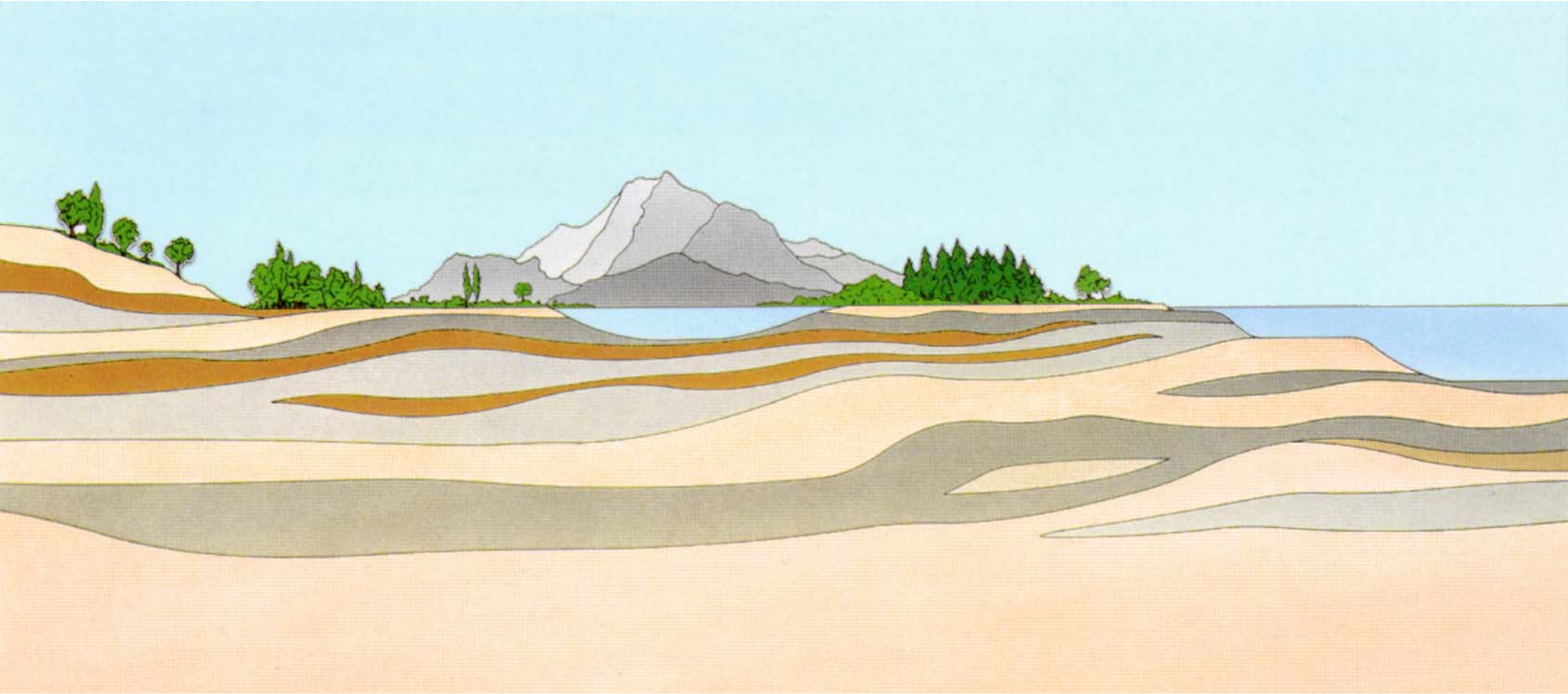
FUGRO WEST, INC.

HYDROGEOLOGIC AND GEOTECHNICAL ASSESSMENT OF APN 090-311-001 NIPOMO, CALIFORNIA

Prepared for:
NIPOMO COMMUNITY SERVICES DISTRICT

Prepared by:
FUGRO WEST, INC.

July 2008



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July 30, 2008
Project No. 3596.002

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Attention: *Mr. Bruce Buel*
General Manager

Subject: Hydrogeologic and Geotechnical Assessment of APN 090-311-001, Nipomo, California

Dear Mr. Buel:

Fugro West Inc. is pleased to submit this initial feasibility analysis and hydrogeologic and geotechnical assessment of the 192-acre parcel southwest of Orchard Road. The objective of the study is to provide a preliminary assessment of the parcel as a potential new site for expansion of the percolation pond component of the Nipomo Community Services District's Southland Wastewater Treatment Facility. It is important to understand that this report is a compilation of our current understanding of the hydrogeology of the site and immediately surrounding area. Further field investigation will be required to more completely characterize the site. Recommendations for such field work are outlined in this report.

Sincerely,

FUGRO WEST, INC.

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SITE DESCRIPTION AND BACKGROUND

The Nipomo Community Services District (District) is planning for the expansion of the District's Southland Wastewater Treatment Facilities (WWTF). One site being investigated is a 192-acre parcel southwest of Orchard Road (APN 090-311-001) in Nipomo, California, known as the Pasquini property. The intent of this investigation was to provide a preliminary assessment of the parcel as a potential new site for expansion of the percolation pond and effluent disposal component of the District's Southland WWTF.

The Pasquini property is currently fallow land that is used for cattle grazing. The property extends approximately 3,500 feet southwest of Orchard Road to Riverside Road. The southern edge of the parcel is formed by the floodplain of the Santa Maria River, and is characterized by a steep bluff that is approximately 80 to 130 feet high. The northwestern edge of the parcel is bounded by houses. Natural slope inclinations along the face of the bluff range from approximately 2h:1v to 1.2h:1v (horizontal to vertical). The slope appears to have been eroded by past meanders of the Santa Maria River. The existing ground surface above the bluff is mainly gently sloping, stabilized sand dunes. The existing site grade ranges from approximately elevation (el.) 320 feet near Orchard Road to approximately el. 290 feet along the top of the bluff. The base of the bluff along Riverside Drive is at about el. 170 feet. The Central Coast Aqueduct Extension (state water pipeline) passes through the southeastern quarter of the site along a northeast to southwest alignment. Immediately northwest of the state water pipeline alignment, a relatively deeply eroded drainage canyon intersects the face of the bluff, and occupies approximately six acres along the bluff slope. The slopes within the upper approximately 5 to 40 feet of the drainage canyon have vertical faces.

Development of percolation ponds at the site would likely consist of grading an earth pond that would generally be excavated to provide the needed storage capacity and surface area to allow for percolation of the effluent. Relatively small earthen berms would likely be used in combination with graded cut slopes to create the ponds. The suitability of the site for percolation requires that the soils beneath the site have sufficient permeability to allow for percolation of the treated effluent, and that aquitards (clay layers) are not present that would prevent vertical percolation or cause infiltrated water to daylight at the ground surface, such as along the face of the bluff or drainage canyon.

Characterization of the Southland WWTF (located on Southland Drive as shown on Plate 1) in Fugro's Phase 1 investigation led to a better understanding of a dual aquifer system beneath the WWTF. The shallow aquifer, which ranges from 60- to 140-feet below ground surface (bgs) at the Southland facility, is separated from a deep aquifer by a thick, relatively impermeable aquitard (clay layer) that precludes vertical migration of treated wastewater discharged to percolation basins from the surface to the deep aquifer. In the subsurface, the aquitard layer is inclined to the southwest. If the inclination of the aquitard continues without change to the west, it would be more than 250 feet bgs beneath the parcel under investigation. With regional groundwater levels apparently approximately 170 to 200 feet below ground surface, the aquitard would not present a constraint to effluent disposal.

WORK PERFORMED

PURPOSE

The purpose of this investigation was to assess the presence and thickness of possible aquitards under the parcel, as well as to evaluate the suitability of the parcel, or portions of the parcel, for development of percolation ponds. In addition to investigating the gross suitability of the parcel for percolation ponds, the potential for the percolated water to daylight on the bluff that borders the site was also considered.

SCOPE OF WORK

This report presents the results of a preliminary assessment that incorporates hydrogeological characterization of the site based on field exploration. Work conducted as part of this study included the following tasks:

- Conduct an initial site visit;
- Evaluate the site geologic and hydrogeologic setting and potential geologic hazards;
- Grossly characterize the presence of low permeability layers or lenses within the dune sand, geologic contacts, and local unconformities;
- Conduct Cone Penetrometer soundings (CPT);
- Drill three hollow stem auger (HSA) borings to depths of approximately 150 to 200 feet;
- Prepare gross geologic and hydrogeologic cross sections across the site;
- Analyze the gross suitability of the site for potential percolation ponds;
- Assess the potential for the site relative to geologic hazards such as seismicity, liquefaction of the subsurface with additional saturation, and slope stability;
- Prepare this summary report; and
- Present conclusions and recommendations for future work.

FIELD EXPLORATION

The field exploration program for this study consisted of advancing a total of 13 cone penetration test (CPT) soundings and three borings. A summary of the CPT and Hollow Stem Auger exploration is presented as Table 1 – Summary of CPT and Hollow Stem Auger Exploration. The locations of the hollow stem auger holes are presented on Plate 2. Logs of the CPT and hollow stem auger exploration are included in Appendix A.

Table 1 – Summary of CPT and Hollow Stem Auger Exploration

Exploration Number	Total Depth	Elevation
B-101	160	303
B-102	126	303
B-103	126	313
C-101	74	305
C-102	87	302
C-103	123	314
C-104	104	295
C-105	62	324
C-106	49	298
C-107	51	313
C-108	125	287
C-109	90	318
C-110	98	306
C-111	46	291
C-112	57	306
C-113	82	328

Drilling

The drilling subcontractor for the project was S/G Drilling Company of Lompoc, California. S/G used a truck mounted CME 85 drill rig to advance three (3) 8-inch diameter hollow stem auger borings at the site. The drilling was performed during the period of Wednesday, May 21 to Friday, May 23, 2008. The borings were advanced to depths between approximately 98 and 157 feet below the existing ground surface. The approximate locations of the borings are shown on Plate 2, Site Map and Cross Section Locations.

The borings were sampled using a 2-inch outside diameter standard penetration test (SPT) split-spoon sampler and a 3-inch outside diameter modified California split-spoon sampler. The modified California sampler was equipped with 1-inch high brass rings. The SPT sampler was used without liners. The samplers were driven into the materials at the bottom of the drill hole using a 140-pound automatic trip hammer with a 30-inch drop. The blow count (N-value) shown on the boring logs is the number of blows from the hammer that were needed to drive the sampler 1 foot, after the sampler had been seated at least 6 inches into the material at the bottom of the hole.

Groundwater was encountered at depths of between 98 and 157 feet below ground surface. The borings were backfilled with the soil cuttings and tamped after drilling. The sample intervals, N-values, a description of the subsurface conditions encountered, and other field and laboratory data are presented on the logs of the borings in Appendix A.

Cone Penetrometer Testing

Fugro Geosciences of Santa Fe Springs, California performed the CPT soundings for field exploration program during the period of May 19 to May 21, 2008. Two CPT soundings (CPT-101 and CPT-102) were advanced at the Southland WWTF adjacent to two existing percolation ponds and 11 CPTs at the subject parcel. At the Southland WWTF, the two CPTs were advanced to obtain CPT signatures at the existing ponds. The CPTs at the Southland WWTF were advanced to 74 and 86 feet below ground surface, respectively for C-101 and C-102. The 11 CPTs at the subject parcel were advanced to depths of between 46 feet (C-111) and 124 feet (C-108). The locations of the CPT soundings on the Pasquini property are shown on Plate 2.

The CPT soundings were performed using an electric cone penetrometer. The penetrometers were advanced into the ground using a hydraulic ram mounted in a truck having a weight of approximately 20 tons. The cone penetrometer has a diameter of approximately 1.4 inches. Cone tip resistance (q_c) and sleeve friction (f_s) were recorded on the penetrometer during all CPT soundings. Data was recorded at approximately 2 cm intervals using an on-board computer to provide a near-continuous profile of the soil conditions encountered during penetration. The friction ratio (FR) was computed for each value of q_c and f_s recorded. The data was retrieved electronically for use in subsequent geotechnical analyses. CPT data and soil behavior type classifications were used to evaluate the subsurface conditions encountered at the site. Plots of each CPT sounding are presented with the boring log data in Appendix A.

LABORATORY TESTING

Laboratory testing was performed on selected samples obtained during the field exploration. Laboratory tests for moisture content, unit weight, fines content (percent of soil, by dry weight, passing the No. 200 sieve), grain size analysis, direct shear strength and permeability were performed as part of this program. The tests were performed in general accordance with the applicable standards of ASTM. Direct shear samples were performed on samples saturated with water prior to testing and samples having the in situ moisture content. Results of laboratory testing are presented in Appendix B.

GENERAL CONDITIONS

Fugro prepared the conclusions, recommendations, and professional opinions of this report in accordance with the generally accepted geotechnical principles and practices at this time and location. This warranty is in lieu of all other warranties, either expressed or implied. This report was prepared for the exclusive use of Nipomo Community Services District and their authorized agents only. It is not intended to address issues or conditions pertinent to other parties, projects or for other uses. The report and the drawings contained herein are not intended to act as construction drawings or specifications. Explorations and services have not been requested nor performed to assess the presence or absence of hazardous or toxic materials.

The scope of services did not include any environmental assessments for the presence or absence of hazardous/toxic materials in the soil, surface water, groundwater, or atmosphere. Any statements, or absence of statements, in this report or data presented herein regarding odors, unusual or suspicious items, or conditions observed are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous/toxic assessment.

Soil and rock deposits can vary in type, strength, and other geotechnical properties between points of observations and exploration. Additionally, groundwater and soil moisture conditions also can vary seasonally or for other reasons. Therefore, we do not and cannot have a complete knowledge of the subsurface conditions underlying the site. The conclusions and recommendations presented in this report are based upon the findings at the points of exploration, and interpolation and extrapolation of information between and beyond the points of observation, and are subject to confirmation based on the conditions revealed by construction.

SITE CONDITIONS

GEOLOGIC SETTING

The project vicinity is within the Santa Maria basin, a transitional area between the Coast Ranges geomorphic province to the north and the Transverse Ranges to the south. The Santa Maria basin is underlain by a structural depression, with Tertiary-age rocks forming a series of broad folds (synclines and anticlines) with westward trending axes (Worts, 1951; Dibblee, 1994). The northernmost synclinal fold forms the basin beneath the Santa Maria Valley. The basin originated during the Miocene and is filled with up to 15,000 feet of marine and non-marine sediments overlying Cretaceous-age ultramafic and sedimentary rocks (Tennyson, 1992).

A map showing the a compilation of the regional geology as mapped by Lettis et al. (1994), Dibblee (1994) and Hall (1978) is shown on Plate 7, Regional Geologic Map. The Southland WWTF and the Pasquini property are located in the southeastern edge of the Nipomo Mesa. Surficial sediments on the Nipomo Mesa typically consist of Pleistocene Older Dune Sand Deposits, as mapped by Hall and Corbató (1967). The wind blown sediment has been stabilized by vegetation, and is present over most of the Nipomo Mesa. The deposits form a triangular lobe approximately four miles wide that extends inland 12 miles to just beyond Highway 101 and typically range from about 150 to 250 feet in thickness. The southern end of Nipomo Mesa is the steep bluff above Riverside Road, and is entirely composed of units of dune sand as exposed at the site. The sediments are typically highly permeable, which precludes appreciable runoff (DWR, 2002). Groundwater production from the sediments is relatively insignificant (Papadopulos, 2004). Relatively fine-grained layers of variable thickness and continuity are interlayered throughout the dune sand deposits, which locally restricts the vertical movement of groundwater (or applied wastewater from percolation ponds) within the unsaturated zone.

Sandy colluvial deposits are present at the base of the bluff and as thinly overlying soil along portions of the slope. The flood plain of the Santa Maria River borders the base of the bluff and is mapped by Hall and Corbató as being underlain by alluvial terrace deposits (Qt), but is likely younger alluvium (Qa). Throughout the Nipomo Mesa, the dune sand is generally underlain by the Paso Robles and Careaga Formations (DWR, 2002). The Paso Robles Formation is typically composed of unconsolidated to poorly consolidated sediments. The Careaga Formation is composed of unconsolidated to well consolidated sediments.

HYDROGEOLOGIC SETTING

The hydrogeology of the Nipomo Mesa has been described by numerous investigators. Papadopulos (2004) reports that the older dune sand deposits (Qds) of the Nipomo Mesa contain limited amounts of groundwater, with the primary aquifer being the underlying Paso Robles Formation. This primary aquifer is in direct hydraulic connection with the Santa Maria groundwater basin. Papadopulos (2004) also reports that the older dune sand deposits locally contain clay layers and that some of the shallow groundwater of the Nipomo Mesa is diverted laterally along these low permeability layers, creating such geographic features as Black Lake and Little Oso Flaco Lake.

For several years the firm of SAIC has worked for Nipomo CSD to create various maps that depict annual changes of groundwater in storage in the Nipomo Mesa and surrounding area. The maps use a GIS based contouring program that integrates water level data from key wells. Two such monitoring wells exist in the immediate vicinity of the Pasquini parcel (Appendix E) which are inferred to represent current and basin water level high (1982) and basin low (1992) water level conditions (personal communication with Mr. Brad Newton, SAIC).

The data used by SAIC were reviewed within the context of the CPT soundings and borings drilled as part of this study of the Pasquini parcel. SAIC recognizes that the data used in their analysis are “less than optimal” for the area simply because there is a general lack of water level data for the deeper aquifer (i.e., the Paso Robles formation). Water level data do not exist for the overlying older dune sand deposits. In general, data from SAIC would support a southwesterly flow of groundwater in the Paso Robles formation toward the Santa Maria River. Depth to groundwater is in the range of 200 to 250 feet below ground surface, depending on seasonal conditions and longer term (i.e. wet cycle v. dry cycle) conditions. The data are not sufficient to determine either the presence or absence of shallow, perched groundwater.

Similarly, both CPT and boring log data from this study were inconclusive with respect to the presence or absence of shallow (perched) groundwater within the older dune sand deposits. The hollow-stem auger borings encountered groundwater (wet cuttings) at depths as shallow as 157 feet (B-101), 116 feet (B-102), and 98 feet (B-103). The groundwater encountered in the borings may be associated with a perched groundwater table encountered within the dune sand, and above the groundwater level associated with the regional deeper aquifer described by SAIC. Inspection of Plate 2 and Plate 4 -- Cross Section B-B’ suggests that the depths to inferred perched groundwater relative to the deep aquifer regional water level surface developed by SAIC is significant. The continuity of such perched groundwater is unknown but would appear to be at depths below the layers of dense older dune sand deposits obtained from the CPT soundings. While it is tempting to interpret a uniformly sloping perched groundwater surface flowing to the southwest, more data are needed to convincingly support such an interpretation. It is equally possible that the perched water surfaces encountered in the borings are isolated and not connected.

SUBSURFACE CONDITIONS

The subsurface conditions encountered beneath the parcel consist of dune sand deposits (Qds). The locations of the three (3) borings drilled and eleven (11) CPT soundings are shown on Plate 2. The logs for the explorations are presented in Appendix A. A discussion of the soil conditions encountered is provided below.

Dune Sand Deposits (Qds)

Dune sand deposits beneath the parcel consist of poorly graded sand (SP), sand with silt (SP-SM) and silty sand (SM) and were encountered in each of the explorations performed. The dune sand deposits were encountered to the maximum depths explored. Field blow counts recorded in the dune sand deposits ranged from 12 blows per foot (bpf) to refusal using standard penetration samplers and 17 bpf to refusal using modified California samplers. The subsurface profile is characterized as a dense dune sand unit overlying a very dense dune sand unit. Explorations within about 400 feet of the top of the bluff encountered an upper dense dune sand unit to depths ranging from approximately 25 to 40 feet. Explorations further back from the top of the bluff encountered the upper dense dune sand unit to depths of up to approximately 15 to 50 feet below ground surface.

Driven ring samples of the dune sand deposits tested in the laboratory had unit weights ranging from 91 to 128 pounds per cubic foot (pcf) and moisture contents ranging from 3 to 21 percent. Friction angles ranging from 35 to 38 degrees were estimated from direct shear tests performed on driven ring samples of the dune sand. The approximate cohesion values estimated from the direct shear tests ranged from approximately 300 pounds per square foot (psf) for samples that were saturated with water prior to testing, up to approximately 700 psf for samples tested at their in situ moisture content.

Six undisturbed samples collected from the hollow stem flight auger borings were tested in the laboratory for permeability determination (vertical direction) in accordance with ASTM method D-5084 (falling head method) or D-2434 (constant head method). The results of these tests are summarized on Table 2 that also includes the borings from which the samples were collected, the depths of the samples, soil classification per ASTM D2487 (based on the Unified Soil Classification System), and the percent passing the number 200 sieve (fines percentage). All of the undisturbed samples were representative of older dune sand deposits but reflect variable permeability values that correlate directly to the percentage of fines. Not surprisingly, samples of silty sand (SM) with a greater amount of fines display a lower permeability value. The slower permeability values, about 10 gallons per day per square foot, are representative of older dune sand deposits that were subject to some degree of weathering and soil development, likely resulting from extended periods when the dune sand deposits were exposed to surficial weathering, oxidation, and erosion. The higher permeability values estimated from the laboratory tests, in the 200 gallon per day per square foot range, are representative of clean, poorly graded sand (SP, SP-SM) having lesser amounts of silt.

Table 2 – Laboratory Testing Summary

Boring No.	Depth (feet)	Classification	Laboratory Determined Permeability		Passing No. 200 Sieve
			cm/sec	gpd/ft2	
B-102	10	Silty Sand (SM)	4.4E-4	9.3	29
B-102	50	Sand (SP), poorly graded	1.0E-2	212.0	4
B-102	70	Sand with Silt (SP-SM)	9.4E-3	199.3	9
B-103	10	Silty Sand (SM)	3.6E-3	7.6	15
B-103	20	Sand (SP), poorly graded	1.2E-2	254.5	3
B-103	70	Silty Sand (SM)	5.2E-4	11.0	15

A general comparison of the CPT profiles (see Plate 4 -- Cross Section B–B', boring B-102 and CPT C-107) to the laboratory determined permeability values suggest the higher values can be assigned to the zones of lower friction ratios (light yellow) while the lower permeability values are representative of the higher friction ratios and the zones delineated by the olive green color. The lower permeability values may reflect the previously mentioned fines content and weathering process as well as increases in density of the dune sand deposits with increasing depth. Importantly, the lower permeability values and inferred CPT correlations represent potential restrictions to the vertical flow of groundwater in the unsaturated zone to the regional water table.

GEOLOGIC HAZARDS

SEISMICITY

The parcel is within a seismically active region of Central California that will likely be subjected to strong ground motion resulting from moderate to large earthquakes in the future. We understand no structures are planned for the development of the site. Impacts to the new percolation ponds and site could consist of instability of the bluff or percolation pond slopes in response to seismic loads, liquefaction of saturated soil below the pond, and settlement of the ground surface and berms used to confine the ponds, if needed. Earthquake (pseudostatic) forces were considered in our slope stability analyses of the existing bluff slope, discussed in the following section of this report.

FAULTING

Three faults are mapped or are inferred in the site vicinity: the inferred trace of the Wilmar Avenue fault mapped approximately 4,500 northeast of the site, the inferred trace of the Oceano fault, mapped approximately 6,000 southwest of the site, and the inferred trace of the Santa Maria River fault, tentatively mapped just east of Orchard Road. The Santa Maria River fault adopts the west-northwest trend and displays a vertical offset of about 180 to 250 feet, according to interpretations by DWR (2002) and Luhdorff and Scalmanini (2000). The fault may act as a partial hydraulic barrier to groundwater flow in the area. The Wilmar Avenue fault is mapped by Anderson and LaForge (1985) as merging with the Santa Maria River fault upstream near the Santa Maria River Bridge on Highway 101. The fault locations are interpreted from inferred offsets in well logs and steps in the Franciscan bedrock from geophysical data. The California Geologic Survey (CGS, 2002) groups the Oceano, Wilmar Avenue and several other faults as the San Luis Range fault system, which they consider to be potentially active. No known active faults cross the site and the site is not located within an Alquist-Priolo zone.

The mapped fault locations are poorly constrained and lack clear evidence of displacement of Holocene dune sands or Quaternary alluvium (Asquith 1997, Manson 1985) in the project vicinity. Within the Santa Maria Valley, the inferred locations of the faults are concealed by relatively deep alluvium. It is our opinion that the presence of the faults does not pose a significant fault rupture hazard to the project. However, significant ground motion could impact the site if an earthquake were to occur on the San Luis Range fault system within the life of the project.

LIQUEFACTION

The potential for liquefaction to impact the site was evaluated using the CPT data and estimated ground motion parameters for the design earthquake. Liquefaction is a loss of soil strength due to a rapid increase in soil pore water pressures due to cyclic loading during a seismic event. Liquefaction commonly occurs in loose to medium dense sandy soil that is below the groundwater table at the time of an earthquake. The potential and severity of liquefaction will depend on the intensity and duration of the strong ground motion.

A ground motion of approximately 0.52g was considered for the liquefaction analysis in accordance with the California Building Code (CBC, 2007). An earthquake magnitude of 7.2 was used in the evaluation, corresponding to the maximum magnitude of the San Luis Range (S. Margin) fault (CGS, 2002), located approximately 1.1 miles from the site (Blake, 2000). The analysis was performed using procedures described in Moss et al. (2003), 1997 NCEER guidelines (Youd and Idriss, 2001) and Boulanger and Idriss (2004) for performing liquefaction analyses using CPT results. The results of the liquefaction analysis are presented in Appendix D.

The soil encountered at the site generally consisted of loose to very dense dune sand. Based on the analysis, near-surface loose to medium dense sand encountered to depths ranging from about 2 to 15 feet below the ground surface are potentially liquefiable under the design earthquake. Liquefaction would only occur if the soil was saturated by the pond during an earthquake. The potentially liquefiable soil is near the surface, and could be removed by grading, if needed. The design of the ponds may need to consider the presence of the potentially liquefiable near-surface soil below the pond slopes so that proper site preparation and grading can be performed to maintain slope stability.

Interbedded layers of medium dense dune sand were encountered below the near-surface unit at various depths between about 15 and 40 feet in CPT-106. The interbedded layers of soil had estimated factors of safety near 1, and although theoretically prone to liquefaction, are likely dense enough that the deeper soils would not be prone to significant strength loss or settlement based on the preliminary analysis.

Typically, liquefaction hazards are mitigated by removal-and-replacement or in situ densification of liquefiable soils. However, note that these mitigation measures may affect the percolation capacity of the site. The grading could likely be limited to supporting the perimeter berm or slopes of the pond, if needed, to maintain slope stability of the slopes considering liquefaction.

SLOPE STABILITY

The stability of the existing bluff that forms the southern boundary was evaluated as part of this study. The slope of the existing bluff is relatively steep, with inclinations ranging from approximately 2h:1v to 1.2h:1v. The purpose of the analyses was to evaluate the stability of the bluff under existing slope conditions, and to evaluate whether or not the stability of the slope could be impacted if the site is developed with the new percolation ponds. The analyses also considered the stability of an existing near-vertical slope face within the eroded drainage canyon to back-calculate strength parameters for comparison to strength parameters estimated from laboratory tests. Output and results from the slope stability analyses are presented in Appendix C.

Slope Geometry

The location of the profile selected for the analyses is about 600 feet northwest of the eroded drainage canyon, as shown on Plate 2. We estimated the bluff slope profile with an approximately 1.2:1 (horizontal to vertical) inclination based on topographic mapping by the United States Geological Survey (USGS, 1965) and our own field measurements at the site. We estimated the drainage canyon slope profile based on field observations, because the geometry of the existing cut slope includes: inclinations varying from near-vertical to 1.5h:1v; colluvium deposited along the base of the slope face; undermined and eroded features; and a near-vertical head of the slope. Due to the scale of the topographic map, these features were not accurately identified on the map. The slopes were evaluated with respect to the stability criteria discussed below.

Slope Stability Criteria

Slope stability results were evaluated relative to criteria presented in the State's *Guidelines for Evaluating and Mitigating Seismic Hazards* (California Division of Mines and Geology, 1997) and San Luis Obispo County (2005). For the purpose of evaluating analytical results, a slope is considered stable when the estimated factor of safety is at least 1.5 under static loading conditions, and at least 1.1 under pseudostatic (earthquake) loading conditions when using a horizontal pseudostatic coefficient of 0.15. A factor of safety 1.0 represents the theoretical boundary below which a slope is no longer stable and experiences failure. Factors of safety greater than 1.0 are theoretically stable; however, a factor of safety of at least 1.5 are typically used to define stable slope conditions in practice to help account for uncertainties associated with characterizing subsurface conditions and limitations associated with the geotechnical analyses used to evaluate slope stability.

