouse Distress\AutoCAD Files\Survey\Fill Section for REPORT (Fig5).dwg 9-23-16 03:30:44 PM kdrozynska



PLAN



CROSS SECTION



119 Filbert Street
Oakland, CA, 94607

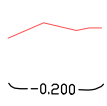
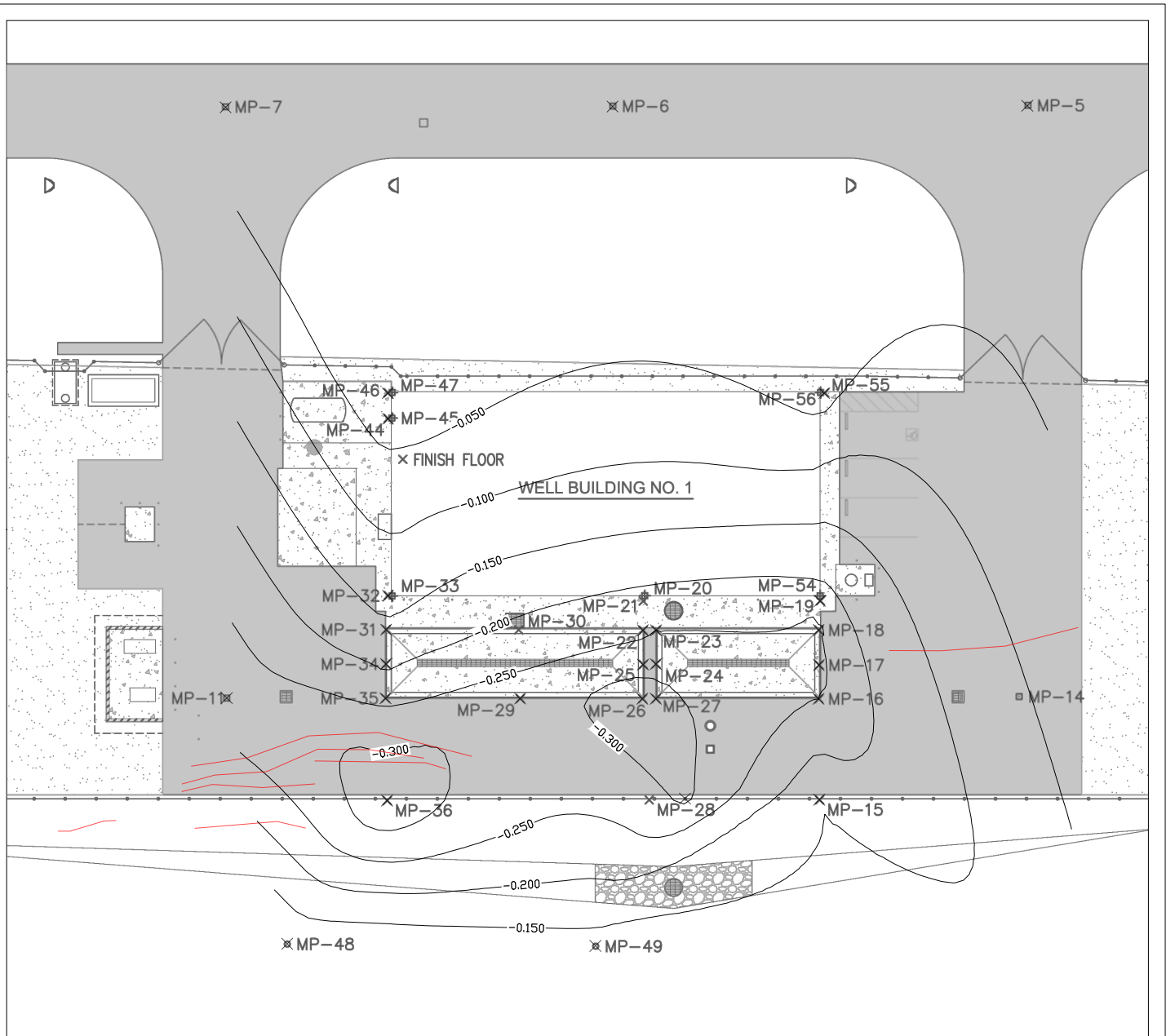
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PRELIMINARY DISTRESS EVALUATION
ZONE 7 WATER AGENCY - COPE LAKE WELL HOUSE #1
PLEASANTON, ALAMEDA COUNTY, CALIFORNIA
APPROXIMATE CROSS SECTION

160820

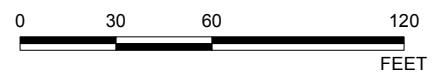
SEPTEMBER 2016

FIGURE 5



SURFACE CRACKS AS OF 2013
PER KIER & WRIGHT (2013)

SETTLEMENT CONTOURS (IN FEET)



BASEMAP REFERENCE

1. KIER & WRIGHT MONITORING SURVEY POINTS, NOV 2013 AND MAY 2016.
2. SETTLEMENT CONTOURS BY CE&G, 2016.



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PRELIMINARY DISTRESS EVALUATION
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PLEASANTON, ALAMEDA COUNTY, CALIFORNIA

SETTLEMENT CONTOUR MAP

160820

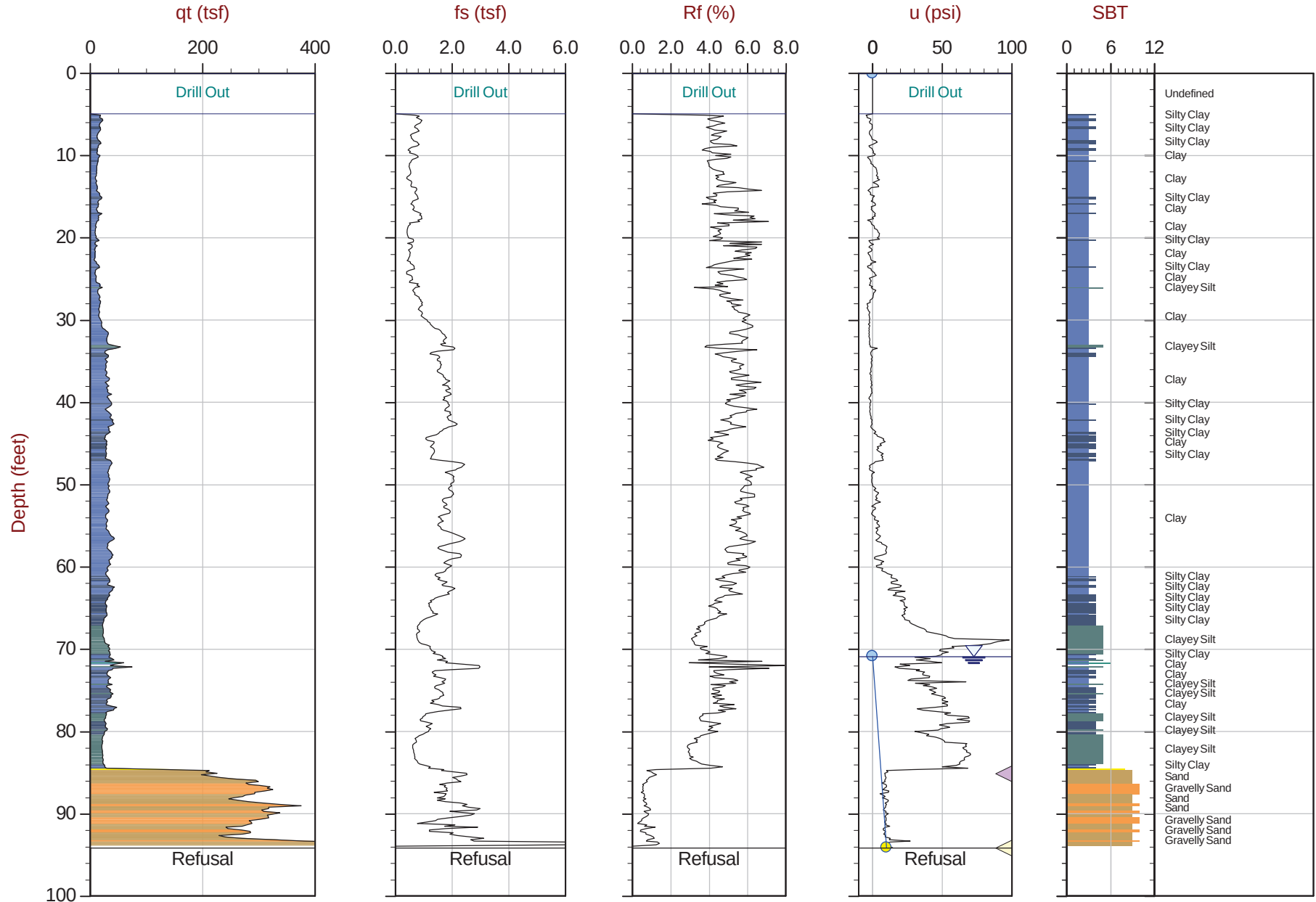
SEPTEMBER 2016

FIGURE 6

APPENDIX A
CE&G DATA AND CALCULATIONS

TABLE OF CONTENTS

CPT LOG	A-1
SLOPE INCLINOMETER READINGS	A-2 TO A-6
SETTLEMENT CALCULATIONS	A-7
SLOPE STABILTY ANALYSES RESULTS	A-8 TO A-13



Max Depth: 28.700 m / 94.16 ft

Depth Inc: 0.050 m / 0.164 ft

Avg Int: Every Point

File: 16-56051 CP01.COR

Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986

Coords: UTM Zone 10 N: 4171553 E: 601713

Page No: 1 of 1

- Equilibrium Pore Pressure (U_{eq})

- Assumed Ueq

◀ Dissipation, U_{eq} achieved

◀ Dissipation, U_{eq} not achieved

—— Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Borehole : Borehole_1

Project : zone7

Location :

Northing :

Easting :

Collar :

Spiral Correction : N/A

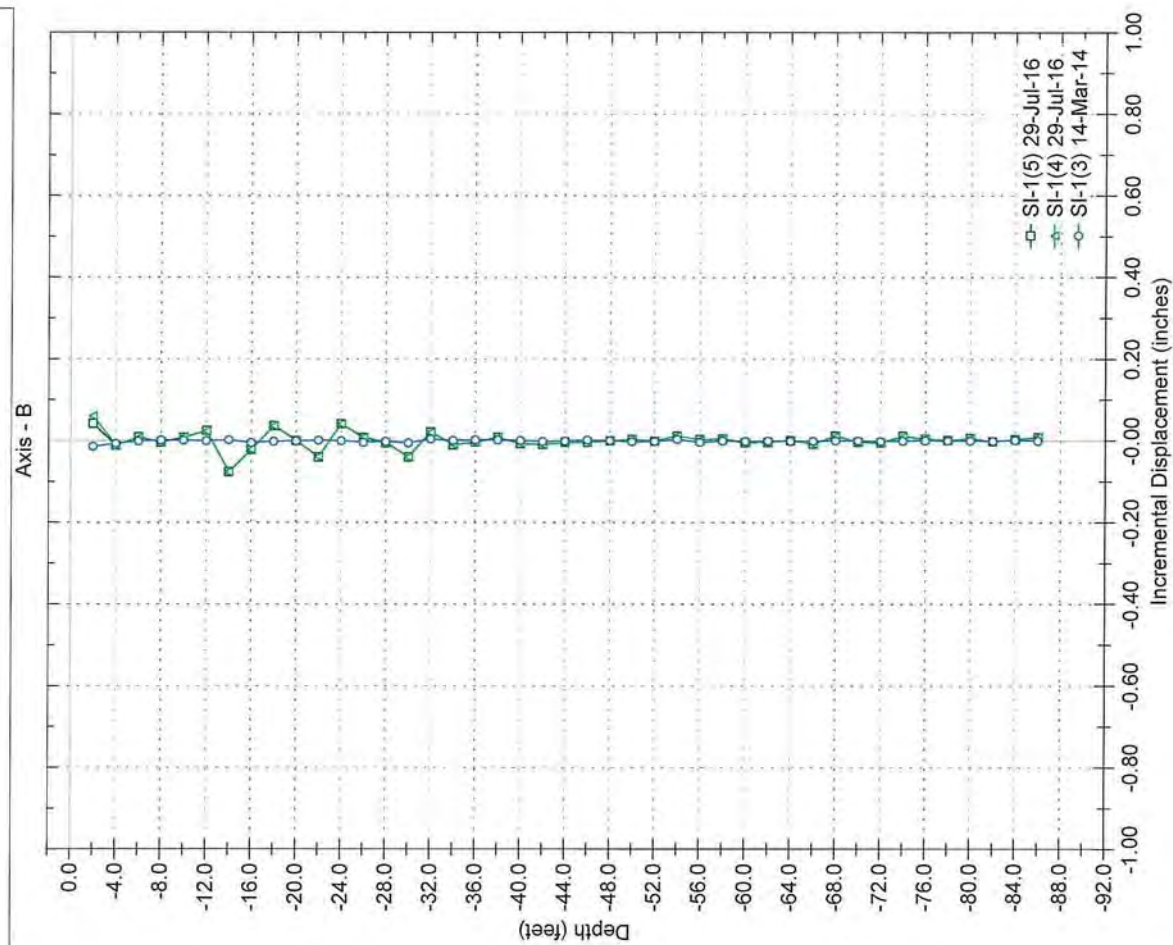
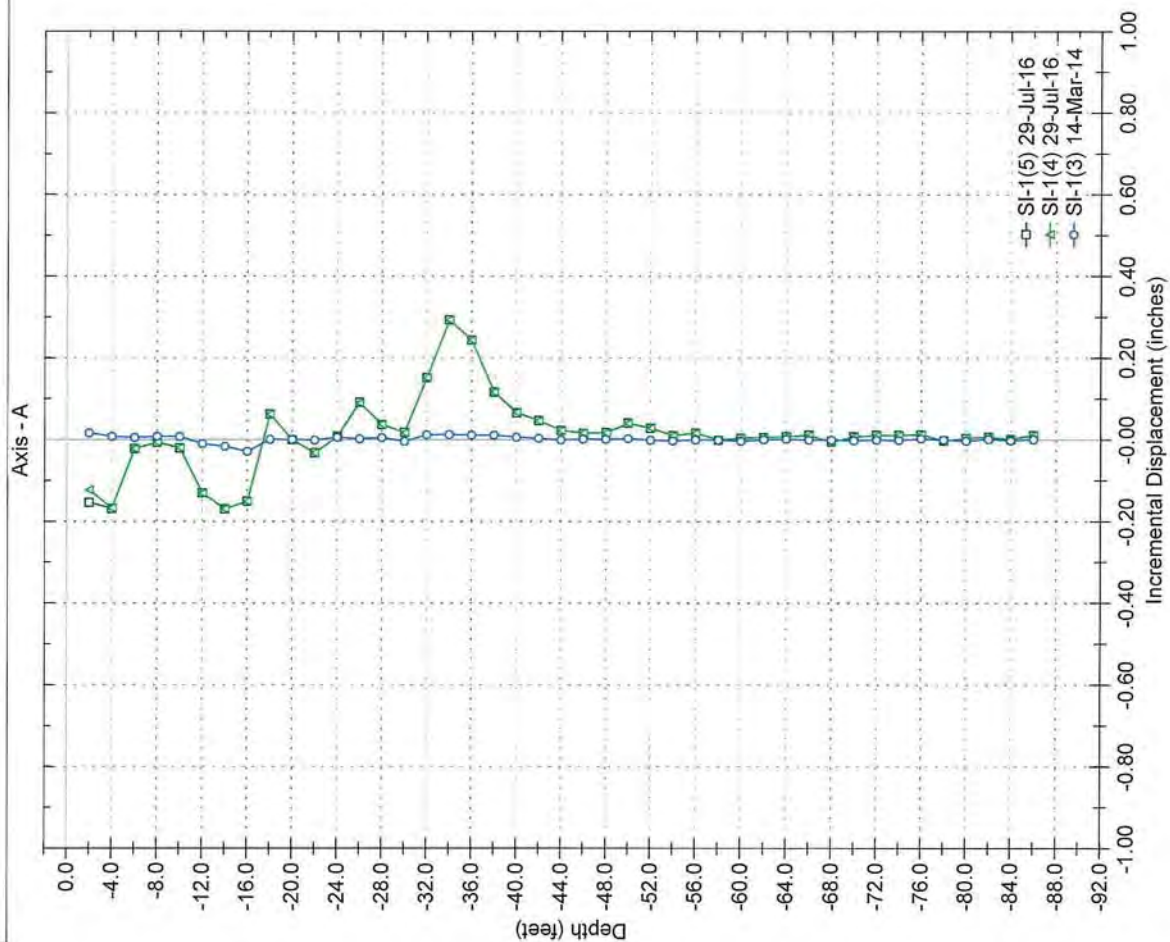
Collar Elevation : 0.0 feet

Borehole Total Depth : 86.0 feet

A+ Groove Azimuth :

Base Reading : 2014 Jan 31 09:29

Applied Azimuth : 0.0 degrees

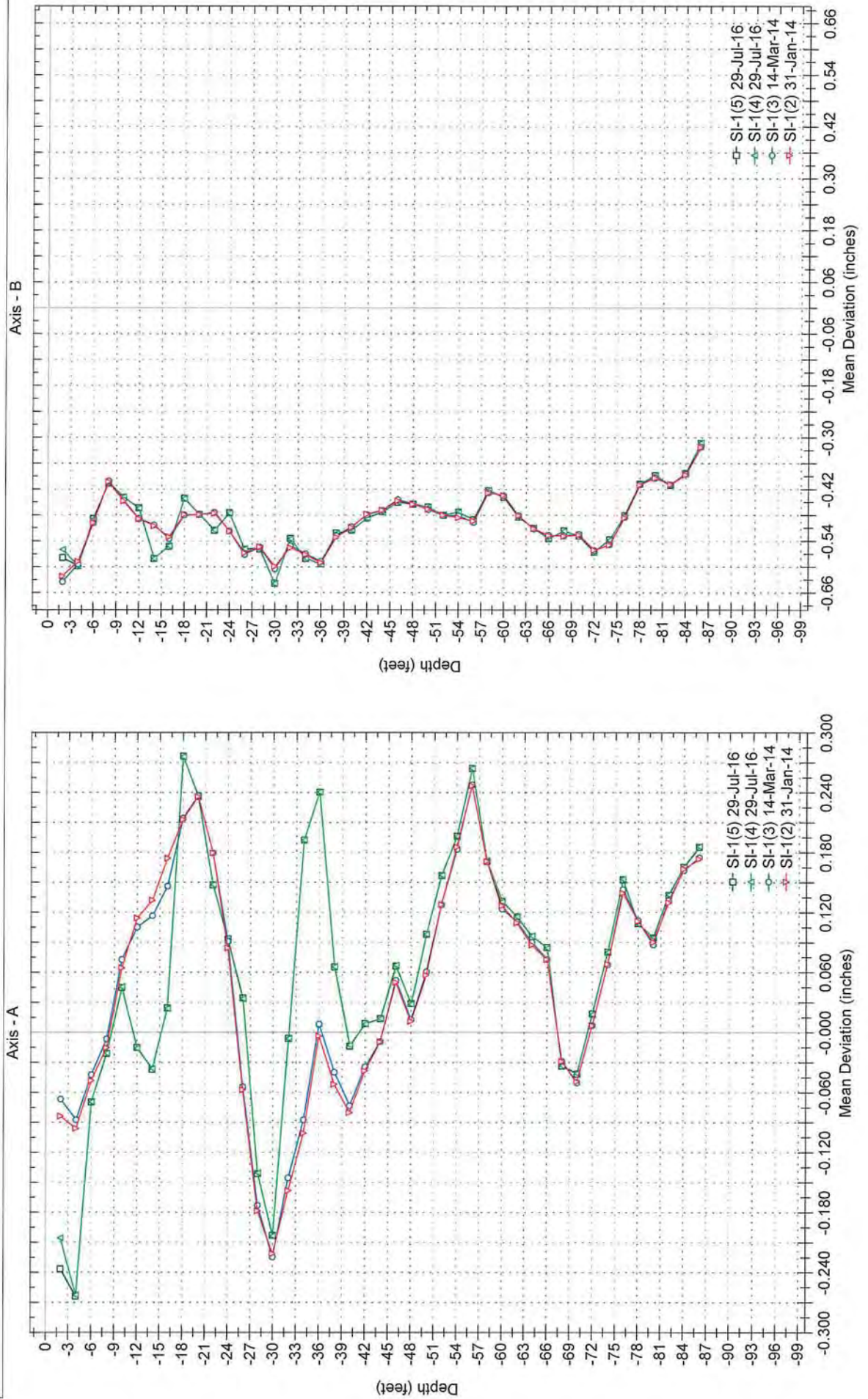


RST Instruments Ltd.

