Appendix E

Geology and Soils

Geotechnical Exploration Report

Slope Stabilization Plan

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GEOTECHNICAL EXPLORATION
PROPOSED CITY OF GOLETA FIRE STATION NO. 10
7952 HOLLISTER AVENUE
GOLETA, CALIFORNIA

Prepared for:

CITY OF GOLETA
Goleta, California 93030-5650

Project No. 11389.001

February 21, 2017

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

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Project No. 11389.001

City of Goleta
130 Cremona Drive, Suite B
Goleta, California 93117

Attention: Ms. Claudia Dato, Project Manager

Subject: Geotechnical Exploration
Proposed City of Goleta Fire Station No. 10
7952 Hollister Avenue
Goleta, California

In accordance with our May 5, 2016 proposal authorized on June 21, 2016, Leighton Consulting, Inc. presents the results of our geotechnical exploration for use in entitling and designing the proposed City of Goleta Fire Station No. 10. It will be constructed at the northeast corner of Hollister Avenue and Cathedral Oaks Avenue in western Goleta, California. The purpose of our exploration has been to (1) explore subsurface soil conditions onsite, and (2) provide geotechnical recommendations for design and construction of this proposed fire station.

The site is essentially flat and covered with grasses, shrubs and eucalyptus trees. The northern side of the property has a 35-foot high, slope that descends to the north towards Union Pacific Railroad property at a gradient of approximately 1:1 h:v (horizontal:vertical), and has been subjected to severe erosion. The property boundary between the Fire Station #10 site and the Union Pacific Railroad property is located mid-slope. Site soils consist of a thin layer of undocumented fill and or native soil mantling marine terrace deposits to the depths explored. No groundwater was encountered during site exploration, however we observed runoff ponded in the southeast corner of the site after heavy rainfall.

The principal constraints to site development is the stability and potential for continued severe erosion of the slope at the north site boundary. Leighton has evaluated and provided design parameters for three options to mitigate slope instability, which include: piles installed at top of slope, in between the property line and the of the slope, and at property line We have also provided recommendations for a structural setback from the top of the slope. Based on discussions with you, the City's preferred option is a pile wall at the midslope property line and the placement of fill behind it in order to obtain additional buildable space. to proposed finished grade at the property line. We also present foundation design recommendations for the proposed fire station and other improvements proposed for the project.

More detailed recommendations are presented in this report. If you have any questions regarding, please do not hesitate to contact this office at (805) 654-9257 or 866-LEIGHTON, directly at the phone extensions and/or e-mail addresses listed below. We appreciated being of service.

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Respectfully submitted,

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1.0 INTRODUCTION

1.1 Site Location and Project Description

The proposed fire station site is located at 7952 Hollister Avenue in western Goleta, as depicted on Figure 1, *Site Location Map*. This approximately 2-acre site is bounded on the north by an approximately 35-foot-high slope that descends to railroad tracks, on the east by an existing multifamily development, on the south by Hollister Avenue, and on the west by the Cathedral Oaks/Winchester Canyon Road overpass. The descending slope has an overall gradient of approximately 1:1 (horizontal:vertical, h:v), is sparsely vegetated and exhibits severe rill erosion typical of marine terrace deposits along the coast of southern California. To the west, the slope is protected by concrete adjacent to the overpass. The toe of the northern slope is located about 15 to 20 feet from the railroad tracks and no water seepage was observed in the slope. The central and western portion of the site was formerly occupied by a gas station that was demolished in the early 1990s.

The conceptual project layout showing project elements was provided by KBZ Architects (2016) and consists of an 11,000 square foot facility, centrally located on the site. The project layout was used as a base map for Plate 1, *Geotechnical Exploration Location Map.* We understand that the following improvements are proposed:

- **Fire Station**: The general outline of the fire station was provided by KBZ Architects, and may be one or two stories. This building will be located centrally on the site and oriented parallel to Hollister Avenue. A concrete access driveway will wrap around the building with fire truck turnarounds located at the back. Parking spaces will be located in the front of the building.

- **Appurtenant Structures**: Trash enclosures and fire hose drying racks will be located at the edge of the driveway and along the slope at the back of the building. We assume masonry screen walls, light poles, and a flagpole will be located onsite, along with landscaping and drainage features.

Basements or substructures are not anticipated. Based on June 2016 conceptual plans from KBZ Architects, and a site survey by Wallace Group dated June 13, 2016, it appears that site grading will consist of minor cuts and fills on the order of five to seven feet to attain the desired site grades and surface drainage.

1.2 Purpose and Scope of Exploration

Purposes of this geotechnical exploration have been to (1) explore subsurface soil conditions onsite, and (2) provide geotechnical recommendations for design and construction of this proposed fire station. We have relied on discussions with you during the exploration phase of this project, and on the preliminary plan prepared provided by the project team. In accordance with our May 5, 2016 proposal (costs revised July 12, 2016), the scope of our exploration has included the following tasks:

- **Background Review:** A background review of readily-available, relevant, public and in-house geotechnical literature was performed. Information was obtained from adjacent projects, including the condominiums to the east of the site and the reconfiguration of the Cathedral Oaks Railroad overpass to the west. Pertinent references are presented at the end of this report text.

- **Subsurface Exploration:** Prior to subsurface exploration, we contacted Underground Service Alert (USA) so they would locate and mark existing registered public underground utilities onsite. Our subsurface exploration consisted of a total of seven hollow stem auger borings drilled to a maximum depth of 55 feet and sampled to a depth of 56.5 feet. Earth material samples were retrieved from our borings for classification and geotechnical laboratory testing. Approximate locations of the borings are shown on Plate 1. A more detailed description of our field exploration is presented in Appendix A, *Field Exploration*.

- **Geotechnical Laboratory Testing:** Physical and engineering properties of sampled subsurface soils were evaluated by visually classifying recovered samples and performing various geotechnical laboratory tests on selected samples at our in-house (Irvine) geotechnical laboratory. Descriptions of these tests and results are presented in Appendix B, "*Geotechnical Laboratory Testing*."

- **Geotechnical Analyses:** Geotechnical engineering analyses were performed, including a site-specific ground motion study, a seismic settlement analysis, and slope stability analyses, to develop geotechnical recommendations and design parameters for this proposed fire station.

- **Report Preparation:** This report was prepared to summarize our findings, and to present our design-specific geotechnical conclusions and recommendations solely for design of Fire Station No. 10 and appurtenant structures.

As mentioned earlier, the site was formerly occupied by a gas station with underground tanks located in the western portion of the site under the proposed driveway area, and the former building footprint is located close to the proposed fire station. The approximate locations of these former structures are shown on Figure 2 of the Holguin Fahan (2012) Site Closure report included in Appendix E and also on Plate 1. Site assessment to evaluate the environmental conditions at the site was not a part of our scope of work.

2.0 FINDINGS

2.1 Regional Geologic Setting

The site lies in the Santa Barbara Coastal Plain, within the western portion of the Transverse Ranges Geomorphic Province, which is characterized by west-trending compressional (thrust and reverse) faults and mountain ranges. The Santa Barbara Coastal Plain (SBCP) is bounded to the north by the Santa Ynez Mountains, by the Santa Barbara Channel and the Pacific Ocean to the south, and narrows on the western boundary to the west of the City of Goleta and on the eastern boundary east of the City of Carpinteria (USGS, 2009).

The SBCP is dominated by irregularly deformed Cretaceous- through Pleistocene-age marine and non-marine sedimentary strata, which form the ridgelines of the Santa Ynez Mountains north of the site. These highly resistant strata record a long history of continental-margin tectonism, and deposits as young as Quaternary age, and have sustained strong deformations that include faulting, folding, and clockwise rotation of crustal blocks. Quaternary deformation (uplift and folding) has exposed less resistant terrestrial and marine sedimentary rocks, which form the coastal hills and mesas that bound the southwestern limits of the City of Santa Barbara to the east of the site.

2.2 Current Site Surface Condition

This approximately 2-acre site was previously occupied by a one-story gas station that was demolished in 1993. Currently the site is vacant and covered with brush, leaves, and eucalyptus trees. The site topography is uneven and there is approximately 4 feet of relief across the site. Generally, the site slopes gently towards the southeast corner. Drainage is to the southeast via sheet flow runoff, but collects in low spots across the site and also appears to flow over the northern slope locally. The site has an average elevation of between 117 feet and 121 feet above mean sea level (MSL), with a 35-foot-high slope at the northern portion of the site which descends to the railroad tracks offsite. The northeast corner of the site slopes gently towards this slope, and runoff drains over the slope in this area resulting in periodic, localized, severe erosion on the slope.

2.3 Available Site History

Based on our review of historic aerial photographs and available site documentation, the property was formerly occupied by a gas station from 1969 until 1993. The approximate location of the gas station and associated facilities is depicted in the reports by Holguin and Fahan (2012), and were located on the western portion of the property in the vicinity of LB-7.

2.4 Previous Geotechnical Subsurface Explorations

No geotechnical investigations have been performed on the site. However, exploration was performed nearby for the Cathedral Oaks Overpass to the west and the Whimbrel Lane residential development to the east. The City of Goleta provided the Log of Test Borings provided by State of California (1968) for the Hollister Avenue Overpass and the preliminary geotechnical investigation performed by Padre Geotechnical (1999) for the residential development to the east. A subsequent update report by others was not made available, however, plans for a shear pin wall installed along the slope immediately east of the site were provided by Burnett & Young, the shoring engineers for that project (Burnett & Young, 2013). This information is included in Appendix E.

2.5 Subsurface Soil Conditions

Based upon our review of pertinent geotechnical literature and our recent subsurface exploration, the site is blanketed by undocumented fill (Afu) as much as 5 feet thick, overlying Pleistocene-age Marine Terrace Deposits (Qmt) to the depths explored. Locations of geotechnical explorations are shown on the Geotechnical Exploration Location Map, Plate 1, and logs of the explorations, LB-1 through LB-7, are included in Appendix A, Field Exploration. Fill and terrace deposits are described in further detail as follows:

- **Undocumented Fill (Afu)**: Undocumented fill consisted of brown silty sand with angular gravel as much as 5 feet in thickness across the old gas station site. Fill placement during previous construction and demolition associated with the gas station is not well documented. Therefore, considering past site development, undocumented fill may be as deep as 7 to 10 feet in the area of former tank locations onsite, which, based on the proposed site layout, is under the proposed western driveway area. We are unaware of any engineered fill placement documentation for this site, so we classify all fill soils on site as undocumented.

- **Marine Terrace Deposits (Qmt)**: Below the fill to the depths explored, we sampled Pleistocene-age Marine Terrace Deposits. These deposits consisted of interbeds and lenses of dense silty sand (SM) and sandy silt (ML) with some minor stiff clay layers that were interbedded with three distinct layers of dense to very dense, silty to poorly graded sand (SP). The sand layers were encountered at depths of 10 feet, 25 feet and 50 feet, and ranged from 5 to 10 feet in thickness.

The interpreted site stratigraphy is depicted on Geotechnical Cross-Sections A-A' and B-B' (Plate 2).

The geotechnical properties of samples of the site soils that were tested are summarized in the table below, described in the following subsections, and summarized in Appendix B, Geotechnical Laboratory Testing.

Table 1 – Select Geotechnical Laboratory Testing Results

Material Description	Depth Interval, bgs (feet)	Average Fines* (percent)	Unit Weight γ_{TOT} (pcf)	Other Index Properties
Undocumented Artificial Fill (Afu) silty SAND (SM) to clayey SAND (SC)	0 to 5	30-40	125	Plasticity Index (PI) = 24 Expansion Index (EI) = 6 R-value >40 (64). Maximum Density = 129.5 pcf OMC 8.4%
Marine Terrace Deposits (Qmt) **coarse grained** silty SAND (SM)	10 to 15 25 to 35	25-40	120	See Appendix B for additional test results.
Marine Terrace Deposits (Qmt) **fine grained** sandy, silty CLAY (CL) and SILT (ML)	5 to 10 15 to25 35 to50	50-70	120	
Marine Terrace Deposits (Qmt) well graded SAND (SM)	50 to 56.5	13	120	

*Qualitative average of percent silt and clay passing the No. 200 U.S. Standard Sieve

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2.5.1 Expansive Soil Collapse (moisture sensitivity) potential refers to the potential settlement of a soil under existing stresses upon being wetted. Representative samples from 10 feet depth in Borings LB-5 and LB-6 were tested for swell and collapse potential. Test results suggest that sandy soils at this site within 15 feet of the ground surface may have a low collapse potential of about 1%. Test results of the clay soils at 10 to 15 feet depths indicated the potential for swell of up to 4%, indicating that some clay layers at those depths have the potential to swell moderately. The clay layer tested is on the order of two to five thick feet at depths of 10 feet or more below grade. Therefore, if swelling occurs, the maximum swell anticipated is about two inches but at depths that may not adversely impact the proposed improvements.

We performed preliminary testing on the shallow soil which may be used for backfill next to, and in contact with the proposed construction foundations and flatwork. A bulk sample from Boring LB-7 was tested for expansion potential. Test results indicated an Expansion Index (EI) of 6. Based on this test result, our field observation of onsite soil and our experience in the area, near-surface onsite soil does not appear to be expansive. Due to the presence of fine-grained soils, pockets of expansive soil may be present at the site.

2.5.2 Sulfate and Chloride Content, Resistivity and pH

The near-surface on-site soil was screened for corrosion potential. The test results are as follows:

- Sulfates: 425 ppm
- Chlorides: 345 ppm
- pH: 7.07
- Resistivity: 988 ohm-cm

Water-soluble sulfates in soil can react adversely with concrete. However, concrete in contact with soil containing sulfate concentrations less-than (<) 0.10 percent (1,000 parts-per-million) is considered to have negligible sulfate exposure (see ACI 318-05, Table 4.3.1 as referenced in the 2016 California Building Code - CBC, Section 1904). As summarized, based on ACI criteria, sulfate exposure, although slightly elevated for this near-

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marine environment, can be considered “**negligible**” for soils sampled at this site and tested.

Corrosivity of soils in direct contact with ferrous metals and embedded metals can be evaluated by measuring electrical resistivity, soluble chloride content and pH of soil. In general, soil having a minimum resistivity less-than (<) 3,000 ohm-cm is considered corrosive to ferrous metals. Soil with a chloride content greater-than-or-equal-to (≥) 500 ppm is considered corrosive to embedded metals. Based on the test results, soils tested were considered **corrosive** to buried ferrous metals. However, the on-site soil is not considered to be corrosive to embedded metals.

2.6 Infiltration Testing

Leighton drilled two hollow-stem auger borings adjacent to borings that were logged and sampled in locations identified by the civil engineer as potential infiltration areas. LB-1 was drilled to a depth of 7 feet (adjacent to LB-2) and LB-3A was drilled to a depth of 25 feet (adjacent to LB-3). LB-3A was drilled to a depth of 25 feet and encountered sand at a depth of about 20 feet. Before the pipe could be installed, the hole collapsed to a depth of about 15 feet. After drilling, slotted 2-inch diameter standpipes were installed and backfilled in accordance with County of Santa Barbara Water Resources Division (2014) requirements for infiltration testing. Potable water was provided by the drilling contractor. After infiltration testing was completed, Leighton attempted to remove the pipes, but could not. Therefore, the pipes were cut off one foot below grade and the borings backfilled with soil cuttings to the ground surface. The results of infiltration testing are included in Appendix A, Field Exploration. County of Santa Barbara and Central Coast Water Board Standards refer to Orange County Technical Guidelines (2011) for calculating Infiltration Rates. The resulting calculated Infiltration Rates are as follows, and do not include a factor of safety of 2:

- LB-1 (depth 7 feet): 0.05 inches/hour
- LB-3A (depth 15 feet): 0.07 inches/hour

2.7 Groundwater

The site is located near the western boundary of the Goleta Basin, within the Goleta West Basin. Groundwater in Goleta occurs in the alluvium, the fanglomerate, and the Santa Barbara Formation (CADWR, 2004). Groundwater in the Goleta Basin is generally divided into a shallow zone and a deep zone. The shallow zone includes the recent alluvium, parts of the Upper Pleistocene alluvium, and the upper part of the fanglomerate. The deep zone includes the lower part of the Upper Pleistocene alluvium and the Santa Barbara Formation. Based on the above information, regionally, depth to groundwater in the site vicinity appears to be below 100 ft. bgs, and the groundwater flow direction in the Goleta Basin is generally toward the south.

Based on historical data from Caltrans for the Hollister Avenue overpass (State of California, 1968) and more recent data from the adjacent residential site (Padre Geotechnical, 1999), drilled during historically wet periods, ground water has not been encountered to depths of 70 feet. The state borings were drilled in march 1957 and extended into bedrock to depths of 75 feet. Padre borings extended into terrace deposits to depths of 51.5 feet. Groundwater was not encountered during our July 2016 exploration. Also, groundwater was not observed in nearby borings, advanced up to 70 feet deep, performed in support of the Cathedral Oaks Crossing or for the adjacent development to the east. Seepage was not observed on the slope at the northern site boundary during the field investigation.

2.8 Flood Hazard

According to the FEMA Flood Insurance Rate Map (FEMA, 2012), this site is located in an area determined to be “outside the 0.2% annual chance floodplain”, but does not imply the absence of a flood hazard.

2.9 Faulting and Earthquakes

The site lies within the Santa Barbara Fold and Fault Belt (SBFFB), a region within the SBCP characterized by folds and partially-buried oblique and reverse faults that transect the coastal plain, and which are expressed geomorphically on the surface as mesas and hills characteristic of the area (USGS, 2009). Active faults are defined as those that have demonstrated surface displacement within Holocene time (i.e. within the last 11,000 years). Potentially active faults are those that have demonstrated surface displacement in Quaternary time (i.e. the last 1.6 million years).

Our review of available in-house and published literature indicates that there are no currently known active or potentially active faults that traverse or project toward the site, and the site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone (Bryant and Hart, 2007; CGS, 2010).

The closest active fault to the site is a portion of the Santa Ynez Fault, located in the eastern section of the Santa Ynez fault zone approximately 8.5 miles to the northeast.

Potentially active faults mapped within the SBFFB are closer to the site and include the north and south branches of the More Ranch Fault of the Mission Ridge fault system, located approximately 0.4 miles to the south and 1.6 miles to the southeast, respectively, and the Glen Annie Fault, located approximately 1.0 miles to the north (see Figure 3, Regional Fault Map) (USGS, 2009; CGS, 2010). The USGS (2009) *Geologic Map of the Santa Barbara Coastal Plain Area* names the north and south branches of the More Ranch Fault as "North Branch Western More Ranch Fault" and "South Branch Western More Ranch Fault" (see Figure 2, Regional Geology Map), whereas the CGS (2010) *Fault Activity Map of California* makes no distinction between the two branches and labels both branches as the "More Ranch Fault" (see http://www.quake.ca.gov/gmaps/FAM/faultactivitymap.html). In Figure 3, Regional Fault Map, the two branches are distinguished by "north branch" and "south branch". Although it has not been demonstrated that many of the mapped faults in the immediate vicinity are active, this may be due to a lack of subsurface exploration of these faults which may mean some of the faults are active.

The nearest fault outside of the SBFFB is the Pitas Point Fault located approximately 15.7 miles to the southeast. Other nearby active and potentially active faults that could cause strong ground shaking at the site include the Los Alamos Fault, located approximately 25.7 miles to the northwest, the active portion (southern strand) of the Red Mountain Fault within the Red Mountain fault zone, located approximately 26.1 miles to the southeast, the Javon Canyon Fault located approximately 28.9 miles to the southeast, and the Santa Ana section of the Mission Ridge fault system and faults near Oakview and Meiners Oaks, California, located approximately 34.1 miles to the east. The San Andreas Fault is the largest fault in southern California and is located approximately 44 miles to the northeast (CGS, 2010). Additional faults identified within 100 kilometers (62 miles) of the site are presented in Appendix C (Blake 2000a).

Historical Seismicity Figure 4 illustrates the epicentral locations of historic earthquakes in the vicinity of the site. Strong offshore earthquakes located within 0.6 miles of the SBFFB, including a 6.3 magnitude earthquake in 1925, a 5.5 magnitude earthquake in 1941, and a 5.1 magnitude earthquake in 1978. Several other seismic events offshore of, and within, the SBFFB are likely to have occurred along oblique-slip faults that may be continuous with Quaternary-age reverse faults in the area. Faults within and around the SBFFB pose a significant risk for activity and strong ground shaking (USGS, 2009). Additionally, the San Andreas Fault Zone, a 744-mile long fault system located approximately 44 miles to the northeast and outside of the SBFFB, has been responsible for several significant historical seismic events including the 1857 magnitude 7.9 Fort Tejon Earthquake, and can also pose a significant risk for activity and strong ground shaking (SCEDC, 2016).

The computer program EQSEARCH (Blake, 2000b) was used to evaluate past, documented seismic activity near the site. This program performs an automated search of a catalog of historic southern California earthquakes, and computes the distance from a project site to each of the earthquake epicenters within a specified search radius of 62 miles (approximately 100 kilometers). From the computed distances, the program also estimates (using an appropriate attenuation relationship) the peak horizontal ground acceleration that may have occurred at the site due to each earthquake. A database of recorded earthquakes with magnitudes of 4.0 or larger between 1800 and 2016 was used in the analysis. The results of each analysis, including an earthquake epicenter map for events from 1800 to 2016, and a listing of historic earthquakes with an epicentral distance of less than 62 miles from the site, are presented in Appendix C.

The largest historical earthquake within the 62-mile radius of the site was the 1857 magnitude 7.9 Fort Tejon Earthquake that occurred on the San Andreas Fault approximately 60.3 miles to the northeast. It is estimated to have produced a horizontal ground acceleration of 0.13g at the site. The earthquake event to have produced the highest estimated horizontal ground acceleration, 0.25g, at the site was a magnitude 5.7 earthquake that occurred approximately 4.9 miles east-southeast of the site near the More Ranch fault in 1862. Other significant historical earthquakes within southern California include the 1952 magnitude 7.7 Arvin-Tehachapi Earthquake that occurred approximately 63.9 miles to the northeast, the 1971 magnitude 6.6 San Fernando Earthquake that occurred approximately 86.3 miles to the east, and the 1994 magnitude 6.7 Northridge Earthquake that occurred approximately 79.6 miles to the east-southeast (SCEDC, 2016).

2.10 Secondary Seismic Hazards

The Goleta Quadrangle has not yet been evaluated and mapped by the State of California Seismic Hazard Mapping Program. However, the County of Santa Barbara has characterized seismic hazards in the region in planning documents (County of Santa Barbara, 2015).

2.10.1 Liquefaction Potential

Liquefaction is the loss of soil strength due to a buildup of excess pore-water pressure during strong and long-duration ground shaking. Liquefaction is associated primarily with loose (low density), saturated, relatively uniform fine- to medium-grained, clean cohesionless soils. As shaking action of an earthquake progresses, soil granules are rearranged and the soil densifies within a short period. This rapid densification of soil results in a buildup of pore-water pressure. When the pore-water pressure approaches the total overburden pressure, soil shear strength reduces abruptly and temporarily behaves similar to a fluid. For liquefaction to occur, there must be:

(1) Loose granular soils,

(2) Shallow groundwater, **and**

(3) Strong, long-duration ground shaking

If all above conditions occur or exist simultaneously, then liquidation may occur. If one is missing, then liquefaction will not occur. Effects of liquefaction can include sand boils, settlement and bearing capacity failures below structures. Based on blow counts, and current and historic groundwater conditions, the potential for liquefaction at the site is considered low.

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Based on a review of the County of Santa Barbara's Seismic Safety & Safety Element (County of Santa Barbara, Planning and Development, 2015) and the County of Santa Barbara's 2016 Multi-Jurisdictional Hazard Mitigation Plan (see Section 5 of: https://www.countyofsb.org/ceo/oem/2016HMP.sbc), the site appears to have a low potential for liquefaction potential.

2.10.2 Seismically-Induced Settlement

During a strong seismic event, seismically-induced settlement can occur within loose to moderately dense, dry or saturated granular soil. Settlement caused by ground shaking is often non-uniformly distributed, which can result in differential settlement. Because the shallow surface soils will be over-excavated and recompacted, the potential for dry sand seismic settlement is expected to be low to moderate. Based on SPT blow counts from Boring LB-2, Leighton analyzed dry sand seismic settlement using the program LIQUEFY-PRO. The stratigraphy is relatively uniform across the site, and Boring LB-2 was judged to be representative of site conditions. As tabulated, we estimate that seismically-induced settlement due to dry sand settlement is on the order of 1.5 to 2 inches. Differential settlement may be assumed to be one-half of the total settlement over a horizontal distance of 40 feet.

2.10.3 Seismically-Induced Landslides

As shown on Plate 1, the site is bounded on the north by an approximately 35-foot-high descending slope that has a gradient of about 1H:1V and which is locally steeper. Based on the results of our slope stability analyses, the descending slope is grossly stable with respect to pseudostatic conditions based on seismic screening procedures (CGS, 2008). A discussion of our findings and conclusions is presented in the section 2.11 Slope Stability.

2.10.4 Earthquake-Induced Flooding

Earthquake-induced flooding can result from failure of up-gradient dams or other water-retaining structures resulting from earthquakes. There are no significant retained bodies of water located up-gradient from the site. Therefore, the site is not considered susceptible to earthquake-induced flooding.

2.10.5 Seiches and Tsunamis

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. No bodies of water wherein seiches may occur are proximal to the site. Tsunamis are waves generated in large bodies of water by fault displacement or major ground movement. According to the California Geological Survey (CGS, 2009), although relatively close to the Pacific Ocean, this site (roughly 120 feet above mean sea level) is not within an area currently considered susceptible to tsunami hazard.

2.11 Slope Stability

A topographic survey of the site was performed by Wallace Group in June 2016 and is part of the base map for our Geotechnical Exploration Map. Site layout plans by KBZ Architects (2016) were also used. The topographic survey shows the location and elevation of the toe and top of slope, which were utilized to establish general slope geometries for our stability analyses by utilizing the locations of the tops and toes of the slope. The survey does not provide detail of gradient changes within the slope or the slope gradient. Geotechnical Cross-Sections A-A’ and B-B’ extend through the site perpendicular to the northern slope and depict the slope geometry assumed for our analyses.

Detailed topography was not available for the lower portion of the slope beyond the City’s property line, except of the location and elevation of the toe of the slope; therefore, this portion of the slope along each cross section line was estimated simply by joining the closest known points. The slope may have a steeper or gentler gradient than shown due to the uneven erosion and differences in soils type exposed. Based on observations in early January 2017, it appears that on the eastern half of the slope, surficial erosion due to recent rains has created a talus of soil on the lower portion of the slope, and created a steeper more vertical slope section on the upper portion of the slope. The western half of the slope is more vegetated and the slope gradient from toe to crest is more even and regular.

Geotechnical Cross Sections A-A’ and B-B’ were analyzed for gross stability in accordance with current standard practice. Cross section locations were chosen based on representative soil profiles and critical locations with respect to slope height, gradient and assumed subsurface conditions. The approximate locations of the analyzed geotechnical cross-sections are presented on the Geotechnical Map (Plate 1). Geotechnical Cross-Section A-A' (Plate 2) extends through the center of the proposed Fire Station structure and depicts the slope geometry assumed for our analyses. Geotechnical Cross-Section B-B' (Plate 2) extends through the western side of the site, where portions of the slope have eroded and retreated , and depicts the slope geometry assumed for our analyses.

The slopes were analyzed using the computer software SLIDE (RocScience, 2015) which performs 2D Limit Equilibrium slope stability analyses capable of analyzing circular and non-circular slip surfaces by a number of analysis methods. For this project, stability analysis was performed using Bishop's (simplified) method and Spencer's method, run simultaneously for comparison, for circular failure slip surfaces to evaluate the effect of layered sediments on the stability of the slope. Pseudostatic screening analysis was performed using the SP117A Guidelines for Evaluating and Mitigating Seismic Hazards in California" (CGS, 2008). These guidelines provide methods of screening seismic stability for slopes, which utilize coefficients of horizontal acceleration (k_h) based on predicting ground deformation 5cm (two inches) and 15cm (six inches). Factors of Safety and the results of the stability analyses are presented below. A more detailed explanation, of the material parameters and our calculations is presented in Appendix D.

2.11.1 Shear Strength Parameters

Shear strength parameters were derived from laboratory testing performed on samples recovered during our subsurface exploration, in-situ testing and previous reports. Shear strength parameters are summarized in Table 2. Ultimate and peak strengths of the soil were used to analyze the static and pseudo-static stability of the slopes, respectively.

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Table 2 – Shear Strength Test Results

Layer	Description	Unit Weight γ_{TOT} (pcf)	Ultimate Shear Strength		Peak Shear Strength	
			Cohesion (psf)	ϕ	Cohesion (psf)	ϕ
Fill	0 to 5 ft Remolded, 90%	125	0	34	248	33
1	Mixed fine grained, SM-ML	120	132	33	300	30
2	Silty Sand, SM	120	50	33	50	36
3	Silty Sand, SC-SM	120	50	39	90	40
4	Clay and Silt, CL-ML	120	247	25	390	32
5	Well-graded Sand, SW	120	0	36	0	39

2.11.2 Factor of Safety

Analysis of the static factor of safety is straightforward, and the standard threshold is FS≥1.5. Pseudo-static analysis of slopes is subject to applicable guidelines which provide methods and associated acceptable factors of safety. The Kho is then applied as a seismic load on the modeled slope to generate a factor of safety. The calculated factors of safety generated are compared to minimum factors of safety in order to assess the potential for failure for the slope configurations as modeled. The following minimum factors of safety (FS) were considered reasonable or acceptable minimum parameters:

- Static Analysis: minimum FS = 1.5
- Pseudo-Static (Seismic) Analysis with a seismic coefficient of Kh = 0.211: minimum FS = 1.0, with up to 15cm of displacement.

2.11.3 Conditions Analyzed

The existing slope was analyzed to assess whether mitigation of slope stability was needed. The existing slope was calculated to not meet minimum required static factors of safety. Therefore, various mitigation options were evaluated and analyzed based on a cursory assessment of constructability and magnitude of seismic loading. In addition to setback from the existing unmodified slope, three mitigation options were evaluated:

- piles at the top of the slope,
- piles in between the property line and the top of the slope with a reconstructed slope behind it, and
- piles at the property line extended to proposed finished grade, with backfill behind it to create additional level space.

Each of these options is summarized in the following table.

Table 3 – Conditions Analyzed

Case	*Description*
Mitigation Option 1: Piles at top of slope, no repair of erosion on City owned portion of slope.	▪ Cross-section A-A' (critical). Piles installed at top of slope, from El. 122. to El. 85 ▪ Long term condition, erosion of entire slope to angle of repose (2.5:1 h:v).
Mitigation Option 2A and 2B – Piles in between the top of slope and the property line, and a trimmed or reconstructed upper slope at 2:1 h:v	▪ Cross-section A-A' (critical). ▪ Piles installed to min El. 84: **2A - Property Line, at El. 111**, long term condition, possible UPRR removal toe of slope (i.e. removal of slope support). ▪ **2B -Intermediate location on slope at El. 117**, long term condition, slope between property line and toe of slope erodes to angle of repose (2.5:1 h:v).
Mitigation Option 3 – Piles at property line, extended to retain backfill to Finished Grade	▪ Cross-section A-A' (critical) ▪ Piles installed property line and extend to Finished Grade at approximate El. 122. ▪ Long term condition, possible UPRR removal toe of slope (i.e. removal of slope support).

2.11.4 Results of Slope Stability

As modeled, the long-term static stability analysis of the northern descending slope below the site yielded calculated static factors of safety (FOS) of 1.27 at Section A-A' and 1.43 at Section B-B'. This is below the code minimum required FS of 1.5 and therefore mitigation is required. When analyzed for pseudo static conditions under SCEC SP117A Guidelines, the slope meets the minimum screening criteria of 1.0 with a displacement of up to 15cm. Table 4 summarizes the results of the analysis.

Table 4 – Summary of Stability Analyses for Conditions Analyzed

Option/Geotechnical Cross Section	Condition Evaluated	Factor of Safety	
		Static	Seismic (k_h = 0.211g)
Section A-A' – Circular	Existing, Long term	1.27	1.1
Section B-B' – Circular	Existing, Long term	1.42	1.18
Section A-A' - Circular	Short Term, Construction loads (minimum FS 1.25)	1.39	N/A
Option 1– Section A-A' Piles at top of slope	Long Term, Stabilization Minimum embedment El 84	1.79	1.66
Option 2A and 2B Section A-A' Piles at property line, no wall	Long Term, Stabilization Minimum embedment El 84	1.53	1.55
Option 3 Section A-A' Piles at property line, extend to FG El122	Long Term, Stabilization Minimum embedment El 84	1.59	1.41

Because the existing slope without modification met the screening criteria for seismically-induced landslides, Newmark analyses for estimating slope deformation during strong seismic shaking was not required or performed. Under the seismic loading criteria selected, the slope meets the minimum screening factor of safety with 15cm deformation and in front of the FS=1.1 line. The structures should be set back from this line, or designed to accommodate displacement up to 15 cm. At Cross-Section A-A' this setback distance is 16 feet, and at Cross-Section B-B' this setback distance is 10 feet.

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 Summary of Conclusions and Recommendations

This proposed Fire Station No. 10 site is not within a currently designated Alquist-Priolo Earthquake Fault Zone. However, as is the case for most of southern California, strong ground shaking is expected to occur at this site, and these buildings should be designed to resist ground shaking.

The soils at the site consist of undocumented fill and or native soils encountered to depths up to approximately 5 feet below existing grade; possibly deeper locally. Existing undocumented fill should not be used to support new shallow foundations without excavation, replacement in lifts on undisturbed native soils, and proper compaction throughout, as described below.

Based on local historical and recent subsurface exploration data, (State of California 1968, Padre 1999), ground water has not been encountered to depths of 70 feet. On site soils consist of a thin layer of undocumented fill mantling young marine terrace deposits to the depths explored. Due to the potential for ground shaking, we have performed a seismic settlement evaluation based on Boring LB-2 which has SPT blow counts at 2½-foot intervals. Based on our analyses, dry sand settlement has been predicted to occur at this site with a potential for surficial settlement in the range of 1.5 to 2 inches resulting from a strong ground shaking induced by a regional earthquake.

A conventional shallow spread-footings may be utilized to support the structure. Foundations should be designed to tolerate anticipated settlements on the order of 2 inches and differential settlement on-the-order of an inch over 40 feet.

Specific geotechnical design recommendations are provided in the following sections for use in designing this fire station.

3.2 Plans, Specifications, and Construction Review

Because subsurface conditions will vary due to previous construction and demolition on site, we anticipate that while the conditions are expected to be relatively uniform across the site at depth, shallow soil conditions may vary considerably between and beyond our borings (particularly in the area of the old gas station). Based on this and to check that these report recommendations have been properly implemented, we recommend that a California licensed Geotechnical Engineer be retained to:

1) Review final civil and structural plans and specifications,

2) Observe and document existing fill removal excavations, and

3) Observe and test all structural and ancillary/utility backfill.

In addition, our assumed and/or actual geotechnical conditions can be greatly affected by construction processes and seasonal weather changes. In addition, our conclusions and recommendations in this report have been based on assumed subsurface conditions using a limited number of exploration locations. For these reasons, our geotechnical recommendations are contingent upon a reputable California licensed Geotechnical Engineer providing geotechnical observation and testing services when actual subsurface conditions become known within excavations across all portions of proposed improvement areas during construction.

3.3 Earthwork

All earthwork should be performed in accordance with the Earthwork and Grading Guide Specifications presented in Appendix F, unless specifically revised or amended below or by our future review of project design documents. Site-specific earthwork recommendations are presented in the following subsections:

3.3.1 Preparation

Prior to grading, the site should be cleared of vegetation, trash, significant organic material and debris. Any underground obstructions onsite should be removed (e.g. abandoned utilities, monitoring wells, etc.). Resulting cavities should be properly backfilled and compacted. Efforts should be made to locate any existing utilities. Those utilities should be removed or rerouted where interfering with proposed construction and resulting cavities should be properly backfilled and compacted. In addition, any uncontrolled artificial fill, if encountered, should be excavated from proposed areas of improvements.

3.3.2 Overexcavation and Recompaction

All undocumented fill at the site should be removed within all proposed structural and flatwork areas. Thereafter, and to reduce the potential for adverse differential settlement of proposed structures, we recommend that onsite soil below the proposed buildings be over-excavated and recompacted such that at least 3 feet of compacted fill results below the bottom of proposed foundations. Overexcavation and recompaction should extend a minimum horizontal distance of 3 feet from the exterior portions of shallow foundation perimeters, or the thickness of fill that underlies footings, whichever is greater. These preceding recommendations are valid for buildings up to two stories in height.

Areas outside overexcavation limits for buildings planned for asphalt or concrete pavement, flatwork, and/or areas to receive fill should be over-excavated to a minimum depth of 2 feet below proposed pavement subgrade, whichever is lower. Local conditions may require deeper overexcavation (such as areas of former USTs backfilled with non-engineered fill); such areas should be evaluated by the Geotechnical Engineer of Record during grading. If encountered under building footprints, all undocumented fill should be excavated and recompacted.

After completion of the undocumented fill removal, overexcavation, and prior to fill placement, exposed surfaces should be scarified to a minimum depth of 6 inches and moisture-conditioned. After moisture conditioning, exposed surfaces at the bottom of excavations should be moisture conditioned to approximately 2% above optimum moisture and recompacted to a minimum 90 percent relative compaction, relative to the ASTM D 1557 laboratory maximum density.

3.3.3 Fill Placement and Compaction

Encountered onsite sandy silt materials are generally suitable for use as compacted structural fill, provided that proposed fill soils are free of significant organic material, debris and oversized rock (greater-than 6 inches in greatest dimension). Soil to be placed as fill, whether onsite or import material, should be observed and reviewed by the California licensed Geotechnical Engineer of Record; and tested if deemed necessary. Clay, organic and/or contaminated soils should not be imported to the site. Soils near the surface at our exploration locations were at or near Optimum Moisture content when samples from these locations were tested by us. However, some moisture conditioning of earth materials may be required to achieve adequate compaction.

All fill soil should be placed in thin, loose lifts, sufficiently and uniformly moisture-conditioned to approximately 2% above optimum moisture, and compacted to a minimum of 90 percent relative compaction within proposed building footprints, and 95 percent relative compaction underneath paved areas. Aggregate base should also be compacted to a minimum of 95 percent relative compaction. In all cases for this project, relative compaction should be measured using the ASTM D 1557 modified Proctor laboratory maximum-density test-method.

3.3.4 **Utility Trench Backfill**

Utility trenches should be backfilled with compacted fill in accordance with Sections 306-1.2 and 306-1.3 of the *Standard Specifications for Public Works Construction,* ("Greenbook"), current Edition. Otherwise, or as an option, the pipe bedding zone can be backfilled with Controlled Low Strength Material (CLSM) consisting of at least one-and-one-half (1.5) sack of Portland cement per cubic-yard of sand, and conforming to Section 201-6 of the current edition of Greenbook and City of Goleta standards. Specifically, prior to backfilling trenches, pipes should be bedded in and covered with either CLSM or a uniform, granular material that has a Sand Equivalent (SE) of 30 or greater, and a gradation meeting requirements of the pipe manufacturer. Onsite soils are predominantly **un**suitable for the pipe zone. Bedding should be placed to 1-foot (0.3 m) over the top of the conduit, and densified by jetting in areas of granular soils, if allowed by the permitting agency. Jetting of the bedding around the conduits should be observed by the Geotechnical Engineer of Record during pipe installation. CLSM should **not** be jetted.

Above the pipe zone, trenches can be backfilled with excavated onsite soils free of debris, organic and oversized material greater-than 3-inches in largest dimension. As an option, the whole trench can be backfilled with one-sack CLSM in the same manner as presented above as an option for the pipe bedding zone. Oversized rock (cobbles and/or boulders) should either be removed from the alignment, or pulverized for use in backfill above the pipe zone. Gravel larger than ¾-inch in diameter should be mixed with at least 80-percent soil, by volume which passes the No. 4 sieve. Native soil backfill over the pipe bedding zone should be placed in thin lifts, moisture conditioned, as necessary, and mechanically compacted using a minimum standard of 90 percent relative compaction, relative to the ASTM D 1557 laboratory maximum dry density. Backfill above the pipe zone should **not** be jetted. In any case, backfill above the pipe zone (bedding) should be observed and tested under the supervision of a California licensed Geotechnical Engineer.

3.3.5 Surface Drainage

Surface drainage should be designed to direct water away from foundations and the top of the northern slope toward approved drainage devices. Irrigation of landscaping (if any) should be controlled to maintain, as much as possible, a consistent moisture content sufficient to provide healthy plant growth without over-watering. Water should not be allowed to flow uncontrolled to flood foundation soils. Care should be taken by the civil engineer to ensure the final project grades direct surface drainage away from the slope.

Landscaping irrigation should not be installed adjacent to the northern slope and surface drainage should be directed away from the slope. Portions of the slope that are not improved will be especially subject to erosion, and any water that enters into the subsurface near or immediately adjacent to the slope may cause seepage.

Field testing indicated low infiltration rates, when compared to the sandy nature of the marine terrace deposits onsite. Based on the depth and the soils encountered in the borings, it appears that the tests were affected by shallow clayey soils identified in the boring logs at depths of between 10 to 15 feet. Sandy soils are present below this depth, as observed in LB-3A, which collapsed from a depth of 25 feet to 15 feet before the standpipe casing could be installed. If onsite infiltration systems are to be designed, they should be set well away from the slope and deeper infiltration testing should be performed to determine the infiltration rate of the sandy soils below 15 feet.

3.3.6 Construction Observation

All grading and earthwork should be observed and testing under the direction of a licensed California Geotechnical Engineer to check that the site is properly prepared, the selected fill materials are satisfactory, and that placement and compaction of the fills has been performed in accordance with our recommendations and the project specifications. Sufficient notification to the Geotechnical Engineer of Record prior to earthwork is essential. Project plans and specifications should incorporate all recommendations contained in the text of this report.

Variations in site conditions are possible and may be encountered during construction. To confirm correlation between subsurface data obtained during our subsurface explorations and actual subsurface conditions encountered during construction, and to observe conformance with the plans and specifications, it is essential that a reputable California licensed Geotechnical Engineer be retained to perform continuous or intermittent review during earthwork, excavation and foundation construction phases.

3.4 Slope Mitigation Alternatives

At this time, the existing slope that extends across and parallel to the north site margin has a long term Factor of Safety (FS) of less than 1.5, and requires mitigation. Based on discussions with the project team and the City, the City requested evaluation of the option to install piles along the northern property line and extend it above grade. This has been included as Mitigation Option 3 in this report, and preliminary design parameters are provided following. However, there are design and constructability issues with this alternative that must be addressed with a pile installation contractor and the structural engineer before final design parameters can be provided. Leighton has evaluated two other options, Option 2A and 2B, that also use piles and a reconstructed slope to mitigate slope stability and slope erosion. We provide those recommendations herein.

Design Considerations: During project meetings and engineering evaluation, Leighton concluded the following:

- UPRR has stated that it reserves the right to modify the slope within its right of way at any time.

- Because of the loose sandy nature of the onsite soil, any exposed slope will need to be protected from erosion.
- Based on stability analyses for seismic conditions, the area adjacent to the slope will be subject to seismic deformation on the order of 15cm. If a lower threshold of displacement is preferred, higher seismic design loads will be required.
- Piles placed between the top of slope and the property line will need to retain the entire height of the slope that is subject to seismic displacement to finished grade (depending on option selected), from approximately elevation 84 feet (minimum five-foot pile embedment into competent materials) to design grade.

Based on the above design considerations, following are slope mitigation alternatives;

- Option 1: Piles at top of existing slope, no mitigation of the descending slope. This is the simplest mitigation for site stability, but without repair of the existing eroded slope, may not be acceptable to the City.
- Option 2A and 2B: Piles installed at either the property line (El. 111) with a reconstructed 2:1 h:v slope behind it (Option 2A) or piles installed midslope (El. 117) with a reconstructed 2:1 h:v slope behind, utilizing soil amendments or erosion control in order to improve its long term surficial performance. This option addresses stability and the eroded slope condition.
- Option 3, City preferred alternative: Piles installed at the property line (El. 111) and extended to finished grade (estimated at El. 122). This option is feasible, but due to existing topography, this option requires special consideration due to constructability issues. Extending the piles from the current elevation of the property line to the finished grade level will require special construction methods and structural details. Input will be needed from a pile installer. Design loads will require specialized design-specific analysis once a final configuration has been selected.

Recommendations following are provided for mitigation Options 2 and 3.

3.4.1 Design Earth Pressure

The analysis assumed continuous 24-inch diameter piles utilizing a mass concrete shear strength derived from a concrete compressive strength of

3,600 psi. The actual shear strength of the pile should be higher if the shear strength of the steel reinforcement (not known at this time) is included in the calculations. The recommended earth pressure parameters designing the piles are as follows:

Table 5 – Active Earth Pressures

Options	Ka, Active	Keq, (kh=0.211)
Option 2A *Piles along property line*	0.239	0.503
Option 2B – Piles at mid-slope between top of slope and property line	0.227	0.127
Option 3 - Pile Wall at Property Line	0.234	0.1

A passive coefficient Kp of 3.5 may be used to calculate the passive resistance in front of the piles. The value should be reduced by one-half if the piles are embedded in sloping ground. A unit weight of 120 pounds per cubic foot (pcf) may be used in calculating the equivalent fluid pressure. A uniform surcharge load of 100 psf should be included in calculating the lateral earth pressure.

3.4.2 <u>Pile Embedment</u>

In order to determine the minimum embedment depth for piles, static and pseudo-static global stability analyses were conducted evaluating the final conditions. Both options assume 24-inch diameter piles along the slope. Based on the analyses, global stability issues requires a minimum pile embedment depth of 5 feet below the lowest adjacent Railroad grade at toe of slope (approximately El. 89), whether the piles are installed near the property line or at the top of slope. Minimum embedment depth is based on stability analyses for final conditions assumed; actual pile embedment will need to be determined based on design by the project structural engineer.

3.4.3 <u>Drilled Soldier Piles</u>

Drilled reinforced piles or soldier piles should be designed by a licensed structural engineer. Due to the sandy, slightly cemented nature of the soils, and potential for future erosion, a continuous line of piles should be installed along the slope for global stabilization. Piles will need to return into the slope at both western and eastern limits of the stabilized slope. Piles should be spaced horizontally at a minimum of three pile diameters center-to-center, and the space between may be bridged with smaller piles, depending on final design. Groundwater is not expected to be encountered above a depth of 70 feet based on previous explorations in the vicinity (Padre, 1999 and Caltrans, 1968). Pile reinforcement should be designed to allow workers to lower a concrete pump hose down through the reinforcement cage, for proper concrete placement.

Drilling for pile installation must be monitored by Leighton Consulting, Inc. to confirm that piles are properly constructed. Insufficient cleaning of the caisson or soldier pile excavation bottoms and improper placement of concrete may greatly reduce supporting capacity. All proposed construction methods should be reviewed by Leighton Consulting, Inc. prior to the start of construction.

3.4.4 Backfill

Retaining structures planned at the site should be backfilled with granular, non-expansive soil (Expansion Index less than 20). Based on our tests, the use of onsite soils can be considered. Backfill should be compacted to at least 90 percent of the maximum dry density obtained by ASTM Test Method D 1557. Relatively light equipment should be used for backfilling behind retaining structures.

3.4.5 Drainage

All walls should be constructed with a backdrain. The backdrain should be sloped at a minimum of two percent toward an approved non-erosive outlet. The walls should also be waterproofed or at least damp-proofed, depending upon the degree of moisture protection desired. Surface drainage should be designed to direct water away from the wall and toward approved drainage devices.

3.5 Seismic Design Parameters

Moderate to strong ground shaking due to seismic activity is expected at the site during the life span of the project. A site-specific ground motion analysis was performed in accordance with the 2016 California Building Code (CBC) following the procedures of ASCE 7-10 Publication, Section 21.2, as presented in *Seismic Design Parameters*, Appendix C.

The deterministic and probabilistic seismic hazard analysis was performed using the computer program EZ-FRISK (Risk Engineering, 2011) to estimate peak horizontal ground acceleration (PHGA) that could occur at the site, and to develop design response spectra. Various probabilistic density functions were used in this analysis to assess uncertainty inherent in these calculations with respect to magnitude, distance and ground motion. An averaging of the following next-generation attenuation relationships (NGAs) was used with equal weights to calculate site-specific PHGA and spectra:

- Abrahamson et al. (2014),
- Boore et al. (2014),
- Campbell and Bozorgnia (2014), and
- Chiou and Youngs (2014).

The design response spectrum shown on Figure D-1 is derived from a comparison of probabilistic Maximum Considered Earthquake (MCE) and the 84th percentile of the deterministic MCE. In accordance with the 2016 CBC, peak ground accelerations are estimated based on earthquake ground motion having a 2 percent probability of exceedance in 50 years (ASCE, 2013). The seismic coefficients for the General Procedure were calculated utilizing an interactive program on current United States Geological Survey (USGS) website using ASCE 7-10 reference. The site-specific seismic coefficients are presented in Table 1 below.

Table 6 – 2016 CBC Based Seismic Design Parameters

Categorization/Coefficients	Code-Based (1) (2)	Site-Specific (2) (3)
Site Longitude (decimal degrees) West	-119.90555° W	
Site Latitude (decimal degrees) North	34.43136° N	
Site Class	D	
Mapped Spectral Response Acceleration at 0.2s Period, S_s	2.891	-
Mapped Spectral Response Acceleration at 1s Period, S_1	1.030	-
Short Period Site Coefficient at 0.2s Period, F_a	1.0	-
Long Period Site Coefficient at 1s Period, F_v	1.5	-
Adjusted Spectral Response Acceleration at 0.2s Period, S_{MS}	2.891	2.891
Adjusted Spectral Response Acceleration at 1s Period, S_{M1}	1.545	1.545
Design Spectral Response Acceleration at 0.2s Period, S_{DS}	1.928	1.767
Design Spectral Response Acceleration at 1s Period, S_{D1}	1.030	1.446

1. All were derived from the USGS web page: http://earthquake.usgs.gov/designmaps/us/application.php
2. All coefficients in units of g (spectral acceleration)
3. See Appendix C for details of the site-specific evaluation.

Based on our borings, the building will be underlain by moderately dense silty sand and sandy silt. Therefore, in accordance with the 2016 CBC, this site should be classified as a Class D site. The results of this analysis also indicate that the Peak Ground Acceleration (PGA_M) for this site is 1.186g based on the USGS General Procedure. The summary reports are included in Appendix C.

3.6 Shallow Foundations

Based on our exploration and our experience in the region, and discussions with the design team, shallow foundations may be utilized for the Fire Station main building.

3.6.1 Allowable Bearing

Footings should extend at least 18-inches beneath the lowest adjacent finish grade. At these depths, footings should be founded in engineered fill compacted to a minimum 90% relative density. and may be designed for a maximum allowable bearing pressure of 2,500 psf. The allowable pressures may be increased by one-third when considering loads of short

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duration such as wind or seismic forces. The minimum recommended width of footings is 12 inches for continuous footings and 18 inches for square or round footings. Footings should be designed in accordance with the structural engineer's requirements and have a minimum reinforcement of four No. 5 reinforcing bars (two top and two bottom).

This allowable bearing value may be increased by 400 psf per foot increase in depth or width to a maximum allowable bearing pressure of 4,000 psf. These allowable bearing pressures are for total dead load and sustained live loads, and can be increased by one-third for short duration seismic and wind loads. Slab reinforcement should be designed by the structural engineer.

3.6.2 Lateral Load Resistance

Soil resistance available to withstand lateral loads on a shallow foundation is a function of frictional resistance along the base of foundations and passive resistance that may develop as the edge of the mat is forced horizontally into soil. Frictional resistance between the base of the foundation and the subgrade soil may be computed using an allowable coefficient of friction of 0.30 (30% of vertical dead plus sustained loads). Passive resistance may be computed using an equivalent fluid pressure of 400 pounds-per-square-foot per foot embedment (pcf), assuming there is constant contact between the foundation and compacted fill.. These allowable passive pressure and coefficient of friction values may be increased by one-third when considering loads of short duration, such as those imposed by wind and seismic forces. These design parameters have also already been reduced by a factor-of-safety of 1.5.

3.6.3 Settlement Estimates

Static settlement of the fire station structures will depend on the loads imposed. However, based on the assumption that single-story structures are proposed, recommendations for foundation design and site preparation, we preliminarily estimate static post-construction settlement of less than 1/2 inch (total) and 1/4-inch (differential) over 40 feet. We can provide refined settlement estimates when we are provided structural loads.

Total dynamically-induced settlement for the site was calculated to be on the order of 1.5 to 2 inches due to dry sand settlement. Differential settlement may be taken at half of total settlement, but is expected to be on the order of an inch over a 40-foot horizontal run at this site. These settlement estimates should be reevaluated by us when foundation plans and actual loads for the proposed structures become available.

3.7 Foundations for Ancillary Improvements

Trash enclosures, masonry screen walls and hose drying racks can all be founded on conventional spread footings bearing on at least 2 feet of properly compacted fill over native soils, as described in Section 3.4 of this report. Specific recommendations for ancillary structures are presented in the following subsections:

3.7.1 Minimum Embedment and Width

Spread footings for trash enclosures and screen walls should have a minimum embedment of 24 inches, or 12-inches for other lightly loaded foundations, all with a minimum width of 12-inches.

3.7.2 Allowable Bearing Capacity

An allowable bearing capacity of 2,500 pounds-per-square-foot (psf) may be used, based on the minimum embedment depths and width, above. This allowable bearing value may be increased by 400 psf per foot increase in embedment-depth or width to a maximum allowable bearing pressure of 4,000 psf. These allowable bearing pressures are for total dead load and sustained live loads, and can be increased by one-third when considering short-duration wind or seismic loads. Footing reinforcement should be designed by the structural engineer, but continuous horizontal reinforcement of wall foundations is recommended to span across variations in subgrade support which may result in localized differential settlement.

3.7.3 Lateral Load Resistance

Frictional resistance between the base of footings and compacted subgrade soils may be computed using a coefficient of friction of 0.30. The passive resistance may be computed using an equivalent fluid pressure of 400 pounds-per-cubic-foot (pcf), assuming there is constant contact between the footing and properly compacted backfill. This passive resistance is reduced compared to what is recommended for mat foundations, due to diminished lateral capacity in areas of less overexcavation and recompaction. These friction and passive values have already been reduced by a factor-of-safety of 1.5, and can be increased by one-third when considering short-duration wind loads. For spread footings and slabs-on-grade bearing on properly compacted fill over undisturbed native soils, full friction and passive resistance can be combined to resist lateral loads; although some lateral displacement is required to mobilize full passive resistance.

3.8 Pier Foundations (Flagpole and Light Poles)

Although specified in the design, we assume that lightpoles and flagpole are likely to be included in site improvements. These can be supported on cast-in-drilled-hole (CIDH) piles (or piers) on site, depending on the structure height, vertical and lateral loads. For shallow drilled cast-in-place concrete friction piles/shafts, the following design recommendations can be used:

3.8.1 Downward Pier Capacity

Flag and light poles can be supported on drilled cast-in-place concrete pier foundations, **if** caving sands are controlled by temporary casing or other effective means that do not reduce or eliminate skin friction. Friction parameters presented in this section are based on the assumption that drilling mud will not be used to install these piers. An allowable skin friction of 100 pounds-per-square-foot (psf)/foot can be used for concrete piers cast directly against undisturbed native alluvium and/or properly compacted fill, a minimum of 6 feet deep when discounting the top one foot of penetration. End bearing should **not** be used due to the caving potential and likelihood of loose sands at the bottom of piers. This allowable skin-friction value can be increased by one-third for wind loading (should not be increased for seismic loading). Piers should have a minimum center-to-center spacing of at least three-pier-diameters on center. Otherwise, a group action reduction in capacity will be required for piers spaced closer than three-pier-diameters.

3.8.2 Lateral Pier Capacity

Resistance to lateral loads during short-duration wind and/or seismic ground shaking may be developed by passive soil pressures acting on the side of piers cast against undisturbed soil or properly compacted fill. In accordance with Section 1806A.3.4 of the 2016 California Building Code (CBC); specifically, a passive equivalent fluid pressure of 400 pounds-per-square-foot per foot of embedment (pcf) acting against an isolated pier can be used, not to exceed total passive pressure of 3,000 pounds-per-square-foot (psf). This can be increased by a factor of two to 900 pounds-per-square-foot per foot of embedment (pcf) if designed to accommodate one-inch of deflection. This allowable passive pressure can be increased by one-third for wind loading in combination with static loading (should not be increased for seismic loading). This design allowable passive resistance is based on the assumption that piers penetrate either undisturbed native alluvium or new fill compacted to at least 90-percent of the ASTM D 1557 laboratory maximum density, and is also based on the assumption that ½-inch of lateral deflection at the ground surface is allowable.

3.9 Portland Cement Type and Corrosion Protection

Based on results of our laboratory testing (soluble sulfate of ≤425 ppm), concrete structures in contact with onsite soil will have "**negligible**" exposure to water-soluble sulfates in tested site soil. Therefore, in accordance with ACI 318-05, Table 4.3.1 as referenced in the 2016 California Building Code (CBC) Section 1904, there are no special requirements for concrete in contact with shallow site soils we tested provided the concrete will not be exposed to irrigation water. Import fill soils should be tested for corrosivity and sulfate attack before import to the sites. The site soil is also not corrosive to embedded metals (soluble chloride and pH)

Based on our laboratory test results, tested soils exhibited soil resistivity's as low as 988 ohm-centimeters. Based on generally-accepted resistivity correlations, it appears that corrosion potential for onsite soils may be characterized as "**very severely corrosive**" for ferrous metals in contact with these soils. Therefore, based on these results, ferrous pipe buried in moist to wet site earth materials should be avoided by using high-density polyethylene (HDPE), polyvinyl chloride (PVC) and/or other non-ferrous coatings or pipe when possible. Ferrous pipe can also be protected by polyethylene bags, tap or coatings, di-electric fittings or other means to separate the pipe from on-site soils.

A corrosion engineer should be consulted for mitigation measures for corrosive soils against buried metals.

3.10 Preliminary Pavement Design

Based on testing of 1 bulk soil sample on site, the R-value of the subgrade section is greater than R=40, which was used in evaluating pavement sections. We understand that both asphaltic concrete pavement (AC) and Portland Cement Concrete (PCC) will be utilized in the project. We have provided pavement sections for both based on Traffic Indices of TI=5 through 12. Appropriate Traffic Index (TI) data should be verified by the project civil engineer or traffic engineering consultant and design R-value of subgrade soils will need to be verified after completion of rough grading to finalize pavement design. The values for AC pavement sections are based on the current Caltrans *Highway Design Manual.*

Table 7 – AC Pavement Section based on R-Value =40

Traffic Condition	Traffic Index (TI)*	Pavement Section Thickness (inches)**	
		AC	Aggregate Base
Arterial - Heavy truck traffic	12.0	7.5	13.5
Arterial - Heavy truck traffic	11.0	7	12
Arterial - Heavy truck traffic	10.0	6.5	10.5
Arterial - Heavy truck traffic	9.0	5.5	9.5
Local Industrial and Major Collector	8.0	4.5	9
Local Commercial and Minor Collector	7.0	4	7
Local surface streets	6.0	3.5	5.5
Local surface streets	5.0	3	4

*TI range provided by Civil Engineer to include possible Hollister Avenue improvement

**This does not include City of Goleta minimum pavement section thickness.

Based on design procedures outlined in the current Caltrans *Highway Design Manual* (Table 623.1D), an R-value of at least (≥) 40 for subgrade soils (based on fill material in the upper 5 feet from LB-7 and anticipated import soil variations) and assumed R-value of 78 for aggregate base, jointed plain concrete pavement (JPCP) sections may consist of the following for the Traffic Index (TI) indicated:

Table 8 –Caltrans Concrete Pavement Section

Traffic Condition	Traffic Index (TI)	Pavement Section Thickness (inches)	
		JPCP	Aggregate Base
Heavy truck traffic	≤9.0	9	6

Caltrans JPCP is **not** reinforced other than dowels/tie-bars at joints. PCA-designed concrete pavement should be adequately reinforced to prevent shrinkage cracking (minimal welded-wire-fabric or equivalent) and have a minimum 28-day flexural strength of 550 pounds-per-square-inch (psi). We recommend that crack-control joints be spaced no more than 12 feet on center each way. If sawcuts are used, they should be a minimum depth of ¼ of the slab thickness and made within 24 hours of concrete placement. We recommend that jointed sections be as nearly square as possible (in plan view).

3.10.1 General Pavement Recommendations

Prior to placement of aggregate base, the subgrade should be scarified to a depth of 6 inches and large size rocks (greater than 3 inches) should be removed or broken up. The subgrade should be properly moisture conditioned (±2% of optimum) and compacted to a minimum relative compaction of 95 percent of the laboratory dry density (ASTM Test Method D 1557) and non-yielding. Similarly, aggregate base should be properly moisture conditioned and compacted to a minimum relative compaction of 95 percent and non-yielding under typical construction equipment wheel loads.

Adequate drainage (both surface and subsurface) should be provided such that subgrade soils and aggregate base materials are not allowed to become saturated. All pavement construction should be performed in accordance with the Caltrans *Standard Specifications* (current). Recommended structural pavement materials should conform to the specified provisions in the Caltrans *Standard Specifications* (2010) including grading and quality requirements, shown below:

- **Portland Cement Concrete (PCC)** pavement should conform to Section 40 of the *Standard Specifications*. PCC pavement materials (pavement, structures, minor concrete) should conform to Section 90 of the *Standard Specifications*.

- **Asphaltic Concrete (AC)** pavement should conform to City Standards, Caltrans Standard Specifications, or the Greenbook (current).

- **Class 2 Aggregate Base (AB)** should conform to Section 26 of the *Standard Specifications*.

4.0 CONSTRUCTION CONSIDERATIONS

4.1 Temporary Excavations

The contractor is responsible for all temporary excavations and trenches excavated at the site and is responsible for design of temporary shoring. Shoring, bracing and benching should be performed by the contractor in accordance with the current edition of the California Construction Safety Orders (see: http://www.dir.ca.gov/title8/sb4a6.html). Existing fill soils conform to OSHA soil Type C. Therefore, if workers are to enter unshored excavations, then temporary cut slopes should be cut no steeper than 1½:1 (horizontal:vertical), for a height no-greater-than 20 feet (California Construction Safety Orders, Appendix B to Section 1541.1, Table B-1). Surcharge loads should not be permitted within a horizontal distance equal to either the height of excavation or 5 feet, whichever is greater, measured from the top of the excavation, unless the excavation is shored or shielded appropriately as described in the following section.

During construction, soil conditions should be regularly evaluated to verify that conditions are as anticipated. The contractor is responsible for providing the "competent person" required by OSHA standards to evaluate soil conditions. Soil types will vary, but Type C soils can be expected at shallow depths (in fill and alluvium). Close coordination between the contractor's competent person and a California licensed Geotechnical Engineer should be maintained to facilitate construction while providing safe excavations. Spoil piles from excavation(s) and construction equipment should be kept away from the sides of cuts. Surcharge loads should not be permitted within a horizontal distance equal to the height of cut or 5 feet, whichever is greater, measured from the top of the cut, without specific review/analysis by a California-licensed Geotechnical Engineer.

4.2 Drilled Cast-In-Place Concrete Pile/Pier Installation Considerations

All pile or pier installation should be observed by the Geotechnical Engineer of Record in accordance with Section/Table 1705A.8/1705.8 of the 2016 California Building Code (CBC). Drilled cast-in-place concrete piles should be installed in general accordance with Section 205-3.3.2 of the current Standard Specifications for Public Works Construction (Green Book). The Geotechnical Engineer of Record should observe and document all pile or pier drilling, and verify that anticipated properly compacted new fill and/or undisturbed native sands are encountered in drilled shafts to the depths specified by the Structural Engineer.

Our borings were drilled with hollow-stem-augers, and when drilling Boring LB-3A we encountered caving sands at depths ranging from 15 to 25 feet. When drilling deeper than approximately 15 feet, temporary casing will probably be required to control drilled shaft caving in fill soils and cohesionless native sands and gravel, prior and during concrete placement.

Concrete should be placed by pump or tremie to within 6-feet of the deposited surface, to reduce concrete segregation and to reduce the potential for shaft wall caving. Casing must be withdrawn as concrete is placed, with no-less-than a vertical foot of concrete within the casing measured from the bottom of the casing, at any time until concrete has been placed up to the top-of-pile. This is to keep a head of concrete in the shaft at all times to reduce caving.

4.3 Geotechnical Review During Construction

If and when plans and specifications are revised, then the California licensed Geotechnical Engineer of record should review these documents to evaluate proposed changes on geotechnical recommendations and design parameters. Our conclusions and recommendations presented in this report should be reviewed and verified by the California licensed Geotechnical Engineer of Record during site construction, and revised accordingly, if exposed geotechnical conditions vary from our preliminary findings and interpretations. Recommendations presented in this report are only valid if a reputable California licensed Geotechnical Engineer verifies site conditions during construction. Geotechnical observation and testing should be provided by a reputable California licensed Geotechnical Engineer during all earthwork, and/or when any unusual geotechnical conditions are encountered.

5.0 LIMITATIONS

This report was based in part on data obtained from a limited number of observations, site visits, soil excavations, samples and tests. Such information is, by necessity, incomplete. The nature of many sites is such that differing soil or geologic conditions can be present within small distances and under varying climatic conditions. Changes in subsurface conditions can and do occur over time. Therefore, our findings, conclusions and recommendations presented in this report are based on the assumption that a reputable California licensed Geotechnical Engineer will provide geotechnical observation and testing during construction.

Environmental services were not included as part of this study. This report was prepared for the sole use of the City of Goleta and their design team for use in designing proposed Fire Station No. 10 in accordance with generally accepted geotechnical engineering practices at this time in Southern California. Please refer to ASFE's Important Information About Your Geotechnical Engineering Report presented in Appendix G of this report.

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APPENDIX A

FIELD EXPLORATION

Prior to subsurface exploration, proposed subsurface exploration locations were cleared by Underground Service Alert (USA). Our subsurface exploration consisted of 7 geotechnical exploratory borings (LB-1 through LB-7) drilled to 55 feet and sampled to 56.6 feet and two infiltration test holes at locations approximately depicted on Plate 1 Geotechnical Exploration Map. Borings and infiltration testing were performed on July 23 and July 24, 2016.

Soils encountered and sampled from our borings were continuously logged in the field by our representative and described in accordance with the Unified Soil Classification System (ASTM D 2488). Both relatively undisturbed California ring-lined soil samples and Standard Penetration Test (SPT) soil samples were obtained at selected depth intervals within the hollow-stem-auger borings, driven with a 140-pound hammer falling 30-inches for both samplers. Blow counts to drive the sampler three 6-inch increments are listed on the boring logs. Shallow bulk soil samples were also collected from our borings. All soil samples were transported to our Irvine geotechnical laboratory for evaluation and appropriate geotechnical testing.

Boring logs are included as part of this appendix. These logs and related information depict subsurface condition only at the location indicated and at the particular date designated on the log. Subsurface conditions at other locations may differ from conditions occurring at each boring location. Passage of time may result in altered subsurface conditions due to possible environmental changes. In addition, any stratification lines on logs represent approximate boundaries between soil types and these transitions may be gradual.

GEOTECHNICAL BORING LOG LB-1

Project No.	11389.001	**Date Drilled**	7-23-16
Project	Goleta Fire Station #10	**Logged By**	BER
Drilling Co.	Woodward	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	116'
Location	Lat: 34.4311105, Long: -119.9054405	**Sampled By**	BER

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
115	0			B-1				ML	**Native Soil (Ts):** @surface: Leaves and bark over SANDY SILT	SA, CR
									Marine-terrace deposits (Qmt):	
110	5			R-1	50/3"				@5' SANDY SILT, brown, slightly moist, nonplastic, 30% fines (field estimate)	SA, CR
									Total depth - 7.5 feet No groundwater encountered Backfilled with soil cuttings	
105	10									
100	15									
95	20									
90	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG LB-2

Project No.	11389.001	**Date Drilled**	7-24-16
Project	Goleta Fire Station #10	**Logged By**	BER
Drilling Co.	Woodward	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	120'
Location	Lat: 34.43125278, Long: -119.9054089	**Sampled By**	BER

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
120	0								**Native Soil (Ts):** @surface: Dry grass and leaves over SILTY SAND	
									Marine-terrace deposits (Qmt):	
				S-1	6 8 11		5	ML	@2.5' SANDY SILT, very stiff, brown, dry, nonplastic	SA
115	5			S-2	6 12 25			CL	@5' CLAY, hard, brown, dry, slightly plastic fines	AL
								CL-ML	@6.3' SILTY CLAY, hard, brown, slightly moist, medium plasticity, lean	
				S-3	10 27 40			ML	@7.5' SILT, hard, yellowish brown, dry, no to low plasticity, contains trace slightly plastic fines	
								SM	@8.3' SILTY SAND, very dense, brown to dark brown, slightly moist, very fine sand, nonplastic	
110	10			S-4	11 27 43		5	SM	@10' Same as above, brown	SA
				S-5	21 21 25			SM	@12.5' Same as above, dense, 1" thick silty bed	
								CL	@13' SANDY CLAY, hard, yellowish brown, moist, medium plasticity	
105	15			S-6	9 14 18			ML	@15' SANDY, CLAYEY SILT, hard, yellowish brown, slightly moist, low plasticity	
								SM	@15.8' SILTY SAND, dense, brown, slightly moist, sand with non-plastic fines	
				S-7	9 33 50/6"			CL-ML	@17.5' SILTY CLAY, hard, dark brown, slightly moist, medium plasticity, Iron oxide staining and black organics observed	
100	20			S-8	18 26 38		11	CL-ML	@20' Same as above	SA
				S-9	19 39 50/3"			SP	@22.5' Poorly-graded SAND, very dense, light brown, slightly moist, fine to medium sand, nonplastic	
								CL	@23.3' SANDY CLAY, dark brown, moist, high plasticity, iron oxide staining	
95	25			S-10	28 50/6"		10	SM	@25' SILTY SAND, very dense, brown, slightly moist, fine to medium grained sand with non-plastic fines, two ~0.5" interbedded silts observed	SA
				S-11	26 42 50/3"			CL	@27.5' SANDY CLAY, hard, moist, medium plasticity, iron oxide staining	
90	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

* * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * *

GEOTECHNICAL BORING LOG LB-2

Project No.	11389.001	**Date Drilled**	7-24-16
Project	Goleta Fire Station #10	**Logged By**	BER
Drilling Co.	Woodward	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	120'
Location	Lat: 34.43125278, Long: -119.9054089	**Sampled By**	BER

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
90	30			S-12	18 22 34			CL	@30' Same as above	
				S-13	16 38 50/4"			ML-CL	@32.5' CLAYEY SILT, hard, light yellowish brown, slightly moist, low plasticity	
85	35			S-14	17 50/4"		12	ML-CL	@35' Same as above, yellowish brown, no to low plasticity	SA
				S-15	33 50/6"			SM	@37.5' SILTY SAND, very dense, light brown, slightly moist, nonplastic, 20% fines (field estimate)	
80	40			S-16	10 18 28		13	ML	@40' SANDY SILT, hard, brown, slightly moist, ~15% (field estimate) non-plastic fines with sand	SA
				S-17	21 50/5"		7	ML	@42.5' same as above	SA
75	45			S-18	30 50/6"			ML	@45' SANDY, CLAYEY SILT, hard, brown	
				S-19	23 50/6"			ML	@47.5 SILT, hard, light yellowish brown to dark bluish gray, dry, nonplastic	
70	50			S-20	26 50/6"			ML	@50' SILT, hard, yellowish brown to light brown, dry, nonplastic	
				S-21	37 50/6"			SM	@52.5' SILTY SAND, very dense, brown, slightly moist, sand with non-plastic fines	SA
65	55			S-22	24 17 14			SM	@55' same as above, dense	
								CL	@56.1' CLAY, gray to light gray, moist, medium plasticity, iron oxide staining	
									Total depth - 56.5 feet No groundwater encountered Backfilled with soil cuttings	
60	60									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG LB-3

Project No.	11389.001	**Date Drilled**	7-23-16
Project	Goleta Fire Station #10	**Logged By**	BER
Drilling Co.	Woodward	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	117'
Location	Lat: 34.43119918, Long: -119.9052246	**Sampled By**	BER

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0							SM	**Native Soil (Ts):** @surface: Leaves and bark over SILTY SAND	
115									**Marine-terrace deposits (Qmt):**	
	5			R-1	50/3"			SM	@5' SILTY SAND, very dense, olive brown, slightly moist, nonplastic, 30% fines (field estimate)	
110										
	10			S-2	23 30 31			ML	@10' SANDY, CLAYEY SILT, brown, slightly moist, no to low plasticity	
105										
	15			R-3	50/5.5"				@15' no recovery	
100										
	20			S-4	8 17 27			CL-ML SP	@20' SILTY CLAY, hard, brown to dark brown, slightly moist, medium plasticity @20.5' Poorly-graded SAND, dense, light brown, slightly moist, fine to medium sand, nonplastic, trace non-plastic fines and charcoal present	
95										
	25			R-5	50/6"			SP	@25' very dense, brown, medium grained sand	
90										
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG LB-3

Project No.	11389.001	**Date Drilled**	7-23-16
Project	Goleta Fire Station #10	**Logged By**	BER
Drilling Co.	Woodward	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	117'
Location	Lat: 34.43119918, Long: -119.9052246	**Sampled By**	BER

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	30			S-6	19			SP	@30-30.7' same as at 25'	
					37 43			GC	@30.7' becomes CLAYEY GRAVEL, very dense, gray, 1/2" average rounded gravel with slightly plastic fines	
85									Total depth - 31.5 feet No groundwater encountered Backfilled with soil cuttings	
	35									
80										
	40									
75										
	45									
70										
	50									
65										
	55									
60										
	60									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-4

Project No.	11389.001	**Date Drilled**	7-24-16
Project	Goleta Fire Station #10	**Logged By**	BER
Drilling Co.	Woodward	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	119'
Location	Lat: 34.43142915, Long: -119.9051491	**Sampled By**	BER

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
	0							SM	**Native Soil (Ts):** @surface: Dry grass and leaves over SILTY SAND	
115									**Marine-terrace deposits (Qmt):** @5' SANDY SILT, hard, light yellowish brown, dry, sand with non-plastic fines	
	5			R-1	50/3"	86	8	ML		
110										
	10			S-2	13 40 503"		11	ML	@10' brown	
105										
	15			R-3	26 34 42	108	12	SC	@15-16' CLAYEY SAND, very dense, brown, slightly moist, sand with slightly plastic fines	
								CL-ML	@16' SILTY CLAY, hard, yellowish brown, slightly moist, slightly to moderately plastic fines with non-plastic fines	
100										
	20			R-4	24 50/6"	107	8	ML	@20' SANDY SILT, hard, brown to dark brown, slightly moist, sand with non-plastic fines, iron oxide staining	
95										
	25			R-5	32 50/4"	79	3	SP	@25' Poorly-graded SAND, very dense, brown, slightly moist, fine to medium grained sand, contains trace slightly plastic fines	
90										
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-4

Project No.	11389.001	**Date Drilled**	7-24-16
Project	Goleta Fire Station #10	**Logged By**	BER
Drilling Co.	Woodward	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	119'
Location	Lat: 34.43142915, Long: -119.9051491	**Sampled By**	BER

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	30			R-6	36 50/6"	113	6	SC-SM	@30' SILTY, CLAYEY SAND, very dense, yellowish brown, slightly moist, sand with non-plastic and slightly plastic fines	DS
85										
	35			R-7	28 50/5"	109	13	SM	@35' SILTY SAND with GRAVEL, very dense, brown to dark brown, slightly moist, sand with up to 10% non-plastic fines and maximum 1.5" rounded gravel	
								CH	@35.5-36' SILTY CLAY, hard, gray to yellowish brown, slightly moist, highly plastic fines with non-plastic fines, contains trace organics	
								ML	@36-36.5' SILT, hard, yellowish brown, dry, non-plastic fines	
									Total depth = 36.5 feet No groundwater encountered Backfilled with soil cuttings	
80	40									
75	45									
70	50									
65	55									
60	60									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-5

Project No.	11389.001	**Date Drilled**	7-24-16
Project	Goleta Fire Station #10	**Logged By**	BER
Drilling Co.	Woodward	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	120'
Location	Lat: 34.43145019, Long: -119.9054776	**Sampled By**	BER

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
120	0							SM	**Native Soil (Ts):** @surface: Tall, dry grass over SILTY SAND	
									Marine-terrace deposits (Qmt):	
115	5			R-1	50/6"	95	4	SM	@5' SILTY SAND, very dense, brown, slightly moist, nonplastic, 10% fines (field estimate), rootlets	
				S-2	22 50/6"			ML	@7.5' SANDY SILT, hard, light yellowish brown, slightly moist, nonplastic	
110	10			R-3	28 35 50/4"	106	3	SP-SM	@10' Poorly-graded SAND with SILT, very dense, yellowish brown, slightly moist, sand with non-plastic fines	CN
				S-4	8 50/6"			SC	@12.5' CLAYEY SAND, very dense, brown, slightly moist, no to low plasticity	
105	15			R-5	28 39 50/3"	114	6	SC-SM	@15' SILTY, CLAYEY SAND, very dense, brown, slightly moist, high plasticity, organics present	DS, CN
				S-6	10 28 39			SM	@17.5' same as above, brown to light brown, clayey component is slightly plastic	
100	20			R-7	44 50/6"	107	10	ML-CL	@20' CLAYEY SILT, hard, light brown, slightly moist, no to low plasticity, organics present	
				S-8	26 50/4"			ML	@22.5' SANDY SILT, hard, brown, dry, nonplastic, organics present	
95	25			R-9	8 34 50/4"	94	3	SP-SM	@25' Poorly-graded SAND with SILT, very dense, brown, slightly moist, sand with non-plastic fines	DS
90	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-5

Project No.	11389.001	**Date Drilled**	7-24-16
Project	Goleta Fire Station #10	**Logged By**	BER
Drilling Co.	Woodward	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	120'
Location	Lat: 34.43145019, Long: -119.9054776	**Sampled By**	BER

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
90	30			S-10	22 27 18			SM	@30' SILTY SAND, dense, brown, slightly moist, nonplastic, 1" thick bed of dark brown, high plastic CLAY in middle of sample	
85	35			R-11	28 34 50/6"	109	10	CL	@35' CLAY, hard, light yellowish brown, slightly moist, slightly plastic fines	DS
80	40			S-12	7 20 20			CL-ML	@40' SILTY CLAY, hard, brown, slightly moist, medium plasticity	
75	45			R-13	8 27 50/4"	112	7	CL	@45' CLAY, hard, dark brown, slightly moist, medium plasticity	
								ML	@45.7' SANDY SILT, hard, brown, slightly moist, nonplastic, slightly cemented	
70	50			S-14	30 50/5"			SP	@50' Poorly-graded SAND, very dense, white to light tan, slightly moist, very fine sand, nonplastic	
65	55			R-15	32 50/6"	83	2	SP	@55' same as above	
									Total depth of 56.0 feet No groundwater encountered Backfilled with soil cuttings	
60	60									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-6

Project No.	11389.001	**Date Drilled**	7-23-16
Project	Goleta Fire Station #10	**Logged By**	BER
Drilling Co.	Woodward	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	121'
Location	Lat: 34.43145946, Long: -119.9058257	**Sampled By**	BER

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Soil Description	Type of Tests
120	0			B-1 R-1	8 10 10			SM	**Artificial Fill (Afu):** @surface: Tall grass, shrubs, bushes over SILTY SAND, brown, dry, sand with ~15% non-plastic fines, contains up to 1" angular gravel - possible fill	RV, CR
									Marine-terrace deposits (Qmt):	
115	5			R-2	50/6"			SM	@5' SILTY SAND, very dense, brown, slightly moist, sand (coarse grained sand up to 1/2" average) with non-plastic fines, trace gravel, possible slough	
110	10			R-3	50/6"			CL	@10' CLAY, hard, brown, slightly moist, slightly plastic fines, possible claystone gravel	CN
105	15			R-4	44 27 33			ML	@15-15.75' SILT, hard, brown, slightly moist, non-plastic fines	
								CL-ML	@15.75' SILTY CLAY, hard, brown to dark brown, slightly moist, moderately plastic fines with non-plastic fines	
									Total depth - 16.5 feet No groundwater encountered Backfilled with soil cuttings	
100	20									
95	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-7

Project No.	11389.001	**Date Drilled**	7-23-16
Project	Goleta Fire Station #10	**Logged By**	BER
Drilling Co.	Woodward	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	120'
Location	Lat: 34.43125657, Long: -119.9057104	**Sampled By**	BER

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Graphic Log: N S

Elevation Feet	Depth Feet	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
120	0		B-1				SM	**Artificial Fill (Afu):** @surface: Tall dry grass and shrubs over SILTY SAND, dark brown, sand with non-plastic fines	SA, EI, DS, MD
115	5		R-1	50/4"				**Marine-terrace deposits (Qmt):** @5' No recovery	
110	10		S-2	16 18 25			ML-CL	@10' CLAYEY SILT, hard, brown to reddish brown, slightly moist, slightly plastic and non-plastic fines	
105	15		R-3	50/6"			SM	@15-16' SILTY SAND with GRAVEL, very dense, light brown, slightly moist, sand with ~20% non-plastic fines (field estimate) and angular/broken gravel, possible slough	
							CL-ML	@16' SILTY CLAY, hard, brown to dark brown, slightly moist, moderately plastic fines with non-plastic fines	
100	20		S-4	9 15 25			CL-ML	@20' trace iron oxide staining and magnesium oxide observed	
95	25		R-5	20 39			CL-ML	@25-26' same as at 16'	
				50/3"			SP	@26' Poorly-graded SAND, very dense, light brown, slightly moist, fine to medium grained sand, contains trace non-plastic fines	
								Total depth - 26.5 feet No groundwater encountered Backfilled with soil cuttings	
90	30								

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
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Boring Percolation Test Data Sheet

Project Number:	11389.001	**Test Hole Number:**	LB-3
Project Name:	Goleta Fire Station #10	**Date Excavated:**	7/23/2016
Earth Description:	Alluvium	**Date Tested:**	7/23/2016
Liquid Description:	Tap water	**Depth of boring (ft):**	14.00
Tested By:	LJD	**Diameter of boring (in):**	8.00
Time Interval Standard		**Diameter of casing (in):**	2
Start Time for Pre-Soak:	7/23/16 9:30 AM	**Length of slotted of casing (ft):**	10
Start Time for Standard:	7/23/16 10:00 AM	**Depth to Initial Water Depth (ft):**	6.90
Standard Time Interval Between Readings, mins:	5	**Porosity of Annulus Material, *n* :**	0.35
Fall in 2 hours, in	23.4	**Bentonite Plug at Bottom:**	No

Percolation Data

Reading	Time	Time Interval, Δt (min.)	Initial(Do) Final (Df) Depth to Water (ft.)	Initial (Ho) Final (Hf) Water Height, H_0/H_f (in.)	Total Water Drop, ΔH (in.)	Percolation Rate (min./in.)	Infiltration Rate (in./hr.)
1	9:00	5	5.30	104.4	1.2	4.17	0.11
	9:05		5.40	103.2			
2	9:07	5	5.40	103.2	2.4	2.08	0.22
	9:12		5.60	100.8			
3	9:13	5	5.60	100.8	6.8	0.73	0.65
	9:18		6.17	94.0			
4	9:19	5	6.17	94.0	1.0	5.21	0.09
	9:24		6.25	93.0			
5	9:28	5	6.25	93.0	0.6	8.33	0.06
	9:33		6.30	92.4			
6	9:34	10	6.30	92.4	1.3	7.58	0.07
	9:44		6.41	91.1			
7	9:46	10	6.41	91.1	1.7	5.95	0.09
	9:56		6.55	89.4			
8	9:57	10	6.55	89.4	1.2	8.33	0.06
	10:07		6.65	88.2			
9	10:09	10	6.65	88.2	0.6	16.67	0.03
	10:19		6.70	87.6			
10	10:21	20	6.70	87.6	1.8	11.11	0.05
	10:41		6.85	85.8			
11	10:21	10	6.85	85.8	2.4	4.17	0.13
	10:31		7.05	83.4			
12	10:43	10	7.05	83.4	0.8	11.90	0.05
	10:53		7.12	82.6			
13	10:33	5	7.20	81.6	0.6	8.33	0.07
	10:38		7.25	81.0			

Infiltration Rate (I) = Flow Volume/Flow Area/Δt

Infiltration Rate, I (Final Reading) = **0.07** **in./hr.**

Flow Volume = Volume Inside of Pipe (V_1) + Volume in Annular Space (V_2)

$V_1 = \pi(r_{casing})^2 \Delta d$

$V_2 = n\,\pi[(r_{boring})^2 - (r_{casing})^2]\Delta d$

Flow Area = $2\pi(r_{boring})H_{average} + \pi(r_{boring})^2$

$H_{average} = (H_o + H_f)/2$

$H_{average} = (H_o + [H_o - \Delta d])/2$

$H_{average} = (2H_o - \Delta d)/2$

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Boring Percolation Test Data Sheet

Project Number:	11389.001	**Test Hole Number:**	LB-1
Project Name:	Goleta Fire Station #10	**Date Excavated:**	7/23/2016
Earth Description:	Alluvium	**Date Tested:**	7/23/2016
Liquid Description:	Tap water	**Depth of boring (ft):**	7
Tested By:	LJD	**Diameter of boring (in):**	8
Time Interval Standard		**Diameter of casing (in):**	2
Start Time for Pre-Soak:	7/23/16 8:20 AM	**Length of slotted of casing (ft):**	4
Start Time for Standard:	7/23/16 9:00 AM	**Depth to Initial Water Depth (ft):**	3.65
Standard Time Interval		**Porosity of Annulus Material, *n* :**	0.35
Between Readings, mins:	10	**Bentonite Plug at Bottom:**	No
Fall in 2 hours, in	6.36		

Percolation Data

Reading	Time	Time Interval, Δt (min.)	Initial/Final Depth to Water (ft.)	Initial/Final Water Height, H_0/H_f (in.)	Total Water Drop, Δd (in.)	Percolation Rate (min./in.)	Infiltration Rate (in./hr.)
1	9:00	5	2.27	56.8	0.6	8.33	0.10
	9:05		2.32	56.2			
2	9:07	5	2.32	56.2	0.5	10.42	0.08
	9:12		2.36	55.7			
3	9:13	10	2.36	55.7	0.7	13.89	0.06
	9:23		2.42	55.0			
4	9:24	10	2.42	55.0	0.7	13.89	0.06
	9:34		2.48	54.2			
5	9:38	13	2.48	54.2	0.6	21.67	0.04
	9:51		2.53	53.6			
6	9:52	17	2.53	53.6	0.8	20.24	0.04
	10:09		2.60	52.8			
7	10:11	20	2.60	52.8	0.8	23.81	0.04
	10:31		2.67	52.0			
8	10:32	10	2.67	52.0	0.4	27.78	0.03
	10:42		2.70	51.6			
9	10:44	10	2.70	51.6	0.4	27.78	0.03
	10:54		2.73	51.2			
10	10:56	10	2.73	51.2	0.2	41.67	0.02
	11:06		2.75	51.0			
11	11:08	10	2.75	51.0	0.6	16.67	0.05
	11:18		2.80	50.4			

Infiltration Rate (I) = Flow Volume/Flow Area/Δt

Infiltration Rate, I (Final Reading) = 0.05 in./hr.

Flow Volume = Volume Inside of Pipe (V_1) + Volume in Annular Space (V_2)

$V_1 = \pi(r_{casing})^2 \Delta d$

$V_2 = n\,\pi[(r_{boring})^2 - (r_{casing})^2]\Delta d$

Flow Area = $2\pi(r_{boring})H_{average} + \pi(r_{boring})^2$

$H_{average} = (H_o + H_f)/2$

$H_{average} = (H_o + [H_o - \Delta d])/2$

$H_{average} = (2H_o - \Delta d)/2$

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APPENDIX B

GEOTECHNICAL LABORATORY TESTING

The geotechnical laboratory-testing program was directed toward a quantitative and qualitative evaluation of the physical and mechanical properties of the soils underlying the site and to aid in verifying soil classification.

In-Situ Moisture and Density: In place dry density determination (ASTM d 2937) was performed on selected relatively-undisturbed samples to measure the unit weight of the subsurface soils (undisturbed samples appropriate for testing were difficult to recover due to rocky soil conditions). Results of these tests are shown on boring logs in Appendix A.

Sieve Analysis: Sieve analyses (ASTM D 6913 and ASTM d 422) were performed on selected samples of the subsurface soils. These tests were performed to assist in the classification of the soil and to determine grain size distributions of the soils. Results of these tests are presented on the “Particle Size Distribution” and “Particle Size Analysis” figures.

Atterberg Limits: The Atterberg Limits testing (ASTM D 4318) was performed to determine engineering classification of the Liquid Limit, Plastic Limit, and Plasticity Index, which are used to classify fine-grained materials. The results of the Atterberg Limits testing are presented on the “Atterberg Limits” figures.

Compaction: A laboratory compaction test (ASTM d 1557) was performed on a representative bulk sample of the surface soil to determine the maximum dry density and optimum moisture content. Results of this test are presented on the following “Modified Proctor Compaction Test” figure.

Direct Shear and Remolded Direct Shear: A direct shear test (ASTM D 3080) was performed on a relatively-undisturbed ring sample. And a remolded direct shear test (ASTM D 3080) was also performed on a selected bulk sample of the subsurface soils, remolded to 90 percent relative compaction, relative to the ASTM D 1557 modified Proctor laboratory maximum density. These tests were performed to estimate strength characteristics (i.e., shear strength) of in-situ soils and future engineered fill comprised of onsite soils. Results of these tests are presented on the “Direct Shear Test Results” figures in this appendix.

Consolidation Tests: Consolidation tests (ASTM D 2435) were performed on selected, relatively-undisturbed ring samples. Soil samples were placed in a consolidometer, and loads were applied in geometric progression. The percent consolidation for each load cycle was recorded as the ratio of the amount of vertical compression to the original 1-inch height. Consolidation curves are plotted on the "One-Dimensional Consolidation" figures in this appendix.

"R"-Value: Pavement subgrade soil resistance "R"-value of a representative bulk sample was determined by the California Standard Test Method No. 301 for subgrade soils. Three specimens were prepared from one bulk sample and exudation pressure and "R"-value determined on each one. The graphically determined "R"-value at exudation pressure of 300 pounds-per-square-inch (psi) is presented in this appendix.

Corrosivity Tests: To evaluate corrosion potential of shallow subsurface soils at the site, we tested two bulk soil samples collected during our subsurface exploration for pH, resistivity and soluble sulfate and chloride content testing. Results of these tests are presented at the end of this appendix.

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
LB-2	2.5							5.3			
LB-2	10.0							5.3			
LB-2	20.0							11.2			
LB-2	25.0							10.4			
LB-2	35.0							11.8			
LB-2	40.0							13.4			
LB-2	42.5							7.1			
LB-4	5.0							8.1	86.3		
LB-4	10.0							10.7			
LB-4	15.0							12.2	107.7		
LB-4	20.0							7.9	107.1		
LB-4	25.0							3.1	79.0		
LB-4	30.0							6.4	113.0		
LB-4	35.0							12.5	109.3		
LB-5	5.0							4.4	94.8		
LB-5	10.0							2.8	106.3		
LB-5	15.0							5.5	114.0		
LB-5	20.0							10.2	106.9		
LB-5	25.0							3.1	93.8		
LB-5	35.0							9.8	109.0		
LB-5	45.0							6.8	111.6		
LB-5	55.0							2.2	82.8		

US_LAB_SUMMARY 11389.001 FIRE STATION BORING LOGS.GPJ ROCKLOG2012.GDT 9/27/16

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Summary of Laboratory Results

Project Name: Goleta Fire Station #10

Project Number: 11389.001

Date: 9/27/2016 11:21:33 AM

Figure No. 1

PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS
ASTM D 6913

Leighton

Project Name: Goleta Fire Station #10
Project No.: 11389.001
Boring No.: LB-1
Sample No.: B-1
Soil Identification: Brown sandy silt s(ML)

Tested By: A. Santos Date: 09/26/16
Checked By: J. Ward Date: 09/27/16
Depth (feet): 0-7

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	M-25	CP-13	Wt. of Air-Dry Soil + Cont.(g)	0.0	0.0
Wt. Air-Dried Soil + Cont.(g)	3081.8	728.9	Wt. of Dry Soil + Cont. (g)	0.0	0.0
Wt. of Container (g)	231.1	223.2	Wt. of Container No.______(g)	1.0	1.0
Dry Wt. of Soil (g)	2850.7	505.7	Moisture Content (%)	0.0	0.0

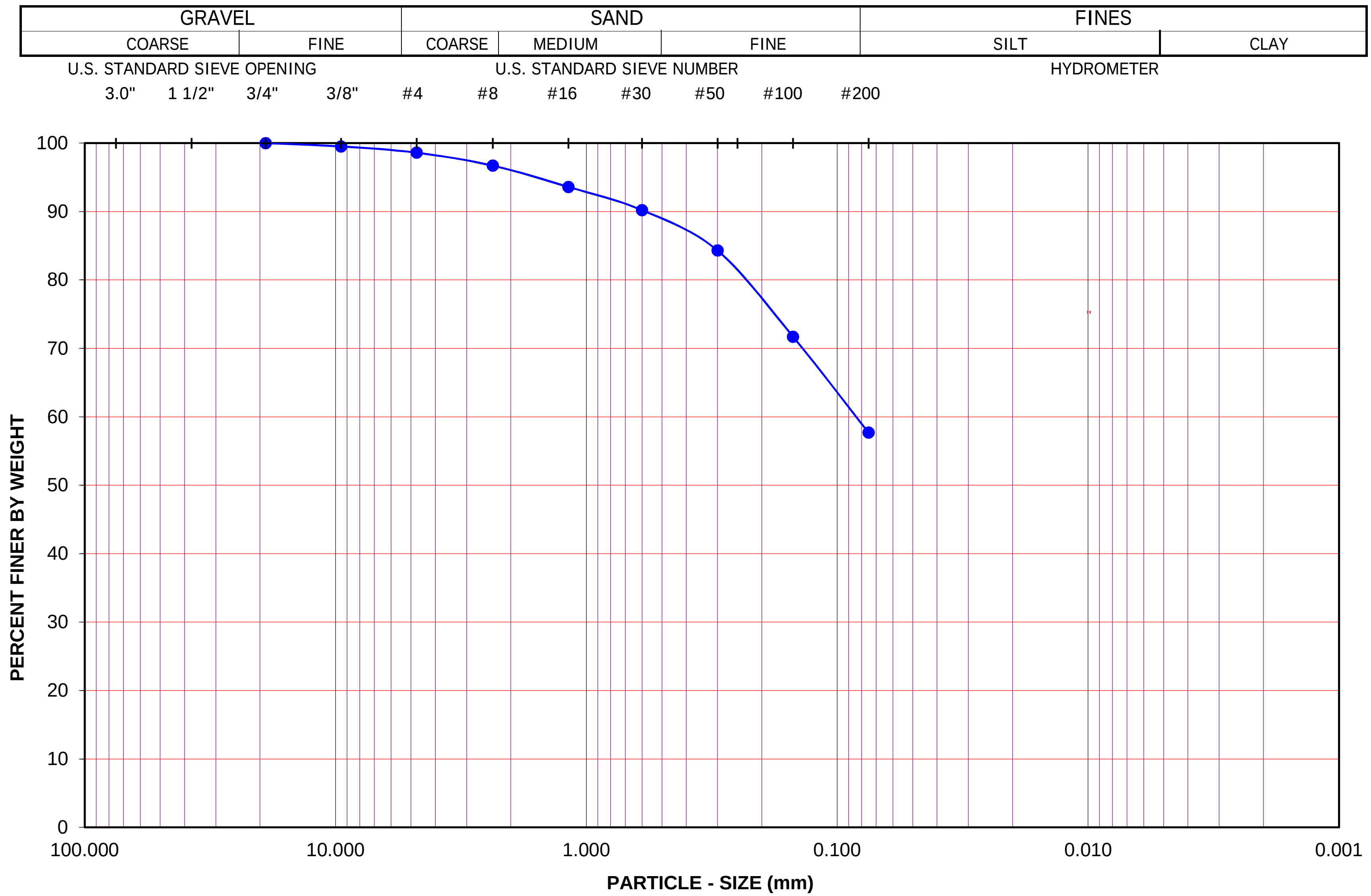
Passing #4 Material After Wet Sieve		
	Container No.	CP-13
	Wt. of Dry Soil + Container (g)	434.1
	Wt. of Container (g)	223.2
	Dry Wt. of Soil Retained on # 200 Sieve (g)	210.9

U. S. Sieve Size		Cumulative Weight of Dry Soil Retained (g)		Percent Passing (%)
	(mm.)	Whole Sample	Sample Passing #4	
3"	75.0			
1 1/2"	37.5			
3/4"	19.0	0.0		100.0
3/8"	9.5	14.4		99.5
#4	4.75	40.3		98.6
#8	2.36		9.7	96.7
#16	1.18		25.5	93.6
#30	0.600		43.2	90.2
#50	0.300		73.2	84.3
#100	0.150		137.8	71.7
#200	0.075		210.0	57.7
PAN				

GRAVEL: **1 %**
SAND: **41 %**
FINES: **58 %**
GROUP SYMBOL: **s(ML)**

Cu = D60/D10 = ________
Cc = $(D30)^2/(D60*D10)$ = ________

Remarks:



Project Name: Goleta Fire Station #10

Project No.: 11389.001

Boring No.: LB-1 Sample No.: B-1

Depth (feet): 0-7 Soil Type : s(ML)

Soil Identification: Brown sandy silt s(ML)

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

GR:SA:FI : (%) 1 : 41 : 58

Sep-16

SA LB-1, B-1 @ 0-7

PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS
ASTM D 6913

Leighton

Project Name: Goleta Fire Station #10
Project No.: 11389.001
Boring No.: LB-2
Sample No.: S-1
Soil Identification: Brown sandy silt s(ML)

Tested By: S. Felter Date: 09/27/16
Checked By: J. Ward Date: 09/27/16
Depth (feet): 2.5

		Moisture Content of Total Air - Dry Soil	
Container No.:	NG-18	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	505.1	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	74.8	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	430.3	Moisture Content (%)	0.00

After Wet Sieve	Container No.	NG-18
	Wt. of Dry Soil + Container (g)	261.9
	Wt. of Container (g)	74.8
	Dry Wt. of Soil Retained on # 200 Sieve (g)	187.1

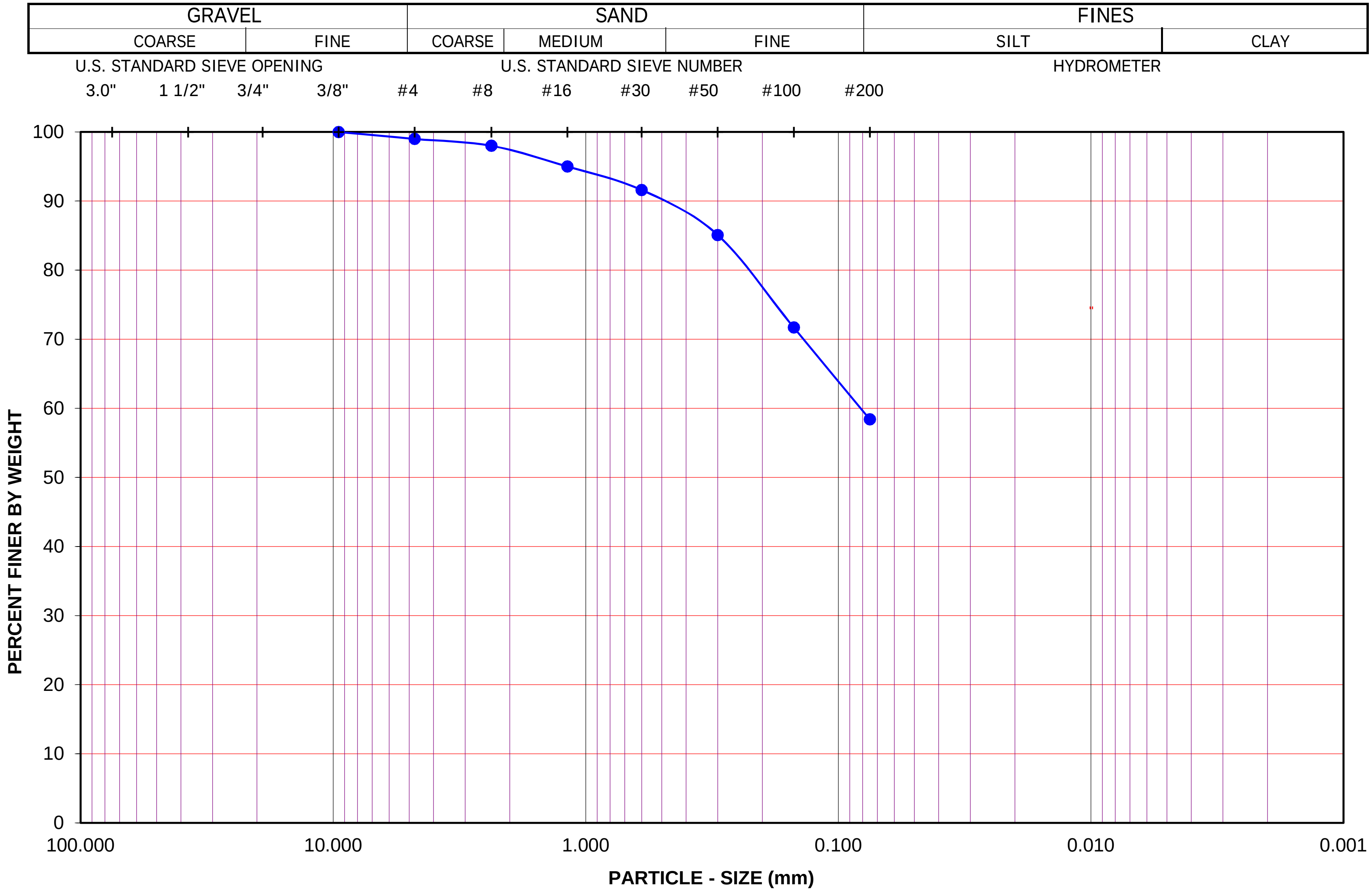
U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
3"	75.0		
1 1/2	37.5		
3/4"	19.0		
3/8"	9.5	0.0	100.0
#4	4.75	4.1	99.0
#8	2.36	8.5	98.0
#16	1.18	21.6	95.0
#30	0.600	36.2	91.6
#50	0.300	64.3	85.1
#100	0.150	121.6	71.7
#200	0.075	178.9	58.4
PAN			

GRAVEL: **1 %**
SAND: **41 %**
FINES: **58 %**
GROUP SYMBOL: **s(ML)**

Cu = D60/D10 = ______

Cc = (D30)²/(D60*D10) = ______

Remarks:



Project Name: Goleta Fire Station #10

Project No.: 11389.001

Boring No.: LB-2 Sample No.: S-1

Depth (feet): 2.5 Soil Type : s(ML)

Soil Identification: Brown sandy silt s(ML)

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

GR:SA:FI : (%) 1 : 41 : 58

Sep-16

PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS

ASTM D 6913

Leighton

Project Name:	Goleta Fire Station #10	Tested By:	S. Felter
		Date:	09/27/16
Project No.:	11389.001	Checked By:	J. Ward
		Date:	09/27/16
Boring No.:	LB-2	Depth (feet):	10.0
Sample No.:	S-4		
Soil Identification:	Brown silty sand (SM)		

		Moisture Content of Total Air - Dry Soil	
Container No.:	725	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	545.8	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	76.1	Wt. of Container No.______ (g)	1.00
Dry Wt. of Soil (g)	469.7	Moisture Content (%)	0.00

After Wet Sieve	Container No.	725
	Wt. of Dry Soil + Container (g)	438.1
	Wt. of Container (g)	76.1
	Dry Wt. of Soil Retained on # 200 Sieve (g)	362.0

U. S. Sieve Size		Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
(in.)	(mm.)		
3"	75.0		
1 1/2	37.5		
3/4"	19.0		
3/8"	9.5		
#4	4.75	0.0	100.0
#8	2.36	0.1	100.0
#16	1.18	1.0	99.8
#30	0.600	13.5	97.1
#50	0.300	143.7	69.4
#100	0.150	304.4	35.2
#200	0.075	359.2	23.5
PAN			

GRAVEL: **0 %**

SAND: **76 %**

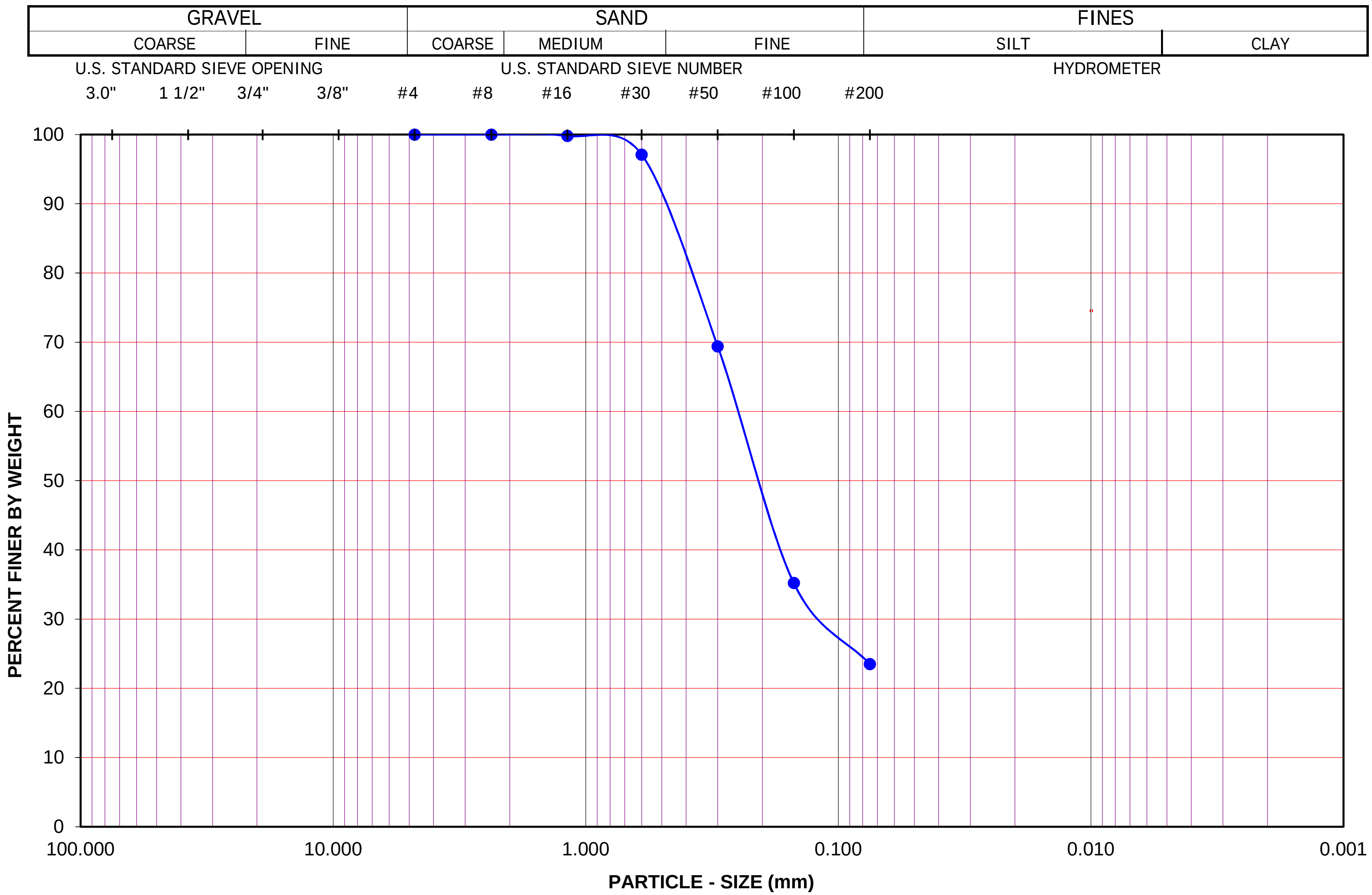
FINES: **24 %**

GROUP SYMBOL: **SM**

Cu = D60/D10 = ______

Cc = (D30)²/(D60*D10) = ______

Remarks: ______



Project Name: Goleta Fire Station #10

Project No.: 11389.001

Boring No.: LB-2 Sample No.: S-4

Depth (feet): 10.0 Soil Type : SM

Soil Identification: Brown silty sand (SM)

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

GR:SA:FI : (%) 0 : 76 : 24

Sep-16

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Leighton

Project Name: Goleta Fire Station #10 | Tested By: G. Berdy | Date: 09/27/16

Project No.: 11389.001 | Data Input By: J. Ward | Date: 09/29/16

Boring No.: LB-2

Sample No.: S-8 | Depth (feet): 20.0

Soil Identification: Yellowish brown lean clay with sand (CL)s

		Soil Type
% Gravel	0	(CL)s
% Sand	22	
% Fines	78	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	141.71	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	140.56	90.60
Wt.of Air-Dry Soil + Cont. (g)	240.45	Wt. of Container No.___ (g)	1.00	69.12	77.65
Wt. of Container	77.20	Moisture Content (%)	0.00	1.61	
Dry Wt. of Soil (g)	163.25	Wt. of Dry Soil (g)			12.95

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	0.00	100.0
Pan		

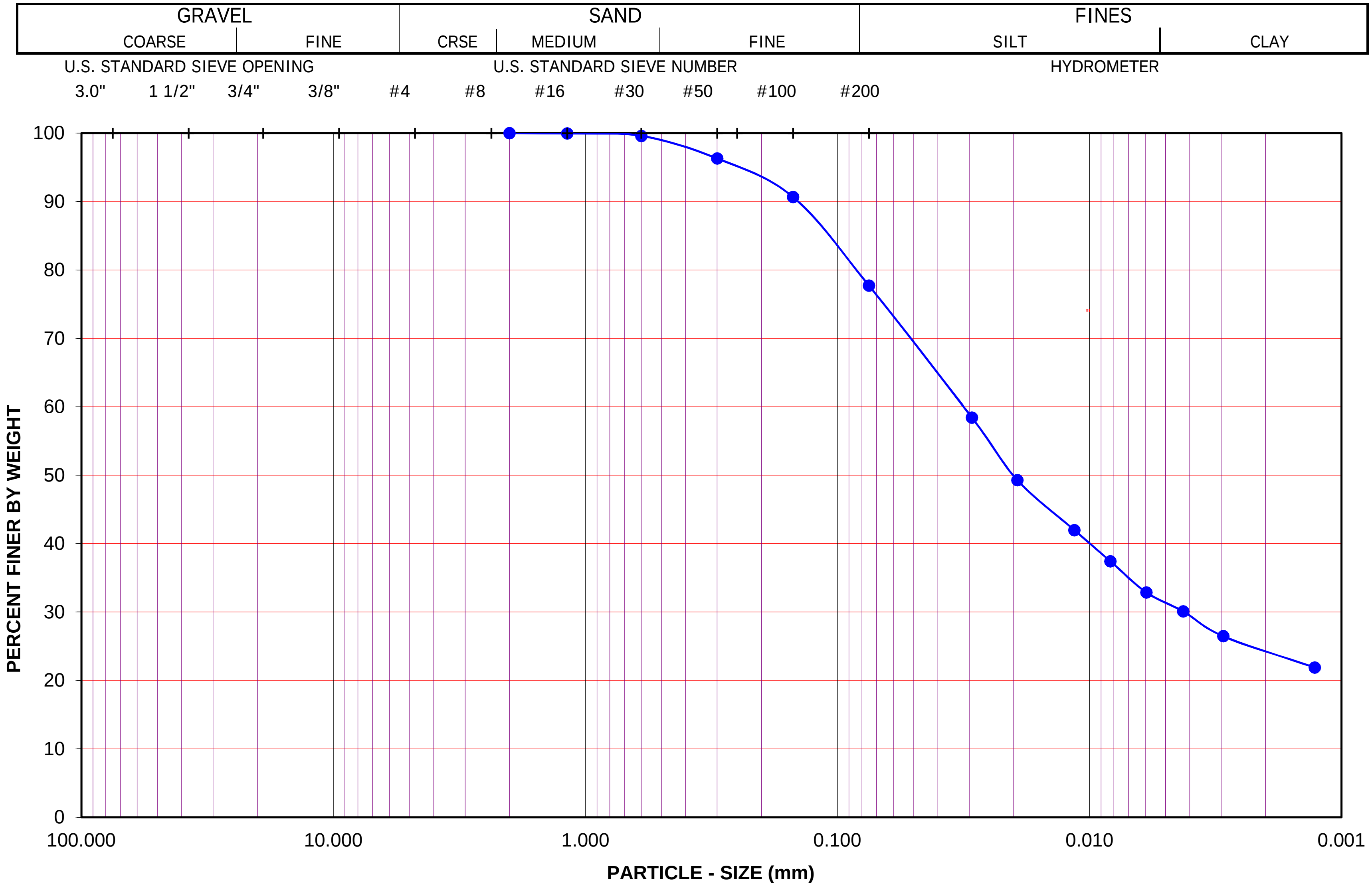
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	100.0
No. 16	0.03	99.9	99.9
No. 30	0.22	99.6	99.6
No. 50	2.01	96.3	96.3
No. 100	5.07	90.7	90.7
No. 200	12.10	77.7	77.7
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 55.21 Wt. of Dry Soil (g) 54.34

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
27-Sep-16	9:38	0		8.0			
	9:40	2	21.4	8.0	40.0	58.4	0.0292
	9:43	5	21.4	8.0	35.0	49.3	0.0193
	9:53	15	21.4	8.0	31.0	42.0	0.0115
	10:08	30	21.5	8.0	28.5	37.4	0.0083
	10:38	60	21.4	8.0	26.0	32.9	0.0059
	11:38	120	21.6	8.0	24.5	30.1	0.0043
	13:48	250	22.2	8.0	22.5	26.5	0.0029
28-Sep-16	9:38	1440	20.6	8.0	20.0	21.9	0.0013



Project Name: Goleta Fire Station #10

Project No.: 11389.001

Boring No.: LB-2 Sample No.: S-8

Depth (feet): 20.0 Soil Type : (CL)s

Soil Identification: Yellowish brown lean clay with sand (CL)s

GR:SA:FI : (%) 0 : 22 : 78

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Sep-16

Leighton

PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS

ASTM D 6913

Project Name:	Goleta Fire Station #10	Tested By:	S. Felter	Date:	09/27/16
Project No.:	11389.001	Checked By:	J. Ward	Date:	09/27/16
Boring No.:	LB-2	Depth (feet):	25.0		
Sample No.:	S-10				
Soil Identification:	Brown silty sand (SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	537	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	407.1	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	83.0	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	324.1	Moisture Content (%)	0.00

After Wet Sieve	Container No.	537
	Wt. of Dry Soil + Container (g)	290.6
	Wt. of Container (g)	83.0
	Dry Wt. of Soil Retained on # 200 Sieve (g)	207.6

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
3"	75.0		
1 1/2	37.5		
3/4"	19.0		
3/8"	9.5		
#4	4.75	0.0	100.0
#8	2.36	0.4	99.9
#16	1.18	1.1	99.7
#30	0.600	6.6	98.0
#50	0.300	52.9	83.7
#100	0.150	144.7	55.4
#200	0.075	201.7	37.8
PAN			

GRAVEL: **0 %**

SAND: **62 %**

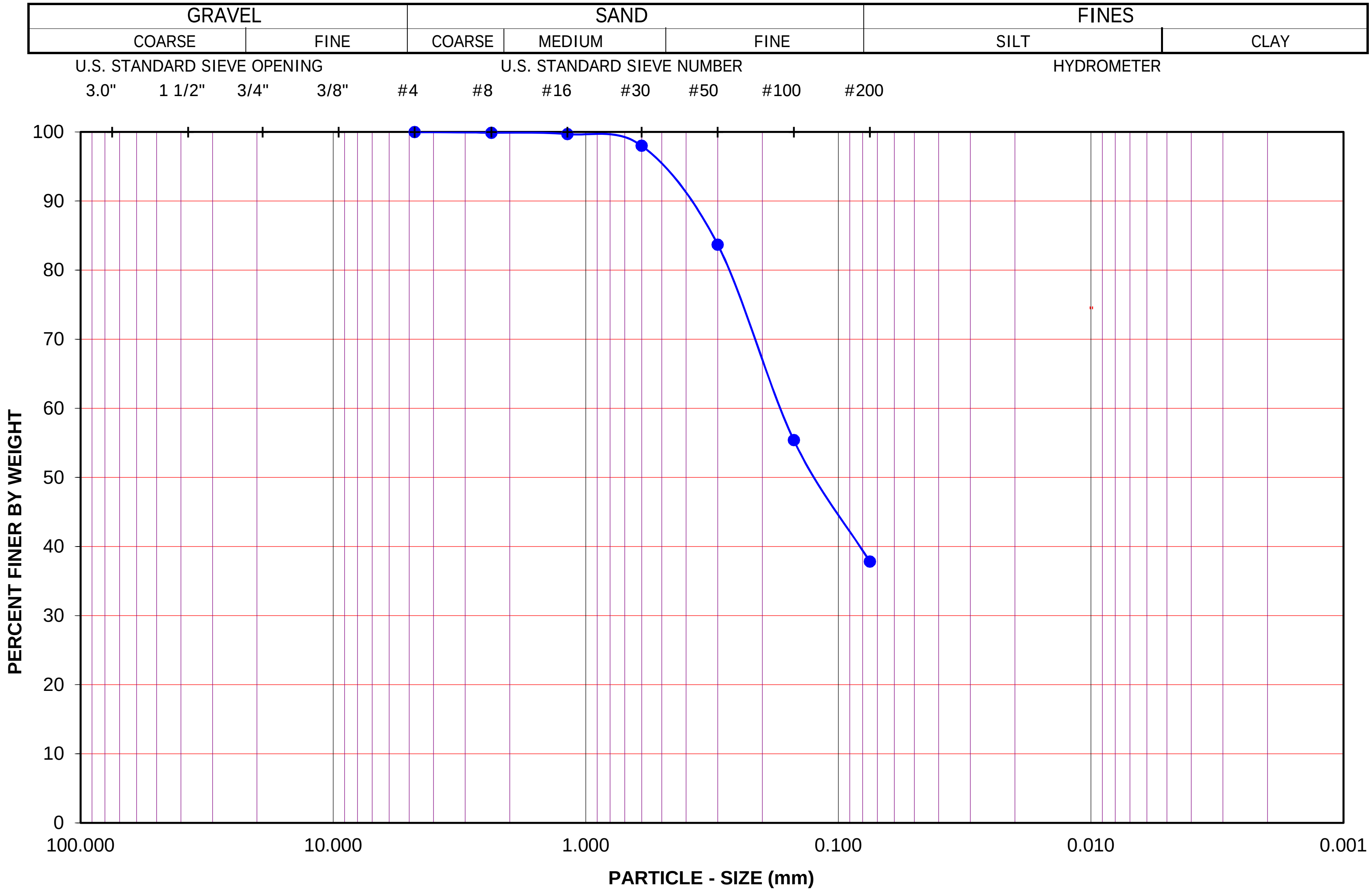
FINES: **38 %**

GROUP SYMBOL: **SM**

Cu = D60/D10 = _____

Cc = (D30)²/(D60*D10) = _____

Remarks: _____



Project Name: Goleta Fire Station #10

Project No.: 11389.001

Boring No.: LB-2 Sample No.: S-10

Depth (feet): 25.0 Soil Type : SM

Soil Identification: Brown silty sand (SM)

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

GR:SA:FI : (%) 0 : 62 : 38

Sep-16

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Leighton

Project Name: Goleta Fire Station #10 | Tested By: G. Berdy | Date: 09/27/16

Project No.: 11389.001 | Data Input By: J. Ward | Date: 09/29/16

Boring No.: LB-2

Sample No.: S-14 | Depth (feet): 35.0

Soil Identification: Yellowish brown lean clay with sand (CL)s

		Soil Type
% Gravel	0	(CL)s
% Sand	22	
% Fines	78	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	124.59	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	123.89	87.44
Wt.of Air-Dry Soil + Cont. (g)	281.77	Wt. of Container No.___ (g)	1.00	74.48	76.76
Wt. of Container	76.12	Moisture Content (%)	0.00	1.42	
Dry Wt. of Soil (g)	205.65	Wt. of Dry Soil (g)			10.68

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.20	99.9
No. 10	3.06	98.5
Pan		

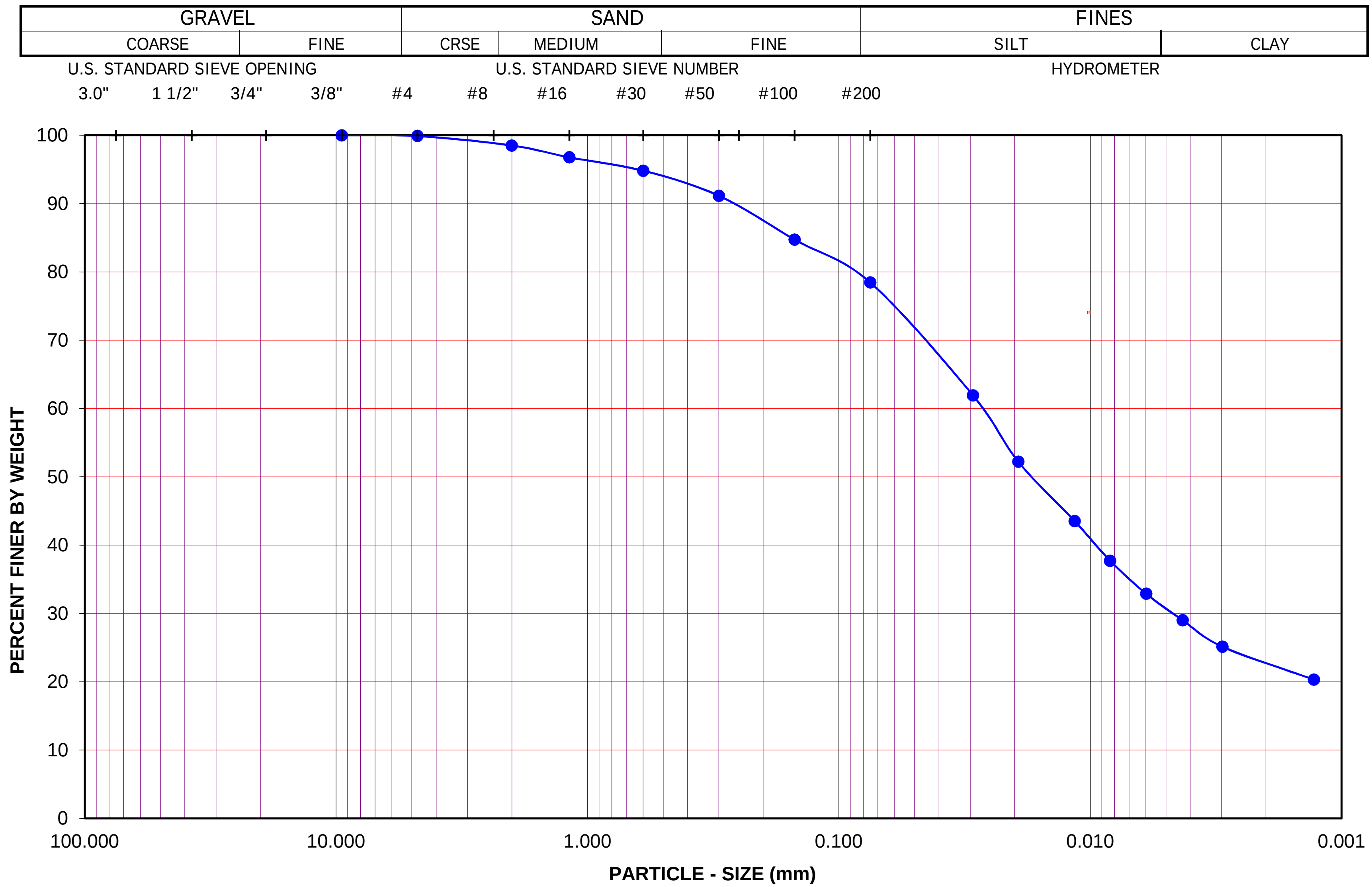
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	98.5
No. 16	0.89	98.2	96.8
No. 30	1.89	96.3	94.8
No. 50	3.77	92.5	91.2
No. 100	7.06	86.0	84.7
No. 200	10.28	79.6	78.5
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 51.22 Wt. of Dry Soil (g) 50.50

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
27-Sep-16	9:42	0		8.0			
	9:44	2	21.5	8.0	40.0	61.9	0.0292
	9:47	5	21.6	8.0	35.0	52.2	0.0193
	9:57	15	21.6	8.0	30.5	43.5	0.0115
	10:12	30	21.6	8.0	27.5	37.7	0.0083
	10:42	60	21.6	8.0	25.0	32.9	0.0060
	11:42	120	21.6	8.0	23.0	29.0	0.0043
	13:52	250	22.2	8.0	21.0	25.2	0.0030
28-Sep-16	9:42	1440	20.7	8.0	18.5	20.3	0.0013



Project Name: Goleta Fire Station #10

Project No.: 11389.001

Boring No.: LB-2 Sample No.: S-14

Depth (feet): 35.0 Soil Type : (CL)s

Soil Identification: Yellowish brown lean clay with sand (CL)s

GR:SA:FI : (%) 0 : 22 : 78

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PARTICLE - SIZE DISTRIBUTION ASTM D 422

Sep-16

PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS

ASTM D 6913

Leighton

Project Name:	Goleta Fire Station #10	Tested By:	S. Felter	Date:	09/27/16
Project No.:	11389.001	Checked By:	J. Ward	Date:	09/27/16
Boring No.:	LB-2	Depth (feet):	40.0		
Sample No.:	S-16				
Soil Identification:	Brown sandy silt s(ML)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	724	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	191.9	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	77.3	Wt. of Container No.______ (g)	1.00
Dry Wt. of Soil (g)	114.6	Moisture Content (%)	0.00

After Wet Sieve	Container No.	724
	Wt. of Dry Soil + Container (g)	134.6
	Wt. of Container (g)	77.3
	Dry Wt. of Soil Retained on # 200 Sieve (g)	57.3

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
3"	75.0		
1 1/2	37.5		
3/4"	19.0		
3/8"	9.5		
#4	4.75		
#8	2.36	0.0	100.0
#16	1.18	1.0	99.1
#30	0.600	4.3	96.2
#50	0.300	17.4	84.8
#100	0.150	37.6	67.2
#200	0.075	54.6	52.4
PAN			

GRAVEL: **0 %**

SAND: **48 %**

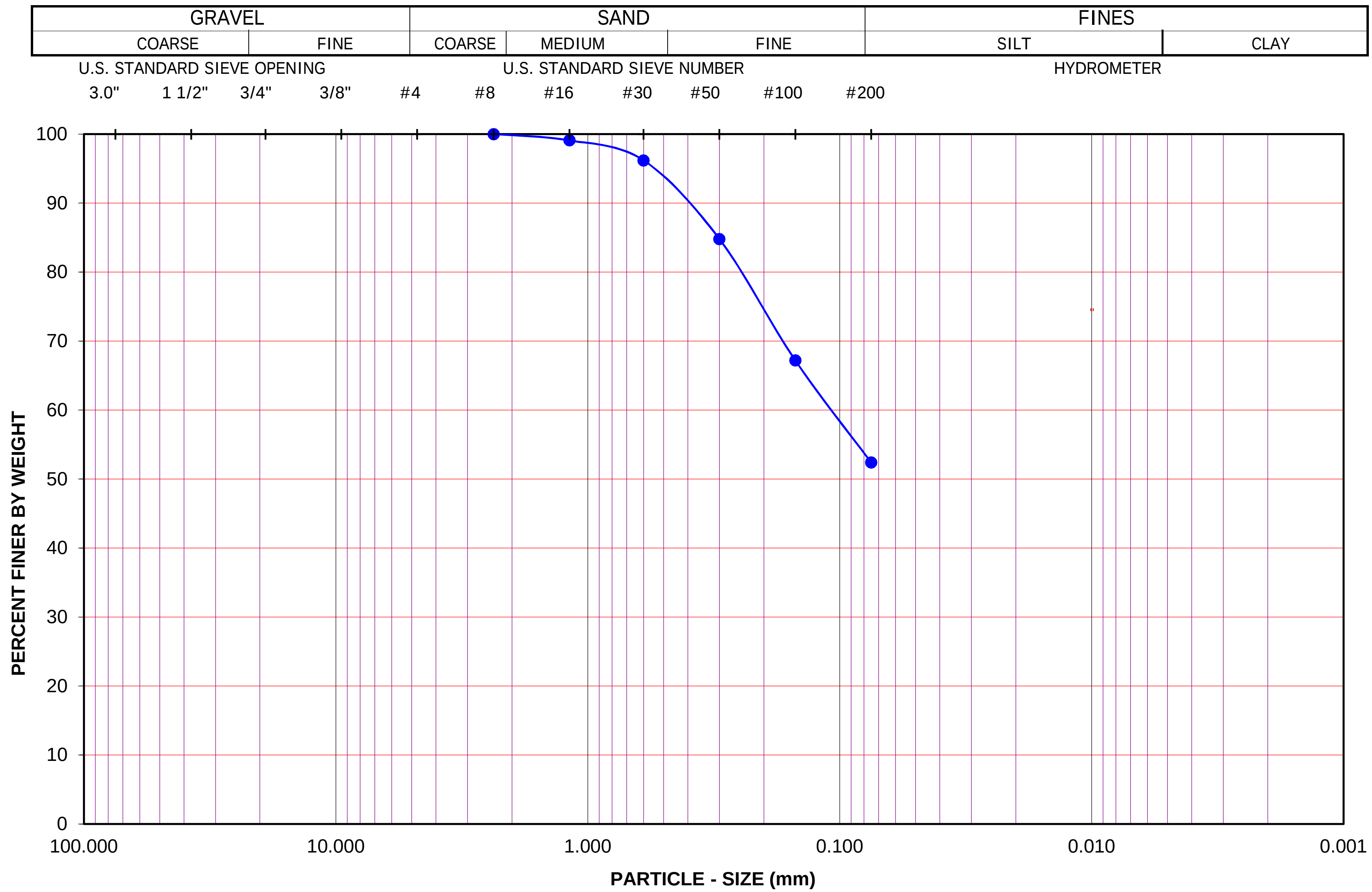
FINES: **52 %**

GROUP SYMBOL: **s(ML)**

Cu = D60/D10 = ______

Cc = (D30)²/(D60*D10) = ______

Remarks:



Project Name: Goleta Fire Station #10

Project No.: 11389.001

Boring No.: LB-2

Sample No.: S-16

Depth (feet): 40.0

Soil Type : s(ML)

Soil Identification: Brown sandy silt s(ML)

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

GR:SA:FI : (%) 0 : 48 : 52

Sep-16

SA LB-2, S-16 @ 40

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Leighton

Project Name: Goleta Fire Station #10 | Tested By: G. Berdy | Date: 09/27/16

Project No.: 11389.001 | Data Input By: J. Ward | Date: 09/29/16

Boring No.: LB-2

Sample No.: S-17 | Depth (feet): 42.5

Soil Identification: Brown sandy lean clay s(CL)

		Soil Type
% Gravel	0	s(CL)
% Sand	32	
% Fines	68	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	107.24	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	106.77	92.78
Wt.of Air-Dry Soil + Cont. (g)	293.35	Wt. of Container No.___ (g)	1.00	57.84	76.31
Wt. of Container	74.24	Moisture Content (%)	0.00	0.96	
Dry Wt. of Soil (g)	219.11	Wt. of Dry Soil (g)			16.47

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	0.37	99.8
Pan		

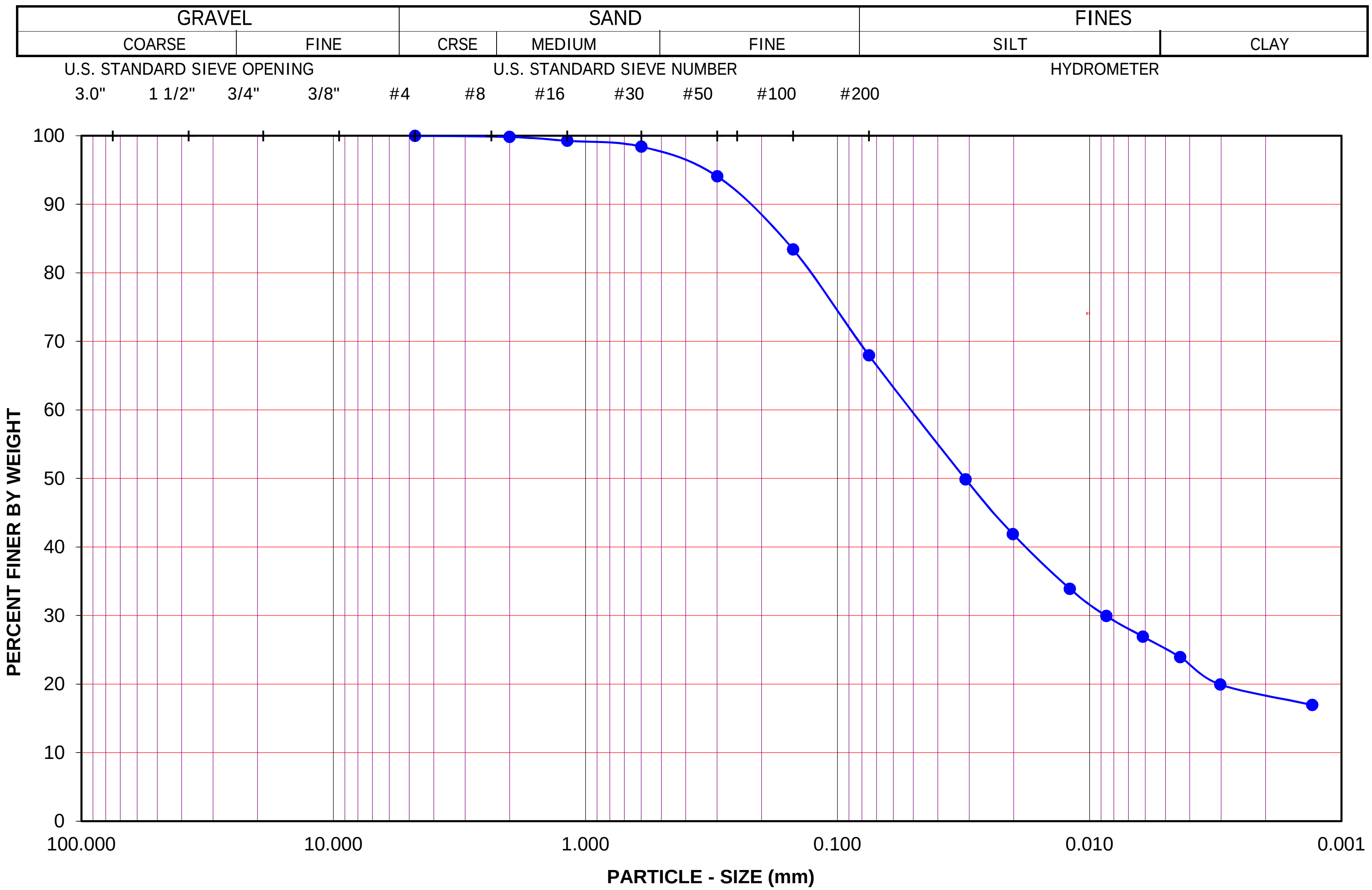
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	99.8
No. 16	0.28	99.4	99.3
No. 30	0.70	98.6	98.4
No. 50	2.85	94.3	94.1
No. 100	8.15	83.6	83.4
No. 200	15.83	68.1	68.0
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 50.09 Wt. of Dry Soil (g) 49.61

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
27-Sep-16	9:46	0		8.0			
	9:48	2	21.5	8.0	33.0	49.9	0.0310
	9:51	5	21.5	8.0	29.0	41.9	0.0201
	10:01	15	21.5	8.0	25.0	33.9	0.0120
	10:16	30	21.5	8.0	23.0	29.9	0.0086
	10:46	60	21.6	8.0	21.5	26.9	0.0061
	11:46	120	21.7	8.0	20.0	24.0	0.0044
	13:56	250	22.2	8.0	18.0	20.0	0.0030
28-Sep-16	9:46	1440	20.8	8.0	16.5	17.0	0.0013



Project Name: Goleta Fire Station #10

Project No.: 11389.001

Boring No.: LB-2

Sample No.: S-17

Depth (feet): 42.5

Soil Type : s(CL)

Soil Identification: Brown sandy lean clay s(CL)

GR:SA:FI : (%) 0 : 32 : 68

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Sep-16

Leighton

PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS

ASTM D 6913

Project Name: Goleta Fire Station #10
Project No.: 11389.001
Boring No.: LB-2
Sample No.: S-21
Soil Identification: Brown silty sand (SM)

Tested By: S. Felter Date: 09/27/16
Checked By: J. Ward Date: 09/27/16
Depth (feet): 52.5

		Moisture Content of Total Air - Dry Soil	
Container No.:	772	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	430.1	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	76.0	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	354.1	Moisture Content (%)	0.00

After Wet Sieve	Container No.	772
	Wt. of Dry Soil + Container (g)	387.5
	Wt. of Container (g)	76.0
	Dry Wt. of Soil Retained on # 200 Sieve (g)	311.5

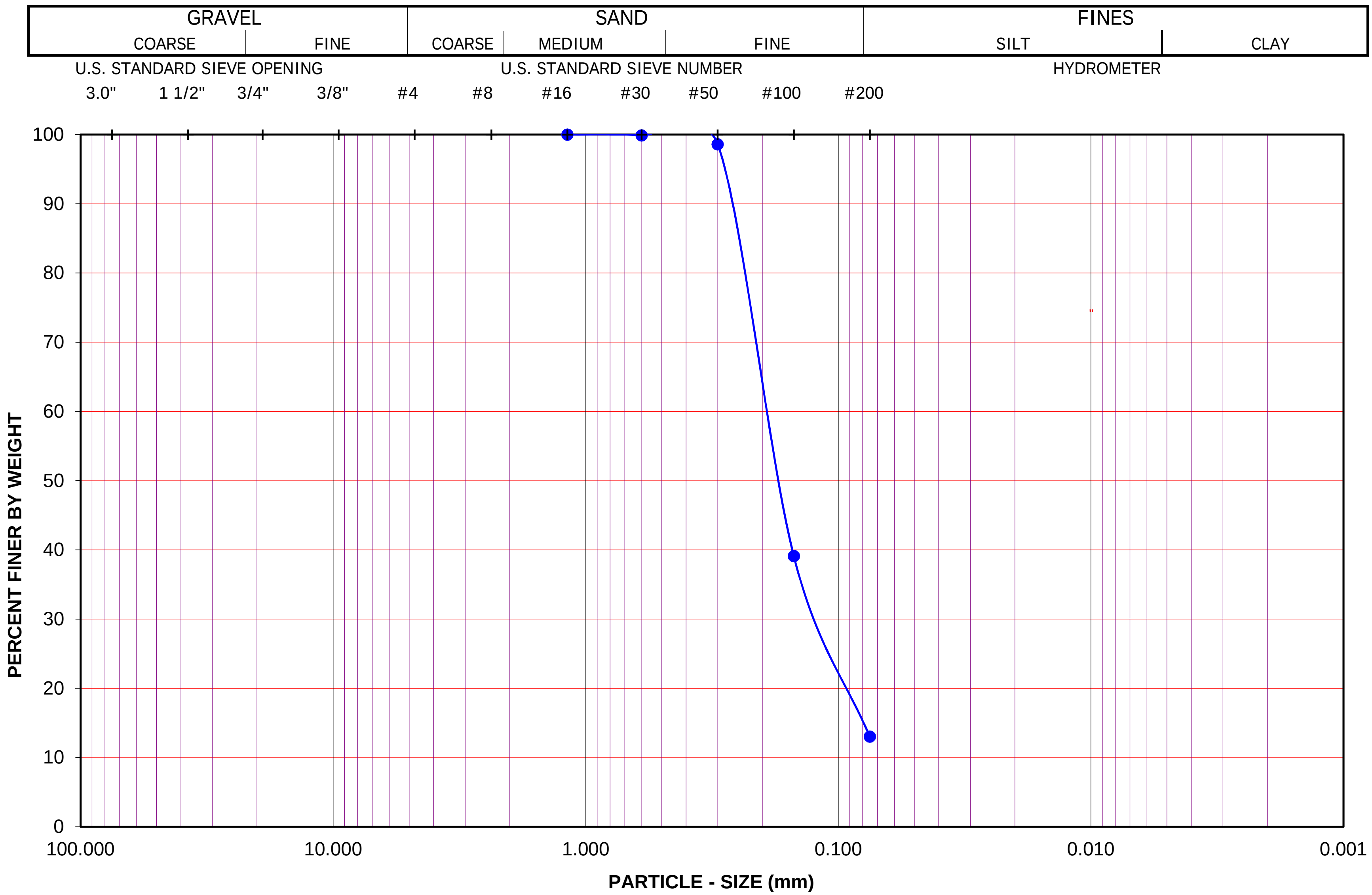
U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
3"	75.0		
1 1/2	37.5		
3/4"	19.0		
3/8"	9.5		
#4	4.75		
#8	2.36		
#16	1.18	0.0	100.0
#30	0.600	0.4	99.9
#50	0.300	5.0	98.6
#100	0.150	215.8	39.1
#200	0.075	308.1	13.0
PAN			

GRAVEL: **0 %**
SAND: **87 %**
FINES: **13 %**
GROUP SYMBOL: **SM**

Cu = D60/D10 = ______

Cc = (D30)²/(D60*D10) = ______

Remarks:



Project Name: Goleta Fire Station #10

Project No.: 11389.001

Boring No.: LB-2 Sample No.: S-21

Depth (feet): 52.5 Soil Type : SM

Soil Identification: Brown silty sand (SM)

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

GR:SA:FI : (%) 0 : 87 : 13

Sep-16

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Leighton

Project Name:	Goleta Fire Station #10	Tested By:	G. Berdy	Date:	09/26/16
Project No.:	11389.001	Data Input By:	J. Ward	Date:	09/29/16
Boring No.:	LB-7				
Sample No.:	B-1	Depth (feet):	0-5		
Soil Identification:	Dark brown clayey sand (SC)				

		Soil Type
% Gravel	10	SC
% Sand	56	
% Fines	34	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	212.68	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	212.40	127.88
Wt.of Air-Dry Soil + Cont. (g)	1762.41	Wt. of Container No.___ (g)	1.00	69.13	82.65
Wt. of Container	230.72	Moisture Content (%)	0.00	0.20	
Dry Wt. of Soil (g)	1531.69	Wt. of Dry Soil (g)			45.23

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	26.29	98.3
3/8"	81.54	94.7
No. 4	152.94	90.0
No. 10	203.63	86.7
Pan		

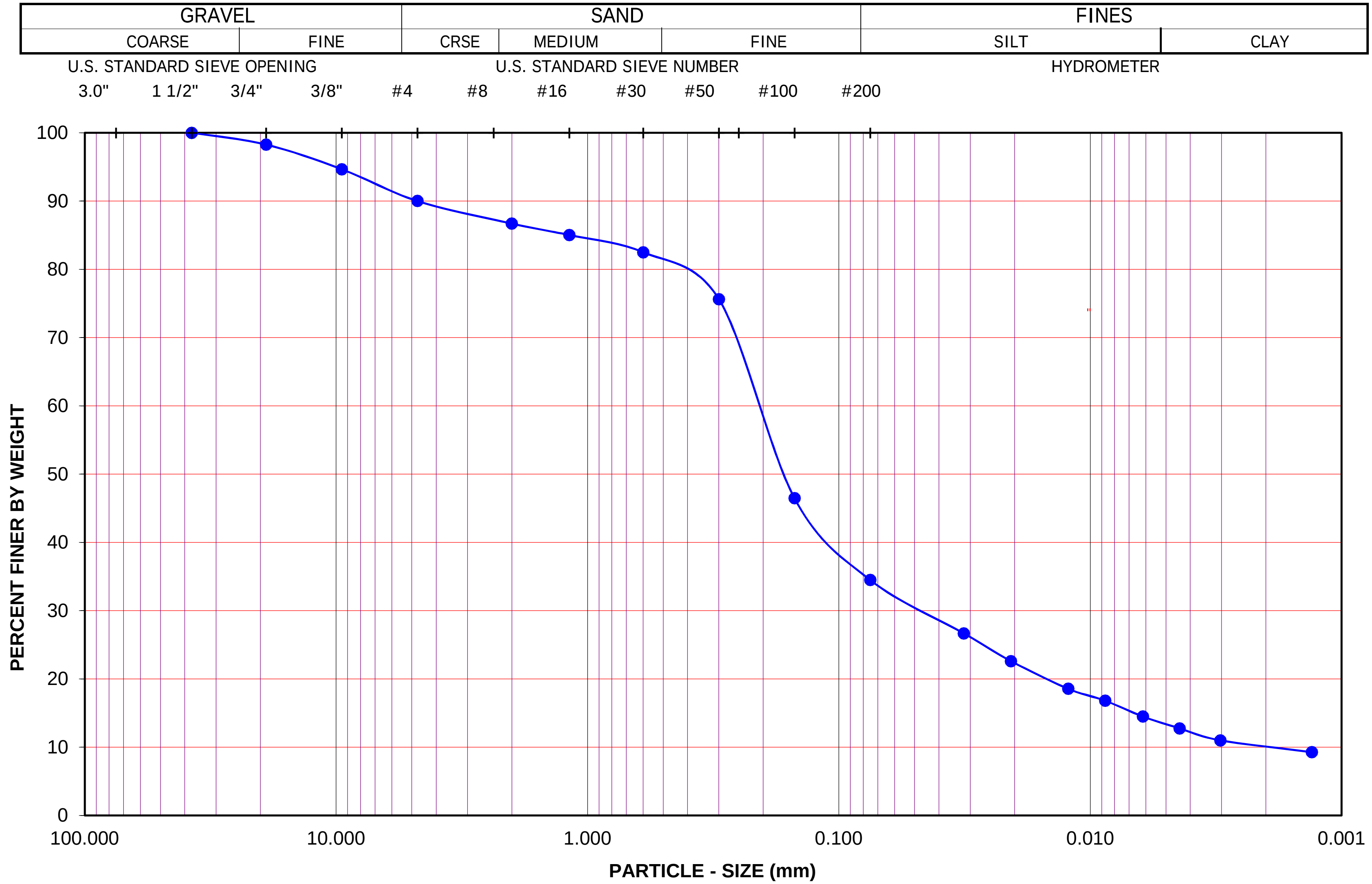
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	86.7
No. 16	1.44	98.1	85.0
No. 30	3.59	95.2	82.5
No. 50	9.46	87.2	75.6
No. 100	34.40	53.6	46.5
No. 200	44.64	39.8	34.5
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 74.28 Wt. of Dry Soil (g) 74.14

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
26-Sep-16	9:30	0		8.0			
	9:32	2	20.9	8.0	31.0	26.7	0.0318
	9:35	5	20.8	8.0	27.5	22.6	0.0207
	9:45	15	20.9	8.0	24.0	18.6	0.0122
	10:00	30	20.9	8.0	22.5	16.8	0.0087
	10:30	60	21.0	8.0	20.5	14.5	0.0062
	11:30	120	21.3	8.0	19.0	12.8	0.0044
	13:40	250	22.3	8.0	17.5	11.0	0.0030
27-Sep-16	9:30	1440	20.4	8.0	16.0	9.3	0.0013



Project Name: Goleta Fire Station #10

Project No.: 11389.001

Boring No.: LB-7 Sample No.: B-1

Depth (feet): 0-5 Soil Type : SC

Soil Identification: Dark brown clayey sand (SC)

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

GR:SA:FI : (%) 10 : 56 : 34

Sep-16

Leighton

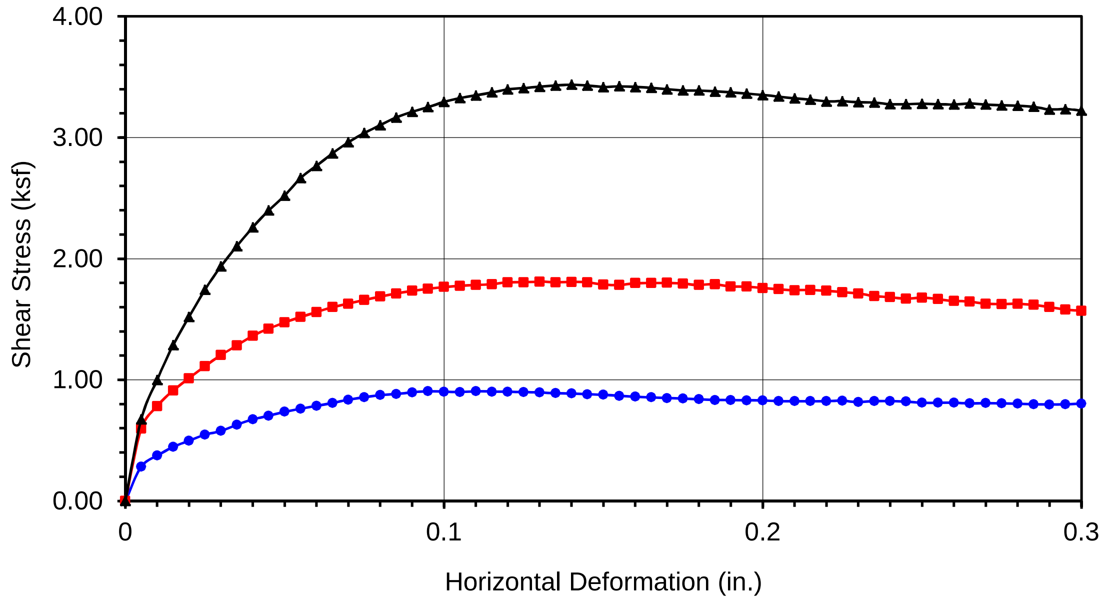
DIRECT SHEAR TEST

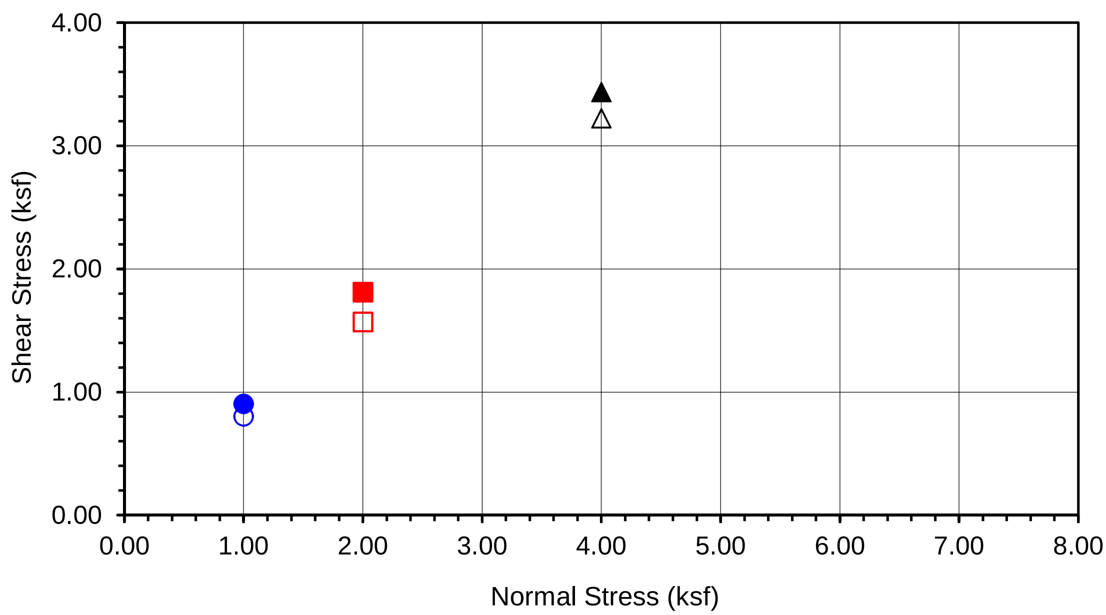
Consolidated Drained - ASTM D 3080

Project Name:	Goleta Fire Station #10	Tested By:	G. Bathala	Date:	09/25/16
Project No.:	11389.001	Checked By:	J. Ward	Date:	09/27/16
Boring No.:	LB-4	Sample Type:	Ring		
Sample No.:	R-6	Depth (ft.):	30.0		

Soil Identification: Yellowish brown silty, clayey sand (SC-SM)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	185.27	186.72	192.76
Weight of Ring(gm):	45.51	41.66	45.16
Before Shearing			
Weight of Wet Sample+Cont.(gm):	231.70	231.70	231.70
Weight of Dry Sample+Cont.(gm):	221.28	221.28	221.28
Weight of Container(gm):	57.27	57.27	57.27
Vertical Rdg.(in): Initial	0.2615	0.2811	0.0000
Vertical Rdg.(in): Final	0.2834	0.3203	-0.0473
After Shearing			
Weight of Wet Sample+Cont.(gm):	204.98	217.66	213.06
Weight of Dry Sample+Cont.(gm):	184.19	198.98	194.30
Weight of Container(gm):	55.47	66.16	57.88
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**LB-4**
Sample No.	**R-6**
Depth (ft)	**30**

Sample Type:

Ring

Soil Identification:
Yellowish brown silty, clayey sand (SC-SM)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.905	■ 1.811	▲ 3.436
Shear Stress @ End of Test (ksf)	○ 0.802	□ 1.569	△ 3.222
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	6.35	6.35	6.35
Dry Density (pcf)	109.3	113.4	115.4
Saturation (%)	31.6	35.3	37.3
Soil Height Before Shearing (in.)	0.9781	0.9608	0.9527
Final Moisture Content (%)	16.2	14.1	13.8

Leighton

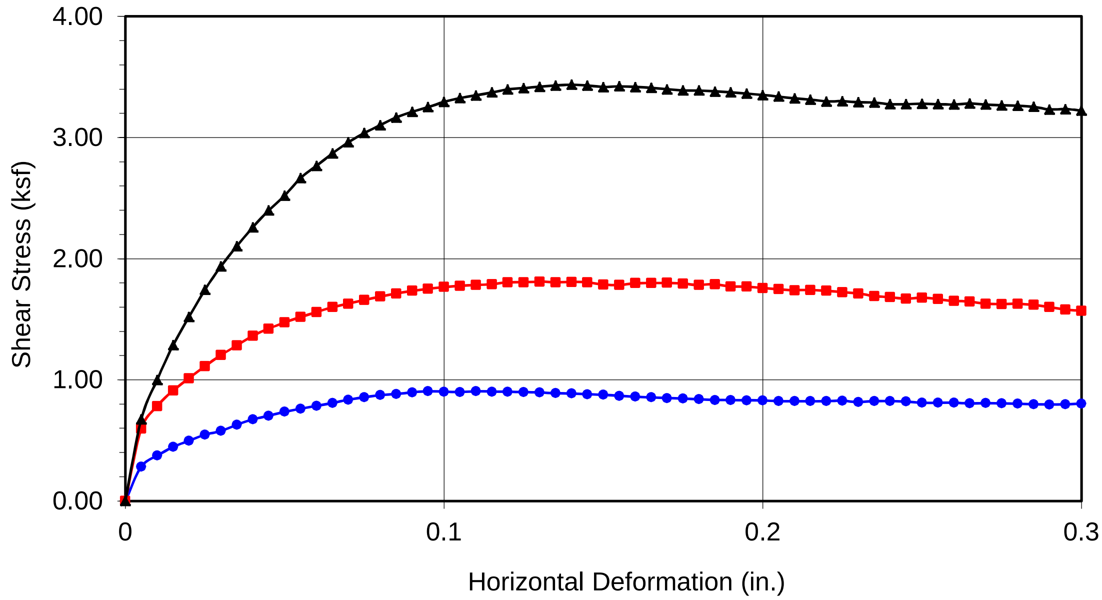
DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