Analysis Methods

The slope stability analyses were performed using the computer program GSTABL7 (Gregory, 2001). GSTABL7 was used with STEDwin Version 3.07 (Van Aller 2002) to estimate factors of safety for slope stability under the static and pseudostatic loading conditions being evaluated. GSTABL7 requires the user to input the surface and subsurface profile boundaries; soil properties including unit weight (γ), friction angle (ϕ) and cohesion (c); groundwater levels; and the analysis method to be used. The soil properties and conditions used for our analyses are presented in Appendix C. Slope stability analyses were performed using the modified Bishop method to estimate factors of safety for circular failure surfaces. A key to the results of our slope stability analyses is presented on Plate C-1 in Appendix C.

Selection of Shear Strength Parameters

Effective shear strength parameters (ϕ and c) were selected for slope stability analyses based on laboratory direct shear tests and back-calculation analysis. Laboratory tests were performed on driven ring samples obtained from the field exploration program. The strength parameters used for the analyses are presented on the slope stability plots included in Appendix C. The shear strength of dune sand deposits was estimated for the peak strength condition obtained from direct shear tests results (Blake et al 2002, CDMG 1997). As part of our analysis, we back-calculated the strength parameters necessary to maintain the stability (factor of safety equal to 1.0) of the upper sand unit exposed in an approximately 40-foot high, near-vertical slope face within the drainage canyon. The purpose of evaluating the near-vertical slope was to provide a comparison of strength parameters (mainly cohesion) with those estimated from laboratory tests.

Based on direct shear laboratory tests, a friction angle of 35 and 36 degrees was used to characterize the strength of the upper and lower dune sand units, respectively. To further characterize the strength of the upper dune sand unit, cohesion values of 150 and 400 psf were selected using half the estimated cohesion obtained from direct shear test results and back-calculation, respectively. A cohesion value of 300 psf for the lower dune sand unit was selected based on half the estimated cohesion obtained from direct shear test results.

Groundwater Considerations

Groundwater was encountered in B-101, B-102 and B-103 at el. 143, 190 and 212 feet, respectively. A groundwater elevation of 143 feet, about 30 feet below the base of the bluff, was used in the slope stability analyses. The location of the groundwater table is shown on the plots of the slope stability results in Appendix C.

Summary of Slope Stability Results

Based on visual observation of the bluff slope, the bluff face appears to have weathered to its angle of repose as the Santa Maria River eroded away the sandy material at the toe of the slope. The slope is locally rilled and eroded. We observed evidence of relatively shallow (less than 2 to 3 feet) slumps and eroded areas within the upper approximately 20 feet of the bluff. Some of the features appear relatively recent, and some have been stabilized by vegetation. These geomorphic features are characteristic of past surficial instability. Sandy materials on the subject slope may become prone to surficial instability due to weathering and exposure of the near-surface soils that can destroy or weaken the cohesive properties of these materials. However, we did not observe evidence of deep-seated or global slope instability of the existing bluff that would suggest that there is instability that extends significantly beyond the tops of the existing slopes.

For the initial stability analysis of the bluff slope, strength parameters from direct shear tests were used to estimate factors of safety for slope stability. The estimated factor of safety from the initial analyses ranges from about 1.2 and 0.94 for static and pseudostatic conditions, respectively. The factors of safety are below the minimum 1.5 and 1.1 factors of safety used to define stable slope conditions for static and pseudostatic loading conditions. The existing bluff slope, at an inclination of about 1.2:1, is therefore considered potentially unstable relative to the minimum factors of safety used to define stable slope conditions. While evidence of deep-seated slope instability was not observed along the slope, the slope would still be considered potentially unstable or to have its stability compromised more easily than a slope that is considered stable. .

Further slope stability analysis of the bluff slope was performed to check the shear strength parameters used in the analysis compared to strength parameters estimated from the back-calculation analysis of the existing near-vertical slope within the drainage canyon. The cohesion estimated from the back calculation was about 400 psf, more than double that estimated from the direct shear tests. The estimated factors of safety for the existing bluff slope using the back-calculated cohesion is about 1.3 and 1.0 for static and pseudostatic conditions, respectively, suggesting that the stability of the slope may be better than initially estimated under static and pseudostatic loading conditions. The laboratory tests do suggest however, that the cohesive strength of the soil may be vulnerable to weakening when the soil is saturated.

The estimated factors of safety for the existing slope are independent of whether or not the percolation ponds are constructed on the site. The estimated factors of safety for static loading is below the minimum 1.5 used to define slope stability; however as discussed above, the visual reconnaissance of the bluff did not reveal that there is active slope instability of the overall bluff. Pseudostatic analysis suggests that the existing slope maybe prone to displacement in response to strong ground motion, such as may occur during a relatively strong earthquake on one of the local faults.

Table 3 – Summary of Slope Stability Analyses

Slope Conditions	Estimated Factor of Safety: Static Condition	Estimated Factor of Safety: Pseudostatic Condition
Bluff Slope, cohesion value of upper unit based on direct shear laboratory tests	1.18	0.94
Bluff Slope, cohesion value of upper unit based on back-calculation analysis	1.27	1.00
Near-Vertical Drainage Canyon Slope (back-calculation used to estimate cohesion of dune sand corresponding to a static factor of safety of 1).	1.00	--

The stability of the bluff, and slopes in general, will be influenced by the potential for groundwater to daylight on the existing slopes. Springs or elevated groundwater daylighting on the slope can result in piping and erosion of the slope, loss of cohesion, and further instability of the slope. Seepage forces from groundwater in association with surface runoff and erosion likely contributed to the formation of the existing drainage canyon that intersects the buff face. The stability of the existing bluff slope is likely to not be impacted by the construction of new percolation ponds provided that groundwater does not daylight at the base of the bluff or on the slope surface. The ponds would need to be setback sufficiently to prevent daylighting of groundwater at the base of the bluff or on the slope surface.

CONCLUSIONS

HYDROGEOLOGY

The CPT and boring log data compiled as part of this study indicate the presence of low permeability layers at variable depths in the unsaturated zone, older dune sand deposits. The low permeability layers are most pronounced at depths below about 75 feet and within the southerly parts of the Pasquini parcel. The continuity of these low permeability layers is not exactly known but are sufficiently represented in the CPT soundings to create a concern relative to the ultimate fate of wastewater discharged in percolation ponds on the parcel. Water level data obtained from the three hollow stem auger borings drilled on the parcel suggest that discharge of wastewater within the northerly third of the Pasquini parcel (i.e., adjacent to and immediately south of Orchard Road within an approximate 35-acre area) would be at a sufficient distance from the bluff of the floodplain of the Santa Maria River, and would not daylight on the slope face. This conclusion is however subject to performing supplemental field work on the northerly portion of the parcel.

We understand that the Nipomo CSD has an ultimate need to dispose of up to an additional 0.63 million gallons per day (daily average) of treated wastewater in supplemental percolation basins. This assumption is based on the ability of the existing Southland WWTF percolation ponds to accommodate about 0.57 MGD (Fugro Project Memorandum dated June

30, 2008) and various assumptions of future Nipomo CSD build out wastewater flow volumes. The roughly square shaped northerly third of the Pasquini parcel is about 35 acres in size. Assuming 80 percent of this area could be developed to percolation basins and that the soils (subject to confirmation percolation testing) could be expected to percolate up to 10 gallons per day per square foot (gpd/ft2; considered a reasonable assumption given the percolation characteristics of unweathered dune sand deposits as evident on the CPT soundings). Given an infiltration rate of up to 10 gpd/ft2, the 35-acre gross area should be able to accommodate about 1.2 MGD of treated wastewater. Further field work however is recommended to support this conclusion as in the following sections of this report.

SLOPE INSTABILITY

The existing bluff slope that borders the project site to the south is potentially unstable relative to the minimum factors of safety used to define stable slope conditions. The potentially unstable state of the existing bluff slope is unlikely to be adversely impacted by the proposed project, provided groundwater elevations remain below the base of the bluff and the proposed percolation ponds are adequately set back from the top of the bluff. The bluff slope is generally prone to surficial instability due to surface run-off and weathering associated with its steep inclination, lack of vegetation, and grazing livestock. To help maintain stability of the bluff slope, the percolation ponds should be designed to maintain groundwater levels below the base of the existing bluff, and such that grading of the site does not modify the drainage conditions that would allow uncontrolled surface water to run over the slope.

DRAINAGE AND EROSION CONSIDERATIONS

It is our opinion that the stability of the existing bluff slope is predominantly influenced by erosion that has resulted from groundwater daylighting on the slope during high groundwater periods and storm events. In addition, subsurface seepage and piping at the toe of the slope may erode and destabilize the bluff. Percolation ponds are likely to be setback from the top of the bluff, and should not require grading near the top of the bluff. Surface drainage should generally be controlled such that surface water does not run toward or over the bluff slope. If drainage must be directed towards the bluff, drainage water should be collected in lined swales or ditches that will direct surface water to controlled drainage structures. Concentrated flows and runoff should not be permitted to discharge onto the bluff slope. Down drains, solid pipes, or lined ditches should be provided to carry water to the base of the slope. Energy dissipation and erosion control devices should be provided at the outlet of drainage pipes and in areas of concentrated flow and runoff to reduce the potential for erosion.

OPERATIONS AND MAINTENANCE

The dune sand deposits at the site will be vulnerable to erosion where exposed or disturbed by grading. Site conditions, particularly on sloping ground, are dynamic and should be considered in the operation and maintenance of the facility. Ongoing erosion, changes in drainage, and landsliding are some of the factors that should be reviewed on an ongoing basis.

The top of the bluff slope is comprised of dune sand and colluvial deposits. In our opinion, localized instability could occur as a result of periods of storm runoff or precipitation, ongoing weathering of the slope, earthquakes or other factors. Ongoing maintenance of slopes should be provided to help maintain the slope, reduce the potential for raveling or erosion along the face of the slope, and evaluate whether or not additional grading of the slope is needed to maintain the stability of the slope.

RECOMMENDATIONS

Based on the findings and conclusions of this report, should the District desire to move forward with additional investigation of the Pasquini parcel for potential percolation pond development, we recommend the following field work be performed within the northerly one-third, roughly square-shaped 35 acres adjacent to Orchard Road.

- To assess the percolation capacity of surficial soils, a series of conventional percolation tests should be performed in accordance with Uniform Plumbing Code standards or County of San Luis Obispo Health Department accepted methods. Given the gently rolling topography of the area, the percolation tests should be performed at the anticipated grade (elevation) of the base of the percolation basins. It will be necessary to develop a conceptual grading plan for percolation basins in the area which will provide a rough estimate of the anticipated elevation of the base of the percolation basins. Based on the approximate 35-acre gross area under consideration, we recommend a percolation test for every 2 acres of actual percolation basin area, or about 12 such tests.

- Consideration should also be given to constructing a prototype percolation pond to allow for larger scale testing of the percolation capacity of the soil. A small percolation basin, perhaps 10- to 20-foot square could be installed at the site. A metered supply of water, possibly from a local hydrant, would be needed to charge the basin and estimate the percolation capacity of the soil. The basin would be flooded with water to maintain a constant head above the bottom of the basin, and the test would be continued until a stabilized infiltration capacity for the basin could be obtained (typically up to about 30 days). Casings would be installed in drilled holes, backfilled with native soils, to allow for hydro-probe monitoring during testing. The hydro-probe is a nuclear device that can be used to estimate the degree of saturation in the soil versus depth. The hydro-probe could be particularly useful to evaluate whether or not the siltier soils encountered at various depth will cause any horizontal deflection of the infiltrated water.

- Critical to the success of the supplemental percolation basin facility is the ability of the wastewater to percolate and flow more or less vertically through the relatively deep unsaturated zone and merge with the water table of the deeper aquifer at an elevation below the base of the bluff (some 2000 feet to the southwest). The success of this is dependent on a better definition of the depth and continuity of any low permeability layers under the suggested 35-acre portion of the Pasquini parcel.

We recommend the drilling and construction of four groundwater monitoring wells (possibly completed in two different depth zones) in the proposed 35-acre area. The monitoring wells would be drilled under permit with the County of San Luis Obispo using the rotary wash method, geophysically electric logged, and appropriately completed in either an upper and/or deep aquifer zone depending on interpretation of the geophysical survey. The completed monitoring wells would be used to obtain water level data and background water quality data for the area. Ultimately, the monitoring wells could be used as part of Regional Water Quality Control Board points of compliance associated with Waste Discharge Requirements (WDRs) that would be developed for use of the parcel.

- Based on the data obtained from the above field work, a numerical groundwater flow model could be constructed for the area to better predict the fate and transport of wastewater discharged into percolation basins. The model would essentially be an expansion of the numerical model developed to assess the percolation capacity of the Southland WWTF basins recently performed by Fugro. The need for and attributes of the numerical model would depend on the data obtained from the previously described work actions.

REFERENCES

Anderson, L.W. and LaForge, R. (1985), *Seismotectonic Study for Twitchell Dam, Santa Maria Project, California,* U.S. Bureau of Reclamation, Seismotectonic Study 85-1, dated January 21.

Asquith, D.O. (1997), *Review of Potentially Problematic Faults in San Luis Obispo County,* consultant report prepared for Fugro West, Inc., January 28.

Blake, T.F. (2000), FRISKSP, Version 4.0, “A Computer Program for the Probabilistic Estimation of Peak Acceleration and Uniform Hazard Spectra Using 3-D Faults as Earthquake Sources,” Users Manual.

Blake, T.F., Hollingsworth, R.A. and Stewart, J.P. (2002), Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing Landslide Hazards in California, Southern California Earthquake Center, and available through www.scec.org

Boyle Engineering (2007), Evaluation of *Supplemental Water Alternatives- Technical Memorandum No. 1,* prepared for NCSD, dated June.

Boyle Engineering (2007), Southland Wastewater Treatment Facility Master Plan - Draft*,* prepared for NCSD, dated February 19.

Boulanger, R. W., and Idriss, I. M. (2004). Evaluating the potential for liquefaction or cyclic failure of silts and clays. Report UCD/CGM-04/01, Center for Geotechnical Modeling, University of California, Davis, CA, 130 pp.

California Building Code (2007). California Code of Regulations, Title 24, Part 2, Volume 2, California Building Standards Commission.

California Department of Water Resources (DWR) (2002), *Water Resources of the Arroyo Grande - Nipomo Mesa Area, http://wwwdpla.water.ca.gov/sd/.*

California Division of Mines and Geology (1997), Guidelines for Evaluating and Mitigating Seismic Hazards in California, Special Publication 117.

California Geological Survey (2002), California Fault Parameters Database Page, http://www.consrv.ca.gov/cgs/rghm/psha/Pages/index.aspx

Cleath and Associates (1996), *Water Resources Management Study for The Woodlands,* prepared for USI Properties Inc., dated April.

Cleath and Associates (1997a), *Ground Water Flow from Percolation Ponds,* unpublished consultant report prepared for Nipomo Community Services District, May 22 1997.

Cleath and Associates (1997b), *Hydrogeologic Study of the Nipomo Community Services District Wastewater Disposal Site,* unpublished consultant report prepared for Nipomo Community Services District, July 1997.

Cleath and Associates (2000), *Test Hole Results and Recommended Monitoring Well Locations for the Nipomo CSD Wastewater Disposal Site,* prepared for NCSD, dated January 13. DWR (2002), *Water Resources of the Arroyo Grande - Nipomo Mesa Area,* dated January.

Cooper, William S. (1967), "Coastal Dunes of California", The Geological Society of America, Memoir 104.

Dibblee, T.W. Jr. (1994), "Geology of the Santa Maria Valley and Vicinity, Santa Barbara and San Luis Obispo Counties, California", *Geology of the Santa Maria Valley, Sponsored by the Central Coast Geological Society,* July 9.

Gregory, G. H. (2001), "GSTABL7 with STEDwin v.2", Gregory Geotechnical Software: Fort Worth, Texas.

Hall, C. and Corbató, C. (1967), "Stratigraphy and Structure of Mesozoic and Cenozoic Rocks, Nipomo Quadrangle, Southern Coast Ranges, California: Geologic Map of the Nipomo Quadrangle, California", *Geologic Society of America Bulletin*, Vol. 78, Plate 1.

Manson, M.W. (1985), "Santa Maria Valley Faults, Santa Barbara and San Luis Obispo Counties, California", California Division of Mines and Geology Fault Evaluation Report FER-168, December 6.

Moss, R.E.S. (2003), "CPT-Based Probabilistic Assessment of Seismic Soil Liquefaction Initiation."

Luhdorff and Scalmanini (2000), *Development of a Numerical Groundwater Flow Model and Assessment of Groundwater Basin Yield, Santa Maria Valley Groundwater Basin*, prepared for Santa Maria Valley Water Conservation District, dated March 2000.

Papadopulos and Associates (2004), *Nipomo Mesa Groundwater Resource Capacity Study, San Luis Obispo County, California*, prepared for San Luis Obispo County Public Works Department, dated March 2004.

San Luis Obispo County (2005), Guidelines for Engineering Geology Reports, Department of Planning and Building.

Tennyson, M.E. (1992), *Preliminary geologic map of Santa Maria 30' by 60' quadrangle, California*, U.S. Geological Survey Open-File Report 92-189.

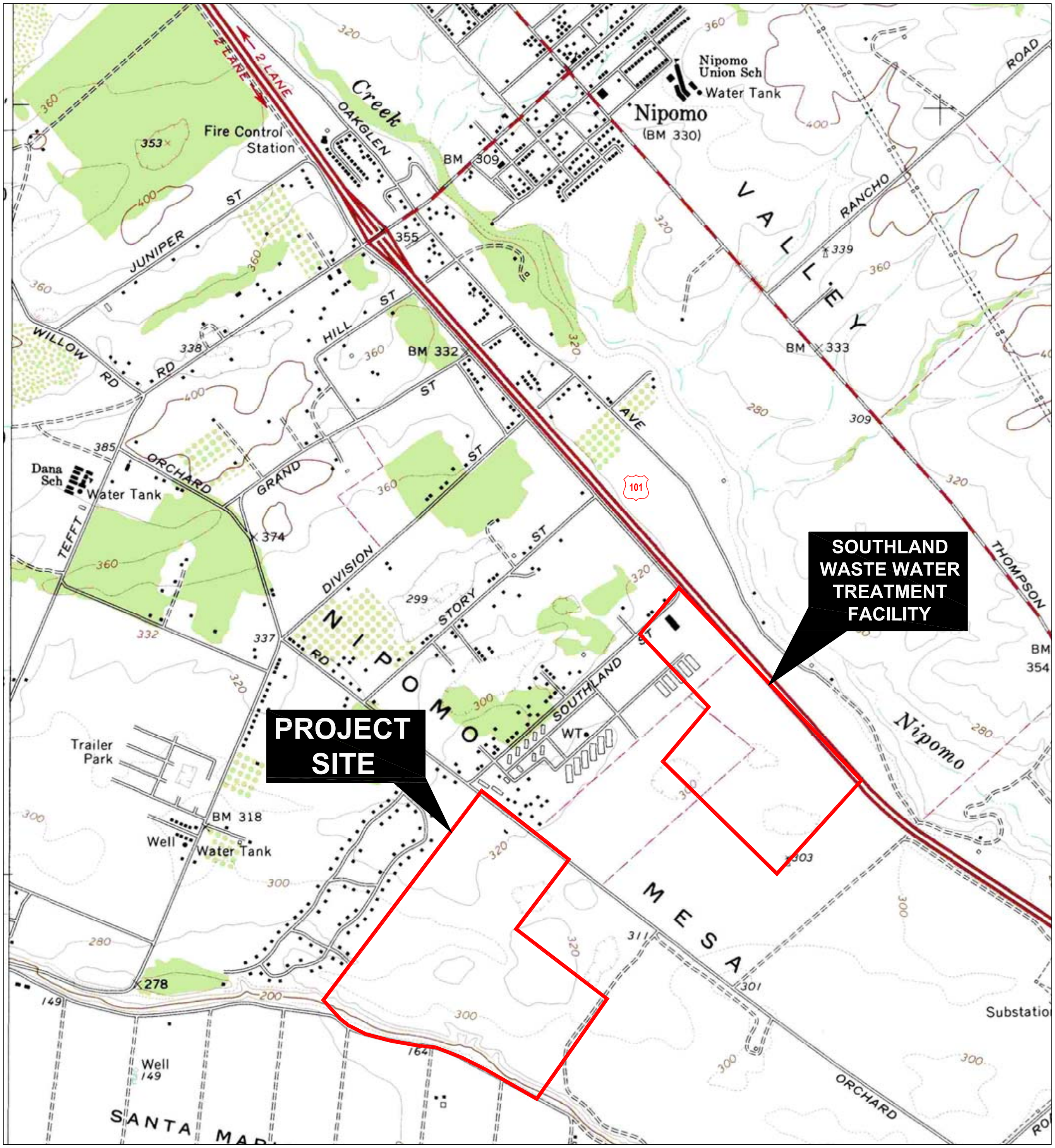
United States Geological Survey (1965), *Nipomo Quadrangle, San Luis Obispo County, California*, *7.5 Minute Series (Topographic)*, Scale 1:24000.

Van Aller, H. (2002), “STEDwin Version 3.07, the Smart Editor for GSTABL7”, Annapolis, Engineering Software; Annapolis, Maryland.

Worts, G.F. Jr. (1951), *Geology and groundwater resources of the Santa Maria Valley area, California*, U.S. Geological Survey Water Supply Paper 1000.

Youd, T.L. and I.M. Idriss (1997), “Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils.” Edited by Youd, T.L., Idriss, I.M., Technical Report No. NCEER-97-0022, December 31, 1997.

PLATES



BASE MAP SOURCE: USGS NIPOMO QUADRANGLE TOPOGRAPHIC MAP

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NORTH
0 2000
FEET

VICINITY MAP
Percolation Pond Feasibilty Investigation
Nipomo, California

PLATE 1

BASE MAP SOURCE: GOOGLE EARTH PRO

LEGEND

C-113 Approximate Location of CPT soundings

B-103 Approximate Location of borings

CB-4595 Approximate Location of CPT

DH-301 Approximate Location of boring

A — A' Approximate Location of cross sections

Approximate Location of Slope Stability Analysis

NORTH

0 1000 FEET

SITE MAP AND CROSS SECTION LOCATIONS

Percolation Pond Feasibilty Investigation

Nipomo, California

PLATE 2

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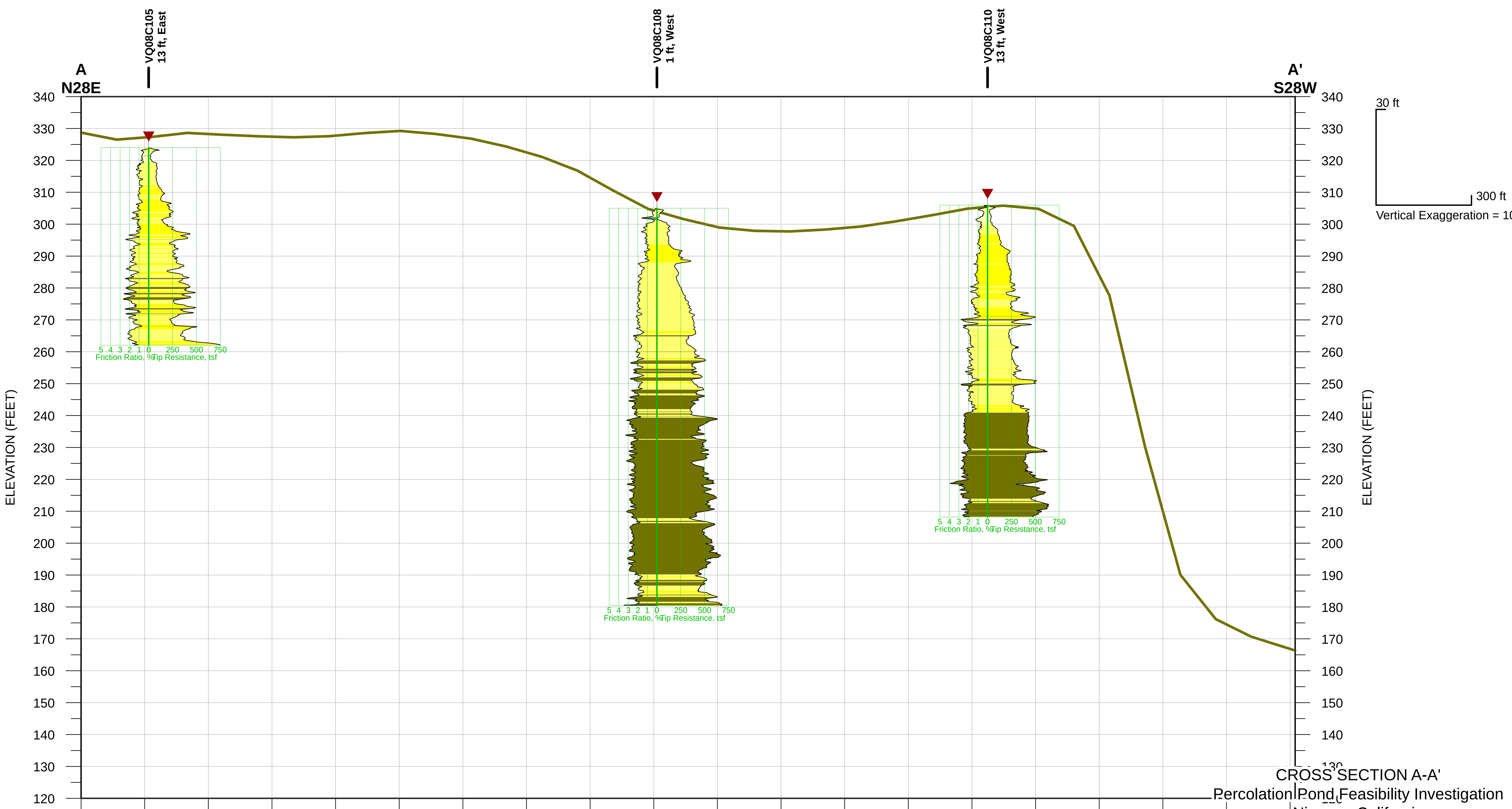
Nipomo Community Services District
Project No. 3596.002.03



CROSS SECTION A-A'
Percolation Pond Feasibility Investigation
Nipomo, California

PLATE 3

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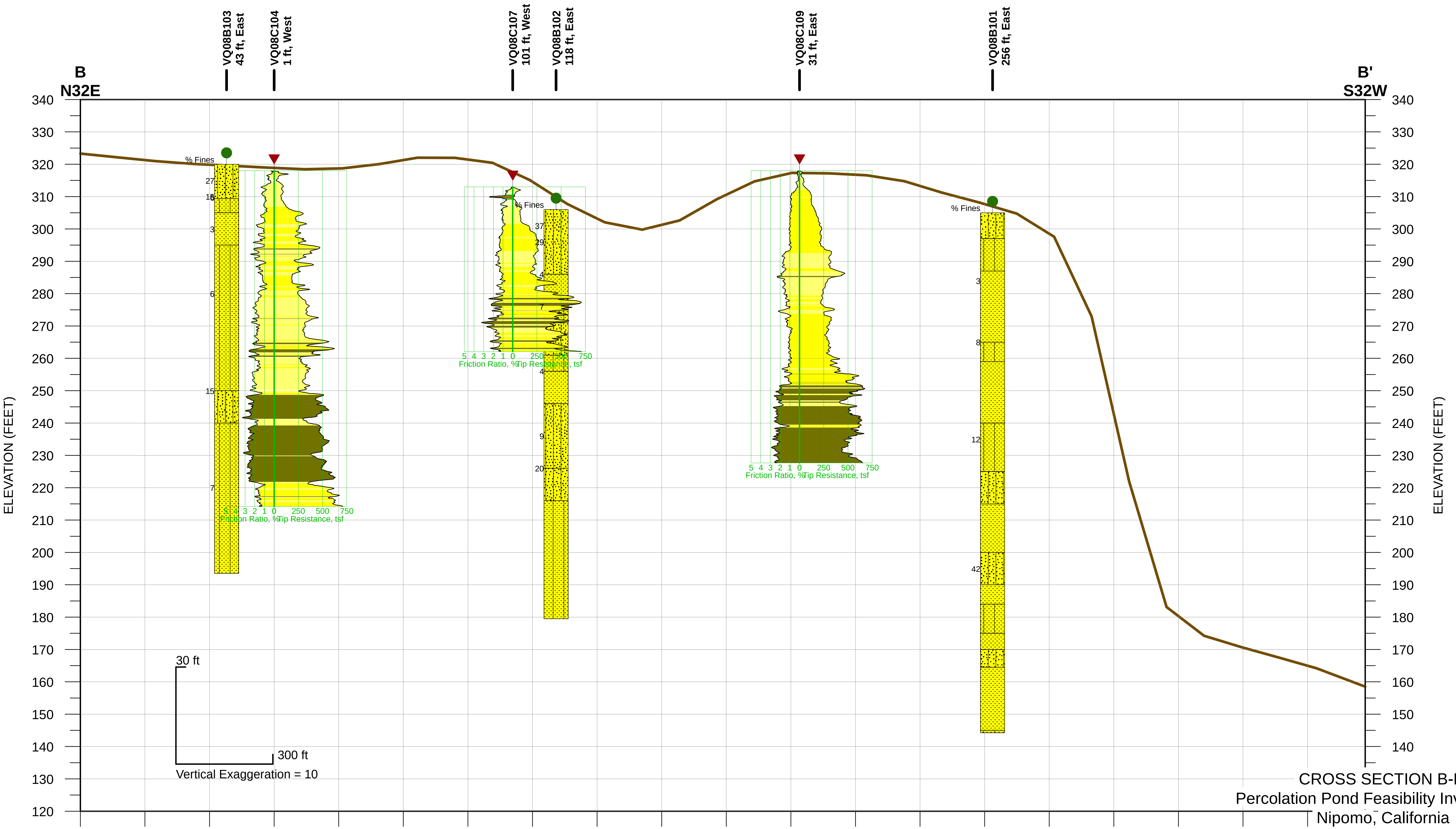