MEAN DEVIATION

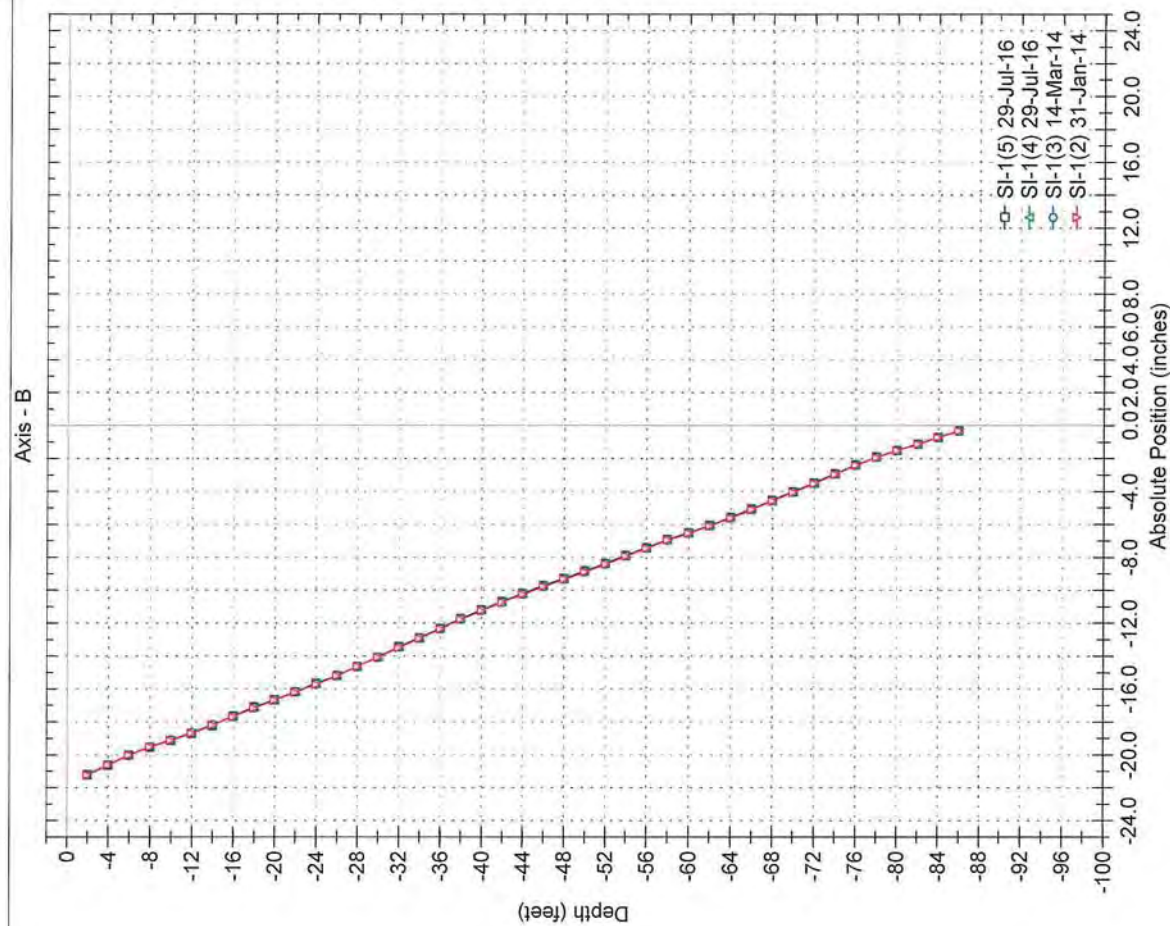
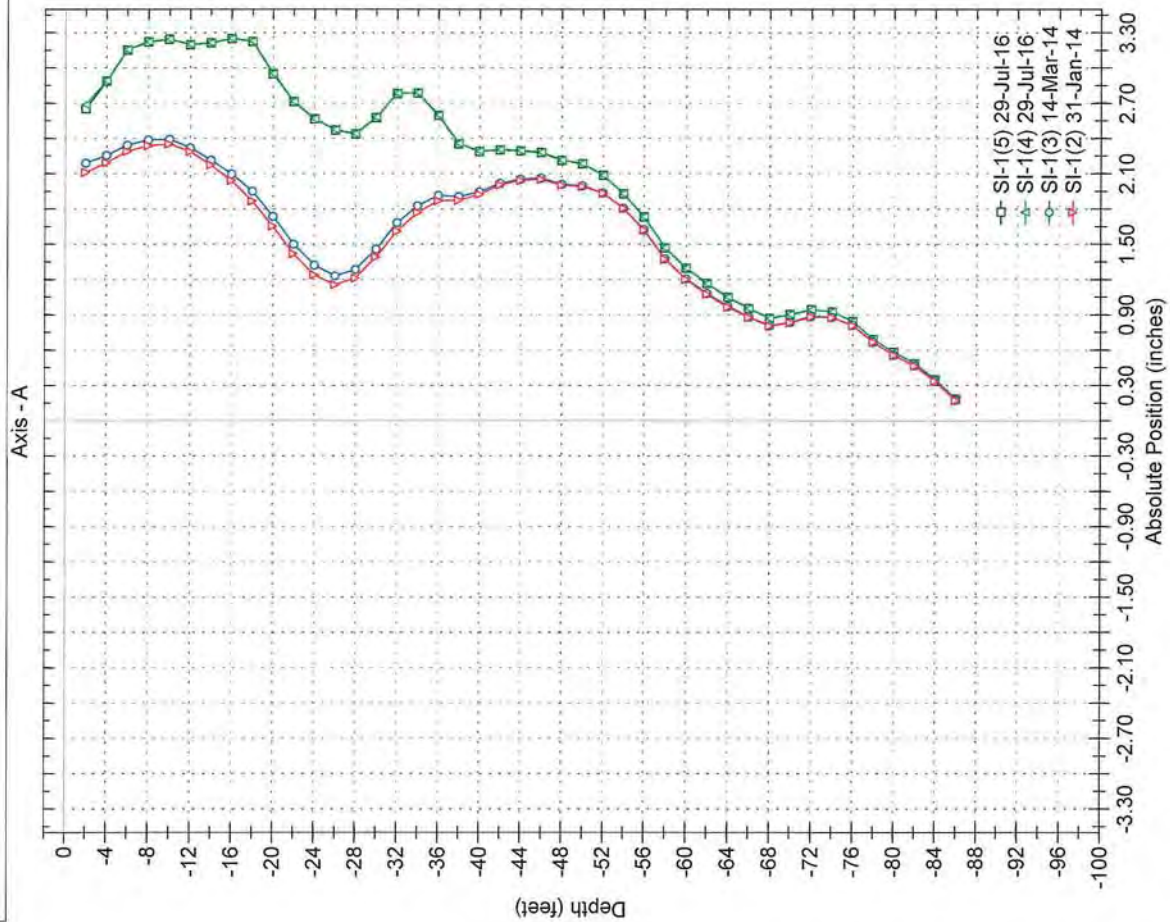
Inclinalysis v. 2.47.5

Borehole : Borehole_1
Project : zone7
Location :
Northing :
Easting :
Collar :
Spiral Correction : N/A
Collar Elevation : 0.0 feet
Borehole Total Depth : 86.0 feet
A+ Groove Azimuth :
Base Reading : 2014 Jan 31 09:29
Applied Azimuth : 0.0 degrees



Borehole : Borehole_1
Project : zone7
Location :
Northing :
Easting :
Collar :

Spiral Correction : N/A
Collar Elevation : 0.0 feet
Borehole Total Depth : 86.0 feet
A+ Groove Azimuth :
Base Reading : 2014 Jan 31 09:29
Applied Azimuth : 0.0 degrees



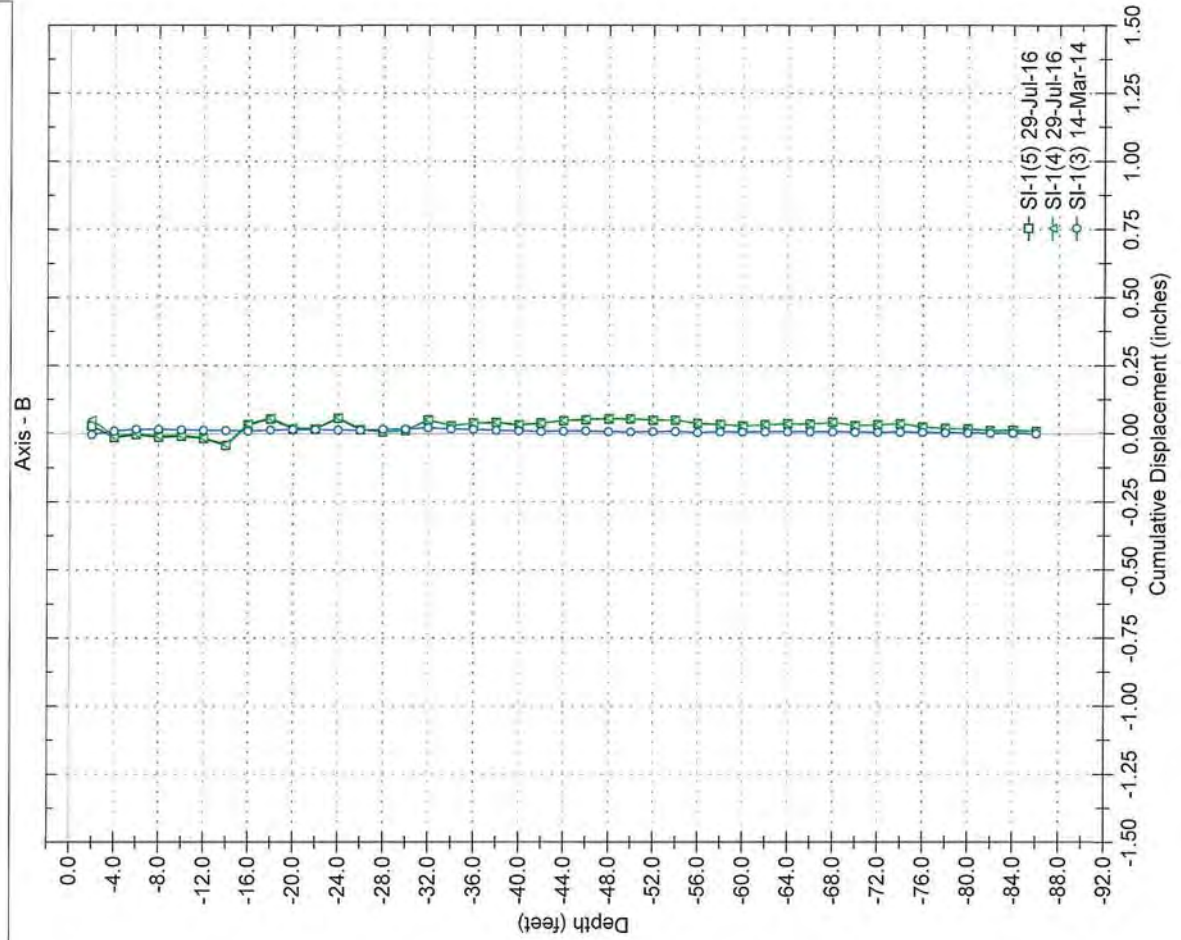
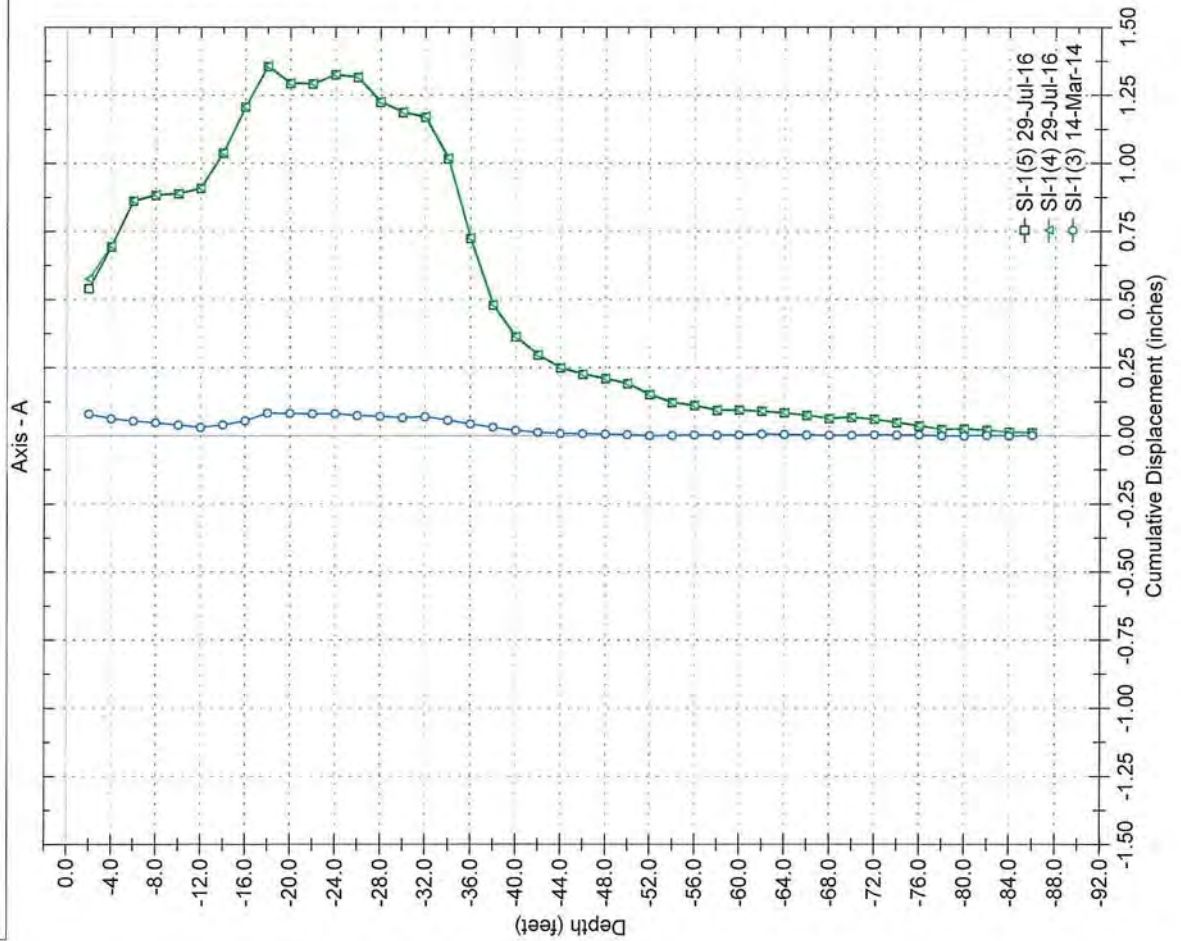
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CUMULATIVE DISPLACEMENT

Inclanalysis v. 2.47.5

Borehole : Borehole_1
Project : zone7
Location :
Northing :
Easting :
Collar :

Spiral Correction : N/A
Collar Elevation : 0.0 feet
Borehole Total Depth : 86.0 feet
A+ Groove Azimuth :
Base Reading : 2014 Jan 31 09:29
Applied Azimuth : 0.0 degrees



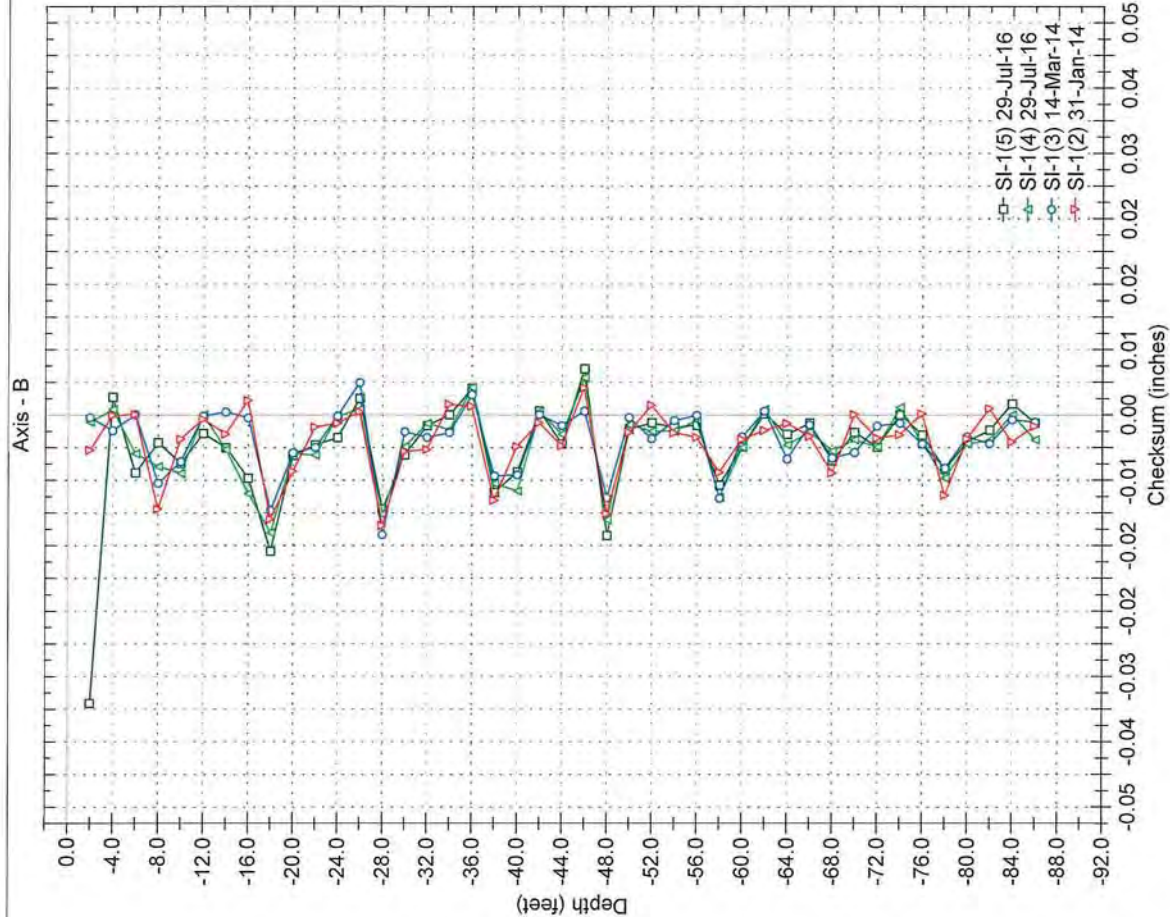
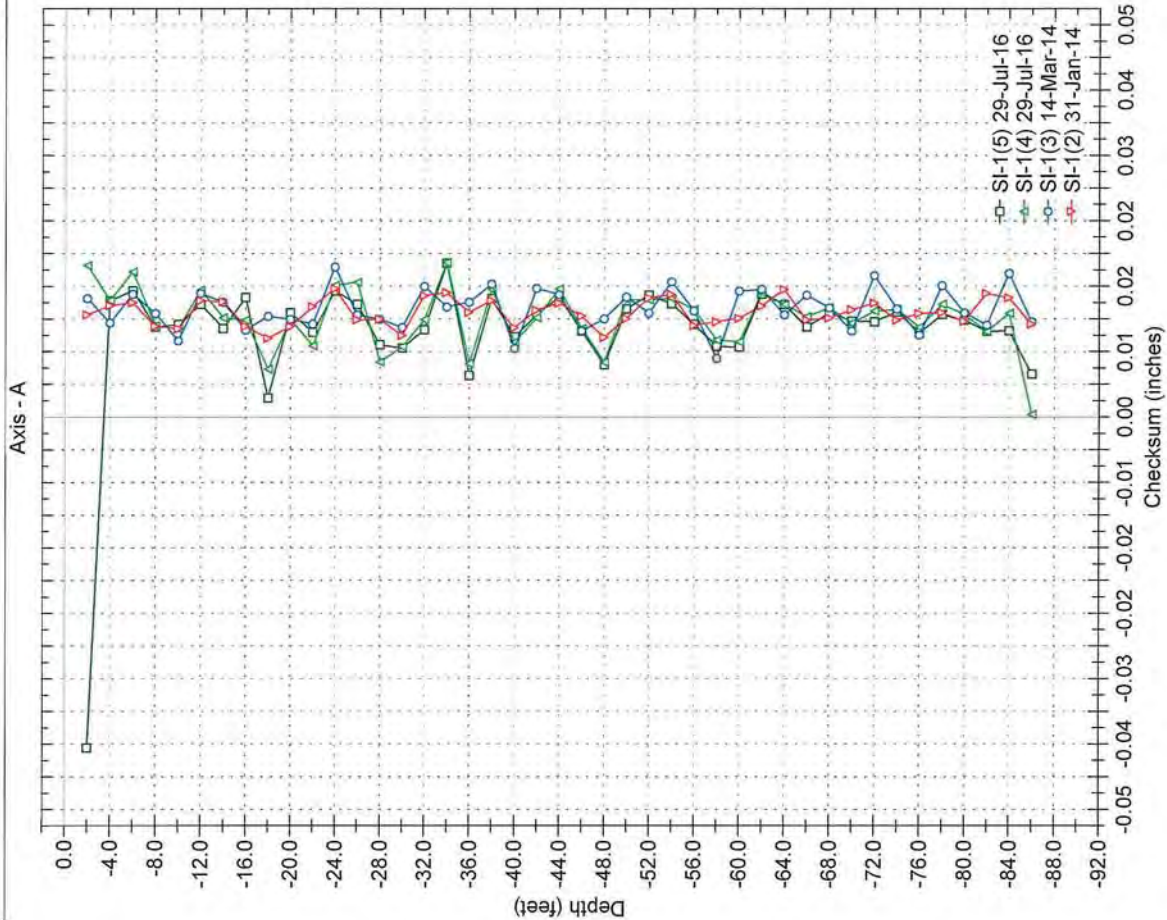
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CHECKSUM

Inclinalysis v. 2.47.5

Borehole : Borehole_1
Project : zone7
Location :
Northing :
Easting :
Collar :

Spiral Correction : N/A
Collar Elevation : 0.0 feet
Borehole Total Depth : 86.0 feet
A+ Groove Azimuth :
Base Reading : 2014 Jan 31 09:29
Applied Azimuth : 0.0 degrees



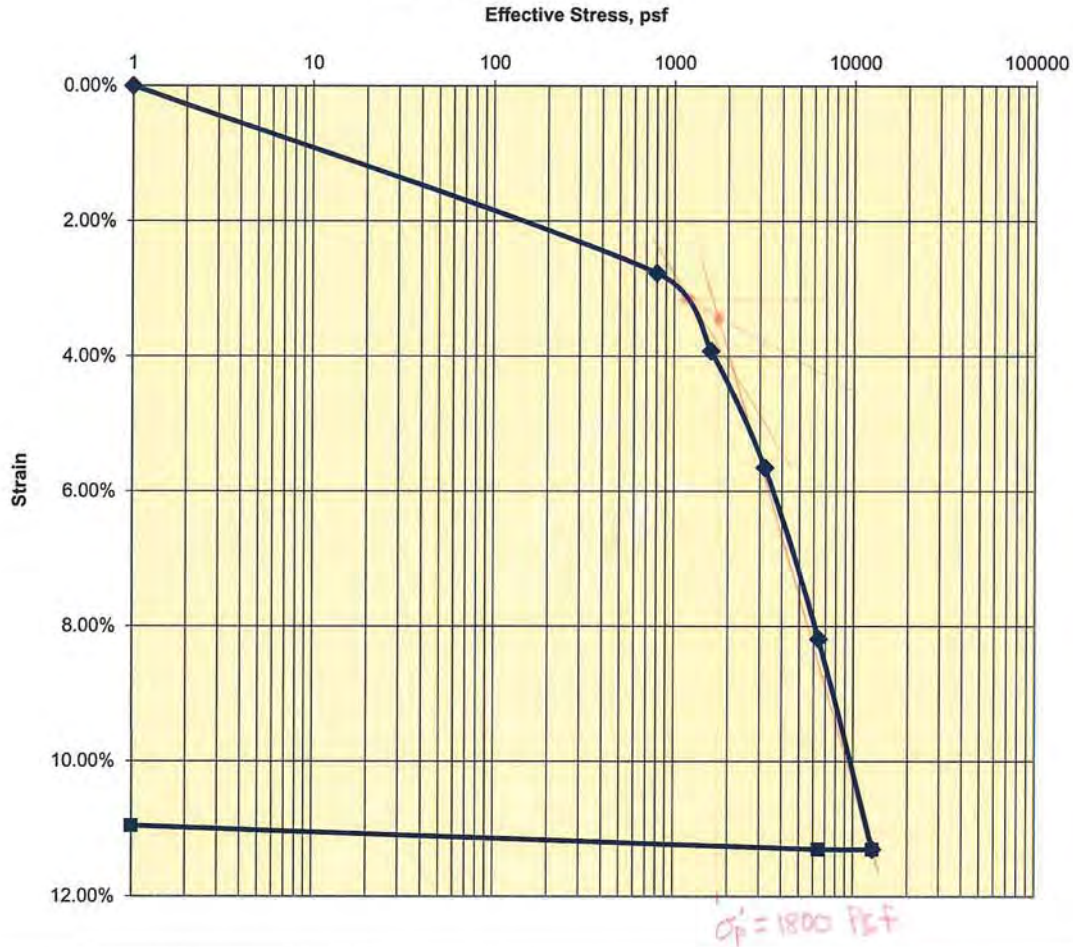
Consolidation Test

ASTM D2435

Job No.: 1492.03
 Client: _____
 Project: COPE LAKE PUMPHOUSE
 Soil Type: Silty CLAY

Boring: B3
 Depth, ft.: 26
 Date: 2/27/2014
 Run By: BAS
 Reduced: _____
 Checked: NGK

Strain-Log-P Curve



Ass. Gs = 2.68	Initial	Final
Moisture %:	22.4	20.4
Dry Density, pcf:	101.3	109.5
Void Ratio:	0.650	0.527
% Saturation:	92.4	104

Remarks:

$Cc' = 0.09$

$H \approx 35 \text{ ft}$

$$d_c = Cc' \cdot H = 109 \left(\frac{\sigma'_v}{\sigma'_p} \right)$$

$$d_c = 1109 (35 \text{ ft}) 109 \left(\frac{129.5 + 26}{1800} \right)$$

AVG UNIT WEIGHT OF SOIL COLUMN $\approx 129.5 \text{ PCF}$

$$d_c = 2.56 \text{ ft} \Rightarrow 11 \text{ inches}$$

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CONSOLIDATION TEST RESULTS

Zone 7 Water Agency
 Cope Lake Pumphouse Investigation
 Livermore, California

Drawn: JTO
 Checked: _____

A-20
 FIGURE

Project No. 1492.03 Date: 3/7/14

SETTLEMENT ALREADY OCCURRED FROM TIME OF SAMPLING TO MAY 2016 IS

EXPECT APPROX. 7 inches OF ADDITIONAL SETTLEMENT

APPROX. 4 inches

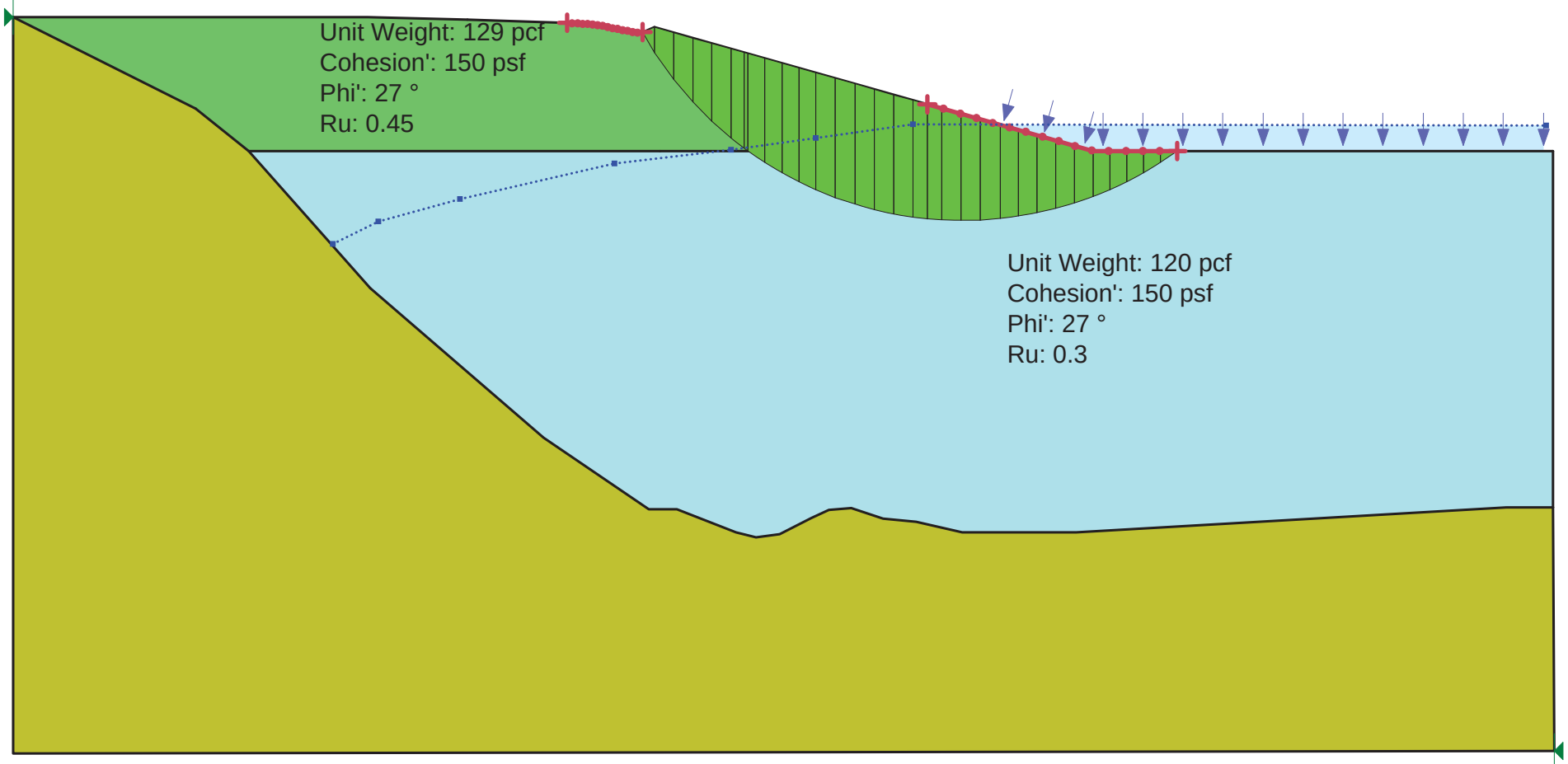
Unit Weight: 129 pcf
 Cohesion': 150 psf
 Phi': 27 °
 Ru: 0.45

Unit Weight: 120 pcf
 Cohesion': 150 psf
 Phi': 27 °
 Ru: 0.3

Zone 7 Cope Lake Wellhouse Slope Stability Analysis

Regraded Slope Geometry with Circular Slip Surfaces near Inclinometer

09/13/2016

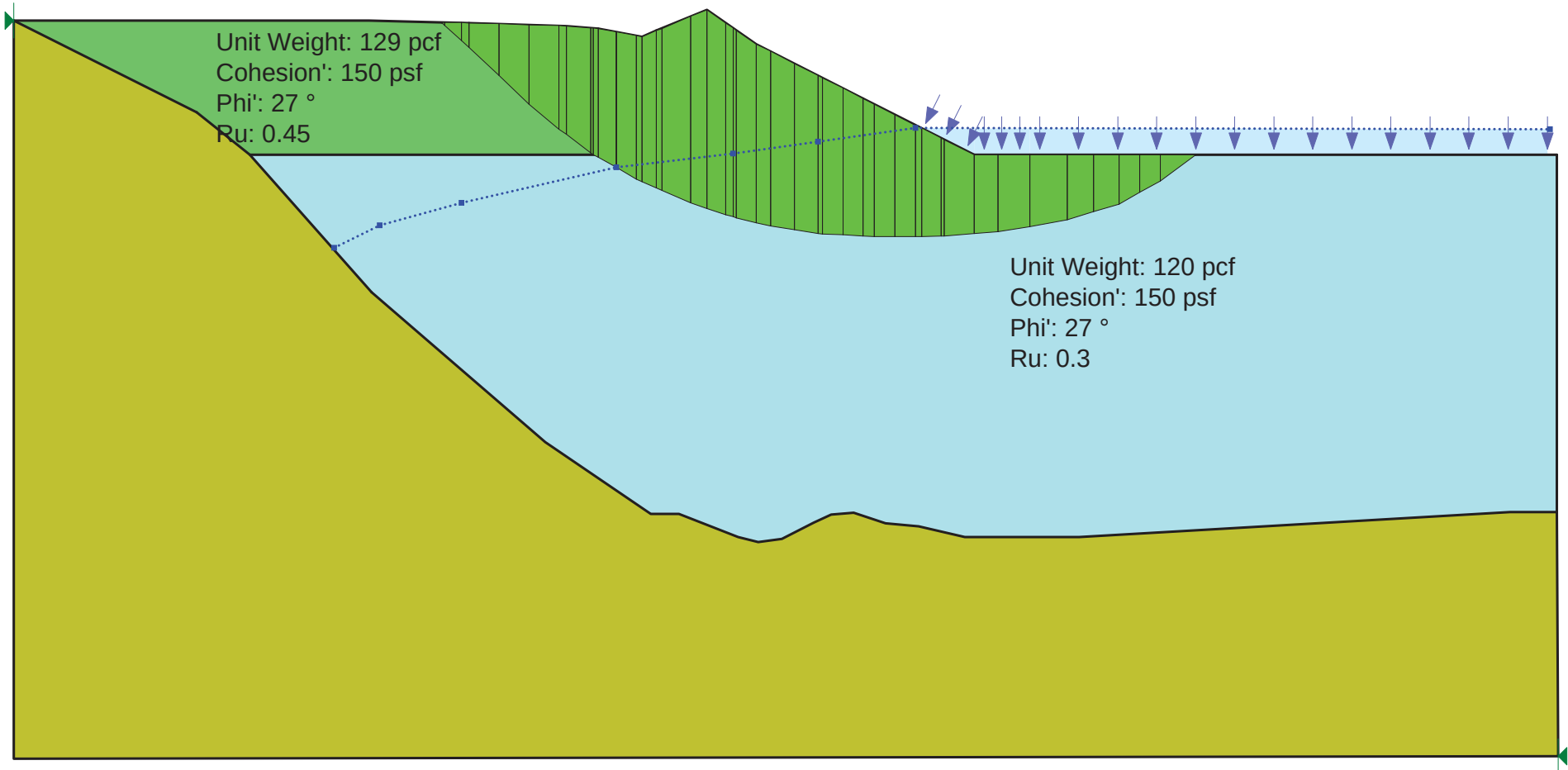


30% Increase in Factor of Safety,
compared to existing slope geometry
stability shown on page A-8

Zone 7 Cope Lake Wellhouse Slope Stability

Existing Slope Geometry with User Specified Deep Failure Surfaces

09/13/2016



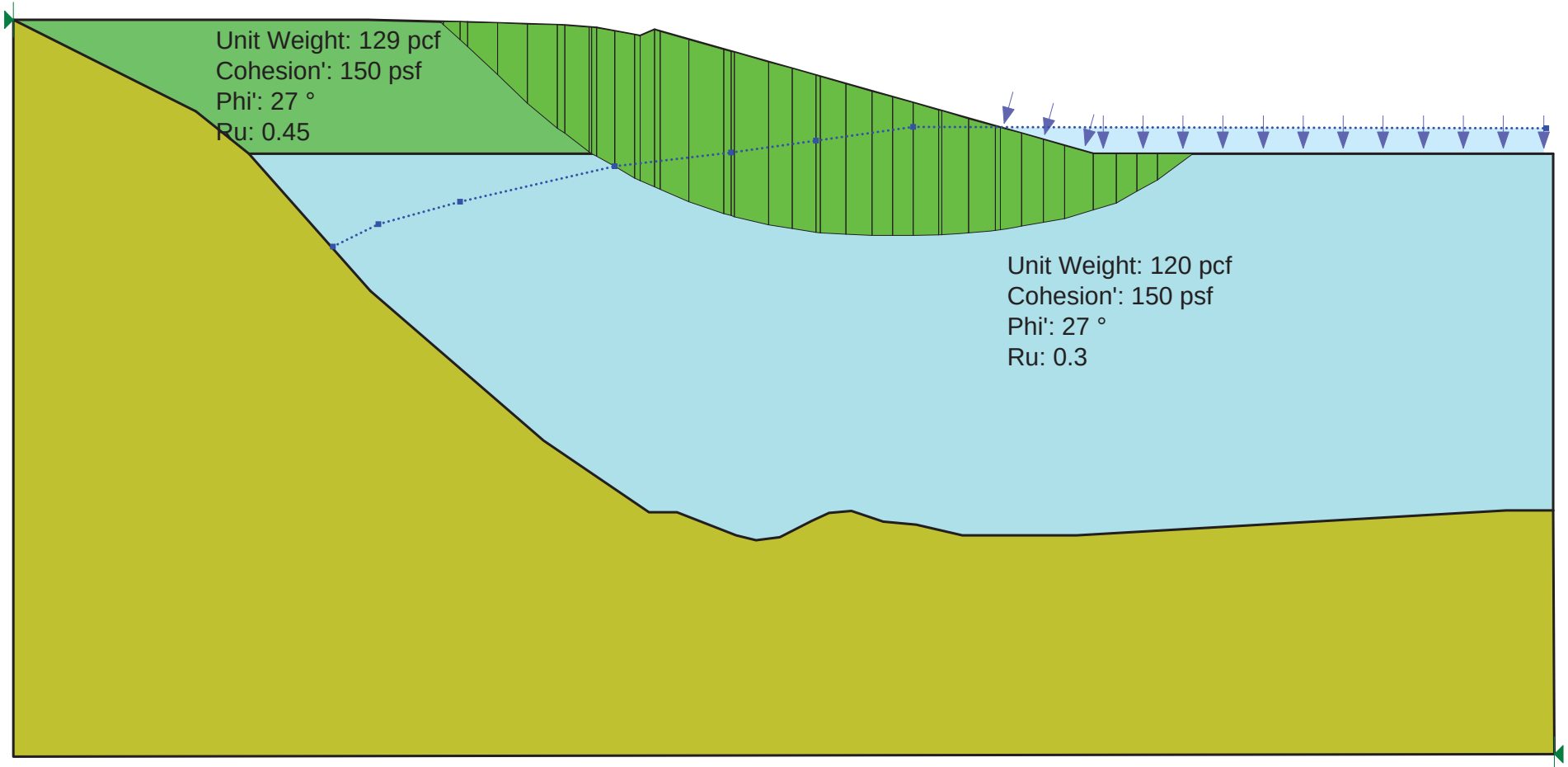
Zone 7 Cope Lake Wellhouse Slope Stability

Regraded Slope Geometry with User Specified Deep Failure Surface

09/13/2016

● 1.626

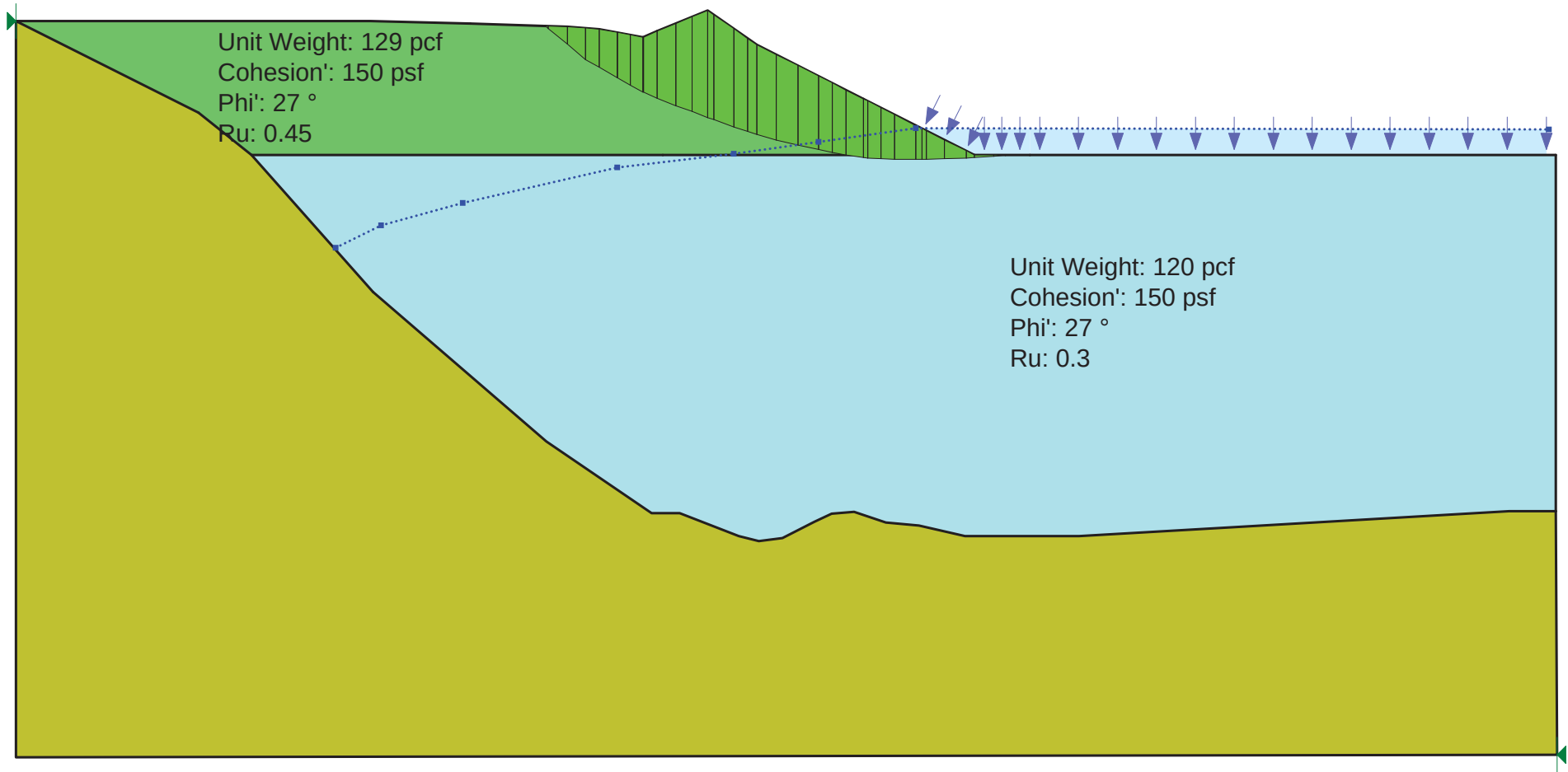
10% Increase in Factor of Safety,
compared to existing slope geometry
stability shown on page A-10



Zone 7 Cope Lake Wellhouse Slope Stability

Existing Slope Geometry with User Specified Shallow Failure Surfaces

09/13/2016



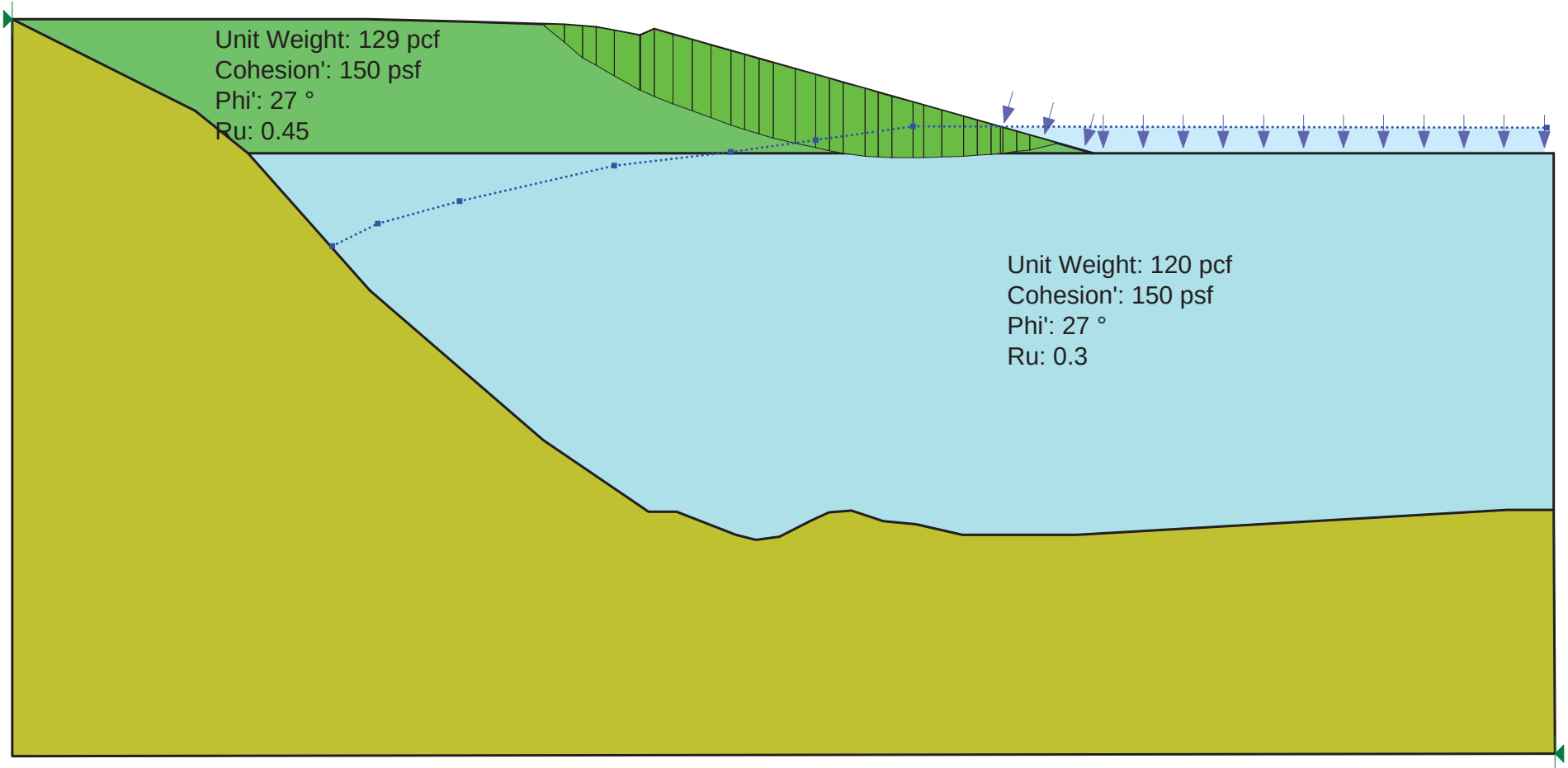
Zone 7 Cope Lake Wellhouse Slope Stability

Regraded Slope Geometry with User Specified Shallow Failure Surface

09/13/2016

1.872

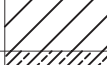
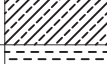
24% Increase in Factor of Safety,
compared to existing slope geometry
stability shown on page A-12



APPENDIX B
PREVIOUS INVESTIGATION DATA

TABLE OF CONTENTS

MILLER PACIFIC BORING LOGS	B-1 TO B-16
MILLER PACIFIC LABORATORY TESTS	B-17 TO B-22
MILLER PACIFIC SLOPE INCLINOMETER	B-23 TO B-25
KIER & WRIGHT MONITORING SURVEY POINTS	B-26 TO B-27

MAJOR DIVISIONS		SYMBOL	DESCRIPTION
COARSE GRAINED SOILS over 50% sand and gravel	CLEAN GRAVEL	GW	 Well-graded gravels or gravel-sand mixtures, little or no fines
		GP	 Poorly-graded gravels or gravel-sand mixtures, little or no fines
	GRAVEL with fines	GM	 Silty gravels, gravel-sand-silt mixtures
		GC	 Clayey gravels, gravel-sand-clay mixtures
	CLEAN SAND	SW	 Well-graded sands or gravelly sands, little or no fines
		SP	 Poorly-graded sands or gravelly sands, little or no fines
	SAND with fines	SM	 Silty sands, sand-silt mixtures
		SC	 Clayey sands, sand-clay mixtures
FINE GRAINED SOILS over 50% silt and clay	SILT AND CLAY liquid limit <50%	ML	 Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL	 Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	 Organic silts and organic silt-clays of low plasticity
	SILT AND CLAY liquid limit >50%	MH	 Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
		CH	 Inorganic clays of high plasticity, fat clays
		OH	 Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS		PT	 Peat, muck, and other highly organic soils
ROCK			Undifferentiated as to type or composition

KEY TO BORING AND TEST PIT SYMBOLS

CLASSIFICATION TESTS

PI	PLASTICITY INDEX
LL	LIQUID LIMIT
SA	SIEVE ANALYSIS
SS	SHRINK/SWELL
CSL	CONSOLIDOMETER
HYD	HYDROMETER ANALYSIS
P200	PERCENT PASSING NO. 200 SIEVE
P4	PERCENT PASSING NO. 4 SIEVE

SAMPLER TYPE

	MODIFIED CALIFORNIA		HAND SAMPLER
	STANDARD PENETRATION TEST		ROCK CORE
	THIN-WALLED / FIXED PISTON		DISTURBED OR BULK SAMPLE

NOTE: Test boring and test pit logs are an interpretation of conditions encountered at the excavation location during the time of exploration. Subsurface rock, soil or water conditions may vary in different locations within the project site and with the passage of time. Boundaries between differing soil or rock descriptions are approximate and may indicate a gradual transition.

