FUGRO WEST, INC.

PRELIMINARY GEOTECHNICAL REPORT
LOS OSOS WASTEWATER PROJECT
LOS OSOS MORTUARY, GIACOMAZZI, AND BRANIN PROPERTIES
SAN LUIS OBISPO COUNTY, CALIFORNIA

Prepared for:
COUNTY OF SAN LUIS OBISPO

July 17, 2007

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July 17, 2007
Project No. 3014.026

County of San Luis Obispo
Department of Public Works, Room 207
County Government Center
San Luis Obispo, CA 93408

Attention: Mr. John Waddell

Subject: Preliminary Geotechnical Report, Los Osos Mortuary, Giacomazzi, and Branin Properties, Los Osos Wastewater Project, San Luis Obispo County, California

Dear Mr. Waddell:

Fugro is pleased to submit this Preliminary Geotechnical Report for the Los Osos Wastewater Project on in San Luis Obispo County, California. This report was prepared in accordance with the scope of services presented in our proposal dated April 3, 2007, and authorized under the County's Purchase Order No. 25003474, dated April 24, 2007.

The purpose of this report is to provide preliminary geotechnical considerations for the three combined properties that are being considered as a possible site for the new wastewater treatment plant. This report provides preliminary geotechnical considerations and opinions regarding site geology, soil and groundwater conditions encountered, potential for the sites to be impacted by geologic hazards, and anticipated grading and foundation support for the proposed structures.

Please contact the undersigned if you have questions regarding this report, or require additional information.

Sincerely,

FUGRO WEST, INC.

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Copies: 4 – Addressee, 1 PDF

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1. SITE DESCRIPTION

The proposed site consists of three neighboring properties that are being considered as the possible location for the new wastewater treatment plant. The three properties are identified as the Los Osos Mortuary and Memorial Park, the Giacomazzi, and the Branin properties. The site is located behind the Los Osos Valley Memorial Park on the north side of Los Osos Valley Road, approximately 1 mile east of the community of Los Osos. The location of the site relative to nearby streets and geographic landmarks is shown on Plate 1, Vicinity Map. The layout of the site, showing each of the three properties is shown on Plate 2, Field Exploration Plan.

The site is within an agricultural property (grass-lands and crops) and is bound by the Los Osos Mortuary to the south, agricultural fields and northerly-draining canyon drainage to the west, the Los Osos Valley drainage (Warden/Eto Lake) to the north, and grasslands to the east. The Los Osos Mortuary property is currently undeveloped and covered with grass and weeds. The Giacomazzi and portions of the Branin properties are currently active agricultural fields. Other portions of the Branin property are being used as grazing/grass-lands.

The topography over the majority of the site and vicinity is characterized by gently rolling hills. Elevations range from about 30 feet near the Los Osos Valley drainage in the northern portion of the site to about 110 feet near the mortuary and Los Osos Valley Road. Slope inclinations in the vicinity of the Los Osos Valley drainage near the northern portion of the property and along the northerly-draining drainage along the western edge of the site range from about 3h:1v to 5h:1v.

Two northeast trending drainages cross the Giacomazzi property diagonally near the eastern edge of the property that appear to be subject to erosion in an easterly direction. A north-draining swale crosses the Branin Property along the western portion of the property. A second north-draining drainage is located west of the Branin property that appears to be subject to surficial instability and erosion along the western portion of the Branin Property.

2. WORK PERFORMED

2.1 PURPOSE

The purpose of this report is to provide preliminary geotechnical considerations and opinions for the proposed wastewater treatment plant site. The primary geotechnical considerations evaluated for the project are characterization of the subsurface materials, geologic hazards, anticipated site preparation and grading for support of the improvements, and foundation considerations. The information provided herein is preliminary and is not intended for design of the project. A design-level geotechnical study will be required if the project proceeds to design.

2.2 SCOPE

To evaluate the geotechnical considerations for the project, we performed the following scope of work:

- Site visits to observe the general site conditions, meet with the Los Osos Mortuary and Giacomazzi property representatives, and notifying Underground Service Alert of the field exploration program;
- Data review of selected published geologic maps, and geotechnical data available from our in-house files;
- Field exploration consisting of drilling four hand auger borings to depths of approximately 10 to 12.5 feet below the existing ground surface and advancing seven cone penetration test (CPT) soundings to depths of approximately 34 to 100 feet below the existing ground surface; and
- Preparation of this report summarizing the data obtained for the site, and our preliminary conclusions and recommendations regarding;
  - Geologic setting;
  - Soil and groundwater conditions encountered;
  - Potential for the site to be impacted by geologic hazards such as seismic shaking, fault rupture, liquefaction, landsliding, or slope instability;
  - Anticipated site grading and foundation support for the improvements, and
  - Construction considerations.

2.3 FIELD EXPLORATION

The field exploration program was modified from our proposed scope of work because of site access and accessibility considerations. Cone Penetration Test (CPT) soundings were limited to areas accessible to the truck-mounted equipment. At the time of our exploration, the Giacomazzi property was recently plowed and planted, and the CPT rig could only be operated on graded roads along the perimeter of the properties. Also, Mr. Waddell of the County of San Luis Obispo informed us that entry to the Branin property would not be permitted, therefore, CPT exploration was not performed on that property. Based on the CPT access constraints, hand auger explorations were used to supplement CPT data as agreed to with the County.