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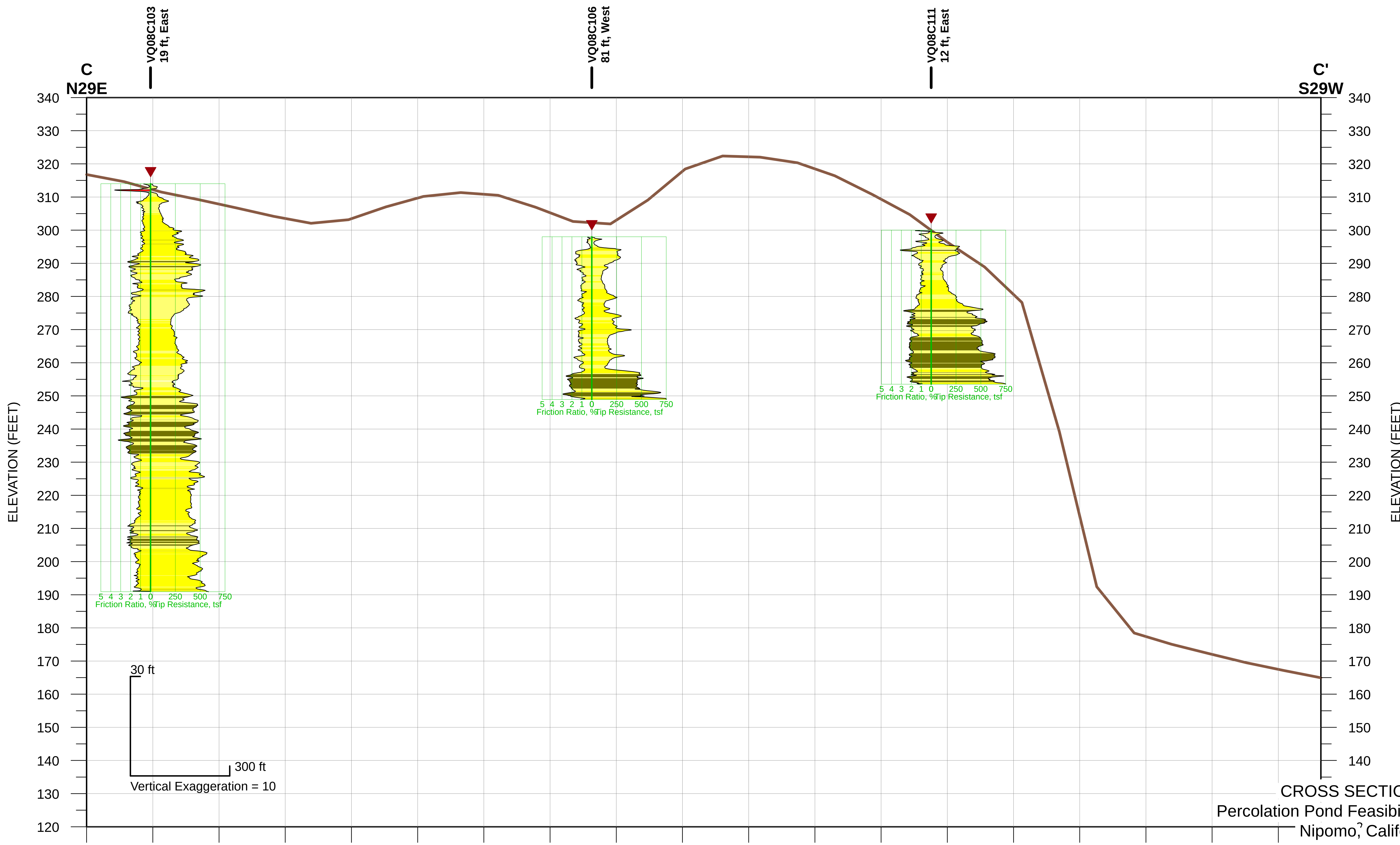
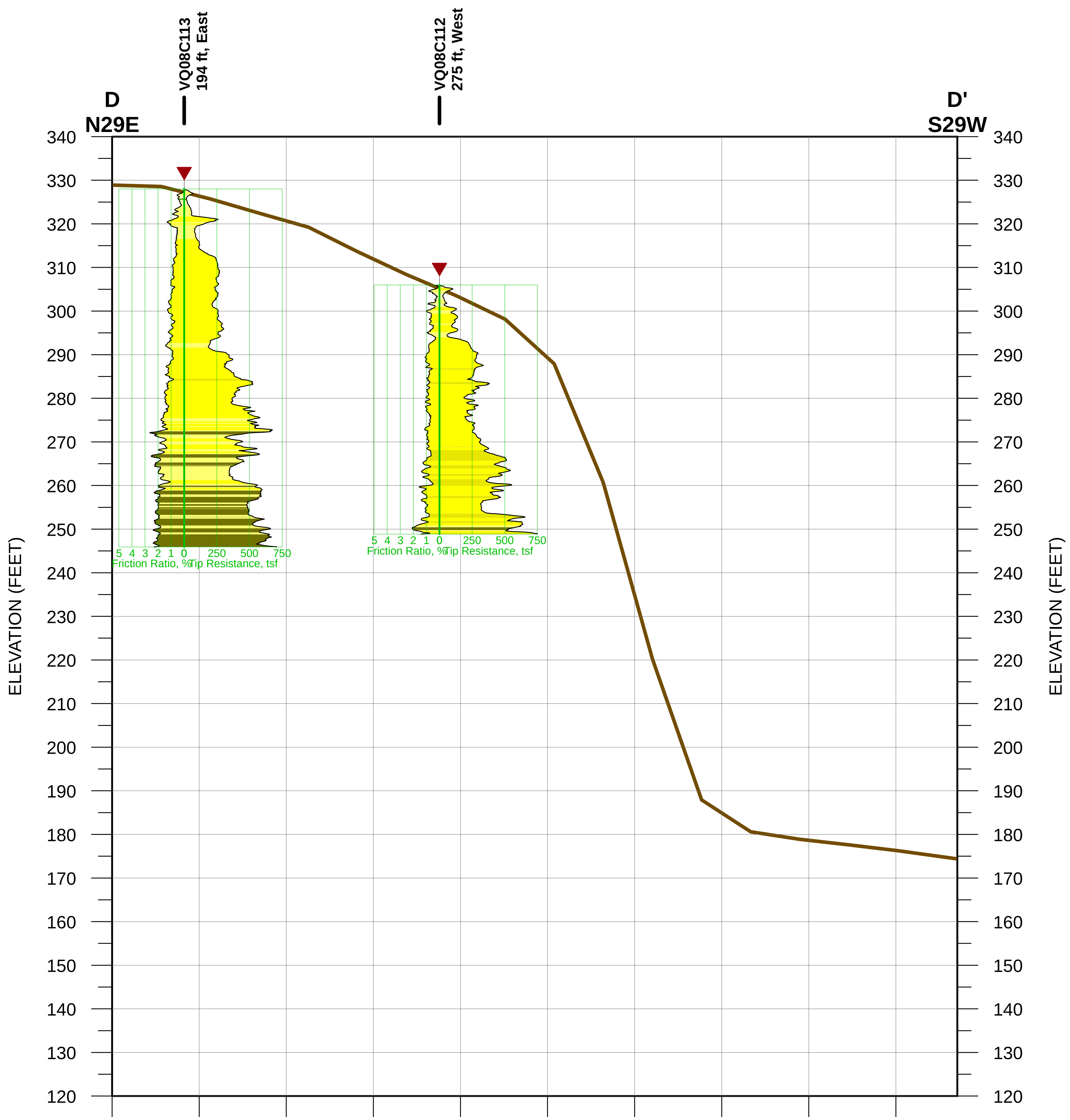
Nipomo, California



CROSS SECTION C-C'
Percolation Pond Feasibility Investigation
Nipomo, California



30 ft
300 ft
Vertical Exaggeration = 10

CROSS SECTION D-D'
Percolation Pond Feasibility Investigation
Nipomo, California

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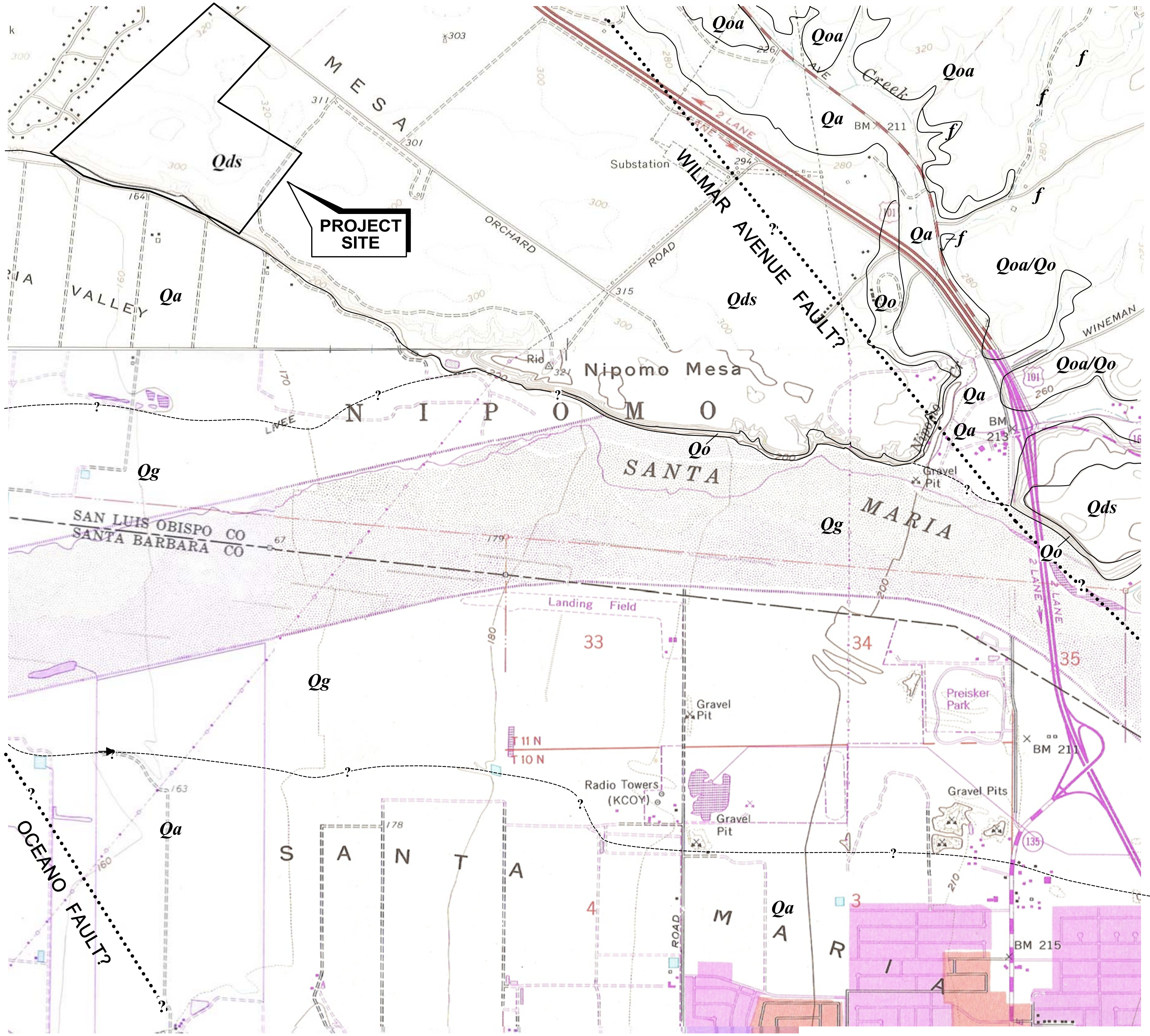


LEGEND

Qg	Alluvium - channel deposits
Qa	Alluvium - flood plain and overbank deposits
Qds	Dune sand - stabilized wind blown deposits
Qoa	Older Alluvium
Qo	Orcutt sand
QTp	Paso Robles Formation
T?	Unnamed Tertiary sand
f	Franciscan Rocks
	Geologic contact, dashed where approximate, queried where uncertain
	Fault - dotted where concealed and inferred

References:

Lettis et al. (1994). *Quarternary Geology of the Southern Margin of the San Luis Range from Shell Beach to the Santa Maria Valley, South-Central,* Plate 3.

Dibblee, T.W. Jr. (1994). *Geologic Map of the Santa Maria and Twitchell Dam Quadrangles.*

Hall, C.A.(1978). Geologic Map of Twitchell Dam and Parts of Santa Maria and Tepusquet Canyon Quadrangles, Santa Barbra County, California

NORTH

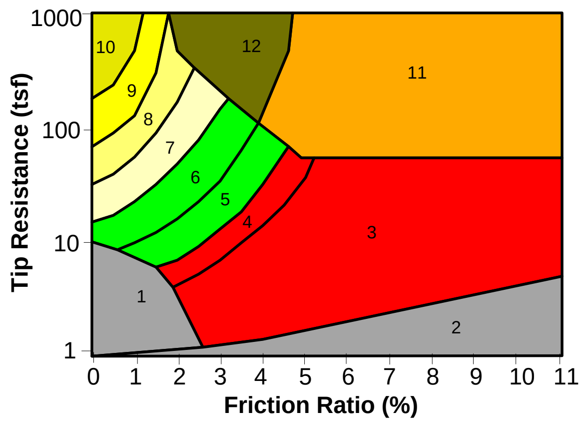
0 1000 2000

FEET

REGIONAL GEOLOGIC MAP
Percolation Pond Feasibility Investigation
Nipomo, California

APPENDIX A

COLOR LEGEND FOR FRICTION RATIO TRACES

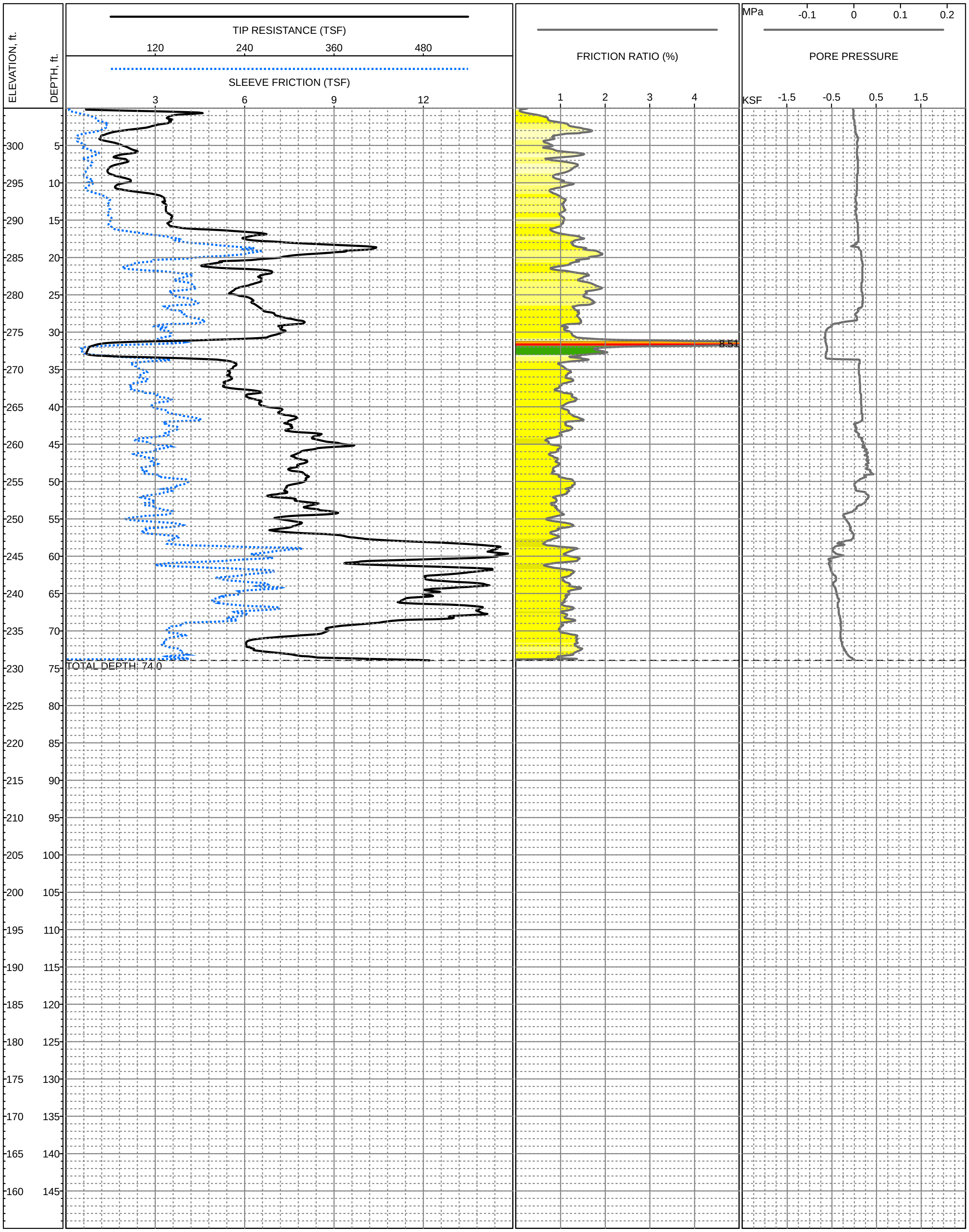


Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay	CH
4	Silty Clay to Clay	CL-CH
5	Clayey Silt to Silty Clay	MH-CL
6	Sandy Silt to Clayey Silt	ML-MH
7	Silty Sand to Sandy Silt	SM-ML
8	Sand to Silty Sand	SM-SP
9	Sand	SW-SP
10	Gravelly Sand to Sand	SW-GW
11	Very Stiff Fine-grained *	CH-CL
12	Sand to Clayey Sand *	SC-SM

*overconsolidated or cemented

CPT CORRELATION CHART
(Robertson and Campanella, 1984)

KEY TO CPT LOGS
Percolation Pond Feasibility Investigation
Nipomo, California

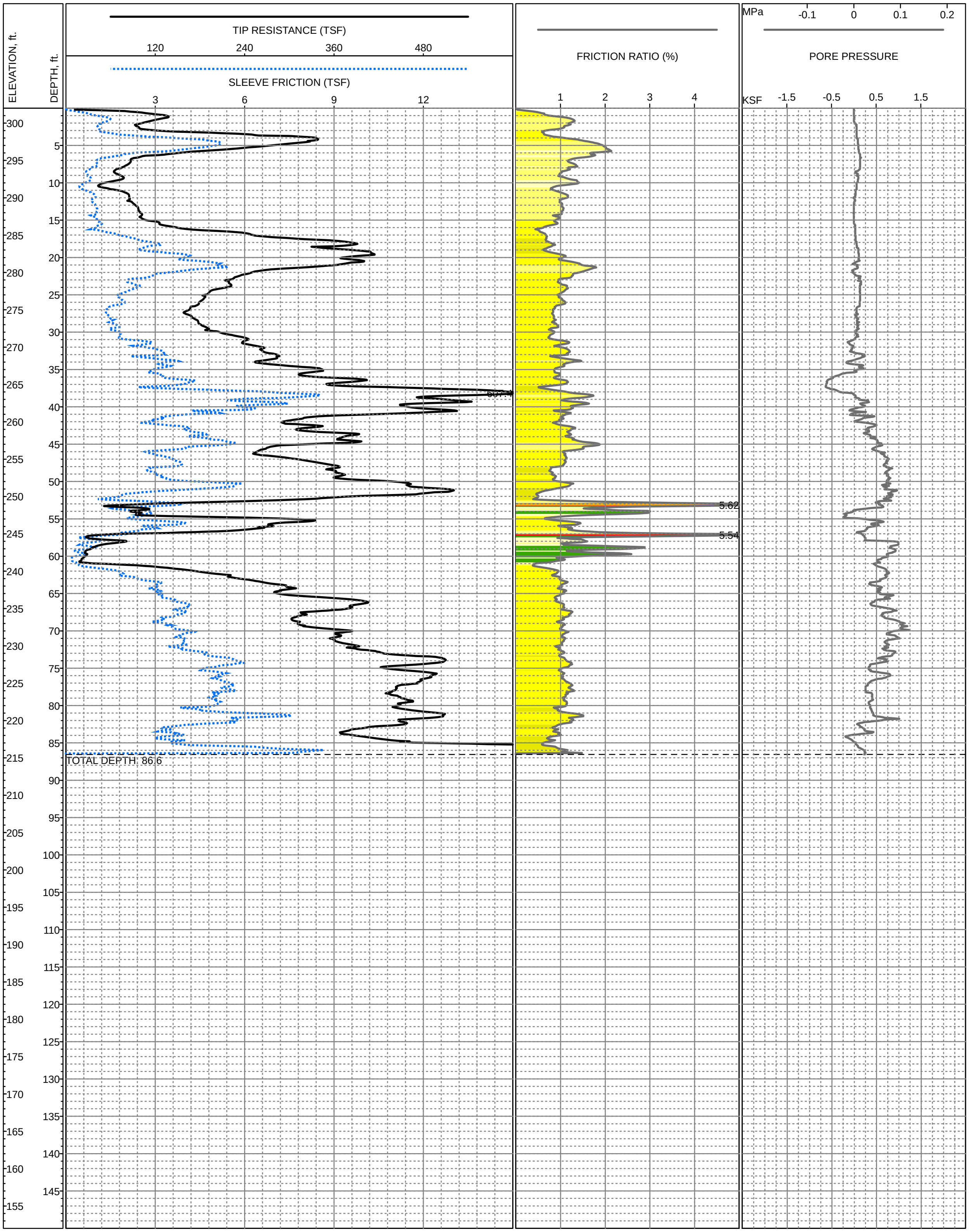


COORDINATES: 731,226.00W 3,878,051.00N
SURFACE EL: 305.0ft +/- (MSL)
COMPLETION DEPTH: 74.0ft
TESTDATE: 5/19/2008

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro
REVIEWED BY: P Sorensen & J Blanchard

LOG OF C-101

Percolation Pond Feasibility Investigation
Nipomo, California



COORDINATES: 731,061.00W 3,877,729.00N
SURFACE EL: 302.0ft +/- (MSL)
COMPLETION DEPTH: 86.6ft
TESTDATE: 5/19/2008

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro
REVIEWED BY: P Sorensen & J Blanchard

LOG OF C-102
Percolation Pond Feasibility Investigation
Nipomo, California

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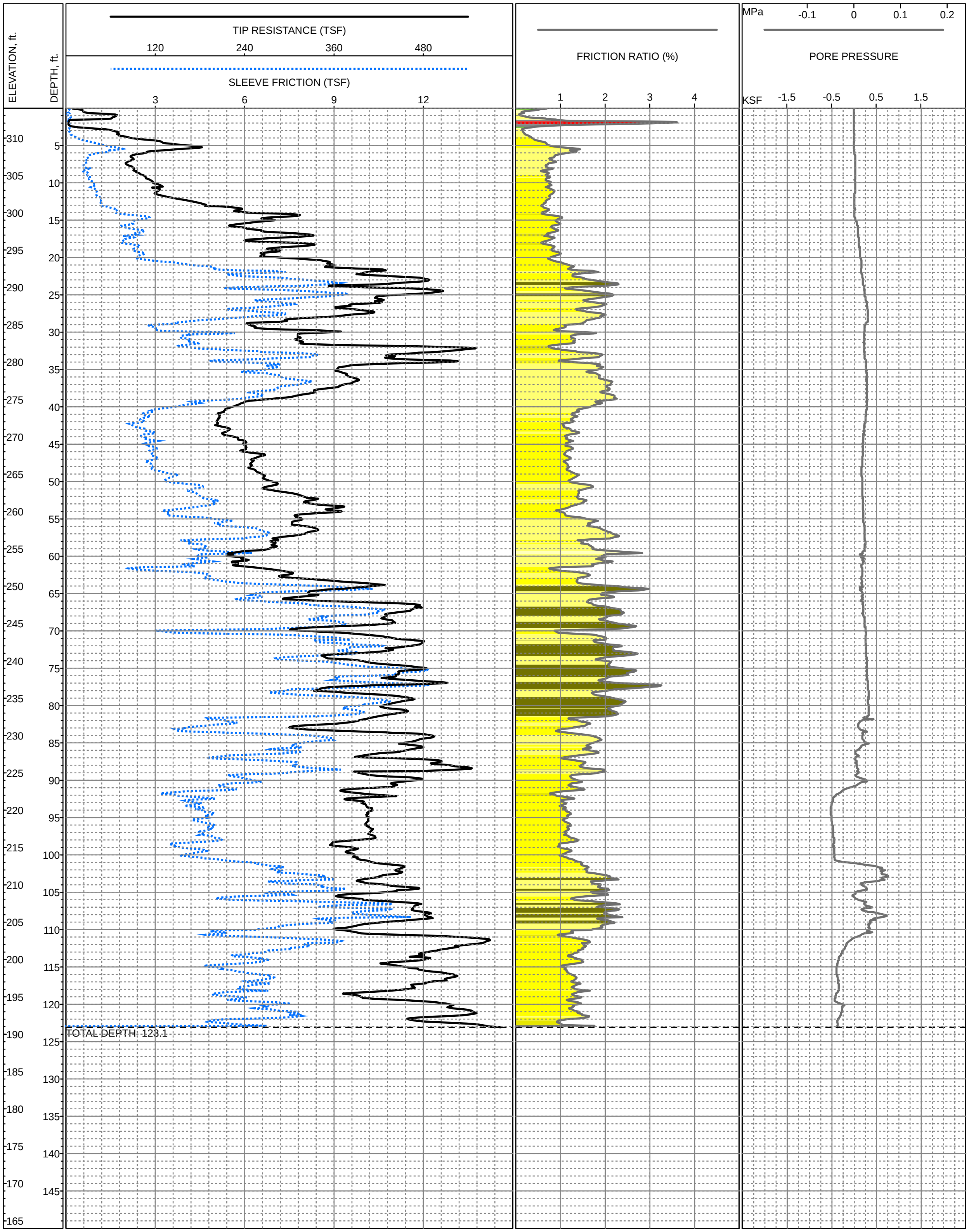

COORDINATES: 730,195.00W 3,877,480.00N
SURFACE EL: 314.0ft +/- (MSL)
COMPLETION DEPTH: 123.1ft
TESTDATE: 5/19/2008

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro
REVIEWED BY: P Sorensen & J Blanchard