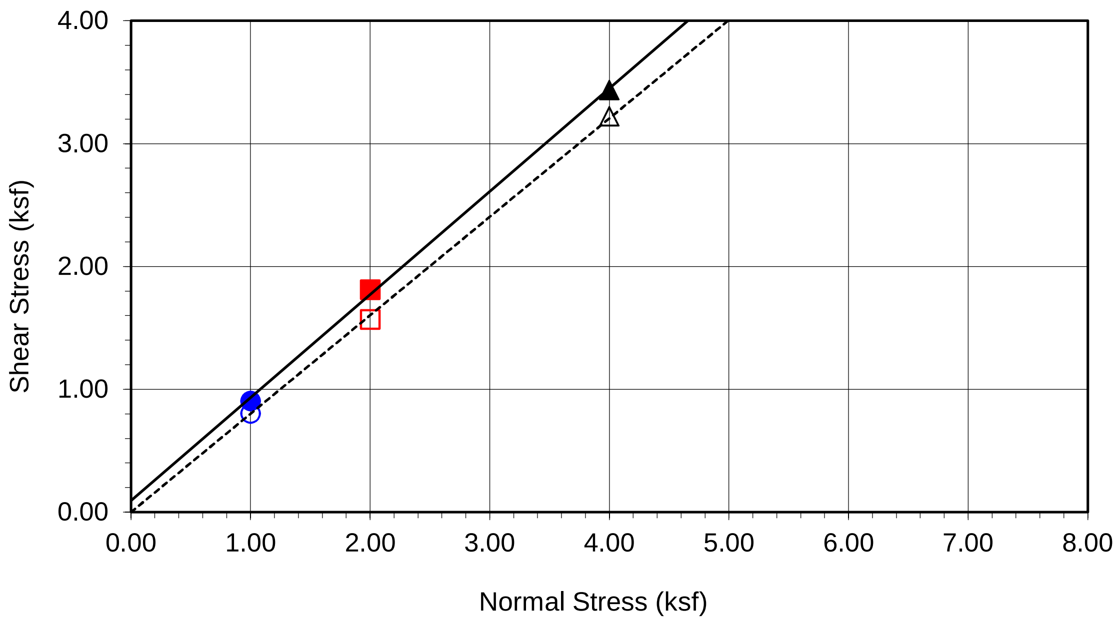
Project No.: 11389.001

Goleta Fire Station #10

09-16

DS LB-4, R-6 @ 30





Boring No.	**LB-4**
Sample No.	**R-6**
Depth (ft)	**30**
Sample Type:	Ring

Soil Identification:
Yellowish brown silty, clayey sand (SC-SM)

Strength Parameters

	C (psf)	ϕ (°)
Peak	92	40
Ultimate	0	39

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.905	■ 1.811	▲ 3.436
Shear Stress @ End of Test (ksf)	○ 0.802	□ 1.569	△ 3.222
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	6.35	6.35	6.35
Dry Density (pcf)	109.3	113.4	115.4
Saturation (%)	31.6	35.3	37.3
Soil Height Before Shearing (in.)	0.9781	0.9608	0.9527
Final Moisture Content (%)	16.2	14.1	13.8

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 11389.001

Goleta Fire Station #10

09-16

DS LB-4, R-6 @ 30

Leighton

DIRECT SHEAR TEST

Consolidated Drained - ASTM D 3080

Project Name: Goleta Fire Station #10
Tested By: G. Bathala
Date: 09/25/16

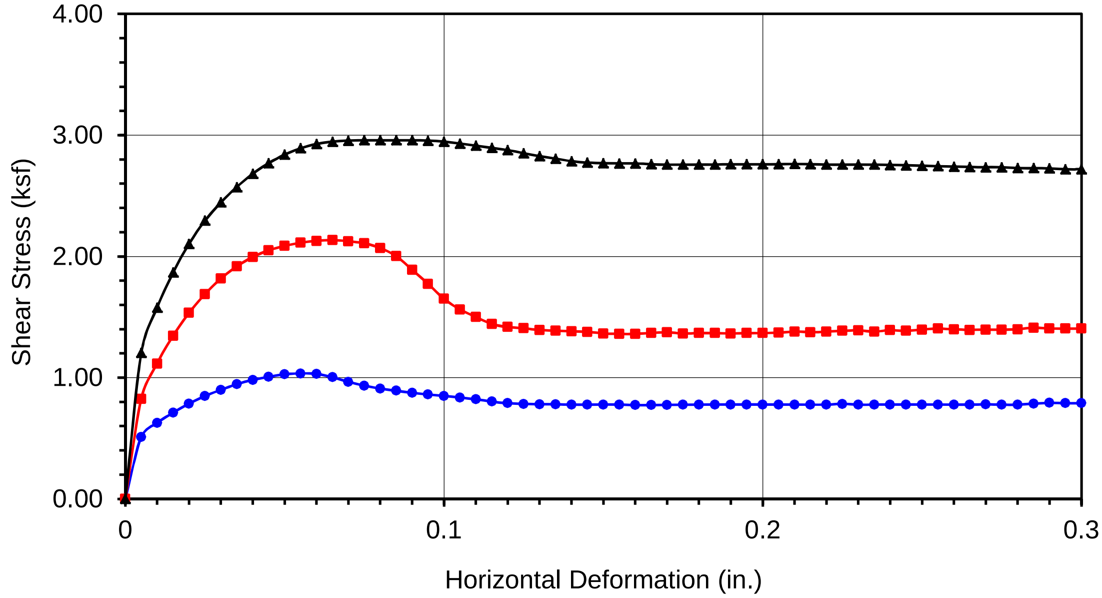
Project No.: 11389.001
Checked By: J. Ward
Date: 09/27/16

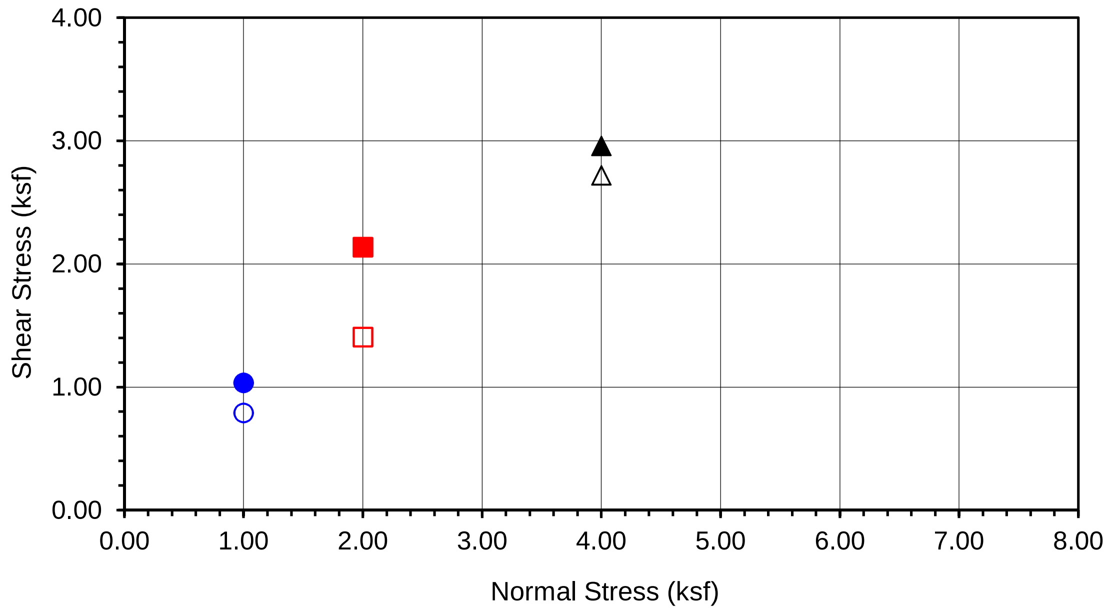
Boring No.: LB-5
Sample Type: Ring

Sample No.: R-5
Depth (ft.): 15.0

Soil Identification: Brown silty, clayey sand (SC-SM)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	185.71	184.36	193.05
Weight of Ring(gm):	46.14	44.56	43.74
Before Shearing			
Weight of Wet Sample+Cont.(gm):	245.12	245.12	245.12
Weight of Dry Sample+Cont.(gm):	236.28	236.28	236.28
Weight of Container(gm):	76.24	76.24	76.24
Vertical Rdg.(in): Initial	0.2559	0.2074	0.0000
Vertical Rdg.(in): Final	0.2632	0.2216	-0.0133
After Shearing			
Weight of Wet Sample+Cont.(gm):	226.67	205.60	216.07
Weight of Dry Sample+Cont.(gm):	205.01	186.77	194.37
Weight of Container(gm):	76.53	57.13	57.73
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**LB-5**
Sample No.	**R-5**
Depth (ft)	**15**

Sample Type:

Ring

Soil Identification:

Brown silty, clayey sand (SC-SM)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.034	■ 2.135	▲ 2.958
Shear Stress @ End of Test (ksf)	○ 0.789	□ 1.405	△ 2.719
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	5.52	5.52	5.52
Dry Density (pcf)	110.0	110.2	117.7
Saturation (%)	28.0	28.1	34.5
Soil Height Before Shearing (in.)	0.9927	0.9858	0.9867
Final Moisture Content (%)	16.9	14.5	15.9

Leighton

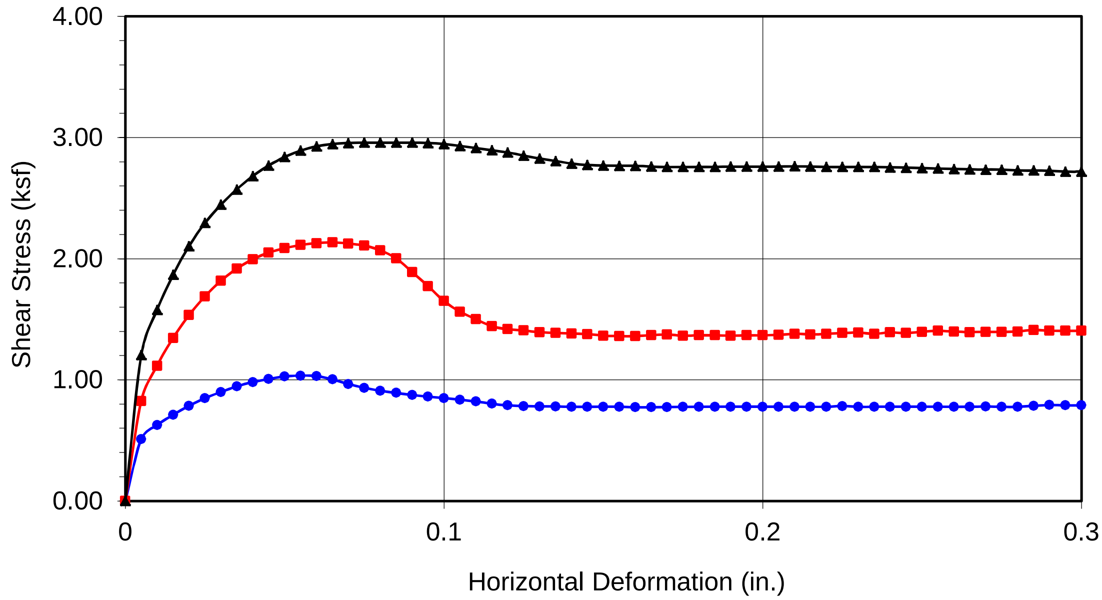
DIRECT SHEAR TEST RESULTS

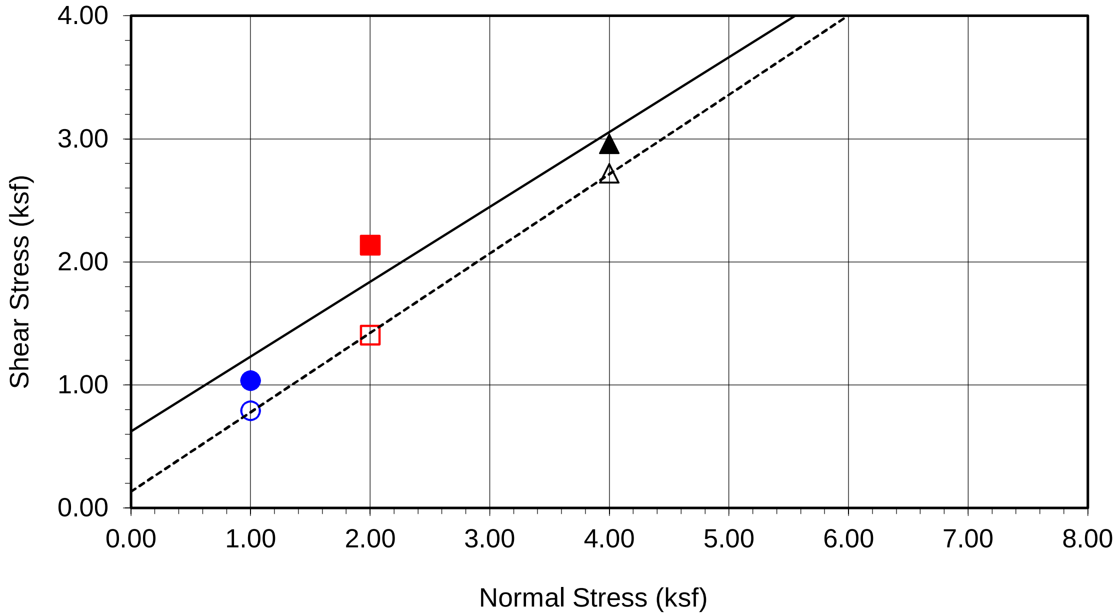
Consolidated Drained - ASTM D 3080

Project No.: 11389.001

Goleta Fire Station #10

09-16





Boring No.	**LB-5**
Sample No.	**R-5**
Depth (ft)	**15**
Sample Type:	Ring

Soil Identification:
Brown silty, clayey sand (SC-SM)

Strength Parameters

	C (psf)	ϕ (°)
Peak	623	31
Ultimate	132	33

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.034	■ 2.135	▲ 2.958
Shear Stress @ End of Test (ksf)	○ 0.789	□ 1.405	△ 2.719
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	5.52	5.52	5.52
Dry Density (pcf)	110.0	110.2	117.7
Saturation (%)	28.0	28.1	34.5
Soil Height Before Shearing (in.)	0.9927	0.9858	0.9867
Final Moisture Content (%)	16.9	14.5	15.9

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 11389.001

Goleta Fire Station #10

09-16

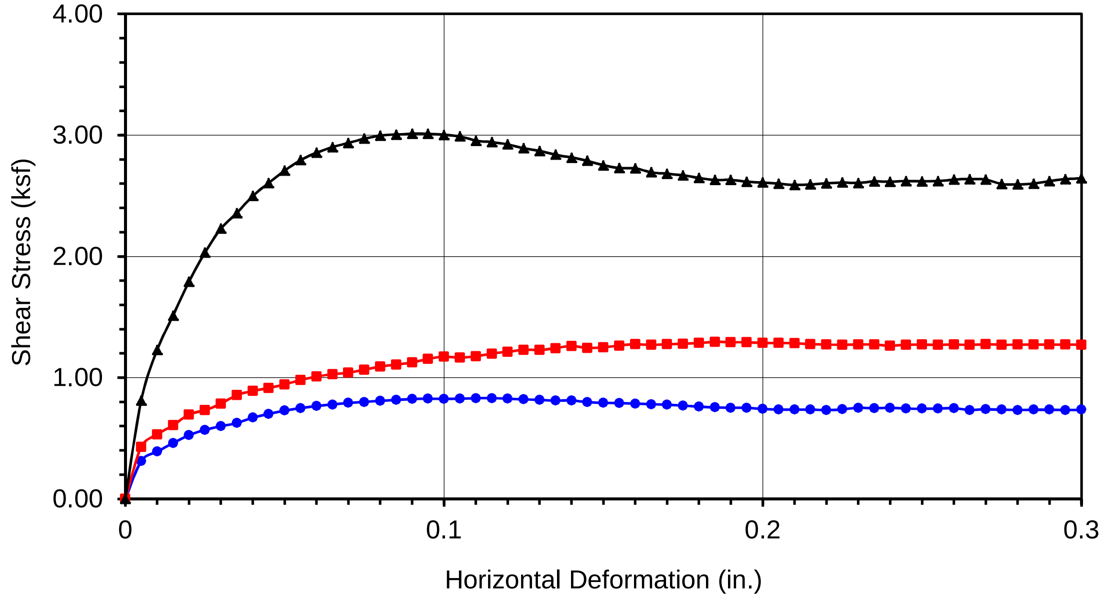
DIRECT SHEAR TEST

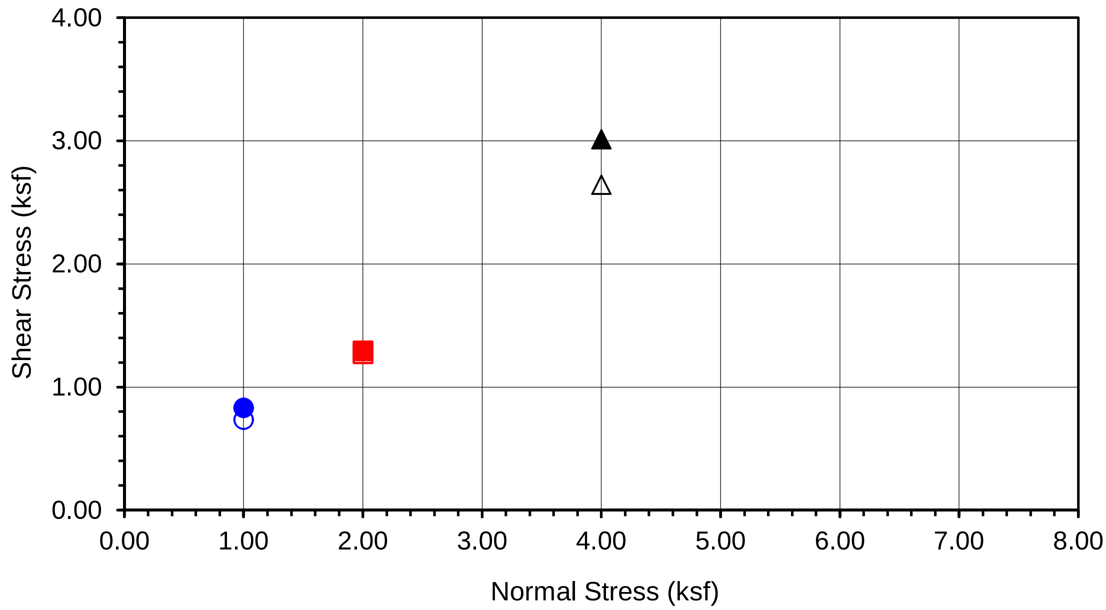
Consolidated Undrained

Project Name:	Goleta Fire Station #10	Tested By:	G. Bathala	Date:	09/25/16
Project No.:	11389.001	Checked By:	J. Ward	Date:	09/27/16
Boring No.:	LB-5	Sample Type:	Ring		
Sample No.:	R-9	Depth (ft.):	25.0		

Soil Identification: Brown poorly-graded sand with silt (SP-SM)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	165.76	167.13	179.39
Weight of Ring(gm):	43.35	44.41	43.34
Before Shearing			
Weight of Wet Sample+Cont.(gm):	206.81	206.81	206.81
Weight of Dry Sample+Cont.(gm):	202.49	202.49	202.49
Weight of Container(gm):	64.61	64.61	64.61
Vertical Rdg.(in): Initial	0.2528	0.2663	0.0000
Vertical Rdg.(in): Final	0.2678	0.3424	-0.0198
After Shearing			
Weight of Wet Sample+Cont.(gm):	204.06	191.78	204.62
Weight of Dry Sample+Cont.(gm):	181.06	171.92	183.55
Weight of Container(gm):	69.14	57.91	58.20
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**LB-5**
Sample No.	**R-9**
Depth (ft)	**25**
Sample Type: Ring	
Soil Identification: Brown poorly-graded sand with silt (SP-SM)	

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.830	■ 1.295	▲ 3.012
Shear Stress @ End of Test (ksf)	○ 0.736	□ 1.270	△ 2.644
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	3.13	3.13	3.13
Dry Density (pcf)	98.7	99.0	109.7
Saturation (%)	12.0	12.0	15.8
Soil Height Before Shearing (in.)	0.9850	0.9239	0.9802
Final Moisture Content (%)	20.6	17.4	16.8

Leighton

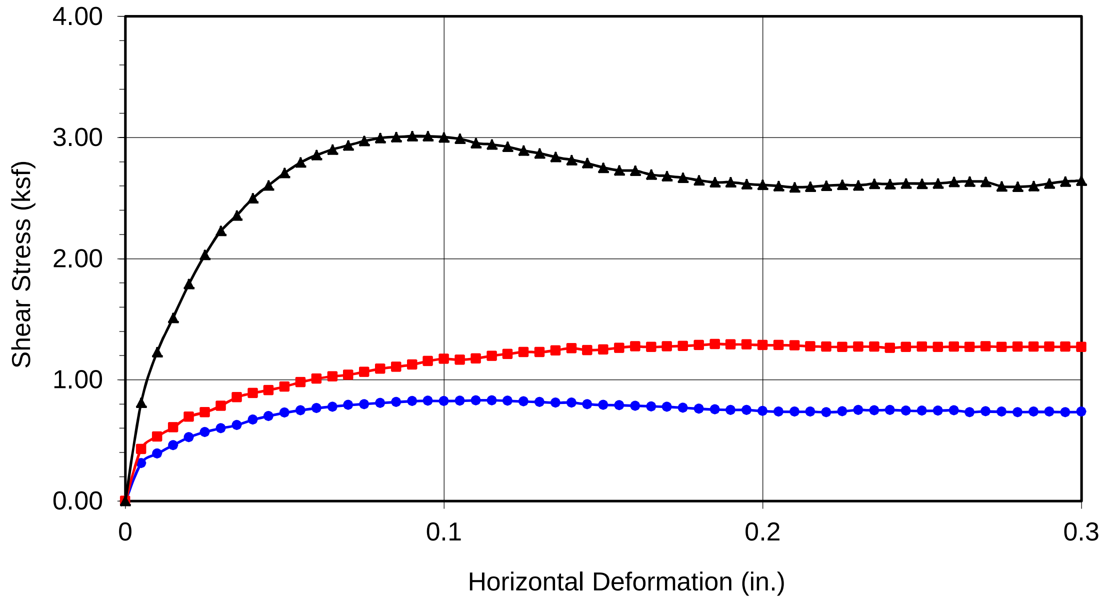
DIRECT SHEAR TEST RESULTS

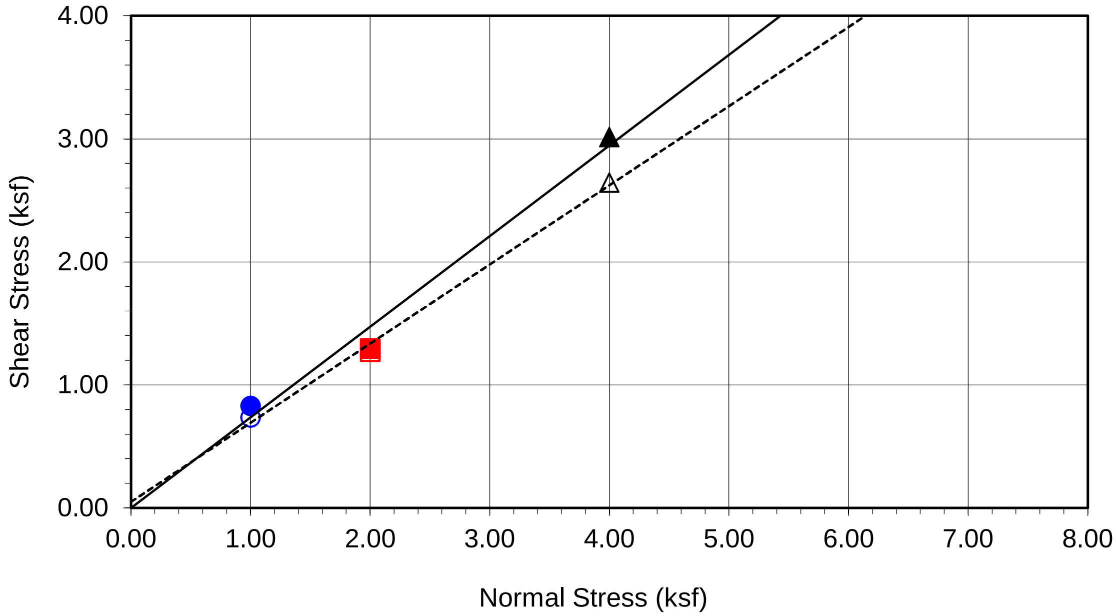
Consolidated Undrained

Project No.: 11389.001

Goleta Fire Station #10

09-16





Boring No.	**LB-5**
Sample No.	**R-9**
Depth (ft)	**25**
Sample Type:	Ring

Soil Identification:
Brown poorly-graded sand with silt (SP-SM)

Strength Parameters

	C (psf)	ϕ (°)
Peak	0	36
Ultimate	49	33

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.830	■ 1.295	▲ 3.012
Shear Stress @ End of Test (ksf)	○ 0.736	□ 1.270	△ 2.644
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	3.13	3.13	3.13
Dry Density (pcf)	98.7	99.0	109.7
Saturation (%)	12.0	12.0	15.8
Soil Height Before Shearing (in.)	0.9850	0.9239	0.9802
Final Moisture Content (%)	20.6	17.4	16.8

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 11389.001

Goleta Fire Station #10

09-16

DIRECT SHEAR TEST

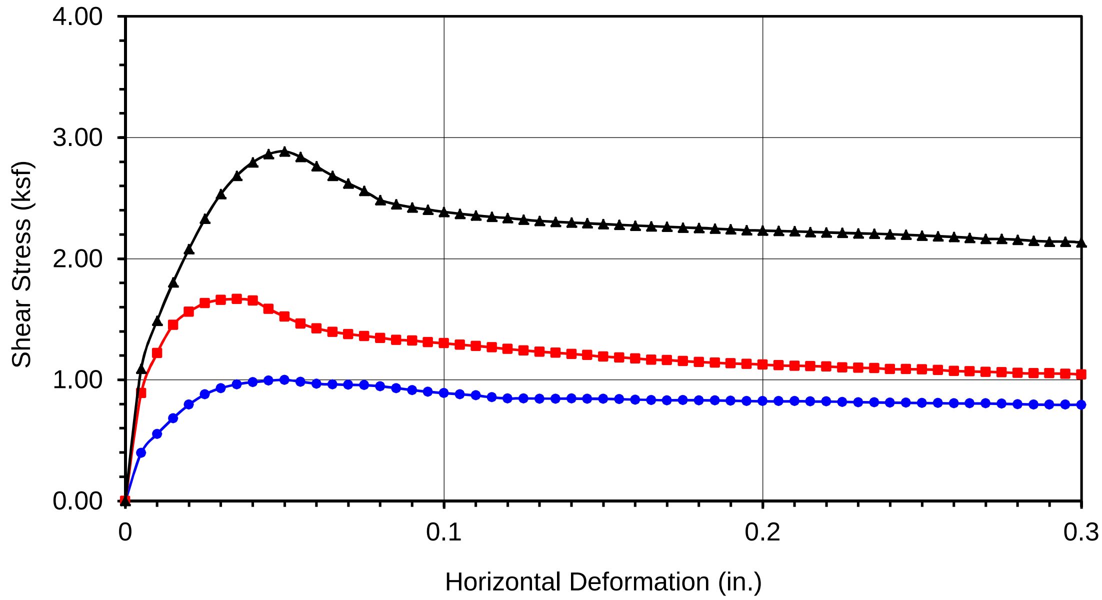
Consolidated Drained - ASTM D 3080

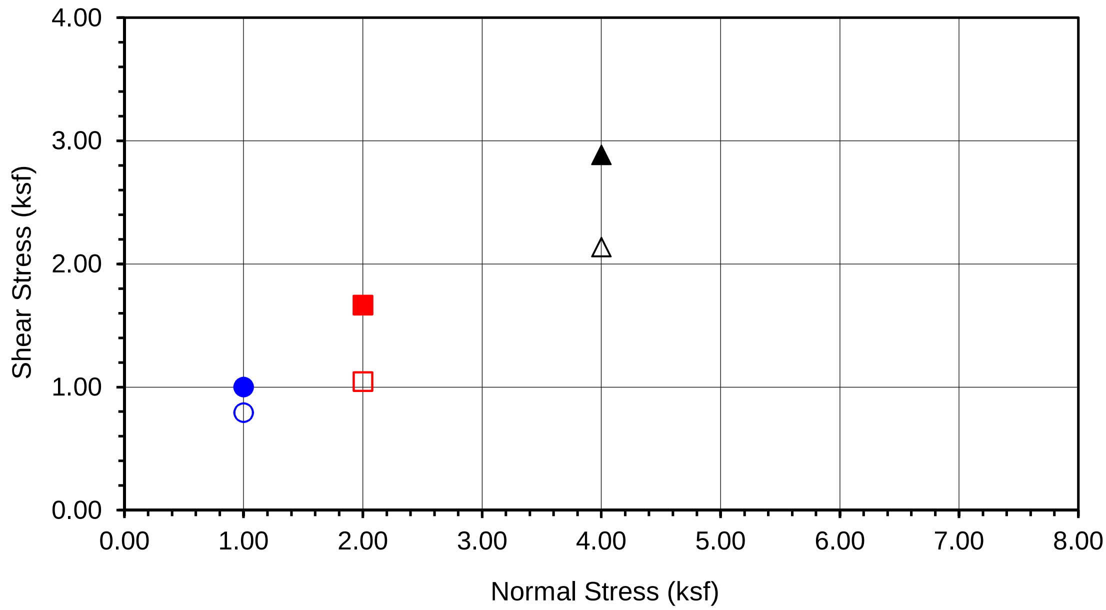
Leighton

Project Name:	Goleta Fire Station #10	Tested By:	G. Bathala	Date:	09/26/16
Project No.:	11389.001	Checked By:	J. Ward	Date:	09/28/16
Boring No.:	LB-5	Sample Type:	Ring		
Sample No.:	R-11	Depth (ft.):	35.0		

Soil Identification: Yellowish brown lean clay (CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	180.71	186.57	190.36
Weight of Ring(gm):	43.74	43.28	44.68
Before Shearing			
Weight of Wet Sample+Cont.(gm):	204.91	204.91	204.91
Weight of Dry Sample+Cont.(gm):	190.04	190.04	190.04
Weight of Container(gm):	37.59	37.59	37.59
Vertical Rdg.(in): Initial	0.0000	0.3110	0.0000
Vertical Rdg.(in): Final	-0.0019	0.3246	-0.0180
After Shearing			
Weight of Wet Sample+Cont.(gm):	216.58	212.50	220.55
Weight of Dry Sample+Cont.(gm):	190.88	182.18	193.75
Weight of Container(gm):	66.14	58.20	64.60
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**LB-5**
Sample No.	**R-11**
Depth (ft)	**35**

Sample Type:

Ring

Soil Identification:
Yellowish brown lean clay (CL)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.000	■ 1.666	▲ 2.886
Shear Stress @ End of Test (ksf)	○ 0.792	□ 1.044	△ 2.135
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	9.75	9.75	9.75
Dry Density (pcf)	103.8	108.6	110.4
Saturation (%)	42.2	47.7	50.0
Soil Height Before Shearing (in.)	0.9981	0.9864	0.9820
Final Moisture Content (%)	20.6	24.5	20.8

Leighton

DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 11389.001

Goleta Fire Station #10

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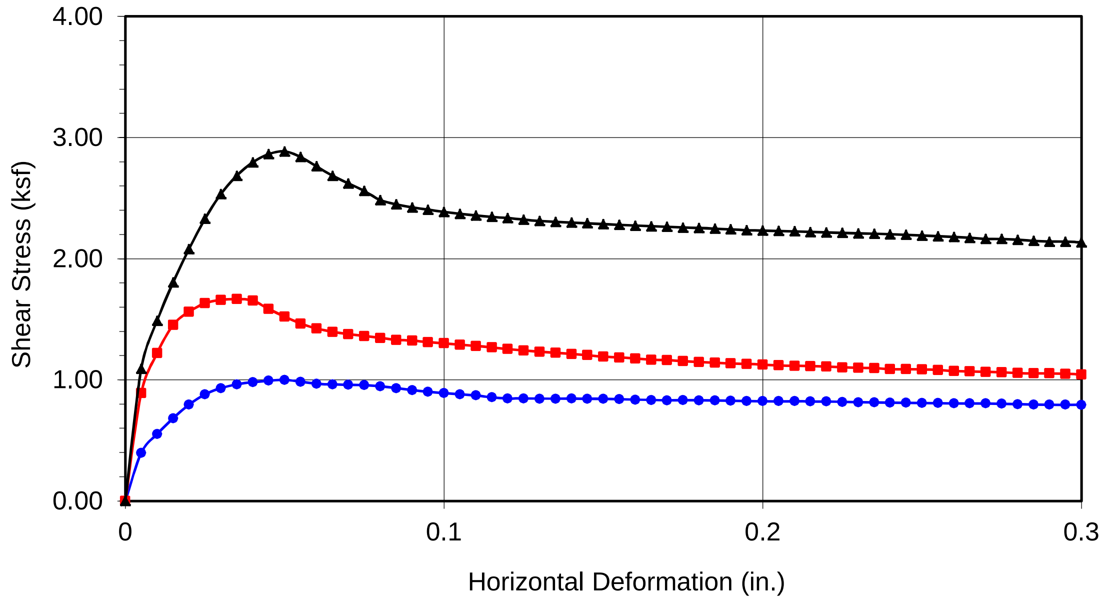
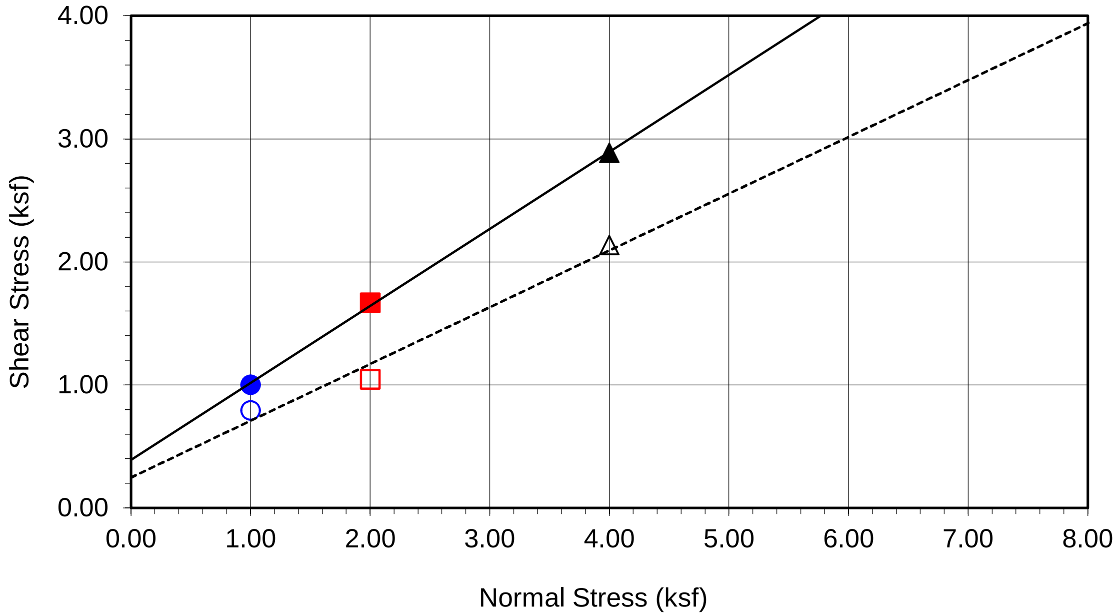




Boring No.	**LB-5**
Sample No.	**R-11**
Depth (ft)	**35**
Sample Type:	Ring

Soil Identification:
Yellowish brown lean clay (CL)

Strength Parameters

	C (psf)	ϕ (°)
Peak	390	32
Ultimate	247	25

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.000	■ 1.666	▲ 2.886
Shear Stress @ End of Test (ksf)	○ 0.792	□ 1.044	△ 2.135
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	9.75	9.75	9.75
Dry Density (pcf)	103.8	108.6	110.4
Saturation (%)	42.2	47.7	50.0
Soil Height Before Shearing (in.)	0.9981	0.9864	0.9820
Final Moisture Content (%)	20.6	24.5	20.8

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 11389.001

Goleta Fire Station #10

09-16

DIRECT SHEAR TEST

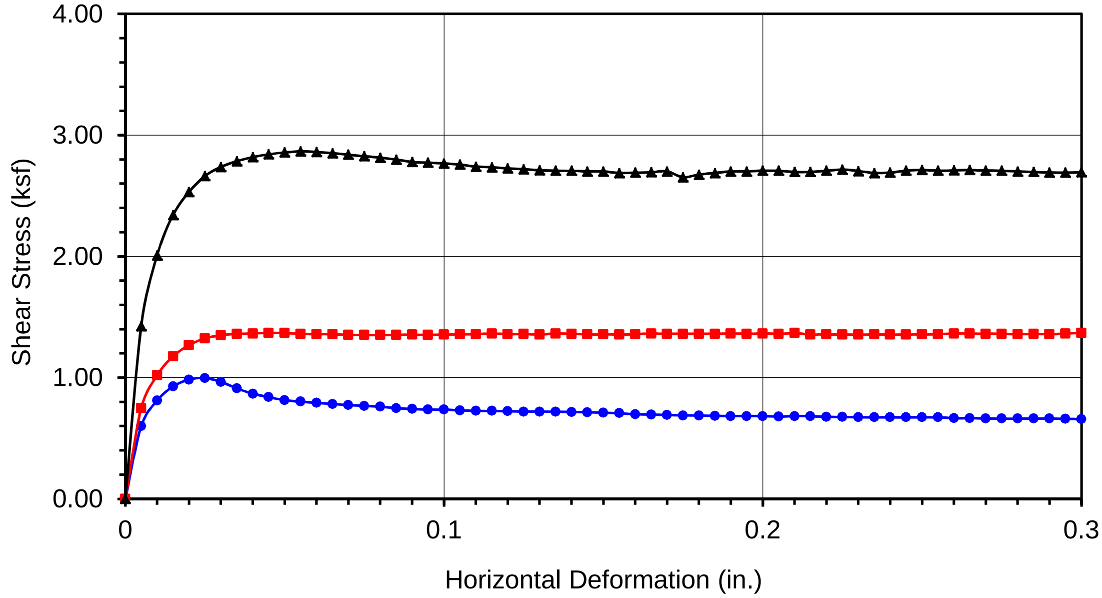
Consolidated Drained - ASTM D 3080

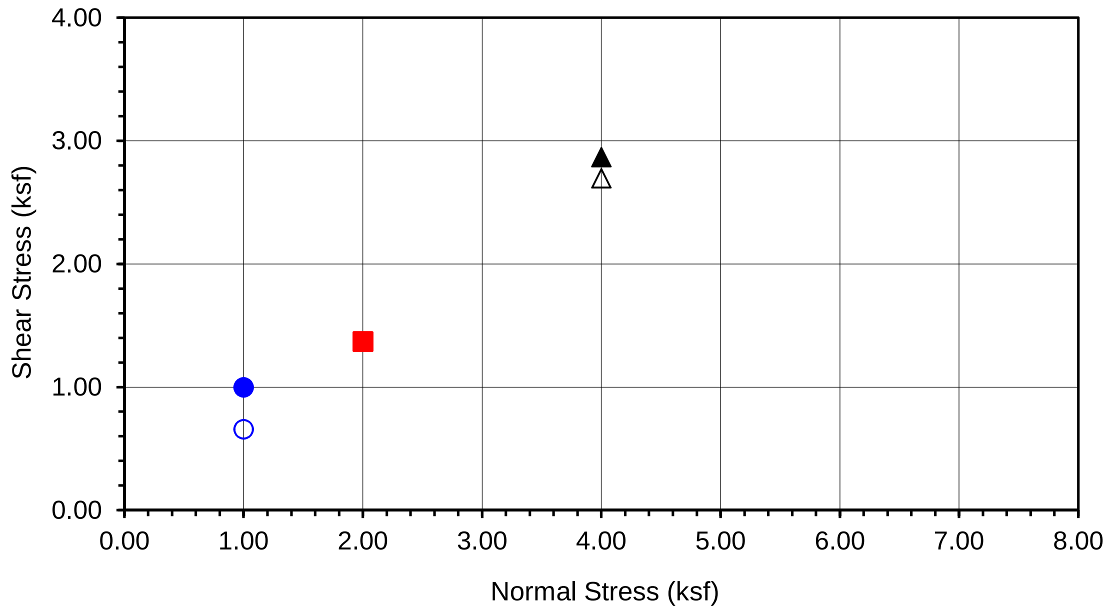
Leighton

Project Name:	Goleta Fire Station #10	Tested By:	G. Bathala	Date:	09/26/16
Project No.:	11389.001	Checked By:	J. Ward	Date:	09/28/16
Boring No.:	LB-7	Sample Type:	90% Remold		
Sample No.:	B-1	Depth (ft.):	0-5		

Soil Identification: Dark brown clayey sand (SC)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	193.28	193.13	193.33
Weight of Ring(gm):	43.20	42.94	43.22
Before Shearing			
Weight of Wet Sample+Cont.(gm):	246.30	246.30	246.30
Weight of Dry Sample+Cont.(gm):	228.69	228.69	228.69
Weight of Container(gm):	38.80	38.80	38.80
Vertical Rdg.(in): Initial	0.0000	0.2933	0.2615
Vertical Rdg.(in): Final	-0.0059	0.3055	0.2808
After Shearing			
Weight of Wet Sample+Cont.(gm):	214.20	226.42	214.15
Weight of Dry Sample+Cont.(gm):	193.81	205.85	194.68
Weight of Container(gm):	57.90	69.13	58.64
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**LB-7**
Sample No.	**B-1**
Depth (ft)	**0-5**

Sample Type:

90% Remold

Soil Identification:

Dark brown clayey sand (SC)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.997	■ 1.368	▲ 2.867
Shear Stress @ End of Test (ksf)	○ 0.657	□ 1.368	△ 2.694
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	9.27	9.27	9.27
Dry Density (pcf)	114.2	114.3	114.2
Saturation (%)	52.6	52.8	52.7
Soil Height Before Shearing (in.)	0.9941	0.9878	0.9807
Final Moisture Content (%)	15.0	15.0	14.3

Leighton

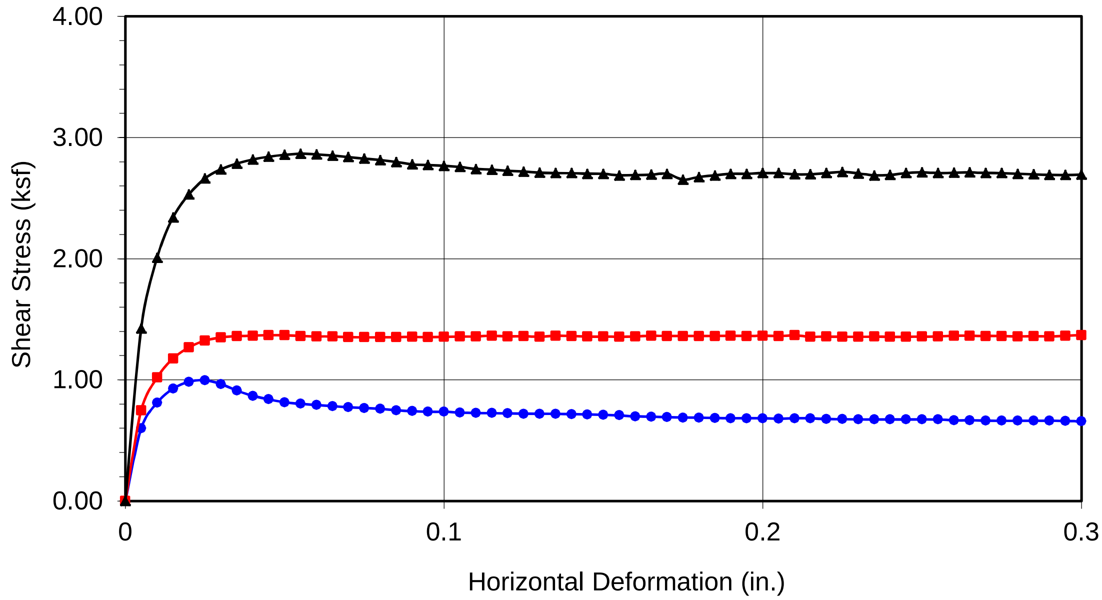
DIRECT SHEAR TEST RESULTS

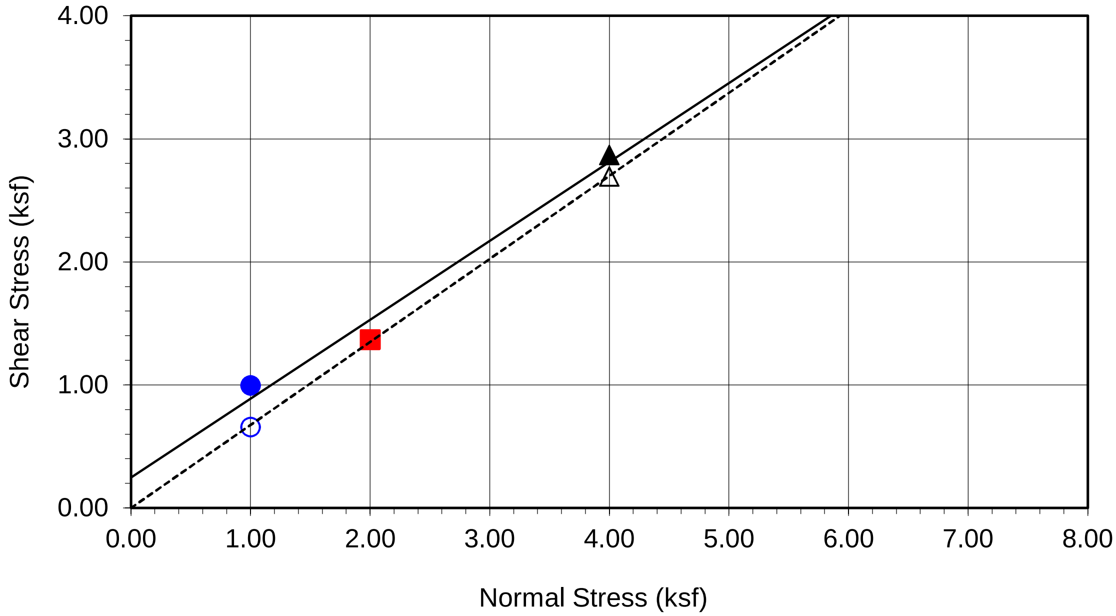
Consolidated Drained - ASTM D 3080

Project No.: 11389.001

Goleta Fire Station #10

09-16





Boring No.	**LB-7**
Sample No.	**B-1**
Depth (ft)	**0-5**
Sample Type:	90% Remold

Soil Identification:
Dark brown clayey sand (SC)

Strength Parameters

	C (psf)	ϕ (^{o})
Peak	248	33
Ultimate	0	34

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.997	■ 1.368	▲ 2.867
Shear Stress @ End of Test (ksf)	○ 0.657	□ 1.368	△ 2.694
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	9.27	9.27	9.27
Dry Density (pcf)	114.2	114.3	114.2
Saturation (%)	52.6	52.8	52.7
Soil Height Before Shearing (in.)	0.9941	0.9878	0.9807
Final Moisture Content (%)	15.0	15.0	14.3

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 11389.001

Goleta Fire Station #10

09-16

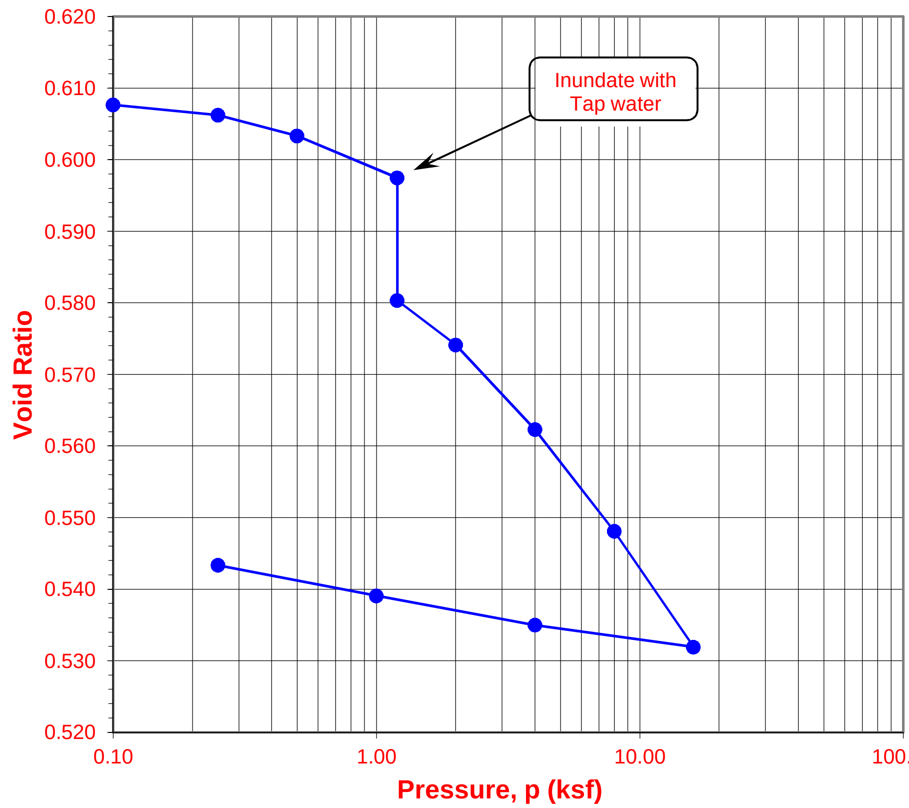
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

ASTM D 2435

Leighton

Project Name:	Goleta Fire Station #10	Tested By:	G. Bathala Date: 09/21/16
Project No.:	11389.001	Checked By:	J. Ward Date: 09/28/16
Boring No.:	LB-5	Depth (ft.):	10.0
Sample No.:	R-3	Sample Type:	Ring
Soil Identification:	Yellowish brown poorly-graded sand with silt (SP-SM)		

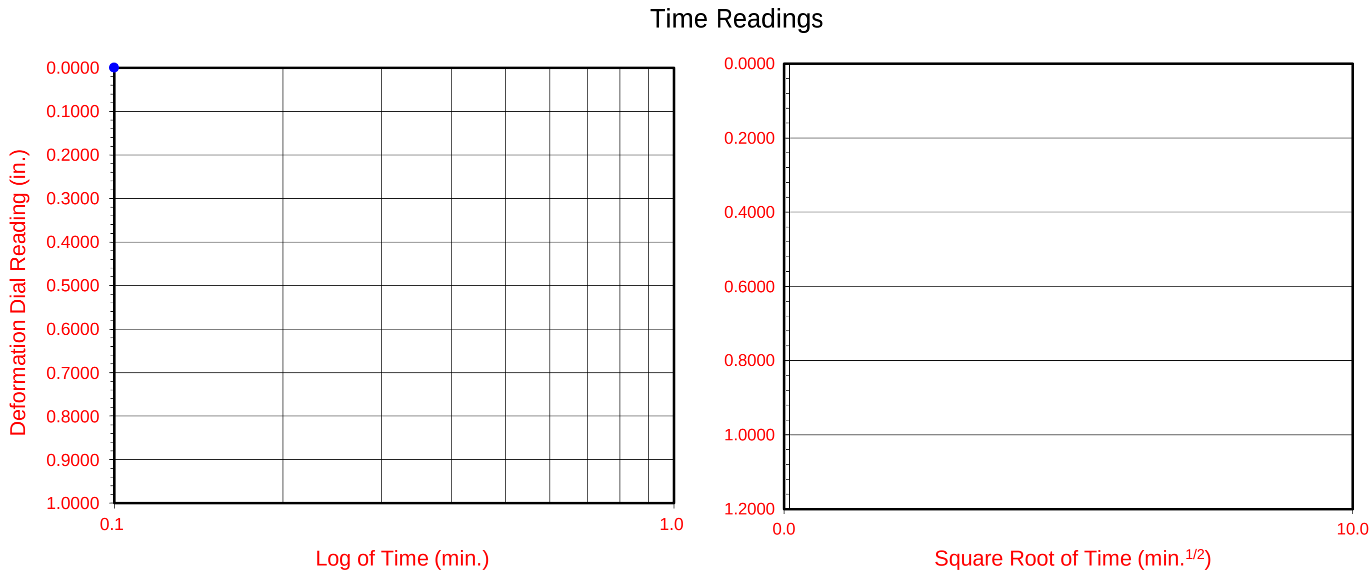
Sample Diameter (in.):	2.415
Sample Thickness (in.):	1.000
Weight of Sample + ring (g):	175.18
Weight of Ring (g):	45.58
Height after consol. (in.):	0.9596
Before Test	
Wt. of Wet Sample+Cont. (g):	228.11
Wt. of Dry Sample+Cont. (g):	223.41
Weight of Container (g):	57.95
Initial Moisture Content (%)	2.8
Initial Dry Density (pcf)	104.8
Initial Saturation (%):	13
Initial Vertical Reading (in.)	0.1633
After Test	
Wt. of Wet Sample+Cont. (g):	229.16
Wt. of Dry Sample+Cont. (g):	208.33
Weight of Container (g):	37.33
Final Moisture Content (%)	16.61
Final Dry Density (pcf):	108.7
Final Saturation (%):	81
Final Vertical Reading (in.)	0.2042
Specific Gravity (assumed):	2.70
Water Density (pcf):	62.43

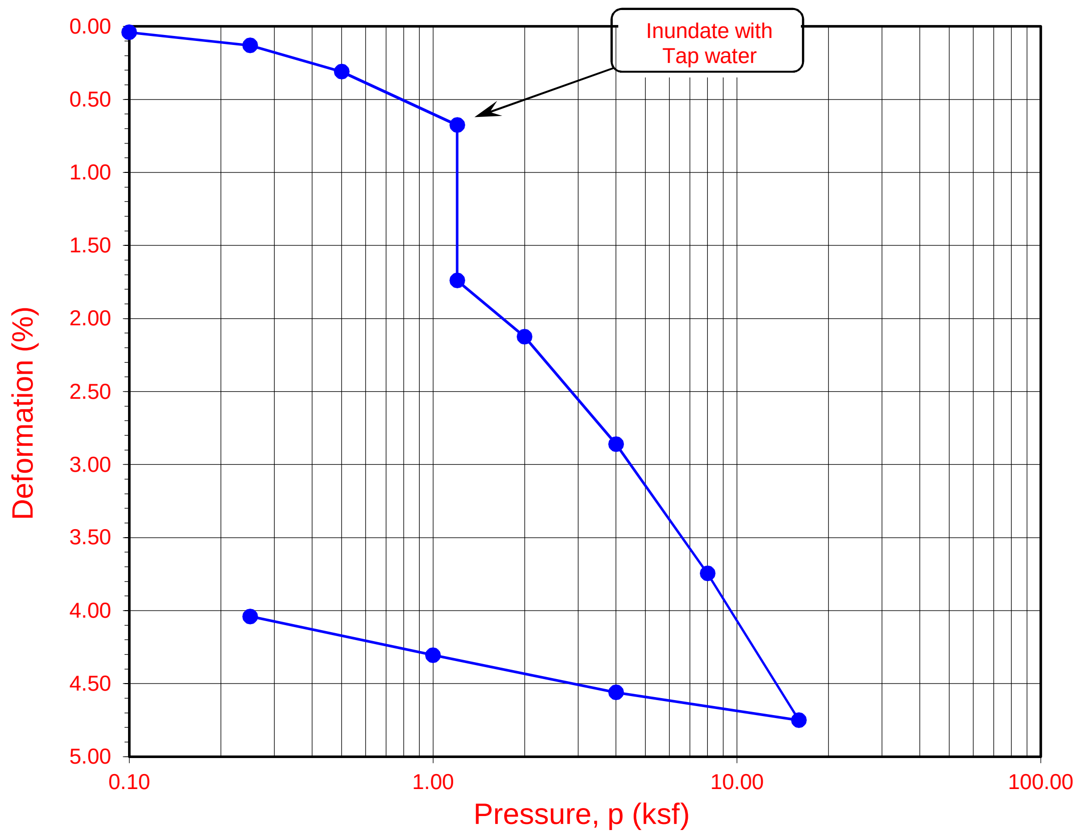


Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deforma-tion (%)
0.10	0.1637	0.9996	0.00	0.04	0.608	0.04
0.25	0.1647	0.9986	0.01	0.14	0.606	0.13
0.50	0.1666	0.9967	0.02	0.33	0.603	0.31
1.20	0.1705	0.9929	0.04	0.71	0.597	0.67
1.20	0.1811	0.9822	0.04	1.78	0.580	1.74
2.00	0.1852	0.9782	0.06	2.19	0.574	2.13
4.00	0.1929	0.9704	0.10	2.96	0.562	2.86
8.00	0.2023	0.9611	0.15	3.90	0.548	3.75
16.00	0.2130	0.9503	0.22	4.97	0.532	4.75
4.00	0.2103	0.9530	0.14	4.70	0.535	4.56
1.00	0.2072	0.9562	0.08	4.38	0.539	4.30
0.25	0.2042	0.9591	0.05	4.09	0.543	4.04

Time Readings

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)





Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
LB-5	**R-3**	**10**	**2.8**	**16.6**	**104.8**	**108.7**	**0.608**	**0.543**	**13**	**81**

Soil Identification: Yellowish brown poorly-graded sand with silt (SP-SM)

Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 11389.001

Goleta Fire Station #10

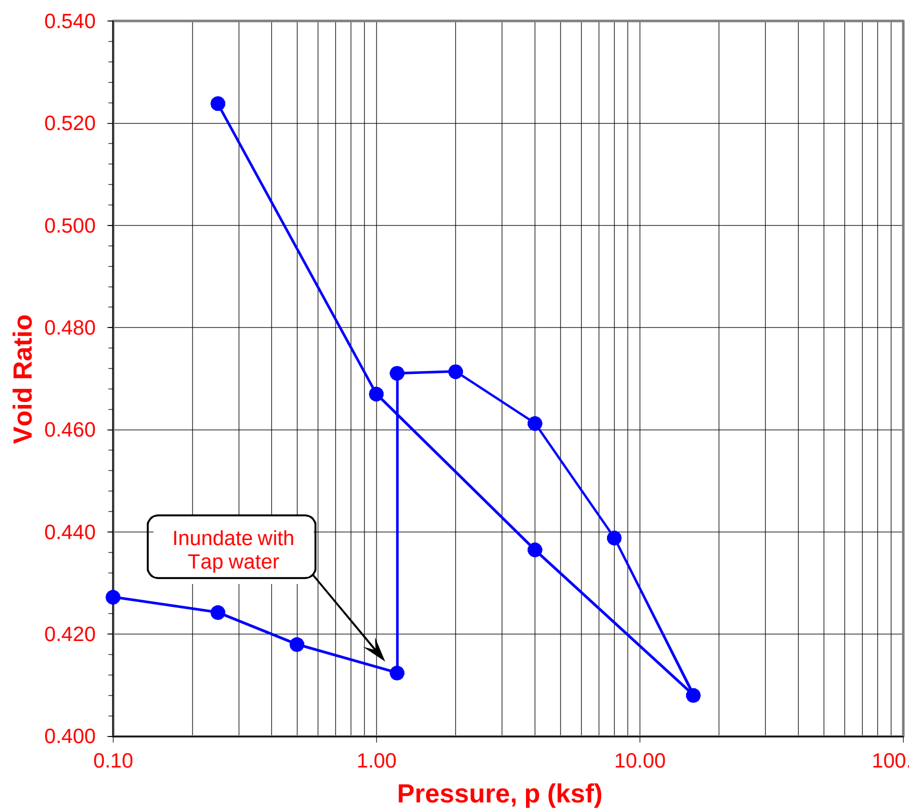
09-16

Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project Name:	Goleta Fire Station #10	Tested By: G. Bathala	Date: 09/21/16
Project No.:	11389.001	Checked By: J. Ward	Date: 09/29/16
Boring No.:	LB-6	Depth (ft.):	10.0
Sample No.:	R-3	Sample Type:	Ring
Soil Identification:	Brown lean clay'stone' (CL)		

Sample Diameter (in.):	2.415
Sample Thickness (in.):	1.000
Weight of Sample + ring (g):	201.49
Weight of Ring (g):	42.35
Height after consol. (in.):	1.0666
Before Test	
Wt. of Wet Sample+Cont. (g):	250.27
Wt. of Dry Sample+Cont. (g):	230.40
Weight of Container (g):	67.24
Initial Moisture Content (%)	12.2
Initial Dry Density (pcf)	118.0
Initial Saturation (%):	77
Initial Vertical Reading (in.)	0.1005
After Test	
Wt. of Wet Sample+Cont. (g):	377.21
Wt. of Dry Sample+Cont. (g):	347.73
Weight of Container (g):	169.53
Final Moisture Content (%)	21.70
Final Dry Density (pcf):	105.9
Final Saturation (%):	99
Final Vertical Reading (in.)	0.0347
Specific Gravity (assumed):	2.70
Water Density (pcf):	62.43

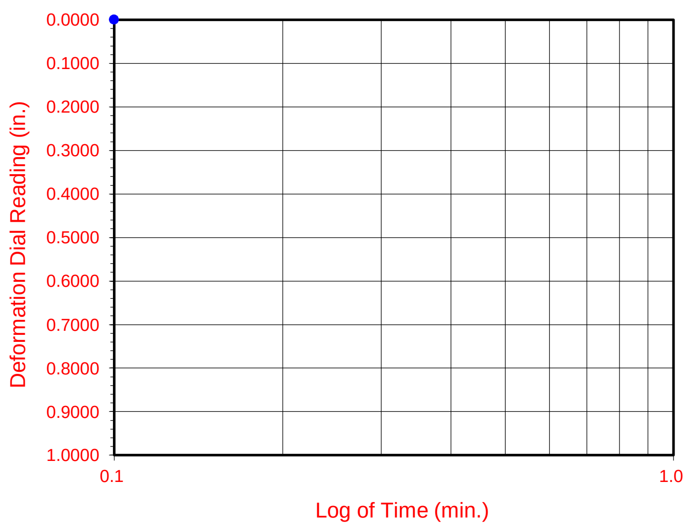


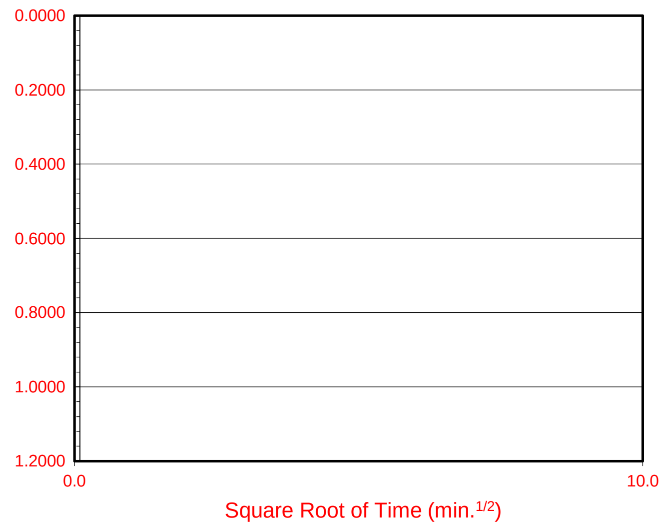
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.10	0.1015	0.9990	0.00	0.10	0.427	0.10
0.25	0.1037	0.9968	0.01	0.32	0.424	0.31
0.50	0.1085	0.9920	0.05	0.80	0.418	0.75
1.20	0.1128	0.9877	0.09	1.23	0.412	1.14
1.20	0.0718	1.0288	0.09	-2.88	0.471	-2.97
2.00	0.0719	1.0286	0.13	-2.86	0.471	-2.99
4.00	0.0798	1.0207	0.21	-2.07	0.461	-2.28
8.00	0.0967	1.0038	0.33	-0.38	0.439	-0.71
16.00	0.1202	0.9804	0.52	1.96	0.408	1.44
4.00	0.0976	1.0030	0.25	-0.30	0.436	-0.55
1.00	0.0751	1.0254	0.14	-2.54	0.467	-2.68
0.25	0.0347	1.0658	0.08	-6.58	0.524	-6.66

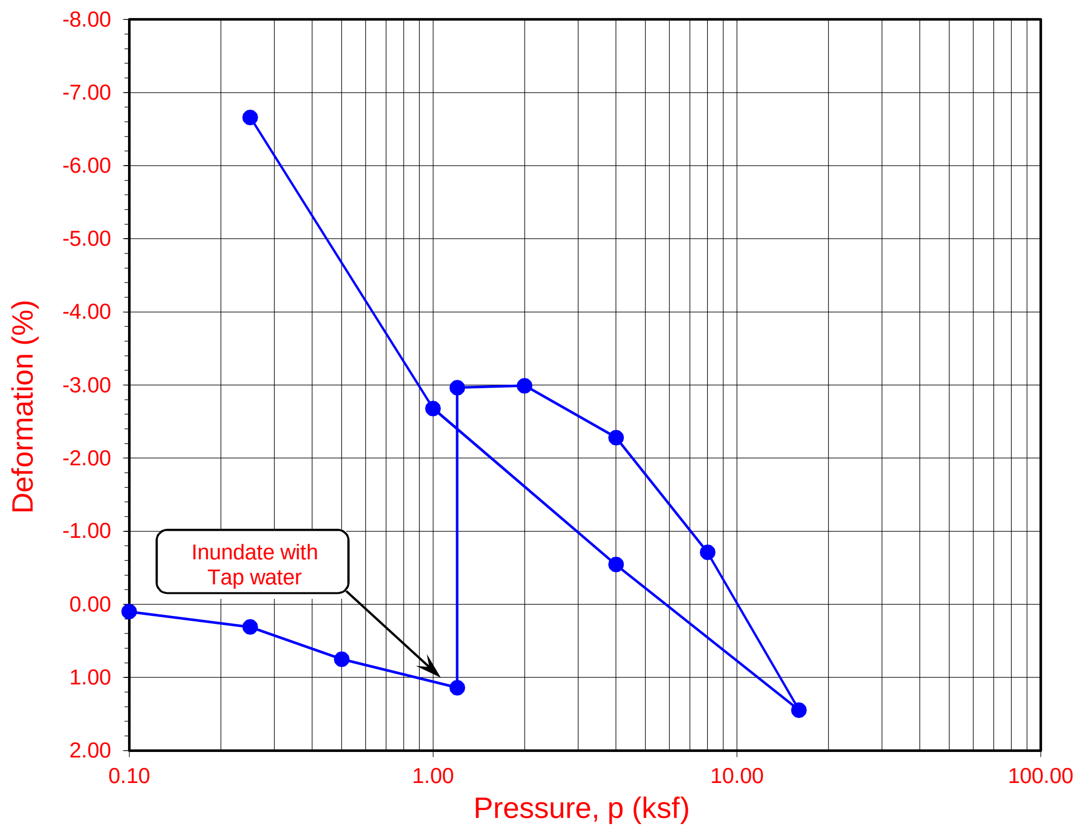
Time Readings

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)

Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
LB-6	**R-3**	**10**	**12.2**	**21.7**	**118.0**	**105.9**	**0.429**	**0.524**	**77**	**99**

Soil Identification: Brown lean clay'stone' (CL)

EXPANSION INDEX of SOILS

ASTM D 4829

Leighton

Project Name:	Goleta Fire Station #10	Tested By:	S. Felter	Date:	09/27/16
Project No.:	11389.001	Checked By:	J. Ward	Date:	09/28/16
Boring No.:	LB-7	Depth (ft.):	0-5		
Sample No.:	B-1				
Soil Identification:	Dark brown clayey sand (SC)				

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN		Before Test	After Test
Specimen Diameter	(in.)	4.01	4.01
Specimen Height	(in.)	1.0000	1.0060
Wt. Comp. Soil + Mold	(g)	604.10	423.81
Wt. of Mold	(g)	201.50	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	808.60	625.31
Dry Wt. of Soil + Cont.	(g)	738.50	569.13
Wt. of Container	(g)	0.00	201.50
Moisture Content	(%)	9.49	15.28
Wet Density	(pcf)	121.4	127.1
Dry Density	(pcf)	110.9	110.2
Void Ratio		0.520	0.529
Total Porosity		0.342	0.346
Pore Volume	(cc)	70.8	72.1
Degree of Saturation (%) [S_{meas}]		**49.3**	77.9

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
09/27/16	10:40	1.0	0	0.1690
09/27/16	10:50	1.0	10	0.1690
Add Distilled Water to the Specimen				
09/27/16	14:10	1.0	200	0.1750
09/28/16	6:34	1.0	1184	0.1750
09/28/16	8:25	1.0	1295	0.1750

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**6**

ATTERBERG LIMITS

ASTM D 4318

Leighton

Project Name:	Goleta Fire Station #10	Tested By:	A. Santos	Date:	09/26/16
Project No. :	11389.001	Input By:	J. Ward	Date:	09/27/16
Boring No.:	LB-2	Checked By:	J. Ward		
Sample No.:	S-2	Depth (ft.)	5.0		
Soil Identification:	Brown lean clay (CL)				

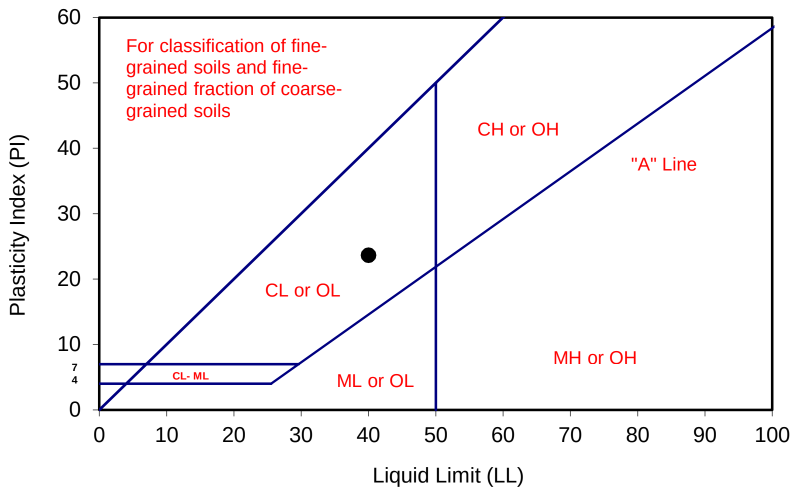
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			30	24	19	
Wet Wt. of Soil + Cont. (g)	10.60	10.28	22.12	21.01	23.87	
Dry Wt. of Soil + Cont. (g)	9.25	8.99	16.27	15.33	17.27	
Wt. of Container (g)	1.02	1.08	1.09	1.07	1.06	
Moisture Content (%) [Wn]	16.40	16.31	38.54	39.83	40.72	

Liquid Limit	**40**
Plastic Limit	**16**
Plasticity Index	**24**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 14.6

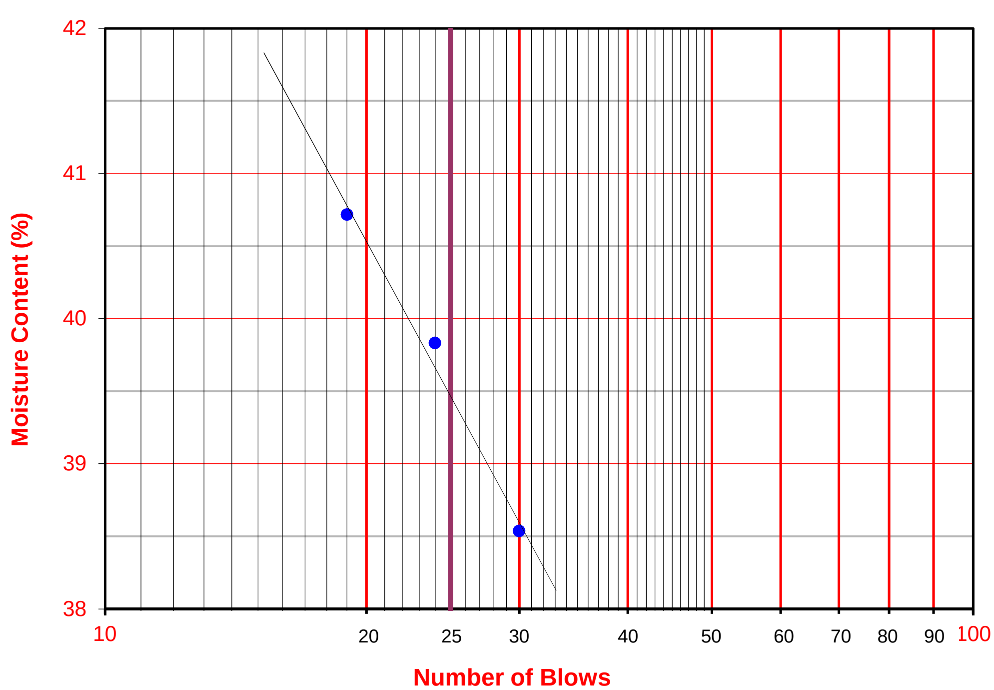
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



MODIFIED PROCTOR COMPACTION TEST
ASTM D 1557

Leighton

Project Name:	Goleta Fire Station #10	Tested By:	O. Figueroa	Date:	09/23/16
Project No.:	11389.001	Input By:	J. Ward	Date:	09/26/16
Boring No.:	LB-7	Depth (ft.):	0-5		
Sample No.:	B-1				
Soil Identification:	Dark brown clayey sand (SC)				

Note: Corrected dry density calculation assumes specific gravity of 2.70 and moisture content of 1.0% for oversize particles

			Scalp Fraction (%)	
Preparation Method:	X	Moist	#3/4	
		Dry	#3/8	
Compaction Method	X	Mechanical Ram	#4	10.0
		Manual Ram		

Rammer Weight (lb.) = 10.0
Height of Drop (in.) = 18.0
Mold Volume (ft³) 0.03330

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3835	3930	3876			
Weight of Mold (g)	1829	1829	1829			
Net Weight of Soil (g)	2006	2101	2047			
Wet Weight of Soil + Cont. (g)	416.0	430.1	446.3			
Dry Weight of Soil + Cont. (g)	389.6	394.2	400.6			
Weight of Container (g)	38.8	38.9	38.6			
Moisture Content (%)	7.53	10.10	12.62			
Wet Density (pcf)	132.8	139.1	135.5			
Dry Density (pcf)	123.5	126.3	120.3			

Maximum Dry Density (pcf) 126.5 **Optimum Moisture Content (%)** 9.5

Corrected Dry Density (pcf) 129.5 **Corrected Moisture Content (%)** 8.5

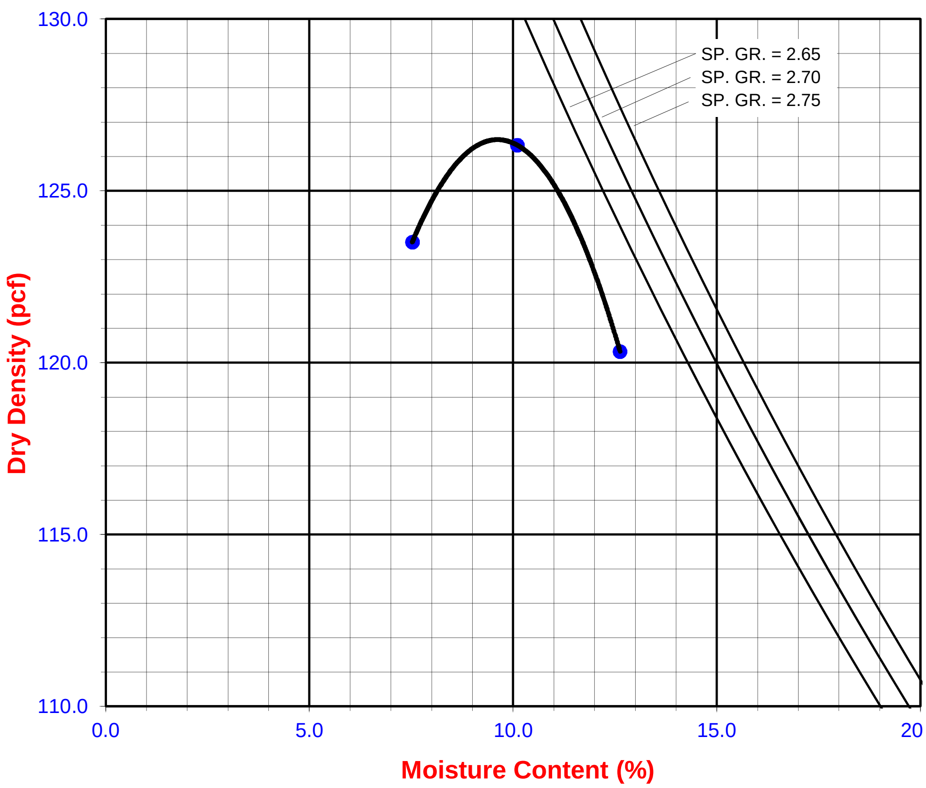
☒ **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

☐ **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

☐ **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
10:56:34
GR:SA:FI
Atterberg Limits:

LL,PL,PI



R-VALUE TEST RESULTS

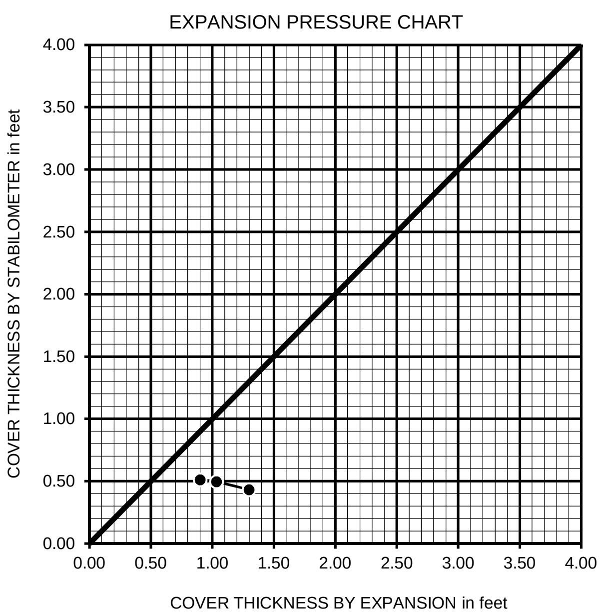
DOT CA Test 301

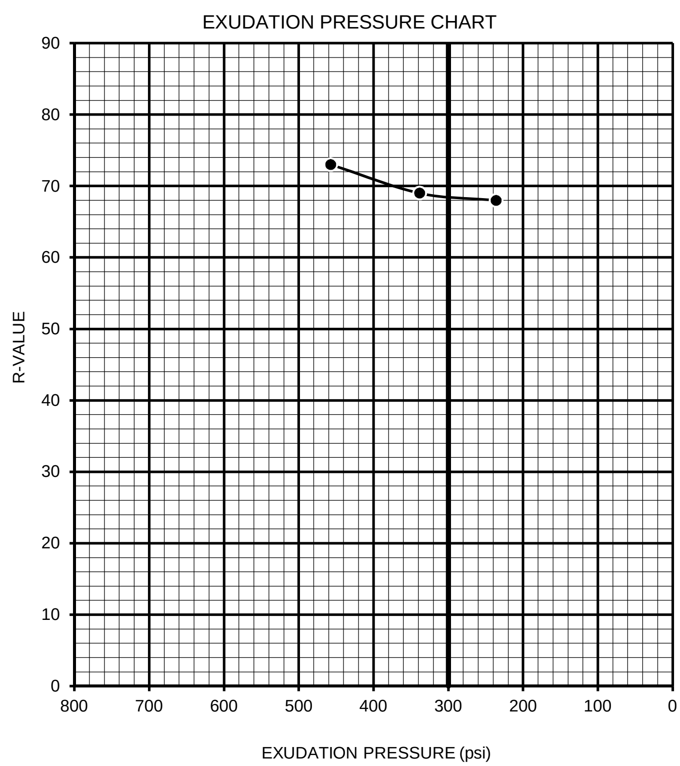
Leighton

PROJECT NAME:	Goleta Fire Station #10	PROJECT NUMBER:	11389.001
BORING NUMBER:	LB-6	DEPTH (FT.):	0-5
SAMPLE NUMBER:	B-1	TECHNICIAN:	S. Felter
SAMPLE DESCRIPTION:	Brown silty sand (SM)	DATE COMPLETED:	9/28/2016

TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	11.8	12.2	12.7
HEIGHT OF SAMPLE, Inches	2.52	2.52	2.62
DRY DENSITY, pcf	119.9	119.3	118.1
COMPACTOR PRESSURE, psi	350	310	280
EXUDATION PRESSURE, psi	457	338	236
EXPANSION, Inches x 10exp-4	39	31	27
STABILITY Ph 2,000 lbs (160 psi)	28	32	35
TURNS DISPLACEMENT	4.47	4.52	4.61
R-VALUE UNCORRECTED	73	69	66
R-VALUE CORRECTED	73	69	68

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.43	0.50	0.51
EXPANSION PRESSURE THICKNESS, ft.	1.30	1.03	0.90





R-VALUE BY EXPANSION:	64
R-VALUE BY EXUDATION:	68
EQUILIBRIUM R-VALUE:	64

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Leighton

Project Name: Goleta Fire Station #10 Tested By : G. Berdy Date: 09/23/16

Project No. : 11389.001 Data Input By: J. Ward Date: 09/28/16

Boring No.	LB-1			
Sample No.	B-1			
Sample Depth (ft)	0-7			
Soil Identification:	Brown s(ML)			
Wet Weight of Soil + Container (g)	207.93			
Dry Weight of Soil + Container (g)	197.89			
Weight of Container (g)	57.46			
Moisture Content (%)	7.15			
Weight of Soaked Soil (g)	100.67			

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	92			
Crucible No.	6			
Furnace Temperature (°C)	860			
Time In / Time Out	11:00/11:45			
Duration of Combustion (min)	45			
Wt. of Crucible + Residue (g)	23.3579			
Wt. of Crucible (g)	23.3483			
Wt. of Residue (g) (A)	0.0096			
PPM of Sulfate (A) x 41150	395.04			
PPM of Sulfate, Dry Weight Basis	**425**			

CHLORIDE CONTENT, DOT California Test 422

ml of Extract For Titration (B)	15			
ml of AgNO3 Soln. Used in Titration (C)	1.8			
PPM of Chloride (C -0.2) * 100 * 30 / B	320			
PPM of Chloride, Dry Wt. Basis	**345**			

pH TEST, DOT California Test 643

pH Value	**6.62**			
Temperature °C	20.5			

SOIL RESISTIVITY TEST

DOT CA TEST 643

Project Name:	Goleta Fire Station #10	Tested By :	G. Berdy	Date: 09/27/16
Project No. :	11389.001	Data Input By:	J. Ward	Date: 09/28/16
Boring No.:	LB-1	Depth (ft.) :	0-7
Sample No. :	B-1		

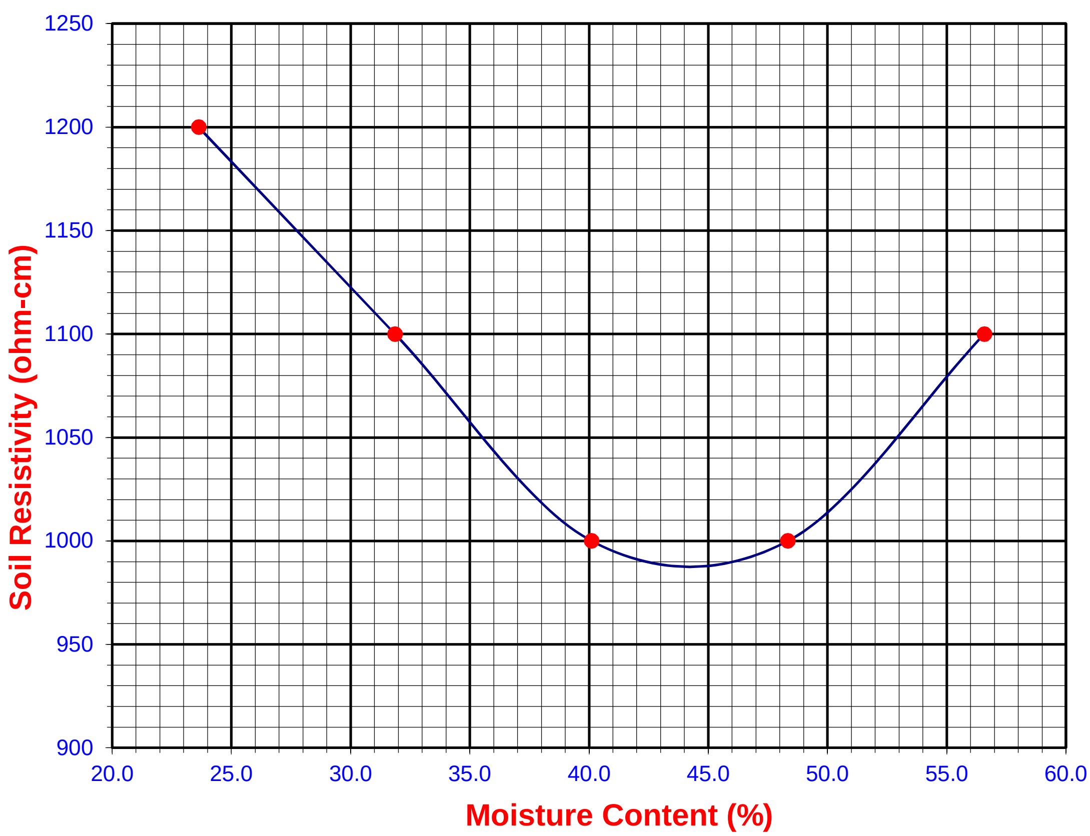
Soil Identification:* Brown s(ML)

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	20	23.63	1200	1200
2	30	31.86	1100	1100
3	40	40.10	1000	1000
4	50	48.34	1000	1000
5	60	56.58	1100	1100

Moisture Content (%) (MCi)	7.15
Wet Wt. of Soil + Cont. (g)	207.93
Dry Wt. of Soil + Cont. (g)	197.89
Wt. of Container (g)	57.46
Container No.	
Initial Soil Wt. (g) (Wt)	130.06
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
988	**44.2**	**425**	**345**	**6.62**	**20.5**



TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Leighton

Project Name:	Goleta Fire Station #10	Tested By :	G. Berdy	Date: 09/23/16
Project No. :	11389.001	Data Input By:	J. Ward	Date: 09/28/16

Boring No.	LB-6			
Sample No.	B-1			
Sample Depth (ft)	0-5			
Soil Identification:	Brown SM			
Wet Weight of Soil + Container (g)				
Dry Weight of Soil + Container (g)				
Weight of Container (g)				
Moisture Content (%)	N/A			
Weight of Soaked Soil (g)				

SULFATE CONTENT, DOT California Test 417, Part II

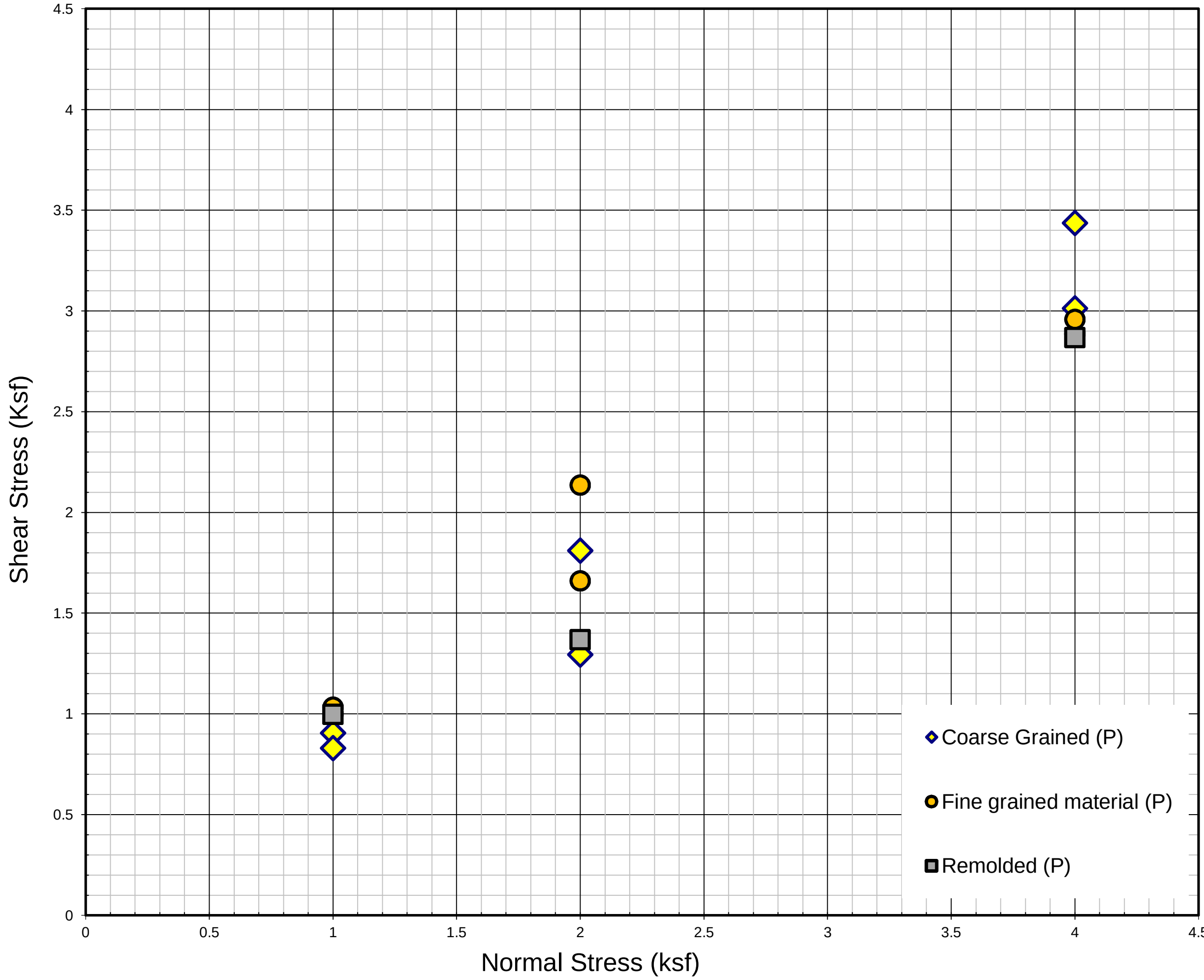
Beaker No.				
Crucible No.				
Furnace Temperature (°C)				
Time In / Time Out				
Duration of Combustion (min)				
Wt. of Crucible + Residue (g)				
Wt. of Crucible (g)				
Wt. of Residue (g) (A)				
PPM of Sulfate (A) x 41150				
PPM of Sulfate, Dry Weight Basis	**N/A**			

CHLORIDE CONTENT, DOT California Test 422

ml of Extract For Titration (B)				
ml of AgNO3 Soln. Used in Titration (C)				
PPM of Chloride (C -0.2) * 100 * 30 / B				
PPM of Chloride, Dry Wt. Basis	**N/A**			

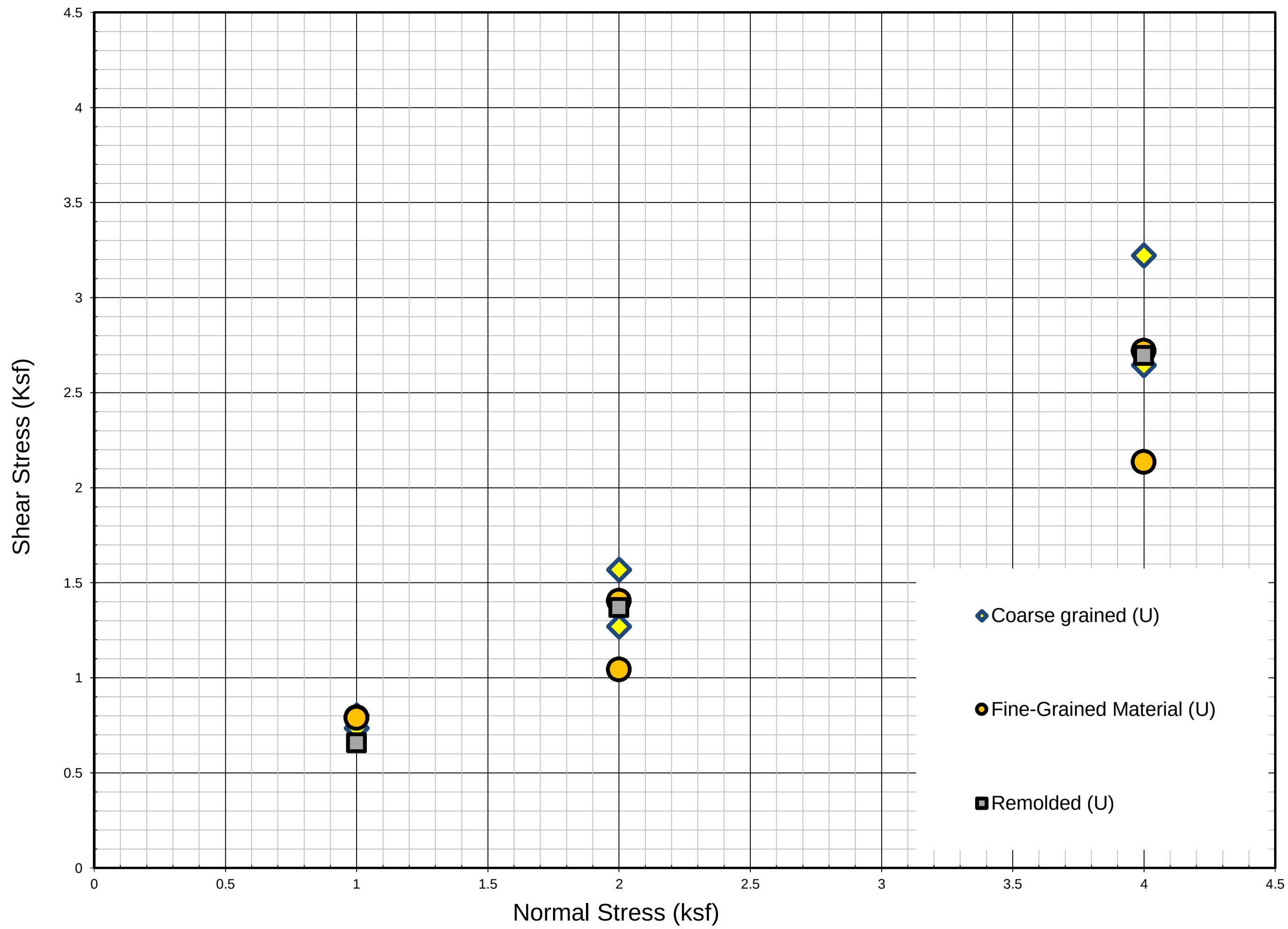
pH TEST, DOT California Test 643

pH Value	**7.07**			
Temperature °C	20.5			



Summary of Direct Shear Test Data, Peak Strength
Marine Terrace Deposits, Goleta Fire Station #10
7952 Hollister Avenue, Goleta, California

Project No. 11389.001
Date: September 2016



Summary of Direct Shear Test Data, Ultimate Strength Marine Terrace Deposits, Goleta Fire Station #10 7952 Hollister Avenue, Goleta, California	Project No. 11389.001 Date: September 2016	

APPENDIX C

SEISMIC DESIGN PARAMETERS

USGS Design Maps Summary Report

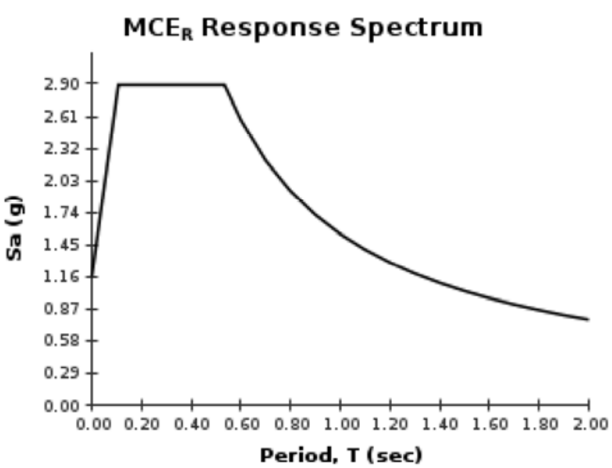
User–Specified Input

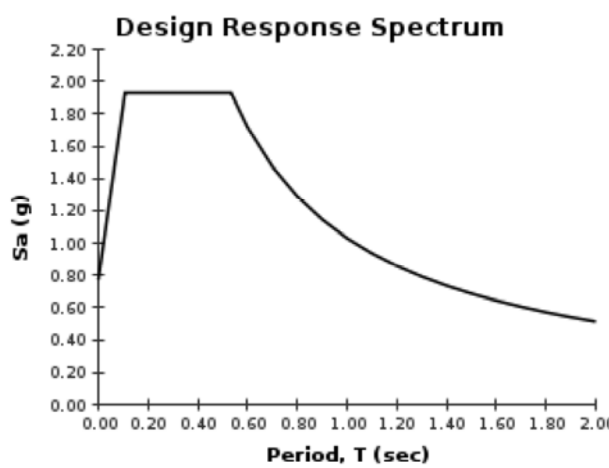
Report Title	Goleta Fire Station Thu July 28, 2016 22:12:56 UTC
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	34.43136°N, 119.90555°W
Site Soil Classification	Site Class D – “Stiff Soil”
Risk Category	IV (e.g. essential facilities)

USGS–Provided Output

S_S = 2.891 g	S_{MS} = 2.891 g	S_{DS} = 1.928 g
S_1 = 1.030 g	S_{M1} = 1.545 g	S_{D1} = 1.030 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the “2009 NEHRP” building code reference document.





For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

Design Maps Detailed Report

ASCE 7-10 Standard (34.43136°N, 119.90555°W)

Site Class D – "Stiff Soil", Risk Category IV (e.g. essential facilities)

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1]	S_S = 2.891 g
From Figure 22-2 [2]	S_1 = 1.030 g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index *PI* > 20, • Moisture content *w* ≥ 40%, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk–Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4–1: Site Coefficient F_a

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at Short Period				
	$S_S \le 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_S

For Site Class = D and S_s = 2.891 g, F_a = 1.000

Table 11.4–2: Site Coefficient F_v

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at 1–s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 1.030 g, F_v = 1.500

Equation (11.4–1): $S_{MS} = F_aS_S = 1.000 \times 2.891 = 2.891$ g

---

Equation (11.4–2): $S_{M1} = F_vS_1 = 1.500 \times 1.030 = 1.545$ g

---

Section 11.4.4 — Design Spectral Acceleration Parameters

Equation (11.4–3): $S_{DS} = ⅔\ S_{MS} = ⅔ \times 2.891 = 1.928$ g

---

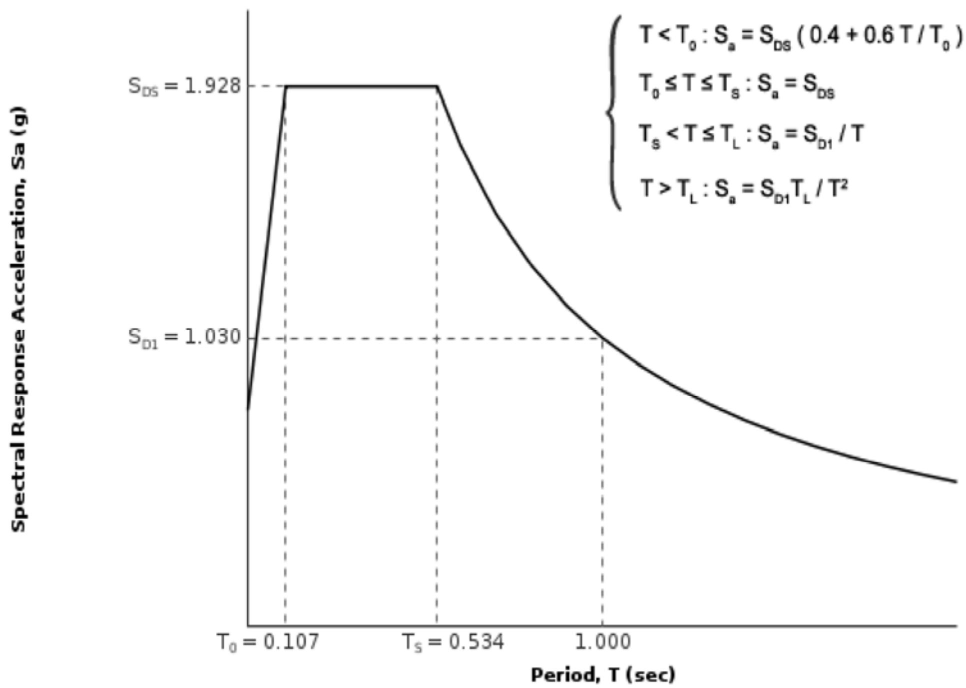
Equation (11.4–4): $S_{D1} = ⅔\ S_{M1} = ⅔ \times 1.545 = 1.030$ g

---

Section 11.4.5 — Design Response Spectrum

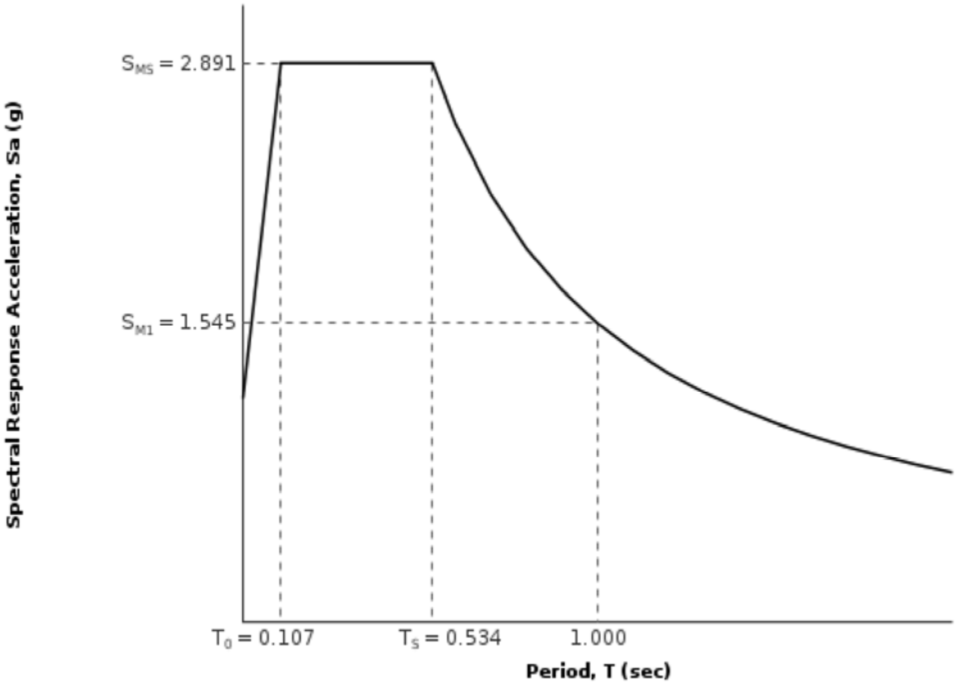
From Figure 22-12 [3] $T_L = 8$ seconds

Figure 11.4–1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4] PGA = 1.186

Equation (11.8–1): $PGA_M = F_{PGA}PGA = 1.000 \times 1.186 = 1.186$ g

Table 11.8–1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of PGA

For Site Class = D and PGA = 1.186 g, F_{PGA} = 1.000

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5] C_{RS} = 0.859

From Figure 22-18 [6] C_{R1} = 0.864

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = IV and S_{DS} = 1.928 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = IV and S_{D1} = 1.030 g, Seismic Design Category = D

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = F

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf

Design Maps Detailed Report

ASCE 7-10 Standard (34.43136°N, 119.90555°W)

Site Class D – "Stiff Soil", Risk Category IV (e.g. essential facilities)

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1]	S_S = 2.891 g
From Figure 22-2 [2]	S_1 = 1.030 g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index *PI* > 20, • Moisture content *w* ≥ 40%, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk–Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4–1: Site Coefficient F_a

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at Short Period				
	$S_S \le 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_S

For Site Class = D and S_S = 2.891 g, F_a = 1.000

Table 11.4–2: Site Coefficient F_v

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at 1–s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 1.030 g, F_v = 1.500

Equation (11.4–1): $S_{MS} = F_aS_S = 1.000 \times 2.891 = 2.891$ g

Equation (11.4–2): $S_{M1} = F_vS_1 = 1.500 \times 1.030 = 1.545$ g

Section 11.4.4 — Design Spectral Acceleration Parameters

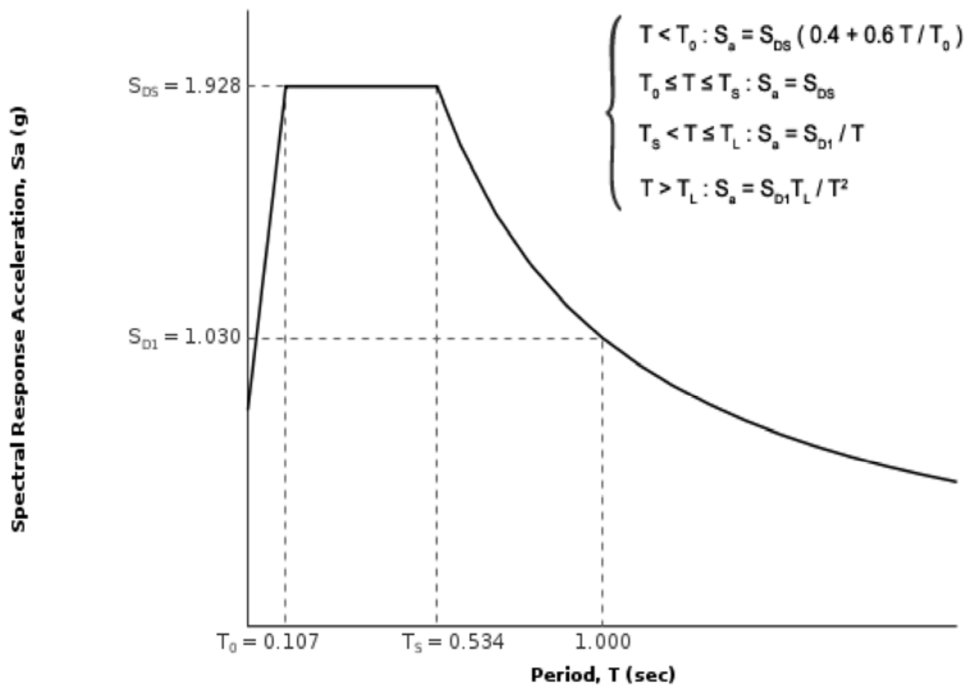
Equation (11.4–3): $S_{DS} = ⅔ S_{MS} = ⅔ \times 2.891 = 1.928$ g

Equation (11.4–4): $S_{D1} = ⅔ S_{M1} = ⅔ \times 1.545 = 1.030$ g

Section 11.4.5 — Design Response Spectrum

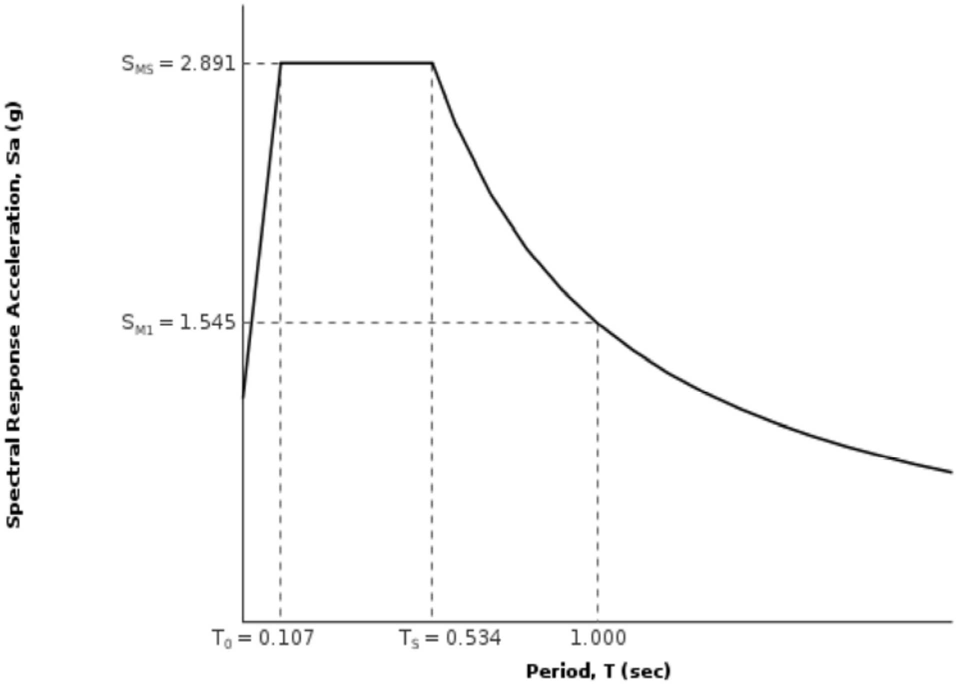
From Figure 22-12 [3] T_L = 8 seconds

Figure 11.4–1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4] PGA = 1.186

Equation (11.8–1): $PGA_M = F_{PGA}PGA = 1.000 \times 1.186 = 1.186$ g

Table 11.8–1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of PGA

For Site Class = D and PGA = 1.186 g, F_{PGA} = 1.000

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5] C_{RS} = 0.859

From Figure 22-18 [6] C_{R1} = 0.864

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \leq S_{DS} < 0.33g$	B	B	C
$0.33g \leq S_{DS} < 0.50g$	C	C	D
$0.50g \leq S_{DS}$	D	D	D

For Risk Category = IV and S_{DS} = 1.928 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \leq S_{D1} < 0.133g$	B	B	C
$0.133g \leq S_{D1} < 0.20g$	C	C	D
$0.20g \leq S_{D1}$	D	D	D

For Risk Category = IV and S_{D1} = 1.030 g, Seismic Design Category = D

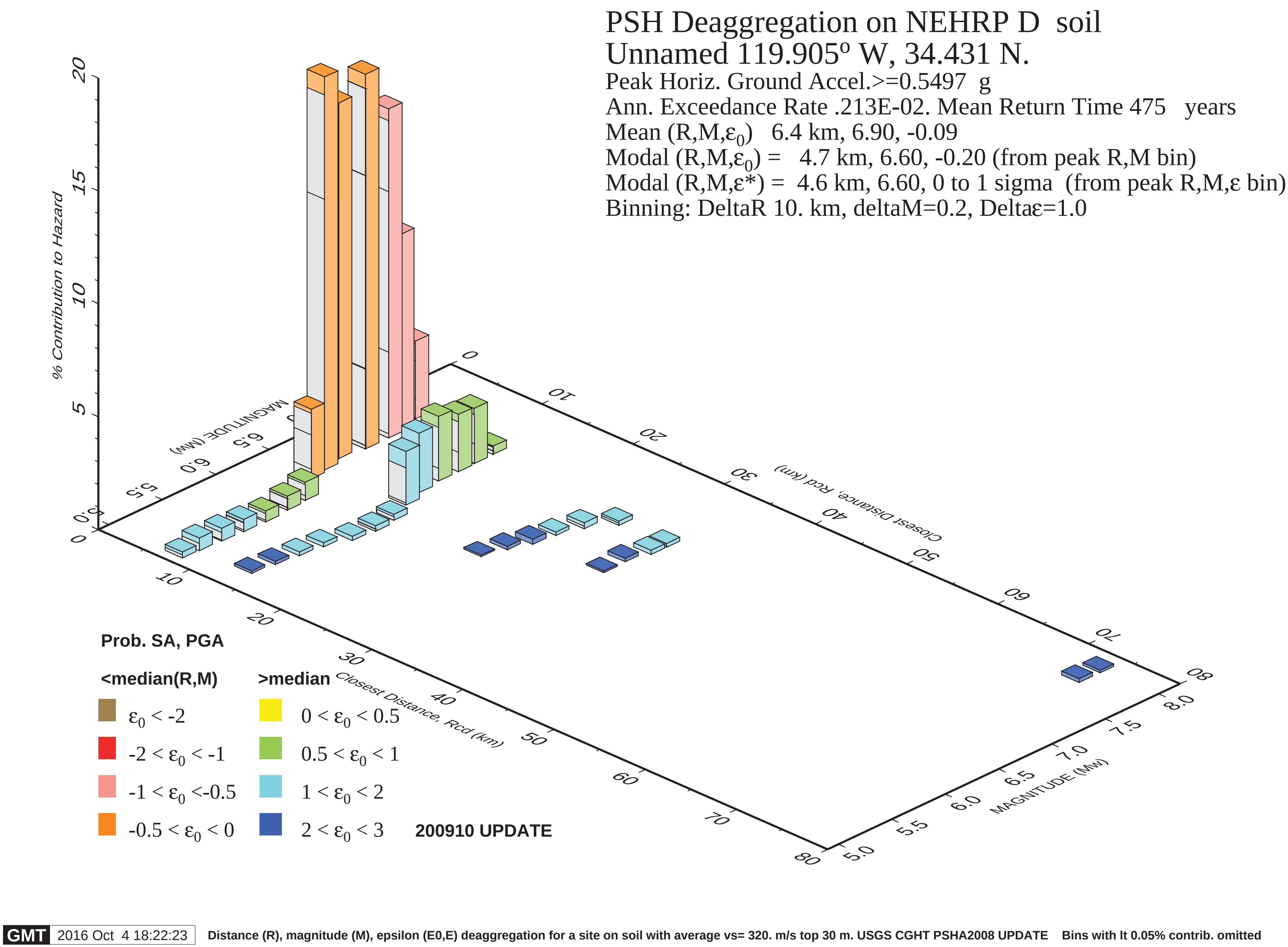
Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

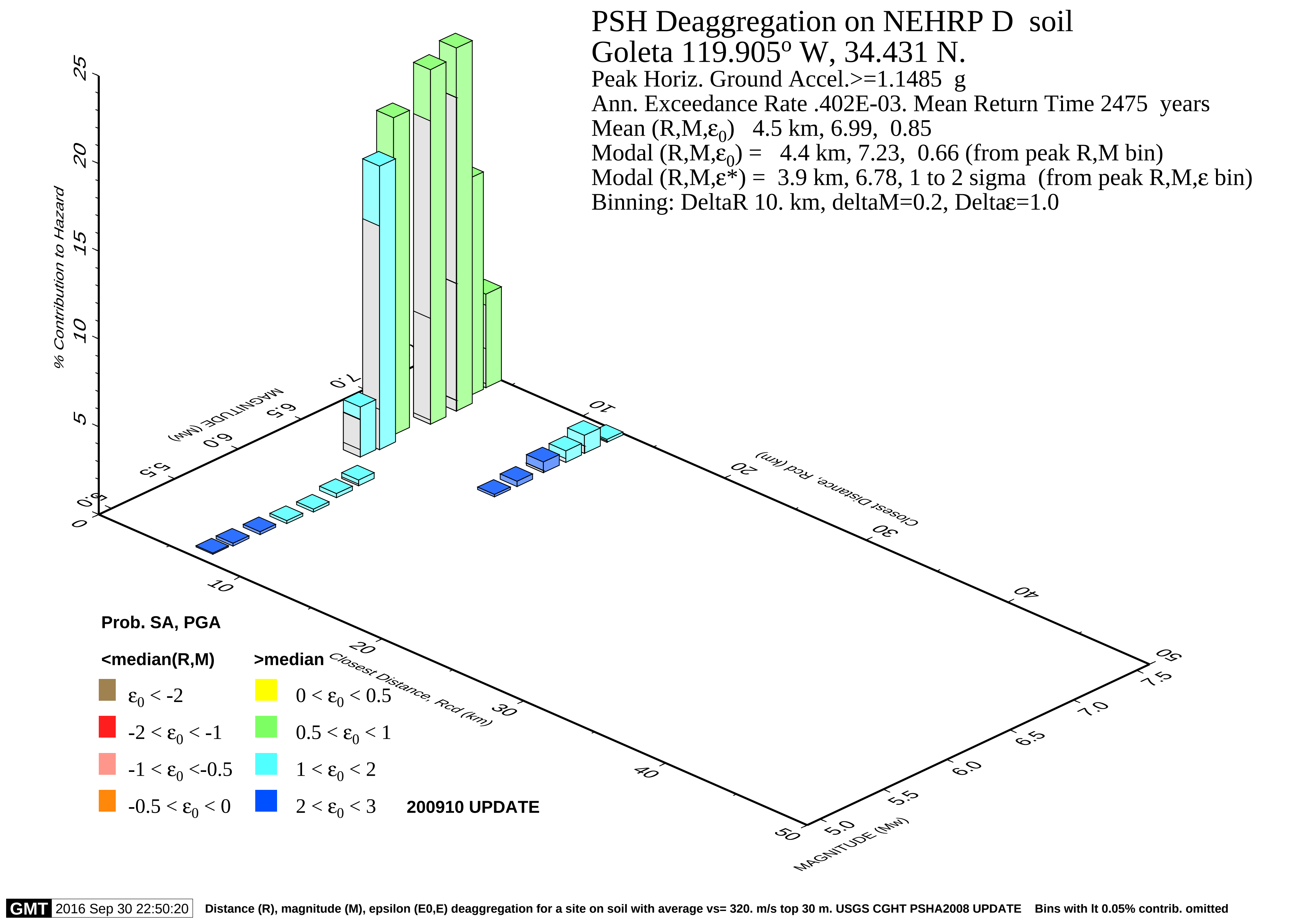
Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = F

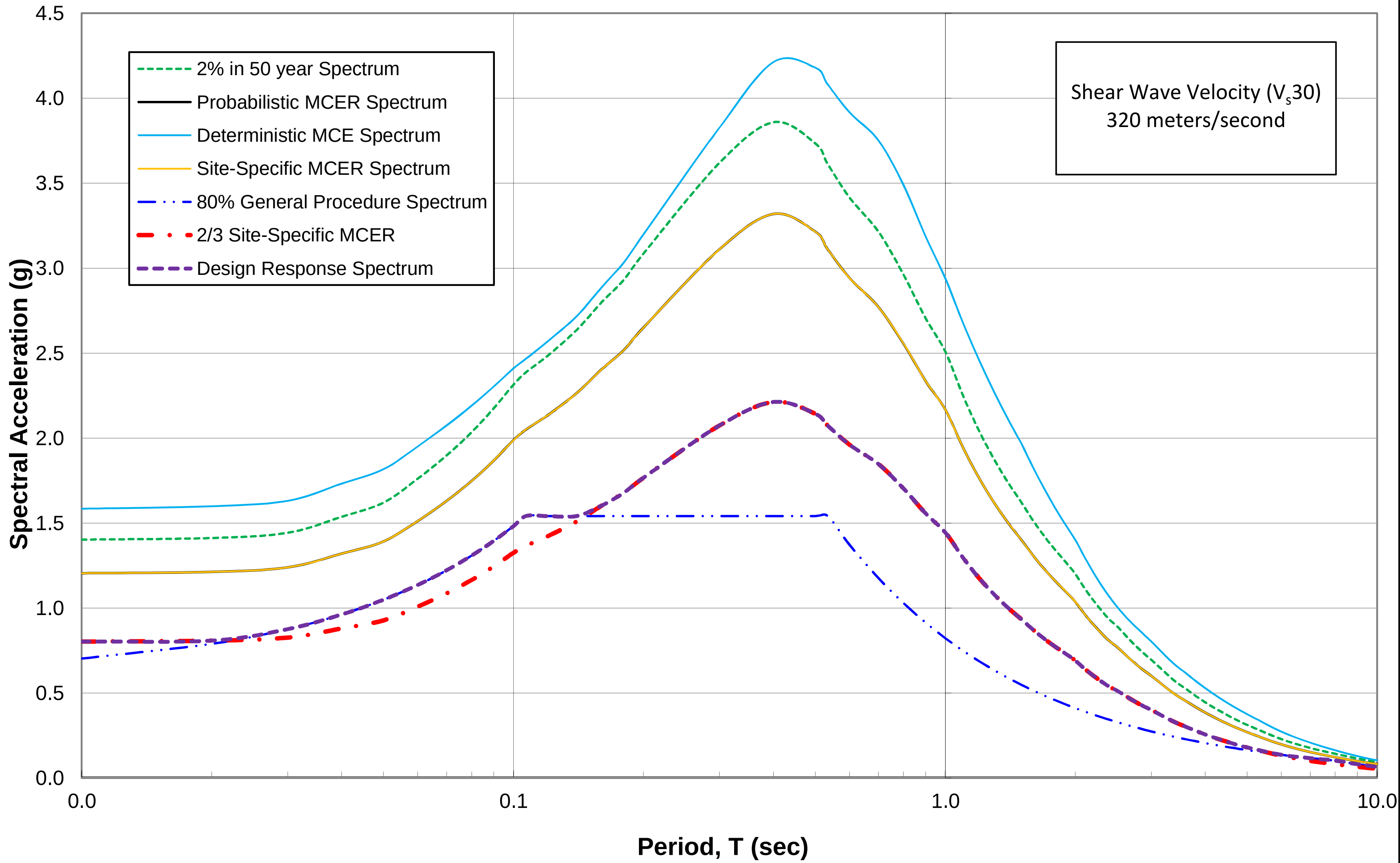
Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf


PSH Deaggregation on NEHRP D soil
Unnamed 119.905º W, 34.431 N.
Peak Horiz. Ground Accel.>=0.5497 g
Ann. Exceedance Rate .213E-02. Mean Return Time 475 years
Mean (R,M,ε0) 6.4 km, 6.90, -0.09
Modal (R,M,ε0) = 4.7 km, 6.60, -0.20 (from peak R,M bin)
Modal (R,M,ε*) = 4.6 km, 6.60, 0 to 1 sigma (from peak R,M,ε bin)
Binning: DeltaR 10. km, deltaM=0.2, Deltaε=1.0
% Contribution to Hazard
Closest Distance, Rcd (km)
MAGNITUDE (Mw)
Prob. SA, PGA
<median(R,M)
>median
ε0 < -2
-2 < ε0 < -1
-1 < ε0 <-0.5
-0.5 < ε0 < 0
0 < ε0 < 0.5
0.5 < ε0 < 1
1 < ε0 < 2
2 < ε0 < 3
200910 UPDATE
GMT 2016 Oct 4 18:22:23
Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 320. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted


PSH Deaggregation on NEHRP D soil
Goleta 119.905° W, 34.431 N.
Peak Horiz. Ground Accel.>=1.1485 g
Ann. Exceedance Rate .402E-03. Mean Return Time 2475 years
Mean (R,M,ε0) 4.5 km, 6.99, 0.85
Modal (R,M,ε0) = 4.4 km, 7.23, 0.66 (from peak R,M bin)
Modal (R,M,ε*) = 3.9 km, 6.78, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR 10. km, deltaM=0.2, Deltaε=1.0
% Contribution to Hazard
0
5
10
15
20
25
MAGNITUDE (Mw)
5.0
5.5
6.0
6.5
7.0
7.5
Closest Distance, Rcd (km)
10
20
30
40
50
Prob. SA, PGA
<median(R,M)
>median
ε0 < -2
-2 < ε0 < -1
-1 < ε0 <-0.5
-0.5 < ε0 < 0
0 < ε0 < 0.5
0.5 < ε0 < 1
1 < ε0 < 2
2 < ε0 < 3
200910 UPDATE
GMT 2016 Sep 30 22:50:20
Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 320. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted



SITE-SPECIFIC RESPONSE SPECTRUM
FIRE STATION #10
7952 HOLLISTER AVENUE
GOLETA, CALIFORNIA

Project Name:	FS #10
Project No.:	11389.001
Designed/Checked by:	SP
Date:	08/2016

Figure 7

Table D-1: Site-Specific Seismic Ground Motion Hazard Analysis per ASCE 7-10

Project Name:	Goleta Fire Station #10		Date:	2016	Seismic Design Coefficients: Per ASCE 7-10/2013 CBC (USGS Seismic Design Maps)					
Project Number:	11389.001		Site Coordinates							
			Latitude	Longitude	S_s	2.891	S_{MS}	2.8910	T_0	0.107
Site Class:	D	Chapter 20	34.4314	-119.9056	S_1	1.03	S_{M1}	1.5450	T_s	0.534
Shear Wave Velocity:	320	m/sec			F_a	1	S_{DS}	1.927	T_L	8
Return Period:	2475	years (2 percent probability of exceedance in 50 years)			F_v	1.5	S_{D1}	1.030	**Design S_{DS}**	**1.767**
Percent Damping:	5	%			C_{RS}	0.859	C_{R1}	0.864	**Design S_{D1}**	**1.446**

	Sec. 21.2.1.1 Method 1 Probabilistic			**Sec. 21.2.2 Deterministic**			**Sec. 21.2.3 Site - Specific**	**Section 11.4.5 General Procedure**		**Sec. 21.3 Design Response Spectrum**			**Section 11.4.6 Risk-Targeted MCE_R**
Period (sec.)	Spectral Acceleration (g)	Siesmic Risk Coefficients from Figs. 22-17 and 22-18 (C_{RS} and C_{R1})	MCE_R Response Spectrum (g)	Spectral Acceleration at 84th-percentile (g)	Lower Limit on MCE_R Response Spectrum Figure 21.2-1	MCE_R Response Spectrum (g)	MCE_R S_{aM} (g)	Design Response Spectral Accelerations-Sa (g)	MCE_R Response Spectral Accelerations-Sa (g)	Lower Limit of General Procedure Spectrum-80% of Sa (g)	(2/3)*S_{aM}	Design Response Spectrum (g)	1.5* Final Design Response Spectrum (g)
0.01	1.403	0.859	1.205	1.585	0.600	1.585	1.205	0.879	1.319	0.703	0.803	0.803	1.205
0.02	1.413	0.859	1.213	1.599	0.682	1.599	1.213	0.987	1.481	0.790	0.809	0.809	1.213
0.03	1.443	0.859	1.240	1.631	0.764	1.631	1.240	1.096	1.643	0.876	0.827	0.876	1.315
0.04	1.537	0.859	1.321	1.733	0.845	1.733	1.321	1.204	1.806	0.963	0.880	0.963	1.444
0.05	1.621	0.859	1.392	1.817	0.927	1.817	1.392	1.312	1.968	1.050	0.928	1.050	1.574
0.06	1.761	0.859	1.513	1.952	1.009	1.952	1.513	1.420	2.130	1.136	1.009	1.136	1.704
0.07	1.898	0.859	1.630	2.074	1.091	2.074	1.630	1.528	2.292	1.223	1.087	1.223	1.834
0.08	2.035	0.859	1.748	2.191	1.173	2.191	1.748	1.636	2.455	1.309	1.165	1.309	1.964
0.09	2.175	0.859	1.869	2.304	1.255	2.304	1.869	1.745	2.617	1.396	1.246	1.396	2.094
0.10	2.315	0.859	1.988	2.411	1.336	2.411	1.988	1.853	2.779	1.482	1.325	1.482	2.223
0.107	2.387	0.859	2.051	2.467	1.500	2.467	2.051	1.927	2.891	1.542	1.367	1.542	2.313
0.12	2.485	0.859	2.134	2.569	1.500	2.569	2.134	1.927	2.891	1.542	1.423	1.542	2.313
0.14	2.636	0.859	2.264	2.717	1.500	2.717	2.264	1.927	2.891	1.542	1.509	1.542	2.313
0.16	2.800	0.859	2.405	2.887	1.500	2.887	2.405	1.927	2.891	1.542	1.603	1.603	2.405
0.18	2.930	0.859	2.517	3.032	1.500	3.032	2.517	1.927	2.891	1.542	1.678	1.678	2.517
0.2	3.086	0.859	2.650	3.198	1.500	3.198	2.650	1.927	2.891	1.542	1.767	1.767	2.650
0.3	3.620	0.860	3.112	3.827	1.500	3.827	3.112	1.927	2.891	1.542	2.074	2.074	3.112
0.4	3.859	0.860	3.319	4.213	1.500	4.213	3.319	1.927	2.891	1.542	2.213	2.213	3.319
0.5	3.734	0.861	3.215	4.180	1.500	4.180	3.215	1.927	2.891	1.542	2.143	2.143	3.215
0.534	3.613	0.861	3.111	4.081	1.500	4.081	3.111	1.927	2.891	1.542	2.074	2.074	3.111
0.6	3.416	0.862	2.943	3.918	1.500	3.918	2.943	1.717	2.575	1.373	1.962	1.962	2.943
0.7	3.215	0.862	2.772	3.752	1.286	3.752	2.772	1.471	2.207	1.177	1.848	1.848	2.772
0.8	2.964	0.863	2.557	3.491	1.125	3.491	2.557	1.288	1.931	1.030	1.705	1.705	2.557
0.9	2.707	0.863	2.337	3.188	1.000	3.188	2.337	1.144	1.717	0.916	1.558	1.558	2.337
1	2.510	0.864	2.168	2.941	0.900	2.941	2.168	1.030	1.545	0.824	1.446	1.446	2.168
1.1	2.249	0.864	1.943	2.676	0.818	2.676	1.943	0.936	1.405	0.749	1.296	1.296	1.943
1.2	2.039	0.864	1.761	2.455	0.750	2.455	1.761	0.858	1.288	0.687	1.174	1.174	1.761
1.3	1.872	0.864	1.618	2.268	0.692	2.268	1.618	0.792	1.188	0.634	1.079	1.079	1.618
1.4	1.736	0.864	1.500	2.108	0.643	2.108	1.500	0.736	1.104	0.589	1.000	1.000	1.500
1.5	1.623	0.864	1.402	1.969	0.600	1.969	1.402	0.687	1.030	0.549	0.935	0.935	1.402
1.6	1.513	0.864	1.307	1.824	0.563	1.824	1.307	0.644	0.966	0.515	0.871	0.871	1.307
1.7	1.420	0.864	1.227	1.698	0.529	1.698	1.227	0.606	0.909	0.485	0.818	0.818	1.227
1.8	1.340	0.864	1.158	1.587	0.500	1.587	1.158	0.572	0.858	0.458	0.772	0.772	1.158
1.9	1.271	0.864	1.098	1.489	0.474	1.489	1.098	0.542	0.813	0.434	0.732	0.732	1.098
2	1.202	0.864	1.038	1.402	0.450	1.402	1.038	0.515	0.773	0.412	0.692	0.692	1.038
2.1	1.119	0.864	0.967	1.302	0.429	1.302	0.967	0.490	0.736	0.392	0.644	0.644	0.967
2.2	1.048	0.864	0.905	1.214	0.409	1.214	0.905	0.468	0.702	0.375	0.604	0.604	0.905
2.3	0.987	0.864	0.852	1.135	0.391	1.135	0.852	0.448	0.672	0.358	0.568	0.568	0.852
2.4	0.933	0.864	0.806	1.065	0.375	1.065	0.806	0.429	0.644	0.343	0.537	0.537	0.806
2.5	0.893	0.864	0.772	1.009	0.360	1.009	0.772	0.412	0.618	0.330	0.515	0.515	0.772
2.6	0.847	0.864	0.731	0.958	0.346	0.958	0.731	0.396	0.594	0.317	0.488	0.488	0.731
2.7	0.802	0.864	0.693	0.915	0.333	0.915	0.693	0.381	0.572	0.305	0.462	0.462	0.693
2.8	0.763	0.864	0.659	0.875	0.321	0.875	0.659	0.368	0.552	0.294	0.439	0.439	0.659
2.9	0.728	0.864	0.629	0.839	0.310	0.839	0.629	0.355	0.533	0.284	0.419	0.419	0.629
3	0.696	0.864	0.602	0.805	0.300	0.805	0.602	0.343	0.515	0.275	0.401	0.401	0.602
3.2	0.631	0.864	0.545	0.731	0.281	0.731	0.545	0.322	0.483	0.258	0.363	0.363	0.545
3.4	0.572	0.864	0.494	0.669	0.265	0.669	0.494	0.303	0.454	0.242	0.329	0.329	0.494
3.6	0.527	0.864	0.455	0.619	0.250	0.619	0.455	0.286	0.429	0.229	0.303	0.303	0.455
3.8	0.484	0.864	0.418	0.572	0.237	0.572	0.418	0.271	0.407	0.217	0.279	0.279	0.418
4	0.446	0.864	0.385	0.530	0.225	0.530	0.385	0.258	0.386	0.206	0.257	0.257	0.385
4.2	0.413	0.864	0.357	0.492	0.214	0.492	0.357	0.245	0.368	0.196	0.238	0.238	0.357
4.4	0.385	0.864	0.332	0.458	0.205	0.458	0.332	0.234	0.351	0.187	0.222	0.222	0.332
4.6	0.358	0.864	0.309	0.428	0.196	0.428	0.309	0.224	0.336	0.179	0.206	0.206	0.309
4.8	0.334	0.864	0.288	0.401	0.188	0.401	0.288	0.215	0.322	0.172	0.192	0.192	0.288
5	0.313	0.864	0.271	0.377	0.180	0.377	0.271	0.206	0.309	0.165	0.180	0.180	0.271
6	0.230	0.864	0.198	0.274	0.150	0.274	0.198	0.172	0.258	0.137	0.132	0.137	0.206
7	0.177	0.864	0.153	0.209	0.129	0.209	0.153	0.147	0.221	0.118	0.102	0.118	0.177
8	0.143	0.864	0.124	0.164	0.113	0.164	0.124	0.129	0.193	0.103	0.082	0.103	0.155
9	0.116	0.864	0.100	0.129	0.089	0.129	0.100	0.102	0.153	0.081	0.067	0.081	0.122
10	0.096	0.864	0.083	0.105	0.072	0.105	0.083	0.082	0.124	0.066	0.055	0.066	0.099

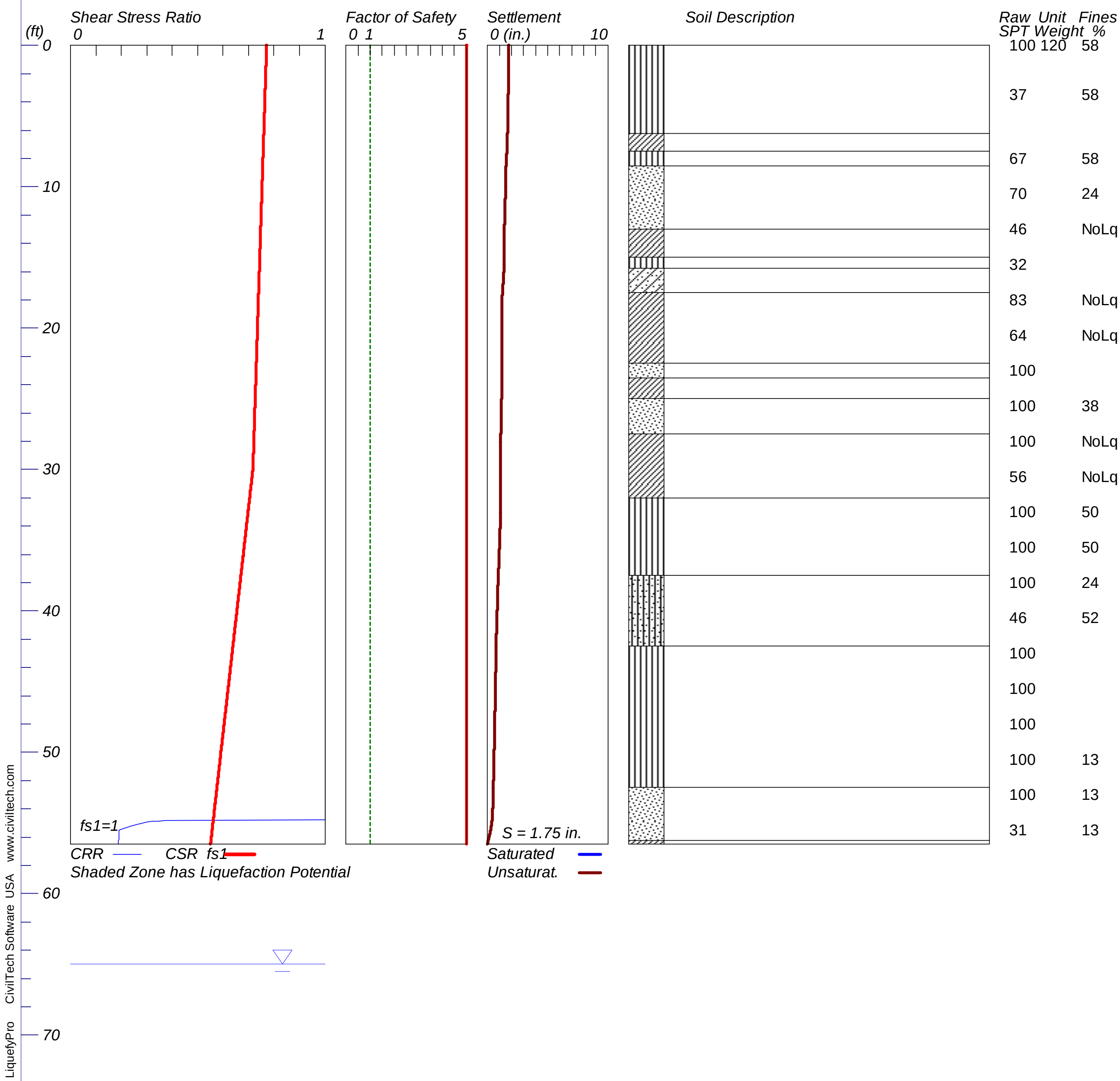
Leighton

LIQUEFACTION ANALYSIS

Goleta Fire Station #10

Hole No.=LB-2   Water Depth=65 ft   Surface Elev.=119

Magnitude=7.2
Acceleration=1.186g



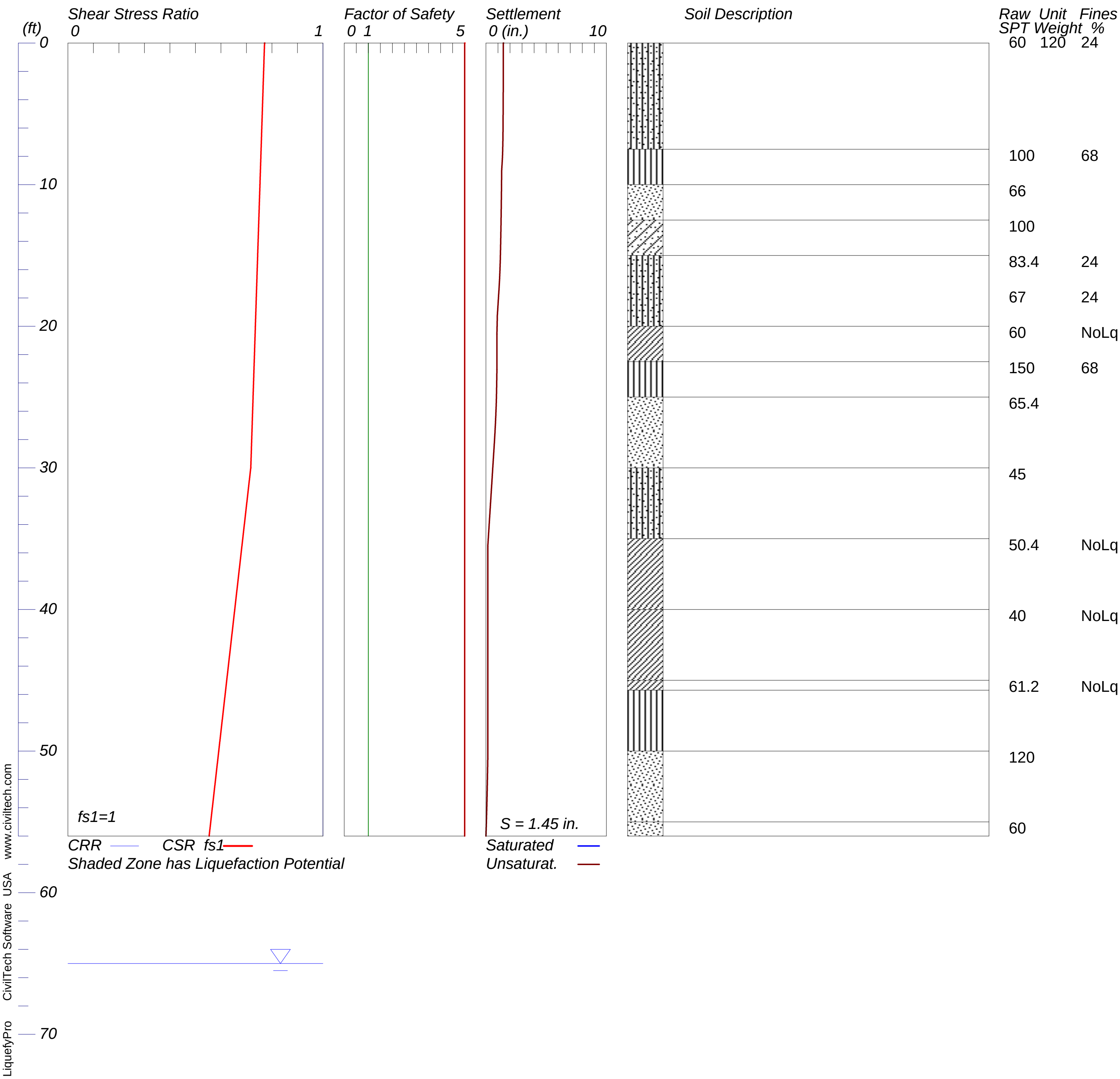
CivilTech Corporation   **11389.001**   **Figure 1**

DRY SAND SETTLEMENT

Goleta Fire Station #10

Hole No.=LB-5 Water Depth=65 ft Surface Elev.=120 Magnitude=7.2

Acceleration=1.186g



Leighton and Associates, Inc. **11389.001** **Plate A-1**

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*                     *
*    E Q F A U L T    *
*                     *
*    Version 3.00     *
*                     *
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DETERMINISTIC ESTIMATION OF
PEAK ACCELERATION FROM DIGITIZED FAULTS

JOB NUMBER: 11389.001

DATE: 10-03-2016

JOB NAME: Goleta Fire Station #10

CALCULATION NAME: EQ Fault Analysis

FAULT-DATA-FILE NAME: CDMGFLTE.DAT

SITE COORDINATES:
SITE LATITUDE: 34.4313
SITE LONGITUDE: 119.9058

SEARCH RADIUS: 62 mi

ATTENUATION RELATION: 3) Boore et al. (1997) Horiz. - NEHRP D (250)
UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0
DISTANCE MEASURE: cd_2drp
SCOND: 0
Basement Depth: 5.00 km Campbell SSR: Campbell SHR:
COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED: CDMGFLTE.DAT

MINIMUM DEPTH VALUE (km): 0.0

EQFAULT SUMMARY

DETERMINISTIC SITE PARAMETERS

Page 1

ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE mi (km)	ESTIMATED MAX. EARTHQUAKE EVENT: MAXIMUM EARTHQUAKE MAG.(Mw)	PEAK SITE ACCEL. g	EST. SITE INTENSITY MOD.MERC.
NORTH CHANNEL SLOPE	0.0(0.0)	7.1	0.790	XI
M.RIDGE-ARROYO PARIDA-SANTA ANA	0.5(0.8)	6.7	0.635	X
SANTA YNEZ (West)	6.7(10.8)	6.9	0.319	IX
CHANNEL IS. THRUST (Eastern)	11.0(17.7)	7.4	0.363	IX
RED MOUNTAIN	14.2(22.8)	6.8	0.220	IX
LOS ALAMOS-W. BASELINE	15.0(24.1)	6.8	0.212	VIII
MONTALVO-OAK RIDGE TREND	15.1(24.3)	6.6	0.189	VIII
SANTA YNEZ (East)	15.9(25.6)	7.0	0.185	VIII
VENTURA - PITAS POINT	21.0(33.8)	6.8	0.164	VIII
OAK RIDGE(Blind Thrust Offshore)	22.1(35.5)	6.9	0.167	VIII
SANTA CRUZ ISLAND	24.4(39.2)	6.8	0.147	VIII
LIONS HEAD	26.3(42.3)	6.6	0.125	VII
SANTA ROSA ISLAND	28.1(45.3)	6.9	0.138	VIII
ANACAPA-DUME	30.4(48.9)	7.3	0.161	VIII
BIG PINE	32.9(52.9)	6.7	0.091	VII
SAN LUIS RANGE (S. Margin)	34.5(55.6)	7.0	0.125	VII
CASMALIA (Orcutt Frontal Fault)	37.8(60.8)	6.5	0.089	VII
OAK RIDGE (Onshore)	41.9(67.4)	6.9	0.102	VII
SAN CAYETANO	41.9(67.5)	6.8	0.097	VII
SIMI-SANTA ROSA	44.9(72.2)	6.7	0.087	VII
PLEITO THRUST	45.2(72.7)	7.2	0.113	VII
SAN ANDREAS - Carrizo	45.2(72.8)	7.2	0.092	VII
SAN ANDREAS - 1857 Rupture	45.2(72.8)	7.8	0.127	VIII
SAN JUAN	49.6(79.8)	7.0	0.078	VII
LOS OSOS	52.9(85.2)	6.8	0.081	VII
HOSGRI	53.7(86.5)	7.3	0.085	VII
MALIBU COAST	60.6(97.5)	6.7	0.069	VI
SAN ANDREAS - Cholame	60.8(97.9)	6.9	0.063	VI
SAN GABRIEL	61.8(99.5)	7.0	0.065	VI

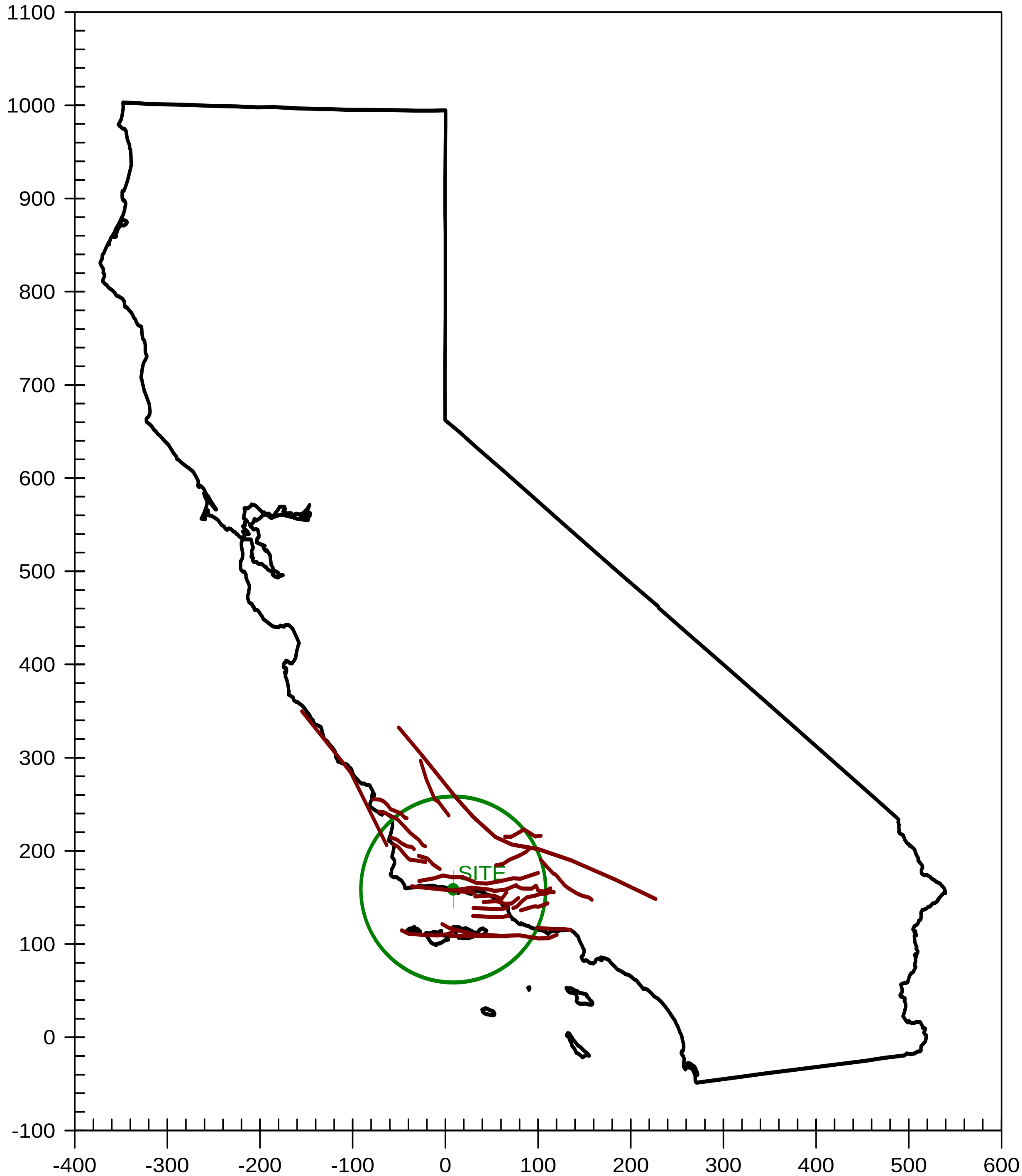
-END OF SEARCH- 29 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.

THE NORTH CHANNEL SLOPE FAULT IS CLOSEST TO THE SITE.
IT IS ABOUT 0.0 MILES (0.0 km) AWAY.