2.3.1 Cone Penetration Testing

Seven CPT soundings were advanced at the project site by Fugro Geosciences of Santa Fe Springs, California near the locations shown on Plate 2. CPT soundings C-1 and C-2 were advanced to refusal depths of approximately 34.5 and 42 feet below the existing ground surface, respectively. CPT C-3 through C-6 were advanced to depths of 50 feet, and CPT C-7 was advanced to 100 feet below the existing ground surface.

The CPT soundings were performed using electric cone penetrometers and piezocone penetrometers. The penetrometers were advanced into the ground using a hydraulic ram mounted in a truck having a weight of approximately 20 tons. The cone and piezocone penetrometers have 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. The porewater pressure during penetration was measured behind the tip (u_2) in piezocone 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 CPT sounding data are presented in Appendix A.

2.3.2 Hand Auger Borings

The hand auger borings were performed by a field engineer using a 3-inch, outside diameter, hand auger. The hand auger borings were drilled to depths ranging from approximately 10 to 12.5 feet below the existing ground surface. Hand auger borings were performed to supplement soil data obtained from the CPT soundings and at areas that could not be accessed by the CPT rig. The logs of the borings are presented in Appendix B.

2.4 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 The County of San Luis Obispo 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.

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.

3. SITE CONDITIONS

3.1 GEOLOGIC SETTING

The project is located in the Los Osos Valley that is part of the Coast Ranges geologic and geomorphic province. That province consists of north-northwest-trending sedimentary, volcanic, and igneous rocks extending from the Transverse ranges to the south, into northern California. Rocks of the Coast Ranges province are predominately of Jurassic and Cretaceous age; however, some pre-Jurassic, along with Paleocene-age to Recent rocks are present. The surficial geology in the project vicinity, as mapped by Hall (1979), is shown on Plate 3.

The site is located on a terrace that is dissected by Los Osos Creek to the west. As shown on Plate 3, the Paso Robles Formation underlies the plateau and gently rolling hill area of the majority of the project site as mapped by Hall (1979). Alluvium is located in the low-lying areas near the base of the gently rolling hills along the western project boundary and at the northern end of the Branin property. The alluvial sediments are associated with the Los Osos Valley drainage and Warden Lake. Other authors have mapped the plateau area as being underlain by eolian dune sand (Qe) as indicated on Plate 4. Based on our site reconnaissance and the results of the CPT soundings advanced for this study, it appears that the plateau area is underlain by the Paso Robles Formation as suggested by Hall (1979).

The Paso Robles Formation is described as consisting of weakly consolidated sandstone, siltstone, claystone, and conglomerate in the Los Osos Valley area. Although described in terms of rock designation because of the formational name, the sediments of the Paso Robles Formation are generally equivalent to stiff to hard cohesive soils and medium dense to very dense granular soils.

3.2 FAULTING

The closest active fault (as defined by the California Geologic Survey [CGS]) in the site vicinity is the Los Osos fault zone (PG&E 1988, Lettis & Hall, 1990; Asquith, 1997). A segment of the fault is designated as an Alquist-Priolo earthquake fault zone near the City of San Luis Obispo. Lettis & Hall (1990) describe the Los Osos fault zone as a series of discontinuous, subparallel and en echelon fault traces that extend from Hosgri fault offshore to Lopez Reservoir, a distance of about 35 miles. Lettis and Hall (1990) subdivided the fault zone into four segments: Estero Bay, Irish Hills, Lopez Reservoir, and Newsom Ridge. The Irish Hills segment of the Los Osos fault is about 10 to 12 miles long and extends from Morro Bay eastward to San Luis Creek. This segment of the fault forms the boundary between the Los Osos Valley and the Irish Hills and has documented Holocene offset (PG&E 1988). Portions of the fault east of Los Osos (east of study area) have been zoned active by the CGS.

3.3 SUBSURFACE CONDITIONS

The soil and groundwater conditions were characterized for the preliminary study based on the results of the field exploration program. The locations of the explorations are shown on Plate 2. Logs of the CPT soundings and hand auger borings are presented in Appendices A and

B, respectively. Correlations developed by Robertson and Campanella (1984) were use to classify soils encountered in the CPT soundings.

Paso Robles Formation and alluvium are mapped at the site. The alluvium is mapped along the northern portion of the site along Warden Lake and the low lying agricultural field to the west of the site. Materials of undifferentiated Paso Robles Formation and/or alluvium were encountered in each of the explorations at the ground surface to the maximum depth explored, approximately 100 feet below the existing ground surface in CPT C-7. The upper 3 to 4 feet of materials appear to be relatively loose/soft and likely represent topsoil/colluvial materials disturbed during previous agricultural/plowing activities.

Stiff clay and hard clay and silt with interbedded layers of dense sand were encountered in C-1 through C-5 from the ground surface to depths of approximately 20 to 30 feet below the existing ground surface. Below depths of about 20 to 30 feet, dense to very dense clayey sand with interbeds of hard silt and clay were encountered to the maximum depth explored, approximately 35 to 50 feet below the existing ground surface. Refusal was encountered in CPT's C-1 and C-2 at approximately 35 and 42.5 feet, respectively. Along the western portion of the site the stiff to very stiff silty clay to clayey silt with interbedded firm to stiff clay were encountered in CPT's C-6 and C-7 to 100 feet below the existing ground surface.

3.4 GROUNDWATER

The CPT holes were checked with a water-level sounder after completion of the CPT sounding at each location. Groundwater was recorded in the CPT holes or interpreted from porewater pressure measurements in CPT C-2 through C-7 at depths ranging from 30 to 48 feet below the existing ground surface. Water was not recorded in CPT C-1 to the maximum depth explored, approximately 34.5 feet below the existing ground surface. Based on published mapping, the Warden Lake area at the northern end of the property can be a marshy environment and has contained surface water in the past. Variations in surface and groundwater conditions will likely occur as a result of changes in precipitation, irrigation, runoff, and other factors.