LOG OF C-103

Percolation Pond Feasibility Investigation
Nipomo, California

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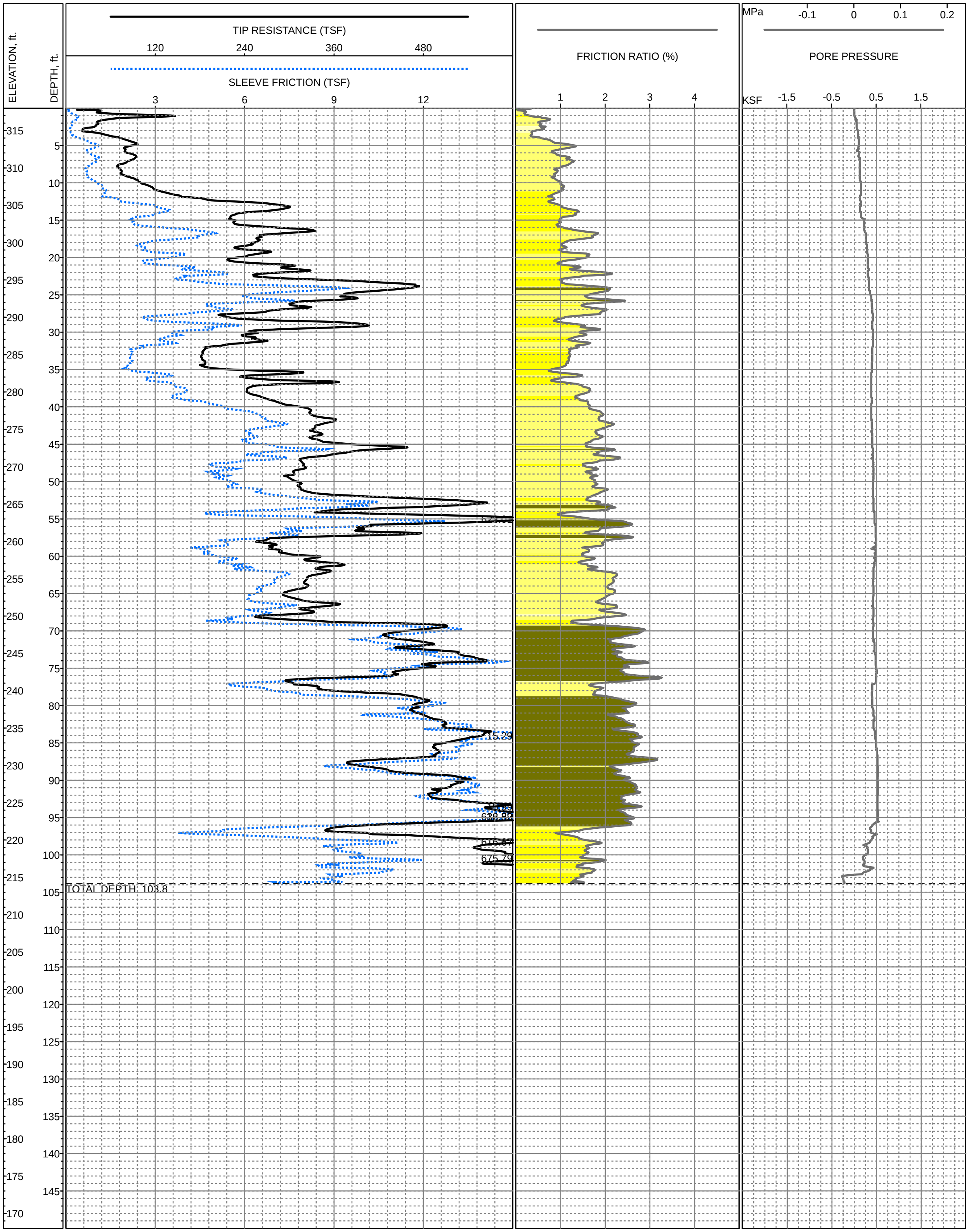
Nipomo Community Services District
Project No. 3596.002.03



COORDINATES: 730,036.00W 3,877,450.00N
SURFACE EL: 318.0ft +/- (MSL)
COMPLETION DEPTH: 103.8ft
TESTDATE: 5/20/2008

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro
REVIEWED BY: P Sorensen & J Blanchard

LOG OF C-104

Percolation Pond Feasibility Investigation
Nipomo, California

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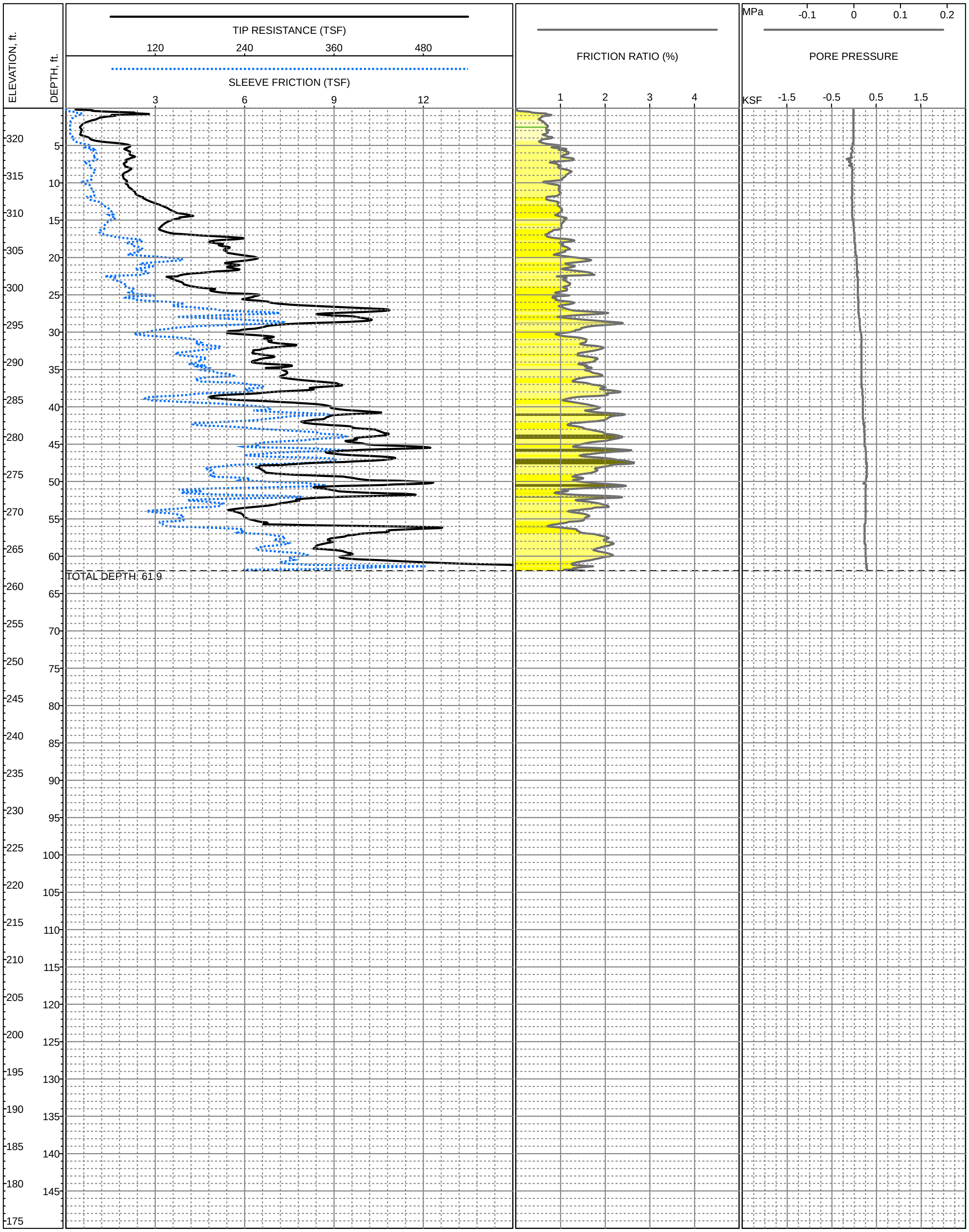

COORDINATES: 729,947.00W 3,877,660.00N
SURFACE EL: 324.0ft +/- (MSL)
COMPLETION DEPTH: 61.9ft
TESTDATE: 5/20/2008

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro
REVIEWED BY: P Sorensen & J Blanchard

LOG OF C-105
Percolation Pond Feasibility Investigation
Nipomo, California

PLATE A-6

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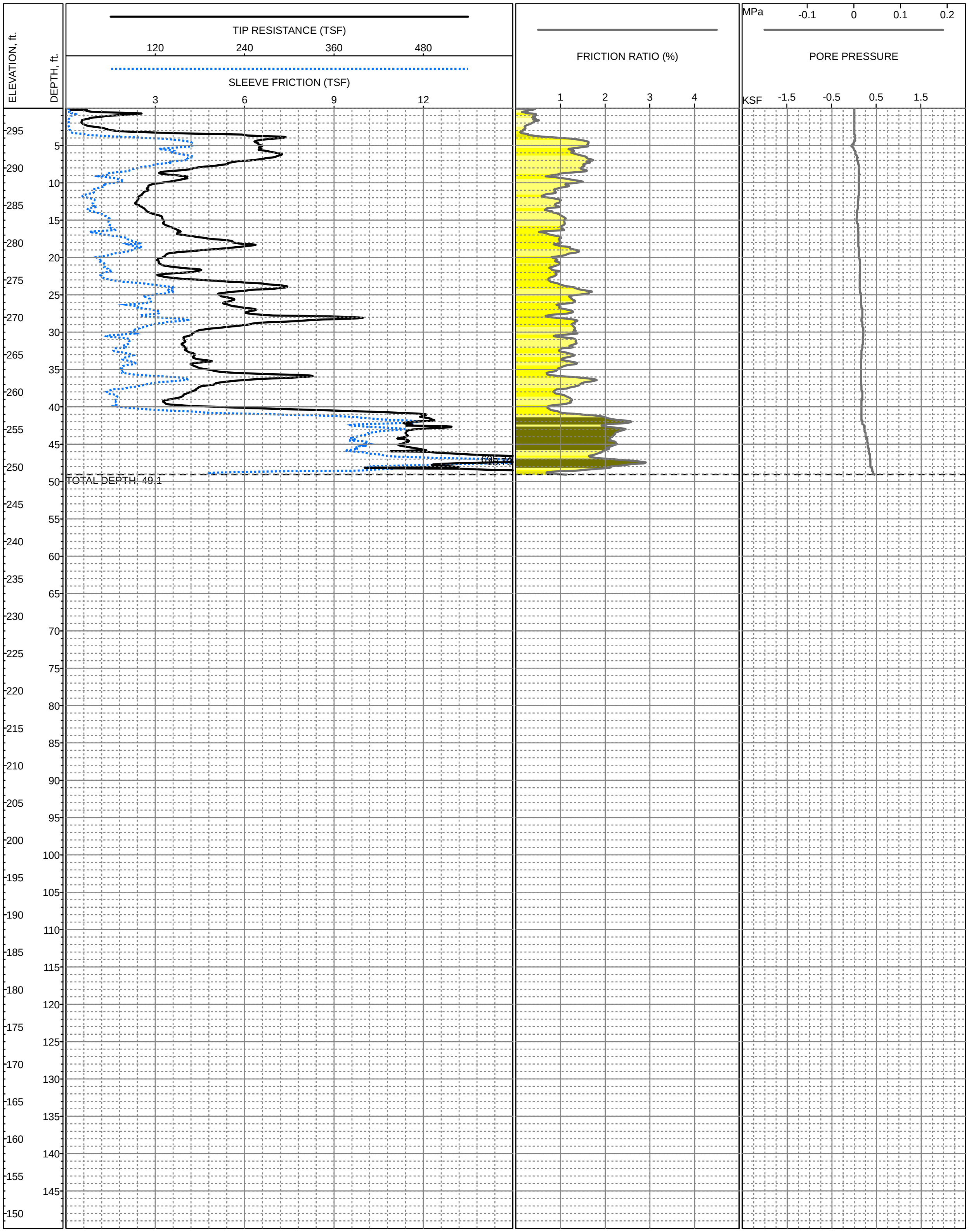
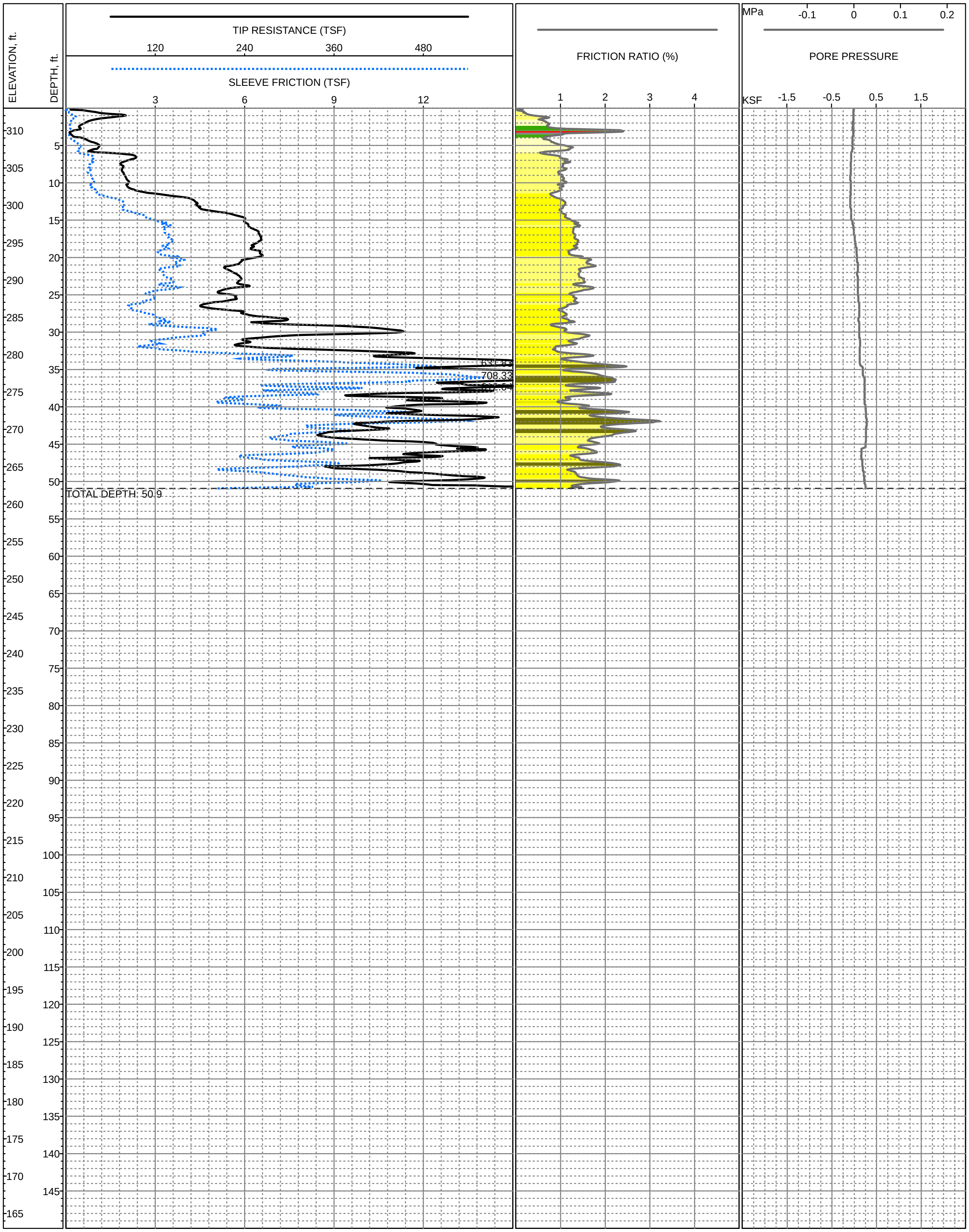


COORDINATES: 729,969.00W 3,877,141.00N
SURFACE EL: 298.0ft +/- (MSL)
COMPLETION DEPTH: 49.1ft
TESTDATE: 5/20/2008

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro
REVIEWED BY: P Sorensen & J Blanchard

LOG OF C-106

Percolation Pond Feasibility Investigation
Nipomo, California



COORDINATES: 729,891.00W 3,877,275.00N
SURFACE EL: 313.0ft +/- (MSL)
COMPLETION DEPTH: 50.9ft
TESTDATE: 5/20/2008

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro
REVIEWED BY: P Sorensen & J Blanchard

LOG OF C-107
Percolation Pond Feasibility Investigation
Nipomo, California

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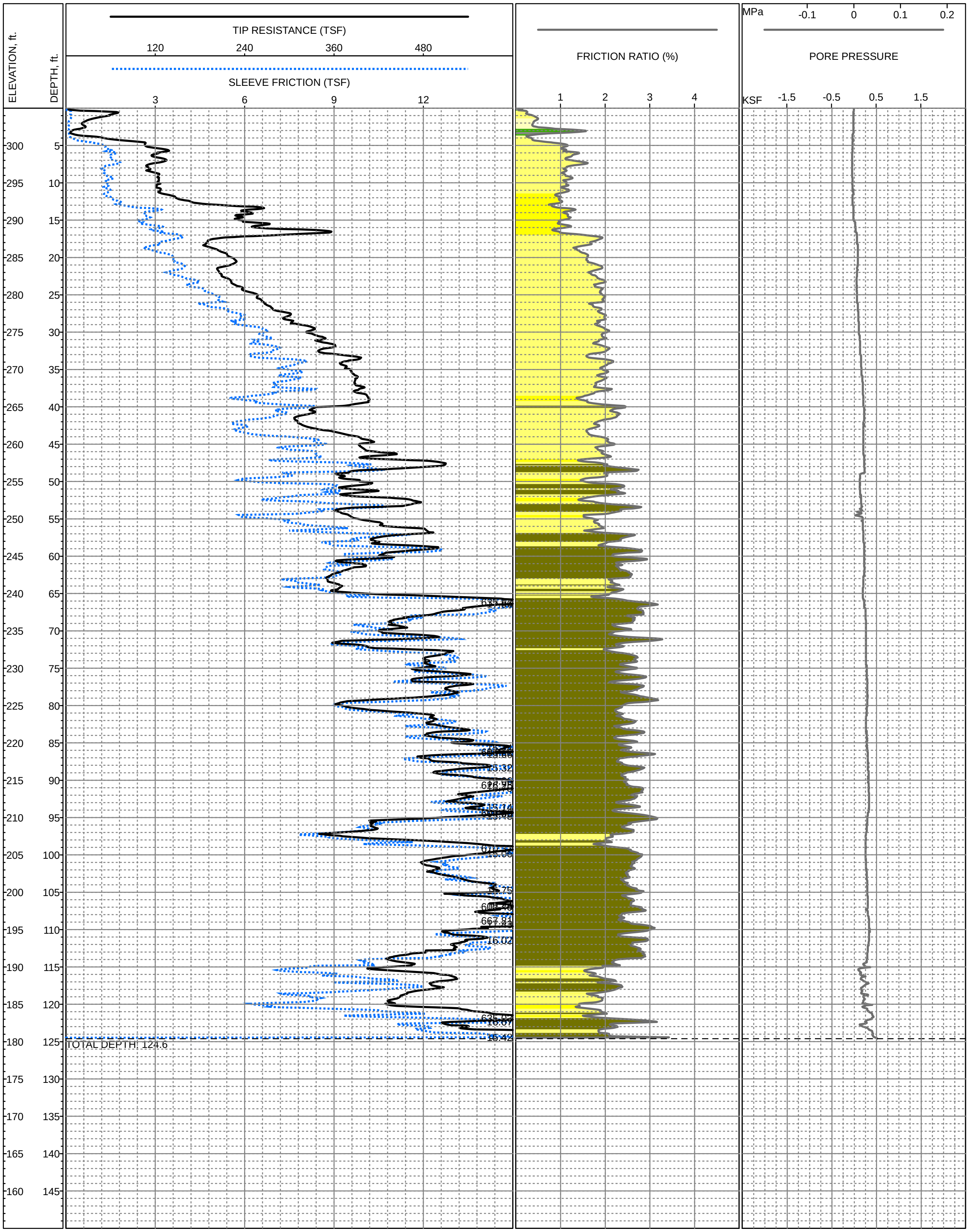

COORDINATES: 729,715.00W 3,877,232.00N
SURFACE EL: 305.0ft +/- (MSL)
COMPLETION DEPTH: 124.6ft
TESTDATE: 5/20/2008

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro
REVIEWED BY: P Sorensen & J Blanchard

LOG OF C-108
Percolation Pond Feasibility Investigation
Nipomo, California

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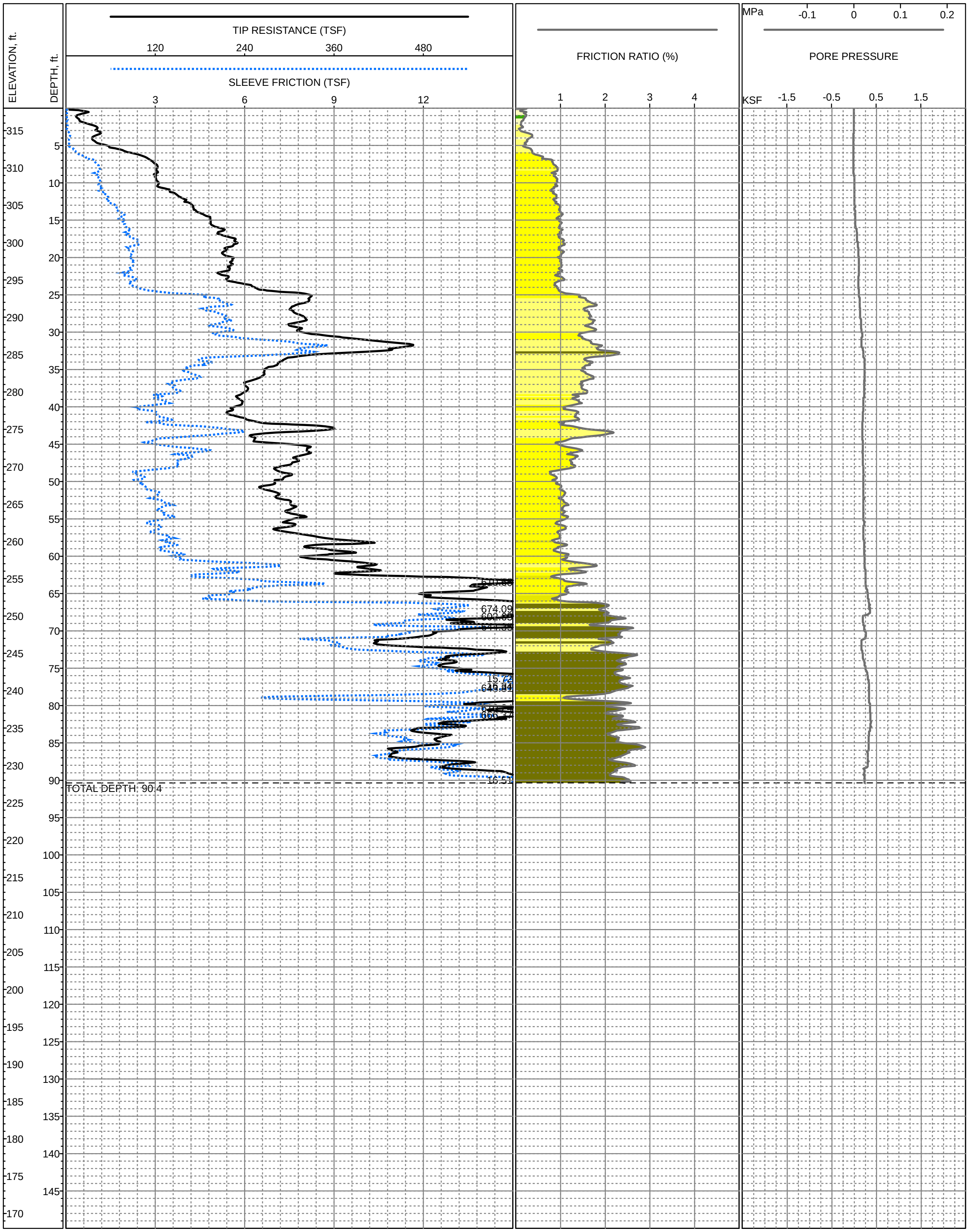
Nipomo Community Services District
Project No. 3596.002.03



COORDINATES: 729,782.00W 3,877,024.00N
SURFACE EL: 318.0ft +/- (MSL)
COMPLETION DEPTH: 90.4ft
TESTDATE: 5/20/2008

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro
REVIEWED BY: P Sorensen & J Blanchard

LOG OF C-109

Percolation Pond Feasibility Investigation
Nipomo, California

PLATE A-10

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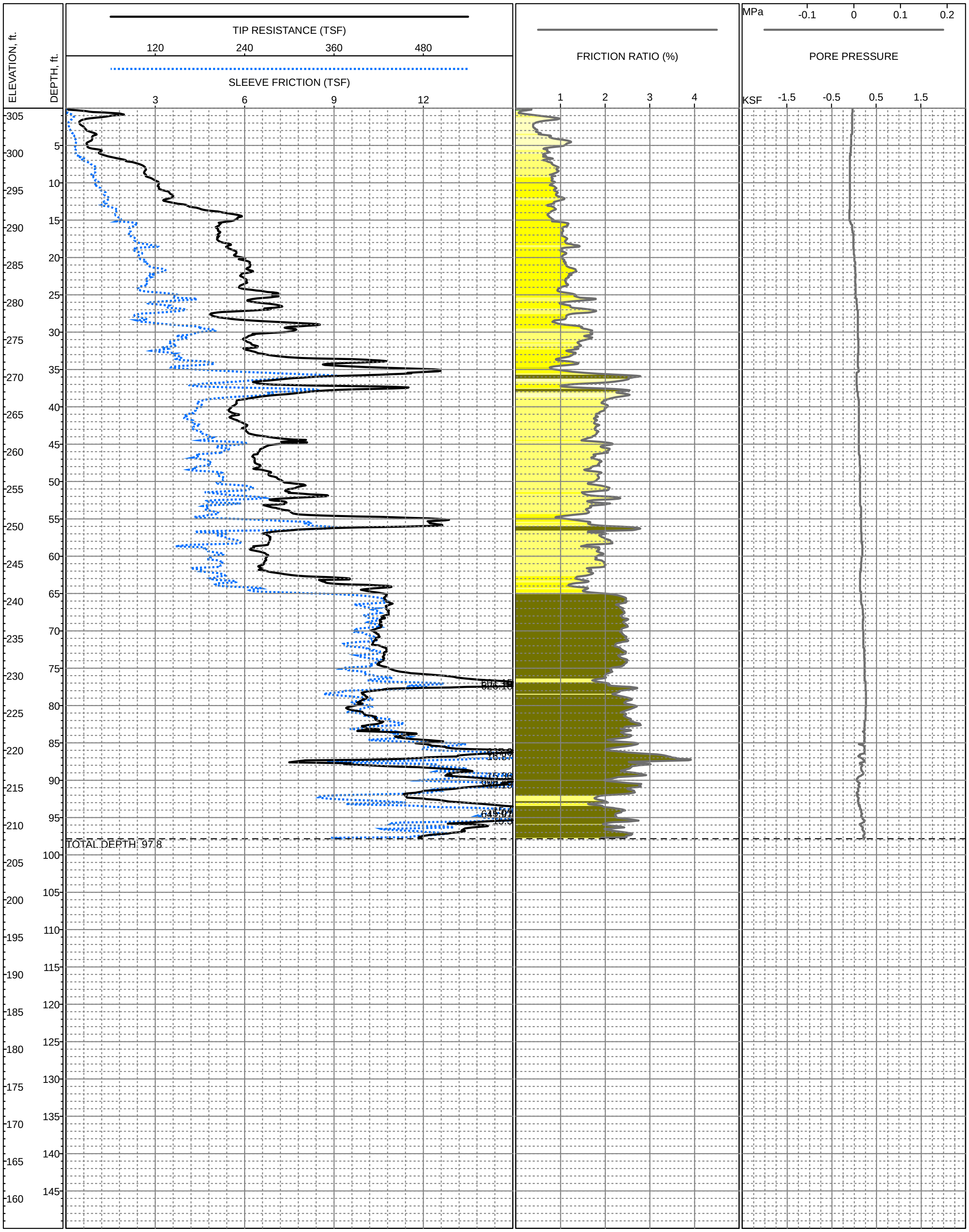
Nipomo Community Services District
Project No. 3596.002.03



COORDINATES: 729,563.00W 3,876,954.00N
SURFACE EL: 306.0ft +/- (MSL)
COMPLETION DEPTH: 97.8ft
TESTDATE: 5/20/2008

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro
REVIEWED BY: P Sorensen & J Blanchard

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Percolation Pond Feasibility Investigation
Nipomo, California