LARGEST MAXIMUM-EARTHQUAKE SITE ACCELERATION: 0.7903 g

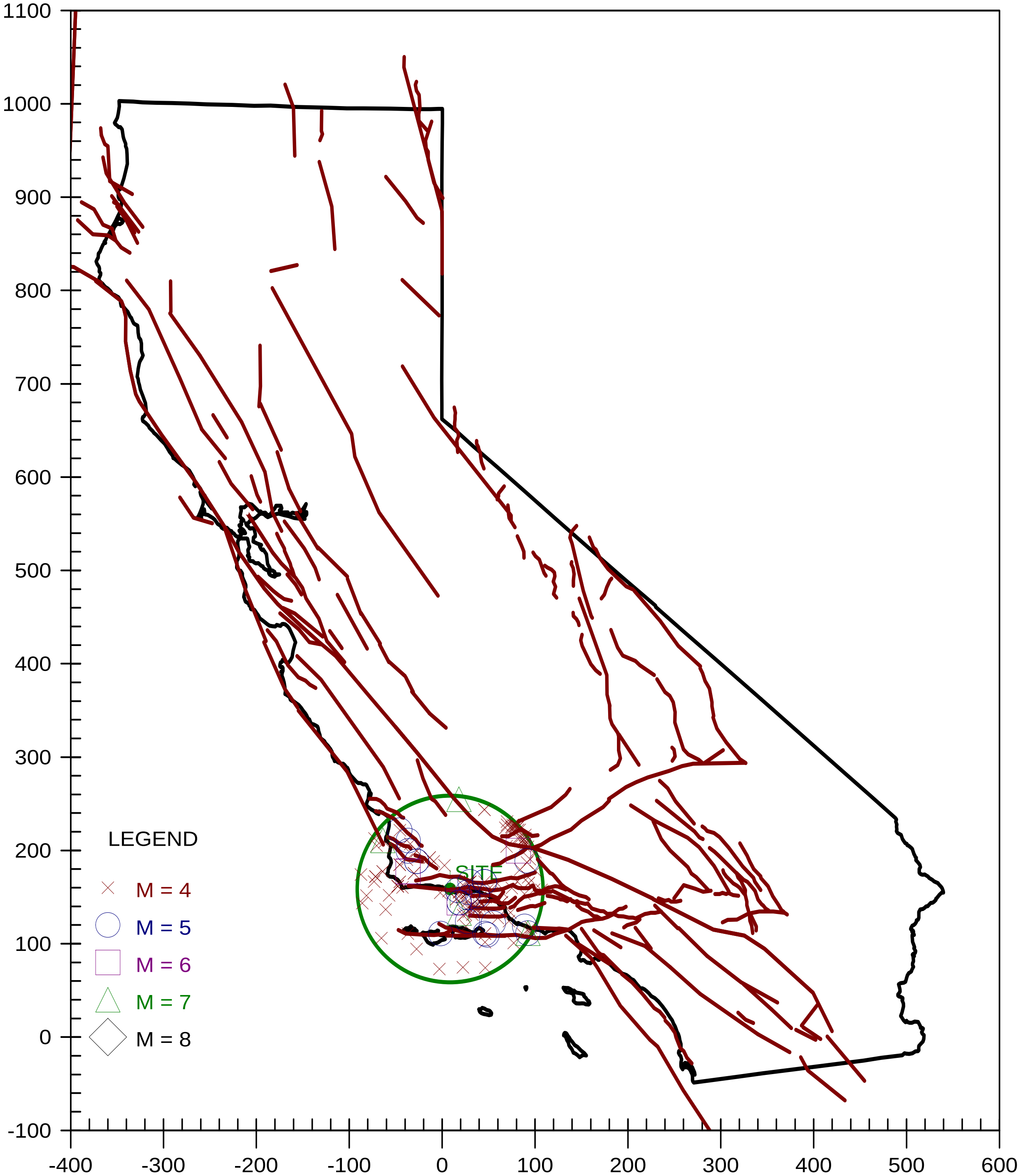
CALIFORNIA FAULT MAP

Goleta Fire Station #10



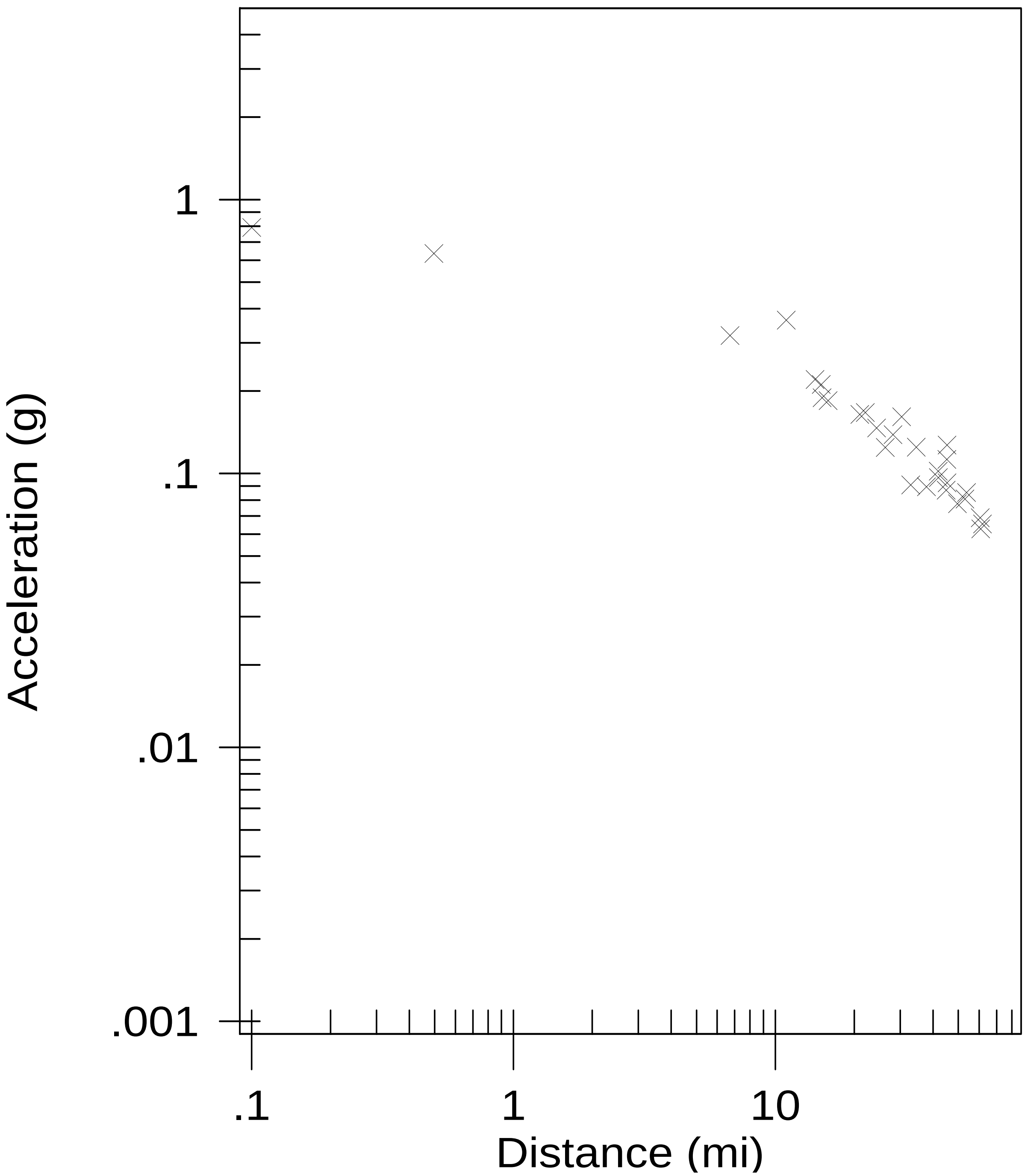
EARTHQUAKE EPICENTER MAP

Goleta Fire Station #10



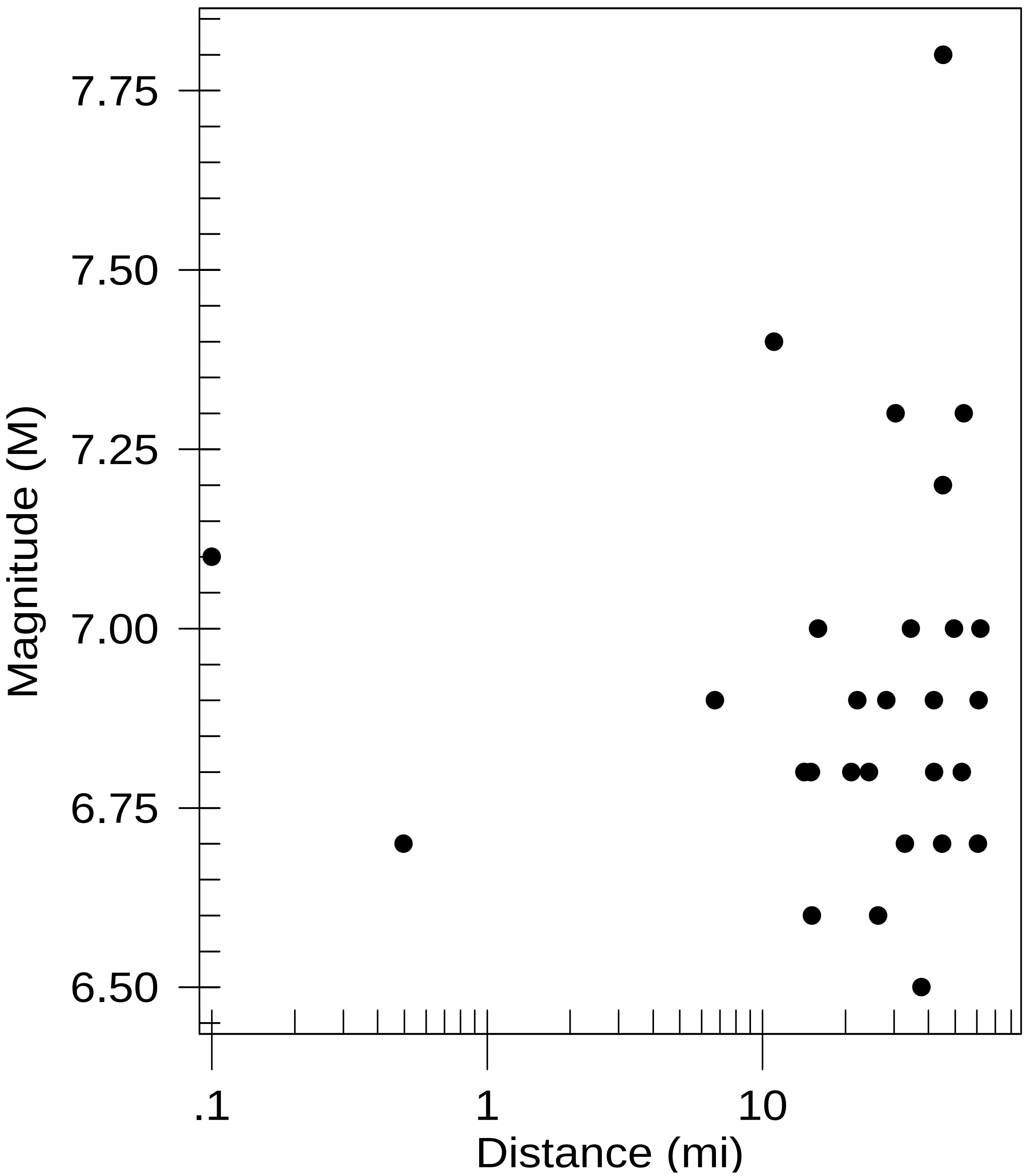
MAXIMUM EARTHQUAKES

Goleta Fire Station #10



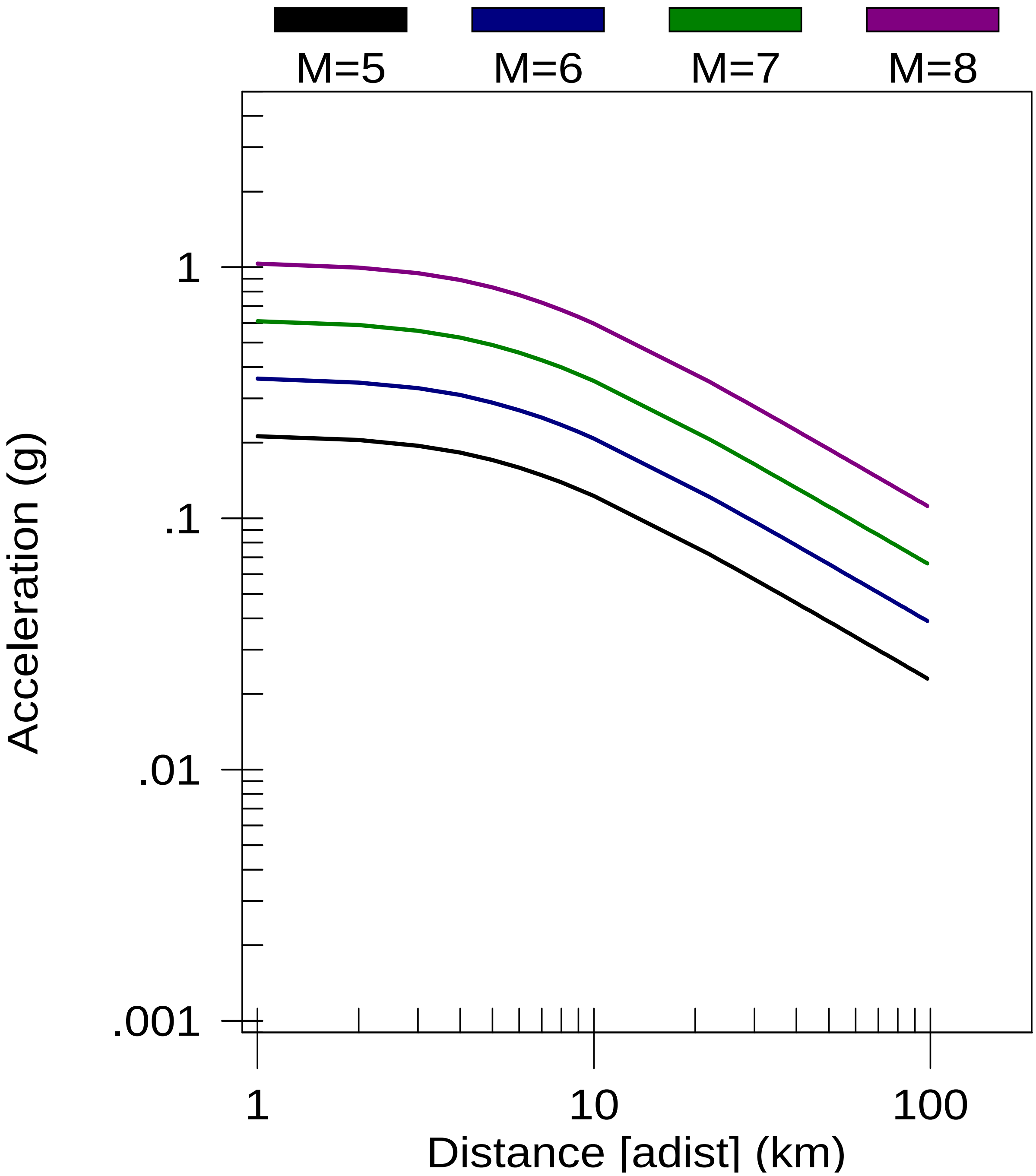
EARTHQUAKE MAGNITUDES & DISTANCES

Goleta Fire Station #10



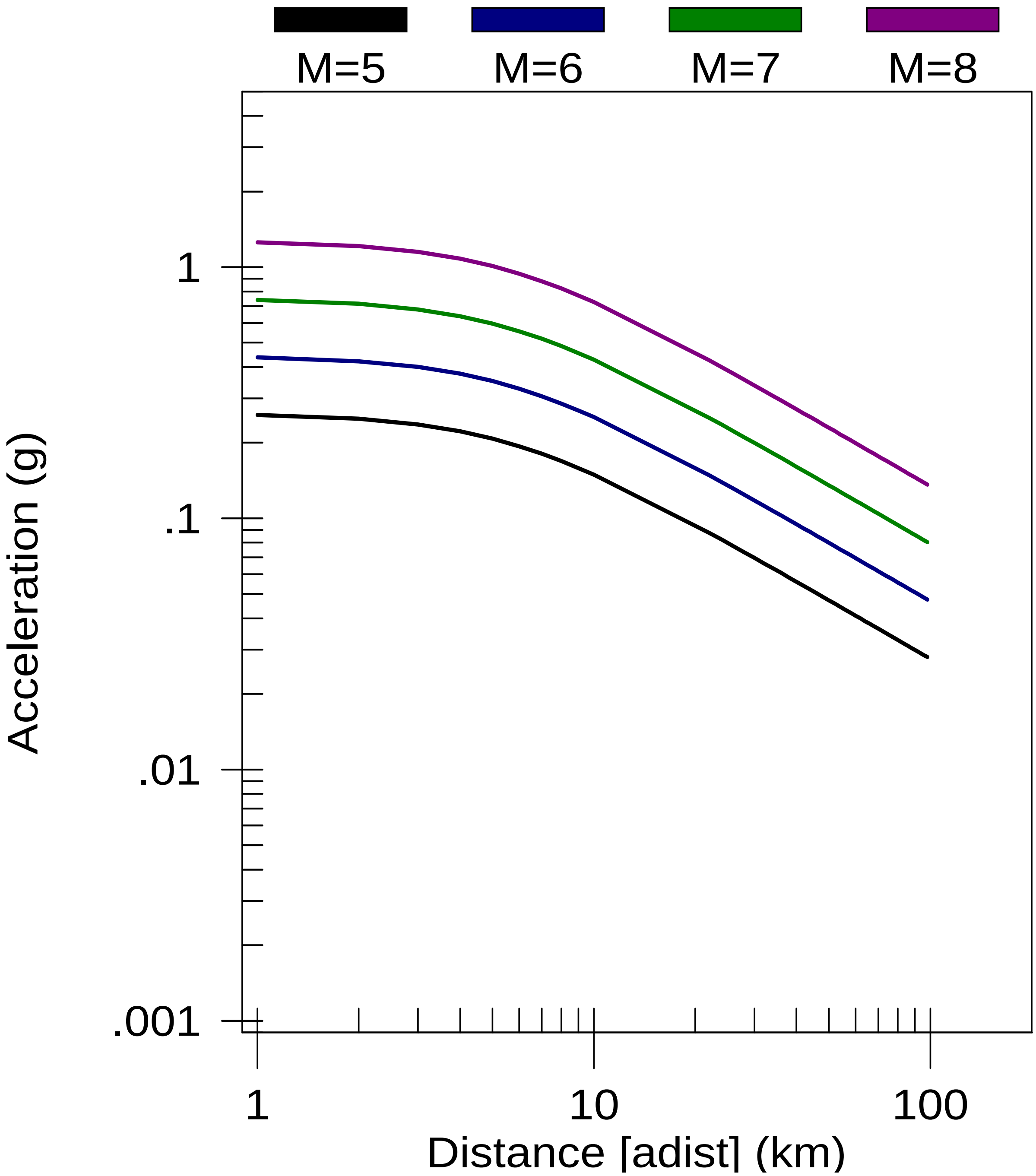
STRIKE-SLIP FAULTS

3) Boore et al. (1997) Horiz. - NEHRP D (250)



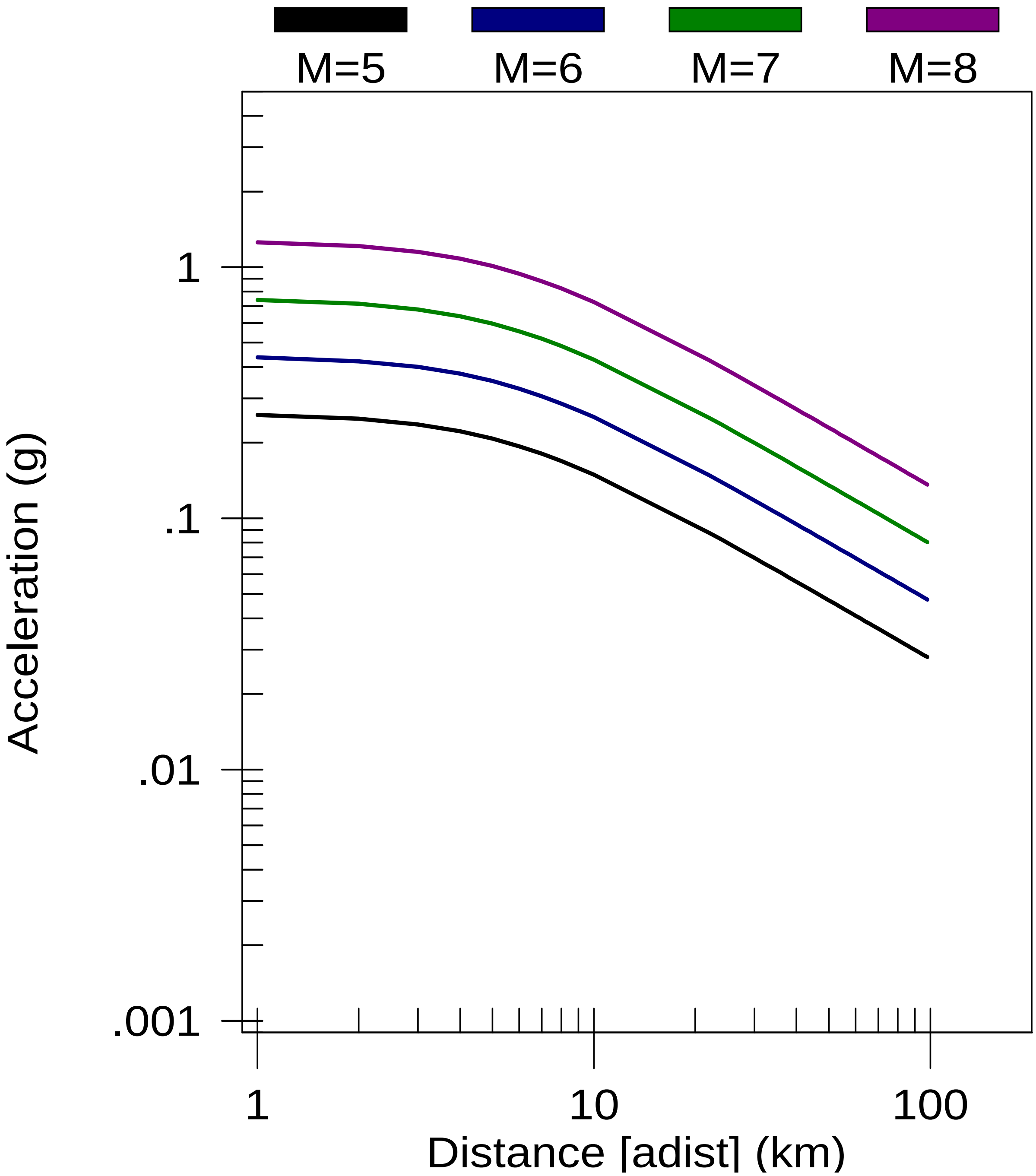
DIP-SLIP FAULTS

3) Boore et al. (1997) Horiz. - NEHRP D (250)



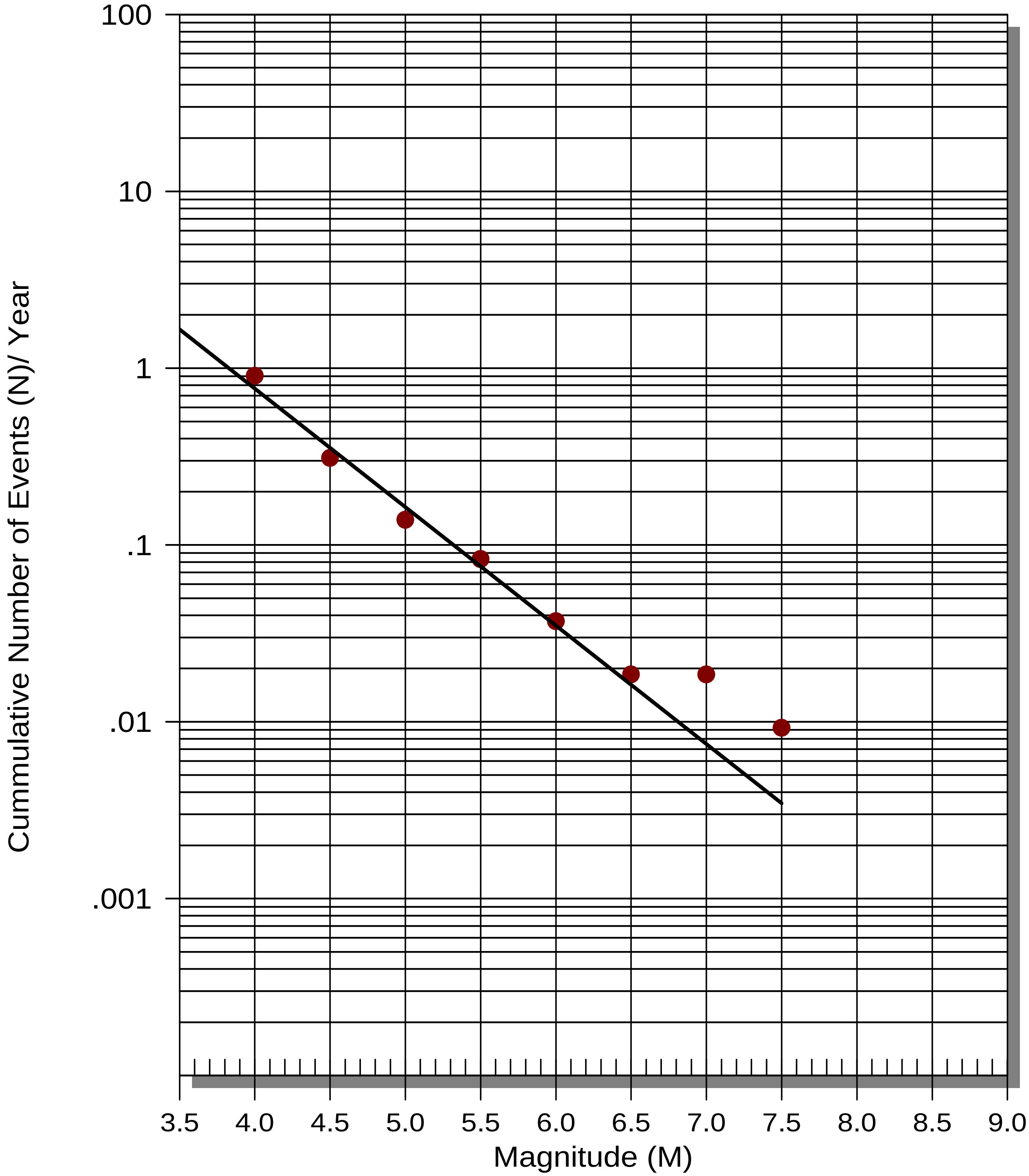
BLIND-THRUST FAULTS

3) Boore et al. (1997) Horiz. - NEHRP D (250)



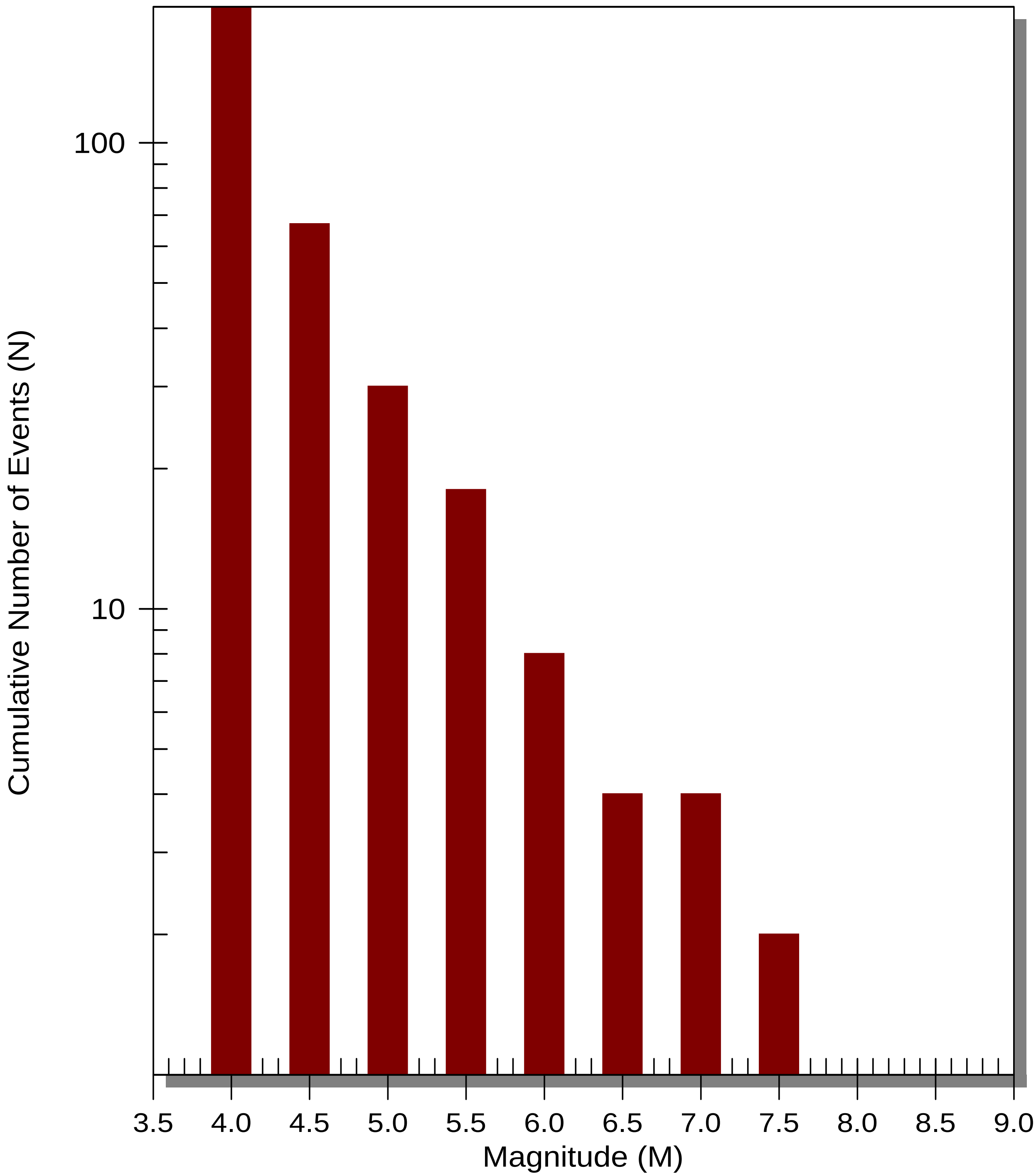
EARTHQUAKE RECURRENCE CURVE

Goleta Fire Station #10



Number of Earthquakes (N) Above Magnitude (M)

Goleta Fire Station #10



APPENDIX D

SLOPE STABILITY

APPENDIX D

SLOPE STABILITY ANALYSES

The northern embankment slope was analyzed using Roc Science's *SLIDE 7.0* software and Bishop's simplified method of analyses modeling circular slip surfaces within homogeneous and isotropic soil conditions (for fill and alluvium).

Leighton evaluated both two cross-sections, Cross sections A-A' and B-B'. These two cross sections are depicted on Plate 2, and represent generalized stratigraphy based on boring logs and laboratory soil testing. Modeled earth material properties are tabulated below:

Table D-1. Earth Material Parameters

Layer	Description	Unit Weight γ_{TOT} (pcf)	Ultimate Shear Strength		Peak Shear Strength	
			Cohesion (psf)	ϕ	Cohesion (psf)	ϕ
Fill	0 to 5 ft Remolded, 90%	125	0	34	248	33
Layer 1	Mixed Fine grained, SM-ML	120	132	33	300	30
Layer 2	Silty Sand, SM	120	50	33	50	36
Layer 3	Silty Sand, SC-SM	120	50	39	90	40
Layer 4	Clay and Silt, CL-ML	120	247	25	390	32
Layer 5	Well-graded Sand, SW	120	0	36	0	39

Static Analyses: Current practice for static analyses evaluates long term stability of slope, and utilizes a threshold minimum Factor of Safety of FS=1.5.

Pseudo-Static Analyses: Statewide, SP117A Guidelines for Evaluating and Mitigating Seismic Hazards in California" (CGS, 2008) provide methods of screening seismic stability for slopes, which utilize coefficients of horizontal acceleration (k_h) based on predicting ground threshold displacements of 5cm (one inch) and 15cm (3 inches). The horizontal ground acceleration k_h (seismic load) can be calculated to predict a 50% probability of 5cm displacement or a 15 cm displacement. If the factor of safety falls below the threshold of FS=1.0, additional slope deformation analyses are performed to further evaluate the magnitude of displacement. Because no groundwater was encountered at the site, highest historical groundwater is at greater than 50 feet, liquefaction is not an issue. Pseudo static factors of safety using this seismic screening

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methodology were above 1.0. Leighton adopted City of Los Angeles Building and Safety Slope Stability Evaluation Standards and evaluated the pseudo static factor of safety based on a return period of 475 years, which generated a MHGr of 0.549 and an feq of 0.385. A seismic load of Kh of .211 was calculated and utilized for a displacement threshold of 15cm. .

Analyses: Leighton modeled both cross-sections initially, and compared block failure mode with circular failure modes for both sections, under static and seismic conditions. Spencer and Bishops simplified methods of failure analysis were utilized. We determined that circular failures were more critical. Additionally, cross section A-A had lower factors of safety than section cross section B-B' under both static and seismic conditions. Therefore, we selected cross section A-A' as the most critical section and based our design analyses on it. The results of our analyses are tabulated below. The results of the analyses are included in this appendix in graphic and data output form, in the order of the table. The file prefix is noted in the lower right hand corner of each slope stability graphic.

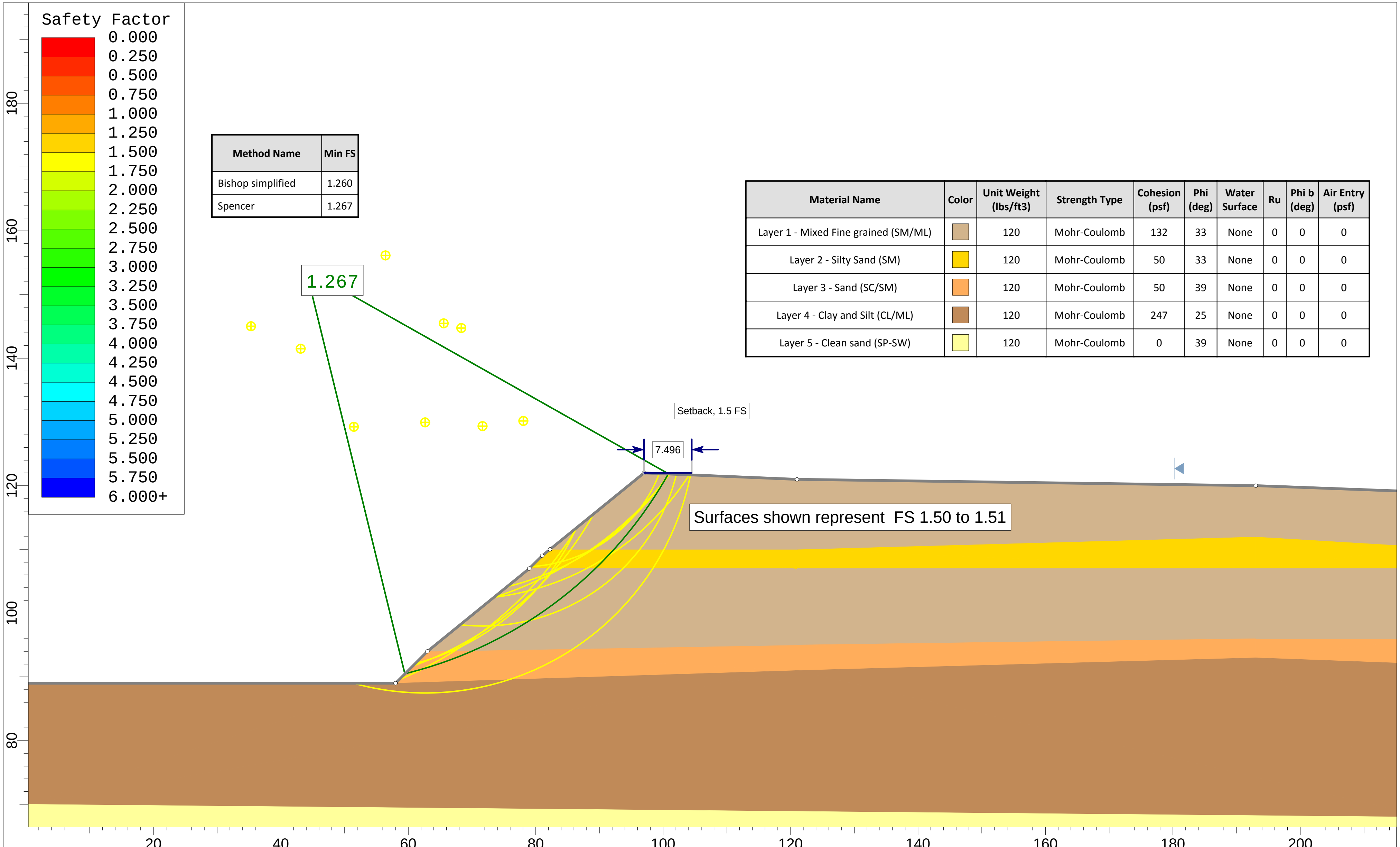
Table D-2. SLIDE 7.0 Stability Analyses Summary

File prefix	*Section*	*Case*	*Conditions, Loads*	*Strength*	*Static, FS*	*Seismic, FS Kh=0.211[1]*
1_AA	A-A'	Static, circular	existing condition	ultimate	1.27	--
2_AA	A-A'	Seismic, circular	existing condition	peak	--	1.1
3_BB	B-B'	Static, circular	existing condition	ultimate	1.42	--
4_BB	B-B'	Seismic, circular	existing condition	peak	--	1.18
5_AA	A-A'	Static, circular	Mitigation Option 2 – Pile El 111 and Reconstruct Upper Slope	ultimate	1.70	--
5a_AA	A-A'	Seismic, circular	Mitigation Option 2 – Pile El 111 and Reconstruct Upper Slope	peak	--	1.60
5_1_AA	A-A'	Static, circular	Mitigation Option 2 – Pile El 117 and Reconstruct Upper Slope	ultimate	1.53	--
5_1a_AA	A-A'	Seismic, circular	Mitigation Option 2 – Pile El 117 and Reconstruct Upper Slope	peak	--	1.55
6_AA	A-A'	Static, circular	Mitigation Option 1 – Pile at Top of Slope	ultimate	1.79	--
6a_AA	A-A'	Seismic, circular	Mitigation Option 1 – Pile at Top of Slope	peak	--	1.66
7_AA	A-A'	Static, circular	Mitigation Option 3 – Pile Wall at El 111	ultimate	1.51	--
7a_AA	A-A'	Seismic, circular	Mitigation Option 3 – Pile Wall at El 111	peak	--	1.49
Upper slope, Fill		Surficial Stability	At 1H:1V to 2H:1V Min Soil Phi =34, C=200psf	ultimate	1.5	
Lower Slope, Qmt		Surficial Stability	Current gradient 1H:1V to 2H:1V	ultimate	<1.5	--
			Required gradient, 2.5H:1V	ultimate	=1.5	--

*Pseudo-static analyses with horizontal ground acceleration set at 0.211g assumes 15 cm ground deformation.

In summary, cross section A-A' is considered the most critical because it has lower factors of safety. The slope as is does not meet the minimum required factors of safety for long term static stability, and meets the seismic stability threshold (with allowable deformation). Because a significant portion of the slope supporting the fire station site is on Union Pacific Railroads' (UPRR) property, the possibility exists that UPRR may choose to modify the slope in the future, which could result in loss of support of the slope. Therefore, the long term design conditions evaluated incorporate these factors into the model in order to provide resulting design loads and embedment depths. This includes the proposed condition of extending the piles to the existing ground surface at the top of the slope.at the property line.. Surficial stability indicates that at current slope gradients (1H:1V and locally steeper), the slopes not surficial stable and subject to erosion and shallow surficial failures. Based on this analysis the angle of repose appears to about 2.5.H:1V without reinforcement or improvement.

Based on the factors of safety above 1.0 for the seismic cases, no yield analyses were performed. SLIDE 7.0 analyses graphics and output files are included in this appendix following.



Method Name	Min FS
Bishop simplified	1.260
Spencer	1.267

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Phi b (deg)	Air Entry (psf)
Layer 1 - Mixed Fine grained (SM/ML)		120	Mohr-Coulomb	132	33	None	0	0	0
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	33	None	0	0	0
Layer 3 - Sand (SC/SM)		120	Mohr-Coulomb	50	39	None	0	0	0
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	247	25	None	0	0	0
Layer 5 - Clean sand (SP-SW)		120	Mohr-Coulomb	0	39	None	0	0	0

Project	Goleta Fire Station #10		
Analysis Description	A-A' Static Analysis - Circular failure		
Drawn By LD	*Scale* 1:250	*Company* Leighton	
Date 7/29/2016, 6:01:40 PM		*File Name* 1_AA_StaticCircle_11389001_Rev3.slim	

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SLIDEINTERPRET 7.021

Slide Analysis Information
Goleta Fire Station #10

Project Summary

File Name:	1_AA_StaticCircle_11389001_Rev3
Slide Modeler Version:	7.021
Project Title:	Goleta Fire Station #10
Analysis:	A-A' Static Analysis - Circular failure
Author:	LD
Company:	Leighton
Date Created:	7/29/2016, 6:01:40 PM
	Comments
	Utlimate strength, depth specific

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
	Spencer

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	No
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Slope Search
Number of Surfaces:	5000
Upper Angle:	Not Defined
Lower Angle:	Not Defined
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Material Properties

Property	Layer 1 - Mixed Fine grained (SM/ML)	Layer 2 - Silty Sand (SM)	Layer 3 - Sand (SC/SM)	Layer 4 - Clay and Silt (CL/ML)	Layer 5 - Clean sand (SP-SW)
Color					
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	120	120	120
Cohesion [psf]	132	50	50	247	0
Friction Angle [deg]	33	33	39	25	39
Water Surface	None	None	None	None	None
Ru Value	0	0	0	0	0
Unsat. Shear Strength Phi b [deg]	0	0	0	0	0
Unsat. Shear Strength Air Entry Value [psf]	0	0	0	0	0

Global Minimums

Method: bishop simplified

FS	1.259510
Center:	46.464, 147.432
Radius:	59.433
Left Slip Surface Endpoint:	58.163, 89.163
Right Slip Surface Endpoint:	100.118, 121.870
Resisting Moment:	1.53906e+006 lb-ft
Driving Moment:	1.22195e+006 lb-ft
Total Slice Area:	293.46 ft2
Surface Horizontal Width:	41.9551 ft
Surface Average Height:	6.99462 ft

Method: spencer

FS	1.266580
Center:	43.930, 153.972
Radius:	65.378
Left Slip Surface Endpoint:	59.466, 90.466
Right Slip Surface Endpoint:	100.866, 121.839
Resisting Moment:	1.52836e+006 lb-ft
Driving Moment:	1.20668e+006 lb-ft
Resisting Horizontal Force:	18602.2 lb
Driving Horizontal Force:	14687 lb
Total Slice Area:	262.398 ft2
Surface Horizontal Width:	41.4 ft
Surface Average Height:	6.33812 ft

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	3945
Number of Invalid Surfaces:	1055

Error Codes:

Error Code -103 reported for 22 surfaces
Error Code -105 reported for 1 surface
Error Code -106 reported for 28 surfaces
Error Code -107 reported for 82 surfaces
Error Code -108 reported for 43 surfaces
Error Code -112 reported for 1 surface
Error Code -114 reported for 878 surfaces

Method: spencer

Number of Valid Surfaces:	3766
Number of Invalid Surfaces:	1234

Error Codes:

Error Code -103 reported for 22 surfaces
Error Code -105 reported for 1 surface
Error Code -106 reported for 28 surfaces
Error Code -107 reported for 82 surfaces
Error Code -108 reported for 131 surfaces
Error Code -111 reported for 91 surfaces
Error Code -112 reported for 1 surface
Error Code -114 reported for 878 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-105 = More than two surface / slope intersections with no valid slip surface.
-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-111 = safety factor equation did not converge
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
-114 = Surface with Reverse Curvature.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.25951

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	0.862875	35.3587	11.7777	Layer 3 - Sand (SC/SM)	50	39	58.2631	73.383	28.8755	0	28.8755
2	0.862875	105.381	12.6288	Layer 3 - Sand (SC/SM)	50	39	103.382	130.211	99.0525	0	99.0525
3	0.862875	174.008	13.4828	Layer 3 - Sand (SC/SM)	50	39	146.808	184.906	166.595	0	166.595
4	0.862875	241.223	14.3398	Layer 3 - Sand (SC/SM)	50	39	188.561	237.495	231.537	0	231.537
5	0.862875	307.012	15.2001	Layer 3 - Sand (SC/SM)	50	39	228.663	288.003	293.909	0	293.909
6	0.862875	370.056	16.0639	Layer 3 - Sand (SC/SM)	50	39	266.312	335.423	352.468	0	352.468
7	0.862875	419.261	16.9315	Layer 3 - Sand (SC/SM)	50	39	294.642	371.105	396.531	0	396.531
8	0.862875	463.91	17.8032	Layer 3 - Sand (SC/SM)	50	39	319.62	402.565	435.382	0	435.382
9	0.862875	507.055	18.6791	Layer 3 - Sand (SC/SM)	50	39	343.195	432.257	472.048	0	472.048
10	0.862875	548.675	19.5595	Layer 3 - Sand (SC/SM)	50	39	365.374	460.192	506.545	0	506.545

11	0.862875	588.743	20.4448	Layer 3 - Sand (SC/SM)	50	39	386.169	486.384	538.889	0	538.889
12	0.862875	627.234	21.3353	Layer 3 - Sand (SC/SM)	50	39	405.587	510.841	569.091	0	569.091
13	0.862875	664.12	22.2311	Layer 3 - Sand (SC/SM)	50	39	423.635	533.573	597.163	0	597.163
14	0.862875	699.37	23.1327	Layer 3 - Sand (SC/SM)	50	39	440.32	554.587	623.113	0	623.113
15	0.862875	732.952	24.0405	Layer 3 - Sand (SC/SM)	50	39	455.643	573.887	646.947	0	646.947
16	0.862875	764.83	24.9547	Layer 3 - Sand (SC/SM)	50	39	469.61	591.478	668.669	0	668.669
17	0.862875	794.966	25.8757	Layer 3 - Sand (SC/SM)	50	39	482.219	607.36	688.283	0	688.283
18	0.81864	780.467	26.78	Layer 1 - Mixed Fine grained (SM/ML)	132	33	473.591	596.492	715.255	0	715.255
19	0.81864	804.433	27.6676	Layer 1 - Mixed Fine grained (SM/ML)	132	33	481.727	606.74	731.036	0	731.036
20	0.81864	826.804	28.5624	Layer 1 - Mixed Fine grained (SM/ML)	132	33	488.856	615.719	744.862	0	744.862
21	0.81864	847.539	29.4649	Layer 1 - Mixed Fine grained (SM/ML)	132	33	494.969	623.419	756.718	0	756.718
22	0.81864	866.595	30.3756	Layer 1 - Mixed Fine grained (SM/ML)	132	33	500.06	629.83	766.59	0	766.59
23	0.81864	883.925	31.2948	Layer 1 - Mixed Fine grained (SM/ML)	132	33	504.118	634.942	774.462	0	774.462
24	0.81864	899.479	32.223	Layer 1 - Mixed Fine grained (SM/ML)	132	33	507.135	638.741	780.313	0	780.313
25	0.81864	914.835	33.1608	Layer 1 - Mixed Fine grained (SM/ML)	132	33	509.868	642.184	785.615	0	785.615
26	0.81864	939.592	34.1088	Layer 1 - Mixed Fine grained (SM/ML)	132	33	516.799	650.913	799.056	0	799.056
27	0.81864	964.549	35.0675	Layer 1 - Mixed Fine grained (SM/ML)	132	33	523.535	659.397	812.121	0	812.121
28	0.81864	979.619	36.0376	Layer 1 - Mixed Fine grained (SM/ML)	132	33	525.436	661.792	815.809	0	815.809
29	0.81864	985.384	37.0199	Layer 1 - Mixed Fine grained (SM/ML)	132	33	522.888	658.583	810.866	0	810.866
30	0.81864	988.97	38.015	Layer 1 - Mixed Fine grained (SM/ML)	132	33	519.209	653.949	803.73	0	803.73
31	0.81864	990.29	39.0238	Layer 1 - Mixed Fine grained (SM/ML)	132	33	514.379	647.866	794.363	0	794.363
32	0.81864	989.245	40.0472	Layer 1 - Mixed Fine grained	132	33	508.378	640.307	782.724	0	782.724

				(SM/ML)						
33	0.81864	985.73	41.0862	Layer 1 - Mixed Fine grained (SM/ML)	132	33	501.18	631.241	768.764	0	768.764
34	0.81864	979.624	42.142	Layer 1 - Mixed Fine grained (SM/ML)	132	33	492.761	620.637	752.435	0	752.435
35	0.81864	970.799	43.2156	Layer 1 - Mixed Fine grained (SM/ML)	132	33	483.092	608.459	733.683	0	733.683
36	0.81864	959.109	44.3085	Layer 1 - Mixed Fine grained (SM/ML)	132	33	472.143	594.669	712.448	0	712.448
37	0.81864	944.392	45.4222	Layer 1 - Mixed Fine grained (SM/ML)	132	33	459.881	579.225	688.667	0	688.667
38	0.81864	926.467	46.5583	Layer 1 - Mixed Fine grained (SM/ML)	132	33	446.27	562.081	662.267	0	662.267
39	0.86784	958.731	47.7544	Layer 2 - Silty Sand (SM)	50	33	389.186	490.184	677.825	0	677.825
40	0.86784	930.396	49.0145	Layer 2 - Silty Sand (SM)	50	33	372.342	468.968	645.154	0	645.154
41	0.86784	897.373	50.3073	Layer 2 - Silty Sand (SM)	50	33	353.858	445.688	609.307	0	609.307
42	0.832358	824.992	51.6083	Layer 1 - Mixed Fine grained (SM/ML)	132	33	373.631	470.592	521.386	0	521.386
43	0.832358	785.075	52.9199	Layer 1 - Mixed Fine grained (SM/ML)	132	33	351.926	443.254	479.289	0	479.289
44	0.832358	739.83	54.2724	Layer 1 - Mixed Fine grained (SM/ML)	132	33	328.505	413.755	433.864	0	433.864
45	0.832358	688.717	55.671	Layer 1 - Mixed Fine grained (SM/ML)	132	33	303.297	382.005	384.974	0	384.974
46	0.832358	631.085	57.1216	Layer 1 - Mixed Fine grained (SM/ML)	132	33	276.226	347.91	332.472	0	332.472
47	0.832358	546.387	58.6315	Layer 1 - Mixed Fine grained (SM/ML)	132	33	240.571	303.001	263.319	0	263.319
48	0.832358	404.418	60.2099	Layer 1 - Mixed Fine grained (SM/ML)	132	33	187.281	235.882	159.965	0	159.965
49	0.832358	250.592	61.8684	Layer 1 - Mixed Fine grained (SM/ML)	132	33	132.621	167.037	53.9526	0	53.9526
50	0.832358	85.5553	63.6225	Layer 1 - Mixed Fine grained (SM/ML)	132	33	77.5136	97.6291	-52.9265	0	-52.9265

Global Minimum Query (spencer) - Safety Factor: 1.26658

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]

1	0.829381	30.8884	14.1223	Layer 3 - Sand (SC/SM)	50	39	76.8127	97.2894	58.3976	0	58.3976
2	0.829381	92.0881	14.8731	Layer 3 - Sand (SC/SM)	50	39	126.804	160.608	136.59	0	136.59
3	0.829381	152.128	15.6265	Layer 3 - Sand (SC/SM)	50	39	173.967	220.343	210.357	0	210.357
4	0.829381	210.995	16.3827	Layer 3 - Sand (SC/SM)	50	39	218.402	276.624	279.857	0	279.857
5	0.829381	264.444	17.1418	Layer 3 - Sand (SC/SM)	50	39	256.873	325.35	340.03	0	340.03
6	0.829381	305.972	17.9041	Layer 3 - Sand (SC/SM)	50	39	284.638	360.517	383.457	0	383.457
7	0.829381	345.761	18.6696	Layer 3 - Sand (SC/SM)	50	39	309.98	392.615	423.094	0	423.094
8	0.829381	384.317	19.4386	Layer 3 - Sand (SC/SM)	50	39	333.382	422.255	459.696	0	459.696
9	0.829381	421.625	20.2113	Layer 3 - Sand (SC/SM)	50	39	354.908	449.52	493.366	0	493.366
10	0.829381	457.665	20.9878	Layer 3 - Sand (SC/SM)	50	39	374.622	474.489	524.201	0	524.201
11	0.829381	492.418	21.7684	Layer 3 - Sand (SC/SM)	50	39	392.582	497.237	552.291	0	552.291
12	0.829381	525.864	22.5532	Layer 3 - Sand (SC/SM)	50	39	408.844	517.834	577.727	0	577.727
13	0.829381	557.98	23.3426	Layer 3 - Sand (SC/SM)	50	39	423.462	536.348	600.59	0	600.59
14	0.832877	591.287	24.1383	Layer 1 - Mixed Fine grained (SM/ML)	132	33	421.368	533.696	618.558	0	618.558
15	0.832877	620.914	24.9407	Layer 1 - Mixed Fine grained (SM/ML)	132	33	430.443	545.19	636.256	0	636.256
16	0.832877	649.118	25.7484	Layer 1 - Mixed Fine grained (SM/ML)	132	33	438.369	555.23	651.717	0	651.717
17	0.832877	675.871	26.5616	Layer 1 - Mixed Fine grained (SM/ML)	132	33	445.177	563.852	664.993	0	664.993
18	0.832877	701.141	27.3807	Layer 1 - Mixed Fine grained (SM/ML)	132	33	450.89	571.088	676.136	0	676.136
19	0.832877	724.896	28.2058	Layer 1 - Mixed Fine grained (SM/ML)	132	33	455.535	576.971	685.195	0	685.195
20	0.832877	747.102	29.0374	Layer 1 - Mixed Fine grained (SM/ML)	132	33	459.134	581.53	692.215	0	692.215
21	0.832877	767.72	29.8757	Layer 1 - Mixed Fine grained (SM/ML)	132	33	461.711	584.794	697.242	0	697.242
22	0.832877	786.711	30.7211	Layer 1 - Mixed Fine grained (SM/ML)	132	33	463.288	586.791	700.317	0	700.317
23	0.832877	804.032	31.574	Layer 1 - Mixed Fine grained (SM/ML)	132	33	463.883	587.545	701.478	0	701.478
24	0.832877	821.53	32.4348	Layer 1 - Mixed Fine grained	132	33	464.343	588.127	702.375	0	702.375

				(SM/ML)						
25	0.832877	848.968	33.3039	Layer 1 - Mixed Fine grained (SM/ML)	132	33	468.852	593.838	711.168	0	711.168
26	0.832877	876.535	34.1817	Layer 1 - Mixed Fine grained (SM/ML)	132	33	473.044	599.148	719.345	0	719.345
27	0.832877	893.133	35.0688	Layer 1 - Mixed Fine grained (SM/ML)	132	33	472.327	598.24	717.948	0	717.948
28	0.832877	901.348	35.9656	Layer 1 - Mixed Fine grained (SM/ML)	132	33	468.001	592.761	709.509	0	709.509
29	0.832877	907.561	36.8728	Layer 1 - Mixed Fine grained (SM/ML)	132	33	462.796	586.168	699.357	0	699.357
30	0.832877	911.703	37.7908	Layer 1 - Mixed Fine grained (SM/ML)	132	33	456.724	578.478	687.516	0	687.516
31	0.832877	913.694	38.7204	Layer 1 - Mixed Fine grained (SM/ML)	132	33	449.799	569.707	674.009	0	674.009
32	0.832877	913.451	39.6623	Layer 1 - Mixed Fine grained (SM/ML)	132	33	442.031	559.867	658.858	0	658.858
33	0.832877	910.882	40.6172	Layer 1 - Mixed Fine grained (SM/ML)	132	33	433.429	548.973	642.082	0	642.082
34	0.832877	905.886	41.5859	Layer 1 - Mixed Fine grained (SM/ML)	132	33	424.004	537.035	623.699	0	623.699
35	0.832877	898.354	42.5694	Layer 1 - Mixed Fine grained (SM/ML)	132	33	413.762	524.063	603.723	0	603.723
36	0.832877	888.165	43.5687	Layer 1 - Mixed Fine grained (SM/ML)	132	33	402.71	510.065	582.169	0	582.169
37	0.726721	764.51	44.519	Layer 2 - Silty Sand (SM)	50	33	333.403	422.281	573.262	0	573.262
38	0.726721	752.687	45.4193	Layer 2 - Silty Sand (SM)	50	33	322.985	409.086	552.944	0	552.944
39	0.726721	738.826	46.3342	Layer 2 - Silty Sand (SM)	50	33	311.97	395.135	531.462	0	531.462
40	0.726721	722.823	47.2646	Layer 2 - Silty Sand (SM)	50	33	300.361	380.431	508.819	0	508.819
41	0.855495	827.237	48.2974	Layer 1 - Mixed Fine grained (SM/ML)	132	33	342.998	434.435	465.709	0	465.709
42	0.855495	798.012	49.4374	Layer 1 - Mixed Fine grained (SM/ML)	132	33	327.111	414.312	434.722	0	434.722
43	0.855495	764.601	50.6045	Layer 1 - Mixed Fine grained (SM/ML)	132	33	310.373	393.112	402.078	0	402.078
44	0.855495	726.684	51.8014	Layer 1 - Mixed Fine grained (SM/ML)	132	33	292.776	370.824	367.756	0	367.756
[illegible]	[illegible]	[illegible]	[illegible]	Layer 1 - Mixed	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

				Fine grained (SM/ML)							
46	0.855495	625.689	54.2966	Layer 1 - Mixed Fine grained (SM/ML)	132	33	252.224	319.462	288.666	0	288.666
47	0.855495	505.447	55.6026	Layer 1 - Mixed Fine grained (SM/ML)	132	33	214.691	271.923	215.463	0	215.463
48	0.855495	370.15	56.9536	Layer 1 - Mixed Fine grained (SM/ML)	132	33	175.028	221.687	138.107	0	138.107
49	0.855495	227.737	58.3556	Layer 1 - Mixed Fine grained (SM/ML)	132	33	135.546	171.68	61.1023	0	61.1023
50	0.855495	77.3262	59.8157	Layer 1 - Mixed Fine grained (SM/ML)	132	33	95.0009	120.326	-17.9762	0	-17.9762

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.25951

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	58.1628	89.1628	0	0	0
2	59.0257	89.3428	44.8886	0	0
3	59.8886	89.5361	114.608	0	0
4	60.7515	89.743	206.34	0	0
5	61.6143	89.9636	317.356	0	0
6	62.4772	90.198	445.014	0	0
7	63.3401	90.4465	586.362	0	0
8	64.203	90.7091	735.479	0	0
9	65.0658	90.9862	889.589	0	0
10	65.9287	91.278	1046.9	0	0
11	66.7916	91.5845	1205.69	0	0
12	67.6545	91.9062	1364.3	0	0
13	68.5174	92.2432	1521.15	0	0
14	69.3802	92.5959	1674.7	0	0
15	70.2431	92.9645	1823.51	0	0
16	71.106	93.3494	1966.17	0	0
17	71.9689	93.751	2101.36	0	0
18	72.8317	94.1695	2227.81	0	0
19	73.6504	94.5827	2318.52	0	0
20	74.469	95.0119	2397.63	0	0
21	75.2876	95.4575	2464.37	0	0
22	76.1063	95.92	2518.06	0	0
23	76.9249	96.3999	2558.05	0	0
24	77.7436	96.8975	2583.78	0	0
25	78.5622	97.4135	2594.74	0	0
26	79.3808	97.9484	2590.33	0	0
27	80.1995	98.5028	2568.77	0	0
28	81.0181	99.0775	2529.05	0	0
29	81.8368	99.6731	2471.67	0	0
30	82.6554	100.29	2397.53	0	0
31	83.474	100.93	2306.63	0	0
32	84.2927	101.594	2199.08	0	0
33	85.1113	102.282	2075.12	0	0
34	85.93	102.996	1935.11	0	0
35	86.7486	103.736	1779.58	0	0
36	87.5672	104.506	1609.24	0	0
37	88.3859	105.305	1424.96	0	0
38	89.2045	106.136	1227.88	0	0
39	90.0232	107	1019.35	0	0
40	90.891	107.956	708.117	0	0
41	91.7588	108.954	385.619	0	0
42	92.6267	110	54.4664	0	0
43	93.459	111.05	-183.425	0	0
44	94.2914	112.152	-419.478	0	0
45	95.1238	113.309	-649.135	0	0
46	95.9561	114.528	-866.87	0	0
47	96.7885	115.816	-1065.94	0	0
48	97.6208	117.181	-1225.97	0	0
49	98.4532	118.635	-1303.26	0	0
50	99.2856	120.192	-1277.28	0	0
51	100.118	121.87	0	0	0

Global Minimum Query (spencer) - Safety Factor: 1.26658

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	59.4665	90.4665	0	0	0
2	60.2958	90.6751	51.526	34.731	33.9819
3	61.1252	90.8954	126.617	85.3462	33.9819
4	61.9546	91.1274	222.115	149.716	33.9818
5	62.784	91.3712	335.03	225.826	33.9818
6	63.6134	91.627	461.108	310.809	33.9819
7	64.4428	91.895	594.453	400.689	33.9818
8	65.2721	92.1752	732.997	494.074	33.9818
9	66.1015	92.4679	874.965	589.768	33.9818
10	66.9309	92.7732	1018.7	686.651	33.9818
11	67.7603	93.0914	1162.64	783.677	33.9819
12	68.5897	93.4226	1305.35	879.868	33.9818
13	69.419	93.7671	1445.47	974.315	33.9818
14	70.2484	94.125	1581.74	1066.17	33.9819
15	71.0813	94.4982	1701.85	1147.13	33.9819
16	71.9142	94.8855	1813.95	1222.69	33.9819
17	72.7471	95.2872	1917.28	1292.34	33.9819
18	73.5799	95.7036	2011.2	1355.65	33.982
19	74.4128	96.135	2095.1	1412.2	33.9819
20	75.2457	96.5817	2168.46	1461.65	33.9819
21	76.0786	97.0441	2230.83	1503.68	33.9817
22	76.9114	97.5225	2281.81	1538.05	33.9819
23	77.7443	98.0175	2321.08	1564.52	33.9819
24	78.5772	98.5293	2348.4	1582.94	33.982
25	79.4101	99.0586	2363.43	1593.06	33.9818
26	80.2429	99.6058	2364.82	1594	33.9818
27	81.0758	100.171	2351.95	1585.32	33.9817
28	81.9087	100.756	2325.6	1567.56	33.9818
29	82.7416	101.36	2286.62	1541.29	33.9818
30	83.5745	101.985	2235.19	1506.63	33.9819
31	84.4073	102.631	2171.6	1463.76	33.9818
32	85.2402	103.299	2096.19	1412.93	33.9818
33	86.0731	103.989	2009.4	1354.43	33.9818
34	86.906	104.704	1911.79	1288.63	33.9817
35	87.7388	105.443	1803.98	1215.97	33.9819
36	88.5717	106.208	1686.74	1136.94	33.9818
37	89.4046	107	1560.94	1052.15	33.9819
38	90.1313	107.715	1393.59	939.343	33.9818
39	90.858	108.452	1220.56	822.717	33.9819
40	91.5848	109.213	1042.65	702.797	33.9819
41	92.3115	110	860.728	580.171	33.9818
42	93.167	110.96	707.057	476.59	33.9818
43	94.0225	111.96	552.441	372.371	33.9818
44	94.878	113.001	399.154	269.049	33.9819
45	95.7335	114.088	249.818	168.389	33.9818
46	96.589	115.225	107.47	72.4396	33.9817
47	97.4445	116.415	-20.366	-13.7277	33.9819
48	98.2999	117.665	-105.914	-71.3913	33.9819
49	99.1554	118.98	-137.779	-92.8697	33.9819
50	100.011	120.368	-106.632	-71.8749	33.9818
51	100.866	121.839	0	0	0

List Of Coordinates

External Boundary

X	Y
0	60
121	60
193	60
220	64
220	68
220	92
220	96
220	107
220	110.388
220	119
193	120
121	121
97	122
82.2308	110
81	109
79	107
63	94
58	89
0	89
0	70
0	64

Material Boundary

X	Y
63	94
121	95
193	96
220	96

Material Boundary

X	Y
79	107
121	107
193	107
220	107

Material Boundary

X	Y
0	70
220	68

Material Boundary

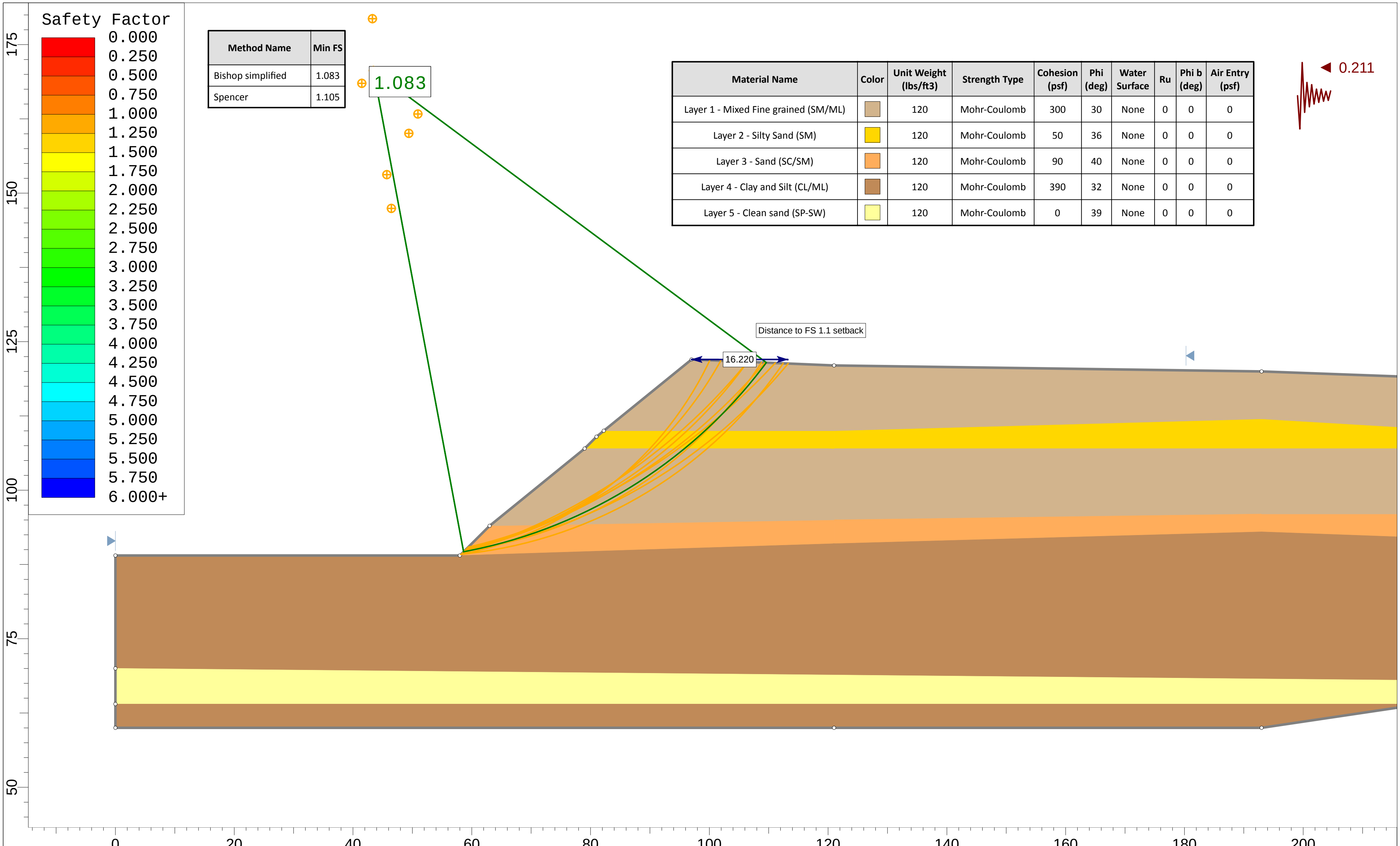
X	Y
0	64
220	64

Material Boundary

X	Y
82.2308	110
121	110
193	112
220	110.388

Material Boundary

X	Y
58	89
121	91
193	93
220	92



Method Name	Min FS
Bishop simplified	1.083
Spencer	1.105

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Phi b (deg)	Air Entry (psf)
Layer 1 - Mixed Fine grained (SM/ML)		120	Mohr-Coulomb	300	30	None	0	0	0
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	36	None	0	0	0
Layer 3 - Sand (SC/SM)		120	Mohr-Coulomb	90	40	None	0	0	0
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	390	32	None	0	0	0
Layer 5 - Clean sand (SP-SW)		120	Mohr-Coulomb	0	39	None	0	0	0

Project	Goleta Fire Station #10		
Analysis Description	A-A' Pseudostatic Analysis - Circular failure		
Drawn By LD	*Scale* 1:268	*Company*	Leighton
Date	7/29/2016, 6:01:40 PM	*File Name*	2_AA_StaticCircle_11389001_Rev3_Pseudo-static.slim

Leighton

SLIDEINTERPRET 7.018

Slide Analysis Information

Goleta Fire Station #10

Project Summary

File Name:	2_AA_StaticCircle_11389001_Rev3_Pseudo-static
Slide Modeler Version:	7.018
Project Title:	Goleta Fire Station #10
Analysis:	A-A' Pseudostatic Analysis - Circular failure
Author:	LD
Company:	Leighton
Date Created:	7/29/2016, 6:01:40 PM
Comments	
	Peak strength, depth specific

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
	Spencer

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	No
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Slope Search
Number of Surfaces:	5000
Upper Angle:	Not Defined
Lower Angle:	Not Defined
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal): 0.211

Material Properties

Property	Layer 1 - Mixed Fine grained (SM/ML)	Layer 2 - Silty Sand (SM)	Layer 3 - Sand (SC/SM)	Layer 4 - Clay and Silt (CL/ML)	Layer 5 - Clean sand (SP-SW)
Color					
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	120	120	120
Cohesion [psf]	300	50	90	390	0
Friction Angle [deg]	30	36	40	32	39
Water Surface	None	None	None	None	None
Ru Value	0	0	0	0	0
Unsat. Shear Strength Phi b [deg]	0	0	0	0	0
Unsat. Shear Strength Air Entry Value [psf]	0	0	0	0	0

Global Minimums

Method: bishop simplified

FS	1.083470
Center:	43.434, 170.626
Radius:	82.416
Left Slip Surface Endpoint:	58.621, 89.621
Right Slip Surface Endpoint:	109.591, 121.475
Resisting Moment:	3.34437e+006 lb-ft
Driving Moment:	3.08671e+006 lb-ft
Total Slice Area:	455.936 ft2
Surface Horizontal Width:	50.9698 ft
Surface Average Height:	8.94521 ft

Method: spencer

FS	1.105020
Center:	29.581, 184.372
Radius:	99.232
Left Slip Surface Endpoint:	58.425, 89.425
Right Slip Surface Endpoint:	106.441, 121.607
Resisting Moment:	3.23996e+006 lb-ft
Driving Moment:	2.93203e+006 lb-ft
Resisting Horizontal Force:	26964.4 lb
Driving Horizontal Force:	24401.6 lb
Total Slice Area:	341.541 ft2
Surface Horizontal Width:	48.0167 ft
Surface Average Height:	7.11297 ft

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	4070
Number of Invalid Surfaces:	930

Error Codes:

Error Code -103 reported for 22 surfaces
Error Code -105 reported for 1 surface
Error Code -106 reported for 28 surfaces
Error Code -112 reported for 1 surface
Error Code -114 reported for 878 surfaces

Method: spencer

Number of Valid Surfaces: 3481
Number of Invalid Surfaces: 1519

Error Codes:

Error Code -103 reported for 22 surfaces
Error Code -105 reported for 1 surface
Error Code -106 reported for 28 surfaces
Error Code -108 reported for 128 surfaces
Error Code -111 reported for 461 surfaces
Error Code -112 reported for 1 surface
Error Code -114 reported for 878 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-105 = More than two surface / slope intersections with no valid slip surface.
-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-111 = safety factor equation did not converge
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
-114 = Surface with Reverse Curvature.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.08347

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	0.977893	46.2604	10.9647	Layer 3 - Sand (SC/SM)	90	40	104.09	112.779	27.1467	0	27.1467
2	0.977893	138.059	11.658	Layer 3 - Sand (SC/SM)	90	40	165.904	179.752	106.961	0	106.961
3	0.977893	228.408	12.3531	Layer 3 - Sand (SC/SM)	90	40	225.692	244.53	184.161	0	184.161
4	0.977893	317.296	13.05	Layer 3 - Sand (SC/SM)	90	40	283.484	307.146	258.785	0	258.785

5	0.977893	401.783	13.7488	Layer 3 - Sand (SC/SM)	90	40	337.36	365.519	328.351	0	328.351
6	0.977893	468.657	14.4498	Layer 3 - Sand (SC/SM)	90	40	378.681	410.289	381.706	0	381.706
7	0.977893	531.57	15.153	Layer 3 - Sand (SC/SM)	90	40	416.688	451.469	430.782	0	430.782
8	0.977893	592.969	15.8585	Layer 3 - Sand (SC/SM)	90	40	453.041	490.856	477.722	0	477.722
9	0.977893	652.839	16.5665	Layer 3 - Sand (SC/SM)	90	40	487.76	528.473	522.551	0	522.551
10	0.977893	711.162	17.2771	Layer 3 - Sand (SC/SM)	90	40	520.862	564.338	565.294	0	565.294
11	0.977893	767.921	17.9905	Layer 3 - Sand (SC/SM)	90	40	552.364	598.47	605.971	0	605.971
12	0.977893	823.097	18.7068	Layer 3 - Sand (SC/SM)	90	40	582.284	630.887	644.605	0	644.605
13	0.977893	876.671	19.4261	Layer 3 - Sand (SC/SM)	90	40	610.636	661.606	681.213	0	681.213
14	0.977893	928.621	20.1486	Layer 3 - Sand (SC/SM)	90	40	637.433	690.64	715.815	0	715.815
15	0.977893	978.925	20.8745	Layer 3 - Sand (SC/SM)	90	40	662.689	718.004	748.425	0	748.425
16	0.977893	1027.56	21.6039	Layer 3 - Sand (SC/SM)	90	40	686.414	743.709	779.06	0	779.06
17	1.0263	1128.86	22.3552	Layer 1 - Mixed Fine grained (SM/ML)	300	30	707.926	767.017	808.897	0	808.897
18	1.0263	1178.57	23.1289	Layer 1 - Mixed Fine grained (SM/ML)	300	30	724.076	784.515	839.205	0	839.205
19	1.0263	1226.26	23.907	Layer 1 - Mixed Fine grained (SM/ML)	300	30	739.066	800.756	867.335	0	867.335
20	1.0263	1271.88	24.6899	Layer 1 - Mixed Fine grained (SM/ML)	300	30	752.895	815.739	893.287	0	893.287
21	1.0263	1317.2	25.4777	Layer 1 - Mixed Fine grained (SM/ML)	300	30	766.298	830.261	918.44	0	918.44
22	1.0263	1377.85	26.2707	Layer 1 - Mixed Fine grained (SM/ML)	300	30	785.708	851.291	954.863	0	954.863
23	1.0263	1438.47	27.0692	Layer 1 - Mixed Fine grained (SM/ML)	300	30	804.704	871.873	990.509	0	990.509
24	1.0263	1479.16	27.8733	Layer 1 - Mixed Fine grained (SM/ML)	300	30	815.227	883.274	1010.26	0	1010.26
25	1.0263	1513.86	28.6836	Layer 1 - Mixed Fine grained (SM/ML)	300	30	823.045	891.745	1024.93	0	1024.93
26	1.0263	1546.22	29.5001	Layer 1 - Mixed Fine grained (SM/ML)	300	30	829.67	898.923	1037.37	0	1037.37
27	1.0263	1576.2	30.3233	Layer 1 - Mixed Fine grained (SM/ML)	300	30	835.093	904.798	1047.54	0	1047.54
				Layer 1 - Mixed							

				Fine grained (SM/ML)							
29	1.0263	1628.74	31.9909	Layer 1 - Mixed Fine grained (SM/ML)	300	30	842.296	912.602	1061.06	0	1061.06
30	1.0263	1651.18	32.8361	Layer 1 - Mixed Fine grained (SM/ML)	300	30	844.053	914.506	1064.35	0	1064.35
31	1.0263	1670.96	33.6894	Layer 1 - Mixed Fine grained (SM/ML)	300	30	844.564	915.06	1065.32	0	1065.32
32	1.0263	1688.01	34.5513	Layer 1 - Mixed Fine grained (SM/ML)	300	30	843.815	914.248	1063.91	0	1063.91
33	1.0263	1702.24	35.4222	Layer 1 - Mixed Fine grained (SM/ML)	300	30	841.791	912.055	1060.11	0	1060.11
34	1.0263	1713.56	36.3027	Layer 1 - Mixed Fine grained (SM/ML)	300	30	838.474	908.461	1053.89	0	1053.89
35	1.0263	1721.87	37.1932	Layer 1 - Mixed Fine grained (SM/ML)	300	30	833.847	903.448	1045.2	0	1045.2
36	1.0263	1727.06	38.0943	Layer 1 - Mixed Fine grained (SM/ML)	300	30	827.889	896.993	1034.03	0	1034.03
37	1.0263	1729.03	39.0067	Layer 1 - Mixed Fine grained (SM/ML)	300	30	820.58	889.074	1020.31	0	1020.31
38	1.14819	1932.49	39.9867	Layer 2 - Silty Sand (SM)	50	36	751.989	814.758	1052.6	0	1052.6
39	1.14819	1862.05	41.0367	Layer 2 - Silty Sand (SM)	50	36	715.914	775.671	998.8	0	998.8
40	1.14819	1715.18	42.1038	Layer 2 - Silty Sand (SM)	50	36	652.552	707.02	904.308	0	904.308
41	1.03268	1412.75	43.1336	Layer 1 - Mixed Fine grained (SM/ML)	300	30	671.007	727.016	739.615	0	739.615
42	1.03268	1285.41	44.1256	Layer 1 - Mixed Fine grained (SM/ML)	300	30	619.894	671.637	643.694	0	643.694
43	1.03268	1153.73	45.1345	Layer 1 - Mixed Fine grained (SM/ML)	300	30	568.154	615.578	546.597	0	546.597
44	1.03268	1017.48	46.1616	Layer 1 - Mixed Fine grained (SM/ML)	300	30	515.791	558.844	448.332	0	448.332
45	1.03268	876.396	47.2083	Layer 1 - Mixed Fine grained (SM/ML)	300	30	462.81	501.441	348.906	0	348.906
46	1.03268	730.191	48.2761	Layer 1 - Mixed Fine grained (SM/ML)	300	30	409.219	443.377	248.336	0	248.336
47	1.03268	578.539	49.3666	Layer 1 - Mixed Fine grained (SM/ML)	300	30	355.031	384.665	146.645	0	146.645
48	1.03268	421.071	50.482	Layer 1 - Mixed Fine grained	300	30	300.262	325.324	43.8631	0	43.8631

				(SM/ML)							
49	1.03268	257.369	51.6243	Layer 1 - Mixed Fine grained (SM/ML)	300	30	244.934	265.379	-59.9653	0	-59.9653
50	1.03268	86.9518	52.7962	Layer 1 - Mixed Fine grained (SM/ML)	300	30	189.081	204.863	-164.782	0	-164.782

Global Minimum Query (spencer) - Safety Factor: 1.10502

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	0.956935	37.9492	17.187	Layer 3 - Sand (SC/SM)	90	40	178.995	197.793	128.462	0	128.462
2	0.956935	113.237	17.7663	Layer 3 - Sand (SC/SM)	90	40	236.521	261.36	204.219	0	204.219
3	0.956935	187.298	18.3475	Layer 3 - Sand (SC/SM)	90	40	290.025	320.483	274.68	0	274.68
4	0.956935	260.119	18.9306	Layer 3 - Sand (SC/SM)	90	40	339.729	375.407	340.136	0	340.136
5	0.956935	331.196	19.5157	Layer 3 - Sand (SC/SM)	90	40	385.474	425.956	400.377	0	400.377
6	0.956935	387.183	20.103	Layer 3 - Sand (SC/SM)	90	40	417.807	461.685	442.957	0	442.957
7	0.956935	435.603	20.6925	Layer 3 - Sand (SC/SM)	90	40	443.001	489.525	476.135	0	476.135
8	0.956935	482.729	21.2843	Layer 3 - Sand (SC/SM)	90	40	465.871	514.797	506.253	0	506.253
9	0.956935	528.544	21.8785	Layer 3 - Sand (SC/SM)	90	40	486.544	537.641	533.477	0	533.477
10	0.956935	573.034	22.4752	Layer 3 - Sand (SC/SM)	90	40	505.138	558.188	557.964	0	557.964
11	0.956935	616.18	23.0745	Layer 3 - Sand (SC/SM)	90	40	521.765	576.561	579.861	0	579.861
12	0.956935	657.965	23.6764	Layer 3 - Sand (SC/SM)	90	40	536.531	592.878	599.306	0	599.306
13	0.956935	698.371	24.2811	Layer 3 - Sand (SC/SM)	90	40	549.532	607.244	616.428	0	616.428
14	0.992836	765.772	24.9002	Layer 1 - Mixed Fine grained (SM/ML)	300	30	613.678	678.127	654.935	0	654.935
15	0.992836	806.173	25.5339	Layer 1 - Mixed Fine grained (SM/ML)	300	30	619.049	684.062	665.214	0	665.214
16	0.992836	844.964	26.1709	Layer 1 - Mixed Fine grained (SM/ML)	300	30	623.562	689.049	673.852	0	673.852
17	0.992836	882.117	26.8114	Layer 1 - Mixed Fine grained (SM/ML)	300	30	627.248	693.122	680.908	0	680.908
18	0.992836	917.604	27.4556	Layer 1 - Mixed Fine grained (SM/ML)	300	30	630.136	696.313	686.434	0	686.434
19	0.992836	951.398	28.1035	Layer 1 - Mixed Fine grained (SM/ML)	300	30	632.251	698.65	690.482	0	690.482

20	0.992836	983.468	28.7554	Layer 1 - Mixed Fine grained (SM/ML)	300	30	633.617	700.16	693.098	0	693.098
21	0.992836	1013.78	29.4114	Layer 1 - Mixed Fine grained (SM/ML)	300	30	634.259	700.869	694.325	0	694.325
22	0.992836	1049.51	30.0717	Layer 1 - Mixed Fine grained (SM/ML)	300	30	636.297	703.121	698.227	0	698.227
23	0.992836	1097.97	30.7363	Layer 1 - Mixed Fine grained (SM/ML)	300	30	641.737	709.132	708.637	0	708.637
24	0.992836	1138.02	31.4056	Layer 1 - Mixed Fine grained (SM/ML)	300	30	644.442	712.121	713.814	0	713.814
25	0.992836	1161.43	32.0797	Layer 1 - Mixed Fine grained (SM/ML)	300	30	642.275	709.727	709.669	0	709.669
26	0.992836	1182.41	32.7589	Layer 1 - Mixed Fine grained (SM/ML)	300	30	639.342	706.486	704.055	0	704.055
27	0.992836	1201.41	33.4432	Layer 1 - Mixed Fine grained (SM/ML)	300	30	635.792	702.563	697.26	0	697.26
28	0.992836	1218.36	34.133	Layer 1 - Mixed Fine grained (SM/ML)	300	30	631.637	697.972	689.307	0	689.307
29	0.992836	1233.22	34.8284	Layer 1 - Mixed Fine grained (SM/ML)	300	30	626.889	692.725	680.219	0	680.219
30	0.992836	1245.95	35.5298	Layer 1 - Mixed Fine grained (SM/ML)	300	30	621.559	686.835	670.017	0	670.017
31	0.992836	1256.48	36.2374	Layer 1 - Mixed Fine grained (SM/ML)	300	30	615.657	680.313	658.721	0	658.721
32	0.992836	1264.75	36.9514	Layer 1 - Mixed Fine grained (SM/ML)	300	30	609.193	673.17	646.349	0	646.349
33	0.992836	1270.71	37.6722	Layer 1 - Mixed Fine grained (SM/ML)	300	30	602.175	665.415	632.916	0	632.916
34	0.992836	1274.27	38.4001	Layer 1 - Mixed Fine grained (SM/ML)	300	30	594.612	657.058	618.442	0	618.442
35	0.89033	1143.76	39.097	Layer 2 - Silty Sand (SM)	50	36	424.551	469.137	576.893	0	576.893
36	0.89033	1142.82	39.7626	Layer 2 - Silty Sand (SM)	50	36	416.201	459.91	564.193	0	564.193
37	0.89033	1140.01	40.4347	Layer 2 - Silty Sand (SM)	50	36	407.344	450.123	550.722	0	550.722
38	0.89033	1135.26	41.1135	Layer 2 - Silty Sand (SM)	50	36	397.989	439.786	536.494	0	536.494
39	0.930469	1179.18	41.8151	Layer 1 - Mixed Fine grained (SM/ML)	300	30	553.509	611.639	539.775	0	539.775
40	0.930469	1168.5	42.5401	Layer 1 - Mixed Fine grained	300	30	543.542	600.625	520.698	0	520.698

				(SM/ML)							
41	0.930469	1099.89	43.2737	Layer 1 - Mixed Fine grained (SM/ML)	300	30	521.461	576.225	478.435	0	478.435
42	0.930469	996.466	44.0161	Layer 1 - Mixed Fine grained (SM/ML)	300	30	492.918	544.684	423.806	0	423.806
43	0.930469	890.418	44.768	Layer 1 - Mixed Fine grained (SM/ML)	300	30	464.928	513.755	370.234	0	370.234
44	0.930469	781.645	45.5299	Layer 1 - Mixed Fine grained (SM/ML)	300	30	437.535	483.485	317.806	0	317.806
45	0.930469	670.038	46.3021	Layer 1 - Mixed Fine grained (SM/ML)	300	30	410.793	453.935	266.623	0	266.623
46	0.930469	555.473	47.0855	Layer 1 - Mixed Fine grained (SM/ML)	300	30	384.766	425.174	216.808	0	216.808
47	0.930469	437.821	47.8805	Layer 1 - Mixed Fine grained (SM/ML)	300	30	359.529	397.286	168.505	0	168.505
48	0.930469	316.937	48.6879	Layer 1 - Mixed Fine grained (SM/ML)	300	30	335.171	370.371	121.886	0	121.886
49	0.930469	192.664	49.5085	Layer 1 - Mixed Fine grained (SM/ML)	300	30	311.8	344.545	77.1544	0	77.1544
50	0.930469	64.8301	50.3432	Layer 1 - Mixed Fine grained (SM/ML)	300	30	287.64	317.848	30.9132	0	30.9132

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.08347

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	58.6208	89.6208	0	0	0
2	59.5986	89.8102	86.8493	0	0
3	60.5765	90.012	198.317	0	0
4	61.5544	90.2261	331.306	0	0
5	62.5323	90.4528	482.819	0	0
6	63.5102	90.6921	649.265	0	0
7	64.4881	90.9441	824.372	0	0
8	65.466	91.2089	1005.46	0	0
9	66.4439	91.4867	1190.51	0	0
10	67.4218	91.7776	1377.56	0	0
11	68.3997	92.0817	1564.73	0	0
12	69.3776	92.3993	1750.23	0	0
13	70.3555	92.7304	1932.33	0	0
14	71.3334	93.0753	2109.34	0	0
15	72.3113	93.4341	2279.69	0	0
16	73.2892	93.807	2441.85	0	0
17	74.267	94.1943	2594.34	0	0
18	75.2933	94.6163	2741.03	0	0
19	76.3196	95.0547	2867.33	0	0
20	77.3459	95.5096	2972.23	0	0
21	78.3722	95.9815	3054.81	0	0
22	79.3985	96.4705	3113.92	0	0
23	80.4248	96.9771	3145.56	0	0
24	81.4511	97.5015	3148.11	0	0
25	82.4774	98.0443	3124.02	0	0
26	83.5037	98.6058	3073.49	0	0
27	84.53	99.1865	2996.08	0	0
28	85.5563	99.7868	2891.44	0	0
29	86.5826	100.407	2759.32	0	0
30	87.6089	101.048	2599.57	0	0
31	88.6352	101.711	2412.18	0	0
32	89.6615	102.395	2197.2	0	0
33	90.6878	103.101	1954.86	0	0
34	91.7141	103.831	1685.48	0	0
35	92.7404	104.585	1389.55	0	0
36	93.7667	105.364	1067.7	0	0
37	94.793	106.169	720.722	0	0
38	95.8193	107	349.603	0	0
39	96.9675	107.963	-208.674	0	0
40	98.1157	108.962	-778.05	0	0
41	99.2638	110	-1329.28	0	0
42	100.297	110.967	-1650.26	0	0
43	101.329	111.969	-1926.3	0	0
44	102.362	113.007	-2150.34	0	0
45	103.395	114.082	-2314.71	0	0
46	104.427	115.198	-2411.08	0	0
47	105.46	116.356	-2430.3	0	0
48	106.493	117.559	-2362.34	0	0
49	107.525	118.811	-2196.14	0	0
50	108.558	120.115	-1919.4	0	0
51	109.591	121.475	0	0	0

Global Minimum Query (spencer) - Safety Factor: 1.10502

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	58.4247	89.4247	0	0	0
2	59.3816	89.7207	125.346	143.749	48.9123
3	60.3385	90.0273	265.29	304.239	48.9123
4	61.2955	90.3446	416.279	477.396	48.9123
5	62.2524	90.6728	575.03	659.454	48.9123
6	63.2093	91.012	738.421	846.833	48.9122
7	64.1663	91.3622	901.605	1033.98	48.9124
8	65.1232	91.7237	1061.74	1217.62	48.9122
9	66.0802	92.0965	1217.2	1395.9	48.9122
10	67.0371	92.4808	1366.51	1567.14	48.9123
11	67.994	92.8766	1508.35	1729.79	48.9121
12	68.951	93.2843	1641.5	1882.5	48.9123
13	69.9079	93.7039	1764.9	2024.01	48.9122
14	70.8648	94.1356	1877.58	2153.24	48.9123
15	71.8577	94.5965	2023.77	2320.89	48.9122
16	72.8505	95.0707	2153.1	2469.21	48.9122
17	73.8433	95.5587	2265.46	2598.06	48.9122
18	74.8362	96.0604	2360.75	2707.35	48.9123
19	75.829	96.5763	2438.99	2797.07	48.9122
20	76.8218	97.1065	2500.2	2867.27	48.9122
21	77.8147	97.6513	2544.49	2918.06	48.9122
22	78.8075	98.211	2572.01	2949.63	48.9123
23	79.8004	98.7859	2581.25	2960.22	48.9123
24	80.7932	99.3762	2568.7	2945.83	48.9123
25	81.786	99.9824	2536.05	2908.39	48.9123
26	82.7789	100.605	2487.36	2852.55	48.9123
27	83.7717	101.244	2423.19	2778.96	48.9123
28	84.7645	101.899	2344.05	2688.2	48.9123
29	85.7574	102.572	2250.49	2580.9	48.9123
30	86.7502	103.263	2143.13	2457.78	48.9123
31	87.743	103.972	2022.65	2319.61	48.9123
32	88.7359	104.7	1889.78	2167.24	48.9124
33	89.7287	105.447	1745.35	2001.6	48.9123
34	90.7215	106.213	1590.22	1823.69	48.9122
35	91.7144	107	1425.35	1634.62	48.9123
36	92.6047	107.723	1144.84	1312.92	48.9122
37	93.495	108.464	856.493	982.24	48.9122
38	94.3854	109.223	561	643.364	48.9123
39	95.2757	110	259.102	297.143	48.9123
40	96.2062	110.832	76.2921	87.493	48.9122
41	97.1366	111.686	-108.828	-124.806	48.9123
42	98.0671	112.562	-274.568	-314.879	48.9122
43	98.9976	113.461	-406.959	-466.708	48.9123
44	99.928	114.384	-503.723	-577.677	48.9122
45	100.859	115.332	-562.552	-645.144	48.9123
46	101.789	116.306	-581.124	-666.443	48.9123
47	102.719	117.307	-557.109	-638.901	48.9122
48	103.65	118.336	-488.186	-559.859	48.9122
49	104.58	119.394	-372.068	-426.694	48.9123
50	105.511	120.484	-206.528	-236.85	48.9123
51	106.441	121.607	0	0	0

List Of Coordinates

External Boundary

X	Y
0	60
121	60
193	60
220	64
220	68
220	92
220	96
220	107
220	110.388
220	119
193	120
121	121
97	122
82.2308	110
81	109
79	107
63	94
58	89
0	89
0	70
0	64

Material Boundary

X	Y
63	94
121	95
193	96
220	96

Material Boundary

X	Y
79	107
121	107
193	107
220	107

Material Boundary

X	Y
0	70
220	68

Material Boundary

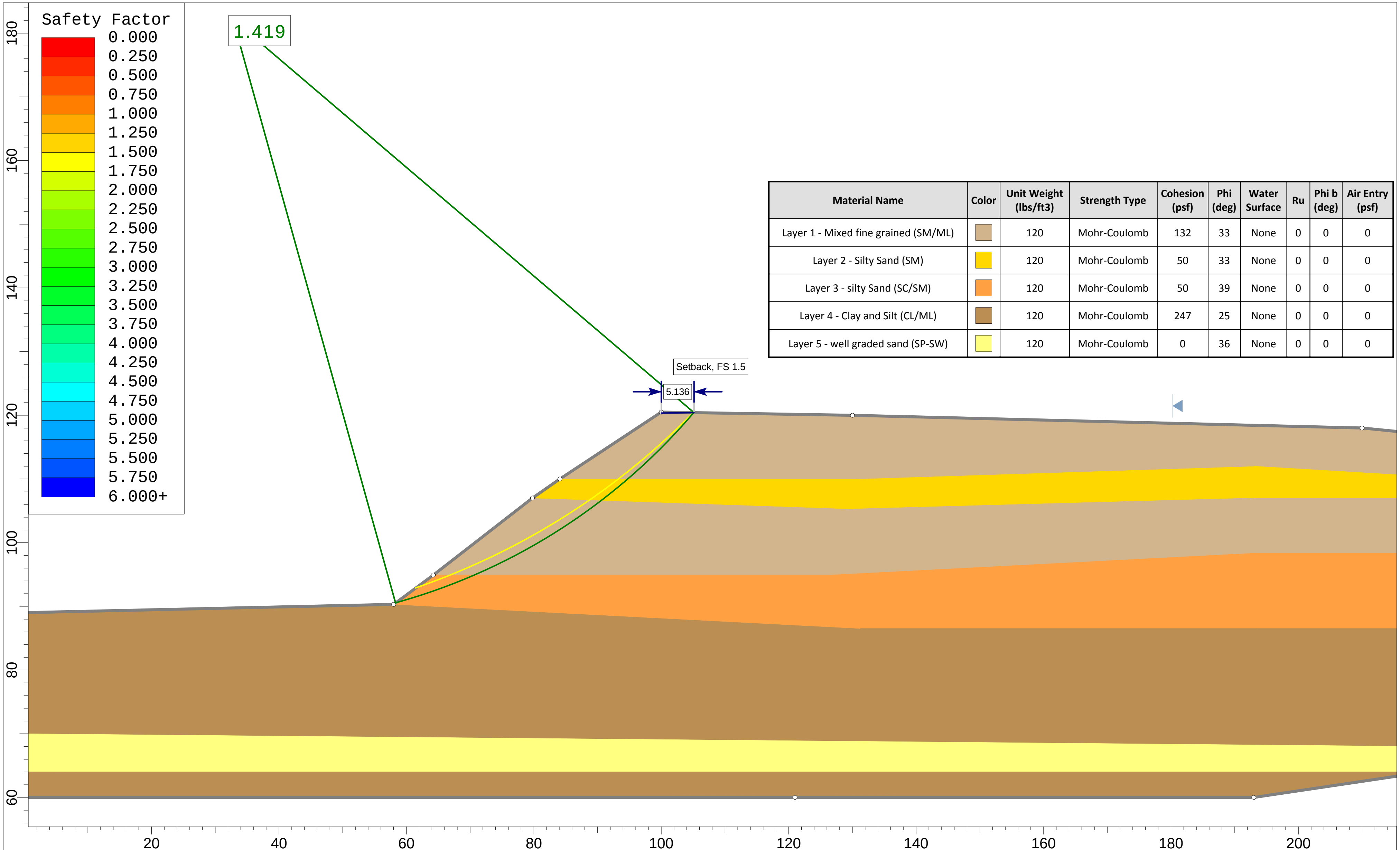
X	Y
0	64
220	64

Material Boundary

X	Y
82.2308	110
121	110
193	112
220	110.388

Material Boundary

X	Y
58	89
121	91
193	93
220	92



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Phi b (deg)	Air Entry (psf)
Layer 1 - Mixed fine grained (SM/ML)		120	Mohr-Coulomb	132	33	None	0	0	0
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	33	None	0	0	0
Layer 3 - silty Sand (SC/SM)		120	Mohr-Coulomb	50	39	None	0	0	0
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	247	25	None	0	0	0
Layer 5 - well graded sand (SP-SW)		120	Mohr-Coulomb	0	36	None	0	0	0

Leighton

SLIDEINTERPRET 7.021

Project	Goleta Fire Station #10
Analysis Description	Section B-B' Static Analysis
Drawn By	LD
Scale	1:250
Company	Leighton
Date	7/29/2016, 6:01:40 PM
File Name	3_BB_Static Circular 11389001_Rev2.slim

Slide Analysis Information

Goleta Fire Station #10

Project Summary

File Name:	3_BB_Static Circular 11389001_Rev2.slim
Slide Modeler Version:	7.021
Project Title:	Goleta Fire Station #10
Analysis:	Section B-B' Static Analysis
Author:	LD
Company:	Leighton
Date Created:	7/29/2016, 6:01:40 PM

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
	Janbu simplified
	Spencer

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	No
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Slope Search
Number of Surfaces:	5000
Upper Angle:	Not Defined
Lower Angle:	Not Defined
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Material Properties

Property	Layer 1 - Mixed fine grained (SM/ML)	Layer 2 - Silty Sand (SM)	Layer 3 - silty Sand (SC/SM)	Layer 4 - Clay and Silt (CL/ML)	Layer 5 - well graded sand (SP-SW)
Color					
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	120	120	120
Cohesion [psf]	132	50	50	247	0
Friction Angle [deg]	33	33	39	25	36
Water Surface	None	None	None	None	None
Ru Value	0	0	0	0	0
Unsat. Shear Strength Phi b [deg]	0	0	0	0	0
Unsat. Shear Strength Air Entry Value [psf]	0	0	0	0	0

Global Minimums

Method: bishop simplified

FS	1.418520
Center:	32.774, 182.146
Radius:	95.115
Left Slip Surface Endpoint:	58.295, 90.519
Right Slip Surface Endpoint:	105.135, 120.414
Resisting Moment:	2.21889e+006 lb-ft
Driving Moment:	1.56423e+006 lb-ft
Total Slice Area:	254.094 ft2
Surface Horizontal Width:	46.8402 ft
Surface Average Height:	5.4247 ft

Method: janbu simplified

FS	1.359260
Center:	55.135, 143.872
Radius:	52.109
Left Slip Surface Endpoint:	60.325, 92.022
Right Slip Surface Endpoint:	101.695, 120.472
Resisting Horizontal Force:	19376.3 lb
Driving Horizontal Force:	14255 lb
Total Slice Area:	263.284 ft2
Surface Horizontal Width:	41.3705 ft
Surface Average Height:	6.36405 ft

Method: spencer

FS	1.421390
Center:	32.774, 182.146
Radius:	95.115
Left Slip Surface Endpoint:	58.295, 90.519
Right Slip Surface Endpoint:	105.135, 120.414
Resisting Moment:	2.22339e+006 lb-ft
Driving Moment:	1.56423e+006 lb-ft
Resisting Horizontal Force:	19518.5 lb
Driving Horizontal Force:	13732 lb
Total Slice Area:	254.094 ft2
Surface Horizontal Width:	46.8402 ft
Surface Average Height:	5.4247 ft

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 4242
Number of Invalid Surfaces: 758

Error Codes:

Error Code -103 reported for 20 surfaces
Error Code -105 reported for 3 surfaces
Error Code -106 reported for 40 surfaces
Error Code -107 reported for 60 surfaces
Error Code -108 reported for 11 surfaces
Error Code -112 reported for 1 surface
Error Code -114 reported for 623 surfaces

Method: janbu simplified

Number of Valid Surfaces: 4191
Number of Invalid Surfaces: 809

Error Codes:

Error Code -103 reported for 20 surfaces
Error Code -105 reported for 3 surfaces
Error Code -106 reported for 40 surfaces
Error Code -107 reported for 60 surfaces
Error Code -108 reported for 62 surfaces
Error Code -112 reported for 1 surface
Error Code -114 reported for 623 surfaces

Method: spencer

Number of Valid Surfaces: 4101
Number of Invalid Surfaces: 899

Error Codes:

Error Code -103 reported for 20 surfaces
Error Code -105 reported for 3 surfaces
Error Code -106 reported for 40 surfaces
Error Code -107 reported for 60 surfaces
Error Code -108 reported for 97 surfaces
Error Code -111 reported for 55 surfaces
Error Code -112 reported for 1 surface
Error Code -114 reported for 623 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-105 = More than two surface / slope intersections with no valid slip surface.
-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-111 = safety factor equation did not converge
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
-114 = Surface with Reverse Curvature.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.41852

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.953495	24.8953	15.8625	Layer 3 - silty Sand (SC/SM)	50	39	43.1632	61.2279	13.8653	0	13.8653	26.1302	26.1302
2	0.953495	74.0687	16.4606	Layer 3 - silty Sand (SC/SM)	50	39	68.1226	96.6333	57.5873	0	57.5873	77.7152	77.7152
3	0.953495	122.002	17.0604	Layer 3 - silty Sand (SC/SM)	50	39	92.1713	130.747	99.7141	0	99.7141	128	128
4	0.953495	168.683	17.6622	Layer 3 - silty Sand (SC/SM)	50	39	115.315	163.576	140.255	0	140.255	176.973	176.973
5	0.953495	214.101	18.266	Layer 3 - silty Sand (SC/SM)	50	39	137.557	195.127	179.217	0	179.217	224.619	224.619
6	0.953495	258.24	18.872	Layer 3 - silty Sand (SC/SM)	50	39	158.903	225.407	216.609	0	216.609	270.927	270.927
7	0.953495	302.261	19.4801	Layer 3 - silty Sand (SC/SM)	50	39	179.94	255.249	253.461	0	253.461	317.111	317.111
8	0.953495	347.62	20.0905	Layer 3 - silty Sand (SC/SM)	50	39	201.391	285.677	291.038	0	291.038	364.699	364.699
9	0.953495	391.758	20.7033	Layer 3 - silty Sand (SC/SM)	50	39	221.984	314.889	327.111	0	327.111	411.007	411.007
10	0.953495	434.56	21.3186	Layer 3 - silty Sand (SC/SM)	50	39	241.672	342.817	361.6	0	361.6	455.914	455.914
11	0.953495	476.009	21.9365	Layer 3 - silty Sand (SC/SM)	50	39	260.458	369.465	394.506	0	394.506	499.402	499.402
12	0.953495	516.088	22.557	Layer 3 - silty Sand (SC/SM)	50	39	278.343	394.835	425.836	0	425.836	541.454	541.454
13	0.953495	554.778	23.1804	Layer 3 - silty Sand (SC/SM)	50	39	295.329	418.93	455.591	0	455.591	582.05	582.05
[illegible]	[illegible]	[illegible]	[illegible]	Layer 1 - Mixed	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

				fine grained (SM/ML)									
15	0.905215	593.598	24.3881	Layer 1 - Mixed fine grained (SM/ML)	132	33	325.763	462.102	508.312	0	508.312	656.003	656.003
16	0.905215	624.74	24.9883	Layer 1 - Mixed fine grained (SM/ML)	132	33	337.19	478.311	533.272	0	533.272	690.422	690.422
17	0.905215	654.625	25.5914	Layer 1 - Mixed fine grained (SM/ML)	132	33	347.962	493.591	556.801	0	556.801	723.452	723.452
18	0.905215	683.234	26.1975	Layer 1 - Mixed fine grained (SM/ML)	132	33	358.077	507.94	578.896	0	578.896	755.073	755.073
19	0.905215	710.547	26.8069	Layer 1 - Mixed fine grained (SM/ML)	132	33	367.534	521.354	599.552	0	599.552	785.262	785.262
20	0.905215	736.545	27.4195	Layer 1 - Mixed fine grained (SM/ML)	132	33	376.329	533.83	618.764	0	618.764	813.997	813.997
21	0.905215	761.203	28.0355	Layer 1 - Mixed fine grained (SM/ML)	132	33	384.461	545.366	636.527	0	636.527	841.255	841.255
22	0.905215	784.501	28.6551	Layer 1 - Mixed fine grained (SM/ML)	132	33	391.926	555.955	652.833	0	652.833	867.007	867.007
23	0.905215	806.414	29.2784	Layer 1 - Mixed fine grained (SM/ML)	132	33	398.721	565.594	667.677	0	667.677	891.231	891.231
24	0.905215	823.558	29.9055	Layer 1 - Mixed fine grained (SM/ML)	132	33	403.498	572.37	678.111	0	678.111	910.184	910.184
25	0.905215	835.038	30.5365	Layer 1 - Mixed fine grained (SM/ML)	132	33	405.929	575.818	683.419	0	683.419	922.878	922.878
26	0.905215	845.039	31.1717	Layer 1 - Mixed fine grained (SM/ML)	132	33	407.705	578.337	687.299	0	687.299	933.939	933.939
27	0.905215	853.546	31.8112	Layer 1 - Mixed fine grained (SM/ML)	132	33	408.828	579.931	689.754	0	689.754	943.349	943.349
28	0.905215	860.451	32.4552	Layer 1 - Mixed fine grained (SM/ML)	132	33	409.265	580.55	690.707	0	690.707	950.987	950.987
29	0.905215	863.25	33.1038	Layer 1 - Mixed fine grained (SM/ML)	132	33	408.048	578.824	688.048	0	688.048	954.089	954.089
30	0.905215	863.221	33.7572	Layer 1 - Mixed fine grained (SM/ML)	132	33	405.697	575.49	682.914	0	682.914	954.066	954.066
31	0.905215	861.564	34.4156	Layer 1 - Mixed fine grained (SM/ML)	132	33	402.693	571.228	676.353	0	676.353	952.244	952.244
32	0.905215	858.239	35.0793	Layer 1 - Mixed fine grained (SM/ML)	132	33	399.03	566.032	668.35	0	668.35	948.577	948.577
33	0.905215	853.206	35.7484	Layer 1 - Mixed fine grained (SM/ML)	132	33	394.702	559.893	658.897	0	658.897	943.024	943.024
34	0.905215	846.422	36.4231	Layer 1 - Mixed fine grained (SM/ML)	132	33	389.703	552.802	647.979	0	647.979	935.536	935.536
35	0.905215	837.842	37.1038	Layer 1 - Mixed fine grained (SM/ML)	132	33	384.028	544.752	635.583	0	635.583	926.062	926.062
36	1.03792	947.672	37.8415	Layer 2 - Silty Sand (SM)	50	33	334.489	474.479	653.64	0	653.64	913.484	913.484

37	1.03792	931.096	38.6376	Layer 2 - Silty Sand (SM)	50	33	326.612	463.305	636.434	0	636.434	897.516	897.516
38	1.03792	911.558	39.4426	Layer 2 - Silty Sand (SM)	50	33	317.822	450.837	617.235	0	617.235	878.693	878.693
39	1.03792	888.957	40.2571	Layer 2 - Silty Sand (SM)	50	33	308.108	437.058	596.018	0	596.018	856.916	856.916
40	0.943483	785.834	41.0435	Layer 1 - Mixed fine grained (SM/ML)	132	33	339.34	481.361	537.969	0	537.969	833.405	833.405
41	0.943483	762.066	41.8015	Layer 1 - Mixed fine grained (SM/ML)	132	33	328.563	466.073	514.427	0	514.427	808.211	808.211
42	0.943483	735.739	42.5685	Layer 1 - Mixed fine grained (SM/ML)	132	33	316.986	449.651	489.14	0	489.14	780.303	780.303
43	0.943483	706.759	43.3451	Layer 1 - Mixed fine grained (SM/ML)	132	33	304.601	432.082	462.085	0	462.085	749.58	749.58
44	0.943483	675.021	44.1318	Layer 1 - Mixed fine grained (SM/ML)	132	33	291.394	413.348	433.239	0	433.239	715.933	715.933
45	0.943483	633.324	44.9291	Layer 1 - Mixed fine grained (SM/ML)	132	33	274.992	390.082	397.411	0	397.411	671.724	671.724
46	0.943483	534.673	45.7377	Layer 1 - Mixed fine grained (SM/ML)	132	33	239.962	340.391	320.894	0	320.894	567.116	567.116
47	0.943483	421.693	46.5581	Layer 1 - Mixed fine grained (SM/ML)	132	33	200.778	284.808	235.304	0	235.304	447.31	447.31
48	0.943483	305.452	47.3911	Layer 1 - Mixed fine grained (SM/ML)	132	33	161.183	228.641	148.814	0	148.814	324.044	324.044
49	0.943483	185.792	48.2375	Layer 1 - Mixed fine grained (SM/ML)	132	33	121.181	171.898	61.4379	0	61.4379	197.151	197.151
50	0.943483	62.544	49.0982	Layer 1 - Mixed fine grained (SM/ML)	132	33	80.7833	114.593	- 26.8049	0	-26.8049	66.4479	66.4479

Global Minimum Query (janbu simplified) - Safety Factor: 1.35926

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.844004	27.0212	6.18207	Layer 3 - silty Sand (SC/SM)	50	39	52.4802	71.3343	26.3458	0	26.3458	32.0303	32.0303
2	0.844004	80.3572	7.1164	Layer 3 - silty Sand (SC/SM)	50	39	87.0484	118.321	84.37	0	84.37	95.2377	95.2377
3	0.844004	132.276	8.05264	Layer 3 - silty Sand (SC/SM)	50	39	120.061	163.194	139.783	0	139.783	156.769	156.769
4	0.844004	182.768	8.99105	Layer 3 - silty Sand (SC/SM)	50	39	151.546	205.991	192.632	0	192.632	216.611	216.611
5	0.844004	232.034	9.9319	Layer 3 - silty Sand (SC/SM)	50	39	181.668	246.934	243.192	0	243.192	275.003	275.003
6	0.844004	282.1	10.8755	Layer 3 - silty Sand (SC/SM)	50	39	211.737	287.806	293.666	0	293.666	334.346	334.346
7	0.844004	331.312	11.822	Layer 3 - silty Sand (SC/SM)	50	39	240.709	327.186	342.296	0	342.296	392.679	392.679
8	0.844004	379.047	12.7719	Layer 3 - silty Sand (SC/SM)	50	39	268.214	364.573	388.465	0	388.465	449.263	449.263
9	0.844004	425.289	13.7253	Layer 3 - silty Sand (SC/SM)	50	39	294.274	399.995	432.208	0	432.208	504.082	504.082
10	0.844004	470.02	14.6826	Layer 3 - silty Sand (SC/SM)	50	39	318.904	433.474	473.551	0	473.551	557.11	557.11
11	0.844004	513.222	15.6441	Layer 3 - silty	50	39	342.122	465.033	512.522	0	512.522	608.329	608.329

				Sand (SC/SM)									
12	0.844004	554.873	16.6102	Layer 3 - silty Sand (SC/SM)	50	39	363.94	494.689	549.145	0	549.145	657.711	657.711
13	0.844004	594.949	17.5812	Layer 3 - silty Sand (SC/SM)	50	39	384.371	522.46	583.439	0	583.439	705.23	705.23
14	0.844004	633.428	18.5574	Layer 3 - silty Sand (SC/SM)	50	39	403.425	548.359	615.422	0	615.422	750.856	750.856
15	0.844004	670.281	19.5392	Layer 3 - silty Sand (SC/SM)	50	39	421.111	572.399	645.109	0	645.109	794.556	794.556
16	0.807235	674.046	20.5054	Layer 1 - Mixed fine grained (SM/ML)	132	33	421.017	572.271	677.958	0	677.958	835.415	835.415
17	0.807235	704.77	21.456	Layer 1 - Mixed fine grained (SM/ML)	132	33	433.117	588.718	703.284	0	703.284	873.509	873.509
18	0.807235	733.991	22.4129	Layer 1 - Mixed fine grained (SM/ML)	132	33	444.222	603.813	726.529	0	726.529	909.742	909.742
19	0.807235	761.678	23.3765	Layer 1 - Mixed fine grained (SM/ML)	132	33	454.332	617.555	747.689	0	747.689	944.075	944.075
20	0.807235	787.799	24.3471	Layer 1 - Mixed fine grained (SM/ML)	132	33	463.442	629.938	766.758	0	766.758	976.468	976.468
21	0.807235	812.317	25.3252	Layer 1 - Mixed fine grained (SM/ML)	132	33	471.548	640.956	783.723	0	783.723	1006.88	1006.88
22	0.807235	835.195	26.3112	Layer 1 - Mixed fine grained (SM/ML)	132	33	478.643	650.6	798.575	0	798.575	1035.25	1035.25
23	0.807235	856.39	27.3058	Layer 1 - Mixed fine grained (SM/ML)	132	33	484.722	658.863	811.297	0	811.297	1061.54	1061.54
24	0.807235	874.906	28.3093	Layer 1 - Mixed fine grained (SM/ML)	132	33	489.327	665.123	820.937	0	820.937	1084.52	1084.52
25	0.807235	887.136	29.3224	Layer 1 - Mixed fine grained (SM/ML)	132	33	490.8	667.125	824.02	0	824.02	1099.7	1099.7
26	0.807235	896.956	30.3456	Layer 1 - Mixed fine grained (SM/ML)	132	33	491.005	667.403	824.447	0	824.447	1111.89	1111.89
27	0.807235	904.89	31.3797	Layer 1 - Mixed fine grained (SM/ML)	132	33	490.202	666.312	822.769	0	822.769	1121.75	1121.75
28	0.807235	910.877	32.4253	Layer 1 - Mixed fine grained (SM/ML)	132	33	488.382	663.838	818.958	0	818.958	1129.2	1129.2
29	0.807235	914.756	33.4832	Layer 1 - Mixed fine grained (SM/ML)	132	33	485.487	659.903	812.898	0	812.898	1134.03	1134.03
30	0.807235	914.442	34.5541	Layer 1 - Mixed fine grained (SM/ML)	132	33	480.607	653.27	802.686	0	802.686	1133.67	1133.67
31	0.807235	911.084	35.6391	Layer 1 - Mixed fine grained (SM/ML)	132	33	474.297	644.693	789.479	0	789.479	1129.53	1129.53
32	0.807235	905.468	36.7389	Layer 1 - Mixed fine grained (SM/ML)	132	33	466.932	634.682	774.062	0	774.062	1122.6	1122.6
33	0.807235	897.497	37.8548	Layer 1 - Mixed fine grained (SM/ML)	132	33	458.491	623.209	756.396	0	756.396	1112.74	1112.74
34	0.807235	887.062	38.9878	Layer 1 - Mixed fine grained (SM/ML)	132	33	448.955	610.246	736.435	0	736.435	1099.83	1099.83
				Layer 1 - Mixed									

				fine grained (SM/ML)									
36	0.807235	858.314	41.3107	Layer 1 - Mixed fine grained (SM/ML)	132	33	426.495	579.718	689.425	0	689.425	1064.25	1064.25
37	0.807235	839.722	42.5035	Layer 1 - Mixed fine grained (SM/ML)	132	33	413.518	562.079	662.263	0	662.263	1041.23	1041.23
38	0.807235	818.103	43.7195	Layer 1 - Mixed fine grained (SM/ML)	132	33	399.336	542.802	632.58	0	632.58	1014.45	1014.45
39	0.795778	782.207	44.9518	Layer 2 - Silty Sand (SM)	50	33	343.157	466.439	641.259	0	641.259	983.839	983.839
40	0.795778	754.796	46.2021	Layer 2 - Silty Sand (SM)	50	33	327.296	444.881	608.063	0	608.063	949.389	949.389
41	0.795778	723.879	47.4816	Layer 2 - Silty Sand (SM)	50	33	310.183	421.619	572.243	0	572.243	910.529	910.529
42	0.795778	689.194	48.793	Layer 2 - Silty Sand (SM)	50	33	291.777	396.601	533.718	0	533.718	866.93	866.93
43	0.870109	708.986	50.2045	Layer 1 - Mixed fine grained (SM/ML)	132	33	309.412	420.572	444.361	0	444.361	815.789	815.789
44	0.870109	656.838	51.7242	Layer 1 - Mixed fine grained (SM/ML)	132	33	285.411	387.948	394.125	0	394.125	755.832	755.832
45	0.870109	598.284	53.2968	Layer 1 - Mixed fine grained (SM/ML)	132	33	259.647	352.928	340.199	0	340.199	688.502	688.502
46	0.870109	532.594	54.9297	Layer 1 - Mixed fine grained (SM/ML)	132	33	232.045	315.41	282.427	0	282.427	612.959	612.959
47	0.870109	458.864	56.6321	Layer 1 - Mixed fine grained (SM/ML)	132	33	202.526	275.286	220.642	0	220.642	528.163	528.163
48	0.870109	375.958	58.4151	Layer 1 - Mixed fine grained (SM/ML)	132	33	171.008	232.444	154.67	0	154.67	432.804	432.804
49	0.870109	254.765	60.2938	Layer 1 - Mixed fine grained (SM/ML)	132	33	129.139	175.534	67.0364	0	67.0364	293.385	293.385
50	0.870109	87.2353	62.2879	Layer 1 - Mixed fine grained (SM/ML)	132	33	76.0346	103.351	-44.116	0	-44.116	100.634	100.634

Global Minimum Query (spencer) - Safety Factor: 1.42139

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.953495	24.8953	15.8625	Layer 3 - silty Sand (SC/SM)	50	39	55.774	79.2766	36.1536	0	36.1536	52.0019	52.0019
2	0.953495	74.0687	16.4606	Layer 3 - silty Sand (SC/SM)	50	39	84.3386	119.878	86.2922	0	86.2922	111.211	111.211
3	0.953495	122.002	17.0604	Layer 3 - silty Sand (SC/SM)	50	39	111.459	158.427	133.895	0	133.895	168.1	168.1
4	0.953495	168.683	17.6622	Layer 3 - silty Sand (SC/SM)	50	39	137.17	194.972	179.025	0	179.025	222.702	222.702
5	0.953495	214.101	18.266	Layer 3 - silty Sand (SC/SM)	50	39	161.504	229.56	221.738	0	221.738	275.044	275.044
6	0.953495	258.24	18.872	Layer 3 - silty Sand (SC/SM)	50	39	184.493	262.237	262.091	0	262.091	325.157	325.157
7	0.953495	302.261	19.4801	Layer 3 - silty Sand (SC/SM)	50	39	206.819	293.97	301.278	0	301.278	374.436	374.436
8	0.953495	347.62	20.0905	Layer 3 - silty Sand (SC/SM)	50	39	229.29	325.911	340.721	0	340.721	424.586	424.586
9	0.953495	391.758	20.7033	Layer 3 - silty	50	39	250.507	356.068	377.962	0	377.962	472.637	472.637

				Sand (SC/SM)									
10	0.953495	434.56	21.3186	Layer 3 - silty Sand (SC/SM)	50	39	270.442	384.403	412.952	0	412.952	518.494	518.494
11	0.953495	476.009	21.9365	Layer 3 - silty Sand (SC/SM)	50	39	289.121	410.953	445.74	0	445.74	562.179	562.179
12	0.953495	516.088	22.557	Layer 3 - silty Sand (SC/SM)	50	39	306.57	435.755	476.368	0	476.368	603.712	603.712
13	0.953495	554.778	23.1804	Layer 3 - silty Sand (SC/SM)	50	39	322.814	458.845	504.882	0	504.882	643.11	643.11
14	0.905215	561.218	23.7908	Layer 1 - Mixed fine grained (SM/ML)	132	33	335.204	476.456	530.416	0	530.416	678.195	678.195
15	0.905215	593.598	24.3881	Layer 1 - Mixed fine grained (SM/ML)	132	33	345.702	491.378	553.394	0	553.394	710.125	710.125
16	0.905215	624.74	24.9883	Layer 1 - Mixed fine grained (SM/ML)	132	33	355.415	505.184	574.653	0	574.653	740.297	740.297
17	0.905215	654.625	25.5914	Layer 1 - Mixed fine grained (SM/ML)	132	33	364.355	517.89	594.218	0	594.218	768.72	768.72
18	0.905215	683.234	26.1975	Layer 1 - Mixed fine grained (SM/ML)	132	33	372.531	529.512	612.115	0	612.115	795.403	795.403
19	0.905215	710.547	26.8069	Layer 1 - Mixed fine grained (SM/ML)	132	33	379.955	540.064	628.364	0	628.364	820.35	820.35
20	0.905215	736.545	27.4195	Layer 1 - Mixed fine grained (SM/ML)	132	33	386.637	549.562	642.989	0	642.989	843.57	843.57
21	0.905215	761.203	28.0355	Layer 1 - Mixed fine grained (SM/ML)	132	33	392.587	558.019	656.012	0	656.012	865.066	865.066
22	0.905215	784.501	28.6551	Layer 1 - Mixed fine grained (SM/ML)	132	33	397.813	565.448	667.452	0	667.452	884.843	884.843
23	0.905215	806.414	29.2784	Layer 1 - Mixed fine grained (SM/ML)	132	33	402.327	571.863	677.33	0	677.33	902.905	902.905
24	0.905215	823.558	29.9055	Layer 1 - Mixed fine grained (SM/ML)	132	33	404.862	575.467	682.879	0	682.879	915.736	915.736
25	0.905215	835.038	30.5365	Layer 1 - Mixed fine grained (SM/ML)	132	33	405.146	575.87	683.5	0	683.5	922.497	922.497
26	0.905215	845.039	31.1717	Layer 1 - Mixed fine grained (SM/ML)	132	33	404.8	575.379	682.743	0	682.743	927.626	927.626
27	0.905215	853.546	31.8112	Layer 1 - Mixed fine grained (SM/ML)	132	33	403.838	574.011	680.637	0	680.637	931.137	931.137
28	0.905215	860.451	32.4552	Layer 1 - Mixed fine grained (SM/ML)	132	33	402.237	571.736	677.134	0	677.134	932.945	932.945
29	0.905215	863.25	33.1038	Layer 1 - Mixed fine grained (SM/ML)	132	33	399.123	567.309	670.317	0	670.317	930.539	930.539
30	0.905215	863.221	33.7572	Layer 1 - Mixed fine grained (SM/ML)	132	33	394.996	561.443	661.285	0	661.285	925.284	925.284
31	0.905215	861.564	34.4156	Layer 1 - Mixed fine grained (SM/ML)	132	33	390.311	554.784	651.03	0	651.03	918.438	918.438
32	0.905215	858.239	35.0793	Layer 1 - Mixed fine grained (SM/ML)	132	33	385.072	547.338	639.564	0	639.564	909.99	909.99
				Layer 1 - Mixed									

				fine grained (SM/ML)									
34	0.905215	846.422	36.4231	Layer 1 - Mixed fine grained (SM/ML)	132	33	372.957	530.117	613.046	0	613.046	888.246	888.246
35	0.905215	837.842	37.1038	Layer 1 - Mixed fine grained (SM/ML)	132	33	366.09	520.356	598.016	0	598.016	874.926	874.926
36	1.03792	947.672	37.8415	Layer 2 - Silty Sand (SM)	50	33	304.076	432.211	588.553	0	588.553	824.772	824.772
37	1.03792	931.096	38.6376	Layer 2 - Silty Sand (SM)	50	33	295.255	419.672	569.245	0	569.245	805.261	805.261
38	1.03792	911.558	39.4426	Layer 2 - Silty Sand (SM)	50	33	285.748	406.16	548.439	0	548.439	783.512	783.512
39	1.03792	888.957	40.2571	Layer 2 - Silty Sand (SM)	50	33	275.563	391.683	526.146	0	526.146	759.486	759.486
40	0.943483	785.834	41.0435	Layer 1 - Mixed fine grained (SM/ML)	132	33	317.816	451.74	492.356	0	492.356	769.053	769.053
41	0.943483	762.066	41.8015	Layer 1 - Mixed fine grained (SM/ML)	132	33	307.053	436.442	468.8	0	468.8	743.351	743.351
42	0.943483	735.739	42.5685	Layer 1 - Mixed fine grained (SM/ML)	132	33	295.738	420.359	444.033	0	444.033	715.679	715.679
43	0.943483	706.759	43.3451	Layer 1 - Mixed fine grained (SM/ML)	132	33	283.873	403.494	418.064	0	418.064	685.995	685.995
44	0.943483	675.021	44.1318	Layer 1 - Mixed fine grained (SM/ML)	132	33	271.462	385.853	390.9	0	390.9	654.257	654.257
45	0.943483	633.324	44.9291	Layer 1 - Mixed fine grained (SM/ML)	132	33	256.55	364.658	358.262	0	358.262	614.178	614.178
46	0.943483	534.673	45.7377	Layer 1 - Mixed fine grained (SM/ML)	132	33	226.493	321.935	292.475	0	292.475	524.876	524.876
47	0.943483	421.693	46.5581	Layer 1 - Mixed fine grained (SM/ML)	132	33	193.413	274.915	220.07	0	220.07	424.299	424.299
48	0.943483	305.452	47.3911	Layer 1 - Mixed fine grained (SM/ML)	132	33	160.408	228.002	147.83	0	147.83	322.217	322.217
49	0.943483	185.792	48.2375	Layer 1 - Mixed fine grained (SM/ML)	132	33	127.483	181.203	75.7666	0	75.7666	218.537	218.537
50	0.943483	62.544	49.0982	Layer 1 - Mixed fine grained (SM/ML)	132	33	100.575	142.957	16.8721	0	16.8721	132.972	132.972

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.41852

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	58.2952	90.5186	0	0	0
2	59.2487	90.7896	37.3299	0	0
3	60.2022	91.0713	85.9512	0	0
4	61.1557	91.3639	144.51	0	0
5	62.1092	91.6675	211.695	0	0
6	63.0627	91.9822	286.232	0	0
7	64.0162	92.3082	366.889	0	0
8	64.9697	92.6454	452.685	0	0
9	65.9232	92.9942	542.887	0	0
10	66.8767	93.3545	636.314	0	0
11	67.8302	93.7266	731.805	0	0
12	68.7837	94.1107	828.238	0	0
13	69.7372	94.5067	924.531	0	0
14	70.6907	94.915	1019.64	0	0
15	71.5959	95.3141	1110.79	0	0
16	72.5011	95.7245	1196.57	0	0
17	73.4063	96.1464	1276.3	0	0
18	74.3115	96.5799	1349.36	0	0
19	75.2167	97.0253	1415.12	0	0
20	76.122	97.4827	1473.03	0	0
21	77.0272	97.9523	1522.54	0	0
22	77.9324	98.4343	1563.14	0	0
23	78.8376	98.929	1594.38	0	0
24	79.7428	99.4365	1615.84	0	0
25	80.648	99.9571	1627.42	0	0
26	81.5532	100.491	1629.32	0	0
27	82.4585	101.039	1621.38	0	0
28	83.3637	101.6	1603.54	0	0
29	84.2689	102.176	1575.75	0	0
30	85.1741	102.766	1538.42	0	0
31	86.0793	103.371	1491.88	0	0
32	86.9845	103.991	1436.33	0	0
33	87.8897	104.627	1372.05	0	0
34	88.795	105.279	1299.39	0	0
35	89.7002	105.947	1218.75	0	0
36	90.6054	106.631	1130.6	0	0
37	91.6433	107.438	950.16	0	0
38	92.6812	108.267	760.55	0	0
39	93.7192	109.121	562.84	0	0
40	94.7571	110	358.262	0	0
41	95.7006	110.821	235.987	0	0
42	96.6441	111.665	111.48	0	0
43	97.5875	112.532	-13.8529	0	0
44	98.531	113.422	-138.438	0	0
45	99.4745	114.337	-260.527	0	0
46	100.418	115.279	-375.538	0	0
47	101.361	116.247	-460.176	0	0
48	102.305	117.243	-505.485	0	0
49	103.248	118.269	-506.308	0	0
50	104.192	119.325	-457.085	0	0
51	105.135	120.414	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 1.35926

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	60.3249	92.0216	0	0	0
2	61.1689	92.1131	41.7699	0	0
3	62.0129	92.2184	106.158	0	0
4	62.8569	92.3378	190.535	0	0
5	63.7009	92.4714	292.384	0	0
6	64.5449	92.6192	409.373	0	0
7	65.3889	92.7813	539.996	0	0
8	66.2329	92.958	682.156	0	0
9	67.0769	93.1493	833.622	0	0
10	67.9209	93.3554	992.249	0	0
11	68.7649	93.5766	1155.98	0	0
12	69.6089	93.8129	1322.85	0	0
13	70.4529	94.0647	1490.96	0	0
14	71.2969	94.3321	1658.49	0	0
15	72.1409	94.6155	1823.73	0	0
16	72.9849	94.915	1984.99	0	0
17	73.7922	95.2169	2119.3	0	0
18	74.5994	95.5342	2244.89	0	0
19	75.4066	95.8671	2360.66	0	0
20	76.2139	96.216	2465.57	0	0
21	77.0211	96.5813	2558.63	0	0
22	77.8283	96.9633	2638.89	0	0
23	78.6356	97.3625	2705.51	0	0
24	79.4428	97.7792	2757.67	0	0
25	80.25	98.214	2794.69	0	0
26	81.0573	98.6675	2816.22	0	0
27	81.8645	99.14	2821.94	0	0
28	82.6717	99.6324	2811.53	0	0
29	83.479	100.145	2784.79	0	0
30	84.2862	100.679	2741.62	0	0
31	85.0934	101.235	2682.35	0	0
32	85.9007	101.814	2607.31	0	0
33	86.7079	102.416	2516.84	0	0
34	87.5152	103.044	2411.43	0	0
35	88.3224	103.697	2291.71	0	0
36	89.1296	104.378	2158.49	0	0
37	89.9369	105.087	2012.77	0	0
38	90.7441	105.827	1855.78	0	0
39	91.5513	106.599	1688.99	0	0
40	92.3471	107.393	1451.91	0	0
41	93.1429	108.223	1207.06	0	0
42	93.9387	109.091	956.621	0	0
43	94.7344	110	703.172	0	0
44	95.6045	111.045	507.557	0	0
45	96.4747	112.147	320.646	0	0
46	97.3448	113.314	148.898	0	0
47	98.2149	114.554	0.235621	0	0
48	99.085	115.875	-115.513	0	0
49	99.9551	117.29	-185.991	0	0
50	100.825	118.815	-176.154	0	0
51	101.695	120.472	0	0	0

Global Minimum Query (spencer) - Safety Factor: 1.42139

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	58.2952	90.5186	0	0	0
2	59.2487	90.7896	43.3919	25.1375	30.0843
3	60.2022	91.0713	99.5082	57.6464	30.0843
4	61.1557	91.3639	166.618	96.524	30.0843
5	62.1092	91.6675	243.073	140.815	30.0842
6	63.0627	91.9822	327.302	189.611	30.0844
7	64.0162	92.3082	417.815	242.046	30.0843
8	64.9697	92.6454	513.427	297.435	30.0843
9	65.9232	92.9942	613.256	355.267	30.0843
10	66.8767	93.3545	715.942	414.755	30.0843
11	67.8302	93.7266	820.177	475.139	30.0843
12	68.7837	94.1107	924.721	535.703	30.0843
13	69.7372	94.5067	1028.4	595.765	30.0843
14	70.6907	94.915	1130.11	654.686	30.0842
15	71.5959	95.3141	1221.9	707.865	30.0844
16	72.5011	95.7245	1307.77	757.607	30.0842
17	73.4063	96.1464	1387.1	803.566	30.0843
18	74.3115	96.5799	1459.35	845.419	30.0842
19	75.2167	97.0253	1523.99	882.869	30.0843
20	76.122	97.4827	1580.57	915.644	30.0843
21	77.0272	97.9523	1628.65	943.499	30.0843
22	77.9324	98.4343	1667.85	966.21	30.0843
23	78.8376	98.929	1697.84	983.581	30.0843
24	79.7428	99.4365	1718.31	995.44	30.0843
25	80.648	99.9571	1729.31	1001.81	30.0842
26	81.5532	100.491	1731.12	1002.86	30.0843
27	82.4585	101.039	1723.73	998.578	30.0842
28	83.3637	101.6	1707.16	988.977	30.0842
29	84.2689	102.176	1681.49	974.112	30.0843
30	85.1741	102.766	1647.22	954.257	30.0843
31	86.0793	103.371	1604.74	929.647	30.0843
32	86.9845	103.991	1554.35	900.455	30.0843
33	87.8897	104.627	1496.39	866.88	30.0843
34	88.795	105.279	1431.27	829.154	30.0843
35	89.7002	105.947	1359.44	787.541	30.0843
36	90.6054	106.631	1281.41	742.337	30.0843
37	91.6433	107.438	1122.51	650.283	30.0842
38	92.6812	108.267	956.708	554.233	30.0843
39	93.7192	109.121	785.045	454.787	30.0843
40	94.7571	110	608.673	352.612	30.0843
41	95.7006	110.821	504.137	292.053	30.0843
42	96.6441	111.665	398.387	230.791	30.0843
43	97.5875	112.532	292.639	169.529	30.0842
44	98.531	113.422	188.217	109.037	30.0844
45	99.4745	114.337	86.5737	50.1533	30.0843
46	100.418	115.279	-8.52275	-4.93734	30.0843
47	101.361	116.247	-77.9459	-45.1551	30.0843
48	102.305	117.243	-114.684	-66.438	30.0843
49	103.248	118.269	-114.953	-66.5939	30.0843
50	104.192	119.325	-74.7157	-43.2838	30.0843
51	105.135	120.414	0	0	0

List Of Coordinates

External Boundary

X	Y
0	60
121	60
193	60
220	64
220	68
219.991	86.515
220	92
220	96
220	98.32
220	107
220	110.388
220	117
210	118
130	120
100	120.5
84.088	110
79.797	107
64.232	94.915
58	90.3
0	89
0	70
0	64

Material Boundary

X	Y
64.232	94.915
126.567	94.915
192.857	98.32
220	98.32

Material Boundary

X	Y
79.797	107
130.157	105.282
193	107
220	107

Material Boundary

X	Y
0	70
220	68

Material Boundary

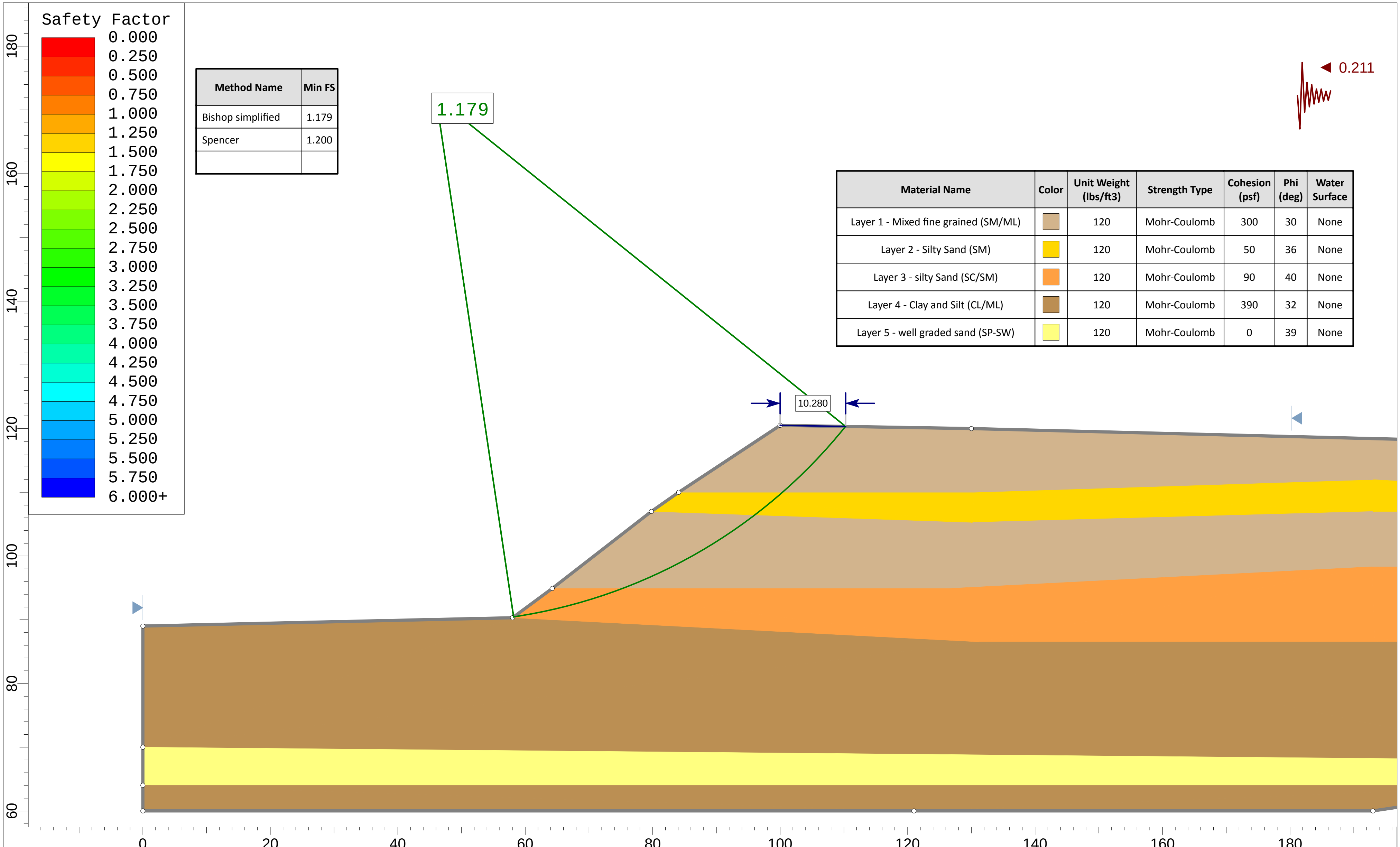
X	Y
0	64
220	64

Material Boundary

X	Y
84.088	110
130.425	110
193	112
220	110.388

Material Boundary

X	Y
58	90.3
131.217	86.515
193.311	86.515
219.991	86.515



Method Name	Min FS
Bishop simplified	1.179
Spencer	1.200

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Layer 1 - Mixed fine grained (SM/ML)		120	Mohr-Coulomb	300	30	None
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	36	None
Layer 3 - silty Sand (SC/SM)		120	Mohr-Coulomb	90	40	None
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	390	32	None
Layer 5 - well graded sand (SP-SW)		120	Mohr-Coulomb	0	39	None

Leighton

SLIDEINTERPRET 7.018

Project	Goleta Fire Station #10		
Analysis Description	Section B-B' Seismic Statbility Analysis		
Drawn By LD	*Scale* 1:250	*Company* Leighton	
Date 7/29/2016, 6:01:40 PM		*File Name* BB_SeismicCircle_screen_ 11389001_Rev2.slim	

Slide Analysis Information

Goleta Fire Station #10

Project Summary

File Name:	BB_SeismicCircle_screen_ 11389001_Rev2
Slide Modeler Version:	7.018
Project Title:	Goleta Fire Station #10
Analysis:	Section B-B' Seismic Statbility Analysis
Author:	LD
Company:	Leighton
Date Created:	7/29/2016, 6:01:40 PM
Comments	
	Peak strength, existing slope

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	No
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Slope Search
Number of Surfaces:	5000
Upper Angle:	Not Defined
Lower Angle:	Not Defined
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal): 0.211

Material Properties

Property	Layer 1 - Mixed fine grained (SM/ML)	Layer 2 - Silty Sand (SM)	Layer 3 - silty Sand (SC/SM)	Layer 4 - Clay and Silt (CL/ML)	Layer 5 - well graded sand (SP-SW)
Color					
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	120	120	120
Cohesion [psf]	300	50	90	390	0
Friction Angle [deg]	30	36	40	32	39
Water Surface	None	None	None	None	None
Ru Value	0	0	0	0	0
Unsat. Shear Strength Phi b [deg]	0	0	0	0	0
Unsat. Shear Strength Air Entry Value [psf]	0	0	0	0	0

Global Minimums

Method: bishop simplified

FS	1.178640
Center:	45.998, 172.007
Radius:	82.479
Left Slip Surface Endpoint:	58.179, 90.432
Right Slip Surface Endpoint:	110.280, 120.329
Resisting Moment:	3.14618e+006 lb-ft
Driving Moment:	2.66933e+006 lb-ft
Total Slice Area:	407.501 ft2
Surface Horizontal Width:	52.1012 ft
Surface Average Height:	7.82133 ft

Method: spencer

FS	1.200350
Center:	45.998, 172.007
Radius:	82.479
Left Slip Surface Endpoint:	58.179, 90.432
Right Slip Surface Endpoint:	110.280, 120.329
Resisting Moment:	3.20413e+006 lb-ft
Driving Moment:	2.66933e+006 lb-ft
Resisting Horizontal Force:	33439 lb
Driving Horizontal Force:	27857.8 lb
Total Slice Area:	407.501 ft2
Surface Horizontal Width:	52.1012 ft
Surface Average Height:	7.82133 ft

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	4309
Number of Invalid Surfaces:	691

Error Codes:

Error Code -103 reported for 20 surfaces
Error Code -105 reported for 3 surfaces
Error Code -106 reported for 40 surfaces
Error Code -108 reported for 1 surface
Error Code -112 reported for 4 surfaces
Error Code -114 reported for 623 surfaces

Method: spencer

Number of Valid Surfaces: 3812
Number of Invalid Surfaces: 1188

Error Codes:

Error Code -103 reported for 20 surfaces
Error Code -105 reported for 3 surfaces
Error Code -106 reported for 40 surfaces
Error Code -108 reported for 98 surfaces
Error Code -111 reported for 400 surfaces
Error Code -112 reported for 4 surfaces
Error Code -114 reported for 623 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-105 = More than two surface / slope intersections with no valid slip surface.
-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-111 = safety factor equation did not converge
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
-114 = Surface with Reverse Curvature.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.17864

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.07117	40.2388	8.86908	Layer 3 - silty Sand (SC/SM)	90	40	92.8065	109.385	23.1026	0	23.1026
2	1.07117	119.787	9.623	Layer 3 - silty Sand (SC/SM)	90	40	139.192	164.058	88.2587	0	88.2587
3	1.07117	197.468	10.3786	Layer 3 - silty Sand (SC/SM)	90	40	183.682	216.495	150.751	0	150.751
4	1.07117	273.271	11.1361	Layer 3 - silty	90	40	226.307	266.735	210.625	0	210.625

				Sand (SC/SM)							
5	1.07117	347.18	11.8955	Layer 3 - silty Sand (SC/SM)	90	40	267.099	314.813	267.923	0	267.923
6	1.07117	419.481	12.657	Layer 3 - silty Sand (SC/SM)	90	40	306.256	360.965	322.924	0	322.924
7	1.07117	493.45	13.4209	Layer 3 - silty Sand (SC/SM)	90	40	345.671	407.422	378.29	0	378.29
8	1.07117	566.523	14.1871	Layer 3 - silty Sand (SC/SM)	90	40	383.884	452.461	431.965	0	431.965
9	1.07117	637.633	14.956	Layer 3 - silty Sand (SC/SM)	90	40	420.316	495.401	483.139	0	483.139
10	1.07117	706.761	15.7276	Layer 3 - silty Sand (SC/SM)	90	40	454.99	536.269	531.842	0	531.842
11	1.07117	773.883	16.5022	Layer 3 - silty Sand (SC/SM)	90	40	487.924	575.087	578.105	0	578.105
12	1.07117	838.975	17.2799	Layer 3 - silty Sand (SC/SM)	90	40	519.14	611.879	621.951	0	621.951
13	1.07117	902.014	18.0609	Layer 3 - silty Sand (SC/SM)	90	40	548.653	646.664	663.406	0	663.406
14	1.07117	962.971	18.8453	Layer 3 - silty Sand (SC/SM)	90	40	576.478	679.46	702.491	0	702.491
15	1.07117	1021.82	19.6335	Layer 3 - silty Sand (SC/SM)	90	40	602.631	710.285	739.227	0	739.227
16	1.07117	1078.53	20.4255	Layer 3 - silty Sand (SC/SM)	90	40	627.124	739.153	773.63	0	773.63
17	1.0363	1095.35	21.2087	Layer 1 - Mixed fine grained (SM/ML)	300	30	649.072	765.022	805.442	0	805.442
18	1.0363	1144.39	21.9829	Layer 1 - Mixed fine grained (SM/ML)	300	30	664.286	782.954	836.501	0	836.501
19	1.0363	1191.4	22.7614	Layer 1 - Mixed fine grained (SM/ML)	300	30	678.439	799.635	865.393	0	865.393
20	1.0363	1236.34	23.5444	Layer 1 - Mixed fine grained (SM/ML)	300	30	691.528	815.063	892.117	0	892.117
21	1.0363	1276.9	24.3321	Layer 1 - Mixed fine grained (SM/ML)	300	30	702.669	828.194	914.86	0	914.86
22	1.0363	1308.17	25.1247	Layer 1 - Mixed fine grained (SM/ML)	300	30	710.001	836.835	929.826	0	929.826
23	1.0363	1336.73	25.9224	Layer 1 - Mixed fine grained (SM/ML)	300	30	716.109	844.035	942.298	0	942.298
24	1.0363	1363.06	26.7256	Layer 1 - Mixed fine grained (SM/ML)	300	30	721.192	850.026	952.669	0	952.669
25	1.0363	1386.4	27.5346	Layer 1 - Mixed fine grained (SM/ML)	300	30	724.969	854.478	960.383	0	960.383
26	1.0363	1403.62	28.3495	Layer 1 - Mixed fine grained (SM/ML)	300	30	726.296	856.042	963.092	0	963.092
27	1.0363	1417.92	29.1707	Layer 1 - Mixed fine grained (SM/ML)	300	30	726.402	856.167	963.306	0	963.306

28	1.0363	1429.79	29.9986	Layer 1 - Mixed fine grained (SM/ML)	300	30	725.484	855.084	961.436	0	961.436
29	1.0363	1439.17	30.8334	Layer 1 - Mixed fine grained (SM/ML)	300	30	723.532	852.784	957.448	0	957.448
30	1.0363	1445.99	31.6755	Layer 1 - Mixed fine grained (SM/ML)	300	30	720.54	849.257	951.343	0	951.343
31	1.0363	1450.18	32.5254	Layer 1 - Mixed fine grained (SM/ML)	300	30	716.496	844.491	943.085	0	943.085
32	1.0363	1451.67	33.3833	Layer 1 - Mixed fine grained (SM/ML)	300	30	711.39	838.473	932.661	0	932.661
33	1.0363	1450.38	34.2499	Layer 1 - Mixed fine grained (SM/ML)	300	30	705.212	831.191	920.053	0	920.053
34	1.0363	1446.21	35.1254	Layer 1 - Mixed fine grained (SM/ML)	300	30	697.947	822.628	905.22	0	905.22
35	1.0363	1439.09	36.0105	Layer 1 - Mixed fine grained (SM/ML)	300	30	689.583	812.77	888.141	0	888.141
36	1.0363	1428.91	36.9056	Layer 1 - Mixed fine grained (SM/ML)	300	30	680.104	801.598	868.796	0	868.796
37	1.08541	1482.24	37.8331	Layer 2 - Silty Sand (SM)	50	36	598.211	705.075	901.631	0	901.631
38	1.08541	1463.81	38.7941	Layer 2 - Silty Sand (SM)	50	36	584.497	688.912	879.384	0	879.384
39	1.08541	1441.45	39.7683	Layer 2 - Silty Sand (SM)	50	36	569.348	671.056	854.81	0	854.81
40	1.08541	1408.97	40.7565	Layer 2 - Silty Sand (SM)	50	36	550.514	648.858	824.255	0	824.255
41	0.989494	1192.65	41.7147	Layer 1 - Mixed fine grained (SM/ML)	300	30	588.37	693.476	681.52	0	681.52
42	0.989494	1084.23	42.6423	Layer 1 - Mixed fine grained (SM/ML)	300	30	545.514	642.965	594.032	0	594.032
43	0.989494	972.259	43.584	Layer 1 - Mixed fine grained (SM/ML)	300	30	502.077	591.768	505.357	0	505.357
44	0.989494	856.577	44.5407	Layer 1 - Mixed fine grained (SM/ML)	300	30	458.058	539.885	415.494	0	415.494
45	0.989494	736.999	45.5133	Layer 1 - Mixed fine grained (SM/ML)	300	30	413.458	487.318	324.445	0	324.445
46	0.989494	613.321	46.5031	Layer 1 - Mixed fine grained (SM/ML)	300	30	368.28	434.07	232.216	0	232.216
47	0.989494	485.315	47.5113	Layer 1 - Mixed fine grained (SM/ML)	300	30	322.528	380.145	138.815	0	138.815
48	0.989494	352.73	48.5392	Layer 1 - Mixed fine grained	300	30	276.21	325.552	44.2576	0	44.2576

				(SM/ML)							
49	0.989494	215.282	49.5885	Layer 1 - Mixed fine grained (SM/ML)	300	30	229.335	270.304	-51.4355	0	-51.4355
50	0.989494	72.6525	50.6608	Layer 1 - Mixed fine grained (SM/ML)	300	30	181.919	214.416	-148.235	0	-148.235

Global Minimum Query (spencer) - Safety Factor: 1.20035

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.07117	40.2388	8.86908	Layer 3 - silty Sand (SC/SM)	90	40	174.488	209.447	142.352	0	142.352
2	1.07117	119.787	9.623	Layer 3 - silty Sand (SC/SM)	90	40	237.068	284.565	231.874	0	231.874
3	1.07117	197.468	10.3786	Layer 3 - silty Sand (SC/SM)	90	40	294.098	353.021	313.456	0	313.456
4	1.07117	273.271	11.1361	Layer 3 - silty Sand (SC/SM)	90	40	345.979	415.296	387.672	0	387.672
5	1.07117	347.18	11.8955	Layer 3 - silty Sand (SC/SM)	90	40	393.078	471.831	455.049	0	455.049
6	1.07117	419.481	12.657	Layer 3 - silty Sand (SC/SM)	90	40	435.955	523.298	516.385	0	516.385
7	1.07117	493.45	13.4209	Layer 3 - silty Sand (SC/SM)	90	40	477.252	572.869	575.46	0	575.46
8	1.07117	566.523	14.1871	Layer 3 - silty Sand (SC/SM)	90	40	515.259	618.491	629.832	0	629.832
9	1.07117	637.633	14.956	Layer 3 - silty Sand (SC/SM)	90	40	549.48	659.568	678.784	0	678.784
10	1.07117	706.761	15.7276	Layer 3 - silty Sand (SC/SM)	90	40	580.166	696.402	722.681	0	722.681
11	1.07117	773.883	16.5022	Layer 3 - silty Sand (SC/SM)	90	40	607.548	729.27	761.853	0	761.853
12	1.07117	838.975	17.2799	Layer 3 - silty Sand (SC/SM)	90	40	631.841	758.43	796.604	0	796.604
13	1.07117	902.014	18.0609	Layer 3 - silty Sand (SC/SM)	90	40	653.24	784.117	827.216	0	827.216
14	1.07117	962.971	18.8453	Layer 3 - silty Sand (SC/SM)	90	40	671.928	806.549	853.95	0	853.95
15	1.07117	1021.82	19.6335	Layer 3 - silty Sand (SC/SM)	90	40	688.071	825.926	877.043	0	877.043
16	1.07117	1078.53	20.4255	Layer 3 - silty Sand (SC/SM)	90	40	701.823	842.433	896.716	0	896.716
17	1.0363	1095.35	21.2087	Layer 1 - Mixed fine grained (SM/ML)	300	30	682.613	819.374	899.583	0	899.583
18	1.0363	1144.39	21.9829	Layer 1 - Mixed fine grained (SM/ML)	300	30	688.357	826.269	911.523	0	911.523
19	1.0363	1191.4	22.7614	Layer 1 - Mixed fine grained (SM/ML)	300	30	693.04	831.89	921.264	0	921.264
20	1.0363	1236.34	23.5444	Layer 1 - Mixed fine grained (SM/ML)	300	30	696.699	836.283	928.873	0	928.873

21	1.0363	1276.9	24.3321	Layer 1 - Mixed fine grained (SM/ML)	300	30	698.662	838.639	932.946	0	932.946
22	1.0363	1308.17	25.1247	Layer 1 - Mixed fine grained (SM/ML)	300	30	697.519	837.267	930.577	0	930.577
23	1.0363	1336.73	25.9224	Layer 1 - Mixed fine grained (SM/ML)	300	30	695.412	834.738	926.19	0	926.19
24	1.0363	1363.06	26.7256	Layer 1 - Mixed fine grained (SM/ML)	300	30	692.529	831.277	920.202	0	920.202
25	1.0363	1386.4	27.5346	Layer 1 - Mixed fine grained (SM/ML)	300	30	688.681	826.658	912.2	0	912.2
26	1.0363	1403.62	28.3495	Layer 1 - Mixed fine grained (SM/ML)	300	30	683.042	819.89	900.478	0	900.478
27	1.0363	1417.92	29.1707	Layer 1 - Mixed fine grained (SM/ML)	300	30	676.589	812.144	887.06	0	887.06
28	1.0363	1429.79	29.9986	Layer 1 - Mixed fine grained (SM/ML)	300	30	669.492	803.625	872.309	0	872.309
29	1.0363	1439.17	30.8334	Layer 1 - Mixed fine grained (SM/ML)	300	30	661.768	794.353	856.245	0	856.245
30	1.0363	1445.99	31.6755	Layer 1 - Mixed fine grained (SM/ML)	300	30	653.427	784.341	838.901	0	838.901
31	1.0363	1450.18	32.5254	Layer 1 - Mixed fine grained (SM/ML)	300	30	644.482	773.604	820.31	0	820.31
32	1.0363	1451.67	33.3833	Layer 1 - Mixed fine grained (SM/ML)	300	30	634.945	762.156	800.477	0	800.477
33	1.0363	1450.38	34.2499	Layer 1 - Mixed fine grained (SM/ML)	300	30	624.824	750.008	779.437	0	779.437
34	1.0363	1446.21	35.1254	Layer 1 - Mixed fine grained (SM/ML)	300	30	614.132	737.173	757.206	0	757.206
35	1.0363	1439.09	36.0105	Layer 1 - Mixed fine grained (SM/ML)	300	30	602.874	723.66	733.8	0	733.8
36	1.0363	1428.91	36.9056	Layer 1 - Mixed fine grained (SM/ML)	300	30	591.061	709.48	709.24	0	709.24
37	1.08541	1482.24	37.8331	Layer 2 - Silty Sand (SM)	50	36	447.062	536.631	669.79	0	669.79
38	1.08541	1463.81	38.7941	Layer 2 - Silty Sand (SM)	50	36	431.353	517.775	643.837	0	643.837
39	1.08541	1441.45	39.7683	Layer 2 - Silty Sand (SM)	50	36	414.978	498.119	616.782	0	616.782
40	1.08541	1408.97	40.7565	Layer 2 - Silty Sand (SM)	50	36	396.442	475.869	586.158	0	586.158
41	0.989494	1192.65	41.7147	Layer 1 - Mixed fine grained	300	30	506.674	608.186	533.793	0	533.793

				(SM/ML)							
42	0.989494	1084.23	42.6423	Layer 1 - Mixed fine grained (SM/ML)	300	30	476.438	571.892	470.93	0	470.93
43	0.989494	972.259	43.584	Layer 1 - Mixed fine grained (SM/ML)	300	30	446.632	536.115	408.963	0	408.963
44	0.989494	856.577	44.5407	Layer 1 - Mixed fine grained (SM/ML)	300	30	417.299	500.905	347.977	0	347.977
45	0.989494	736.999	45.5133	Layer 1 - Mixed fine grained (SM/ML)	300	30	388.488	466.321	288.077	0	288.077
46	0.989494	613.321	46.5031	Layer 1 - Mixed fine grained (SM/ML)	300	30	360.262	432.44	229.394	0	229.394
47	0.989494	485.315	47.5113	Layer 1 - Mixed fine grained (SM/ML)	300	30	332.699	399.356	172.089	0	172.089
48	0.989494	352.73	48.5392	Layer 1 - Mixed fine grained (SM/ML)	300	30	305.896	367.182	116.362	0	116.362
49	0.989494	215.282	49.5885	Layer 1 - Mixed fine grained (SM/ML)	300	30	279.969	336.06	62.4581	0	62.4581
50	0.989494	72.6525	50.6608	Layer 1 - Mixed fine grained (SM/ML)	300	30	252.642	303.258	5.64367	0	5.64367

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.17864

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	58.1787	90.4323	0	0	0
2	59.2498	90.5995	86.9286	0	0
3	60.321	90.7811	194.527	0	0
4	61.3922	90.9773	319.782	0	0
5	62.4634	91.1881	459.805	0	0
6	63.5345	91.4138	611.827	0	0
7	64.6057	91.6543	773.256	0	0
8	65.6769	91.9099	942.232	0	0
9	66.748	92.1807	1116.39	0	0
10	67.8192	92.4668	1293.24	0	0
11	68.8904	92.7685	1470.41	0	0
12	69.9615	93.0858	1645.63	0	0
13	71.0327	93.4191	1816.71	0	0
14	72.1039	93.7684	1981.59	0	0
15	73.1751	94.134	2138.26	0	0
16	74.2462	94.5161	2284.84	0	0
17	75.3174	94.915	2419.54	0	0
18	76.3537	95.3171	2536.27	0	0
19	77.39	95.7355	2632.36	0	0
20	78.4263	96.1703	2706.84	0	0
21	79.4626	96.6218	2758.82	0	0
22	80.4989	97.0904	2787.9	0	0
23	81.5352	97.5764	2794.8	0	0
24	82.5715	98.0801	2779.24	0	0
25	83.6078	98.6019	2740.93	0	0
26	84.6441	99.1421	2679.84	0	0
27	85.6804	99.7013	2596.84	0	0
28	86.7167	100.28	2492.19	0	0
29	87.753	100.878	2366.13	0	0
30	88.7893	101.497	2219.01	0	0
31	89.8256	102.136	2051.32	0	0
32	90.8618	102.797	1863.62	0	0
33	91.8981	103.48	1656.67	0	0
34	92.9344	104.185	1431.31	0	0
35	93.9707	104.914	1188.57	0	0
36	95.007	105.668	929.642	0	0
37	96.0433	106.446	655.88	0	0
38	97.1287	107.289	231.559	0	0
39	98.2142	108.161	-210.995	0	0
40	99.2996	109.065	-670.141	0	0
41	100.385	110	-1141.75	0	0
42	101.374	110.882	-1413.12	0	0
43	102.364	111.793	-1644.13	0	0
44	103.353	112.735	-1829.05	0	0
45	104.343	113.709	-1961.73	0	0
46	105.332	114.716	-2035.5	0	0
47	106.322	115.759	-2043.14	0	0
48	107.311	116.839	-1976.78	0	0
49	108.301	117.959	-1827.82	0	0
50	109.29	119.121	-1586.84	0	0
51	110.28	120.329	0	0	0

Global Minimum Query (spencer) - Safety Factor: 1.20035

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	58.1787	90.4323	0	0	0
2	59.2498	90.5995	155.025	149.227	43.9083
3	60.321	90.7811	342.125	329.33	43.9083
4	61.3922	90.9773	554.672	533.928	43.9083
5	62.4634	91.1881	786.669	757.249	43.9083
6	63.5345	91.4138	1032.7	994.074	43.9082
7	64.6057	91.6543	1287.95	1239.79	43.9085
8	65.6769	91.9099	1549.07	1491.13	43.9082
9	66.748	92.1807	1812.09	1744.32	43.9083
10	67.8192	92.4668	2073.18	1995.65	43.9084
11	68.8904	92.7685	2328.85	2241.76	43.9084
12	69.9615	93.0858	2575.98	2479.65	43.9084
13	71.0327	93.4191	2811.78	2706.63	43.9084
14	72.1039	93.7684	3033.75	2920.29	43.9083
15	73.1751	94.134	3239.65	3118.5	43.9084
16	74.2462	94.5161	3427.53	3299.35	43.9084
17	75.3174	94.915	3595.65	3461.17	43.9083
18	76.3537	95.3171	3711.69	3572.88	43.9083
19	77.39	95.7355	3803.78	3661.52	43.9083
20	78.4263	96.1703	3871.57	3726.78	43.9083
21	79.4626	96.6218	3914.81	3768.41	43.9084
22	80.4989	97.0904	3933.78	3786.67	43.9084
23	81.5352	97.5764	3929.91	3782.94	43.9083
24	82.5715	98.0801	3903.54	3757.56	43.9084
25	83.6078	98.6019	3855	3710.83	43.9083
26	84.6441	99.1421	3784.86	3643.32	43.9084
27	85.6804	99.7013	3694.56	3556.39	43.9083
28	86.7167	100.28	3584.9	3450.83	43.9083
29	87.753	100.878	3456.63	3327.35	43.9083
30	88.7893	101.497	3310.57	3186.76	43.9083
31	89.8256	102.136	3147.66	3029.94	43.9083
32	90.8618	102.797	2968.89	2857.86	43.9083
33	91.8981	103.48	2775.37	2671.58	43.9084
34	92.9344	104.185	2568.28	2472.23	43.9083
35	93.9707	104.914	2348.91	2261.06	43.9083
36	95.007	105.668	2118.66	2039.43	43.9084
37	96.0433	106.446	1879.04	1808.77	43.9084
38	97.1287	107.289	1487.99	1432.34	43.9083
39	98.2142	108.161	1086.58	1045.94	43.9082
40	99.2996	109.065	676.674	651.367	43.9083
41	100.385	110	262.279	252.47	43.9083
42	101.374	110.882	42.22	40.641	43.9083
43	102.364	111.793	-143.234	-137.877	43.9083
44	103.353	112.735	-290.633	-279.763	43.9083
45	104.343	113.709	-396.411	-381.586	43.9083
46	105.332	114.716	-456.889	-439.802	43.9083
47	106.322	115.759	-468.272	-450.759	43.9083
48	107.311	116.839	-426.663	-410.707	43.9084
49	108.301	117.959	-328.077	-315.808	43.9084
50	109.29	119.121	-168.466	-162.166	43.9084
51	110.28	120.329	0	0	0

List Of Coordinates

External Boundary

X	Y
0	60
121	60
193	60
220	64
220	68
219.991	86.515
220	92
220	96
220	98.32
220	107
220	110.388
220	117
210	118
130	120
100	120.5
84.088	110
79.797	107
64.232	94.915
58	90.3
0	89
0	70
0	64