4. GEOLOGIC HAZARDS

The following geologic hazard assessment is based on review of published information regarding regional and local geologic conditions and observations made during our site visits. The site is not within a San Luis Obispo County designated Geologic Study Area (San Luis Obispo 2006). Our assessment of geologic hazards was performed for input to the environmental impact report being prepared for the project, and to assist the County is considering potential sites for a new wastewater treatment plant.

4.1 SEISMICITY AND STRONG GROUND MOTION

4.1.1 Recent Seismicity

The site is located within a seismically active region of Central California that is prone to moderate to large earthquakes. The Los Osos area was impacted by the December 22, 2003 magnitude 6.5 earthquake that occurred near the town of San Simeon. The earthquake, now known as the San Simeon Earthquake, may have occurred on the Oceanic or Nacimiento fault zones located in the Santa Lucia Mountains, north of Cambria and west of the City of Paso Robles. Fault rupture likely occurred following a reverse or oblique-reverse type fault mechanism.

The epicenter of the San Simeon earthquake was located approximately 15 to 20 miles north of the project site. A ShakeMap for the site developed by the California Integrated Seismic Network (CISN 2003) shows that the project site likely experienced moderate ground motion during the earthquake. Peak horizontal ground accelerations at the project site, as estimated from the ShakeMap, were likely about approximately 0.12g.

4.1.2 Ground Motion Study

A probabilistic seismic hazard evaluation for the site was performed using the computer program FRISKSP (Blake, 2000) and the CGS (1996) California fault database. The program FRISKSP is based on FRISK (McGuire, 1978) and has been modified for the probabilistic estimations of seismic hazards using three-dimensional earthquake sources. The intent of our evaluation was to estimate strong ground motion corresponding to the Design Basis Earthquake (DBE) and Upper-Bound Earthquake (UBE). The DBE is defined by the building code as an earthquake having a 10 percent chance of being exceeded in 50 years (Statistical Return Period ≈ 475 years). The UBE is defined as an earthquake having a 10 percent chance of being exceeded in 100 years (Statistical Return Period ≈ 949 Years). FRISKSP was used to perform a search of potential earthquakes occurring on active or potentially faults mapped within a 62-mile radius of the site. The site location was estimated as –120.8017 degrees longitude and 35.3097 degrees latitude. Summarized below are 11 faults and fault segments that were considered the most capable of causing strong ground motion at the site. Additional information is provided in the CDMG (1996) fault database.

Summary of Predominant Faults

Fault	Approximate Distance From the Site (miles)	Maximum Moment Magnitude (M_w)	Fault or Fault Segment Length (miles)	Slip Rate (mm/yr)
Los Osos	0.7	6.8	27	0.5 ± 0.4
Hosgri	8.6	7.3	107	2.5 ± 1.0
San Luis Range (S. Margin)	8.8	7.0	40	0.2 ± 0.1

Fault	Approximate Distance From the Site (miles)	Maximum Moment Magnitude (M_w)	Fault or Fault Segment Length (miles)	Slip Rate (mm/yr)
Rinconada	14.5	7.3	117	1.0 ± 1.0
Casmalia (Orcutt Frontal Fault)	27.3	6.5	18	0.25 ± 0.2
Lions Head	32	6.6	25	0.02 ± 0.02
San Juan	35	7.0	42	1.0 ± 1.0
San Andreas (Cholame)	41	6.9	38	34 ± 5
San Andreas (Parkfield Segment)	41	6.7	23	34 ± 5
San Andreas (1857 Rupture)	41	7.8	214	34 ± 5
Los Alamos(W. Baseline)	47	6.8	17	0.7 ± 0.7

Based on subsurface conditions encountered at the site, the Soil Profile Type selected for our evaluations was Site Class D, "S_D". FRISKSP was then used to estimate strong ground motion for the DBE and UBE using the attenuation relationship proposed by Boore et al. (1997) and assuming an average shear wave velocity of 250 meters per second in the upper 100 feet.

The DBE and UBE were estimated to have a peak ground accelerations of 0.36g and 0.5g with a corresponding earthquake magnitude 6.7. As a result of statistical variations in the methods used to estimate strong ground motion, we expect that peak ground accelerations exceeding the DBE or UBE could potentially occur if a near-field earthquake were to occur on either of these faults.

4.2 SURFACE FAULT RUPTURE

Fault rupture is the displacement of the ground surface created by movement along a fault plane during an earthquake. Mapping by Lettis and Hall (1994) indicate tonal lineaments from aerial photographic review that trend northwestward south of the project site. Tonal lineaments can be related to different soil/bedrock materials resulting from fault offset. According to Lettis and Hall, the tonal lineaments may be related to faulting within the Los Osos fault zone (LOFZ). A portion of the Lettis and Hall map is reproduced on Plate 4.

No indication of scarps or other fault-related features was observed during our site visits for this project or for Fugro (2004). Tonal lineaments mapped by Lettis and Hall are subtle features that may have been disturbed by farming activities over time and/or may not be readily visible at the surface.

The LOFZ is an en-echelon-style reverse fault that extends east-southeast from the Hosgri fault zone offshore of Morro Bay to the Huasna fault zone east of San Luis Obispo. The LOFZ is considered active and a portion of the LOFZ (near the intersection of Los Osos Valley Road and Foothill Boulevard, about 7 miles southeast of the project site) is zoned by the State

of California Alquist-Priolo Special Studies Zones Act In our opinion, the potential exists for fault rupture to affect the project site and proposed improvements.