STRENGTH TESTS

TV	FIELD TORVANE (UNDRAINED SHEAR)
UC	LABORATORY UNCONFINED COMPRESSION
TXCU	CONSOLIDATED UNDRAINED TRIAXIAL
TXUU	UNCONSOLIDATED UNDRAINED TRIAXIAL
UC, CU, UU = 1/2 Deviator Stress	

SAMPLER DRIVING RESISTANCE

Modified California and Standard Penetration Test samplers are driven 18 inches with a 140-pound hammer falling 30 inches per blow. Blows for the initial 6-inch drive seat the sampler. Blows for the final 12-inch drive are recorded onto the logs. Sampler refusal is defined as 50 blows during a 6-inch drive. Examples of blow records are as follows:

25 sampler driven 12 inches with 25 blows after initial 6-inch drive

85/7" sampler driven 7 inches with 85 blows after initial 6-inch drive

50/3" sampler driven 3 inches with 50 blows during initial 6-inch drive or beginning of final 12-inch drive

Miller Pacific ENGINEERING GROUP A CALIFORNIA CORPORATION, © 2010, ALL RIGHTS RESERVED FILE: 1492.03BL.dwg	504 Redwood Blvd. Suite 220 Novato, CA 94947 T 415 / 382-3444 F 415 / 382-3450 www.millerpac.com	SOIL CLASSIFICATION CHART Zone 7 Water Agency Cope Lake Pumphouse Investigation Livermore, California Project No. 1492.03 Date: 1-29-14		Drawn MFJ Checked	A-1 FIGURE

OTHER TEST DATA		OTHER TEST DATA		UNDRAINED SHEAR STRENGTH psf (1)		BLOWS PER FOOT		MOISTURE CONTENT (%)		DRY UNIT WEIGHT pcf (2)		DEPTH meters feet		SAMPLE		SYMBOL (3)		BORING 1	
LL=36 PI=19 SA		71.4% P200		15		15.9		119		0		0						EQUIPMENT: Truck-mounted CME-75 Drill Rig with 6-inch Mud-Rotary "Finger" Bit	
										-1		5						DATE: 1/22/2014	
										-2		10						ELEVATION: 359-Feet*	
										-3		15						*REFERENCE: Google Earth Used For Elevation	
										-4		20						CLAY WITH SAND (CL)	
										-5								Medium brown to olive gray, moist, medium stiff to stiff, medium plasticity, ~15% fine to coarse subrounded sand, ~5% fine to coarse subrounded gravel [FILL]	
										-6								Grades with ~20% fine to coarse subrounded sand, ~10% fine to coarse subrounded gravel at 9.0-feet.	
																		Note soft drilling from 9.5 to 19.5-feet.	
																		Note loss of fluid circulation at 9.5-feet, approximately 100-gallons lost between 9.5 and 19.5-feet.	
																		Note soil is laminated, slightly porous at 19.5-feet.	

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

Miller Pacific ENGINEERING GROUP A CALIFORNIA CORPORATION, © 2010, ALL RIGHTS RESERVED FILE: 1492 03BL.dwg	504 Redwood Blvd.	BORING LOG		
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	F 415 / 382-3450	Livermore, California		
www.millerpac.com	Project No. 1492.03	Date: 1-29-14	Drawn <u>MFJ</u> Checked _____	A-2 FIGURE

OTHER TEST DATA		OTHER TEST DATA		UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	meters feet	DEPTH	SAMPLE	SYMBOL (3)	BORING 1 (CONTINUED)
SS				2150 UC	8	20.7	106	20				CLAY WITH SAND (CL) Medium brown to olive gray, moist, medium stiff to stiff, medium plasticity, ~20% fine to coarse subrounded sand, ~10% fine to coarse subrounded gravel [FILL]
								7				
SA	50.9% P200	TXCU 1370	6	20.3			97	25				GRAVELLY CLAY WITH SAND (CL) Medium brown to olive gray, moist, medium stiff to stiff, medium plasticity, ~25% fine to coarse subrounded gravel, ~25% fine to coarse subrounded sand [FILL]
								8				
								9				
								30				
								10				No recovery at 29.5-feet, sample recovered by re-driving with sandcatcher. Note recovered samples are soft and wet while material in sampler shoe is moist and very stiff.
								11				
								35				
								40				
												No recovery at 39.5-feet, sample recovered by re-driving with sandcatcher.

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
 (2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m³ = 0.1571 x DRY UNIT WEIGHT (pcf)
 (3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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		Project No. 1492.03	Date: 2-3-14
		A-3 FIGURE	

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters feet	SAMPLE	SYMBOL (3)	BORING 1 (CONTINUED)
SS		3850 UC	10	19.4	101	40			GRAVELLY CLAY WITH SAND (CL) Medium brown to olive gray, moist, medium stiff to stiff, medium plasticity, ~25% fine to coarse subrounded gravel, ~25% fine to coarse subrounded sand [FILL] Harder drilling noted at 43.0-feet, still poor circulation, no fluid return. Grades stiff at 43.0-feet.
						13			
						45			
						14			
						15			
						50			
						16			
						55			
						17			
						18			
						60			

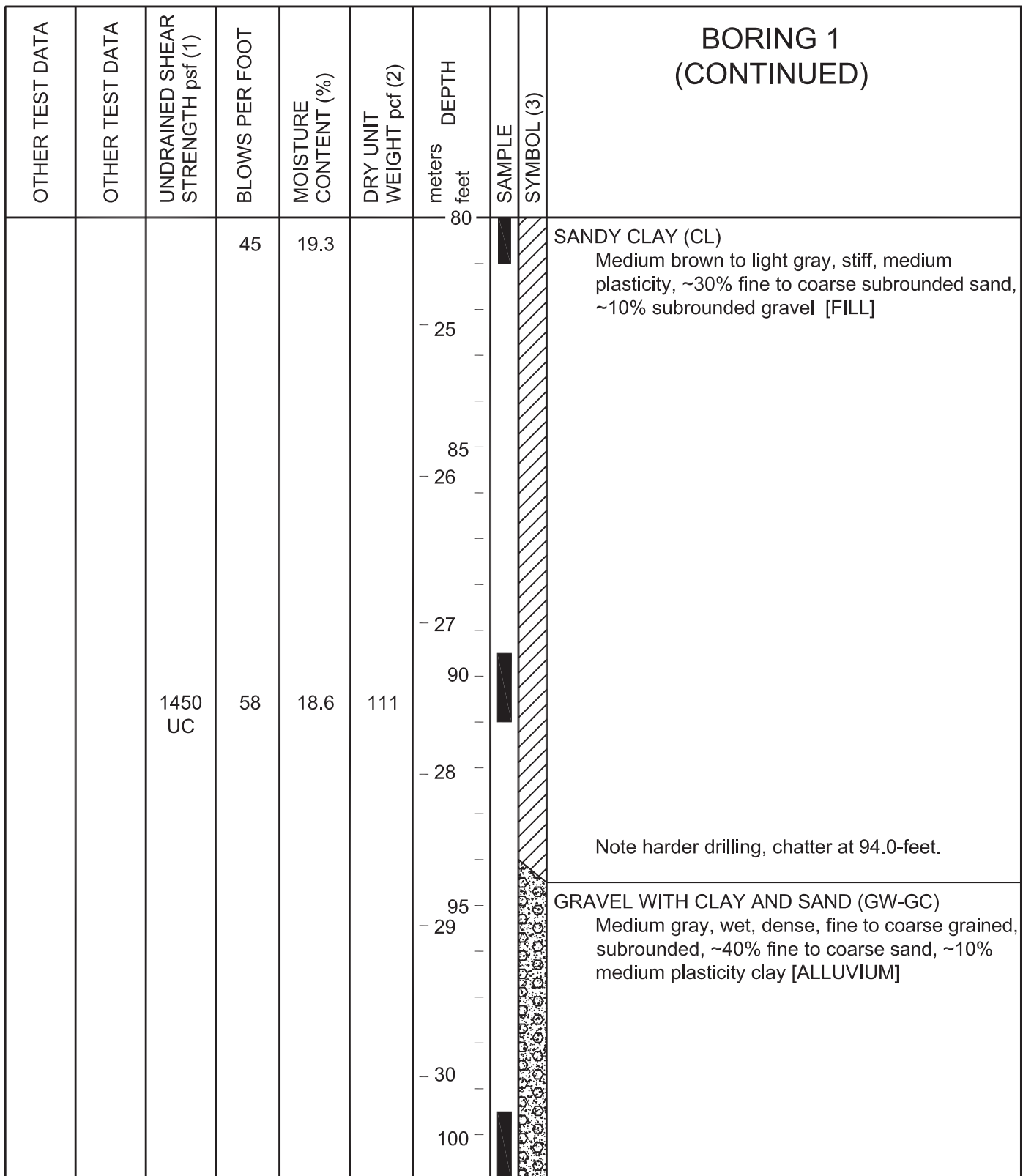
NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
 (2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m³ = 0.1571 x DRY UNIT WEIGHT (pcf)
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	T 415 / 382-3444 F 415 / 382-3450 www.millerpac.com			
		Project No. 1492.03	Date: 2-3-14	

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	meters feet	DEPTH	SAMPLE	SYMBOL (3)	BORING 1 (CONTINUED)
LL=36 PI=15		TXCU 3640	28	19.0	114	60				GRAVELLY CLAY WITH SAND (CL) Medium brown to olive gray, moist, medium stiff to stiff, medium plasticity, ~25% fine to coarse subrounded gravel, ~25% fine to coarse subrounded sand [FILL] Note minor chatter at 68.0-feet. No recovery at 69.5-feet, sample recovered by re-driving with sandcatcher. No recovery at 79.5-feet, sample recovered by re-driving with sandcatcher.
						19				
						65				
						20				
						21				
						70				
						22				
						75				
						23				
						24				
						80				
										SANDY CLAY (CL)

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m³ = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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				A-5 FIGURE



NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
 (2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m³ = 0.1571 x DRY UNIT WEIGHT (pcf)
 (3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	meters feet	DEPTH	SAMPLE	SYMBOL (3)	BORING 1 (CONTINUED)
SA	7.5% P200		77	8.8		100				GRAVEL WITH CLAY AND SAND (GW-GC) Medium gray, wet, dense, fine to coarse grained, subrounded, ~40% fine to coarse sand, ~10% medium plasticity clay [ALLUVIUM]
						31				Boring terminated at 101.0-feet BGS. Depth to groundwater unknown due to mud-rotary drill method. Boring converted to 2.75-inch OD inclinometer. Inclinometer set to 88-feet and backfilled with cement grout and bentonite chips.
						105				
						32				
						33				
						110				
						34				
						115				
						35				
						36				
						120				

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
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 (3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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OTHER TEST DATA		OTHER TEST DATA		UNDRAINED SHEAR STRENGTH psf (1)		BLOWS PER FOOT		MOISTURE CONTENT (%)		DRY UNIT WEIGHT pcf (2)		DEPTH meters feet		SAMPLE SYMBOL (3)		BORING 2 EQUIPMENT: Truck-mounted CME-75 Drill Rig with 8-inch Hollow-Stem Augers DATE: 1/22/2014 ELEVATION: 361-Feet* *REFERENCE: Google Earth Used For Elevation		
LL=39 PI=21	77.6% P200	900 UC	9	13.1	103	0	0									CLAY WITH SAND (CL) Light brown to olive gray, moist, medium stiff, medium to high plasticity, ~15% fine to coarse subrounded sand, trace fine to coarse subrounded gravel [FILL]		
						-1												
						5											Grades with ~20% sand at 5.0-feet.	
						-2												
						-3												Grades with ~5% subrounded to subangular gravel at 9.0-feet.
						10												
						-4												
						15												Grades medium brown at 15.0-feet, note slightly porous interval between 15.5 and 16.0-feet.
						-5												
						20												

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m³ = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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F 415 / 382-3450	Livermore, California			Drawn Checked MFJ
www.millerpac.com	Project No. 1492.03 Date: 1-29-14			A-8 FIGURE

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	meters feet	DEPTH	SAMPLE	SYMBOL (3)	BORING 2 (CONTINUED)
SS		3040 TXUU	10	19.8	104	20				CLAY WITH SAND (CL) Light brown to olive gray, moist, medium stiff, medium to high plasticity, ~20% fine to coarse subrounded sand, ~5% fine to coarse subrounded gravel [FILL]
						7				
			12			25				
		1250 UC	14	16.8	112	30				
						35				Note occasional very thin lenses of fine sand in samples between 35.0 and 36.5-feet.
			12	20.2	108	40				
						11				
						12				

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
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 (3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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		Project No. 1492.03	Date: 2-3-14
		A-9 FIGURE	

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	meters feet	DEPTH	SAMPLE	SYMBOL (3)	BORING 2 (CONTINUED)
			38	11.1	128	40				CLAY WITH SAND (CL) Light brown to olive gray, moist, medium stiff, medium to high plasticity, ~20% fine to coarse subrounded sand, ~5% fine to coarse subrounded gravel [FILL] Boring terminated at 40.5-feet BGS. No groundwater encountered during exploration. Boring backfilled with neat cement grout.
						13				
						45				
						14				
						15				
						50				
						16				
						55				
						17				
						18				
						60				

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
 (2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m³ = 0.1571 x DRY UNIT WEIGHT (pcf)
 (3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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	Novato, CA 94947	Cope Lake Pumphouse Investigation		
	T 415 / 382-3444	Livermore, California		
	F 415 / 382-3450	Project No. 1492.03 Date: 2-3-14		
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OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters feet	SAMPLE SYMBOL (3)	BORING 3 EQUIPMENT: Truck-mounted CME-75 Drill Rig with 8-inch Hollow-Stem Augers DATE: 1/23/2014 ELEVATION: 357-Feet* *REFERENCE: Google Earth Used For Elevation
SA	68.3% P200	3450 UC 3640 TXUU	19	17.6	112	0 - 0		2-IN. ASPHALT CONCRETE 4-IN. AGGREGATE BASEROCK
						- 1		SILTY SAND (SM) Dark gray, moist, medium dense, fine grained, ~25% medium-plasticity silt. [FILL]
			21	16.9	117	- 2		SANDY CLAY (CL) Medium brown to olive gray, moist, medium stiff, medium to high plasticity, laminated, ~20% fine to coarse subrounded sand, ~10% fine to coarse subrounded gravel [FILL]
						- 3 10		
SA	68.3% P200	3450 UC 3640 TXUU	10	17.0	111	- 4		
						- 5		
						- 6 20		

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m³ = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	meters feet	DEPTH	SAMPLE	SYMBOL (3)	BORING 3 (CONTINUED)
CSL		550 UC	9	16.7	108	20				SANDY CLAY (CL) Medium brown to olive gray, moist, medium stiff, medium to high plasticity, laminated, ~20% fine to coarse subrounded sand, ~10% fine to coarse subrounded gravel [FILL]
						7				
			12			25				
		1150 UC	13	20.6	104	30				
						10				
						35				
			16	20.4	107	11				
						12				
						40				

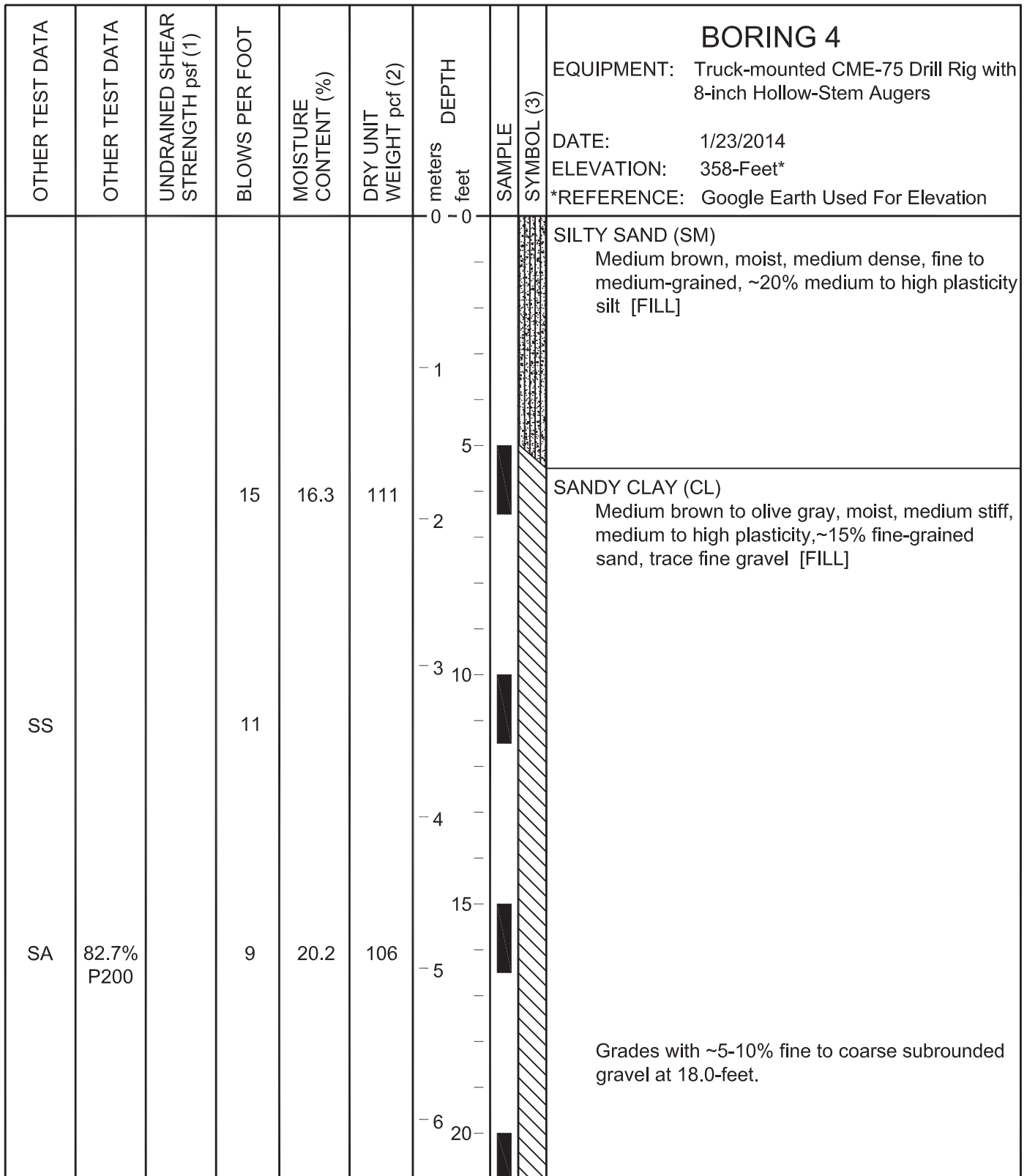
NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
 (2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m³ = 0.1571 x DRY UNIT WEIGHT (pcf)
 (3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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	Novato, CA 94947	Zone 7 Water Agency		Drawn <u>MFJ</u> Checked
	T 415 / 382-3444	Cope Lake Pumpouse Investigation		
	F 415 / 382-3450	Livermore, California		
www.millerpac.com	Project No. 1492.03	Date:	2-3-14	A-12 FIGURE

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	meters feet	DEPTH	SAMPLE	SYMBOL (3)	BORING 3 (CONTINUED)
			15			40				SANDY CLAY (CL) Medium brown to olive gray, moist, medium stiff, medium to high plasticity, laminated, ~20% fine to coarse subrounded sand, ~10% fine to coarse subrounded gravel [FILL] Boring terminated at 40.5-feet BGS. No groundwater encountered during exploration. Boring backfilled with neat cement grout.
						13				
						45				
						14				
						15				
						50				
						16				
						55				
						17				
						18				
						60				

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m³ = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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	Novato, CA 94947	Zone 7 Water Agency			
	T 415 / 382-3444	Cope Lake Pumphouse Investigation			
	F 415 / 382-3450	Livermore, California			
	www.millerpac.com	Project No. 1492.03	Date:	2-3-14	



NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
 (2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m³ = 0.1571 x DRY UNIT WEIGHT (pcf)
 (3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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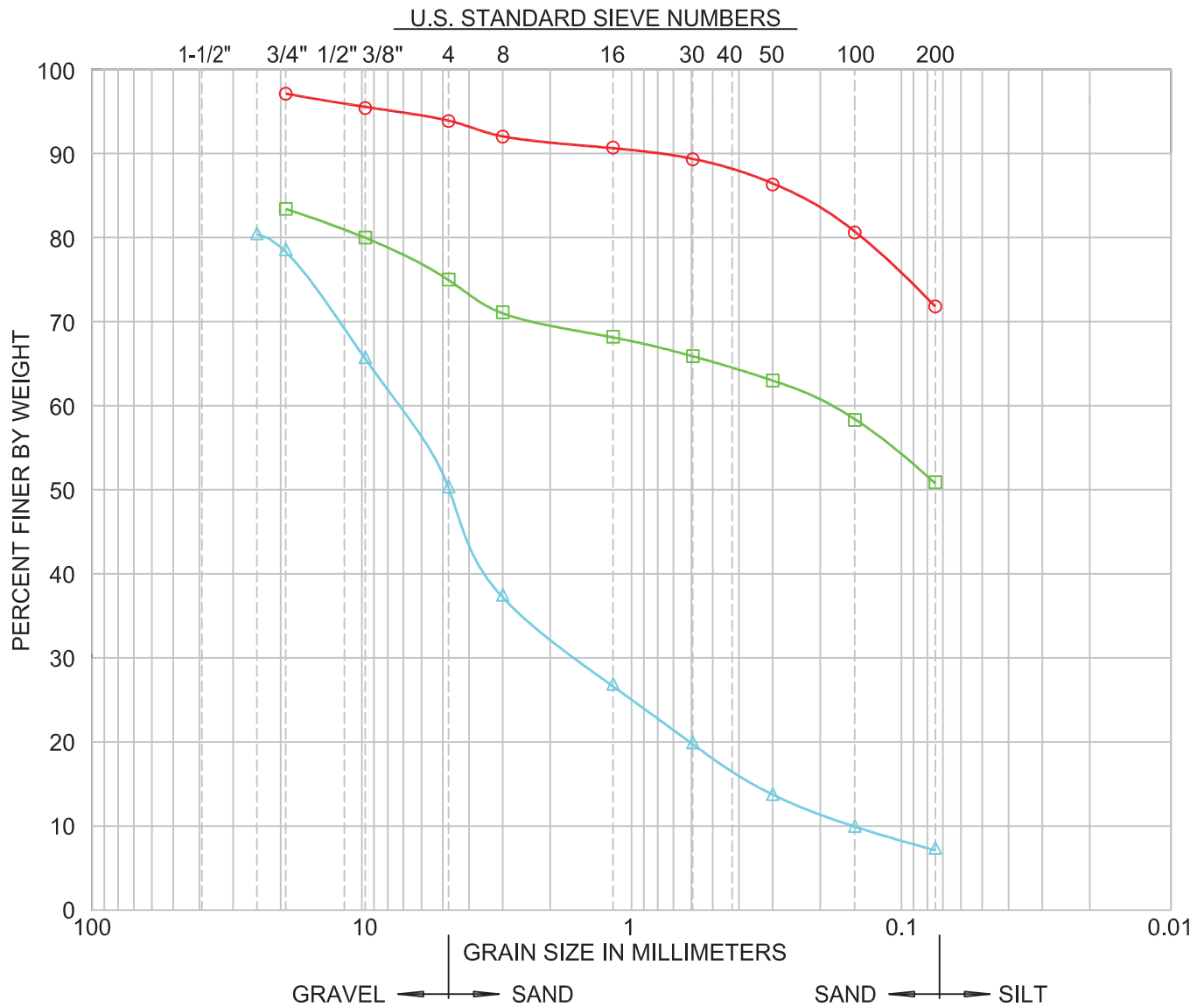
OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	meters feet	DEPTH	SAMPLE	SYMBOL (3)	BORING 4 (CONTINUED)	
LL=43 PI=24		1350 UC	8	18.2	104	20				SANDY CLAY (CL) Medium brown to olive gray, moist, medium stiff, medium to high plasticity,~15% fine-grained sand, trace fine gravel [FILL] Grades with ~20% each fine to coarse subrounded sand and fine to coarse subrounded gravel at 24.0-feet. Grades stiff at 35.0-feet. SANDY CLAY WITH GRAVEL (CL) Medium brown to olive gray, moist, stiff, medium to high plasticity, ~30% fine to coarse subrounded sand, ~15-20% fine to coarse subrounded gravel [FILL]	
						7					
						25					
			10	16.5	106	8					
						9					
						30					
		2100 TXUU	10	16.6	97	10					
						35					
						11					
			1650 UC	17	16.0	103	12				
							40				