Material Boundary

X	Y
64.232	94.915
126.567	94.915
192.857	98.32
220	98.32

Material Boundary

X	Y
79.797	107
130.157	105.282
193	107
220	107

Material Boundary

X	Y
0	70
220	68

Material Boundary

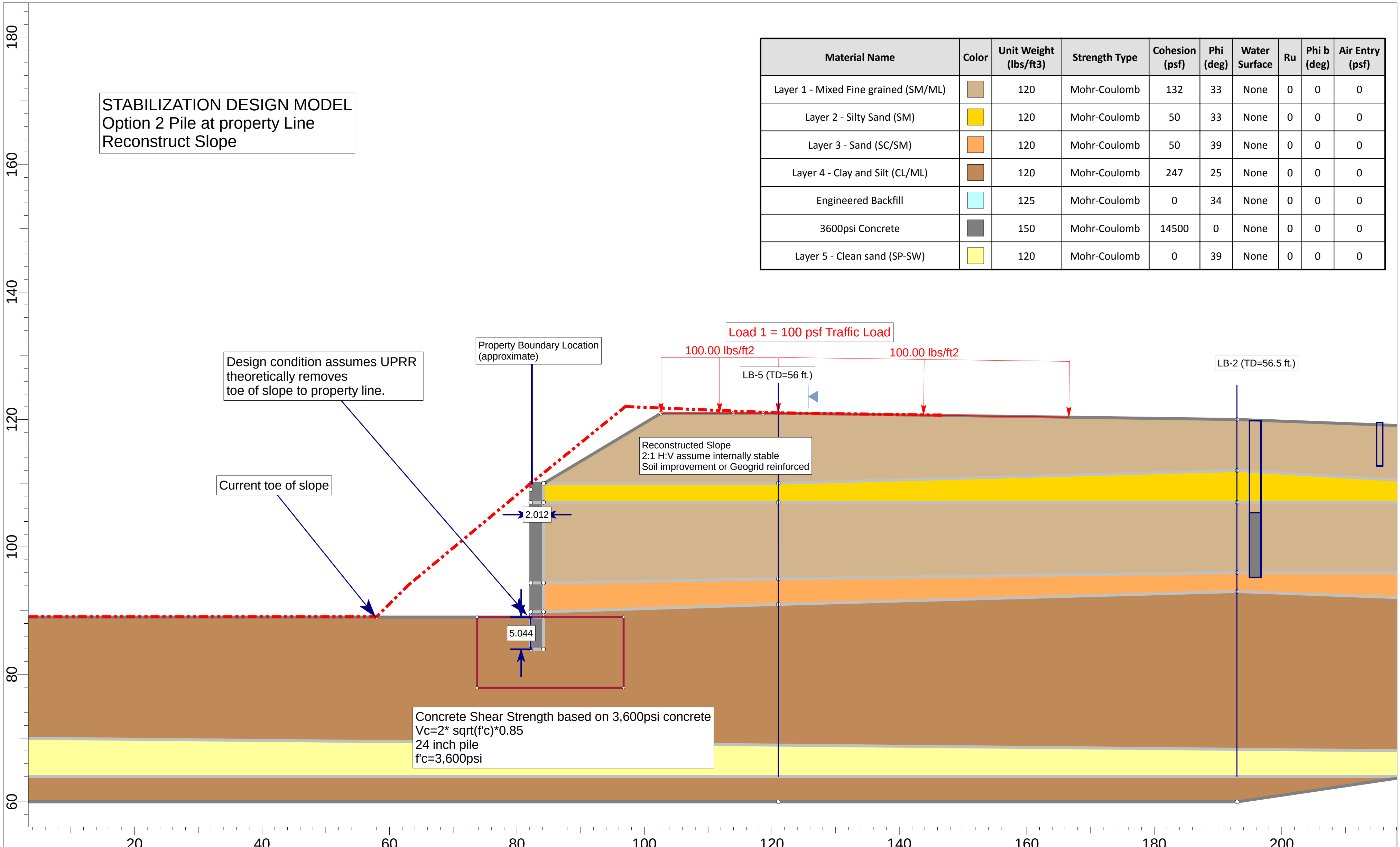
X	Y
0	64
220	64

Material Boundary

X	Y
84.088	110
130.425	110
193	112
220	110.388

Material Boundary

X	Y
58	90.3
131.217	86.515
193.311	86.515
219.991	86.515

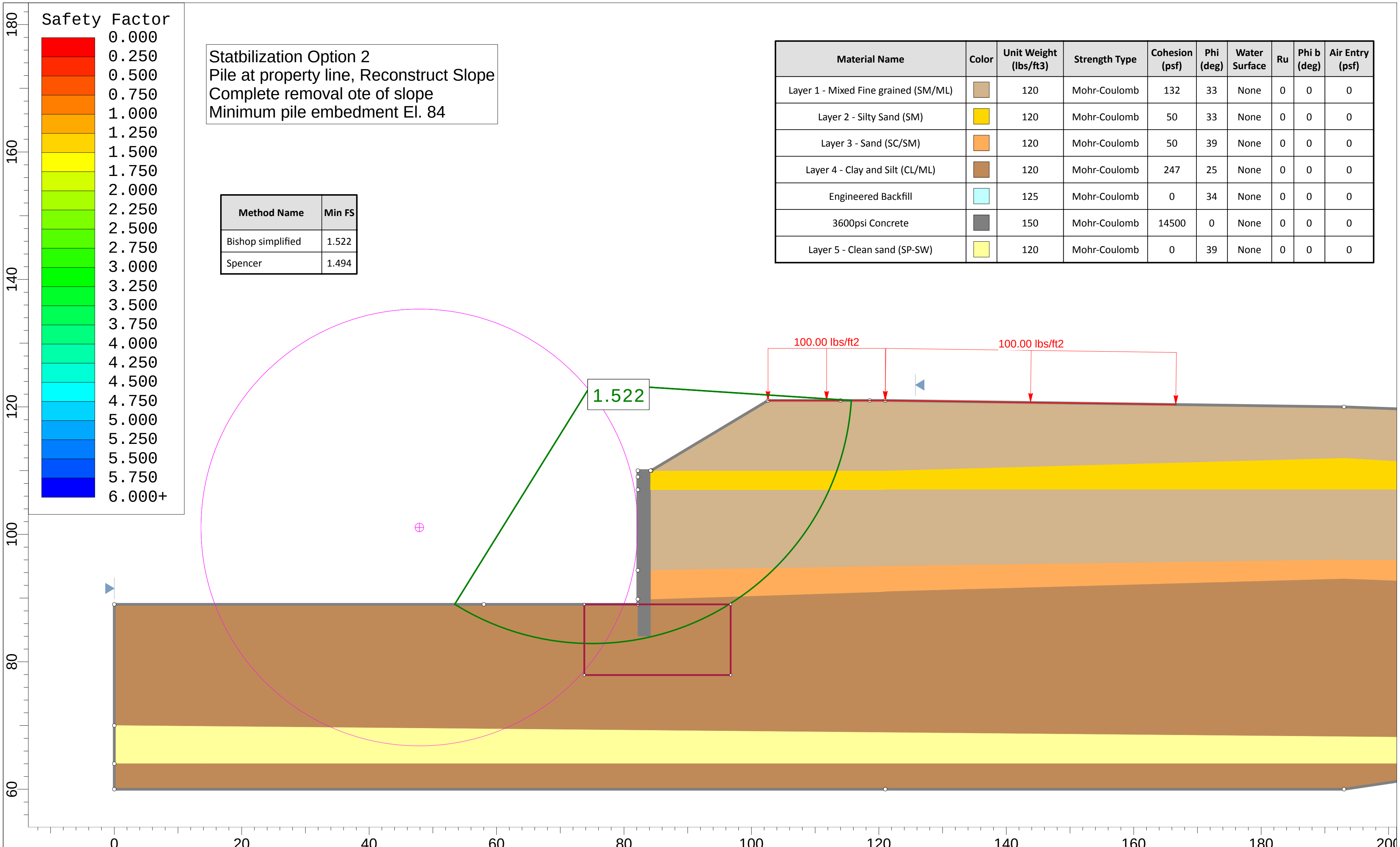


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Phi b (deg)	Air Entry (psf)
Layer 1 - Mixed Fine grained (SM/ML)		120	Mohr-Coulomb	132	33	None	0	0	0
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	33	None	0	0	0
Layer 3 - Sand (SC/SM)		120	Mohr-Coulomb	50	39	None	0	0	0
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	247	25	None	0	0	0
Engineered Backfill		125	Mohr-Coulomb	0	34	None	0	0	0
3600psi Concrete		150	Mohr-Coulomb	14500	0	None	0	0	0
Layer 5 - Clean sand (SP-SW)		120	Mohr-Coulomb	0	39	None	0	0	0

Project	Goleta Fire Station #10		
Analysis Description	A-A' Static Analysis - Circular failure, Stabilized condition		
Drawn By LD	*Scale* 1:250	*Company*	Leighton
Date 7/29/2016, 6:01:40 PM		*File Name*	5_AA_11389001_Option 2 Embedment_Static.slim

Leighton

SLIDE 7.018



Method Name	Min FS
Bishop simplified	1.522
Spencer	1.494

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Phi b (deg)	Air Entry (psf)
Layer 1 - Mixed Fine grained (SM/ML)		120	Mohr-Coulomb	132	33	None	0	0	0
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	33	None	0	0	0
Layer 3 - Sand (SC/SM)		120	Mohr-Coulomb	50	39	None	0	0	0
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	247	25	None	0	0	0
Engineered Backfill		125	Mohr-Coulomb	0	34	None	0	0	0
3600psi Concrete		150	Mohr-Coulomb	14500	0	None	0	0	0
Layer 5 - Clean sand (SP-SW)		120	Mohr-Coulomb	0	39	None	0	0	0

Project	Goleta Fire Station #10		
Analysis Description	A-A' Static Analysis - Circular failure, Stabilized condition		
Drawn By LD	*Scale* 1:250	*Company*	Leighton
Date 7/29/2016, 6:01:40 PM		*File Name*	5_AA_11389001_Option 2 Embedment_Static.slim

Leighton

SLIDEINTERPRET 7.018

Slide Analysis Information

Goleta Fire Station #10

Project Summary

File Name:	5_AA_11389001_Option 2 Embedment_Static
Slide Modeler Version:	7.018
Project Title:	Goleta Fire Station #10
Analysis:	A-A' Static Analysis - Circular failure, Stabilized condition
Author:	LD
Company:	Leighton
Date Created:	7/29/2016, 6:01:40 PM
Comments	
	Final condition - Option 2
	Backfill/traffic loads under static condition

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	No
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Slope Search
Number of Surfaces:	10000
Upper Angle:	Not Defined
Lower Angle:	Not Defined
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	100
Orientation:	Normal to boundary

Material Properties

Property	Layer 1 - Mixed Fine grained (SM/ML)	Layer 2 - Silty Sand (SM)	Layer 3 - Sand (SC/SM)	Layer 4 - Clay and Silt (CL/ML)	3600psi Concrete	Layer 5 - Clean sand (SP-SW)
Color						
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	120	120	150	120
Cohesion [psf]	132	50	50	247	14500	0
Friction Angle [deg]	33	33	39	25	0	39
Water Surface	None	None	None	None	None	None
Ru Value	0	0	0	0	0	0
Unsat. Shear Strength Phi b [deg]	0	0	0	0	0	0
Unsat. Shear Strength Air Entry Value [psf]	0	0	0	0	0	0

Global Minimums

Method: bishop simplified

FS	1.522240
Center:	74.956, 123.678
Radius:	40.820
Left Slip Surface Endpoint:	53.422, 89.000
Right Slip Surface Endpoint:	115.688, 121.000
Resisting Moment:	3.21011e+006 lb-ft
Driving Moment:	2.1088e+006 lb-ft
Total Slice Area:	933.147 ft2
Surface Horizontal Width:	62.2659 ft
Surface Average Height:	14.9865 ft

Method: spencer

FS	1.494140
Center:	74.956, 123.678
Radius:	40.820
Left Slip Surface Endpoint:	53.422, 89.000
Right Slip Surface Endpoint:	115.688, 121.000
Resisting Moment:	3.15084e+006 lb-ft
Driving Moment:	2.1088e+006 lb-ft
Resisting Horizontal Force:	63181.9 lb
Driving Horizontal Force:	42286.5 lb
Total Slice Area:	933.147 ft2
Surface Horizontal Width:	62.2659 ft
Surface Average Height:	14.9865 ft

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	2406
Number of Invalid Surfaces:	7594

Error Codes:

Error Code -103 reported for 222 surfaces
Error Code -105 reported for 1 surface
Error Code -112 reported for 31 surfaces
Error Code -114 reported for 7026 surfaces
Error Code -118 reported for 314 surfaces

Method: spencer

Number of Valid Surfaces: 2310
Number of Invalid Surfaces: 7690

Error Codes:

Error Code -103 reported for 222 surfaces
Error Code -105 reported for 1 surface
Error Code -108 reported for 19 surfaces
Error Code -111 reported for 77 surfaces
Error Code -112 reported for 31 surfaces
Error Code -114 reported for 7026 surfaces
Error Code -118 reported for 314 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-105 = More than two surface / slope intersections with no valid slip surface.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-111 = safety factor equation did not converge
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
-114 = Surface with Reverse Curvature.
-118 = Surface does not pass through the search focus

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.52224

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.24999	55.9254	-30.818	Layer 4 - Clay and Silt (CL/ML)	247	25	215.267	327.688	173.037	0	173.037
2	1.24999	163.38	-28.7953	Layer 4 - Clay and Silt (CL/ML)	247	25	243.211	370.226	264.26	0	264.26
3	1.24999	262.288	-26.8112	Layer 4 - Clay and Silt (CL/ML)	247	25	267.988	407.942	345.141	0	345.141
4	1.24999	353.107	-24.8613	Layer 4 - Clay and Silt (CL/ML)	247	25	289.906	441.307	416.693	0	416.693

5	1.24999	436.228	-22.9418	Layer 4 - Clay and Silt (CL/ML)	247	25	309.222	470.71	479.748	0	479.748
6	1.24999	511.989	-21.0491	Layer 4 - Clay and Silt (CL/ML)	247	25	326.145	496.471	534.992	0	534.992
7	1.24999	580.678	-19.1802	Layer 4 - Clay and Silt (CL/ML)	247	25	340.851	518.857	582.998	0	582.998
8	1.24999	642.546	-17.3323	Layer 4 - Clay and Silt (CL/ML)	247	25	353.489	538.095	624.255	0	624.255
9	1.24999	697.808	-15.5028	Layer 4 - Clay and Silt (CL/ML)	247	25	364.185	554.377	659.171	0	659.171
10	1.24999	746.647	-13.6895	Layer 4 - Clay and Silt (CL/ML)	247	25	373.047	567.867	688.102	0	688.102
11	1.24999	789.221	-11.89	Layer 4 - Clay and Silt (CL/ML)	247	25	380.169	578.708	711.35	0	711.35
12	1.24999	825.663	-10.1023	Layer 4 - Clay and Silt (CL/ML)	247	25	385.63	587.021	729.177	0	729.177
13	1.24999	856.084	-8.32456	Layer 4 - Clay and Silt (CL/ML)	247	25	389.5	592.912	741.81	0	741.81
14	1.24999	880.574	-6.55485	Layer 4 - Clay and Silt (CL/ML)	247	25	391.838	596.472	749.445	0	749.445
15	1.24999	899.204	-4.7914	Layer 4 - Clay and Silt (CL/ML)	247	25	392.698	597.781	752.253	0	752.253
16	1.24999	912.029	-3.0325	Layer 4 - Clay and Silt (CL/ML)	247	25	392.125	596.908	750.381	0	750.381
17	1.24999	919.084	-1.27645	Layer 4 - Clay and Silt (CL/ML)	247	25	390.157	593.913	743.956	0	743.956
18	1.24999	920.39	0.478393	Layer 4 - Clay and Silt (CL/ML)	247	25	386.828	588.845	733.089	0	733.089
19	1.24999	915.951	2.23369	Layer 4 - Clay and Silt (CL/ML)	247	25	382.166	581.749	717.873	0	717.873
20	1.24999	905.753	3.99108	Layer 4 - Clay and Silt (CL/ML)	247	25	376.197	572.662	698.384	0	698.384
21	1.24999	889.768	5.75226	Layer 4 - Clay and Silt (CL/ML)	247	25	368.939	561.613	674.689	0	674.689
22	1.24999	867.951	7.5189	Layer 4 - Clay and Silt (CL/ML)	247	25	360.407	548.626	646.84	0	646.84
23	1.24999	876.803	9.29278	Layer 4 - Clay and Silt (CL/ML)	247	25	359.15	546.712	642.736	0	642.736
24	1.24999	4933.17	11.0757	Layer 4 - Clay and Silt (CL/ML)	247	25	1293.71	1969.33	3693.55	0	3693.55
25	1.24999	4500.79	12.8695	Layer 4 - Clay and Silt (CL/ML)	247	25	1182.56	1800.14	3330.72	0	3330.72
26	1.24999	3963.53	14.6763	Layer 4 - Clay and Silt (CL/ML)	247	25	1049.47	1597.54	2896.24	0	2896.24
27	1.24999	4023.72	16.4982	Layer 4 - Clay and Silt (CL/ML)	247	25	1052.9	1602.76	2907.44	0	2907.44
28	1.24999	4077.39	18.3374	Layer 4 - Clay and Silt (CL/ML)	247	25	1054.52	1605.24	2912.75	0	2912.75
29	1.24999	4124.35	20.1964	Layer 4 - Clay and Silt (CL/ML)	247	25	1054.3	1604.9	2912.02	0	2912.02
30	1.24999	4164.35	22.0779	Layer 4 - Clay and Silt (CL/ML)	247	25	1052.19	1601.68	2905.12	0	2905.12
31	1.24999	4197.12	23.9849	Layer 4 - Clay and Silt (CL/ML)	247	25	1048.11	1595.48	2891.84	0	2891.84
32	1.24999	4222.36	25.9205	Layer 4 - Clay and Silt (CL/ML)	247	25	1042.02	1586.21	2871.94	0	2871.94
33	1.24999	4239.69	27.8885	Layer 4 - Clay and	247	25	1033.82	1573.72	2845.17	0	2845.17

				Silt (CL/ML)							
34	1.24999	4248.7	29.8931	Layer 4 - Clay and Silt (CL/ML)	247	25	1023.42	1557.89	2811.2	0	2811.2
35	1.24999	4248.87	31.9388	Layer 4 - Clay and Silt (CL/ML)	247	25	1010.69	1538.51	2769.66	0	2769.66
36	1.24999	4239.63	34.0313	Layer 4 - Clay and Silt (CL/ML)	247	25	995.507	1515.4	2720.09	0	2720.09
37	1.32082	4458.48	36.2393	Layer 3 - Sand (SC/SM)	50	39	1315.93	2003.16	2411.96	0	2411.96
38	1.32082	4423.9	38.5744	Layer 3 - Sand (SC/SM)	50	39	1274.41	1939.96	2333.91	0	2333.91
39	1.32082	4375.09	40.9883	Layer 3 - Sand (SC/SM)	50	39	1227.89	1869.15	2246.46	0	2246.46
40	1.32082	4266.3	43.4943	Layer 3 - Sand (SC/SM)	50	39	1193.77	1817.21	2182.32	0	2182.32
41	1.21549	3744.41	46.0003	Layer 1 - Mixed Fine grained (SM/ML)	132	33	1001.55	1524.6	2144.41	0	2144.41
42	1.21549	3552.36	48.5164	Layer 1 - Mixed Fine grained (SM/ML)	132	33	928.586	1413.53	1973.39	0	1973.39
43	1.21549	3342	51.1647	Layer 1 - Mixed Fine grained (SM/ML)	132	33	851.528	1296.23	1792.76	0	1792.76
44	1.21549	3109.98	53.9758	Layer 1 - Mixed Fine grained (SM/ML)	132	33	769.76	1171.76	1601.09	0	1601.09
45	1.21549	2851.62	56.9926	Layer 1 - Mixed Fine grained (SM/ML)	132	33	682.463	1038.87	1396.46	0	1396.46
46	1.21549	2559.88	60.2796	Layer 1 - Mixed Fine grained (SM/ML)	132	33	588.479	895.806	1176.16	0	1176.16
47	1.21549	2223.31	63.9429	Layer 1 - Mixed Fine grained (SM/ML)	132	33	486.048	739.881	936.055	0	936.055
48	1.2027	1804.05	68.1542	Layer 2 - Silty Sand (SM)	50	33	346.766	527.861	735.843	0	735.843
49	1.13588	1243.3	73.1789	Layer 1 - Mixed Fine grained (SM/ML)	132	33	247.46	376.694	376.795	0	376.795
50	1.13588	493.616	81.0869	Layer 1 - Mixed Fine grained (SM/ML)	132	33	84.6679	128.885	-4.79697	0	-4.79697

Global Minimum Query (spencer) - Safety Factor: 1.49414

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.24999	55.9254	-30.818	Layer 4 - Clay and Silt (CL/ML)	247	25	285.693	426.865	385.722	0	385.722
2	1.24999	163.38	-28.7953	Layer 4 - Clay and Silt (CL/ML)	247	25	324.865	485.394	511.237	0	511.237
3	1.24999	262.288	-26.8112	Layer 4 - Clay and Silt (CL/ML)	247	25	357.198	533.704	614.838	0	614.838
4	1.24999	353.107	-24.8613	Layer 4 - Clay	247	25	383.858	573.538	700.264	0	700.264

				and Silt (CL/ML)								
5	1.24999	436.228	-22.9418	Layer 4 - Clay and Silt (CL/ML)	247	25	405.735	606.225	770.357	0	770.357
6	1.24999	511.989	-21.0491	Layer 4 - Clay and Silt (CL/ML)	247	25	423.516	632.792	827.333	0	827.333
7	1.24999	580.678	-19.1802	Layer 4 - Clay and Silt (CL/ML)	247	25	437.743	654.049	872.918	0	872.918
8	1.24999	642.546	-17.3323	Layer 4 - Clay and Silt (CL/ML)	247	25	448.851	670.646	908.51	0	908.51
9	1.24999	697.808	-15.5028	Layer 4 - Clay and Silt (CL/ML)	247	25	457.19	683.106	935.231	0	935.231
10	1.24999	746.647	-13.6895	Layer 4 - Clay and Silt (CL/ML)	247	25	463.05	691.862	954.008	0	954.008
11	1.24999	789.221	-11.89	Layer 4 - Clay and Silt (CL/ML)	247	25	466.67	697.271	965.61	0	965.61
12	1.24999	825.663	-10.1023	Layer 4 - Clay and Silt (CL/ML)	247	25	468.249	699.63	970.671	0	970.671
13	1.24999	856.084	-8.32456	Layer 4 - Clay and Silt (CL/ML)	247	25	467.958	699.195	969.735	0	969.735
14	1.24999	880.574	-6.55485	Layer 4 - Clay and Silt (CL/ML)	247	25	465.939	696.178	963.267	0	963.267
15	1.24999	899.204	-4.7914	Layer 4 - Clay and Silt (CL/ML)	247	25	462.316	690.765	951.66	0	951.66
16	1.24999	912.029	-3.0325	Layer 4 - Clay and Silt (CL/ML)	247	25	457.195	683.114	935.254	0	935.254
17	1.24999	919.084	-1.27645	Layer 4 - Clay and Silt (CL/ML)	247	25	450.671	673.365	914.338	0	914.338
18	1.24999	920.39	0.478393	Layer 4 - Clay and Silt (CL/ML)	247	25	442.821	661.636	889.19	0	889.19
19	1.24999	915.951	2.23369	Layer 4 - Clay and Silt (CL/ML)	247	25	433.717	648.034	860.023	0	860.023
20	1.24999	905.753	3.99108	Layer 4 - Clay and Silt (CL/ML)	247	25	423.423	632.653	827.034	0	827.034
21	1.24999	889.768	5.75226	Layer 4 - Clay and Silt (CL/ML)	247	25	411.993	615.575	790.411	0	790.411
22	1.24999	867.951	7.5189	Layer 4 - Clay and Silt (CL/ML)	247	25	399.476	596.873	750.304	0	750.304
23	1.24999	876.803	9.29278	Layer 4 - Clay and Silt (CL/ML)	247	25	395.073	590.294	736.197	0	736.197
24	1.24999	4933.17	11.0757	Layer 4 - Clay and Silt (CL/ML)	247	25	1382.84	2066.15	3901.17	0	3901.17
25	1.24999	4500.79	12.8695	Layer 4 - Clay and Silt (CL/ML)	247	25	1251.7	1870.21	3480.99	0	3480.99
26	1.24999	3963.53	14.6763	Layer 4 - Clay and Silt (CL/ML)	247	25	1100.87	1644.86	2997.72	0	2997.72
27	1.24999	4023.72	16.4982	Layer 4 - Clay and Silt (CL/ML)	247	25	1093.16	1633.33	2972.99	0	2972.99
28	1.24999	4077.39	18.3374	Layer 4 - Clay and Silt (CL/ML)	247	25	1083.68	1619.17	2942.63	0	2942.63
29	1.24999	4124.35	20.1964	Layer 4 - Clay and Silt (CL/ML)	247	25	1072.44	1602.38	2906.62	0	2906.62
30	1.24999	4164.35	22.0779	Layer 4 - Clay and Silt (CL/ML)	247	25	1059.43	1582.94	2864.92	0	2864.92
31	1.24999	4197.12	23.9849	Layer 4 - Clay and Silt (CL/ML)	247	25	1044.62	1560.81	2817.47	0	2817.47
32	1.24999	4222.36	25.9205	Layer 4 - Clay and Silt (CL/ML)	247	25	1027.98	1535.94	2764.15	0	2764.15

33	1.24999	4239.69	27.8885	Layer 4 - Clay and Silt (CL/ML)	247	25	1009.47	1508.29	2704.85	0	2704.85
34	1.24999	4248.7	29.8931	Layer 4 - Clay and Silt (CL/ML)	247	25	989.051	1477.78	2639.41	0	2639.41
35	1.24999	4248.87	31.9388	Layer 4 - Clay and Silt (CL/ML)	247	25	966.643	1444.3	2567.62	0	2567.62
36	1.24999	4239.63	34.0313	Layer 4 - Clay and Silt (CL/ML)	247	25	942.181	1407.75	2489.24	0	2489.24
37	1.32082	4458.48	36.2393	Layer 3 - Sand (SC/SM)	50	39	1276.77	1907.67	2294.03	0	2294.03
38	1.32082	4423.9	38.5744	Layer 3 - Sand (SC/SM)	50	39	1219.01	1821.37	2187.46	0	2187.46
39	1.32082	4375.09	40.9883	Layer 3 - Sand (SC/SM)	50	39	1157.48	1729.43	2073.92	0	2073.92
40	1.32082	4266.3	43.4943	Layer 3 - Sand (SC/SM)	50	39	1108.37	1656.06	1983.32	0	1983.32
41	1.21549	3744.41	46.0003	Layer 1 - Mixed Fine grained (SM/ML)	132	33	902.961	1349.15	1874.25	0	1874.25
42	1.21549	3552.36	48.5164	Layer 1 - Mixed Fine grained (SM/ML)	132	33	826.502	1234.91	1698.33	0	1698.33
43	1.21549	3342	51.1647	Layer 1 - Mixed Fine grained (SM/ML)	132	33	748.083	1117.74	1517.91	0	1517.91
44	1.21549	3109.98	53.9758	Layer 1 - Mixed Fine grained (SM/ML)	132	33	667.395	997.182	1332.26	0	1332.26
45	1.21549	2851.62	56.9926	Layer 1 - Mixed Fine grained (SM/ML)	132	33	584.031	872.624	1140.46	0	1140.46
46	1.21549	2559.88	60.2796	Layer 1 - Mixed Fine grained (SM/ML)	132	33	497.409	743.198	941.161	0	941.161
47	1.21549	2223.31	63.9429	Layer 1 - Mixed Fine grained (SM/ML)	132	33	406.631	607.563	732.302	0	732.302
48	1.2027	1804.05	68.1542	Layer 2 - Silty Sand (SM)	50	33	275.418	411.513	556.681	0	556.681
49	1.13588	1243.3	73.1789	Layer 1 - Mixed Fine grained (SM/ML)	132	33	209.567	313.123	278.904	0	278.904
50	1.13588	493.616	81.0869	Layer 1 - Mixed Fine grained (SM/ML)	132	33	88.1737	131.744	-0.394338	0	-0.394338

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.52224

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	53.4222	89	0	0	0
2	54.6722	88.2543	397.859	0	0
3	55.9222	87.5673	883.147	0	0
4	57.1722	86.9355	1435.85	0	0
5	58.4222	86.3563	2039.24	0	0
6	59.6722	85.8272	2679.23	0	0
7	60.9222	85.3462	3343.89	0	0
8	62.1722	84.9114	4023.04	0	0
9	63.4222	84.5213	4708.01	0	0
10	64.6722	84.1746	5391.36	0	0
11	65.9222	83.8701	6066.73	0	0
12	67.1722	83.6069	6728.71	0	0
13	68.4222	83.3842	7372.69	0	0
14	69.6721	83.2013	7994.78	0	0
15	70.9221	83.0577	8591.76	0	0
16	72.1721	82.9529	9160.99	0	0
17	73.4221	82.8867	9700.37	0	0
18	74.6721	82.8588	10208.3	0	0
19	75.9221	82.8692	10683.8	0	0
20	77.1721	82.918	11126	0	0
21	78.4221	83.0052	11534.9	0	0
22	79.6721	83.1311	11910.7	0	0
23	80.9221	83.2961	12254.1	0	0
24	82.1721	83.5007	12571.1	0	0
25	83.4221	83.7453	13282.9	0	0
26	84.6721	84.0309	13808.5	0	0
27	85.9221	84.3583	14171	0	0
28	87.172	84.7285	14409.4	0	0
29	88.422	85.1428	14519.6	0	0
30	89.672	85.6026	14497.2	0	0
31	90.922	86.1097	14338.3	0	0
32	92.172	86.6658	14038.9	0	0
33	93.422	87.2733	13595.5	0	0
34	94.672	87.9348	13004.4	0	0
35	95.922	88.6534	12262.4	0	0
36	97.172	89.4326	11366.4	0	0
37	98.422	90.2768	10313.5	0	0
38	99.7428	91.2448	9714.99	0	0
39	101.064	92.2983	8938.07	0	0
40	102.384	93.446	7980.11	0	0
41	103.705	94.6991	6820.59	0	0
42	104.921	95.9578	5337.67	0	0
43	106.136	97.3325	3752.58	0	0
44	107.352	98.8423	2079.82	0	0
45	108.567	100.514	338.377	0	0
46	109.783	102.385	-1445.87	0	0
47	110.998	104.514	-3235.55	0	0
48	112.214	107	-4972.19	0	0
49	113.416	110	-6763.05	0	0
50	114.552	113.757	-7897.94	0	0
51	115.688	121	0	0	0

Global Minimum Query (spencer) - Safety Factor: 1.49414

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	53.4222	89	0	0	0
2	54.6722	88.2543	644.316	231.049	19.7276
3	55.9222	87.5673	1401.16	502.451	19.7277
4	57.1722	86.9355	2235.54	801.654	19.7276
5	58.4222	86.3563	3120.38	1118.96	19.7277
6	59.6722	85.8272	4034.54	1446.77	19.7276
7	60.9222	85.3462	4961.3	1779.1	19.7276
8	62.1722	84.9114	5887.38	2111.19	19.7276
9	63.4222	84.5213	6802.19	2439.24	19.7276
10	64.6722	84.1746	7697.26	2760.21	19.7277
11	65.9222	83.8701	8565.86	3071.68	19.7276
12	67.1722	83.6069	9402.64	3371.75	19.7276
13	68.4222	83.3842	10203.4	3658.91	19.7277
14	69.6721	83.2013	10965	3932.02	19.7277
15	70.9221	83.0577	11685.1	4190.24	19.7277
16	72.1721	82.9529	12362.1	4432.98	19.7276
17	73.4221	82.8867	12994.8	4659.88	19.7276
18	74.6721	82.8588	13582.9	4870.78	19.7277
19	75.9221	82.8692	14126.5	5065.71	19.7276
20	77.1721	82.918	14626.1	5244.85	19.7276
21	78.4221	83.0052	15082.6	5408.56	19.7276
22	79.6721	83.1311	15497.5	5557.32	19.7276
23	80.9221	83.2961	15872.4	5691.78	19.7276
24	82.1721	83.5007	16215.1	5814.67	19.7276
25	83.4221	83.7453	16987	6091.47	19.7276
26	84.6721	84.0309	17555.7	6295.38	19.7276
27	85.9221	84.3583	17948.7	6436.34	19.7277
28	87.172	84.7285	18212.9	6531.06	19.7276
29	88.422	85.1428	18346.7	6579.06	19.7276
30	89.672	85.6026	18349.2	6579.93	19.7276
31	90.922	86.1097	18219.3	6533.38	19.7277
32	92.172	86.6658	17956.7	6439.18	19.7276
33	93.422	87.2733	17560.8	6297.24	19.7277
34	94.672	87.9348	17031.9	6107.56	19.7276
35	95.922	88.6534	16370.1	5870.25	19.7276
36	97.172	89.4326	15576.2	5585.56	19.7276
37	98.422	90.2768	14651.3	5253.89	19.7276
38	99.7428	91.2448	14114.9	5061.53	19.7276
39	101.064	92.2983	13418.7	4811.9	19.7277
40	102.384	93.446	12565.5	4505.93	19.7276
41	103.705	94.6991	11542.3	4139.02	19.7276
42	104.921	95.9578	10279.4	3686.16	19.7277
43	106.136	97.3325	8948.24	3208.8	19.7276
44	107.352	98.8423	7564.63	2712.64	19.7276
45	108.567	100.514	6148.01	2204.65	19.7276
46	109.783	102.385	4723.08	1693.68	19.7277
47	110.998	104.514	3323.02	1191.62	19.7276
48	112.214	107	1996.31	715.869	19.7276
49	113.416	110	657.122	235.641	19.7276
50	114.552	113.757	-153.025	-54.8741	19.7276
51	115.688	121	0	0	0

List Of Coordinates

Distributed Load

X	Y
166.586	120.367
121	121
118.56	121
113.968	121
102.598	121

Focus Search Window

X	Y
73.7596	89
73.7596	77.905
96.732	77.905
96.732	89

External Boundary

X	Y
0	60
121	60
193	60
220	64
220	68
220	92
220	96
220	107
220	110.388
220	119
193	120
121	121
118.56	121
113.968	121
102.598	121
84.2893	110.014
84.277	110
84.162	110
82.161	110
82.161	109
82.161	107
82.161	94.3591
82.161	89.82
82.161	89
58	89
0	89
0	70
0	64

Material Boundary

X	Y
82.161	94.3591
84.162	94.3591
121	95
193	96
220	96

Material Boundary

X	Y
82.161	107
84.162	107
121	107
193	107
220	107

Material Boundary

X	Y
0	70
220	68

Material Boundary

X	Y
0	64
220	64

Material Boundary

X	Y
84.277	110
121	110
193	112
220	110.388

Material Boundary

X	Y
82.161	89.82
84.162	89.82
121	91
193	93
220	92

Material Boundary

X	Y
82.161	89
84.162	89
84.162	89.82

Material Boundary

X	Y
84.162	89.82
84.162	94.3591

Material Boundary

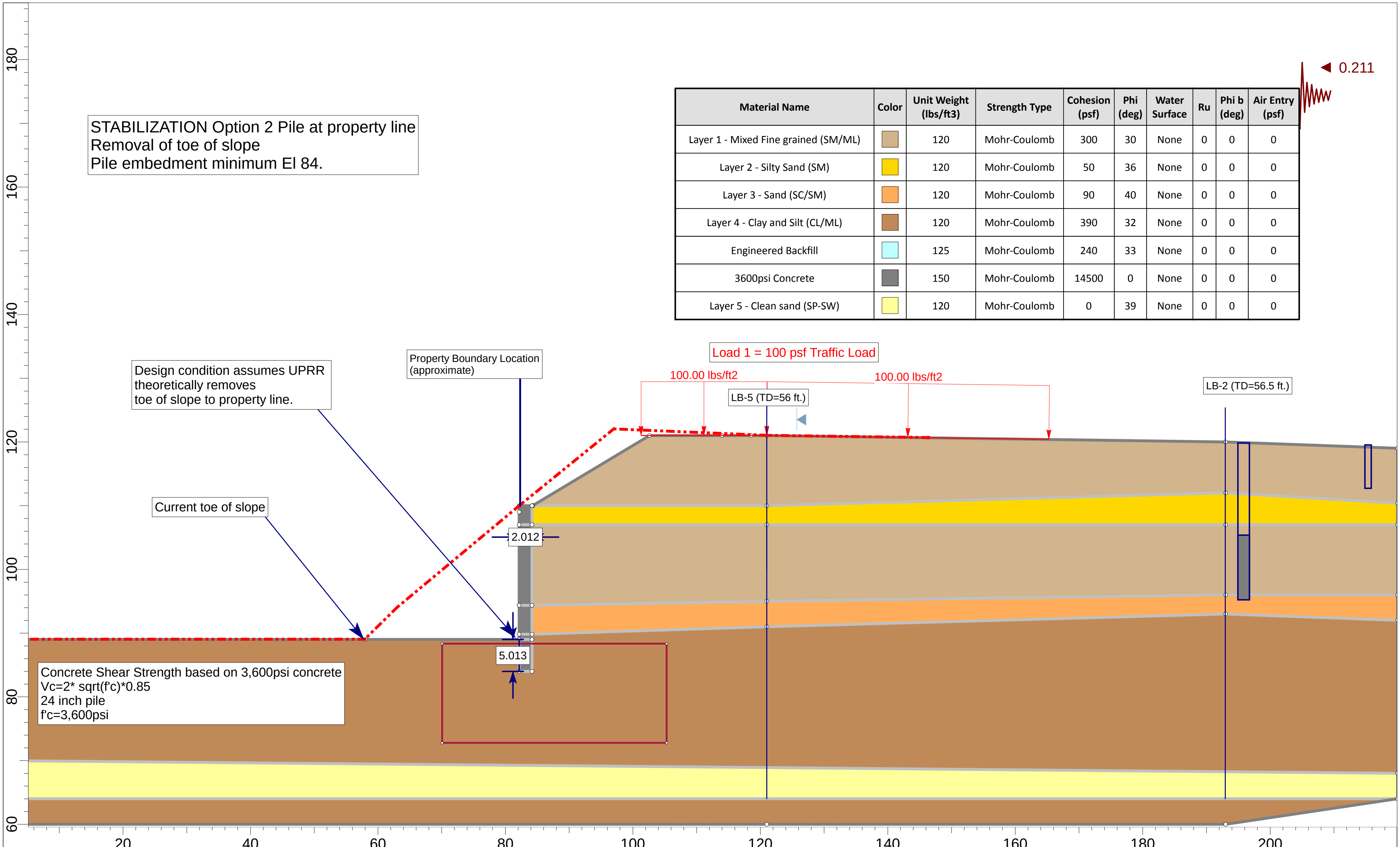
X	Y
84.162	94.3591
84.162	107

Material Boundary

X	Y
84.162	107
84.162	110

Material Boundary

X	Y
82.161	89
82.161	83.956
84.162	83.956
84.162	89



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Phi b (deg)	Air Entry (psf)
Layer 1 - Mixed Fine grained (SM/ML)		120	Mohr-Coulomb	300	30	None	0	0	0
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	36	None	0	0	0
Layer 3 - Sand (SC/SM)		120	Mohr-Coulomb	90	40	None	0	0	0
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	390	32	None	0	0	0
Engineered Backfill		125	Mohr-Coulomb	240	33	None	0	0	0
3600psi Concrete		150	Mohr-Coulomb	14500	0	None	0	0	0
Layer 5 - Clean sand (SP-SW)		120	Mohr-Coulomb	0	39	None	0	0	0

Leighton

SLIDE 7.018

Project Goleta Fire Station #10

Analysis Description A-A' Seismic Analysis - Circular failure, Stabilized condition

Drawn By LD

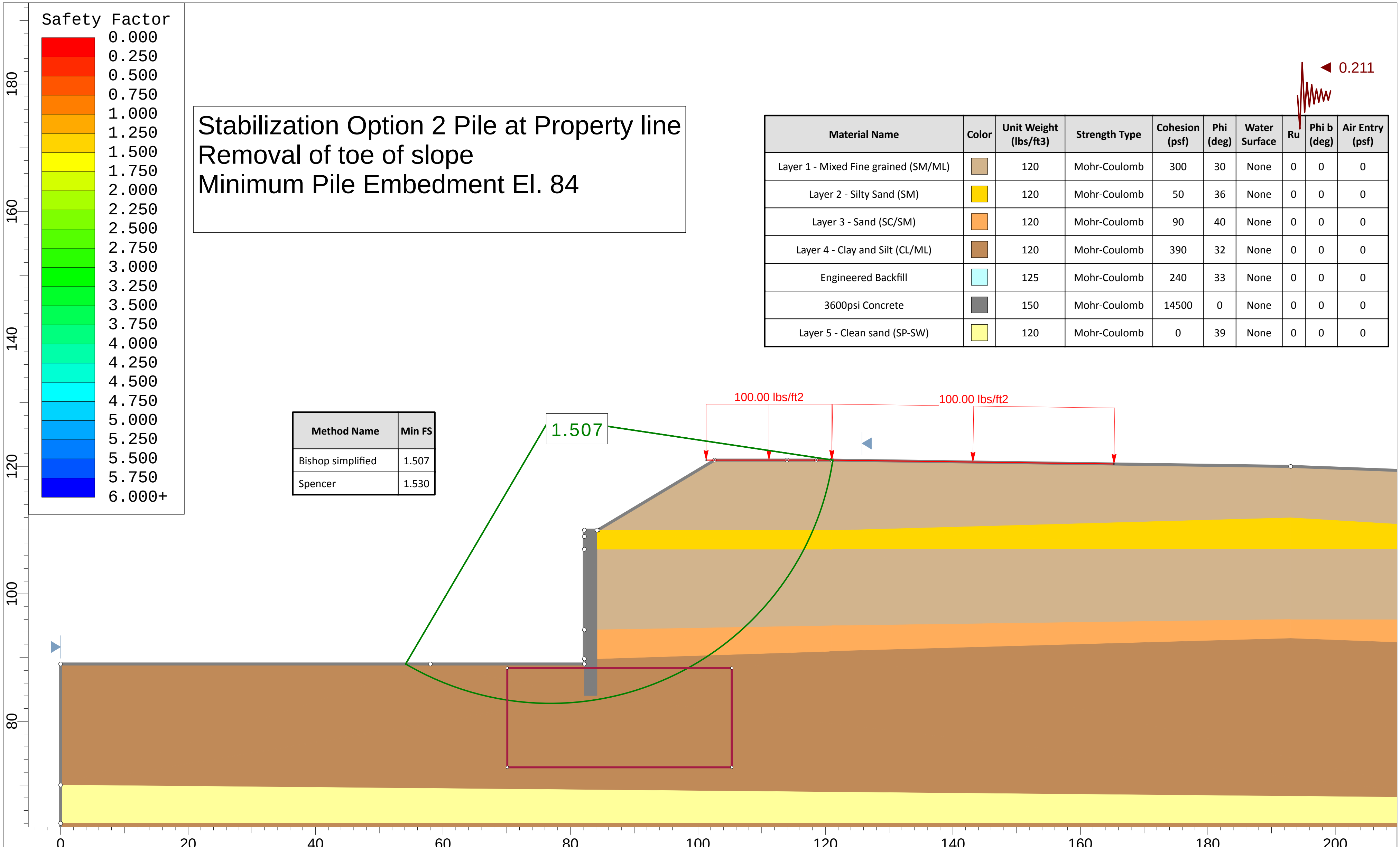
Scale 1:250

Company Leighton

Date 7/29/2016, 6:01:40 PM

File Name 5a_AA_11389001_Option 2 Embedment_Seismic_15.slim

Stabilization Option 2 Pile at Property line
Removal of toe of slope
Minimum Pile Embedment El. 84



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Phi b (deg)	Air Entry (psf)
Layer 1 - Mixed Fine grained (SM/ML)		120	Mohr-Coulomb	300	30	None	0	0	0
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	36	None	0	0	0
Layer 3 - Sand (SC/SM)		120	Mohr-Coulomb	90	40	None	0	0	0
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	390	32	None	0	0	0
Engineered Backfill		125	Mohr-Coulomb	240	33	None	0	0	0
3600psi Concrete		150	Mohr-Coulomb	14500	0	None	0	0	0
Layer 5 - Clean sand (SP-SW)		120	Mohr-Coulomb	0	39	None	0	0	0

Method Name	Min FS
Bishop simplified	1.507
Spencer	1.530

Project	Goleta Fire Station #10		
Analysis Description	A-A' Seismic Analysis - Circular failure, Stabilized condition		
Drawn By LD	*Scale* 1:250	*Company*	Leighton
Date	7/29/2016, 6:01:40 PM	*File Name*	5a_AA_11389001_Option 2 Embedment_Seismic_15.slim

Leighton

SLIDEINTERPRET 7.018

Slide Analysis Information

Goleta Fire Station #10

Project Summary

File Name:	5a_AA_11389001_Option 2 Embedment_Seismic_15
Slide Modeler Version:	7.018
Project Title:	Goleta Fire Station #10
Analysis:	A-A' Seismic Analysis - Circular failure, Stabilized condition
Author:	LD
Company:	Leighton
Date Created:	7/29/2016, 6:01:40 PM
Comments	
	Final condition - Option 2 Peak Strength
	Backfill/traffic loads under seismic condition

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	No
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Slope Search
Number of Surfaces:	5000
Upper Angle:	Not Defined
Lower Angle:	Not Defined
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal): 0.211

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	100
Orientation:	Normal to boundary

Material Properties

Property	Layer 1 - Mixed Fine grained (SM/ML)	Layer 2 - Silty Sand (SM)	Layer 3 - Sand (SC/SM)	Layer 4 - Clay and Silt (CL/ML)	3600psi Concrete	Layer 5 - Clean sand (SP-SW)
Color						
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	120	120	150	120
Cohesion [psf]	300	50	90	390	14500	0
Friction Angle [deg]	30	36	40	32	0	39
Water Surface	None	None	None	None	None	None
Ru Value	0	0	0	0	0	0
Unsat. Shear Strength Phi b [deg]	0	0	0	0	0	0
Unsat. Shear Strength Air Entry Value [psf]	0	0	0	0	0	0

Global Minimums

Method: bishop simplified

FS	1.507010
Center:	76.834, 127.643
Radius:	44.826
Left Slip Surface Endpoint:	54.117, 89.000
Right Slip Surface Endpoint:	121.164, 120.998
Resisting Moment:	4.9118e+006 lb-ft
Driving Moment:	3.2593e+006 lb-ft
Total Slice Area:	1080.76 ft2
Surface Horizontal Width:	67.0469 ft
Surface Average Height:	16.1194 ft

Method: spencer

FS	1.529540
Center:	76.834, 127.643
Radius:	44.826
Left Slip Surface Endpoint:	54.117, 89.000
Right Slip Surface Endpoint:	121.164, 120.998
Resisting Moment:	4.98525e+006 lb-ft
Driving Moment:	3.2593e+006 lb-ft
Resisting Horizontal Force:	95380.6 lb
Driving Horizontal Force:	62358.8 lb
Total Slice Area:	1080.76 ft2
Surface Horizontal Width:	67.0469 ft
Surface Average Height:	16.1194 ft

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	904
Number of Invalid Surfaces:	4096

Error Codes:

Error Code -103 reported for 262 surfaces
Error Code -112 reported for 6 surfaces
Error Code -114 reported for 3685 surfaces
Error Code -118 reported for 143 surfaces

Method: spencer

Number of Valid Surfaces: 813
Number of Invalid Surfaces: 4187

Error Codes:

Error Code -103 reported for 262 surfaces
Error Code -108 reported for 21 surfaces
Error Code -111 reported for 70 surfaces
Error Code -112 reported for 6 surfaces
Error Code -114 reported for 3685 surfaces
Error Code -118 reported for 143 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-111 = safety factor equation did not converge
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
-114 = Surface with Reverse Curvature.
-118 = Surface does not pass through the search focus

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.50701

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.32327	59.3876	-29.4778	Layer 4 - Clay and Silt (CL/ML)	390	32	361.968	545.489	248.834	0	248.834
2	1.32327	173.589	-27.5524	Layer 4 - Clay and Silt (CL/ML)	390	32	399.287	601.73	338.839	0	338.839
3	1.32327	278.877	-25.6602	Layer 4 - Clay and Silt (CL/ML)	390	32	431.945	650.945	417.599	0	417.599
4	1.32327	375.683	-23.7977	Layer 4 - Clay and Silt (CL/ML)	390	32	460.436	693.881	486.312	0	486.312
5	1.32327	464.381	-21.9614	Layer 4 - Clay and Silt (CL/ML)	390	32	485.165	731.148	545.951	0	545.951
6	1.32327	545.295	-20.1487	Layer 4 - Clay and	390	32	506.463	763.245	597.317	0	597.317

				Silt (CL/ML)								
7	1.32327	618.705	-18.3567	Layer 4 - Clay and Silt (CL/ML)	390	32	524.608	790.59	641.078	0	641.078
8	1.32327	684.853	-16.5832	Layer 4 - Clay and Silt (CL/ML)	390	32	539.833	813.533	677.794	0	677.794
9	1.32327	743.95	-14.826	Layer 4 - Clay and Silt (CL/ML)	390	32	552.333	832.371	707.941	0	707.941
10	1.32327	796.175	-13.0828	Layer 4 - Clay and Silt (CL/ML)	390	32	562.278	847.358	731.926	0	731.926
11	1.32327	841.683	-11.352	Layer 4 - Clay and Silt (CL/ML)	390	32	569.812	858.713	750.094	0	750.094
12	1.32327	880.605	-9.63156	Layer 4 - Clay and Silt (CL/ML)	390	32	575.062	866.624	762.756	0	762.756
13	1.32327	913.05	-7.91987	Layer 4 - Clay and Silt (CL/ML)	390	32	578.134	871.254	770.166	0	770.166
14	1.32327	939.108	-6.21527	Layer 4 - Clay and Silt (CL/ML)	390	32	579.125	872.747	772.554	0	772.554
15	1.32327	958.848	-4.51619	Layer 4 - Clay and Silt (CL/ML)	390	32	578.116	871.227	770.121	0	770.121
16	1.32327	972.323	-2.82108	Layer 4 - Clay and Silt (CL/ML)	390	32	575.18	866.802	763.04	0	763.04
17	1.32327	979.57	-1.12844	Layer 4 - Clay and Silt (CL/ML)	390	32	570.38	859.568	751.466	0	751.466
18	1.32327	980.607	0.563214	Layer 4 - Clay and Silt (CL/ML)	390	32	563.77	849.607	735.526	0	735.526
19	1.32327	975.436	2.25536	Layer 4 - Clay and Silt (CL/ML)	390	32	555.4	836.993	715.338	0	715.338
20	1.32327	964.045	3.94948	Layer 4 - Clay and Silt (CL/ML)	390	32	545.31	821.788	691.005	0	691.005
21	1.32327	946.403	5.64707	Layer 4 - Clay and Silt (CL/ML)	390	32	533.538	804.047	662.614	0	662.614
22	1.32327	4448.12	7.34965	Layer 4 - Clay and Silt (CL/ML)	390	32	1568.95	2364.43	3159.75	0	3159.75
23	1.32327	4957.63	9.05879	Layer 4 - Clay and Silt (CL/ML)	390	32	1700.21	2562.23	3476.3	0	3476.3
24	1.32327	4280.33	10.7761	Layer 4 - Clay and Silt (CL/ML)	390	32	1483.33	2235.39	2953.25	0	2953.25
25	1.32327	4363.12	12.5033	Layer 4 - Clay and Silt (CL/ML)	390	32	1489.45	2244.61	2968	0	2968
26	1.32327	4439.24	14.2421	Layer 4 - Clay and Silt (CL/ML)	390	32	1493.17	2250.22	2976.97	0	2976.97
27	1.32327	4508.55	15.9944	Layer 4 - Clay and Silt (CL/ML)	390	32	1494.48	2252.19	2980.13	0	2980.13
28	1.32327	4570.87	17.7623	Layer 4 - Clay and Silt (CL/ML)	390	32	1493.34	2250.48	2977.38	0	2977.38
29	1.32327	4626	19.5478	Layer 4 - Clay and Silt (CL/ML)	390	32	1489.72	2245.02	2968.64	0	2968.64
30	1.32327	4673.71	21.3533	Layer 4 - Clay and Silt (CL/ML)	390	32	1483.55	2235.73	2953.79	0	2953.79
31	1.32327	4713.73	23.1814	Layer 4 - Clay and Silt (CL/ML)	390	32	1474.8	2222.54	2932.68	0	2932.68
32	1.32327	4745.76	25.0348	Layer 4 - Clay and Silt (CL/ML)	390	32	1463.37	2205.32	2905.11	0	2905.11
33	1.32327	4769.44	26.9167	Layer 4 - Clay and Silt (CL/ML)	390	32	1449.18	2183.93	2870.89	0	2870.89
34	1.32327	4784.36	28.8306	Layer 4 - Clay and Silt (CL/ML)	390	32	1432.13	2158.23	2829.76	0	2829.76

35	1.32327	4790.04	30.7804	Layer 4 - Clay and Silt (CL/ML)	390	32	1412.09	2128.03	2781.42	0	2781.42
36	1.32327	4785.91	32.7706	Layer 4 - Clay and Silt (CL/ML)	390	32	1400.61	2110.74	2753.75	0	2753.75
37	1.38611	4986.66	34.8561	Layer 3 - Sand (SC/SM)	90	40	1527.91	2302.57	2636.85	0	2636.85
38	1.38611	4844.95	37.0456	Layer 3 - Sand (SC/SM)	90	40	1452.93	2189.58	2502.18	0	2502.18
39	1.38611	4663.58	39.3004	Layer 3 - Sand (SC/SM)	90	40	1367.51	2060.85	2348.77	0	2348.77
40	1.38611	4466.77	41.6305	Layer 3 - Sand (SC/SM)	90	40	1278.84	1927.22	2189.52	0	2189.52
41	1.332	4091.13	43.9992	Layer 1 - Mixed Fine grained (SM/ML)	300	30	1033.09	1556.88	2176.99	0	2176.99
42	1.332	3876.48	46.4176	Layer 1 - Mixed Fine grained (SM/ML)	300	30	965.077	1454.38	1999.45	0	1999.45
43	1.332	3642.38	48.9489	Layer 1 - Mixed Fine grained (SM/ML)	300	30	893.279	1346.18	1812.04	0	1812.04
44	1.332	3385.75	51.6163	Layer 1 - Mixed Fine grained (SM/ML)	300	30	817.212	1231.55	1613.49	0	1613.49
45	1.332	3102.39	54.4518	Layer 1 - Mixed Fine grained (SM/ML)	300	30	736.226	1109.5	1402.1	0	1402.1
46	1.332	2786.31	57.5007	Layer 1 - Mixed Fine grained (SM/ML)	300	30	649.457	978.738	1175.61	0	1175.61
47	1.332	2428.48	60.8323	Layer 1 - Mixed Fine grained (SM/ML)	300	30	555.667	837.396	930.799	0	930.799
48	1.41807	2127.1	64.7004	Layer 2 - Silty Sand (SM)	50	36	398.95	601.221	758.69	0	758.69
49	1.56141	1665.64	69.6989	Layer 1 - Mixed Fine grained (SM/ML)	300	30	317.894	479.07	310.159	0	310.159
50	1.56141	635.299	77.0253	Layer 1 - Mixed Fine grained (SM/ML)	300	30	147.981	223.009	-133.352	0	-133.352

Global Minimum Query (spencer) - Safety Factor: 1.52954

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.32327	59.3876	-29.4778	Layer 4 - Clay and Silt (CL/ML)	390	32	785.141	1200.91	1297.72	0	1297.72
2	1.32327	173.589	-27.5524	Layer 4 - Clay and Silt (CL/ML)	390	32	815.785	1247.78	1372.73	0	1372.73
3	1.32327	278.877	-25.6602	Layer 4 - Clay and Silt (CL/ML)	390	32	832.639	1273.55	1413.99	0	1413.99
4	1.32327	375.683	-23.7977	Layer 4 - Clay and Silt (CL/ML)	390	32	840.481	1285.55	1433.18	0	1433.18
5	1.32327	464.381	-21.9614	Layer 4 - Clay and Silt (CL/ML)	390	32	842.201	1288.18	1437.39	0	1437.39

6	1.32327	545.295	-20.1487	Layer 4 - Clay and Silt (CL/ML)	390	32	839.591	1284.19	1431	0	1431
7	1.32327	618.705	-18.3567	Layer 4 - Clay and Silt (CL/ML)	390	32	833.797	1275.33	1416.81	0	1416.81
8	1.32327	684.853	-16.5832	Layer 4 - Clay and Silt (CL/ML)	390	32	825.565	1262.74	1396.67	0	1396.67
9	1.32327	743.95	-14.826	Layer 4 - Clay and Silt (CL/ML)	390	32	815.396	1247.18	1371.78	0	1371.78
10	1.32327	796.175	-13.0828	Layer 4 - Clay and Silt (CL/ML)	390	32	803.631	1229.19	1342.97	0	1342.97
11	1.32327	841.683	-11.352	Layer 4 - Clay and Silt (CL/ML)	390	32	790.51	1209.12	1310.86	0	1310.86
12	1.32327	880.605	-9.63156	Layer 4 - Clay and Silt (CL/ML)	390	32	776.202	1187.23	1275.84	0	1275.84
13	1.32327	913.05	-7.91987	Layer 4 - Clay and Silt (CL/ML)	390	32	760.835	1163.73	1238.22	0	1238.22
14	1.32327	939.108	-6.21527	Layer 4 - Clay and Silt (CL/ML)	390	32	744.502	1138.74	1198.24	0	1198.24
15	1.32327	958.848	-4.51619	Layer 4 - Clay and Silt (CL/ML)	390	32	727.276	1112.4	1156.07	0	1156.07
16	1.32327	972.323	-2.82108	Layer 4 - Clay and Silt (CL/ML)	390	32	709.215	1084.77	1111.87	0	1111.87
17	1.32327	979.57	-1.12844	Layer 4 - Clay and Silt (CL/ML)	390	32	690.366	1055.94	1065.73	0	1065.73
18	1.32327	980.607	0.563214	Layer 4 - Clay and Silt (CL/ML)	390	32	670.768	1025.97	1017.76	0	1017.76
19	1.32327	975.436	2.25536	Layer 4 - Clay and Silt (CL/ML)	390	32	650.454	994.895	968.034	0	968.034
20	1.32327	964.045	3.94948	Layer 4 - Clay and Silt (CL/ML)	390	32	629.453	962.774	916.628	0	916.628
21	1.32327	946.403	5.64707	Layer 4 - Clay and Silt (CL/ML)	390	32	607.793	929.644	863.61	0	863.61
22	1.32327	4448.12	7.34965	Layer 4 - Clay and Silt (CL/ML)	390	32	1656.94	2534.36	3431.69	0	3431.69
23	1.32327	4957.63	9.05879	Layer 4 - Clay and Silt (CL/ML)	390	32	1758.63	2689.9	3680.61	0	3680.61
24	1.32327	4280.33	10.7761	Layer 4 - Clay and Silt (CL/ML)	390	32	1515.08	2317.37	3084.44	0	3084.44
25	1.32327	4363.12	12.5033	Layer 4 - Clay and Silt (CL/ML)	390	32	1495.65	2287.66	3036.89	0	3036.89
26	1.32327	4439.24	14.2421	Layer 4 - Clay and Silt (CL/ML)	390	32	1474.8	2255.77	2985.85	0	2985.85
27	1.32327	4508.55	15.9944	Layer 4 - Clay and Silt (CL/ML)	390	32	1452.52	2221.68	2931.3	0	2931.3
28	1.32327	4570.87	17.7623	Layer 4 - Clay and Silt (CL/ML)	390	32	1428.78	2185.37	2873.18	0	2873.18
29	1.32327	4626	19.5478	Layer 4 - Clay and Silt (CL/ML)	390	32	1403.56	2146.8	2811.46	0	2811.46
30	1.32327	4673.71	21.3533	Layer 4 - Clay and Silt (CL/ML)	390	32	1376.84	2105.93	2746.06	0	2746.06
31	1.32327	4713.73	23.1814	Layer 4 - Clay and Silt (CL/ML)	390	32	1348.59	2062.72	2676.91	0	2676.91
32	1.32327	4745.76	25.0348	Layer 4 - Clay and Silt (CL/ML)	390	32	1318.76	2017.1	2603.91	0	2603.91
33	1.32327	4769.44	26.9167	Layer 4 - Clay and Silt (CL/ML)	390	32	1287.33	1969.02	2526.96	0	2526.96
34	1.32327	4784.36	28.8306	Layer 4 - Clay and	390	32	1254.23	1918.4	2445.95	0	2445.95

				Silt (CL/ML)							
35	1.32327	4790.04	30.7804	Layer 4 - Clay and Silt (CL/ML)	390	32	1219.41	1865.14	2360.71	0	2360.71
36	1.32327	4785.91	32.7706	Layer 4 - Clay and Silt (CL/ML)	390	32	1193.27	1825.15	2296.72	0	2296.72
37	1.38611	4986.66	34.8561	Layer 3 - Sand (SC/SM)	90	40	1281.29	1959.78	2228.31	0	2228.31
38	1.38611	4844.95	37.0456	Layer 3 - Sand (SC/SM)	90	40	1196.01	1829.34	2072.86	0	2072.86
39	1.38611	4663.58	39.3004	Layer 3 - Sand (SC/SM)	90	40	1104.96	1690.08	1906.9	0	1906.9
40	1.38611	4466.77	41.6305	Layer 3 - Sand (SC/SM)	90	40	1014.07	1551.06	1741.23	0	1741.23
41	1.332	4091.13	43.9992	Layer 1 - Mixed Fine grained (SM/ML)	300	30	803.983	1229.72	1610.33	0	1610.33
42	1.332	3876.48	46.4176	Layer 1 - Mixed Fine grained (SM/ML)	300	30	742.776	1136.11	1448.18	0	1448.18
43	1.332	3642.38	48.9489	Layer 1 - Mixed Fine grained (SM/ML)	300	30	680.618	1041.03	1283.51	0	1283.51
44	1.332	3385.75	51.6163	Layer 1 - Mixed Fine grained (SM/ML)	300	30	617.344	944.253	1115.88	0	1115.88
45	1.332	3102.39	54.4518	Layer 1 - Mixed Fine grained (SM/ML)	300	30	552.756	845.463	944.771	0	944.771
46	1.332	2786.31	57.5007	Layer 1 - Mixed Fine grained (SM/ML)	300	30	486.612	744.293	769.539	0	769.539
47	1.332	2428.48	60.8323	Layer 1 - Mixed Fine grained (SM/ML)	300	30	418.631	640.313	589.439	0	589.439
48	1.41807	2127.1	64.7004	Layer 2 - Silty Sand (SM)	50	36	253.814	388.218	465.517	0	465.517
49	1.56141	1665.64	69.6989	Layer 1 - Mixed Fine grained (SM/ML)	300	30	265.05	405.404	182.565	0	182.565
50	1.56141	635.299	77.0253	Layer 1 - Mixed Fine grained (SM/ML)	300	30	185.258	283.36	-28.8209	0	-28.8209

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.50701

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	54.1174	89	0	0	0
2	55.4407	88.252	651.048	0	0
3	56.7639	87.5616	1375.03	0	0
4	58.0872	86.9259	2151.42	0	0
5	59.4105	86.3423	2963.28	0	0
6	60.7337	85.8087	3796.57	0	0
7	62.057	85.3232	4639.57	0	0
8	63.3803	84.8841	5482.49	0	0
9	64.7035	84.4901	6317.15	0	0
10	66.0268	84.1398	7136.69	0	0
11	67.3501	83.8323	7935.45	0	0
12	68.6733	83.5666	8708.74	0	0
13	69.9966	83.3421	9452.75	0	0
14	71.3199	83.158	10164.5	0	0
15	72.6431	83.0139	10841.5	0	0
16	73.9664	82.9094	11482.3	0	0
17	75.2897	82.8441	12085.6	0	0
18	76.6129	82.8181	12650.8	0	0
19	77.9362	82.8311	13178	0	0
20	79.2595	82.8832	13667.5	0	0
21	80.5827	82.9746	14120.2	0	0
22	81.906	83.1054	14537.6	0	0
23	83.2293	83.2761	15129.3	0	0
24	84.5525	83.4871	15592.4	0	0
25	85.8758	83.7389	15902.1	0	0
26	87.1991	84.0324	16075.2	0	0
27	88.5223	84.3682	16108.2	0	0
28	89.8456	84.7475	15997.8	0	0
29	91.1689	85.1714	15741	0	0
30	92.4921	85.6413	15335.2	0	0
31	93.8154	86.1586	14777.8	0	0
32	95.1387	86.7252	14066.8	0	0
33	96.4619	87.3433	13200.2	0	0
34	97.7852	88.0151	12176.7	0	0
35	99.1085	88.7435	10995	0	0
36	100.432	89.5317	9654.6	0	0
37	101.755	90.3835	8146.53	0	0
38	103.141	91.3489	6659.87	0	0
39	104.527	92.3951	5027.21	0	0
40	105.913	93.5297	3267.91	0	0
41	107.299	94.7616	1394.97	0	0
42	108.631	96.0479	-896.738	0	0
43	109.963	97.4475	-3231.71	0	0
44	111.295	98.977	-5585.77	0	0
45	112.627	100.659	-7928.26	0	0
46	113.959	102.523	-10218.9	0	0
47	115.291	104.614	-12402.6	0	0
48	116.623	107	-14398.5	0	0
49	118.041	110	-16559.5	0	0
50	119.603	114.221	-17725.3	0	0
51	121.164	120.998	0	0	0

Global Minimum Query (spencer) - Safety Factor: 1.52954

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	54.1174	89	0	0	0
2	55.4407	88.252	1996.3	1117.79	29.2458
3	56.7639	87.5616	3986.05	2231.9	29.2457
4	58.0872	86.9259	5927.04	3318.72	29.2457
5	59.4105	86.3423	7795.44	4364.9	29.2458
6	60.7337	85.8087	9578.03	5363.02	29.2457
7	62.057	85.3232	11267.9	6309.23	29.2458
8	63.3803	84.8841	12861.9	7201.77	29.2458
9	64.7035	84.4901	14359.4	8040.24	29.2457
10	66.0268	84.1398	15761	8825.07	29.2458
11	67.3501	83.8323	17068.6	9557.23	29.2458
12	68.6733	83.5666	18284.5	10238	29.2457
13	69.9966	83.3421	19411.5	10869.1	29.2458
14	71.3199	83.158	20452.8	11452.1	29.2457
15	72.6431	83.0139	21411.8	11989.1	29.2458
16	73.9664	82.9094	22291.9	12481.9	29.2458
17	75.2897	82.8441	23097	12932.7	29.2458
18	76.6129	82.8181	23830.9	13343.6	29.2457
19	77.9362	82.8311	24497.7	13717	29.2458
20	79.2595	82.8832	25101.5	14055.1	29.2458
21	80.5827	82.9746	25646.6	14360.3	29.2458
22	81.906	83.1054	26137.6	14635.2	29.2457
23	83.2293	83.2761	26804.1	15008.4	29.2457
24	84.5525	83.4871	27306.9	15289.9	29.2457
25	85.8758	83.7389	27630.2	15471	29.2458
26	87.1991	84.0324	27796	15563.8	29.2458
27	88.5223	84.3682	27806.5	15569.7	29.2458
28	89.8456	84.7475	27664	15489.9	29.2458
29	91.1689	85.1714	27370.7	15325.7	29.2458
30	92.4921	85.6413	26929.6	15078.7	29.2458
31	93.8154	86.1586	26343.3	14750.4	29.2458
32	95.1387	86.7252	25615	14342.6	29.2458
33	96.4619	87.3433	24748.1	13857.2	29.2458
34	97.7852	88.0151	23746.2	13296.2	29.2458
35	99.1085	88.7435	22613.5	12662	29.2458
36	100.432	89.5317	21354.4	11956.9	29.2456
37	101.755	90.3835	19965.9	11179.5	29.2458
38	103.141	91.3489	18537.2	10379.5	29.2457
39	104.527	92.3951	17002.7	9520.31	29.2457
40	105.913	93.5297	15385.6	8614.87	29.2458
41	107.299	94.7616	13702.5	7672.45	29.2458
42	108.631	96.0479	11838.1	6628.49	29.2457
43	109.963	97.4475	9981.88	5589.15	29.2458
44	111.295	98.977	8156.05	4566.81	29.2457
45	112.627	100.659	6386.92	3576.22	29.2457
46	113.959	102.523	4706.89	2635.53	29.2458
47	115.291	104.614	3157.64	1768.05	29.2457
48	116.623	107	1795.72	1005.48	29.2458
49	118.041	110	309.995	173.575	29.2457
50	119.603	114.221	-398.497	-223.13	29.2457
51	121.164	120.998	0	0	0

List Of Coordinates

Distributed Load

X	Y
165.27	120.385
121	121
118.56	121
113.968	121
102.598	121
101.282	121

Focus Search Window

X	Y
70.078	88.352
70.078	72.779
105.292	72.779
105.292	88.352

External Boundary

X	Y
0	60
121	60
193	60
220	64
220	68
220	92
220	96
220	107
220	110.388
220	119
193	120
121	121
118.56	121
113.968	121
102.598	121
84.2892	110.014
84.277	110
84.162	110
82.161	110
82.161	109
82.161	107
82.161	94.3591
82.161	89.82
82.161	89
58	89
0	89
0	70
0	64

Material Boundary

X	Y
82.161	94.3591
84.162	94.3591
121	95
193	96
220	96

Material Boundary

X	Y
82.161	107
84.162	107
121	107
193	107
220	107

Material Boundary

X	Y
0	70
220	68

Material Boundary

X	Y
0	64
220	64

Material Boundary

X	Y
84.277	110
121	110
193	112
220	110.388

Material Boundary

X	Y
82.161	89.82
84.162	89.82
121	91
193	93
220	92

Material Boundary

X	Y
82.161	89
84.162	89
84.162	89.82

Material Boundary

X	Y
84.162	89.82
84.162	94.3591

Material Boundary

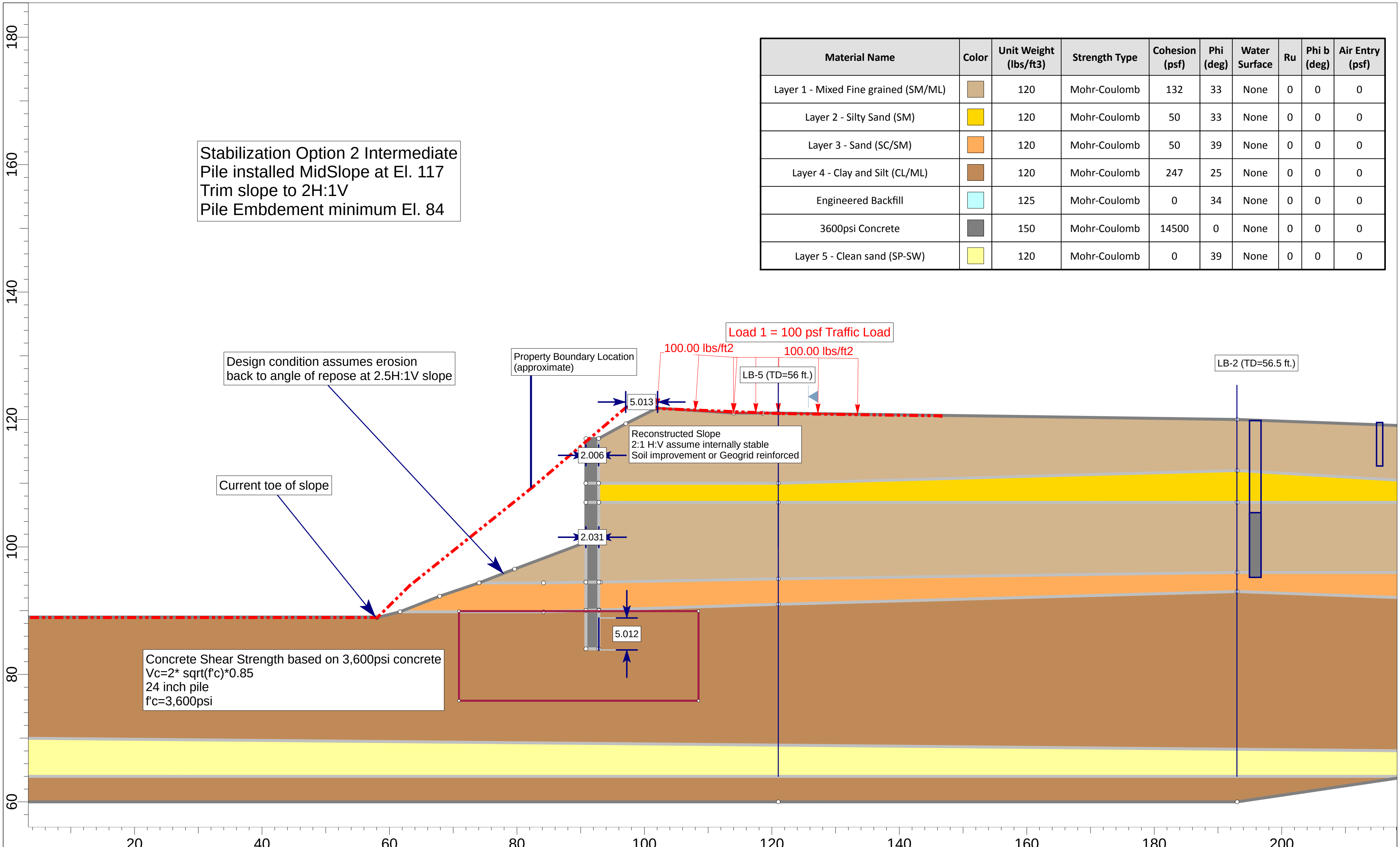
X	Y
84.162	94.3591
84.162	107

Material Boundary

X	Y
84.162	107
84.162	110

Material Boundary

X	Y
82.161	89
82.161	83.987
84.162	83.987
84.162	89

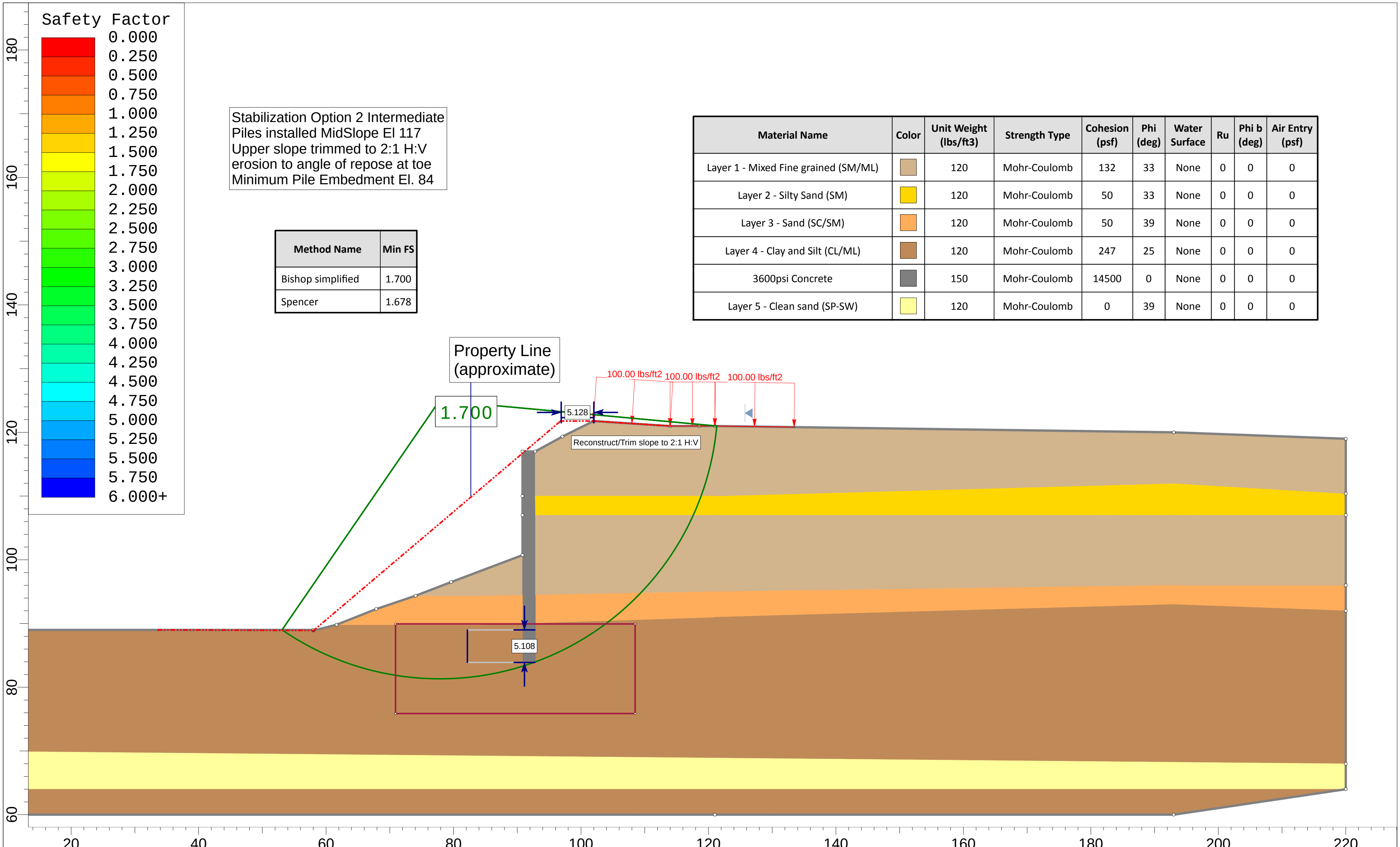


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Phi b (deg)	Air Entry (psf)
Layer 1 - Mixed Fine grained (SM/ML)		120	Mohr-Coulomb	132	33	None	0	0	0
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	33	None	0	0	0
Layer 3 - Sand (SC/SM)		120	Mohr-Coulomb	50	39	None	0	0	0
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	247	25	None	0	0	0
Engineered Backfill		125	Mohr-Coulomb	0	34	None	0	0	0
3600psi Concrete		150	Mohr-Coulomb	14500	0	None	0	0	0
Layer 5 - Clean sand (SP-SW)		120	Mohr-Coulomb	0	39	None	0	0	0

Leighton

SLIDE 7.018

Project	Goleta Fire Station #10
Analysis Description	A-A' Static Analysis - Circular failure, Stabilized condition
Drawn By	LD
Scale	1:250
Company	Leighton
Date	7/29/2016, 6:01:40 PM
File Name	5_1_AA_11389001_Option 2 Embedment_Static.slim



Method Name	Min FS
Bishop simplified	1.700
Spencer	1.678

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Phi b (deg)	Air Entry (psf)
Layer 1 - Mixed Fine grained (SM/ML)		120	Mohr-Coulomb	132	33	None	0	0	0
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	33	None	0	0	0
Layer 3 - Sand (SC/SM)		120	Mohr-Coulomb	50	39	None	0	0	0
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	247	25	None	0	0	0
3600psi Concrete		150	Mohr-Coulomb	14500	0	None	0	0	0
Layer 5 - Clean sand (SP-SW)		120	Mohr-Coulomb	0	39	None	0	0	0

Leighton

SLIDEINTERPRET 7.018

Project	Goleta Fire Station #10		
Analysis Description	A-A' Static Analysis - Circular failure, Stabilized condition		
Drawn By LD	*Scale* 1:250	*Company* Leighton	
Date 7/29/2016, 6:01:40 PM		*File Name* 5_1_AA_11389001_Option 2 Embedment_Static.slim	

Slide Analysis Information

Goleta Fire Station #10

Project Summary

File Name:	5_1_AA_11389001_Option 2 Embedment_Static
Slide Modeler Version:	7.018
Project Title:	Goleta Fire Station #10
Analysis:	A-A' Static Analysis - Circular failure, Stabilized condition
Author:	LD
Company:	Leighton
Date Created:	7/29/2016, 6:01:40 PM
Comments	
	Final condition - Option 2
	Backfill/traffic loads under static condition

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	No
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Slope Search
Number of Surfaces:	10000
Upper Angle:	Not Defined
Lower Angle:	Not Defined
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	100
Orientation:	Normal to boundary

Material Properties

Property	Layer 1 - Mixed Fine grained (SM/ML)	Layer 2 - Silty Sand (SM)	Layer 3 - Sand (SC/SM)	Layer 4 - Clay and Silt (CL/ML)	3600psi Concrete	Layer 5 - Clean sand (SP-SW)
Color						
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	120	120	150	120
Cohesion [psf]	132	50	50	247	14500	0
Friction Angle [deg]	33	33	39	25	0	39
Water Surface	None	None	None	None	None	None
Ru Value	0	0	0	0	0	0
Unsat. Shear Strength Phi b [deg]	0	0	0	0	0	0
Unsat. Shear Strength Air Entry Value [psf]	0	0	0	0	0	0

Global Minimums

Method: bishop simplified

FS	1.699670
Center:	77.814, 125.006
Radius:	43.681
Left Slip Surface Endpoint:	53.084, 89.000
Right Slip Surface Endpoint:	121.310, 120.996
Resisting Moment:	4.28784e+006 lb-ft
Driving Moment:	2.52275e+006 lb-ft
Total Slice Area:	1202.49 ft2
Surface Horizontal Width:	68.2256 ft
Surface Average Height:	17.6252 ft

Method: spencer

FS	1.678120
Center:	76.820, 127.105
Radius:	46.076
Left Slip Surface Endpoint:	50.915, 89.000
Right Slip Surface Endpoint:	122.487, 120.979
Resisting Moment:	4.60461e+006 lb-ft
Driving Moment:	2.74391e+006 lb-ft
Resisting Horizontal Force:	83559 lb
Driving Horizontal Force:	49793.2 lb
Total Slice Area:	1245.21 ft2
Surface Horizontal Width:	71.5718 ft
Surface Average Height:	17.398 ft

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	2335
Number of Invalid Surfaces:	7665

Error Codes:

Error Code -103 reported for 409 surfaces
Error Code -105 reported for 2 surfaces
Error Code -112 reported for 51 surfaces
Error Code -114 reported for 6877 surfaces
Error Code -118 reported for 326 surfaces

Method: spencer

Number of Valid Surfaces: 2148
Number of Invalid Surfaces: 7852

Error Codes:

Error Code -103 reported for 409 surfaces
Error Code -105 reported for 2 surfaces
Error Code -108 reported for 98 surfaces
Error Code -111 reported for 82 surfaces
Error Code -112 reported for 58 surfaces
Error Code -114 reported for 6877 surfaces
Error Code -118 reported for 326 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-105 = More than two surface / slope intersections with no valid slip surface.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-111 = safety factor equation did not converge
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
-114 = Surface with Reverse Curvature.
-118 = Surface does not pass through the search focus

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.69967

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.35469	72.6521	-33.4173	Layer 4 - Clay and Silt (CL/ML)	247	25	195.372	332.068	182.428	0	182.428
2	1.35469	212.286	-31.3128	Layer 4 - Clay and Silt (CL/ML)	247	25	226	384.125	294.066	0	294.066
3	1.35469	340.944	-29.2544	Layer 4 - Clay and Silt (CL/ML)	247	25	253.256	430.451	393.411	0	393.411
4	1.35469	457.814	-27.2367	Layer 4 - Clay and Silt (CL/ML)	247	25	277.144	471.053	480.482	0	480.482

5	1.35469	601.247	-25.2549	Layer 4 - Clay and Silt (CL/ML)	247	25	306.754	521.38	588.41	0	588.41
6	1.35469	755.8	-23.3051	Layer 4 - Clay and Silt (CL/ML)	247	25	338.339	575.065	703.538	0	703.538
7	1.35469	908.955	-21.3834	Layer 4 - Clay and Silt (CL/ML)	247	25	369.012	627.198	815.337	0	815.337
8	1.35469	1076.06	-19.4867	Layer 4 - Clay and Silt (CL/ML)	247	25	402.266	683.719	936.549	0	936.549
9	1.35469	1236.53	-17.612	Layer 4 - Clay and Silt (CL/ML)	247	25	433.464	736.746	1050.27	0	1050.27
10	1.35469	1389.1	-15.7566	Layer 4 - Clay and Silt (CL/ML)	247	25	462.408	785.941	1155.77	0	1155.77
11	1.35469	1533.97	-13.918	Layer 4 - Clay and Silt (CL/ML)	247	25	489.214	831.503	1253.47	0	1253.47
12	1.35469	1664.54	-12.094	Layer 4 - Clay and Silt (CL/ML)	247	25	512.53	871.132	1338.45	0	1338.45
13	1.35469	1782.75	-10.2823	Layer 4 - Clay and Silt (CL/ML)	247	25	532.864	905.693	1412.57	0	1412.57
14	1.35469	1893.78	-8.48096	Layer 4 - Clay and Silt (CL/ML)	247	25	551.39	937.181	1480.1	0	1480.1
15	1.35469	1997.75	-6.68804	Layer 4 - Clay and Silt (CL/ML)	247	25	568.172	965.705	1541.27	0	1541.27
16	1.35469	2096.29	-4.90168	Layer 4 - Clay and Silt (CL/ML)	247	25	583.583	991.898	1597.44	0	1597.44
17	1.35469	2195.88	-3.12008	Layer 4 - Clay and Silt (CL/ML)	247	25	598.983	1018.07	1653.57	0	1653.57
18	1.35469	2289.74	-1.34151	Layer 4 - Clay and Silt (CL/ML)	247	25	612.976	1041.86	1704.58	0	1704.58
19	1.35469	2376.76	0.435771	Layer 4 - Clay and Silt (CL/ML)	247	25	625.361	1062.91	1749.72	0	1749.72
20	1.35469	2456.74	2.21347	Layer 4 - Clay and Silt (CL/ML)	247	25	636.123	1081.2	1788.95	0	1788.95
21	1.35469	2528.08	3.99331	Layer 4 - Clay and Silt (CL/ML)	247	25	644.969	1096.24	1821.19	0	1821.19
22	1.35469	2592.12	5.77702	Layer 4 - Clay and Silt (CL/ML)	247	25	652.193	1108.51	1847.52	0	1847.52
23	1.35469	2649.22	7.56637	Layer 4 - Clay and Silt (CL/ML)	247	25	657.889	1118.19	1868.29	0	1868.29
24	1.35469	2699.3	9.36319	Layer 4 - Clay and Silt (CL/ML)	247	25	662.061	1125.29	1883.49	0	1883.49
25	1.35469	2742.26	11.1694	Layer 4 - Clay and Silt (CL/ML)	247	25	664.71	1129.79	1893.14	0	1893.14
26	1.35469	2777.99	12.9868	Layer 4 - Clay and Silt (CL/ML)	247	25	665.83	1131.69	1897.23	0	1897.23
27	1.35469	2806.33	14.8177	Layer 4 - Clay and Silt (CL/ML)	247	25	665.41	1130.98	1895.69	0	1895.69
28	1.35469	3446.8	16.6643	Layer 4 - Clay and Silt (CL/ML)	247	25	779.416	1324.75	2311.25	0	2311.25
29	1.35469	6772.85	18.5288	Layer 4 - Clay and Silt (CL/ML)	247	25	1389.32	2361.39	4534.33	0	4534.33
30	1.35469	5837.1	20.414	Layer 4 - Clay and Silt (CL/ML)	247	25	1204.57	2047.37	3860.9	0	3860.9
31	1.35469	5409.13	22.3225	Layer 4 - Clay and Silt (CL/ML)	247	25	1115.26	1895.58	3535.38	0	3535.38
32	1.35469	5434.74	24.2576	Layer 4 - Clay and Silt (CL/ML)	247	25	1108.99	1884.91	3512.5	0	3512.5
33	1.35469	5449.86	26.2226	Layer 4 - Clay and	247	25	1100.45	1870.41	3481.4	0	3481.4

				Silt (CL/ML)							
34	1.35469	5447.41	28.2214	Layer 4 - Clay and Silt (CL/ML)	247	25	1088.42	1849.95	3437.54	0	3437.54
35	1.35469	5433.73	30.2584	Layer 4 - Clay and Silt (CL/ML)	247	25	1074.01	1825.47	3385.04	0	3385.04
36	1.35469	5409.42	32.3387	Layer 4 - Clay and Silt (CL/ML)	247	25	1057.34	1797.13	3324.27	0	3324.27
37	1.35469	5322.97	34.4681	Layer 4 - Clay and Silt (CL/ML)	247	25	1050.49	1785.49	3299.29	0	3299.29
38	1.35469	5151.61	36.6533	Layer 4 - Clay and Silt (CL/ML)	247	25	1010.04	1716.74	3151.87	0	3151.87
39	1.5959	5829.68	39.1099	Layer 3 - Sand (SC/SM)	50	39	1310.34	2227.15	2688.55	0	2688.55
40	1.5959	5548.51	41.8645	Layer 3 - Sand (SC/SM)	50	39	1215.14	2065.34	2488.73	0	2488.73
41	1.5959	5240.12	44.7439	Layer 3 - Sand (SC/SM)	50	39	1115.26	1895.58	2279.1	0	2279.1
42	1.37673	4249.4	47.5558	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	913.766	1553.1	2188.3	0	2188.3
43	1.37673	3973.16	50.3077	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	834.638	1418.61	1981.2	0	1981.2
44	1.37673	3669.08	53.2302	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	750.657	1275.87	1761.41	0	1761.41
45	1.37673	3334.15	56.3693	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	661.527	1124.38	1528.13	0	1528.13
46	1.37673	2966.9	59.7949	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	567.264	964.161	1281.42	0	1281.42
47	1.37673	2542.22	63.6226	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	464.124	788.857	1011.47	0	1011.47
48	1.22542	1838.13	67.7813	Layer 2 - Silty Sand (SM)	50	33	331.205	562.94	789.86	0	789.86
49	1.23702	1339.44	72.6249	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	238.549	405.454	421.083	0	421.083
50	1.23702	523.25	80.0374	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	87.444	148.626	25.6017	0	25.6017

Global Minimum Query (spencer) - Safety Factor: 1.67812

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.41745	78.7548	-33.1563	Layer 4 - Clay and Silt (CL/ML)	247	25	248.615	417.206	365.008	0	365.008
2	1.41745	230.157	-31.0746	Layer 4 - Clay and Silt (CL/ML)	247	25	292.62	491.051	523.369	0	523.369
3	1.41745	369.73	-29.0375	Layer 4 - Clay and Silt (CL/ML)	247	25	329.4	552.772	655.733	0	655.733
4	1.41745	498.184	-27.0399	Layer 4 - Clay and Silt (CL/ML)	247	25	360.202	604.462	766.578	0	766.578

5	1.41745	616.124	-25.0773	Layer 4 - Clay and Silt (CL/ML)	247	25	385.966	647.698	859.3	0	859.3
6	1.41745	739.109	-23.1458	Layer 4 - Clay and Silt (CL/ML)	247	25	411.869	691.166	952.519	0	952.519
7	1.41745	897.747	-21.2417	Layer 4 - Clay and Silt (CL/ML)	247	25	446.699	749.614	1077.86	0	1077.86
8	1.41745	1050.66	-19.3619	Layer 4 - Clay and Silt (CL/ML)	247	25	478.18	802.444	1191.15	0	1191.15
9	1.41745	1220.36	-17.5036	Layer 4 - Clay and Silt (CL/ML)	247	25	512.714	860.396	1315.43	0	1315.43
10	1.41745	1386.94	-15.6642	Layer 4 - Clay and Silt (CL/ML)	247	25	544.84	914.307	1431.05	0	1431.05
11	1.41745	1545.21	-13.8411	Layer 4 - Clay and Silt (CL/ML)	247	25	573.429	962.283	1533.93	0	1533.93
12	1.41745	1695.35	-12.0323	Layer 4 - Clay and Silt (CL/ML)	247	25	598.796	1004.85	1625.22	0	1625.22
13	1.41745	1830.64	-10.2356	Layer 4 - Clay and Silt (CL/ML)	247	25	619.519	1039.63	1699.79	0	1699.79
14	1.41745	1952.03	-8.44896	Layer 4 - Clay and Silt (CL/ML)	247	25	636.134	1067.51	1759.59	0	1759.59
15	1.41745	2065.75	-6.6706	Layer 4 - Clay and Silt (CL/ML)	247	25	650.343	1091.35	1810.73	0	1810.73
16	1.41745	2171.9	-4.89869	Layer 4 - Clay and Silt (CL/ML)	247	25	662.3	1111.42	1853.75	0	1853.75
17	1.41745	2273.33	-3.13146	Layer 4 - Clay and Silt (CL/ML)	247	25	672.758	1128.97	1891.39	0	1891.39
18	1.41745	2375.62	-1.36722	Layer 4 - Clay and Silt (CL/ML)	247	25	682.998	1146.15	1928.24	0	1928.24
19	1.41745	2471.03	0.395729	Layer 4 - Clay and Silt (CL/ML)	247	25	691.345	1160.16	1958.28	0	1958.28
20	1.41745	2559.02	2.15905	Layer 4 - Clay and Silt (CL/ML)	247	25	697.765	1170.93	1981.38	0	1981.38
21	1.41745	2638.83	3.92443	Layer 4 - Clay and Silt (CL/ML)	247	25	702.181	1178.34	1997.27	0	1997.27
22	1.41745	2709.35	5.69354	Layer 4 - Clay and Silt (CL/ML)	247	25	704.448	1182.15	2005.43	0	2005.43
23	1.41745	2772.24	7.46813	Layer 4 - Clay and Silt (CL/ML)	247	25	704.987	1183.05	2007.37	0	2007.37
24	1.41745	2827.53	9.24996	Layer 4 - Clay and Silt (CL/ML)	247	25	703.863	1181.17	2003.33	0	2003.33
25	1.41745	2875.09	11.0409	Layer 4 - Clay and Silt (CL/ML)	247	25	701.113	1176.55	1993.43	0	1993.43
26	1.41745	2914.81	12.8428	Layer 4 - Clay and Silt (CL/ML)	247	25	696.77	1169.26	1977.8	0	1977.8
27	1.41745	2946.51	14.6577	Layer 4 - Clay and Silt (CL/ML)	247	25	690.859	1159.34	1956.53	0	1956.53
28	1.41745	2970.02	16.4878	Layer 4 - Clay and Silt (CL/ML)	247	25	683.398	1146.82	1929.68	0	1929.68
29	1.41745	6532.65	18.3355	Layer 4 - Clay and Silt (CL/ML)	247	25	1301.33	2183.78	4153.45	0	4153.45
30	1.41745	6451	20.2031	Layer 4 - Clay and Silt (CL/ML)	247	25	1263.31	2119.98	4016.63	0	4016.63
31	1.41745	5667.88	22.0934	Layer 4 - Clay and Silt (CL/ML)	247	25	1106.8	1857.35	3453.42	0	3453.42
32	1.41745	5697.1	24.0094	Layer 4 - Clay and Silt (CL/ML)	247	25	1090.88	1830.62	3396.08	0	3396.08
33	1.41745	5715.5	25.9544	Layer 4 - Clay and	247	25	1072.92	1800.49	3331.48	0	3331.48

				Silt (CL/ML)							
34	1.41745	5714.87	27.9322	Layer 4 - Clay and Silt (CL/ML)	247	25	1051.68	1764.84	3255.03	0	3255.03
35	1.41745	5701.55	29.9469	Layer 4 - Clay and Silt (CL/ML)	247	25	1028.25	1725.52	3170.7	0	3170.7
36	1.41745	5676.8	32.0034	Layer 4 - Clay and Silt (CL/ML)	247	25	1002.87	1682.93	3079.35	0	3079.35
37	1.41745	5575.58	34.1071	Layer 4 - Clay and Silt (CL/ML)	247	25	985.978	1654.59	3018.6	0	3018.6
38	1.41745	5389.78	36.2647	Layer 4 - Clay and Silt (CL/ML)	247	25	937.001	1572.4	2842.33	0	2842.33
39	1.62827	5943.12	38.6542	Layer 3 - Sand (SC/SM)	50	39	1239.68	2080.34	2507.26	0	2507.26
40	1.62827	5655.33	41.2984	Layer 3 - Sand (SC/SM)	50	39	1134.61	1904.01	2289.51	0	2289.51
41	1.62827	5340.86	44.0549	Layer 3 - Sand (SC/SM)	50	39	1027.7	1724.61	2067.97	0	2067.97
42	1.43588	4425.21	46.7672	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	820.21	1376.41	1916.23	0	1916.23
43	1.43588	4132.9	49.4438	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	740.233	1242.2	1709.56	0	1709.56
44	1.43588	3812.24	52.2763	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	657.994	1104.19	1497.04	0	1497.04
45	1.43588	3465.59	55.3042	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	574.727	964.461	1281.88	0	1281.88
46	1.43588	3084.36	58.5858	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	488.909	820.448	1060.12	0	1060.12
47	1.43588	2647.04	62.2144	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	399.065	669.679	827.952	0	827.952
48	1.32507	1987.61	66.1694	Layer 2 - Silty Sand (SM)	50	33	275.185	461.793	634.107	0	634.107
49	1.44175	1541.77	70.9574	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	209.691	351.886	338.594	0	338.594
50	1.44175	590.164	78.0333	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	94.4251	158.457	40.7397	0	40.7397

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.69967

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	53.0845	89	0	0	0
2	54.4392	88.1062	427.502	0	0
3	55.7938	87.2821	975.731	0	0
4	57.1485	86.5233	1617.04	0	0
5	58.5032	85.826	2327.2	0	0
6	59.8579	85.1869	3118.43	0	0
7	61.2126	84.6034	3986.93	0	0
8	62.5673	84.0729	4918.89	0	0
9	63.9219	83.5936	5912.32	0	0
10	65.2766	83.1635	6950.68	0	0
11	66.6313	82.7813	8018.33	0	0
12	67.986	82.4456	9101.29	0	0
13	69.3407	82.1553	10183.5	0	0
14	70.6954	81.9096	11251.9	0	0
15	72.0501	81.7076	12297.2	0	0
16	73.4047	81.5487	13311.1	0	0
17	74.7594	81.4325	14286.6	0	0
18	76.1141	81.3587	15219.4	0	0
19	77.4688	81.327	16103.2	0	0
20	78.8235	81.3373	16931.6	0	0
21	80.1782	81.3896	17698.9	0	0
22	81.5329	81.4842	18399.7	0	0
23	82.8875	81.6212	19029.2	0	0
24	84.2422	81.8012	19583.5	0	0
25	85.5969	82.0246	20058.9	0	0
26	86.9516	82.292	20452.2	0	0
27	88.3063	82.6045	20760.7	0	0
28	89.661	82.9628	20982	0	0
29	91.0157	83.3683	21099.7	0	0
30	92.3703	83.8224	20921.5	0	0
31	93.725	84.3266	20605.3	0	0
32	95.0797	84.8828	20148.4	0	0
33	96.4344	85.4932	19505.2	0	0
34	97.7891	86.1605	18671.7	0	0
35	99.1438	86.8875	17645.7	0	0
36	100.498	87.6778	16424.2	0	0
37	101.853	88.5355	15004.2	0	0
38	103.208	89.4654	13349.9	0	0
39	104.563	90.4735	11531	0	0
40	106.158	91.7709	10121.8	0	0
41	107.754	93.201	8489.66	0	0
42	109.35	94.7827	6652.7	0	0
43	110.727	96.2881	4606.41	0	0
44	112.104	97.9468	2459.2	0	0
45	113.48	99.7891	237.666	0	0
46	114.857	101.859	-2018.38	0	0
47	116.234	104.224	-4268.59	0	0
48	117.611	107	-6438.17	0	0
49	118.836	110	-8402.22	0	0
50	120.073	113.953	-9772.07	0	0
51	121.31	120.996	0	0	0

Global Minimum Query (spencer) - Safety Factor: 1.67812

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	50.9153	89	0	0	0
2	52.3328	88.074	690.035	222.618	17.8807
3	53.7503	87.2198	1551.44	500.523	17.8807
4	55.1677	86.4329	2533.87	817.473	17.8807
5	56.5852	85.7094	3598.51	1160.94	17.8806
6	58.0026	85.0461	4715	1521.14	17.8806
7	59.4201	84.4402	5875.36	1895.5	17.8807
8	60.8375	83.8892	7101.75	2291.15	17.8806
9	62.255	83.3911	8372.17	2701.01	17.8806
10	63.6724	82.9441	9686.18	3124.94	17.8807
11	65.0899	82.5466	11026.5	3557.34	17.8806
12	66.5073	82.1973	12374.1	3992.12	17.8807
13	67.9248	81.8952	13713	4424.07	17.8807
14	69.3422	81.6393	15025.3	4847.44	17.8807
15	70.7597	81.4287	16296.5	5257.56	17.8807
16	72.1771	81.2629	17517.6	5651.49	17.8806
17	73.5946	81.1415	18680.6	6026.7	17.8806
18	75.012	81.0639	19779.9	6381.34	17.8806
19	76.4295	81.0301	20812.2	6714.4	17.8807
20	77.8469	81.0399	21772	7024.03	17.8806
21	79.2644	81.0933	22654.1	7308.62	17.8806
22	80.6818	81.1906	23454.2	7566.74	17.8806
23	82.0993	81.3319	24168.2	7797.11	17.8807
24	83.5168	81.5177	24793.5	7998.83	17.8806
25	84.9342	81.7485	25327.7	8171.17	17.8806
26	86.3517	82.0251	25769.1	8313.58	17.8806
27	87.7691	82.3483	26116.6	8425.69	17.8806
28	89.1866	82.719	26369.5	8507.27	17.8806
29	90.604	83.1385	26527.6	8558.27	17.8806
30	92.0215	83.6083	26419.1	8523.29	17.8807
31	93.4389	84.1299	26112.8	8424.48	17.8807
32	94.8564	84.7053	25693	8289.04	17.8807
33	96.2738	85.3366	25093.5	8095.62	17.8806
34	97.6913	86.0266	24314.2	7844.21	17.8807
35	99.1087	86.7781	23357.2	7535.44	17.8806
36	100.526	87.5947	22223.9	7169.83	17.8806
37	101.944	88.4806	20916.1	6747.91	17.8806
38	103.361	89.4405	19405.5	6260.57	17.8807
39	104.779	90.4804	17767.4	5732.07	17.8806
40	106.407	91.7827	16507.8	5325.71	17.8806
41	108.035	93.2131	15067.8	4861.14	17.8806
42	109.663	94.7885	13470.8	4345.94	17.8807
43	111.099	96.3158	11711.3	3778.28	17.8807
44	112.535	97.9937	9895.27	3192.39	17.8806
45	113.971	99.8499	8050.87	2597.36	17.8807
46	115.407	101.924	6216.64	2005.6	17.8806
47	116.843	104.275	4425.55	1427.76	17.8806
48	118.279	107	2741.76	884.54	17.8806
49	119.604	110	1203.7	388.336	17.8807
50	121.045	114.177	91.3203	29.4616	17.8807
51	122.487	120.979	0	0	0

List Of Coordinates

Distributed Load

X	Y
133.433	120.827
121	121
118.56	121
113.968	121
101.982	121.784

Focus Search Window

X	Y
70.8988	89.9362
70.8988	75.8672
108.482	75.8672
108.482	89.9362

External Boundary

X	Y
0	60
121	60
193	60
220	64
220	68
220	92
220	96
220	107
220	110.388
220	119
193	120
121	121
118.56	121
113.968	121
101.982	121.784
97.0842	119.346
92.811	117.009
90.8048	117.009
90.8048	110
90.8048	107
90.8048	100.732
79.624	96.525
74.031	94.3591
67.879	92.274
61.6349	89.82
58.035	88.918
58	89
0	89
0	70
0	64

Material Boundary

X	Y
74.031	94.3591
84.162	94.3591
90.8048	94.4747
92.836	94.4747
121	95
193	96
220	96

Material Boundary

X	Y
90.8048	107
92.836	107
121	107
193	107
220	107

Material Boundary

X	Y
0	70
220	68

Material Boundary

X	Y
0	64
220	64

Material Boundary

X	Y
90.8048	110
92.811	110
121	110
193	112
220	110.388

Material Boundary

X	Y
61.6349	89.82
84.162	89.82
90.8048	90.0328
92.8409	90.098
121	91
193	93
220	92

Material Boundary

X	Y
92.811	110
92.811	117.009

Material Boundary

X	Y
92.811	110
92.836	107

Material Boundary

X	Y
90.8048	94.4747
90.8048	100.732

Material Boundary

X	Y
92.836	94.4747
93.068	94.4747

Material Boundary

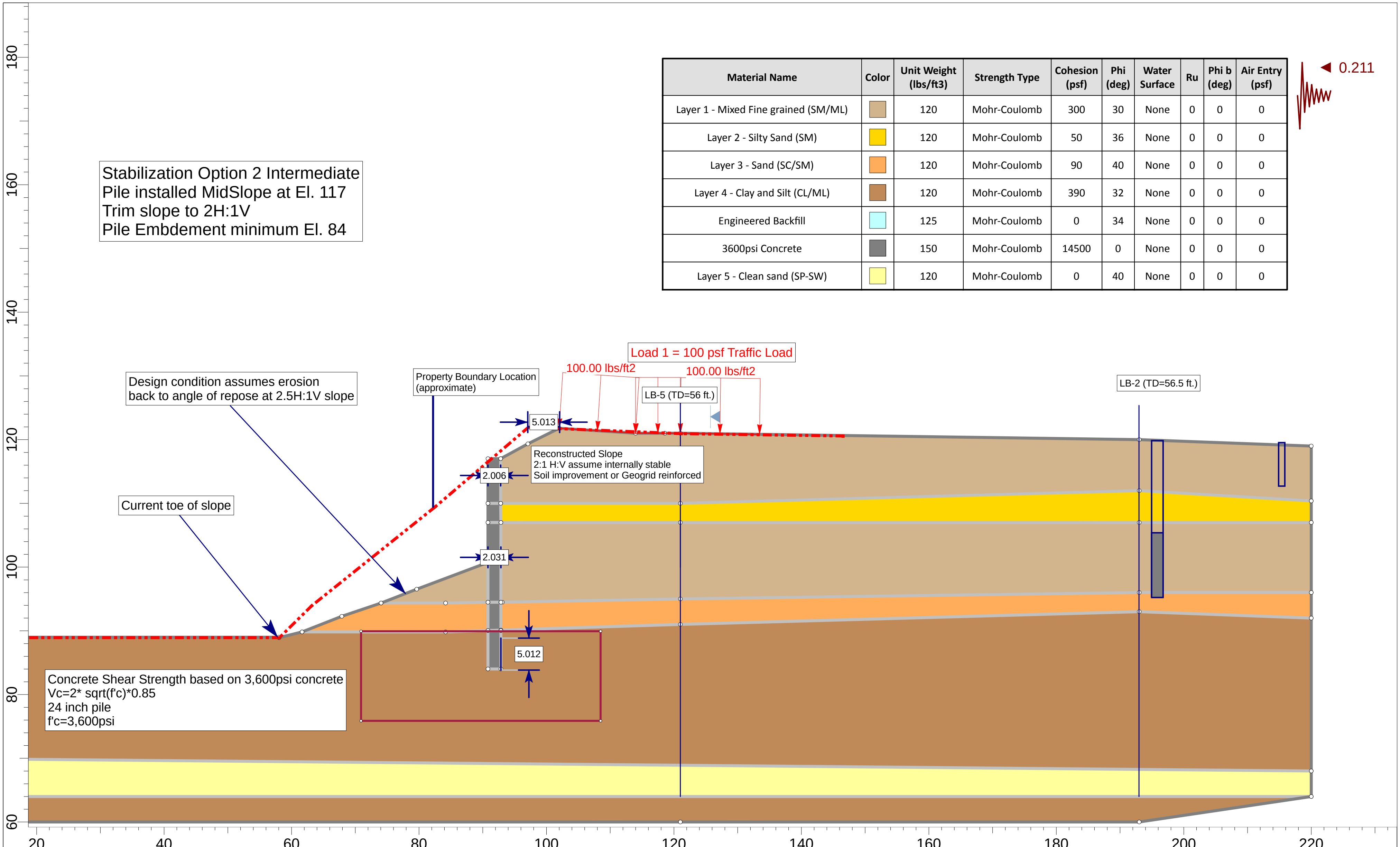
X	Y
92.836	94.4747
92.836	107

Material Boundary

X	Y
90.8048	94.4747
90.8048	90.0328
92.841	90.0328
92.8409	90.098
92.836	94.4747

Material Boundary

X	Y
90.8048	90.0328
90.8048	84.009
92.841	84.009
92.841	90.0328

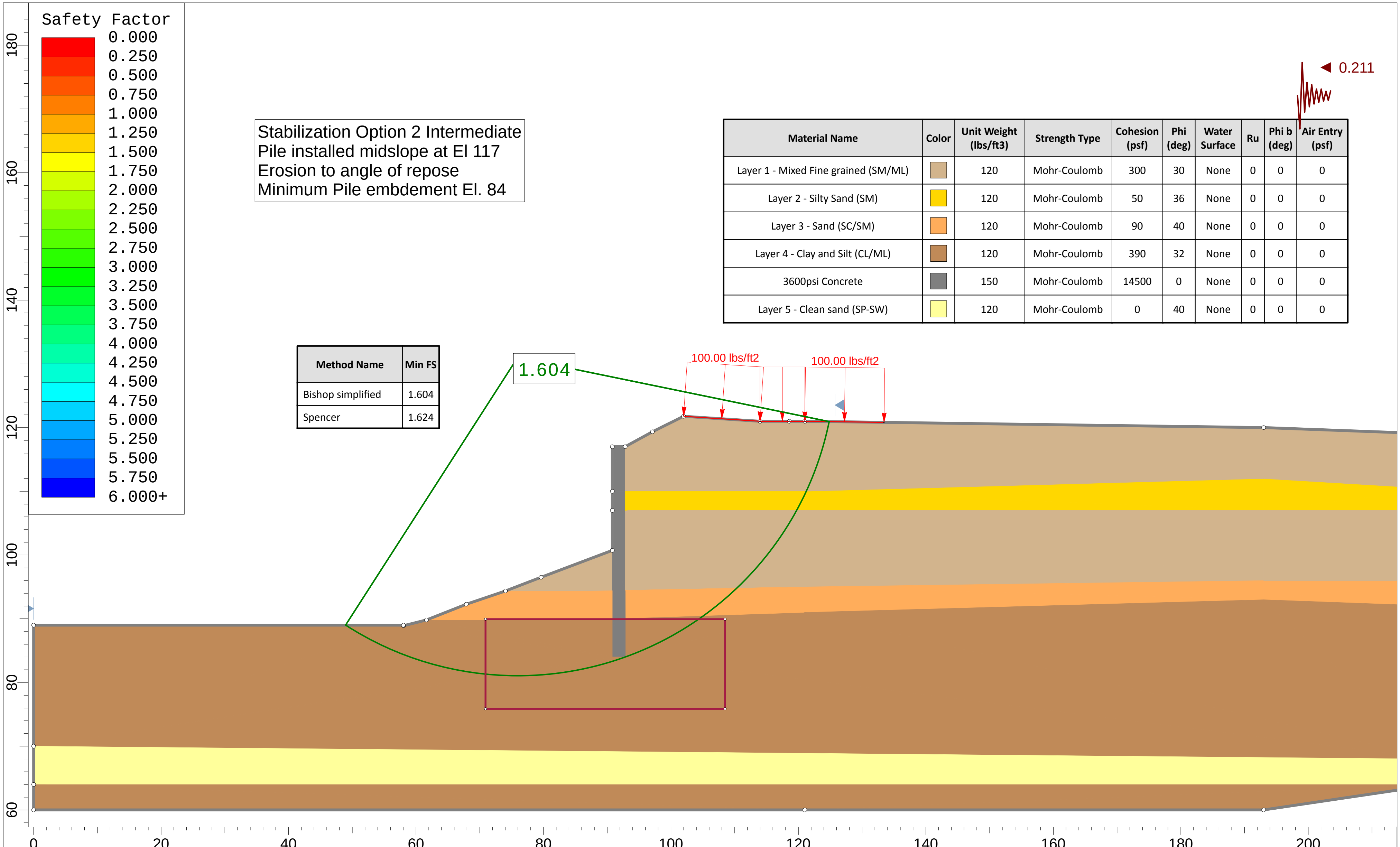


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Phi b (deg)	Air Entry (psf)
Layer 1 - Mixed Fine grained (SM/ML)		120	Mohr-Coulomb	300	30	None	0	0	0
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	36	None	0	0	0
Layer 3 - Sand (SC/SM)		120	Mohr-Coulomb	90	40	None	0	0	0
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	390	32	None	0	0	0
Engineered Backfill		125	Mohr-Coulomb	0	34	None	0	0	0
3600psi Concrete		150	Mohr-Coulomb	14500	0	None	0	0	0
Layer 5 - Clean sand (SP-SW)		120	Mohr-Coulomb	0	40	None	0	0	0

Project	Goleta Fire Station #10
Analysis Description	A-A' Seismic Analysis - Circular failure, Stabilized condition
Drawn By	LD
Scale	1:250
Company	Leighton
Date	7/29/2016, 6:01:40 PM
File Name	5_1a_AA_11389001_Option 2 Embedment_Seismic.slim

Leighton

SLIDE 7.018



Method Name	Min FS
Bishop simplified	1.604
Spencer	1.624

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Phi b (deg)	Air Entry (psf)
Layer 1 - Mixed Fine grained (SM/ML)		120	Mohr-Coulomb	300	30	None	0	0	0
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	36	None	0	0	0
Layer 3 - Sand (SC/SM)		120	Mohr-Coulomb	90	40	None	0	0	0
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	390	32	None	0	0	0
3600psi Concrete		150	Mohr-Coulomb	14500	0	None	0	0	0
Layer 5 - Clean sand (SP-SW)		120	Mohr-Coulomb	0	40	None	0	0	0

Project	Goleta Fire Station #10
Analysis Description	A-A' Static Analysis - Circular failure, Stabilized condition
Drawn By	LD
Scale	1:250
Company	Leighton
Date	7/29/2016, 6:01:40 PM
File Name	5_1a_AA_11389001_Option 2 Embedment_Seismic.slim

Leighton

SLIDEINTERPRET 7.018

Slide Analysis Information
Goleta Fire Station #10

Project Summary

File Name:	5_1a_AA_11389001_Option 2 Embedment_Seismic
Slide Modeler Version:	7.018
Project Title:	Goleta Fire Station #10
Analysis:	A-A' Static Analysis - Circular failure, Stabilized condition
Author:	LD
Company:	Leighton
Date Created:	7/29/2016, 6:01:40 PM
Comments	
	Final condition - Option 2
	Backfill/traffic loads under static condition

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	No
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Slope Search
Number of Surfaces:	10000
Upper Angle:	Not Defined
Lower Angle:	Not Defined
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal): 0.211

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	100
Orientation:	Normal to boundary

Material Properties

Property	Layer 1 - Mixed Fine grained (SM/ML)	Layer 2 - Silty Sand (SM)	Layer 3 - Sand (SC/SM)	Layer 4 - Clay and Silt (CL/ML)	3600psi Concrete	Layer 5 - Clean sand (SP-SW)
Color						
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	120	120	150	120
Cohesion [psf]	300	50	90	390	14500	0
Friction Angle [deg]	30	36	40	32	0	40
Water Surface	None	None	None	None	None	None
Ru Value	0	0	0	0	0	0
Unsat. Shear Strength Phi b [deg]	0	0	0	0	0	0
Unsat. Shear Strength Air Entry Value [psf]	0	0	0	0	0	0

Global Minimums

Method: bishop simplified

FS	1.603960
Center:	75.945, 130.994
Radius:	49.924
Left Slip Surface Endpoint:	48.946, 89.000
Right Slip Surface Endpoint:	124.848, 120.947
Resisting Moment:	6.58059e+006 lb-ft
Driving Moment:	4.10272e+006 lb-ft
Total Slice Area:	1297.09 ft2
Surface Horizontal Width:	75.9012 ft
Surface Average Height:	17.0892 ft

Method: spencer

FS	1.623910
Center:	75.945, 130.994
Radius:	49.924
Left Slip Surface Endpoint:	48.946, 89.000
Right Slip Surface Endpoint:	124.848, 120.947
Resisting Moment:	6.66246e+006 lb-ft
Driving Moment:	4.10272e+006 lb-ft
Resisting Horizontal Force:	115551 lb
Driving Horizontal Force:	71155.9 lb
Total Slice Area:	1297.09 ft2
Surface Horizontal Width:	75.9012 ft
Surface Average Height:	17.0892 ft

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 2371
Number of Invalid Surfaces: 7629

Error Codes:

Error Code -103 reported for 409 surfaces
Error Code -105 reported for 2 surfaces
Error Code -112 reported for 15 surfaces
Error Code -114 reported for 6877 surfaces
Error Code -118 reported for 326 surfaces

Method: spencer

Number of Valid Surfaces: 2010
Number of Invalid Surfaces: 7990

Error Codes:

Error Code -103 reported for 409 surfaces
Error Code -105 reported for 2 surfaces
Error Code -108 reported for 147 surfaces
Error Code -111 reported for 212 surfaces
Error Code -112 reported for 17 surfaces
Error Code -114 reported for 6877 surfaces
Error Code -118 reported for 326 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-105 = More than two surface / slope intersections with no valid slip surface.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-111 = safety factor equation did not converge
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
-114 = Surface with Reverse Curvature.
-118 = Surface does not pass through the search focus

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.60396

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.51296	84.8807	-31.7171	Layer 4 - Clay and Silt (CL/ML)	390	32	348.733	559.354	271.023	0	271.023
2	1.51296	248.09	-29.6969	Layer 4 - Clay and Silt (CL/ML)	390	32	394.418	632.63	388.29	0	388.29
3	1.51296	398.576	-27.7167	Layer 4 - Clay and Silt (CL/	390	32	434.453	696.846	491.056	0	491.056

				ML)							
4	1.51296	537.044	-25.7718	Layer 4 - Clay and Silt (CL/ ML)	390	32	469.495	753.052	581.005	0	581.005
5	1.51296	664.096	-23.8584	Layer 4 - Clay and Silt (CL/ ML)	390	32	500.07	802.092	659.486	0	659.486
6	1.51296	780.171	-21.9728	Layer 4 - Clay and Silt (CL/ ML)	390	32	526.576	844.607	727.525	0	727.525
7	1.51296	905.004	-20.112	Layer 4 - Clay and Silt (CL/ ML)	390	32	555.158	890.451	800.893	0	800.893
8	1.51296	1069.45	-18.2731	Layer 4 - Clay and Silt (CL/ ML)	390	32	594.83	954.083	902.724	0	902.724
9	1.51296	1231.55	-16.4534	Layer 4 - Clay and Silt (CL/ ML)	390	32	632.877	1015.11	1000.38	0	1000.38
10	1.51296	1413.04	-14.6508	Layer 4 - Clay and Silt (CL/ ML)	390	32	675.617	1083.66	1110.09	0	1110.09
11	1.51296	1588.27	-12.8628	Layer 4 - Clay and Silt (CL/ ML)	390	32	715.6	1147.79	1212.72	0	1212.72
12	1.51296	1754.5	-11.0875	Layer 4 - Clay and Silt (CL/ ML)	390	32	752.187	1206.48	1306.64	0	1306.64
13	1.51296	1910.16	-9.32297	Layer 4 - Clay and Silt (CL/ ML)	390	32	785.074	1259.23	1391.06	0	1391.06
14	1.51296	2046.01	-7.5673	Layer 4 - Clay and Silt (CL/ ML)	390	32	811.887	1302.24	1459.88	0	1459.88
15	1.51296	2171.35	-5.81875	Layer 4 - Clay and Silt (CL/ ML)	390	32	835.331	1339.84	1520.06	0	1520.06
16	1.51296	2288.23	-4.07563	Layer 4 - Clay and Silt (CL/ ML)	390	32	856.054	1373.08	1573.25	0	1573.25
17	1.51296	2397.89	-2.33628	Layer 4 - Clay and Silt (CL/ ML)	390	32	874.454	1402.59	1620.48	0	1620.48
18	1.51296	2509.07	-0.599089	Layer 4 - Clay and Silt (CL/ ML)	390	32	892.853	1432.1	1667.7	0	1667.7
19	1.51296	2614.15	1.13755	Layer 4 - Clay and Silt (CL/ ML)	390	32	909.268	1458.43	1709.84	0	1709.84
20	1.51296	2710.9	2.87524	Layer 4 - Clay and Silt (CL/ ML)	390	32	923.178	1480.74	1745.55	0	1745.55
21	1.51296	2798.49	4.61558	Layer 4 - Clay and Silt (CL/ ML)	390	32	934.444	1498.81	1774.46	0	1774.46
22	1.51296	2875.57	6.36021	Layer 4 - Clay and Silt (CL/ ML)	390	32	942.773	1512.17	1795.84	0	1795.84

23	1.51296	2944.04	8.11078	Layer 4 - Clay and Silt (CL/ ML)	390	32	948.702	1521.68	1811.07	0	1811.07
24	1.51296	3003.93	9.86902	Layer 4 - Clay and Silt (CL/ ML)	390	32	952.287	1527.43	1820.27	0	1820.27
25	1.51296	3055.11	11.6367	Layer 4 - Clay and Silt (CL/ ML)	390	32	953.54	1529.44	1823.48	0	1823.48
26	1.51296	3097.42	13.4157	Layer 4 - Clay and Silt (CL/ ML)	390	32	952.461	1527.71	1820.72	0	1820.72
27	1.51296	3130.68	15.208	Layer 4 - Clay and Silt (CL/ ML)	390	32	949.057	1522.25	1811.98	0	1811.98
28	1.51296	4633.23	17.0157	Layer 4 - Clay and Silt (CL/ ML)	390	32	1283.58	2058.81	2670.66	0	2670.66
29	1.51296	7533.36	18.841	Layer 4 - Clay and Silt (CL/ ML)	390	32	1927.45	3091.55	4323.38	0	4323.38
30	0.0189605	86.3148	19.7699	3600psi Concrete	14500	0	9040.13	14500	1312.19	0	1312.19
31	1.53661	6110.54	20.7243	Layer 4 - Clay and Silt (CL/ ML)	390	32	1562.68	2506.47	3387.05	0	3387.05
32	1.53661	6152.86	22.6224	Layer 4 - Clay and Silt (CL/ ML)	390	32	1551.87	2489.13	3359.3	0	3359.3
33	1.53661	6183.68	24.5471	Layer 4 - Clay and Silt (CL/ ML)	390	32	1538.02	2466.92	3323.77	0	3323.77
34	1.53661	6193.43	26.5018	Layer 4 - Clay and Silt (CL/ ML)	390	32	1519.12	2436.6	3275.24	0	3275.24
35	1.53661	6186.97	28.4905	Layer 4 - Clay and Silt (CL/ ML)	390	32	1496.26	2399.94	3216.57	0	3216.57
36	1.53661	6167.43	30.5174	Layer 4 - Clay and Silt (CL/ ML)	390	32	1471.76	2360.64	3153.68	0	3153.68
37	1.53661	6046.67	32.5875	Layer 4 - Clay and Silt (CL/ ML)	390	32	1454.04	2332.23	3108.22	0	3108.22
38	1.53661	5839.45	34.7067	Layer 4 - Clay and Silt (CL/ ML)	390	32	1388.89	2227.72	2940.97	0	2940.97
39	1.73282	6316.33	37.025	Layer 3 - Sand (SC/SM)	90	40	1446.28	2319.77	2657.34	0	2657.34
40	1.73282	6008.04	39.5604	Layer 3 - Sand (SC/SM)	90	40	1343.34	2154.67	2460.58	0	2460.58
41	1.73282	5672.33	42.1925	Layer 3 - Sand (SC/SM)	90	40	1236.28	1982.94	2255.92	0	2255.92
42	1.56547	4810.69	44.8008	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	979.881	1571.69	2202.64	0	2202.64
				Layer 1 -							

				Mixed Fine grained (SM/ ML)							
44	1.56547	4134.86	50.1224	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	821.03	1316.9	1761.32	0	1761.32
45	1.56547	3762.61	53.0171	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	736.934	1182.01	1527.69	0	1527.69
46	1.56547	3348.35	56.1223	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	647.021	1037.8	1277.9	0	1277.9
47	1.56547	2879.67	59.5045	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	549.97	882.13	1008.28	0	1008.28
48	1.51829	2276.77	63.2082	Layer 2 - Silty Sand (SM)	50	36	398.899	639.818	811.814	0	811.814
49	1.80205	1894.21	67.8898	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	319.293	512.134	367.427	0	367.427
50	1.80205	705.954	74.514	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	158.588	254.369	-79.0353	0	-79.0353

Global Minimum Query (spencer) - Safety Factor: 1.62391

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.51296	84.8807	-31.7171	Layer 4 - Clay and Silt (CL/ ML)	390	32	666.743	1082.73	1108.6	0	1108.6
2	1.51296	248.09	-29.6969	Layer 4 - Clay and Silt (CL/ ML)	390	32	721.05	1170.92	1249.73	0	1249.73
3	1.51296	398.576	-27.7167	Layer 4 - Clay and Silt (CL/ ML)	390	32	757.837	1230.66	1345.33	0	1345.33
4	1.51296	537.044	-25.7718	Layer 4 - Clay and Silt (CL/ ML)	390	32	782.679	1271	1409.9	0	1409.9
5	1.51296	664.096	-23.8584	Layer 4 - Clay and Silt (CL/ ML)	390	32	799.014	1297.53	1452.35	0	1452.35
6	1.51296	780.171	-21.9728	Layer 4 - Clay and Silt (CL/ ML)	390	32	808.998	1313.74	1478.29	0	1478.29
7	1.51296	905.004	-20.112	Layer 4 - Clay and Silt (CL/ ML)	390	32	823.063	1336.58	1514.84	0	1514.84
8	1.51296	1069.45	-18.2731	Layer 4 - Clay and Silt (CL/	390	32	853.927	1386.7	1595.05	0	1595.05

				ML)							
9	1.51296	1231.55	-16.4534	Layer 4 - Clay and Silt (CL/ ML)	390	32	881.44	1431.38	1666.55	0	1666.55
10	1.51296	1413.04	-14.6508	Layer 4 - Clay and Silt (CL/ ML)	390	32	914.657	1485.32	1752.88	0	1752.88
11	1.51296	1588.27	-12.8628	Layer 4 - Clay and Silt (CL/ ML)	390	32	943.162	1531.61	1826.96	0	1826.96
12	1.51296	1754.5	-11.0875	Layer 4 - Clay and Silt (CL/ ML)	390	32	966.599	1569.67	1887.86	0	1887.86
13	1.51296	1910.16	-9.32297	Layer 4 - Clay and Silt (CL/ ML)	390	32	985.03	1599.6	1935.76	0	1935.76
14	1.51296	2046.01	-7.5673	Layer 4 - Clay and Silt (CL/ ML)	390	32	995.96	1617.35	1964.16	0	1964.16
15	1.51296	2171.35	-5.81875	Layer 4 - Clay and Silt (CL/ ML)	390	32	1003.12	1628.97	1982.76	0	1982.76
16	1.51296	2288.23	-4.07563	Layer 4 - Clay and Silt (CL/ ML)	390	32	1007.46	1636.02	1994.05	0	1994.05
17	1.51296	2397.89	-2.33628	Layer 4 - Clay and Silt (CL/ ML)	390	32	1009.56	1639.44	1999.52	0	1999.52
18	1.51296	2509.07	-0.599089	Layer 4 - Clay and Silt (CL/ ML)	390	32	1012.06	1643.5	2006.02	0	2006.02
19	1.51296	2614.15	1.13755	Layer 4 - Clay and Silt (CL/ ML)	390	32	1012.75	1644.62	2007.82	0	2007.82
20	1.51296	2710.9	2.87524	Layer 4 - Clay and Silt (CL/ ML)	390	32	1011.13	1641.99	2003.6	0	2003.6
21	1.51296	2798.49	4.61558	Layer 4 - Clay and Silt (CL/ ML)	390	32	1007.12	1635.48	1993.18	0	1993.18
22	1.51296	2875.57	6.36021	Layer 4 - Clay and Silt (CL/ ML)	390	32	1000.52	1624.76	1976.02	0	1976.02
23	1.51296	2944.04	8.11078	Layer 4 - Clay and Silt (CL/ ML)	390	32	991.958	1610.85	1953.76	0	1953.76
24	1.51296	3003.93	9.86902	Layer 4 - Clay and Silt (CL/ ML)	390	32	981.526	1593.91	1926.66	0	1926.66
25	1.51296	3055.11	11.6367	Layer 4 - Clay and Silt (CL/ ML)	390	32	969.302	1574.06	1894.89	0	1894.89
26	1.51296	3097.42	13.4157	Layer 4 - Clay and Silt (CL/ ML)	390	32	955.336	1551.38	1858.59	0	1858.59
27	1.51296	3130.68	15.208	Layer 4 - Clay and Silt (CL/ ML)	390	32	939.664	1525.93	1817.88	0	1817.88

28	1.51296	4633.23	17.0157	Layer 4 - Clay and Silt (CL/ ML)	390	32	1234.6	2004.88	2584.35	0	2584.35
29	1.51296	7533.36	18.841	Layer 4 - Clay and Silt (CL/ ML)	390	32	1799.42	2922.09	4052.19	0	4052.19
30	0.0189605	86.3148	19.7699	3600psi Concrete	14500	0	8929.07	14500	4467.61	0	4467.61
31	1.53661	6110.54	20.7243	Layer 4 - Clay and Silt (CL/ ML)	390	32	1449.36	2353.63	3142.46	0	3142.46
32	1.53661	6152.86	22.6224	Layer 4 - Clay and Silt (CL/ ML)	390	32	1419.78	2305.59	3065.59	0	3065.59
33	1.53661	6183.68	24.5471	Layer 4 - Clay and Silt (CL/ ML)	390	32	1388.22	2254.35	2983.58	0	2983.58
34	1.53661	6193.43	26.5018	Layer 4 - Clay and Silt (CL/ ML)	390	32	1353.02	2197.19	2892.1	0	2892.1
35	1.53661	6186.97	28.4905	Layer 4 - Clay and Silt (CL/ ML)	390	32	1315.21	2135.79	2793.85	0	2793.85
36	1.53661	6167.43	30.5174	Layer 4 - Clay and Silt (CL/ ML)	390	32	1276.89	2073.55	2694.23	0	2694.23
37	1.53661	6046.67	32.5875	Layer 4 - Clay and Silt (CL/ ML)	390	32	1246.5	2024.2	2615.26	0	2615.26
38	1.53661	5839.45	34.7067	Layer 4 - Clay and Silt (CL/ ML)	390	32	1176.97	1911.3	2434.58	0	2434.58
39	1.73282	6316.33	37.025	Layer 3 - Sand (SC/SM)	90	40	1203.27	1954	2221.43	0	2221.43
40	1.73282	6008.04	39.5604	Layer 3 - Sand (SC/SM)	90	40	1097.07	1781.54	2015.9	0	2015.9
41	1.73282	5672.33	42.1925	Layer 3 - Sand (SC/SM)	90	40	990.738	1608.87	1810.12	0	1810.12
42	1.56547	4810.69	44.8008	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	772.534	1254.53	1653.28	0	1653.28
43	1.56547	4485.56	47.394	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	704.184	1143.53	1461.04	0	1461.04
44	1.56547	4134.86	50.1224	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	635.559	1032.09	1268.02	0	1268.02
45	1.56547	3762.61	53.0171	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	566.719	920.301	1074.4	0	1074.4
46	1.56547	3348.35	56.1223	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	495.996	805.453	875.469	0	875.469

47	1.56547	2879.67	59.5045	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	423.237	687.299	670.823	0	670.823
48	1.51829	2276.77	63.2082	Layer 2 - Silty Sand (SM)	50	36	266.622	432.97	527.112	0	527.112
49	1.80205	1894.21	67.8898	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	266.458	432.704	229.85	0	229.85
50	1.80205	705.954	74.514	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	179.727	291.86	-14.099	0	-14.099

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.60396

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	48.9463	89	0	0	0
2	50.4593	88.065	761.644	0	0
3	51.9723	87.2021	1639.4	0	0
4	53.4852	86.4072	2601.09	0	0
5	54.9982	85.6767	3620.52	0	0
6	56.5111	85.0076	4676.13	0	0
7	58.0241	84.3972	5750.07	0	0
8	59.537	83.8431	6840.4	0	0
9	61.05	83.3436	7963.14	0	0
10	62.5629	82.8967	9105.1	0	0
11	64.0759	82.5012	10265.3	0	0
12	65.5888	82.1557	11428.8	0	0
13	67.1018	81.8593	12580.8	0	0
14	68.6148	81.6109	13707.8	0	0
15	70.1277	81.4099	14794.4	0	0
16	71.6407	81.2557	15830.8	0	0
17	73.1536	81.1479	16809.2	0	0
18	74.6666	81.0862	17722.5	0	0
19	76.1795	81.0704	18566.5	0	0
20	77.6925	81.1004	19335.4	0	0
21	79.2054	81.1764	20023.6	0	0
22	80.7184	81.2985	20626.2	0	0
23	82.2314	81.4672	21138.9	0	0
24	83.7443	81.6828	21558.5	0	0
25	85.2573	81.946	21882.3	0	0
26	86.7702	82.2576	22108.1	0	0
27	88.2832	82.6184	22234.5	0	0
28	89.7961	83.0297	22260.6	0	0
29	91.3091	83.4927	21983	0	0
30	92.822	84.009	21069.4	0	0
31	92.841	84.0158	21213.1	0	0
32	94.3776	84.5972	20349.1	0	0
33	95.9142	85.2375	19277.7	0	0
34	97.4508	85.9393	17997	0	0
35	98.9874	86.7055	16508.5	0	0
36	100.524	87.5395	14813.2	0	0
37	102.061	88.4453	12910	0	0
38	103.597	89.4275	10799.2	0	0
39	105.134	90.4918	8555.21	0	0
40	106.867	91.7987	6237.2	0	0
41	108.6	93.2302	3757.1	0	0
42	110.332	94.801	1141.51	0	0
43	111.898	96.3557	-1778.38	0	0
44	113.463	98.0577	-4708.66	0	0
45	115.029	99.9315	-7603.04	0	0
46	116.594	102.01	-10422.2	0	0
47	118.16	104.342	-13098.3	0	0
48	119.725	107	-15527.4	0	0
49	121.243	110.007	-17845.2	0	0
50	123.046	114.442	-19303.4	0	0
51	124.848	120.947	0	0	0

Global Minimum Query (spencer) - Safety Factor: 1.62391

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	48.9463	89	0	0	0
2	50.4593	88.065	2028.88	998.886	26.2126
3	51.9723	87.2021	4147.36	2041.89	26.2126
4	53.4852	86.4072	6280.85	3092.28	26.2126
5	54.9982	85.6767	8383.28	4127.38	26.2126
6	56.5111	85.0076	10425.6	5132.87	26.2126
7	58.0241	84.3972	12389.1	6099.57	26.2126
8	59.537	83.8431	14284.4	7032.71	26.2126
9	61.05	83.3436	16149.4	7950.92	26.2127
10	62.5629	82.8967	17969.7	8847.1	26.2126
11	64.0759	82.5012	19750.7	9723.94	26.2126
12	65.5888	82.1557	21475.7	10573.2	26.2126
13	67.1018	81.8593	23129.8	11387.6	26.2126
14	68.6148	81.6109	24700	12160.6	26.2125
15	70.1277	81.4099	26172	12885.4	26.2127
16	71.6407	81.2557	27539.4	13558.6	26.2126
17	73.1536	81.1479	28798	14178.2	26.2125
18	74.6666	81.0862	29945	14743	26.2127
19	76.1795	81.0704	30980.8	15252.9	26.2126
20	77.6925	81.1004	31903.3	15707.1	26.2126
21	79.2054	81.1764	32711	16104.8	26.2127
22	80.7184	81.2985	33403	16445.5	26.2127
23	82.2314	81.4672	33978.9	16729	26.2126
24	83.7443	81.6828	34439.4	16955.7	26.2126
25	85.2573	81.946	34785.6	17126.1	26.2125
26	86.7702	82.2576	35019.2	17241.1	26.2125
27	88.2832	82.6184	35142.3	17301.8	26.2127
28	89.7961	83.0297	35157.8	17309.4	26.2126
29	91.3091	83.4927	34854.2	17159.9	26.2126
30	92.822	84.009	33899	16689.6	26.2126
31	92.841	84.0158	34019.9	16749.2	26.2127
32	94.3776	84.5972	33133.8	16312.9	26.2126
33	95.9142	85.2375	32057.4	15782.9	26.2125
34	97.4508	85.9393	30794.9	15161.4	26.2126
35	98.9874	86.7055	29354.3	14452.1	26.2126
36	100.524	87.5395	27742.7	13658.7	26.2126
37	102.061	88.4453	25965.4	12783.6	26.2125
38	103.597	89.4275	24028.8	11830.2	26.2126
39	105.134	90.4918	22006.7	10834.7	26.2127
40	106.867	91.7987	19847.3	9771.53	26.2127
41	108.6	93.2302	17586.3	8658.33	26.2126
42	110.332	94.801	15254	7510.05	26.2126
43	111.898	96.3557	12869.5	6336.11	26.2127
44	113.463	98.0577	10530	5184.28	26.2126
45	115.029	99.9315	8274.62	4073.88	26.2126
46	116.594	102.01	6135.78	3020.86	26.2126
47	118.16	104.342	4165.59	2050.86	26.2126
48	119.725	107	2438.36	1200.49	26.2126
49	121.243	110.007	778.111	383.091	26.2126
50	123.046	114.442	-162.747	-80.126	26.2126
51	124.848	120.947	0	0	0

List Of Coordinates

Distributed Load

X	Y
133.433	120.827
121	121
118.56	121
113.968	121
101.982	121.784

Focus Search Window

X	Y
70.8988	89.9362
70.8988	75.8672
108.482	75.8672
108.482	89.9362

External Boundary

X	Y
0	60
121	60
193	60
220	64
220	68
220	92
220	96
220	107
220	110.388
220	119
193	120
121	121
118.56	121
113.968	121
101.982	121.784
97.0842	119.346
92.811	117.009
90.8048	117.009
90.8048	110
90.8048	107
90.8048	100.732
79.624	96.525
74.031	94.3591
67.879	92.274
61.6349	89.82
58.035	88.918
58	89
0	89
0	70
0	64

Material Boundary

X	Y
74.031	94.3591
84.162	94.3591
90.8048	94.4747
92.836	94.4747
121	95
193	96
220	96

Material Boundary

X	Y
90.8048	107
92.836	107
121	107
193	107
220	107

Material Boundary

X	Y
0	70
220	68

Material Boundary

X	Y
0	64
220	64

Material Boundary

X	Y
90.8048	110
92.811	110
121	110
193	112
220	110.388

Material Boundary

X	Y
61.6349	89.82
84.162	89.82
90.8048	90.0328
92.8409	90.098
121	91
193	93
220	92

Material Boundary

X	Y
92.811	110
92.811	117.009

Material Boundary

X	Y
92.811	110
92.836	107

Material Boundary

X	Y
90.8048	94.4747
90.8048	100.732

Material Boundary

X	Y
92.836	94.4747
93.068	94.4747

Material Boundary

X	Y
92.836	94.4747
92.836	107

Material Boundary

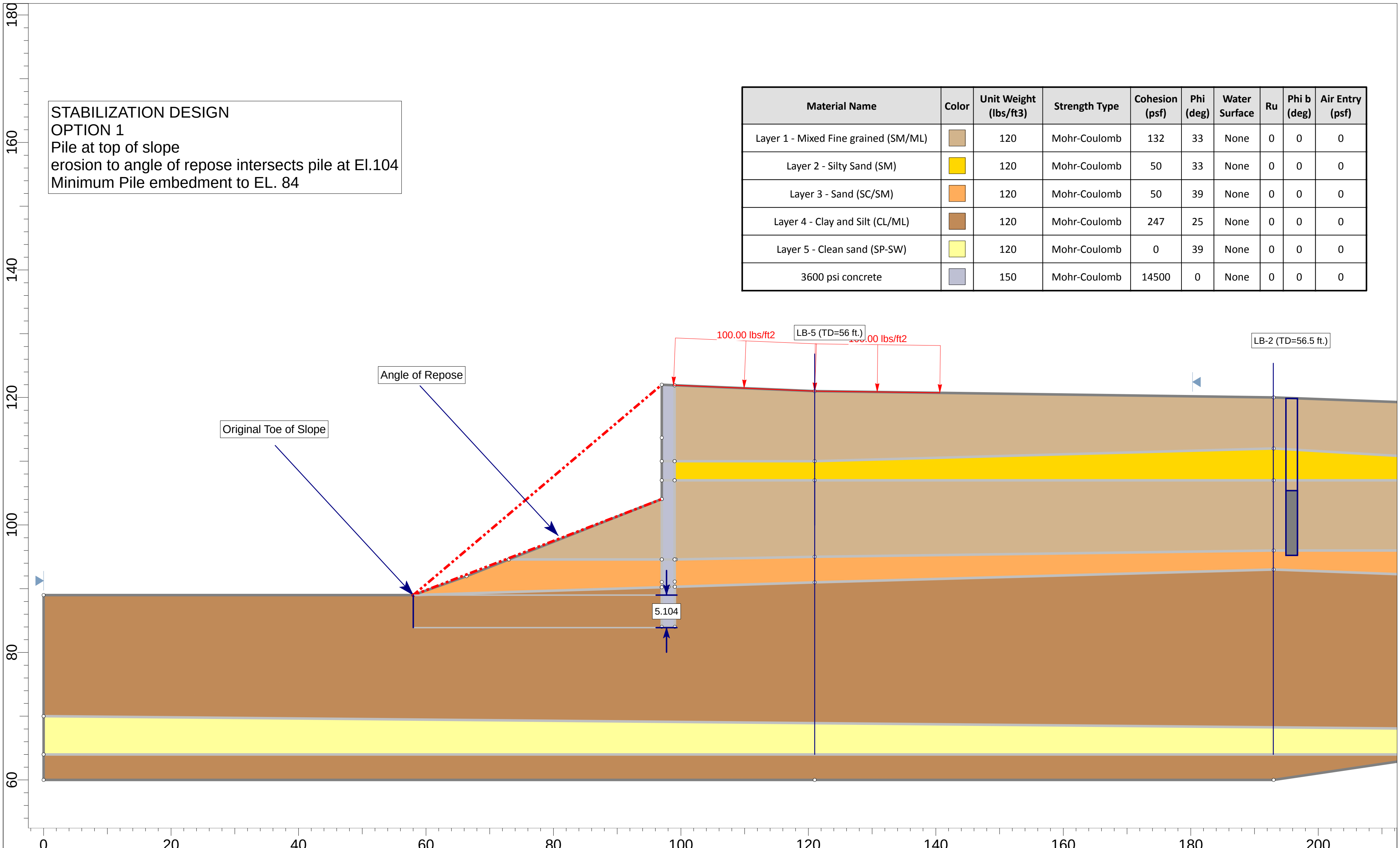
X	Y
90.8048	94.4747
90.8048	90.0328
92.841	90.0328
92.8409	90.098
92.836	94.4747

Material Boundary

X	Y
90.8048	90.0328
90.8048	84.009
92.841	84.009
92.841	90.0328

STABILIZATION DESIGN
OPTION 1
Pile at top of slope
erosion to angle of repose intersects pile at El.104
Minimum Pile embedment to EL. 84

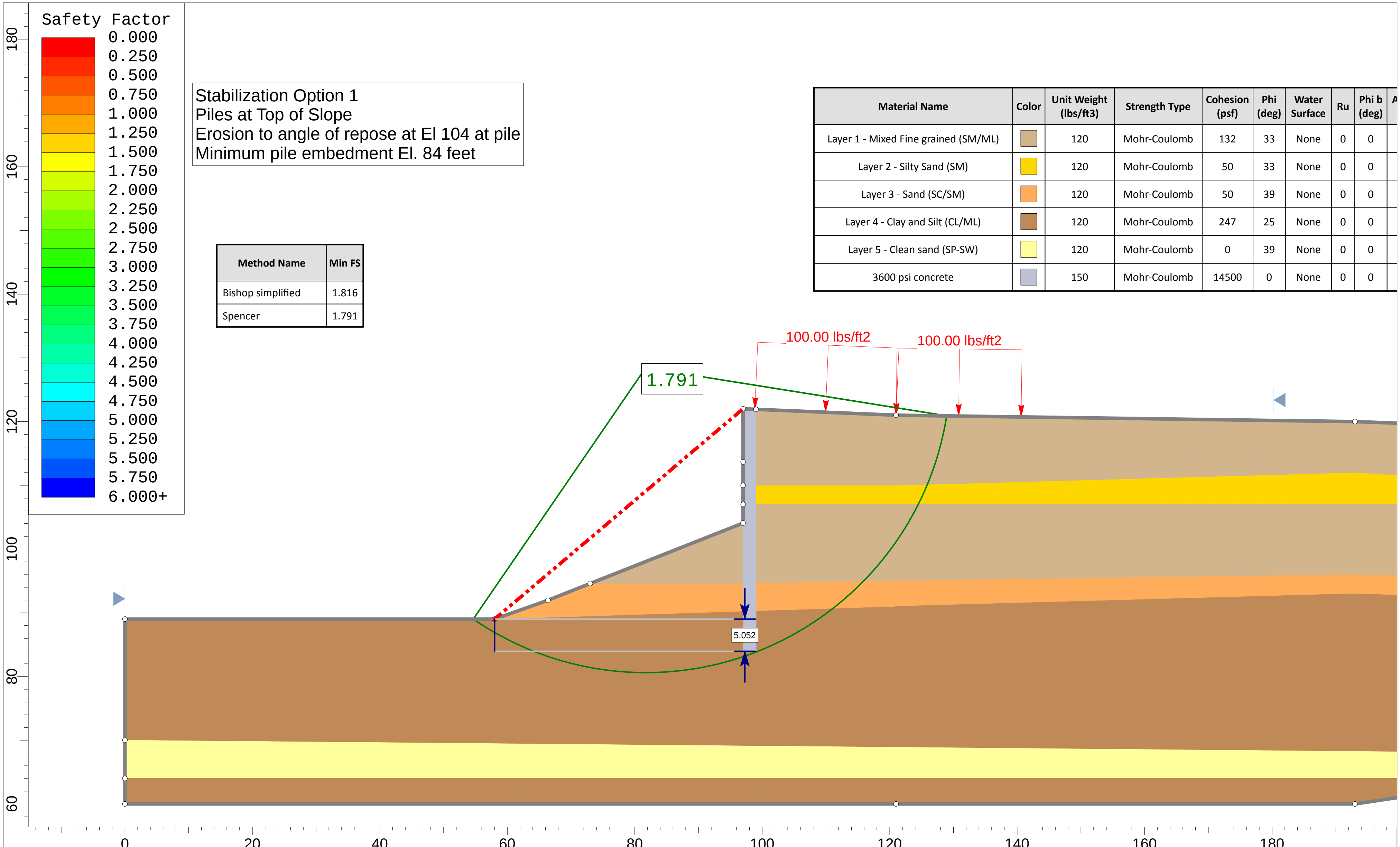
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Phi b (deg)	Air Entry (psf)
Layer 1 - Mixed Fine grained (SM/ML)		120	Mohr-Coulomb	132	33	None	0	0	0
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	33	None	0	0	0
Layer 3 - Sand (SC/SM)		120	Mohr-Coulomb	50	39	None	0	0	0
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	247	25	None	0	0	0
Layer 5 - Clean sand (SP-SW)		120	Mohr-Coulomb	0	39	None	0	0	0
3600 psi concrete		150	Mohr-Coulomb	14500	0	None	0	0	0



Leighton

SLIDE 7.018

Project	Goleta Fire Station #10		
Analysis Description	A-A' Static Analysis - Circular failure		
Drawn By LD	*Scale* 1:250	*Company* Leighton	
Date 7/29/2016, 6:01:40 PM		*File Name* 6_AA_11389001_Option 1 Embedment Static.slim	



Method Name	Min FS
Bishop simplified	1.816
Spencer	1.791

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Phi b (deg)	A
Layer 1 - Mixed Fine grained (SM/ML)		120	Mohr-Coulomb	132	33	None	0	0	
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	33	None	0	0	
Layer 3 - Sand (SC/SM)		120	Mohr-Coulomb	50	39	None	0	0	
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	247	25	None	0	0	
Layer 5 - Clean sand (SP-SW)		120	Mohr-Coulomb	0	39	None	0	0	
3600 psi concrete		150	Mohr-Coulomb	14500	0	None	0	0	

Leighton

SLIDEINTERPRET 7.018

Project	Goleta Fire Station #10
Analysis Description	A-A' Static Analysis - Circular failure
Drawn By	LD
Scale	1:250
Company	Leighton
Date	7/29/2016, 6:01:40 PM
File Name	6_AA_11389001_Option 1 Embedment Static.slim

Slide Analysis Information

Goleta Fire Station #10

Project Summary

File Name:	6_AA_11389001_Option 1 Embedment Static
Slide Modeler Version:	7.018
Project Title:	Goleta Fire Station #10
Analysis:	A-A' Static Analysis - Circular failure
Author:	LD
Company:	Leighton
Date Created:	7/29/2016, 6:01:40 PM

Comments

Stabilization Option 1 - Pile at edge of slope
Utlimate strength, depth specific

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used

Bishop simplified
Spencer

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	No
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Slope Search
Number of Surfaces:	5000
Upper Angle:	Not Defined
Lower Angle:	Not Defined
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	100
Orientation:	Normal to boundary

Material Properties

Property	Layer 1 - Mixed Fine grained (SM/ML)	Layer 2 - Silty Sand (SM)	Layer 3 - Sand (SC/SM)	Layer 4 - Clay and Silt (CL/ML)	Layer 5 - Clean sand (SP-SW)	3600 psi concrete
Color						
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	120	120	120	150
Cohesion [psf]	132	50	50	247	0	14500
Friction Angle [deg]	33	33	39	25	39	0
Water Surface	None	None	None	None	None	None
Ru Value	0	0	0	0	0	0
Unsat. Shear Strength Phi b [deg]	0	0	0	0	0	0
Unsat. Shear Strength Air Entry Value [psf]	0	0	0	0	0	0

Global Minimums

Method: bishop simplified

FS	1.816450
Center:	81.721, 128.451
Radius:	47.847
Left Slip Surface Endpoint:	54.647, 89.000
Right Slip Surface Endpoint:	128.966, 120.889
Resisting Moment:	5.40146e+006 lb-ft
Driving Moment:	2.97363e+006 lb-ft
Total Slice Area:	1407.26 ft2
Surface Horizontal Width:	74.3191 ft
Surface Average Height:	18.9353 ft

Method: spencer

FS	1.791270
Center:	81.721, 128.451
Radius:	47.847
Left Slip Surface Endpoint:	54.647, 89.000
Right Slip Surface Endpoint:	128.966, 120.889
Resisting Moment:	5.32657e+006 lb-ft
Driving Moment:	2.97363e+006 lb-ft
Resisting Horizontal Force:	94068.6 lb
Driving Horizontal Force:	52515.2 lb
Total Slice Area:	1407.26 ft2
Surface Horizontal Width:	74.3191 ft
Surface Average Height:	18.9353 ft

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	3721
Number of Invalid Surfaces:	1279

Error Codes:

Error Code -101 reported for 1 surface
Error Code -103 reported for 17 surfaces
Error Code -105 reported for 2 surfaces
Error Code -106 reported for 87 surfaces
Error Code -107 reported for 47 surfaces
Error Code -108 reported for 56 surfaces
Error Code -112 reported for 101 surfaces
Error Code -114 reported for 968 surfaces

Method: spencer

Number of Valid Surfaces: 3220
Number of Invalid Surfaces: 1780

Error Codes:

Error Code -101 reported for 1 surface
Error Code -103 reported for 17 surfaces
Error Code -105 reported for 2 surfaces
Error Code -106 reported for 87 surfaces
Error Code -107 reported for 47 surfaces
Error Code -108 reported for 457 surfaces
Error Code -111 reported for 100 surfaces
Error Code -112 reported for 101 surfaces
Error Code -114 reported for 968 surfaces

Error Codes

The following errors were encountered during the computation:

-101 = Only one (or zero) surface / slope intersections.
-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-105 = More than two surface / slope intersections with no valid slip surface.
-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-111 = safety factor equation did not converge
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
-114 = Surface with Reverse Curvature.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.81645

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base	Base Material	Base Cohesion [psf]	Base Friction Angle	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress	Pore Pressure [psf]	Effective Normal Stress

			[degrees]			[degrees]			[psf]		[psf]
1	1.48559	87.2959	-33.3946	Layer 4 - Clay and Silt (CL/ML)	247	25	181.81	330.249	178.527	0	178.527
2	1.48559	255.066	-31.2882	Layer 4 - Clay and Silt (CL/ML)	247	25	213.309	387.465	301.229	0	301.229
3	1.48559	435.49	-29.228	Layer 4 - Clay and Silt (CL/ML)	247	25	246.632	447.994	431.034	0	431.034
4	1.48559	668.22	-27.2085	Layer 4 - Clay and Silt (CL/ML)	247	25	289.649	526.133	598.602	0	598.602
5	1.48559	892.331	-25.225	Layer 4 - Clay and Silt (CL/ML)	247	25	330.063	599.543	756.029	0	756.029
6	1.48559	1105.32	-23.2734	Layer 4 - Clay and Silt (CL/ML)	247	25	367.533	667.605	901.991	0	901.991
7	1.48559	1307.69	-21.35	Layer 4 - Clay and Silt (CL/ML)	247	25	402.289	730.738	1037.38	0	1037.38
8	1.48559	1499.93	-19.4516	Layer 4 - Clay and Silt (CL/ML)	247	25	434.538	789.317	1163	0	1163
9	1.48559	1688.95	-17.5752	Layer 4 - Clay and Silt (CL/ML)	247	25	465.672	845.869	1284.28	0	1284.28
10	1.48559	1872.85	-15.718	Layer 4 - Clay and Silt (CL/ML)	247	25	495.376	899.825	1399.99	0	1399.99
11	1.48559	2047.53	-13.8777	Layer 4 - Clay and Silt (CL/ML)	247	25	522.94	949.894	1507.36	0	1507.36
12	1.48559	2213.21	-12.0519	Layer 4 - Clay and Silt (CL/ML)	247	25	548.465	996.26	1606.79	0	1606.79
13	1.48559	2370.09	-10.2384	Layer 4 - Clay and Silt (CL/ML)	247	25	572.041	1039.08	1698.63	0	1698.63
14	1.48559	2518.33	-8.43523	Layer 4 - Clay and Silt (CL/ML)	247	25	593.741	1078.5	1783.16	0	1783.16
15	1.48559	2658.08	-6.64046	Layer 4 - Clay and Silt (CL/ML)	247	25	613.628	1114.62	1860.62	0	1860.62
16	1.48559	2789.43	-4.85223	Layer 4 - Clay and Silt (CL/ML)	247	25	631.757	1147.55	1931.25	0	1931.25
17	1.48559	2912.46	-3.06872	Layer 4 - Clay and Silt (CL/ML)	247	25	648.174	1177.38	1995.2	0	1995.2
18	1.48559	3027.22	-1.28818	Layer 4 - Clay and Silt (CL/ML)	247	25	662.916	1204.15	2052.62	0	2052.62
19	1.48559	3133.76	0.491108	Layer 4 - Clay and Silt (CL/ML)	247	25	676.015	1227.95	2103.65	0	2103.65
20	1.48559	3232.06	2.27087	Layer 4 - Clay and Silt (CL/ML)	247	25	687.495	1248.8	2148.37	0	2148.37
21	1.48559	3322.12	4.05283	Layer 4 - Clay and Silt (CL/ML)	247	25	697.377	1266.75	2186.86	0	2186.86
22	1.48559	3403.89	5.83873	Layer 4 - Clay and Silt (CL/ML)	247	25	705.668	1281.81	2219.17	0	2219.17
23	1.48559	3477.3	7.63035	Layer 4 - Clay and Silt (CL/ML)	247	25	712.384	1294.01	2245.33	0	2245.33
24	1.48559	3542.26	9.42952	Layer 4 - Clay and Silt (CL/ML)	247	25	717.526	1303.35	2265.34	0	2265.34
25	1.48559	3598.65	11.2381	Layer 4 - Clay and Silt (CL/ML)	247	25	721.082	1309.81	2279.2	0	2279.2
26	1.48559	3646.32	13.0582	Layer 4 - Clay and Silt (CL/ML)	247	25	723.053	1313.39	2286.88	0	2286.88
27	1.48559	3685.08	14.8917	Layer 4 - Clay and Silt (CL/ML)	247	25	723.422	1314.06	2288.32	0	2288.32
28	1.48559	3714.73	16.741	Layer 4 - Clay and Silt (CL/ML)	247	25	722.172	1311.79	2283.45	0	2283.45