4.3 LIQUEFACTION, SEISMIC SETTLEMENT, AND LATERAL SPREADS

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. Seismically induced settlement, collapse, or lateral spreads can occur in soils that are loose, soft, or that are moderately dense and weakly cemented, or in association with liquefaction.

The Paso Robles Formation is typically equivalent to stiff to hard and dense to very dense soil, thus, the majority of the site that is underlain by the Paso Robles Formation, has a low potential for liquefaction. Areas within the Warden Lake area were not evaluated as part of this preliminary study, but are likely to have a moderate to high liquefaction potential based on anticipated high groundwater elevations and recent alluvial sediments.

4.4 SUBSIDENCE AND COLLAPSE

The site is not in an area where the withdrawal of subsurface fluids is known to have caused ground subsidence. The formational materials that underlie the majority of the site generally have low compressibility, and should not be susceptible to significant compression due to lowering of local water levels. The fine-grained alluvial materials contain layers of relatively soft compressible clay. However the potentially compressible soft clay is of limited thickness (less than about 2 to 3 feet). It is therefore our opinion that there is a low potential for subsidence to impact the potential project site.

4.5 LANDSLIDING/SLOPE INSTABILITY

During our site reconnaissance, we observed evidence of landsliding/erosion along the western edge of the Branin Property and erosion along the eastern portion of the Giacomazzi Property. Access to the Branin property was unavailable at the time of our site visits. The erosion on the Giacomazzi property appears to be associated with concentrated runoff and has formed gullies approximately 2 to 6 feet deep along the eastern edge of the farmed field.

During our previous work for the Andre site (Fugro 2004), we observed evidence of landsliding on the northeast-facing hillside adjacent to the Warden Lake area east of the Giacomazzi property. The landslide has a well-defined, sharp headscarp, and was approximately 100 feet wide by about 200 feet long. The landslide appears to be relatively shallow, possibly about 10 feet deep. The cause of the instability is not known, but it may be related to excess moisture/groundwater seepage.

4.6 GROUND LURCHING

Ground lurching occurs as the ground is accelerated during a seismic event. As evidenced by the Loma Prieta, Landers, Northridge, and San Simeon earthquakes, the effects of ground lurching can damage facilities and buried pipelines. Ground lurching occurs due to detachment of underlying stratigraphic units, allowing near-surface soil to move differentially from underlying soil. The site is within a seismically active region of Central California that is prone to moderate to large earthquakes. It is therefore our opinion that there is a potential for ground lurching to impact the site. Ground lurching is generally not a geologic hazard that can be prevented, and therefore is mitigated by implementing preparedness measures.

4.7 EROSION

As described above, erosion was observed near the eastern edge of the Giacomazzi Property. Graded cut and fill slopes associated with the site development will be subject to sheet and rill erosion. Erosion of soils can be accelerated where soils are exposed directly to runoff and/or areas of concentrated storm runoff, such as at culvert outlets. Site drainage and landscape improvements can be designed to reduce the potential for soil erosion.

4.8 EXPANSIVE SOILS

The topsoil encountered at the site consists of sandy fat clay (CH) and lean clay (CL). These types of soils can be expansive. Based on our site observations, we expect that the near surface soils will have a moderate to high potential for expansion.

4.9 NATURALLY OCCURRING ASBESTOS

Naturally occurring asbestos (NOA) is common in serpentine rock throughout San Luis Obispo County. The California Air Resources Board has identified serpentine rock as having the potential to contain asbestos. The Paso Robles Formation and clayey alluvium were encountered at the site. Franciscan Formation/Serpentine was not encountered within the depth of anticipated site grading at the locations explored, and is not mapped in the site vicinity. Therefore, it is our opinion that there is a low potential for NOA to impact the project.

4.10 FLOODING, TSUNAMIS AND INUNDATION

The northern portion of the Branin Property is located within or near a County of San Luis Obispo mapped flood zone. The Giocamazzi and Los Osos Mortuary Properties are not located within the mapped flood zone. The elevation of the site is approximately 30 feet near the northern drainage to about 110 feet near the Los Osos Mortuary. Therefore, it is our opinion that there is a potential for flood, tsunami and inundation hazards to impact the project the northern portion of the site.

4.11 HYDROCOLLAPSE POTENTIAL

The central and southern portions of the site are underlain by relatively firm fine grained materials and relatively dense sandy materials. These materials are not considered susceptible

to hydrocollapse. Exploration was not performed in the Warden Lake alluvial area at the northern end of the site as part of this study. If project components are planned for that area, exploration should be performed to assess the material characteristics and to evaluate the potential hydrocollapse of the alluvial soils.

5. CONCLUSIONS AND RECOMMENDATIONS

We prepared the conclusions and recommendations for this report based on our preliminary geotechnical evaluation of the site conditions and a review of available geotechnical information for other projects located near the project site.