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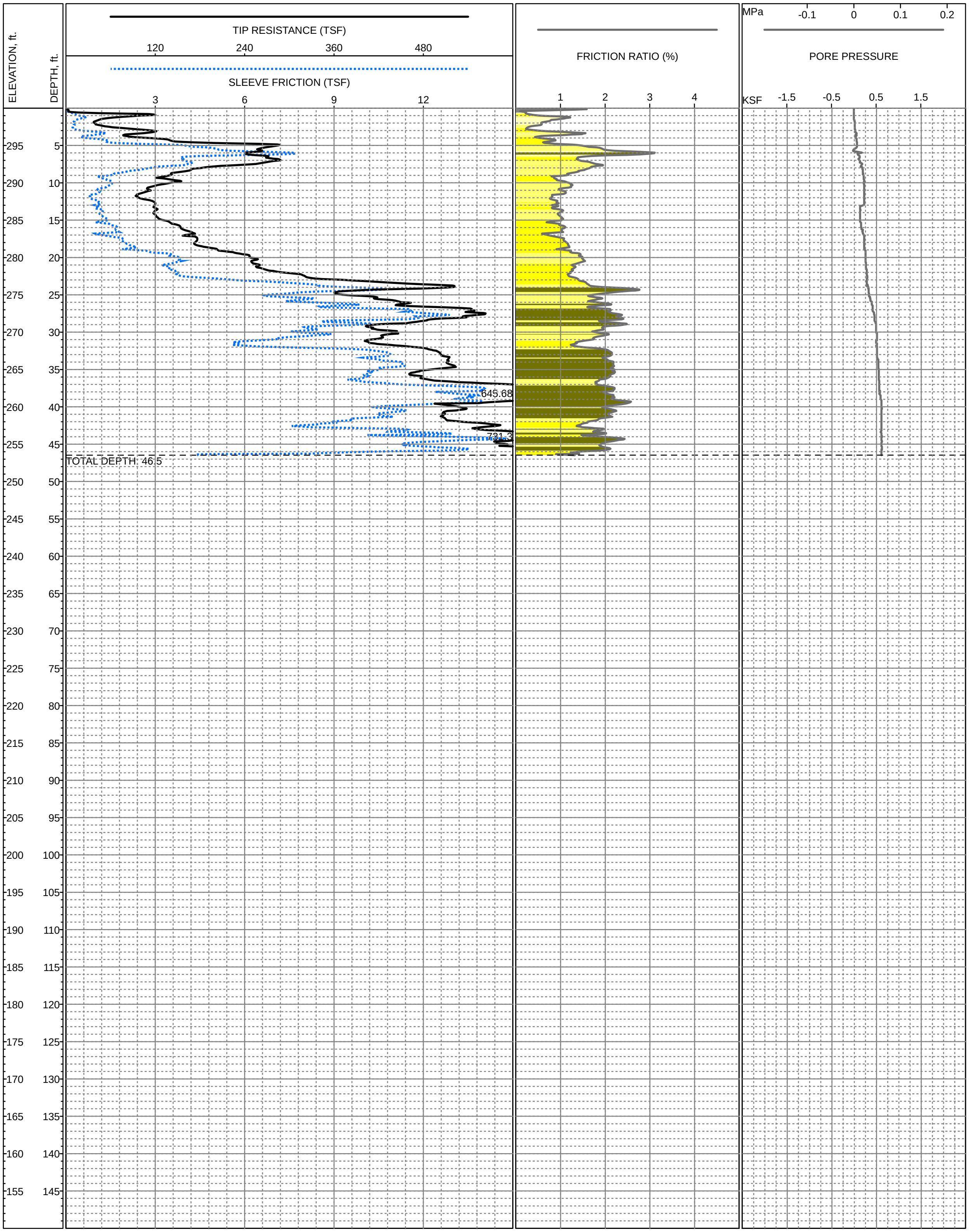
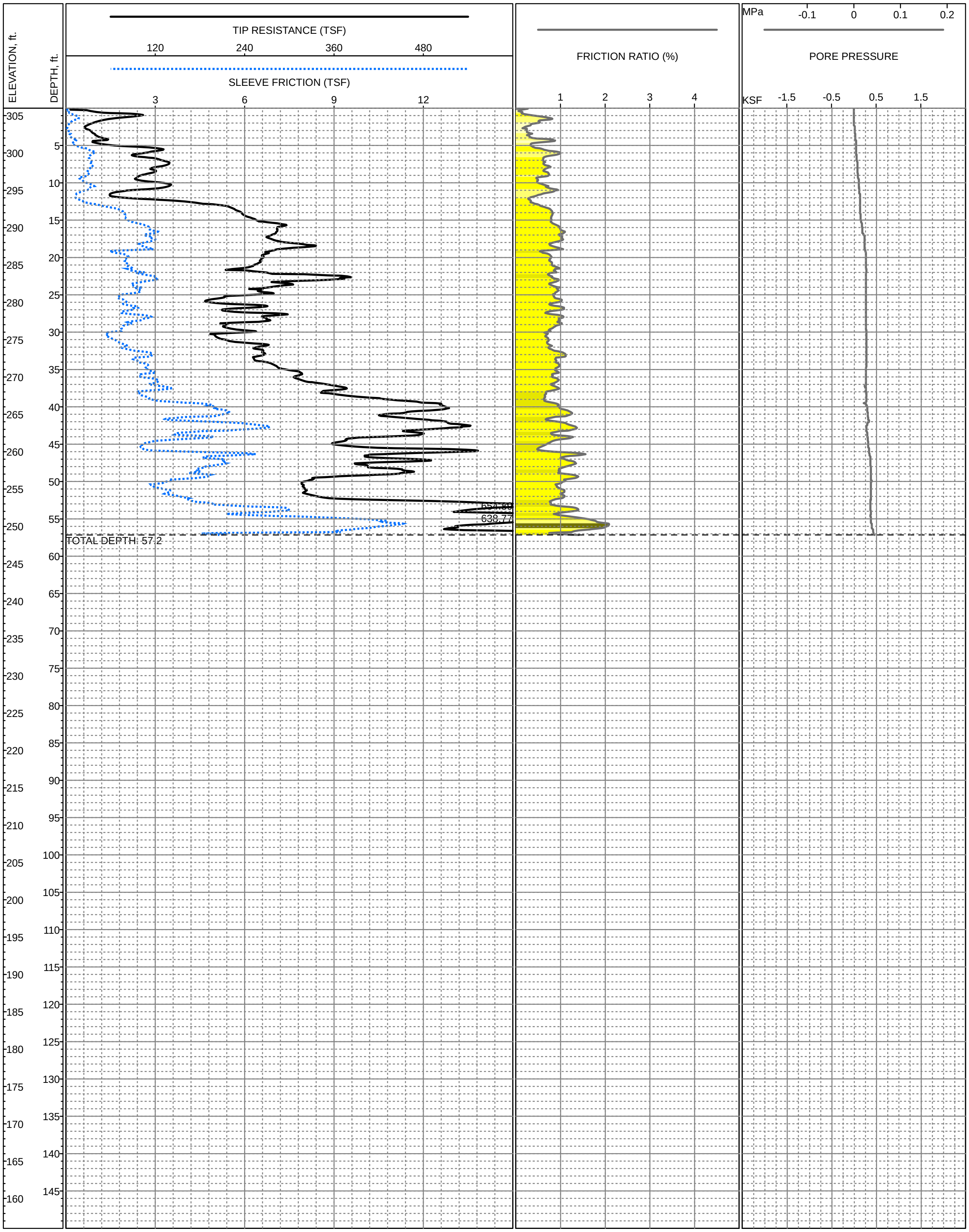


COORDINATES: 729,840.00W 3,876,855.00N
SURFACE EL: 300.0ft +/- (MSL)
COMPLETION DEPTH: 46.5ft
TESTDATE: 5/21/2008

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro
REVIEWED BY: P Sorensen & J Blanchard

LOG OF C-111

Percolation Pond Feasibility Investigation
Nipomo, California



COORDINATES: 730,036.00W 3,876,825.00N
SURFACE EL: 306.0ft +/- (MSL)
COMPLETION DEPTH: 57.2ft
TESTDATE: 5/21/2008

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro
REVIEWED BY: P Sorensen & J Blanchard

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Percolation Pond Feasibility Investigation
Nipomo, California

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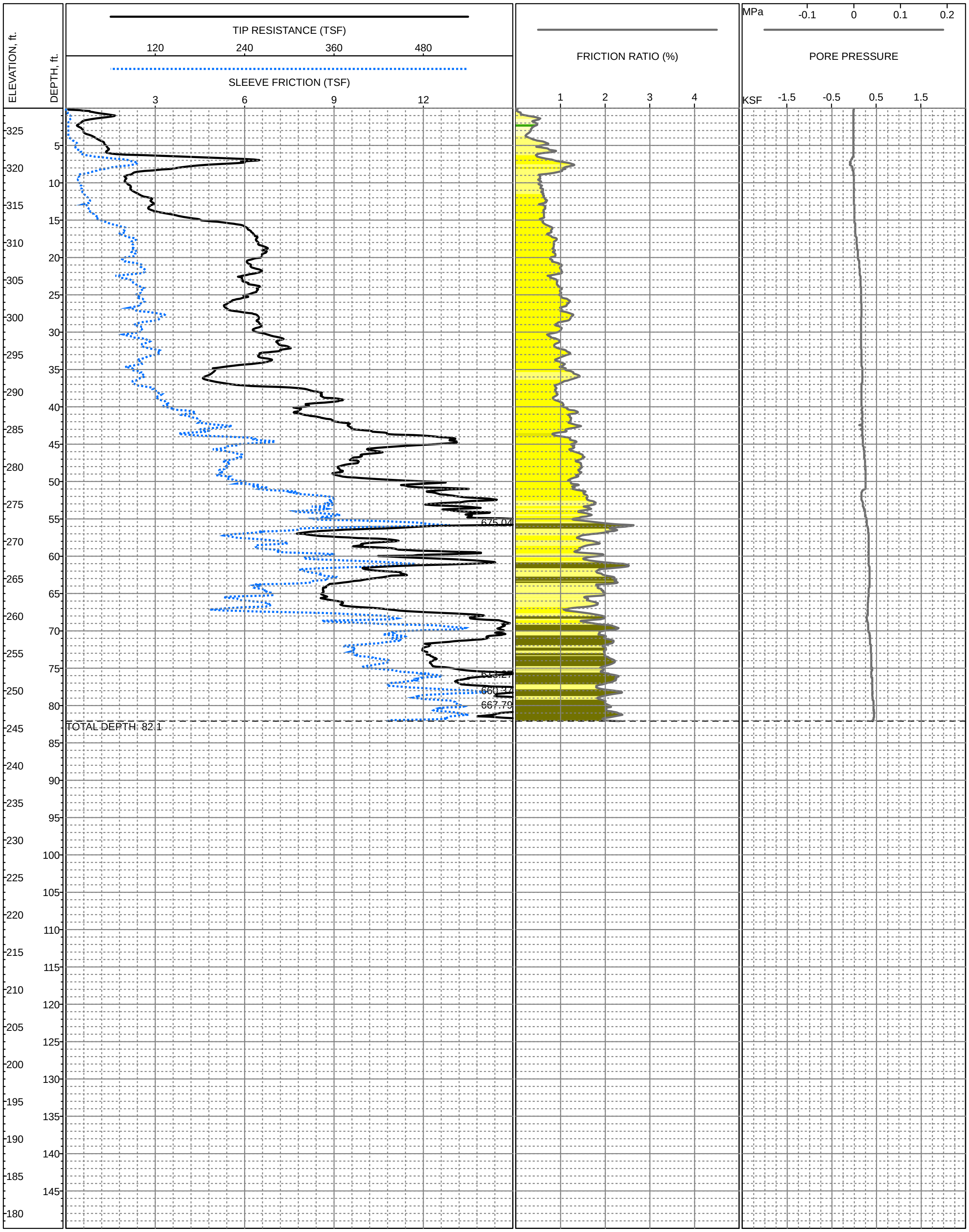

COORDINATES: 730,248.00W 3,876,911.00N
SURFACE EL: 328.0ft +/- (MSL)
COMPLETION DEPTH: 82.1ft
TESTDATE: 5/21/2008

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro
REVIEWED BY: P Sorensen & J Blanchard

LOG OF C-113

Percolation Pond Feasibility Investigation
Nipomo, California

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LOCATION: SW portion of site, approximately 700 feet northeast of bluff

SURFACE EL: 300 ft +/- (rel. MSL datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO.	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
298	2			**DUNE SANDS (Qs)** Silty SAND (SM): medium dense, reddish brown, dry to slightly moist, fine sand, approximately 3 inches of vegetative cover, interbeds of poorly-graded SAND with silt (SP-SM) and clayey SAND (SC)							
296	4										
294	6	1	13								
292	8			Poorly-graded SAND with silt (SP-SM): medium dense, slightly moist, reddish yellow, fine sand, micaceous							
290	10	2	(17)								
288	12										
286	14										
284	16	3	19								
282	18			Poorly-graded SAND (SP): dense, trace to scattered oxidation lenses and manganese lenses							
280	20	4	(33)								
278	22						2	3			
276	24										
274	26	5	34								
272	28										
270	30	6	(61)								
268	32			- moist, approximately 6-inch layer of reddish brown Silty SAND (SM)							
266	34										
264	36	7	36	- stratified color changes from reddish yellow to reddish brown							
262	38										
260	40	8	(50/6")	Poorly-graded SAND with silt (SP-SM): very dense			7	8			
258	42										
256	44										
254	46	9	90/11"	Poorly-graded SAND (SP): very dense, reddish yellow, moist, trace fines							
252	48										

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 160.8 ft
DEPTH TO WATER: 157.0 ft
BACKFILLED WITH: Cuttings
DRILLING DATE: May 21, 2008

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Company
LOGGED BY: G. Eckrich
CHECKED BY: P Sorensen & J Blanchard

LOG OF BORING NO. B-101

Percolation Pond Feasibility Investigation
Nipomo, California

PLATE A-15a

LOCATION: SW portion of site, approximately 700 feet northeast of bluff

SURFACE EL: 300 ft +/- (rel. MSL datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO.	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
		10	(50/6")								
248	52										
246	54										
244	56										
242	58										
240	60	11	71								
238	62										
236	64										
234	66			Poorly-graded SAND with silt (SP-SM): very dense, reddish brown, moist							
232	68										
230	70	12	(89/11")				8	12			
228	72										
226	74										
224	76										
222	78										
220	80	13	78	Silty SAND (SM): very dense, reddish brown, moist, interbedded approximately 1-inch thick strata of fine reddish yellow SAND (SP), scattered manganese inclusions							
218	82										
216	84										
214	86										
212	88										
210	90	14	(50/3")	Poorly-graded SAND (SP): very dense, yellowish brown, moist, sand							
208	92										
206	94										
204	96										
202	98										

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 160.8 ft
DEPTH TO WATER: 157.0 ft
BACKFILLED WITH: Cuttings
DRILLING DATE: May 21, 2008

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Company
LOGGED BY: G. Eckrich
CHECKED BY: P Sorensen & J Blanchard

LOG OF BORING NO. B-101

Percolation Pond Feasibility Investigation
Nipomo, California

LOCATION: SW portion of site, approximately 700 feet northeast of bluff

SURFACE EL: 300 ft +/- (rel. MSL datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO.	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
		15	94/10"								
198	102										
196	104										
194	106			Silty SAND (SM): very dense, yellowish brown, moist							
192	108										
190	110	16	(78/9")		111	106	4	42			
188	112										
186	114										
184	116			Poorly-graded SAND (SP): very dense, very pale brown, moist, fine sand							
182	118										
180	120	17	50/5"								
178	122			Poorly-graded SAND with silt (SP-SM): very dense, strong brown to reddish yellow, moist, gradational contact							
176	124										
174	126										
172	128										
170	130	18	(50/3")	Poorly-graded SAND (SP): very dense, yellowish brown, moist, fine sand							
168	132										
166	134										
164	136			Silty SAND (SM): very dense, pale yellowish brown, moist							
162	138										
160	140	19	50/3"	Poorly-graded SAND (SP): very dense, yellowish brown, moist, fine sand							
158	142										
156	144										
154	146										
152	148										

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 160.8 ft
DEPTH TO WATER: 157.0 ft
BACKFILLED WITH: Cuttings
DRILLING DATE: May 21, 2008

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Company
LOGGED BY: G. Eckrich
CHECKED BY: P Sorensen & J Blanchard

LOG OF BORING NO. B-101

Percolation Pond Feasibility Investigation
Nipomo, California

PLATE A-15c

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	LOCATION: SW portion of site, approximately 700 feet northeast of bluff SURFACE EL: 300 ft +/- (rel. MSL datum) MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
			20										
148	152												
146	154												
144	156												
142	158												
140	160		21		(50/3")	Poorly-graded SAND with silt (SP-SM): very dense, yellowish brown, wet							
138	162												
136	164												
134	166												
132	168												
130	170												
128	172												
126	174												
124	176												
122	178												
120	180												
118	182												
116	184												
114	186												
112	188												
110	190												
108	192												
106	194												
104	196												
102	198												

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 160.8 ft
DEPTH TO WATER: 157.0 ft
BACKFILLED WITH: Cuttings
DRILLING DATE: May 21, 2008

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Company
LOGGED BY: G. Eckrich
CHECKED BY: P Sorensen & J Blanchard

LOG OF BORING NO. B-101

Percolation Pond Feasibility Investigation
Nipomo, California

PLATE A-15d

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	LOCATION: Center of site, approximately 3,500 feet northeast of bluff SURFACE EL: 306 ft +/- (rel. MSL datum) MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
						DUNE SANDS (Qs) Silty SAND (SM): strong brown, slightly moist, interbeds of silty CLAY (CL-ML), sandy SILT (ML) and poorly-graded SAND (SP)							
304	2												
302	4												
			1		12	- medium dense, slightly moist, strong brown, fine sand			5	37			
300	6												
298	8												
296	10		2		(30)	- color change to dark brown	128	117	9	29			
294	12												
292	14												
			3		15								
290	16												
288	18												
286	20		4		(30)	Poorly-graded SAND (SP): medium dense, mottled reddish brown to pale brown, moist, fine sand				4			
284	22												
282	24												
			5		27	- approximately 3-inch layer of friable gray fine SAND (SP)							
280	26												
278	28												
276	30		6		(58)	Poorly-graded SAND with silt (SP-SM): dense, yellow, moist,	105	100	5	7			
274	32												
272	34												
			7		50	Silty SAND (SM): mottled dry reddish brown seams							
270	36												
268	38												
266	40		8		(69)	- interbeds of clayey SAND (SC)							
264	42												
262	44												
			9		52	Poorly-graded SAND with silt (SP-SM): very dense, tan to yellow, moist, fine sand							
260	46												
258	48												

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 126.5 ft
DEPTH TO WATER: 116.0 ft
BACKFILLED WITH: Cuttings
DRILLING DATE: May 22, 2008

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Company
LOGGED BY: T. Nicely
CHECKED BY: P Sorensen & J Blanchard

LOG OF BORING NO. B-102
Percolation Pond Feasibility Investigation
Nipomo, California

PLATE A-16a

LOCATION: Center of site, approximately 3,500 feet northeast of bluff

SURFACE EL: 306 ft +/- (rel. MSL datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
			10		(33)	Poorly-graded SAND (SP): medium dense, yellow, moist	99	96	3	4			
254	52												
252	54												
250	56												
248	58												
246	60		11		57	Poorly-graded SAND with silt (SP-SM): very dense, dry							
244	62												
242	64												
240	66												
238	68												
236	70		12		(93/11")	- minor manganese inclusions	102	97	5	9			
234	72												
232	74												
230	76												
228	78												
226	80		13		50/5"	Silty SAND (SM): very dense, yellow, dry, approximately 4-inch layer of pale gray sandy SILT (ML)				20			
224	82												
222	84												
220	86												
218	88												
216	90		14		(50/2")	Poorly-graded SAND with silt (SP-SM): very dense, pale brown, dry							
214	92												
212	94												
210	96												
208	98												

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 126.5 ft
DEPTH TO WATER: 116.0 ft
BACKFILLED WITH: Cuttings
DRILLING DATE: May 22, 2008

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Company
LOGGED BY: T. Nicely
CHECKED BY: P Sorensen & J Blanchard

LOG OF BORING NO. B-102

Percolation Pond Feasibility Investigation
Nipomo, California

PLATE A-16b

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	LOCATION: Center of site, approximately 3,500 feet northeast of bluff SURFACE EL: 306 ft +/- (rel. MSL datum) MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
			15		93/11"	- color change to yellow to brownish yellow, slightly moist							
204	102												
202	104												
200	106												
198	108												
196	110												
194	112												
192	114												
190	116												
188	118												
186	120												
184	122												
182	124												
			16		44	- dense, yellowish brown, wet, black manganese inclusions, approximately 1-inch thick mottled seam							
180	126												
178	128												
176	130												
174	132												
172	134												
170	136												
168	138												
166	140												
164	142												
162	144												
160	146												
158	148												

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 126.5 ft
DEPTH TO WATER: 116.0 ft
BACKFILLED WITH: Cuttings
DRILLING DATE: May 22, 2008

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Company
LOGGED BY: T. Nicely
CHECKED BY: P Sorensen & J Blanchard

LOG OF BORING NO. B-102

Percolation Pond Feasibility Investigation
Nipomo, California

PLATE A-16c

ELEVATION, ft	DEPTH, ft	SAMPLE NO.	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
				LOCATION: NE portion of site, approximately 1,100 feet southwest of Orchard Road							
				SURFACE EL: 310 ft +/- (rel. MSL datum)							
				DUNE SANDS (Qs) Silty SAND (SM): medium dense, strong brown, moist, interbeds of sandy SILT (ML)							
308	2										
306	4										
		1	14					27			
304	6										
302	8										
300	10										
		2	(18)		91	84	8	15			
				Poorly-graded SAND with silt (SP-SM): loose, reddish yellow, moist				6			
298	12										
296	14										
		3	14	Poorly-graded SAND (SP): medium dense, reddish brown, approximately 1-inch thick seams							
294	16										
292	18										
290	20										
		4	(49)	- dense, reddish brown, slightly moist, fine sand	102	99	3	3			
288	22										
286	24										
		5	18	Poorly-graded SAND with silt (SP-SM): medium dense, reddish brown, slightly moist							
284	26										
282	28										
280	30										
		6	(56)	- very dense, moist							
278	32										
276	34										
		7	17	- medium dense							
274	36										
272	38										
				- dense, yellowish red Silty SAND (SM) pockets, minor black inclusions							
270	40										
		8	(51)		108	103	4	6			
268	42										
266	44										
		9	46	- approximately 2-inch thick interbedded yellowish red Silty SAND (SM) and yellow SAND (SP)							
264	46										
262	48										

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 126.5 ft
DEPTH TO WATER: 98.0 ft
BACKFILLED WITH: Cuttings
DRILLING DATE: May 23, 2008

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Company
LOGGED BY: T. Nicely
CHECKED BY: P Sorensen & J Blanchard

LOG OF BORING NO. B-103

Percolation Pond Feasibility Investigation
Nipomo, California

PLATE A-17a

LOCATION: NE portion of site, approximately 1,100 feet southwest of Orchard Road

SURFACE EL: 310 ft +/- (rel. MSL datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO.	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
		10	(67/11")	- very dense, mottled reddish yellow and yellowish red, moist, fine to medium sand, manganese inclusions							
258	52										
256	54										
254	56										
252	58										
250	60	11	34	- approximately 0.5- to 6-inch thick interbedded very pale brown SAND (SP) and yellowish red Silty SAND (SM), dense, moist							
248	62										
246	64										
244	66										
242	68										
240	70	12	(86/11")	Silty SAND (SM): very dense, reddish yellow, moist, fine sand, manganese inclusions, interbeds of clayey SAND (SC)	107	99	8	15			
238	72										
236	74										
234	76										
232	78										
230	80	13	75	Poorly-graded SAND with silt (SP-SM): very dense, very pale brown, moist							
228	82										
226	84										
224	86										
222	88										
220	90	14	(81/11")	- color change to yellow							
218	92										
216	94										
214	96										
212	98										

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 126.5 ft
DEPTH TO WATER: 98.0 ft
BACKFILLED WITH: Cuttings
DRILLING DATE: May 23, 2008

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Company
LOGGED BY: T. Nicely
CHECKED BY: P Sorensen & J Blanchard

LOG OF BORING NO. B-103

Percolation Pond Feasibility Investigation
Nipomo, California

PLATE A-17b

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	LOCATION: NE portion of site, approximately 1,100 feet southwest of Orchard Road SURFACE EL: 310 ft +/- (rel. MSL datum) MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
			15		43	- dense, wet			21	7			
208	102												
206	104												
204	106												
202	108												
200	110												
198	112												
196	114												
			16		42								
194	116												
192	118												
190	120												
188	122												
186	124												
184	126												
182	128												
180	130												
178	132												
176	134												
174	136												
172	138												
170	140												
168	142												
166	144												
164	146												
162	148												

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 126.5 ft
DEPTH TO WATER: 98.0 ft
BACKFILLED WITH: Cuttings
DRILLING DATE: May 23, 2008

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Company
LOGGED BY: T. Nicely
CHECKED BY: P Sorensen & J Blanchard

LOG OF BORING NO. B-103

Percolation Pond Feasibility Investigation
Nipomo, California

PLATE A-17c

APPENDIX B

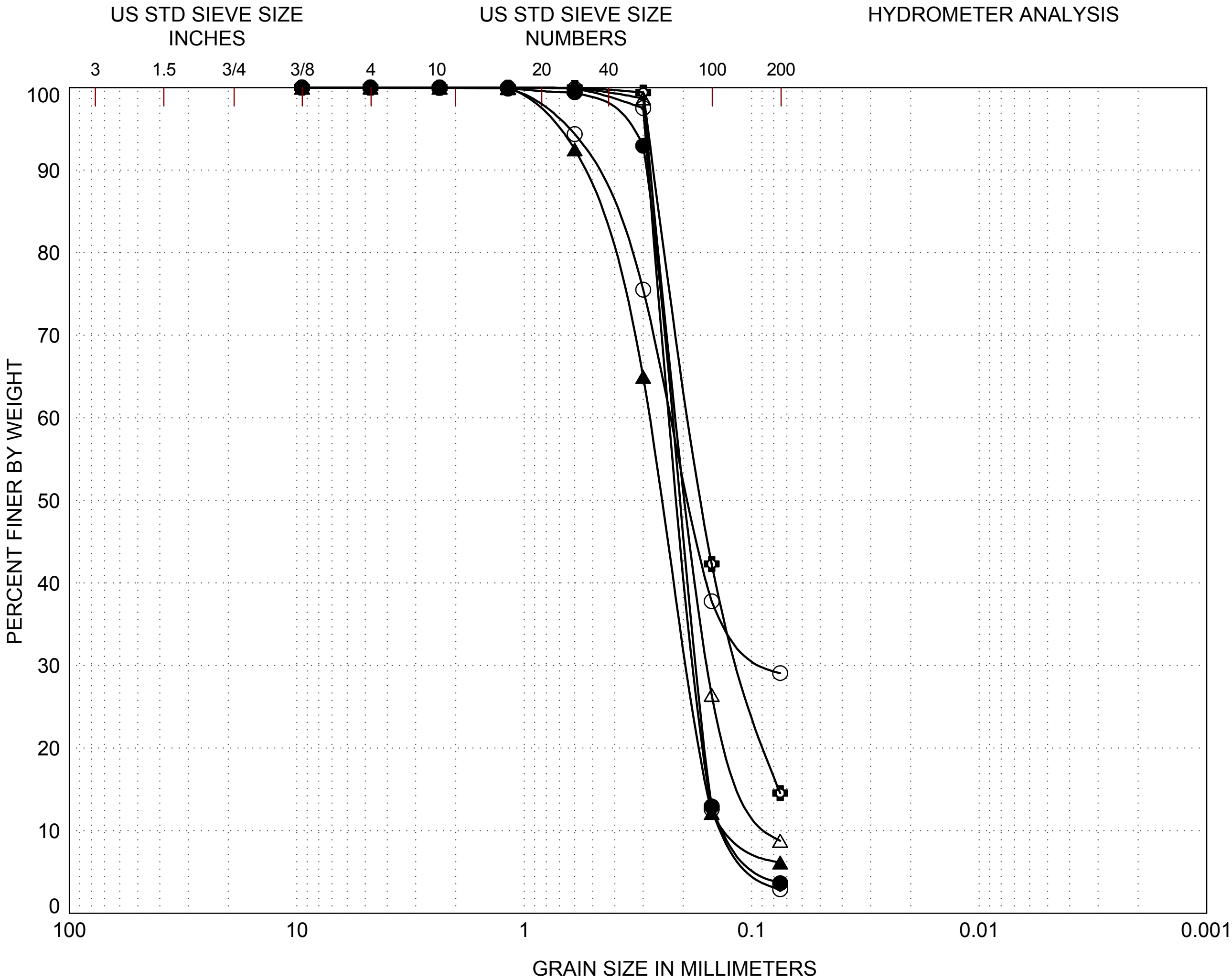
Nipomo Community Services District
Project No. 3596.002