29	1.48559	6120.91	18.6085	Layer 4 - Clay and Silt (CL/ML)	247	25	1098.79	1995.89	3750.51	0	3750.51
30	1.48559	8291.65	20.4968	Layer 4 - Clay and Silt (CL/ML)	247	25	1437.31	2610.8	5069.19	0	5069.19
31	1.48559	6712.55	22.4086	Layer 4 - Clay and Silt (CL/ML)	247	25	1195.18	2170.98	4125.99	0	4125.99
32	1.48559	6586.99	24.3471	Layer 4 - Clay and Silt (CL/ML)	247	25	1164.71	2115.63	4007.29	0	4007.29
33	1.48559	6450.54	26.3158	Layer 4 - Clay and Silt (CL/ML)	247	25	1132.63	2057.36	3882.34	0	3882.34
34	1.48559	6302.66	28.3187	Layer 4 - Clay and Silt (CL/ML)	247	25	1098.87	1996.05	3750.84	0	3750.84
35	1.48559	6142.71	30.36	Layer 4 - Clay and Silt (CL/ML)	247	25	1063.35	1931.52	3612.47	0	3612.47
36	1.48559	5969.92	32.445	Layer 4 - Clay and Silt (CL/ML)	247	25	1025.96	1863.61	3466.83	0	3466.83
37	1.48559	5783.43	34.5794	Layer 4 - Clay and Silt (CL/ML)	247	25	986.589	1792.09	3313.46	0	3313.46
38	1.48559	5582.16	36.7703	Layer 4 - Clay and Silt (CL/ML)	247	25	945.096	1716.72	3151.82	0	3151.82
39	1.57881	5693.65	39.0989	Layer 3 - Sand (SC/SM)	50	39	1233.33	2240.29	2704.79	0	2704.79
40	1.57881	5426.95	41.5809	Layer 3 - Sand (SC/SM)	50	39	1149.98	2088.89	2517.82	0	2517.82
41	1.57881	5136.55	44.1626	Layer 3 - Sand (SC/SM)	50	39	1062.73	1930.4	2322.1	0	2322.1
42	1.44227	4416.11	46.7407	Layer 1 - Mixed Fine grained (SM/ML)	132	33	872.042	1584.02	2235.91	0	2235.91
43	1.44227	4127.84	49.3259	Layer 1 - Mixed Fine grained (SM/ML)	132	33	799.345	1451.97	2032.58	0	2032.58
44	1.44227	3812.14	52.0555	Layer 1 - Mixed Fine grained (SM/ML)	132	33	722.404	1312.21	1817.37	0	1817.37
45	1.44227	3464.27	54.9644	Layer 1 - Mixed Fine grained (SM/ML)	132	33	640.7	1163.8	1588.84	0	1588.84
46	1.44227	3081.08	58.1033	Layer 1 - Mixed Fine grained (SM/ML)	132	33	554.107	1006.51	1346.62	0	1346.62
47	1.44227	2646.72	61.5509	Layer 1 - Mixed Fine grained (SM/ML)	132	33	460.72	836.875	1085.41	0	1085.41
48	1.43418	2129.44	65.4295	Layer 2 - Silty Sand (SM)	50	33	333.518	605.818	855.884	0	855.884
49	1.52123	1583.34	70.1826	Layer 1 - Mixed Fine grained (SM/ML)	132	33	241.312	438.332	471.711	0	471.711
50	1.52123	598.058	76.8887	Layer 1 - Mixed Fine grained (SM/ML)	132	33	98.2622	178.488	71.5858	0	71.5858

Global Minimum Query (spencer) - Safety Factor: 1.79127

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base	Base Material	Base Cohesion [psf]	Base Friction Angle	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress	Pore Pressure [psf]	Effective Normal Stress

			[degrees]			[degrees]			[psf]		[psf]
1	1.48559	87.2959	-33.3946	Layer 4 - Clay and Silt (CL/ML)	247	25	226.211	405.205	339.271	0	339.271
2	1.48559	255.066	-31.2882	Layer 4 - Clay and Silt (CL/ML)	247	25	269.102	482.034	504.032	0	504.032
3	1.48559	435.49	-29.228	Layer 4 - Clay and Silt (CL/ML)	247	25	312.542	559.847	670.901	0	670.901
4	1.48559	668.22	-27.2085	Layer 4 - Clay and Silt (CL/ML)	247	25	367.536	658.357	882.16	0	882.16
5	1.48559	892.331	-25.225	Layer 4 - Clay and Silt (CL/ML)	247	25	416.878	746.741	1071.7	0	1071.7
6	1.48559	1105.32	-23.2734	Layer 4 - Clay and Silt (CL/ML)	247	25	460.615	825.086	1239.71	0	1239.71
7	1.48559	1307.69	-21.35	Layer 4 - Clay and Silt (CL/ML)	247	25	499.478	894.7	1389	0	1389
8	1.48559	1499.93	-19.4516	Layer 4 - Clay and Silt (CL/ML)	247	25	534.064	956.652	1521.85	0	1521.85
9	1.48559	1688.95	-17.5752	Layer 4 - Clay and Silt (CL/ML)	247	25	566.38	1014.54	1645.99	0	1645.99
10	1.48559	1872.85	-15.718	Layer 4 - Clay and Silt (CL/ML)	247	25	596.181	1067.92	1760.47	0	1760.47
11	1.48559	2047.53	-13.8777	Layer 4 - Clay and Silt (CL/ML)	247	25	622.737	1115.49	1862.48	0	1862.48
12	1.48559	2213.21	-12.0519	Layer 4 - Clay and Silt (CL/ML)	247	25	646.322	1157.74	1953.08	0	1953.08
13	1.48559	2370.09	-10.2384	Layer 4 - Clay and Silt (CL/ML)	247	25	667.167	1195.08	2033.16	0	2033.16
14	1.48559	2518.33	-8.43523	Layer 4 - Clay and Silt (CL/ML)	247	25	685.466	1227.85	2103.45	0	2103.45
15	1.48559	2658.08	-6.64046	Layer 4 - Clay and Silt (CL/ML)	247	25	701.385	1256.37	2164.59	0	2164.59
16	1.48559	2789.43	-4.85223	Layer 4 - Clay and Silt (CL/ML)	247	25	715.057	1280.86	2217.13	0	2217.13
17	1.48559	2912.46	-3.06872	Layer 4 - Clay and Silt (CL/ML)	247	25	726.613	1301.56	2261.52	0	2261.52
18	1.48559	3027.22	-1.28818	Layer 4 - Clay and Silt (CL/ML)	247	25	736.154	1318.65	2298.16	0	2298.16
19	1.48559	3133.76	0.491108	Layer 4 - Clay and Silt (CL/ML)	247	25	743.763	1332.28	2327.39	0	2327.39
20	1.48559	3232.06	2.27087	Layer 4 - Clay and Silt (CL/ML)	247	25	749.518	1342.59	2349.5	0	2349.5
21	1.48559	3322.12	4.05283	Layer 4 - Clay and Silt (CL/ML)	247	25	753.482	1349.69	2364.73	0	2364.73
22	1.48559	3403.89	5.83873	Layer 4 - Clay and Silt (CL/ML)	247	25	755.715	1353.69	2373.3	0	2373.3
23	1.48559	3477.3	7.63035	Layer 4 - Clay and Silt (CL/ML)	247	25	756.257	1354.66	2375.39	0	2375.39
24	1.48559	3542.26	9.42952	Layer 4 - Clay and Silt (CL/ML)	247	25	755.151	1352.68	2371.14	0	2371.14
25	1.48559	3598.65	11.2381	Layer 4 - Clay and Silt (CL/ML)	247	25	752.427	1347.8	2360.66	0	2360.66
26	1.48559	3646.32	13.0582	Layer 4 - Clay and Silt (CL/ML)	247	25	748.101	1340.05	2344.06	0	2344.06
27	1.48559	3685.08	14.8917	Layer 4 - Clay and Silt (CL/ML)	247	25	742.205	1329.49	2321.41	0	2321.41
28	1.48559	3714.73	16.741	Layer 4 - Clay and Silt (CL/ML)	247	25	734.741	1316.12	2292.73	0	2292.73

29	1.48559	6120.91	18.6085	Layer 4 - Clay and Silt (CL/ML)	247	25	1101.84	1973.69	3702.9	0	3702.9
30	1.48559	8291.65	20.4968	Layer 4 - Clay and Silt (CL/ML)	247	25	1423.95	2550.67	4940.24	0	4940.24
31	1.48559	6712.55	22.4086	Layer 4 - Clay and Silt (CL/ML)	247	25	1175.34	2105.35	3985.24	0	3985.24
32	1.48559	6586.99	24.3471	Layer 4 - Clay and Silt (CL/ML)	247	25	1135.19	2033.44	3831.03	0	3831.03
33	1.48559	6450.54	26.3158	Layer 4 - Clay and Silt (CL/ML)	247	25	1094.1	1959.82	3673.15	0	3673.15
34	1.48559	6302.66	28.3187	Layer 4 - Clay and Silt (CL/ML)	247	25	1051.99	1884.4	3511.41	0	3511.41
35	1.48559	6142.71	30.36	Layer 4 - Clay and Silt (CL/ML)	247	25	1008.82	1807.07	3345.59	0	3345.59
36	1.48559	5969.92	32.445	Layer 4 - Clay and Silt (CL/ML)	247	25	964.534	1727.74	3175.45	0	3175.45
37	1.48559	5783.43	34.5794	Layer 4 - Clay and Silt (CL/ML)	247	25	919.046	1646.26	3000.73	0	3000.73
38	1.48559	5582.16	36.7703	Layer 4 - Clay and Silt (CL/ML)	247	25	872.292	1562.51	2821.11	0	2821.11
39	1.57881	5693.65	39.0989	Layer 3 - Sand (SC/SM)	50	39	1154.66	2068.31	2492.41	0	2492.41
40	1.57881	5426.95	41.5809	Layer 3 - Sand (SC/SM)	50	39	1062.7	1903.58	2288.98	0	2288.98
41	1.57881	5136.55	44.1626	Layer 3 - Sand (SC/SM)	50	39	968.854	1735.48	2081.39	0	2081.39
42	1.44227	4416.11	46.7407	Layer 1 - Mixed Fine grained (SM/ML)	132	33	776.483	1390.89	1938.52	0	1938.52
43	1.44227	4127.84	49.3259	Layer 1 - Mixed Fine grained (SM/ML)	132	33	703.361	1259.91	1736.83	0	1736.83
44	1.44227	3812.14	52.0555	Layer 1 - Mixed Fine grained (SM/ML)	132	33	628.008	1124.93	1528.98	0	1528.98
45	1.44227	3464.27	54.9644	Layer 1 - Mixed Fine grained (SM/ML)	132	33	550.277	985.694	1314.57	0	1314.57
46	1.44227	3081.08	58.1033	Layer 1 - Mixed Fine grained (SM/ML)	132	33	470.31	842.452	1094	0	1094
47	1.44227	2646.72	61.5509	Layer 1 - Mixed Fine grained (SM/ML)	132	33	386.852	692.956	863.796	0	863.796
48	1.43418	2129.44	65.4295	Layer 2 - Silty Sand (SM)	50	33	267.685	479.496	661.366	0	661.366
49	1.52123	1583.34	70.1826	Layer 1 - Mixed Fine grained (SM/ML)	132	33	202.819	363.304	356.178	0	356.178
50	1.52123	598.058	76.8887	Layer 1 - Mixed Fine grained (SM/ML)	132	33	93.9967	168.373	56.0102	0	56.0102

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.81645

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	54.6472	89	0	0	0
2	56.1328	88.0206	444.731	0	0
3	57.6184	87.1178	1033.34	0	0
4	59.104	86.2866	1757.74	0	0
5	60.5896	85.5228	2644.9	0	0
6	62.0751	84.823	3663.98	0	0
7	63.5607	84.184	4785.91	0	0
8	65.0463	83.6033	5985.5	0	0
9	66.5319	83.0786	7240.74	0	0
10	68.0175	82.6081	8536.32	0	0
11	69.5031	82.19	9857	0	0
12	70.9887	81.8229	11186.5	0	0
13	72.4743	81.5058	12510.3	0	0
14	73.9599	81.2374	13815.3	0	0
15	75.4454	81.0171	15089.5	0	0
16	76.931	80.8442	16322.2	0	0
17	78.4166	80.7181	17503.6	0	0
18	79.9022	80.6384	18624.7	0	0
19	81.3878	80.605	19677.3	0	0
20	82.8734	80.6178	20654	0	0
21	84.359	80.6767	21548	0	0
22	85.8446	80.7819	22353.1	0	0
23	87.3302	80.9338	23063.5	0	0
24	88.8157	81.1329	23674.1	0	0
25	90.3013	81.3796	24180.3	0	0
26	91.7869	81.6748	24578	0	0
27	93.2725	82.0193	24863.3	0	0
28	94.7581	82.4144	25033.2	0	0
29	96.2437	82.8612	25084.8	0	0
30	97.7293	83.3614	24839.9	0	0
31	99.2149	83.9168	24156.9	0	0
32	100.7	84.5294	23397.4	0	0
33	102.186	85.2016	22426.3	0	0
34	103.672	85.9363	21249	0	0
35	105.157	86.7369	19871.3	0	0
36	106.643	87.6071	18300.1	0	0
37	108.128	88.5515	16542.7	0	0
38	109.614	89.5755	14607.9	0	0
39	111.1	90.6857	12505.7	0	0
40	112.678	91.9687	10974.5	0	0
41	114.257	93.3695	9255.21	0	0
42	115.836	94.9028	7364.67	0	0
43	117.278	96.4355	5188.47	0	0
44	118.721	98.1138	2923.12	0	0
45	120.163	99.9636	596.602	0	0
46	121.605	102.021	-1752.7	0	0
47	123.047	104.338	-4076.82	0	0
48	124.49	107	-6304.18	0	0
49	125.924	110.137	-8512.93	0	0
50	127.445	114.358	-10139.5	0	0
51	128.966	120.889	0	0	0

Global Minimum Query (spencer) - Safety Factor: 1.79127

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	54.6472	89	0	0	0
2	56.1328	88.0206	669.206	206.283	17.1319
3	57.6184	87.1178	1525.09	470.108	17.1319
4	59.104	86.2866	2548.28	785.508	17.1319
5	60.5896	85.5228	3769.48	1161.94	17.1319
6	62.0751	84.823	5140.45	1584.55	17.132
7	63.5607	84.184	6618.68	2040.21	17.1319
8	65.0463	83.6033	8169.23	2518.17	17.1319
9	66.5319	83.0786	9763.17	3009.5	17.1319
10	68.0175	82.6081	11381.3	3508.29	17.1319
11	69.5031	82.19	13005.3	4008.9	17.132
12	70.9887	81.8229	14616.5	4505.54	17.1319
13	72.4743	81.5058	16198.6	4993.24	17.132
14	73.9599	81.2374	17737.9	5467.72	17.132
15	75.4454	81.0171	19222.3	5925.29	17.132
16	76.931	80.8442	20641.4	6362.71	17.1319
17	78.4166	80.7181	21986.1	6777.21	17.1319
18	79.9022	80.6384	23248.5	7166.34	17.1319
19	81.3878	80.605	24421.7	7528	17.1319
20	82.8734	80.6178	25499.9	7860.35	17.1319
21	84.359	80.6767	26477.9	8161.81	17.1319
22	85.8446	80.7819	27351.3	8431.04	17.1319
23	87.3302	80.9338	28116.3	8666.87	17.132
24	88.8157	81.1329	28770	8868.37	17.1319
25	90.3013	81.3796	29309.8	9034.75	17.1319
26	91.7869	81.6748	29733.7	9165.42	17.1319
27	93.2725	82.0193	30040.3	9259.93	17.1319
28	94.7581	82.4144	30228.7	9318.01	17.1319
29	96.2437	82.8612	30298.6	9339.55	17.1319
30	97.7293	83.3614	30087.5	9274.5	17.132
31	99.2149	83.9168	29463.4	9082.11	17.1319
32	100.7	84.5294	28766.6	8867.32	17.1319
33	102.186	85.2016	27875.9	8592.76	17.1319
34	103.672	85.9363	26800.6	8261.28	17.1319
35	105.157	86.7369	25550.3	7875.89	17.1319
36	106.643	87.6071	24135.4	7439.75	17.1319
37	108.128	88.5515	22566.9	6956.26	17.1319
38	109.614	89.5755	20856.7	6429.1	17.132
39	111.1	90.6857	19017.9	5862.28	17.1319
40	112.678	91.9687	17641.3	5437.94	17.1319
41	114.257	93.3695	16110.5	4966.08	17.132
42	115.836	94.9028	14446.1	4453.03	17.132
43	117.278	96.4355	12591.8	3881.44	17.132
44	118.721	98.1138	10687.9	3294.56	17.132
45	120.163	99.9636	8761.89	2700.86	17.132
46	121.605	102.021	6849.14	2111.25	17.1319
47	123.047	104.338	4991.98	1538.78	17.1319
48	124.49	107	3249.99	1001.81	17.1319
49	125.924	110.137	1558.35	480.363	17.132
50	127.445	114.358	362.036	111.598	17.132
51	128.966	120.889	0	0	0

List Of Coordinates

Distributed Load

X	Y
140.621	120.727
121	121
99.008	121.916
98.8482	121.923

External Boundary

X	Y
0	60
121	60
193	60
220	64
220	68
220	92
220	96
220	107
220	110.388
220	119
193	120
121	121
99.008	121.916
97	122
97	113.676
97	110
97	107
97	104.068
73.014	94.5862
66.3689	91.9594
58	89
0	89
0	70
0	64

Material Boundary

X	Y
73.014	94.5862
97	94.5862
99.008	94.5862
121	95
193	96
220	96

Material Boundary

X	Y
97	107
99.008	107
121	107
193	107
220	107

Material Boundary

X	Y
0	70
220	68

Material Boundary

X	Y
0	64
220	64

Material Boundary

X	Y
97	110
99.008	110
121	110
193	112
220	110.388

Material Boundary

X	Y
58	89
97	90.2381
98.061	90.303
99.0444	90.303
121	91
193	93
220	92

Material Boundary

X	Y
99.008	110
99.008	121.916

Material Boundary

X	Y
99.008	107
99.008	110

Material Boundary

X	Y
97	94.5862
97	104.068

Material Boundary

X	Y
99.008	94.5862
99.205	94.5862

Material Boundary

X	Y
99.008	94.5862
99.008	107

Material Boundary

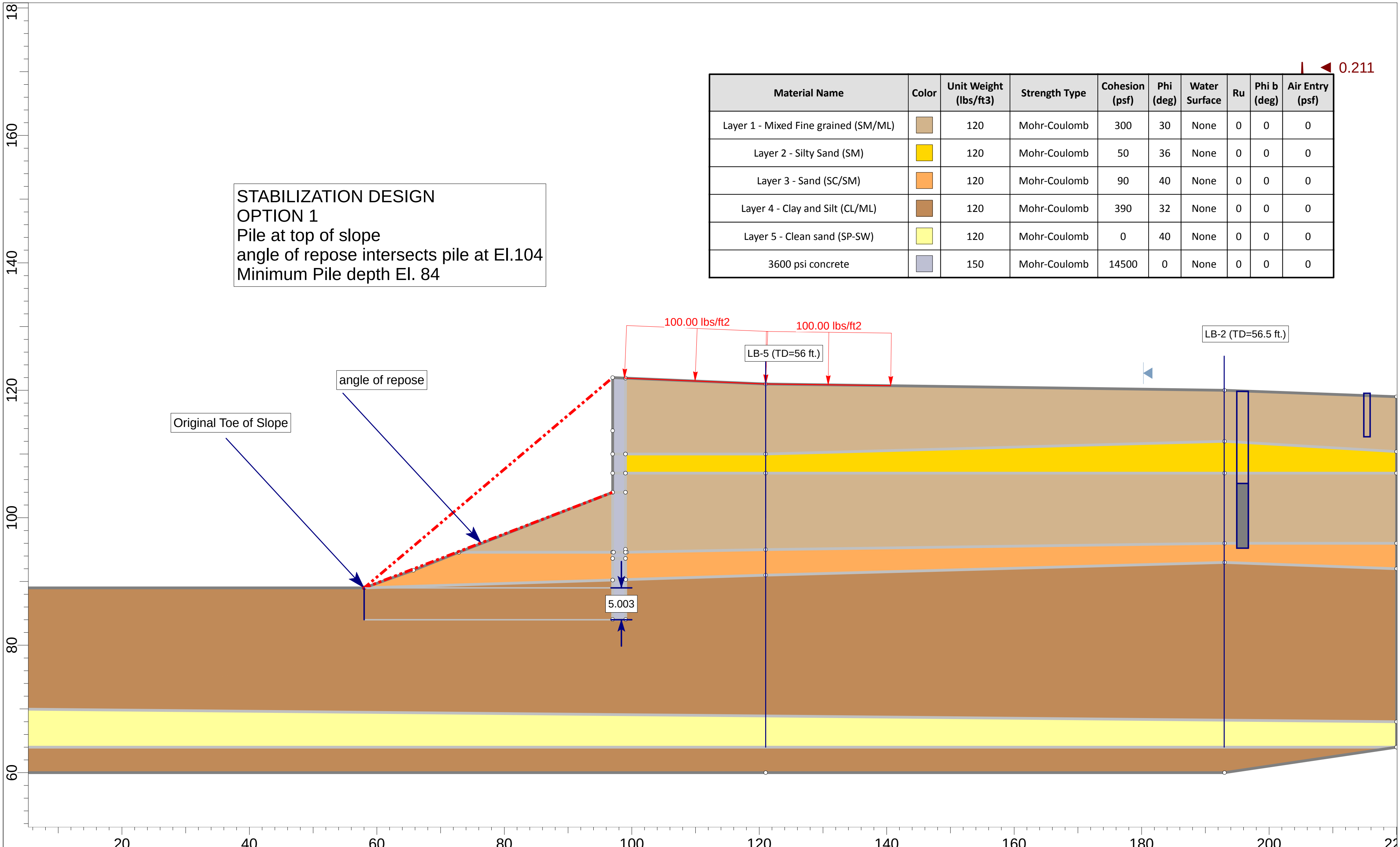
X	Y
97	90.2381
97	91.051
97	94.5862

Material Boundary

X	Y
99.008	94.5862
99.0375	91.1206
99.0444	90.303

Material Boundary

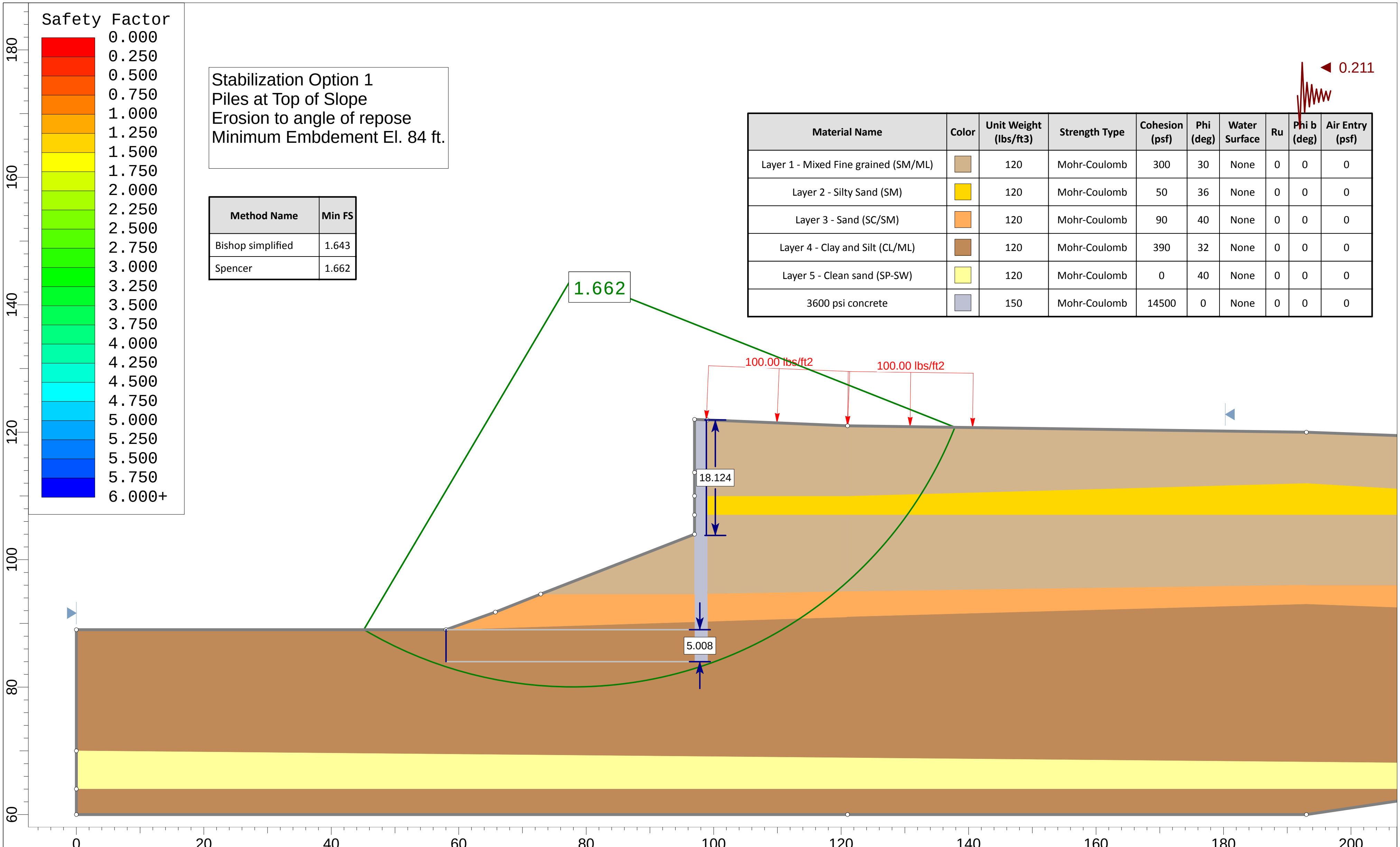
X	Y
97	90.2381
97	84.021
99.0444	84.021
99.0444	90.303



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Phi b (deg)	Air Entry (psf)
Layer 1 - Mixed Fine grained (SM/ML)		120	Mohr-Coulomb	300	30	None	0	0	0
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	36	None	0	0	0
Layer 3 - Sand (SC/SM)		120	Mohr-Coulomb	90	40	None	0	0	0
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	390	32	None	0	0	0
Layer 5 - Clean sand (SP-SW)		120	Mohr-Coulomb	0	40	None	0	0	0
3600 psi concrete		150	Mohr-Coulomb	14500	0	None	0	0	0

Project	Goleta Fire Station #10
Analysis Description	A-A' Seismic Analysis - Circular failure
Drawn By	LD
Scale	1:250
Company	Leighton
Date	7/29/2016, 6:01:40 PM
File Name	6a_AA_11389001_Option 1 Embedment Seismic.slim

SLIDE 7.018



Method Name	Min FS
Bishop simplified	1.643
Spencer	1.662

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Phi b (deg)	Air Entry (psf)
Layer 1 - Mixed Fine grained (SM/ML)		120	Mohr-Coulomb	300	30	None	0	0	0
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	36	None	0	0	0
Layer 3 - Sand (SC/SM)		120	Mohr-Coulomb	90	40	None	0	0	0
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	390	32	None	0	0	0
Layer 5 - Clean sand (SP-SW)		120	Mohr-Coulomb	0	40	None	0	0	0
3600 psi concrete		150	Mohr-Coulomb	14500	0	None	0	0	0

Leighton

SLIDEINTERPRET 7.018

Project	Goleta Fire Station #10		
Analysis Description	A-A' Seismic Analysis - Circular failure		
Drawn By LD	*Scale* 1:250	*Company* Leighton	
Date 7/29/2016, 6:01:40 PM	*File Name* 6a_AA_11389001_Option 1 Embedment Seismic.slim		

Slide Analysis Information

Goleta Fire Station #10

Project Summary

File Name:	6a_AA_11389001_Option 1 Embedment Seismic
Slide Modeler Version:	7.018
Project Title:	Goleta Fire Station #10
Analysis:	A-A' Seismic Analysis - Circular failure
Author:	LD
Company:	Leighton
Date Created:	7/29/2016, 6:01:40 PM
Comments	
	Stabilization Option 1 - Pile at edge of slope
	Peak strength, depth specific

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	No
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Slope Search
Number of Surfaces:	5000
Upper Angle:	Not Defined
Lower Angle:	Not Defined
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal): 0.211

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	100
Orientation:	Normal to boundary

Material Properties

Property	Layer 1 - Mixed Fine grained (SM/ML)	Layer 2 - Silty Sand (SM)	Layer 3 - Sand (SC/SM)	Layer 4 - Clay and Silt (CL/ML)	Layer 5 - Clean sand (SP-SW)	3600 psi concrete
Color						
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	120	120	120	150
Cohesion [psf]	300	50	90	390	0	14500
Friction Angle [deg]	30	36	40	32	40	0
Water Surface	None	None	None	None	None	None
Ru Value	0	0	0	0	0	0
Unsat. Shear Strength Phi b [deg]	0	0	0	0	0	0
Unsat. Shear Strength Air Entry Value [psf]	0	0	0	0	0	0

Global Minimums

Method: bishop simplified

FS	1.643490
Center:	80.682, 146.188
Radius:	65.153
Left Slip Surface Endpoint:	49.466, 89.000
Right Slip Surface Endpoint:	140.655, 120.727
Resisting Moment:	1.06977e+007 lb-ft
Driving Moment:	6.50913e+006 lb-ft
Total Slice Area:	1677.71 ft2
Surface Horizontal Width:	91.1889 ft
Surface Average Height:	18.3982 ft

Method: spencer

FS	1.662490
Center:	77.910, 144.515
Radius:	64.485
Left Slip Surface Endpoint:	45.103, 89.000
Right Slip Surface Endpoint:	137.862, 120.766
Resisting Moment:	1.07667e+007 lb-ft
Driving Moment:	6.47622e+006 lb-ft
Resisting Horizontal Force:	148819 lb
Driving Horizontal Force:	89515.6 lb
Total Slice Area:	1669.94 ft2
Surface Horizontal Width:	92.7596 ft
Surface Average Height:	18.0029 ft

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	3824
Number of Invalid Surfaces:	1176

Error Codes:

Error Code -103 reported for 18 surfaces
Error Code -105 reported for 1 surface
Error Code -106 reported for 81 surfaces
Error Code -112 reported for 109 surfaces
Error Code -114 reported for 967 surfaces

Method: spencer

Number of Valid Surfaces: 3044
Number of Invalid Surfaces: 1956

Error Codes:

Error Code -103 reported for 18 surfaces
Error Code -105 reported for 1 surface
Error Code -106 reported for 81 surfaces
Error Code -108 reported for 494 surfaces
Error Code -111 reported for 286 surfaces
Error Code -112 reported for 109 surfaces
Error Code -114 reported for 967 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-105 = More than two surface / slope intersections with no valid slip surface.
-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-111 = safety factor equation did not converge
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
-114 = Surface with Reverse Curvature.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.64349

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.8206	104.519	-27.7242	Layer 4 - Clay and Silt (CL/ML)	390	32	323.613	531.855	227.015	0	227.015
2	1.8206	305.734	-25.9297	Layer 4 - Clay and Silt (CL/ML)	390	32	369.214	606.8	346.952	0	346.952
3	1.8206	491.651	-24.1621	Layer 4 - Clay and Silt (CL/ML)	390	32	409.657	673.267	453.323	0	453.323
4	1.8206	662.917	-22.4187	Layer 4 - Clay and	390	32	445.414	732.034	547.366	0	547.366

				Silt (CL/ML)							
5	1.8206	827.023	-20.6969	Layer 4 - Clay and Silt (CL/ML)	390	32	478.567	786.52	634.564	0	634.564
6	1.8206	1079	-18.9944	Layer 4 - Clay and Silt (CL/ML)	390	32	532.078	874.465	775.308	0	775.308
7	1.8206	1351.38	-17.3093	Layer 4 - Clay and Silt (CL/ML)	390	32	589.13	968.229	925.362	0	925.362
8	1.8206	1610.97	-15.6394	Layer 4 - Clay and Silt (CL/ML)	390	32	641.86	1054.89	1064.05	0	1064.05
9	1.8206	1858.14	-13.9831	Layer 4 - Clay and Silt (CL/ML)	390	32	690.546	1134.91	1192.1	0	1192.1
10	1.8206	2101.79	-12.3386	Layer 4 - Clay and Silt (CL/ML)	390	32	737.388	1211.89	1315.3	0	1315.3
11	1.8206	2340.51	-10.7044	Layer 4 - Clay and Silt (CL/ML)	390	32	782.143	1285.44	1433.01	0	1433.01
12	1.8206	2567.5	-9.07897	Layer 4 - Clay and Silt (CL/ML)	390	32	823.376	1353.21	1541.46	0	1541.46
13	1.8206	2782.92	-7.46088	Layer 4 - Clay and Silt (CL/ML)	390	32	861.24	1415.44	1641.05	0	1641.05
14	1.8206	2985.32	-5.84875	Layer 4 - Clay and Silt (CL/ML)	390	32	895.527	1471.79	1731.22	0	1731.22
15	1.8206	3175.48	-4.24127	Layer 4 - Clay and Silt (CL/ML)	390	32	926.51	1522.71	1812.71	0	1812.71
16	1.8206	3354.43	-2.63712	Layer 4 - Clay and Silt (CL/ML)	390	32	954.499	1568.71	1886.33	0	1886.33
17	1.8206	3522.23	-1.03505	Layer 4 - Clay and Silt (CL/ML)	390	32	979.58	1609.93	1952.3	0	1952.3
18	1.8206	3678.9	0.56622	Layer 4 - Clay and Silt (CL/ML)	390	32	1001.84	1646.51	2010.83	0	2010.83
19	1.8206	3824.45	2.16793	Layer 4 - Clay and Silt (CL/ML)	390	32	1021.33	1678.54	2062.09	0	2062.09
20	1.8206	3958.85	3.77134	Layer 4 - Clay and Silt (CL/ML)	390	32	1038.11	1706.12	2106.23	0	2106.23
21	1.8206	4082.06	5.37771	Layer 4 - Clay and Silt (CL/ML)	390	32	1052.23	1729.33	2143.37	0	2143.37
22	1.8206	4194	6.98834	Layer 4 - Clay and Silt (CL/ML)	390	32	1063.72	1748.22	2173.61	0	2173.61
23	1.8206	4294.57	8.60454	Layer 4 - Clay and Silt (CL/ML)	390	32	1072.63	1762.85	2197.02	0	2197.02
24	1.8206	4383.64	10.2277	Layer 4 - Clay and Silt (CL/ML)	390	32	1078.95	1773.25	2213.66	0	2213.66
25	1.8206	4461.04	11.8592	Layer 4 - Clay and Silt (CL/ML)	390	32	1082.73	1779.45	2223.58	0	2223.58
26	1.8206	4526.57	13.5005	Layer 4 - Clay and Silt (CL/ML)	390	32	1083.94	1781.45	2226.78	0	2226.78
27	1.8206	9861.27	15.1532	Layer 4 - Clay and Silt (CL/ML)	390	32	2082.83	3423.11	4853.98	0	4853.98
28	1.8206	8763.74	16.8189	Layer 4 - Clay and Silt (CL/ML)	390	32	1884.77	3097.6	4333.07	0	4333.07
29	1.8206	8173.18	18.4994	Layer 4 - Clay and Silt (CL/ML)	390	32	1759.03	2890.95	4002.36	0	4002.36
30	1.8206	8016.91	20.1965	Layer 4 - Clay and Silt (CL/ML)	390	32	1710.91	2811.87	3875.8	0	3875.8
31	1.8206	7847.18	21.9124	Layer 4 - Clay and Silt (CL/ML)	390	32	1660.8	2729.51	3744	0	3744
32	1.8206	7663.52	23.6493	Layer 4 - Clay and Silt (CL/ML)	390	32	1608.65	2643.8	3606.83	0	3606.83

33	1.8206	7465.39	25.4095	Layer 4 - Clay and Silt (CL/ML)	390	32	1554.4	2554.64	3464.14	0	3464.14
34	1.8206	7252.15	27.1959	Layer 4 - Clay and Silt (CL/ML)	390	32	1497.99	2461.93	3315.78	0	3315.78
35	1.8206	7023.1	29.0113	Layer 4 - Clay and Silt (CL/ML)	390	32	1439.35	2365.56	3161.55	0	3161.55
36	1.8206	6777.4	30.8594	Layer 4 - Clay and Silt (CL/ML)	390	32	1378.4	2265.39	3001.26	0	3001.26
37	1.99428	7120.76	32.8356	Layer 3 - Sand (SC/SM)	90	40	1451.79	2386.01	2736.28	0	2736.28
38	1.99428	6780.11	34.9492	Layer 3 - Sand (SC/SM)	90	40	1358.27	2232.31	2553.11	0	2553.11
39	1.99428	6412.85	37.1189	Layer 3 - Sand (SC/SM)	90	40	1261.49	2073.25	2363.54	0	2363.54
40	1.67751	5093.99	39.1701	Layer 1 - Mixed Fine grained (SM/ML)	300	30	999.233	1642.23	2324.8	0	2324.8
41	1.67751	4804.45	41.1004	Layer 1 - Mixed Fine grained (SM/ML)	300	30	937.328	1540.49	2148.6	0	2148.6
42	1.67751	4494.53	43.0894	Layer 1 - Mixed Fine grained (SM/ML)	300	30	872.85	1434.52	1965.04	0	1965.04
43	1.67751	4162.2	45.1453	Layer 1 - Mixed Fine grained (SM/ML)	300	30	805.627	1324.04	1773.69	0	1773.69
44	1.67751	3804.97	47.2784	Layer 1 - Mixed Fine grained (SM/ML)	300	30	735.477	1208.75	1574	0	1574
45	1.67751	3419.75	49.5015	Layer 1 - Mixed Fine grained (SM/ML)	300	30	662.185	1088.29	1365.37	0	1365.37
46	1.67751	3002.56	51.831	Layer 1 - Mixed Fine grained (SM/ML)	300	30	585.501	962.265	1147.08	0	1147.08
47	2.38861	3475.24	54.8493	Layer 2 - Silty Sand (SM)	50	36	441.434	725.492	929.734	0	929.734
48	1.84442	1972.19	58.2136	Layer 1 - Mixed Fine grained (SM/ML)	300	30	379.029	622.93	559.33	0	559.33
49	1.84442	1261.99	61.4506	Layer 1 - Mixed Fine grained (SM/ML)	300	30	278.627	457.92	273.525	0	273.525
50	1.84442	442.001	65.0723	Layer 1 - Mixed Fine grained (SM/ML)	300	30	171.758	282.282	-30.688	0	-30.688

Global Minimum Query (spencer) - Safety Factor: 1.66249

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.84947	116.761	-29.6365	Layer 4 - Clay and Silt (CL/ML)	390	32	551.273	916.486	842.556	0	842.556
2	1.84947	341.559	-27.7626	Layer 4 - Clay and Silt (CL/ML)	390	32	622.538	1034.96	1032.16	0	1032.16
3	1.84947	549.34	-25.9204	Layer 4 - Clay and Silt (CL/ML)	390	32	676.616	1124.87	1176.03	0	1176.03

4	1.84947	740.92	-24.1066	Layer 4 - Clay and Silt (CL/ML)	390	32	717.687	1193.15	1285.3	0	1285.3
5	1.84947	917.002	-22.3182	Layer 4 - Clay and Silt (CL/ML)	390	32	748.658	1244.64	1367.7	0	1367.7
6	1.84947	1078.2	-20.5525	Layer 4 - Clay and Silt (CL/ML)	390	32	771.601	1282.78	1428.74	0	1428.74
7	1.84947	1225.09	-18.8069	Layer 4 - Clay and Silt (CL/ML)	390	32	788.041	1310.11	1472.48	0	1472.48
8	1.84947	1435.11	-17.0793	Layer 4 - Clay and Silt (CL/ML)	390	32	824.147	1370.14	1568.55	0	1568.55
9	1.84947	1701.05	-15.3676	Layer 4 - Clay and Silt (CL/ML)	390	32	874.965	1454.62	1703.74	0	1703.74
10	1.84947	1953.85	-13.6698	Layer 4 - Clay and Silt (CL/ML)	390	32	918.087	1526.31	1818.47	0	1818.47
11	1.84947	2193.81	-11.9842	Layer 4 - Clay and Silt (CL/ML)	390	32	954.58	1586.98	1915.56	0	1915.56
12	1.84947	2426.84	-10.3091	Layer 4 - Clay and Silt (CL/ML)	390	32	986.839	1640.61	2001.39	0	2001.39
13	1.84947	2657.81	-8.6428	Layer 4 - Clay and Silt (CL/ML)	390	32	1016.6	1690.09	2080.58	0	2080.58
14	1.84947	2876.81	-6.98387	Layer 4 - Clay and Silt (CL/ML)	390	32	1041.58	1731.61	2147.03	0	2147.03
15	1.84947	3083.76	-5.33081	Layer 4 - Clay and Silt (CL/ML)	390	32	1062.18	1765.87	2201.86	0	2201.86
16	1.84947	3277.48	-3.68219	Layer 4 - Clay and Silt (CL/ML)	390	32	1078.52	1793.03	2245.31	0	2245.31
17	1.84947	3457.98	-2.03663	Layer 4 - Clay and Silt (CL/ML)	390	32	1090.92	1813.65	2278.31	0	2278.31
18	1.84947	3626.68	-0.392739	Layer 4 - Clay and Silt (CL/ML)	390	32	1100.01	1828.75	2302.48	0	2302.48
19	1.84947	3783.61	1.25083	Layer 4 - Clay and Silt (CL/ML)	390	32	1106	1838.72	2318.43	0	2318.43
20	1.84947	3928.74	2.89542	Layer 4 - Clay and Silt (CL/ML)	390	32	1109.11	1843.88	2326.69	0	2326.69
21	1.84947	4062.06	4.54241	Layer 4 - Clay and Silt (CL/ML)	390	32	1109.49	1844.51	2327.7	0	2327.7
22	1.84947	4183.48	6.19317	Layer 4 - Clay and Silt (CL/ML)	390	32	1107.28	1840.85	2321.84	0	2321.84
23	1.84947	4292.91	7.84912	Layer 4 - Clay and Silt (CL/ML)	390	32	1102.62	1833.09	2309.43	0	2309.43
24	1.84947	4390.23	9.51169	Layer 4 - Clay and Silt (CL/ML)	390	32	1095.6	1821.42	2290.75	0	2290.75
25	1.84947	4475.27	11.1824	Layer 4 - Clay and Silt (CL/ML)	390	32	1086.3	1805.97	2266.03	0	2266.03
26	1.84947	4547.83	12.8628	Layer 4 - Clay and Silt (CL/ML)	390	32	1074.82	1786.88	2235.48	0	2235.48
27	1.84947	4607.68	14.5545	Layer 4 - Clay and Silt (CL/ML)	390	32	1061.21	1764.25	2199.26	0	2199.26
28	1.84947	4654.54	16.2594	Layer 4 - Clay and Silt (CL/ML)	390	32	1045.52	1738.17	2157.52	0	2157.52
29	1.84947	10339.8	17.9791	Layer 4 - Clay and Silt (CL/ML)	390	32	1969.7	3274.6	4616.33	0	4616.33
30	1.84947	8765.62	19.7159	Layer 4 - Clay and Silt (CL/ML)	390	32	1697.79	2822.56	3892.91	0	3892.91
31	1.84947	8278.05	21.4717	Layer 4 - Clay and Silt (CL/ML)	390	32	1582.24	2630.45	3585.46	0	3585.46
32	1.84947	8092.05	23.2489	Layer 4 - Clay and	390	32	1515.83	2520.06	3408.81	0	3408.81

				Silt (CL/ML)							
33	1.84947	7890.86	25.0502	Layer 4 - Clay and Silt (CL/ML)	390	32	1449.15	2409.2	3231.39	0	3231.39
34	1.84947	7673.81	26.8784	Layer 4 - Clay and Silt (CL/ML)	390	32	1382.11	2297.74	3053.02	0	3053.02
35	1.84947	7440.16	28.7367	Layer 4 - Clay and Silt (CL/ML)	390	32	1314.65	2185.6	2873.55	0	2873.55
36	1.84947	7189.01	30.6287	Layer 4 - Clay and Silt (CL/ML)	390	32	1246.73	2072.67	2692.83	0	2692.83
37	1.84947	6919.35	32.5585	Layer 4 - Clay and Silt (CL/ML)	390	32	1178.27	1958.87	2510.72	0	2510.72
38	1.8821	6744.15	34.5486	Layer 3 - Sand (SC/SM)	90	40	1218.83	2026.3	2307.59	0	2307.59
39	1.8821	6422.23	36.6055	Layer 3 - Sand (SC/SM)	90	40	1123.99	1868.62	2119.68	0	2119.68
40	1.8821	6076.25	38.7189	Layer 3 - Sand (SC/SM)	90	40	1029	1710.7	1931.48	0	1931.48
41	1.86331	5649.11	40.8856	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	799.229	1328.71	1781.77	0	1781.77
42	1.86331	5262.4	43.1146	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	734.031	1220.32	1594.04	0	1594.04
43	1.86331	4850.13	45.4283	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	668.232	1110.93	1404.57	0	1404.57
44	1.86331	4402.81	47.8414	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	601.497	999.982	1212.41	0	1212.41
45	1.86331	3915.39	50.3728	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	533.806	887.447	1017.49	0	1017.49
46	1.86331	3381.11	53.048	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	465.155	773.316	819.808	0	819.808
47	2.22361	3253.68	56.2013	Layer 2 - Silty Sand (SM)	50	36	311.625	518.074	644.25	0	644.25
48	1.75981	1902.76	59.5188	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	313.37	520.974	382.739	0	382.739
49	1.75981	1220.83	62.7691	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	245.776	408.6	188.101	0	188.101
50	1.75981	428.584	66.4338	Layer 1 - Mixed Fine grained (SM/ ML)	300	30	181.902	302.41	4.17423	0	4.17423

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.64349

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	49.4656	89	0	0	0
2	51.2862	88.0432	782.702	0	0
3	53.1068	87.158	1695.65	0	0
4	54.9274	86.3412	2705.93	0	0
5	56.748	85.5901	3785.87	0	0
6	58.5686	84.9023	4916.71	0	0
7	60.3893	84.2756	6140.95	0	0
8	62.2099	83.7082	7450.44	0	0
9	64.0305	83.1986	8818.19	0	0
10	65.8511	82.7452	10220.3	0	0
11	67.6717	82.347	11639.4	0	0
12	69.4923	82.0028	13058.8	0	0
13	71.3129	81.7119	14460.4	0	0
14	73.1335	81.4735	15828.1	0	0
15	74.9541	81.287	17147	0	0
16	76.7747	81.1519	18403.8	0	0
17	78.5953	81.0681	19587.2	0	0
18	80.4159	81.0352	20686.7	0	0
19	82.2365	81.0532	21693.2	0	0
20	84.0571	81.1221	22598.4	0	0
21	85.8777	81.2421	23395.1	0	0
22	87.6983	81.4135	24076.8	0	0
23	89.5189	81.6367	24638.1	0	0
24	91.3395	81.9122	25074.1	0	0
25	93.1601	82.2406	25380.9	0	0
26	94.9807	82.6229	25555.3	0	0
27	96.8013	83.0601	25594.9	0	0
28	98.6219	83.5531	24902.4	0	0
29	100.442	84.1034	24084	0	0
30	102.263	84.7126	23107.5	0	0
31	104.084	85.3823	21918.9	0	0
32	105.904	86.1146	20529	0	0
33	107.725	86.9119	18949.4	0	0
34	109.545	87.7768	17192.8	0	0
35	111.366	88.7123	15272.8	0	0
36	113.187	89.7219	13204.6	0	0
37	115.007	90.8098	11004.6	0	0
38	117.002	92.0967	8859.58	0	0
39	118.996	93.4905	6563.5	0	0
40	120.99	94.9998	4143.62	0	0
41	122.668	96.3665	1560.75	0	0
42	124.345	97.8299	-1031.55	0	0
43	126.023	99.3991	-3605.61	0	0
44	127.7	101.085	-6128.95	0	0
45	129.378	102.902	-8562.98	0	0
46	131.055	104.866	-10861	0	0
47	132.733	107	-12965.4	0	0
48	135.121	110.392	-15804.4	0	0
49	136.966	113.369	-17190.7	0	0
50	138.81	116.759	-17874.3	0	0
51	140.655	120.727	0	0	0

Global Minimum Query (spencer) - Safety Factor: 1.66249

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	45.1026	89	0	0	0
2	46.9521	87.9478	1884.26	891.307	25.3154
3	48.8016	86.9742	3971.6	1878.67	25.3154
4	50.651	86.0754	6167.6	2917.44	25.3154
5	52.5005	85.2478	8405.92	3976.23	25.3154
6	54.35	84.4886	10639.2	5032.64	25.3155
7	56.1994	83.7952	12833.4	6070.55	25.3154
8	58.0489	83.1653	14963.8	7078.3	25.3155
9	59.8984	82.5971	17080.8	8079.66	25.3154
10	61.7479	82.0887	19210.5	9087.09	25.3154
11	63.5973	81.6389	21318.9	10084.4	25.3154
12	65.4468	81.2463	23378.3	11058.6	25.3155
13	67.2963	80.9099	25369.6	12000.5	25.3154
14	69.1457	80.6288	27279.1	12903.7	25.3153
15	70.9952	80.4023	29090.1	13760.4	25.3154
16	72.8447	80.2297	30789.3	14564.2	25.3155
17	74.6942	80.1107	32365.2	15309.6	25.3154
18	76.5436	80.0449	33808.5	15992.4	25.3155
19	78.3931	80.0322	35112.5	16609.2	25.3155
20	80.2426	80.0726	36271.7	17157.5	25.3154
21	82.092	80.1661	37281.9	17635.4	25.3155
22	83.9415	80.3131	38140.4	18041.5	25.3155
23	85.791	80.5138	38845.2	18374.8	25.3154
24	87.6405	80.7687	39395.5	18635.1	25.3154
25	89.4899	81.0786	39791.1	18822.3	25.3155
26	91.3394	81.4442	40032.9	18936.7	25.3155
27	93.1889	81.8665	40122.5	18979	25.3154
28	95.0383	82.3467	40062.3	18950.6	25.3155
29	96.8878	82.8861	39855.4	18852.7	25.3154
30	98.7373	83.4863	38555.9	18238	25.3154
31	100.587	84.1491	37267.6	17628.6	25.3154
32	102.436	84.8766	35839.3	16952.9	25.3153
33	104.286	85.6711	34226.8	16190.2	25.3154
34	106.135	86.5355	32448.5	15349	25.3154
35	107.985	87.4729	30522.8	14438.1	25.3154
36	109.834	88.487	28469.2	13466.7	25.3154
37	111.684	89.5821	26308	12444.4	25.3154
38	113.533	90.763	24060.6	11381.3	25.3154
39	115.415	92.0588	21939.6	10378	25.3154
40	117.297	93.4569	19734.6	9334.98	25.3154
41	119.179	94.9657	17472.3	8264.86	25.3154
42	121.043	96.579	14891.6	7044.11	25.3154
43	122.906	98.3235	12369.2	5850.97	25.3154
44	124.769	100.215	9935.2	4699.62	25.3154
45	126.633	102.273	7632.42	3610.34	25.3154
46	128.496	104.523	5511.53	2607.11	25.3155
47	130.359	107	3633.97	1718.97	25.3155
48	132.583	110.322	1499.16	709.141	25.3153
49	134.343	113.312	503.897	238.357	25.3154
50	136.102	116.731	34.3155	16.2322	25.3155
51	137.862	120.766	0	0	0

List Of Coordinates

Distributed Load

X	Y
140.621	120.727
121	121
99.008	121.916
98.8482	121.923

External Boundary

X	Y
0	60
121	60
193	60
220	64
220	68
220	92
220	96
220	107
220	110.388
220	119
193	120
121	121
99.008	121.916
97	122
97	113.676
97	110
97	107
97	103.993
72.8674	94.5862
65.75	91.7657
58	89
0	89
0	70
0	64

Material Boundary

X	Y
72.8674	94.5862
97	94.5862
97.137	94.5862
99.008	94.5862
121	95
193	96
220	96

Material Boundary

X	Y
97	107
99.008	107
121	107
193	107
220	107

Material Boundary

X	Y
0	70
220	68

Material Boundary

X	Y
0	64
220	64

Material Boundary

X	Y
97	110
99.008	110
121	110
193	112
220	110.388

Material Boundary

X	Y
58	89
97	90.2381
99.0444	90.303
121	91
193	93
220	92

Material Boundary

X	Y
99.008	110
99.008	121.916

Material Boundary

X	Y
99.008	107
99.008	110

Material Boundary

X	Y
97	94.5862
97	103.993

Material Boundary

X	Y
99.008	94.5862
99.205	94.5862

Material Boundary

X	Y
99.008	94.5862
99.008	95.058
99.008	103.993
99.008	107

Material Boundary

X	Y
97	90.2381
97	93.618
97	94.5862

Material Boundary

X	Y
99.008	94.5862
99.008	93.618
99.0444	90.303

Material Boundary

X	Y
97	90.2381
97	84.053
99.0444	84.053
99.0444	90.303

Material Boundary

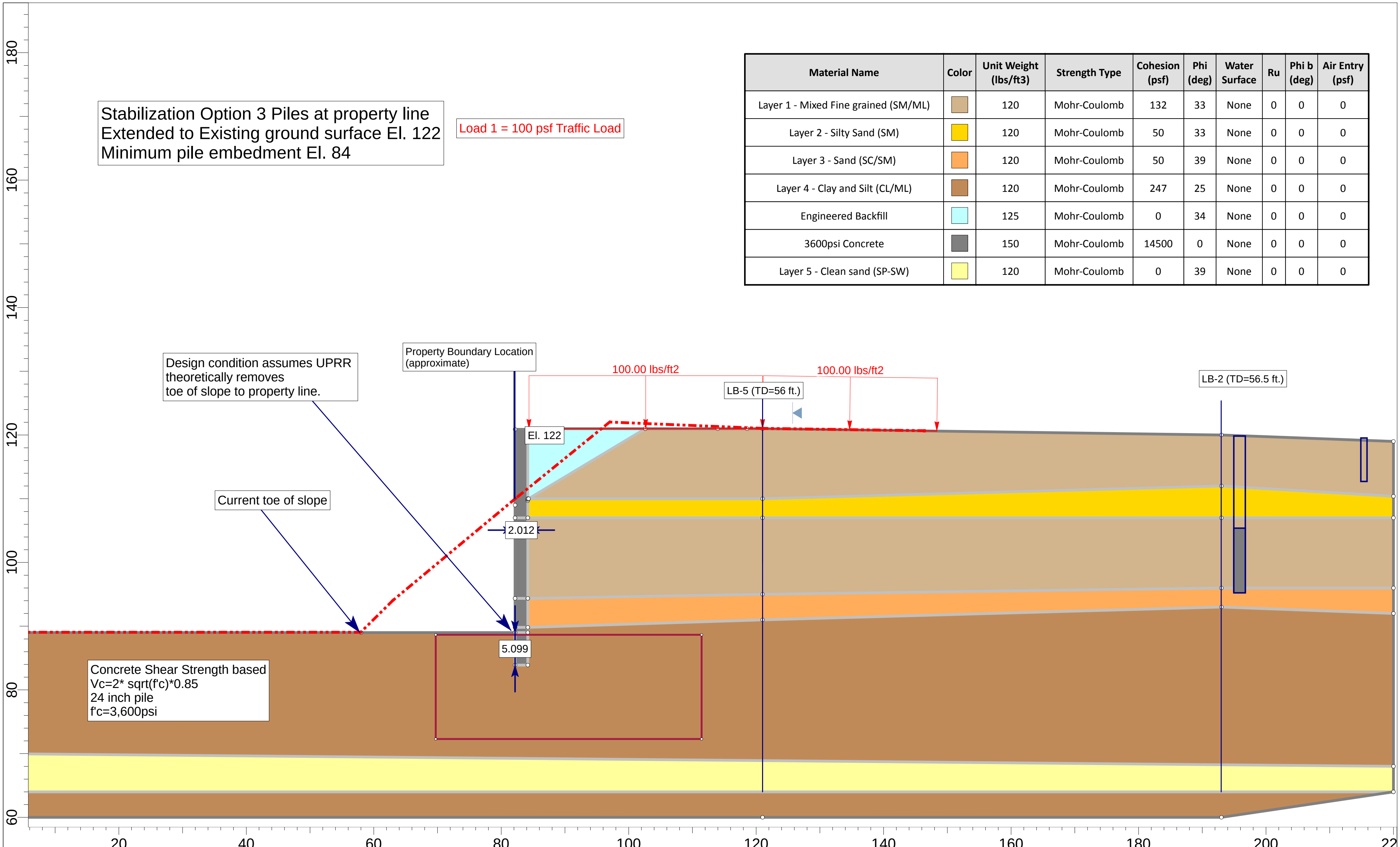
X	Y
97	93.618
99.008	93.618

Material Boundary

X	Y
97	93.618
97.137	94.5862

Material Boundary

X	Y
97	103.993
99.008	103.993

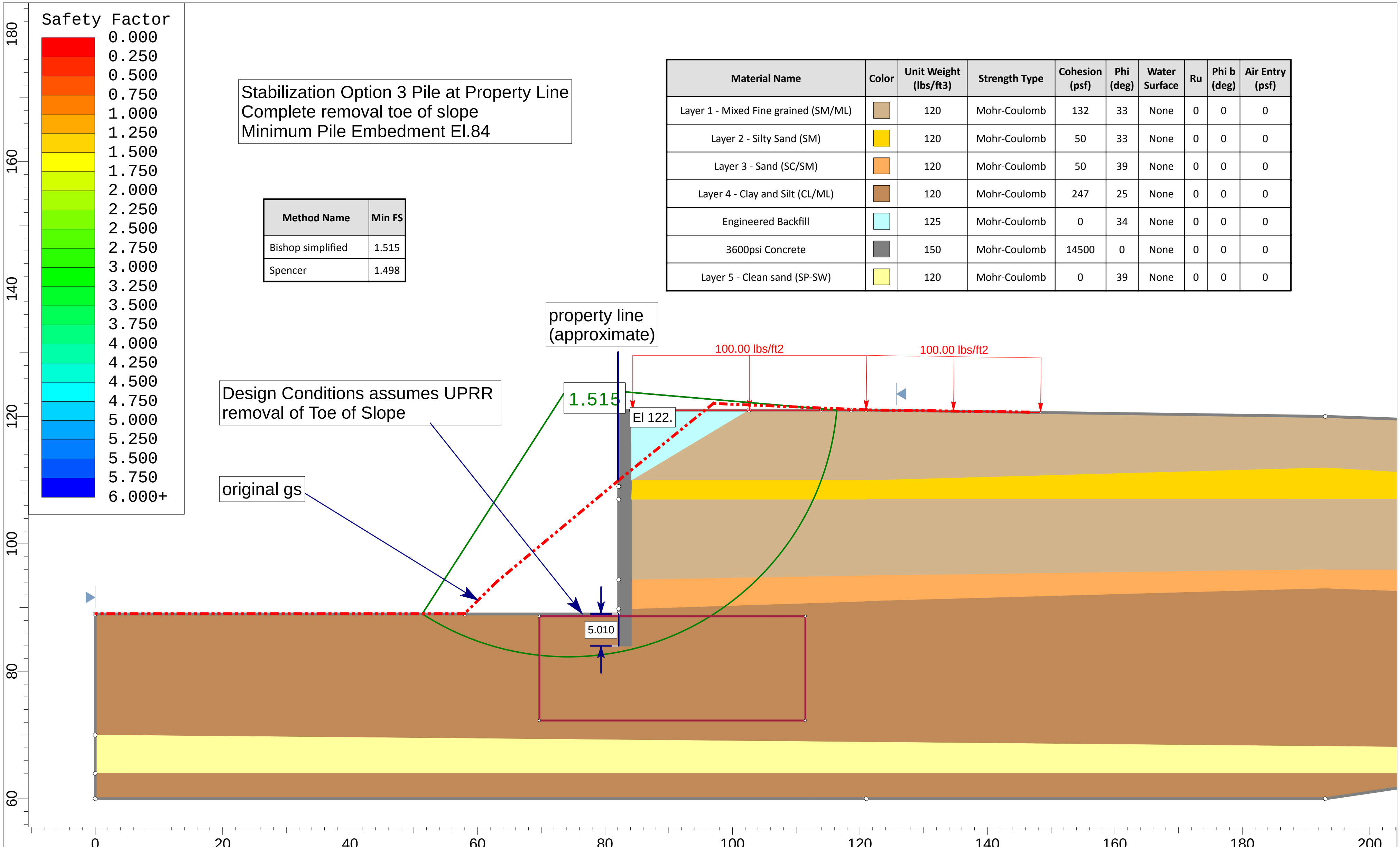


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Phi b (deg)	Air Entry (psf)
Layer 1 - Mixed Fine grained (SM/ML)		120	Mohr-Coulomb	132	33	None	0	0	0
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	33	None	0	0	0
Layer 3 - Sand (SC/SM)		120	Mohr-Coulomb	50	39	None	0	0	0
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	247	25	None	0	0	0
Engineered Backfill		125	Mohr-Coulomb	0	34	None	0	0	0
3600psi Concrete		150	Mohr-Coulomb	14500	0	None	0	0	0
Layer 5 - Clean sand (SP-SW)		120	Mohr-Coulomb	0	39	None	0	0	0

Project	Goleta Fire Station #10
Analysis Description	A-A' Static Analysis - Circular failure, Stabilized condition
Drawn By	LD
Scale	1:250
Company	Leighton
Date	7/29/2016, 6:01:40 PM
File Name	7_AA__11389001_Option3 Static.slim

Leighton

SLIDE 7.018



Method Name	Min FS
Bishop simplified	1.515
Spencer	1.498

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Phi b (deg)	Air Entry (psf)
Layer 1 - Mixed Fine grained (SM/ML)		120	Mohr-Coulomb	132	33	None	0	0	0
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	33	None	0	0	0
Layer 3 - Sand (SC/SM)		120	Mohr-Coulomb	50	39	None	0	0	0
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	247	25	None	0	0	0
Engineered Backfill		125	Mohr-Coulomb	0	34	None	0	0	0
3600psi Concrete		150	Mohr-Coulomb	14500	0	None	0	0	0
Layer 5 - Clean sand (SP-SW)		120	Mohr-Coulomb	0	39	None	0	0	0

Project	Goleta Fire Station #10		
Analysis Description	A-A' Static Analysis - Circular failure, Stabilized condition		
Drawn By LD	*Scale* 1:250	*Company*	Leighton
Date	7/29/2016, 6:01:40 PM	*File Name*	7_AA__11389001_Option3 Static.slim

Leighton

SLIDEINTERPRET 7.018

Slide Analysis Information

Goleta Fire Station #10

Project Summary

File Name:	7_AA__11389001_Option3 Static
Slide Modeler Version:	7.018
Project Title:	Goleta Fire Station #10
Analysis:	A-A' Static Analysis - Circular failure, Stabilized condition
Author:	LD
Company:	Leighton
Date Created:	7/29/2016, 6:01:40 PM
Comments	
	Final condition - Ultimate strength
	Backfill/traffic loads under static condition

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
	Spencer

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	No
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Slope Search
Number of Surfaces:	10000
Upper Angle:	Not Defined
Lower Angle:	Not Defined
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	100
Orientation:	Normal to boundary

Material Properties

Property	Layer 1 - Mixed Fine grained (SM/ML)	Layer 2 - Silty Sand (SM)	Layer 3 - Sand (SC/SM)	Layer 4 - Clay and Silt (CL/ML)	Engineered Backfill	3600psi Concrete	Layer 5 - Clean sand (SP-SW)
Color							
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	120	120	125	150	120
Cohesion [psf]	132	50	50	247	0	14500	0
Friction Angle [deg]	33	33	39	25	34	0	39
Water Surface	None	None	None	None	None	None	None
Ru Value	0	0	0	0	0	0	0
Unsat. Shear Strength Phi b [deg]	0	0	0	0	0	0	0
Unsat. Shear Strength Air Entry Value [psf]	0	0	0	0	0	0	0

Global Minimums

Method: bishop simplified

FS	1.515340
Center:	74.202, 124.619
Radius:	42.336
Left Slip Surface Endpoint:	51.320, 89.000
Right Slip Surface Endpoint:	116.382, 121.000
Resisting Moment:	3.82276e+006 lb-ft
Driving Moment:	2.52272e+006 lb-ft
Total Slice Area:	1102.59 ft2
Surface Horizontal Width:	65.0623 ft
Surface Average Height:	16.9468 ft

Method: spencer

FS	1.497940
Center:	74.202, 124.619
Radius:	42.336
Left Slip Surface Endpoint:	51.320, 89.000
Right Slip Surface Endpoint:	116.382, 121.000
Resisting Moment:	3.77889e+006 lb-ft
Driving Moment:	2.52272e+006 lb-ft
Resisting Horizontal Force:	73858.7 lb
Driving Horizontal Force:	49306.7 lb
Total Slice Area:	1102.59 ft2
Surface Horizontal Width:	65.0623 ft
Surface Average Height:	16.9468 ft

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 1491
Number of Invalid Surfaces: 8509

Error Codes:

Error Code -103 reported for 665 surfaces
Error Code -105 reported for 1 surface
Error Code -107 reported for 1 surface
Error Code -112 reported for 1 surface
Error Code -114 reported for 7672 surfaces
Error Code -118 reported for 169 surfaces

Method: spencer

Number of Valid Surfaces: 1444
Number of Invalid Surfaces: 8556

Error Codes:

Error Code -103 reported for 665 surfaces
Error Code -105 reported for 1 surface
Error Code -107 reported for 1 surface
Error Code -108 reported for 31 surfaces
Error Code -111 reported for 16 surfaces
Error Code -112 reported for 1 surface
Error Code -114 reported for 7672 surfaces
Error Code -118 reported for 169 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-105 = More than two surface / slope intersections with no valid slip surface.
-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-111 = safety factor equation did not converge
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
-114 = Surface with Reverse Curvature.
-118 = Surface does not pass through the search focus

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.51534

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.32398	64.8658	-31.6638	Layer 4 - Clay and Silt (CL/ML)	247	25	219.749	332.995	184.416	0	184.416

2	1.32398	189.433	-29.5809	Layer 4 - Clay and Silt (CL/ML)	247	25	250.804	380.054	285.334	0	285.334
3	1.32398	303.979	-27.5402	Layer 4 - Clay and Silt (CL/ML)	247	25	278.27	421.674	374.589	0	374.589
4	1.32398	409.072	-25.5367	Layer 4 - Clay and Silt (CL/ML)	247	25	302.52	458.421	453.393	0	453.393
5	1.32398	505.197	-23.5663	Layer 4 - Clay and Silt (CL/ML)	247	25	323.856	490.752	522.728	0	522.728
6	1.32398	592.768	-21.625	Layer 4 - Clay and Silt (CL/ML)	247	25	342.527	519.045	583.401	0	583.401
7	1.32398	672.141	-19.7095	Layer 4 - Clay and Silt (CL/ML)	247	25	358.738	543.61	636.082	0	636.082
8	1.32398	743.621	-17.8167	Layer 4 - Clay and Silt (CL/ML)	247	25	372.662	564.71	681.332	0	681.332
9	1.32398	807.47	-15.9438	Layer 4 - Clay and Silt (CL/ML)	247	25	384.446	582.567	719.626	0	719.626
10	1.32398	863.912	-14.0882	Layer 4 - Clay and Silt (CL/ML)	247	25	394.214	597.369	751.372	0	751.372
11	1.32398	913.138	-12.2477	Layer 4 - Clay and Silt (CL/ML)	247	25	402.073	609.278	776.903	0	776.903
12	1.32398	955.311	-10.4199	Layer 4 - Clay and Silt (CL/ML)	247	25	408.114	618.431	796.536	0	796.536
13	1.32398	990.563	-8.60276	Layer 4 - Clay and Silt (CL/ML)	247	25	412.416	624.95	810.518	0	810.518
14	1.32398	1019.01	-6.79432	Layer 4 - Clay and Silt (CL/ML)	247	25	415.046	628.936	819.062	0	819.062
15	1.32398	1040.72	-4.99266	Layer 4 - Clay and Silt (CL/ML)	247	25	416.066	630.481	822.379	0	822.379
16	1.32398	1055.79	-3.19595	Layer 4 - Clay and Silt (CL/ML)	247	25	415.524	629.66	820.615	0	820.615
17	1.32398	1064.23	-1.40237	Layer 4 - Clay and Silt (CL/ML)	247	25	413.466	626.541	813.931	0	813.931
18	1.32398	1066.09	0.389821	Layer 4 - Clay and Silt (CL/ML)	247	25	409.928	621.18	802.434	0	802.434
19	1.32398	1061.37	2.1824	Layer 4 - Clay and Silt (CL/ML)	247	25	404.942	613.625	786.232	0	786.232
20	1.32398	1050.05	3.97712	Layer 4 - Clay and Silt (CL/ML)	247	25	398.536	603.918	765.415	0	765.415
21	1.32398	1032.1	5.77576	Layer 4 - Clay and Silt (CL/ML)	247	25	390.731	592.091	740.05	0	740.05
22	1.32398	1007.46	7.58014	Layer 4 - Clay and Silt (CL/ML)	247	25	381.546	578.172	710.2	0	710.2
23	1.32398	976.069	9.39212	Layer 4 - Clay and Silt (CL/ML)	247	25	370.993	562.18	675.906	0	675.906
24	1.32398	5551.68	11.2136	Layer 4 - Clay and Silt (CL/ML)	247	25	1369.84	2075.77	3921.81	0	3921.81
25	1.32398	7160.45	13.0467	Layer 4 - Clay and Silt (CL/ML)	247	25	1707.34	2587.2	5018.58	0	5018.58
26	1.32398	5993.96	14.8935	Layer 4 - Clay and Silt (CL/ML)	247	25	1466.94	2222.92	4237.38	0	4237.38
27	1.32398	5929.05	16.7563	Layer 4 - Clay and Silt (CL/ML)	247	25	1438.64	2180.03	4145.39	0	4145.39
28	1.32398	5856.65	18.6375	Layer 4 - Clay and Silt (CL/ML)	247	25	1408.89	2134.95	4048.72	0	4048.72
29	1.32398	5776.51	20.5399	Layer 4 - Clay and Silt (CL/ML)	247	25	1377.66	2087.62	3947.21	0	3947.21
30	1.32398	5688.35	22.4662	Layer 4 - Clay and	247	25	1344.88	2037.95	3840.69	0	3840.69

				Silt (CL/ML)							
31	1.32398	5591.84	24.4197	Layer 4 - Clay and Silt (CL/ML)	247	25	1310.49	1985.84	3728.96	0	3728.96
32	1.32398	5486.61	26.404	Layer 4 - Clay and Silt (CL/ML)	247	25	1274.43	1931.2	3611.77	0	3611.77
33	1.32398	5372.2	28.4231	Layer 4 - Clay and Silt (CL/ML)	247	25	1236.61	1873.88	3488.86	0	3488.86
34	1.32398	5248.11	30.4815	Layer 4 - Clay and Silt (CL/ML)	247	25	1196.93	1813.75	3359.91	0	3359.91
35	1.32398	5113.72	32.5845	Layer 4 - Clay and Silt (CL/ML)	247	25	1155.28	1750.64	3224.57	0	3224.57
36	1.32398	4968.3	34.7382	Layer 4 - Clay and Silt (CL/ML)	247	25	1111.53	1684.34	3082.39	0	3082.39
37	1.29443	4705.47	36.9242	Layer 3 - Sand (SC/SM)	50	39	1447.99	2194.2	2647.87	0	2647.87
38	1.29443	4543.05	39.1495	Layer 3 - Sand (SC/SM)	50	39	1367.5	2072.23	2497.25	0	2497.25
39	1.29443	4367.5	41.4478	Layer 3 - Sand (SC/SM)	50	39	1284.02	1945.73	2341.03	0	2341.03
40	1.29443	4180.63	43.8307	Layer 3 - Sand (SC/SM)	50	39	1198.17	1815.63	2180.37	0	2180.37
41	1.21938	3754.18	46.2381	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	1001.55	1517.69	2133.77	0	2133.77
42	1.21938	3559.55	48.681	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	928.63	1407.19	1963.62	0	1963.62
43	1.21938	3346.91	51.2492	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	851.782	1290.74	1784.31	0	1784.31
44	1.21938	3113.1	53.9705	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	770.454	1167.5	1594.54	0	1594.54
45	1.21938	2853.67	56.8839	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	683.912	1036.36	1392.59	0	1392.59
46	1.21938	2562.08	60.0473	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	591.133	895.767	1176.1	0	1176.1
47	1.21938	2227.91	63.5532	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	490.611	743.443	941.541	0	941.541
48	1.23636	1854.54	67.6025	Layer 2 - Silty Sand (SM)	50	33	352.456	534.09	745.435	0	745.435
49	1.22464	1329.98	72.5657	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	251.898	381.711	384.52	0	384.52
50	1.22464	521.723	80.2142	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	89.7374	135.983	6.13268	0	6.13268

Global Minimum Query (spencer) - Safety Factor: 1.49794

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.32398	64.8658	-31.6638	Layer 4 - Clay and	247	25	293.673	439.904	413.685	0	413.685

				Silt (CL/ML)							
2	1.32398	189.433	-29.5809	Layer 4 - Clay and Silt (CL/ML)	247	25	336.808	504.518	552.249	0	552.249
3	1.32398	303.979	-27.5402	Layer 4 - Clay and Silt (CL/ML)	247	25	371.835	556.986	664.767	0	664.767
4	1.32398	409.072	-25.5367	Layer 4 - Clay and Silt (CL/ML)	247	25	400.367	599.725	756.425	0	756.425
5	1.32398	505.197	-23.5663	Layer 4 - Clay and Silt (CL/ML)	247	25	423.568	634.479	830.954	0	830.954
6	1.32398	592.768	-21.625	Layer 4 - Clay and Silt (CL/ML)	247	25	442.3	662.539	891.125	0	891.125
7	1.32398	672.141	-19.7095	Layer 4 - Clay and Silt (CL/ML)	247	25	457.217	684.884	939.047	0	939.047
8	1.32398	743.621	-17.8167	Layer 4 - Clay and Silt (CL/ML)	247	25	468.825	702.272	976.331	0	976.331
9	1.32398	807.47	-15.9438	Layer 4 - Clay and Silt (CL/ML)	247	25	477.521	715.298	1004.27	0	1004.27
10	1.32398	863.912	-14.0882	Layer 4 - Clay and Silt (CL/ML)	247	25	483.625	724.441	1023.88	0	1023.88
11	1.32398	913.138	-12.2477	Layer 4 - Clay and Silt (CL/ML)	247	25	487.393	730.086	1035.98	0	1035.98
12	1.32398	955.311	-10.4199	Layer 4 - Clay and Silt (CL/ML)	247	25	489.04	732.552	1041.27	0	1041.27
13	1.32398	990.563	-8.60276	Layer 4 - Clay and Silt (CL/ML)	247	25	488.739	732.102	1040.3	0	1040.3
14	1.32398	1019.01	-6.79432	Layer 4 - Clay and Silt (CL/ML)	247	25	486.64	728.958	1033.56	0	1033.56
15	1.32398	1040.72	-4.99266	Layer 4 - Clay and Silt (CL/ML)	247	25	482.868	723.308	1021.44	0	1021.44
16	1.32398	1055.79	-3.19595	Layer 4 - Clay and Silt (CL/ML)	247	25	477.53	715.311	1004.3	0	1004.3
17	1.32398	1064.23	-1.40237	Layer 4 - Clay and Silt (CL/ML)	247	25	470.716	705.105	982.41	0	982.41
18	1.32398	1066.09	0.389821	Layer 4 - Clay and Silt (CL/ML)	247	25	462.508	692.809	956.043	0	956.043
19	1.32398	1061.37	2.1824	Layer 4 - Clay and Silt (CL/ML)	247	25	452.973	678.526	925.408	0	925.408
20	1.32398	1050.05	3.97712	Layer 4 - Clay and Silt (CL/ML)	247	25	442.173	662.348	890.719	0	890.719
21	1.32398	1032.1	5.77576	Layer 4 - Clay and Silt (CL/ML)	247	25	430.159	644.352	852.123	0	852.123
22	1.32398	1007.46	7.58014	Layer 4 - Clay and Silt (CL/ML)	247	25	416.98	624.611	809.792	0	809.792
23	1.32398	976.069	9.39212	Layer 4 - Clay and Silt (CL/ML)	247	25	402.678	603.187	763.848	0	763.848
24	1.32398	5551.68	11.2136	Layer 4 - Clay and Silt (CL/ML)	247	25	1447.08	2167.64	4118.84	0	4118.84
25	1.32398	7160.45	13.0467	Layer 4 - Clay and Silt (CL/ML)	247	25	1782.3	2669.78	5195.67	0	5195.67
26	1.32398	5993.96	14.8935	Layer 4 - Clay and Silt (CL/ML)	247	25	1517.58	2273.25	4345.31	0	4345.31
27	1.32398	5929.05	16.7563	Layer 4 - Clay and Silt (CL/ML)	247	25	1473.64	2207.42	4204.14	0	4204.14
28	1.32398	5856.65	18.6375	Layer 4 - Clay and Silt (CL/ML)	247	25	1429.08	2140.68	4061.01	0	4061.01
29	1.32398	5776.51	20.5399	Layer 4 - Clay and Silt (CL/ML)	247	25	1383.85	2072.93	3915.72	0	3915.72

30	1.32398	5688.35	22.4662	Layer 4 - Clay and Silt (CL/ML)	247	25	1337.89	2004.08	3768.08	0	3768.08
31	1.32398	5591.84	24.4197	Layer 4 - Clay and Silt (CL/ML)	247	25	1291.13	1934.04	3617.86	0	3617.86
32	1.32398	5486.61	26.404	Layer 4 - Clay and Silt (CL/ML)	247	25	1243.5	1862.69	3464.86	0	3464.86
33	1.32398	5372.2	28.4231	Layer 4 - Clay and Silt (CL/ML)	247	25	1194.94	1789.95	3308.85	0	3308.85
34	1.32398	5248.11	30.4815	Layer 4 - Clay and Silt (CL/ML)	247	25	1145.36	1715.68	3149.6	0	3149.6
35	1.32398	5113.72	32.5845	Layer 4 - Clay and Silt (CL/ML)	247	25	1094.69	1639.78	2986.83	0	2986.83
36	1.32398	4968.3	34.7382	Layer 4 - Clay and Silt (CL/ML)	247	25	1042.84	1562.11	2820.25	0	2820.25
37	1.29443	4705.47	36.9242	Layer 3 - Sand (SC/SM)	50	39	1394.61	2089.04	2518	0	2518
38	1.29443	4543.05	39.1495	Layer 3 - Sand (SC/SM)	50	39	1300.73	1948.42	2344.35	0	2344.35
39	1.29443	4367.5	41.4478	Layer 3 - Sand (SC/SM)	50	39	1205.72	1806.09	2168.59	0	2168.59
40	1.29443	4180.63	43.8307	Layer 3 - Sand (SC/SM)	50	39	1110.2	1663.01	1991.9	0	1991.9
41	1.21938	3754.18	46.2381	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	902.279	1351.56	1877.96	0	1877.96
42	1.21938	3559.55	48.681	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	826.388	1237.88	1702.9	0	1702.9
43	1.21938	3346.91	51.2492	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	748.433	1121.11	1523.09	0	1523.09
44	1.21938	3113.1	53.9705	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	668.144	1000.84	1337.9	0	1337.9
45	1.21938	2853.67	56.8839	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	585.172	876.552	1146.51	0	1146.51
46	1.21938	2562.08	60.0473	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	499.053	747.552	947.866	0	947.866
47	1.21938	2227.91	63.5532	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	409.135	612.86	740.458	0	740.458
48	1.23636	1854.54	67.6025	Layer 2 - Silty Sand (SM)	50	33	277.242	415.292	562.501	0	562.501
49	1.22464	1329.98	72.5657	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	210.992	316.053	283.417	0	283.417
50	1.22464	521.723	80.2142	Layer 1 - Mixed Fine grained (SM/ ML)	132	33	92.7178	138.886	10.6031	0	10.6031

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.51534

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	51.3201	89	0	0	0
2	52.6441	88.1834	441.304	0	0
3	53.968	87.4319	987.548	0	0
4	55.292	86.7415	1614.3	0	0
5	56.616	86.109	2301.32	0	0
6	57.94	85.5315	3031.64	0	0
7	59.264	85.0066	3791	0	0
8	60.5879	84.5323	4567.29	0	0
9	61.9119	84.1068	5350.22	0	0
10	63.2359	83.7285	6131.02	0	0
11	64.5599	83.3963	6902.2	0	0
12	65.8839	83.1089	7657.42	0	0
13	67.2078	82.8654	8391.27	0	0
14	68.5318	82.6651	9099.22	0	0
15	69.8558	82.5073	9777.51	0	0
16	71.1798	82.3917	10423.1	0	0
17	72.5038	82.3178	11033.5	0	0
18	73.8277	82.2853	11606.8	0	0
19	75.1517	82.2944	12141.9	0	0
20	76.4757	82.3448	12638	0	0
21	77.7997	82.4369	13094.8	0	0
22	79.1237	82.5708	13512.6	0	0
23	80.4476	82.747	13892.2	0	0
24	81.7716	82.966	14235	0	0
25	83.0956	83.2284	15017.8	0	0
26	84.4196	83.5352	15736.9	0	0
27	85.7435	83.8874	16185.5	0	0
28	87.0675	84.286	16436.3	0	0
29	88.3915	84.7325	16492.3	0	0
30	89.7155	85.2286	16356.8	0	0
31	91.0395	85.7761	16033.2	0	0
32	92.3634	86.3772	15525.3	0	0
33	93.6874	87.0346	14837.2	0	0
34	95.0114	87.7511	13973.2	0	0
35	96.3354	88.5305	12938.3	0	0
36	97.6594	89.3767	11738	0	0
37	98.9833	90.2947	10378.6	0	0
38	100.278	91.2675	9675.79	0	0
39	101.572	92.3213	8812.92	0	0
40	102.867	93.4644	7797.65	0	0
41	104.161	94.707	6637.97	0	0
42	105.38	95.9803	5141.47	0	0
43	106.6	97.3674	3549.28	0	0
44	107.819	98.8866	1876.28	0	0
45	109.039	100.563	141.764	0	0
46	110.258	102.433	-1628.21	0	0
47	111.477	104.549	-3396.65	0	0
48	112.697	107	-5106.96	0	0
49	113.933	110	-6907.83	0	0
50	115.158	113.9	-8099.08	0	0
51	116.382	121	0	0	0

Global Minimum Query (spencer) - Safety Factor: 1.49794

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	51.3201	89	0	0	0
2	52.6441	88.1834	726.859	245.458	18.6597
3	53.968	87.4319	1588.11	536.299	18.6596
4	55.292	86.7415	2539.68	857.642	18.6597
5	56.616	86.109	3548.57	1198.34	18.6597
6	57.94	85.5315	4589.6	1549.89	18.6596
7	59.264	85.0066	5643.29	1905.72	18.6597
8	60.5879	84.5323	6694.41	2260.68	18.6597
9	61.9119	84.1068	7730.96	2610.72	18.6597
10	63.2359	83.7285	8743.45	2952.64	18.6597
11	64.5599	83.3963	9724.37	3283.89	18.6597
12	65.8839	83.1089	10667.8	3602.5	18.6597
13	67.2078	82.8654	11569.2	3906.9	18.6597
14	68.5318	82.6651	12425.1	4195.92	18.6597
15	69.8558	82.5073	13232.9	4468.7	18.6596
16	71.1798	82.3917	13990.7	4724.62	18.6597
17	72.5038	82.3178	14697.6	4963.34	18.6597
18	73.8277	82.2853	15353.1	5184.68	18.6596
19	75.1517	82.2944	15957.2	5388.7	18.6597
20	76.4757	82.3448	16510.6	5575.58	18.6597
21	77.7997	82.4369	17014.4	5745.72	18.6597
22	79.1237	82.5708	17470.2	5899.63	18.6597
23	80.4476	82.747	17879.9	6038	18.6597
24	81.7716	82.966	18246.1	6161.67	18.6597
25	83.0956	83.2284	19082.1	6443.98	18.6597
26	84.4196	83.5352	19849.3	6703.06	18.6597
27	85.7435	83.8874	20329.8	6865.31	18.6597
28	87.0675	84.286	20606.2	6958.65	18.6597
29	88.3915	84.7325	20686.1	6985.63	18.6597
30	89.7155	85.2286	20577	6948.79	18.6597
31	91.0395	85.7761	20286.5	6850.68	18.6596
32	92.3634	86.3772	19822.2	6693.89	18.6597
33	93.6874	87.0346	19192	6481.07	18.6596
34	95.0114	87.7511	18404	6214.99	18.6597
35	96.3354	88.5305	17466.9	5898.54	18.6597
36	97.6594	89.3767	16389.7	5534.76	18.6597
37	98.9833	90.2947	15182.1	5126.95	18.6597
38	100.278	91.2675	14539.1	4909.81	18.6597
39	101.572	92.3213	13753.4	4644.47	18.6596
40	102.867	93.4644	12836.1	4334.72	18.6597
41	104.161	94.707	11798.9	3984.45	18.6597
42	105.38	95.9803	10508.7	3548.76	18.6597
43	106.6	97.3674	9154.99	3091.61	18.6597
44	107.819	98.8866	7754.2	2618.57	18.6597
45	109.039	100.563	6326.43	2136.42	18.6597
46	110.258	102.433	4897.17	1653.76	18.6597
47	111.477	104.549	3500.35	1182.06	18.6597
48	112.697	107	2184.4	737.666	18.6597
49	113.933	110	839.889	283.628	18.6597
50	115.158	113.9	-6.77921	-2.28932	18.6597
51	116.382	121	0	0	0

List Of Coordinates

Distributed Load

X	Y
148.335	120.62
121	121
118.56	121
113.968	121
84.345	121

Focus Search Window

X	Y
69.718	88.644
69.718	72.291
111.439	72.291
111.439	88.644

External Boundary

X	Y
0	60
121	60
193	60
220	64
220	68
220	92
220	96
220	107
220	110.388
220	119
193	120
121	121
118.56	121
113.968	121
102.598	121
84.277	121
84.277	121.002
84.162	121.002
84.162	120.892
82.161	120.892
82.161	109
82.161	107
82.161	94.3591
82.161	89.82
82.161	89
58	89
0	89
0	70
0	64

Material Boundary

X	Y
82.161	94.3591
84.162	94.3591
121	95
193	96
220	96

Material Boundary

X	Y
82.161	107
84.162	107
121	107
193	107
220	107

Material Boundary

X	Y
0	70
220	68

Material Boundary

X	Y
0	64
220	64

Material Boundary

X	Y
84.277	110
121	110
193	112
220	110.388

Material Boundary

X	Y
82.161	89.82
84.162	89.82
121	91
193	93
220	92

Material Boundary

X	Y
82.161	89
84.162	89
84.162	89.82

Material Boundary

X	Y
84.162	89.82
84.162	94.3591

Material Boundary

X	Y
84.162	94.3591
84.162	107

Material Boundary

X	Y
84.162	107
84.162	109.684
84.162	109.885
84.162	110
84.162	120.892

Material Boundary

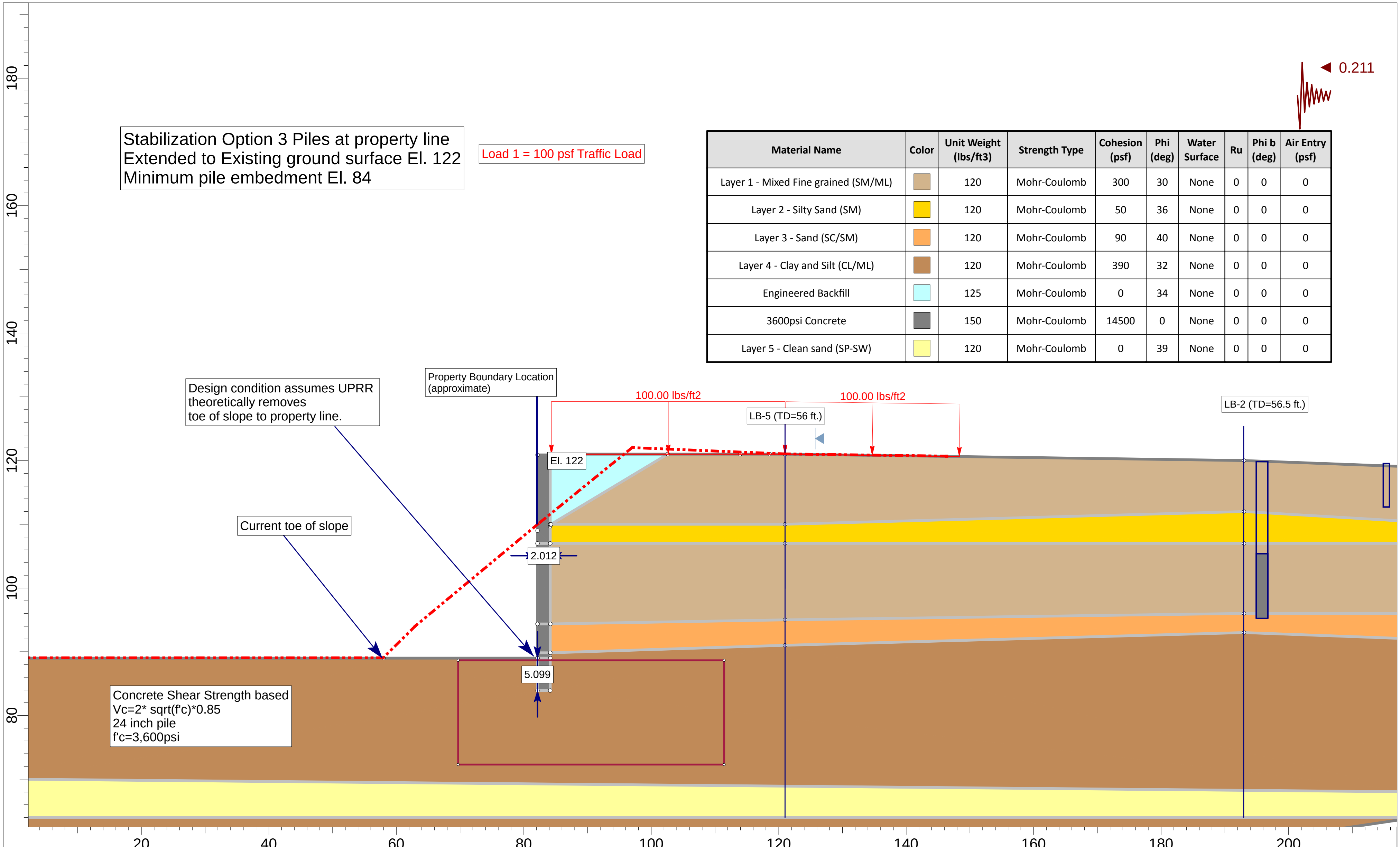
X	Y
82.161	89
82.161	83.901
84.162	83.901
84.162	89

Material Boundary

X	Y
84.162	110
84.277	110

Material Boundary

X	Y
84.277	110
102.598	121

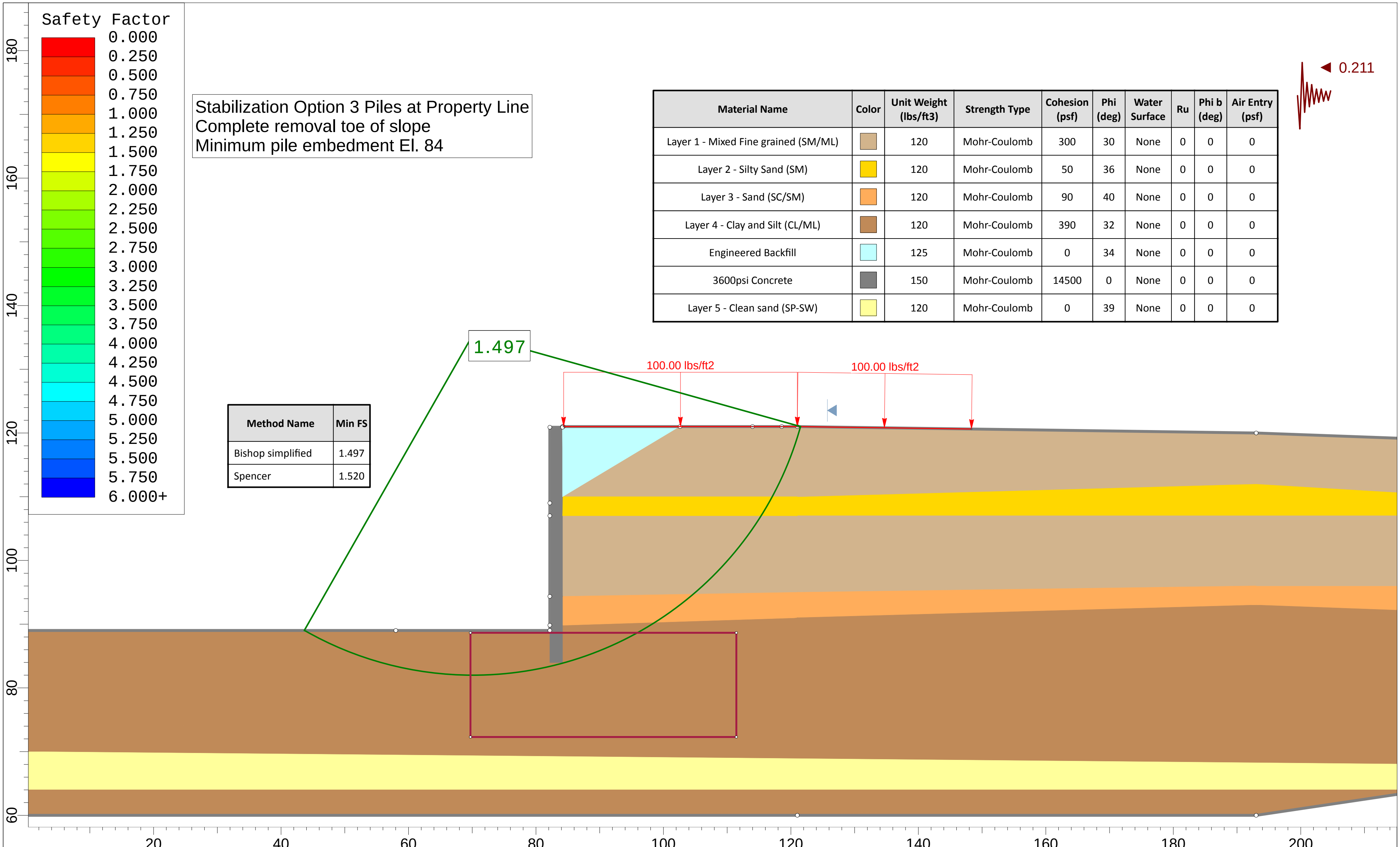


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Phi b (deg)	Air Entry (psf)
Layer 1 - Mixed Fine grained (SM/ML)		120	Mohr-Coulomb	300	30	None	0	0	0
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	36	None	0	0	0
Layer 3 - Sand (SC/SM)		120	Mohr-Coulomb	90	40	None	0	0	0
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	390	32	None	0	0	0
Engineered Backfill		125	Mohr-Coulomb	0	34	None	0	0	0
3600psi Concrete		150	Mohr-Coulomb	14500	0	None	0	0	0
Layer 5 - Clean sand (SP-SW)		120	Mohr-Coulomb	0	39	None	0	0	0

Leighton

SLIDE 7.018

Project	Goleta Fire Station #10
Analysis Description	A-A' Seismic Analysis - Circular failure, Stabilized condition
Drawn By	LD
Scale	1:250
Company	Leighton
Date	7/29/2016, 6:01:40 PM
File Name	7a_AA__11389001_Option3 Seismic.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru	Phi b (deg)	Air Entry (psf)
Layer 1 - Mixed Fine grained (SM/ML)		120	Mohr-Coulomb	300	30	None	0	0	0
Layer 2 - Silty Sand (SM)		120	Mohr-Coulomb	50	36	None	0	0	0
Layer 3 - Sand (SC/SM)		120	Mohr-Coulomb	90	40	None	0	0	0
Layer 4 - Clay and Silt (CL/ML)		120	Mohr-Coulomb	390	32	None	0	0	0
Engineered Backfill		125	Mohr-Coulomb	0	34	None	0	0	0
3600psi Concrete		150	Mohr-Coulomb	14500	0	None	0	0	0
Layer 5 - Clean sand (SP-SW)		120	Mohr-Coulomb	0	39	None	0	0	0

Method Name	Min FS
Bishop simplified	1.497
Spencer	1.520

Project	Goleta Fire Station #10		
Analysis Description	A-A' Seismic Analysis - Circular failure, Stabilized condition		
Drawn By LD	*Scale* 1:250	*Company*	Leighton
Date	7/29/2016, 6:01:40 PM	*File Name*	7a_AA__11389001_Option3 Seismic.slim

SLIDEINTERPRET 7.018

Slide Analysis Information

Goleta Fire Station #10

Project Summary

File Name:	7a_AA__11389001_Option3 Seismic
Slide Modeler Version:	7.018
Project Title:	Goleta Fire Station #10
Analysis:	A-A' Seismic Analysis - Circular failure, Stabilized condition
Author:	LD
Company:	Leighton
Date Created:	7/29/2016, 6:01:40 PM
Comments	
	Final condition - Peak strength
	Backfill/traffic loads under static condition

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
	Spencer

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	No
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Slope Search
Number of Surfaces:	10000
Upper Angle:	Not Defined
Lower Angle:	Not Defined
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal):	0.211

1 Distributed Load present

Distributed Load 1	
Distribution:	Constant
Magnitude [psf]:	100
Orientation:	Normal to boundary

Material Properties

Property	Layer 1 - Mixed Fine grained (SM/ML)	Layer 2 - Silty Sand (SM)	Layer 3 - Sand (SC/ SM)	Layer 4 - Clay and Silt (CL/ML)	Engineered Backfill	3600psi Concrete	Layer 5 - Clean sand (SP-SW)
Color							
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	120	120	120	125	150	120
Cohesion [psf]	300	50	90	390	0	14500	0
Friction Angle [deg]	30	36	40	32	34	0	39
Water Surface	None	None	None	None	None	None	None
Ru Value	0	0	0	0	0	0	0
Unsat. Shear Strength Phi b [deg]	0	0	0	0	0	0	0
Unsat. Shear Strength Air Entry Value [psf]	0	0	0	0	0	0	0

Global Minimums

Method: bishop simplified

FS	1.497490
Center:	70.097, 135.410
Radius:	53.415
Left Slip Surface Endpoint:	43.653, 89.000
Right Slip Surface Endpoint:	121.530, 120.993
Resisting Moment:	6.64985e+006 lb-ft
Driving Moment:	4.44068e+006 lb-ft
Total Slice Area:	1218.76 ft2
Surface Horizontal Width:	77.8768 ft
Surface Average Height:	15.6498 ft

Method: spencer

FS	1.519990
Center:	70.097, 135.410
Radius:	53.415
Left Slip Surface Endpoint:	43.653, 89.000
Right Slip Surface Endpoint:	121.530, 120.993
Resisting Moment:	6.74979e+006 lb-ft
Driving Moment:	4.44068e+006 lb-ft
Resisting Horizontal Force:	109832 lb
Driving Horizontal Force:	72258.3 lb
Total Slice Area:	1218.76 ft2
Surface Horizontal Width:	77.8768 ft
Surface Average Height:	15.6498 ft

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 1493
Number of Invalid Surfaces: 8507

Error Codes:

Error Code -103 reported for 665 surfaces
Error Code -105 reported for 1 surface
Error Code -114 reported for 7672 surfaces
Error Code -118 reported for 169 surfaces

Method: spencer

Number of Valid Surfaces: 1318
Number of Invalid Surfaces: 8682

Error Codes:

Error Code -103 reported for 665 surfaces
Error Code -105 reported for 1 surface
Error Code -108 reported for 48 surfaces
Error Code -111 reported for 127 surfaces
Error Code -114 reported for 7672 surfaces
Error Code -118 reported for 169 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-105 = More than two surface / slope intersections with no valid slip surface.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-111 = safety factor equation did not converge
-114 = Surface with Reverse Curvature.
-118 = Surface does not pass through the search focus

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.49749

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.57216	81.2351	-28.7126	Layer 4 - Clay and Silt (CL/ML)	390	32	365.245	546.95	251.173	0	251.173
2	1.57216	237.404	-26.8064	Layer 4 - Clay and Silt (CL/ML)	390	32	409.551	613.299	357.353	0	357.353
3	1.57216	381.276	-24.9317	Layer 4 - Clay and Silt (CL/ML)	390	32	448.356	671.408	450.347	0	450.347
4	1.57216	513.426	-23.0852	Layer 4 - Clay and Silt (CL/ML)	390	32	482.232	722.138	531.532	0	531.532
5	1.57216	634.35	-21.2638	Layer 4 - Clay and Silt (CL/ML)	390	32	511.651	766.193	602.034	0	602.034

6	1.57216	744.475	-19.4646	Layer 4 - Clay and Silt (CL/ML)	390	32	537.002	804.155	662.786	0	662.786
7	1.57216	844.176	-17.6853	Layer 4 - Clay and Silt (CL/ML)	390	32	558.607	836.508	714.56	0	714.56
8	1.57216	933.773	-15.9233	Layer 4 - Clay and Silt (CL/ML)	390	32	576.74	863.662	758.019	0	758.019
9	1.57216	1013.55	-14.1768	Layer 4 - Clay and Silt (CL/ML)	390	32	591.633	885.964	793.711	0	793.711
10	1.57216	1083.73	-12.4436	Layer 4 - Clay and Silt (CL/ML)	390	32	603.485	903.713	822.114	0	822.114
11	1.57216	1144.54	-10.7218	Layer 4 - Clay and Silt (CL/ML)	390	32	612.469	917.166	843.642	0	843.642
12	1.57216	1196.13	-9.0099	Layer 4 - Clay and Silt (CL/ML)	390	32	618.731	926.543	858.649	0	858.649
13	1.57216	1238.66	-7.30602	Layer 4 - Clay and Silt (CL/ML)	390	32	622.4	932.038	867.44	0	867.44
14	1.57216	1272.24	-5.60863	Layer 4 - Clay and Silt (CL/ML)	390	32	623.589	933.819	870.291	0	870.291
15	1.57216	1296.95	-3.91616	Layer 4 - Clay and Silt (CL/ML)	390	32	622.397	932.034	867.435	0	867.435
16	1.57216	1312.87	-2.22712	Layer 4 - Clay and Silt (CL/ML)	390	32	618.909	926.81	859.077	0	859.077
17	1.57216	1320.04	-0.540006	Layer 4 - Clay and Silt (CL/ML)	390	32	613.201	918.262	845.397	0	845.397
18	1.57216	1318.47	1.14664	Layer 4 - Clay and Silt (CL/ML)	390	32	605.338	906.487	826.549	0	826.549
19	1.57216	1308.16	2.83427	Layer 4 - Clay and Silt (CL/ML)	390	32	595.378	891.572	802.681	0	802.681
20	1.57216	1289.08	4.52438	Layer 4 - Clay and Silt (CL/ML)	390	32	583.372	873.593	773.913	0	773.913
21	1.57216	1261.19	6.21844	Layer 4 - Clay and Silt (CL/ML)	390	32	569.362	852.614	740.338	0	740.338
22	1.57216	1224.4	7.91798	Layer 4 - Clay and Silt (CL/ML)	390	32	553.387	828.692	702.056	0	702.056
23	1.57216	1178.63	9.62457	Layer 4 - Clay and Silt (CL/ML)	390	32	535.479	801.875	659.14	0	659.14
24	1.57216	1123.74	11.3398	Layer 4 - Clay and Silt (CL/ML)	390	32	515.665	772.203	611.653	0	611.653
25	1.57216	4990.35	13.0655	Layer 4 - Clay and Silt (CL/ML)	390	32	1445.39	2164.45	2839.71	0	2839.71
26	1.57216	8364.58	14.8033	Layer 4 - Clay and Silt (CL/ML)	390	32	2239.2	3353.18	4742.08	0	4742.08
27	1.57216	7021.37	16.5551	Layer 4 - Clay and Silt (CL/ML)	390	32	1927.36	2886.2	3994.75	0	3994.75
28	1.57216	6920.75	18.3231	Layer 4 - Clay and Silt (CL/ML)	390	32	1879.99	2815.27	3881.24	0	3881.24
29	1.57216	6809.92	20.1093	Layer 4 - Clay and Silt (CL/ML)	390	32	1830.72	2741.49	3763.18	0	3763.18
30	1.57216	6688.54	21.9162	Layer 4 - Clay and Silt (CL/ML)	390	32	1779.51	2664.8	3640.44	0	3640.44
31	1.57216	6556.21	23.7463	Layer 4 - Clay and Silt (CL/ML)	390	32	1726.29	2585.1	3512.89	0	3512.89
32	1.57216	6412.48	25.6025	Layer 4 - Clay and Silt (CL/ML)	390	32	1670.98	2502.28	3380.35	0	3380.35
33	1.57216	6256.84	27.4881	Layer 4 - Clay and Silt (CL/ML)	390	32	1613.51	2416.22	3242.63	0	3242.63
34	1.57216	6088.67	29.4066	Layer 4 - Clay and	390	32	1553.8	2326.8	3099.53	0	3099.53

				Silt (CL/ML)							
35	1.57216	5907.28	31.362	Layer 4 - Clay and Silt (CL/ML)	390	32	1491.74	2233.86	2950.8	0	2950.8
36	1.50477	5471.29	33.3153	Layer 3 - Sand (SC/SM)	90	40	1575.07	2358.65	2703.68	0	2703.68
37	1.50477	5279.11	35.2697	Layer 3 - Sand (SC/SM)	90	40	1492.25	2234.63	2555.87	0	2555.87
38	1.50477	5073.36	37.2724	Layer 3 - Sand (SC/SM)	90	40	1407.02	2107	2403.77	0	2403.77
39	1.50477	4857.41	39.3301	Layer 3 - Sand (SC/SM)	90	40	1320.4	1977.29	2249.19	0	2249.19
40	1.51895	4668.52	41.4606	Layer 1 - Mixed Fine grained (SM/ML)	300	30	1062.86	1591.62	2237.15	0	2237.15
41	1.51895	4414.04	43.6741	Layer 1 - Mixed Fine grained (SM/ML)	300	30	994.31	1488.97	2059.35	0	2059.35
42	1.51895	4138.66	45.9727	Layer 1 - Mixed Fine grained (SM/ML)	300	30	922.477	1381.4	1873.04	0	1873.04
43	1.51895	3839.68	48.3714	Layer 1 - Mixed Fine grained (SM/ML)	300	30	847.065	1268.47	1677.44	0	1677.44
44	1.51895	3513.64	50.8893	Layer 1 - Mixed Fine grained (SM/ML)	300	30	767.699	1149.62	1471.59	0	1471.59
45	1.51895	3155.92	53.5522	Layer 1 - Mixed Fine grained (SM/ML)	300	30	683.923	1024.17	1254.3	0	1254.3
46	1.51895	2760.16	56.3957	Layer 1 - Mixed Fine grained (SM/ML)	300	30	595.156	891.24	1024.06	0	1024.06
47	1.75088	2626.31	59.7311	Layer 2 - Silty Sand (SM)	50	36	442.695	662.931	843.626	0	843.626
48	1.48285	1694.26	63.3689	Layer 1 - Mixed Fine grained (SM/ML)	300	30	384.562	575.878	477.835	0	477.835
49	1.48285	1117.37	67.1957	Layer 1 - Mixed Fine grained (SM/ML)	300	30	276.543	414.121	197.664	0	197.664
50	1.48285	402.214	71.7944	Layer 1 - Mixed Fine grained (SM/ML)	300	30	158.358	237.139	-108.878	0	-108.878

Global Minimum Query (spencer) - Safety Factor: 1.51999

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.57216	81.2351	-28.7126	Layer 4 - Clay and Silt (CL/ML)	390	32	709.986	1079.17	1102.9	0	1102.9
2	1.57216	237.404	-26.8064	Layer 4 - Clay and Silt (CL/ML)	390	32	760.908	1156.57	1226.77	0	1226.77
3	1.57216	381.276	-24.9317	Layer 4 - Clay and Silt (CL/ML)	390	32	795.096	1208.54	1309.93	0	1309.93
4	1.57216	513.426	-23.0852	Layer 4 - Clay and Silt (CL/ML)	390	32	817.579	1242.71	1364.63	0	1364.63

5	1.57216	634.35	-21.2638	Layer 4 - Clay and Silt (CL/ML)	390	32	831.57	1263.98	1398.66	0	1398.66
6	1.57216	744.475	-19.4646	Layer 4 - Clay and Silt (CL/ML)	390	32	839.185	1275.55	1417.18	0	1417.18
7	1.57216	844.176	-17.6853	Layer 4 - Clay and Silt (CL/ML)	390	32	841.857	1279.61	1423.68	0	1423.68
8	1.57216	933.773	-15.9233	Layer 4 - Clay and Silt (CL/ML)	390	32	840.581	1277.67	1420.58	0	1420.58
9	1.57216	1013.55	-14.1768	Layer 4 - Clay and Silt (CL/ML)	390	32	836.065	1270.81	1409.59	0	1409.59
10	1.57216	1083.73	-12.4436	Layer 4 - Clay and Silt (CL/ML)	390	32	828.828	1259.81	1391.99	0	1391.99
11	1.57216	1144.54	-10.7218	Layer 4 - Clay and Silt (CL/ML)	390	32	819.253	1245.26	1368.7	0	1368.7
12	1.57216	1196.13	-9.0099	Layer 4 - Clay and Silt (CL/ML)	390	32	807.632	1227.59	1340.43	0	1340.43
13	1.57216	1238.66	-7.30602	Layer 4 - Clay and Silt (CL/ML)	390	32	794.193	1207.17	1307.73	0	1307.73
14	1.57216	1272.24	-5.60863	Layer 4 - Clay and Silt (CL/ML)	390	32	779.114	1184.24	1271.06	0	1271.06
15	1.57216	1296.95	-3.91616	Layer 4 - Clay and Silt (CL/ML)	390	32	762.541	1159.05	1230.75	0	1230.75
16	1.57216	1312.87	-2.22712	Layer 4 - Clay and Silt (CL/ML)	390	32	744.59	1131.77	1187.08	0	1187.08
17	1.57216	1320.04	-0.540006	Layer 4 - Clay and Silt (CL/ML)	390	32	725.362	1102.54	1140.31	0	1140.31
18	1.57216	1318.47	1.14664	Layer 4 - Clay and Silt (CL/ML)	390	32	704.939	1071.5	1090.63	0	1090.63
19	1.57216	1308.16	2.83427	Layer 4 - Clay and Silt (CL/ML)	390	32	683.392	1038.75	1038.21	0	1038.21
20	1.57216	1289.08	4.52438	Layer 4 - Clay and Silt (CL/ML)	390	32	660.784	1004.39	983.224	0	983.224
21	1.57216	1261.19	6.21844	Layer 4 - Clay and Silt (CL/ML)	390	32	637.169	968.491	925.779	0	925.779
22	1.57216	1224.4	7.91798	Layer 4 - Clay and Silt (CL/ML)	390	32	612.598	931.143	866.008	0	866.008
23	1.57216	1178.63	9.62457	Layer 4 - Clay and Silt (CL/ML)	390	32	587.114	892.407	804.022	0	804.022
24	1.57216	1123.74	11.3398	Layer 4 - Clay and Silt (CL/ML)	390	32	560.759	852.348	739.91	0	739.91
25	1.57216	4990.35	13.0655	Layer 4 - Clay and Silt (CL/ML)	390	32	1446.79	2199.1	2895.16	0	2895.16
26	1.57216	8364.58	14.8033	Layer 4 - Clay and Silt (CL/ML)	390	32	2174.45	3305.14	4665.21	0	4665.21
27	1.57216	7021.37	16.5551	Layer 4 - Clay and Silt (CL/ML)	390	32	1855.5	2820.34	3889.36	0	3889.36
28	1.57216	6920.75	18.3231	Layer 4 - Clay and Silt (CL/ML)	390	32	1784.51	2712.43	3716.67	0	3716.67
29	1.57216	6809.92	20.1093	Layer 4 - Clay and Silt (CL/ML)	390	32	1714.02	2605.3	3545.22	0	3545.22
30	1.57216	6688.54	21.9162	Layer 4 - Clay and Silt (CL/ML)	390	32	1643.92	2498.74	3374.69	0	3374.69
31	1.57216	6556.21	23.7463	Layer 4 - Clay and Silt (CL/ML)	390	32	1574.07	2392.57	3204.78	0	3204.78
32	1.57216	6412.48	25.6025	Layer 4 - Clay and Silt (CL/ML)	390	32	1504.37	2286.63	3035.25	0	3035.25
33	1.57216	6256.84	27.4881	Layer 4 - Clay and	390	32	1434.73	2180.77	2865.83	0	2865.83

				Silt (CL/ML)								
34	1.57216	6088.67	29.4066	Layer 4 - Clay and Silt (CL/ML)	390	32	1365.04	2074.85	2696.32	0	2696.32
35	1.57216	5907.28	31.362	Layer 4 - Clay and Silt (CL/ML)	390	32	1295.22	1968.72	2526.48	0	2526.48
36	1.50477	5471.29	33.3153	Layer 3 - Sand (SC/SM)	90	40	1354.96	2059.53	2347.2	0	2347.2
37	1.50477	5279.11	35.2697	Layer 3 - Sand (SC/SM)	90	40	1263.88	1921.09	2182.2	0	2182.2
38	1.50477	5073.36	37.2724	Layer 3 - Sand (SC/SM)	90	40	1173.24	1783.32	2018.03	0	2018.03
39	1.50477	4857.41	39.3301	Layer 3 - Sand (SC/SM)	90	40	1083.88	1647.48	1856.13	0	1856.13
40	1.51895	4668.52	41.4606	Layer 1 - Mixed Fine grained (SM/ML)	300	30	853.914	1297.94	1728.48	0	1728.48
41	1.51895	4414.04	43.6741	Layer 1 - Mixed Fine grained (SM/ML)	300	30	791.256	1202.7	1563.52	0	1563.52
42	1.51895	4138.66	45.9727	Layer 1 - Mixed Fine grained (SM/ML)	300	30	727.825	1106.29	1396.53	0	1396.53
43	1.51895	3839.68	48.3714	Layer 1 - Mixed Fine grained (SM/ML)	300	30	663.546	1008.58	1227.31	0	1227.31
44	1.51895	3513.64	50.8893	Layer 1 - Mixed Fine grained (SM/ML)	300	30	598.347	909.481	1055.65	0	1055.65
45	1.51895	3155.92	53.5522	Layer 1 - Mixed Fine grained (SM/ML)	300	30	532.149	808.861	881.374	0	881.374
46	1.51895	2760.16	56.3957	Layer 1 - Mixed Fine grained (SM/ML)	300	30	464.894	706.634	704.312	0	704.312
47	1.75088	2626.31	59.7311	Layer 2 - Silty Sand (SM)	50	36	303.119	460.738	565.332	0	565.332
48	1.48285	1694.26	63.3689	Layer 1 - Mixed Fine grained (SM/ML)	300	30	317.563	482.693	316.433	0	316.433
49	1.48285	1117.37	67.1957	Layer 1 - Mixed Fine grained (SM/ML)	300	30	249.77	379.649	137.955	0	137.955
50	1.48285	402.214	71.7944	Layer 1 - Mixed Fine grained (SM/ML)	300	30	183.022	278.191	-37.7736	0	-37.7736

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.49749

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	43.6532	89	0	0	0
2	45.2253	88.1388	771.758	0	0
3	46.7975	87.3444	1647.59	0	0
4	48.3696	86.6136	2599.16	0	0
5	49.9418	85.9435	3603	0	0
6	51.514	85.3317	4639.6	0	0
7	53.0861	84.776	5692.65	0	0
8	54.6583	84.2748	6748.46	0	0
9	56.2305	83.8262	7795.58	0	0
10	57.8026	83.4291	8824.44	0	0
11	59.3748	83.0822	9827.06	0	0
12	60.9469	82.7845	10796.9	0	0
13	62.5191	82.5352	11728.5	0	0
14	64.0913	82.3336	12617.7	0	0
15	65.6634	82.1792	13461.3	0	0
16	67.2356	82.0716	14256.7	0	0
17	68.8078	82.0105	15002.5	0	0
18	70.3799	81.9957	15697.8	0	0
19	71.9521	82.0271	16342.6	0	0
20	73.5242	82.105	16937.4	0	0
21	75.0964	82.2294	17483.7	0	0
22	76.6686	82.4007	17983.4	0	0
23	78.2407	82.6193	18439	0	0
24	79.8129	82.8859	18854.1	0	0
25	81.3851	83.2012	19232.6	0	0
26	82.9572	83.5661	19409.4	0	0
27	84.5294	83.9815	19184.7	0	0
28	86.1015	84.4489	18857.7	0	0
29	87.6737	84.9695	18324	0	0
30	89.2459	85.5452	17591	0	0
31	90.818	86.1777	16666.8	0	0
32	92.3902	86.8693	15560	0	0
33	93.9624	87.6227	14280	0	0
34	95.5345	88.4407	12836.9	0	0
35	97.1067	89.3268	11241.5	0	0
36	98.6788	90.285	9506.17	0	0
37	100.184	91.274	8041.11	0	0
38	101.688	92.3383	6446.28	0	0
39	103.193	93.4834	4734.27	0	0
40	104.698	94.7164	2917.47	0	0
41	106.217	96.0584	540.019	0	0
42	107.736	97.5086	-1871.86	0	0
43	109.255	99.08	-4291.24	0	0
44	110.774	100.789	-6685.36	0	0
45	112.293	102.658	-9013.4	0	0
46	113.812	104.714	-11223.1	0	0
47	115.331	107	-13244.8	0	0
48	117.081	110	-15557	0	0
49	118.564	112.957	-16758.9	0	0
50	120.047	116.484	-17282.9	0	0
51	121.53	120.993	0	0	0

Global Minimum Query (spencer) - Safety Factor: 1.51999

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	43.6532	89	0	0	0
2	45.2253	88.1388	2048.19	1072.23	27.6321
3	46.7975	87.3444	4168.16	2182.03	27.632
4	48.3696	86.6136	6294.3	3295.07	27.6321
5	49.9418	85.9435	8385	4389.55	27.6321
6	51.514	85.3317	10413.4	5451.44	27.6322
7	53.0861	84.776	12362.3	6471.68	27.6321
8	54.6583	84.2748	14220.6	7444.49	27.6321
9	56.2305	83.8262	15981.5	8366.31	27.632
10	57.8026	83.4291	17641.1	9235.1	27.632
11	59.3748	83.0822	19197.5	10049.9	27.6321
12	60.9469	82.7845	20650.7	10810.6	27.632
13	62.5191	82.5352	22001.4	11517.7	27.632
14	64.0913	82.3336	23251.5	12172.2	27.6321
15	65.6634	82.1792	24403.4	12775.2	27.6321
16	67.2356	82.0716	25460.3	13328.5	27.6321
17	68.8078	82.0105	26425.8	13833.9	27.632
18	70.3799	81.9957	27303.9	14293.6	27.6321
19	71.9521	82.0271	28098.9	14709.8	27.6321
20	73.5242	82.105	28815.9	15085.1	27.632
21	75.0964	82.2294	29459.8	15422.2	27.632
22	76.6686	82.4007	30036.2	15724	27.6321
23	78.2407	82.6193	30551	15993.5	27.6321
24	79.8129	82.8859	31010.4	16234	27.6321
25	81.3851	83.2012	31421.1	16449	27.6321
26	82.9572	83.5661	31585	16534.8	27.6321
27	84.5294	83.9815	31298.3	16384.7	27.6321
28	86.1015	84.4489	30914.5	16183.7	27.632
29	87.6737	84.9695	30323	15874.1	27.6321
30	89.2459	85.5452	29538.5	15463.4	27.6321
31	90.818	86.1777	28575.5	14959.3	27.6321
32	92.3902	86.8693	27448.8	14369.4	27.632
33	93.9624	87.6227	26172.9	13701.5	27.632
34	95.5345	88.4407	24762.7	12963.3	27.6321
35	97.1067	89.3268	23233.5	12162.7	27.632
36	98.6788	90.285	21601.2	11308.2	27.632
37	100.184	91.274	20162.9	10555.3	27.6321
38	101.688	92.3383	18627.3	9751.42	27.6321
39	103.193	93.4834	17010.2	8904.87	27.6321
40	104.698	94.7164	15326.8	8023.58	27.6321
41	106.217	96.0584	13318.4	6972.18	27.632
42	107.736	97.5086	11320.7	5926.39	27.6321
43	109.255	99.08	9357.76	4898.79	27.6321
44	110.774	100.789	7457.26	3903.88	27.6321
45	112.293	102.658	5651.85	2958.75	27.6321
46	113.812	104.714	3981.08	2084.1	27.6321
47	115.331	107	2494.46	1305.85	27.6321
48	117.081	110	774.716	405.564	27.6321
49	118.564	112.957	-47.9119	-25.0819	27.6321
50	120.047	116.484	-400.076	-209.44	27.6321
51	121.53	120.993	0	0	0

List Of Coordinates

Distributed Load

X	Y
148.335	120.62
121	121
118.56	121
113.968	121
84.345	121

Focus Search Window

X	Y
69.718	88.644
69.718	72.291
111.439	72.291
111.439	88.644

External Boundary

X	Y
0	60
121	60
193	60
220	64
220	68
220	92
220	96
220	107
220	110.388
220	119
193	120
121	121
118.56	121
113.968	121
102.598	121
84.277	121
84.277	121.002
84.162	121.002
84.162	120.892
82.161	120.892
82.161	109
82.161	107
82.161	94.3591
82.161	89.82
82.161	89
58	89
0	89
0	70
0	64

Material Boundary

X	Y
82.161	94.3591
84.162	94.3591
121	95
193	96
220	96

Material Boundary

X	Y
82.161	107
84.162	107
121	107
193	107
220	107

Material Boundary

X	Y
0	70
220	68

Material Boundary

X	Y
0	64
220	64

Material Boundary

X	Y
84.277	110
121	110
193	112
220	110.388

Material Boundary

X	Y
82.161	89.82
84.162	89.82
121	91
193	93
220	92

Material Boundary

X	Y
82.161	89
84.162	89
84.162	89.82

Material Boundary

X	Y
84.162	89.82
84.162	94.3591

Material Boundary

X	Y
84.162	94.3591
84.162	107

Material Boundary

X	Y
84.162	107
84.162	109.684
84.162	109.885
84.162	110
84.162	120.892

Material Boundary

X	Y
82.161	89
82.161	83.901
84.162	83.901
84.162	89

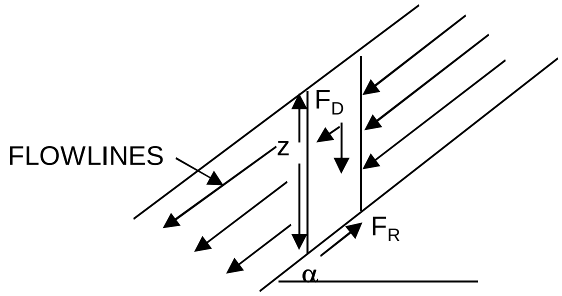
Material Boundary

X	Y
84.162	110
84.277	110

Material Boundary

X	Y
84.277	110
102.598	121

SURFICIAL SLOPE STABILITY ANALYSIS



Project No.:	11043.002		
Case:	Lower Slope Marine Terrace 2:5:1 H:V		
Depth of Saturation (ft), Z		=	4
Buoyant Unit Weight of Soil (pcf), γ_b		=	**57.6**
Total Unit Weight of Soil (pcf), γ_t		=	120
Slope Angle, α		=	23
Angle of Internal Friction, ϕ		=	33
Cohesion (psf), c		=	132

Force Tending To Cause Movement:

$F_D = Z\gamma_t \sin 2\alpha / 2$ = **172.64** lb/ft

Force Tending To Resist Movement:

$F_R = Z\gamma_b \cos^2 \alpha \tan \phi + (c)$

= **258.78** lb/ft

F.S. : $$\frac{2Z\gamma_b \cos^2 \alpha \tan \phi + 2c}{Z\gamma_t \sin 2\alpha}$$

F.S. = 1.50

SURFICIAL STABILITY Angle of repose for toe of slope	Project Name :	Goleta Fire Station #10
	Project Number :	11389.001
	Designed/Checked :	LJD

Surficial Stability Summary Goleta Fire Station #10				Ultimate Strength Parameters		Requirements to Attain Min. F.S. =1.5		Note
Boring No.	Sample No.	Depth	Soil ID	C	φ	Slope Ratio	Slope Angle	
LB-7	B-1 remold	0-5	Dark Brown Clayey Sand (SC)	50*	34	**3.5:1**	16	remolded fill 90%
LB-5	R-5	15	Brown Silty Clayey Sand (SC-SM)	132	33	**2.5:1**	23	upper slope
LB-5	R-9	25	Brown Poorly Graded Sand With Silt (SP-SM)	49	33	**4.5:1**	12	mid-slope
LB-4	R-6	30	Yellowish Brown Silty, Clayey Sand (SC-SM)	50*	39	**3:1**	18	lower slope
LB-5	R-11	35	Yellowish Brown Lean Clay (CL)	247	25	**1.6:1**	32	lower slope

* nominal cohesion assigned

APPENDIX E

PREVIOUS GEOTECHNICAL DATA

FED. ROAD DIV. No.	STATE	PROJ. No.	FISCAL YEAR	SHEET No.	TOTAL SHEETS
7	CAL.			191	197

F-007(2)

DIST.	COUNTY	ROUTE	SECTION	SHEET No.	TOTAL SHEETS
V	SB	2	Q	K-8	95

BRIDGE ENGINEER — CIVIL ENGINEER—LICENSE 5585

DATE APPROVED December 15, 1959

AS BUILT Corr. by [signature] Date 9-20-62

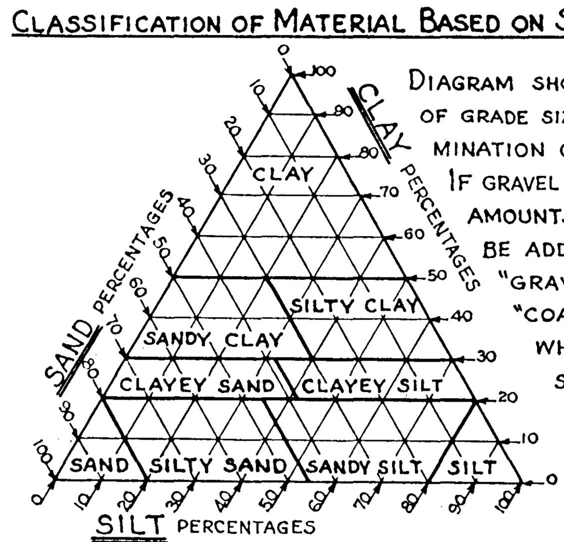
Field Study: Snowden & Nelson
Drawn: M. Heaney 4-17-57
Checked: T. Nelson 5-6-57
Approval Recommended by: Engineering Geologist

191

Classification of Material Based on Standard Grade Size Limits

Diagram showing the basis for estimates of grade size distribution used in determination of class names.

If gravel is present in appreciable amounts the term "gravelly" may be added to the class name, viz. "gravelly sand." The terms "coarse", "medium" and "fine" when used to describe sand, silt and gravel refer to standard grade size limits.

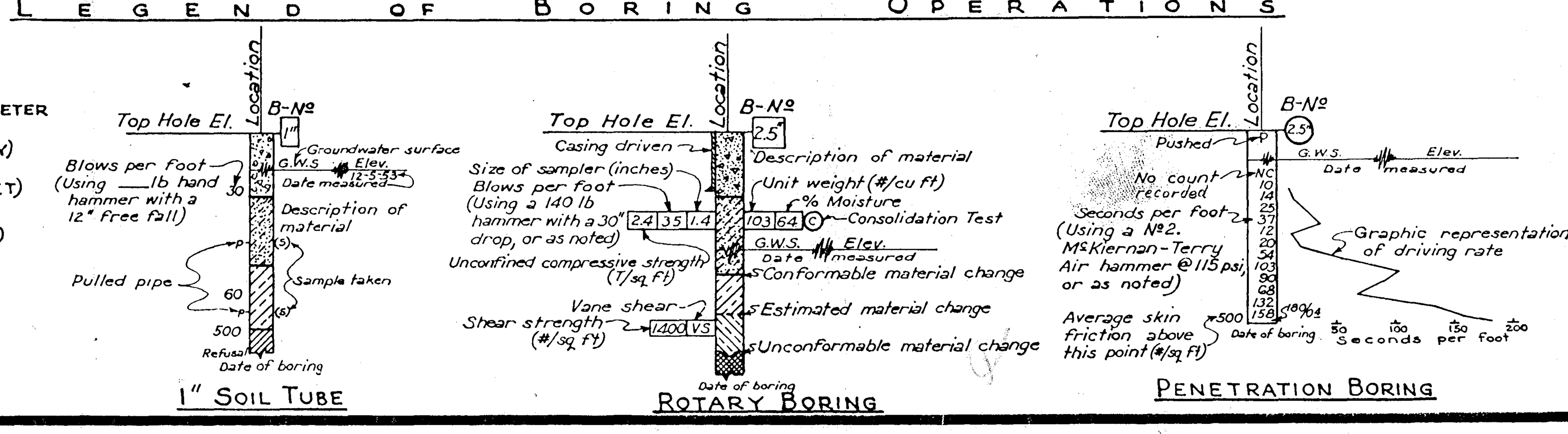


Legend of Earth Materials

- Gravel
- Sand
- Silt
- Clay
- Sandy Clay or Clayey Sand
- Sandy Silt or Silty Sand
- Silty Clay or Clayey Silt
- Peat and/or Organic Matter
- Fill Material
- Igneous Rock
- Sedimentary Rock
- Metamorphic Rock

Legend of Boring Operations

- Plan of any boring
- Penetrometer
- 2¼" Cone Penetrometer
- Sampler boring (dry)
- Rotary boring (wet)
- Auger boring (dry)
- Jet boring
- Core boring
- Test pit



Notes

The contractor's attention is directed to Section 2—1.03 of the Standard Specifications and to the Special Provisions accompanying this set of plans.

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

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

Hollister Avenue Overcrossing

Log of Test Borings

SCALE	BRIDGE	FILE	DRAWING
1" = 10'	51-123		C-4577-8

PREL. DRAWING NO. P-4577 24

29-A-1

padre
associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

PRELIMINARY GEOTECHNICAL STUDY FOR THE SANDPIPER RESIDENTIAL DEVELOPMENT

Santa Barbara County, California

Prepared for:
The Oly Chadmar Sandpiper General Partnership

November 1999

1861 Knoll Drive ▪ Ventura, California 93003 ▪ 805-644-2220 ▪ FAX 805-644-2050

padre
associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

November 8, 1999
Project No.: 9904-1131

Oly Chadmar Sandpiper General Partnership
C/o Chadmar, LLC
3187-F Airway Avenue
Costa Mesa, California 92626

Attention: Mr. Dan McGregor

Subject: Preliminary Geotechnical Study, Sandpiper Residential Development, Goleta, Santa Barbara County, California

Dear Mr. McGregor:

Padre Associates, Inc. (Padre), is pleased to submit this preliminary geotechnical engineering report to the Oly Chadmar Sandpiper General Partnership (Chadmar) for the design of the proposed Sandpiper Residential Development, located in the Goleta area of Santa Barbara County, California. The project is located on an undeveloped parcel located adjacent to Hollister Avenue, north of Sandpiper Golf Course. This report was prepared in general accordance with terms presented in our proposal dated July 26, 1999.

The report summarizes the field and laboratory data that were collected for the study and provides geotechnical recommendations for design and construction of the project. Please contact our office if you have questions or comments regarding this study, or if you need additional information.

REGISTERED GEOLOGIST
JAMES A. BIANCHIN
EG NO. 1644
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Sincerely,
PADRE ASSOCIATES, INC.

James A. Bianchin, C.E.G.
Senior Geologist

Jeffrey T. Damron, P.E.
Senior Engineer

REGISTERED PROFESSIONAL ENGINEER
JEFFREY T. DAMRON
No. 43872
Exp. June 30, 2001
CIVIL
STATE OF CALIFORNIA

Copies submitted: (5)

padre

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INTRODUCTION

This report presents the findings, conclusions, and recommendations of a preliminary geotechnical study performed for the proposed Sandpiper Residential Development. The proposed site is an approximately 14-acre parcel located north of Hollister Avenue and Sandpiper Golf Course, in the Goleta area of Santa Barbara County, California, as shown on Plate 1 – Site Vicinity Map. The services provided for this study were in general accordance with our proposal dated July 26, 1999. Our proposal was developed through discussions with Mr. Dan McGregor of Oly, Chadmar, Sandpiper General Partners (Chadmar) and Mr. Michael Caccese of MAC Design Associates, Inc.

STUDY PURPOSE

The purpose of this study was to develop preliminary geotechnical grading and foundation recommendations for the proposed residential structures and site work on the proposed property. Our recommendations were developed through exploration and analysis of the subsurface conditions at the site.

PROJECT UNDERSTANDING

It is our understanding, based on the preliminary Concept Site Study provided to us by Chadmar, that the proposed development will consist of the construction of 46 two-story, single family homes; 67 two-story townhouses; and 46 2.5-story affordable housing units. In addition to the structures, paved access roads, parking lots, and vehicle courts will be constructed on site. A green belt is also proposed along Deveroux Creek and the existing sewer easement located in about the center of the project.

WORK PERFORMED

The work for our study was performed in general accordance with our proposal dated July 26, 1999. Notification to proceed was verbally received in a written memorandum dated August 11, 1999 from Mr. Dan McGregor. Authorization to perform this study was provided by execution of a Professional Services Agreement between Padre and Chadmar on August 12, 1999. Work included:

- Notification of Underground Service Alert in an effort to locate underground utilities at the proposed exploration locations;
- Performance of eleven cone penetrometer test (CPT) soundings. Locations of the CPT soundings at the site are shown on Plate 2 – Geotechnical Map. Logs of the CPT soundings are presented in Appendix A – Subsurface Exploration;
- Drilling, logging, and sampling of four hollow-stem-auger drill holes at locations within the proposed site improvements. Locations of the drill holes are shown on Plate 2. Logs of drill holes are presented in Appendix A;

- Laboratory testing of samples obtained from the drill holes. A description of laboratory tests performed and the results of those tests are presented in Appendix B – Laboratory Testing.
- Evaluation of geotechnical design parameters that can be used by the project designers; and,
- Preparation of this report summarizing the geotechnical data and the proposed geotechnical design parameters for the building foundations, site improvements and access road improvements.

Although a brief discussion of geology and faulting is included as part of this report, this study focused primarily on the development of geotechnical recommendations for grading and building foundations. A detailed site-specific seismic hazards analysis (probabilistic or deterministic seismic hazards, and site response spectra evaluations) is beyond the scope of services for this study. In addition, our proposed scope of services did not include any services for the evaluation of the presence or absence of hazardous substances in the soil, ground water, surface water, or atmosphere, or the presence of any environmentally sensitive habitats, protected species, or culturally significant areas.

EXISTING GEOTECHNICAL DATA

No site specific geotechnical information is known to exist for the project property. A number of regional geologic documents were reviewed during performance of this study. Those documents are listed in the References section of this report.

FINDINGS

SITE CONDITIONS

Topography

The site is relatively flat with subdued and gently rolling topography inclined at 5:1 or flatter. The site is bisected by Deveroux Creek, which creates the relatively steepest slopes and lowest portion of the property. Slopes lining the creek banks are about 6 to 8 feet tall and are inclined at up to about 45 degrees. Elevations on the property range from +85 feet above mean sea level (MSL) where Deveroux Creek intersects Hollister Avenue, to +120 feet above MSL along the northern edge of the property.

Drainage Conditions

Drainage at the site consists of sheet flow toward Deveroux Creek and toward Hollister Avenue to the south. Engineered drainage improvements were not observed to exist at the site.

Existing Land Uses

The property is fallow and does not appear to have been used recently for agricultural or other uses. A dirt road across the property appears to have provided access for vehicles to reach the Union Pacific Railroad easement located along the properties northern boundary. In addition, an existing sewer pipeline alignment traverses the property. No other land uses were evident.

GEOLOGIC CONDITIONS

Regional Setting

The site is situated on an alluvial plain within the Goleta Valley. This area is located south of the Santa Ynez Mountains in the Transverse Ranges Geomorphic Province of southern California. The Transverse Ranges Geomorphic Province is a west-trending geomorphic province within southern California bounded on the north by the Santa Ynez and San Andreas faults, on the east by the San Bernardino Mountains, on the south by the Transverse Ranges Frontal Fault Zone, and on the west by the Pacific Ocean. The province contains igneous, volcanic, metamorphic, and sedimentary rocks ranging in age from Cretaceous to Recent. Major east-trending folds and reverse faults reflect regional north-south compression, and are characteristic of the basin (Norris, R.M. and Webb, R.W., 1990).

Local Geology

The site is situated on a relatively flat surface comprised of Quaternary-age, older alluvium derived from the Santa Ynez Mountains. The alluvium ranges in thickness, but was observed to extend deeper than the depth of penetration of each drill hole excavated for this project. At the project site, the alluvium is comprised of interbedded moderately dense to very dense sand and stiff to hard clay.

Geologic Structure

Geologic structures consist of folds, faults, and formational bedding orientations. Faulting is not discussed in this section but in the Significant Faults section, below.

The project is located on the alluvial plain of the Goleta Valley. No near-surface geologic structures have been mapped at the project site (Dibblee, 1987; Olsen, 1982). The structure of the older alluvium can be observed in the cut slopes created for the railroad alignment north of the site and it appears that the older alluvium is relatively flat lying beneath the site.

No bedrock is exposed at the site. The closest mapped bedrock is the Monterey Formation, approximately 2,000 feet south of the southern property boundary (Olsen, 1982). The Monterey Formation in this area dips to the north or south at about 50 degrees (Dibblee, 1987).

The closest fold to the site is an unnamed syncline located about 1,000 feet south of the site. About 1,800 feet south of the site is the Ellwood anticline. No other folds are mapped in the project area.

Significant Faults

The State of California designates faults as active, potentially active, and inactive depending on the recency of movement that can be substantiated for a fault. A fault is considered active if it can be substantiated that the fault has ruptured during the Holocene (the last 11,000 years). A fault is considered potentially active if it can be substantiated that it has ruptured during the Quaternary (the last 2-million years) but not the Holocene. A fault is considered inactive if it can be substantiated as not having ruptured within the Quaternary.

The California Division of Mines and Geology (CDMG) evaluates the activity rating of a fault in fault evaluation reports (FER). FERs compile available geologic and seismologic data and evaluate if a fault should be zoned as active, potentially active, or inactive. If an FER evaluates a fault as active, then it is typically incorporated into a Special Studies Zone in accordance with the Alquist-Priolo Earthquakes Hazards Act (AP). AP Special Studies Zones require site-specific evaluation of fault location and require a structure setback if the fault is found traversing a project site.

No active faults are known to project through the project site (Dibblee, 1987; Olsen, 1982, Moore & Taber, 1974). However, a number of regional and local faults traverse the project region. The largest of these faults is the More Ranch fault, located about 1,800 feet south of the site. The More Ranch fault is not zoned as an AP Special Studies zone, and, therefore, is not considered active by the State of California. However, recent studies by researchers at the Institute of Crustal Studies have found evidence that the More Ranch fault is probably active. It is likely that future assessment of the More Ranch fault could result in AP zoning of the fault.

The site is bounded to the north by a number of additional faults. Those faults consist of the Las Varas and Glenn Anne faults, located about 2,500 and 6,000 feet away, respectively (Dibblee, 1987). Each of those faults is considered potentially active.

Groundwater Conditions

The project site is located within an area zoned as having moderately deep groundwater (Moore & Taber, 1974). Groundwater was not encountered in drill holes excavated for this project.

The groundwater conditions noted herein are based on our findings at the locations of the drill holes on the date and time of our exploration. The depth to groundwater can vary throughout the year and from year to year. Intense and long duration precipitation, modification of topography, and cultural land uses, such as irrigation, water well usage, on site waste disposal systems, can contribute to fluctuations in groundwater levels. If the Contractors bidding on this project are concerned about groundwater impacting construction, it is their responsibility to perform an independent evaluation of groundwater depths and dewatering requirements prior to bidding on the project and prior to initiation of construction.

EARTH MATERIALS

For this study, we advanced and collected soil samples from four hollow-stem-auger drill holes (DH-1 through DH-4) and 11 CPT soundings (CPT-1 through CPT-11) at the locations indicated on Plate 2. The explorations encountered older alluvium.

Older Alluvium (Qoal)/Terrace Deposits (Qt)

Older alluvium/terrace deposit materials (heretofore discussed as older alluvium) were encountered from the ground surface to a depth of 51.5 feet (DH-1), and to depths explored in each CPT sounding. The older alluvium materials consisted of interbedded fine silty sand (SM), fine sand (SP), clayey sand (SC), sandy silt (ML), sandy and silty clay (CL), and clay (CH). Granular older alluvium was generally moderately dense to very dense and ranged from fine to coarse grained. Fine-grained older alluvium ranged from stiff to hard, and was locally plastic. Gravel, cobbles, and boulders were not encountered in the drill holes but can be expected to be encountered locally throughout the older alluvium, as evidenced by gravel layers exposed in the railroad easement cut slopes.

ENGINEERING PROPERTIES OF SELECTED EARTH MATERIALS

As part of this study, laboratory testing was performed on selected samples of earth materials to aid in the assessment of pertinent engineering properties. The results are included in Appendix B. The laboratory tests include moisture content and dry density determinations, grain-size analyses, compaction, direct shear, expansion index (EI), R-value, and one-dimensional consolidation.

The older alluvium/terrace deposits tested range in color from dusky yellowish brown to moderate brown, to grayish orange, and consist predominately of silty and sandy clay (CL) and clay (CL/CH) with minor granular interbeds and gravel. The granular materials are typically moderately dense to dense and the fine-grained materials are typically stiff to hard. Gravels were observed up to about 2 inches in diameter in the railroad cut slope.

GEOLOGIC HAZARDS AND SEISMIC DESIGN CONSIDERATIONS

FAULT RUPTURE

The proposed site is not located within an established Alquist-Priolo Fault Hazard Zone. As noted above, the More Ranch fault is mapped approximately 1,800 feet south of the site. Because no active or potentially active faults are known to traverse the site, the likelihood of ground-surface rupture due to faulting on the proposed site appears to be low.

HISTORICAL SEISMICITY

The project region has historically been subjected to seismic activity. The earliest reported seismic event occurred on November 11, 1800, causing light damage to the Santa Barbara Mission (Olson 1982). The epicenter for this earthquake is unknown.

The 1800 earthquake is not included within the CDMG earthquake catalog. According to that catalog, the earliest recorded destructive earthquake occurred on December 21, 1812. That major earthquake destroyed the Royal Presidio and partially destroyed the Santa Barbara Mission (Olson 1982). The 1812 earthquake was estimated to be a moment magnitude 7.0 (M7.0) and was reportedly accompanied by a tsunami along the coast of Santa Barbara (Moore & Taber 1974). It is thought that the earthquake occurred on an offshore fault (Moore & Taber 1974; Olson 1982)

The Santa Barbara area was shaken by the 1857 Fort Tejon earthquake that occurred along the Mojave segment of the San Andreas fault. There are reports of cracking occurring to structure walls in the area, rocks rolling down from the hills, and water spilling from the Mission reservoir during that earthquake (Moore & Taber 1974).

The most well known seismic event in the region was the Santa Barbara earthquake that occurred on June 29, 1925. That earthquake is estimated as a M6.25 event that destroyed large areas within the City and County of Santa Barbara. It is thought that an offshore fault was the source for the 1925 earthquake (Moore & Taber 1974).

A M5.9 earthquake occurred offshore of Carpinteria on June 30, 1941. That earthquake damaged buildings in Santa Barbara that reportedly were "imperfectly repaired" from the 1925 earthquake (Moore & Taber 1974).

A swarm of earthquakes affected the Santa Barbara area in 1968. This swarm of earthquakes occurred in the Santa Barbara Channel and consisted of 63 shocks, the greatest being M5.2 (Olsen & Sylvester 1975).

The most recent relatively significant earthquake to effect the project area occurred on August 13, 1978. Data recorded from instrumentation during that M5.1 earthquake have indicated that the earthquake epicenter was located offshore within about 2.5 miles of Santa Barbara and occurred on north dipping reverse fault (Lee et al. 1978; Corbett & Johnson 1981).

LIQUEFACTION

Liquefaction is described as the sudden loss of soil shear strength due to a rapid increase of soil pore water pressures caused by cyclic loading from a seismic event. In simple terms, it means that a liquefied soil acts more like a fluid than a solid when shaken during an earthquake. In order for liquefaction to occur, the following are needed:

- Granular soils (sand, silty sand, sandy silt, and some gravels);
- A high groundwater table; and
- A low density in the granular soils underlying the site.

If those criteria are present, then there is a potential that the soils could liquefy during a seismic event.

There was no evidence of an established ground water table within the upper 50 feet below the site. Soil in the upper 50 feet of the site is primarily fine-grained silt and clay with some minor lenses of silty clayey sand. In addition, sampler blowcount data from the drill holes and CPT tip resistance measurements indicate that granular soils were dense to very dense below a depth of about 10 feet. On the basis of the data collected for this study, the liquefaction potential for soil in the upper 50 feet below the site appears to be very low.

SEISMICALLY-INDUCED SETTLEMENT

Seismically-induced settlement, as used herein, refers to settlement of unsaturated granular material as a result of densification and particle rearrangement due to earthquake shaking. Seismically-induced settlement differs from settlement resulting from liquefaction because there is not a buildup of excess pore water pressure during the seismic shaking.

Unsaturated granular soils were discontinuously encountered at the ground surface and extend down to depths greater than 50 feet. The granular soils are generally moderately dense to dense and consist of sand (SP), silty sand (SM), and clayey sand (SC). The cumulative thickness of granular soils encountered in our drill holes is estimated to be less than 5 to 10 feet. Using the empirical procedure described by Tokimatsu and Seed (1987), seismically-induced settlement of those unsaturated granular layers is anticipated to be less than about ½-inch.

TSUNAMIS AND SEICHES

Tsunamis are large-period seawaves generated by earthquakes and submarine landslides. A number of historical records of tsunamis have been recorded in the Santa Barbara region; however, we know of no records of tsunamis affecting the project area. Modeling has been performed to evaluate the potential for tsunamis to adversely affect the Goleta/Ellwood area (Houston and Garcia, 1974). That modeling estimated that tsunami run-up of about 5 and 11 feet above meteorological and astronomical tides for a 100-year and 500-year tsunami event, respectively, could affect the project region. Because the project site is located at a minimum elevation of about 85 feet above MSL, it is our opinion that tsunamis have a low potential to adversely impact the site.

Seiches are oscillations of impounded water bodies due to shaking from a seismic event. No known water tanks, reservoirs, or impoundments are known to be located in the vicinity or upstream of the project site. Even if a seiche were to occur upstream from the project area, Highway 101 and the entrenched railroad easement north of the site would act as a buffer to protect the property. It is our opinion that there is a low potential for seiches to adversely affect the project site.

LANDSLIDING

The site is a relatively flat parcel. No landslides were observed on the property during this study. Slopes surrounding the property are relatively subdued. No landslides were observed on those slopes. It is our opinion that the potential for landslides to adversely affect the project is low.

Slope failures can occur in temporary excavations made for construction of the project. Precautions should be taken to reduce the potential for failure of temporary slopes. Those precautions are discussed in Utility Trenches, Pipe Bedding, and Trench Backfill section below.

UBC DESIGN RECOMMENDATIONS

At a minimum, structures should be designed in accordance with the Uniform Building Code (UBC) criteria. UBC-based design requires the definition of a Seismic Zone Factor (Z), a Soil Profile Type (S), Seismic Source Type, Near-Source Factors (N_a and N_v), Seismic Coefficient (C_a and C_v), Site Coefficient Factor (S) and an Importance Factor (I).

The Structural Engineers Association of California (SEAOC) Commentary to the UBC indicates that "the primary function of the UBC design requirements are to provide minimum standards for use in building design regulations to maintain public safety in the extreme earthquakes....not to limit damage, maintain function, or provide for easy repair". The owner should note that in the event of severe ground motions, structures designed per the UBC may be subject to structural damage.

UBC Seismic Zone Factor

The design of structures for seismic loading conditions, in accordance with the 1997 edition of the UBC, should be based on a Seismic Zone Factor, Z, equal to 0.40. The UBC's Seismic Zone Factor should not be used as an estimate of peak ground acceleration. If required, peak ground accelerations at the site should be estimated by performing a site-specific probabilistic or deterministic seismic hazard analysis.

UBC Soil Profile Type

The UBC Soil Profile Type, S, is a function of the soil conditions and subsurface stratigraphy. As noted in this report, the site is underlain by medium dense to dense sand and stiff to hard clay to depths of at least 50 feet. We estimate that the site is underlain by a site profile S_C, which corresponds to stiff soils. In our opinion this soil profile type, of those provided in the UBC, most closely describes the site conditions.

UBC Seismic Source Type

The UBC Seismic Source Type is based upon the estimated maximum moment magnitudes and slip rates of faults in the project region. As discussed above, a number of seismic sources are present in the project region. Based upon the estimated slip rates and moment magnitudes of the controlling fault, the More Ranch fault, we estimate that the Seismic Source Type conforms to a Type "B". Seismic Source Type B encompasses faults that have the potential to generate moment magnitudes of greater than 6.5 and with a slip rate of less than 2 millimeters per year. According to Petersen et al., (1996), the More Ranch fault is capable of generating a moment magnitude of 6.7 and has a slip rate of less than 1 millimeter per year, thus qualifying it as a Type "B" fault. In addition, Petersen et al. (1996) reports that all the faults recorded within the Santa Barbara Channel qualify as Type "B" faults, with the exception of the Anacapa-Dume fault system, located about 30 miles offshore.

UBC Near-Source Factors

The UBC Near-Source Factors, N_a and N_v, are based upon distance of the seismic source from the site and the Seismic Source Type. The distance to the More Ranch fault is estimated to be about 1,800 feet (550 meters) from the site. Using a Seismic Source Type "B" and a distance to the seismic source of less than 2 kilometers, the following Near-Source Factors are applied:

- N_a – 1.3
- N_v – 1.6

UBC Seismic Coefficient

The UBC seismic coefficients, C_a and C_v, are based upon the Seismic Zone Factor, Z, and Soil Profile Type, S. As discussed above, the Seismic Zone Factor is estimated to be 0.4 and the Soil Profile Type is estimated to be S_C. Using those criteria, the Seismic Coefficients are estimated to be the following:

- C_a – 0.36N_a

- $C_v - 0.96N_v$

CONCLUSIONS AND RECOMMENDATIONS

The geotechnical conditions, as encountered in the 4 drill holes and 11 CPT soundings advanced for this study, indicate that the proposed development, as we currently understand it, can be supported on conventional shallow foundations once the improvements, as recommended herein, have been completed.

GRADING AND EARTHWORK

General

All grading and earthwork should be performed in accordance with the County of Santa Barbara Grading Ordinance. The following sections provide recommendations for site preparation, fill placement, compaction requirements, and construction of utility trenches and pipe bedding. Also included are anticipated excavation characteristics of the site materials.

Surficial soils encountered within the depths affected by grading include plastic, highly expansive clay. Ideally, those highly expansive soils should be placed below a depth of 3 feet from finish grade to minimize the effects of expansive soil properties on the residential foundations and slabs. However, selective grading may be impractical or there may be inadequate lower expansive native soil or import soil quantities to provide lower expansive soil fills under all residences. If highly expansive soil is placed below the residences, the mitigation measures presented in the *Recommendations For Shallow Foundation Design* section should be followed.

Materials

General Fill. Typically, onsite soils free from organics, debris, deleterious materials, and oversize materials (i.e., over 3 inches in largest dimension) are considered suitable for general fill. Soil types that could be encountered within the anticipated shallow depths of excavation are anticipated to consist primarily of sandy and silty clay (CL), and clay (CH) with some clayey sand (SC). Locally those materials could contain gravel, cobbles, and boulders.

General Import Fill. Fill materials imported to the site should be free of organics, trash and debris, deleterious materials, and oversize materials (i.e., over 3 inches in largest dimension). In addition, general imported fill should have an Expansion Index of less than 30, less than 40 percent passing the No. 200 sieve, and a Plasticity Index of less than 10. General imported fill should be observed and tested by Padre prior to being brought to the site.

Pervious Backfill Material. Pervious backfill material shall meet the requirements specified for Pervious Backfill Material in Section 19 of the Caltrans Standard Specifications, latest edition.

Structural Backfill Material. Structural backfill material shall meet the requirements specified for Structural Backfill Material in Section 19 of the Caltrans Standard Specifications, latest edition.

Filter Fabric. Filter fabric shall consist of a needle-punched nonwoven geotextile conforming to specifications presented in Section 88-1.03 of the Caltrans Standard Specifications, latest edition.

Site Preparation

Site preparation for the proposed site improvements should initially consist of removal and disposal of existing debris, vegetation, tree root systems, structures, etc. These materials should be removed to expose earth materials that are free of organics and other deleterious matter. Organic materials should be stripped and removed from the project site in areas to be graded. We estimate that approximately 1 to 3 inches of surface soil will be removed from the site along with the organic materials. If buried tanks, abandoned wells, or other underground structures are encountered, they should be removed or destroyed in accordance with the requirements of the appropriate regulatory agency. Any resulting excavations should be filled with engineered fill that is placed and compacted in accordance with the recommendations of the Engineered Fill Section of this report.

Artificial fill materials, if encountered on site, should be removed prior to fill placement in those areas. Those artificial fill materials should be screened of organics, deleterious materials, debris, and oversize rocks and used within fill materials placed on site. Fine-grained artificial fill materials should be segregated and placed as general fill on the site, but should not be used beneath structures or retaining walls. A geologist or engineer from Padre should observe the artificial fill excavations to confirm that the vertical and lateral extent of those materials have been removed prior to fill placement.

OVEREXCAVATION

The surface soils at the site appear to be soft or loose to a depth of about 2 feet below existing grades. In addition, although we have not yet seen a grading plan or detailed site layout with elevations, we suspect that there is a potential for some of the structures to straddle a cut/fill daylight line. To support the proposed buildings and site improvements, the areas of proposed improvements should be overexcavated following completion of the Site Preparation recommendations. Generally, all of the materials encountered appear to be capable of being excavated with conventional earth moving equipment.

The engineer or geologist should observe the resulting overexcavation surface prior to scarification and recompaction to observe that subsurface conditions are consistent with those anticipated based on our exploration. If variations in subsurface conditions are evident, those variations may effect the recommendations contained in this report.

Building Areas

Within the footprint of proposed buildings and foundations, and extending to a minimum distance of 5 feet beyond the foundation footprint, soils should be overexcavated to a depth of 3 feet below existing grade or 1 foot below bottom of the foundation, whichever is deeper. Once the engineer or geologist has observed the resulting overexcavation area, the exposed surface should be scarified to a depth of 8 to 12 inches. The scarified surface should be moisture conditioned to achieve a moisture content that is 2 to 4 percentage points above optimum moisture content, and compacted to a minimum of 90 percent relative compaction (percent of maximum dry density as determined per standard test method ASTM D1557).

Pavement Areas

Within areas to be paved and extending to a minimum distance of 2 feet beyond the limits of pavement and curbing, soils should be overexcavated to a depth of 2 feet below existing grade or one foot below pavement subgrade elevations (bottom of aggregate base section), whichever is deeper. In areas where the finish subgrade elevation is more than 2 feet below existing grade, no overexcavation is necessary. Once the resulting overexcavation area (or cut subgrade) has been observed by the engineer or geologist, the exposed surface should be scarified to a depth of 8 to 12 inches. The scarified surface should be moisture conditioned to achieve a moisture content that is 2 to 4 percentage points above optimum moisture content, and compacted to a minimum of 90 percent relative compaction. The upper one foot of subgrade should be compacted to a minimum of 95 percent relative compaction. The soil materials should be mixed, moisture conditioned, and/or removed, as needed, to achieve the recommended compaction.

The prepared subgrade should be proof rolled with a loaded water truck or other heavy pneumatic-tired equipment. Soft, loose, or yielding areas identified from proof rolling should be overexcavated and replaced with compacted on-site soils.

We recommend that the subgrade materials be reviewed and tested at the time of construction to verify the R-value and structural pavement section for those areas. On the basis of observations and tests made during grading, revised pavement recommendations may be needed. We recommend that the project specifications provide for variations in the subgrade conditions and resulting changes to the thickness of the pavement section.

Areas to Receive Fill

Areas to receive fill that do not fall within building and pavement areas should be overexcavated to a depth of 2 feet below existing grade. Once the resulting overexcavation area has been observed by the engineer or geologist, the exposed surface should be scarified, moisture conditioned, and compacted as recommended for the pavement areas above.

FILL MATERIALS AND PLACEMENT

Descriptions of materials proposed for fills are discussed in the Materials Section above. Prior to placement of fill, the ground surface to receive fill should be observed by the engineer or engineering geologist. The ground surface should be tested where the subgrade has been scarified and compacted. Fill should be placed and compacted in accordance with the recommendations of the Engineered Fill section of this report.