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		F 415 / 382-3450	Project No. 1492.03		Date: 2-3-14
		www.millerpac.com	A-15 FIGURE		

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	meters feet	DEPTH	SAMPLE	SYMBOL (3)	BORING 4 (CONTINUED)
			21	13.0		40				SANDY CLAY WITH GRAVEL (CL) Medium brown to olive gray, moist, stiff, medium to high plasticity, ~30% fine to coarse subrounded sand, ~15-20% fine to coarse subrounded gravel [FILL] Boring terminated at 40.5-feet BGS. No groundwater encountered during exploration. Boring backfilled with neat cement grout.
						13				
						45				
						14				
						15				
						50				
						16				
						55				
						17				
						18				
						60				

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m³ = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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SYMBOL	SAMPLE SOURCE	CLASSIFICATION
—○—	BORING 1 @ 10.5 Feet	CLAY WITH SAND (CL)
—□—	BORING 1 @ 30.5 Feet	GRAVELLY CLAY WITH SAND (CL)
—△—	BORING 1 @ 100.5 Feet	GRAVEL WITH CLAY AND SAND (GW-GC)

REFERENCE: CALTRANS STANDARD SPECIFICATIONS, JULY 1995

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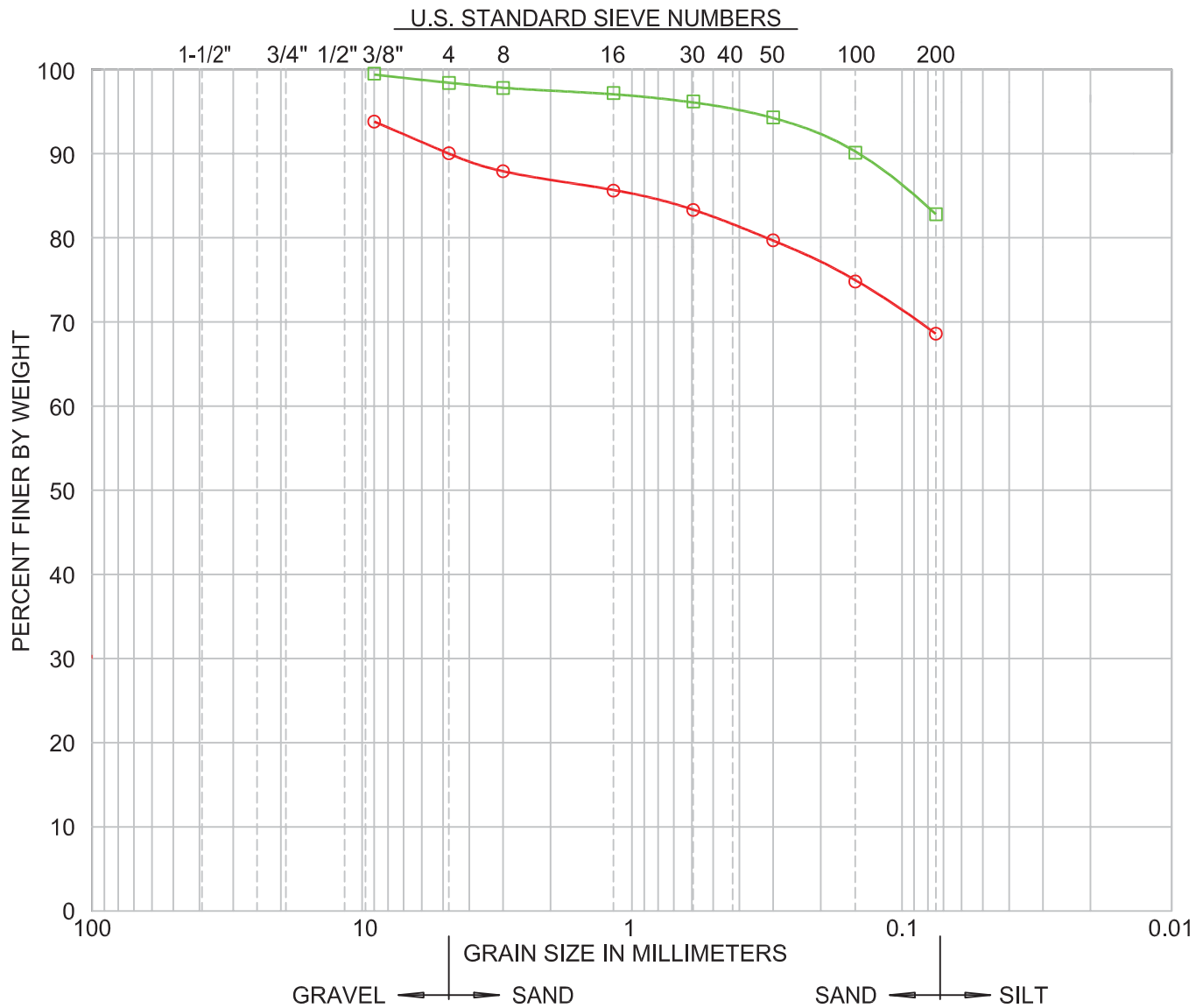
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GRADATION ANALYSIS RESULTS

Zone 7 Water Agency
Cope Lake Pump House Investigation
Livermore, California
Project No. 1492.03 Date: 2/27/14

Drawn MFJ
Checked _____

A-17
FIGURE



SYMBOL	SAMPLE SOURCE	CLASSIFICATION
—○—	BORING 3 @ 16.0 Feet	SANDY CLAY (CL)
—□—	BORING 4 @ 16.0 Feet	CLAY WITH SAND (CL)

REFERENCE: CALTRANS STANDARD SPECIFICATIONS, JULY 1995

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GRADATION ANALYSIS RESULTS

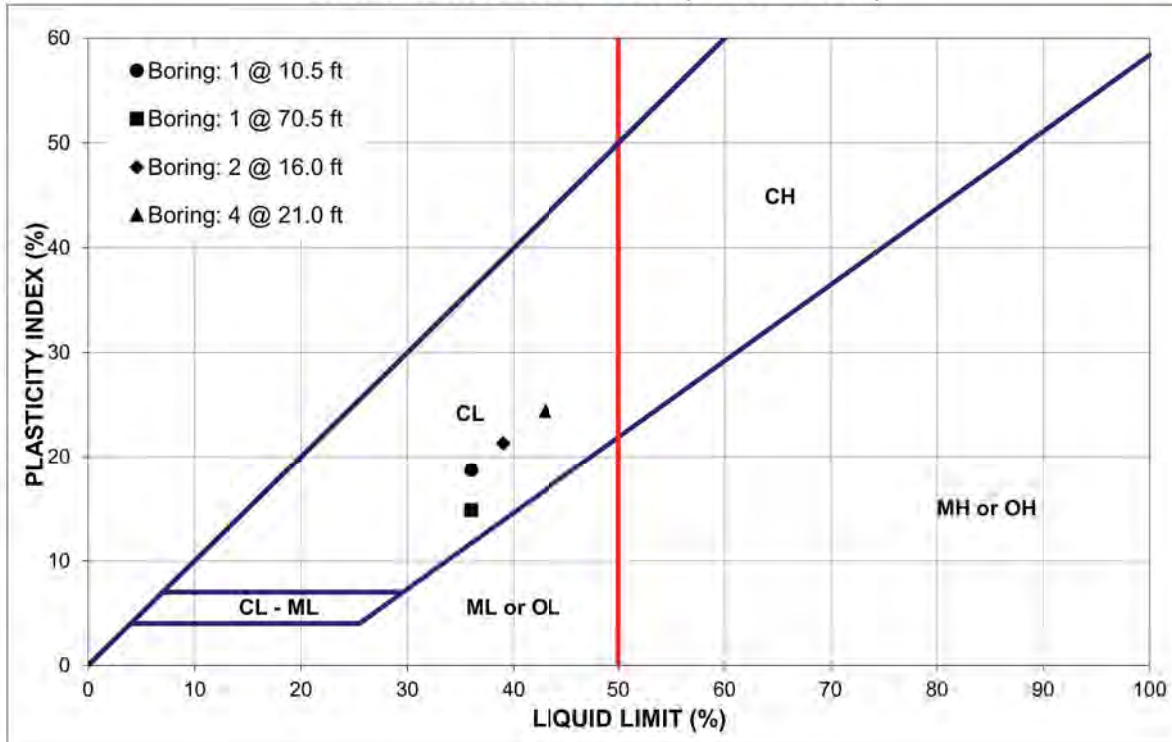
Zone 7 Water Agency
Cope Lake Pump House Investigation
Livermore, California
Project No. 1492.03 Date: 2/27/14

Drawn _____
Checked MFJ

A-18
FIGURE

MILLER PACIFIC ENGINEERING GROUP

ATTERBERG LIMITS TEST (ASTM D 4318)



Sample	Classification	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
Boring: 1 @ 10.5 ft	CLAY (CL) MEDIUM OLIVE - BROWN	36	17	19
Boring: 1 @ 70.5 ft	CLAY WITH SAND ((CL) MEDIUM GRAY BROWN	36	21	15
Boring: 2 @ 16.0 ft	SILTY CLAY (CL) MEDIUM BROWN	39	18	21
Boring: 4 @ 21.0 ft	SANDY CLAY (CL) MEDIUM BROWN	43	19	24

PI = 0-1: Non-Plastic

PI = 1-5: Slightly Plastic

PI = 5-10: Low Plasticity

PI = 10-20: Medium Plasticity

PI = 20-40: High Plasticity

PI > 40: Very High Plasticity

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PLASTICITY INDEX

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Livermore, California

Project No. 1492.03

Date: 2/28/14

Drawn JTO
Checked

A-19
FIGURE

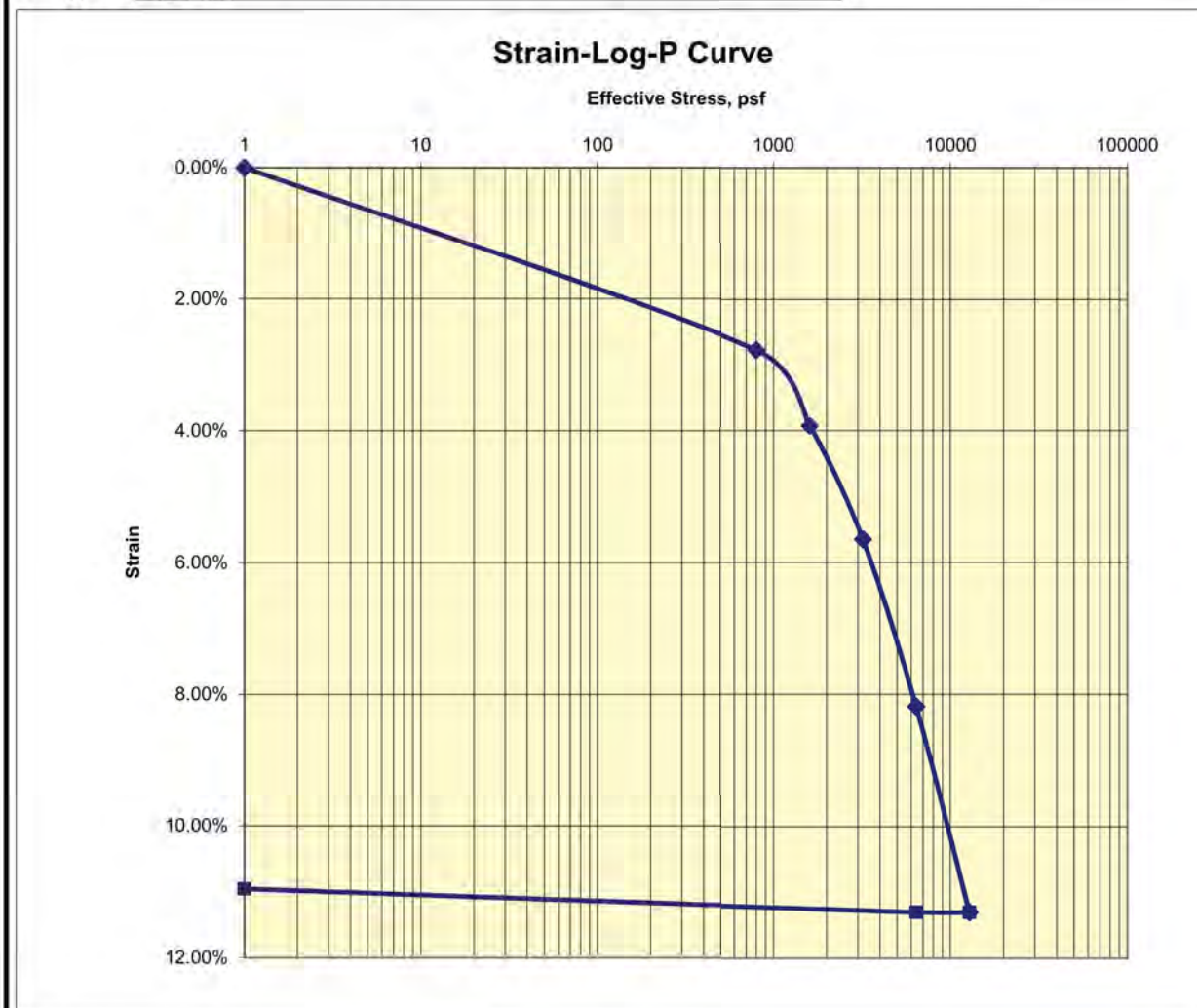
Consolidation Test

ASTM D2435

Job No.: 1492.03
 Client: _____
 Project: COPE LAKE PUMPHOUSE
 Soil Type: Silty CLAY

Boring: B3
 Depth, ft.: 26
 Date: 2/27/2014

Run By: BAS
 Reduced: _____
 Checked: NGK



Ass. Gs = 2.68	Initial	Final
Moisture %:	22.4	20.4
Dry Density, pcf:	101.3	109.5
Void Ratio:	0.650	0.527
% Saturation:	92.4	104

Remarks:

 $Cc' = 0.09$

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CONSOLIDATION TEST RESULTS

Zone 7 Water Agency
 Cope Lake Pumphouse Investigation
 Livermore, California

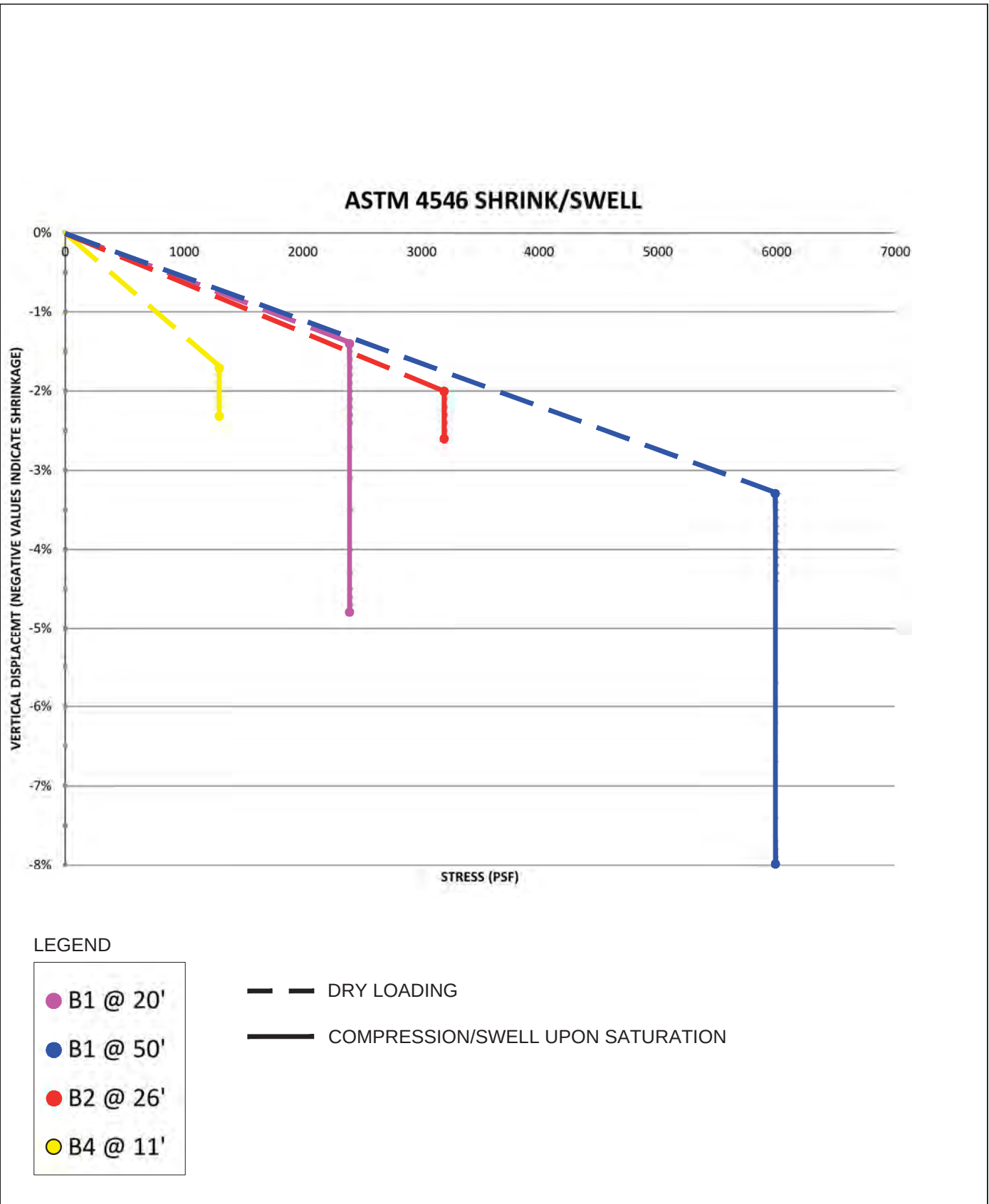
Project No. 1492.03

Date: 3/7/14

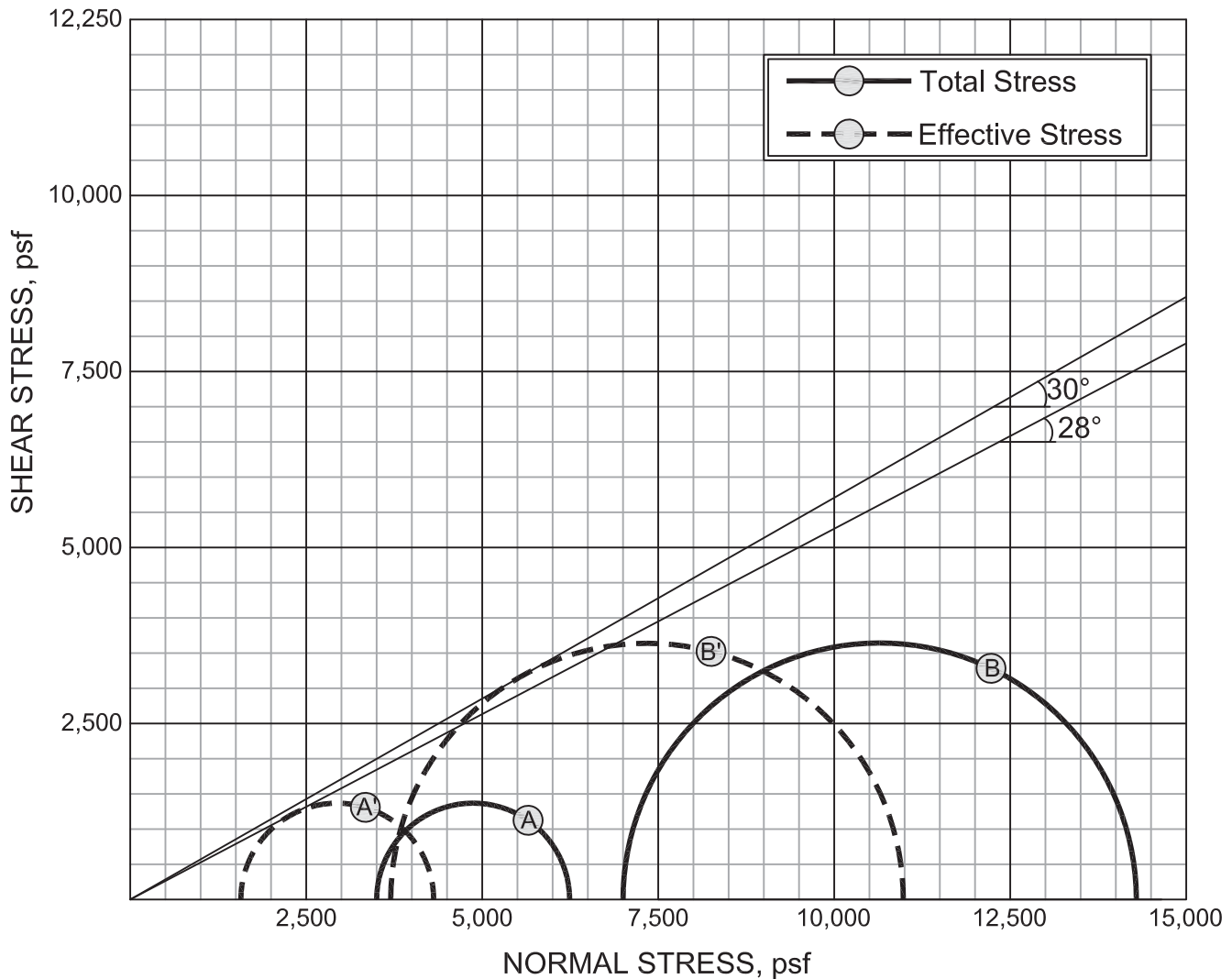
Drawn JTO
 Checked

A-20

FIGURE



CONSOLIDATED UNDRAINED TRIAXIAL TEST ASTM D 4767



TXCU - TEST DATA	Test Specimen	
	A	B
Sample Location	B1 at 30.0-ft	B1 at 60.5-ft
Initial Dry Density	97.1 pcf	113.5 pcf
Consolidation Pressure	3500 psf	7000 psf
Final Dry Density	111.5 pcf	115.9 pcf
σ_1 , Major Principal Stress	6240 psf	14290 psf
σ_3 , Minor Principal Stress	3500 psf	7000 psf
u, Pore Pressure	1930 psf	3300 psf

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COMPACTED FILL TXCU TEST RESULTS

Zone 7 Water Agency
Cope Lake Pump House Investigation
Livermore, California

Project No. 1492.03

Date: 2/28/14

Drawn JTO
Checked

A-22
FIGURE

INCLINOMETER FOR MONITORING GROUND MOVEMENT

METHODOLOGY

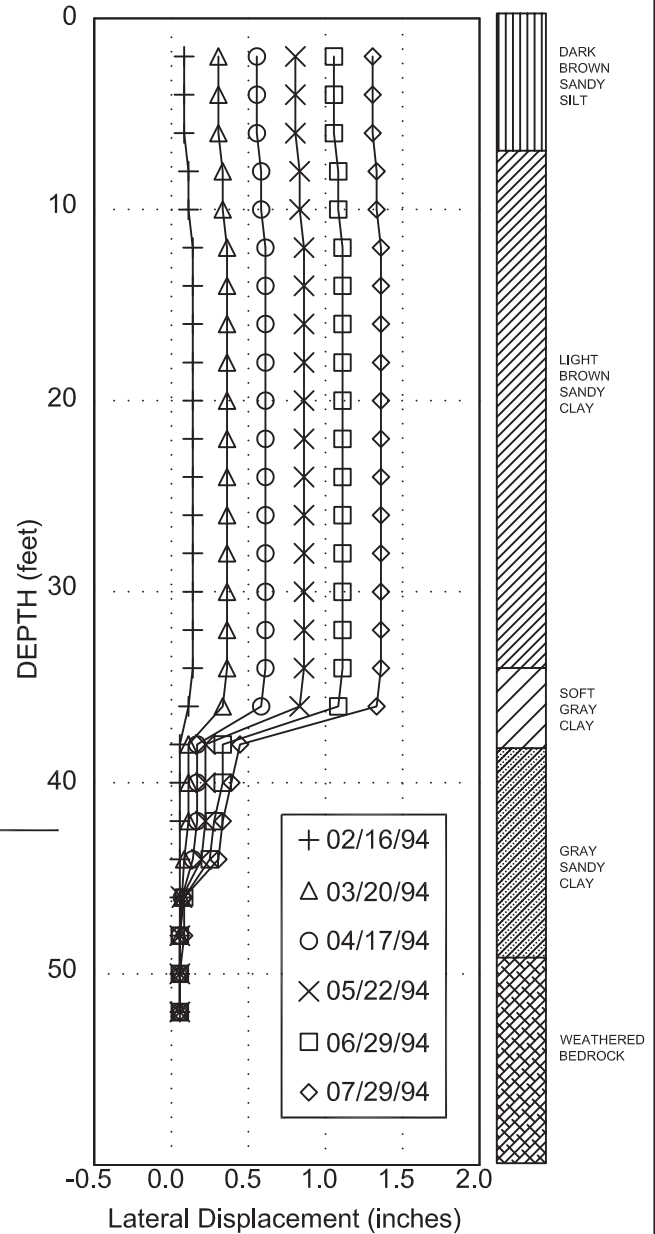
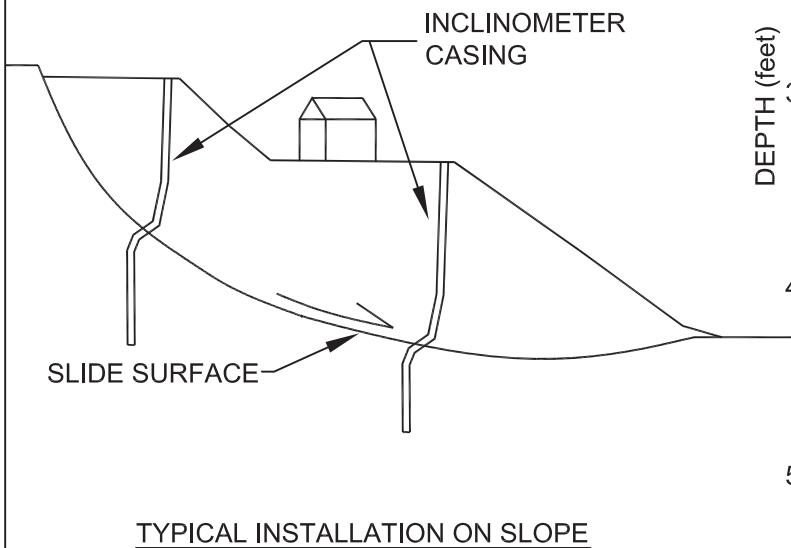
Inclinometers are used to determine and monitor depth, magnitude and rate of lateral movement in soil or rock masses.