DRILL HOLE	DEPTH, ft	SAMPLE NUMBER	MATERIAL DESCRIPTION	UWW pcf	UDW pcf	MC %	FINES %	ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				R-VALUE	EXPANSION INDEX	SAND EQUIVALENT (SE)	Permeability, cm/s
								LL	PI	MAX DD pcf	OPT MC %	C ksf	PHI deg	Qu, ksf	S_u (Cell Prs.) ksf	R	pH	Cl	So_4 (%)				
B-101	21.0	4	Poorly-graded SAND with silt (SP-SM)	106	103	2	3					0.3	35										
B-101	40.0	8	Poorly-graded SAND with silt (SP-SM)	111	103	7	8					0.3	38										
B-101	70.0	12	Poorly-graded SAND with silt (SP-SM)	114	105	8	12																
B-101	71.0		Silty SAND (SM)									0.6	36										
B-101	110.0	16	Silty SAND (SM)	111	106	4	42																
B-102	5.0	1	Silty SAND (SM)			5	37																
B-102	10.0	2	Silty SAND (SM)	128	117	9	29																4.4E-4
B-102	20.0	4	Poorly-graded SAND (SP)				4																
B-102	30.0	6	Poorly-graded SAND with silt (SP-SM)	105	100	5	7																
B-102	50.0	10	Poorly-graded SAND (SP)	99	96	3	4																1.0E-2
B-102	70.0	12	Poorly-graded SAND with silt (SP-SM)	102	97	5	9																9.4E-3
B-102	80.0	13	Silty SAND (SM)				20																
B-103	5.0	1	Silty SAND (SM)				27																
B-103	10.0	2	Silty SAND (SM)	91	84	8	15																3.6E-4
B-103	10.3	2	Poorly-graded SAND with silt (SP-SM)				6																
B-103	20.0	4	Poorly-graded SAND (SP)	102	99	3	3																1.2E-2
B-103	40.0	8	Poorly-graded SAND with silt (SP-SM)	108	103	4	6																
B-103	70.0	12	Silty SAND (SM)	107	99	8	15																5.2E-4
B-103	100.0	15	Poorly-graded SAND with silt (SP-SM)			21	7																

SUMMARY OF LABORATORY TEST RESULTS

Percolation Pond Feasibility Assessment
Nipomo, California

PLATE B-1

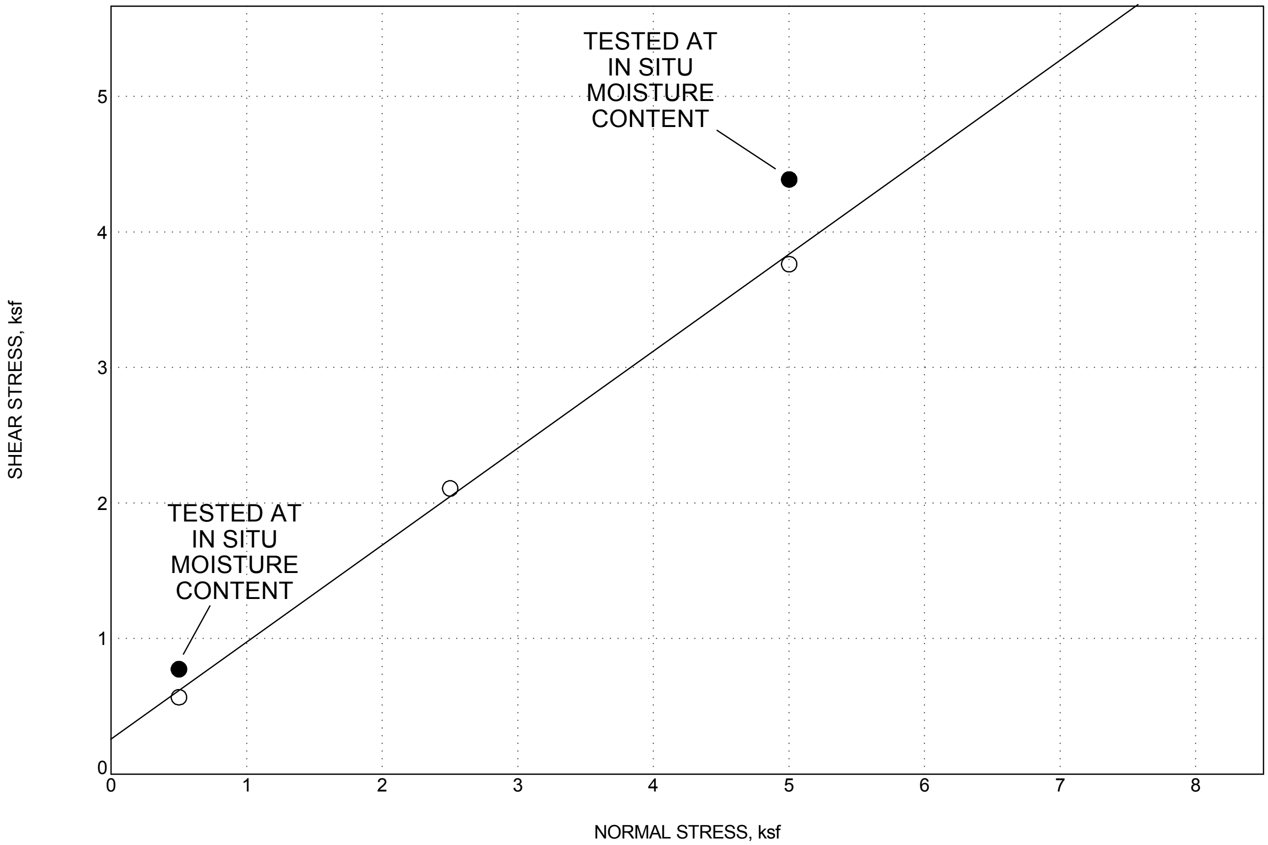


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND	(location)	(depth,ft)	CLASSIFICATION	Cc	Cu
○	B-102	10.0	Silty SAND (SM)		
●	B-102	50.0	Poorly-graded SAND (SP)	1.1	1.9
△	B-102	70.0	Poorly-graded SAND with silt (SP-SM)	1.5	2.6
▲	B-103	10.3	Poorly-graded SAND with silt (SP-SM)	1.1	2.4
⊙	B-103	20.0	Poorly-graded SAND (SP)	1.1	1.8
✪	B-103	70.0	Silty SAND (SM)		

GRAIN SIZE CURVES
Percolation Pond Feasibility Assessment
Nipomo, California

PLATE B-2



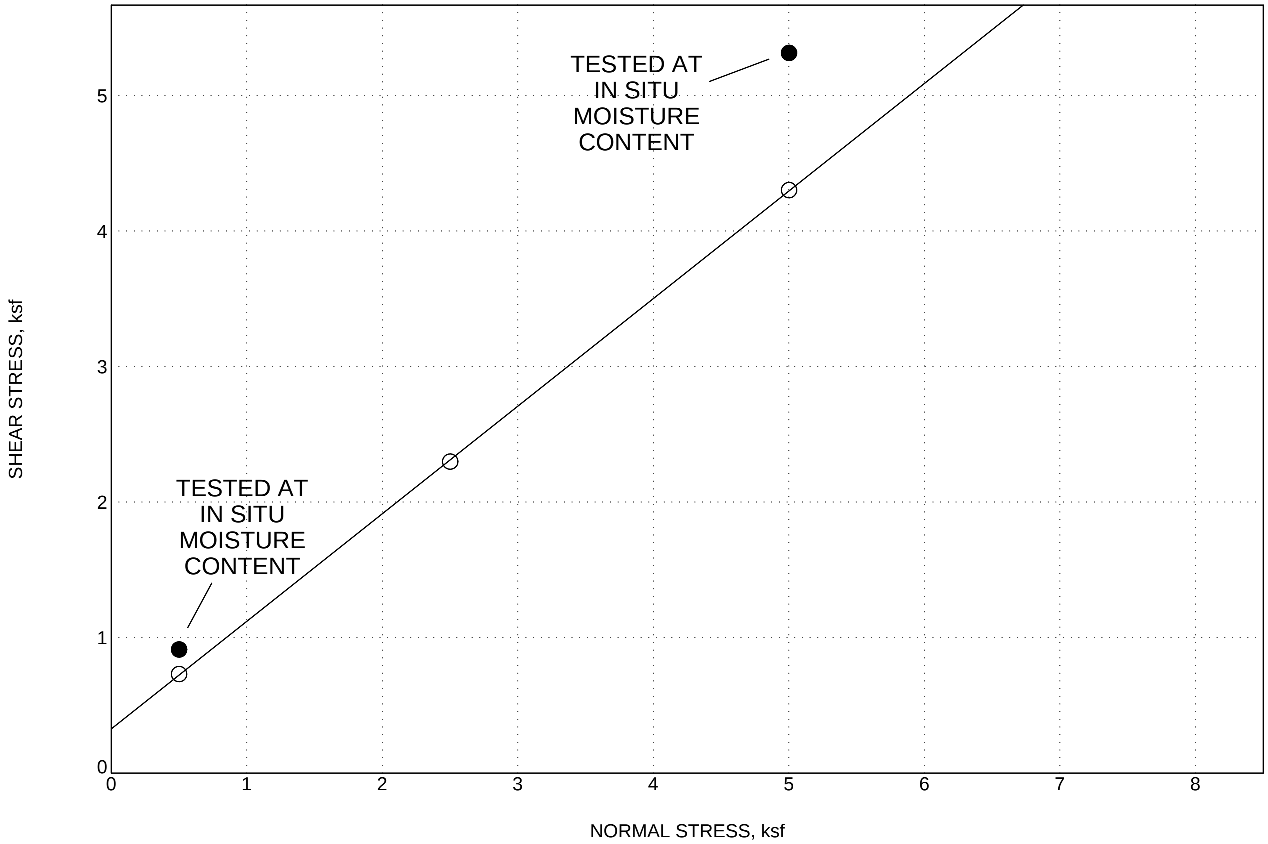
	SATURATED
COHESION, ksf	0.3
ANGLE OF INTERNAL FRICTION, deg	35

DRILL HOLE	B-101
DEPTH, ft	21.0
MOISTURE CONTENT, %	2.3
UNIT DRY WEIGHT, pcf	103.2
MATERIAL DESCRIPTION	Poorly-graded SAND with silt (SP-SM)
SAMPLE CONDITION	Driven Ring

DIRECT SHEAR TEST RESULTS

Percolation Pond Feasibility Assessment
Nipomo, California

PLATE B-3a



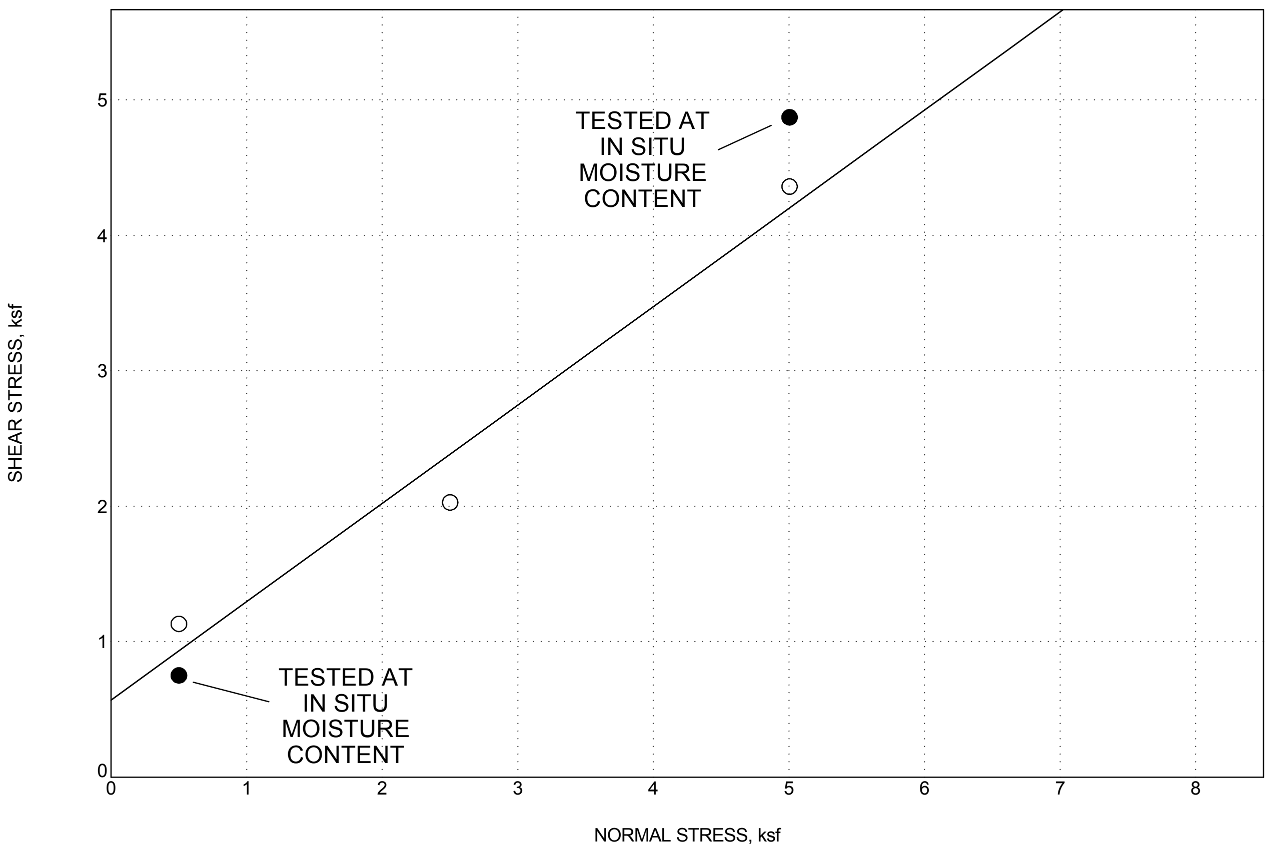
	○ SATURATED
COHESION, ksf	0.3
ANGLE OF INTERNAL FRICTION, deg	38

DRILL HOLE	B-101
DEPTH, ft	40.0
MOISTURE CONTENT, %	7.2
UNIT DRY WEIGHT, pcf	103.4
MATERIAL DESCRIPTION	Poorly-graded SAND with silt (SP-SM)
SAMPLE CONDITION	Driven Ring

DIRECT SHEAR TEST RESULTS

Percolation Pond Feasibility Assessment
Nipomo, California

PLATE B-3b



	○SATURATED
COHESION, ksf	0.6
ANGLE OF INTERNAL FRICTION, deg	36

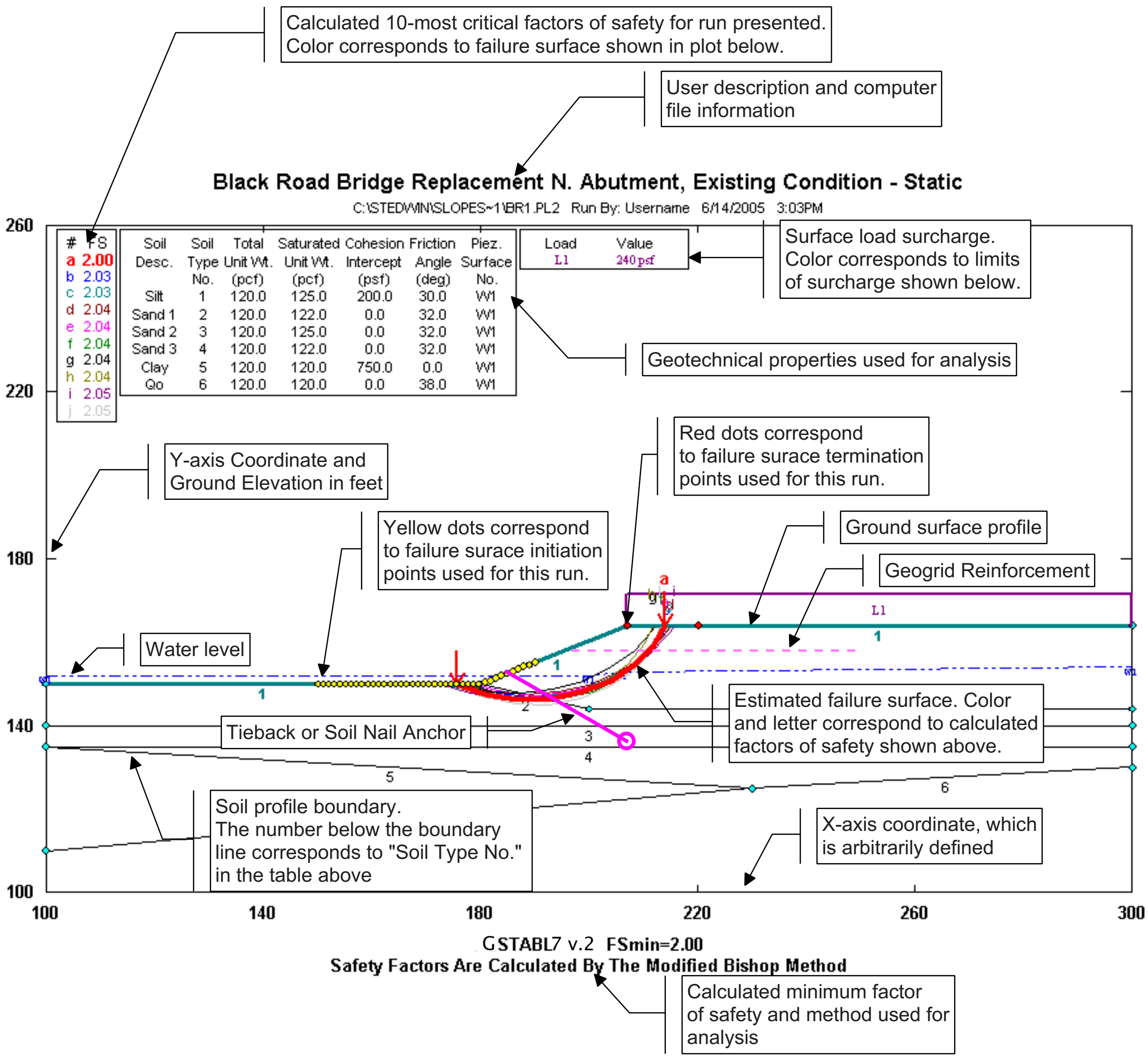
DRILL HOLE	B-101
DEPTH, ft	71.0
MOISTURE CONTENT, %	8.1
UNIT DRY WEIGHT, pcf	105.1
MATERIAL DESCRIPTION	Silty SAND (SM)
SAMPLE CONDITION	Driven Ring

DIRECT SHEAR TEST RESULTS

Percolation Pond Feasibility Assessment
Nipomo, California

PLATE B-3c

APPENDIX C



Notes:

1. Plots are shown for run with least calculated factor of safety. Additional termination and initiation limits may have been considered. Typically over 100 surfaces are calculated for each run.

2. Discussion of the results and methodology is provided in the text of the report.

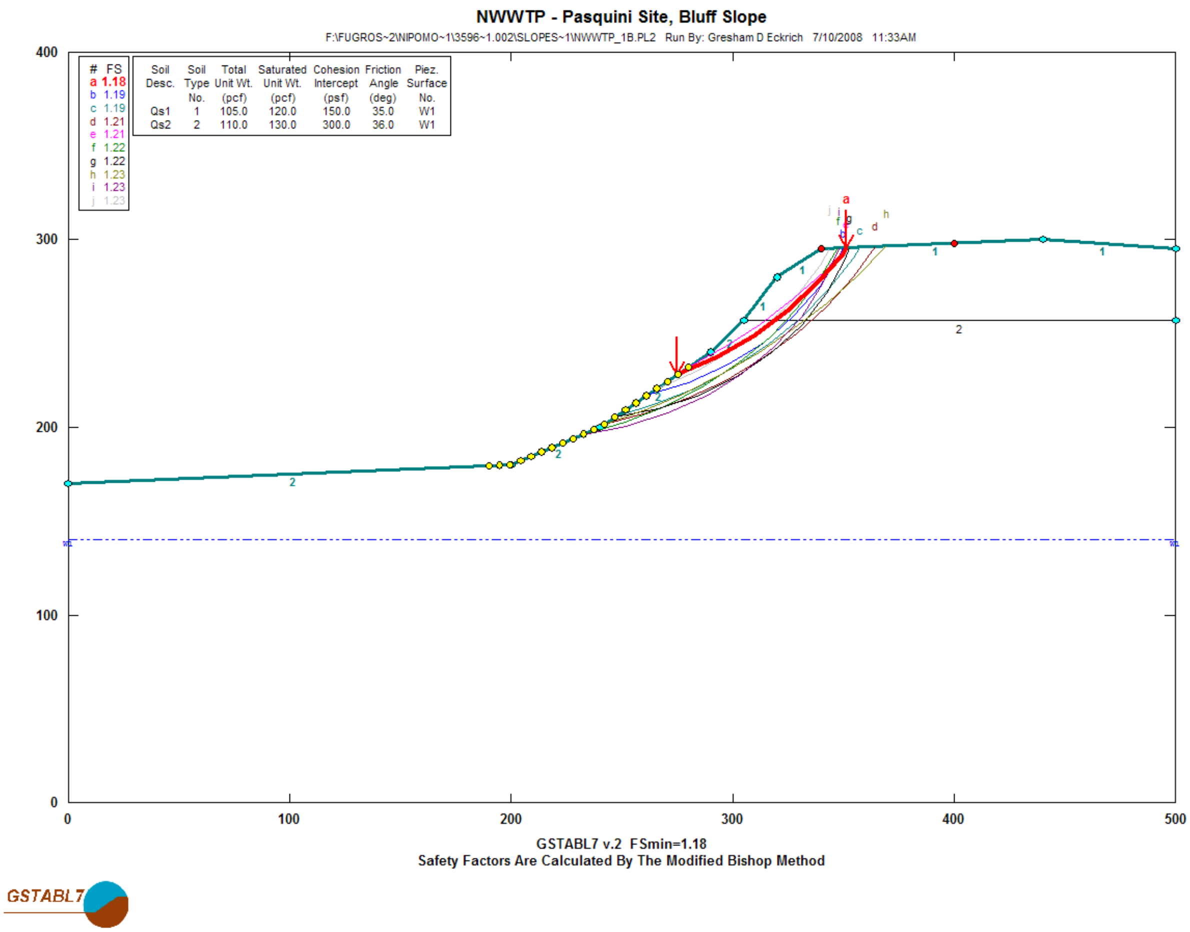
3. The surface and subsurface boundaries are approximate and represent only a generalization of interpreted and inferred subsurface conditions estimated from limited points of exploration.

KEY TO SLOPE STABILITY PLOTS

Percolation Pond Feasibility Assessment

Nipomo,California

PLATE C-1



ESTIMATED FACTORS OF SAFETY

Static Loading Condition: 1.18

Pseudostatic Loading Condition: 0.94

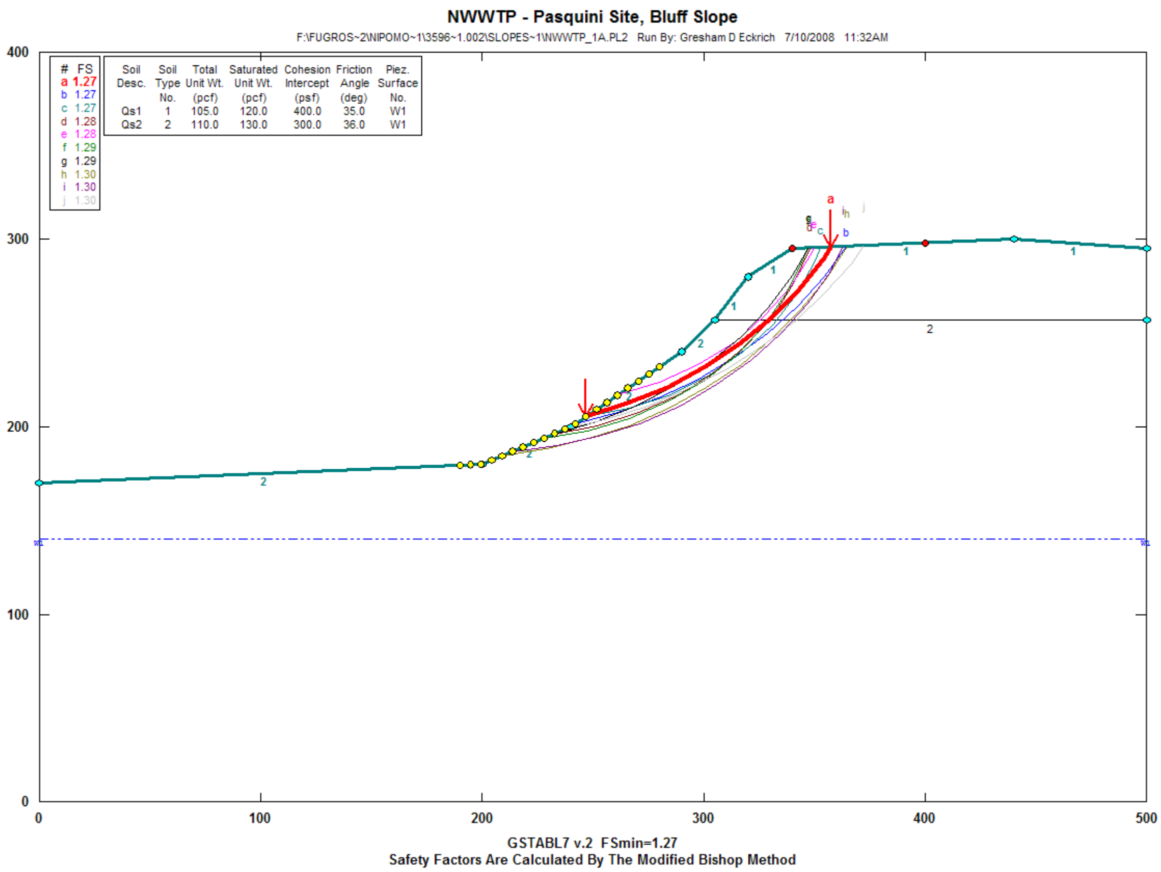
Pseudostatic Coefficient: 0.15

Condition: Existing Slope

Note: Cohesion Value of Upper Unit Based on Direct Shear Test Results

SLOPE STABILITY PLOT FOR BLUFF
Percolation Pond Feasibility Assessment
Nipomo, California

PLATE C-2a



GSTABL7

ESTIMATED FACTORS OF SAFETY

Static Loading Condition: 1.27

Pseudostatic Loading Condition: 1.00

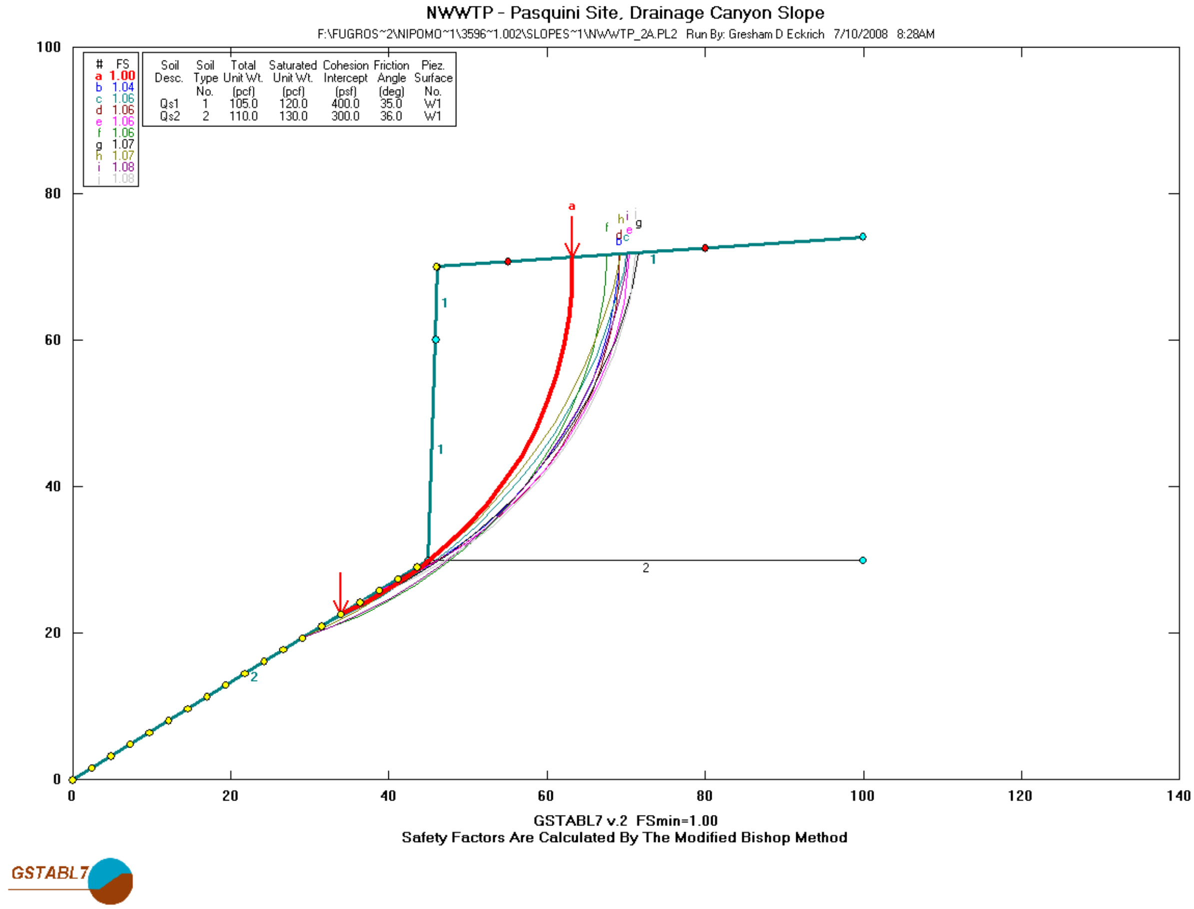
Pseudostatic Coefficient: 0.15

Condition: Existing Slope

Note: Cohesion Value of Upper Unit
Based on Back-Calculation

SLOPE STABILITY PLOT FOR BLUFF
Percolation Pond Feasibility Assessment
Nipomo, California