Fill Materials

Fill materials and imported fill materials should be used as backfill of excavations, unless otherwise noted in this report. All imported fill should be observed, tested if necessary, and approved by the engineer prior to hauling to the site.

When fill material includes rock, large rocks should not be allowed to nest and form voids within the fill. Therefore, fill material with rock must be carefully placed so those potential voids are filled with granular fines and properly compacted. Special mixing operations may be required, depending on the character of the fill materials. Rocks larger than 3 inches in diameter should not be permitted in the compacted fill.

Engineered Fill

Engineered fill placed in the overexcavation areas, to fill voids left by the removal of vegetation, tree roots, or utilities, or to bring the site to final grade should be placed to provide uniform conditions to support the proposed improvements. Fill should be placed in layers not to exceed 8 inches in loose thickness. Because some of the native soil is highly expansive, that soil should be moisture conditioned to achieve a moisture content of 2 to 4 percentage points above optimum moisture content prior to compaction. Non-expansive import or native soil should be moisture conditioned to 0 to 2 percentage points above optimum moisture content.

Within building areas and extending to a minimum distance of 5 feet beyond the foundation footprint, fill should be compacted to at least 90 percent relative compaction. Within pavement areas fill should be compacted to at least 90 percent relative compaction up to within 1-foot of subgrade elevation. The upper one-foot of pavement subgrade and the aggregate base should be compacted to a minimum of 95 percent relative compaction. Fill placed outside the building and pavement areas should be compacted to at least 90 percent relative compaction.

Where fills are made on hillsides or exposed slopes inclined steeper than 5 horizontal to 1 vertical (5:1), horizontal benches should be cut into firm, undisturbed, natural ground. This should provide a horizontal base so that each layer of fill is placed and compacted on a horizontal plane. The initial bench (key) at the toe of the fill should be at least 15 feet in width and inclined into the slope. The key should be founded on competent material as determined by the engineer or engineering geologist. The width and frequency of the succeeding benches will vary with the soil conditions and the steepness of the slope.

Structural Backfill

Retaining walls and other subsurface structures aside from conventional spread footings should be backfilled with free-draining structural backfill material. Earth retaining walls that are not designed to support hydrostatic forces should be constructed with pervious backfill material and weep holes or pipe outlets. The pervious backfill material should be placed in a one-foot wide zone directly behind the wall for the entire wall height. Alternatively, a prefabricated drainage panel, such as Miradrain, should be installed on the back of retaining walls to provide drainage. The remaining backfill behind structures and retaining walls should consist of structural backfill material, as described above. Backfill for retaining structures should be compacted to 90 percent relative compaction. Retaining wall backfill should be placed within a zone bounded by the back of the wall and a 1:1 line projected upward from the heal of the retaining wall footing.

Utility Trenches, Pipe Bedding, and Trench Backfill

Utility trenches greater than 5 feet deep should be braced and shored in accordance with good construction practice and all applicable safety ordinances. Where shoring is not used in shallow trenches, we anticipate that some sloughing will occur if sidewalls are constructed steeper than 1:1. The actual construction of the trench walls and worker safety is the responsibility of the contractor.

Pipe bedding for utilities should consist of sand with a minimum sand equivalent of 30. The sand should extend a minimum of 4 inches below the pipe and 1 foot above the pipe for the entire trench width. The bedding material should be compacted to a minimum of 90 percent relative compaction with care given to ensure compaction in the pipeline haunch area. When placed within areas requiring more stringent compaction requirements, the higher degree of compaction will govern. Jetting will not be allowed.

Estimated Volume Change

Grading operations will result in volume changes of the on-site earth materials through shrinkage due to stripping of surface vegetation, and increased densification of surficial soil due to compaction. The shrinkage losses can be estimated based on laboratory tests and experience with similar projects. The actual volume losses will be dependent on construction technique, extent of tree or vegetation root systems and the accuracy of topographic survey data, all of which can not be accurately accounted for in the estimate.

Based on our experience, site conditions at the time of our exploration, and comparisons of in-place dry densities to dry densities at 90 percent compaction, we estimate that a shrinkage factor as a result of soil densification of 2 to 5 percent should be used for design. In addition to soil densification, the loss of approximately 1 to 3 inches of soil across the site as a result of clearing operations should be considered in the earthwork volume calculations.

RECOMMENDATIONS FOR SHALLOW FOUNDATION DESIGN

Introduction

Shallow foundations and slabs-on-grade may be used for the planned structures provided the recommendations contained herein (including those for Earthwork and Grading presented above) are followed and locally accepted, good quality, construction techniques are utilized. Shallow foundation elements may consist of continuous wall footings or isolated spread footings.

Surficial soils encountered within the depths affected by grading include plastic, highly expansive clay. Because test results indicate that there is highly expansive soil present at the site, minimum foundation requirements for highly expansive soils and the proposed building types, as defined by the UBC, should be considered as minimum requirements for foundation and slab-on-grade design.

The allowable bearing values recommended below are based on an evaluation of a safe load that should not result in a shear failure within the soil (i.e., maintains an adequate factor of safety against shear failure) or immediate elastic settlement.

Expansive Soil Mitigation Measures

Expansion Index tests performed on two bulk samples collected from the surficial soil encountered at the site indicate that the expansiveness of soil likely to be encountered during grading ranges from low to high (EI = 21 and 114) as defined by the Uniform Building Code. Ideally, those highly expansive soils should be placed below a depth of 3 feet from finish grade to minimize the effects of expansive soil properties on the residential foundations and slabs. However, selective grading may be impractical or there may be inadequate lower expansive native soil or import soil quantities to provide lower expansive soil fills under all residences.

If highly expansive soil is placed within the upper three feet below buildings then the foundations and slabs should be constructed in accordance with UBC Chapter 18, section 1803. In addition, the following measures should be completed as the minimum requirements towards mitigating the effects of expansive soil on the buildings.

- Prior to placement of concrete for foundations or slabs, the soils to a depth of 33 inches below lowest adjacent grade within the building foot print should be premoistened to 140 percent of optimum moisture content.
- Exterior grades adjacent to foundations or slabs should be graded to provide positive drainage away from foundation areas.
- Any planters adjacent to foundations should be lined with a high density polyethylene sheeting to prevent over-watering from impacting foundation soils. It may be necessary to connect lined planters to a subdrain system.

Additional measures that may be considered to mitigate the effects of expansive soil include the use of post-tensioned slabs, perimeter moisture barriers, and the use of a grade beam foundation system.

Once grading is complete, the individual lots or groups of lots should be tested for expansion index so that the extent of the mitigation measures can be limited to those lots affected.

Shallow Footing Design Criteria

Minimum Footing Embedment. We recommend that shallow isolated and continuous wall footings be founded on fill soils compacted as described above. The minimum embedment depth relative to the adjacent finished grade or slab elevation, whichever is lower, should be 27 inches for perimeter continuous footings, and 24 inches for interior footings.

Minimum Footing Dimension. A minimum footing width of 15-inches is recommended for both continuous wall and isolated footings. The footing thickness should be determined by the structural engineer, but should not be less than 12-inches thick.

Allowable Bearing Pressure. Isolated and continuous wall footing elements should be proportioned for dead load plus probable maximum live load and a maximum allowable bearing pressure of 1,800 pounds per square foot (psf) for footings meeting the minimum requirements stated above. The allowable bearing pressure can be increased by 200 psf for each additional foot of footing depth above the minimum recommended. An increase of 150 psf can be added to the allowable bearing pressure for each additional one-foot of increase in footing width. However, the maximum allowable bearing pressure should not exceed 2,500 psf. When considering wind and seismic loads, the allowable bearing pressure may be increased by one-third. The allowable bearing value is for vertical loads only; eccentric loads may require an adjustment to the values recommended above.

Minimum Footing Reinforcement. Footing reinforcement should be designed by a structural engineer and should conform to pertinent structural code requirements. Minimum footing reinforcement should not be less than that required for shrinkage, temperature control, and structural integrity, but should consist of at least four No. 4 bars with two placed at the top, and two placed at the bottom of the footing. In addition, due to the highly expansive soils, No. 4 bars should be placed vertically at 24 inches on center in exterior footings and be bent to extend a minimum of 3 feet into the slab.

Corrosivity. One soil chemistry (e.g., sulfates, chlorides, resistivity) test was performed for this study. The laboratory test results indicate that the native soils are corrosive to unprotected ferrous metals and that Type II Portland cement should be used in concrete. Test results and complete recommendations are included in Appendix B.

Estimated Settlement. Estimated settlements of shallow foundations supported on a relatively uniform thickness of compacted fill were made using the results of consolidation tests and estimated building loads (Duncan, J.M., and Buchignani, A.L., 1976). On the basis of our test results and estimated building loads no greater than 4 kips per lineal foot for continuous footings and 50-kip column loads, we estimate that total consolidation settlement will be on the order of one inch. Differential settlements for footings of similar sizes and loading conditions can be assumed equal to one-half of the total settlement. We expect that up to one-half of the estimated settlements should occur during construction.

Seismically Induced Settlement Potential. Because the subsurface soil materials appear to consist primarily of stiff to very stiff fine grained soil, in our opinion, the potential for seismically induced settlement is likely to be low.

Slabs-On-Grade

All ground-supported slabs should be designed by a civil engineer to support the anticipated loading conditions but as a minimum should be at least 4 inches thick. Reinforcement for floor slabs should be designed by the civil engineer to maintain structural integrity, and should not be less than that required to meet pertinent code, shrinkage and temperature requirements, but should be no less than No. 4 bars (Grade 60), spaced 18 inches on center each way. Reinforcement should be placed at mid-thickness of the slab with provisions to ensure it stays in that position during construction and concrete placement.

Slabs on grade should be constructed on a relatively uniform thickness of compacted fill. In areas where moisture vapors penetrating the slab may be detrimental to carpet or linoleum floor coverings, we recommend the placement of a 10-mil thick visqueen layer placed between two, 2-inch-thick lifts of clean sand below the slab.

Sliding and Passive Resistance

Sliding Resistance. Ultimate sliding resistance generated through a compacted soil/concrete interface can be computed by multiplying the total dead weight structural loads by the friction coefficient 0.35.

Passive Resistance. Ultimate passive resistance developed from lateral bearing of shallow foundation elements bearing against compacted soil surfaces for that portion of the foundation element extending below a depth of 1 foot below the lowest adjacent grade can be determined using an equivalent fluid weight of 350 pcf.

Safety Factors. Sliding resistance and passive pressure may be used together without reduction in conjunction with recommended safety factors outlined below. A minimum factor of safety of 2.0 is recommended for foundation sliding, where sliding resistance and passive pressure are used together. The safety factor for sliding can be reduced to 1.5 if passive pressure is neglected.

RETAINING WALL DESIGN

Active and Passive Pressures

Retaining walls that are free to rotate at least 0.2 percent of the wall height can be considered unrestrained walls. Unrestrained retaining walls that support vertical cuts and cantilevered walls less than about 6 feet high can be designed using equivalent fluid weights of 35 pcf and 350 pcf for active and passive pressures, respectively, assuming a horizontal, drained backfill. For design of a retaining wall with backfill placed at a 2:1 slope above the wall, an equivalent fluid weight of 55 pcf should be used for active earth pressures. Where a uniform vertical surcharge will be present above the wall, a lateral earth pressure coefficient of 0.5 should be applied to the vertical surcharge load to compute the increased active pressure on the wall due to the surcharge.

Restrained retaining walls that support vertical cuts can be designed using an equivalent fluid weight of 55 pcf for at rest pressures, assuming a horizontal, drained backfill condition. In the event that free draining backfill is not provided behind retaining walls, Padre should be contacted to provide revised active, at-rest, and passive pressures for the backfill materials proposed for use.

If there is any surcharge point or line loads located within 0.5H feet from the top of the wall, Padre should be contacted to evaluate the lateral components of those surcharge loads.

Sliding Resistance

Ultimate sliding resistance generated through a soil/concrete interface can be computed assuming a coefficient of friction of 0.35. Minimum factors of safety of 1.5 and 2.0 are recommended for foundation overturning and sliding, respectively, where sliding resistance and passive pressure are used together. The safety factor for sliding can be reduced to 1.5 if passive pressure is neglected.

Backfill Recommendations

Retaining wall foundations should be supported on a uniform thickness of compacted fill material prepared according to the recommendations in the Fill Materials and Placement, and Recommendations for Shallow Foundation design sections of this report. Backfill behind retaining walls should consist of pervious backfill and structural backfill materials. Those materials should meet the requirements for Pervious and Structure Backfill Materials outlined in Section 19 of the Caltrans Standard Specifications. The pervious backfill material should be placed in a one-foot wide zone directly behind the wall for the entire wall height. Alternatively, a prefabricated drainage panel, such as Miradrain, should be installed on the back of retaining walls to provide drainage. The remaining backfill behind structures and retaining walls should consist of structural backfill, as described above. Backfill for retaining structures should be compacted to 95 percent relative compaction. Retaining wall backfill should be placed within a zone bounded by the back of the wall and a 1:1 line projected upward from the heal of the retaining wall footing. Weep holes or subdrains should be incorporated into the design of retaining structures to keep water pressure forces from acting on the walls.

ASPHALT PAVEMENT DESIGN

R-value tests conducted for this study indicate that the surficial soils have R-values of 5 and 7. Asphalt pavement designs were calculated using traffic indices (TI) equal to 5.0, 6.0, and 7.0.

Using the conservative R-value of 5 and the traffic indices noted above, we recommend the following minimum asphalt pavement sections.

- TI = 5.0, use 0.21 ft. asphalt over 0.91 ft. aggregate base.
- TI = 6.0, use 0.21 ft. asphalt over 1.22 ft. aggregate base.
- TI = 7.0, use 0.25 ft. asphalt over 1.45 ft. aggregate base.

The preliminary design should be verified at the time of construction by obtaining R-values from the actual subgrade, and modifications should be made to the design section if the actual R-values are lower than those assumed for this design. If possible, granular materials should be placed within road areas during fill placement to reduce pavement section requirements.

REVIEW OF PLANS AND SPECIFICATIONS

We recommend that Padre provide a general review of the grading and improvement plans. The purpose of the review is to assess general compliance with the earthwork and slope stabilization recommendations of this report, and to confirm that the recommendations given in this report are incorporated in the project design plans and specifications. We recommend that plans and specifications be made available to Padre upon their completion.

CONSTRUCTION MONITORING

The construction process is an integral design component with respect to the geotechnical aspects of a project. Because geotechnical engineering is inexact, unanticipated or changed conditions can occur due to the variability of natural process. Proper engineering and geologic observation and testing during construction are imperative in allowing the engineer the opportunity to verify assumptions made during the design process. Therefore, Padre should be retained during site grading and construction to observe compliance with the design components and geotechnical recommendations, and to allow design changes in the event that subsurface conditions, or methods of construction, differ from those anticipated. Padre can conduct the observation and field testing services, and provide results on a timely basis so that actions, if necessary, can be taken to mitigate unforeseen changes in subsurface conditions.

CLOSURE AND LIMITATIONS

This report has been prepared for the exclusive use Oly Chadmar Sandpiper General Partners, and their agents for specific application to the design and construction of the proposed Sandpiper Residential Development, located in the Goleta area of Santa Barbara County, California, as shown on Plate 2. Padre prepared the findings, conclusions, and recommendations presented herein in accordance with generally accepted geotechnical engineering practices at the time and location that this report was prepared. No other warranty, express or implied, is made.

Soil and rock materials are typically not homogenous in type, strength, and other geotechnical properties and can vary between points of observation and exploration. In addition, groundwater and soil moisture conditions can vary seasonally and for other reasons. Padre does not and can not have a complete knowledge of the subsurface conditions underlying a site. The conclusions and recommendations presented in this report are based upon the findings at the points of exploration, interpolation and extrapolation of information between and beyond the points of observation, and are subject to confirmation of the conditions revealed by construction.

If the proposed construction is relocated, redesigned, or should structural loading be greater than anticipated, the recommendations contained within this report should be considered invalid unless the changes are reviewed and our recommendations modified or approved in writing.

We recommend that Padre be retained to review and comment on the geotechnical aspects of the project and specifications before they are finalized. Also, the construction process is an integral design component with respect to the geotechnical aspects of a project. Because geotechnical engineering is inexact, unanticipated or changed conditions can occur due to the variability of natural process.

Findings of this report are valid as of the date of issuance; however, changes in condition of a property can and will occur with the passage of time. Furthermore, changes in applicable or appropriate standards occur whether they result from legislation or advancement in technology. Accordingly, findings of this report may be invalidated wholly or partially by changes outside of our control. This report is subject to our review and remains valid for a period of one year, unless we issue a written opinion of its continued applicability thereafter.

The scope of our services did not include any assessment for the presence or absence of any hazardous/toxic substances in the soil, ground water, surface water, or atmosphere, or the presence of any environmentally sensitive habitats or culturally significant areas.

--♦--

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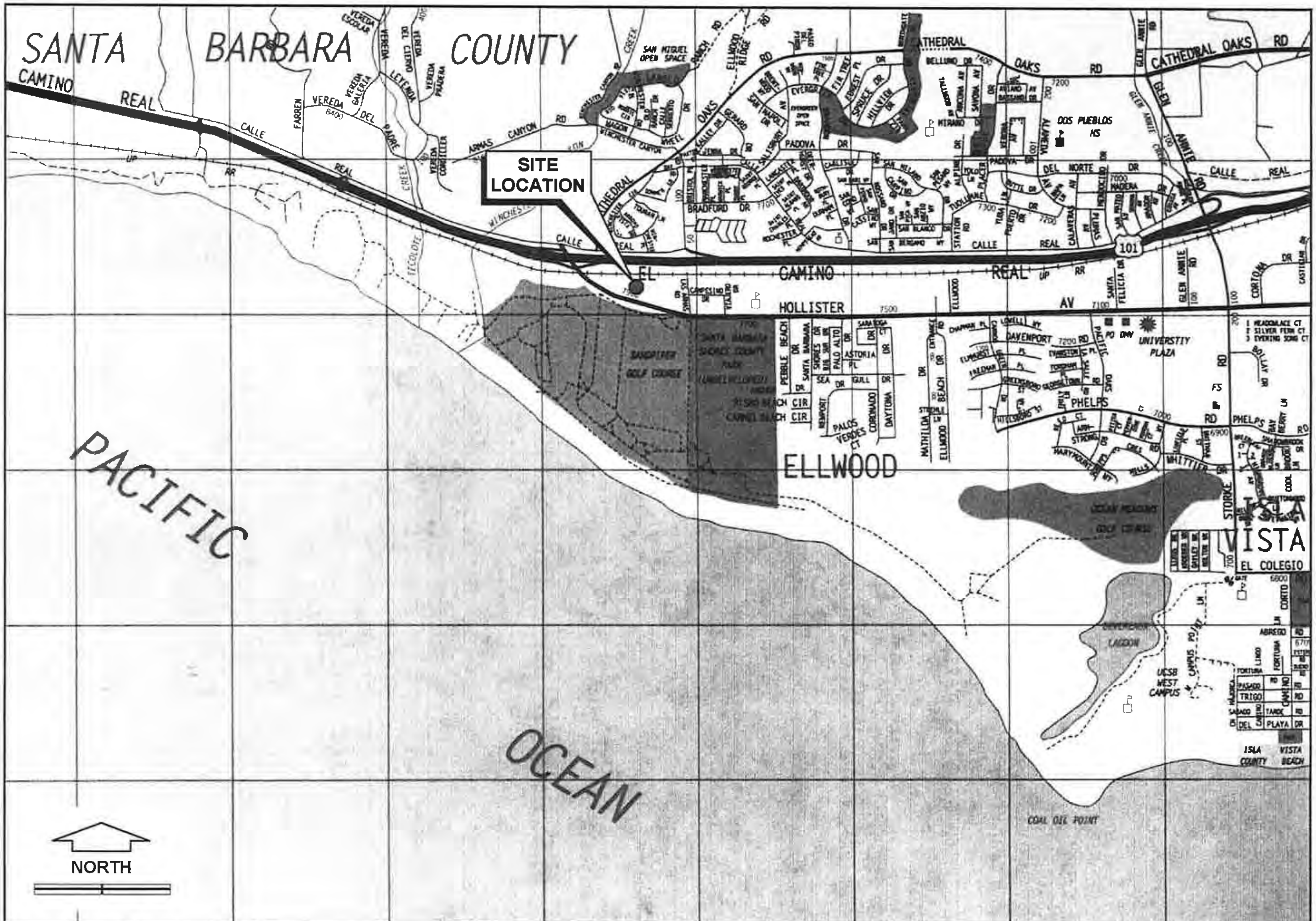
September 1999
Project No. 9904-1131



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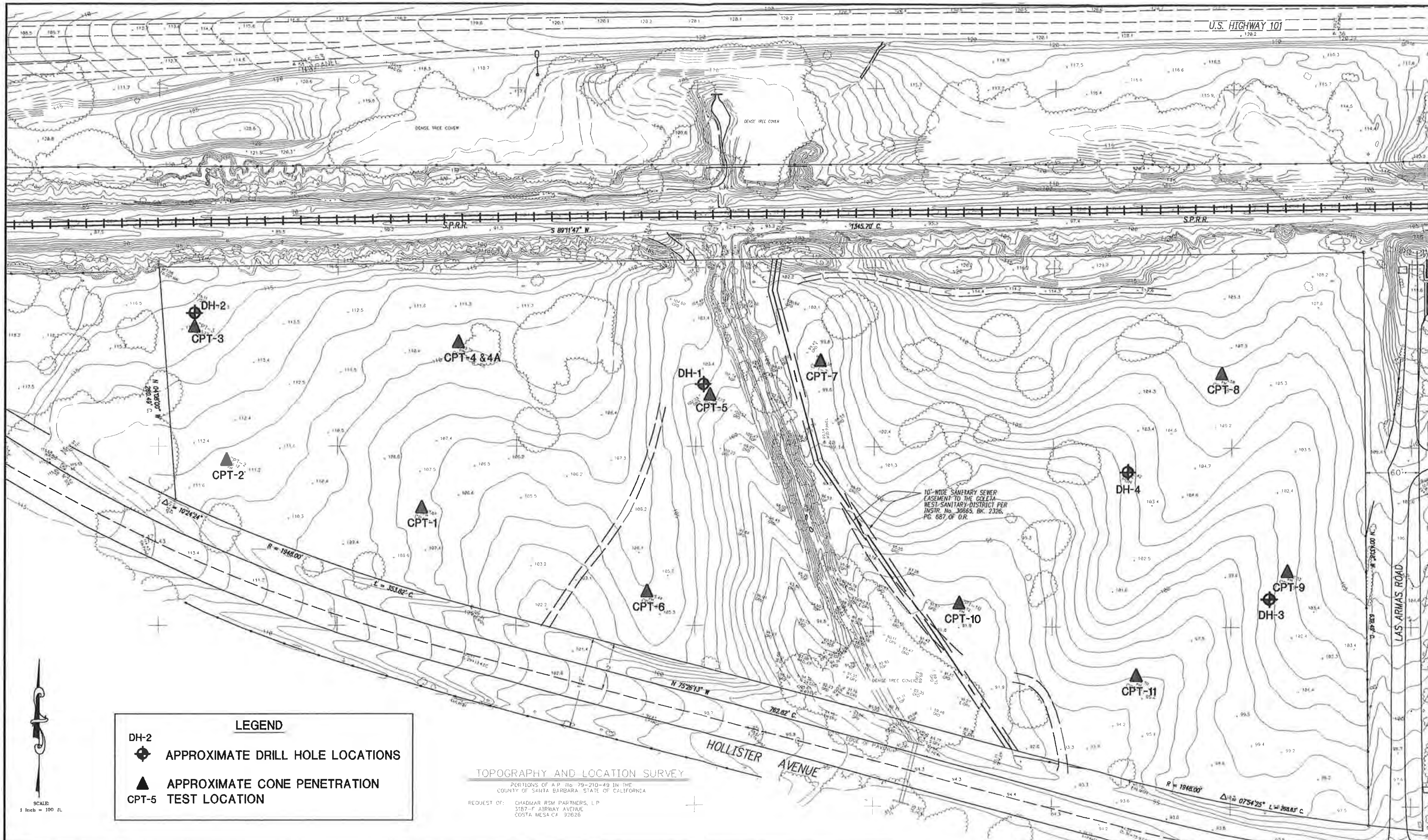
Chadmar/Sand Piper

SITE VICINITY MAP
PLATE 1

September 1999
Project No. 9904-1131



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EXPLORATION LOCATION PLAN
PLATE 2

APPENDIX A
SUBSURFACE EXPLORATION

The subsurface exploration program for the proposed Sandpiper Residential Development, in Goleta, California, consisted of the excavation of 11 CPT soundings and 4 hollow-stem-auger drill holes, as indicated on Plate 2.

CONE PENETROMETER SOUNDINGS

Eleven CPT soundings were performed by Holguin, Fahan & Associates using an approximately 25-ton CPT truck. The CPT sounding is performed by pushing into the ground a 10 square-centimeter (cm^2) conical tip on the end of a series of rods. Load cells within the tip and within a 150-cm^2-friction sleeve located above the tip, measure tip resistance (qc) and sleeve friction (fs), respectively, nearly continuously throughout the push. Subsurface stratigraphy and other properties can be determined by applying empirical correlations to that data.

The 11 CPT soundings were completed to depths ranging from about 9 to 43 feet below existing grade. The graphical logs and interpretations of each CPT are presented behind the drill hole logs.

HOLLOW-STEM AUGER DRILL HOLES

The drill holes were excavated using a truck-mounted CME 75 drill rig supplied by S/G Testing Laboratories of Lompoc, California. The drill holes were excavated to depths ranging from 21.5 to 51.5 feet below existing ground surface. Sampling was performed using a 1-3/8-inch inside diameter (ID) standard penetration split-spoon sampler (SPT), and a Modified California sampler (2-3/8-inch ID). The SPT and Modified California samplers were driven by an above-hole, automatic trip hammer delivering approximately an equivalent amount of driven energy as a 140-pound safety hammer free-falling from a height of 30 inches. Bulk samples were recovered from the near-surface drill cuttings.

The logs of the drill holes describe the earth materials encountered, sampling method used, and laboratory tests performed. The logs also show the location, drill hole number, date of drilling, and the names of the logger and drilling subcontractor. A Padre geologist, using ASTM 2488 for visual soil classification logged the drill holes. The boundaries between soil types shown on the logs are approximate because the transition between different soil layers may be gradual and may change with time. The logs of the drill holes advanced for this study are presented as Plates A-2.1 through A-2.4. A Key to Terms & Symbols Used on Logs is presented on Plate A-1

LOG OF BORING

(Page 1 of 1)

PLATE A-1

LEGEND TO DRILL HOLE LOGS

PROJECT	: Padre's Project Name	DRILLER	: Drilling Subcontractor
PROJECT NO.	: Padre's Project No.	DRILLING METHOD	: How Hole was Excavated
LOCATION	: General Location	DRILL HOLE DIAM.	: Outside Dia. of Drill Hole
START DATE	: Date Drilling Started	LOGGED BY	: Padre's Logger
END DATE	: Date Drilling Ended	CHECKED BY	: Padre's Reviewer

Depth in feet	Surf. Elev. +28	GRAPHIC	Sample No.	Samples	Blow Count	USCS	DESCRIPTION	Water Levels
0	28		1			0	SAMPLES/BLOW COUNT SYMBOLS KEY Bulk soil sample	
5	23		2		(7)	0	California modified split-spoon (CMSS) sample. Brackets on blow counts indicate CMSS sample.	
10	18		3		14	0	Standard penetration test (SPT) sample.	
15	13		4		(9)	0	No sample recovery. Brackets on blow-count indicate CMSS used in sample attempt.	
20	8		5		3	0	No recovery. Lack of brackets on blow count indicates SPT sample attempt.	
25	3					0	LITHOLOGIC GRAPHICS DESCRIPTIONS FOR SOILS MATERIALS (per ASTM D2487 & D2488)	
30	-2					GW	well graded GRAVEL	
						GP	poorly graded GRAVEL	
35	-7					GM	silty GRAVEL	
						GC	clayey GRAVEL	
						SW	well graded SAND	
40	-12					SP	poorly graded SAND	
						SM	silty SAND	▽
45	-17					SC	clayey SAND	
						ML	SILT	▼
50	-22					MH	elastic SILT	
						CL	lean CLAY	
						CH	fat CLAY	
55	-27					PT	organic soils or peat	
						0	LITHOLOGIC GRAPHICS DESCRIPTIONS FOR ROCK MATERIALS	
60	-32					SS	SANDSTONE	
						SH	SHALE	
65	-37					MS	MUDSTONE	
						SL	SILTSTONE	
70						CG	CONGLOMERATE	

Well Construction Information

NOTES

SAMPLERS
- SPT Sampler, 1-3/8" ID, 2" OD, Driven
- CMSS Sampler, 2-3/8" ID, 3" OD, Driven
- Shelby Tube, 2-7/8" ID, 3" OD, Pushed

SAMPLE DRIVING RESISTANCE
- Blow Counts are recorded as the number of blows required for one foot of sampler penetration using a 140-lb hammer falling 30 inches. Typically, sampler is driven 18" and the initial 6" discarded.

Blows/ft	Description
44	44 blows were required to drive sample 12" after initial 6".
72/8"	22 blows to drive sample initial 6" and 50 blows to drive sample final 2"
50/3"	50 blows to drive sample 3"

▽ Water level after initial measurement**

▼ Initial water level measurement**
**(both water levels may not represent stabilized water levels)

NOTE FOR ALL LOGS:
The data presented on the logs are a generalization of actual geologic conditions present in the area of exploration at the time and location that the exploration was performed. Actual subsurface geologic and geotechnical conditions may vary at the drill hole site and other locations, and with the passage of time.

LABORATORY TESTS PERFORMED ABBREVIATIONS:
DS - Direct Shear; Consol - One-Dimensional Consolidation; GS - Grain-Size Distribution; EI - Expansion Index; UC - Unconfined Compression; TC - Triaxial Compression; SC - Soil-Chemistry; AL - Atterberg Limits; SE - Sand Equivalent; RV - R-value.

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LOG OF BORING DH-1

Plate A-2.1

Oly Chadmar Sandpiper General Partnership
3187-F Airway Avenue
Costa Mesa, California 92626

PROJECT	: Sandpiper Residential Dev.	DRILLER	: S/G Testing Laboratories
PROJECT NO.	: 9904-1131	DRILLING METHOD	: Hollow-Stem Auger
LOCATION	: Goleta, CA	HAMMER TYPE	: Auto-Trip
START DATE	: 8/19/99	LOGGED BY	: J.A. Bianchin
END DATE	: 8/19/99	CHECKED BY	: J.A. Bianchin

Depth in feet	Surf. Elev. 102	Sample No.	Blow Count (Blows/foot)	DESCRIPTION	Water Levels	% Passing 200 Sieve	Unit Dry Wt., pcf	Water Content, %	Maximum Density, pcf	Optimum Moisture Content, %	Lab Tests Performed
0	102	1		OLDER ALLUVIUM (Qoal) Silty CLAY (CL), grayish orange, dry, with organics and abundant roots.		56			124	11	E1, GS
		2	(51)	Clayey SAND (SC), moderate brown, dry, very dense, fine to coarse grained.			111.0	12.9			Consol.
5	97	1									DS, Comp
		3	(77)								
				Silty CLAY (CL), grayish orange, dry, hard, with minor fine sand.							
		4	(41)	Sandy CLAY (SC), moderate yellowish brown, damp, very dense, fine grained, interbedded with Silty CLAY (CL/CH), moderate brown, moist, hard, slightly plastic, with organics.			107.7	12.0			Consol.
10	92	5	(78)	Clayey SAND (SC), moderate brown, moist, very dense, fine to coarse grained, with minor fine gravel.							
15	87	6	(55)	Silty SAND (SM), moderate brown, moist, very dense, fine grained, interbedded with Silty CLAY (CL/CH), moderate brown, moist, hard, plastic, with abundant charcoal.							
20	82	7	(78)	Clayey SAND (SC), moderate brown, moist, very dense, fine to coarse grained, thinly bedded, slightly plastic.							
25	77	8	27	Silty CLAY (CL), moderate brown, to dark yellowish orange, moist, very stiff to hard, slightly plastic.							
30											

No groundwater encountered in drill hole.
Drill hole backfilled with excavated cuttings.

See Plate A-1 for Legend to Drill Hole Logs.

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LOG OF BORING DH-1

(Page 2 of 2)

Plate A-2.1

Oly Chadmar Sandpiper General Partnership
3187-F Airway Avenue
Costa Mesa, California 92626

PROJECT	: Sandpiper Residential Dev.	DRILLER	: S/G Testing Laboratories
PROJECT NO.	: 9904-1131	DRILLING METHOD	: Hollow-Stem Auger
LOCATION	: Goleta, CA	HAMMER TYPE	: Auto-Trip
START DATE	: 8/19/99	LOGGED BY	: J.A. Bianchin
END DATE	: 8/19/99	CHECKED BY	: J.A. Bianchin

Depth in feet	Surf. Elev. 102	Sample No.	Blow Count (Blows/foot)	DESCRIPTION
30	72	11	(85:4")	
35	67	12	25	Silty SAND (SM), grayish orange, moist, dense, fine to medium grained, interbedded with Silty CLAY (CL), moderate brown mottled to grayish orange, moist, very stiff, slightly plastic, thinly bedded.
40	62	13	88:5.5"	
45	57	14	9	Silty CLAY (CL), dark yellowish brown, damp, stiff, with near-vertical mineralized partings.
50	52	15	10	At 50 feet: abundant gypsum mottling, minor iron oxide staining.
				Terminated drilling at a depth of 51.5 feet.
55	47			
60				

Column headings also printed: GRAPHIC, Samples, Water Levels, % Passing 200 Sieve, Unit Dry Wt., pcf, Water Content, %, Maximum Density, pcf, Optimum Moisture Content, %, Lab Tests Performed

No groundwater encountered in drill hole.
Drill hole backfilled with excavated cuttings.

See Plate A-1 for Legend to Drill Hole Logs.

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LOG OF BORING DH-2

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Plate A-2.2

Oly Chadmar Sandpiper General Partnership
3187-F Airway Avenue
Costa Mesa, California 92626

PROJECT	: Sandpiper Residential Dev.	DRILLER	: S/G Testing Laboratories
PROJECT NO.	: 9904-1131	DRILLING METHOD	: Hollow-Stem Auger
LOCATION	: Goleta, CA	HAMMER TYPE	: Auto-Trip
START DATE	: 8/19/99	LOGGED BY	: J.A. Bianchin
END DATE	: 8/19/99	CHECKED BY	: J.A. Bianchin

Depth in feet	Surf. Elev. 115	GRAPHIC	Samples	Sample No.	Blow Count (Blows/foot)	DESCRIPTION	Water Levels	% Passing 200 Sieve	Unit Dry Wt., pcf	Water Content, %	Maximum Density, pcf	Optimum Moisture Content, %	Lab Tests Performed
0	115					OLDER ALLUVIUM (Qoal) Silty CLAY (CL), pale brown, damp, very stiff, with iron oxide staining.							
				1	(19)								
5	110			3	(37)	Clayey SILT (ML), yellowish orange, damp, dense, with minor fine sand and gray laminations.							Consol.
				4	(28)	Silty CLAY (CL) to Clayey SILT (ML), pale yellowish brown, damp, very stiff, with minor fine to coarse sand, and iron oxide staining.							
10	105			5	(27)	Silty CLAY to CLAY (CL/CH), gray, damp to moist, very stiff, plastic, with fine sandy seams, organics, and iron oxide staining.							
15	100			6	(47)	Silty SAND (SM), moderate brown, damp, dense, fine grained.							
20	95			7	47	At 20 feet: moderate yellowish brown, fine to medium grained.							
						Terminated drilling at a depth of 21.5 feet.							
25	90												
30													

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No groundwater encountered in drill hole.
Drill hole backfilled with excavated cuttings.

See Plate A-1 for Legend to Drill Hole Logs.

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LOG OF BORING DH-3

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Plate A-2.3

Oly Chadmar Sandpiper General Partnership
3187-F Airway Avenue
Costa Mesa, California 92626

PROJECT	: Sandpiper Residential Dev.	DRILLER	: S/G Testing Laboratories
PROJECT NO.	: 9904-1131	DRILLING METHOD	: Hollow-Stem Auger
LOCATION	: Goleta, CA	HAMMER TYPE	: Auto-Trip
START DATE	: 8/19/99	LOGGED BY	: J.A. Bianchin
END DATE	: 8/19/99	CHECKED BY	: J.A. Bianchin

Depth in feet	Surf. Elev. 102	GRAPHIC	Samples	Sample No.	Blow Count (Blows/foot)	DESCRIPTION	Water Levels	% Passing 200 Sieve	Unit Dry Wt., pcf	Water Content, %	Maximum Density, pcf	Optimum Moisture Content, %	Lab Tests Performed
0	102			1		OLDER ALLUVIUM (Qoal) Clayey SILT (ML), dark yellowish orange, dry, very dense, slightly micaceous.							Comp , EI
				2	(55)								DS
5	97			3	(81)	At 5 feet: mottled yellowish gray, with thin partings and secondary mineralization.							
				4	(120:5")	Silty SAND (SM), yellowish orange, dry to damp, very dense, fine to coarse grained, with minor subrounded to rounded gravel.							
10	92			5	(71)	SILT (ML), dark yellowish orange, dry to damp, very dense, slightly micaceous, with gray clay partings.							
15	87			6	(99:3")	At 15 feet: laminated, no clay partings observed.							
20	82			7	43	Clayey SILT (ML), to Silty SAND (SM), grayish orange to dark yellowish orange, dry to damp, dense, fine grained, slightly micaceous.							
						Terminated drilling at a depth of 21.5 feet.							
25	77												
30													

No groundwater encountered in drill hole.
Drill hole backfilled with excavated cuttings.

See Plate A-1 for Legend to Drill Hole Logs.

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LOG OF BORING DH-4

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Plate A-2.4

Oly Chadmar Sandpiper General Partnership
3187-F Airway Avenue
Costa Mesa, California 92626

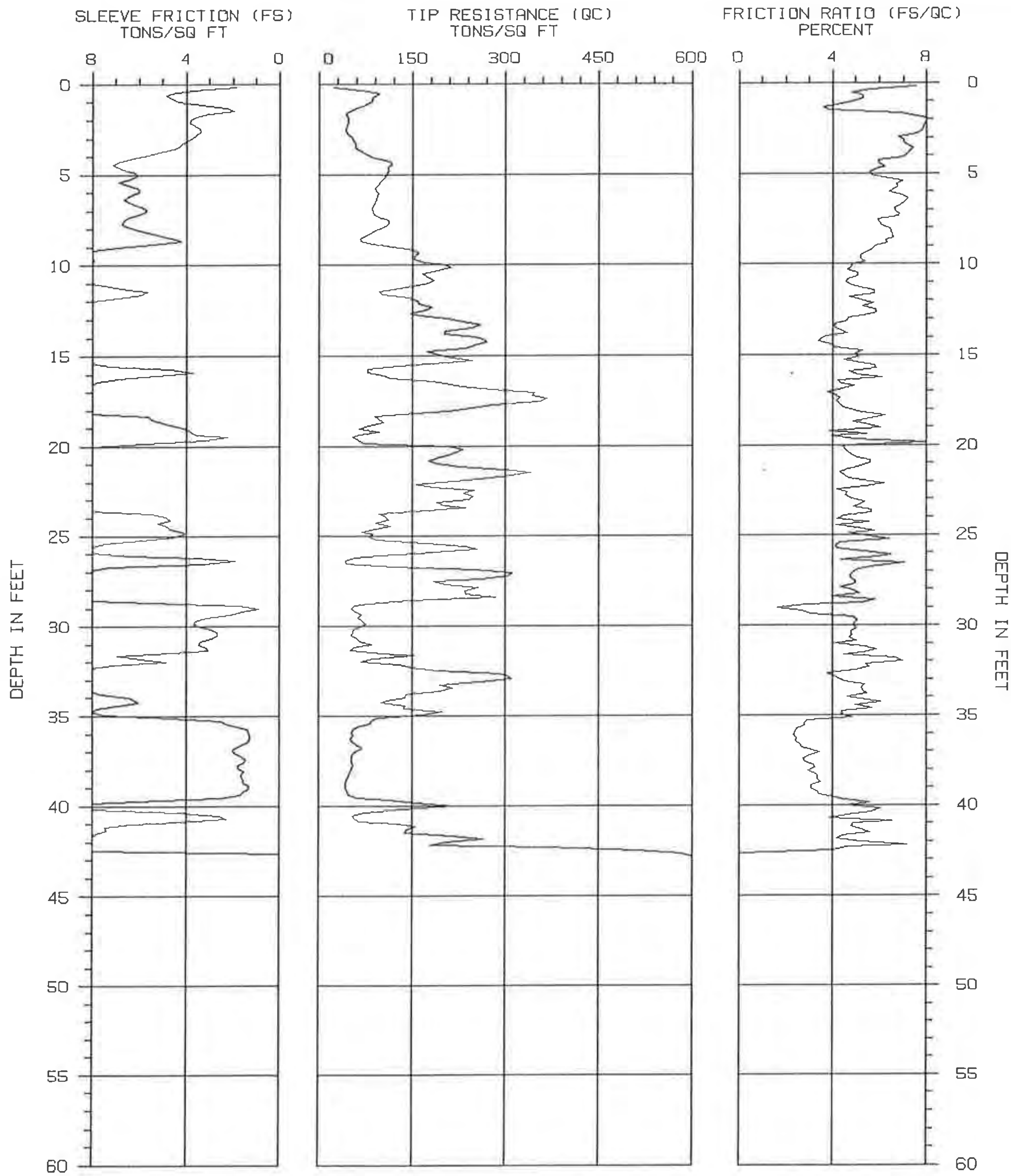
PROJECT	: Sandpiper Residential Dev.	DRILLER	: S/G Testing Laboratories
PROJECT NO.	: 9904-1131	DRILLING METHOD	: Hollow-Stem Auger
LOCATION	: Goleta, CA	HAMMER TYPE	: Auto-Trip
START DATE	: 8/19/99	LOGGED BY	: J.A. Bianchin
END DATE	: 8/19/99	CHECKED BY	: J.A. Bianchin

Depth in feet	Surf. Elev. 102	GRAPHIC	Samples	Sample No.	Blow Count (Blows/foot)	DESCRIPTION	Water Levels	% Passing 200 Sieve	Unit Dry Wt., pcf	Water Content, %	Maximum Density, pcf	Optimum Moisture Content, %	Lab Tests Performed
0	102					OLDER ALLUVIUM (Qoal) Sandy CLAY (SC), moderate brown, dry, hard, fine to medium grained, with iron oxide staining.							
			■	1	(81)								
5	97		■	2	(70)	Clayey SILT (ML) to Sandy SILT (ML), grayish orange with pale orange laminations, dry to damp, very dense, with fine sand.							Consol., GS
			■	3	(59)	At 7 feet: dark yellowish orange, slightly micaceous.							
10	92		■	4	(75)	Silty CLAY (CL), moderate brown to dark yellowish orange, dry, hard, slightly micaceous, with minor organics and clay partings.							
15	87		■	5	(79)	Silty SAND (SM), dark yellowish brown, damp, very dense, well graded, with minor interbedded, laminated silty clay at 16.3 feet.							
20	82		▨	6	31	SILT (ML) to Silty CLAY (CL), dark yellowish orange to moderate brown, dry to damp, dense, slightly plastic with organics and mica.							
						Terminated drilling at a depth of 21.5 feet.							
25	77												
30													

No groundwater encountered in drill hole.
Drill hole backfilled with excavated cuttings.

See Plate A-1 for Legend to Drill Hole Logs.

padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS



TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

CONE PENETRATION TEST	SOUNDING NUMBER: CPT-1
PROJECT NAME : PADRE\SANDPIPER	CONE/RIG : 473\#1 BH\JH
PROJECT NUMBER : 9904-1131	DATE/TIME: 08-12-99 08:10

HFA

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CPT INTERPRETATIONS

SOUNDING : CPT-1 PROJECT No.: 9904-1131
PROJECT : PADRE\SANDPIPER CONE/RIG : 473\#1 BH\JH
DATE/TIME: 08-12-99 08:10

****

DEPTH (m)	DEPTH (ft)	TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N(60)	N1(60)	Dr (%)	Su (tsf)	PHI (Degrees)
.150	.49	97.05	4.78	*VERY STIFF FINE GRAINED	97	100			
.300	.98	86.08	4.97	*VERY STIFF FINE GRAINED	86	100			
.450	1.48	50.33	3.87	CLAYEY SILT to SILTY CLAY	25	40		3.0	
.600	1.97	46.84	8.07	CLAY	47	75		2.7	
.750	2.46	43.36	7.86	CLAY	43	69		2.5	
.900	2.95	54.64	6.81	CLAY	55	87		3.2	
1.050	3.44	59.00	7.20	CLAY	59	94		3.5	
1.200	3.94	78.29	7.15	*VERY STIFF FINE GRAINED	78	100			
1.350	4.43	117.74	6.01	*VERY STIFF FINE GRAINED	100	100			
1.500	4.92	110.41	5.59	*VERY STIFF FINE GRAINED	100	100			
1.650	5.41	98.36	6.96	*VERY STIFF FINE GRAINED	98	100			
1.800	5.91	91.44	6.53	*VERY STIFF FINE GRAINED	91	100			
1.950	6.40	92.24	7.21	*VERY STIFF FINE GRAINED	92	100			
2.100	6.89	85.45	6.64	*VERY STIFF FINE GRAINED	85	100			
2.250	7.38	95.64	6.78	*VERY STIFF FINE GRAINED	96	100			
2.400	7.87	106.90	6.07	*VERY STIFF FINE GRAINED	100	100			
2.550	8.37	77.42	6.52	*VERY STIFF FINE GRAINED	77	100			
2.700	8.86	85.62	6.30	*VERY STIFF FINE GRAINED	86	100			
2.850	9.35	160.50	5.43	*VERY STIFF FINE GRAINED	100	100			
3.000	9.84	170.53	5.38	*VERY STIFF FINE GRAINED	100	100			
3.150	10.33	191.67	4.64	*VERY STIFF FINE GRAINED	100	100			
3.300	10.83	185.93	4.62	*VERY STIFF FINE GRAINED	100	100			
3.450	11.32	120.46	5.38	*VERY STIFF FINE GRAINED	100	100			
3.600	11.81	145.76	4.71	*VERY STIFF FINE GRAINED	100	100			
3.750	12.30	181.37	5.29	*VERY STIFF FINE GRAINED	100	100			
3.900	12.80	162.12	5.56	*VERY STIFF FINE GRAINED	100	100			
4.050	13.29	259.23	4.10	*SAND to CLAYEY SAND	100	100			
4.200	13.78	202.10	4.64	*VERY STIFF FINE GRAINED	100	100			
4.350	14.27	269.94	3.37	*SAND to CLAYEY SAND	100	100			
4.500	14.76	173.85	5.28	*VERY STIFF FINE GRAINED	100	100			
4.650	15.26	246.33	4.48	*VERY STIFF FINE GRAINED	100	100			
4.800	15.75	79.03	5.87	*VERY STIFF FINE GRAINED	79	81			
4.950	16.24	112.89	6.09	*VERY STIFF FINE GRAINED	100	100			
5.100	16.73	230.02	4.95	*VERY STIFF FINE GRAINED	100	100			
5.250	17.22	343.66	4.13	*SAND to CLAYEY SAND	100	100			
5.400	17.72	279.79	4.29	*VERY STIFF FINE GRAINED	100	100			
5.550	18.21	155.28	5.27	*VERY STIFF FINE GRAINED	100	100			
5.700	18.70	102.91	4.88	*VERY STIFF FINE GRAINED	100	97			
5.850	19.19	97.32	3.86	CLAYEY SILT to SILTY CLAY	49	45		5.7	
6.000	19.69	64.16	4.93	*VERY STIFF FINE GRAINED	64	59			
6.150	20.18	231.87	4.47	*VERY STIFF FINE GRAINED	100	100			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 pcf
ASSUMED DEPTH OF WATER TABLE = 50.0 ft
N(60) = EQUIVALENT SPT VALUE (60% Energy)
N1(60) = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE (60% Energy)
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = OVERBURDEN NORMALIZED UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

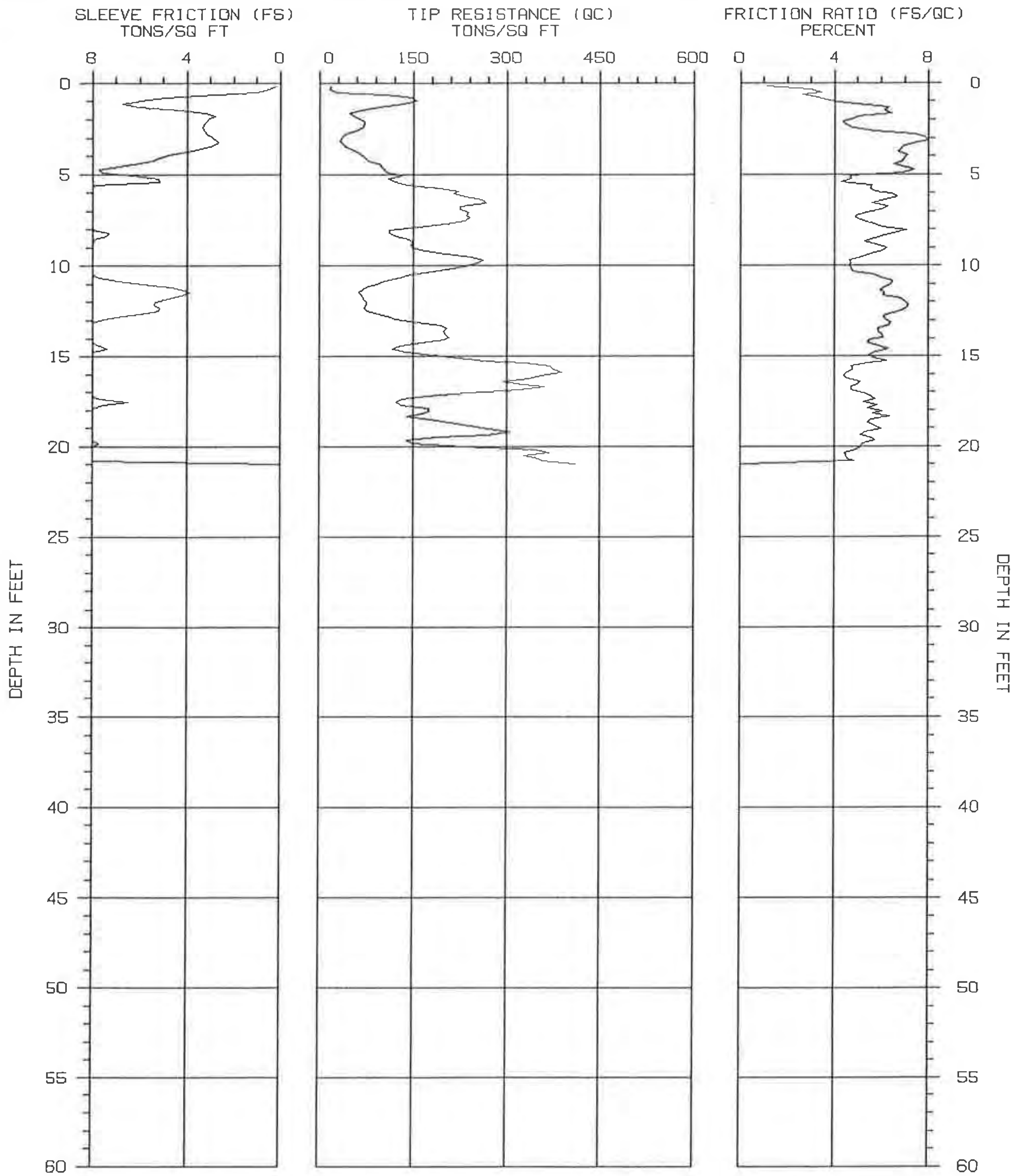
Interpretations based on: Robertson and Campanella, 1989.

SOUNDING : CPT-1

DEPTH (m)	DEPTH (ft)	TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N(60)	N1(60)	Dr (%)	Su (tsf)	PHI (Degrees)
6.300	20.67	187.97	5.09	*VERY STIFF FINE GRAINED	100	100			
6.450	21.16	226.58	5.22	*VERY STIFF FINE GRAINED	100	100			
6.600	21.65	309.49	4.48	*VERY STIFF FINE GRAINED	100	100			
6.750	22.15	155.92	6.19	*VERY STIFF FINE GRAINED	100	100			
6.900	22.64	232.99	4.64	*VERY STIFF FINE GRAINED	100	100			
7.050	23.13	189.48	5.37	*VERY STIFF FINE GRAINED	100	100			
7.200	23.62	176.01	5.66	*VERY STIFF FINE GRAINED	100	100			
7.350	24.11	111.79	4.18	*VERY STIFF FINE GRAINED	100	93			
7.500	24.61	91.54	5.09	*VERY STIFF FINE GRAINED	92	75			
7.650	25.10	81.92	5.58	*VERY STIFF FINE GRAINED	82	67			
7.800	25.59	235.31	4.13	*SAND to CLAYEY SAND	100	95			
7.950	26.08	97.68	6.49	*VERY STIFF FINE GRAINED	98	78			
8.100	26.57	44.95	7.05	CLAY	45	36		2.6	
8.250	27.07	310.81	4.89	*VERY STIFF FINE GRAINED	100	100			
8.400	27.56	184.79	4.99	*VERY STIFF FINE GRAINED	100	100			
8.550	28.05	235.27	4.88	*VERY STIFF FINE GRAINED	100	100			
8.700	28.54	145.19	5.83	*VERY STIFF FINE GRAINED	100	100			
8.850	29.04	54.56	1.65	SILTY SAND to SANDY SILT	18	14	42		35.0
9.000	29.53	63.54	4.88	CLAY to SILTY CLAY	42	32		3.6	
9.150	30.02	67.18	4.96	*VERY STIFF FINE GRAINED	67	50			
9.300	30.51	54.64	4.83	CLAY to SILTY CLAY	36	27		3.1	
9.450	31.00	84.85	4.05	CLAYEY SILT to SILTY CLAY	42	31		4.9	
9.600	31.50	102.57	5.28	*VERY STIFF FINE GRAINED	100	75			
9.750	31.99	69.00	6.97	*VERY STIFF FINE GRAINED	69	50			
9.900	32.48	192.63	4.96	*VERY STIFF FINE GRAINED	100	100			
10.050	32.97	310.62	4.26	*SAND to CLAYEY SAND	100	100			
10.200	33.46	214.85	5.25	*VERY STIFF FINE GRAINED	100	100			
10.350	33.96	139.22	4.61	*VERY STIFF FINE GRAINED	100	98			
10.500	34.45	138.52	4.98	*VERY STIFF FINE GRAINED	100	96			
10.650	34.94	168.56	4.42	*VERY STIFF FINE GRAINED	100	100			
10.800	35.43	81.75	2.76	SANDY SILT to CLAYEY SILT	33	22		5.3	
10.950	35.93	53.88	2.43	SANDY SILT to CLAYEY SILT	22	15		3.4	
11.100	36.42	54.32	2.43	SANDY SILT to CLAYEY SILT	22	15		3.5	
11.250	36.91	66.56	2.99	SANDY SILT to CLAYEY SILT	27	18		3.8	
11.400	37.40	53.54	2.71	SANDY SILT to CLAYEY SILT	21	14		3.4	
11.550	37.89	54.28	3.24	CLAYEY SILT to SILTY CLAY	27	18		3.1	
11.700	38.39	49.39	3.34	CLAYEY SILT to SILTY CLAY	25	16		2.8	
11.850	38.88	43.28	3.10	CLAYEY SILT to SILTY CLAY	22	14		2.7	
12.000	39.37	48.97	3.41	CLAYEY SILT to SILTY CLAY	24	16		2.7	
12.150	39.86	156.17	5.59	*VERY STIFF FINE GRAINED	100	100			
12.300	40.35	76.12	5.66	*VERY STIFF FINE GRAINED	76	49			
12.450	40.85	65.65	6.52	*VERY STIFF FINE GRAINED	66	42			
12.600	41.34	140.34	5.23	*VERY STIFF FINE GRAINED	100	89			
12.750	41.83	265.67	4.18	*SAND to CLAYEY SAND	100	84			
12.900	42.32	363.71	4.62	*VERY STIFF FINE GRAINED	100	100			
13.050	42.81	647.69	*****		0	0			.0

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 pcf
ASSUMED DEPTH OF WATER TABLE = 50.0 ft
N(60) = EQUIVALENT SPT VALUE (60% Energy)
N1(60) = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE (60% Energy)
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = OVERBURDEN NORMALIZED UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

Interpretations based on: Robertson and Campanella, 1989.



TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

CONE PENETRATION TEST SOUNDING NUMBER: CPT-2

PROJECT NAME : PADRE\SANDPIPER CONE/RIG : 473\#1 BH\JH

PROJECT NUMBER : 9904-1131 DATE/TIME: 08-12-99 08:48

HFA

CPT INTERPRETATIONS

SOUNDING : CPT-2 PROJECT No.: 9904-1131
PROJECT : PADRE\SANDPIPER CONE/RIG : 473\#1 BH\JH
DATE/TIME: 08-12-99 08:48

DEPTH (m)	DEPTH (ft)	TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N(60)	N1(60)	Dr (%)	Su (tsf)	PHI (Degrees)
.150	.49	29.34	3.41	CLAYEY SILT to SILTY CLAY	15	23		2.0	
.300	.98	155.64	3.83	*SAND to CLAYEY SAND	78	100			
.450	1.48	69.60	6.13	*VERY STIFF FINE GRAINED	70	100			
.600	1.97	63.12	4.81	CLAY to SILTY CLAY	42	67		3.7	
.750	2.46	68.79	4.81	*VERY STIFF FINE GRAINED	69	100			
.900	2.95	37.16	7.87	CLAY	37	59		2.2	
1.050	3.44	41.15	6.98	CLAY	41	66		2.4	
1.200	3.94	66.75	7.13	*VERY STIFF FINE GRAINED	67	100			
1.350	4.43	96.56	6.54	*VERY STIFF FINE GRAINED	97	100			
1.500	4.92	108.86	6.95	*VERY STIFF FINE GRAINED	100	100			
1.650	5.41	120.35	4.26	*VERY STIFF FINE GRAINED	100	100			
1.800	5.91	221.03	5.73	*VERY STIFF FINE GRAINED	100	100			
1.950	6.40	259.99	6.14	*VERY STIFF FINE GRAINED	100	100			
2.100	6.89	224.88	5.99	*VERY STIFF FINE GRAINED	100	100			
2.250	7.38	240.30	4.90	*VERY STIFF FINE GRAINED	100	100			
2.400	7.87	159.12	6.04	*VERY STIFF FINE GRAINED	100	100			
2.550	8.37	123.69	5.99	*VERY STIFF FINE GRAINED	100	100			
2.700	8.86	146.97	5.79	*VERY STIFF FINE GRAINED	100	100			
2.850	9.35	202.04	5.57	*VERY STIFF FINE GRAINED	100	100			
3.000	9.84	250.41	4.72	*VERY STIFF FINE GRAINED	100	100			
3.150	10.33	180.69	4.79	*VERY STIFF FINE GRAINED	100	100			
3.300	10.83	106.22	6.48	*VERY STIFF FINE GRAINED	100	100			
3.450	11.32	68.28	5.97	*VERY STIFF FINE GRAINED	68	83			
3.600	11.81	69.83	6.85	*VERY STIFF FINE GRAINED	70	83			
3.750	12.30	72.83	7.04	*VERY STIFF FINE GRAINED	73	85			
3.900	12.80	109.41	6.10	*VERY STIFF FINE GRAINED	100	100			
4.050	13.29	193.41	6.32	*VERY STIFF FINE GRAINED	100	100			
4.200	13.78	201.21	6.03	*VERY STIFF FINE GRAINED	100	100			
4.350	14.27	164.37	5.44	*VERY STIFF FINE GRAINED	100	100			
4.500	14.76	138.05	5.78	*VERY STIFF FINE GRAINED	100	100			
4.650	15.26	264.12	6.23	*VERY STIFF FINE GRAINED	100	100			
4.800	15.75	374.42	4.80	*VERY STIFF FINE GRAINED	100	100			
4.950	16.24	336.69	4.52	*VERY STIFF FINE GRAINED	100	100			
5.100	16.73	360.12	4.71	*VERY STIFF FINE GRAINED	100	100			
5.250	17.22	172.34	5.56	*VERY STIFF FINE GRAINED	100	100			
5.400	17.72	129.95	5.80	*VERY STIFF FINE GRAINED	100	100			
5.550	18.21	165.71	5.63	*VERY STIFF FINE GRAINED	100	100			
5.700	18.70	208.56	5.44	*VERY STIFF FINE GRAINED	100	100			
5.850	19.19	304.61	5.30	*VERY STIFF FINE GRAINED	100	100			
6.000	19.69	140.98	5.75	*VERY STIFF FINE GRAINED	100	100			
6.150	20.18	344.65	4.96	*VERY STIFF FINE GRAINED	100	100			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 pcf
ASSUMED DEPTH OF WATER TABLE = 50.0 ft
N(60) = EQUIVALENT SPT VALUE (60% Energy)
N1(60) = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE (60% Energy)
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = OVERBURDEN NORMALIZED UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

HOLGUIN, FAHAN & ASSOCIATES, INC.

Interpretations based on: Robertson and Campanella, 1989.

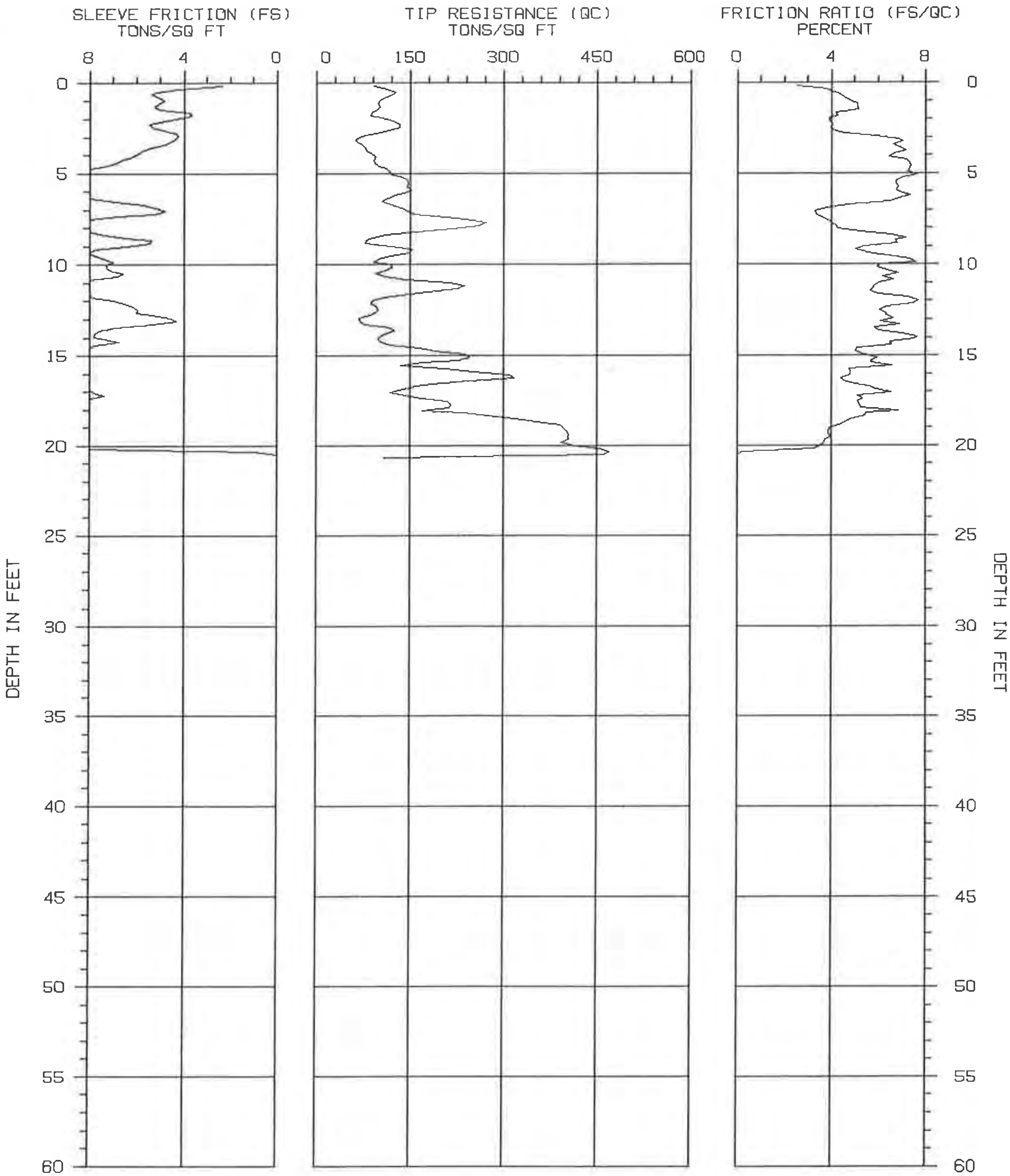
SOUNDING : CPT-2

DEPTH (m)	DEPTH (ft)	TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N(60)	N1(60)	Dr (%)	Su (tsf)	PHI (Degrees)
6.300	20.67	350.73	4.53	*VERY STIFF FINE GRAINED	100	100			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 pcf
ASSUMED DEPTH OF WATER TABLE = 50.0 ft
N(60) = EQUIVALENT SPT VALUE (60% Energy)
N1(60) = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE (60% Energy)
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = OVERBURDEN NORMALIZED UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

HOLGUIN, FAHAN & ASSOCIATES, INC.

Interpretations based on: Robertson and Campanella, 1989.



TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-3

PROJECT NAME : PADRE\SANDPIPER

CONE/RIG : 473\#1 BH\JH

PROJECT NUMBER : 9904-1131

DATE/TIME: 08-12-99 09:20

HFA

CPT INTERPRETATIONS

SOUNDING : CPT-3
PROJECT : PADRE\SANDPIPER
DATE/TIME: 08-12-99 09:20

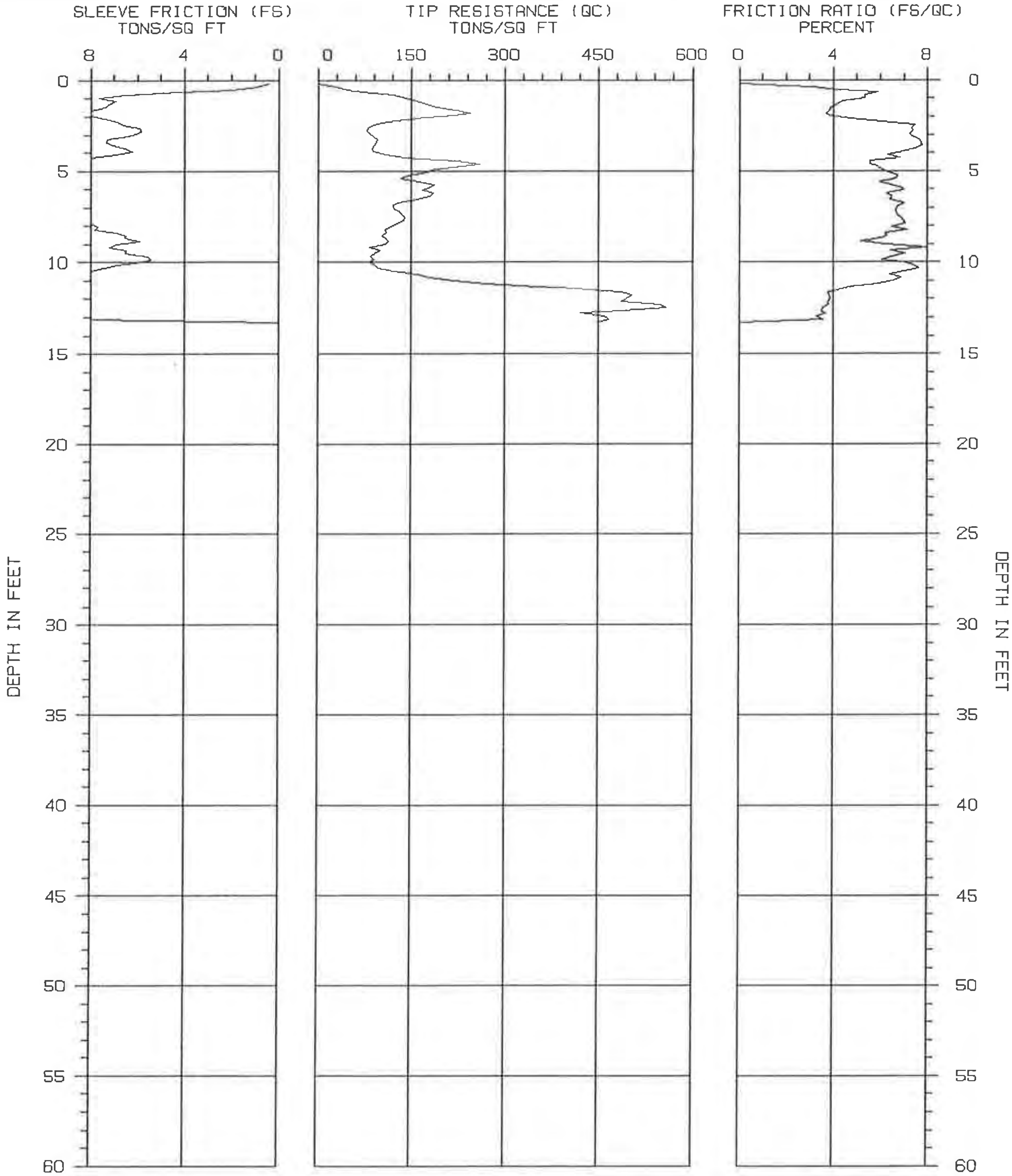
PROJECT No.: 9904-1131
CONE/RIG : 473\#1 BH\JH

DEPTH (m)	DEPTH (ft)	TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N(60)	N1(60)	Dr (%)	Su (tsf)	PHI (Degrees)
.150	.49	126.51	4.07	*VERY STIFF FINE GRAINED	100	100			
.300	.98	101.38	4.77	*VERY STIFF FINE GRAINED	100	100			
.450	1.48	96.52	5.14	*VERY STIFF FINE GRAINED	97	100			
.600	1.97	104.86	3.91	CLAYEY SILT to SILTY CLAY	52	84		6.2	
.750	2.46	134.18	3.98	*VERY STIFF FINE GRAINED	100	100			
.900	2.95	71.49	5.93	*VERY STIFF FINE GRAINED	71	100			
1.050	3.44	73.32	6.61	*VERY STIFF FINE GRAINED	73	100			
1.200	3.94	89.31	6.65	*VERY STIFF FINE GRAINED	89	100			
1.350	4.43	93.63	7.32	*VERY STIFF FINE GRAINED	94	100			
1.500	4.92	117.68	7.26	*VERY STIFF FINE GRAINED	100	100			
1.650	5.41	146.61	6.75	*VERY STIFF FINE GRAINED	100	100			
1.800	5.91	152.62	6.74	*VERY STIFF FINE GRAINED	100	100			
1.950	6.40	115.57	6.89	*VERY STIFF FINE GRAINED	100	100			
2.100	6.89	134.78	3.81	SANDY SILT to CLAYEY SILT	54	84		7.9	
2.250	7.38	191.86	3.53	*SAND to CLAYEY SAND	96	100			
2.400	7.87	261.23	4.17	*SAND to CLAYEY SAND	100	100			
2.550	8.37	112.19	6.54	*VERY STIFF FINE GRAINED	100	100			
2.700	8.86	79.60	6.80	*VERY STIFF FINE GRAINED	80	100			
2.850	9.35	148.42	5.52	*VERY STIFF FINE GRAINED	100	100			
3.000	9.84	91.71	7.58	*VERY STIFF FINE GRAINED	92	100			
3.150	10.33	111.58	6.37	*VERY STIFF FINE GRAINED	100	100			
3.300	10.83	144.19	6.60	*VERY STIFF FINE GRAINED	100	100			
3.450	11.32	224.39	5.72	*VERY STIFF FINE GRAINED	100	100			
3.600	11.81	108.69	7.25	*VERY STIFF FINE GRAINED	100	100			
3.750	12.30	96.83	6.33	*VERY STIFF FINE GRAINED	97	100			
3.900	12.80	84.62	6.31	*VERY STIFF FINE GRAINED	85	97			
4.050	13.29	77.37	6.88	*VERY STIFF FINE GRAINED	77	87			
4.200	13.78	111.22	6.99	*VERY STIFF FINE GRAINED	100	100			
4.350	14.27	103.97	6.48	*VERY STIFF FINE GRAINED	100	100			
4.500	14.76	190.91	5.00	*VERY STIFF FINE GRAINED	100	100			
4.650	15.26	228.02	5.67	*VERY STIFF FINE GRAINED	100	100			
4.800	15.75	206.56	4.76	*VERY STIFF FINE GRAINED	100	100			
4.950	16.24	315.70	4.41	*VERY STIFF FINE GRAINED	100	100			
5.100	16.73	159.72	5.60	*VERY STIFF FINE GRAINED	100	100			
5.250	17.22	144.04	5.12	*VERY STIFF FINE GRAINED	100	100			
5.400	17.72	214.40	5.19	*VERY STIFF FINE GRAINED	100	100			
5.550	18.21	235.22	5.46	*VERY STIFF FINE GRAINED	100	100			
5.700	18.70	353.85	4.57	*VERY STIFF FINE GRAINED	100	100			
5.850	19.19	401.10	3.85	*SAND to CLAYEY SAND	100	100			
6.000	19.69	403.91	3.73	*SAND to CLAYEY SAND	100	100			
6.150	20.18	454.04	3.29	*SAND to CLAYEY SAND	100	100			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 pcf
ASSUMED DEPTH OF WATER TABLE = 50.0 ft
N(60) = EQUIVALENT SPT VALUE (60% Energy)
N1(60) = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE (60% Energy)
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = OVERBURDEN NORMALIZED UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

HOLGUIN, FAHAN & ASSOCIATES, INC.

Interpretations based on: Robertson and Campanella, 1989.



TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

CONE PENETRATION TEST	SOUNDING NUMBER: CPT-4
PROJECT NAME : PADRE\SANDPIPER	CONE/RIG : 473\#1 BH\JH
PROJECT NUMBER : 9904-1131	DATE/TIME: 08-12-99 09:42

HFA

CPT INTERPRETATIONS

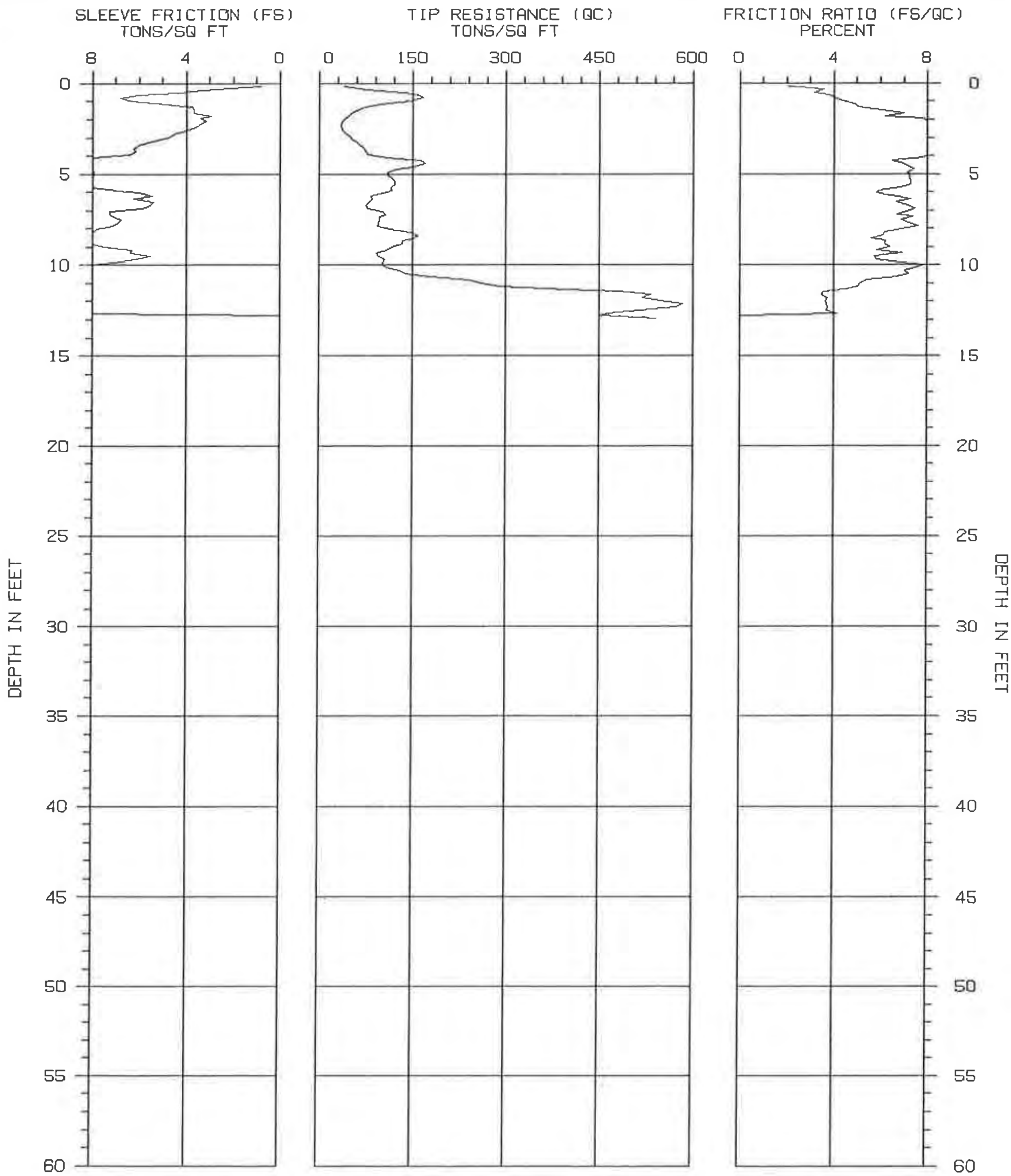
SOUNDING : CPT-4 PROJECT No.: 9904-1131
PROJECT : PADRE\SANDPIPER CONE/RIG : 473\#1 BH\JH
DATE/TIME: 08-12-99 09:42

DEPTH (m)	DEPTH (ft)	TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N(60)	N1(60)	Dr (%)	Su (tsf)	PHI (Degrees)
.150	.49	46.44	4.24	CLAY to SILTY CLAY	31	50		2.7	
.300	.98	142.72	5.33	*VERY STIFF FINE GRAINED	100	100			
.450	1.48	189.89	3.88	*SAND to CLAYEY SAND	95	100			
.600	1.97	218.48	3.87	*SAND to CLAYEY SAND	100	100			
.750	2.46	88.57	7.48	*VERY STIFF FINE GRAINED	89	100			
.900	2.95	83.19	7.24	*VERY STIFF FINE GRAINED	83	100			
1.050	3.44	94.54	7.73	*VERY STIFF FINE GRAINED	95	100			
1.200	3.94	88.55	7.00	*VERY STIFF FINE GRAINED	89	100			
1.350	4.43	224.11	5.56	*VERY STIFF FINE GRAINED	100	100			
1.500	4.92	188.00	6.05	*VERY STIFF FINE GRAINED	100	100			
1.650	5.41	132.93	6.66	*VERY STIFF FINE GRAINED	100	100			
1.800	5.91	179.31	6.93	*VERY STIFF FINE GRAINED	100	100			
1.950	6.40	179.77	6.48	*VERY STIFF FINE GRAINED	100	100			
2.100	6.89	120.44	6.75	*VERY STIFF FINE GRAINED	100	100			
2.250	7.38	135.29	6.73	*VERY STIFF FINE GRAINED	100	100			
2.400	7.87	127.60	7.05	*VERY STIFF FINE GRAINED	100	100			
2.550	8.37	110.32	6.22	*VERY STIFF FINE GRAINED	100	100			
2.700	8.86	113.49	5.18	*VERY STIFF FINE GRAINED	100	100			
2.850	9.35	100.79	6.44	*VERY STIFF FINE GRAINED	100	100			
3.000	9.84	89.82	6.04	*VERY STIFF FINE GRAINED	90	100			
3.150	10.33	97.00	7.65	*VERY STIFF FINE GRAINED	97	100			
3.300	10.83	180.79	6.90	*VERY STIFF FINE GRAINED	100	100			
3.450	11.32	351.26	4.67	*VERY STIFF FINE GRAINED	100	100			
3.600	11.81	502.25	3.84	*SAND to CLAYEY SAND	100	100			
3.750	12.30	548.63	3.77	*SAND to CLAYEY SAND	100	100			
3.900	12.80	420.56	3.69	*SAND to CLAYEY SAND	100	100			
4.050	13.29	448.01	*****		0	0			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 pcf
ASSUMED DEPTH OF WATER TABLE = 50.0 ft
N(60) = EQUIVALENT SPT VALUE (60% Energy)
N1(60) = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE (60% Energy)
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = OVERBURDEN NORMALIZED UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

HOLGUIN, FAHAN & ASSOCIATES, INC.

Interpretations based on: Robertson and Campanella, 1989.



TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

CONE PENETRATION TEST | SOUNDING NUMBER: CPT-4A

PROJECT NAME : PADRE\SANDPIPER
CONE/RIG : 473\#1 BH\JH

PROJECT NUMBER : 9904-1131
DATE/TIME: 08-12-99 09:59

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*                                                                     *
*                      CPT INTERPRETATIONS                            *
*                                                                     *
*  SOUNDING : CPT-4A                     PROJECT No.: 9904-1131       *
*  PROJECT  : PADRE\SANDPIPER            CONE/RIG : 473\#1 BH\JH      *
*  DATE/TIME: 08-12-99 09:59                                          *
*                                                                     *
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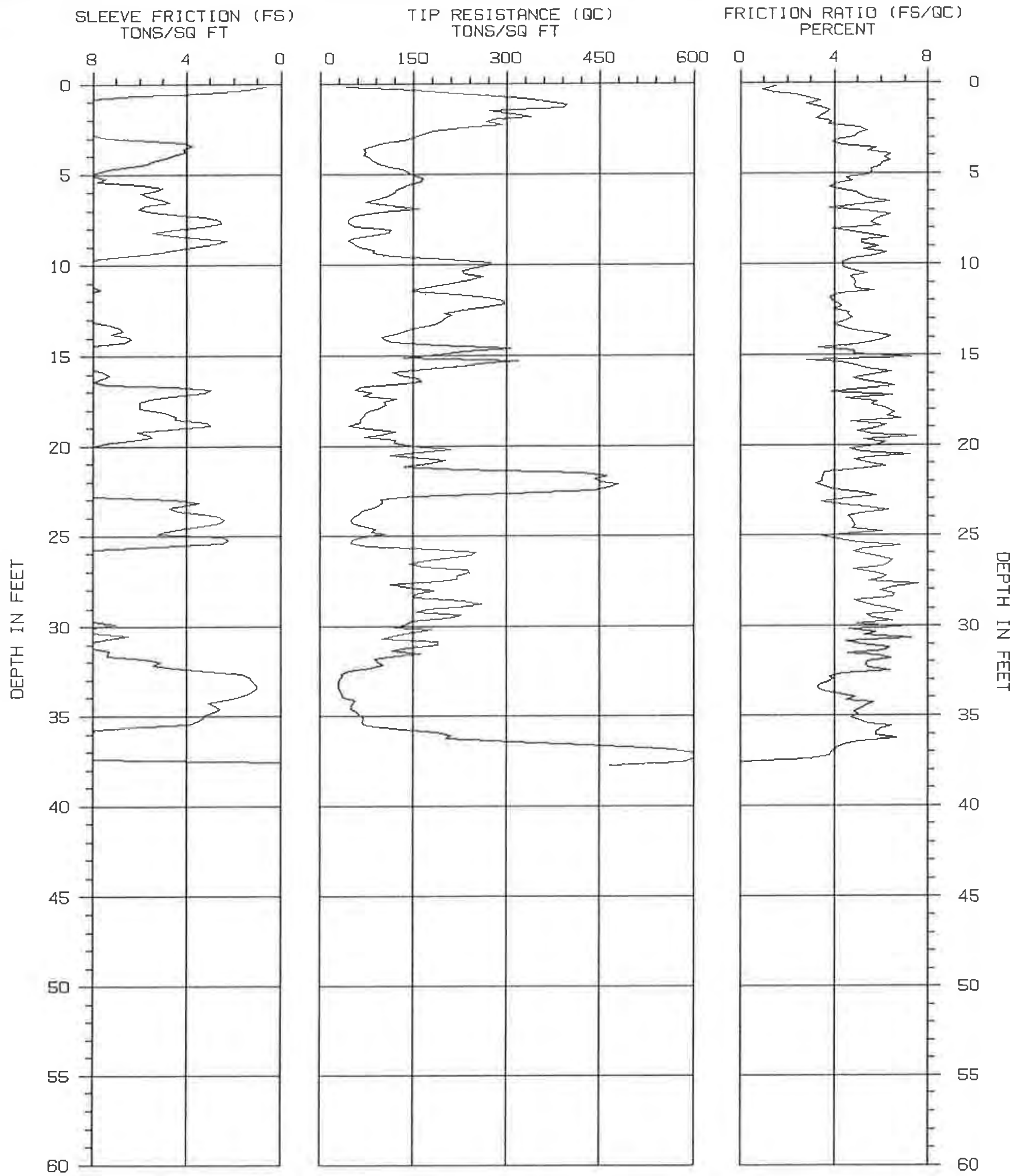
DEPTH (m)	DEPTH (ft)	TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N(60)	N1(60)	Dr (%)	Su (tsf)	PHI (Degrees)
.150	.49	136.29	3.18	SANDY SILT to CLAYEY SILT	55	87		8.0	
.300	.98	144.74	4.34	*VERY STIFF FINE GRAINED	100	100			
.450	1.48	61.10	6.06	CLAY	61	98		3.6	
.600	1.97	42.49	7.88	CLAY	42	68		2.5	
.750	2.46	35.63	10.13	CLAY	36	57		2.1	
.900	2.95	50.41	9.30	CLAY	50	81		3.0	
1.050	3.44	64.73	9.33	*VERY STIFF FINE GRAINED	65	100			
1.200	3.94	78.69	8.16	*VERY STIFF FINE GRAINED	79	100			
1.350	4.43	170.49	6.99	*VERY STIFF FINE GRAINED	100	100			
1.500	4.92	110.83	7.15	*VERY STIFF FINE GRAINED	100	100			
1.650	5.41	121.84	7.30	*VERY STIFF FINE GRAINED	100	100			
1.800	5.91	116.97	5.90	*VERY STIFF FINE GRAINED	100	100			
1.950	6.40	85.23	7.27	*VERY STIFF FINE GRAINED	85	100			
2.100	6.89	78.67	7.45	*VERY STIFF FINE GRAINED	79	100			
2.250	7.38	96.28	7.37	*VERY STIFF FINE GRAINED	96	100			
2.400	7.87	93.20	7.62	*VERY STIFF FINE GRAINED	93	100			
2.550	8.37	158.49	6.10	*VERY STIFF FINE GRAINED	100	100			
2.700	8.86	133.88	6.18	*VERY STIFF FINE GRAINED	100	100			
2.850	9.35	91.59	6.91	*VERY STIFF FINE GRAINED	92	100			
3.000	9.84	102.38	6.89	*VERY STIFF FINE GRAINED	100	100			
3.150	10.33	127.96	7.03	*VERY STIFF FINE GRAINED	100	100			
3.300	10.83	241.15	5.39	*VERY STIFF FINE GRAINED	100	100			
3.450	11.32	397.26	4.48	*VERY STIFF FINE GRAINED	100	100			
3.600	11.81	519.29	3.74	*SAND to CLAYEY SAND	100	100			
3.750	12.30	572.78	3.73	*SAND to CLAYEY SAND	100	100			
3.900	12.80	450.60	*****		0	0			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 pcf
ASSUMED DEPTH OF WATER TABLE = 50.0 ft
N(60) = EQUIVALENT SPT VALUE (60% Energy)
N1(60) = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE (60% Energy)
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = OVERBURDEN NORMALIZED UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

HOLGUIN, FAHAN & ASSOCIATES, INC.

Interpretations based on: Robertson and Campanella, 1989.



TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

CONE PENETRATION TEST   SOUNDING NUMBER: CPT-5

PROJECT NAME : PADRE\SANDPIPER   CONE/RIG : 473\#1 BH\JH

PROJECT NUMBER : 9904-1131   DATE/TIME: 08-12-99 10:18

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# CPT INTERPRETATIONS

SOUNDING : CPT-5
PROJECT : PADRE\SANDPIPER
DATE/TIME: 08-12-99 10:18

PROJECT No.: 9904-1131
CONE/RIG : 473\#1 BH\JH

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DEPTH (m)	DEPTH (ft)	TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N(60)	N1(60)	Dr (%)	Su (tsf)	PHI (Degrees)
.150	.49	216.99	1.47	SAND to SILTY SAND	54	87	99		
.300	.98	363.56	3.38	*SAND to CLAYEY SAND	100	100			
.450	1.48	271.44	3.77	*SAND to CLAYEY SAND	100	100			
.600	1.97	284.81	3.20	*SAND to CLAYEY SAND	100	100			
.750	2.46	226.09	5.11	*VERY STIFF FINE GRAINED	100	100			
.900	2.95	151.69	4.86	*VERY STIFF FINE GRAINED	100	100			
1.050	3.44	87.49	4.31	CLAYEY SILT to SILTY CLAY	44	70		5.1	
1.200	3.94	70.87	6.39	*VERY STIFF FINE GRAINED	71	100			
1.350	4.43	95.75	5.99	*VERY STIFF FINE GRAINED	96	100			
1.500	4.92	141.55	5.59	*VERY STIFF FINE GRAINED	100	100			
1.650	5.41	164.29	4.75	*VERY STIFF FINE GRAINED	100	100			
1.800	5.91	122.14	4.40	*VERY STIFF FINE GRAINED	100	100			
1.950	6.40	94.11	5.41	*VERY STIFF FINE GRAINED	94	100			
2.100	6.89	158.89	3.79	*SAND to CLAYEY SAND	79	100			
2.250	7.38	52.81	6.12	CLAY	53	79		3.1	
2.400	7.87	56.38	5.98	CLAY	56	82		3.3	
2.550	8.37	81.05	5.56	*VERY STIFF FINE GRAINED	81	100			
2.700	8.86	55.30	5.15	CLAY	55	76		3.2	
2.850	9.35	85.17	6.21	*VERY STIFF FINE GRAINED	85	100			
3.000	9.84	273.59	4.35	*VERY STIFF FINE GRAINED	100	100			
3.150	10.33	228.23	4.76	*VERY STIFF FINE GRAINED	100	100			
3.300	10.83	240.32	4.84	*VERY STIFF FINE GRAINED	100	100			
3.450	11.32	154.77	4.96	*VERY STIFF FINE GRAINED	100	100			
3.600	11.81	268.43	3.84	*SAND to CLAYEY SAND	100	100			
3.750	12.30	268.41	4.33	*VERY STIFF FINE GRAINED	100	100			
3.900	12.80	212.11	4.59	*VERY STIFF FINE GRAINED	100	100			
4.050	13.29	184.53	3.95	*SAND to CLAYEY SAND	92	100			
4.200	13.78	124.01	5.79	*VERY STIFF FINE GRAINED	100	100			
4.350	14.27	116.91	5.69	*VERY STIFF FINE GRAINED	100	100			
4.500	14.76	231.48	4.86	*VERY STIFF FINE GRAINED	100	100			
4.650	15.26	317.86	2.79	*SAND to CLAYEY SAND	100	100			
4.800	15.75	169.58	5.40	*VERY STIFF FINE GRAINED	100	100			
4.950	16.24	158.47	4.82	*VERY STIFF FINE GRAINED	100	100			
5.100	16.73	68.68	6.60	*VERY STIFF FINE GRAINED	69	69			
5.250	17.22	71.15	6.48	*VERY STIFF FINE GRAINED	71	70			
5.400	17.72	106.52	5.60	*VERY STIFF FINE GRAINED	100	100			
5.550	18.21	73.04	6.56	*VERY STIFF FINE GRAINED	73	70			
5.700	18.70	65.92	4.70	CLAY to SILTY CLAY	44	41		3.8	
5.850	19.19	121.95	4.99	*VERY STIFF FINE GRAINED	100	100			
6.000	19.69	121.48	5.24	*VERY STIFF FINE GRAINED	100	100			
6.150	20.18	210.68	4.67	*VERY STIFF FINE GRAINED	100	100			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 pcf
ASSUMED DEPTH OF WATER TABLE = 50.0 ft
N(60) = EQUIVALENT SPT VALUE (60% Energy)
N1(60) = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE (60% Energy)
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = OVERBURDEN NORMALIZED UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

HOLGUIN, FAHAN & ASSOCIATES, INC.

Interpretations based on: Robertson and Campanella, 1989.

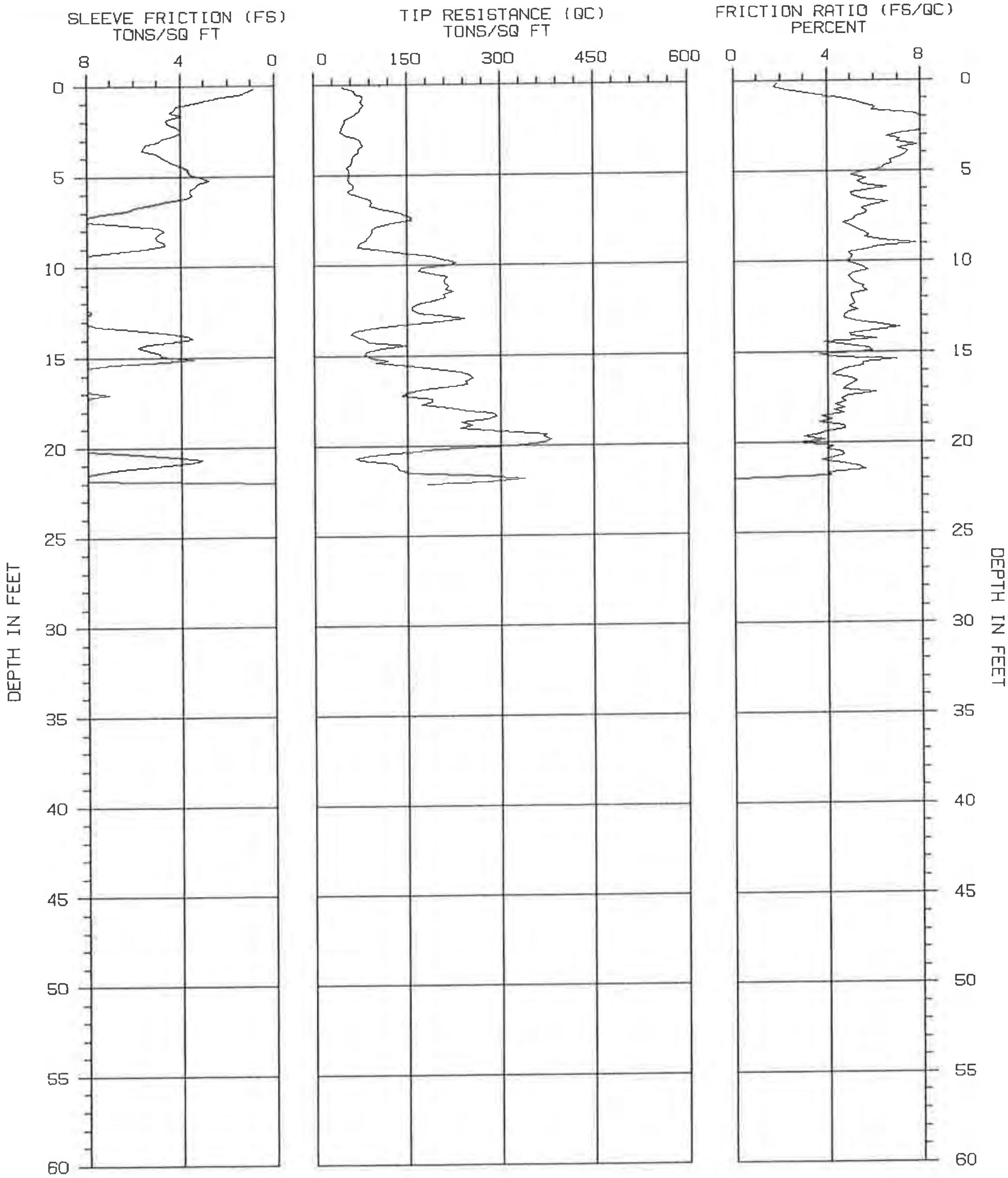
SOUNDING : CPT-5

DEPTH (m)	DEPTH (ft)	TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N(60)	N1(60)	Dr (%)	Su (tsf)	PHI (Degrees)
6.300	20.67	166.35	5.37	*VERY STIFF FINE GRAINED	100	100			
6.450	21.16	136.39	6.17	*VERY STIFF FINE GRAINED	100	100			
6.600	21.65	461.67	3.53	*SAND to CLAYEY SAND	100	100			
6.750	22.15	479.22	3.22	*SAND to CLAYEY SAND	100	100			
6.900	22.64	305.86	5.26	*VERY STIFF FINE GRAINED	100	100			
7.050	23.13	101.81	3.41	SANDY SILT to CLAYEY SILT	41	35		5.9	
7.200	23.62	69.13	6.31	*VERY STIFF FINE GRAINED	69	58			
7.350	24.11	50.71	4.73	CLAY to SILTY CLAY	34	28		2.9	
7.500	24.61	91.10	4.76	*VERY STIFF FINE GRAINED	91	75			
7.650	25.10	70.17	3.46	CLAYEY SILT to SILTY CLAY	35	29		4.0	
7.800	25.59	76.74	6.78	*VERY STIFF FINE GRAINED	77	62			
7.950	26.08	243.15	5.44	*VERY STIFF FINE GRAINED	100	100			
8.100	26.57	145.40	6.30	*VERY STIFF FINE GRAINED	100	100			
8.250	27.07	239.39	5.64	*VERY STIFF FINE GRAINED	100	100			
8.400	27.56	191.56	5.47	*VERY STIFF FINE GRAINED	100	100			
8.550	28.05	183.02	5.94	*VERY STIFF FINE GRAINED	100	100			
8.700	28.54	228.00	4.85	*VERY STIFF FINE GRAINED	100	100			
8.850	29.04	172.93	6.37	*VERY STIFF FINE GRAINED	100	100			
9.000	29.53	208.11	5.65	*VERY STIFF FINE GRAINED	100	100			
9.150	30.02	122.24	6.86	*VERY STIFF FINE GRAINED	100	91			
9.300	30.51	121.92	5.28	*VERY STIFF FINE GRAINED	100	90			
9.450	31.00	189.48	5.16	*VERY STIFF FINE GRAINED	100	100			
9.600	31.50	161.52	4.56	*VERY STIFF FINE GRAINED	100	100			
9.750	31.99	93.65	5.42	*VERY STIFF FINE GRAINED	94	68			
9.900	32.48	47.93	6.38	CLAY	48	34		2.7	
10.050	32.97	32.29	3.96	CLAY to SILTY CLAY	22	15		1.8	
10.200	33.46	30.85	3.31	CLAYEY SILT to SILTY CLAY	15	11		1.9	
10.350	33.96	37.75	4.90	CLAY	38	26		2.1	
10.500	34.45	51.20	5.33	CLAY	51	36		2.9	
10.650	34.94	63.37	5.03	CLAY to SILTY CLAY	42	29		3.6	
10.800	35.43	71.06	5.47	*VERY STIFF FINE GRAINED	71	49			
10.950	35.93	186.64	5.78	*VERY STIFF FINE GRAINED	100	100			
11.100	36.42	309.69	5.03	*VERY STIFF FINE GRAINED	100	100			
11.250	36.91	568.38	4.04	*SAND to CLAYEY SAND	100	100			
11.400	37.40	613.27	2.88	*SAND to CLAYEY SAND	100	100			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 pcf
ASSUMED DEPTH OF WATER TABLE = 50.0 ft
N(60) = EQUIVALENT SPT VALUE (60% Energy)
N1(60) = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE (60% Energy)
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = OVERBURDEN NORMALIZED UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

HOLGUIN, FAHAN & ASSOCIATES, INC.

Interpretations based on: Robertson and Campanella, 1989.



TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

CONE PENETRATION TEST	SOUNDING NUMBER: CPT-6
PROJECT NAME : PADRE\SANDPIPER	CONE/RIG : 473\#1 BH\JH
PROJECT NUMBER : 9904-1131	DATE/TIME: 08-12-99 10:51

HFA

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# CPT INTERPRETATIONS

SOUNDING : CPT-6 — PROJECT No.: 9904-1131

PROJECT : PADRE\SANDPIPER — CONE/RIG : 473\#1 BH\JH

DATE/TIME: 08-12-99 10:51

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DEPTH (m)	DEPTH (ft)	TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N(60)	N1(60)	Dr (%)	Su (tsf)	PHI (Degrees)
.150	.49	66.69	2.25	SANDY SILT to CLAYEY SILT	27	43		4.4	
.300	.98	76.18	4.52	CLAYEY SILT to SILTY CLAY	38	61		4.5	
.450	1.48	73.21	6.06	*VERY STIFF FINE GRAINED	73	100			
.600	1.97	50.84	9.03	CLAY	51	81		3.0	
.750	2.46	45.15	8.84	CLAY	45	72		2.6	
.900	2.95	68.13	7.02	*VERY STIFF FINE GRAINED	68	100			
1.050	3.44	79.48	7.00	*VERY STIFF FINE GRAINED	79	100			
1.200	3.94	65.07	7.45	*VERY STIFF FINE GRAINED	65	100			
1.350	4.43	59.95	6.66	CLAY	60	96		3.5	
1.500	4.92	56.47	6.32	CLAY	56	90		3.3	
1.650	5.41	57.66	5.64	CLAY	58	92		3.4	
1.800	5.91	55.30	6.53	CLAY	55	88		3.2	
1.950	6.40	90.14	5.08	*VERY STIFF FINE GRAINED	90	100			
2.100	6.89	106.69	5.90	*VERY STIFF FINE GRAINED	100	100			
2.250	7.38	157.66	5.64	*VERY STIFF FINE GRAINED	100	100			
2.400	7.87	104.52	4.69	*VERY STIFF FINE GRAINED	100	100			
2.550	8.37	90.78	5.58	*VERY STIFF FINE GRAINED	91	100			
2.700	8.86	73.83	6.31	*VERY STIFF FINE GRAINED	74	100			
2.850	9.35	145.95	5.67	*VERY STIFF FINE GRAINED	100	100			
3.000	9.84	228.13	5.00	*VERY STIFF FINE GRAINED	100	100			
3.150	10.33	167.86	5.55	*VERY STIFF FINE GRAINED	100	100			
3.300	10.83	209.75	4.88	*VERY STIFF FINE GRAINED	100	100			
3.450	11.32	211.11	5.56	*VERY STIFF FINE GRAINED	100	100			
3.600	11.81	211.17	5.03	*VERY STIFF FINE GRAINED	100	100			
3.750	12.30	158.59	5.15	*VERY STIFF FINE GRAINED	100	100			
3.900	12.80	200.89	4.90	*VERY STIFF FINE GRAINED	100	100			
4.050	13.29	142.38	5.31	*VERY STIFF FINE GRAINED	100	100			
4.200	13.78	61.14	6.04	CLAY	61	67		3.5	
4.350	14.27	88.55	6.09	*VERY STIFF FINE GRAINED	89	96			
4.500	14.76	84.58	5.76	*VERY STIFF FINE GRAINED	85	90			
4.650	15.26	118.25	4.55	*VERY STIFF FINE GRAINED	100	100			
4.800	15.75	193.24	5.50	*VERY STIFF FINE GRAINED	100	100			
4.950	16.24	255.07	4.17	*SAND to CLAYEY SAND	100	100			
5.100	16.73	223.77	5.06	*VERY STIFF FINE GRAINED	100	100			
5.250	17.22	141.43	6.05	*VERY STIFF FINE GRAINED	100	100			
5.400	17.72	173.42	4.76	*VERY STIFF FINE GRAINED	100	100			
5.550	18.21	285.83	4.27	*VERY STIFF FINE GRAINED	100	100			
5.700	18.70	236.88	4.18	*VERY STIFF FINE GRAINED	100	100			
5.850	19.19	300.32	4.74	*VERY STIFF FINE GRAINED	100	100			
6.000	19.69	381.81	3.00	*SAND to CLAYEY SAND	100	100			
6.150	20.18	196.94	4.21	*VERY STIFF FINE GRAINED	100	100			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 pcf
ASSUMED DEPTH OF WATER TABLE = 50.0 ft
N(60) = EQUIVALENT SPT VALUE (60% Energy)
N1(60) = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE (60% Energy)
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = OVERBURDEN NORMALIZED UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

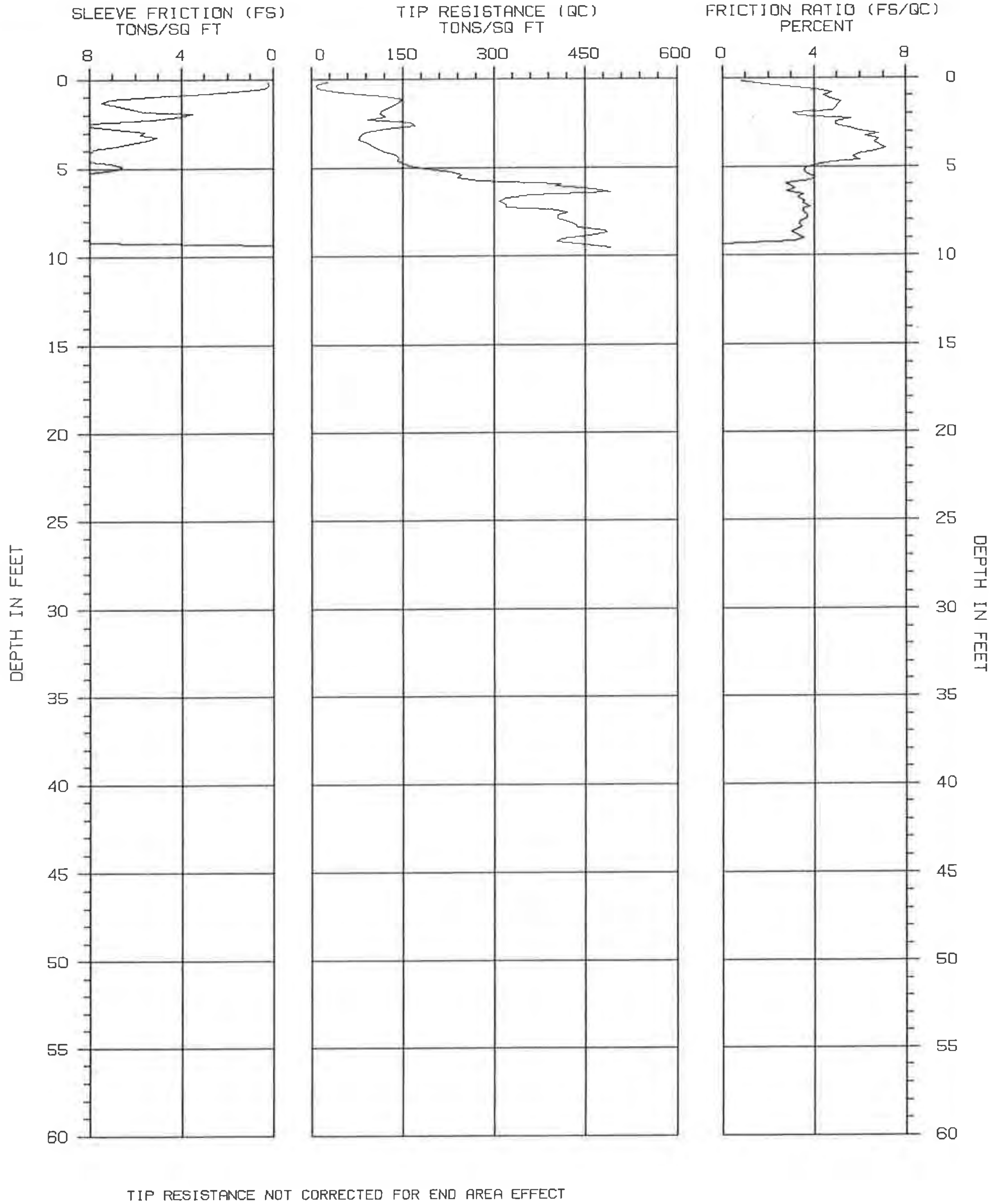
Interpretations based on: Robertson and Campanella, 1989.

SOUNDING : CPT-6

DEPTH (m)	DEPTH (ft)	TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N(60)	N1(60)	Dr (%)	Su (tsf)	PHI (Degrees)
6.300	20.67	66.58	4.67	CLAY to SILTY CLAY	44	40		3.8	
6.450	21.16	134.25	4.63	*VERY STIFF FINE GRAINED	100	100			
6.600	21.65	272.55	4.02	*SAND to CLAYEY SAND	100	100			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 pcf
ASSUMED DEPTH OF WATER TABLE = 50.0 ft
N(60) = EQUIVALENT SPT VALUE (60% Energy)
N1(60) = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE (60% Energy)
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = OVERBURDEN NORMALIZED UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

Interpretations based on: Robertson and Campanella, 1989.



CONE PENETRATION TEST SOUNDING NUMBER: CPT-7

PROJECT NAME : PADRE\SANDPIPER CONE/RIG : 473\#1 BH\JH

PROJECT NUMBER : 9904-1131 DATE/TIME: 08-12-99 11:19

HFA

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# CPT INTERPRETATIONS
*   *
* SOUNDING : CPT-7   PROJECT No.: 9904-1131   *
* PROJECT : PADRE\SANDPIPER   CONE/RIG : 473\#1 BH\JH   *
* DATE/TIME: 08-12-99 11:19   *
*   *
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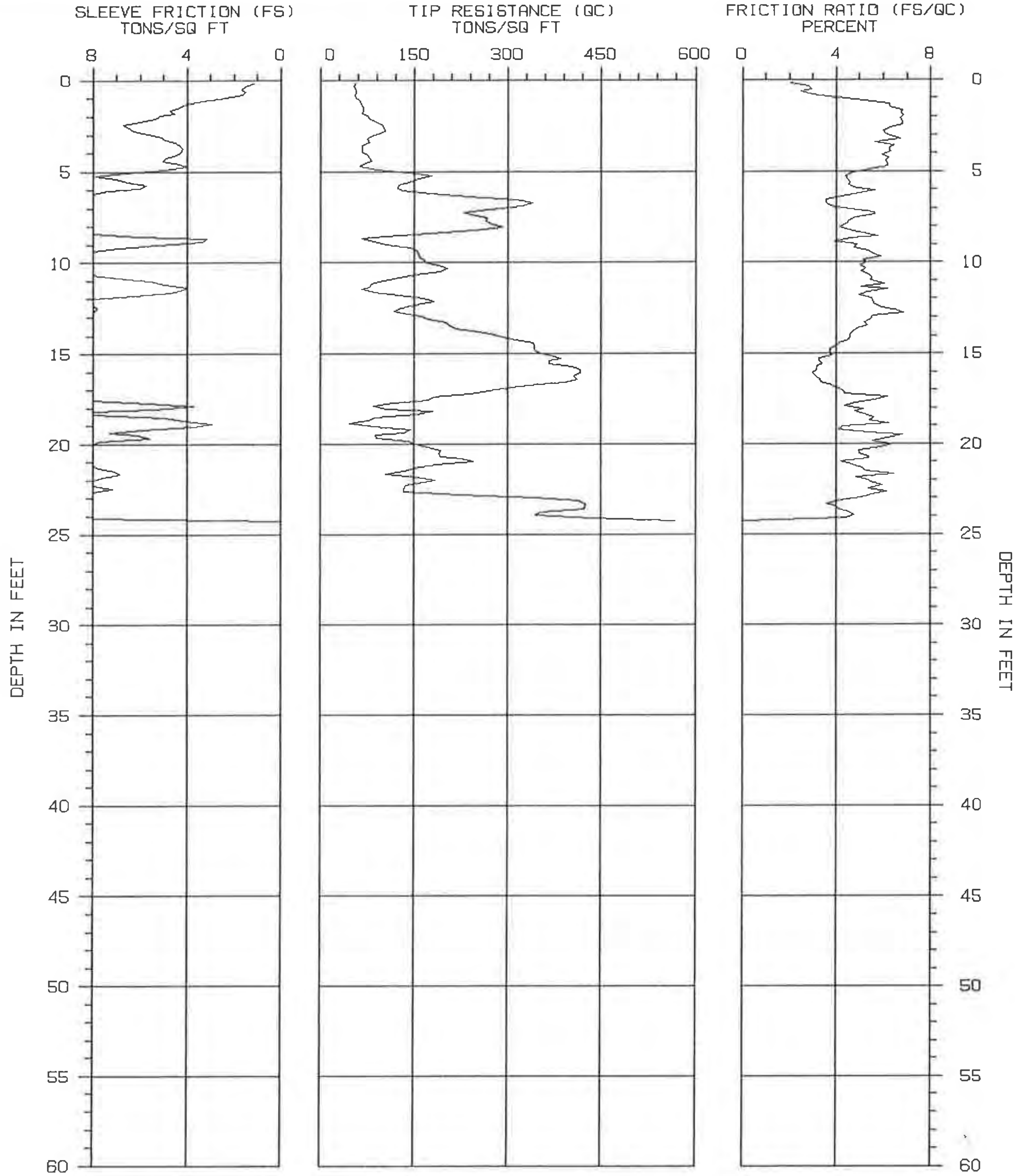
DEPTH (m)	DEPTH (ft)	TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N(60)	N1(60)	Dr (%)	Su (tsf)	PHI (Degrees)
.150	.49	10.92	3.21	CLAY to SILTY CLAY	7	12		.7	
.300	.98	120.65	4.38	*VERY STIFF FINE GRAINED	100	100			
.450	1.48	134.88	5.01	*VERY STIFF FINE GRAINED	100	100			
.600	1.97	114.04	3.07	SANDY SILT to CLAYEY SILT	46	73		6.7	
.750	2.46	163.54	4.92	*VERY STIFF FINE GRAINED	100	100			
.900	2.95	93.65	5.97	*VERY STIFF FINE GRAINED	94	100			
1.050	3.44	79.33	6.81	*VERY STIFF FINE GRAINED	79	100			
1.200	3.94	110.28	7.09	*VERY STIFF FINE GRAINED	100	100			
1.350	4.43	143.91	5.68	*VERY STIFF FINE GRAINED	100	100			
1.500	4.92	161.35	4.07	*VERY STIFF FINE GRAINED	100	100			
1.650	5.41	246.80	3.72	*SAND to CLAYEY SAND	100	100			
1.800	5.91	409.73	2.74	*SAND to CLAYEY SAND	100	100			
1.950	6.40	490.88	2.81	*SAND to CLAYEY SAND	100	100			
2.100	6.89	308.35	3.54	*SAND to CLAYEY SAND	100	100			
2.250	7.38	391.95	3.51	*SAND to CLAYEY SAND	100	100			
2.400	7.87	405.44	3.72	*SAND to CLAYEY SAND	100	100			
2.550	8.37	437.88	3.48	*SAND to CLAYEY SAND	100	100			
2.700	8.86	458.38	3.31	*SAND to CLAYEY SAND	100	100			
2.850	9.35	452.96	*****		0	0			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 pcf
ASSUMED DEPTH OF WATER TABLE = 50.0 ft
N(60) = EQUIVALENT SPT VALUE (60% Energy)
N1(60) = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE (60% Energy)
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = OVERBURDEN NORMALIZED UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

HOLGUIN, FAHAN & ASSOCIATES, INC.

Interpretations based on: Robertson and Campanella, 1989.



TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

CONE PENETRATION TEST — SOUNDING NUMBER: CPT-8

PROJECT NAME : PADRE\SANDPIPER — CONE/RIG : 473\#1 BH\JH

PROJECT NUMBER : 9904-1131 — DATE/TIME: 08-12-99 11:41

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*                      CPT INTERPRETATIONS                           *
*                                                                    *
*  SOUNDING : CPT-8                    PROJECT No.: 9904-1131        *
*  PROJECT  : PADRE\SANDPIPER          CONE/RIG : 473\#1 BH\JH       *
*  DATE/TIME: 08-12-99 11:41                                         *
*                                                                    *
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DEPTH (m)	DEPTH (ft)	TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N(60)	N1(60)	Dr (%)	Su (tsf)	PHI (Degrees)
.150	.49	56.81	2.94	SANDY SILT to CLAYEY SILT	23	36		3.8	
.300	.98	58.04	4.05	CLAYEY SILT to SILTY CLAY	29	46		3.4	
.450	1.48	68.81	6.26	*VERY STIFF FINE GRAINED	69	100			
.600	1.97	75.61	6.82	*VERY STIFF FINE GRAINED	76	100			
.750	2.46	98.89	6.78	*VERY STIFF FINE GRAINED	99	100			
.900	2.95	92.71	6.09	*VERY STIFF FINE GRAINED	93	100			
1.050	3.44	79.37	5.63	*VERY STIFF FINE GRAINED	79	100			
1.200	3.94	67.43	6.32	*VERY STIFF FINE GRAINED	67	100			
1.350	4.43	81.92	6.10	*VERY STIFF FINE GRAINED	82	100			
1.500	4.92	91.12	5.42	*VERY STIFF FINE GRAINED	91	100			
1.650	5.41	157.08	4.45	*VERY STIFF FINE GRAINED	100	100			
1.800	5.91	122.99	4.91	*VERY STIFF FINE GRAINED	100	100			
1.950	6.40	237.28	4.23	*VERY STIFF FINE GRAINED	100	100			
2.100	6.89	322.67	3.74	*SAND to CLAYEY SAND	100	100			
2.250	7.38	242.38	5.64	*VERY STIFF FINE GRAINED	100	100			
2.400	7.87	273.14	4.45	*VERY STIFF FINE GRAINED	100	100			
2.550	8.37	175.95	5.15	*VERY STIFF FINE GRAINED	100	100			
2.700	8.86	85.04	3.90	CLAYEY SILT to SILTY CLAY	43	58		5.0	
2.850	9.35	155.77	5.38	*VERY STIFF FINE GRAINED	100	100			
3.000	9.84	166.84	5.14	*VERY STIFF FINE GRAINED	100	100			
3.150	10.33	203.10	5.26	*VERY STIFF FINE GRAINED	100	100			
3.300	10.83	126.24	5.51	*VERY STIFF FINE GRAINED	100	100			
3.450	11.32	78.73	5.07	*VERY STIFF FINE GRAINED	79	96			
3.600	11.81	126.19	4.97	*VERY STIFF FINE GRAINED	100	100			
3.750	12.30	153.98	5.65	*VERY STIFF FINE GRAINED	100	100			
3.900	12.80	130.59	6.83	*VERY STIFF FINE GRAINED	100	100			
4.050	13.29	201.51	5.21	*VERY STIFF FINE GRAINED	100	100			
4.200	13.78	253.34	4.71	*VERY STIFF FINE GRAINED	100	100			
4.350	14.27	311.81	4.53	*VERY STIFF FINE GRAINED	100	100			
4.500	14.76	343.76	3.72	*SAND to CLAYEY SAND	100	100			
4.650	15.26	383.87	3.26	*SAND to CLAYEY SAND	100	100			
4.800	15.75	403.74	3.17	*SAND to CLAYEY SAND	100	100			
4.950	16.24	407.14	3.11	*SAND to CLAYEY SAND	100	100			
5.100	16.73	349.39	3.72	*SAND to CLAYEY SAND	100	100			
5.250	17.22	242.49	4.34	*VERY STIFF FINE GRAINED	100	100			
5.400	17.72	116.61	4.79	*VERY STIFF FINE GRAINED	100	100			
5.550	18.21	181.01	4.80	*VERY STIFF FINE GRAINED	100	100			
5.700	18.70	76.31	5.43	*VERY STIFF FINE GRAINED	76	72			
5.850	19.19	145.65	4.08	*VERY STIFF FINE GRAINED	100	100			
6.000	19.69	90.50	6.17	*VERY STIFF FINE GRAINED	91	83			
6.150	20.18	172.30	5.90	*VERY STIFF FINE GRAINED	100	100			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 pcf
ASSUMED DEPTH OF WATER TABLE = 50.0 ft
N(60) = EQUIVALENT SPT VALUE (60% Energy)
N1(60) = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE (60% Energy)
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = OVERBURDEN NORMALIZED UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

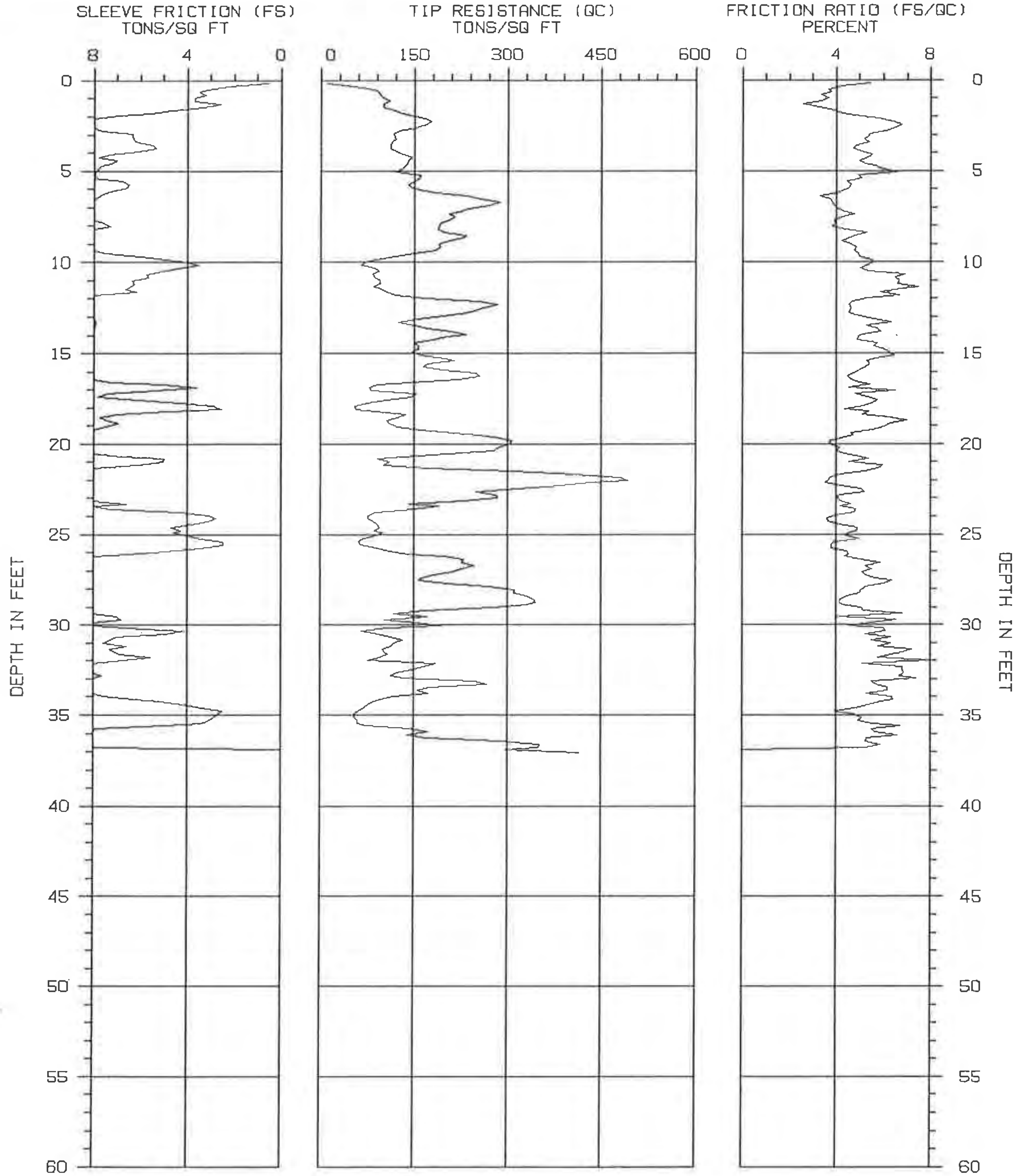
Interpretations based on: Robertson and Campanella, 1989.

SOUNDING : CPT-8

DEPTH (m)	DEPTH (ft)	TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N(60)	N1(60)	Dr (%)	Su (tsf)	PHI (Degrees)
6.300	20.67	193.58	5.36	*VERY STIFF FINE GRAINED	100	100			
6.450	21.16	186.76	4.69	*VERY STIFF FINE GRAINED	100	100			
6.600	21.65	106.20	6.42	*VERY STIFF FINE GRAINED	100	93			
6.750	22.15	166.22	5.45	*VERY STIFF FINE GRAINED	100	100			
6.900	22.64	133.06	6.14	*VERY STIFF FINE GRAINED	100	100			
7.050	23.13	412.53	4.16	*SAND to CLAYEY SAND	100	100			
7.200	23.62	422.58	4.12	*SAND to CLAYEY SAND	100	100			
7.350	24.11	436.22	4.41	*SAND to CLAYEY SAND	100	100			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 pcf
ASSUMED DEPTH OF WATER TABLE = 50.0 ft
N(60) = EQUIVALENT SPT VALUE (60% Energy)
N1(60) = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE (60% Energy)
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = OVERBURDEN NORMALIZED UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

Interpretations based on: Robertson and Campanella, 1989.



TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

CONE PENETRATION TEST — SOUNDING NUMBER: CPT-9

PROJECT NAME : PADRE\SANDPIPER	CONE/RIG : 473\#1 BH\JH
PROJECT NUMBER : 9904-1131	DATE/TIME: 08-12-99 12:07

HFA

CPT INTERPRETATIONS

SOUNDING : CPT-9
PROJECT : PADRE\SANDPIPER
DATE/TIME: 08-12-99 12:07

PROJECT No.: 9904-1131
CONE/RIG : 473\#1 BH\JH

DEPTH (m)	DEPTH (ft)	TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N(60)	N1(60)	Dr (%)	Su (tsf)	PHI (Degrees)
.150	.49	86.19	3.66	CLAYEY SILT to SILTY CLAY	43	69		5.1	
.300	.98	100.02	3.67	SANDY SILT to CLAYEY SILT	40	64		5.9	
.450	1.48	100.70	3.26	SANDY SILT to CLAYEY SILT	40	64		5.9	
.600	1.97	143.53	4.79	*VERY STIFF FINE GRAINED	100	100			
.750	2.46	170.74	6.75	*VERY STIFF FINE GRAINED	100	100			
.900	2.95	116.70	5.44	*VERY STIFF FINE GRAINED	100	100			
1.050	3.44	113.34	5.38	*VERY STIFF FINE GRAINED	100	100			
1.200	3.94	120.37	5.06	*VERY STIFF FINE GRAINED	100	100			
1.350	4.43	140.92	4.98	*VERY STIFF FINE GRAINED	100	100			
1.500	4.92	130.34	6.00	*VERY STIFF FINE GRAINED	100	100			
1.650	5.41	157.89	5.08	*VERY STIFF FINE GRAINED	100	100			
1.800	5.91	145.74	4.51	*VERY STIFF FINE GRAINED	100	100			
1.950	6.40	235.12	3.29	*SAND to CLAYEY SAND	100	100			
2.100	6.89	269.24	3.89	*SAND to CLAYEY SAND	100	100			
2.250	7.38	205.99	4.75	*VERY STIFF FINE GRAINED	100	100			
2.400	7.87	191.12	3.94	*SAND to CLAYEY SAND	96	100			
2.550	8.37	200.36	5.27	*VERY STIFF FINE GRAINED	100	100			
2.700	8.86	206.37	4.22	*VERY STIFF FINE GRAINED	100	100			
2.850	9.35	185.91	4.74	*VERY STIFF FINE GRAINED	100	100			
3.000	9.84	88.57	5.52	*VERY STIFF FINE GRAINED	89	100			
3.150	10.33	87.74	5.02	*VERY STIFF FINE GRAINED	88	100			
3.300	10.83	87.00	6.47	*VERY STIFF FINE GRAINED	87	100			
3.450	11.32	85.74	7.48	*VERY STIFF FINE GRAINED	86	100			
3.600	11.81	120.42	6.65	*VERY STIFF FINE GRAINED	100	100			
3.750	12.30	282.70	4.54	*VERY STIFF FINE GRAINED	100	100			
3.900	12.80	234.46	4.52	*VERY STIFF FINE GRAINED	100	100			
4.050	13.29	125.47	6.30	*VERY STIFF FINE GRAINED	100	100			
4.200	13.78	209.50	5.88	*VERY STIFF FINE GRAINED	100	100			
4.350	14.27	180.45	4.91	*VERY STIFF FINE GRAINED	100	100			
4.500	14.76	157.15	6.06	*VERY STIFF FINE GRAINED	100	100			
4.650	15.26	200.19	5.69	*VERY STIFF FINE GRAINED	100	100			
4.800	15.75	164.77	5.24	*VERY STIFF FINE GRAINED	100	100			
4.950	16.24	254.90	4.49	*VERY STIFF FINE GRAINED	100	100			
5.100	16.73	92.37	5.42	*VERY STIFF FINE GRAINED	92	92			
5.250	17.22	154.24	4.80	*VERY STIFF FINE GRAINED	100	100			
5.400	17.72	77.01	5.56	*VERY STIFF FINE GRAINED	77	75			
5.550	18.21	89.40	5.39	*VERY STIFF FINE GRAINED	89	86			
5.700	18.70	106.33	6.97	*VERY STIFF FINE GRAINED	100	100			
5.850	19.19	160.16	5.56	*VERY STIFF FINE GRAINED	100	100			
6.000	19.69	288.59	4.24	*SAND to CLAYEY SAND	100	100			
6.150	20.18	284.47	4.12	*SAND to CLAYEY SAND	100	100			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 pcf
ASSUMED DEPTH OF WATER TABLE = 50.0 ft
N(60) = EQUIVALENT SPT VALUE (60% Energy)
N1(60) = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE (60% Energy)
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = OVERBURDEN NORMALIZED UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

HOLGUIN, FAHAN & ASSOCIATES, INC.

Interpretations based on: Robertson and Campanella, 1989.

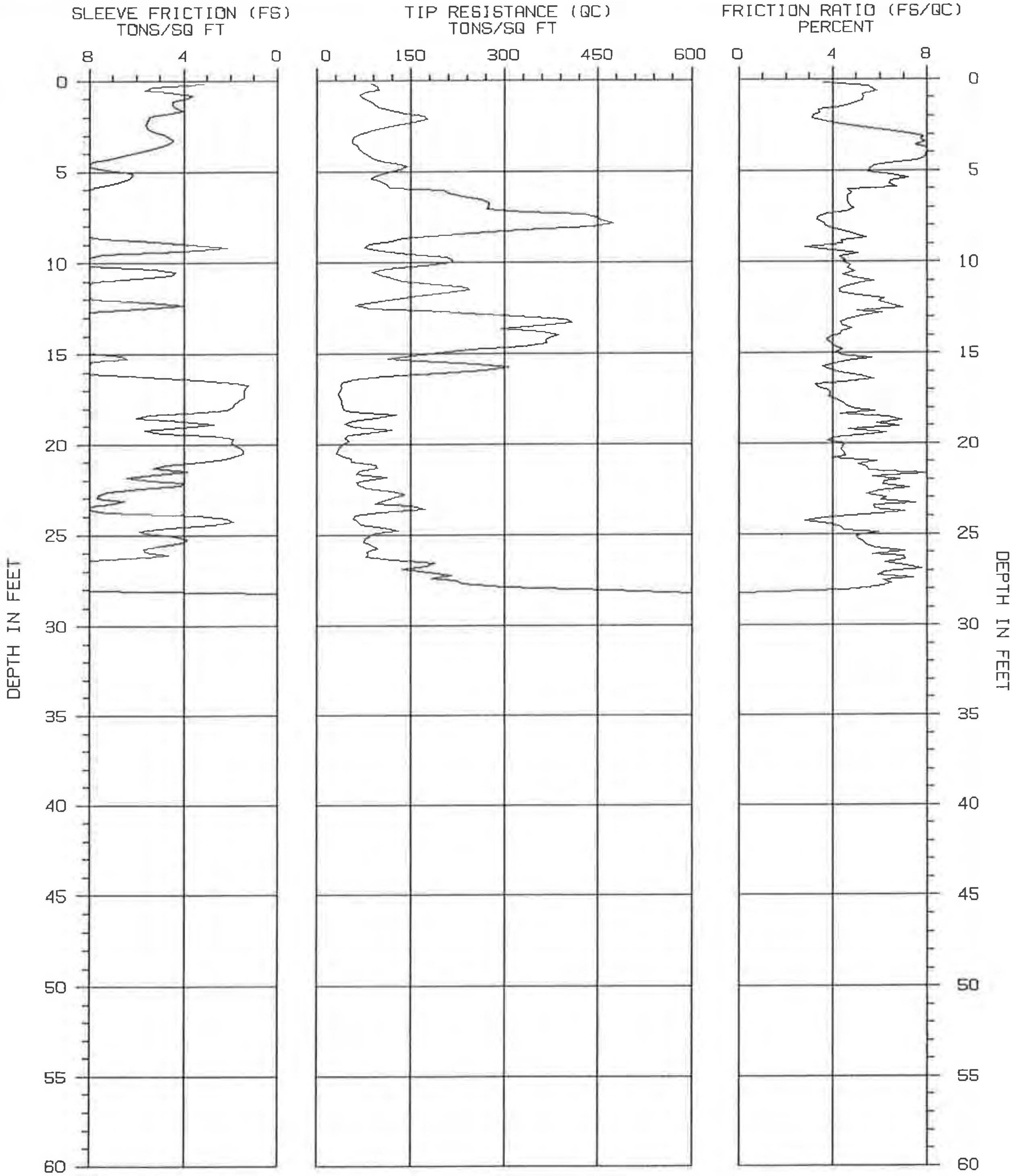
SOUNDING : CPT-9

DEPTH (m)	DEPTH (ft)	TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N(60)	N1(60)	Dr (%)	Su (tsf)	PHI (Degrees)
6.300	20.67	134.20	5.04	*VERY STIFF FINE GRAINED	100	100			
6.450	21.16	102.40	5.94	*VERY STIFF FINE GRAINED	100	91			
6.600	21.65	408.73	4.12	*SAND to CLAYEY SAND	100	100			
6.750	22.15	434.10	3.52	*SAND to CLAYEY SAND	100	100			
6.900	22.64	249.18	5.19	*VERY STIFF FINE GRAINED	100	100			
7.050	23.13	230.74	4.17	*VERY STIFF FINE GRAINED	100	100			
7.200	23.62	149.90	4.84	*VERY STIFF FINE GRAINED	100	100			
7.350	24.11	76.31	3.60	CLAYEY SILT to SILTY CLAY	38	32		4.4	
7.500	24.61	94.99	4.91	*VERY STIFF FINE GRAINED	95	78			
7.650	25.10	90.89	4.39	CLAYEY SILT to SILTY CLAY	45	37		5.3	
7.800	25.59	64.97	3.77	CLAYEY SILT to SILTY CLAY	32	26		3.7	
7.950	26.08	142.64	4.54	*VERY STIFF FINE GRAINED	100	100			
8.100	26.57	225.98	5.85	*VERY STIFF FINE GRAINED	100	100			
8.250	27.07	211.43	5.11	*VERY STIFF FINE GRAINED	100	100			
8.400	27.56	159.31	6.35	*VERY STIFF FINE GRAINED	100	100			
8.550	28.05	310.90	5.07	*VERY STIFF FINE GRAINED	100	100			
8.700	28.54	340.60	4.19	*SAND to CLAYEY SAND	100	100			
8.850	29.04	277.61	5.07	*VERY STIFF FINE GRAINED	100	100			
9.000	29.53	172.25	4.03	*VERY STIFF FINE GRAINED	100	100			
9.150	30.02	194.92	4.60	*VERY STIFF FINE GRAINED	100	100			
9.300	30.51	93.48	5.26	*VERY STIFF FINE GRAINED	93	69			
9.450	31.00	119.18	6.33	*VERY STIFF FINE GRAINED	100	87			
9.600	31.50	104.29	6.78	*VERY STIFF FINE GRAINED	100	76			
9.750	31.99	77.69	8.61	*VERY STIFF FINE GRAINED	78	56			
9.900	32.48	147.46	6.78	*VERY STIFF FINE GRAINED	100	100			
10.050	32.97	133.71	7.36	*VERY STIFF FINE GRAINED	100	95			
10.200	33.46	177.52	6.18	*VERY STIFF FINE GRAINED	100	100			
10.350	33.96	118.16	6.37	*VERY STIFF FINE GRAINED	100	83			
10.500	34.45	77.61	5.31	*VERY STIFF FINE GRAINED	78	54			
10.650	34.94	55.66	4.76	CLAY to SILTY CLAY	37	26		3.2	
10.800	35.43	60.63	5.56	CLAY	61	42		3.4	
10.950	35.93	173.66	5.64	*VERY STIFF FINE GRAINED	100	100			
11.100	36.42	287.91	5.26	*VERY STIFF FINE GRAINED	100	100			
11.250	36.91	296.00	*****		0	0			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 pcf
ASSUMED DEPTH OF WATER TABLE = 50.0 ft
N(60) = EQUIVALENT SPT VALUE (60% Energy)
N1(60) = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE (60% Energy)
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = OVERBURDEN NORMALIZED UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

HOLGUIN, FAHAN & ASSOCIATES, INC.

Interpretations based on: Robertson and Campanella, 1989.



TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

CONE PENETRATION TEST

SOUNDING NUMBER: CPT-10

PROJECT NAME : PADRE\SANDPIPER

PROJECT NUMBER : 9904-1131

CONE/RIG : 473\#1 BH\JH

DATE/TIME: 08-12-99 13:04

HFA

CPT INTERPRETATIONS

SOUNDING : CPT-10
PROJECT : PADRE\SANDPIPER
DATE/TIME: 08-12-99 13:04

PROJECT No.: 9904-1131
CONE/RIG : 473\#1 BH\JH

DEPTH (m)	DEPTH (ft)	TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N(60)	N1(60)	Dr (%)	Su (tsf)	PHI (Degrees)
.150	.49	99.30	5.67	*VERY STIFF FINE GRAINED	99	100			
.300	.98	73.91	5.29	*VERY STIFF FINE GRAINED	74	100			
.450	1.48	99.00	4.39	*VERY STIFF FINE GRAINED	99	100			
.600	1.97	171.17	3.17	SANDY SILT to CLAYEY SILT	68	100		10.1	
.750	2.46	126.70	4.41	*VERY STIFF FINE GRAINED	100	100			
.900	2.95	66.39	7.21	*VERY STIFF FINE GRAINED	66	100			
1.050	3.44	57.59	7.90	CLAY	58	92		3.4	
1.200	3.94	74.21	8.02	*VERY STIFF FINE GRAINED	74	100			
1.350	4.43	103.89	7.57	*VERY STIFF FINE GRAINED	100	100			
1.500	4.92	131.23	5.56	*VERY STIFF FINE GRAINED	100	100			
1.650	5.41	87.32	7.19	*VERY STIFF FINE GRAINED	87	100			
1.800	5.91	117.44	6.72	*VERY STIFF FINE GRAINED	100	100			
1.950	6.40	233.06	4.64	*VERY STIFF FINE GRAINED	100	100			
2.100	6.89	275.50	4.70	*VERY STIFF FINE GRAINED	100	100			
2.250	7.38	426.89	3.80	*SAND to CLAYEY SAND	100	100			
2.400	7.87	474.57	3.60	*SAND to CLAYEY SAND	100	100			
2.550	8.37	248.08	4.66	*VERY STIFF FINE GRAINED	100	100			
2.700	8.86	119.65	4.34	*VERY STIFF FINE GRAINED	100	100			
2.850	9.35	102.12	3.98	CLAYEY SILT to SILTY CLAY	51	68		6.0	
3.000	9.84	216.95	4.53	*VERY STIFF FINE GRAINED	100	100			
3.150	10.33	112.22	4.64	*VERY STIFF FINE GRAINED	100	100			
3.300	10.83	120.59	4.93	*VERY STIFF FINE GRAINED	100	100			
3.450	11.32	239.43	4.46	*VERY STIFF FINE GRAINED	100	100			
3.600	11.81	161.57	5.06	*VERY STIFF FINE GRAINED	100	100			
3.750	12.30	62.35	6.43	CLAY	62	73		3.6	
3.900	12.80	240.07	6.07	*VERY STIFF FINE GRAINED	100	100			
4.050	13.29	407.88	4.30	*SAND to CLAYEY SAND	100	100			
4.200	13.78	360.84	4.38	*VERY STIFF FINE GRAINED	100	100			
4.350	14.27	365.64	3.73	*SAND to CLAYEY SAND	100	100			
4.500	14.76	244.00	4.42	*VERY STIFF FINE GRAINED	100	100			
4.650	15.26	113.09	5.65	*VERY STIFF FINE GRAINED	100	100			
4.800	15.75	307.33	3.58	*SAND to CLAYEY SAND	100	100			
4.950	16.24	108.86	5.16	*VERY STIFF FINE GRAINED	100	100			
5.100	16.73	38.84	3.24	CLAYEY SILT to SILTY CLAY	19	19		2.5	
5.250	17.22	35.71	3.92	CLAYEY SILT to SILTY CLAY	18	18		2.0	
5.400	17.72	41.15	4.45	CLAY to SILTY CLAY	27	27		2.4	
5.550	18.21	55.24	5.77	CLAY	55	53		3.2	
5.700	18.70	58.59	6.91	CLAY	59	55		3.4	
5.850	19.19	120.46	4.68	*VERY STIFF FINE GRAINED	100	100			
6.000	19.69	45.70	4.05	CLAYEY SILT to SILTY CLAY	23	21		2.6	
6.150	20.18	36.69	4.39	CLAY to SILTY CLAY	24	22		2.1	

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 pcf
ASSUMED DEPTH OF WATER TABLE = 50.0 ft
N(60) = EQUIVALENT SPT VALUE (60% Energy)
N1(60) = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE (60% Energy)
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = OVERBURDEN NORMALIZED UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

Interpretations based on: Robertson and Campanella, 1989.

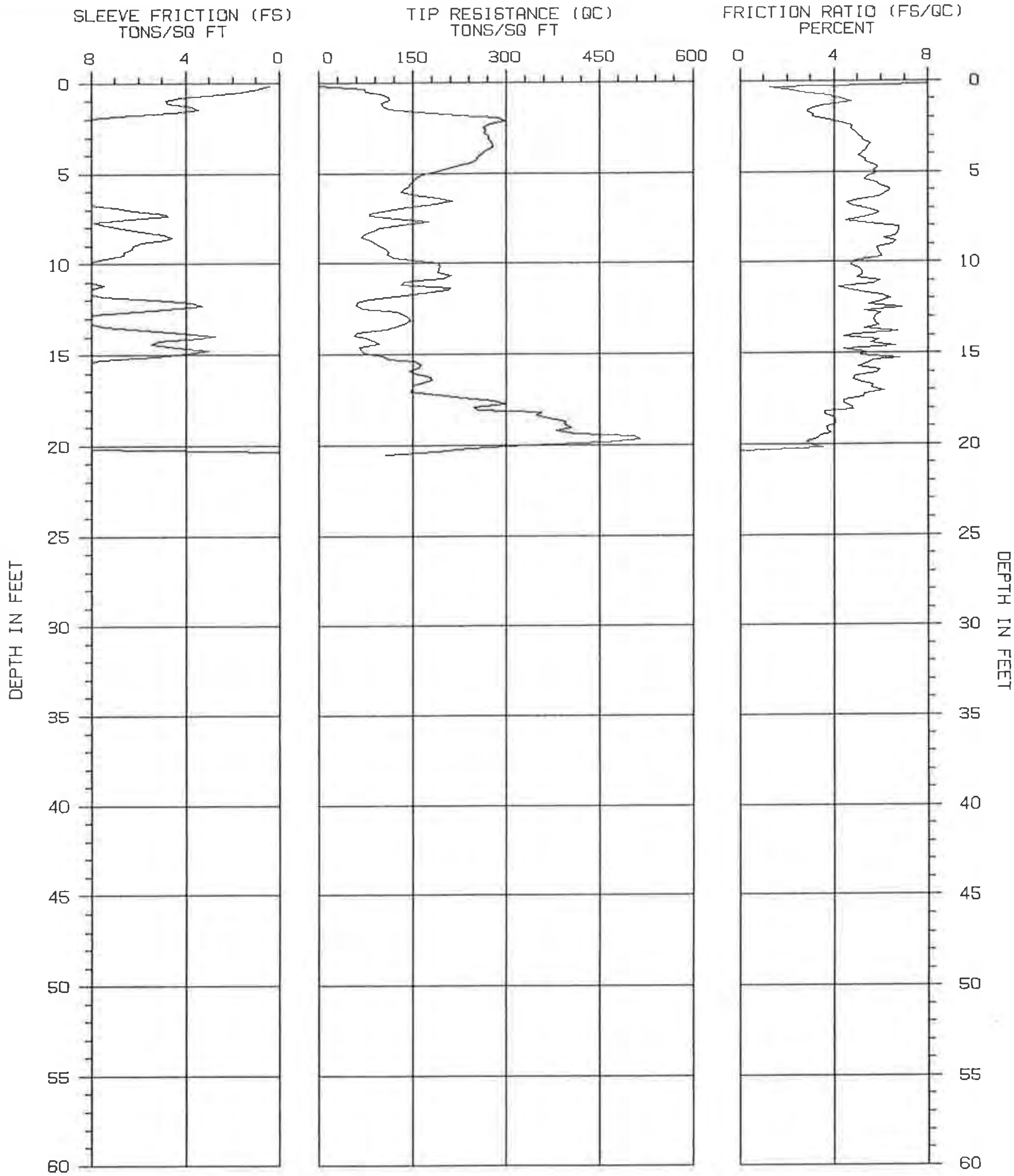
SOUNDING : CPT-10

DEPTH (m)	DEPTH (ft)	TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N(60)	N1(60)	Dr (%)	Su (tsf)	PHI (Degrees)
6.300	20.67	41.81	4.54	CLAY to SILTY CLAY	28	25		2.4	
6.450	21.16	93.82	5.06	*VERY STIFF FINE GRAINED	94	83			
6.600	21.65	63.56	8.17	CLAY	64	56		3.7	
6.750	22.15	64.41	6.18	*VERY STIFF FINE GRAINED	64	56			
6.900	22.64	120.63	5.94	*VERY STIFF FINE GRAINED	100	100			
7.050	23.13	107.58	6.04	*VERY STIFF FINE GRAINED	100	91			
7.200	23.62	173.74	5.78	*VERY STIFF FINE GRAINED	100	100			
7.350	24.11	58.57	3.62	CLAYEY SILT to SILTY CLAY	29	24		3.4	
7.500	24.61	106.93	4.36	*VERY STIFF FINE GRAINED	100	88			
7.650	25.10	86.25	5.03	*VERY STIFF FINE GRAINED	86	70			
7.800	25.59	89.53	5.43	*VERY STIFF FINE GRAINED	90	72			
7.950	26.08	81.69	5.70	*VERY STIFF FINE GRAINED	82	65			
8.100	26.57	188.61	6.21	*VERY STIFF FINE GRAINED	100	100			
8.250	27.07	180.03	6.19	*VERY STIFF FINE GRAINED	100	100			
8.400	27.56	221.94	6.11	*VERY STIFF FINE GRAINED	100	100			
8.550	28.05	471.00	4.49	*VERY STIFF FINE GRAINED	100	100			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 pcf
ASSUMED DEPTH OF WATER TABLE = 50.0 ft
N(60) = EQUIVALENT SPT VALUE (60% Energy)
N1(60) = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE (60% Energy)
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = OVERBURDEN NORMALIZED UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

HOLGUIN, FAHAN & ASSOCIATES, INC.

Interpretations based on: Robertson and Campanella, 1989.



TIP RESISTANCE NOT CORRECTED FOR END AREA EFFECT

CONE PENETRATION TEST — SOUNDING NUMBER: CPT-11

PROJECT NAME : PADRE\SANDPIPER — CONE/RIG : 473\#1 BH\JH

PROJECT NUMBER : 9904-1131 — DATE/TIME: 08-12-99 12:41

HFA

CPT INTERPRETATIONS

SOUNDING : CPT-11 PROJECT No.: 9904-1131
PROJECT : PADRE\SANDPIPER CONE/RIG : 473\#1 BH\JH
DATE/TIME: 08-12-99 12:41

DEPTH (m)	DEPTH (ft)	TIP RESISTANCE (tsf)	FRICTION RATIO (%)	SOIL BEHAVIOR TYPE	N(60)	N1(60)	Dr (%)	Su (tsf)	PHI (Degrees)
.150	.49	75.25	2.25	SILTY SAND to SANDY SILT	25	40	68		
.300	.98	113.40	4.26	*VERY STIFF FINE GRAINED	100	100			
.450	1.48	112.53	3.06	SANDY SILT to CLAYEY SILT	45	72		6.6	
.600	1.97	286.51	3.09	*SAND to CLAYEY SAND	100	100			
.750	2.46	264.05	4.76	*VERY STIFF FINE GRAINED	100	100			
.900	2.95	270.87	5.02	*VERY STIFF FINE GRAINED	100	100			
1.050	3.44	277.65	5.55	*VERY STIFF FINE GRAINED	100	100			
1.200	3.94	260.89	5.18	*VERY STIFF FINE GRAINED	100	100			
1.350	4.43	243.78	5.33	*VERY STIFF FINE GRAINED	100	100			
1.500	4.92	189.78	5.67	*VERY STIFF FINE GRAINED	100	100			
1.650	5.41	152.54	5.27	*VERY STIFF FINE GRAINED	100	100			
1.800	5.91	134.86	6.33	*VERY STIFF FINE GRAINED	100	100			
1.950	6.40	190.37	5.87	*VERY STIFF FINE GRAINED	100	100			
2.100	6.89	142.34	4.85	*VERY STIFF FINE GRAINED	100	100			
2.250	7.38	82.60	5.73	*VERY STIFF FINE GRAINED	83	100			
2.400	7.87	133.82	5.50	*VERY STIFF FINE GRAINED	100	100			
2.550	8.37	73.00	6.71	*VERY STIFF FINE GRAINED	73	100			
2.700	8.86	88.31	6.62	*VERY STIFF FINE GRAINED	88	100			
2.850	9.35	112.22	5.87	*VERY STIFF FINE GRAINED	100	100			
3.000	9.84	160.08	5.11	*VERY STIFF FINE GRAINED	100	100			
3.150	10.33	191.12	5.05	*VERY STIFF FINE GRAINED	100	100			
3.300	10.83	198.11	4.99	*VERY STIFF FINE GRAINED	100	100			
3.450	11.32	209.73	4.16	*VERY STIFF FINE GRAINED	100	100			
3.600	11.81	123.94	6.04	*VERY STIFF FINE GRAINED	100	100			
3.750	12.30	60.12	5.49	CLAY	60	70		3.5	
3.900	12.80	131.95	6.02	*VERY STIFF FINE GRAINED	100	100			
4.050	13.29	140.17	5.71	*VERY STIFF FINE GRAINED	100	100			
4.200	13.78	62.03	6.72	CLAY	62	68		3.6	
4.350	14.27	87.83	5.91	*VERY STIFF FINE GRAINED	88	95			
4.500	14.76	68.58	4.39	CLAYEY SILT to SILTY CLAY	34	36		4.0	
4.650	15.26	111.77	6.82	*VERY STIFF FINE GRAINED	100	100			
4.800	15.75	159.97	5.02	*VERY STIFF FINE GRAINED	100	100			
4.950	16.24	179.22	4.89	*VERY STIFF FINE GRAINED	100	100			
5.100	16.73	150.54	5.64	*VERY STIFF FINE GRAINED	100	100			
5.250	17.22	189.06	5.27	*VERY STIFF FINE GRAINED	100	100			
5.400	17.72	299.21	4.38	*VERY STIFF FINE GRAINED	100	100			
5.550	18.21	357.15	3.61	*SAND to CLAYEY SAND	100	100			
5.700	18.70	393.94	4.04	*SAND to CLAYEY SAND	100	100			
5.850	19.19	379.81	3.68	*SAND to CLAYEY SAND	100	100			
6.000	19.69	514.44	3.29	*SAND to CLAYEY SAND	100	100			
6.150	20.18	242.34	3.50	*SAND to CLAYEY SAND	100	100			

*INDICATES OVERCONSOLIDATED OR CEMENTED MATERIAL
ASSUMED TOTAL UNIT WT = 120 pcf
ASSUMED DEPTH OF WATER TABLE = 50.0 ft
N(60) = EQUIVALENT SPT VALUE (60% Energy)
N1(60) = OVERBURDEN NORMALIZED EQUIVALENT SPT VALUE (60% Energy)
Dr = OVERBURDEN NORMALIZED EQUIVALENT RELATIVE DENSITY
Su = OVERBURDEN NORMALIZED UNDRAINED SHEAR STRENGTH
PHI = OVERBURDEN NORMALIZED EQUIVALENT FRICTION ANGLE

HOLGUIN, FAHAN & ASSOCIATES, INC.

Interpretations based on: Robertson and Campanella, 1989.

APPENDIX B
LABORATORY TESTING

Laboratory Analyses

Laboratory tests were performed on selected undisturbed and bulk soil samples to estimate engineering characteristics of the various earth materials encountered. Laboratory testing was performed by Padre Associates, Inc., ConCeCo of Simi Valley, California, and Fugro West, Inc., of Ventura, California. Testing was performed in accordance with ASTM Standards for Soil Testing, latest revision.

Laboratory Moisture and Density Determinations

Moisture content and dry density determinations were performed on selected relatively undisturbed samples collected to evaluate the natural water content and dry density of the various soils encountered. The results are presented on the respective drill hole logs (Appendix A).

Grain Size Distribution

Grain size distribution was determined for selected soil samples in accordance with standard test method ASTM D422. The grain size distribution data are shown on Plate B-1.

Consolidation Test

One-dimensional consolidation tests were performed on selected samples of the silty sandy clay material in accordance with standard test method ASTM D-2435, Standard Test Method for One-Dimensional Consolidation Properties of Soils.

The tests were performed by placing a trimmed specimen in a consolidation ring and applying an initial load. The sample was then allowed to come to equilibrium before applying additional loads. During the compression process, changes in the sample height were recorded. To estimate the hydroconsolidation (collapse) potential of the soil, the sample was inundated with water after reaching equilibrium at a selected load. The collapse potential was measured after allowing the sample to reach equilibrium after inundation. The results of the consolidation tests are shown on Plate B-2.1 through B-2.4.

Compaction

The compaction characteristics of the surficial soils were determined in accordance with the standard test method ASTM D1557. The compaction characteristics are used to determine the maximum dry density and optimum moisture content of those materials most likely to be used during grading operations. The results of the compaction tests are shown on Plate B-3.1.

Shear Strength Tests

Two direct shear tests were performed in accordance with standard test method ASTM D3080 to estimate the shear strength of the earth materials encountered on-site. The results of the direct shear tests are shown on Plates B-4.1 and B-4.2.

Resistance R-Value Tests

Two R-value tests were performed on selected bulk soil samples to aid in preliminary pavement section design. The tests were performed in general accordance with California Test Method 301. The test results are presented on Plates B-5.1 through B-5.4 and are summarized below.