A boring is drilled and a special casing is installed. An inclinometer probe is then inserted to measure the tilt angle of the casing at various depths. By taking readings at regular intervals inside the casing, a profile can be constructed. Comparison of such measurements provides data on location, magnitude, direction, and rate of movement of the casing.

A sample profile and displacement data points are shown (below right) along with a typical inclinometer installation (below left).

APPLICATIONS

Natural and cut slope stability
Embankment and dam stability
Deflection of bridge piers and abutments
Heave/Settlement and lateral movements of foundations
Extent and rate of landslide movements
Excavation monitoring



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SLOPE MONITORING - INCLINOMETER

Zone 7 Water Agency
Cope Lake Pumphouse Investigation
Livermore, California

Project No. 1492.03

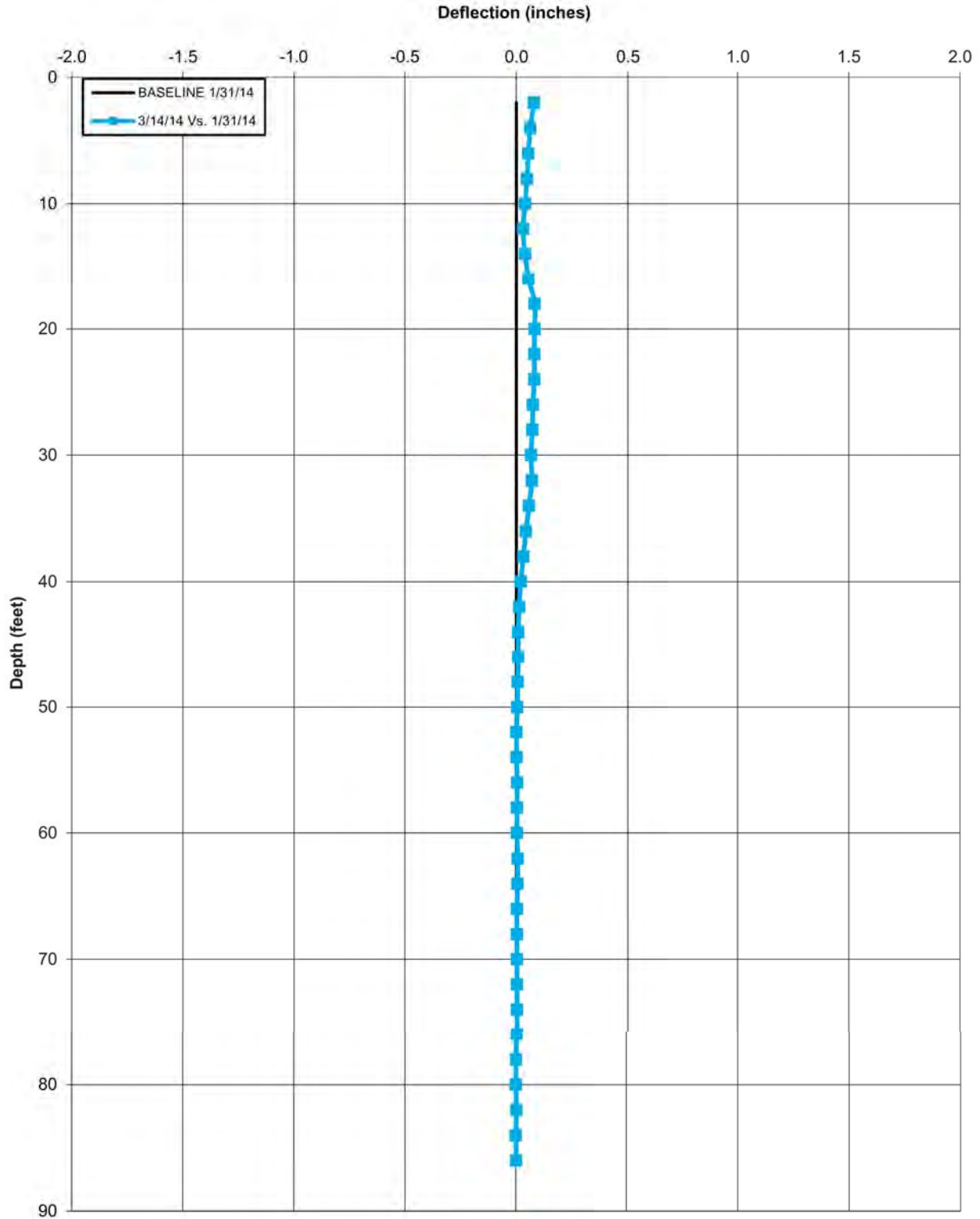
Date: 3-10-14

Drawn MFJ
Checked

4

FIGURE

ZONE 7 COPE LAKE WELL HOUSE INCLINOMETER MPEG SI-1 - A DIRECTION



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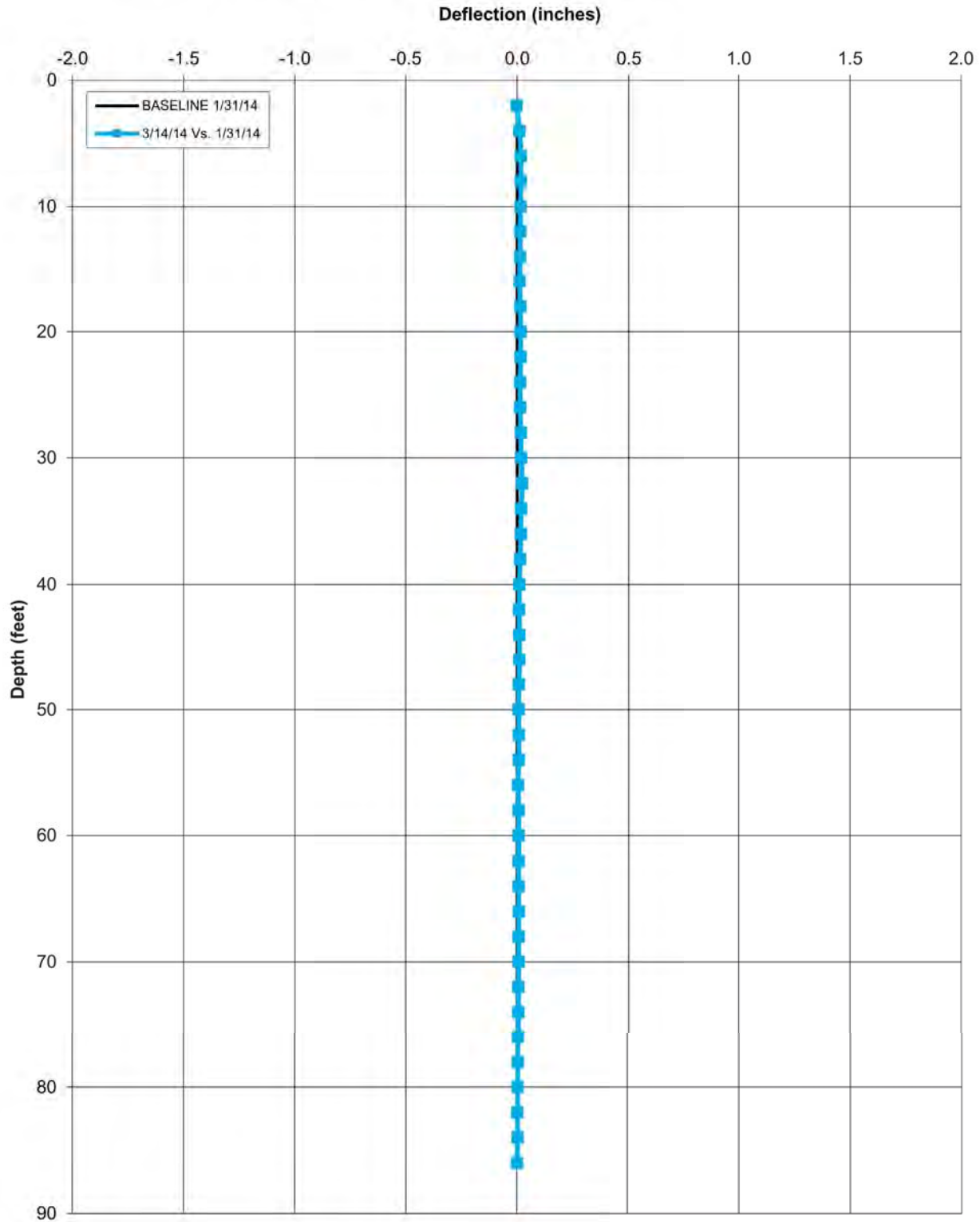
INCLINOMETER PLOT

Zone 7 Water Agency
Cope Lake Pump House Investigation
Livermore, California
Project No. 1492.03 Date: 2/28/14

Drawn JTO
Checked

5
FIGURE

ZONE 7 COPE LAKE WELL HOUSE INCLINOMETER MPEG SI-1 - B DIRECTION



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INCLINOMETER PLOT

Zone 7 Water Agency
Cope Lake PumpHouse Investigation
Livermore, California

Project No. 1492.03

Date: 2/28/14

Drawn JTO
Checked

6
FIGURE



0 15' 30' 60'

Scale 1" = 30 ft

LEGEND

- × SCRIBED X IN CONCRETE
- 3/4" IRON PIPE IN DIRT
- MAG NAIL SET IN PAVEMENT
- # SCRIBED X ON FACE OF BUILDING

VERTICAL BENCHMARKS

BENCHMARK:

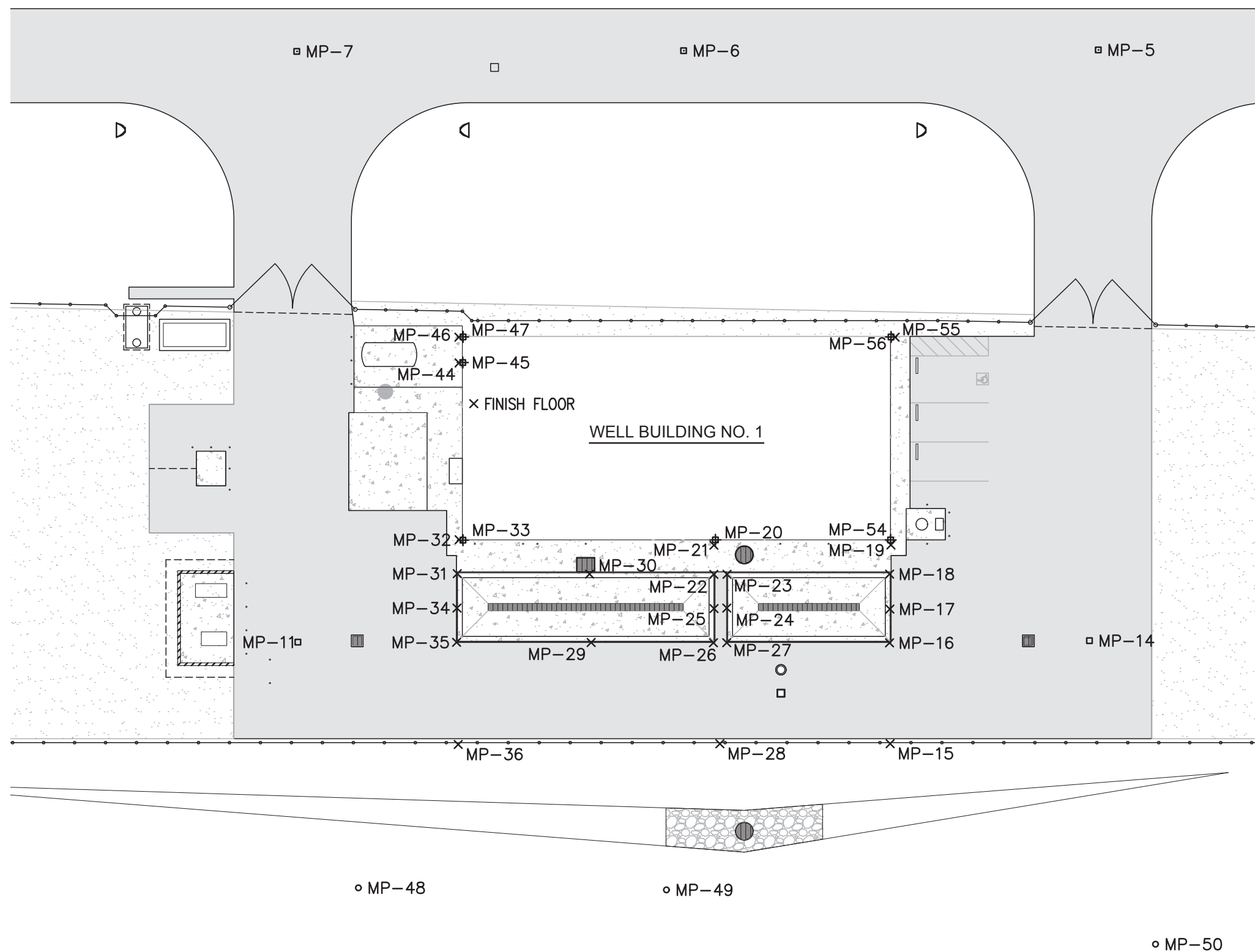
NAME: G 972
ELEVATION: 365.705 FEET
1.75 MILES WEST ALONG BERNAL AVENUE FROM THE JUNCTION OF MAIN STREET
AT PLEASANTON, THENCE 1.95 MILES NORTH ALONG STATE HIGHWAY 21, 20 FEET
WEST OF THE CENTERLINE OF THE HIGHWAY, IN THE TOP OF THE NORTH END OF
THE WEST CONCRETE HEADWALL OF 36 INCH PIPE CULVERT B-24.63, 0.7 FEET
SOUTH OF THE NORTH END OF THE HEADWALL, AN ABOUT 2 FEET LOWER THAN
THE HIGHWAY.

TEMPORARY BENCHMARKS:

NAME: TP 701
ELEVATION: 354.262 FEET
COTTON SPINDLE AND ALUMINUM K&W TURN POINT WASHER IN PLEASANTON ON
THE WEST SIDE OF THE HAUL ROAD IN THE OLD HANSON QUARRY
APPROXIMATELY 950'± NORTH OF THE INTERSECTION WITH THE PAVED ROAD TO
WELL SITE NO. 1.

NAME: TP 702
ELEVATION: 355.67 FEET
COTTON SPINDLE AND ALUMINUM K&W TURN POINT WASHER IN PLEASANTON ON
THE WEST SIDE OF THE HAUL ROAD IN THE OLD HANSON QUARRY
APPROXIMATELY 560'± NORTH OF THE INTERSECTION WITH THE PAVED ROAD TO
WELL SITE NO. 1.

NAME: TP 703
ELEVATION: 357.111 FEET
COTTON SPINDLE AND ALUMINUM K&W TURN POINT WASHER IN PLEASANTON AT
THE INTERSECTION OF THE HAUL ROAD AND THE PAVED ROAD TO WELL SITE NO.
1. IN THE OLD HANSON QUARRY.



KIER & WRIGHT

CIVIL ENGINEERS & SURVEYORS, INC.
2850 Collier Canyon Road Phone (925) 245-8788
Livermore, California 94551 Fax (925) 245-8796

HORIZONTAL AND VERTICAL MONITORING POINTS AT WELL SITE NO. 1 FOR ZONE 7 WATER AGENCY

PLEASANTON

CALIFORNIA

SCALE 1"=30'

DATE 11/26/13

BY RAS II

JOB NO. A13613-5

WELL SITE NO. 1
HANSON QUARRY, PLEASANTON

JOB NO. A15622B-27
(FORMERLY A14599-1)

HORIZONTAL & VERTICAL MONITORING POINTS															
INITIAL MONITORING RESULTS DATE: 11/21/2013				MONITORING DATE: 07/16/2014						MONITORING DATE: 05/17/16					
POINT ID	ELEVATION	NORTHING	EASTING	ELEVATION	Δ ELEVATION	NORTHING	Δ NORTHING	EASTING	Δ EASTING	ELEVATION	Δ ELEVATION	NORTHING	Δ NORTHING	EASTING	Δ EASTING
MP-5	356.84	2075053.85	6172200.82	356.86	0.02	2075053.86	0.02	6172200.80	-0.02	356.83	-0.01	2075053.88	0.04	6172200.82	0.01
MP-6	357.07	2075053.65	6172094.93	357.09	0.02	2075053.66	0.01	6172094.92	-0.02	357.05	-0.02	2075053.68	0.03	6172094.95	0.02
MP-7	357.43	2075053.47	6171996.15	357.44	0.01	2075053.49	0.02	6171996.15	0.00	357.42	-0.01	2075053.51	0.03	6171996.16	0.02
MP-11	357.64	2074902.61	6171996.44	357.60	-0.04	2074902.60	-0.01	6171996.45	0.01	357.35	-0.29	2074902.48	-0.12	6171996.48	0.04
MP-14	357.44	2074902.98	6172198.57	357.44	0.00	2074903.02	0.04	6172198.57	0.00	357.36	-0.08	2074903.02	0.04	6172198.58	0.01
MP-15	357.43	2074876.67	6172147.68	357.40	-0.04	2074876.70	0.04	6172147.68	0.00	357.28	-0.15	2074876.71	0.04	6172147.7	0.02
MP-16	358.16	2074902.42	6172147.52	358.11	-0.05	2074902.45	0.02	6172147.55	0.03	357.91	-0.25	2074902.43	0.01	6172147.57	0.05
MP-17	358.27	2074911.04	6172147.60	358.23	-0.04	2074911.09	0.05	6172147.64	0.03	358.01	-0.26	2074911.07	0.03	6172147.64	0.03
MP-18	358.39	2074919.97	6172147.54	358.34	-0.05	2074920.01	0.03	6172147.53	-0.01	358.11	-0.28	2074919.98	0.01	6172147.53	0.00
MP-19	358.24	2074927.42	6172147.87	358.20	-0.04	2074927.44	0.02	6172147.91	0.03	358.02	-0.22	2074927.43	0.01	6172147.93	0.05
MP-20	361.16	2074928.72	6172103.06	361.14	-0.02	2074928.67	-0.05	6172102.45	-0.61	361.05	-0.11	2074928.6	-0.12	6172102.99	-0.07
MP-21	358.30	2074927.36	6172102.68	358.26	-0.04	2074927.35	0.00	6172102.70	0.03	358.10	-0.20	2074927.23	-0.13	6172102.71	0.03
MP-22	358.23	2074919.91	6172102.66	358.19	-0.04	2074919.87	-0.03	6172102.65	-0.01	357.99	-0.24	2074919.76	-0.15	6172102.67	0.01
MP-23	358.25	2074919.92	6172106.02	358.21	-0.05	2074919.90	-0.02	6172106.02	0.00	358.00	-0.25	2074919.79	-0.13	6172106.01	0.00
MP-24	358.17	2074911.30	6172105.96	358.11	-0.06	2074911.27	-0.03	6172105.95	-0.01	357.89	-0.28	2074911.15	-0.15	6172105.98	0.01
MP-25	358.16	2074911.17	6172102.70	358.10	-0.06	2074911.18	0.01	6172102.71	0.01	357.88	-0.28	2074911.07	-0.11	6172102.75	0.05
MP-26	358.12	2074902.45	6172102.55	358.05	-0.07	2074902.45	0.00	6172102.56	0.01	357.78	-0.34	2074902.32	-0.12	6172102.59	0.05
MP-27	358.09	2074902.46	6172105.95	358.03	-0.06	2074902.44	-0.01	6172105.99	0.04	357.77	-0.32	2074902.33	-0.13	6172106.02	0.07
MP-28	357.32	2074876.65	6172104.20	357.25	-0.07	2074876.67	0.02	6172104.22	0.02	357.01	-0.31	2074876.6	-0.05	6172104.22	0.02
MP-29	358.20	2074902.50	6172071.33	358.16	-0.04	2074902.52	0.01	6172071.38	0.05	357.92	-0.28	2074902.39	-0.11	6172071.4	0.07
MP-30	358.34	2074919.99	6172070.92	358.31	-0.03	2074920.00	0.01	6172070.96	0.05	358.14	-0.20	2074919.88	-0.10	6172070.98	0.07
MP-31	358.33	2074920.09	6172037.13	358.30	-0.03	2074920.08	-0.01	6172037.15	0.01	358.17	-0.16	2074919.97	-0.12	6172037.17	0.04
MP-32	358.38	2074928.76	6172037.62	358.35	-0.03	2074928.72	-0.04	6172037.64	0.02	358.25	-0.13	2074928.7	-0.05	6172037.67	0.05
MP-33	361.15	2074928.65	6172038.59	361.11	-0.04	2074928.65	0.00	6172038.57	-0.02	361.03	-0.12	2074928.62	-0.02	6172038.57	-0.02
MP-34	358.28	2074911.30	6172037.06	358.25	-0.03	2074911.27	-0.04	6172037.08	0.02	358.09	-0.19	2074911.16	-0.15	6172037.11	0.05
MP-35	358.26	2074902.56	6172036.97	358.23	-0.03	2074902.51	-0.05	6172037.02	0.06	358.02	-0.24	2074902.41	-0.15	6172037.06	0.09
MP-36	357.11	2074876.47	6172037.38	357.05	-0.06	2074876.46	-0.01	6172037.39	0.01	356.76	-0.35	2074876.42	-0.05	6172037.4	0.02
MP-44	358.37	2074973.92	6172037.61	358.36	-0.01	2074973.94	0.02	6172037.60	-0.01	358.34	-0.03	2074973.93	0.01	6172037.63	0.02
MP-45	361.18	2074974.01	6172038.53	361.17	-0.01	2074974.00	-0.01	6172038.52	-0.01	361.15	-0.03	2074974.08	0.06	6172038.52	-0.02
MP-46	358.34	2074980.49	6172037.56	358.34	0.00	2074980.52	0.03	6172037.52	-0.04	358.33	-0.01	2074980.47	-0.02	6172037.54	-0.02
MP-47	361.14	2074980.56	6172038.62	361.15	0.00	2074980.56	0.01	6172038.63	0.01	361.15	0.01	2074980.6	0.04	6172038.5	-0.12
MP-48	360.71	2074839.86	6172011.89	360.69	-0.02	2074839.92	0.06	6172011.89	0.00	360.60	-0.11	2074839.97	0.11	6172011.92	0.03
MP-49	361.93	2074839.33	6172090.55	361.91	-0.02	2074839.38	0.05	6172090.55	0.00	361.80	-0.13	2074839.43	0.09	6172090.59	0.04
MP-50	363.43	2074825.46	6172215.44	363.42	-0.01	2074825.53	0.07	6172215.45	0.00	363.31	-0.12	2074825.53	0.07	6172215.45	0.01
MP-54	360.53	2074928.70	6172147.79	360.50	-0.03	2074928.68	-0.02	6172147.80	0.01	360.37	-0.16	2074928.67	-0.02	6172147.87	0.08
MP-55	358.42	2074980.48	6172148.95	358.43	0.01	2074980.50	0.03	6172148.94	-0.01	358.40	-0.03	2074980.48	0.00	6172148.95	0.00
MP-56	361.22	2074980.54	6172147.91	361.20	-0.02	2074980.56	0.02	6172147.89	-0.02	361.20	-0.02	2074980.62	0.08	6172147.88	-0.03
FINISH FLOOR	358.43	VERTICAL ONLY		358.41	-0.02	VERTICAL ONLY				358.39	-0.04	VERTICAL ONLY			