5.1 SUMMARY OF FINDINGS

- The south and eastern portions of the site are underlain by relatively firm fine grained soil and relatively dense sandy soil. The soils in the western portion of the site (CPT C-6 and C-7) contain layers of relatively soft fine-grained soils. Alluvium is mapped along the eastern and northern boundaries of the site. Groundwater was encountered at depths ranging from approximately 30 to 48 feet to below the existing ground surface. Surface and shallow groundwater likely are present along the northern drainage/Warden Lake areas.
- Access to Branin property to conduct subsurface exploration was not permitted for this work. Since subsurface exploration could not be performed on that property, this report and data presented are limited relative to characterizing the subsurface conditions and related geologic hazard for the Branin property. We recommend that additional field exploration be performed to further evaluate the Branin site, if the site is selected for design and construction of the facility.
- The sites are within Seismic Zone 4 and have been subjected to strong ground motions in response to historical earthquakes that have occurred in relatively close proximity to the site. The design of the facility should consider the potential for the site to be subject to strong ground motion in response to nearby or regional earthquakes. The soil encountered by our explorations is generally fine-grained or dense material that would not be considered susceptible to liquefaction. Based on the conditions encountered, there is a low potential for liquefaction or seismic settlement to impact the design of a facility located on the plateau area underlain by Paso Robles formational materials. However, due to the anticipated high groundwater levels and alluvial sediments, the potential for liquefaction to affect project elements located within the low-lying alluvial areas may be moderate to high.
- Development of the site will need to consider the proximity to the low-lying areas that underlie portions of the site, and building set backs from the top of slopes.
- We expect that typical 1 to 2 story structures, below grade structures, and moderately loaded structures can be supported on shallow foundations supported on compacted fill. Relatively heavy structures or large tanks will need to consider the potential for total and differential settlement of the underlying soft soil layers encountered along the western portion of the site.

- Site grading will need to consider the upper potentially expansive soils. Based on the hand auger borings and site observations, we expect that grading for structures would consist of removing the upper 3 to 5 feet of potentially expansive soils and replacing with non-expansive compacted fill.

5.2 PRELIMINARY SEISMIC DATA

The project site is located within Seismic Zone 4 based on the Uniform Building Code and the California Building Code, Title 24. The DBE and UBE for the site is estimated to be an approximately M6.7 earthquake with a corresponding peak ground acceleration of about 0.36g and 0.5g, respectively. The Los Osos fault is the controlling fault for the site, and is mapped approximately 0.7 miles east of the site, and is classified as a type "B" seismic source based on the building code. We recommend that the following values be used for zone-based seismic hazard analyses.

Seismic Data for Use with Building Code

Building Code Ch. 16A Table No.	Parameter	Value
--	Latitude	35.3097
--	Longitude	120.8017
16A-I	Seismic Zone Factor (Z)	0.40
16A-J	Soil Profile Type	(S_D), Stiff Soil Profile
16A-U	Controlling Seismic Source Type	B
16A-S	Near Source Factor (N_a)	1.3
16A-T	Near Source Factor (N_v)	1.6
16A-Q	Seismic Coefficient (C_a)	$0.44N_a = 0.57$
16A-R	Seismic Coefficient (C_v)	$0.64N_v = 1.02$
Figure 16A-3	Control Period (T_s)	0.72
Figure 16A-3	Control Period (T_o)	0.14

5.3 FOUNDATION DESIGN CONSIDERATIONS

Typical 1 to 2 story and moderately loaded structures can likely be supported on shallow foundations bearing in compacted fill. Relatively large or heavy structures located along the western edge of the site will need to consider total and differential settlement of the underlying fine grained materials (See CPT C-6 and C-7).

Allowable bearing pressures of 2,000 to 3,000 pounds per square foot (psf) can be used for preliminary foundation design. Additional exploration testing and analysis will be required as part of the design phase of the project.

5.4 EXPANSIVE SOILS

The clayey soils encountered at the site likely have a medium to high potential for expansion per the UBC. Removal or treatment of potentially expansive soils will need to be considered in foundation design.

5.5 GRADED SLOPES

Graded cut and fill slopes likely can be designed to a slope inclination of 2h:1v or flatter. Retaining structures or reinforced slopes can be provided to allow for steeper slopes, if needed.

5.6 DRAINAGE AND EROSION CONSIDERATIONS

Drainage should be provided such that surface water does not run over slopes or pond on pavements, slabs, or adjacent to foundations. Downspouts should be provided to collect roof drainage and direct the water to drainage pipes or areas away from the building. The sandy soils at the site are particularly vulnerable to erosion as evidenced from the walls of the onsite canyon drainages. Landscaping and maintenance of slopes should be provided to assist vegetation to be established on slopes, and reduce the potential for erosion. The top of slopes should be graded to direct drainage away from the slopes, or be provided with dikes and ditches that will direct surface water to controlled drainage structures. Concentrated flows and runoff should not be permitted to discharge onto slopes. Down drains, solid pipes, or lined ditches should be provided to carry water to the base of slopes. Energy dissipation and erosion control devises should be provided at the outlet of drainage pipes and in areas of concentrated flow and runoff to reduce the potential for erosion.

5.7 CONSTRUCTION CONSIDERATIONS

5.7.1 Excavation

The Paso Robles Formation encountered beneath the project site consists of loose to dense sand and soft to very stiff fine-grained materials. These types of soils likely can be excavated with typical heavy-duty construction equipment in good working order.

5.7.2 Use of On-site Soil

On-site soil consisting of sandy-type material that is free of organics, oversized rocks, pavements, and other deleterious materials should be suitable for use as compacted fill in building and pavement areas. The clayey on-site soils may not be suitable for fill in building and pavement areas due to potentially expansive soils but may be suitable for use as general fill. The on-site soils likely are not suitable for select material such as backfill for pipelines and base for roadways. On-site soil excavated from below the groundwater table (if encountered) will likely not be suitable for compacted fill as excavated. Drying or treating the soils may be needed to reduce the water content of the excavated material and make the material suitable for compaction.