Sample DH-1, 1 – 5 feet	Silty Clay w/ some Clayey Sand	R = 7
Sample DH-2, 1 – 5 feet	Silty Clay	R = 5

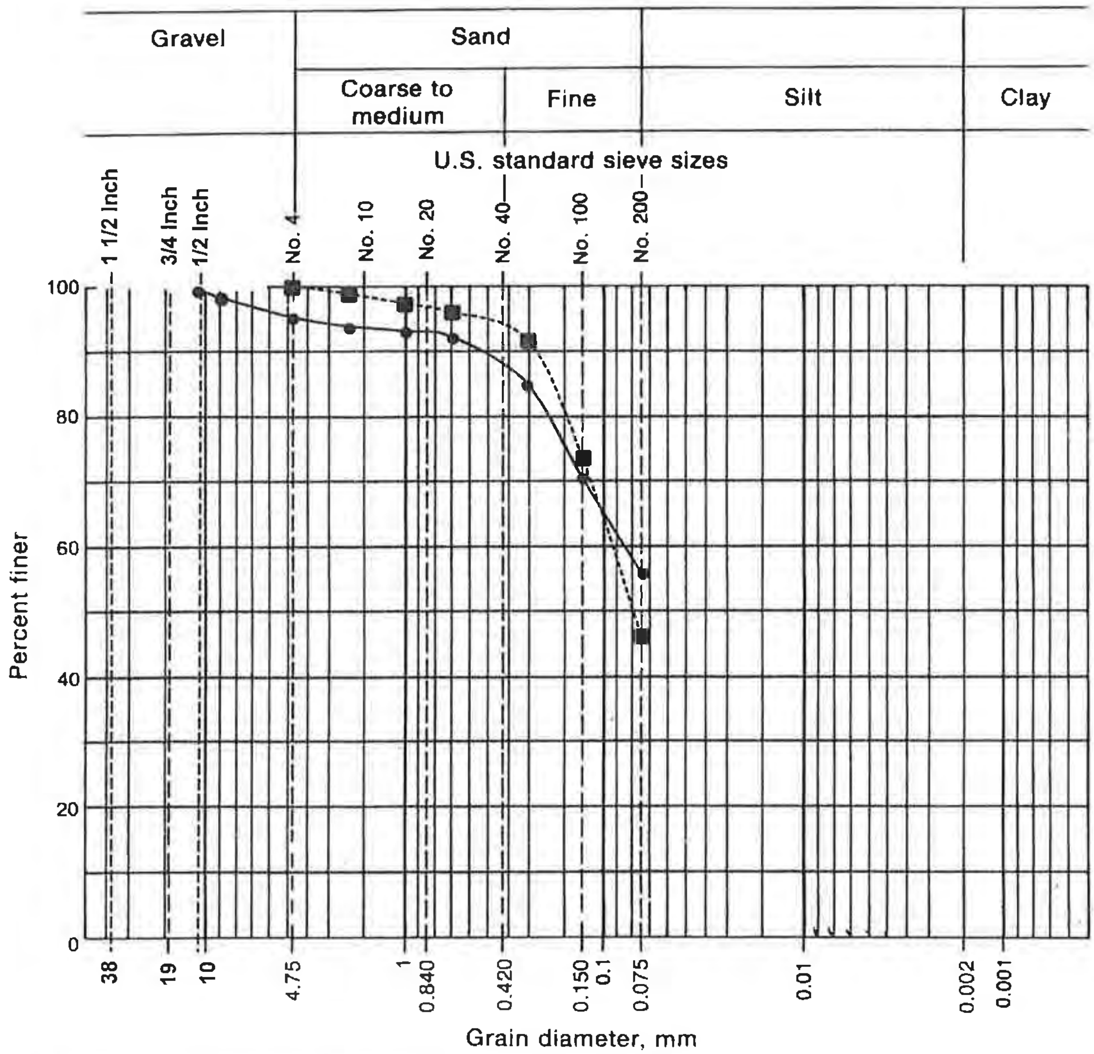
Expansion Index Test

Two soil samples were tested to evaluate their expansive index. The tests were performed in accordance with Uniform Building Code (1997 version) standard test method 18-2. The results of the tests indicate that the soil tested has an expansion index ranging from a low of 21 to a high of 114, which is low to highly expansive, as defined by the UBC.

Soil Chemistry/Corrosion Tests

ConCeCo, of Simi Valley, California, tested one selected soil sample for resistivity, pH, chloride, and sulfate. The test was performed in accordance with Caltrans Standard Test Methods 417, 422, 532, and 643. The results of the corrosivity tests are presented on Plate B-6 – Results of Soil Chemistry Tests.

Project	Sandpiper Residential Development	Job. No.	9904-1131
Location of Project	Goleta, CA	Boring No.	DH-1 & 4
		Sample No.	1 & 2
Description of Soil		Depth of Sample	1-5' & 5'
Tested By.	Fugro West, Inc.	Date of Testing	8/24/99



Symbol	Drill Hole	Sample/ Depth	Soil Description
● ———	DH-1	1@1-5'	Clayey SAND (SC)
■ ------	DH-4	2@5'	CLAY (CL)

padre associates, inc.
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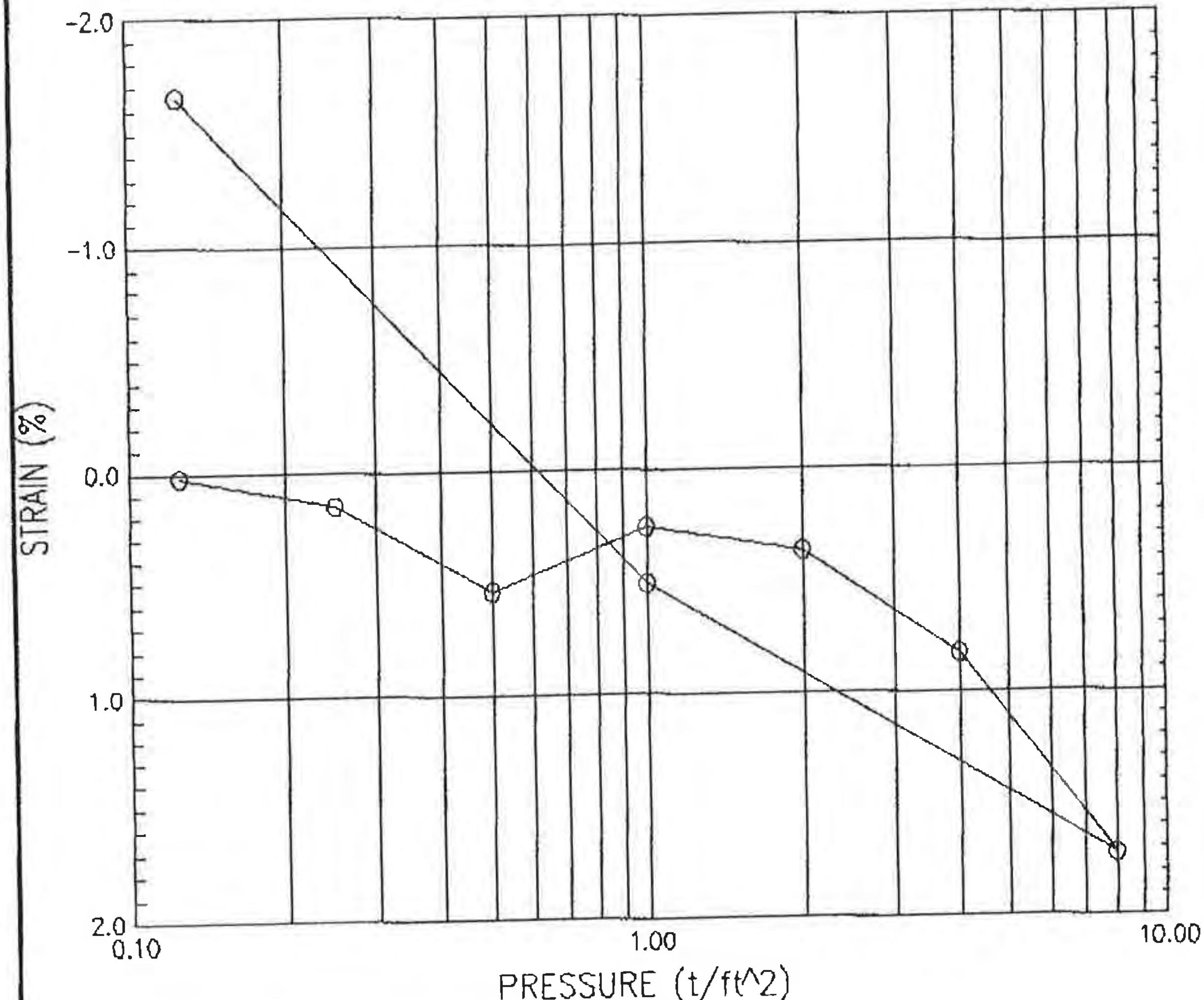
GRAIN SIZE DISTRIBUTION
PLATE B-1



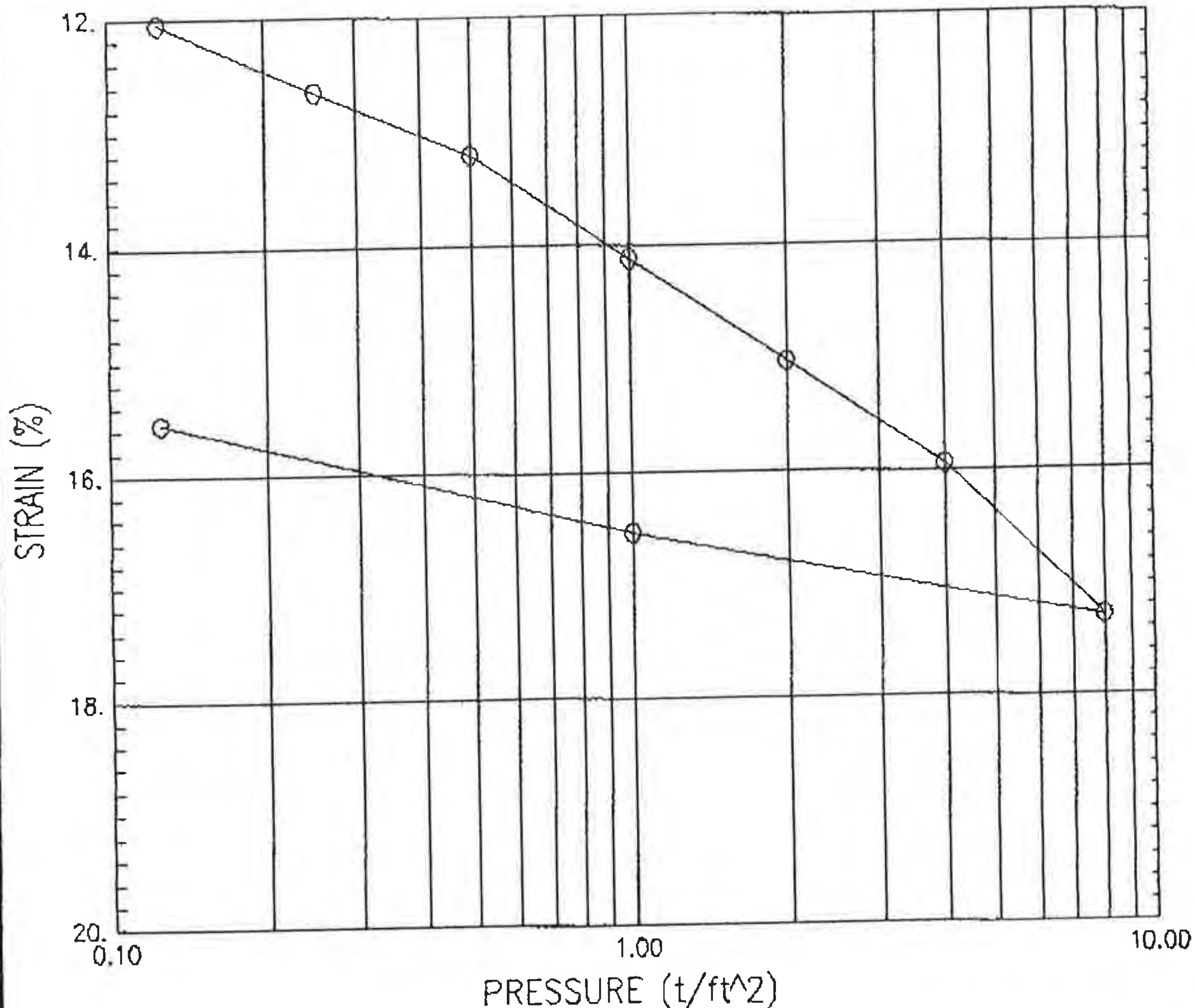
				BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE (t/ft^2)			---	WATER CONTENT (%)	15.7	26.9
PRECONSOL. PRESSURE (t/ft^2)			---	DRY DENSITY (lb/ft^3)	112.99	111.13
COMPRESSION INDEX			---	SATURATION (%)	88.45	140.51
TYPE SPECIMEN	Undist			VOID RATIO	0.49	0.52
DIA. (in) 2.400	HT. (in) 1.000			BACK PRESSURE (t/ft^2)	---	---

CLASSIFICATION Yellowish brown CLAY (CH)			
LL 75.0	PL 25.0	PI 50.0	PROJECT Padre Sandpiper
GS 2.700	D_{10} ---		A:\c1131a.asc
REMARKS		BORING NO. 1	SAMPLE NO. 2
		DEPTH 3'	DATE 8/25/99

Fugro McClelland
CONSOLIDATION TEST REPORT

Fri 09-03-99, 11:56:56

PLATE B-2.1



			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE (t/ft^2)	---	WATER CONTENT (%)	8.3	17.8
PRECONSOL. PRESSURE (t/ft^2)	---	DRY DENSITY (lb/ft^3)	109.05	129.11
COMPRESSION INDEX	---	SATURATION (%)	40.89	156.97
TYPE SPECIMEN	Undist	VOID RATIO	0.55	0.31
DIA. (in) 2.400	HT. (in) 1.000	BACK PRESSURE (t/ft^2)	---	---

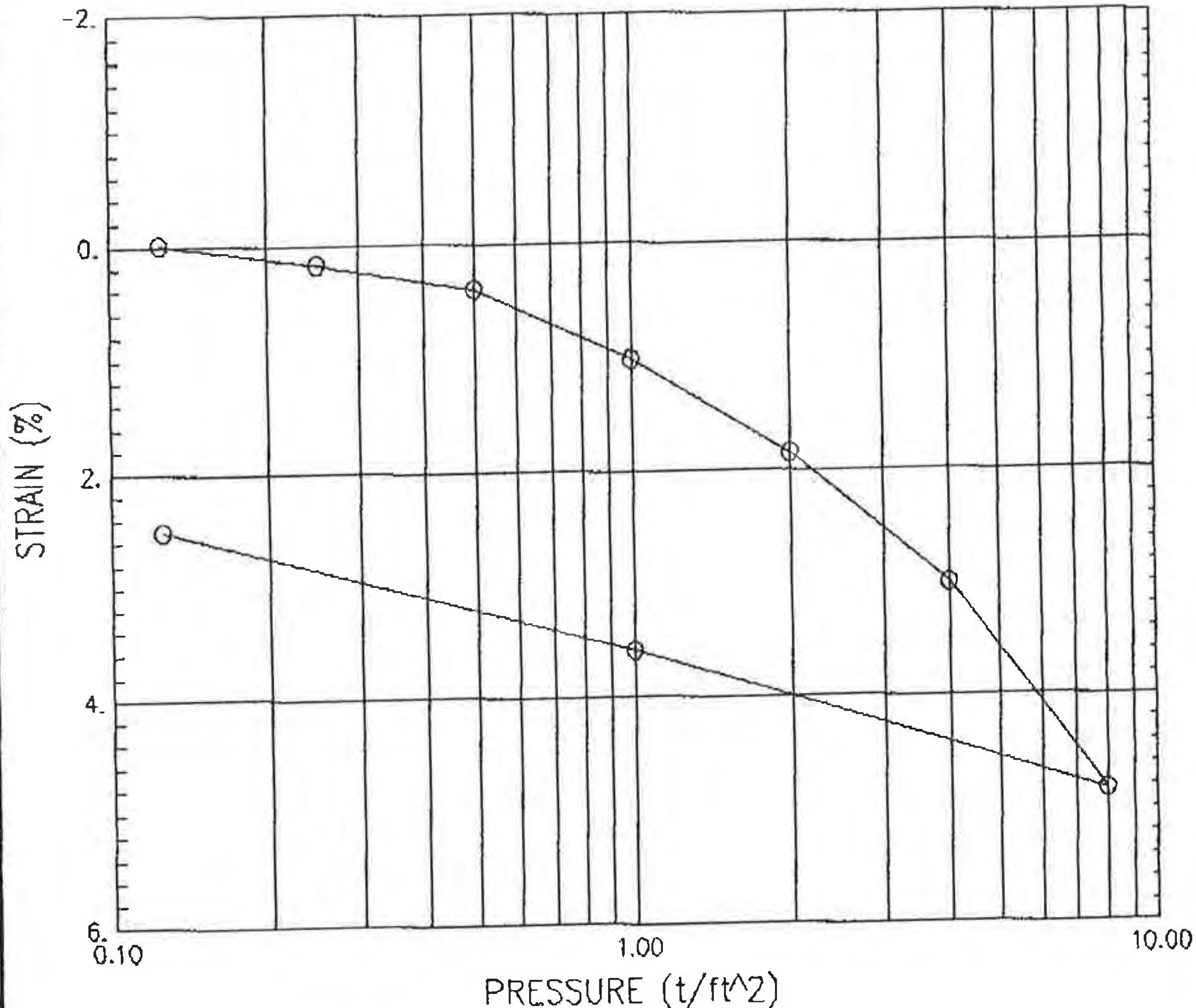
CLASSIFICATION Yellowish Brown Clayey fine SAND (SM)

LL 75.0	PL 25.0	PI 50.0	PROJECT Padre Sandpiper9904-1131
GS 2.700	D_{10} ---		A:\c1131b.asc
REMARKS		BORING NO. 1	SAMPLE NO. 4
		DEPTH 7'	DATE 9/1/99

Fugro McClelland
CONSOLIDATION TEST REPORT

Fri 09-10-99, 11:06:21

PLATE B-2.2



			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE (t/ft^2)	---	WATER CONTENT (%)	15.1	17.2
PRECONSOL. PRESSURE (t/ft^2)	---	DRY DENSITY (lb/ft^3)	115.28	118.23
COMPRESSION INDEX	---	SATURATION (%)	88.35	109.12
TYPE SPECIMEN	Undist	VOID RATIO	0.46	0.43
DIA. (in) 2.400	HT. (in) 1.000	BACK PRESSURE (t/ft^2)	---	---

CLASSIFICATION Mottled yellowish brown CLAY (CL)

LL 75.0	PL 25.0	PI 50.0
GS 2.700	D_{10} ---	

PROJECT Padre Sandpiper9904-1131

A:\c1131c.osc

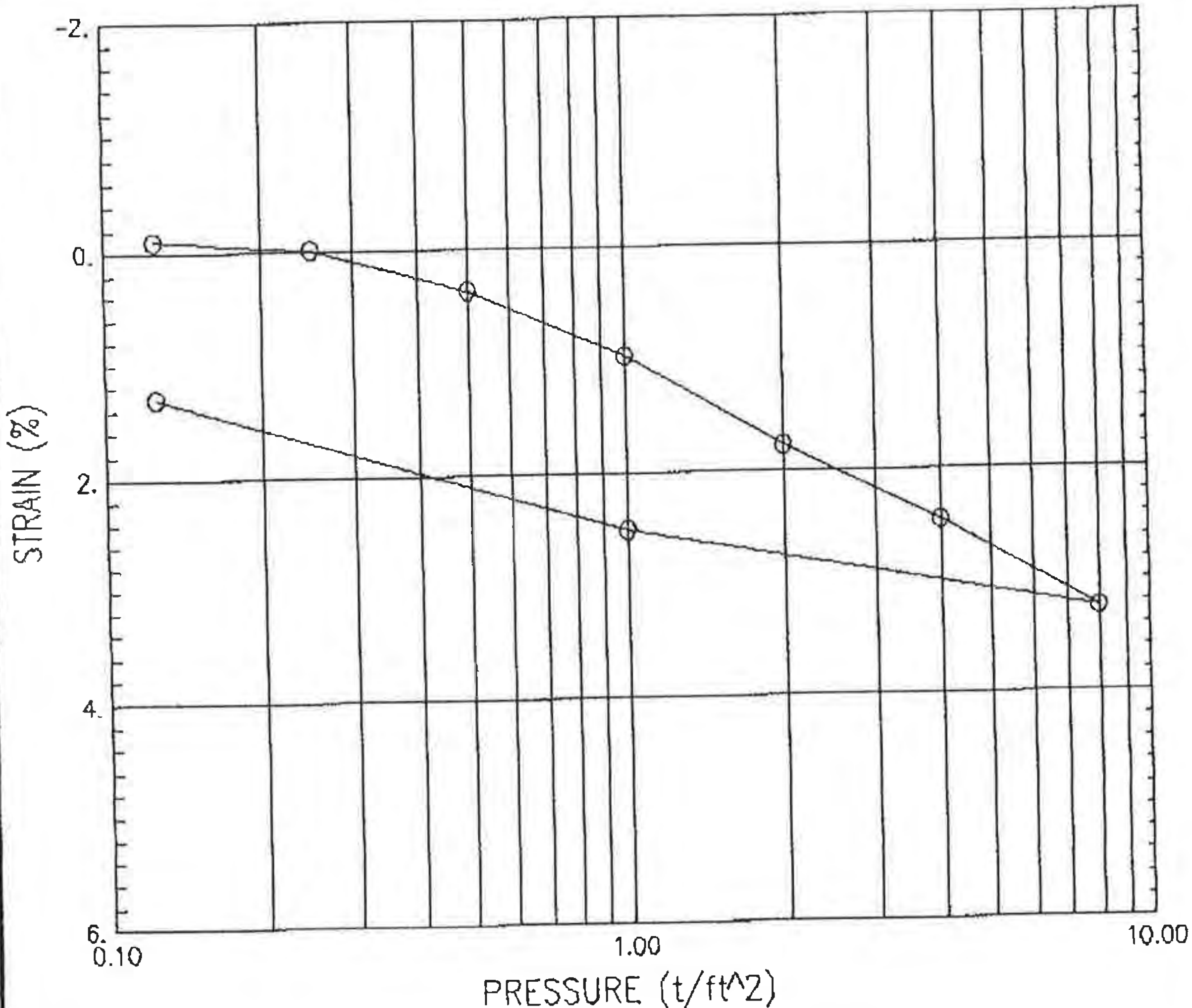
BORING NO. 2	SAMPLE NO. 3
DEPTH 5'	DATE 9/2/99

REMARKS

Fugro McClelland
CONSOLIDATION TEST REPORT

Fri 09-10-99, 11:07:29

PLATE B-2.3



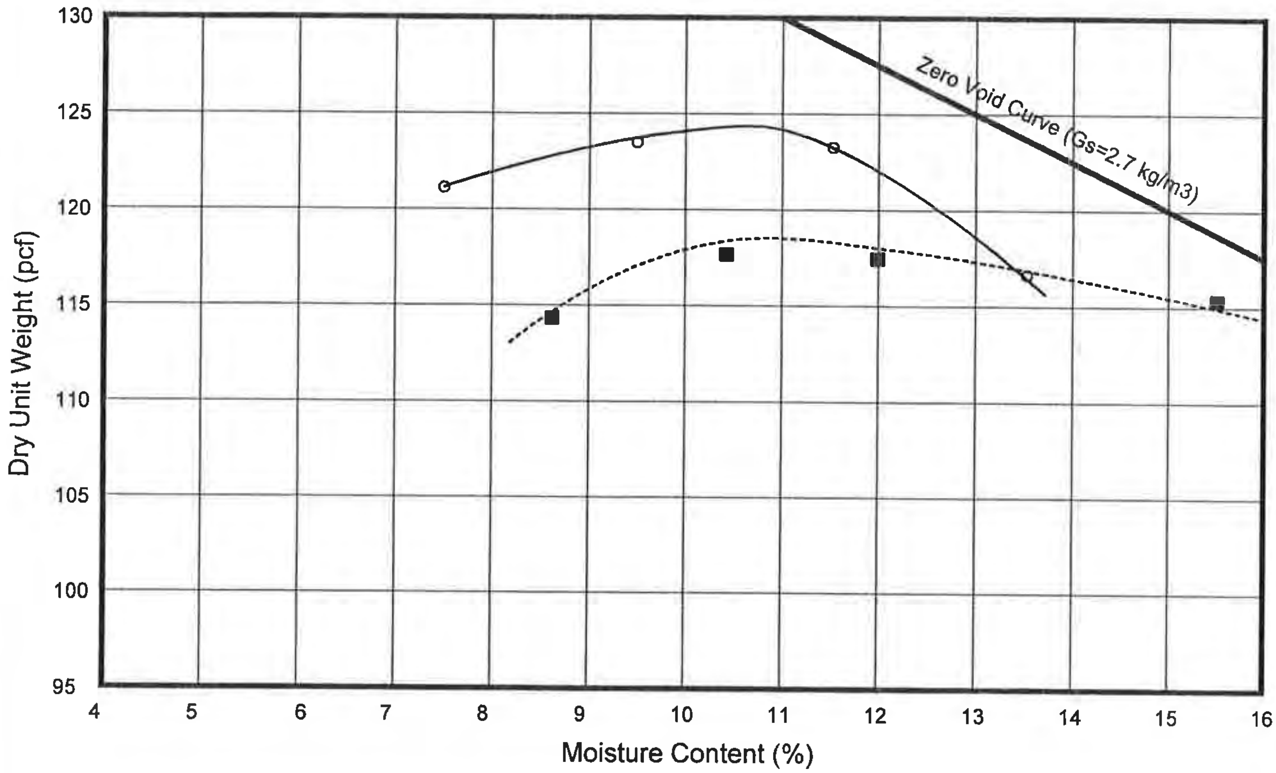
			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE (t/ft^2)	---	WATER CONTENT (%)	9.0	15.4
PRECONSOL. PRESSURE (t/ft^2)	---	DRY DENSITY (lb/ft^3)	110.91	112.36
COMPRESSION INDEX	---	SATURATION (%)	46.54	83.21
TYPE SPECIMEN	Undist	VOID RATIO	0.52	0.50
DIA. (in) 2.400	HT. (in) 1.000	BACK PRESSURE (t/ft^2)	---	---

CLASSIFICATION Yellowish brown clayey fine SAND				
LL 75.0	PL 25.0	PI 50.0	PROJECT Padre Sandpiper9904-1131	
GS 2.700	D_{10} ---		A:\c1131d.asc	
REMARKS			BORING NO. 4	SAMPLE NO. 2
			DEPTH 5'	DATE 9/2/99

Fugro McClelland
CONSOLIDATION TEST REPORT

Fri 09-10-99, 11:12:17

PLATE B-2.4



LEGEND	CLASSIFICATION	MAXIMUM UNIT DRY WEIGHT, pcf	OPTIMUM WATER CONTENT, %
○ DH-1, 1'-5'	Yellowish brown sandy CLAY (CL)	124	11
■ DH-3, 1'-5'	Yellowish brown CLAY (CL)	118	11

Test Method: ASTM D1557

padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

COMPACTION TEST RESULTS

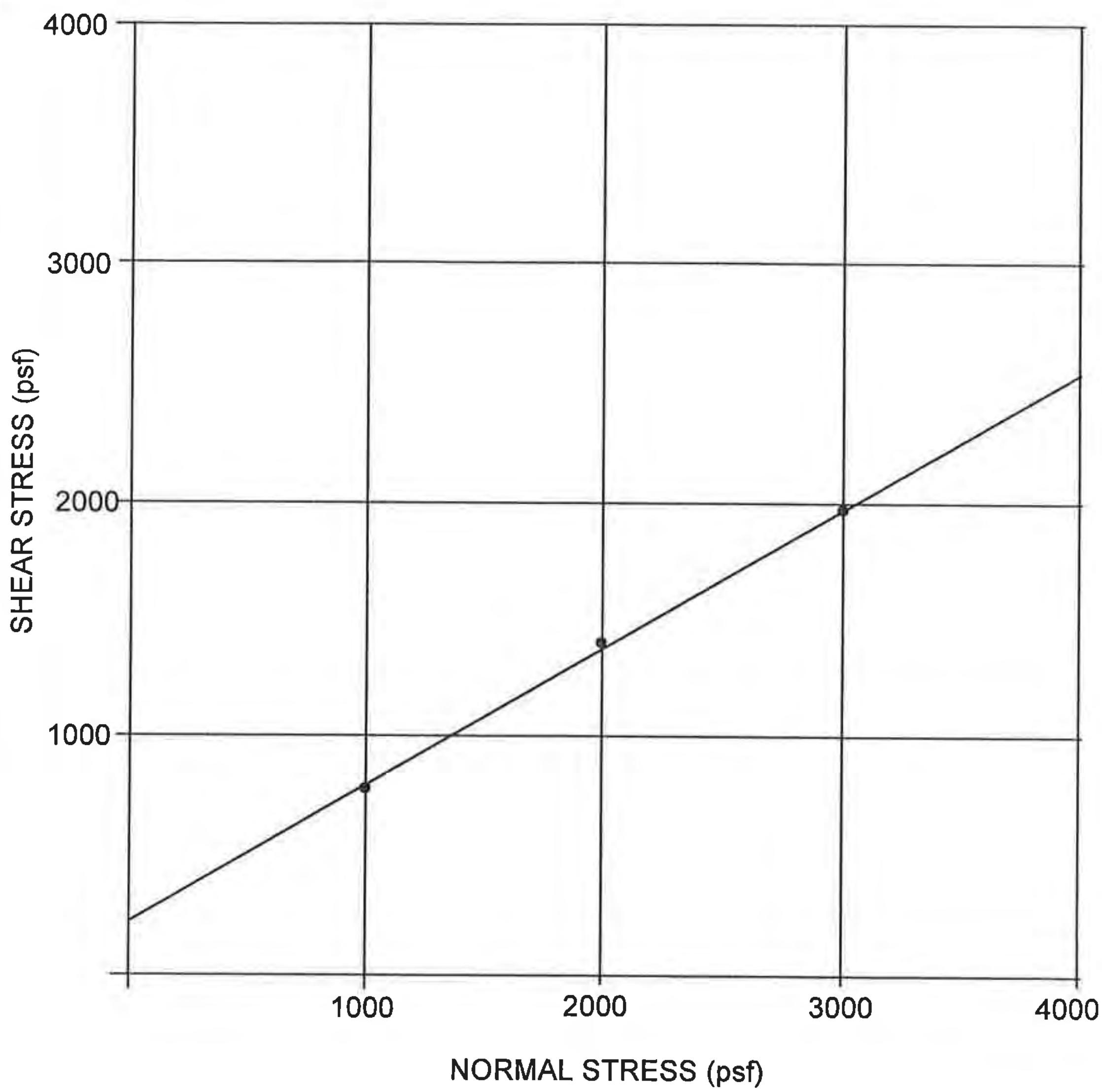
PLATE B-3.1

Project: Sandpiper Residential Development **Job No.:** 9904-1131

Location of Project: Goleta, CA **Boring No.:** DH-1 **Sample No.:** 1

Description of Soil: Sandy CLAY (CL) **Depth of Sample:** 1-5'

Tested By: Fugro West, Inc. **Date of Testing:** 9/10/99



Ø = 28 DEGREES

C= 150 PSF

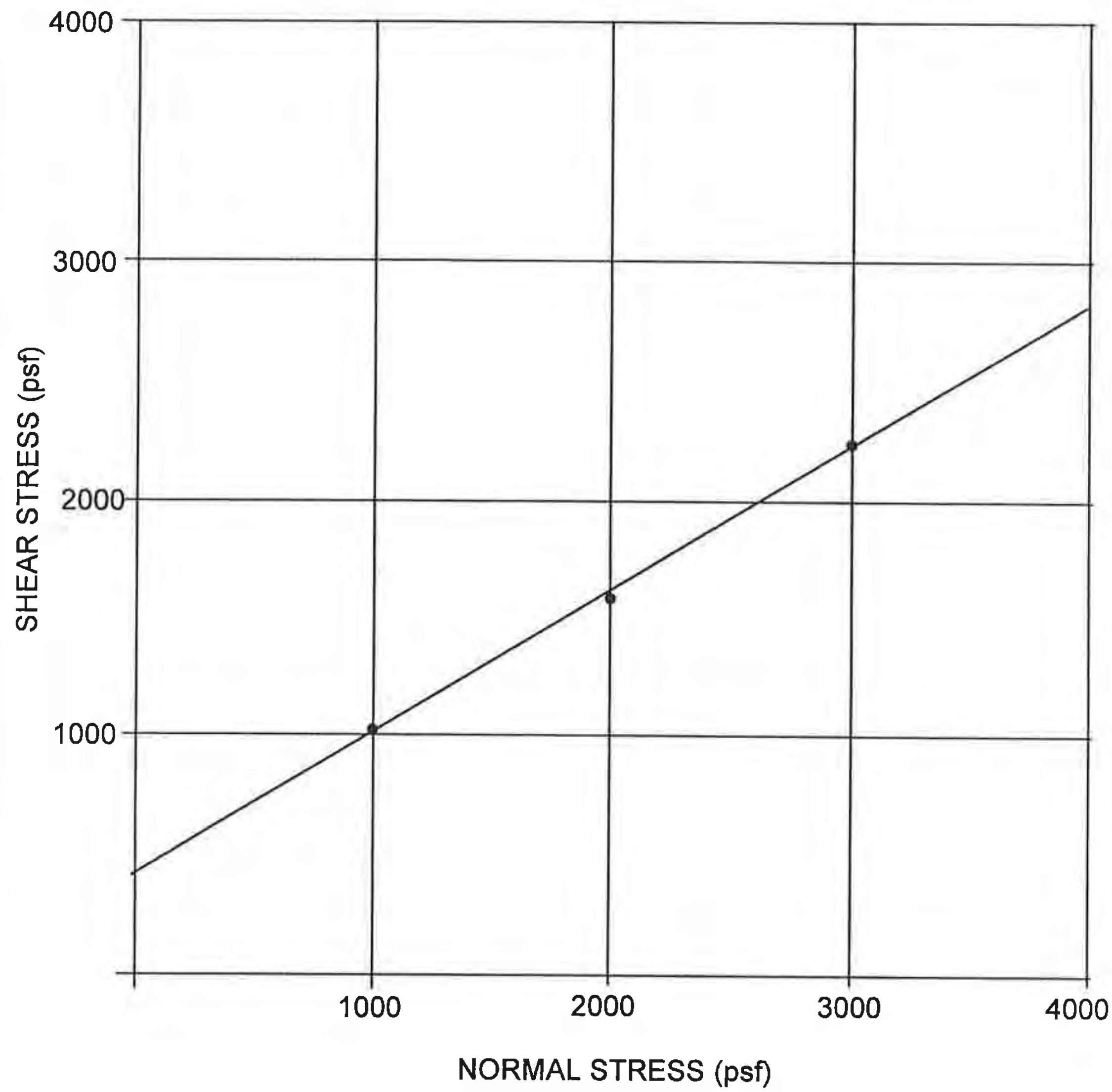
September 1999
Project No. 9904-1131

Project: Sandpiper Residential Development
Job No.: 9904-1131

Location of Project: Goleta, CA
Boring No.: DH-3 **Sample No.:** 2

Description of Soil: Silty CLAY (CL)
Depth of Sample: 3'

Tested By: Fugro West, Inc.
Date of Testing: 9/10/99



Ø = 21 DEGREES

C= 150 PSF

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DIRECT SHEAR TEST RESULT
PLATE B-4.2

BtC Laboratories Incorporated
2978 SEABORG AVENUE, VENTURA, CA 93003-7686 • 805·656·6074 • FAX 805·656·1263

REPORT OF "R" VALUE TEST
(ASTM D2344))

DATE: August 30, 1999

JOB NUMBER: 99-8636-V01
LAB NUMBER: 990524

PROJECT: Sandpiper No. 9904-1131
OWNER:
SAMPLE OF: Soil
SAMPLED BY: Client
SAMPLED FROM: Hole #1, Sample #1 — DATE RECEIVED: Aug. 20, 1999
MATERIAL FOR USE IN: . — DEPTH: 1'-5'

(California 202)

GRADING ANALYSIS				TEST SPECIMEN	A	B	C	D
SIEVE	AS REC'D	AS USED	SPEC'S	COMP. FOOT PRESSURE PSI	350	350	220	
				INITIAL MOISTURE %	8.8	8.8	8.8	
				MOISTURE @ COMPACTION %	13.8	14.3	14.8	
				DRY DENS. OF BRIQ. #/CF	116.4	115.7	112.8	
3"				STABILOMETER VALUE "R"	14	10	7	
2 1/2"				EXUDATION PRESSURE PSI	621	494	279	
2"				THICKNESS IND. BY STAB.				
1 1/2"				THICK. IND. BY EXP. PRESS.	0	0	0	

SIEVE	AS REC'D	AS USED	SPEC'S					
1"				L.L.	P.L.	P.I.	SPEC MAX	SUBASE:
3/4"	100							BASE:
1/2"	98.9							SURFACE:
3/8"	98.1			SAND EQUIVALENT:				COHESION VALUE:
#4	97.6			DURABILITY, COARSE:				TRAFFIC INDEX:
#8	96.6			DURABILITY, FINE:				"R" BY EXUD. PRESSURE: 7
#16	95.5			DURABILITY INDEX:				"R" BY EXPAN. PRESSURE:
#30	93.8							"R" @ EQUILIBRIUM: 7
#50	86.6			L.A. RATTLER				
#100	72.9			100 REV:				INDICATED MINIMUM THICKNESS OF
#200	58.9		(washed)	500 REV:				COVER FOR ABOVE CONDITION:

REMARKS:

Reviewed by:

M.B. (Ben) Lo, P.E.

Respectfully submitted,
BTC LABORATORIES, INC.

Charles N. Dunn, Lab Supervisor

CND:hra

Copies: 1-Padre Associates, Inc.
1-File

hra/RV8

PLATE B-5.1

DATE RECIEVED:8-20-99
MATERIAL: # 1

JOB NO;99-8636-VOI

LAB NO; 990524

"R" VALUE BY EXUDATION

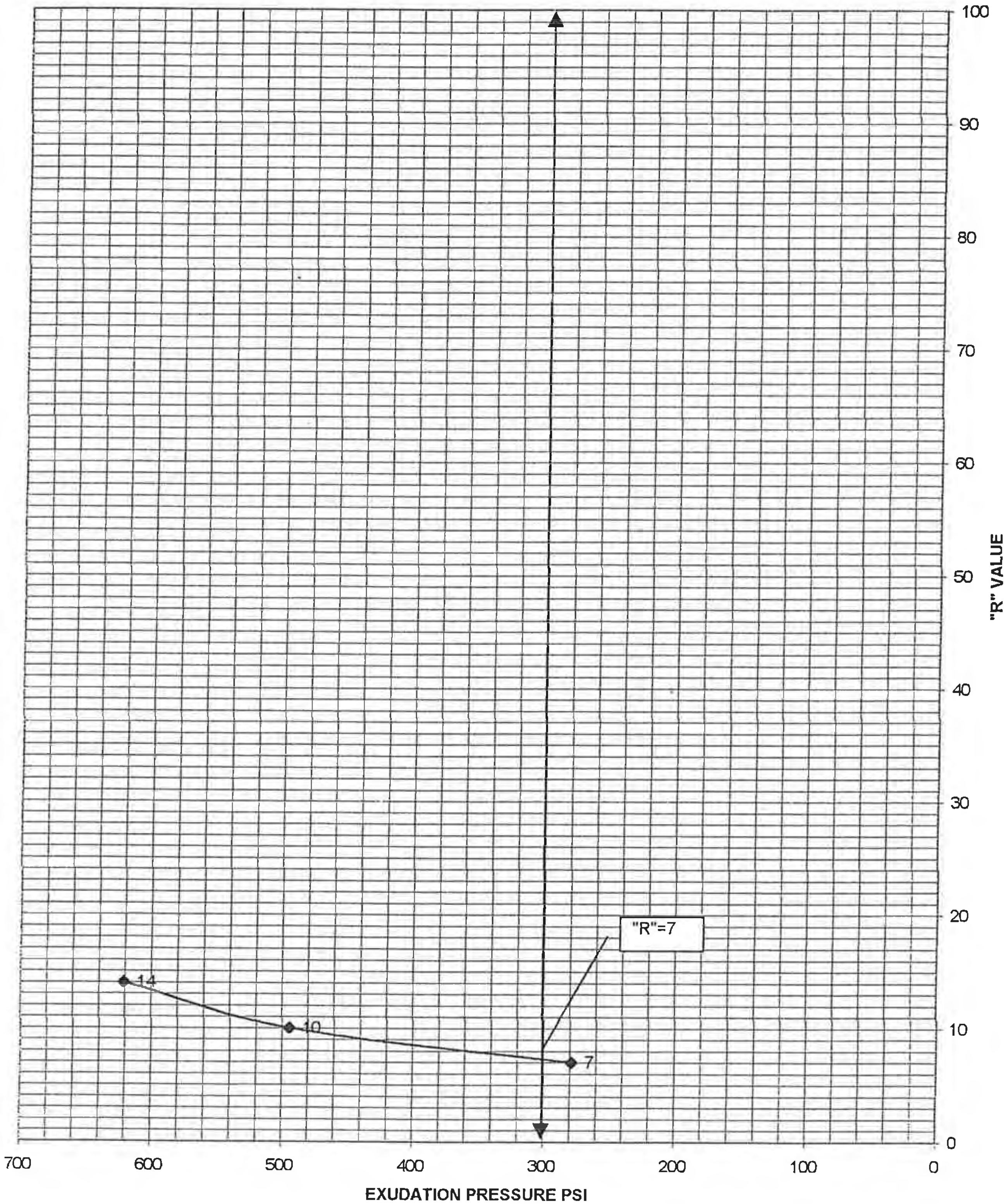

PLATE B-5.2

BtC Laboratories Incorporated
2978 SEABORG AVENUE, VENTURA, CA 93003-7686 • 805·656·6074 • FAX 805·656·1263

REPORT OF "R" VALUE TEST
(ASTM D2344))

DATE: August 30, 1999

JOB NUMBER: 99-8636-V01
LAB NUMBER: 990524

PROJECT: Sandpiper No. 9904-1131
OWNER:
SAMPLE OF: Soil
SAMPLED BY: Client
SAMPLED FROM: Hole #2, Sample #2 DATE RECEIVED: Aug. 20, 1999
MATERIAL FOR USE IN: DEPTH: 1'-5'

(California 202)

GRADING ANALYSIS				TEST SPECIMEN	A	B	C	D
	AS	AS		COMP. FOOT PRESSURE PSI	350	350	200	
				INITIAL MOISTURE %	12.1	12.1	12.1	
SIEVE	REC'D	USED	SPEC'S	MOISTURE @ COMPACTION %	15.6	16.1	16.6	
				DRY DENS. OF BRIQ. #/CF	110.3	109.7	108.6	
3"				STABILOMETER VALUE "R"	10	7	5	
2 1/2"				EXUDATION PRESSURE PSI	533	438	295	
2"				THICKNESS IND. BY STAB.				
1 1/2"				THICK. IND. BY EXP. PRESS.	0	0	0	

SIEVE	AS REC'D	AS USED	SPEC'S	L.L.	P.L.	P.I.	SPEC MAX	
1"								SUBASE:
3/4"								BASE:
1/2"								SURFACE:
3/8"	100			SAND EQUIVALENT:				COHESION VALUE:
#4	99.5			DURABILITY, COARSE:				TRAFFIC INDEX:
#8	97.5			DURABILITY, FINE:				"R" BY EXUD. PRESSURE: 5
#16	94.9			DURABILITY INDEX:				"R" BY EXPAN. PRESSURE:
#30	92.6							"R" @ EQUILIBRIUM: 5
#50	89.1			L.A. RATTLER				
#100	79.7			100 REV:				INDICATED MINIMUM THICKNESS OF
#200	63.6		(washed)	500 REV:				COVER FOR ABOVE CONDITION:

REMARKS:

Reviewed by:

M.B. (Ben) Lo, P.E.

Copies: 1-Padre Associates, Inc.
1-File

BTC LABORATORIES, INC.

Charles N. Dunn, Lab Supervisor

CND:hra

hra/RV8

PLATE B-5.3

DATE RECIEVED:8-20-99
MATERIAL: # 2

JOB NO;99-8636-VOI

LAB NO; 990524

"R" VALUE BY EXUDATION

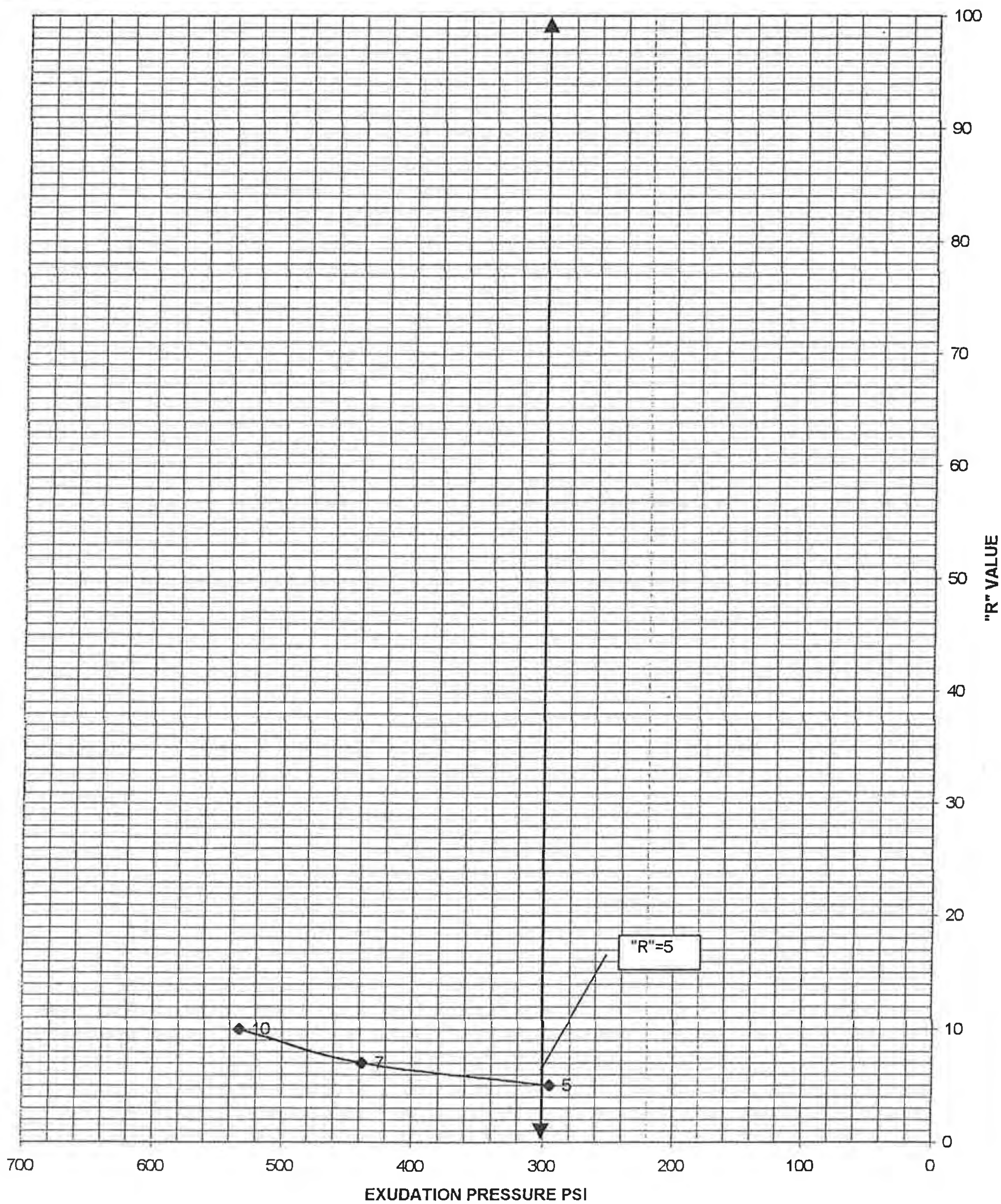

PLATE B-5.4

ConCeCo Engineering, Inc.

2160 Winifred Street
Mail: P.O. Box 115
Simi Valley, CA 93062

Date: September 2, 1999

Padre and Associates, Inc.
Attention: James Bianchin
5450 Telegraph Road Suite 101
Ventura, Ca 93003

Job No.: 1S99099

Subject: Soil Chemistry Analysis for Padre Job # 9904-1131 - Sandpiper
One (1) Sample

Dear Mr. Bianchin:

Soil Chemistry Analysis for the above referenced sample is provided below.

Lot Number	[1]Minimum Resistivity (ohm-cm)	[2]pH	[3]Sulfate (mg/kg)	[3]Chloride (mg/kg)	(As Rec'd) Description
DH-1 (1-5')	2680	6.23	<10	91	Tan Silty Loam, Dry

NOTE: SAMPLES WERE ANALYZED IN ACCORDANCE WITH THE FOLLOWING METHODS.
1. MINIMUM RESISTIVITY DETERMINED BY SOIL BOX METHOD, (PER ASTM G-57)
2. PH MEASURED BY POTENTIOMETRIC METHOD USING STANDARD ELECTRODES. (PER CAL TRANS. #643)
3. CHLORIDE AND SULFATE WERE ANALYZED IN ACCORDANCE WITH EPA METHODS FOR CHEMICAL ANALYSIS FOR WATER AND WASTE, NO. 300 EPA-600/4-79-020. CONCENTRATION BY WEIGHT OF DRY SOIL.

Comments:

1. *Type II modified Portland Cement is recommended for concrete products.*
2. *Soils are corrosive to unprotected ferrous metals.*
3. *Hot and cold water copper pipes require special procedures when installed under concrete floor slabs. Electrical isolation from structural concrete such as footing and steel reinforcing wire or bars in the floor slab should be maintained to prevent future corrosion. We recommed overhead plumbing as the most effective method of preventing corrosion.*

Please call if you have any questions.

Very truly yours,
ConCeCo Engineering, Inc.

Roger J. Carlsen, P.E.

RJC:ch

PLATE B-6

HOLGUIN, FAHAN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT CONSULTANTS

June 13, 2012

Mr. Thomas Rejzek
Santa Barbara County Fire Department
Fire Prevention Division
1430 Mission Drive
Solvang, California 93463
(VIA PAPER COPY)

Subject: **SITE CLOSURE SUMMARY REPORT FOR CHEVRON FORMER SERVICE STATION #9-4268 (FUTURE CITY OF GOLETA FIRE STATION #10) 7952 HOLLISTER AVENUE, GOLETA, CALIFORNIA (FPD FILE #502421)**

Dear Mr. Rejzek:

On behalf of Chevron Environmental Management Company (Chevron), Holguin, Fahan & Associates, Inc. (HFA) presents this site closure summary report for the above-referenced site as required by FPD correspondence dated February 21, 2012.

HFA's review of all available data pertinent to this case indicates that the site has been adequately assessed and remediation is complete. Therefore, Chevron and HFA request that the FPD proceed with the low-risk closure review.

Holguin, Fahan & Associates, Inc. trusts that this report meets the requirements of the Santa Barbara County Fire Department, Fire Prevention Division. If you have any questions or require additional information, please contact me at (805) 641-4087, or Mark_Fahan@hfa.com.

Respectfully submitted,

Mark R. Fahan, PG, REA
Vice President
Holguin, Fahan & Associates, Inc.

JRN:mrf:mgh

Enclosure

cc: Mr. Daryl Pessler, Chevron (VIA INTERNET UPLOAD)
Ms. Claudia Dato, City of Goleta (VIA EMAIL)
Mr. Alan Hanson, City of Goleta (VIA EMAIL)

HOLGUIN, FAHAN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT CONSULTANTS

SITE CLOSURE SUMMARY REPORT

CHEVRON FORMER SERVICE STATION #9-4268
(FUTURE CITY OF GOLETA FIRE STATION #10)
7952 HOLLISTER AVENUE
GOLETA, CALIFORNIA
(FPD FILE #502421)

JUNE 13, 2012

Client: Chevron Environmental Management Company
145 South State College Boulevard, Suite 400
Brea, California 92821

Contact: Daryl Pessler
(714) 671-3277
darylpessler@chevron.com

Consultant: Holguin, Fahan & Associates, Inc.
50 West Main Street
Ventura, California 93001

Project Manager: Mark R. Fahan, PG, REA
(805) 641-4087
Mark_Fahan@hfa.com

PROFESSIONAL GEOLOGIST
MARK R. FAHAN
NUMBER 4279
EXP 7/12
STATE OF CALIFORNIA

Jeff R. Nobriga
Associate Environmental Professional
Holguin, Fahan & Associates, Inc.

Mark R. Fahan, PG, REA
Vice President
Holguin, Fahan & Associates, Inc.

HOLGUIN, FAHAN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT CONSULTANTS

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HOLGUIN, FAHAN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT CONSULTANTS

TABLES

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LIST OF ACRONYMS

BTEX	benzene, toluene, ethylbenzene, and total xylenes
CAP	corrective action plan
COC	constituent of concern
DIPE	diisopropyl ether
EDB	1,2-dibromoethane
EDC	1,2-dichloroethane
EPA	Environmental Protection Agency
ESL	environmental screening level
ETBE	ethyl tertiary butyl ether
fbg	feet below grade
$feet^2$	square feet
$feet^3$	cubic feet
FPD	Santa Barbara County Fire Department, Fire Prevention Division
hr	hour
ID	identification
J	value between the method detection limit and the reporting limit
kg	kilogram
lb	pound
LUFT	leaking underground fuel tank
M^3	cubic meter
mg/kg	milligrams per kilogram
MSL	mean sea level
MTBE	methyl tertiary butyl ether
N/A	not applicable
ppmv	parts per million by volume
REF	report reference
scfm	standard cubic feet per minute
SIL	site investigation level
SWRCB	California State Water Resources Control Board
SVE	soil vapor extraction
TAME	tertiary amyl methyl ether
TBA	tertiary butyl alcohol
TPH	total petroleum hydrocarbons
U.S.	United States
UST	underground storage tank
VOC	volatile organic compound

HOLGUIN, FAHAN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT CONSULTANTS

INTRODUCTION

Chevron Environmental Management Company (Chevron) contracted Holguin, Fahan & Associates, Inc. (HFA) to prepare a site closure summary report for Chevron Former Service Station #9-4268, located at 7952 Hollister Avenue, Goleta, California (see Figure 1 - Site Location Map). The purpose of this report is to summarize site conditions to evaluate low-risk closure as directed by the FPD in correspondences dated February 21, 2012 and extension approval dated March 30, 2012 (see Appendix 1 for the agency correspondence). A list of acronyms used in this report is enclosed.

The responsible party contact is Mr. Daryl Pessler, Chevron Environmental Management Company, 145 South State College Boulevard, Suite 400, Brea, California, 92821, (714) 671-3277. The consultant contact is Mr. Mark Fahan, Holguin, Fahan & Associates, Inc., 50 West Main Street, Ventura, California, 93001, (805) 641-4087. The regulatory agency contact is Mr. Thomas Rejzek, Santa Barbara County Fire Department, Fire Prevention Division, 1430 Mission Drive, Solvang, California, 93463, (805) 686-8176.

SITE DESCRIPTION AND LAND USE

Chevron Former Service Station #9-4268 is located at 7952 Hollister Avenue approximately 100 feet southeast of the intersection of Hollister Avenue and Cathedral Oaks Road in the city of Goleta, California (see Figure 1).

The subject site is a former Chevron service station that was demolished in January 1993. The site is currently a fenced, dirt lot surrounded by seasonal grasses, shrubs, and trees. The property is owned by the City of Goleta who plans to develop the property as live-in fire station #10 in the near future.

The site is bounded by railroad tracks to the north, vacant land to the east, and Hollister Avenue to the south-southwest. Sandpiper Golf Course is located further to the south-southwest, beyond Hollister Avenue (see Figure 2 - Site Vicinity Map). Elwood School (kindergarten through 6th grade) is located 0.5 mile to the southeast at 7686 Hollister Avenue, Goleta, California.

SITE GEOLOGY AND HYDROGEOLOGY

TOPOGRAPHY AND SURFACE WATER

The site is located at an elevation of 120 feet above MSL. The local topography slopes toward the south. The nearest surface water is an unnamed pond at Sandpiper Golf Course, located 800 feet southwest of the site. A seasonal creek is located 1,900 feet west of the site within Bell Canyon. The creek flows to the Pacific Ocean, which is located 2,000 feet southwest of the site (Dibblee, 1987).

GEOLOGY

The site vicinity is underlain by Quaternary alluvium with a thickness of less than 200 feet. The alluvium is derived from the erosion of the Santa Ynez Mountains to the north. The alluvium overlies unconsolidated deposits of the Santa Barbara and Monterey formations and the Vaqueros Sandstone (Dibblee, 1987). Based on site assessment activities, the site is underlain by sand and silty sand (SM/SP) from the surface to 30 fbg, clayey sand (SC) from 30 to 45 fbg, sand and silty sand (SM/SP) from 45 to 60 fbg, and clayey sand (SC) from 60 to 100 fbg, the maximum depth investigated (HFA, 2010).

HYDROGEOLOGY

The site is located near the western boundary of the Goleta Basin, within the Goleta West Basin. Groundwater in the Goleta Basin occurs in the alluvium, the fanglomerate, and the Santa Barbara Formation (DWR, 1975). Groundwater in the Goleta Basin is generally divided into a shallow zone and a deep zone (Todd, 1982). The shallow zone includes the Recent alluvium, parts of the Upper Pleistocene alluvium, and the upper part of the fanglomerate. The deep zone includes the lower part of the Upper Pleistocene alluvium and the Santa Barbara Formation. The depth to first groundwater in the site vicinity is below 100 fbg, and the groundwater flow direction in the Goleta Basin is generally toward the south.

The Goleta area primarily receives municipal water from surface waters associated with the Cachuma and State Water projects (Santa Barbara County Water Agency, 2000). Municipal groundwater from the Goleta Basin is produced on an as-needed basis by the Goleta Water District. Water is generally not produced within the Goleta West Basin due to the generally poor quality of water within the hydraulic unit (Santa Barbara County Public Works, 2001). In addition, water within the Goleta West Basin requires treatment for domestic use.

The closest well (004N/29W14G10S) is located approximately 0.25 mile northwest of the site. The well is inactive and is owned/operated by Goleta Water District.

SUMMARY OF PREVIOUS WORK

UST HISTORY

From 1968 to 1993, a gasoline service station operated at the site. In 1993, the service station was demolished and two 10,000-gallon, gasoline USTs; one 6,000-gallon, gasoline UST; one 1,000-gallon, used-oil UST; two dispenser islands; associated product and vent piping; and two hydraulic lifts were removed (see Figure 3 - Plot Plan) (Groundwater Technology, Inc., 1993).

SITE ASSESSMENT HISTORY

In 1993, a release from the former USTs and the dispenser islands was discovered. Site assessment activities included a total of 12 soil borings (Fluor Daniel GTI [GTI], 1997). Hydrocarbon-containing soil was remediated from 1994 to 1996 by SVE from seven SVE wells (GTI, 1997; SECOR International, Inc. [SECOR], 1996). The remedial system removed 10,574 pounds of TPH through the end of the fourth quarter of 1996 (SECOR, 1996). Confirmation soil samples collected in 1997 indicated hydrocarbon concentrations below the FPD SILs for all locations except B11, drilled through the former southern dispenser island location. Results for soil boring B11 showed a TPH as gasoline concentration of 810 mg/kg (GTI, 1997; Rincon Consultants, Inc. [Rincon], 2008a). All SVE wells were abandoned, and case closure was issued for the site in 1997 (FPD, 1997).

In 2007, a Phase I environmental site assessment was conducted (Rincon, 2008b). Based on the previous site usage as a service station and lack of groundwater assessment data, the Phase I recommended additional assessment. From February to April of 2008, Rincon drilled and sampled six soil borings (SB1 through SB6) to evaluate the potential for residual hydrocarbons in soil and to assess groundwater quality. Laboratory analytical results for the soil samples indicated maximum concentrations for TPH as gasoline of 20,700 mg/kg (SB1 at 20 fbg) and benzene of 11.7 mg/kg (SB1 at 15 fbg) in the vicinity of the former southern dispenser island (see Figure 3, and Appendix 2 for the historical sampling results) (Rincon, 2008a). Groundwater was not encountered to 100 fbg, the maximum depth investigated. Based on these sample results, the FPD opened a new LUFT case.

On November 20 and 21, 2008, HFA performed soil sampling at locations B-13 through B-20 using direct-push sampling techniques. Laboratory analytical results for the soil samples indicated maximum concentrations of TPH as gasoline, benzene, and MTBE of 8,200, 52, and 0.28J mg/kg, respectively (HFA, 2009a). N-butylbenzene, sec-butylbenzene, tert-butylbenzene, naphthalene, isopropylbenzene, n-propylbenzene, 1,2,4-trimethylbenzene, and 1,3,5-trimethylebenzene detections correlated to samples containing elevated TPH as gasoline and BTEX concentrations (see Table 1 - Summary of Soil Sample Analytical Results, and Table 2 - Summary of Additional Soil Sample Analytical Results).

Based on the results of the Rincon and HFA assessments, HFA determined that TPH as gasoline, benzene, naphthalene, and other gasoline-containing VOCs were localized in the immediate vicinity of the former southern dispenser island at depths less than 30 fbg. The total volume of soil containing hydrocarbon concentrations above the FPD SILs within this area was estimated at less than 400 cubic yards (HFA, 2010).

REMEDIATION HISTORY

On July 10, 2009, HFA submitted a CAP to the FPD for remedial excavation using a patterned auger drilling technology (HFA, 2009b). The CAP was approved by the FPD in correspondence dated August 14, 2009. HFA submitted a Land Use Permit to the City of Goleta on September 9, 2009, for implementation of the approved CAP. In correspondence dated February 24, 2010, the City of Goleta notified Chevron that due to the location of the site within the Coastal Zone, submittal and approval of a Development Plan from the City of Goleta, and a Coastal Development Permit from the California Coastal Commission would be required prior to project implementation. As a result of these additional project requirements, all stakeholders agreed that other potentially feasible corrective actions should be evaluated.

On May 3, 2010, HFA submitted a revised CAP to the FPD for remediation using SVE (HFA, 2010). The CAP was approved by the FPD in correspondence dated May 11, 2010.

In August 2010, HFA installed a trailer-mounted, SVE system at the site. The SVE system uses a catalytic oxidizer, and two 300-scfm, rotary-claw, high-vacuum blowers to remove and destroy extracted VOCs. The SVE system is connected to four dual-nested SVE wells installed in the source area (see Figure 3). The wells are 25 to 30 feet deep and are dual-completed with 2-inch-diameter casing, staggered screen intervals, and short screen lengths to allow flexible and targeted extraction of VOCs (see Appendix 3 for the well logs).

HFA began operation of the SVE system on August 24, 2010, and operated the system for 3,693.8 hours through shutdown on April 22, 2011. During this time period, the SVE system removed 3,482 pounds of hydrocarbons, and influent vapor concentrations (based upon laboratory analysis) stabilized at less than 100 ppmv during the last 3 months of operation. Based upon a review of the monitoring data through March 2011, the SVE system mass removal rate has reached the point of asymptotic reduction. On March 17, 2011, HFA notified the FPD of its plans to initiate rebound testing.

On March 21, 2011, HFA shutdown the SVE system for rebound evaluation. The instantaneous SVE mass removal rate (based upon laboratory analysis of TPH as gasoline) for the March 2011 monitoring events ranged from 0.05 to 0.13 lb/hr extracted. The SVE system was left off for 2 weeks and restarted on April 4, 2011. The SVE system operated until April 22, 2011, when it was again shutdown. The instantaneous SVE mass removal rate (based upon laboratory analysis of TPH as gasoline) for samples collected during the April 2011 SVE system monitoring events ranged from 0.10 to 0.12 lb/hr extracted (see Appendix 4 for a summary of SVE operations). Benzene, which is the primary COC at the site, was not detected in any rebound sample, and benzene has not been detected in any vapor sample collected since October 4, 2010 (HFA, 2011a).

Based on similar mass removal rates prior to and after the rebound period, SVE system operations have reached their limit of effectiveness, and continued operations would not remove substantial additional mass from the subsurface. On June 29, 2011, the FPD agreed that the SVE system had removed over 90 percent of the initial mass of hydrocarbons from the soil and concurred that further corrective action was not warranted.

On July 22, 2011, HFA advanced two confirmation soil borings (B-21 and B-22) to 30 fbg using a direct-push rig. The locations and depths of the soil borings were established so that they would penetrate the previously detected hydrocarbon-containing soil in the vicinity of soil borings SB1 and B-18. Laboratory analytical results indicated that five soil samples between depths of 10 and 20 fbg contained TPH as gasoline concentrations above the FPD SIL of 200 mg/kg (see Figure 4 - Plot Plan Showing Hydrocarbon Concentrations In Verification Samples). The maximum residual TPH as gasoline concentration was 2,800 mg/kg (B-21 at 20 fbg). Benzene and MTBE were not detected above the laboratory reporting limit (see Table 1). Recalcitrant hydrocarbon compounds naphthalene, n-propylbenzene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and n-butylbenzene were also detected at concentrations above the FPD SILs (see Table 2). These detections were present in the samples containing residual TPH as gasoline concentrations (see Figure 4, Table 1, and Table 2) (HFA, 2011b).

The results of verification soil samples demonstrate that SVE activities have reduced the VOCs to asymptotic levels. A comparison of pre-remediation and post-remediation hydrocarbon concentrations indicated post-remediation TPH as gasoline, benzene, and naphthalene concentrations had a one to three orders of magnitude reduction at most sample depths (see Table 3 - Comparison of Pre-Remediation and Post-Remediation Results).

MASS OF RESIDUAL HYDROCARBONS

To calculate the mass of residual hydrocarbons in soil, HFA plotted and contoured soil samples with COCs at concentrations above the FPD SIL and constructed cross-sections showing the pre-remediation and post-remediation distribution of COCs. The lateral and vertical distributions of residual hydrocarbons were determined using the soil data from the confirmation soil borings. The limits of the residual hydrocarbons were estimated based on the extent measured in other directions, and/or inferred from the extent measured in other areas of the site. Using the estimated area and thickness, a volume of impacted soil was determined for each constituent above the FPD SIL.

The post-remediation COCs were determined to be TPH as gasoline, total xylenes (further referenced as xylene), and recalcitrant VOCs, naphthalene, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene. Because benzene was not detected in post-remediation soil samples, HFA considered the COC to be de minimus and the mass and volume were not calculated. Additionally, because toluene, ethylbenzene, and n-butylbenzene were detected above the FPD SIL in only one sample (at 20 fbg for B-21), and n-propylbenzene was detected marginally above the FPD SIL in only one additional sample (at 20 fbg for B-22) these four compounds were also considered to be de minimus and were excluded from the calculations (see Table 1 and Table 2).

TPH as gasoline concentrations in excess of the FPD SIL of 200 mg/kg were measured in samples from verification soil boring B-21 at 15 and 20 fbg, and from verification soil boring B-22 at 10, 15, and 20 fbg (see Figure 5 - Post-Remediation TPH as Gasoline Concentrations in Soil, Figure 6 - Geologic Cross-Section A_1–A'_1 showing TPH as Gasoline Concentrations above FPD SIL, and Figure 7 - Geologic Cross-Section B_1–B'_1 showing TPH as Gasoline Concentrations above FPD SIL).

Xylene concentrations in excess of the FPD SIL of 175 mg/kg were measured in samples from verification soil boring B-21 at 20 fbg, and from verification soil boring B-22 at 10 and 20 fbg (see Figure 8 - Post-Remediation Xylene Concentrations in Soil, Figure 9 - Geologic Cross-Section A_2–A'_2 showing Xylene Concentrations above FPD SIL, and Figure 10 - Geologic Cross-Section B_2–B'_2 showing Xylene Concentrations above FPD SIL).

Naphthalene concentrations in excess of the FPD SIL of 1.7 mg/kg were measured in samples from verification soil boring B-21 at 15 and 20 fbg and also from verification soil boring B-22 at 10 and 20 fbg (see Figure 11 - Post-Remediation Naphthalene Concentrations in Soil, Figure 12 - Geologic Cross-Section A_3–A'_3 showing Naphthalene Concentrations above FPD SIL, and Figure 13 - Geologic Cross-Section B_3–B'_3 showing Naphthalene Concentrations above FPD SIL).

Concentrations of 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene above the FPD SILs were generally found in the same samples as the other COCs. The mass and volume of 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene were based upon the contours shown in Figures 14 through 16 (see Figure 14 - Post-Remediation 1,2,4-trimethylbenzene Concentrations in Soil, Figure 15 - Geologic Cross-Section A_4–A'_4 showing 1,2,4-trimethylbenzene Concentrations above FPD SIL, and Figure 16 - Geologic Cross-Section B_4–B'_4 showing 1,2,4-trimethylbenzene Concentrations above FPD SIL).

Calculations for the residual mass and volume of COCs are shown in Table 4 - Estimate of Residual Mass of Hydrocarbons in Soil, and are summarized below.

MASS AND VOLUME ESTIMATES OF RESIDUAL HYDROCARBONS IN SOIL

COC	MASS (kg)	VOLUME (m^3)*
TPH as Gasoline	110.6	76
Xylene	11.6	13
Naphthalene	5.4	51
1,2,4-trimethylbenzene	15.6	18
1,3,5-trimethylbenzene	5.1	18

*Volume of soil containing COC.

SENSITIVE RECEPTORS

HFA performed a sensitive receptor survey based upon readily available public records, site and vicinity inspections, and site assessment results.

Beneficial Groundwater Usage: The Goleta area primarily receives municipal water from surface waters associated with the Cachuma and State Water projects (Santa Barbara County Water Agency, 2000). Municipal groundwater from the Goleta Basin is produced on an as-needed basis by the Goleta Water District. The groundwater is generally not used due to its generally poor quality, and because is requires treatment for domestic use (Santa Barbara County Public Works, 2001).

Nearest well: The closest well (004N/29W14G10S) is located approximately 0.25 mile northwest of the site. The well is inactive and is owned/operated by Goleta Water District.

Nearest surface water body: The nearest body of surface water is the Pacific Ocean, located approximately 2,000 feet south of the site.

Subsurface Features: Only standard utilities such as gas, electricity, cable, telephone, and sewer are located in the immediate site vicinity. These utilities are generally within 5 feet of the surface and would not normally provide conduits for the subsurface migration of hydrocarbons. No unusual subsurface features were noted that might act as subsurface conduits.

Nearest school: Elwood School is located at 7686 Hollister Avenue, Goleta, California, 93117, approximately 2,500 feet east of the site.

Nearest Childcare Facility: No childcare facility has been identified within 1 mile of the site.

Eldercare Facility: No eldercare facility has been identified within 1 mile of the site.

Hospital: Goleta Valley Cottage Hospital is located at 351 South Patterson Avenue, Goleta, California, 93111, approximately 6 miles east of the site.

LANDOWNER IDENTIFICATION AND NOTIFICATION

In accordance with California Health and Safety Code Chapter 6.7 (Section 25297.15), all current fee titleholders for the subject site or sites impacted by releases from USTs must be notified prior to considering case closure. The fee titleholder for the site impacted by the release is provided below.

PROPERTY ADDRESS	PROPERTY DESCRIPTION	ASSESSOR PARCEL NUMBER	OWNER ADDRESS
7952 Hollister Avenue, Goleta, California, 93117	Chevron Former Service Station #9-4268 Vacant, dirt lot	079-21A-048	City of Goleta 130 Cremona Drive, Suite B Goleta, California 93117 Attn: Claudia Dato

This correspondence will serve as notice to the above-referenced landowner that the FPD is reviewing the LUFT case for low-risk case closure.

SUMMARY OF LOW-RISK CLOSURE CONDITIONS

Applicable site conditions consistent with "low-risk" closure are summarized below.

- The hydrocarbons were remediated to the extent practicable and asymptotic conditions have been achieved using SVE methods. Additional mass removal is not feasible or warranted. A total of 3,482 pounds of hydrocarbons has been removed.

- A relatively small mass and volume of residual COCs are present in soil between depths of 10 to 20 fbg.

- The majority of the residual hydrocarbons are composed of nonvolatile components of TPH as gasoline, total xylenes, and recalcitrant hydrocarbons naphthalene, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene. Natural attenuation processes are the best available approach to further reduce concentrations of these recalcitrant hydrocarbons.

- Benzene was not detected in post-remediation soil samples.

- Groundwater has not been impacted and residual hydrocarbon concentrations in soil will not result in groundwater quality less than that prescribed in the Basin Plan.

Review of all available data pertinent to this case indicates that the site has been adequately assessed and that the residual hydrocarbons in soil do not pose a significant threat to human health, to beneficial or potentially beneficial groundwater, or to the environment. As such, the recommended case closure is consistent with closure of similar low-risk petroleum hydrocarbon cases as described by SWRCB Resolution #2009-0042 (SWRCB, 2009).

Based upon the site conditions presented herein, additional active remediation processes and/or continued long-term monitoring would not significantly provide any additional environmental benefit. As such, Chevron and HFA respectfully request that the FPD review this site for “low-risk” closure (see Appendix 5 for the case closure summary).

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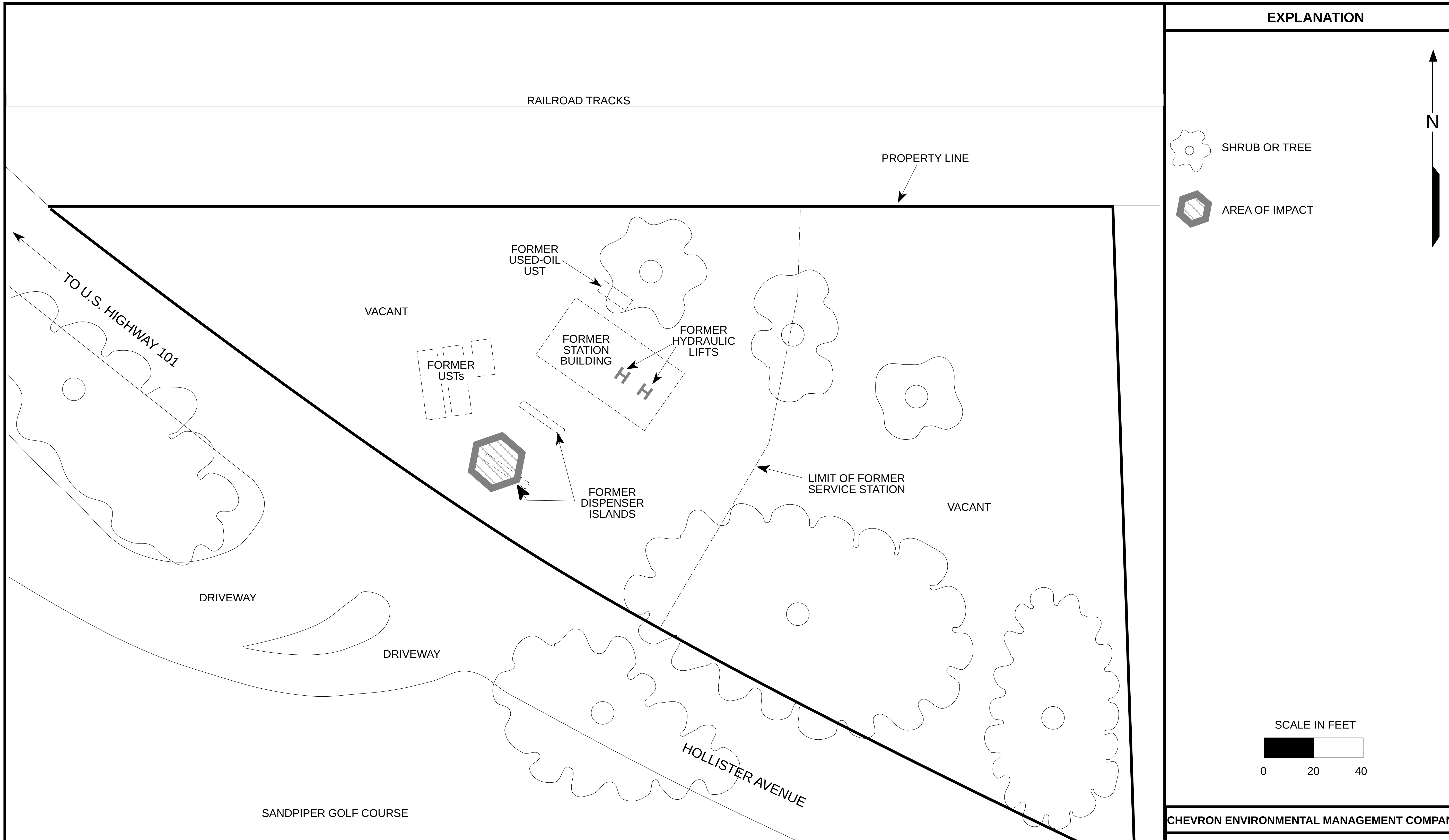
FIGURES

EXPLANATION	CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
0 0.5 1 MILE 0 1,000 2,000 3,000 4,000 5,000 FEET 0 0.5 1 KILOMETER N BASE MAP FROM TOPO! ©2000 NATIONAL GEOGRAPHIC HOLDINGS	FORMER SERVICE STATION #9-4268 7952 HOLLISTER AVENUE GOLETA, CALIFORNIA FIGURE 1 - SITE LOCATION MAP **HOLGUIN, FAHAN & ASSOCIATES, INC.**

REVISION DATE: JANUARY 5, 2011:MGH

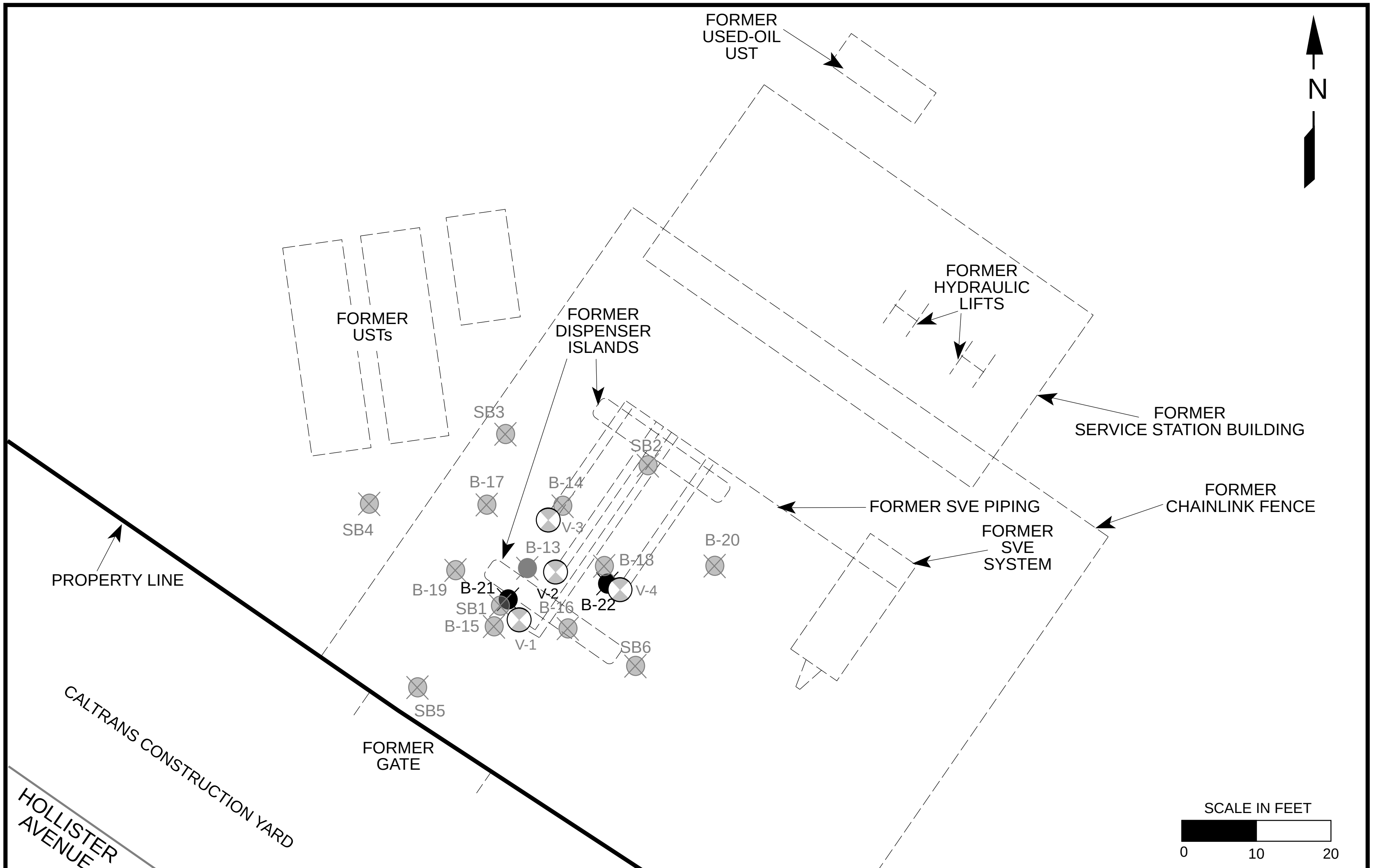


CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY

FORMER SERVICE STATION #9-4268
7952 HOLLISTER AVENUE
GOLETA, CALIFORNIA
FIGURE 2 - SITE VICINITY MAP

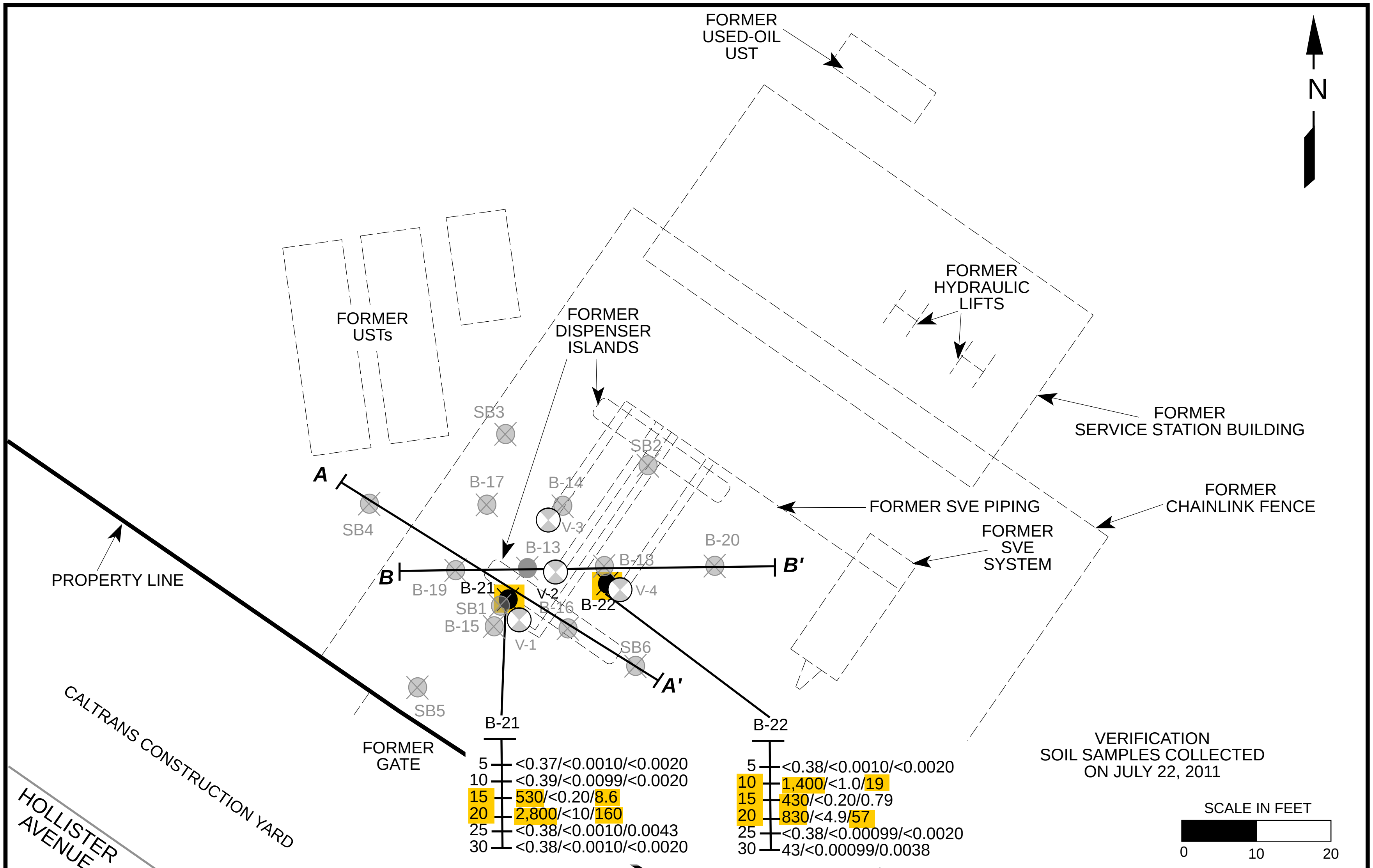
HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: JULY 25, 2011:MGH



EXPLANATION	CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
PRE-REMEDIATION SOIL BORING SOIL VAPOR EXTRACTION WELL VERIFICATION BORING	FORMER SERVICE STATION #9-4268 7952 HOLLISTER AVENUE GOLETA, CALIFORNIA FIGURE 3 - PLOT PLAN
	HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: NOVEMBER 11, 2011:MGH



EXPLANATION

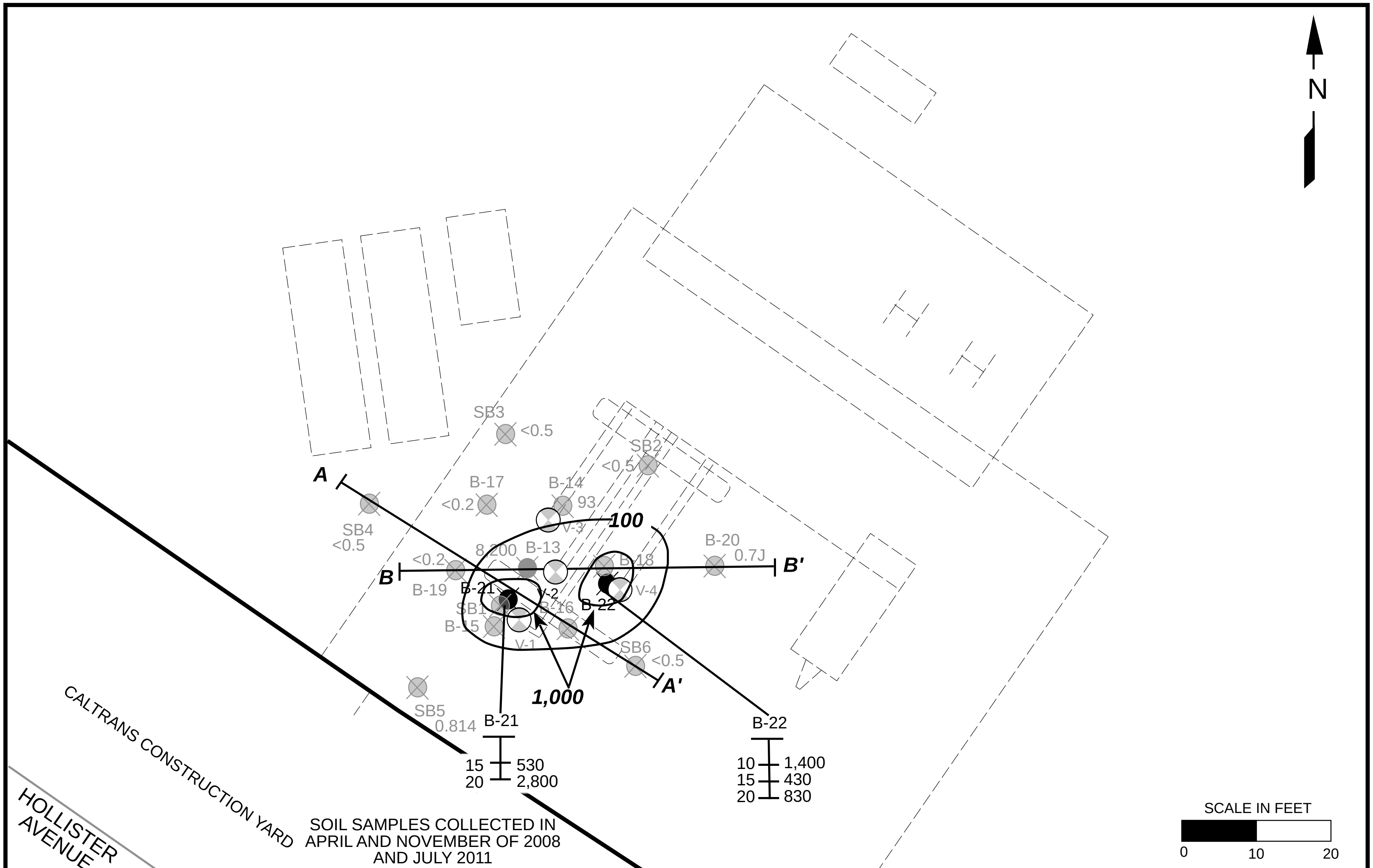
- PRE-REMEDIATION SOIL BORING
- SOIL VAPOR EXTRACTION WELL
- VERIFICATION BORING
- LINE OF CROSS SECTION
- CONCENTRATION ABOVE FPD SITE INVESTIGATION LEVEL
- # DEPTH OF SOIL SAMPLE (fbg)
- #/#/# TPH AS GASOLINE/BENZENE/NAPHTHALENE CONCENTRATIONS IN SOIL (mg/kg)

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY

FORMER SERVICE STATION #9-4268
7952 HOLLISTER AVENUE
GOLETA, CALIFORNIA
FIGURE 4 - PLOT PLAN SHOWING HYDROCARBON CONCENTRATIONS IN VERIFICATION SAMPLES

HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: OCTOBER 14, 2011:MGH



EXPLANATION

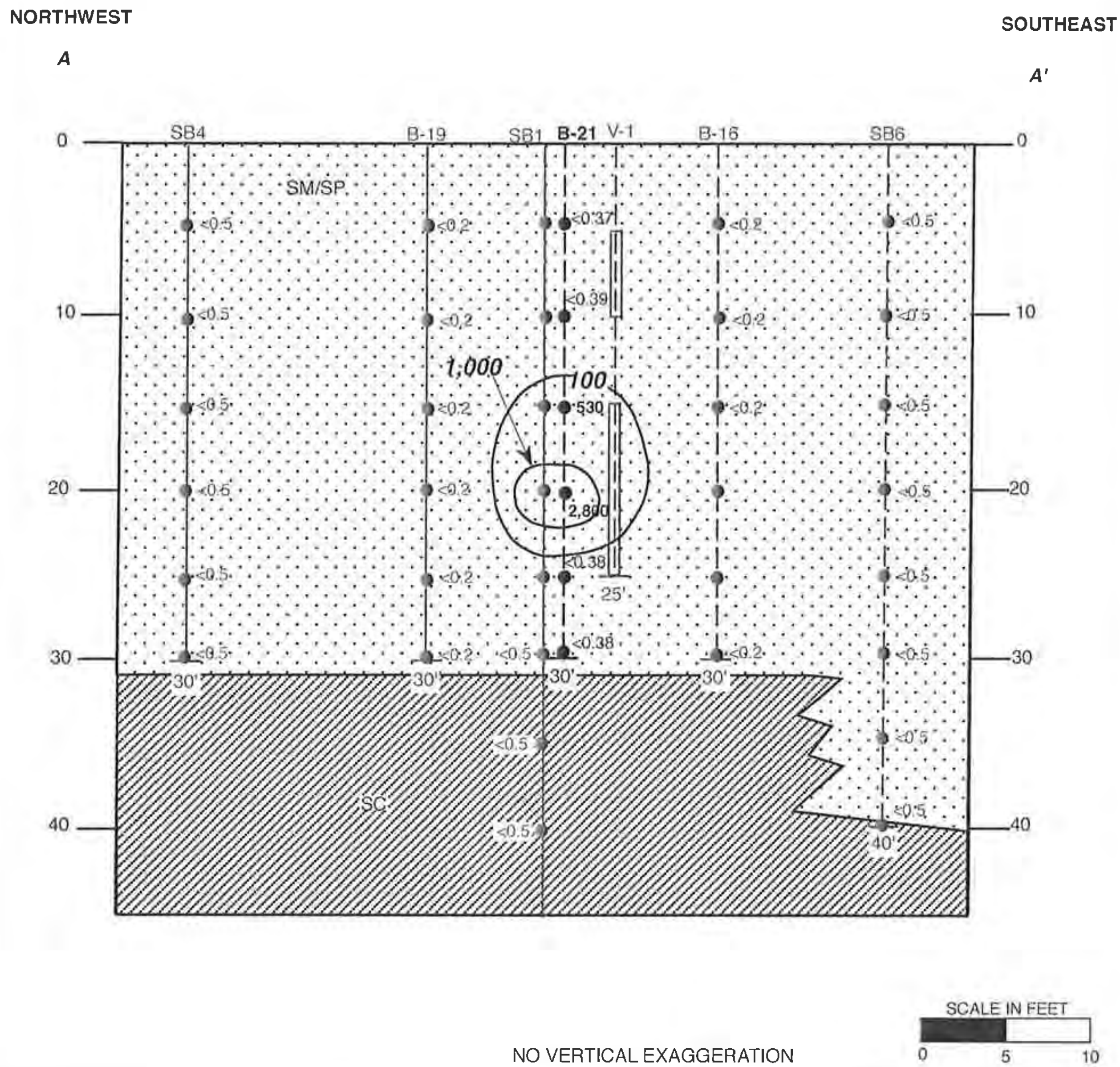
- PRE-REMEDIATION SOIL BORING
- SOIL VAPOR EXTRACTION WELL
- VERIFICATION BORING
- LINE OF CROSS SECTION
- 100 — CONTOUR OF TPH AS GASOLINE CONCENTRATIONS ABOVE FPD SIL (mg/kg)
- # ┼ # — DEPTH OF VERIFICATION SOIL SAMPLE (fbg) AND TPH AS GASOLINE CONCENTRATION ABOVE FPD SIL (mg/kg)
- # — PRE-REMEDIATION, CONTOUR-DEFINING RESULT (mg/kg)

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY

FORMER SERVICE STATION #9-4268
7952 HOLLISTER AVENUE
GOLETA, CALIFORNIA
FIGURE 5 - POST-REMEDIATION TPH AS GASOLINE CONCENTRATIONS IN SOIL

HOLGUIN, FAHAN & ASSOCIATES, INC.

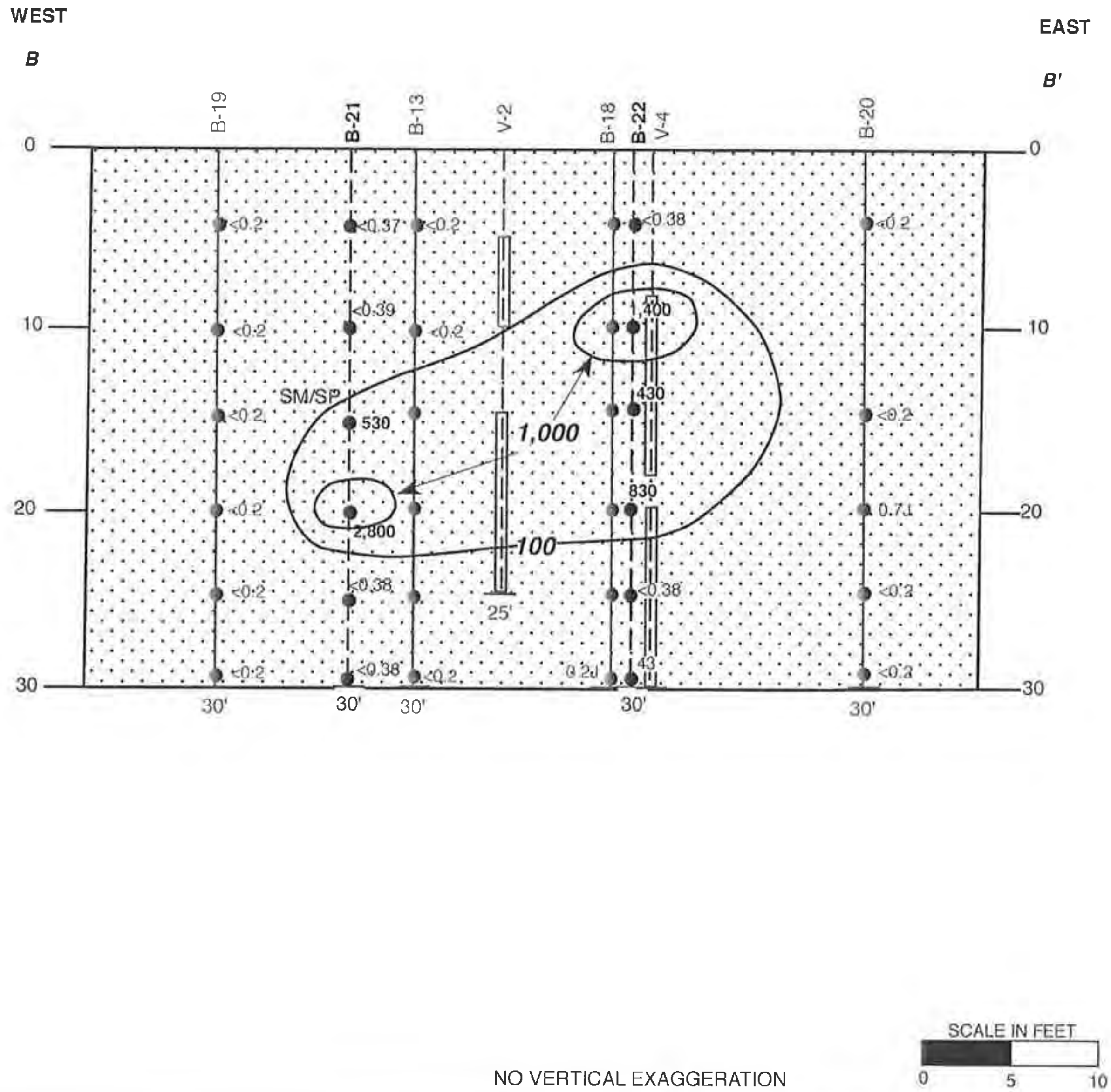
REVISION DATE: OCTOBER 14, 2011:MGH



NO VERTICAL EXAGGERATION

EXPLANATION	CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
B-19 ← BORING/WELL DESIGNATION; BORING/WELL (DASHED WHERE PROJECTED); # TPH AS GASOLINE CONCENTRATION IN SOIL SAMPLE (mg/kg) GRAY = PRE-REMEDIATION, BLACK = POST-REMEDIATION; SVE WELL SCREEN INTERVAL; TD = X' ← TOTAL BORING DEPTH; SAND (SM/SP); CLAYEY SAND (SC); 100 CONTOUR OF POST-REMEDIATION TPH AS GASOLINE CONCENTRATIONS ABOVE FPD SIL (mg/kg)	FORMER SERVICE STATION #9-4268 7952 HOLLISTER AVENUE GOLETA, CALIFORNIA FIGURE 6 - GEOLOGIC CROSS-SECTION A_1-A'_1 SHOWING POST-REMEDIATION TPH AS GASOLINE CONCENTRATIONS ABOVE FPD SIL
	HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: OCTOBER 5, 2011:MGH



EXPLANATION	CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY

B-19 ← BORING/WELL DESIGNATION

SAND (SM/SP)

← BORING/WELL (DASHED WHERE PROJECTED)

\# ← TPH AS GASOLINE CONCENTRATION IN SOIL SAMPLE (mg/kg) GRAY = PRE-REMEDIATION, BLACK = POST-REMEDIATION

← PERFORATED WELL INTERVAL

← DEPTH OF WELL

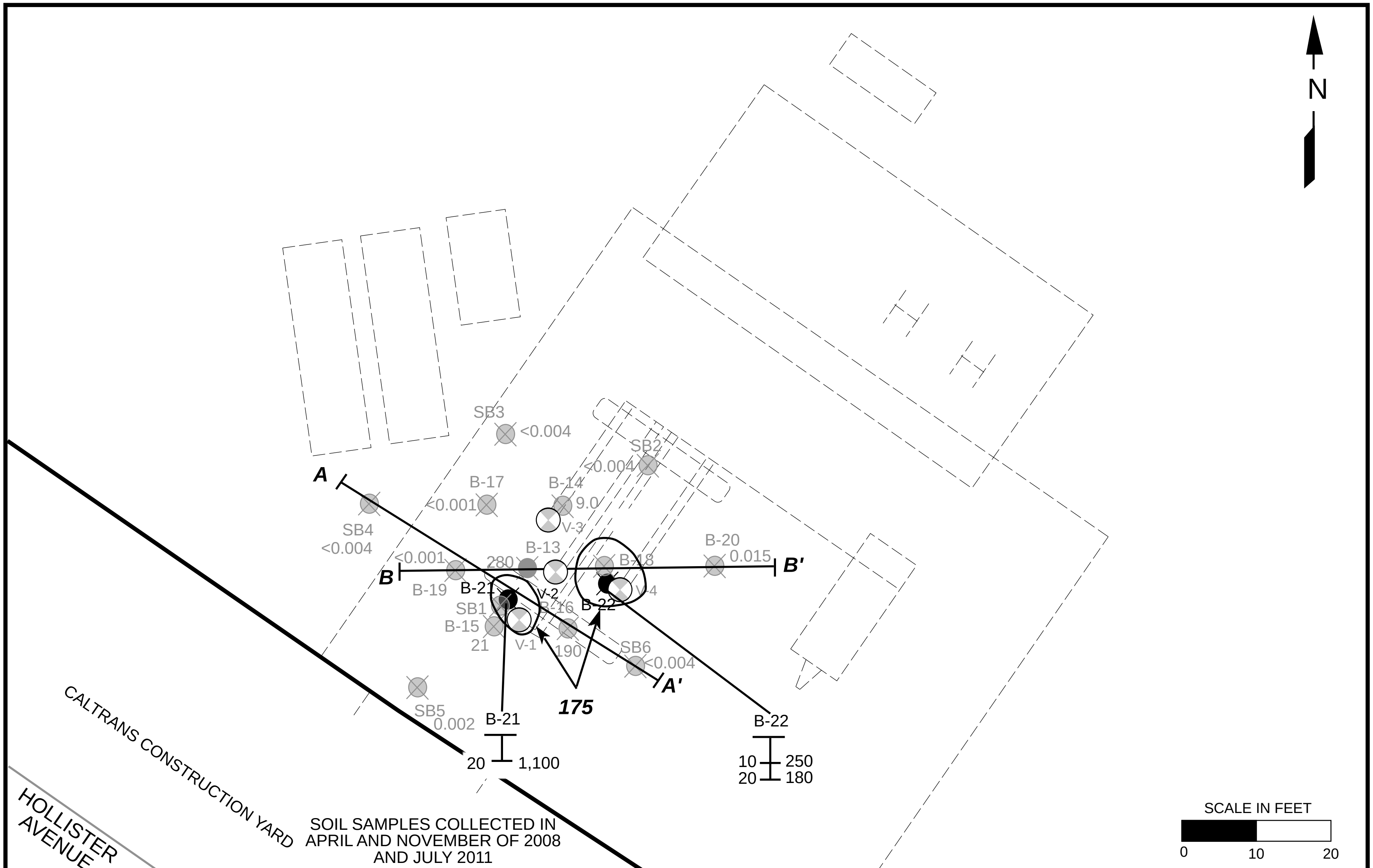
100 CONTOUR OF POST-REMEDIATION TPH AS GASOLINE CONCENTRATIONS ABOVE FPD SIL (mg/kg)

TD = X' ← TOTAL BORING DEPTH

FORMER SERVICE STATION #9-4268
7952 HOLLISTER AVENUE
GOLETA, CALIFORNIA
FIGURE 7 - GEOLOGIC CROSS-SECTION
B_1-B'_1
SHOWING POST-REMEDIATION TPH AS GASOLINE CONCENTRATIONS ABOVE FPD SIL

HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: OCTOBER 5, 2011:MGH



EXPLANATION

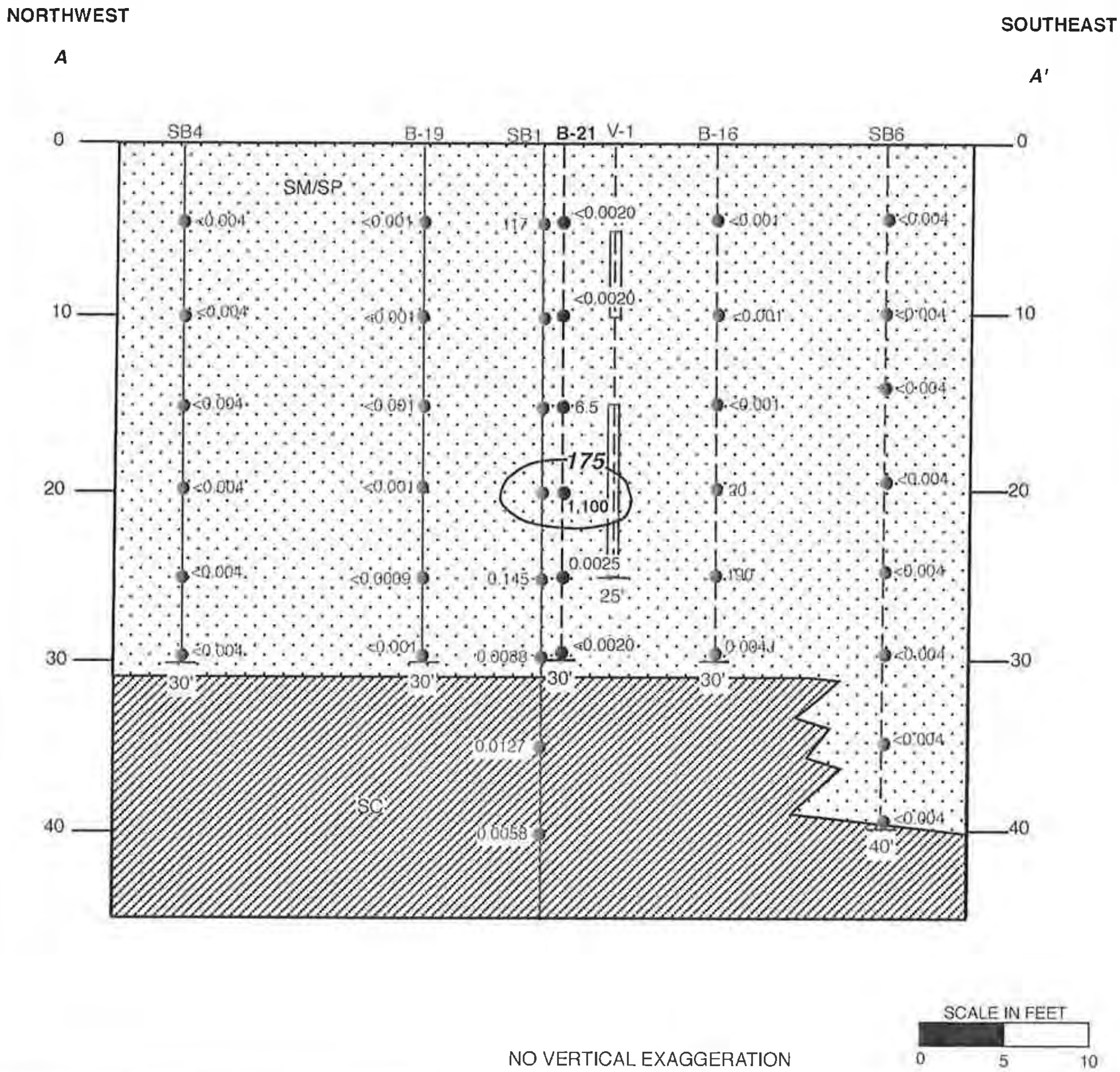
- PRE-REMEDIATION SOIL BORING
- SOIL VAPOR EXTRACTION WELL
- VERIFICATION BORING
- LINE OF CROSS SECTION
- **175** CONTOUR OF XYLENE CONCENTRATIONS ABOVE FPD SIL (mg/kg)
- # ┴ # DEPTH OF SOIL SAMPLE (fbg) AND XYLENE CONCENTRATION ABOVE FPD SIL (mg/kg)
- # PRE-REMEDIATION, CONTOUR-DEFINING RESULT (mg/kg)

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY

FORMER SERVICE STATION #9-4268
7952 HOLLISTER AVENUE
GOLETA, CALIFORNIA
FIGURE 8 - POST-REMEDIATION XYLENE CONCENTRATIONS IN SOIL

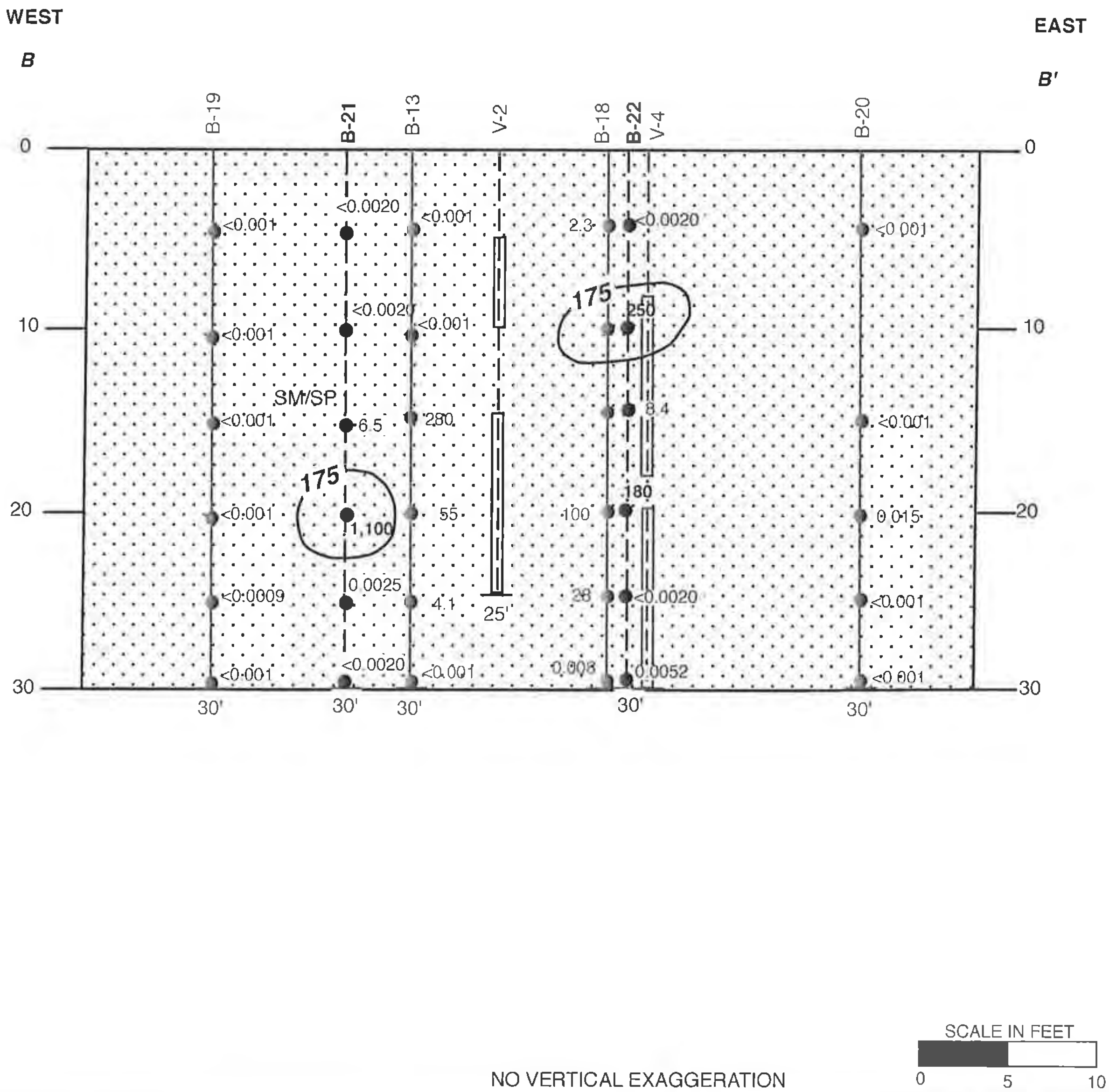
HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: OCTOBER 14, 2011:MGH



EXPLANATION	CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
B-19 ← BORING/WELL DESIGNATION; ← BORING/WELL (DASHED WHERE PROJECTED); # ← XYLENE CONCENTRATION IN SOIL SAMPLE (mg/kg) GRAY = PRE-REMEDIATION, BLACK = POST-REMEDIATION; ← SVE WELL SCREEN INTERVAL; TD = X' ← TOTAL BORING DEPTH; SAND (SM/SP); CLAYEY SAND (SC); 175 CONTOUR OF POST-REMEDIATION XYLENE CONCENTRATIONS ABOVE FPD SIL (mg/kg)	FORMER SERVICE STATION #9-4268 7952 HOLLISTER AVENUE GOLETA, CALIFORNIA FIGURE 6 - GEOLOGIC CROSS-SECTION A_2-A'_2 SHOWING POST-REMEDIATION XYLENE CONCENTRATIONS ABOVE FPD SIL
	HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: OCTOBER 5, 2011:MGH



EXPLANATION

B-19 ← BORING/WELL DESIGNATION

BORING/WELL (DASHED WHERE PROJECTED)

XYLENE CONCENTRATION IN SOIL SAMPLE (mg/kg) GRAY = PRE-REMEDIATION, BLACK = POST-REMEDIATION

PERFORATED WELL INTERVAL

DEPTH OF WELL

TD = X' ← TOTAL BORING DEPTH

SAND (SM/SP)

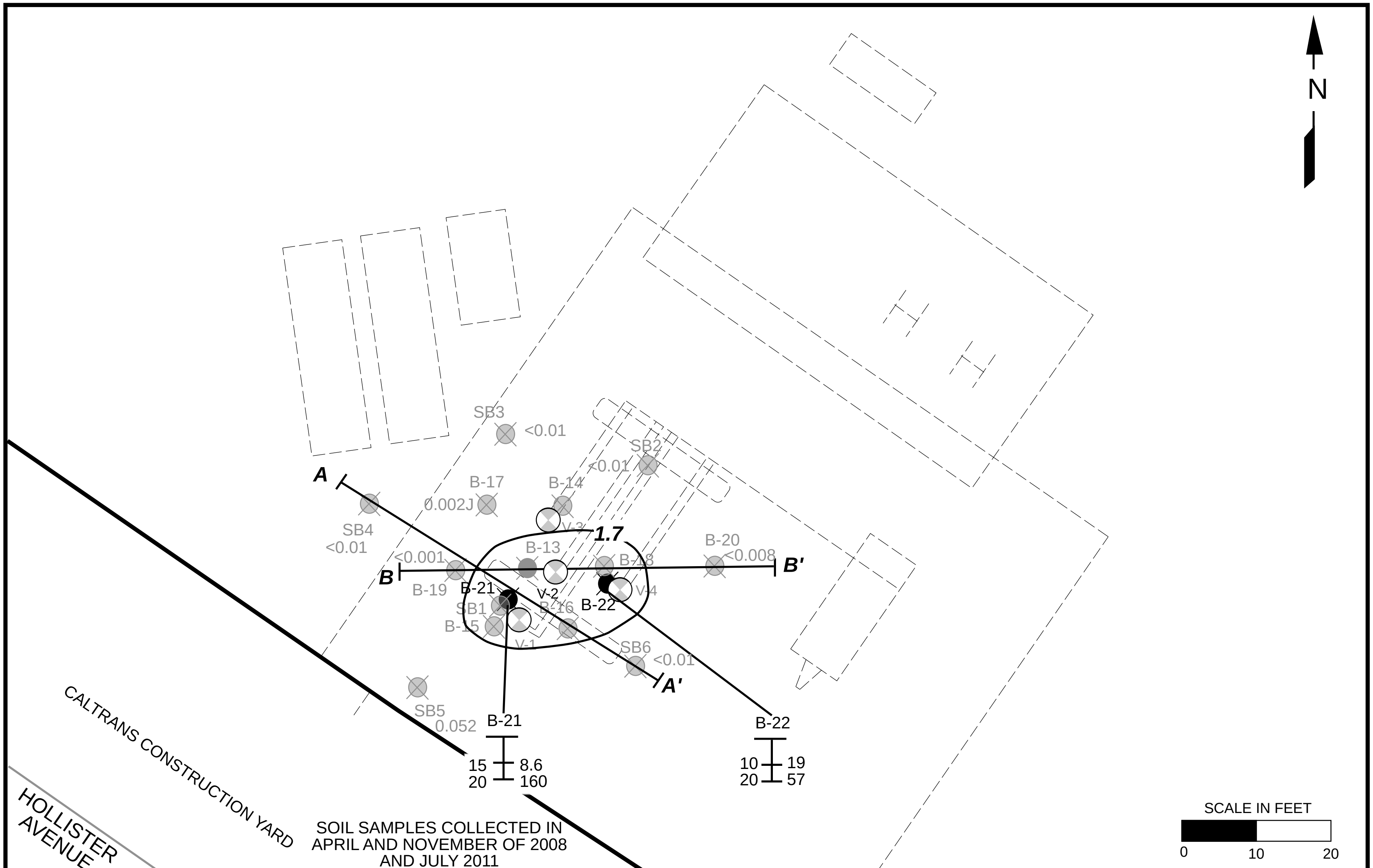
175 CONTOUR OF POST-REMEDIATION XYLENE CONCENTRATIONS ABOVE FPD SIL (mg/kg)

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY

FORMER SERVICE STATION #9-4268
7952 HOLLISTER AVENUE
GOLETA, CALIFORNIA
FIGURE 10-GEOLOGIC CROSS-SECTION
B_2–B'_2
SHOWING POST-REMEDIATION XYLENE CONCENTRATIONS ABOVE FPD SIL

HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: OCTOBER 5, 2011:MGH



EXPLANATION

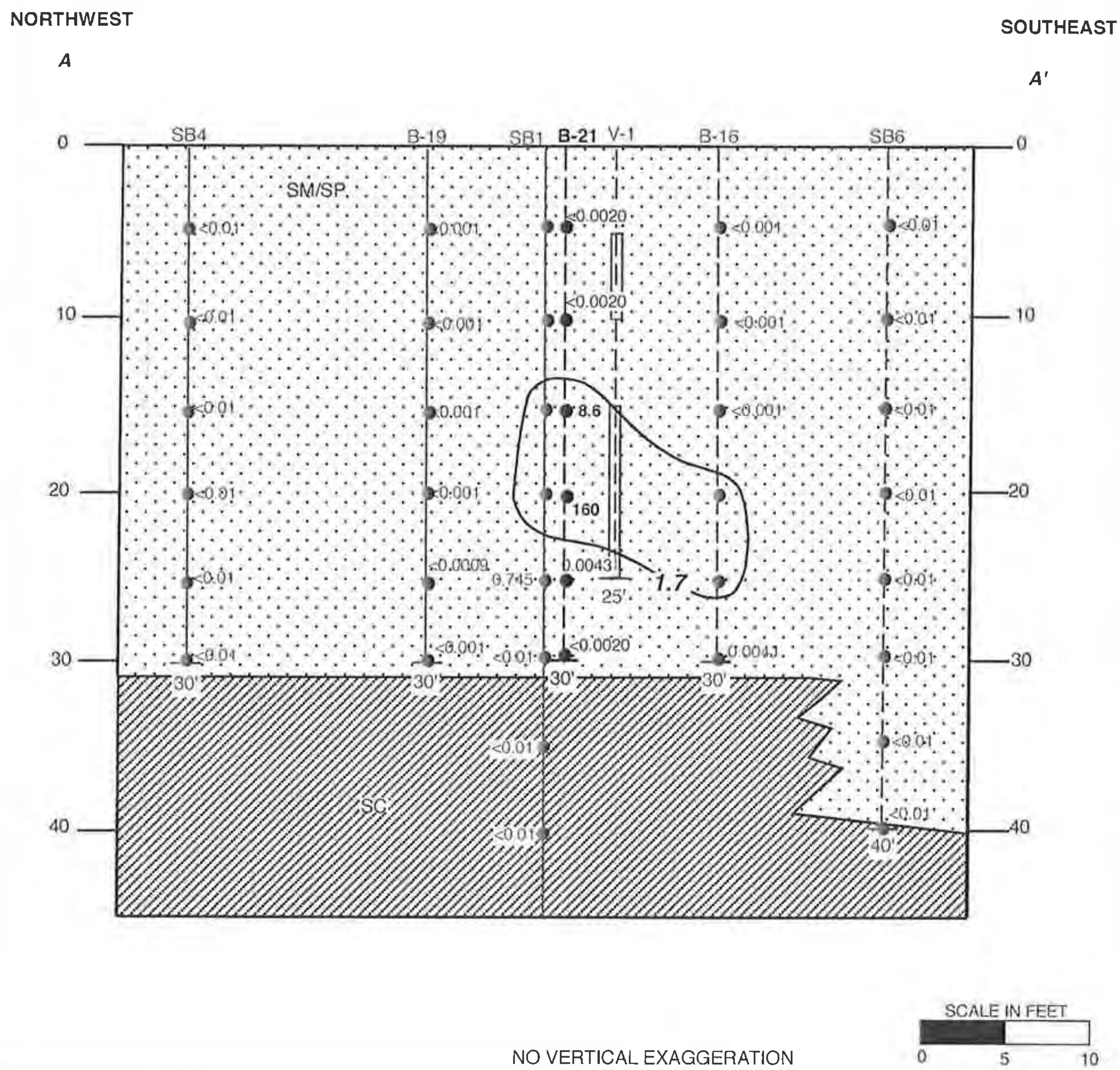
Symbol	Description	Symbol	Description
	PRE-REMEDIATION SOIL BORING	1.7	CONTOUR OF NAPHTHALENE CONCENTRATIONS ABOVE FPD SIL (mg/kg)
	SOIL VAPOR EXTRACTION WELL	# #	DEPTH OF SOIL SAMPLE (fbg) AND NAPHTHALENE CONCENTRATION ABOVE FPD SIL (mg/kg)
	VERIFICATION BORING		
	LINE OF CROSS SECTION	#	PRE-REMEDIATION, CONTOUR-DEFINING RESULT (mg/kg)

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY

FORMER SERVICE STATION #9-4268
7952 HOLLISTER AVENUE
GOLETA, CALIFORNIA
FIGURE 11 - POST-REMEDIATION NAPHTHALENE CONCENTRATIONS IN SOIL

HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: OCTOBER 14, 2011:MGH



EXPLANATION

B-19 ← BORING/WELL DESIGNATION

← BORING/WELL (DASHED WHERE PROJECTED)

\# ← NAPHTHALENE CONCENTRATION IN SOIL SAMPLE (mg/kg) GRAY = PRE-REMEDIATION, BLACK = POST-REMEDIATION

← SVE WELL SCREEN INTERVAL

TD = X' ← TOTAL BORING DEPTH

SAND (SM/SP)

CLAYEY SAND (SC)

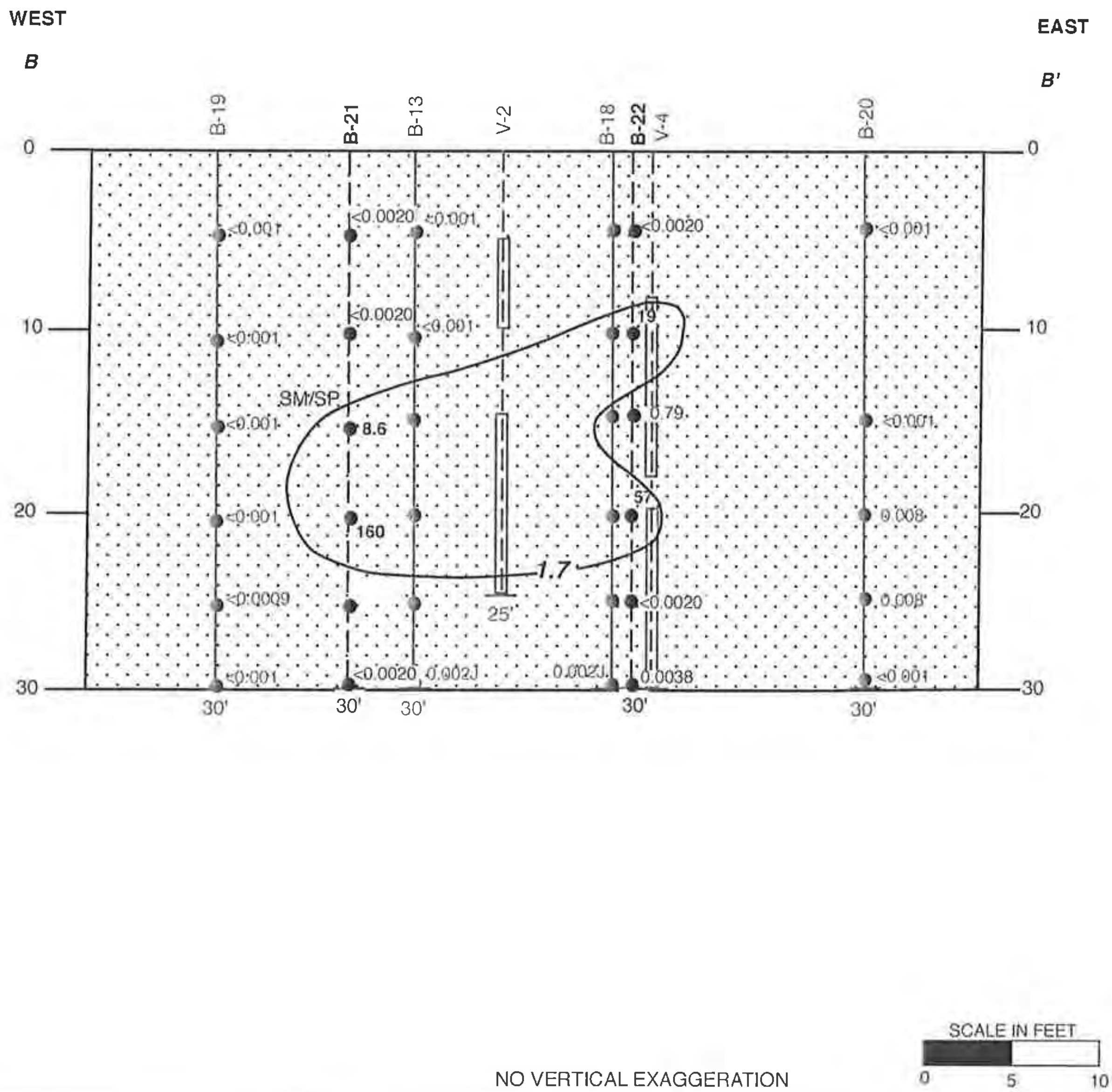
1.7 CONTOUR OF POST-REMEDIATION NAPHTHALENE CONCENTRATIONS ABOVE FPD SIL (mg/kg)

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY

FORMER SERVICE STATION #9-4268
7952 HOLLISTER AVENUE
GOLETA, CALIFORNIA
FIGURE 12 - GEOLOGIC CROSS-SECTION
A–A'
3 3
SHOWING POST-REMEDIATION NAPHTHALENE CONCENTRATIONS ABOVE FPD SIL

HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: OCTOBER 5, 2011:MGH



EXPLANATION

B-19 ← BORING/WELL DESIGNATION

← BORING/WELL (DASHED WHERE PROJECTED)

\# ← NAPHTHALENE CONCENTRATION IN SOIL SAMPLE (mg/kg) GRAY = PRE-REMEDIATION, BLACK = POST-REMEDIATION

← PERFORATED WELL INTERVAL

← DEPTH OF WELL

TD = X' ← TOTAL BORING DEPTH

SAND (SM/SP)

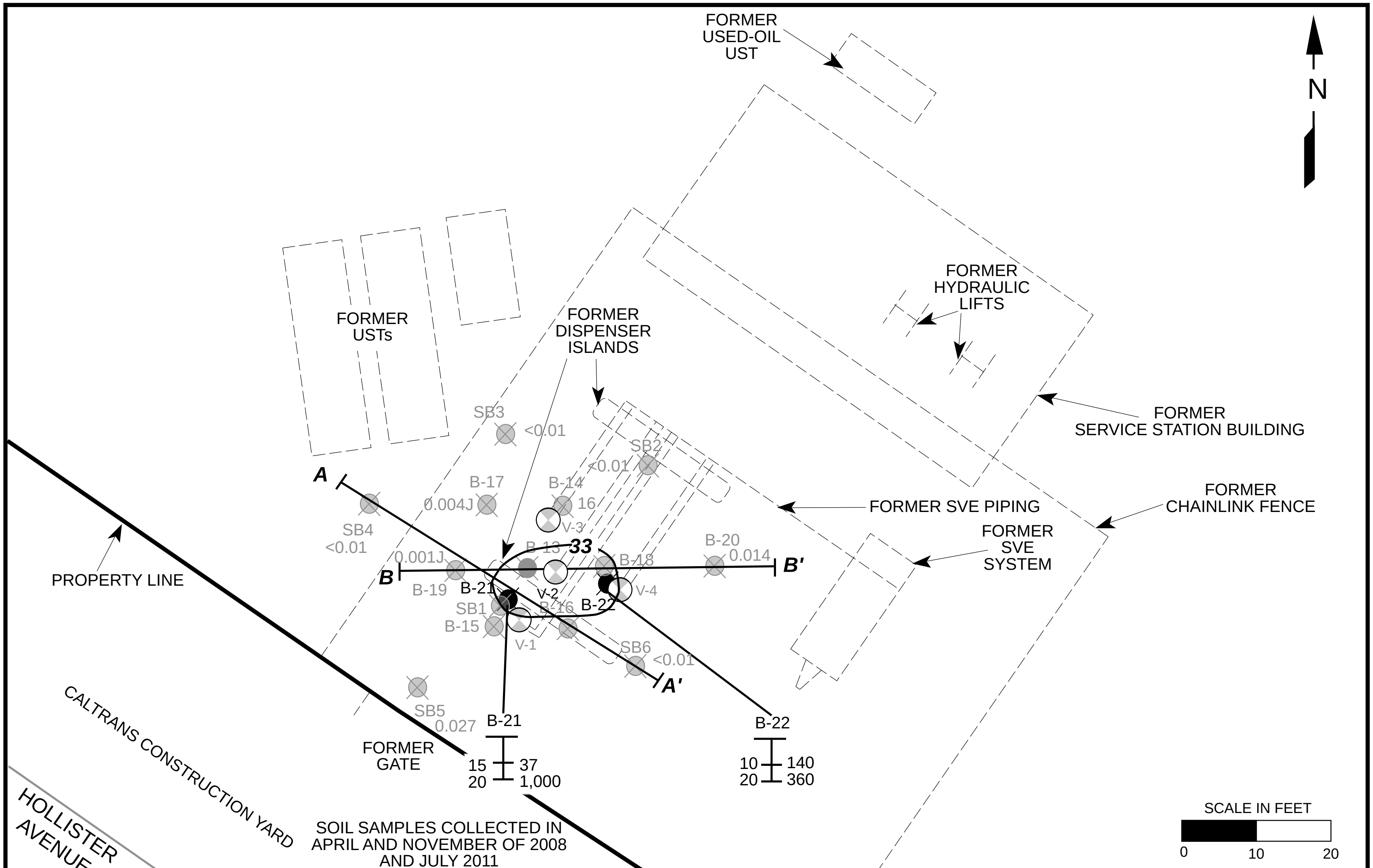
1.7 CONTOUR OF POST-REMEDIATION NAPHTHALENE CONCENTRATIONS ABOVE FPD SIL (mg/kg)

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY

FORMER SERVICE STATION #9-4268
7952 HOLLISTER AVENUE
GOLETA, CALIFORNIA
FIGURE 13 - GEOLOGIC CROSS-SECTION
B-B' 3
SHOWING POST-REMEDIATION NAPHTHALENE CONCENTRATIONS ABOVE FPD SIL

HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: OCTOBER 5, 2011:MGH



EXPLANATION

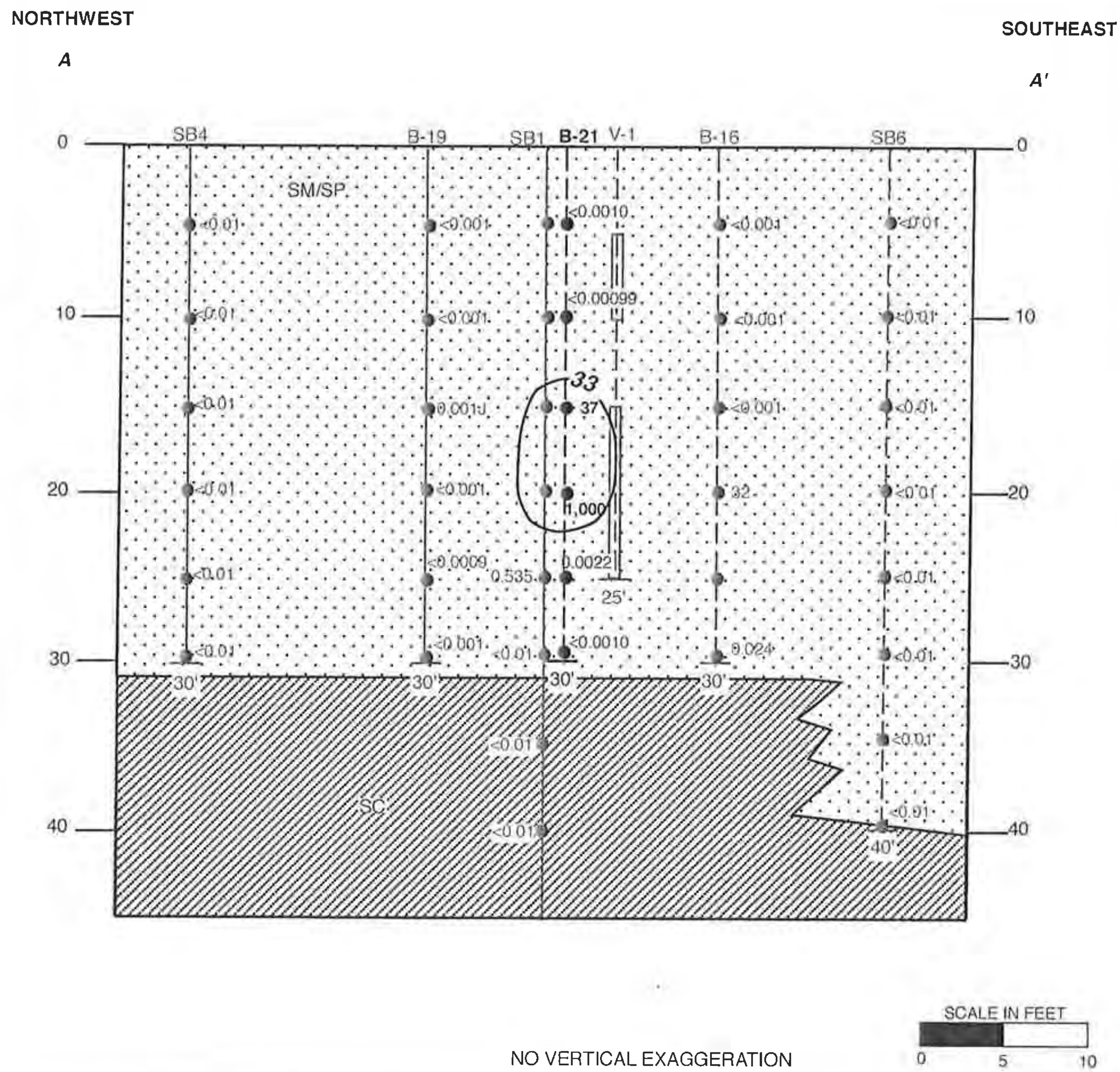
- PRE-REMEDIATION SOIL BORING
- SOIL VAPOR EXTRACTION WELL
- VERIFICATION BORING
- LINE OF CROSS SECTION
- **33** CONTOUR OF 1,2,4-TRIMETHYLBENZENE CONCENTRATIONS ABOVE FPD SIL (mg/kg)
- # ┼ # DEPTH OF SOIL SAMPLE (fbg) AND 1,2,4-TRIMETHYLBENZENE CONCENTRATION ABOVE FPD SIL (mg/kg)
- # PRE-REMEDIATION, CONTOUR-DEFINING RESULT (mg/kg)

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY

FORMER SERVICE STATION #9-4268
7952 HOLLISTER AVENUE
GOLETA, CALIFORNIA
FIGURE 14 - POST-REMEDIATION
1,2,4-TRIMETHYLBENZENE CONCENTRATIONS IN SOIL

HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: NOVEMBER 11, 2011:MGH



EXPLANATION

B-19 ← BORING/WELL DESIGNATION

← BORING/WELL (DASHED WHERE PROJECTED)

← 1,2,4-TRIMETHYLBENZENE CONCENTRATION IN SOIL SAMPLE (mg/kg) GRAY = PRE-REMEDIATION, BLACK = POST-REMEDIATION

← SVE WELL SCREEN INTERVAL

TD = X' ← TOTAL BORING DEPTH

SAND (SM/SP)

CLAYEY SAND (SC)

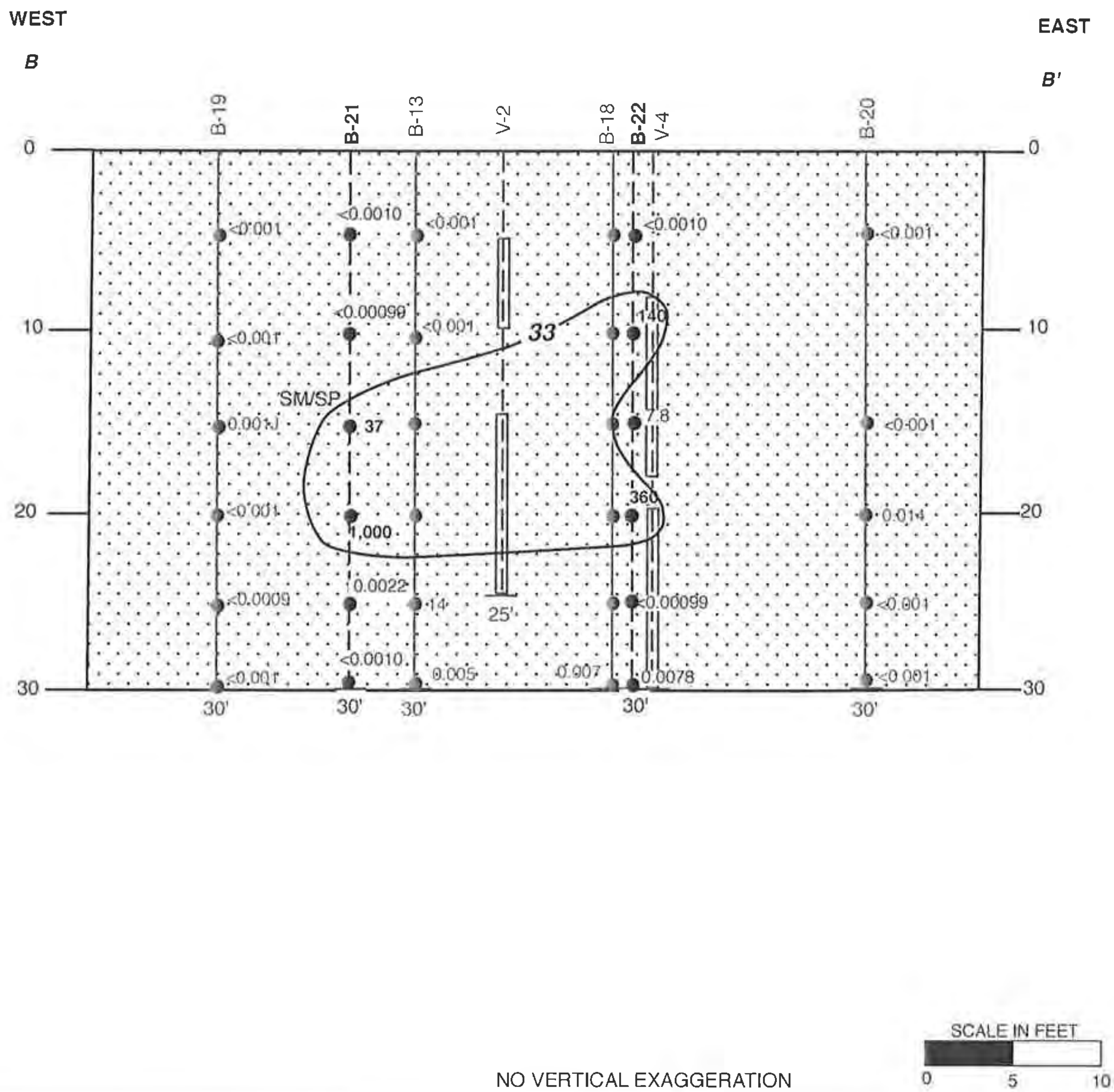
33 CONTOUR OF POST-REMEDIATION 1,2,4-TRIMETHYLBENZENE CONCENTRATIONS ABOVE FPD SIL (mg/kg)

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY

FORMER SERVICE STATION #9-4268
7952 HOLLISTER AVENUE
GOLETA, CALIFORNIA
FIGURE 15 - GEOLOGIC CROSS-SECTION
A_4-A'_4
SHOWING POST-REMEDIATION
1,2,4-TRIMETHYLBENZENE CONCENTRATIONS
ABOVE FPD SIL

HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: OCTOBER 5, 2011:MGH



EXPLANATION

B-19 ← BORING/WELL DESIGNATION

SAND (SM/SP)

← BORING/WELL (DASHED WHERE PROJECTED)

\# ● ← 1,2,4-TRIMETHYLBENZENE CONCENTRATION IN SOIL SAMPLE (mg/kg) GRAY = PRE-REMEDIATION, BLACK = POST-REMEDIATION

← PERFORATED WELL INTERVAL

← DEPTH OF WELL

33 — CONTOUR OF POST-REMEDIATION 1,2,4-TRIMETHYLBENZENE CONCENTRATIONS ABOVE FPD SIL (mg/kg)

TD = X' ← TOTAL BORING DEPTH

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY

FORMER SERVICE STATION #9-4268
7952 HOLLISTER AVENUE
GOLETA, CALIFORNIA
FIGURE 16 - GEOLOGIC CROSS-SECTION
B–B'
4 4
SHOWING POST-REMEDIATION
1,2,4-TRIMETHYLBENZENE CONCENTRATIONS
ABOVE FPD SIL

HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: OCTOBER 5, 2011:MGH

TABLES

TABLE 1.
SUMMARY OF SOIL SAMPLE ANALYTICAL RESULTS
CHEVRON FORMER SERVICE STATION #9-4268, GOLETA, CALIFORNIA

SAMPLE SOURCE	DATE SAMPLED	DEPTH (fbg)	SAMPLE ID	TPH AS GASOLINE (mg/kg)	BENZENE (mg/kg)	TOLUENE (mg/kg)	ETHYL-BENZENE (mg/kg)	TOTAL XYLENES (mg/kg)	MTBE (mg/kg)	TBA (mg/kg)	DIPE (mg/kg)	ETBE (mg/kg)	TAME (mg/kg)	REF
EPA ANALYTICAL METHOD				8015/8015B	8260B									N/A
FPD SIL/ESL				100	0.1	15	30	175	0.050	0.120	*	*	*	N/A
PRE-REMEDIATION														
B-13	11-20-08	5	B-13-S-5-081120	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.020	<0.001	<0.001	<0.001	A
	11-20-08	10	B-13-S-10-081120	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.020	<0.001	<0.001	<0.001	A
	11-20-08	15	B-13-S-15-081120	8,200	0.20J	24	30	280	<0.053	<2.1	<0.11	<0.11	<0.11	A
	11-20-08	20	B-13-S-20-081120	950	0.085J	5.8	6.5	55	<0.025	<0.98	<0.049	<0.049	<0.049	A
	11-20-08	25	B-13-S-25-081120	110	<0.026	0.17J	0.48	4.1	<0.026	<1.0	<0.052	<0.052	<0.052	A
	11-20-08	30	B-13-S-30-081120	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.019	<0.001	<0.001	<0.001	A
B-14	11-20-08	5	B-14-S-5-081120	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.021	<0.001	<0.001	<0.001	A
	11-20-08	10	B-14-S-10-081120	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.020	<0.001	<0.001	<0.001	A
	11-20-08	15	B-14-S-15-081120	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.021	<0.001	<0.001	<0.001	A
	11-20-08	20	B-14-S-20-081120	93	<0.023	0.38	1.3	9.0	<0.023	<0.94	<0.047	<0.047	<0.047	A
	11-20-08	25	B-14-S-25-081120	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.019	<0.001	<0.001	<0.001	A
	11-20-08	30	B-14-S-30-081120	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.020	<0.001	<0.001	<0.001	A
B-15	11-20-08	5	B-15-S-5-081120	<2.0	<0.0005	<0.0009	<0.0009	<0.0009	<0.0005	<0.019	<0.0009	<0.0009	<0.0009	A
	11-20-08	10	B-15-S-10-081120	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.021	<0.001	<0.001	<0.001	A
	11-20-08	15	B-15-S-15-081120	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.020	<0.001	<0.001	<0.001	A
	11-20-08	20	B-15-S-20-081120	270	<0.023	0.95	2.5	21	<0.023	<0.91	<0.046	<0.046	<0.046	A
	11-20-08	25	B-15-S-25-081120	42	<0.025	<0.05	0.060J	0.90	<0.025	<1.0	<0.050	<0.050	<0.050	A
	11-20-08	30	B-15-S-30-081120	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.020	<0.001	<0.001	<0.001	A
B-16	11-20-08	5	B-16-S-5-081120	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.020	<0.001	<0.001	<0.001	A
	11-21-08	10	B-16-S-10-081121	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.020	<0.001	<0.001	<0.001	A
	11-21-08	15	B-16-S-15-081121	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.020	<0.001	<0.001	<0.001	A
	11-21-08	20	B-16-S-20-081121	440	<0.027	0.78	2.0	20	<0.027	<1.1	<0.054	<0.054	<0.054	A
	11-21-08	25	B-16-S-25-081121	1,700	<0.047	12	22	190	<0.047	<1.9	<0.093	<0.093	<0.093	A
	11-21-08	30	B-16-S-30-081121	<0.2	<0.0005	<0.001	<0.001	0.009	<0.0005	<0.021	<0.001	<0.001	<0.001	A

TABLE 1.
SUMMARY OF SOIL SAMPLE ANALYTICAL RESULTS
CHEVRON FORMER SERVICE STATION #9-4268, GOLETA, CALIFORNIA

SAMPLE SOURCE	DATE SAMPLED	DEPTH (fbg)	SAMPLE ID	TPH AS GASOLINE (mg/kg)	BENZENE (mg/kg)	TOLUENE (mg/kg)	ETHYL-BENZENE (mg/kg)	TOTAL XYLENES (mg/kg)	MTBE (mg/kg)	TBA (mg/kg)	DIPE (mg/kg)	ETBE (mg/kg)	TAME (mg/kg)	REF
EPA ANALYTICAL METHOD				8015/8015B	8260B									N/A
FPD SIL/ESL				100	0.1	15	30	175	0.050	0.120	*	*	*	N/A
B-17	11-20-08	5	B-17-S-5-081120	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.019	<0.001	<0.001	<0.001	A
	11-21-08	10	B-17-S-10-081121	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.020	<0.001	<0.001	<0.001	A
	11-21-08	15	B-17-S-15-081121	<0.2	<0.0005	<0.0009	<0.0009	<0.0009	<0.0005	<0.019	<0.0009	<0.0009	<0.0009	A
	11-21-08	20	B-17-S-20-081121	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.019	<0.001	<0.001	<0.001	A
	11-21-08	25	B-17-S-25-081121	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.020	<0.001	<0.001	<0.001	A
	11-21-08	30	B-17-S-30-081121	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.020	<0.001	<0.001	<0.001	A
B-18	11-21-08	5	B-18-S-5-081121	85	<0.026	<0.052	<0.052	2.3	<0.026	<1.0	<0.052	<0.052	<0.052	A
	11-21-08	10	B-18-S-10-081121	5,600	51	570	160	1,100	0.28J	<9.9	<0.5	<0.5	<0.5	A
	11-21-08	15	B-18-S-15-081121	3,500	52	630	170	1,200	0.28J	<10	<0.51	<0.51	<0.51	A
	11-21-08	20	B-18-S-20-081121	500	0.39	13	11	100	<0.024	<0.96	<0.048	<0.048	<0.048	A
	11-21-08	25	B-18-S-25-081121	400	<0.026	2.7	3.3	28	<0.026	<1.0	<0.052	<0.052	<0.052	A
	11-21-08	30	B-18-S-30-081121	0.2J	<0.0005	0.002J	<0.001	0.008	<0.0005	<0.021	<0.001	<0.001	<0.001	A
B-19	11-21-08	5	B-19-S-5-081121	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.020	<0.001	<0.001	<0.001	A
	11-21-08	10	B-19-S-10-081121	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.020	<0.001	<0.001	<0.001	A
	11-21-08	15	B-19-S-15-081121	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.020	<0.001	<0.001	<0.001	A
	11-21-08	20	B-19-S-20-081121	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.019	<0.001	<0.001	<0.001	A
	11-21-08	25	B-19-S-25-081121	<0.2	<0.0005	<0.0009	<0.0009	<0.0009	<0.0005	<0.018	<0.0009	<0.0009	<0.0009	A
	11-21-08	30	B-19-S-30-081121	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.022	<0.001	<0.001	<0.001	A
B-20	11-21-08	5	B-20-S-5-081121	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.020	<0.001	<0.001	<0.001	A
	11-21-08	15	B-20-S-15-081121	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.020	<0.001	<0.001	<0.001	A
	11-21-08	20	B-20-S-20-081121	0.7J	<0.0005	0.004J	0.001J	0.015	<0.0005	<0.020	<0.001	<0.001	<0.001	A
	11-21-08	25	B-20-S-25-081121	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.020	<0.001	<0.001	<0.001	A
	11-21-08	30	B-20-S-30-081121	<0.2	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.020	<0.001	<0.001	<0.001	A
POST-REMEDIATION														
B-21	7-22-11	5	B-21-S-5-110722	<0.37	<0.0010	<0.0010	<0.0010	<0.0020	<0.0020	--	--	--	--	B
	7-22-11	10	B-21-S-10-110722	<0.39	<0.0099	<0.0099	<0.0099	<0.0020	<0.0020	--	--	--	--	B
	7-22-11	15	B-21-S-15-110722	530	<0.20	0.20	0.34	6.5	<0.50	--	--	--	--	B
	7-22-11	20	B-21-S-20-110722	2,800	<10	78	130	1,100	<25	--	--	--	--	B
	7-22-11	25	B-21-S-25-110722	<0.38	<0.0010	<0.0010	<0.0010	0.0025	<0.0020	--	--	--	--	B
	7-22-11	30	B-21-S-30-110722	<0.38	<0.0010	<0.0010	<0.0010	<0.0020	<0.0020	--	--	--	--	B

TABLE 1.
SUMMARY OF SOIL SAMPLE ANALYTICAL RESULTS
CHEVRON FORMER SERVICE STATION #9-4268, GOLETA, CALIFORNIA

SAMPLE SOURCE	DATE SAMPLED	DEPTH (fbg)	SAMPLE ID	TPH AS GASOLINE (mg/kg)	BENZENE (mg/kg)	TOLUENE (mg/kg)	ETHYL-BENZENE (mg/kg)	TOTAL XYLENES (mg/kg)	MTBE (mg/kg)	TBA (mg/kg)	DIPE (mg/kg)	ETBE (mg/kg)	TAME (mg/kg)	REF
EPA ANALYTICAL METHOD				8015/8015B	8260B									N/A
FPD SIL/ESL				100	0.1	15	30	175	0.050	0.120	*	*	*	N/A
B-22	7-22-11	5	B-22-S-5-110722	<0.38	<0.0010	<0.0010	<0.0010	<0.0020	<0.0020	--	--	--	--	B
	7-22-11	10	B-22-S-10-110722	1,400	<1.0	5.6	28	250	<2.5	--	--	--	--	B
	7-22-11	15	B-22-S-15-110722	430	<0.20	0.92	0.63	8.4	<0.49	--	--	--	--	B
	7-22-11	20	B-22-S-20-110722	830	<4.9	<4.9	19	180	<12	--	--	--	--	B
	7-22-11	25	B-22-S-25-110722	<0.38	<0.00099	<0.00099	<0.00099	<0.0020	<0.0020	--	--	--	--	B
	7-22-11	30	B-22-S-30-110722	43	<0.00099	<0.00099	<0.00099	0.0052	<0.0020	--	--	--	--	B

* = not established. <# = not detected at the reporting or detection limit indicated. -- = not analyzed. [grey] = pre-remediation.

[yellow] = concentration above FPD SIL.

A = Holguin, Fahan & Associates, Inc.'s (HFA's) report dated February 18, 2009.

B = HFA's report dated December 20, 2011.

TABLE 2.
SUMMARY OF ADDITIONAL SOIL SAMPLE ANALYTICAL RESULTS
CHEVRON FORMER SERVICE STATION #9-4268, GOLETA, CALIFORNIA

SAMPLE SOURCE	DATE SAMPLED	DEPTH (fbg)	SAMPLE ID	EDB (mg/kg)	EDC (mg/kg)	N-BUTYLBENZENE (mg/kg)	SEC-BUTYLBENZENE (mg/kg)	TERT-BUTYLBENZENE (mg/kg)	NAPHTHALENE (mg/kg)	ISOPROPYLBENZENE (mg/kg)	N-PROPYLBENZENE (mg/kg)	1,2,4-TRIMETHYLBENZENE (mg/kg)	1,3,5-TRIMETHYLBENZENE (mg/kg)	REF
FPD SIL/ESL				0.0005	0.005	26	26	26	1.7	77	26	33	21	N/A
EPA ANALYTICAL METHOD				8260B										N/A
PRE-REMEDIATION														
B-13	11-20-08	5	B-13-S-5-081120	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
	11-20-08	10	B-13-S-10-081120	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
	11-20-08	15	B-13-S-15-081120	<0.11	<0.11	13	3.7	0.35J	20	6.1	24	230	77	A
	11-20-08	20	B-13-S-20-081120	<0.049	<0.049	6.8	1.6	<0.049	18	1.4	6.8	93	28	A
	11-20-08	25	B-13-S-25-081120	<0.052	<0.052	1.2	0.29	<0.052	3.7	0.18J	1.1	14	4.6	A
	11-20-08	30	B-13-S-30-081120	<0.001	<0.001	<0.001	<0.001	<0.001	0.002J	<0.001	<0.001	0.005	0.002J	A
B-14	11-20-08	5	B-14-S-5-081120	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001J	<0.001	A
	11-20-08	10	B-14-S-10-081120	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
	11-20-08	15	B-14-S-15-081120	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
	11-20-08	20	B-14-S-20-081120	<0.047	<0.047	1.4	0.41	<0.047	3.0	0.39	1.7	16	5.3	A
	11-20-08	25	B-14-S-25-081120	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
	11-20-08	30	B-14-S-30-081120	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
B-15	11-20-08	5	B-15-S-5-081120	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	A
	11-20-08	10	B-15-S-10-081120	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
	11-20-08	15	B-15-S-15-081120	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
	11-20-08	20	B-15-S-20-081120	<0.046	<0.046	2.8	0.65	<0.046	11	0.62	3.0	37	11	A
	11-20-08	25	B-15-S-25-081120	<0.050	<0.050	0.93	0.15J	<0.050	3.6	<0.050	0.26	6.3	2.2	A
	11-20-08	30	B-15-S-30-081120	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
B-16	11-20-08	5	B-16-S-5-081120	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
	11-21-08	10	B-16-S-10-081121	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
	11-21-08	15	B-16-S-15-081121	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
	11-21-08	20	B-16-S-20-081121	<0.054	<0.054	1.8	0.5	<0.054	5.1	0.61	2.9	32	9.6	A
	11-21-08	25	B-16-S-25-081121	<0.093	<0.093	42	8.1	0.90	93	5.9	34	520	130	A
	11-21-08	30	B-16-S-30-081121	<0.001	<0.001	0.002J	<0.001	<0.001	0.004J	<0.001	0.001J	0.024	0.007	A
B-17	11-20-08	5	B-17-S-5-081120	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003J	0.001J	A
	11-21-08	10	B-17-S-10-081121	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
	11-21-08	15	B-17-S-15-081121	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	0.002J	<0.0009	<0.0009	0.004J	0.001J	A
	11-21-08	20	B-17-S-20-081121	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
	11-21-08	25	B-17-S-25-081121	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
	11-21-08	30	B-17-S-30-081121	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
B-18	11-21-08	5	B-18-S-5-081121	<0.052	<0.052	0.74	<0.052	<0.052	6.4	<0.052	<0.052	38	18	A
	11-21-08	10	B-18-S-10-081121	0.95J	<0.50	19	5.9	0.83J	43	15	56	390	130	A
	11-21-08	15	B-18-S-15-081121	0.94J	<0.51	19	5.9	0.82J	41	15	57	420	130	A
	11-21-08	20	B-18-S-20-081121	0.056J	<0.048	4.2	1.3	0.20J	8.6	2.1	8.5	100	31	A
	11-21-08	25	B-18-S-25-081121	<0.052	<0.052	3.1	0.97	<0.052	5.4	0.88	5.2	62	19	A
	11-21-08	30	B-18-S-30-081121	<0.001	<0.001	<0.001	<0.001	<0.001	0.002J	<0.001	<0.001	0.007	0.002J	A
B-19	11-21-08	5	B-19-S-5-081121	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
	11-21-08	10	B-19-S-10-081121	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
	11-21-08	15	B-19-S-15-081121	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001J	<0.001	A
	11-21-08	20	B-19-S-20-081121	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
	11-21-08	25	B-19-S-25-081121	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009	A
	11-21-08	30	B-19-S-30-081121	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A

TABLE 2.
SUMMARY OF ADDITIONAL SOIL SAMPLE ANALYTICAL RESULTS
CHEVRON FORMER SERVICE STATION #9-4268, GOLETA, CALIFORNIA

SAMPLE SOURCE	DATE SAMPLED	DEPTH (fbg)	SAMPLE ID	EDB (mg/kg)	EDC (mg/kg)	N-BUTYLBENZENE (mg/kg)	SEC-BUTYLBENZENE (mg/kg)	TERT-BUTYLBENZENE (mg/kg)	NAPHTHALENE (mg/kg)	ISOPROPYLBENZENE (mg/kg)	N-PROPYLBENZENE (mg/kg)	1,2,4-TRIMETHYLBENZENE (mg/kg)	1,3,5-TRIMETHYLBENZENE (mg/kg)	REF
FPD SIL/ESL				0.0005	0.005	26	26	26	1.7	77	26	33	21	N/A
EPA ANALYTICAL METHOD				8260B										N/A
B-20	11-21-08	5	B-20-S-5-081121	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
	11-21-08	15	B-20-S-15-081121	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
	11-21-08	20	B-20-S-20-081121	<0.001	<0.001	<0.001	<0.001	<0.001	0.008	<0.001	<0.001	0.014	0.004J	A
	11-21-08	25	B-20-S-25-081121	<0.001	<0.001	<0.001	<0.001	<0.001	0.008	<0.001	<0.001	<0.001	0.002J	A
	11-21-08	30	B-20-S-30-081121	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	A
POST-REMEDIATION														
B-21	7-22-11	5	B-21-S-5-110722	--	--	<0.0020	--	--	<0.0020	--	<0.0010	<0.0010	<0.0010	B
	7-22-11	10	B-21-S-10-110722	--	--	<0.0020	--	--	<0.0020	--	<0.00099	<0.00099	<0.00099	B
	7-22-11	15	B-21-S-15-110722	--	--	<0.50	--	--	8.6	--	2.3	37	13	B
	7-22-11	20	B-21-S-20-110722	--	--	82	--	--	160	--	120	1,000	330	B
	7-22-11	25	B-21-S-25-110722	--	--	<0.0020	--	--	0.0043	--	<0.0010	0.0022	0.0016	B
	7-22-11	30	B-21-S-30-110722	--	--	<0.0020	--	--	<0.0020	--	<0.0010	<0.0010	<0.0010	B
B-22	7-22-11	5	B-22-S-5-110722	--	--	<0.0020	--	--	<0.0020	--	<0.0010	<0.0010	<0.0010	B
	7-22-11	10	B-22-S-10-110722	--	--	<2.5	--	--	19	--	18	140	53	B
	7-22-11	15	B-22-S-15-110722	--	--	<0.49	--	--	0.79	--	0.63	7.8	3.1	B
	7-22-11	20	B-22-S-20-110722	--	--	<12	--	--	57	--	35	360	110	B
	7-22-11	25	B-22-S-25-110722	--	--	<0.0020	--	--	<0.0020	--	<0.00099	<0.00099	<0.00099	B
	7-22-11	30	B-22-S-30-110722	--	--	<0.0020	--	--	0.0038	--	<0.00099	0.0078	0.0020	B

<# = not detected at the reporting or detection limit indicated. -- = not analyzed. [grey] = pre-remediation. [yellow] = concentration above FPD SIL.
A = Holguin, Fahan & Associates, Inc.'s (HFA's) report dated February 18, 2009.
B = HFA's report dated December 20, 2011.