PLATE C-2b



ESTIMATED FACTORS OF SAFETY

Static Loading Condition: **1.00**

Pseudostatic Loading Condition: **---**

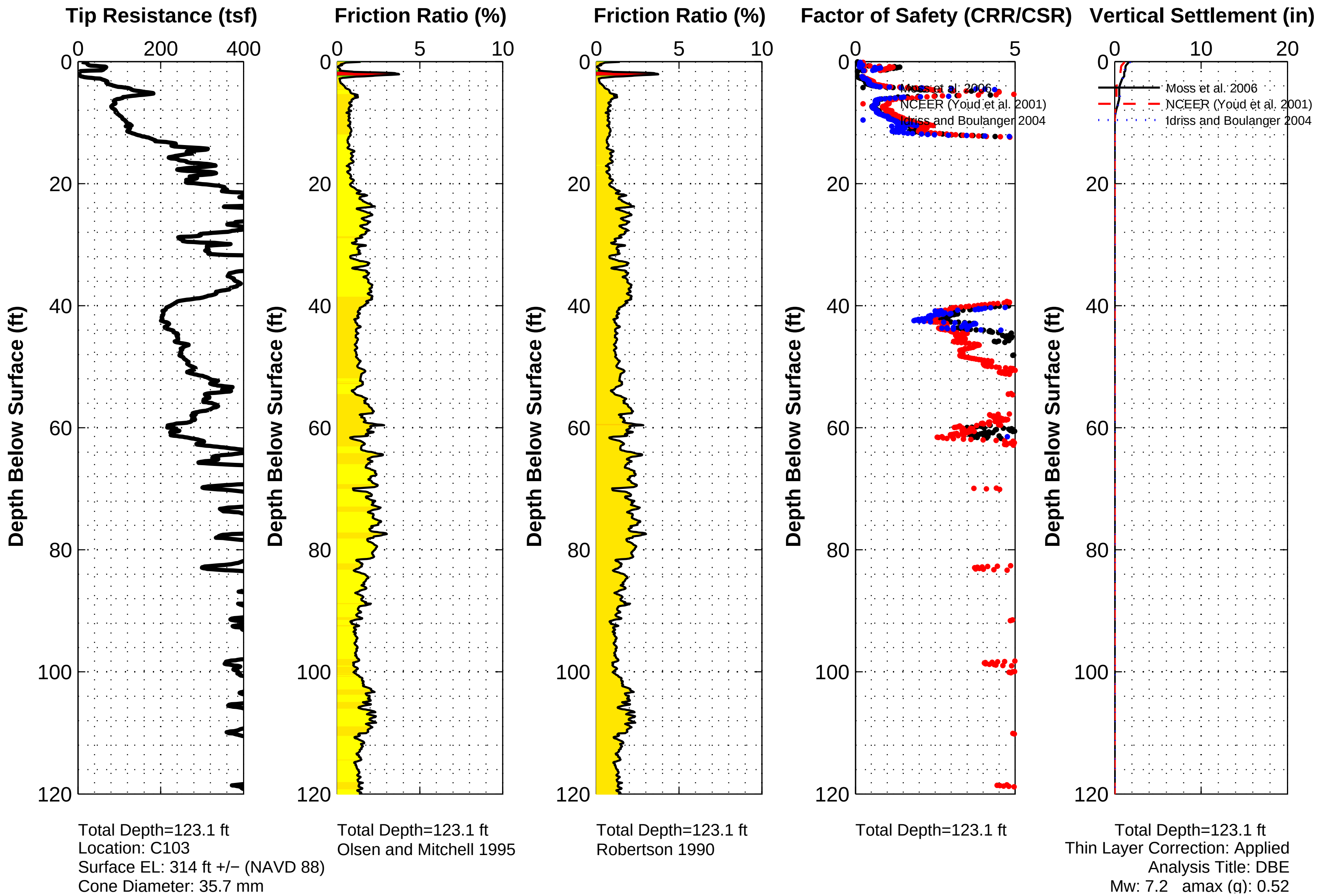
Pseudostatic Coefficient: **---**

Condition: Existing Slope

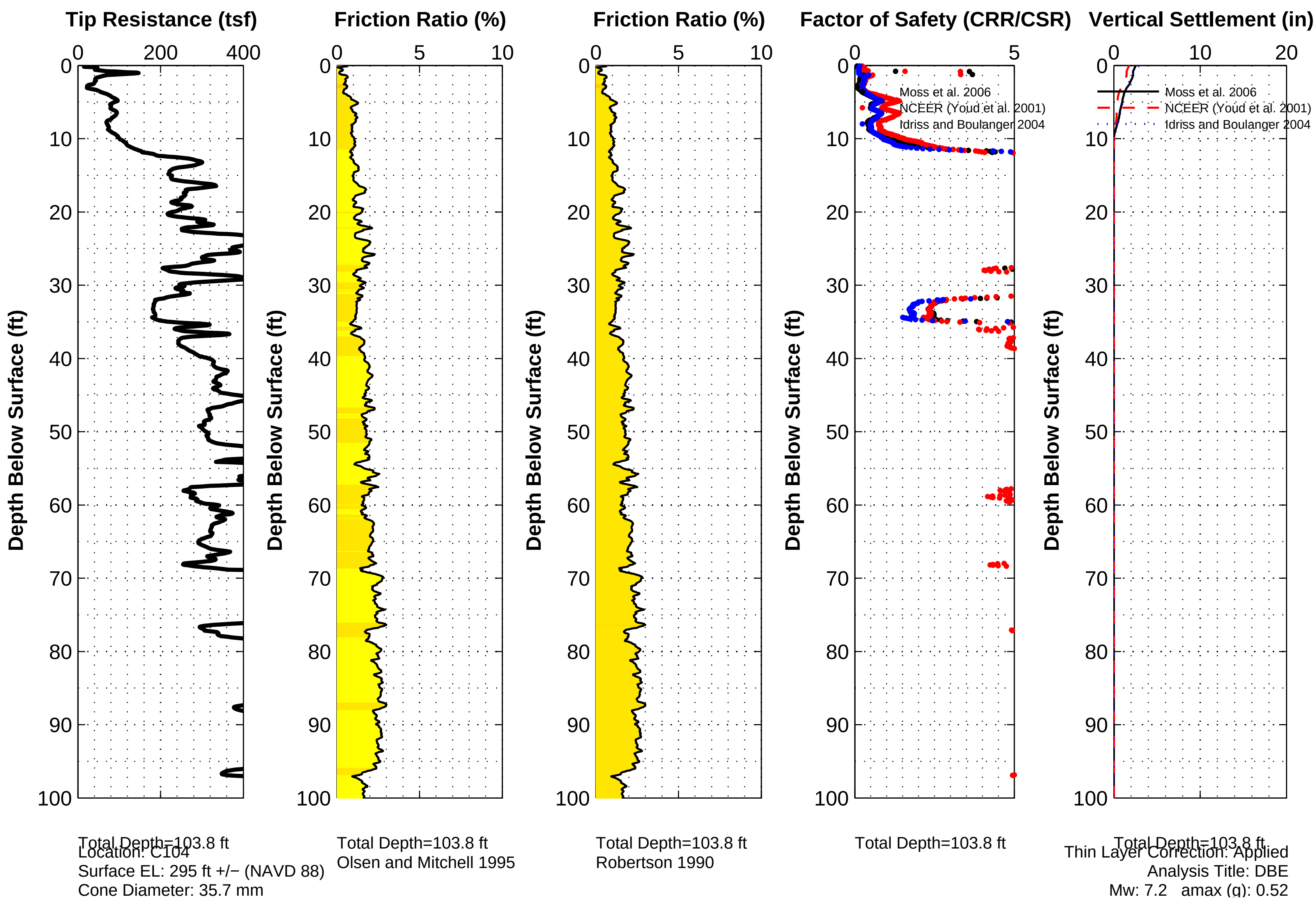
SLOPE STABILITY PLOT FOR DRAINAGE CANYON SLOPE
Percolation Pond Feasibility Assessment
Nipomo, California

PLATE C-2c

APPENDIX D

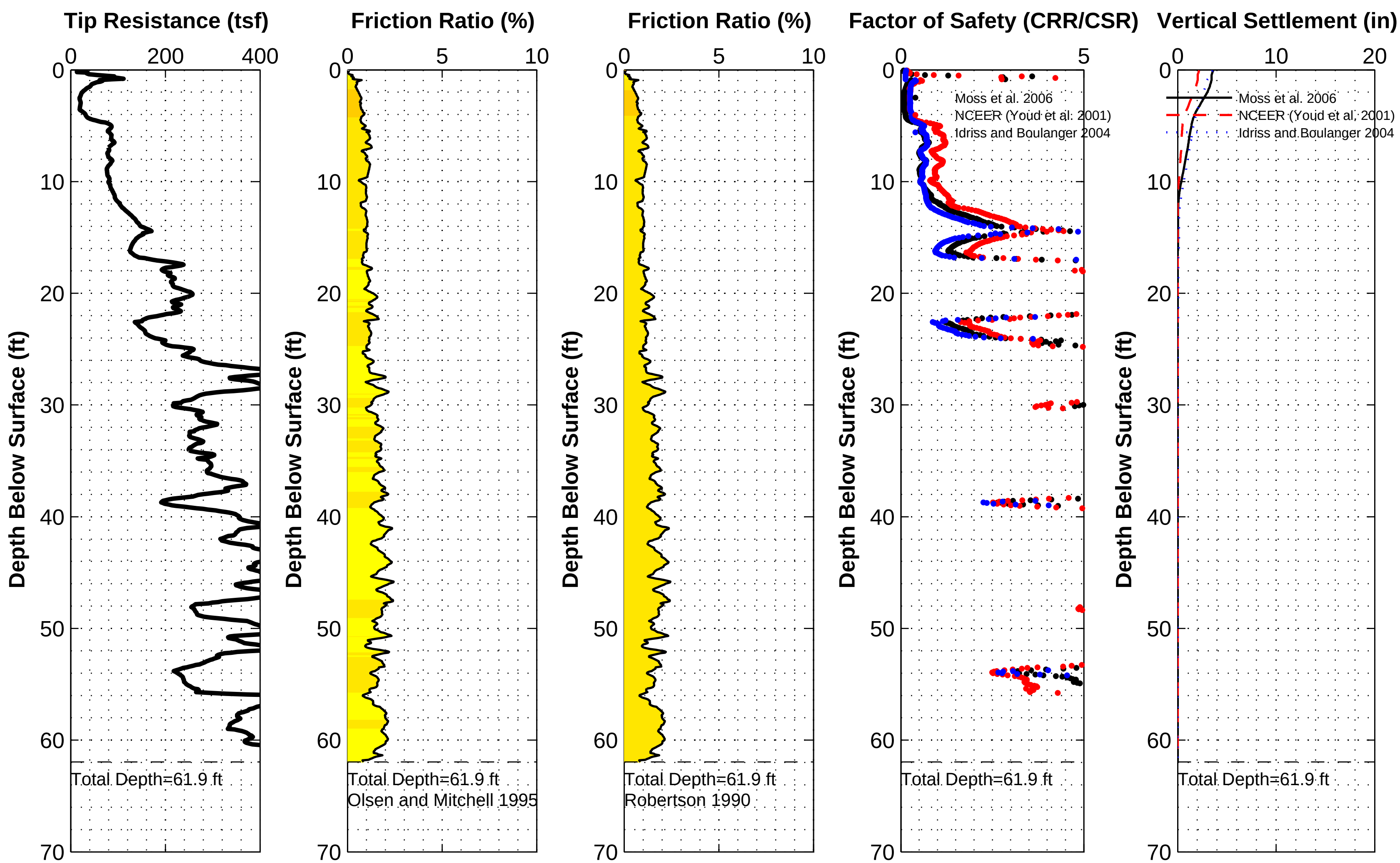


LIQUEFACTION ANALYSIS
Percolation Pond Feasibility Investigation
Nipomo, California



LIQUEFACTION ANALYSIS
Percolation Pond Feasibility Investigation
Nipomo, California

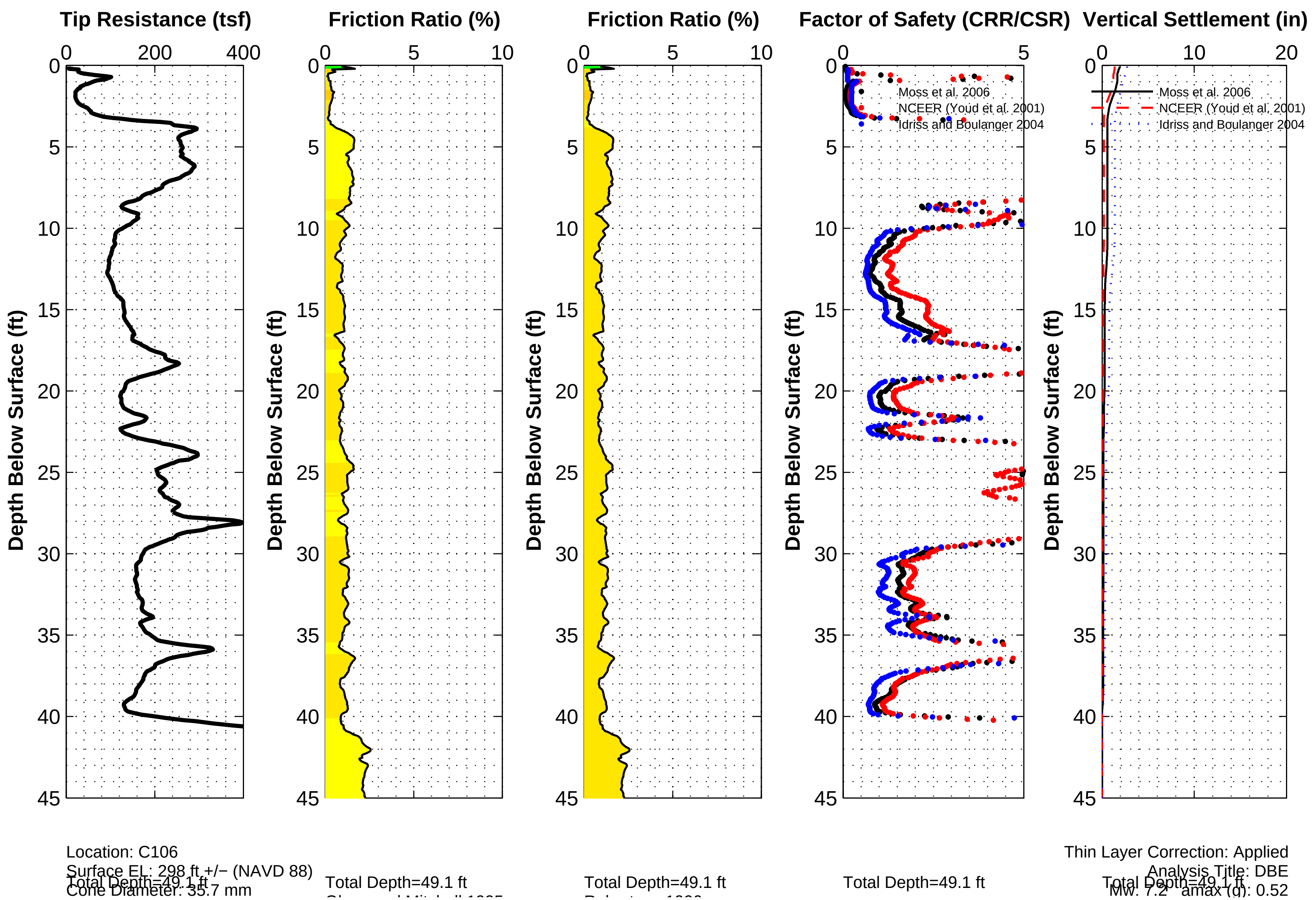
PLATE D-2



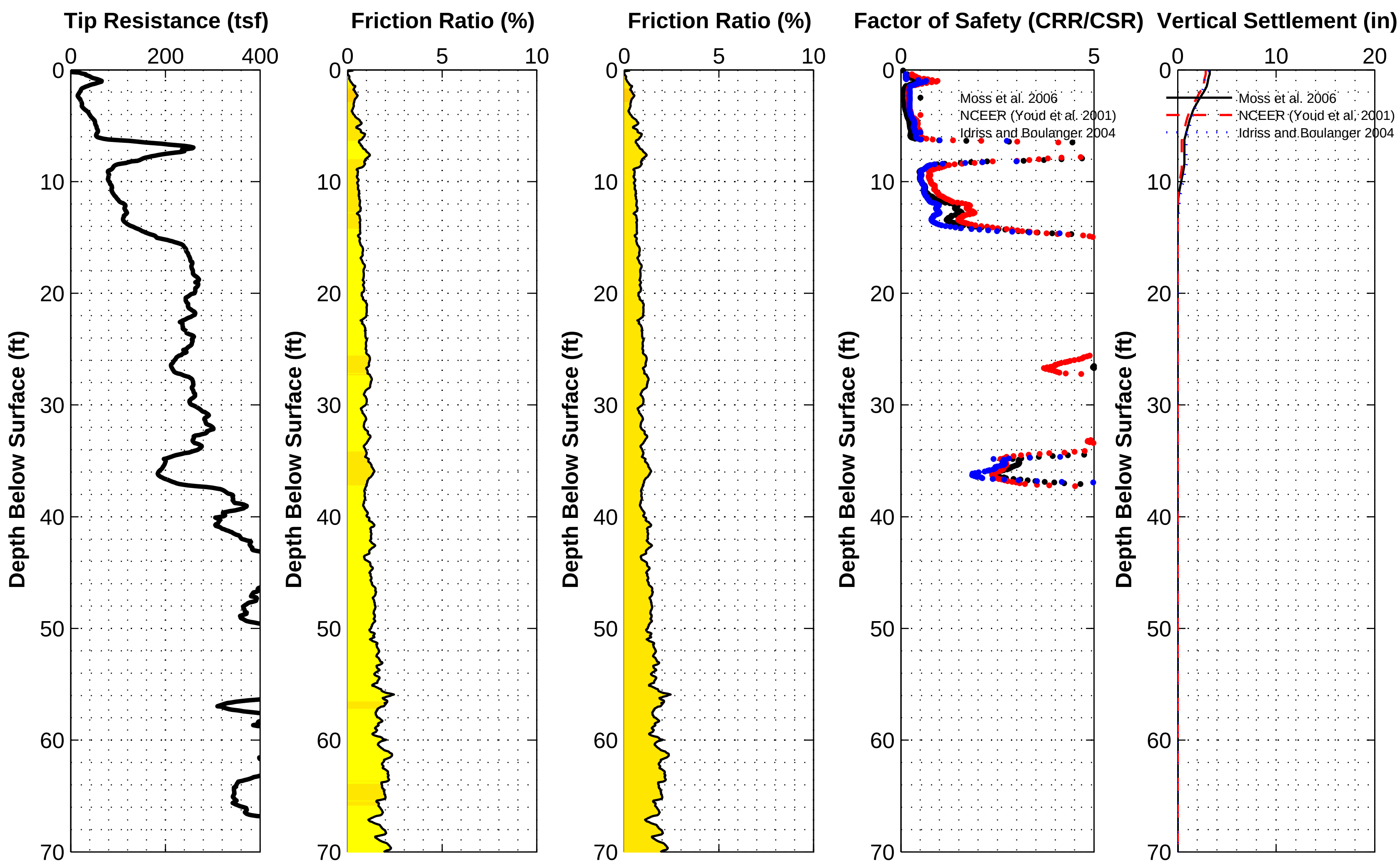
Location: C105
Surface EL: 324 ft +/− (NAVD 88)
Cone Diameter: 35.7 mm

Thin Layer Correction: Applied
Analysis Title: DBE
Mw: 7.2 amax (g): 0.52

LIQUEFACTION ANALYSIS
Percolation Pond Feasibility Investigation
Nipomo, California



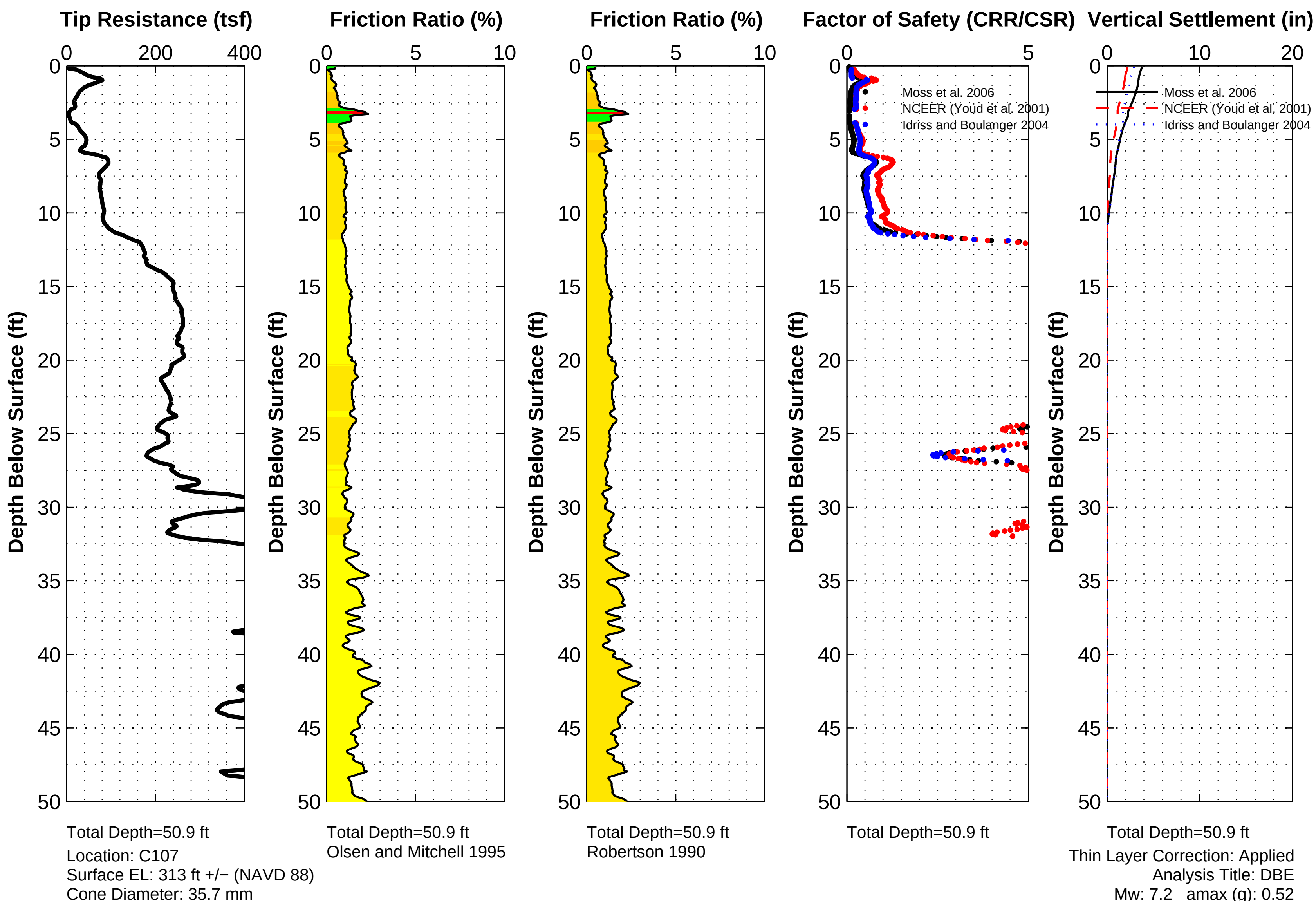
LIQUEFACTION ANALYSIS
Percolation Pond Feasibility Investigation
Nipomo, California



Location: C113
Surface EL: 328 ft +/− (NAVD 88)
Cone Diameter: 35.7 mm

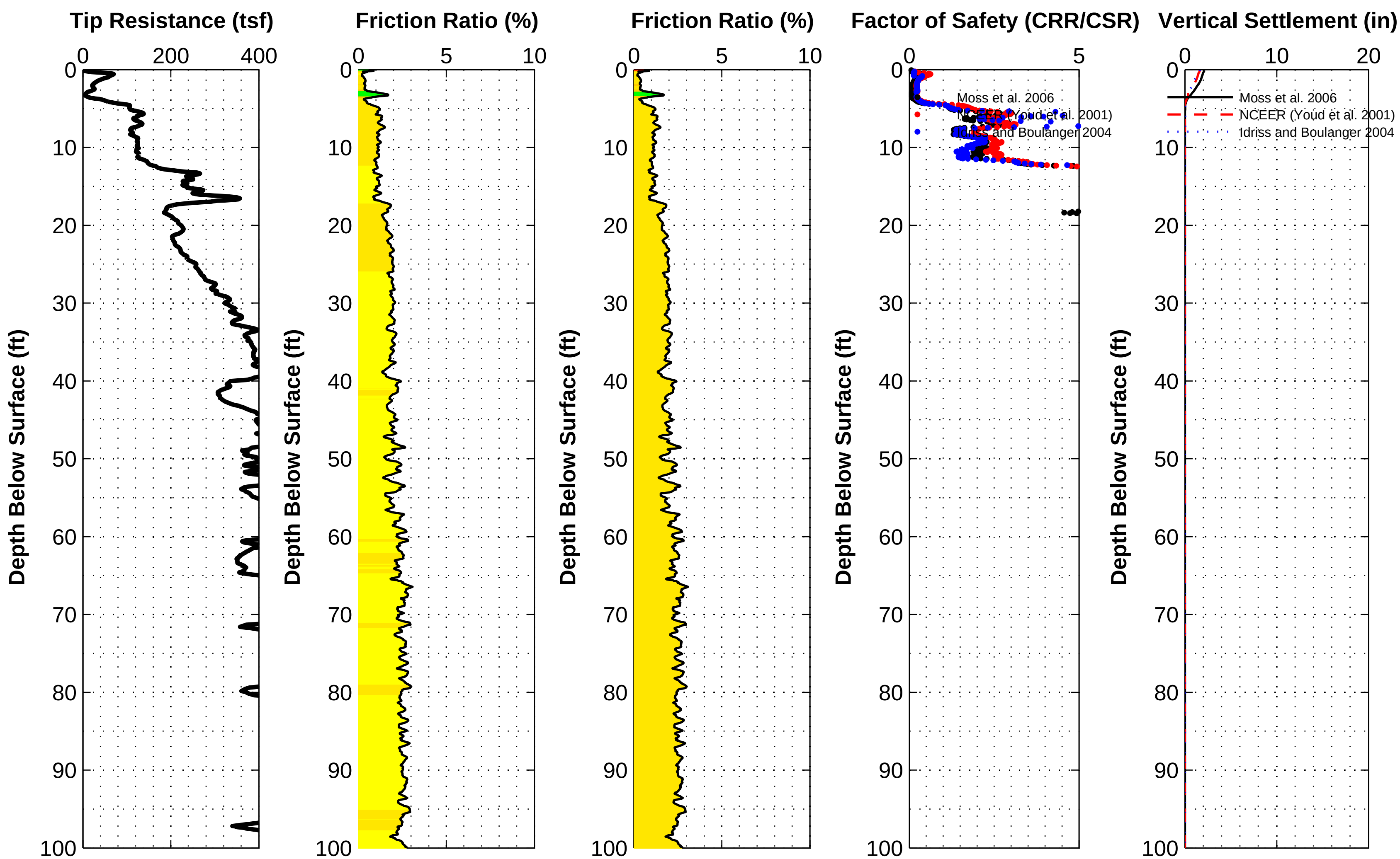
Thin Layer Correction: Applied
Analysis Title: DBE
Mw: 7.2 amax (g): 0.52