5.7.3 Dewatering

We expect that excavations along the upper central and southern portions of the site will not require dewatering. If the northern portion of the site (near Warden Lake) is developed, excavations extending a few feet or more below existing site grades could encounter groundwater, depending on the groundwater level at the time of construction.

6. CONTINUATION OF SERVICES

The geotechnical considerations in this report are intended for preliminary planning and estimating costs associated with developing the site. The recommendations are preliminary based on our limited geotechnical study. A more comprehensive design-level geotechnical investigation should be completed in support of the final design of the proposed improvements.

7. REFERENCES

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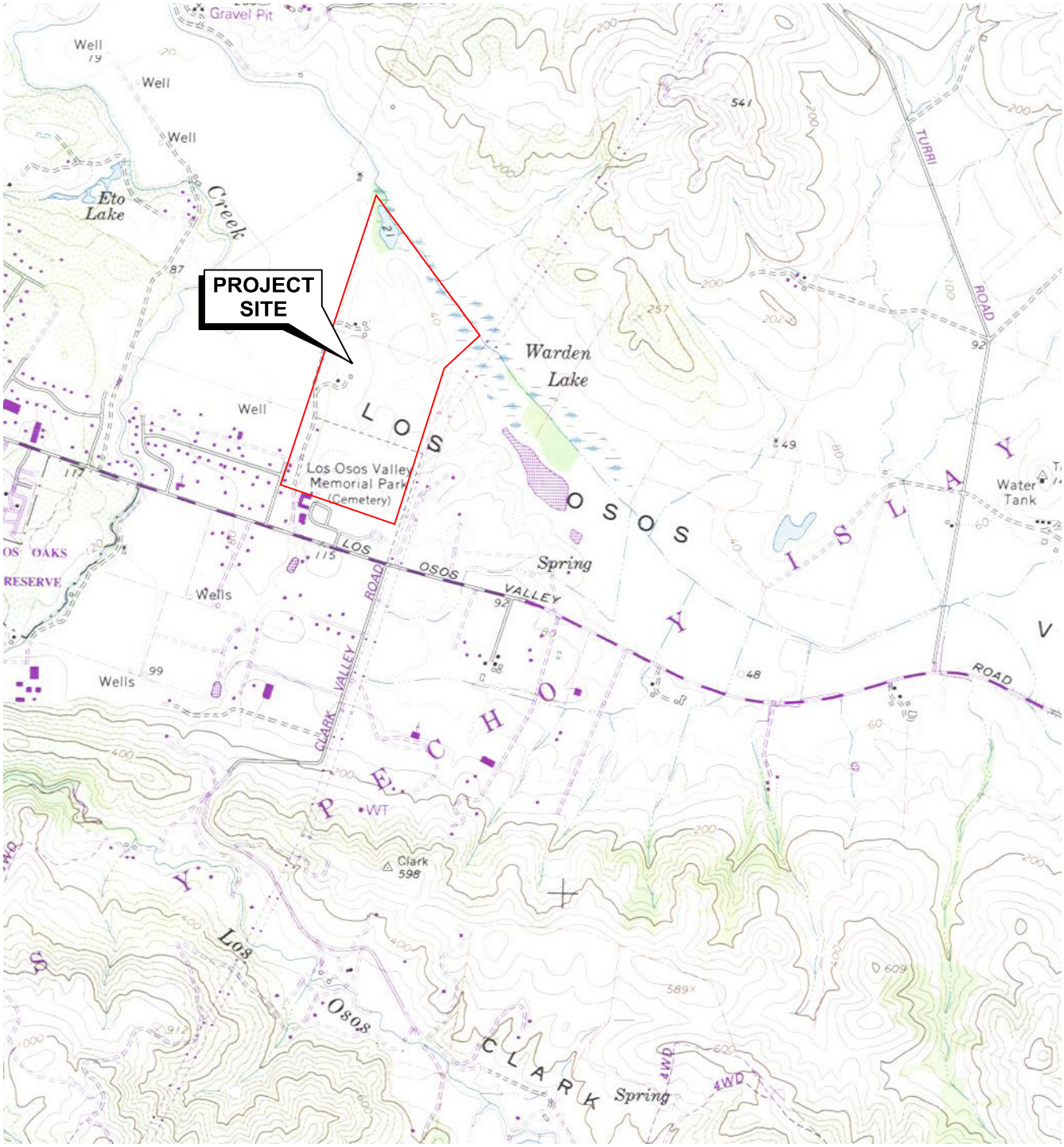
End of Text

PLATES



BASE MAP SOURCE: USGS Morro Bay South 7.5' Quadrangle, revised 1994.