TABLE 3.
COMPARISON OF PRE-REMEDIATION AND POST-REMEDIATION RESULTS
CHEVRON FORMER SERVICE STATION #9-4268, GOLETA, CALIFORNIA

	PRE-REMEDIATION			POST-REMEDIATION			PRE-REMEDIATION			POST-REMEDIATION		
	SB1			B-21			B-18			B-22		
DEPTH (fbg)	TPH AS GASOLINE (mg/kg)	BENZENE (mg/kg)	NAPHTHALENE (mg/kg)	TPH AS GASOLINE (mg/kg)	BENZENE (mg/kg)	NAPHTHALENE (mg/kg)	TPH AS GASOLINE (mg/kg)	BENZENE (mg/kg)	NAPHTHALENE (mg/kg)	TPH AS GASOLINE (mg/kg)	BENZENE (mg/kg)	NAPHTHALENE (mg/kg)
5	3,470	220	35,000	<0.37	<0.0010	<0.0020	85	<0.026	6.4	<0.38	<0.0010	<0.0020
10	6,300	7,000	28,500	<0.39	<0.0099	<0.0020	5,600	51	43	1,400	<1.0	19
15	1,800	11,700	48,100	530	<0.20	8.6	3,500	52	41	430	<0.20	0.79
20	20,700	ND<2,000	82,000	2,800	<10	160	500	0.39	8.6	830	<4.9	57
25	51.6	ND<10	745	<0.38	<0.0010	0.0043	400	<0.026	5.4	<0.38	<0.00099	<0.0020
30	ND<0.5	ND<2	ND<10	<0.38	<0.0010	<0.0020	0.2J	<0.0005	0.002J	43	<0.00099	0.0038
35	ND<0.5	ND<2	ND<10	--	--	--	--	--	--	--	--	--
40	ND<0.5	ND<2	ND<10	--	--	--	--	--	--	--	--	--
50	ND<0.5	ND<2	ND<10	--	--	--	--	--	--	--	--	--
60	ND<0.5	ND<2	ND<10	--	--	--	--	--	--	--	--	--
70	ND<0.5	ND<2	ND<10	--	--	--	--	--	--	--	--	--
80	0.86	5	ND<10	--	--	--	--	--	--	--	--	--
90	ND<0.5	ND<2	ND<10	--	--	--	--	--	--	--	--	--
100	ND<0.5	ND<2	ND<10	--	--	--	--	--	--	--	--	--

ND<# = not detected at the reporting limit indicated. -- = not analyzed at depth.

TABLE 4.
ESTIMATE OF RESIDUAL MASS OF HYDROCARBONS IN SOIL
CHEVRON FORMER SERVICE STATION #9-4268, GOLETA, CALIFORNIA

The mass of residual hydrocarbons was calculated as follows:

$M(compound)_s = C_s P_b V_s$

where:

$M(compound)_s$ = Total mass in soil (kg);
C_s = Average concentration in soil (kg/kg) (post-remediation concentrations);
P_b = Bulk density of dry soil (kg/m^3); and
V_s = Volume of impacted soil (m^3).

TPH AS GASOLINE	
AVERAGE TPH AS GASOLINE CONCENTRATION C_s	
Average TPH as gasoline concentration 1,000 mg/kg contour	2,100
Average TPH as gasoline concentration 100 mg/kg contour	597
BULK DENSITY OF SOIL P_b	
Bulk dry density of soil interval P_b (kg/m^3)	1,750
VOLUME V_s	
Area of impact 1,000 mg/kg contour (feet^2)	60
Area of impact 100 mg/kg contour (feet^2)	224
Thickness of soil interval 1,000 mg/kg contour (feet)	5
Thickness of soil interval 100 mg/kg contour (feet)	12
Volume of soil interval (feet^3)	2,688
Volume of soil interval V_s (m^3)	76
Total mass of TPH as gasoline in soil M_s=$C_s P_b V_s$ (kg)	110.6

XYLENE	
AVERAGE XYLENE CONCENTRATION C_s	
Average Xylene concentration (mg/kg)	510
BULK DENSITY OF SOIL P_b	
Bulk dry density of soil interval P_b (kg/m^3)	1,750
VOLUME V_s	
Area of impact (feet^2)	92
Average Thickness of soil interval (feet)	5
Volume of soil interval (feet^3)	460
Volume of soil interval V_s (m^3)	13
Total mass of Xylene in soil M_s=$C_s P_b V_s$ (kg)	11.6

TABLE 4.
ESTIMATE OF RESIDUAL MASS OF HYDROCARBONS IN SOIL
CHEVRON FORMER SERVICE STATION #9-4268, GOLETA, CALIFORNIA

NAPHTHALENE	
AVERAGE NAPHTHALENE CONCENTRATION C_s	
Average Naphthalene concentration (mg/kg)	61
BULK DENSITY OF SOIL P_b	
Bulk dry density of soil interval P_b (kg/m^3)	1,750
VOLUME V_s	
Area of impact (feet^2)	256
Average Thickness of soil interval (feet)	7
Volume of soil interval (feet^3)	1,792
Volume of soil interval V_s (m^3)	51
Total mass of Naphthalene in soil $M_s=C_sP_bV_s$ (kg)	5.4

1,2,4-TRIMETHYLBENZENE	
AVERAGE 1,2,4-TRIMETHYLBENZENE CONCENTRATION C_s	
Average 1,2,4-Trimethylbenzene concentration (mg/kg)	500
BULK DENSITY OF SOIL P_b	
Bulk dry density of soil interval P_b (kg/m^3)	1,750
VOLUME V_s	
Area of impact (feet^2)	90
Average Thickness of soil interval (feet)	7
Volume of soil interval (feet^3)	630
Volume of soil interval V_s (m^3)	18
Total mass of 1,2,4-Trimethylbenzene in soil $M_s=C_sP_bV_s$ (kg)	15.6

1,3,5-TRIMETHYLBENZENE	
AVERAGE 1,3,5-TRIMETHYLBENZENE CONCENTRATION C_s	
Average 1,3,5-Trimethylbenzene concentration (mg/kg)	164
BULK DENSITY OF SOIL P_b	
Bulk dry density of soil interval P_b (kg/m^3)	1,750
VOLUME V_s	
Area of impact (feet^2)	90
Average Thickness of soil interval (feet)	7
Volume of soil interval (feet^3)	630
Volume of soil interval V_s (m^3)	18
Total mass of 1,3,5-Trimethylbenzene in soil $M_s=C_sP_bV_s$ (kg)	5.1

APPENDICES

APPENDIX 1.

AGENCY CORRESPONDENCE

Fire Department

"Serving the community since 1926"

HEADQUARTERS

4410 Cathedral Oaks Road
Santa Barbara, CA 93110-1042
(805) 681-5500 FAX: (805) 681-5553

Michael W. Dyer
Fire Chief
County Fire Warden

Christian J. Hahn
Deputy Fire Chief

February 21, 2012

Ms. Stephanie McKenna
Chevron EMC
6101 Bollinger Canyon Road
San Ramon, CA 94583

Crestfield Holdings
C/o Lamb & Kawakami, LLP
Attn: Ms. Namrata Dwivedi
333 South Grand Avenue, 42nd Floor
Los Angeles, CA 90071

Mr. Steve Wagner
City of Goleta
130 Cremona Drive, Suite B
Goleta, CA 93117

Received
FEB 24 2012
Holguin, Fahan & Assoc.

Dear Responsible Parties:

SUBJECT: Former Chevron Station #9-4268/ Future Fire Station #10
7952 Hollister Avenue, Goleta, California
LUFT Site #502421

The Santa Barbara County Fire Department, Fire Prevention Division (FPD) Leaking Underground Fuel Tank (LUFT) Program has reviewed the document prepared by your consultant, Holguin, Fahan & Associates, Inc., titled *Verification Soil Sampling Report and Mass Calculation of Residual Hydrocarbons (Report)*, dated December 20, 2011. The *Report* estimates that approximately 148 kilograms of residual contamination reside within 76 cubic meters of soil. The soil impacts are present from 10 to 20 feet below grade. Based upon the data, the soil vapor extraction system removed over 90% of the initial mass. The residual contamination consists of the less volatile constituents. The *Report* recommends case closure.

After careful review of the report and site file, FPD concurs that further corrective action is not warranted at this site. Please submit and case closure report and well abandonment workplan to FPD by **April 6, 2012**. If you have any questions regarding the aforementioned, please call me at (805) 686-8176. Written correspondence regarding this matter should be submitted to FPD at 1430 Mission drive, Solvang, CA 93463 or via facsimile at (805) 686-8183.

Sincerely,

Thomas M. Rejzek
Professional Geologist #6461
Certified Hydrogeologist #601
LUFT Program

pc: Mr. Mark Fahan, Holguin, Fahan & Associates, Inc., Ventura
Geotracker Database

502421 02_12

From: "Rejzek, Tom" <Tom.Rejzek@sbcfire.com>
Subject: **RE: Closure Summary Report Due Date Extension - Chevron 94268, 7952 Hollister Avenue, Goleta (FPD LUFT #502421)**
Date: March 30, 2012 11:46:06 AM PDT
To: 'Jeff Nobriga' <jeff_nobriga@hfa.com>
Cc: Stephanie McKenna <smckenna@chevron.com>, Mark Fahan <mark_fahan@hfa.com>, Todd McFarland <todd_mcfarland@hfa.com>

---

jeff- your extension request is granted.

Thomas Rejzek

Professional Geologist #6461

Certified Hydrogeologist #601

Santa Barbara County Fire Department

LUFT Program

1430 Mission Drive

Solvang, CA 93463

805-686-8176

tom.rejzek@sbcfire.com

From: Jeff Nobriga [mailto:jeff_nobriga@hfa.com]
Sent: Friday, March 30, 2012 9:51 AM
To: Rejzek, Tom
Cc: Stephanie McKenna; Mark Fahan; Todd McFarland
Subject: Closure Summary Report Due Date Extension - Chevron 94268, 7952 Hollister Avenue, Goleta (FPD LUFT #502421)

Tom,

In FPD correspondence dated February 21, 2012, submittal of a well abandonment work plan and case closure summary report was required by April 6, 2012. HFA/Chevron submitted the well abandonment work plan on March 1, 2012, and indicated the case closure summary report would be submitted to the FPD upon completion of well abandonment activities.

Pending FPD approval of the well abandonment work plan, an extension for submittal of the case closure summary report is requested until June 29, 2012, in order to complete well abandonment activities and prepare the case closure summary report, as discussed in our telephone conversation today.

Thank you.

Jeff R. Nobriga
Holguin, Fahan & Associates, Inc.
50 West Main Street, Ventura, CA 93001
Direct: 805.641.4089 | Cell: 805.766.8427 | Fax: 805.641.1654
jeff_nobriga@hfa.com | www.hfa.com

APPENDIX 2.

HISTORICAL SAMPLING RESULTS

Table 1 - Soil Analytical Results - TPH and VOCs
Previous Confirmation Soil Sampling Assessments
Former Service Station - 7952 Hollister Avenue, Goleta, California

Boring	Depth	TPH GRO (C6-C10) (mg/kg)	TPH DRO (C10 to C28) (mg/kg)	TPH ORO (C28+) (mg/kg)	VOCs Benzene (µg/kg)	Toluene (µg/kg)	Ethyl-benzene (µg/kg)	Total Xylenes (µg/kg)	N-Butyl benzene (µg/kg)	Isopropyl-benzene (µg/kg)	Naphthalene (µg/kg)	n-Propyl-benzene (µg/kg)	1,2,4-TMB (µg/kg)	1,3,5 -TMB (µg/kg)	MTBE (µg/kg)	Oxygenates (µg/kg)	Other VOCs (µg/kg)
Previous Assessment - February 25, 1997 - Remediation Confirmation Sampling - Sampling performed by FLOUR DANIEL GTI																	
B10	5	ND<0.1	--	--	ND<0.5	ND<0.5	ND<0.5	ND<0.5	--	--	--	--	--	--	ND<0.5	--	ND
	10	ND<0.1	--	--	ND<0.5	ND<0.5	ND<0.5	ND<0.5	--	--	--	--	--	--	ND<0.5	--	ND
	15	ND<0.1	--	--	ND<0.5	ND<0.5	ND<0.5	ND<0.5	--	--	--	--	--	--	ND<0.5	--	ND
	20	73	--	--	ND<0.5	ND<0.5	ND<0.5	ND<0.5	--	--	--	--	--	--	ND<0.5	--	ND
	25	ND<0.1	--	--	ND<0.5	ND<0.5	ND<0.5	ND<0.5	--	--	--	--	--	--	ND<0.5	--	ND
	30	ND<0.1	--	--	ND<0.5	ND<0.5	ND<0.5	ND<0.5	--	--	--	--	--	--	ND<0.5	--	ND
B11	5	ND<0.1	--	--	ND<0.5	ND<0.5	ND<0.5	ND<0.5	--	--	--	--	--	--	ND<0.5	--	ND
	10	ND<0.1	--	--	ND<0.5	ND<0.5	ND<0.5	ND<0.5	--	--	--	--	--	--	ND<0.5	--	ND
	15	ND<0.1	--	--	ND<0.5	ND<0.5	ND<0.5	ND<0.5	--	--	--	--	--	--	ND<0.5	--	ND
	20	**810**	--	--	ND<0.5	ND<0.5	ND<0.5	ND<0.5	--	--	--	--	--	--	ND<0.5	--	ND
	25	ND<0.1	--	--	ND<0.5	ND<0.5	ND<0.5	ND<0.5	--	--	--	--	--	--	ND<0.5	--	ND
B12	5	ND<0.1	--	--	ND<0.5	ND<0.5	ND<0.5	ND<0.5	--	--	--	--	--	--	ND<0.5	--	ND
	10	ND<0.1	--	--	ND<0.5	ND<0.5	ND<0.5	ND<0.5	--	--	--	--	--	--	ND<0.5	--	ND
	15	ND<0.1	--	--	ND<0.5	ND<0.5	ND<0.5	ND<0.5	--	--	--	--	--	--	ND<0.5	--	ND
	21	ND<0.1	--	--	ND<0.5	ND<0.5	ND<0.5	ND<0.5	--	--	--	--	--	--	ND<0.5	--	ND
	26	ND<0.1	--	--	ND<0.5	ND<0.5	ND<0.5	ND<0.5	--	--	--	--	--	--	ND<0.5	--	ND
Previous Assessment - February 21, 2008 - Additional Site Assessment (Near former boring B11 and Northeast of boring B11) - Sampling performed by Rincon Consultants, Inc.																	
SB1	5	**3,470**	ND<10	ND<50	**220**	440	ND<200	117,500	ND<1,000	ND<1,000	**35,000**	ND<1,000	**170,000**	**83,000**	ND<5	ND	ND
	10	**6,300**	ND<10	ND<50	**7,000**	**250,000**	**113,000**	**811,000**	15,800	ND<10,000	**28,500**	**31,500**	**210,000**	**67,600**	ND<5	ND	ND
	15	**8,570**	ND<10	ND<50	**11,700**	**263,000**	**111,000**	**1,141,000**	25,000	10,000	**48,100**	**42,400**	**341,000**	**108,000**	ND<5	ND	ND
	20	**20,700**	ND<10	ND<50	**ND<2,000**	**513,000**	**444,000**	**1,086,000**	**60,000**	37,400	**82,000**	**139,000**	**933,000**	**296,000**	ND<5	ND	ND
	25	51.6	ND<10	ND<50	ND<10	36	19	145	225	ND<50	745	ND<50	535	209	ND<5	ND	ND
	30	ND<0.5	ND<10	ND<50	ND<2	ND<2	ND<2	8.8	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<5	ND	ND
	35	ND<0.5	ND<10	ND<50	ND<2	ND<2	ND<2	12.7	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<5	ND	ND
	40	ND<0.5	ND<10	ND<50	ND<2	ND<2	ND<2	5.8	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<5	ND	ND
	50	ND<0.5	ND<10	ND<50	ND<2	2.9	ND<2	9.2	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<5	ND	ND
	60	ND<0.5	ND<10	ND<50	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<5	ND	ND
	70	ND<0.5	ND<10	ND<50	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<5	ND	ND
	80	0.86	ND<10	ND<50	5	37	13	94	ND<10	ND<10	ND<10	ND<10	24	ND<10	ND<5	ND	ND
	90	ND<0.5	ND<10	ND<50	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<5	ND	ND
	100	ND<0.5	ND<10	ND<50	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<5	ND	ND
SB2	5	ND<0.5	ND<10	ND<50	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<5	ND	ND
	10	ND<0.5	ND<10	ND<50	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<5	ND	ND
	15	ND<0.5	ND<10	ND<50	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<5	ND	ND
	20	ND<0.5	ND<10	ND<50	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<5	ND	ND
	25	ND<0.5	ND<10	ND<50	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<5	ND	ND
	30	ND<0.5	ND<10	ND<50	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<5	ND	ND
SBCFPD - IL		*200**	*200*	*200*	*100 to 200^*	*15,000*	*30,000*	*175,000*	*26,000*	*77,000*	*17,000*	*26,000*	*33,000*	*21,000*	*50*	*Varies*	*Varies*

mg/kg - milligrams per kilogram
µg/kg - micrograms per kilogram
ND - Not detected above the laboratory practical quantitation limits
-- Not analyzed
SBCFPD - IL - Santa Barbara County, Fire Prevention Division - Investigation Level
* The SBCFPD IL for TPH in soil where groundwater is greater than 50 feet from the soil contamination is 200 mg/kg.
^ The SBCFPD IL for benzene in soil is 100 ug/kg, however, if groundwater is greater than 100 feet below the soil contamination, the IL is 200 ug/kg.
Concentrations in **BOLD** exceed SBCFPD investigation levels

TPH - Total petroleum hydrocarbons
GRO - Gasoline range organics
DRO - Diesel range organics
ORO - Oil range organics
VOCs - Volatile organic compounds
TMB - Trimethylbenzene

Analyses: TPH full range (C6 to C28+) - EPA Method 8015M
VOCs - EPA Method 8260B except for borings B10, B11 and B12 which were analyzed for BTEX and MTBE using EPA Method 8020

Table 2 - Soil Analytical Results - TPH and VOCs
April 24, 2008 Soil Sampling Assessment
Former Service Station - 7952 Hollister Avenue, Goleta, California

Boring	Depth (feet)	TPH-GRO (C6-C10) (mg/kg)	VOCs Benzene (µg/kg)	Toluene (µg/kg)	Ethylbenzene (µg/kg)	Total Xylenes (µg/kg)	Naphthalene (µg/kg)	1,2,4-TMB (µg/kg)	Other VOCs (µg/kg)
Current Assessment - April 24, 2008 - Additional Soil Assessment (surrounding former boring SB1)									
SB3	5	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	10	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	15	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	20	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	25	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	30	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
SB4	5	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	10	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	15	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	20	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	25	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	30	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
SB5	5	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	10	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	15	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	20	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	25	0.814	ND<2	ND<2	ND<2	2	52	27	ND
	30	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	35	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	40	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
SB6	5	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	10	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	15	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	20	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	25	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	30	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	35	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
	40	ND<0.5	ND<2	ND<2	ND<2	ND<4	ND<10	ND<10	ND
SBCFPD - IL		*200**	*100 to 200^*	*15,000*	*30,000*	*175,000*	*17,000*	*33,000*	*Varies*

Soil samples collected on April 24, 2008
SBCFPD - IL - Santa Barbara County, Fire Prevention Division - Investigation Level
^ The SBCFPD IL for benzene in soil is 100 ug/kg, however, if groundwater is greater than 100 feet below the soil contamination, the IL is 200 ug/kg.
ND - Not detected above the laboratory practical quantitation limits
TPH-GRO - Total petroleum hydrocarbons -Gasoline range organics
VOCs - Volatile organic compounds
TMB - Trimethylbenzene
mg/kg - milligrams per kilogram
µg/kg - micrograms per kilogram
Soil samples analyzed by American Scientific Laboratories

Analyses: TPH- GRO (C6 to C10) - EPA Method 8015M
VOCs - EPA Method 8260B

APPENDIX 3.

WELL LOGS

LITHOLOGY
(UNIFIED SOIL CLASSIFICATION SYSTEM)

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS MORE THAN HALF IS LARGER THAN No. 200 SIEVE	GRAVEL MORE THAN HALF COARSE FRACTION IS LARGER THAN No. 4 SIEVE SIZE	GRAVELS WITH LITTLE OR NO FINES	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH OVER 12% FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND MORE THAN HALF COARSE FRACTION IS SMALLER THAN No. 4 SIEVE SIZE	SANDS WITH LITTLE OR NO FINES	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS, SAND-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE-GRAINED SOILS MORE THAN HALF IS SMALLER THAN No. 200 SIEVE	SILT AND CLAY		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS 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 SILTY CLAYS OF LOW PLASTICITY
	SILT AND CLAY		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOIL			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

SYMBOLS AND ACRONYMS

- SOIL SAMPLE COLLECTED
- GROUNDWATER SAMPLE COLLECTED (HYDROPUNCH® OR SIMILAR)
- SAMPLE NOT RECOVERED
- GROUNDWATER ENCOUNTERED DURING DRILLING
- WELL BOX WITH LOCKING CAP
- BLANK SCHEDULE 40 PVC CASING
- MICROPOROUS BUBBLER
- SLOTTED SCHEDULE 40 PVC CASING
- BOTTOM PLUG
- 0.25-INCH NYLON TUBING WITH GAS-TIGHT CAP
- STEEL PROBE

BOREHOLE COMPLETION

- ASPHALT/CONCRETE SURFACE PATCH
- CONCRETE
- BENTONITE CHIPS OR PELLETS
- BENTONITE/CEMENT GROUT
- FILTER PACK

PID = PHOTOIONIZATION DETECTOR
ppmv = PARTS PER MILLION BY VOLUME
fbg = FEET BELOW GRADE
USCS = UNIFIED SOIL CLASSIFICATION SYSTEM
PVC = POLYVINYLCHLORIDE

HOLGUIN, FAHAN & ASSOCIATES, INC.

KEY TO LOG OF EXPLORATORY BORING

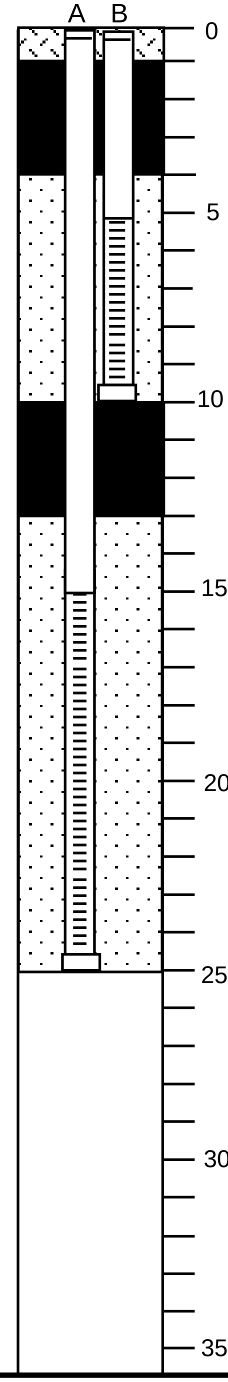
SAMPLE INTERVAL	CLIENT: Chevron Environmental Management Company			
	PROJECT: Former Service Station #9-4268			
	LOCATION: 7952 Hollister Avenue, Goleta, California			

☐ SOIL BORING
☐ GROUNDWATER WELL
☒ VADOSE WELL
☐ SPARGING WELL
☐ SOIL GAS PROBE

CASING: (2) 2" Schedule 40 PVC
SLOT SIZE: 0.02
FILTER PACK: #3 sand

DESCRIPTION AND SOIL CLASSIFICATION
NAME: %gravel/sand/fines, gradation/plasticity, color, angularity, maximum size (gravels), density/consistency, moisture, stain

DEPTH (fbg)	DESCRIPTION AND SOIL CLASSIFICATION	BLOWS PER 6 INCHES	PID (ppmv)	USCS
0	SILTY SAND: 0/70/30, well graded, brown, fine to medium grained sand, medium dense, moist, no stain			SM
5		--	0	
10	0/85/15, dense sand, light gray stain	30,50	0	
15	SANDY CLAY: 0/20/80, low plasticity, brown, fine grained sand, very stiff, moist, no stain	17,20,36	731	CL
20	0/25/75	19,26,33	1881	
24	SAND: 0/100/0, well graded, light brown, fine to medium grained, medium dense, moist, no stain	17,24,32	90	SW
25				
30				
35				



DRILLING METHOD: CME-75, 10" hollow-stem auger	DATE DRILLED: July 20, 2010
SAMPLER TYPE: 2" California-modified split-spoon	LOGGED BY: Nick Pryor
TOTAL BORING DEPTH: 25 fbg	APPROVED BY: Mark R. Fahan, PG #4279
DEPTH TO WATER: not encountered	DRILLED BY: Cascade Drilling, L.P.

HOLGUIN, FAHAN & ASSOCIATES, INC.

LOG OF EXPLORATORY BORING

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Page 1 of 1

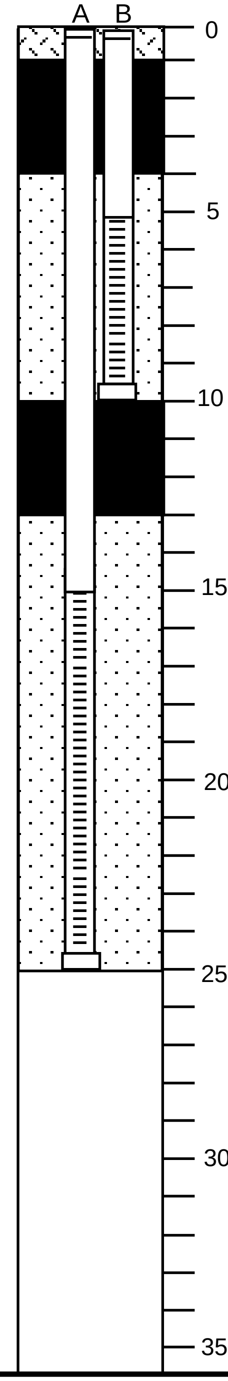
REVISION DATE: MARCH 11, 2010:MGH

CLIENT:	Chevron Environmental Management Company
PROJECT:	Former Service Station #9-4268
LOCATION:	7952 Hollister Avenue, Goleta, California

☐ SOIL BORING
☐ GROUNDWATER WELL
☒ VADOSE WELL
☐ SPARGING WELL
☐ SOIL GAS PROBE

CASING: (2) 2" Schedule 40 PVC
SLOT SIZE: 0.02
FILTER PACK: #3 sand

DEPTH (fbg)	DESCRIPTION AND SOIL CLASSIFICATION NAME: %gravel/sand/fines, gradation/plasticity, color, angularity, maximum size (gravels), density/consistency, moisture, stain	BLOWS PER 6 INCHES	PID (ppmv)	USCS
0	SILTY SAND: 0/70/30, well graded, brown, fine to medium grained, medium dense, moist, no stain			SM
5		--	0	
10	0/60/40, greenish gray stain	7,14,22	1230	
15	hydrocarbon odor	14,22,28	2539	
20	0/80/20	16,21,25	1526	
	SAND: 0/100/0, well graded, light brown, fine to medium grained, medium dense, moist, no stain	18,22,27	162	SW
25				
30				
35				



DRILLING METHOD: CME-75, 10" hollow-stem auger	DATE DRILLED: July 20, 2010
SAMPLER TYPE: 2" California-modified split-spoon	LOGGED BY: Nick Pryor
TOTAL BORING DEPTH: 25 fbg	APPROVED BY: Mark R. Fahan, PG #4279
DEPTH TO WATER: not encountered	DRILLED BY: Cascade Drilling, L.P.

HOLGUIN, FAHAN & ASSOCIATES, INC.

LOG OF EXPLORATORY BORING

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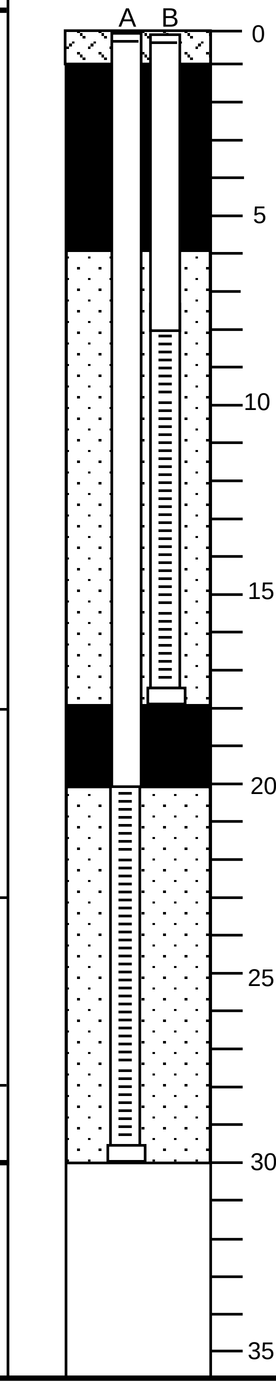
Page 1 of 1

REVISION DATE: MARCH 11, 2010:MGH

SAMPLE INTERVAL	CLIENT: Chevron Environmental Management Company	BLOWS PER 6 INCHES	PID (ppmv)	USCS	
SOIL / GROUNDWATER / DEPTH (fbg)	PROJECT: Former Service Station #9-4268				☐ SOIL BORING ☐ GROUNDWATER WELL ☒ VADOSE WELL ☐ SPARGING WELL ☐ SOIL GAS PROBE
	LOCATION: 7952 Hollister Avenue, Goleta, California				CASING: (2) 2" Schedule 40 PVC SLOT SIZE: 0.02 FILTER PACK: #3 sand
	DESCRIPTION AND SOIL CLASSIFICATION NAME: %gravel/sand/fines, gradation/plasticity, color, angularity, maximum size (gravels), density/consistency, moisture, stain				

DEPTH (fbg)	DESCRIPTION AND SOIL CLASSIFICATION	BLOWS PER 6 INCHES	PID (ppmv)	USCS
0	SILTY SAND: 0/70/30, well graded, brown, fine to medium grained, medium dense, moist, no stain			SM
5		--	0	
10	0/60/40, very dense	8,10,14	0	
15	0/85/15	13,16,18	6	
18	SANDY CLAY: 0/15/85, low plasticity, brown, fine to medium grained sand, very stiff, moist, no stain			CL
20		12,14,18	107	
23	SAND: 0/100/0, well graded, brown, fine to medium grained, medium dense, moist, no stain	7,10,14	43	SW
28	SANDY CLAY: 0/25/75, low plasticity, brown, fine to medium grained sand, very hard, moist, no stain	9,15,18	14	CL
30				
35				



DRILLING METHOD: CME-75, 10" hollow-stem auger	DATE DRILLED: July 20, 2010
SAMPLER TYPE: 2" California-modified split-spoon	LOGGED BY: Nick Pryor
TOTAL BORING DEPTH: 30 fbg	APPROVED BY: Mark R. Fahan, PG #4279
DEPTH TO WATER: not encountered	DRILLED BY: Cascade Drilling, L.P.

HOLGUIN, FAHAN & ASSOCIATES, INC.

LOG OF EXPLORATORY BORING

V-3

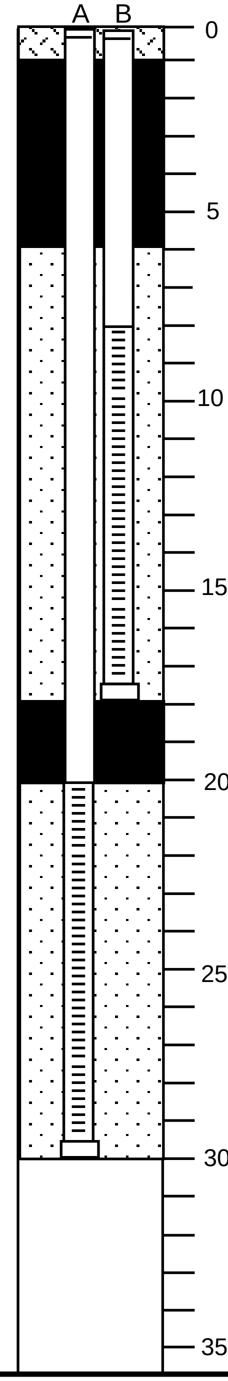
REVISION DATE: MARCH 11, 2010:MGH

SAMPLE INTERVAL		
CLIENT: Chevron Environmental Management Company		
PROJECT: Former Service Station #9-4268		
LOCATION: 7952 Hollister Avenue, Goleta, California		

- [ ] SOIL BORING
- [ ] GROUNDWATER WELL
- [x] VADOSE WELL
- [ ] SPARGING WELL
- [ ] SOIL GAS PROBE

CASING: (2) 2" Schedule 40 PVC
SLOT SIZE: 0.02
FILTER PACK: #3 sand

DEPTH (fbg)	DESCRIPTION AND SOIL CLASSIFICATION NAME: %gravel/sand/fines, gradation/plasticity, color, angularity, maximum size (gravels), density/consistency, moisture, stain	BLOWS PER 6 INCHES	PID (ppmv)	USCS
0	SILTY SAND: 0/70/30, well graded, brown, fine to medium grained, medium dense, moist, no stain			SM
5		--	0	
10	0/85/15, dense, greenish gray hydrocarbon stain	12,18,25	3000	
15	0/60/40	20,27,30	838	
20		15,19,26	2155	
25	0/80/20, no stain	25,30,40	476	
30	0/85/15	18,24,34	4.3	
35				



DRILLING METHOD: CME-75, 10" hollow-stem auger	DATE DRILLED: July 21, 2010
SAMPLER TYPE: 2" California-modified split-spoon	LOGGED BY: Nick Pryor
TOTAL BORING DEPTH: 30 fbg	APPROVED BY: Mark R. Fahan, PG #4279
DEPTH TO WATER: not encountered	DRILLED BY: Cascade Drilling, L.P.

HOLGUIN, FAHAN & ASSOCIATES, INC.

LOG OF EXPLORATORY BORING

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REVISION DATE: MARCH 11, 2010:MGH

APPENDIX 4.

SUMMARY OF SVE OPERATIONS

HOLGUIN, FAHAN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT CONSULTANTS

Quarterly Progress Report
Second Quarter 2011

Summary Sheet
Operations

Chevron Environmental Management Company
Chevron Former Service Station #9-4268
7952 Hollister Avenue
Goleta, California

SBCAPCD ATC # **13462**

VAPOR EXTRACTION PERFORMANCE

Date Started: August 24, 2010

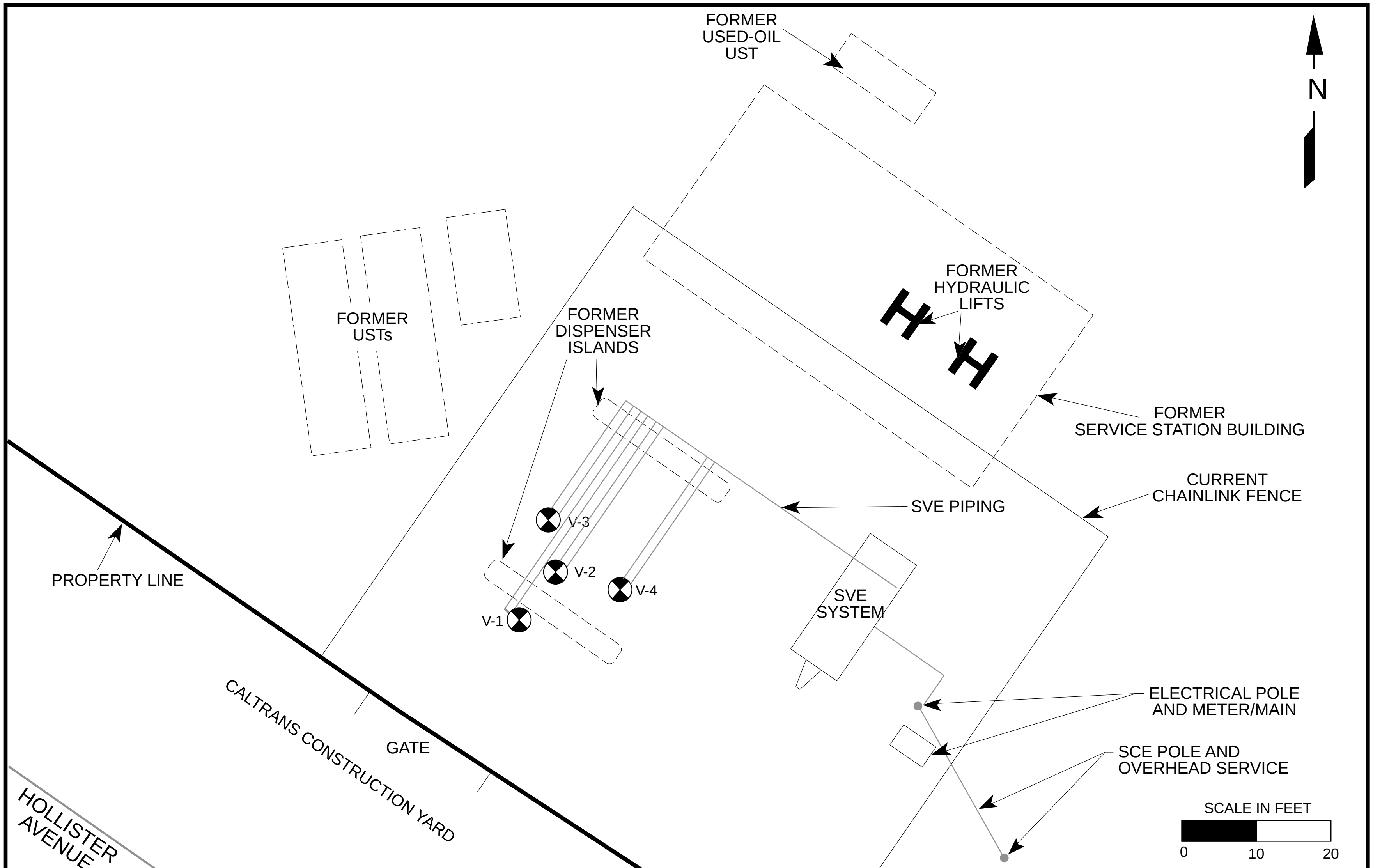
Treatment technology used:	Catalytic oxidizer		
Number of vapor extraction wells on-site:	8	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	
Number of vapor extraction wells open:	0	Maximum influent TPHg concentration this quarter (ppmv):	350
Operating days this quarter:	12	Pounds of hydrocarbons removed this quarter:	78
Total operating days:	154	Cumulative pounds of hydrocarbons removed:	3,482
		Operating mode:	Catalytic

CURRENT QUARTERLY OPERATIONS

HFA started the SVE system on August 24, 2010.
HFA performed Emission Verification Tests (EVT) on September 1, 9, and 24, 2010. Results of each EVT did not meet the 95% destruction efficiency requirement of SBCAPCD ATC #13462.
HFA shut down the SVE system on September 24, 2010, pending SBCAPCD SCDP extension.
HFA received written approval to restart the SVE system from the SBCAPCD on October 1, 2010. The SBCAPCD extended the SCDP until January 30, 2011.
The SVE was restarted on October 4, 2010.
Representatives from Chevron, the City of Goleta, the FPD, and HFA met on-site on December 2, 2010, to inspect and review site operations.
HFA performed an Emission Verification Test (EVT) on December 15, 2010. Results indicated compliance with the requirements of SBCAPCD ATC #13462.
The system was shutdown on March 21, 2011, for rebound evaluation.
The system was restarted on April 4, 2011, for rebound evaluation.
The system was shutdown on April 22, 2011.

FUTURE PLANNED OPERATIONS

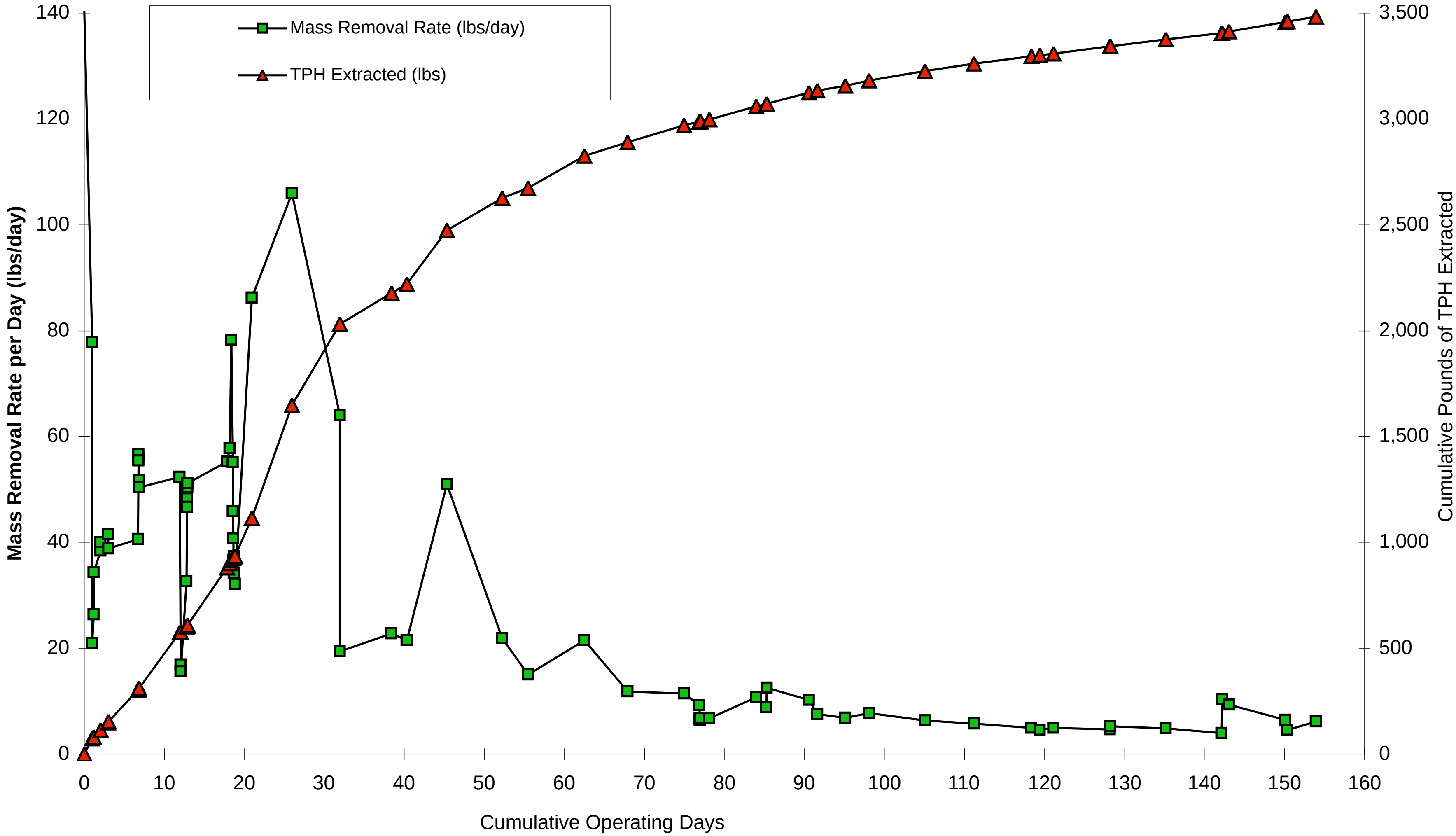
HFA will perform verification sampling upon work plan approval by the FPD.



EXPLANATION	CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
⊗ SOIL VAPOR EXTRACTION WELL	FORMER SERVICE STATION #9-4268 7952 HOLLISTER AVENUE GOLETA, CALIFORNIA FIGURE 1 - PLOT PLAN
	HOLGUIN, FAHAN & ASSOCIATES, INC.

REVISION DATE: JANUARY 5, 2011: MGH

FIGURE 2 - MASS REMOVAL RATE PER DAY AND CUMULATIVE POUNDS OF TPH EXTRACTED
CHEVRON FORMER SERVICE STATION #9-4268,
7952 HOLLISTER AVENUE, GOLETA, CALIFORNIA



LIST OF ACRONYMS

ATC	authority to construct
EVT	emissions verification test
FPD	Santa Barbara County Fire Department, Fire Prevention Division
lbs	pounds
LUFT	leaking underground fuel tank
ppmv	parts per million by volume
SBCAPCD	Santa Barbara County Air Pollution Control District
SCDP	source compliance demonstration period
SVE	soil vapor extraction
TPH	total petroleum hydrocarbons
TPHg	total petroleum hydrocarbons as gasoline
UST	underground storage tank

EXHIBIT 1.

SUMMARY OF REMEDIATION SYSTEM MONITORING DATA

TABLE 1.
SUMMARY OF SOIL VAPOR EXTRACTION SYSTEM MONITORING DATA
CHEVRON FORMER SERVICE STATION #9-4268, GOLETA, CALIFORNIA

Date Monitored	Cumulative Operating Hours	Cumulative Operating Days	Total Flow (scfm)	Field Influent (ppmv)	Field Effluent (ppmv)	Lab Certified TPH In (ppmv)	Lab Certified Benzene In (ppmv)	Lab Instantaneous TPH Lbs/Hour Extracted	Field TPH Extraction rate Lbs/Hour	TPH Cumulative Lbs Extracted	Average TPH Lbs/Hour Emitted	TPH Cumulative Lbs Emitted	PID (OVM) Calibration Date	Inlet Oxidizer Temp (°F)	Outlet Oxidizer Temp (°F)	Operating Extraction Wells	Comments
8/24/10	0.0	0	60	7,196	10.3	1,800	9.7	1.70	5.85	0	0.008	0	8-24-10	704	965	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System startup, system O&M.
8/25/10	23.0	1	60	780	0.0	--	--	--	3.24	75	0.004	0	8-25-10	700	850	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.
8/25/10	24.1	1	100	820	0.0	--	--	--	0.87	76	0.000	0	8-25-10	705	910	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.
8/25/10	28.2	1	100	800	15.0	--	--	--	1.10	80	0.010	0	8-25-10	709	882	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.
8/25/10	29.0	1	113	1,150	20.0	--	--	--	1.43	81	0.026	0	8-25-10	690	877	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.
8/26/10	48.5	2	118	890	0.0	--	--	--	1.60	112	0.015	0	8-26-10	710	843	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.
8/26/10	49.4	2	154	910	0.0	--	--	--	1.67	114	0.000	0	8-26-10	703	856	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.
8/27/10	70.5	3	165	690	0.0	--	--	--	1.73	150	0.000	0	8-27-10	705	805	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.
8/27/10	72.8	3	180	690	5.0	--	--	--	1.62	154	0.006	0	8-27-10	698	804	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.
9/1/10	161.6	7	187	920	90.0	--	--	--	1.69	304	0.121	11	9-1-10	700	743	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, monitor at 9:15.
9/1/10	162.1	7	185	910	85.0	--	--	--	2.32	305	0.222	11	9-1-10	698	742	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, monitor at 9:45.
9/1/10	162.6	7	185	950	90.0	260	1.2	0.76	2.35	307	0.221	11	9-1-10	701	745	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, collect samples, monitor at 10:15.
9/1/10	163.1	7	185	920	85.0	--	--	--	2.36	308	0.221	12	9-1-10	701	744	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, monitor at 10:45.
9/1/10	163.6	7	186	910	95.0	270	1.4	0.79	2.31	309	0.227	12	9-1-10	699	743	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, collect samples, monitor at 11:15.
9/1/10	164.1	7	185	800	85.0	--	--	--	2.16	310	0.227	12	9-1-10	697	743	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, monitor at 11:45.
9/1/10	164.6	7	184	870	90.0	260	1.4	0.76	2.10	311	0.220	12	9-1-10	702	743	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, collect samples, monitor at 12:15.
9/8/10	286.0	12	192	240	10.6	--	--	--	2.18	576	0.127	27	9-8-10	800	821	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.
9/8/10	288.7	12	192	300	8.8	--	--	--	0.70	578	0.025	27	9-8-10	853	866	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.
9/8/10	289.5	12	192	200	1.7	--	--	--	0.65	579	0.014	27	9-8-10	900	909	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.
9/9/10	307.4	13	195	827	0.6	--	--	--	1.36	603	0.003	27	9-9-10	897	907	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, monitor at 9:00.
9/9/10	308.0	13	194	690	0.4	--	--	--	2.01	604	0.001	27	9-9-10	898	906	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, monitor at 9:30.
9/9/10	308.4	13	194	786	0.2	160	ND<1.2	0.49	1.95	605	0.001	27	9-9-10	900	907	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, collect samples, monitor at 10:00.
9/9/10	309.0	13	194	808	0.6	--	--	--	2.10	606	0.001	27	9-9-10	903	912	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, monitor at 10:30.
9/9/10	309.4	13	193	814	2.7	150	ND<1.2	0.46	2.13	607	0.004	27	9-9-10	899	908	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, collect samples, monitor at 11:00.
9/9/10	310.0	13	193	785	0.4	--	--	--	2.10	608	0.004	27	9-9-10	901	908	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, monitor at 11:30.
9/9/10	310.4	13	192	840	0.7	150	ND<1.2	0.46	2.13	609	0.001	27	9-9-10	898	909	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, collect samples, monitor at 12:00.
9/14/10	428.6	18	195	905	2.2	--	--	--	2.30	881	0.004	28	9-14-10	902	902	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.
9/22/10	436.5	18	220	1,088	15.7	--	--	--	2.41	900	0.026	28	9-22-10	744	771	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.
9/23/10	441.5	18	199	991	15.9	--	--	--	3.26	916	0.045	28	9-23-10	790	805	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.
9/24/10	445.7	19	188	748	0.0	--	--	--	2.30	926	0.022	28	9-24-10	801	814	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, monitor at 12:00.
9/24/10	446.2	19	187	759	0.0	--	--	--	1.91	927	0.000	28	9-24-10	800	813	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, monitor at 12:30.

TABLE 1.
SUMMARY OF SOIL VAPOR EXTRACTION SYSTEM MONITORING DATA
CHEVRON FORMER SERVICE STATION #9-4268, GOLETA, CALIFORNIA

Date Monitored	Cumulative Operating Hours	Cumulative Operating Days	Total Flow (scfm)	Field Influent (ppmv)	Field Effluent (ppmv)	Lab Certified TPH In (ppmv)	Lab Certified Benzene In (ppmv)	Lab Instantaneous TPH Lbs/Hour Extracted	Field TPH Extraction rate Lbs/Hour	TPH Cumulative Lbs Extracted	Average TPH Lbs/Hour Emitted	TPH Cumulative Lbs Emitted	PID (OVM) Calibration Date	Inlet Oxidizer Temp (°F)	Outlet Oxidizer Temp (°F)	Operating Extraction Wells	Comments
9/24/10	446.7	19	187	576	0.0	150	ND<2.3	0.44	1.70	928	0.000	28	9-24-10	800	810	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, collect samples, monitor at 13:00.
9/24/10	447.2	19	187	569	0.0	--	--	--	1.46	929	0.000	28	9-24-10	800	811	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, monitor at 13:30.
9/24/10	447.7	19	187	631	0.0	150	ND<2.2	0.44	1.53	929	0.000	28	9-24-10	800	811	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, collect samples, monitor at 14:00.
9/24/10	448.2	19	187	594	0.0	--	--	--	1.56	930	0.000	28	9-24-10	800	811	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, monitor at 14:30.
9/24/10	448.7	19	187	526	0.0	150	ND<2.2	0.44	1.43	931	0.000	28	9-24-10	800	810	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, perform EVT, collect samples, monitor at 15:00.
10/4/10	451.8	19	152	1,486	0.0	430	1.7	1.04	1.34	935	0.000	28	10-4-10	809	921	V-1A, V-2A,V-3A, V-4A, V-4B	System restart, O&M, collect samples.
10/7/10	502.2	21	182	1,655	0.0	--	--	--	3.59	1,116	0.000	28	10-7-10	810	853	V-1A, V-2A,V-3A, V-4A, V-4B	System O&M.
10/12/10	622.7	26	193	1,800	0.0	--	--	--	4.41	1,648	0.000	28	10-12-10	800	815	V-1A, V-2A,V-3A, V-4A, V-4B	System O&M.
10/18/10	766.3	32	196	230	0.0	--	--	--	2.67	2,031	0.000	28	10-18-10	800	808	V-1A, V-2A,V-3A, V-4A, V-4B	System O&M.
10/18/10	766.7	32	164	450	0.0	--	--	--	0.81	2,032	0.000	28	10-18-10	817	840	V-1A, V-2A, V-4A, V-4B	System O&M.
10/26/10	921.5	38	170	386	0.0	--	--	--	0.95	2,179	0.000	28	10-26-10	810	833	V-1A, V-2A, V-4A, V-4B	System O&M.
11/3/10	968.1	40	167	1,345	2.6	230	ND<1.2	0.61	0.89	2,220	0.003	28	11-3-10	810	854	V-1A, V-2A, V-4A, V-4B	System restart, O&M, collect samples.
11/8/10	1087.1	45	176	500	5.0	--	--	--	2.13	2,473	0.009	30	11-8-10	809	825	V-1A, V-2A, V-4A, V-4B	System O&M.
11/15/10	1253.4	52	185	250	5.0	--	--	--	0.91	2,625	0.012	32	11-15-10	809	816	V-1A, V-2A, V-4A, V-4B	System O&M.
11/22/10	1331.6	55	180	520	5.0	--	--	--	0.63	2,674	0.012	33	11-22-10	809	823	V-1A, V-2A, V-4A, V-4B	System restart, O&M.
11/29/10	1499.7	62	190	200	5.0	--	--	--	0.90	2,825	0.013	35	11-29-10	813	807	V-1A, V-2A, V-4A, V-4B	System O&M.
12/6/10	1630.1	68	191	180	5.0	47	ND<1.2	0.14	0.49	2,889	0.013	36	12-6-10	810	805	V-1A, V-2A, V-4A, V-4B	System O&M.
12/13/10	1799.0	75	189	190	5.0	--	--	--	0.48	2,970	0.013	39	12-13-10	809	801	V-1A, V-2A, V-4A, V-4B	System O&M.
12/15/10	1845.3	77	190	110	5.0	41	ND<1.2	0.12	0.39	2,988	0.013	39	12-15-10	812	803	V-1A, V-2A, V-4A, V-4B	System O&M, perform EVT, collect samples, monitor at 9:05.
12/15/10	1845.8	77	190	105	5.0	--	--	--	0.28	2,988	0.013	39	12-15-10	808	801	V-1A, V-2A, V-4A, V-4B	System O&M, perform EVT, monitor at 9:35.
12/15/10	1846.3	77	190	105	5.0	32	ND<1.2	0.10	0.27	2,988	0.013	39	12-15-10	813	807	V-1A, V-2A, V-4A, V-4B	System O&M, perform EVT, collect samples, monitor at 10:05.
12/15/10	1846.8	77	189	110	5.0	--	--	--	0.28	2,988	0.013	39	12-15-10	812	803	V-1A, V-2A, V-4A, V-4B	System O&M, perform EVT, monitor at 10:35.
12/15/10	1847.3	77	189	105	5.0	33	ND<1.2	0.10	0.28	2,988	0.013	39	12-15-10	808	802	V-1A, V-2A, V-4A, V-4B	System O&M, perform EVT, collect samples, monitor at 11:05.
12/15/10	1847.8	77	190	110	5.0	--	--	--	0.28	2,989	0.013	39	12-15-10	809	801	V-1A, V-2A, V-4A, V-4B	System O&M, perform EVT, monitor at 11:35.
12/15/10	1848.3	77	189	110	5.0	38	ND<1.2	0.11	0.28	2,989	0.013	39	12-15-10	810	803	V-1A, V-2A, V-4A, V-4B	System O&M, perform EVT, collect samples, monitor at 12:05.
12/21/10	1874.3	78	184	210	5.0	--	--	--	0.28	2,996	0.013	40	12-21-10	800	823	V-1A, V-2A, V-4A, V-4B	System restart, O&M.
12/27/10	2015.3	84	117	230	10.0	--	--	--	0.45	3,059	0.014	42	12-27-10	805	840	V-1A, V-2A, V-4A, V-4B	System O&M.
1/3/11	2046.2	85	114	342	8.7	--	--	--	0.37	3,071	0.015	42	1-3-11	811	860	V-1A, V-2A, V-4A, V-4B	System restart, O&M, collect samples.
1/3/11	2047.5	85	140	272	8.4	260	ND<1.2	0.58	0.52	3,071	0.015	42	1-3-11	811	851	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.
1/10/11	2173.0	91	124	200	10.0	--	--	--	0.43	3,125	0.016	44	1-10-11	808	828	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.
1/17/11	2199.7	92	124	170	5.0	--	--	--	0.31	3,133	0.013	44	1-17-11	816	830	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.

TABLE 1.
SUMMARY OF SOIL VAPOR EXTRACTION SYSTEM MONITORING DATA
CHEVRON FORMER SERVICE STATION #9-4268, GOLETA, CALIFORNIA

Date Monitored	Cumulative Operating Hours	Cumulative Operating Days	Total Flow (scfm)	Field Influent (ppmv)	Field Effluent (ppmv)	Lab Certified TPH In (ppmv)	Lab Certified Benzene In (ppmv)	Lab Instantaneous TPH Lbs/Hour Extracted	Field TPH Extraction rate Lbs/Hour	TPH Cumulative Lbs Extracted	Average TPH Lbs/Hour Emitted	TPH Cumulative Lbs Emitted	PID (OVM) Calibration Date	Inlet Oxidizer Temp (°F)	Outlet Oxidizer Temp (°F)	Operating Extraction Wells	Comments
1/25/11	2282.5	95	125	190	10.0	--	--	--	0.29	3,157	0.013	45	1-25-11	815	857	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System restart, O&M.
1/31/11	2354.0	98	124	160	5.0	--	--	--	0.32	3,180	0.013	46	1-31-11	803	842	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System restart, O&M.
2/7/11	2521.9	105	127	150	10.0	58	ND<1.2	0.12	0.26	3,225	0.013	49	2-7-11	810	825	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M, collect samples.
2/14/11	2668.0	111	125	130	5.0	--	--	--	0.24	3,260	0.013	50	2-14-11	807	831	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.
2/21/11	2840.4	118	128	110	5.0	--	--	--	0.21	3,296	0.009	52	2-21-11	806	820	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.
2/25/11	2866.8	119	128	120	5.0	--	--	--	0.19	3,301	0.009	52	2-25-11	802	818	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System restart, O&M.
2/28/11	2907.9	121	127	100	5.0	--	--	--	0.21	3,309	0.009	53	2-28-11	800	821	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System restart, O&M.
3/7/11	3075.8	128	124	130	10.0	--	--	--	0.20	3,342	0.013	55	3-7-11	818	828	V-1A, V-1B, V-2A, V-2B, V-3A, V-3B, V-4A, V-4B	System O&M.
3/7/11	3077.4	128	91	180	10.0	89	ND<1.2	0.13	0.22	3,342	0.015	55	3-7-11	813	844	V-1A, V-2A, V-4A, V-4B	System O&M, collect samples.
3/14/11	3244.6	135	91	150	10.0	--	--	--	0.20	3,376	0.012	57	3-14-11	810	817	V-1A, V-2A, V-4A, V-4B	System O&M.
3/21/11	3411.7	142	91	120	10.0	36	ND<1.2	0.05	0.17	3,404	0.012	59	3-21-11	800	822	V-1A, V-2A, V-4A, V-4B	System O&M, shutdown for rebound testing.
4/4/11	3412.4	142	90	350	10.0	--	--	--	0.43	3,405	0.012	59	4-4-11	800	847	V-1A, V-2A, V-4A, V-4B	System restart, O&M.
4/5/11	3433.4	143	86	300	10.0	75	ND<1.2	0.10	0.39	3,413	0.012	59	4-5-11	823	835	V-1A, V-2A, V-4A, V-4B	System O&M, collect samples.
4/12/11	3602.9	150	90	155	5.0	--	--	--	0.27	3,459	0.009	61	4-12-11	818	821	V-1A, V-2A, V-4A, V-4B	System O&M.
4/18/11	3609.8	150	95	200	5.0	--	--	--	0.19	3,460	0.006	61	4-18-11	800	853	V-1A, V-2A, V-4A, V-4B	System restart, O&M.
4/22/11	3693.8	154	93	165	5.0	80	ND<1.2	0.12	0.26	3,482	0.006	61	4-22-11	804	842	V-1A, V-2A, V-4A, V-4B	System restart, collect sample, shutdown.

Temp = temperature. -- = not sampled or not analyzed.
System startup on August 24, 2010.

TABLE 2.
SUMMARY OF SOIL VAPOR EXTRACTION SYSTEM WELL DATA
CHEVRON FORMER SERVICE STATION #9-4268, GOLETA, CALIFORNIA

Date	Lab TPH Inlet (ppmv)	Lab TPH Outlet (ppmv)	Lab Benzene Inlet (ppmv)	Lab Benzene Outlet (ppmv)	Lab MTBE Inlet (ppmv)	Lab MTBE Outlet (ppmv)	Field TPH Well V-1A (ppmv)	Field TPH Well V-1B (ppmv)	Field TPH Well V-2A (ppmv)	Field TPH Well V-2B (ppmv)	Field TPH Well V-3A (ppmv)	Field TPH Well V-3B (ppmv)	Field TPH Well V-4A (ppmv)	Field TPH Well V-4B (ppmv)
8/24/10	1,800	9.8	9.7	ND<1.2	ND<2.8	ND<2.8	>9,999	102	>9,999	99	148	81	1,807	>9,999
8/25/10	--	--	--	--	--	--	1,550	45	3,250	50	65	75	250	4,500
8/25/10	--	--	--	--	--	--	2,200	50	4,000	60	10	40	310	4,200
8/25/10	--	--	--	--	--	--	650	55	3,200	65	30	80	230	3,500
8/25/10	--	--	--	--	--	--	2,300	60	3,800	55	50	50	330	5,800
8/26/10	--	--	--	--	--	--	1,950	60	4,150	70	0	70	280	5,750
8/26/10	--	--	--	--	--	--	1,850	80	4,150	90	0	120	290	6,100
8/27/10	--	--	--	--	--	--	1,850	50	3,850	55	0	55	200	4,700
8/27/10	--	--	--	--	--	--	1,750	65	3,850	65	5	60	220	5,000
8/30/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8/30/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9/1/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9/1/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9/1/10	260	14	1.2	ND<1.2	ND<2.8	ND<2.8	--	--	--	--	--	--	--	--
9/1/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9/1/10	270	14	1.4	ND<1.2	ND<2.8	ND<2.8	--	--	--	--	--	--	--	--
9/1/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9/1/10	260	16	1.4	ND<1.2	ND<2.8	ND<2.8	--	--	--	--	--	--	--	--
9/8/10	--	--	--	--	--	--	806	50	1,850	50	5	35	40	720
9/8/10	--	--	--	--	--	--	900	50	1,900	50	10	35	50	800
9/8/10	--	--	--	--	--	--	850	35	2,150	50	5	40	50	790
9/9/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9/9/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9/9/10	160	15	ND<1.2	ND<1.2	ND<2.8	ND<2.8	--	--	--	--	--	--	--	--
9/9/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9/9/10	150	15	ND<1.2	ND<1.2	ND<2.8	ND<2.8	--	--	--	--	--	--	--	--
9/9/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9/9/10	150	11	ND<1.2	ND<1.2	ND<2.8	ND<2.8	--	--	--	--	--	--	--	--
9/14/10	--	--	--	--	--	--	6,850	106	>9,999	163	69	36	972	2,108
9/22/10	--	--	--	--	--	--	>9,999	32	>9,999	0.7	86	3	1,151	3,804
9/23/10	--	--	--	--	--	--	>9,999	75	>9,999	71	95	8	1,346	2,654
9/24/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9/24/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9/24/10	150	11	ND<2.3	ND<2.3	ND<5.1	ND<5.0	--	--	--	--	--	--	--	--
9/24/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9/24/10	150	11	ND<2.2	ND<2.4	ND<4.9	ND<5.2	--	--	--	--	--	--	--	--
9/24/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9/24/10	150	6.7	ND<2.2	ND<2.3	ND<5.0	ND<5.0	--	--	--	--	--	--	--	--
10/4/10	430	6.8	1.7	ND<1.2	ND<2.8	ND<2.8	5,298	--	8,023	--	94	--	1,555	3,119
10/7/10	--	--	--	--	--	--	4,674	--	2,836	--	83	--	692	2,659
10/12/10	--	--	--	--	--	--	3,500	--	4,500	--	50	--	450	3,200
10/18/10	--	--	--	--	--	--	520	--	270	--	45	--	145	380
10/18/10	--	--	--	--	--	--	600	--	290	--	--	--	200	390
10/20/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
10/26/10	--	--	--	--	--	--	600	--	290	--	--	--	200	390

TABLE 2.
SUMMARY OF SOIL VAPOR EXTRACTION SYSTEM WELL DATA
CHEVRON FORMER SERVICE STATION #9-4268, GOLETA, CALIFORNIA

Date	Lab TPH Inlet (ppmv)	Lab TPH Outlet (ppmv)	Lab Benzene Inlet (ppmv)	Lab Benzene Outlet (ppmv)	Lab MTBE Inlet (ppmv)	Lab MTBE Outlet (ppmv)	Field TPH Well V-1A (ppmv)	Field TPH Well V-1B (ppmv)	Field TPH Well V-2A (ppmv)	Field TPH Well V-2B (ppmv)	Field TPH Well V-3A (ppmv)	Field TPH Well V-3B (ppmv)	Field TPH Well V-4A (ppmv)	Field TPH Well V-4B (ppmv)
11/3/10	230	3.7	ND<1.2	ND<1.2	ND<2.8	ND<2.8	496	--	305	--	--	--	560	835
11/8/10	--	--	--	--	--	--	340	--	280	--	--	--	350	570
11/15/10	--	--	--	--	--	--	210	--	150	--	--	--	190	210
11/17/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
11/18/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
11/22/10	--	--	--	--	--	--	360	--	300	--	--	--	500	540
11/29/10	--	--	--	--	--	--	190	--	120	--	--	--	220	300
12/2/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
12/3/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
12/6/10	47	ND<2.4	ND<1.2	ND<1.2	ND<2.8	ND<2.8	180	--	140	--	--	--	170	290
12/13/10	--	--	--	--	--	--	170	--	130	--	--	--	190	280
12/15/10	41	ND<3.9	ND<1.2	ND<1.2	ND<2.8	ND<2.8	--	--	--	--	--	--	--	--
12/15/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
12/15/10	32	ND<3.9	ND<1.2	ND<1.2	ND<2.8	ND<2.8	--	--	--	--	--	--	--	--
12/15/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
12/15/10	33	ND<4.0	ND<1.2	ND<1.2	ND<2.8	ND<2.8	--	--	--	--	--	--	--	--
12/15/10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
12/15/10	38	2.5	ND<1.2	ND<1.2	ND<2.8	ND<2.8	--	--	--	--	--	--	--	--
12/21/10	--	--	--	--	--	--	160	--	150	--	--	--	230	340
12/27/10	--	--	--	--	--	--	140	--	200	--	--	--	110	220
1/3/11	--	--	--	--	--	--	188	--	360	--	--	--	329	540
1/3/11	260	4.8	ND<1.2	ND<1.2	ND<2.8	ND<2.8	192	38	346	72	102	56	361	492
1/10/11	--	--	--	--	--	--	140	55	440	50	80	70	120	370
1/17/11	--	--	--	--	--	--	130	45	400	50	60	60	130	320
1/25/11	--	--	--	--	--	--	150	40	360	55	50	60	160	350
1/31/11	--	--	--	--	--	--	120	30	350	45	45	60	140	340
2/7/11	58	ND<2.4	ND<1.2	ND<1.2	ND<2.8	ND<2.8	130	45	350	50	45	75	150	360
2/14/11	--	--	--	--	--	--	100	35	320	35	40	55	130	350
2/21/11	--	--	--	--	--	--	90	40	260	45	50	45	90	290
2/25/11	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2/28/11	--	--	--	--	--	--	110	45	250	40	40	50	100	320
3/7/11	--	--	--	--	--	--	150	60	290	50	50	60	110	380
3/7/11	89	4.6	ND<1.2	ND<1.2	ND<2.8	ND<2.8	160	--	260	--	--	--	130	310
3/14/11	--	--	--	--	--	--	130	--	210	--	--	--	90	230
3/21/11	36	--	ND<1.2	--	ND<2.8	--	120	--	200	--	--	--	100	180
4/4/11	--	--	--	--	--	--	180	--	310	--	--	--	160	320
4/5/11	75	ND<2.4	ND<1.2	ND<1.2	ND<2.8	ND<2.8	--	--	--	--	--	--	--	--
4/12/11	--	--	--	--	--	--	140	--	260	--	--	--	120	280
4/18/11	--	--	--	--	--	--	150	--	430	--	--	--	110	580
4/22/11	80	--	ND<1.2	--	ND<2.8	--	130	--	340	--	--	--	85	510

Lab = laboratory. -- = not measured. [shaded] = closed.

APPENDIX 5.

CASE CLOSURE SUMMARY

CASE CLOSURE SUMMARY
LUFT

Date of Closure Request: ______________________

I. Agency Information

Agency name: Santa Barbara County Fire Department, Fire Prevention Division	Address: 1430 Mission Drive
City/State/Zip: Solvang, California 93463	Phone: (805) 686-8176
Responsible staff person: Mr. Thomas Rejzek	Title: Professional Geologist

II. Case Information

Site Facility Name: Chevron Former Service Station #9-4268	LUFT Case #: 502421
Site Facility Address: 7952 Hollister Avenue, Goleta, California	

Responsible Parties	**Addresses**	**Phone Number**
Chevron Environmental Management Company, Attn: Daryl Pessler	145 South State College Boulevard, #400, Brea, California, 92821	(714) 671-3277
City of Goleta, Attn: Claudia Dato	130 Cremona Drive, Suite B, Goleta, California, 93117	(805) 961-7554

III. Tank Information

Tank	**Size in Gal.**	**Contents**	**Closed in-Place/Removed**	**Date**
1	(2) 10,000	Gasoline	Removed in 1993	1968-1993
2	(1) 6,000	Gasoline	Removed in 1993	1968-1993
3	(1) 1,000	Used-oil	Removed in 1993	1968-1993
4				

IV. Release and Site Characterization Information

Cause and Type of Release: Former southern dispenser island.		
Site Characterization Complete? Yes.	Date approved by oversight agency: February 21, 2012	
Vapor Extraction Wells Installed? Yes.	Number: 4	Proper screened interval? Yes.
Monitoring Wells Installed? No.	Number: 0	Proper screened interval? N/A
Highest GW Depth Below Ground Surface: N/A (Groundwater is estimated to be greater than 100 fbg).	Lowest: N/A	Flow Direction: N/A
Most Sensitive Current Use:		
Are Drinking Water Wells Affected? No.	**Public Supply Aquifer:**	
Is Surface Water Affected? No.	Nearest Affected SW Name: N/A	
Off-Site Beneficial Use Impacts (addresses/locations):		

V. Treatment/Disposal Methods (Attach any additional information)

Material	Amount (Include Units)	Action (Treatment or Disposal Method)	Date
Tanks	4 USTs - (2) 10,000, (1) 6,000, and (1) 1,000 gallon	Disposed	1993
Free Product	N/A	N/A	N/A
Piping	N/A	N/A	N/A
Soil	N/A	N/A	N/A
Groundwater	N/A	N/A	N/A

Maximum Documented Contaminant Concentrations--Before and After Cleanup

Contaminant	Soil (mg/kg)		Water (ppb)		Contaminant	Soil (mg/kg)		Water (ppb)	
	Before	After	Before	After		Before	After	Before	After
TPH (Gas)	20,700	2,800	N/A	N/A	**1,2-DCA**	<0.51	N/A	N/A	N/A
TPH (Diesel)	ND<10	N/A	N/A	N/A	**Oil/Grease**	ND<50	N/A	N/A	N/A
Benzene	52	<10	N/A	N/A	**Lead**	N/A	N/A	N/A	N/A
Toluene	630	78	N/A	N/A	**MTBE**	0.28J	<25	N/A	N/A
Ethylbenzene	444	130	N/A	N/A	**Other**	N/A	N/A	N/A	N/A
Xylenes	1,200	1,100	N/A	N/A	**EDB**	0.95J	N/A	N/A	N/A

Comments:

VI. Closure

Does completed corrective action protect existing beneficial uses per the RB Basin Plan? Yes.

Does completed corrective action protect potential beneficial uses per the RB Basin Plan? Yes.

Does corrective action protect public health for current land use? Yes.

Site Management Requirements: Abandon all soil vapor extraction wells prior to case closure.

Should corrective action be reviewed if land use changes? No.

Vapor Wells Decommissioned? Yes.	Number Decommissioned: 4	Number Retained: 0
Monitoring Wells Decommissioned? N/A	Number Decommissioned: 0	Number Retained: 0

List enforcement actions taken: None.
List enforcement actions rescinded: None.

VII. Local Agency Representative Data

Agency: Santa Barbara County Fire Department, Fire Prevention Division	Address: 1430 Mission Drive
City/State/Zip: Solvang, California, 93463	Phone: (805) 686-8176
Responsible Specialist: Thomas Rejzek	Title: Professional Geologist

VIII. Additional Comments

In 2007, a Phase 1 environmental assessment was conducted. From February to April of 2008, six (6) soil borings were advanced. Laboratory analytical results indicated maximum TPH as gasoline concentration of 20,700 mg/kg and maximum benzene concentration of 11.7 mg/kg in the vicinity of the former southern dispenser island. Based on these results, a new LUFT case was opened.
In November 2008, an additional assessment was conducted to define the lateral and vertical extents of hydrocarbons. HFA determined that TPH as gasoline, benzene, naphthalene, and VOCs were localized in the immediate vicinity of the former southern dispenser island at depths less than 30 fbg.
Four (4) SVE wells and an SVE system were installed at the site. The system operated from August 2010 to April 2011 and removed a total of 3,482 pounds of hydrocarbons from the subsurface. The results of the confirmation soil borings demonstrated that the SVE system had reduced the VOCs to asymptotic levels and removed over 90 percent of the initial mass of hydrocarbons.

IX. Regional Board Certification

Signature of Executive Officer:	**Date:**

X. Local Agency Representative Data

Name:	Title: Fire Marshal
Signature:	**Date:**

XI. Additional Information (to be attached to this report)

1. Listing of Reports

2. Extent of Soil Contamination

a) Maps and cross sections showing the extent of soil degradation by chemicals of concern in excess of guidelines, before and after remediation.

b) Geologic logs with degraded soils. All soil boring and monitoring wells showing sample points with a list of contaminant concentrations.

c) Summary table of all historic soil sampling results.

3. Extent of Groundwater Contamination

a) Maps and cross sections showing the extent of groundwater degradation in excess of detection limits for chemicals of concern, before and after remediation.

b) Geologic logs, including construction details, for all wells.

c) Representative geologic log identifying all water bodies (e.g. surface, perched and water table).

d) Two intersecting cross-sections of the site.

e) Summary table of all historic ground water analyses (including detection levels) and water levels.

Listing of Reports
for Santa Barbara County Fire Department, LUFT Site #502421
Chevron Former Service Station #9-4268

7952 Hollister Avenue, Goleta, California

I attest, under penalty of perjury, in accordance with Water Code section 13267, the following documents constitute the complete list of documents pertaining to waste discharged, hydrogeology and other information directly relevant to the characterization and cleanup of the waste discharged at the subject site.

2012
2012, Work Plan for Well Abandonment Activities, March 1.

2011
2011a, Fourth Quarter 2010 Remediation System Progress Report, January 7.
2011b, 2010 Annual Report for Authority to Construct #13462, February 11.
2011c, First Quarter 2011 Remediation System Progress Report, April 6.
2011d, Soil Vapor Extraction Rebound Test Results and Work Plan, May 31.
2011e, Second Quarter 2011 Remediation System Progress Report, July 7.
2011f, Verification Soil Sampling Report and Mass Calculation of Residual Hydrocarbons, December 20.
2011g, Annual Report for Permit to Operate #13462, December 21.

2010
2010a, Corrective Action Plan, May 3.
2010b, Third Quarter 2010 Remediation System Progress Report, October 5.
2010c, Emissions Verification Test Report, December 22.

2009
2009a, Site Assessment Report, February 18.
2009b, Corrective Action Plan, July 10.

2008
2008a, Rincon's Additional Soil Assessment, May 14.
2008b, Work Plan for Site Assessment Activities, September 8.

Signature of Responsible Party: ___________________________________

Printed name of Responsible Party: ________________________________

Date: ____

APPENDIX F

EARTHWORK AND GRADING GUIDE SPECIFICATIONS

APPENDIX F

LEIGHTON CONSULTING, INC.
EARTHWORK AND GRADING GUIDE SPECIFICATIONS

TABLE OF CONTENTS

F-1.0 GENERAL

F-1.1 Intent

These Earthwork and Grading Guide Specifications are for grading and earthwork shown on the current, approved grading plan(s) and/or indicated in the Leighton Consulting, Inc. geotechnical report(s). These Guide Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the project-specific recommendations in the geotechnical report shall supersede these Guide Specifications. Leighton Consulting, Inc. shall provide geotechnical observation and testing during earthwork and grading. Based on these observations and tests, Leighton Consulting, Inc. may provide new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

F-1.2 Role of Leighton Consulting, Inc.

Prior to commencement of earthwork and grading, Leighton Consulting, Inc. shall meet with the earthwork contractor to review the earthwork contractor's work plan, to schedule sufficient personnel to perform the appropriate level of observation, mapping and compaction testing. During earthwork and grading, Leighton Consulting, Inc. shall observe, map, and document subsurface exposures to verify geotechnical design assumptions. If observed conditions are found to be significantly different than the interpreted assumptions during the design phase, Leighton Consulting, Inc. shall inform the owner, recommend appropriate changes in design to accommodate these observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include (1) natural ground after clearing to receiving fill but before fill is placed, (2) bottoms of all "remedial removal" areas, (3) all key bottoms, and (4) benches made on sloping ground to receive fill.

Leighton Consulting, Inc. shall observe moisture-conditioning and processing of the subgrade and fill materials, and perform relative compaction testing of fill to determine the attained relative compaction. Leighton Consulting, Inc. shall provide *Daily Field Reports* to the owner and the Contractor on a routine and frequent basis.

F-1.3 The Earthwork Contractor

The earthwork contractor (Contractor) shall be qualified, experienced and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Guide

Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing grading and backfilling in accordance with the current, approved plans and specifications.

The Contractor shall inform the owner and Leighton Consulting, Inc. of changes in work schedules at least one working day in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that Leighton Consulting, Inc. is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish earthwork and grading in accordance with the applicable grading codes and agency ordinances, these Guide Specifications, and recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of Leighton Consulting, Inc., unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, adverse weather, etc., are resulting in a quality of work less than required in these specifications, Leighton Consulting, Inc. shall reject the work and may recommend to the owner that earthwork and grading be stopped until unsatisfactory condition(s) are rectified.

F-2.0 PREPARATION OF AREAS TO BE FILLED

F-2.1 Clearing and Grubbing

Vegetation, such as brush, grass, roots and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies and Leighton Consulting, Inc.. Care should be taken not to encroach upon or otherwise damage native and/or historic trees designated by the Owner or appropriate agencies to remain. Pavements, flatwork or other construction should not extend under the “drip line” of designated trees to remain.

Leighton Consulting, Inc. shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 3 percent of organic materials (by dry weight: ASTM D 2974). Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area. As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

F-2.2 Processing

Existing ground that has been declared satisfactory for support of fill, by Leighton Consulting, Inc., shall be scarified to a minimum depth of 6 inches (15 cm). Existing ground that is not satisfactory shall be over-excavated as specified in the following Section D-2.3. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

F-2.3 Overexcavation

In addition to removals and over-excavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be over-excavated to competent ground as evaluated by Leighton Consulting, Inc. during grading. All undocumented fill soils under proposed structure footprints should be excavated

F-2.4 Benching

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), (>20 percent grade) the ground shall be stepped or benched. The lowest bench or key shall be a minimum of 15 feet (4.5 m) wide and at least 2 feet (0.6 m) deep, into competent material as evaluated by Leighton Consulting, Inc.. Other benches shall be excavated a minimum height of 4 feet (1.2 m) into competent material or as otherwise recommended by Leighton Consulting, Inc.. Fill placed on ground sloping flatter than 5:1 (horizontal to vertical units), (<20 percent grade) shall also be benched or otherwise over-excavated to provide a flat subgrade for the fill.

F-2.5 Evaluation/Acceptance of Fill Areas

All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by Leighton Consulting, Inc. as suitable to receive fill. The Contractor shall obtain a written acceptance (*Daily Field Report*) from Leighton Consulting, Inc. prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys and benches.

F-3.0 FILL MATERIAL

F-3.1 Fill Quality

Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by Leighton Consulting, Inc. prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to Leighton Consulting, Inc. or mixed with other soils to achieve satisfactory fill material.

F-3.2 Oversize

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 6 inches (15 cm), shall not be buried or placed in fill unless location, materials and placement methods are specifically accepted by Leighton Consulting, Inc.. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 feet (3 m) measured vertically from finish grade, or within 2 feet (0.61 m) of future utilities or underground construction.

F-3.3 Import

If importing of fill material is required for grading, proposed import material shall meet the requirements of Section D-3.1, and be free of hazardous materials (“contaminants”) and rock larger than 3-inches (8 cm) in largest dimension. All import soils shall have an Expansion Index (EI) of 20 or less and a sulfate content no greater than (≤) 500 parts-per-million (ppm). A representative sample of a potential import source shall be given to Leighton Consulting, Inc. at least four full working days before importing begins, so that suitability of this import material can be determined and appropriate tests performed.

F-4.0 FILL PLACEMENT AND COMPACTION

F-4.1 Fill Layers

Approved fill material shall be placed in areas prepared to receive fill, as described in Section D-2.0, above, in near-horizontal layers not exceeding 8 inches (20 cm) in loose thickness. Leighton Consulting, Inc. may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers, and only if the building officials with the appropriate jurisdiction approve. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

F-4.2 Fill Moisture Conditioning

Fill soils shall be watered, dried back, blended and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM) Test Method D 1557.

F-4.3 Compaction of Fill

After each layer has been moisture-conditioned, mixed, and evenly spread, each layer shall be uniformly compacted to not-less-than (≥) 90 percent of the maximum dry density as determined by ASTM Test Method D 1557. In some cases, structural fill may be specified (see project-specific geotechnical report) to be uniformly compacted to at-least (≥) 95 percent of the ASTM D 1557 modified Proctor laboratory maximum dry density. For fills thicker than (>) 15 feet (4.5 m), the portion of fill deeper than 15 feet below proposed finish grade shall be compacted to 95 percent of the ASTM D 1557 laboratory maximum density. Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

F-4.4 Compaction of Fill Slopes

In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by back rolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet (1 to 1.2 m) in fill elevation, or by other methods producing satisfactory results acceptable to Leighton Consulting, Inc.. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of the ASTM D 1557 laboratory maximum density.

F-4.5 Compaction Testing

Field-tests for moisture content and relative compaction of the fill soils shall be performed by Leighton Consulting, Inc.. Location and frequency of tests shall be at our field representative(s) discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

F-4.6 Compaction Test Locations

Leighton Consulting, Inc. shall document the approximate elevation and horizontal coordinates of each density test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that Leighton

Consulting, Inc. can determine the test locations with sufficient accuracy. Adequate grade stakes shall be provided.

F-5.0 EXCAVATION

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by Leighton Consulting, Inc. during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by Leighton Consulting, Inc. based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, then observed and reviewed by Leighton Consulting, Inc. prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by Leighton Consulting, Inc..

F-6.0 TRENCH BACKFILLS

F-6.1 Safety

The Contractor shall follow all OSHA and Cal/OSHA requirements for safety of trench excavations. Work should be performed in accordance with Article 6 of the *California Construction Safety Orders*, 2009 Edition or more current (see also: http://www.dir.ca.gov/title8/sb4a6.html).

F-6.2 Bedding and Backfill

All utility trench bedding and backfill shall be performed in accordance with applicable provisions of the 2015 Edition of the *Standard Specifications for Public Works Construction* (Green Book). Bedding material shall have a Sand Equivalent greater than 30 (SE>30). Bedding shall be placed to 1-foot (0.3 m) over the top of the conduit, and densified by jetting in areas of granular soils, if allowed by the permitting agency. Otherwise, the pipe-bedding zone should be backfilled with Controlled Low Strength Material (CLSM) consisting of at least one sack of Portland cement per cubic-yard of sand, and conforming to Section 201-6 of the 2015 Edition of the *Standard Specifications for Public Works Construction* (Green Book). Backfill over the bedding zone shall be placed and densified mechanically to a minimum of 90 percent of relative compaction (ASTM D 1557) from 1 foot (0.3 m) above the top of the conduit to the surface. Backfill above the pipe zone shall **not** be jetted. Jetting of the bedding around the conduits shall be observed by Leighton Consulting, Inc. and backfill above the pipe zone (bedding) shall be observed and tested by Leighton Consulting, Inc..

F-6.3 Lift Thickness

Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to Leighton Consulting, Inc. that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method, and only if the building officials with the appropriate jurisdiction approve.

APPENDIX G

ASFE Important Information About Your Geotechnical Report

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

FIGURES

Project: 11389.001	Eng/Geol: LJD/GIM
Scale:1 " = 2,000 '	Date: February 2017

Base Map: ESRI ArcGIS Online 2017
Thematic Information: Leighton
Author: Leighton Geomatics (mmurphy)

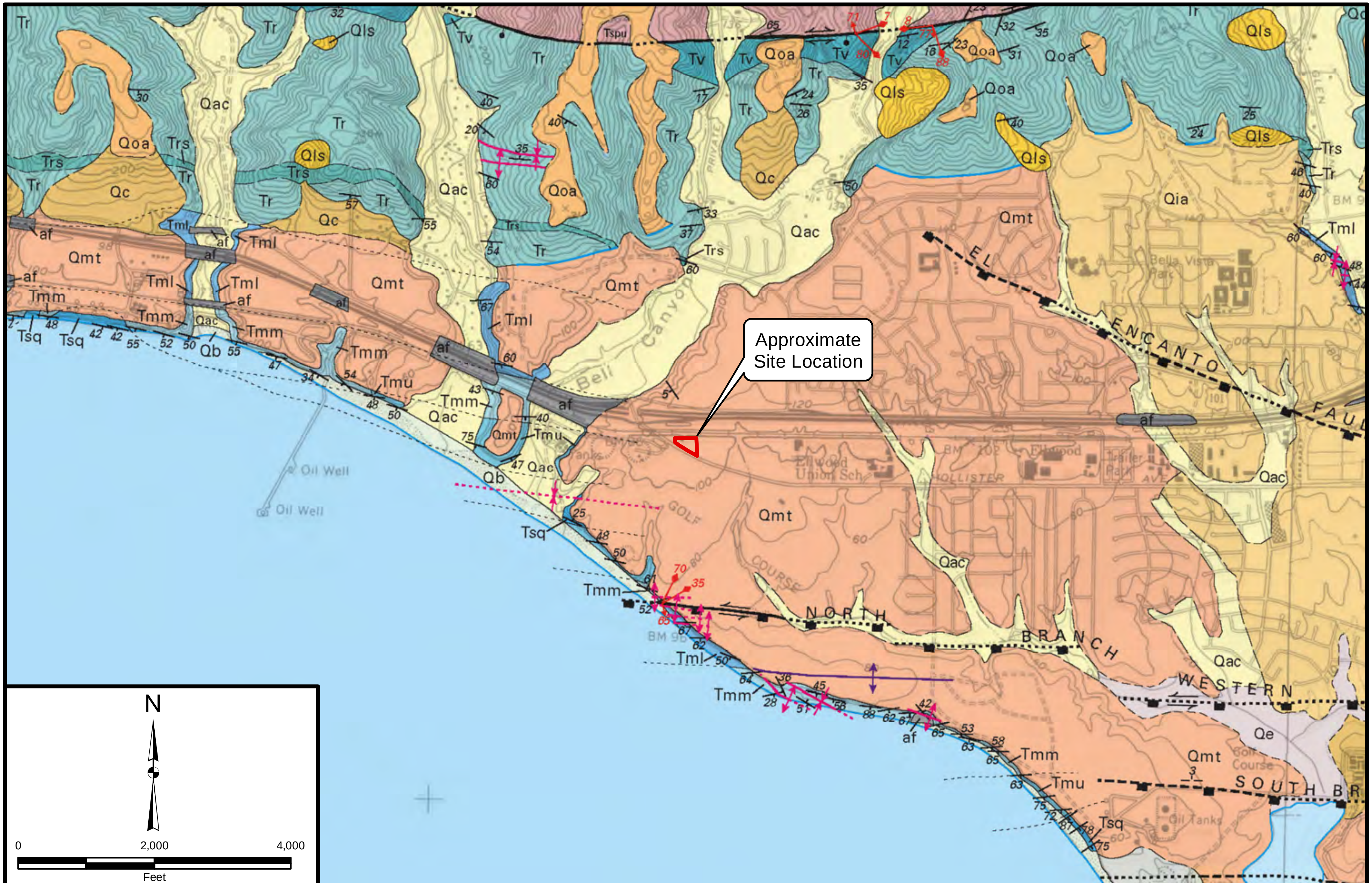
SITE LOCATION MAP

Fire Station #10
7952 Hollister Avenue
Goleta CA

Figure 1

Leighton

Map Saved as V:\Drafting\11389\001\Maps\11389_001_F01_SLM_2016-07-15.mxd on 10/11/2016 1:22:54 PM



Project: 11389.001	Eng/Geol: LJD/GIM
Scale:1 " = 2,000 '	Date: February 2017

Base Map: "Geologic Map of The Santa Barbara Coastal plain Area" Minor, Kellog, Stanley, Gurrola, Keller, and Brandt 2009. USGS National Geographic Society, I-Cubed 2013
Thematic Information: Leighton, USGS
Author: Leighton Geomatics (mmurphy)

REGIONAL GEOLOGY MAP

Fire Station #10
7952 Hollister Avenue
Goleta CA

Figure 2a

Leighton

Map Saved as V:\Drafting\11389\001\Maps\11389_001_F02a_RGM_landscape_2016-07-15.mxd on 2/21/2017 11:26:33 AM

Legend

- af – Artificial fill (Holocene)
- Qb - Beach deposits (Holocene)
- Qds – Dune sand (Holocene)
- Qe - Estuarine deposits (Holocene)
- Qdf – Debris-flow deposits (Holocene and upper Pleistocene)
- Qac – Alluvium and colluvium (Holocene and upper Pleistocene)
- Qc – Colluvium (Holocene and upper Pleistocene)
- Qls - Landslide deposits (Holocene to middle Pleistocene)
- Qia – Intermediate alluvial deposits (upper Pleistocene)
- Qmt - Marine-terrace deposits (upper Pleistocene)
- Qoa - Older alluvial deposits (Upper and middle Pleistocene)
- Tsq – Sisquoc Formation (lower Pliocene and upper Miocene)
- Tmu – Upper siliceous unit (upper Miocene)
- Tmm – Middle shale unit (upper and middle Miocene)
- Tml – Lower calcareous unit (middle and lower Miocene)
- Tr - Rincon Shale (lower Miocene)
- Trs – Siliceous shale interval (lower Miocene)
- Tv - Vaqueros Formation (upper Oligocene)
- Tspu - Upper sandstone and mudstone unit (upper Oligocene)

Contact—Long-dashed where approximately located; short-dashed where inferred; dotted where concealed; tic shows direction and angle of dip

Trace of marker bed

Outline of erosionally beveled geomorphic surface

Marine-terrace shoreline angle—Approximately located based on subtle to strong topographic steps of terrace surface; locally coincides with contact between Qmt and older units

Faults—Long-dashed where approximately located; short dashed where inferred; dotted where concealed; queried where uncertain; small red arrow shows direction and angle of dip; red diamond-headed arrow shows bearing and rake of slickenlines and inferred slip direction of hanging-wall block

Strike-slip fault—Opposing arrows show sense of strike-slip movement, queried where uncertain; bi-directional arrows indicate superposed dextral and sinistral slip on same fault

Normal fault—Ball and bar on apparent downthrown side

Reverse fault—Rectangles on apparent upthrown side

Thrust fault—Sawteeth on apparent upthrown side

Fault-line scarp—Inferred from aerial photographs; hachures point downscarp

Slide-block boundary—Inferred; hachures on slide block

Fold and warp axial traces—Long-dashed where approximately located, short-dashed where inferred; dotted where concealed

Anticline—Large arrow indicates plunge direction

Overturned anticline

Upwarp axis—Large arrow indicates plunge direction; mapped in Quaternary deposits where geomorphically expressed

Syncline—Large arrow indicates plunge direction

Overturned syncline

Downwarp axis—Mapped in Quaternary deposits where geomorphically expressed

Horizontal bedding

Inclined bedding—Showing strike and dip

Inclined bedding—Showing approximate strike and dip

Inclined bedding—Showing strike and dip of beds calculated from bedding trace

Vertical bedding—Showing strike

Overturned bedding—Showing strike and dip

(Tsq) **Concealed bedding**—Measured in unit indicated where temporarily exposed at low tide or in construction excavation

Oil seep

Qas—Asphalt deposit

Qtc—Travertine and caliche? deposit

Project: 11389.001	Eng/Geol: LJD/GIM
Scale: 1 " = 2,000 '	Date: February 2017

Base Map: "Geologic Map of The Santa Barbara Coastal plain Area" Minor, Kellog, Stanley, Gurrola, Keller, and Brandt 2009. USGS National Geographic Society, I-Cubed 2013
Thematic Information: Leighton, USGS
Author: Leighton Geomatics (mmurphy)

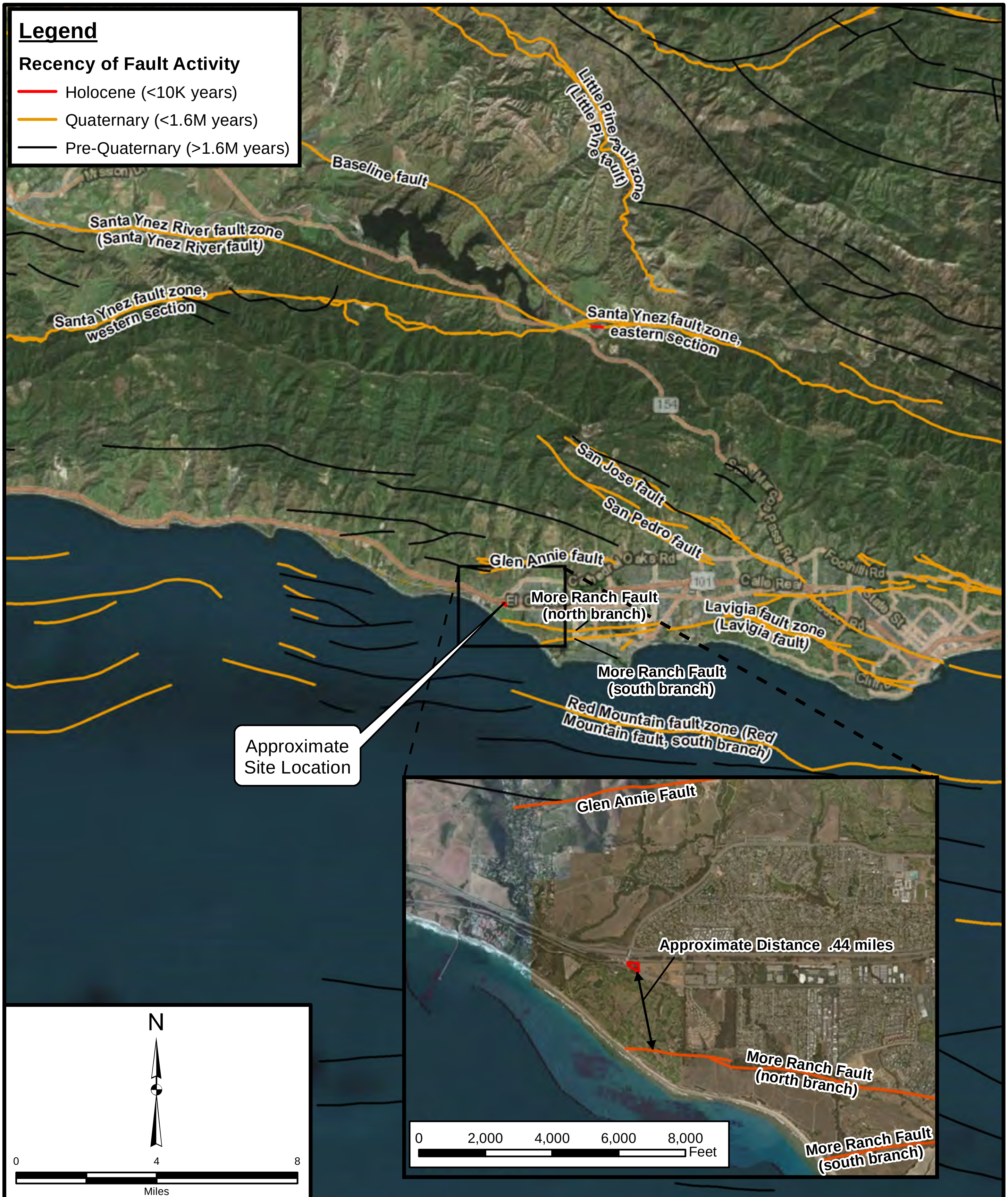
LEGEND TO REGIONAL GEOLOGY MAP

Fire Station #10
7952 Hollister Avenue
Goleta CA

Figure 2b

Leighton

Map Saved as V:\Drafting\11389\001\Maps\11389_001_F02a_RGM-Legend_2017-02-21.mxd on 2/21/2017 3:20:14 PM



Project: 11389.001	Eng/Geol: LJD/GIM
Scale:1 " = 4 miles	Date: February 2017

Base Map: ESRI ArcGIS Online 2017

Thematic Information: Leighton, CGS "Fault Activity Map of California", Jennings & Bryant 2010
Author: Leighton Geomatics (mmurphy)

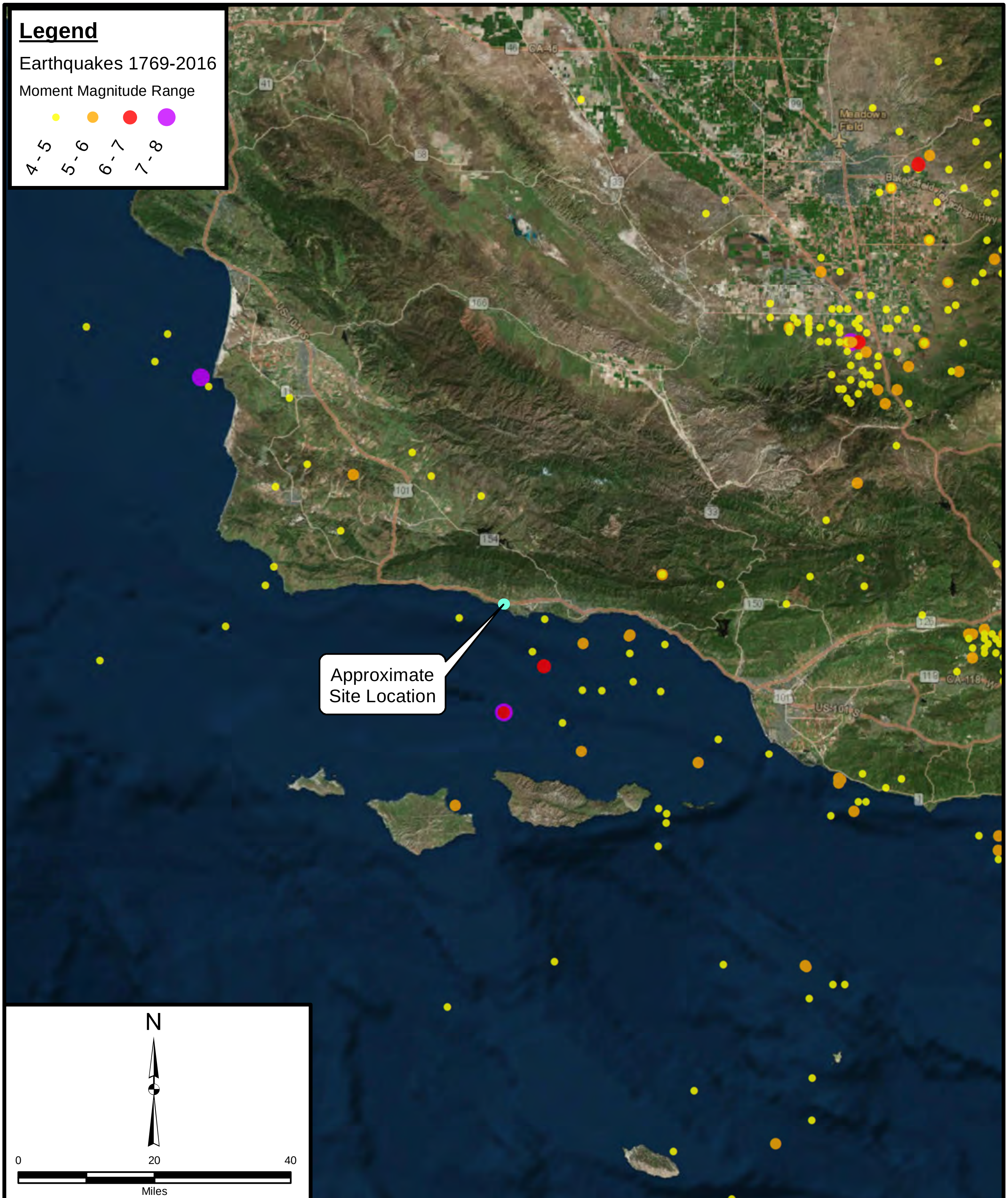
REGIONAL FAULT MAP

Fire Station #10
7952 Hollister Avenue
Goleta CA

Figure 3

Leighton

Map Saved as V:\Drafting\11389\001\Maps\11389_001_F03_RFM_inset_version4_Bryant2010_2016-09-30.mxd on 10/3/2016 11:50:26 AM



Project: 11389.001	Eng/Geol: LJD/GIM
Scale:1 " = 20 miles	Date: February 2017

Base Map: ESRI ArcGIS Online 2017
Thematic Information: Leighton, USGS, SCEC
Author: Leighton Geomatics (mmurphy)

HISTORIC SEISMICITY MAP

Fire Station #10
7952 Hollister Avenue
Goleta CA

Figure 4

Leighton

Map Saved as V:\Drafting\11389\001\Maps\11389_001_F04_RSM_2016-07-15.mxd on 2/21/2017 11:20:21 AM

Map Reference: "Conceptual Plan" by KMZ Architects, August 2016

GEOTECHNICAL EXPLORATION LOCATION MAP

Fire Station #10
7952 Hollister Avenue
Goleta CA

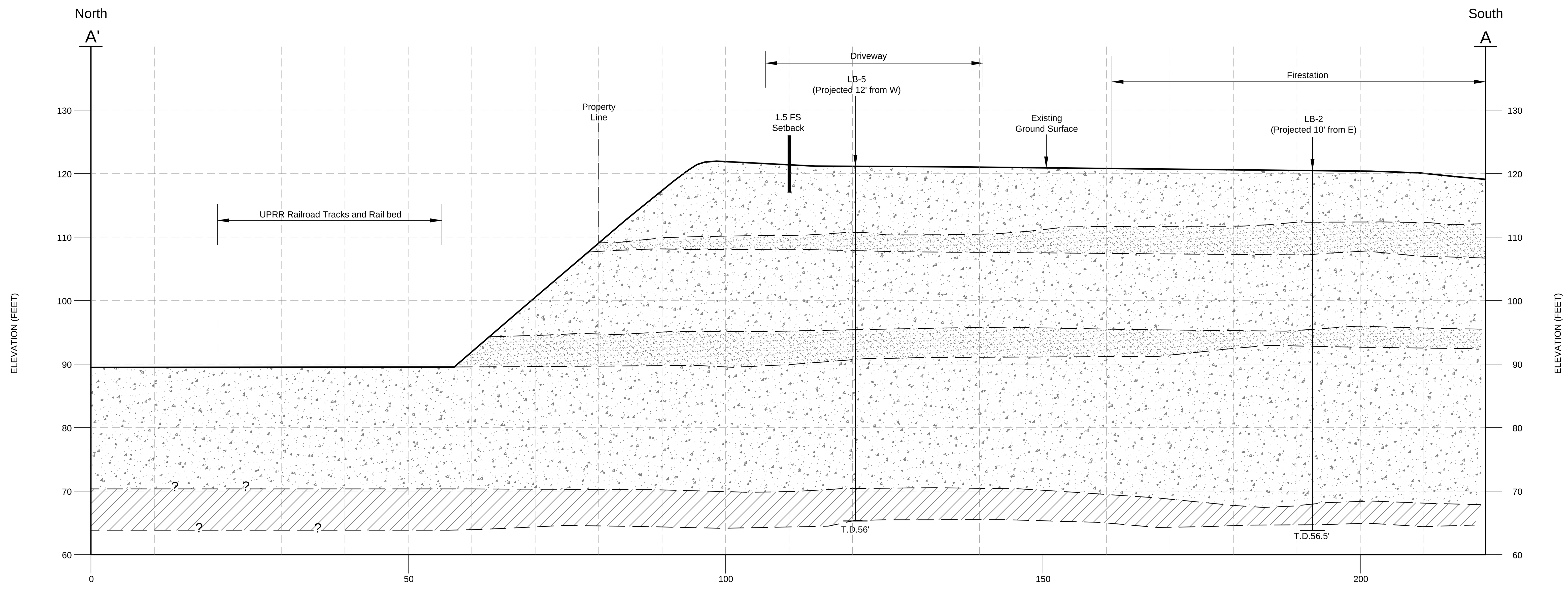
Plate 1

Project: 11389.001	Eng/Geol: LJD/GIM
Scale: 1 " = 20 feet	Date: February 2017

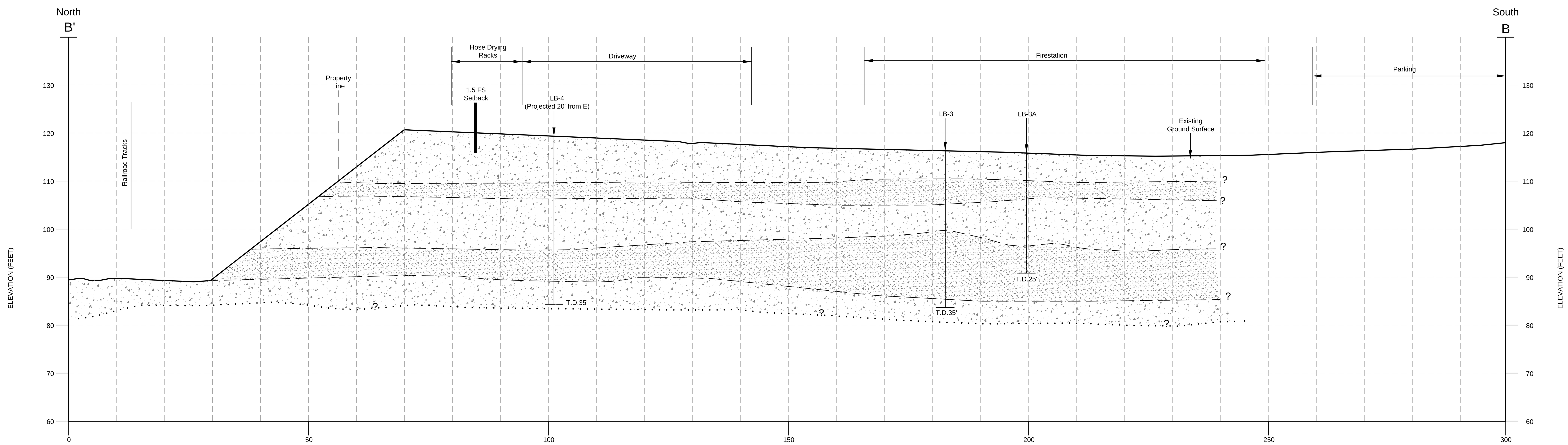
Base Map: Wallace Group "0863-0015 Sheet 2" Thematic Information: Leighton
612 Clarion Court, San Luis Obispo CA 93401
Author: Leighton Geomatics (mmurphy)

Leighton

GEOTECHNICAL CROSS-SECTIONS A-A' AND B-B' Fire Station #10 7952 Hollister Avenue Goleta, California		Plate 2
Proj: 11389.001	Eng/Geol: LJD/GIM	Leighton
Scale: 1"=10'	Date: February 2017	



CROSS SECTION A-A'



CROSS SECTION B-B'

SCALE 0 10 20 FEET

LEGEND

Qmt, Quaternary Marine Terrace Deposits

- Silty Sand (SM) and Poorly Graded Sand (SP)
- Silty, sandy Clay (CL), clayey Silt (ML), and silty, clayey Sand (SC-SM)
- Well Graded Sand (SW)

Abbreviations
APPLIES TO STRUCTURAL DRAWINGS ONLY

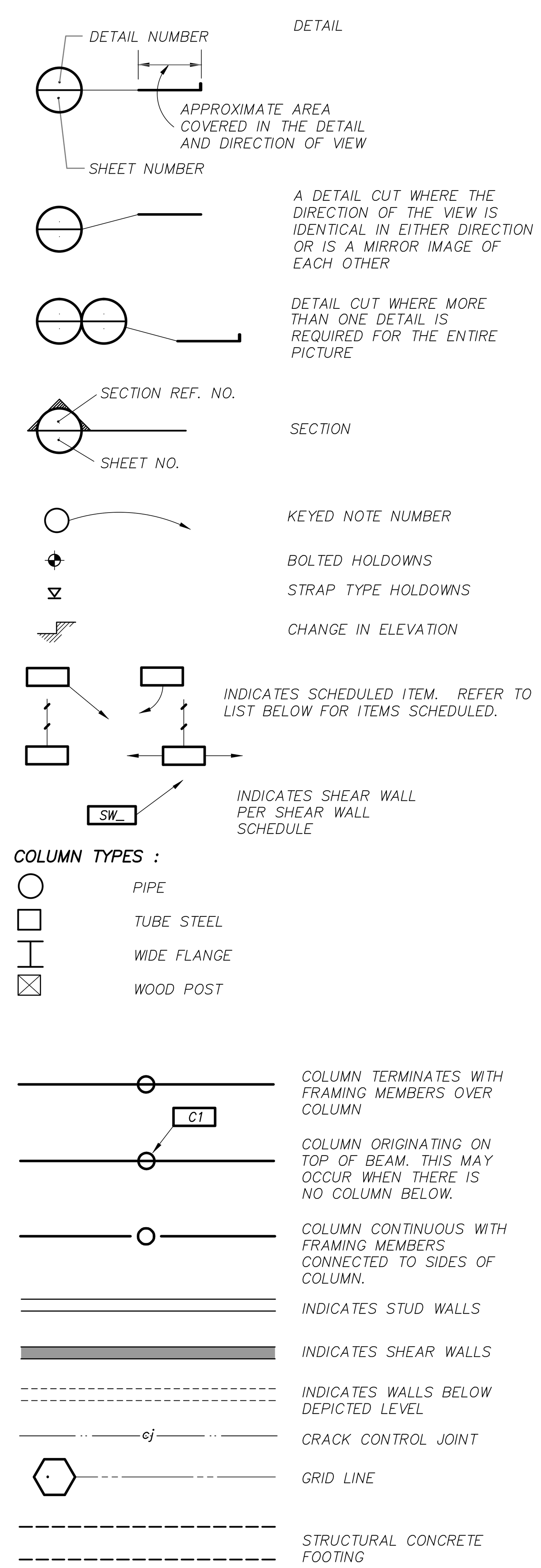
SYMBOLS USED AS ABBREVIATIONS

@	AT
∠	ANGLE
℄	CENTERLINE
[	CHANNEL
d	PENNY
⊥	PERPENDICULAR
℗	PLATE(S)
?	DIAMETER
⌀	SQUARE
w/	WITH
wo/	WITHOUT
#	NUMBER
&	AND
o/	OVER

ABBREVIATIONS

A.C.	ASPHALT CONCRETE
ALT.	ALTERNATE
A.B.	ANCHOR BOLT(S)
APPROX.	APPROXIMATE(LY)
ARCH.	ARCHITECT(URAL)
BSMT.	BASEMENT
BRG.	BEARING
BM.	BEAM
BLK.	BLOCK
BLKG.	BLOCKING
B.O.	BOTTOM OF
B.O.F.	BOTTOM OF FOOTING
BLDG.	BUILDING
B.N.	BOUNDRY NAILING
C.	CAMBER
C.I.P.	CAST-IN-PLACE
CEM.	CEMENT
CNTR.	CENTER(ED)
CHAM.	CHAMFER(ED)
CLR.	CLEAR(ANCE)
CLS.	CLOSURE
C.J.	COLD JOINT or CONTROL JOINT
COL.	COLUMN(S)
CONC.	CONCRETE
C.M.U.	CONCRETE MASONRY UNIT
CONT.	CONTINUE(OUS)
CONTR.	CONTRACT(OR)
CORR.	CORRUGATED
CSK.	COUNTERSINK(SUNK)
C.F.	CUBIC FOOT
C.Y.	CUBIC YARD
DBL.	DOUBLE
D.L.	DEAD LOAD
DEP.	DEPRESS(ED)
DTL.	DETAIL(S)
DIAG.	DIAGONAL
DIA.	DIAMETER
DIM.	DIMENSION(S)
DF.	DOUGLAS FIR
DN.	DOWN
E.	EAST
E.N.	EDGE NAILING
EA.	EACH
E.F.	EACH FACE
(E)	EXISTING
ELEV.	ELEVATION
EQ.	EQUAL
E.B.	EXPANSION BOLT
EXP.	EXPOSE(D)
EXT.	EXTERIOR
F.N.	FIELD NAILING
FAB.	FABRICATE(D)(ION)
F.B.	FLOOR BEAM
F.O.	FACE OF
FOC.	FACE OF CONCRETE
FOM.	FACE OF MASONRY
FOS.	FACE OF STUD
F.S.	FAR SIDE
FIN.	FINISH
FFE.	FINISH FLOOR ELEVATION
FF.	FINISH FLOOR
FLR.	FLOOR
FT.	FOOT, FEET
FTG.	FOOTING
FDN.	FOUNDATION
FUT.	FUTURE
GA.	GAGE, GAUGE
GALV.	GALVANIZE(D)
GL.	GLASS, GLAZING
G.B.	GRADE BEAM
GLB.	GLUED LAMINATED BEAM
GYP.	GYPSUM
GYPBD.	GYPBOARD
HDR.	HEADER
H.V.A.C.	HEATING/VENTILATING /AIR CONDITIONING
HT.	HEIGHT
HK.	HOOK(S)
HORIZ.	HORIZONTAL
INCL.	INCLUDE(D)(ING)
I.D.	INSIDE DIAMETER
IN.	INCHES
INS.	INSULATE(D)(ING)
INSP.	INSPECT(ING)(ION)
INT.	INTERIOR
INTM.	INTERMEDIATE
JT.	JOINT
JST.	JOIST
KO.	KNOCKOUT
K.J.	KEYED JOINT
L.	LENGTH
LB.	POUND
LAM.	LAMINATE(D)
LDGR.	LEDGER
LH.	LEFT HAND
L.L.	LIVE LOAD
M.B.	MACHINE BOLT
M.I.	MALLEABLE IRON
MFR.	MANUFACTURER
MAS.	MASONRY
M.L.	MASONRY LINTEL
MATL.	MATERIAL
MAX.	MAXIMUM
MECH.	MECHANICAL
MED.	MEDIUM
MMB.	MEMBRANE
M.F.D.	METAL FLOOR DECKING
M.R.D.	METAL ROOF DECKING
MDSP.	MIDSPAN
MISC.	MISCELLANEOUS
N.	NORTH
(N)	NEW
N.I.C.	NOT IN CONTRACT
N.T.S.	NOT TO SCALE
N.S.	NEAR SIDE
O.C.	ON CENTER
OPNG.	OPENING
O.W.J.	OPEN-WEB JOIST
OPP.	OPPOSITE
O.D.	OUTSIDE DIAMETER
PNL.	PANEL
PRLN.	PURLIN(S)
PAR.	PARALLEL
PARTN.	PARTITION
PVMT.	PAVEMENT
PERF.	PERFORATE
PLY.	PLYWOOD
P.W.J.	PLYWOOD WEB JOIST
PT.	POINT
PVC.	POLYVINYLCHLORIDE
PCF.	POUNDS PER CUBIC FOOT
PLF.	POUNDS PER LINEAL FOOT
PSI.	POUNDS PER SQUARE INCH
PREFAB.	PREFABRICATE(D)
PREFIN.	PREFINISH(ED)
P.T.D.F.	PRESSURE TREATED DOUGLAS FIR
PL.	PLATE(S)
PLN.	PROPERTY LINE
RAD.	RADIUS
RLNG.	RAILING
REF.	REFER(ENCE)
REINF.	REINFORCE(D)
REQ.	REQUIRE(D)
REV.	REVERSE(D)
REV.	REVISE(ION)
RH.	RIGHT HAND
R.D.	ROOF DRAIN
RFG.	ROOFING
RM.	ROOM
R.O.	ROUGH OPENING
S.J.	SAWED JOINT
SCHED.	SCHEDULE
SEC.	SECTION
SHT.	SHEET or SHEATHING
SIMP.	"SIMPSON" (a manufacturer)
SIM.	SIMILAR
S.	SOUTH
SPC.	SPACE(R)(D)(ING)
SPEC.	SPECIFICATION
SQ.	SQUARE
STAG.	STAGGER(ED)
STL.	STEEL
STD.	STANDARD
STRL.	STRUCTURAL
SYM.	SYMMETRICAL
THRD.	THREAD(ED)
THK.	THICK
T&G	TONGUE & GROOVE
T.O.	TOP OF
TOC.	TOP OF CONCRETE
TOCB.	TOP OF CURB
TOF.	TOP OF FOOTING
TOG.	TOP OF GRADE
TOM.	TOP OF MASONRY
TOP.	TOP OF PAVING
TOPL.	TOP OF PLATE
TOS.	TOP OF SLAB
TOSHTG.	TOP OF SHEATHING
TOSTL.	TOP OF STEEL
TOW.	TOP OF WALL
TYP.	TYPICAL
U.N.O.	UNLESS NOTED OTHERWISE
V.B.	VAPOR BARRIER
VNR.	VENEER
VERT.	VERTICAL
WF.	WIDE FLANGE
WWF.	WELDED WIRE FABRIC
WP.	WATERPROOFING
W.	WEST
W.	WIDTH or WIDE
WD.	WOOD
W.I.	WROUGHT IRON
WM.	WIRE MESH

Symbols
APPLIES TO STRUCTURAL DRAWINGS ONLY



Structural General Notes
APPLIES TO STRUCTURAL DRAWINGS ONLY

GENERAL

1. All materials and workmanship are subject to the review of the Architect and Structural Engineer.
2. Report any and all discrepancies, ambiguities, unclear items or items that are subject to more than one interpretation, on the Drawings and/or Specifications to the Structural Engineer for clarification before proceeding with Work.
3. All Work done under this contract is to comply with the 2016 edition of the California Building Code.
4. Design and install all temporary bracing and shoring to ensure the safety of the Work until it is in its completed form. When required by law, employ a Civil Engineer to design shoring, bracing, and installation plans for structural items.
5. Verify all dimensions prior to starting Work. The Architect and Structural Engineer are to be notified of any discrepancies or inconsistences. Check and coordinate all dimensions. See architectural Drawings for dimensions and non-structural items not shown on these Plans. Do not scale the Drawings to obtain dimensions.
6. All scaffoldings and shoring is to comply with the rules and regulations of the Industrial Safety Commission of the State of California.
7. The Structural Engineer will provide only periodic observation of the Work.
8. Fees or costs associated with the redesign or modification of these Plans by the Architect or Structural Engineer as a result of deviation by the Contractor from the Plans and Specifications, or due to errors, faulty materials or faulty workmanship, is to be paid to the Structural Engineer by the Contractor.
9. The Contractor is required to assume sole and complete responsibility for job site conditions during the course of construction of the project, including safety of all persons and property. This requirement applies continuously and is not limited to normal working hours. The Contractor further agrees to defend, indemnify and hold harmless the Structural Engineer from any and all liability, real or alleged, in connection with the performance of Work of this project, excepting liability arising from the sole negligence of the Structural Engineer.
10. Neither the professional activities nor the presence of the Structural Engineer at the construction site relieves the Contractor of his obligation, duties and responsibilities for construction means, methods, sequences, techniques and procedures necessary for the Contractor to complete the Work in accordance with the Plans and Specifications in a manner to ensure the health and safety of persons who enter the construction site.
11. Any differences between the existing construction as observed in the field and as shown on the Drawings is to be reported to the Structural Engineer before proceeding with Work.
12. Bidders must visit the building site and familiarize themselves with the existing conditions. Discrepancies or deletions must be brought to the attention of the Architect and Structural Engineer before bid date for correction.
13. Notify the owner of the adjoining property no less than ten days prior to making basement excavation. Protect adjoining property and buildings as defined in Section 1804.1 of the California Building Code.

EXCAVATING, GRADING, AND FILLING

1. Notify the Soils Engineer when clearing and demolition commence.
2. Notify the governmental agencies having jurisdiction over the project prior to grading commencing. Make all necessary arrangements for their inspection.
3. Backfilling in trenches and around footings is to be placed in 6" layers and compacted with either air or gasoline operated compacting equipment.
4. Remove all vegetation and debris on the surface from the site prior to commencing excavation and grading. Notify the Soil Engineer at least 48 hours prior to commencement of any excavation, clearing or demolition.
5. Backfill behind retaining walls is not to be placed sooner than 14 days after grout or concrete is poured.
6. A soils investigation report has been prepared by Leighton Consulting Inc. of 26074 Avenue Hall, Suite 21, Santa Clarita, CA., 91355. Earth and foundation work is to be done in compliance with the recommendations of this report. A copy of the soils investigation is available at the Architect's office.

FOUNDATIONS

1. Prior to pouring concrete foundations, all loose earth, water, and debris is to be removed from foundation bed.
2. The bottom elevation of all footings is subject to the approval of the Soils Engineer.
3. Provide for de-watering of all excavations from either surface water or seepage.
4. Protect all foundation excavations on the site from caving.
5. After foundation excavations have been completed and prior to placing reinforcing and formwork, the foundation bed is to be inspected by the Soils Engineer. All loose material is to be removed.
6. Secure in position prior to inspection and pouring concrete or grouting block, all anchor bolts, holdown anchors, reinforcing steel, dowels, inserts, etc. For anchor bolts and holdowns, use Simpson Anchormate anchor bolt holders. Stabbing bolts after pouring will not be allowed.

CONCRETE

1. All concrete is to have a minimum ultimate compressive strength at 28 days as follows:
   Gradebeam & Reinforced drilled concrete tangent piles..........4,000 psi
   Unreinforced filler piles...3,000 psi
2. Reinforcing bars are to be of intermediate grade conforming to ASTM A 615, grade 40 for #2 and #3 bars and grade 60 for #4 bars and larger.
3. Cement is to be type II, low alkali (no higher than .4%), conforming to ASTM C-150. Up to a maximum of 18% of cement may be substituted with Fly Ash (type "F").
4. All aggregate used in concrete are to conform to ASTM C-33. Aggregate shall be uniformly graded, with the maximum aggregate size required to be 1" to 3/4".
5. Coarse and fine aggregate (sand) are to come from a source proven to have non-reactive characteristics. Coarse aggregate which is heavy media processed (Saticoy, Sisquoc), Santa Margarita rock, or San Gabriel rock will be considered as meeting the criteria of non-reactivity. Moorpark sand (Quality, Best, Blue Star) will be considered as meeting the requirements of non-reactivity. Other aggregates meeting or exceeding the aggregate reactivity characteristics of the aggregates listed above are acceptable upon submittal of adequate documentation (ASTM C289 and ASTM C277 test results that are not more than 2 years old). Use an approximate 60% to 40% ratio of coarse aggregate to fine aggregate (by weight) respectively.
6. Splices of reinforcing steel are to be lapped as specified in these drawings and securely wired together. Splices of adjacent reinforcing bars shall be staggered wherever possible. See Drawings for particular requirements for splice breaks.
7. Minimum concrete cover for reinforcing is as follows:
   Cast against and permanently exposed to earth 3"
   Cast in forms and exposed to earth or weather 2"
8. Location of sleeves for pipes, and for pipes intended to be cast in concrete, for which no specific details are shown shall be subject to the review of the Structural Engineer.
9. Secure in position prior to inspection and pouring concrete, all anchor bolts, holdown anchors, reinforcing steel, dowels, inserts, etc. For anchor bolts and holdowns, use Simpson Anchormate anchor bolt holders. Stabbing bolts after pouring slab will not be allowed.
10. Concrete shall contain a minimum of 5.5 sacks of cement per cubic yard, a maximum water/cement ratio of .5, and shall have a slump no greater than 4". Do not exceed 36 gallons of water per cubic yard of concrete.
11. Continuous inspection by a Deputy Inspector approved by the Building Department is required for all concrete with an ultimate compressive strength greater than 2500 psi.
12. Make and test concrete cylinders in accordance with Section 1704.4 of the CBC.
13. Spray slabs with a curing compound immediately after finishing.
14. Do not place backfill behind retaining walls sooner than 14 days after concrete or grout is placed.
15. Vibrate all concrete as it is being placed with electronically-operated vibrating equipment.
16. Welded reinforcing bars to conform to ASTM A706.

NOTIFICATION

Notify the Structural Engineer 48 hours before the following times:
1. Prior to the time that the site grading work begins.
2. After foundation excavations have been made and prior to placing reinforcing steel and formwork.
3. Prior to all concrete pours.

DESIGN PARAMETERS

1. The design parameters for the pile footings per geotechnical investigation are as follow:

Active Pressure,	p_a =	32 psf per unit depth of soil retained above grade [hydrostatic pressure distribution]
Earth Pressure Coefficient, K_A	=	0.272
Surcharge Pressure,	p_{sur} =	K_Ax100 psf [uniform pressure distribution]
Seismic Earth Pressure,	p_E =	33 psf [uniform pressure distribution]
Passive Pressure,	p_p =	700 + 300 D psf, where D is the depth of pile embedment below grade
	$p_{p,lim}$ =	4000 psf
Factor of Safety	=	1.5

SPECIAL INSPECTIONS (CBC Sections 1704A & 1705A)

The owner or the architect of record, acting as the owner's agent, shall employ one or more special inspectors who are approved by DSA who shall provide inspections during construction on the following, but not limited to, types of work:

1. Reinforced concrete per Table 1705A.3.
   A. Required for all concrete designed for f'c exceeding 2,500 psi.
   B. Deep pier foundations per Table 1705.8

TABLE 1705.3

REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD [a]	IBC REFERENCE
1. Inspect reinforcement, including pretressing tendons, and verify placement.	—	X	ACI 318 Ch. 20, 25.2, 25.3, 26.5.1-26.5.3	1908.4
2. Reinforcing bar welding: a. Verify weldability of reinforcing bars other than ASTM A706; b. Inspect single-pass fillet welds, maximum 5/16"; and c. Inspect all other welds.	— — X	X X	AWS D1.4 ACI 318: 26.5.4	—
3. Inspect anchors cast in concrete	—	X	ACI 318: 17.8.2	—
4. Inspection of anchors post-installed in hardened concrete members. [b] a. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads. b. Mechanical anchors and adhesive anchors not defined in 4.a.	X	 X	ACI 318: 17.8.2.4 ACI 318: 17.8.2	—
5. Verify use of required design mix.	—	X	ACI 318: Ch. 19, 26.4.3, 26.4.4	1904.1, 1904.2, 1908.2, 1908.3
6. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	—	ASTM C172 ASTM C31 ACI 318: 26.4.5, 26.12	1908.10
7. Inspect concrete and shotcrete placement for proper application techniques.	X	—	ACI 318: 26.4.5	1908.6, 1908.7, 1908.8
8. Verify maintenance of specified curing temperature and techniques.	—	X	ACI 318: 26.4.7-26.4.9	1908.9
9. Inspect prestressed concrete for: a. Application of prestressing forces; and b. Grouting of bonded prestressing tendons	X X	— —	ACI 318: 26.9.2.1 ACI 318: 26.9.2.3	—
10. Inspect erection of precast concrete members.	—	X	ACI 318: Ch. 26.8	—
11. Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	—	X	ACI 318: 26.10.2	—
12. Inspect formwork for shape, location and dimensions of the concrete member being formed.	—	X	ACI 318: 26.10.1(b)	—

For SI: 1 inch=25.4 mm.
a. Where applicable, see also Section 1705.12, Special inspection for seismic resistance.
b. Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with 17.8.2 in ACI 318, or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.

TABLE 1705.8

REQUIRED VERIFICATION AND INSPECTION OF CAST IN PLACE DEEP PIER FOUNDATIONS

VERIFICATION AND INSPECTION TASKS	CONTINUOUS DURING TASK LISTED	PERIODICALLY DURING TASK LISTED
1. Observe drilling operations and maintain complete and accurate records for each pier.	X	—
2. Verify placement locations and plumbness, confirm pier diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end bearing strata capacity. Record concrete volumes.	X	—
3. For concrete piers, perform additional inspections in accordance with Section 1705.3.	—	—

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GREGORY H. STORK
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3	-	-/-/-	XX
2	-	-/-/-	XX
1	-	-/-/-	XX

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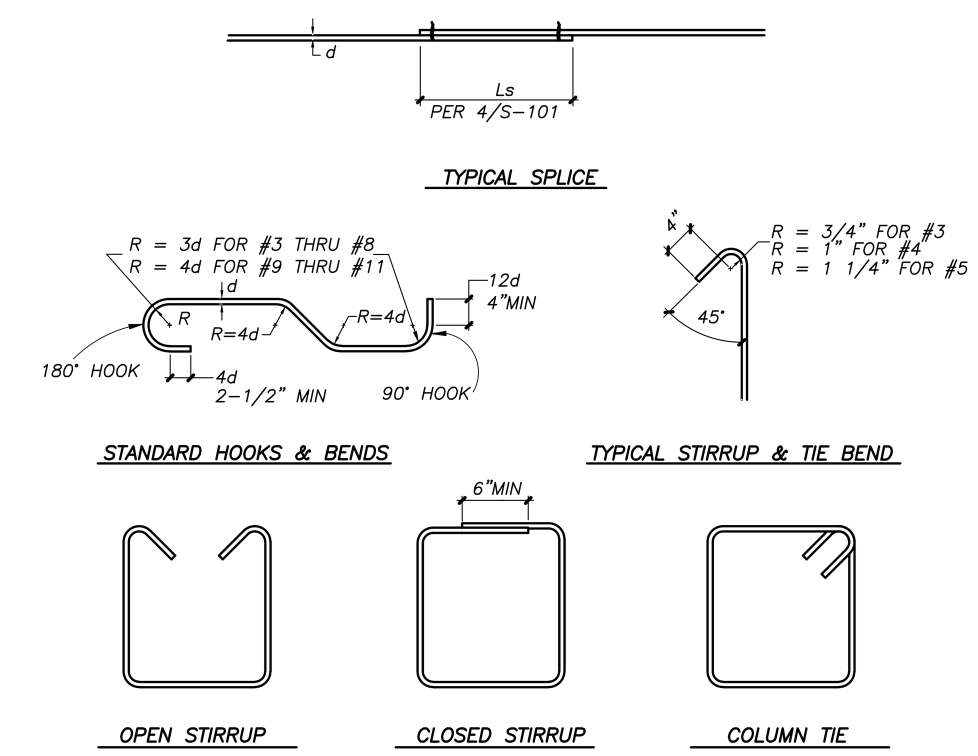
SHEET TITLE STRUCTURAL GENERAL NOTES, ABBREVIATIONS, SYMBOLS, & SPECIAL INSPECTIONS

SHEET

S-001

The details on the S-10X sheets are "typical" details which are to be used by the contractor where these various general conditions exist. These details are not necessarily referenced anywhere else in this set of construction documents. Prior to starting work, the contractor is to confirm with the Engineer that these details are properly interpreted and applied to the appropriate conditions.

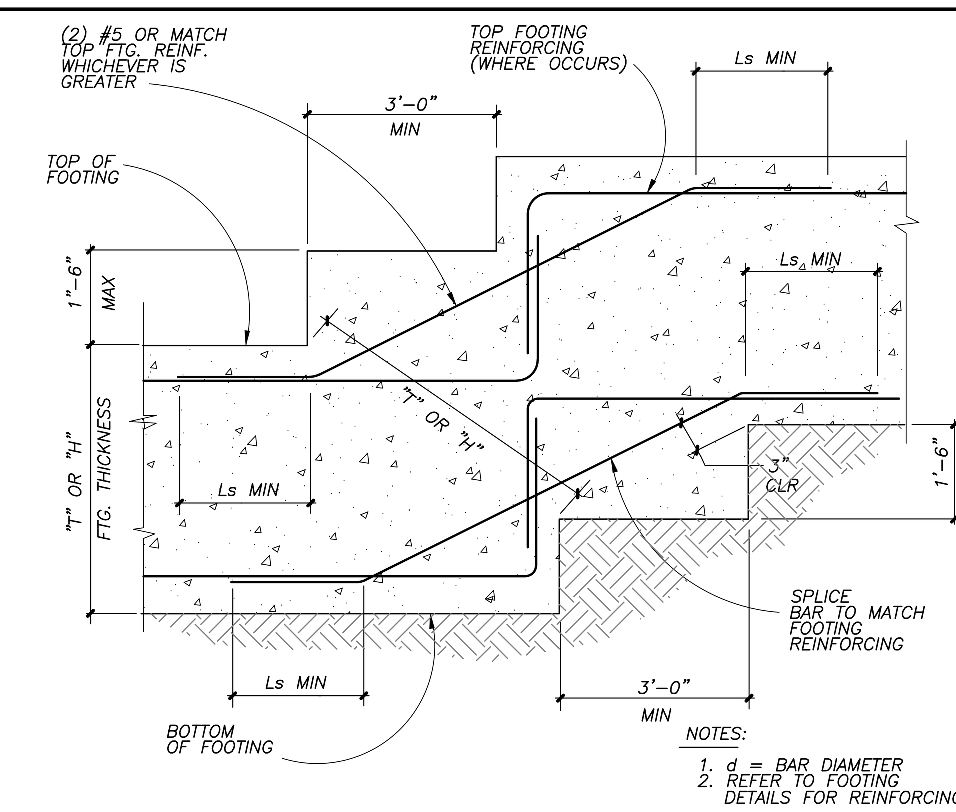
1



REINFORCING DETAILS

Scale: N.T.S.

2

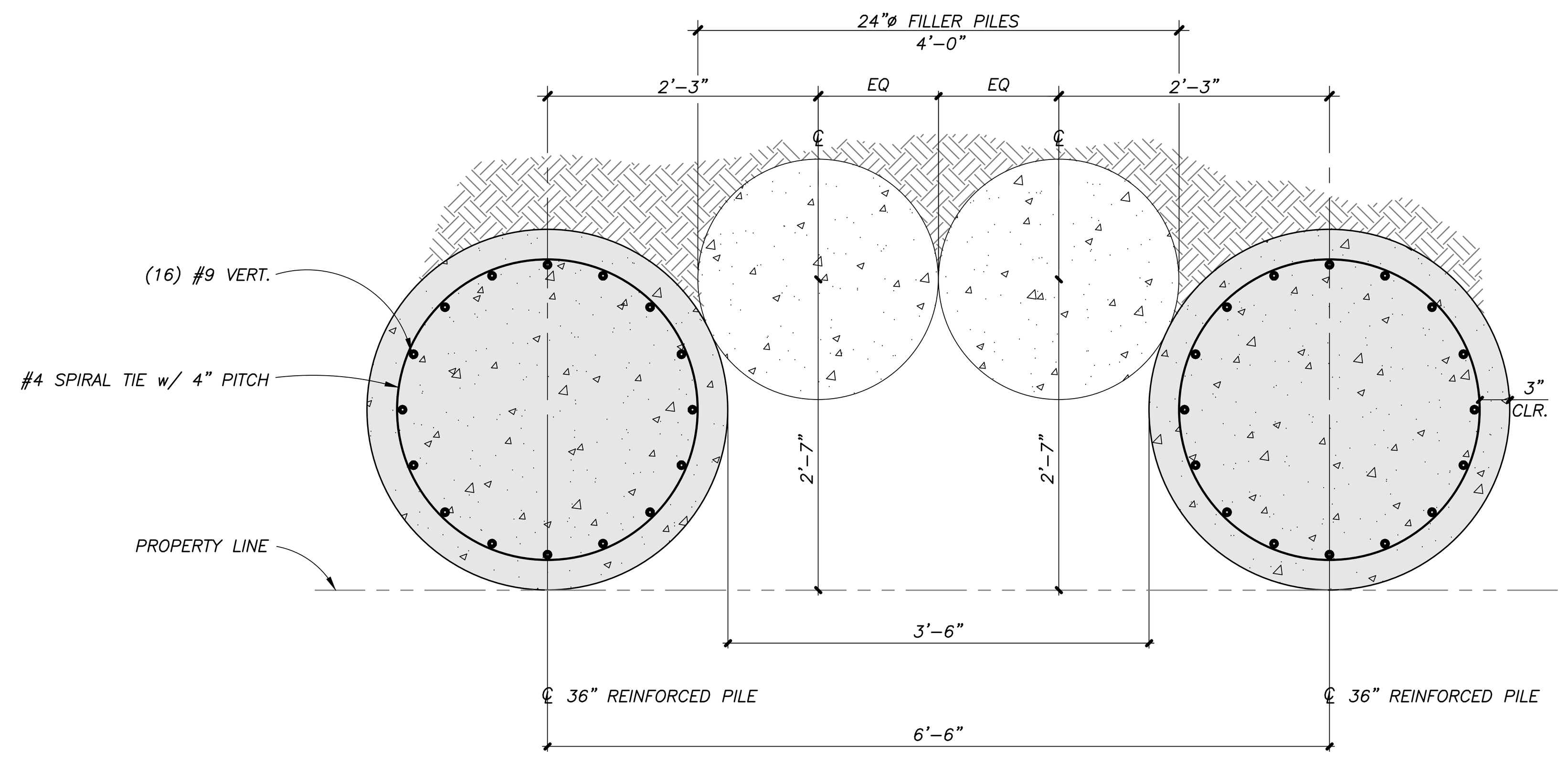


TYP. STEP IN TOP & BOTTOM OF FOOTING

Scale: N.T.S.

3

13



TYP. CONCRETE PILE LAYOUT

14

6

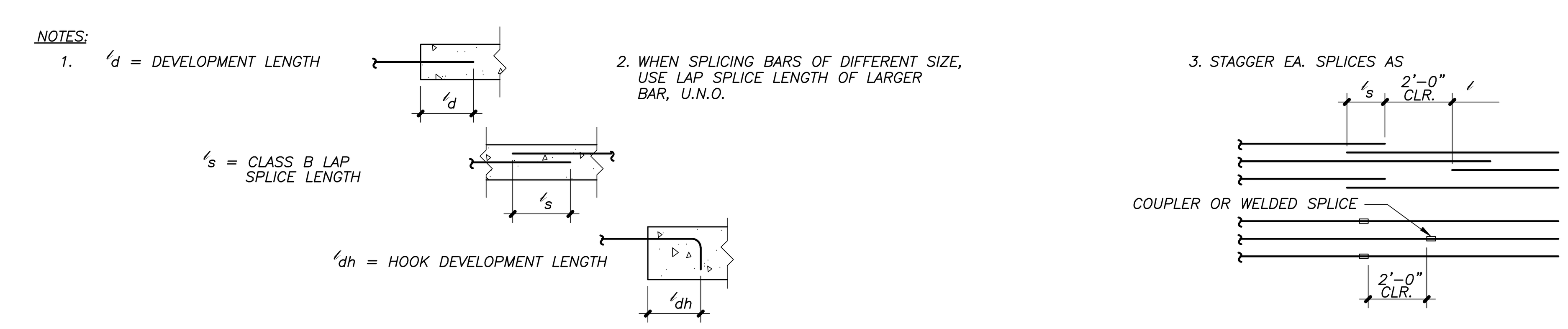
15

11

7

CONCRETE REINFORCING DEVELOPMENT & SPLICE LENGTHS (IN INCHES) - PER ACI 318-14

BAR LOCATION	CONCRETE		BAR SIZE																				
	TYPE	STRENGTH	#3			#4			#5			#6			#7			#8			#9		
			l_d	l_s	l_{dh}	l_d	l_s	l_{dh}	l_d	l_s	l_{dh}	l_d	l_s	l_{dh}	l_d	l_s	l_{dh}	l_d	l_s	l_{dh}	l_d	l_s	l_{dh}
GRADE BEAM & REINFORCED DRILLED CONCRETE TANGENT PILES	NORMAL	f'c = 4ksi	19	25	8	22	33	10	31	41	12	37	49	15	54	71	17	62	81	19	70	91	22



REINFORCING DEVELOPMENT & SPLICE LENGTHS

Scale: N.T.S.

16

12

4

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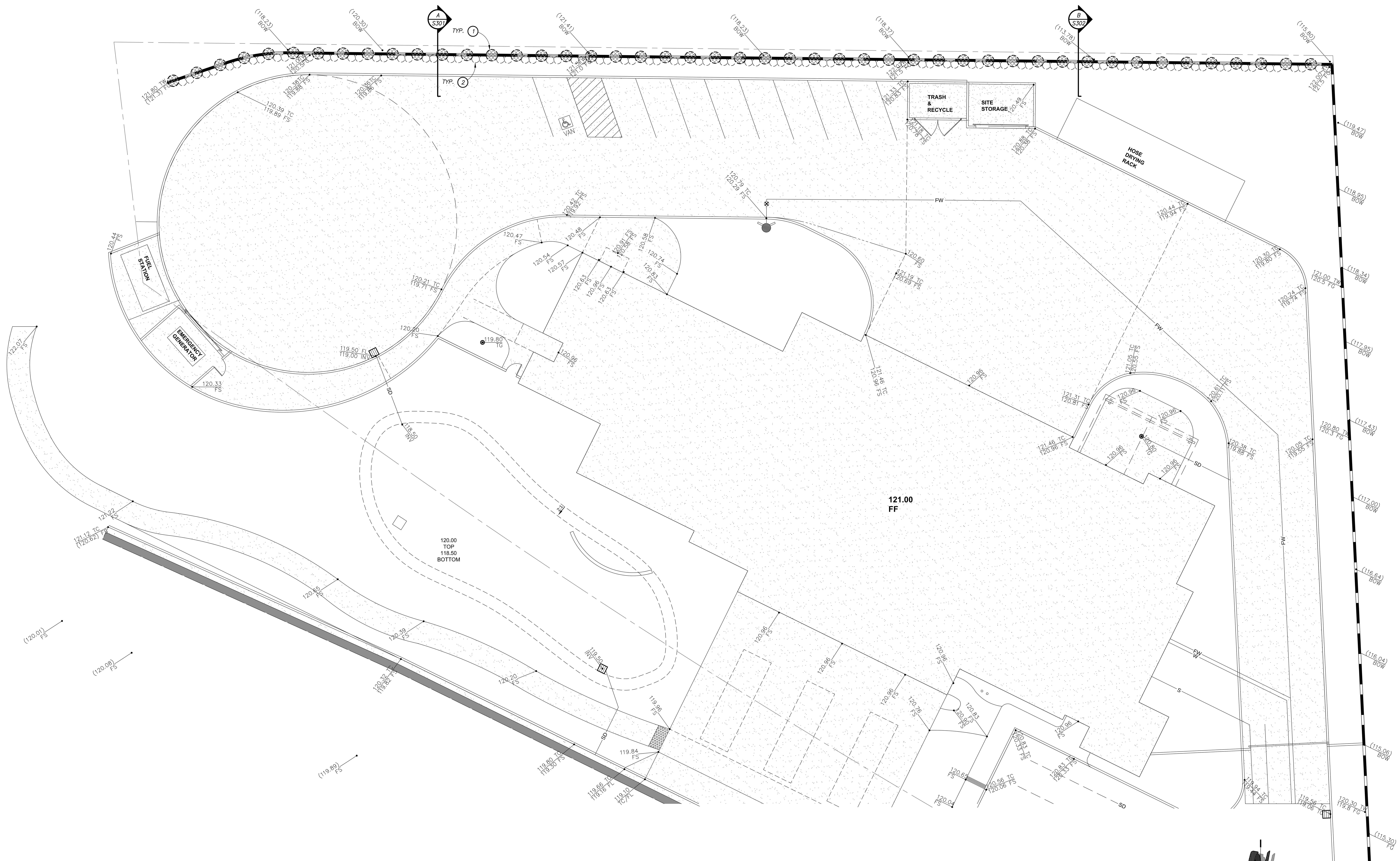
SHEET TITLE TYPICAL DETAILS

SHEET

S-101



SITE RETAINING WALL PLAN

SCALE: 3/32" = 1'-0"

RETAINING WALL PLAN NOTES :

FOUNDATION PLAN KEYED NOTES :

1. 36"ø REINF. CONCRETE TANGENT PILE RETAINING WALL
2. 24"ø UNREINF. FILLER PILES

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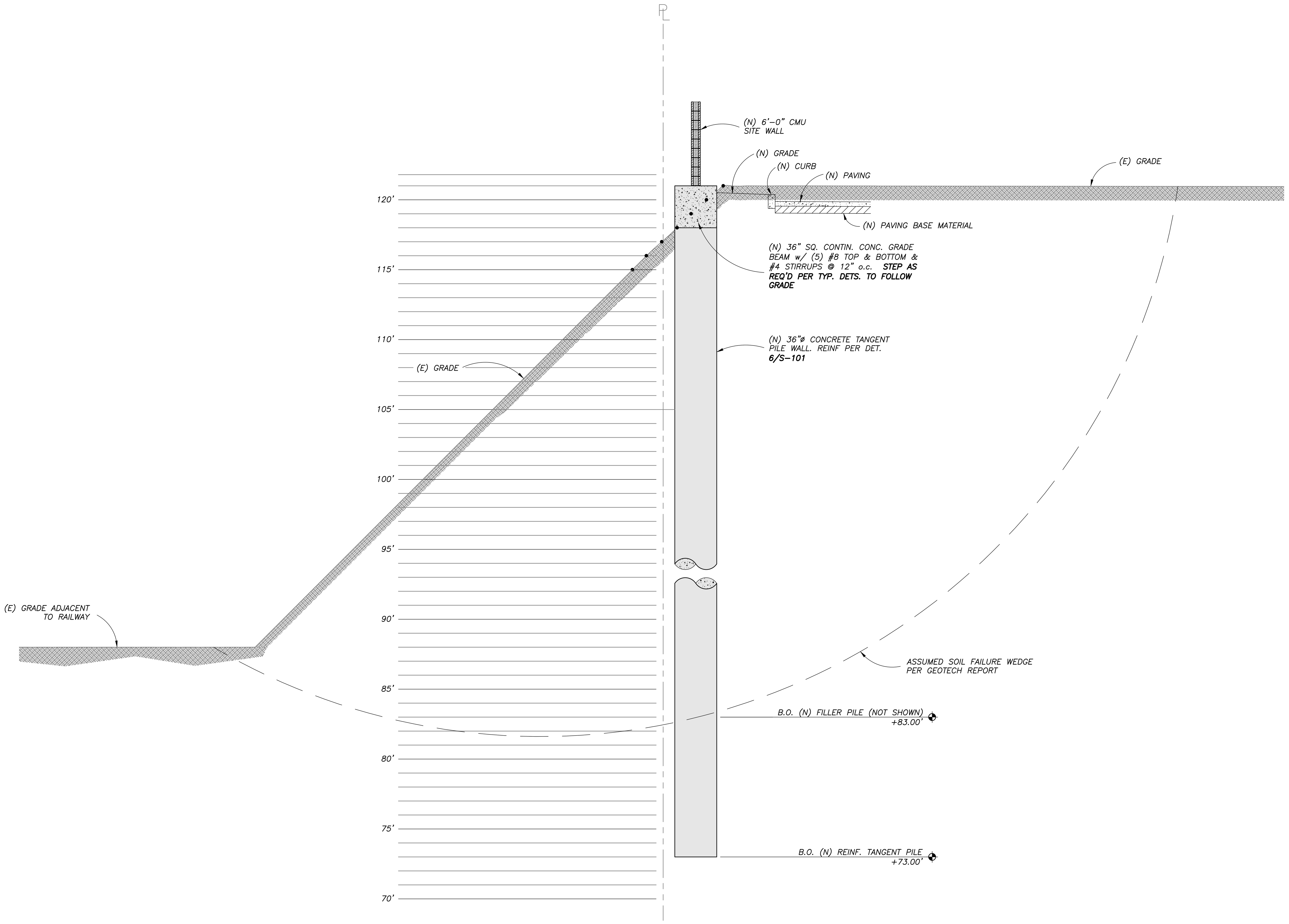
SHEET TITLE RETAINING WALL PLAN

SHEET
S-201



SECTION A

Scale : 1/4" = 1'-0"

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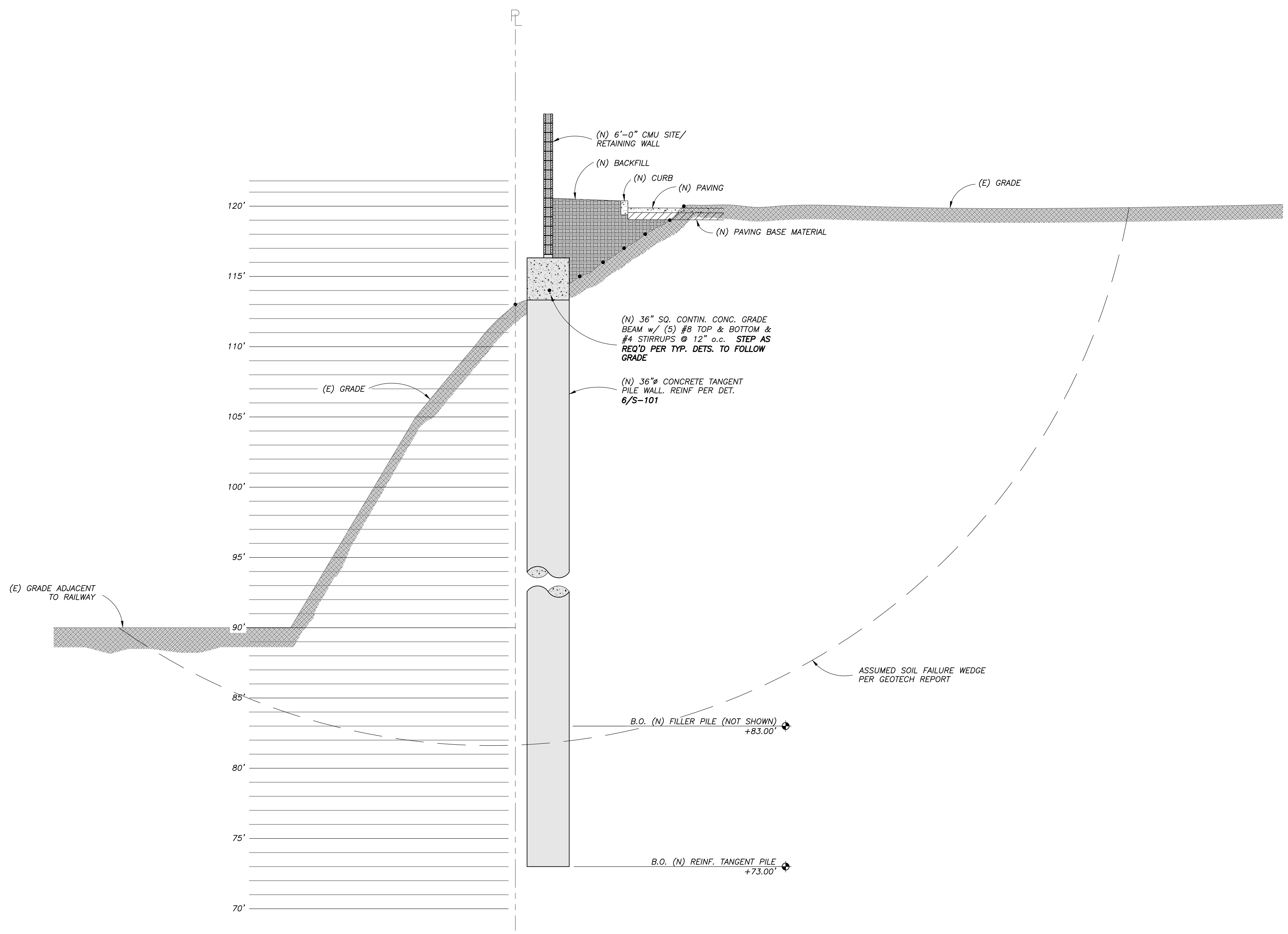
SHEET TITLE RETAINING WALL SECTION

SHEET
S-301



SECTION B

Scale : 1/4" = 1'-0"

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SHEET TITLE RETAINING WALL SECTION

SHEET

S-302