Δ DIFFERENCE IN VALUE BETWEEN THE INITIAL READING AND THE CURRENT READING

KIER & WRIGHT CIVIL ENGINEERS & SURVEYORS
2850 COLLIER CANYON ROAD
LIVERMORE, CA 94551

APPENDIX C
EMERGENCY STABILIZATION PLAN SHEETS

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EMERGENCY SLOPE STABILIZATION PROJECT

GENERAL NOTES

1. STANDARD SPECIFICATIONS

ALL MATERIALS AND CONSTRUCTION METHODS SHALL COMPLY WITH THE REQUIREMENTS OF THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION (CALTRANS) STANDARD SPECIFICATIONS, 2010 EDITION, UNLESS OTHERWISE NOTED ON THESE PLANS.

2. BUILDING CODE

THE GOVERNING BUILDING CODE IN THE COUNTY OF ALAMEDA SHALL BE CBC 2013.

3. PERMITS

THE OWNER WILL BE RESPONSIBLE FOR OBTAINING ALL REQUIRED PERMITS.

4. TRAFFIC CONTROL AND PUBLIC SAFETY

THE CONTRACTOR SHALL PROVIDE ALL LIGHTS, SIGNS, BARRICADES, FENCING, FLAGGING, AND OTHER DEVICES NECESSARY FOR TRAFFIC CONTROL AND PUBLIC SAFETY.

5. EXISTING FACILITIES

EXISTING SITE IMPROVEMENTS TO REMAIN MAY INTERFERE WITH THE WORK. THESE FACILITIES SHALL BE PROTECTED OR REMOVED AND REPLACED WITH LIKE KIND AND QUALITY AT THE CONTRACTOR'S EXPENSE.

6. SITE INFORMATION

THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING ALL ABOVE GROUND AND UNDERGROUND FACILITIES WHICH MAY BE AFFECTED BY HIS OPERATIONS. THE CONTRACTOR SHALL CONTACT OWNERS OF THESE FACILITIES AND SHALL PROTECT FACILITIES AND MAINTAIN SERVICE DURING CONSTRUCTION. THE CONTRACTOR SHALL CONTACT UNDERGROUND SERVICE ALERT (USA) AT (800) 642-2444 AT LEAST TWO WORKING DAYS PRIOR TO CONSTRUCTION.

DIMENSIONS AND LIMITS OF WORK SHOWN ON THE PLANS ARE APPROXIMATE AND ARE SUBJECT TO CHANGE BASED ON CONDITIONS ENCOUNTERED. CONTRACTOR SHALL VERIFY ALL EXISTING DIMENSIONS AND SITE CONDITIONS PRIOR TO THE START OF CONSTRUCTION. DISCREPANCIES BETWEEN ACTUAL CONDITIONS AND THOSE SHOWN ON THE PLANS SHALL BE IMMEDIATELY BROUGHT TO THE ATTENTION OF THE ENGINEER.

7. INSPECTIONS AND TESTING

THE CONTRACTOR SHALL COORDINATE WITH THE ENGINEER AT LEAST TWO WORKING DAYS PRIOR TO ALL REQUIRED INSPECTIONS AND TESTING. INSPECTIONS AND TESTING SHALL BE COMPLETED BY CAL ENGINEERING & GEOLOGY (925)935-9771.

ZONE 7 WATER AGENCY
COPE LAKE WELL HOUSE #1
PLEASANTON, ALAMEDA COUNTY, CALIFORNIA

SEPTEMBER 2016



VICINITY MAP



DESCRIPTION OF WORK

THE WORK SHALL CONSIST IN GENERAL OF PROVIDING ALL MATERIAL, LABOR, AND EQUIPMENT NECESSARY TO COMPLETE THE EMERGENCY SLOPE STABILIZATION PROJECT. WORK SHALL INCLUDE, BUT NOT BE LIMITED TO: MOBILIZATION, WATER POLLUTION CONTROL, DEVELOP SITE ACCESS, CLEARING & GRUBBING, EXCAVATION, COMPACTED FILL, RSP FABRIC, EXTENDING EXISTING CORRUGATED METAL DOWNDRAINS, AND RELOCATING/REPLACING DOWNDRAIN ENERGY DISSIPATION.

CONTRACTOR LICENSE

THE CONTRACTOR SHALL POSSESS A VALID CLASS A LICENSE AT THE TIME THE CONTRACT IS AWARDED.

INDEX OF SHEETS

1. TITLE SHEET
2. PROJECT SPECIFICATIONS
3. PLOT PLAN
4. GRADING PLAN
5. TYPICAL SECTION & DETAILS
6. EROSION CONTROL PLAN

STANDARD PLANS

THE FOLLOWING STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION (CALTRANS) STANDARD PLANS, 2010 EDITION, APPLY:

- | | |
|------|---|
| A10A | ABBREVIATIONS (SHEET 1 OF 2) |
| A10B | ABBREVIATIONS (SHEET 2 OF 2) |
| A10C | LINES AND SYMBOLS (SHEET 1 OF 3) |
| A10D | LINES AND SYMBOLS (SHEET 2 OF 3) |
| D87A | CORRUGATED METAL PIPE DOWNDRAIN DETAILS |
| D87C | CABLE ANCHORAGE SYSTEM |
| T51 | TEMPORARY WATER POLLUTION CONTROL DETAILS (TEMPORARY SILT FENCE) |
| T56 | TEMPORARY WATER POLLUTION CONTROL DETAILS (TEMPORARY FIBER ROLLS) |



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NO.	REVISION DESCRIPTION	BY	DATE

 CAL ENGINEERING & GEOLOGY			ZONE 7 WATER AGENCY - COPE LAKE WELL HOUSE #1			
			EMERGENCY SLOPE STABILIZATION PROJECT PLEASANTON, ALAMEDA COUNTY, CALIFORNIA TITLE SHEET			
DESIGNED M. MYERS	DRAWN M. VITTHAL	CHECKED P. GREGORY	PROJECT NO. 160820	DATE 16 SEPTEMBER 2016	SHEET NO. 1	OF 6

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1. GENERAL

THE WORK TO BE DONE UNDER THIS CONTRACT, EXCEPT AS MODIFIED OR SUPPLEMENTED HEREIN, SHALL CONFORM TO THE FOLLOWING, IN THE ORDER OF PRECEDENCE AS SHOWN:

- STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION (CALTRANS) STANDARD SPECIFICATIONS DATED MAY 2010, HEREIN REFERRED TO AS THE "STANDARD SPECIFICATIONS".
- STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION (CALTRANS) STANDARD PLANS DATED MAY 2010, HEREIN REFERRED TO AS THE "STANDARD PLANS".

THESE SPECIFICATIONS ARE ADDITIONS, MODIFICATIONS, OR CLARIFICATIONS TO THESE LISTED STANDARD SPECIFICATIONS AND PLANS. ALL REQUIREMENTS OF THE REFERENCED SPECIFICATIONS SHALL APPLY UNLESS SPECIFICALLY DELETED BY THESE SPECIFICATIONS. IN CASE OF CONFLICT, THE STRICTER SPECIFICATION AS DETERMINED AT THE SOLE DISCRETION OF THE ENGINEER SHALL APPLY.

2. EXISTING UTILITIES

EXISTING UTILITIES WORK SHALL CONFORM TO THE PROVISIONS OF SECTION 8-1.10, "UTILITY AND NON-HIGHWAY FACILITIES," OF THE STANDARD SPECIFICATIONS AND THESE SPECIFICATIONS.

UTILITY LOCATIONS, BOTH ABOVE GROUND AND BELOW GROUND, IF SHOWN ON THE PLANS, ARE APPROXIMATE. THERE IS NO GUARANTEE THAT THE UTILITIES SHOWN ON THE PLANS WILL BE THE ONLY UTILITIES ENCOUNTERED.

THE CONTRACTOR SHALL CONTACT UNDERGROUND SERVICE ALERT (USA) TO DETERMINE UNDERGROUND UTILITY LOCATIONS AT LEAST TWO WORKING DAYS PRIOR TO EXCAVATING.

THE CONTRACTOR SHALL PERFORM ADDITIONAL POTHOLING AS NEEDED TO VERIFY THE LOCATION AND DEPTH OF UTILITY MAINS AND SERVICE LINES.

THE CONTRACTOR SHALL EXPOSE, BY HAND DIGGING, PROTECT, AND SUPPORT, ALL EXISTING UTILITY MAINS AND SERVICE LATERALS THAT CROSS, ARE ADJACENT TO, OR ARE WITHIN, TRENCH OR EXCAVATION AREAS.

THE CONTRACTOR IS HEREBY NOTIFIED THAT DURING CONSTRUCTION IT MAY BE NECESSARY TO COORDINATE THE OPERATION WITH THE AFFECTED UTILITY COMPANIES FOR THE REARRANGEMENT OF OBSTRUCTIONS AS NEEDED FOR THE CONSTRUCTION OF THIS PROJECT. THE CONTRACTOR SHALL PREPARE, MAINTAIN, AND KEEP AT THE CONSTRUCTION SITE, A LIST OF ALL UTILITY CONTACT PERSONS AND THEIR EMERGENCY TELEPHONE NUMBERS.

3. MOBILIZATION

MOBILIZATION WORK SHALL CONFORM TO THE PROVISIONS OF SECTION 11, "MOBILIZATION," OF THE STANDARD SPECIFICATIONS AND THESE SPECIFICATIONS.

WORK SHALL INCLUDE, BUT NOT BE LIMITED TO, PREPARATORY WORK AND OPERATIONS NECESSARY FOR THE MOVEMENT OF PERSONNEL, EQUIPMENT, SUPPLIES, AND INCIDENTALS TO THE PROJECT SITE; FOR THE ESTABLISHMENT OF ALL OFFICES, BUILDINGS, AND OTHER FACILITIES NECESSARY FOR WORK ON THE PROJECT, AND FOR ALL OTHER WORK AND OPERATIONS WHICH MUST BE PERFORMED OR COSTS INCURRED PRIOR TO BEGINNING WORK ON THE VARIOUS CONTRACT ITEMS ON THE PROJECT SITE.

4. DUST CONTROL

DUST CONTROL WORK SHALL CONFORM TO THE PROVISIONS OF SECTION 10, "DUST CONTROL," OF THE STANDARD SPECIFICATIONS AND THESE SPECIFICATIONS.

WORK SHALL INCLUDE, BUT NOT BE LIMITED TO, APPLYING EITHER WATER OR DUST PALLIATIVE, OR BOTH, FOR THE ALLEVIATION OR PREVENTION OF DUST NUISANCE.

WATER OR DUST PALLIATIVE (DUST CONTROL) SHALL BE APPLIED TO MAINTAIN THE PROJECT SITE IN AS DUST-FREE A CONDITION AS POSSIBLE DURING NORMAL WORK HOURS AND OFF WORK HOURS (INCLUDING HOLIDAYS AND WEEKENDS). DUST CONTROL SHALL BE APPLIED TO EXCAVATION AREAS PRIOR TO EXCAVATING AND/OR DURING MATERIAL LOADING. DUSTY IMPORT MATERIAL SHALL RECEIVE DUST CONTROL PRIOR TO, OR IMMEDIATELY AFTER PLACEMENT. DUST CONTROL SHALL BE APPLIED TO IN-PLACE MATERIAL AS NECESSARY TO CONTROL DUST, AS DIRECTED BY THE ENGINEER.

5. POLLUTION CONTROL

POLLUTION CONTROL WORK SHALL CONFORM TO THE PROVISIONS OF SECTION 7.101G, "WATER POLLUTION," OF THE STANDARD SPECIFICATIONS, AND THESE SPECIFICATIONS. AT LEAST TEN WORKING DAYS IN ADVANCE OF THE START OF WORK,

THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER FOR APPROVAL A POLLUTION CONTROL PLAN THAT PROVIDES FOR THE PREVENTION, CONTROL, AND ABATEMENT OF WATER POLLUTION TO STREAMS, WATERWAYS, AND OTHER BODIES OF WATER AT ALL TIMES DURING CONSTRUCTION. IN ADDITION TO CONFORMING TO THE REQUIREMENTS OF SECTION 7-101G OF THE STANDARD SPECIFICATIONS, THE CONTRACTOR'S POLLUTION CONTROL PLAN SHALL CONFORM TO THE REQUIREMENTS OF THE ALAMEDA COUNTY GRADING ORDINANCE.

6. DISPOSAL OF MATERIAL

ARRANGEMENT HAVE NOT BEEN MADE FOR DISPOSAL OF MATERIAL. IT IS ANTICIPATED THAT THE PROJECT EARTHWORK IS BALANCED AND THAT NO IMPORT OR OFF-HAUL IS REQUIRED. ALL EXCESS AND UNSUITABLE MATERIAL SHALL BE DISPOSED OF BY THE CONTRACTOR IN ACCORDANCE WITH SECTION 7-1.13, "DISPOSAL OF MATERIAL OUTSIDE THE HIGHWAY RIGHT OF WAY," OF THE STANDARD SPECIFICATIONS, EXCEPT THAT WRITTEN PERMISSION OF THE ENGINEER FOR DISPOSAL OF MATERIAL WILL NOT BE REQUIRED.

7. CLEARING AND GRUBBING

CLEARING AND GRUBBING WORK SHALL CONFORM TO THE PROVISIONS OF SECTION 16, "CLEARING AND GRUBBING," AND SECTION 4-1.02, "FINAL CLEANING UP," OF THE STANDARD SPECIFICATIONS AND THESE SPECIFICATIONS.

WORK SHALL INCLUDE, BUT NOT BE LIMITED TO, REMOVAL AND DISPOSAL OF BRUSH, TREES, AND OBJECTIONABLE MATERIAL FROM WITHIN THE LIMITS OF GRADING, AS SHOWN ON THE PLANS AND AS DIRECTED BY THE ENGINEER.

TREES AND PLANTS (INCLUDING ROOT SYSTEMS) THAT ARE NOT TO BE REMOVED SHALL BE FULLY PROTECTED FROM INJURY BY THE CONTRACTOR, AT THE CONTRACTOR'S EXPENSE. IF TREE ROOTS ARE EXPOSED WHILE EXCAVATING NEAR EXISTING TREES TO BE PROTECTED, THE ROOTS SHALL BE TRIMMED AND COVERED WITH WET MULCH IMMEDIATELY.

8. EARTHWORK

EARTHWORK SHALL CONFORM TO THE PROVISIONS OF SECTION 19, "EARTHWORK," OF THE STANDARD SPECIFICATIONS AND THESE SPECIFICATIONS.

WORK SHALL INCLUDE, BUT NOT BE LIMITED TO, EXCAVATION AND COMPACTED EARTH FILL TO CONSTRUCT THE LANDSLIDE REPAIR SHOWN ON THE PLANS AND AS DIRECTED BY THE ENGINEER.

FILL ABOVE ELEV. 332 FEET SHALL BE COMPACTED TO A RELATIVE COMPACTION OF NO LESS THAN 90% AS DETERMINED BY THE ASTM D-1557 TEST PROCEDURE. FILL WHICH DOES NOT MEET THE COMPACTION REQUIREMENT SHALL BE SCARIFIED, MOISTURE CONDITIONED, AND RE-WORKED UNTIL THE REQUIRED RELATIVE COMPACTION HAS BEEN ATTAINED.

9. SURFACE DRAINS

SURFACE DRAIN WORK SHALL CONFORM TO THE PROVISIONS OF SECTION 66, "CORRUGATED METAL PIPE," AND SECTION 90-10,

"MINOR CONCRETE," OF THE STANDARD SPECIFICATIONS, CALTRANS STANDARD PLANS D87A AND D87C, AND THESE SPECIFICATIONS.

WORK SHALL INCLUDE, BUT NOT BE LIMITED TO CORRUGATED METAL PIPE DOWNDRAINS FOR THE CONSTRUCTION OF SURFACE DRAINS AS SHOWN ON THE PLANS AND AS DIRECTED BY THE ENGINEER.

PIPES SHALL BE OF THE DIAMETER AND TYPE SHOWN ON THE PLANS.

10. ROCK SLOPE PROTECTION (RSP) FABRIC

RSP FABRIC SHALL BE PLACED WITHIN THE LIMITS OF GRADING AS SHOWN ON THE PLANS AND/OR AT LOCATIONS IDENTIFIED BY THE ENGINEER. RSP FABRIC SHALL BE ANCHORED AT THE TOP OF THE SLOPE IN A 18 IN. X 18IN. TRENCH. AT SOME LOCATIONS, SITE PREPARATION FOR INSTALLATION OF RSP FABRIC, INCLUDING TRIMMING AND SHAPING OF SLOPE AND REMOVAL OF LOOSE MATERIALS, SHALL BE PERFORMED TO ENSURE CONTACT BETWEEN THE GROUND AND THE RSP FABRIC.

11. HYDRO-SEEDING

HYDRO-SEED WORK SHALL CONFORM TO THE PROVISIONS OF SECTION 20, "EROSION CONTROL AND HIGHWAY PLANTING," OF THE STANDARD SPECIFICATIONS AND THESE SPECIFICATIONS.

WORK SHALL INCLUDE, BUT NOT BE LIMITED TO, PROVIDING, MIXING, AND APPLYING SEED MIX, AS SHOWN ON THE PLANS AND AS DIRECTED BY THE ENGINEER.

SEED MIX SHALL BE PACIFIC COAST SEED'S NATIVE EROSION CONTROL MIX OR APPROVED EQUIVALENT.

HYDRO-SEED SLURRY SHALL CONTAIN THE FOLLOWING:
SEED: 60 LBS PER ACRE
FERTILIZER: 800 LBS PER ACRE
WOOD FIBER: 2000 LBS PER ACRE
STABILIZING EMULSION: M-BINDER OR APPROVED EQUIVALENT

FERTILIZER SHALL HAVE A GUARANTEED CHEMICAL ANALYSIS OF 6% NITROGEN, 20% PHOSPHORIC ACID, AND 20% SOLUBLE POTASH. FERTILIZER SHALL BE A PELLETED FORM SLOW RELEASE (9 MONTH) TYPE. FERTILIZER SHALL CONFORM TO THE PROVISIONS OF THE CALIFORNIA FOOD AND AGRICULTURAL CODE.

WOOD FIBER SHALL CONFORM TO THE PROVISIONS OF SECTION 20-2.07 "FIBER," OF THE STANDARD SPECIFICATIONS.

HYDRO-SEED SHALL BE APPLIED TO ALL AREAS WHERE EXISTING VEGETATION HAS BEEN DISTURBED BY THE CONTRACTOR'S OPERATIONS AND AS DIRECTED BY THE ENGINEER. HYDRO-SEED SHALL BE APPLIED PRIOR TO INSTALLATION OF EROSION CONTROL MAT.

12. EROSION CONTROL

EROSION CONTROL WORK SHALL INCLUDE, BUT NOT BE LIMITED TO, FURNISHING, INSTALLING, AND ANCHORING EROSION CONTROL MAT ON THE GROUND SURFACE, INSTALLING FIBER ROLLS, AND PROTECTING EXISTING DRAINAGE INLET WITH SILT SACK AS SHOWN ON THE PLANS AND AS DIRECTED BY THE ENGINEER.

EROSION CONTROL MAT SHALL BE AMERICAN EXELSIOR "CURLEX II CL" OR APPROVED EQUIVALENT.

EROSION CONTROL MAT SHALL BE PLACED WITHIN THE LIMITS OF GRADING AS SHOWN ON THE PLANS AND/OR AT LOCATIONS

IDENTIFIED BY THE ENGINEER. OUTSIDE OF THESE LIMITS, IF THE SLOPE IS STEEPER THAN 4H:1V, WHERE EXISTING VEGETATION HAS BEEN DISTURBED BY THE CONTRACTOR'S OPERATIONS, EROSION CONTROL MAT SHALL BE INSTALLED AT THE CONTRACTOR'S EXPENSE.

FIBER ROLLS SHALL CONFORM TO SECTION 21-1.02P FIBER ROLLS OF THE CALTRANS STANDARD SPECIFICATIONS 2010 TYPE B.