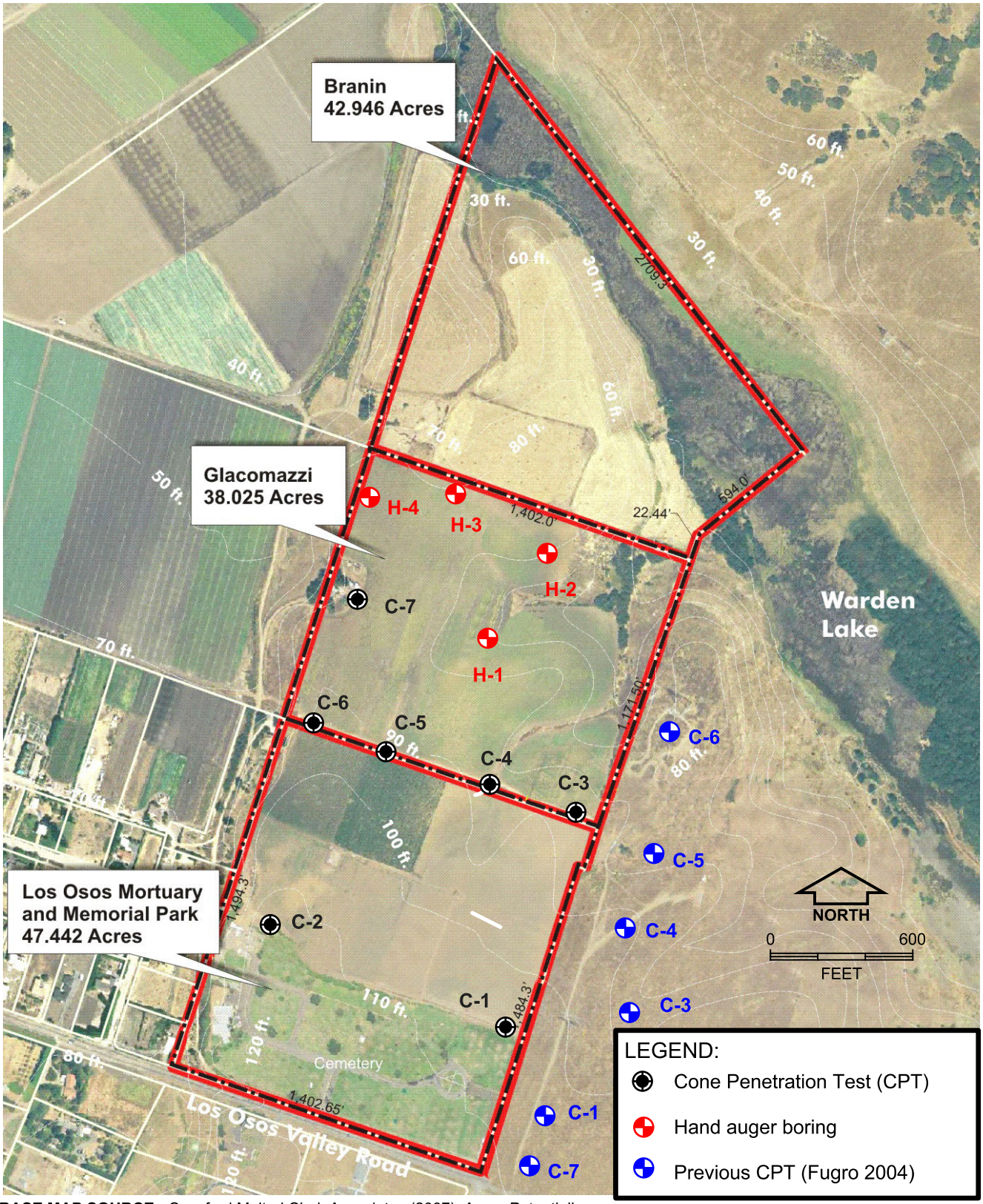
NORTH

0 1000 2000

FEET

VICINITY MAP
Los Osos Wastewater Project
San Luis Obispo County, California

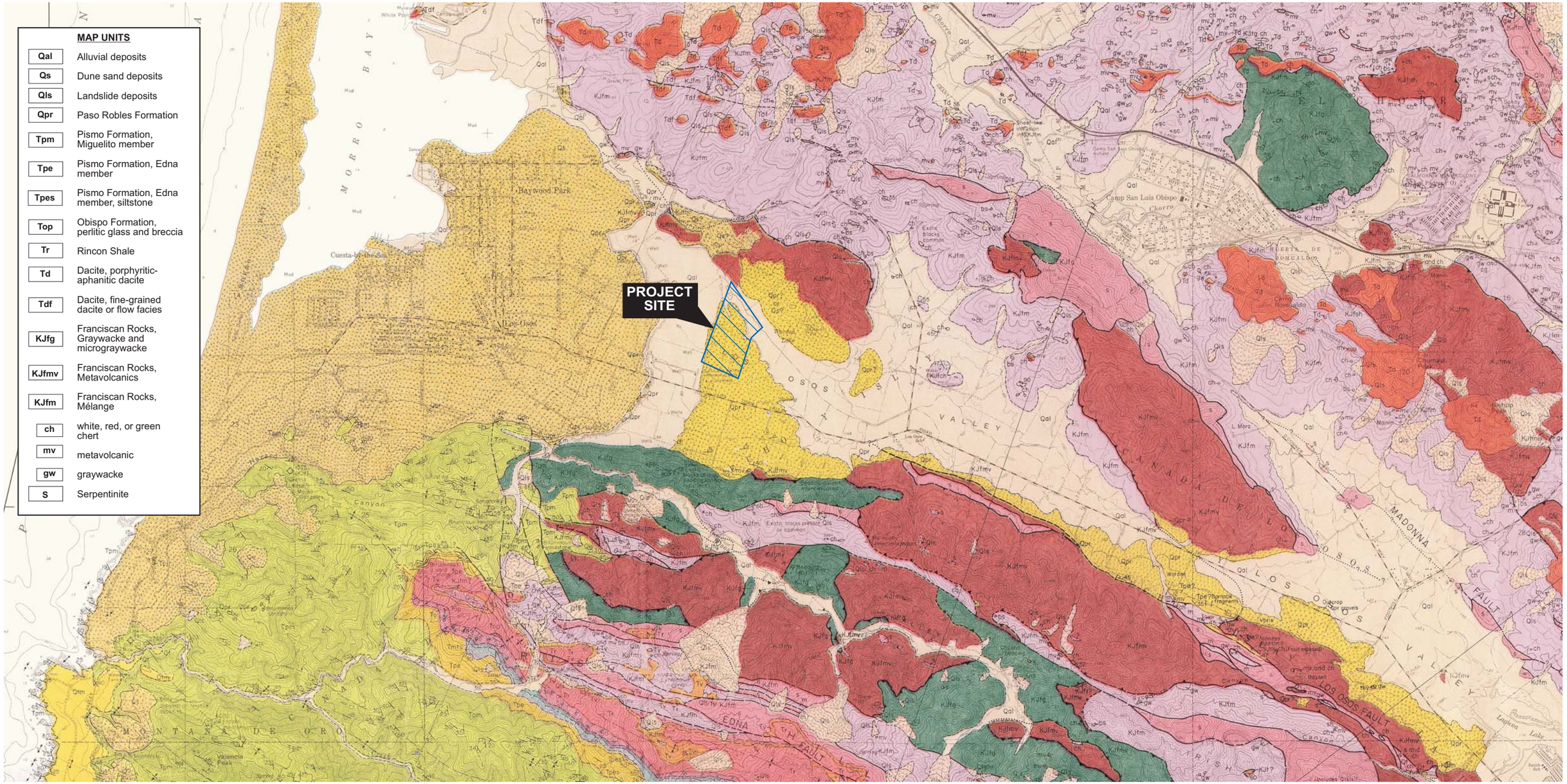
PLATE 1



BASE MAP SOURCE: Crawford Multari Clark Associates (2007). Areas Potentially Suitable for Wastewater Facilities.

FIELD EXPLORATION PLAN
Los Osos Wastewater Project
San Luis Obispo County, California

PLATE 2



M:\Drafting\JOBFILES\2007\3014.026\3014.026geo.cdr

BASE MAP SOURCE: Geologic Map of the the San Luis Obispo-San Simeon Region, USGS Misc. Investigations Series Map I-1097, Sheet 3 of 3 (Hall, et al., 1979).

LEGEND

- Contact - Dashed where approximately located or inferred; queried where doubtful; dotted where concealed
- High-angle fault - Dashed where approximately located or inferred; dotted where concealed and inferred; queried where uncertain. Arrows show relative direction of movement on cross sections when known; queried where uncertain.
- Thrust or reverse fault - Dashed where approximately located or inferred, dotted where concealed and inferred; queried where concealed or doubtful. Sawteeth on upper plate. Dip of fault plane between 30° and 80°
- Photo lineament - Queried where uncertain
- Synform - Trace of axis at surface. Dashed where approximately located. Flanks coverate downward in folds and in rocks whose stratigraphic sequence is unknown.
- Antiform - Trace of axis at surface. Dashed where approximately located. Flanks diverge downward in folds and in rocks whose stratigraphic sequence is unknown.
- Strike and dip of beds uncertain

Marker beds

- Conglomerate or gravel bed
- Sandstone
- Siltstone or diatomaceous
- siltstone
- Tuff

- 30 — Strike and dip of flow banding
- x6193 — Megafossil locality - U.C.L.A. locality number
- Vollmer — Ranch name/property owner

NORTH

0 2000 4000

FEET

REGIONAL GEOLOGIC MAP

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE 3

MAP UNITS

Qal	Stream deposit
Qe	Eolian deposit
Qf	Fluvial and alluvial deposits
Qc	Colluvial deposit