LIQUEFACTION ANALYSIS
Percolation Pond Feasibility Investigation
Nipomo, California



LIQUEFACTION ANALYSIS
Percolation Pond Feasibility Investigation
Nipomo, California

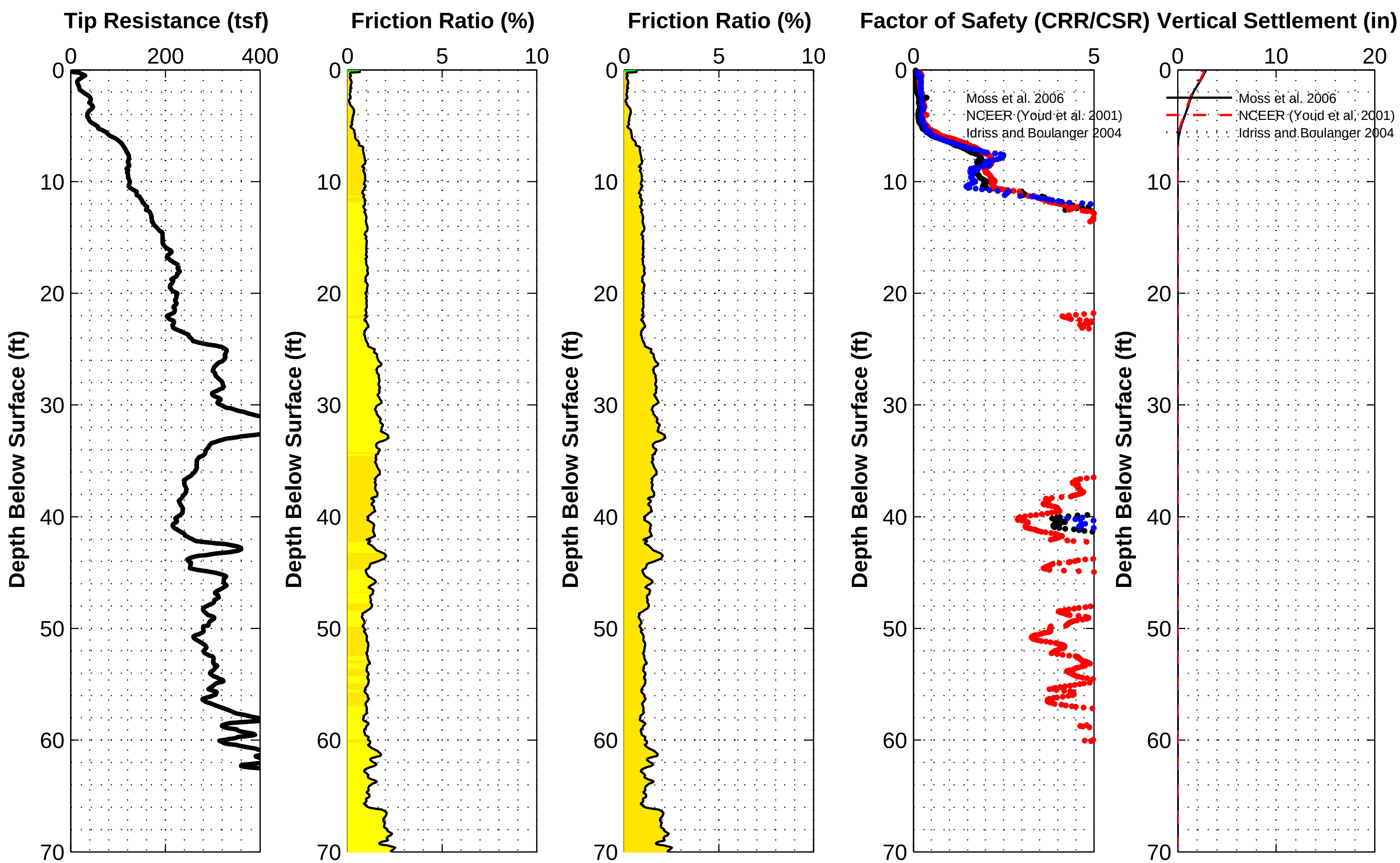
PLATE D-6



Location: C108
Surface EL: 287 ft +/− (NAVD 88)
Cone Diameter: 35.7 mm

Thin Layer Correction: Applied
Analysis Title: DBE
Mw: 7.2 amax (g): 0.52

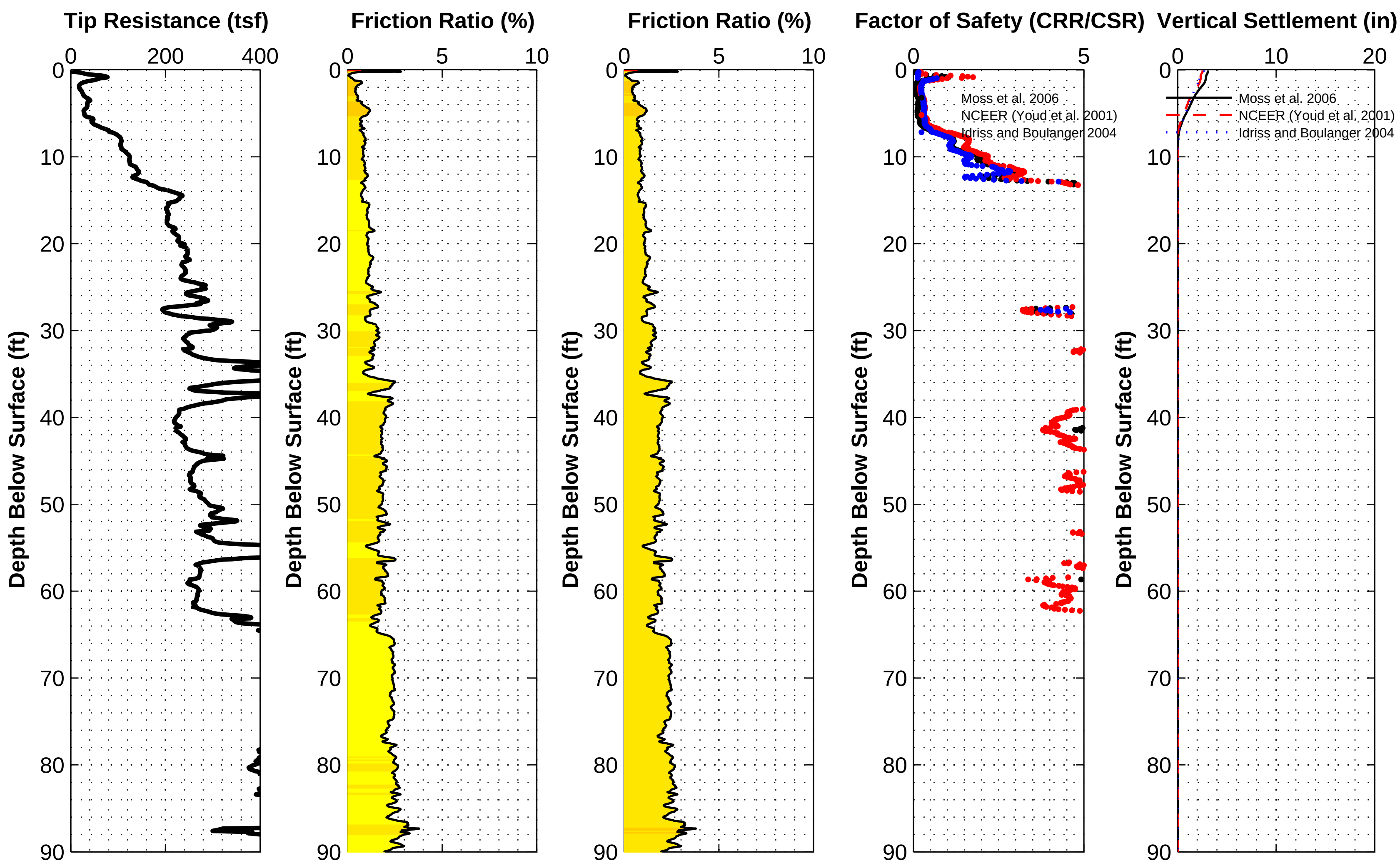
LIQUEFACTION ANALYSIS
Percolation Pond Feasibility Investigation
Nipomo, California



Location: C109
Surface EL: 318 ft +/− (NAVD 88)
Cone Diameter: 35.7 mm

Thin Layer Correction: Applied
Analysis Title: DBE
Mw: 7.2 amax (g): 0.52

LIQUEFACTION ANALYSIS
Percolation Pond Feasibility Investigation
Nipomo, California



Location: C110
Surface El.: 306 ft +/− (NAVD 88)
Total Depth=97.8 ft
Cone Diameter: 35.7 mm

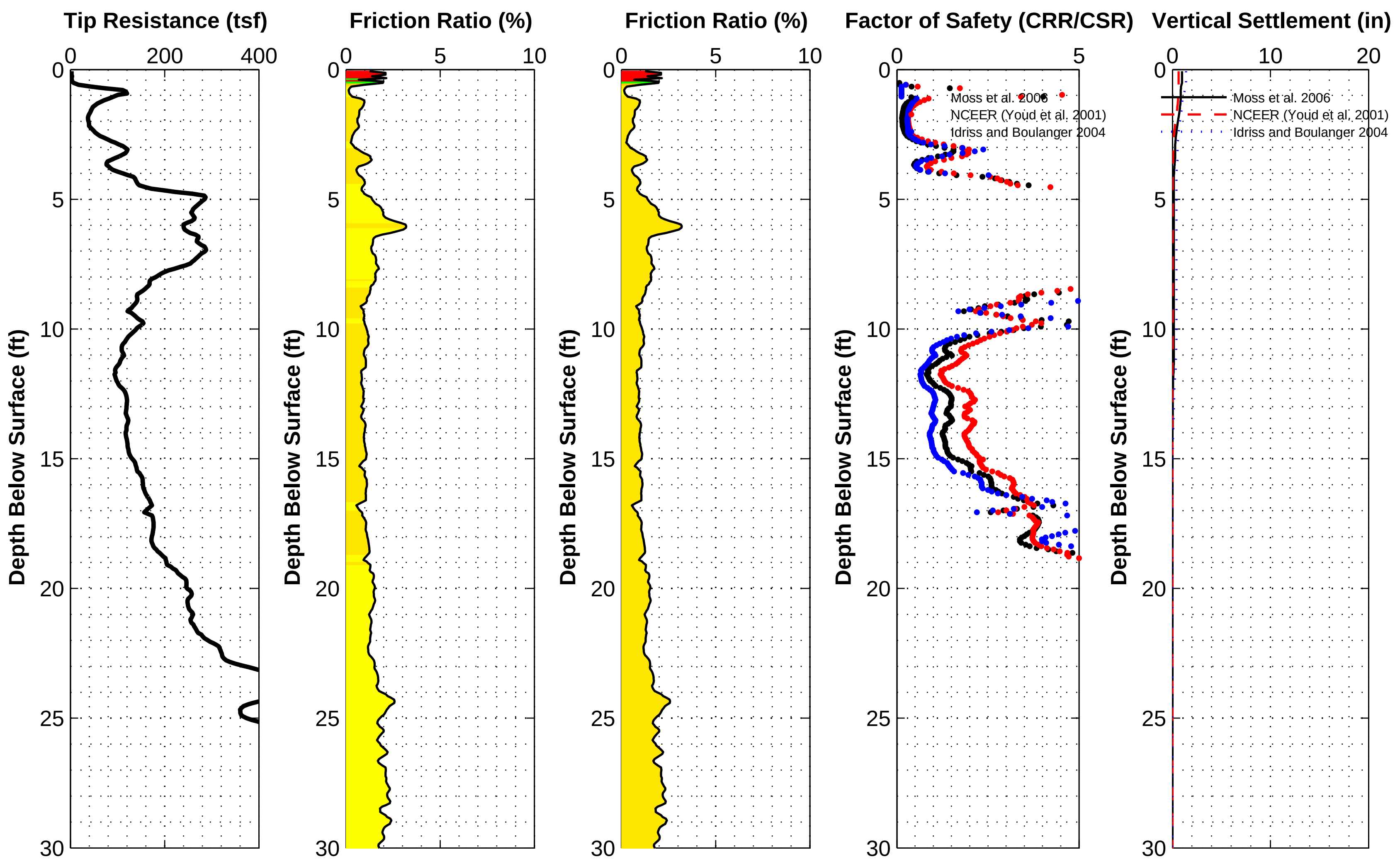
Total Depth=97.8 ft
Olson and Mitchell 1995

Total Depth=97.8 ft
Robertson 1990

Total Depth=97.8 ft

Thin Layer Correction: Applied
Analysis Title: DBE
Total Depth=97.8 ft
Mw: 7.2 amax (g): 0.52

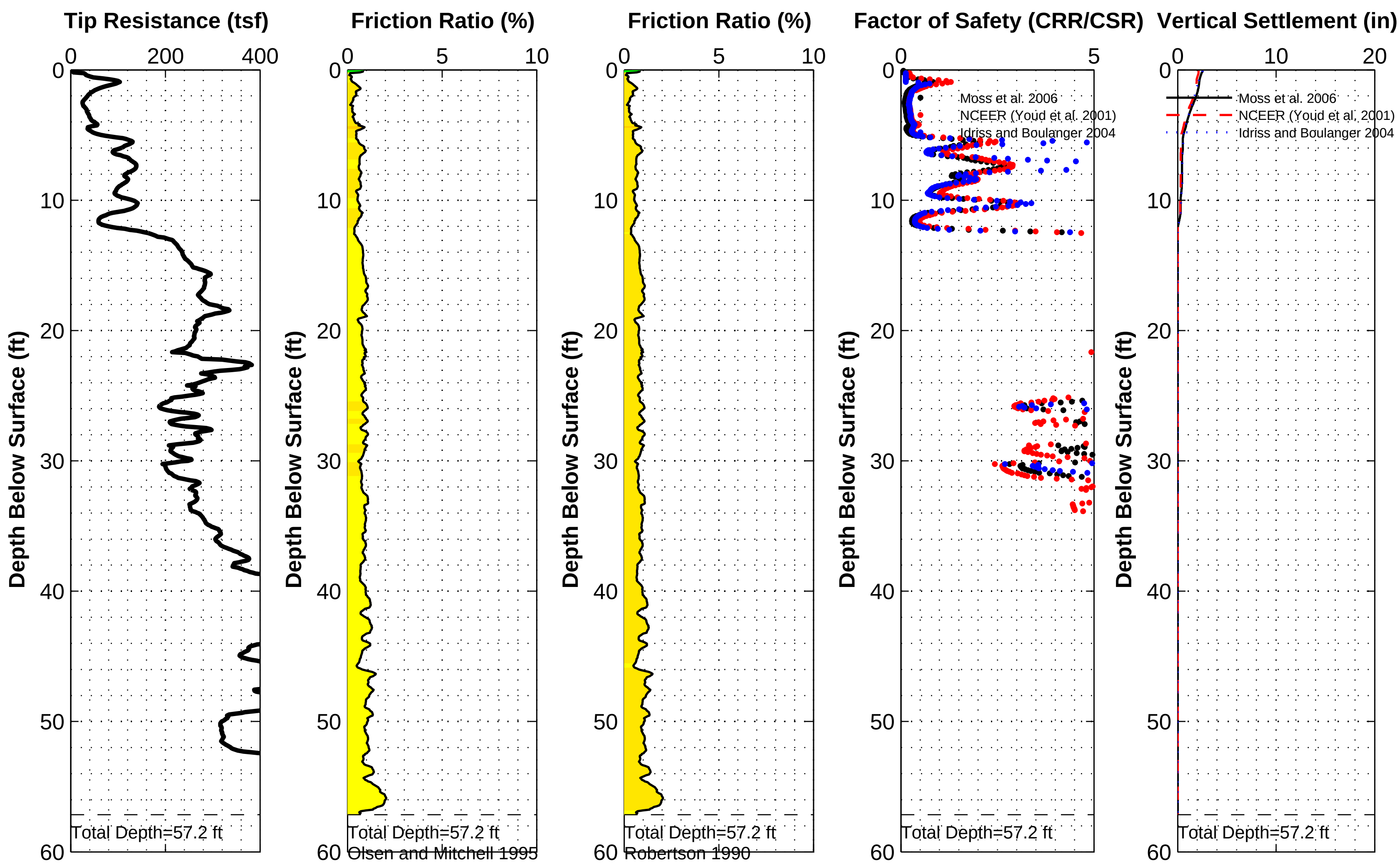
LIQUEFACTION ANALYSIS
Percolation Pond Feasibility Investigation
Nipomo, California



Location: C111
Surface EL: 291 ft +/− (NAVD 88)
Cone Diameter: 35.7 mm

Thin Layer Correction: Applied
Analysis Title: DBE
Mw: 7.2   amax (g): 0.52

LIQUEFACTION ANALYSIS
Percolation Pond Feasibility Investigation
Nipomo, California

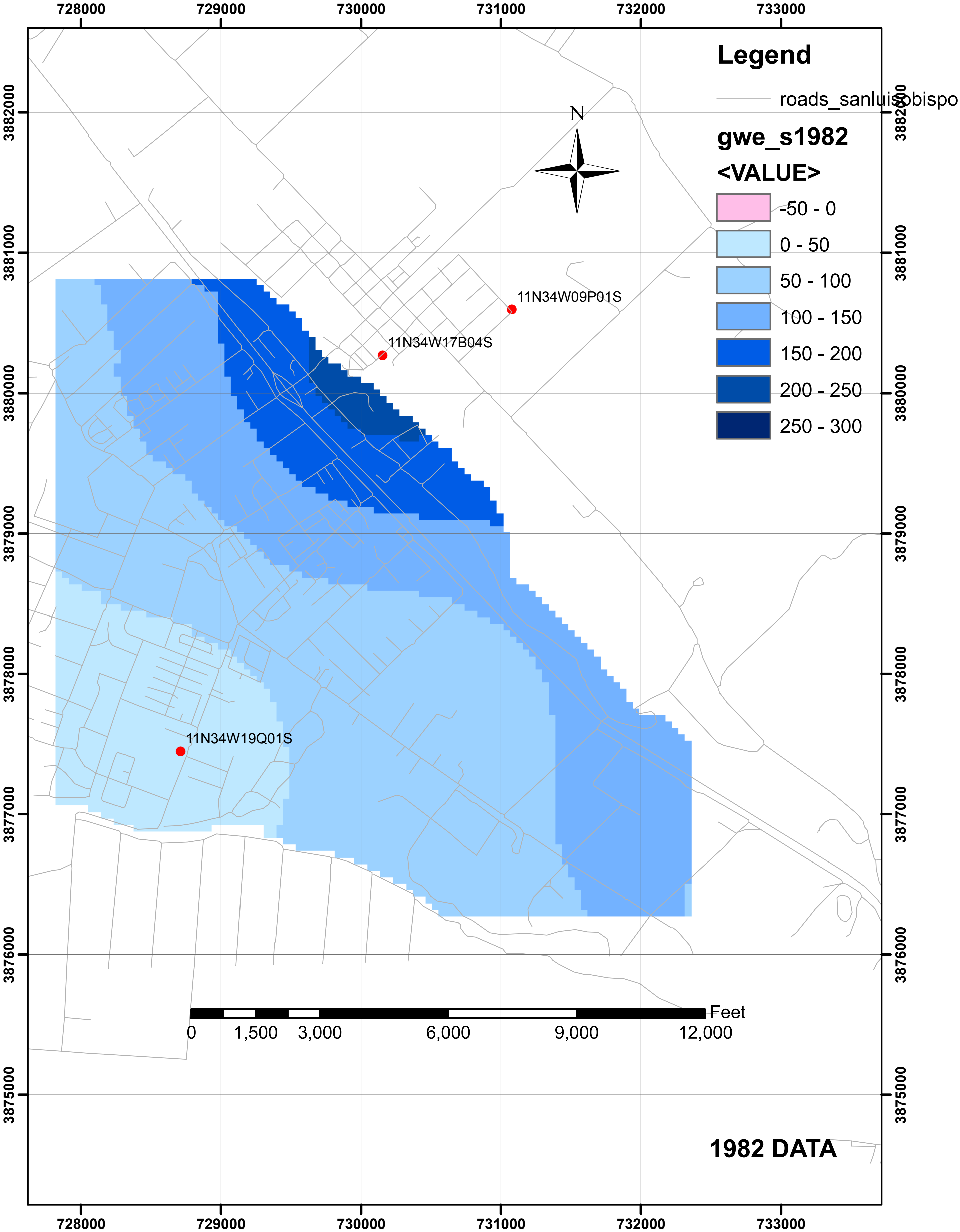


Location: C112
Surface EL: 306 ft +/− (NAVD 88)
Cone Diameter: 35.7 mm

Thin Layer Correction: Applied
Analysis Title: DBE
Mw: 7.2 amax (g): 0.52

LIQUEFACTION ANALYSIS
Percolation Pond Feasibility Investigation
Nipomo, California

Appendix E



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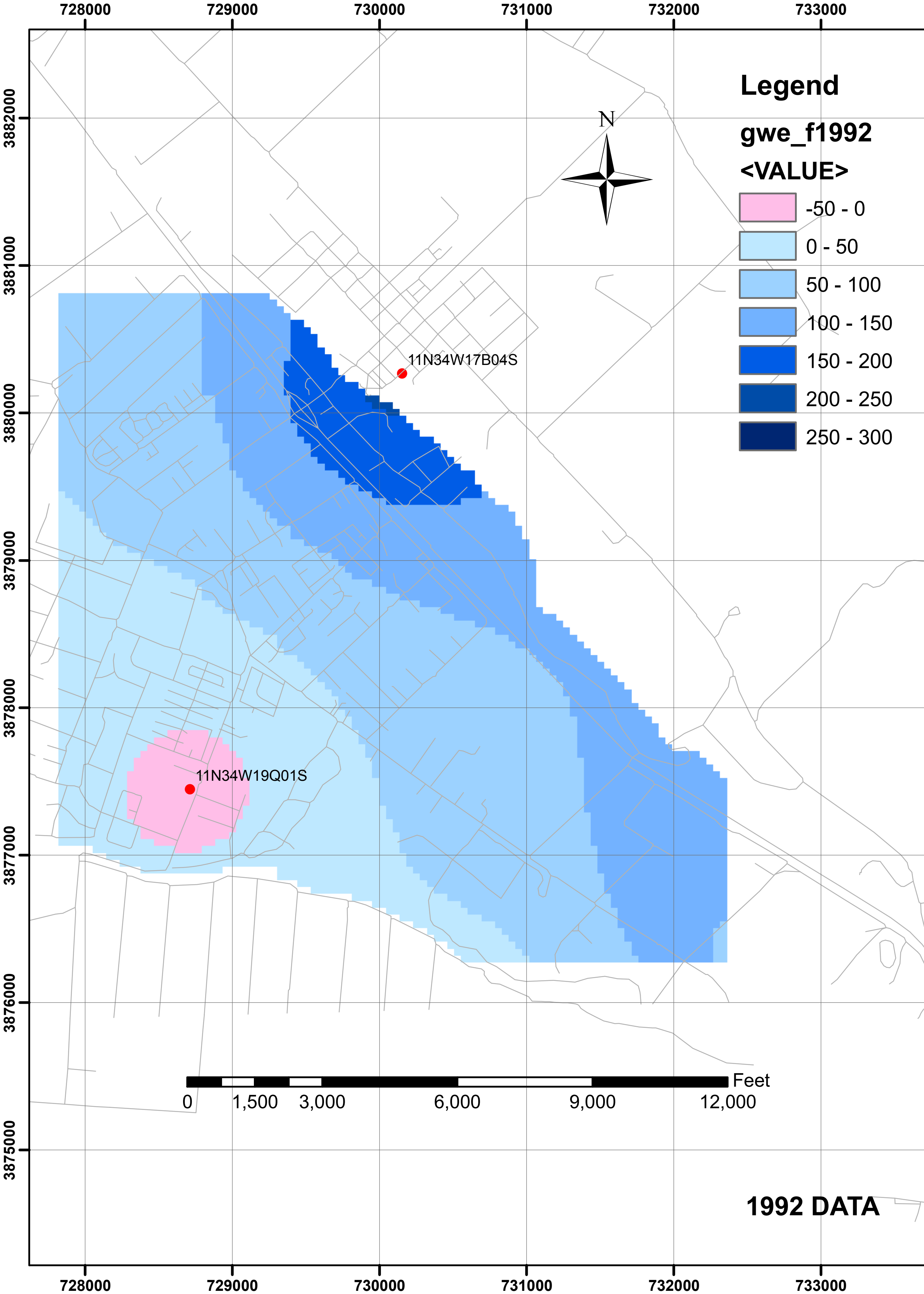

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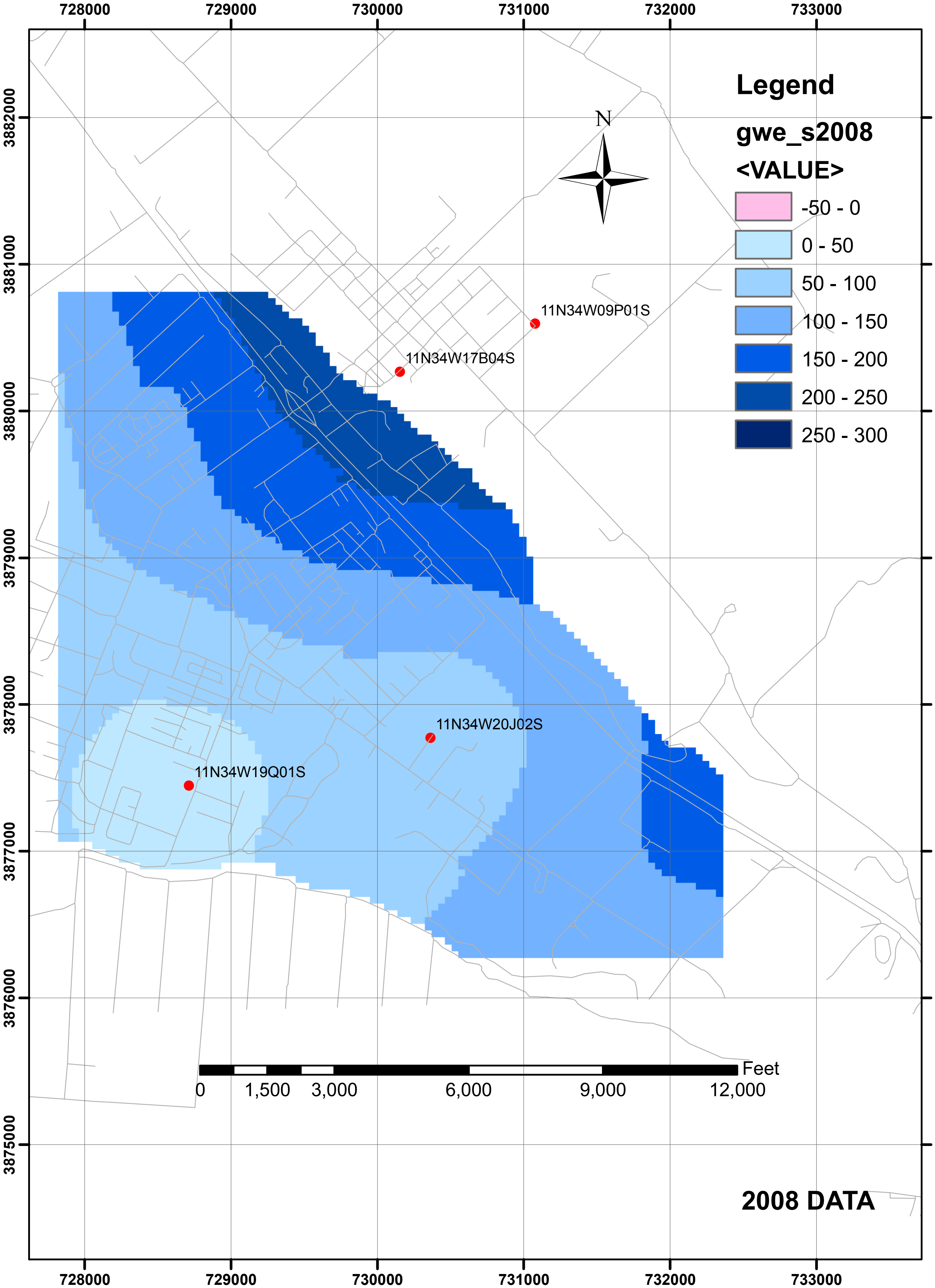

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