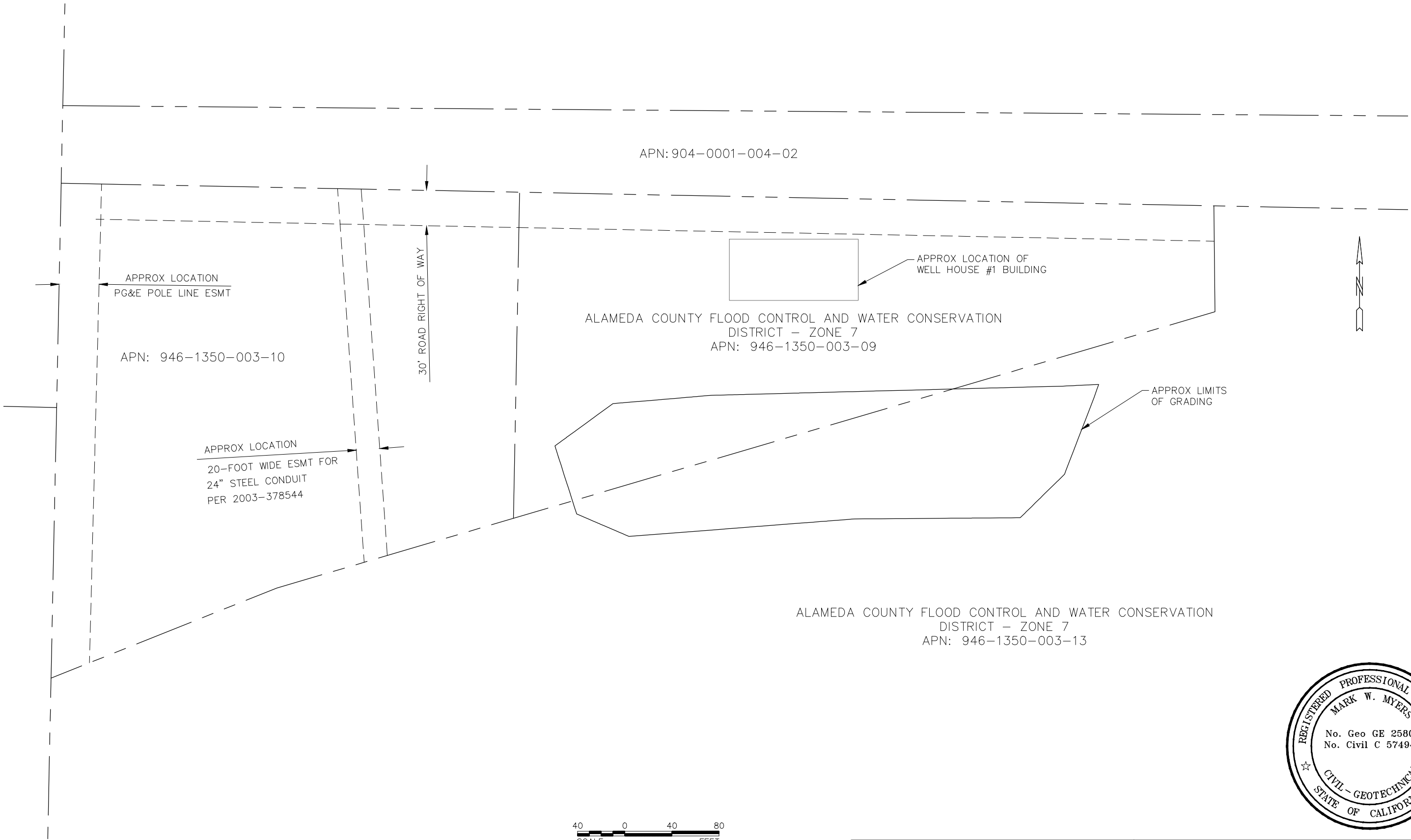
WOOD STAKES SHALL BE PROVIDED AT MINIMUM 6 FT SPACING (CENTER TO CENTER) TO ANCHOR THE EROSION CONTROL MAT TO THE GROUND SURFACE. EROSION CONTROL MAT SHALL BE ANCHORED AT THE TOP OF THE SLOPE IN A 12 IN. X 12 IN. TRENCH. AT SOME LOCATIONS, SITE PREPARATION FOR INSTALLATION OF EROSION CONTROL MATTING, INCLUDING TRIMMING AND SHAPING OF SLOPE AND REMOVAL OF LOOSE MATERIALS, SHALL BE PERFORMED TO ENSURE CONTACT BETWEEN THE GROUND AND THE EROSION CONTROL MAT.



	REVISION DESCRIPTION	INI	M/D/YEAR
NO.	REVISION DESCRIPTION	BY	DATE

 CAL ENGINEERING & GEOLOGY			119 Filbert Street Oakland, CA, 94607 Phone: (510) 451-2350		ZONE 7 WATER AGENCY - COPE LAKE WELL HOUSE #1			
					EMERGENCY SLOPE STABILIZATION PROJECT PLEASANTON, ALAMEDA COUNTY, CALIFORNIA PROJECT SPECIFICATIONS			
DESIGNED M. MYERS	DRAWN M. VITTHAL	CHECKED P. GREGORY	PROJECT NO. 160820	DATE 16 SEPTEMBER 2016	SHEET NO. 2	OF 6		

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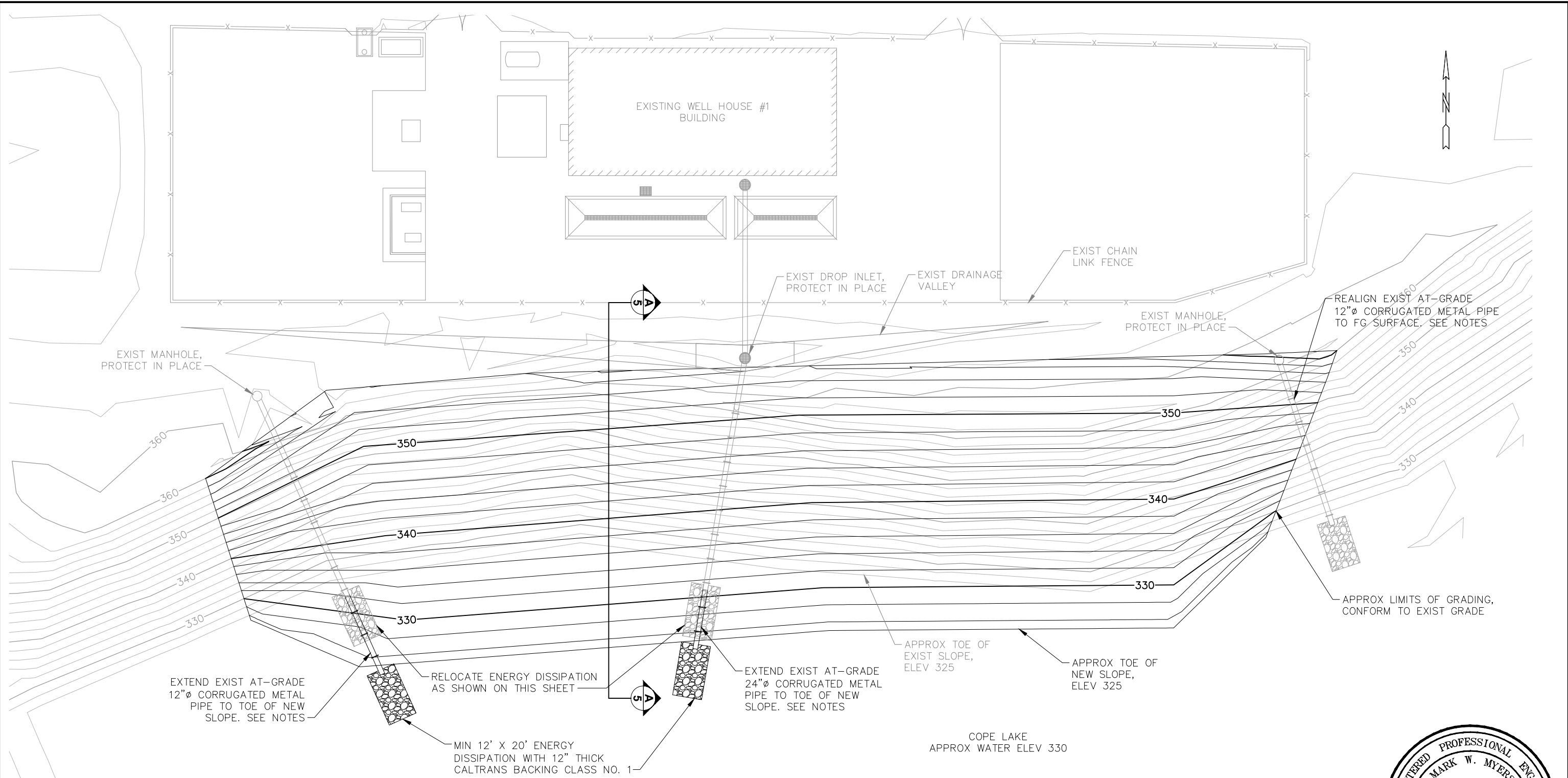
119 Filbert Street
Oakland, CA, 94607
Phone: (510) 451-2350

DESIGNED M. MYERS	DRAWN M. VITTHAL	CHECKED P. GREGORY
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ZONE 7 WATER AGENCY - COPE LAKE WELL HOUSE #1		
EMERGENCY SLOPE STABILIZATION PROJECT PLEASANTON, ALAMEDA COUNTY, CALIFORNIA PLOT PLAN		
PROJECT NO. 160820	DATE 16 SEPTEMBER 2016	SHEET NO. OF 3 6



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- NOTES:
- EXISTING GRADE TOPOGRAPHIC SURFACE PROVIDED BY ZONE 7 FROM 2016 KIER & WRIGHT SURVEY.
 - EARTHWORK IS INTENDED TO BE BALANCE USING ON-SITE SOIL AND ZONE 7 STOCKPILE OF CONCRETE RUBBLE. FINAL SLOPE MAY VARY SLIGHTLY FROM GRADES SHOWN. FINAL SLOPE MUST CONFORM TO EXISTING GROUND AT THE LIMITS OF GRADING.
 - CONTRACTOR SHALL PROTECT EXISTING IMPROVEMENTS. IMPROVEMENTS DAMAGED BY CONTRACTOR SHALL BE REPLACED WITH LIKE KIND AND QUALITY.
 - EXTENT OF ALTERATION TO CORRUGATED METAL PIPES AT GRADE MAY VARY DEPENDING ON FIELD CONDITIONS.
 - CORRUGATED METAL PIPE TO BE CONSTRUCTED PER CALTRANS STANDARD PLAN D87A AND SECURED WITH A CABLE ANCHOR SYSTEM PER CALTRANS STANDARD PLAN D87C.



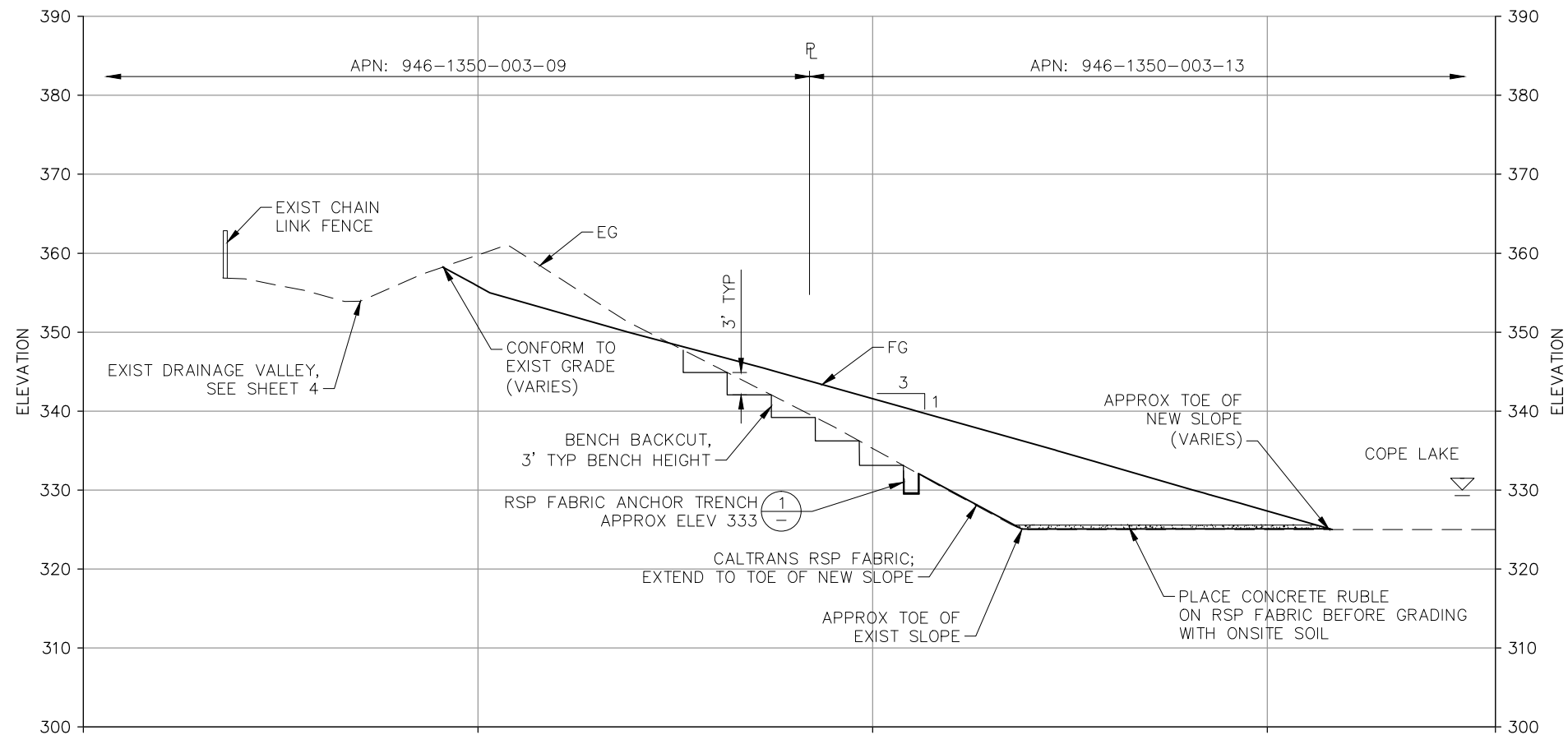
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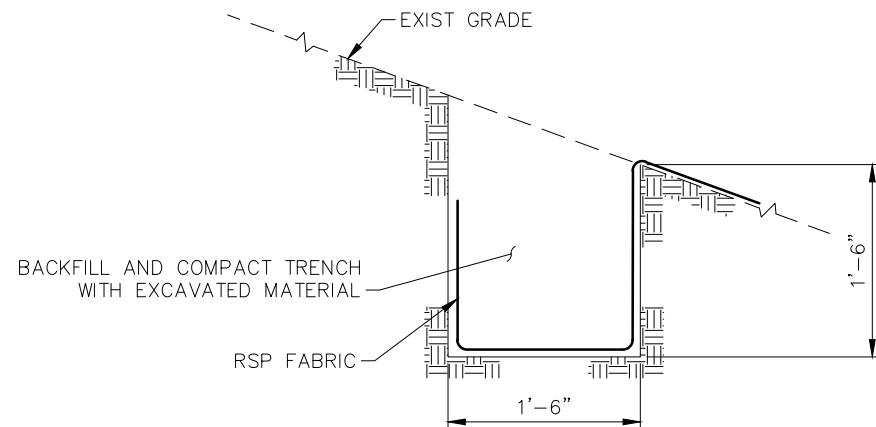
ZONE 7 WATER AGENCY - COPE LAKE WELL HOUSE #1			
EMERGENCY SLOPE STABILIZATION PROJECT PLEASANTON, ALAMEDA COUNTY, CALIFORNIA GRADING PLAN			
PROJECT NO. 160820	DATE 16 SEPTEMBER 2016	SHEET NO. 4	OF 6

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A
4 **TYPICAL SECTION**

10 0 10 20
SCALE FEET



1
- **RSP FABRIC ANCHOR TRENCH**
NOT TO SCALE



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Oakland, CA, 94607
Phone: (510) 451-2350

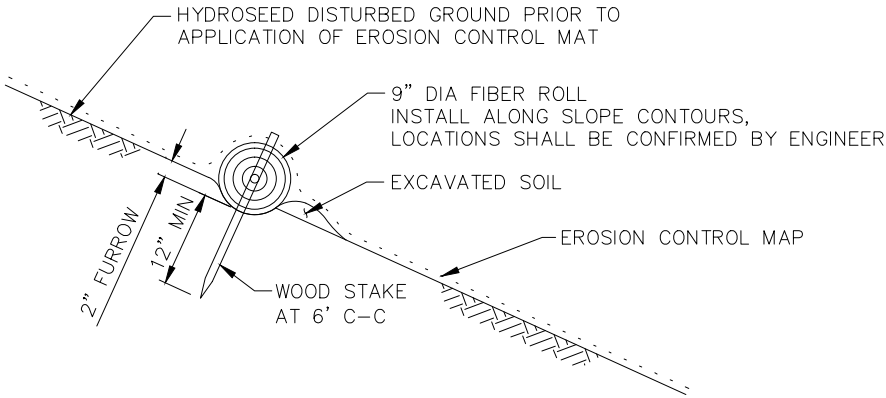
DESIGNED M. MYERS	DRAWN M. VITTHAL	CHECKED P. GREGORY
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ZONE 7 WATER AGENCY - COPE LAKE WELL HOUSE #1			
EMERGENCY SLOPE STABILIZATION PROJECT PLEASANTON, ALAMEDA COUNTY, CALIFORNIA TYPICAL SECTION & DETAILS			
PROJECT NO. 160820	DATE 16 SEPTEMBER 2016	SHEET NO. 5	OF 6

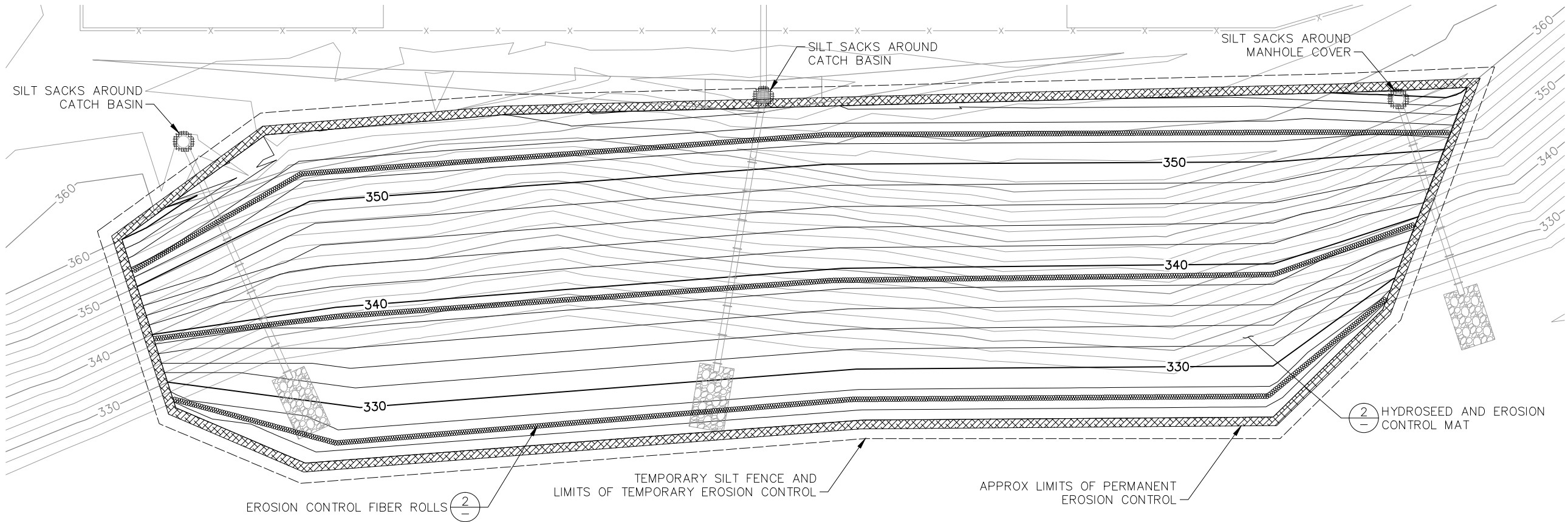
NOTES

1. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL CONFORM TO MANUAL OF STANDARDS FOR EROSION & SEDIMENT CONTROL MEASURES PUBLISHED BY ASSOCIATION OF BAY AREA GOVERNMENTS (ABAG) SECOND EDITION, DATED MAY 1995, AND ALAMEDA COUNTY REQUIREMENTS.
2. THE CONTRACTOR SHALL CLEANUP ANY MATERIAL SPILLED ON ANY PUBLIC ROAD.
3. TEMPORARY EROSION CONTROL MEASURES SHOWN, WHICH INTERFERE WITH THE WORK, SHALL BE RELOCATED OR MODIFIED AS REQUESTED BY THE INSPECTOR OR AS DIRECTED BY THE ENGINEER.
4. THE CONTRACTOR SHALL NOT BLOCK EXISTING DRAINAGE FLOWING ONTO THE WORK AREA.
5. THE CONTRACTOR SHALL INSPECT THE SITE WORK AT THE BEGINNING OF AND THROUGH THE DURATION OF EACH STORM TO ASSURE THAT INLETS AND PIPES ARE NOT BLOCKED WITH SILT OR DEBRIS AND SHALL MAKE REPAIRS TO THE TEMPORARY EROSION CONTROL MEASURES AND TAKE ANY OTHER REMEDIAL MEASURE AS DIRECTED BY THE COUNTY. AT THE END OF A STORM EVENT ALL WATER PONDED IN DEPRESSIONS, CATCH BASINS, AND CHECK DAM PONDS SHALL BE PUMPED AND ALL SILT AND DEBRIS REMOVED. THIS WORK SHALL BE COMPLETED WITHIN 24 HOURS AFTER THE END OF EACH STORM.
6. EROSION CONTROL MEASURES SHALL BE ADJUSTED BY THE CONTRACTOR TO REFLECT ALL CHANGES IN DRAINAGE AS CONSTRUCTION DICTATES.

7. TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED TO CONTROL AND CONTAIN EROSION-CAUSED SILT DEPOSITS AND TO PROVIDE FOR THE SAFE DISCHARGE OF STORM WATERS INTO EXISTING STORM WATER FACILITIES. DESIGN OF THESE MEASURES SHALL BE APPROVED BY THE ENGINEER.
8. SEDIMENT SHALL BE REMOVED AND DEPOSITED IN A SUITABLE AREA AND IN SUCH A MANNER THAT IT WILL NOT ERODE.
9. IT IS THE PROPERTY OWNER AND CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT HIS OR HER CONSTRUCTION SITE IMPLEMENTS AN EFFECTIVE EROSION CONTROL, RUN-ON AND RUN-OFF CONTROL, SEDIMENT CONTROL ACTIVE TREATMENT SYSTEMS (AS APPROPRIATE), GOOD SITE MANAGEMENT, AND NON STORM WATER MANAGEMENT THROUGH ALL PHASES OF CONSTRUCTION (INCLUDING BUT LIMITED TO SITE GRADING, AND BUILDING) UNTIL THE SITE IS FULLY STABILIZED BY LANDSCAPING OR THE INSTALLATION OF PERMANENT EROSION CONTROL MEASURES.
10. ALL EROSION AND SEDIMENT CONTROL MEASURES ARE SUBJECT TO CHANGE THROUGH THE COURSE OF GRADING AND CONSTRUCTION. ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURES MAY BE NEEDED TO ENSURE THAT THE PROJECT SITE IS IN COMPLIANCE WITH LOCAL REQUIREMENTS.



2 EROSION CONTROL
- NOT TO SCALE



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Δ			
Δ			
Δ	REVISION DESCRIPTION	INI	M/D/YEAR
NO.	REVISION DESCRIPTION	BY	DATE



119 Filbert Street
Oakland, CA, 94607
Phone: (510) 451-2350

ZONE 7 WATER AGENCY - COPE LAKE WELL HOUSE #1

EMERGENCY SLOPE STABILIZATION PROJECT
PLEASANTON, ALAMEDA COUNTY, CALIFORNIA
EROSION CONTROL PLAN

PROJECT NO. 160820
DATE 16 SEPTEMBER 2016
SHEET NO. 6 OF 6