Qm	Marine terrace deposit
Qoa	Older alluvial deposit
Tca	Cereaga sandstone
Tmpm	Miguelito member of Pismo Formation
KJf	Franciscan Complex
KJfmv	Metavolcanics
KJfch	Red, white or green cherts
KJfg	Graywacke
S	Serpentinite

PROJECT SITE

LOS OSOS FAULT ZONE

GS-1 -188? Tca
GS-2 -153 Tca
GS-3 -2, Tca -74, KJf
GS-4 -185 Tca
GS-5 8, Tca -72, KJf
GS-6 -85 Tca
MBO-2 -169.5
W.H. Provost Spooner 1 T.D. 533

Fluvial gravels buried by Qe

NORTH
0 1000 2000
FEET

M:\Drafting\JOBFILES\2007\3014.026\3014.026fault.cdr

BASE MAP SOURCE: Quaternary Geologic Map of Los Osos Fault Zone, Los Osos Fault Zone, San Luis Obispo County, CA, Plate 5 (Lettis and

LEGEND

Fault - Dashed where approximately located; dotted where concealed; U = up/D = down indicates relative sense of displacement; small arrow and number indicate strike and dip of fault exposed in outcrop

Aerial photo lineament - Or fault-related feature; dashed where less distinct; queried where uncertain; hachures indicate topographic scarp and show direction; ld = linear drainage, tc = tonal contrast, v = vegetation lineament, dd = deflected drainage, bis = break in slope, s = saddle, shb = side hill bench

Los Osos fault of Hall (1973) - Dashed where approximately located; dotted where concealed

Edna fault

Indian Knob fault

Other faults

Shoreline angle - Solid where well constrained; double dot dash where concealed; dotted where eroded; altitude shown in meters

Contact - Dashed where approximately located or inferred; queried

Strike and dip of bedding

Syncline - Showing trace of axial surfaces and direction of plunge

Anticline - Showing trace of axial surface and direction of plunge

Borehole - GS-1 - U.S. Geological Survey (unpublished data, G. Yates, Water Resource Division); MBO-2 - California Department of Water Resources (1972); altitude of subsurface of formations shown in meters

Borehole - Completed during this study

Exploratory oil well - Producer, name of well, and depth (meters) are indicated

Closed depression

Spring

Trench location

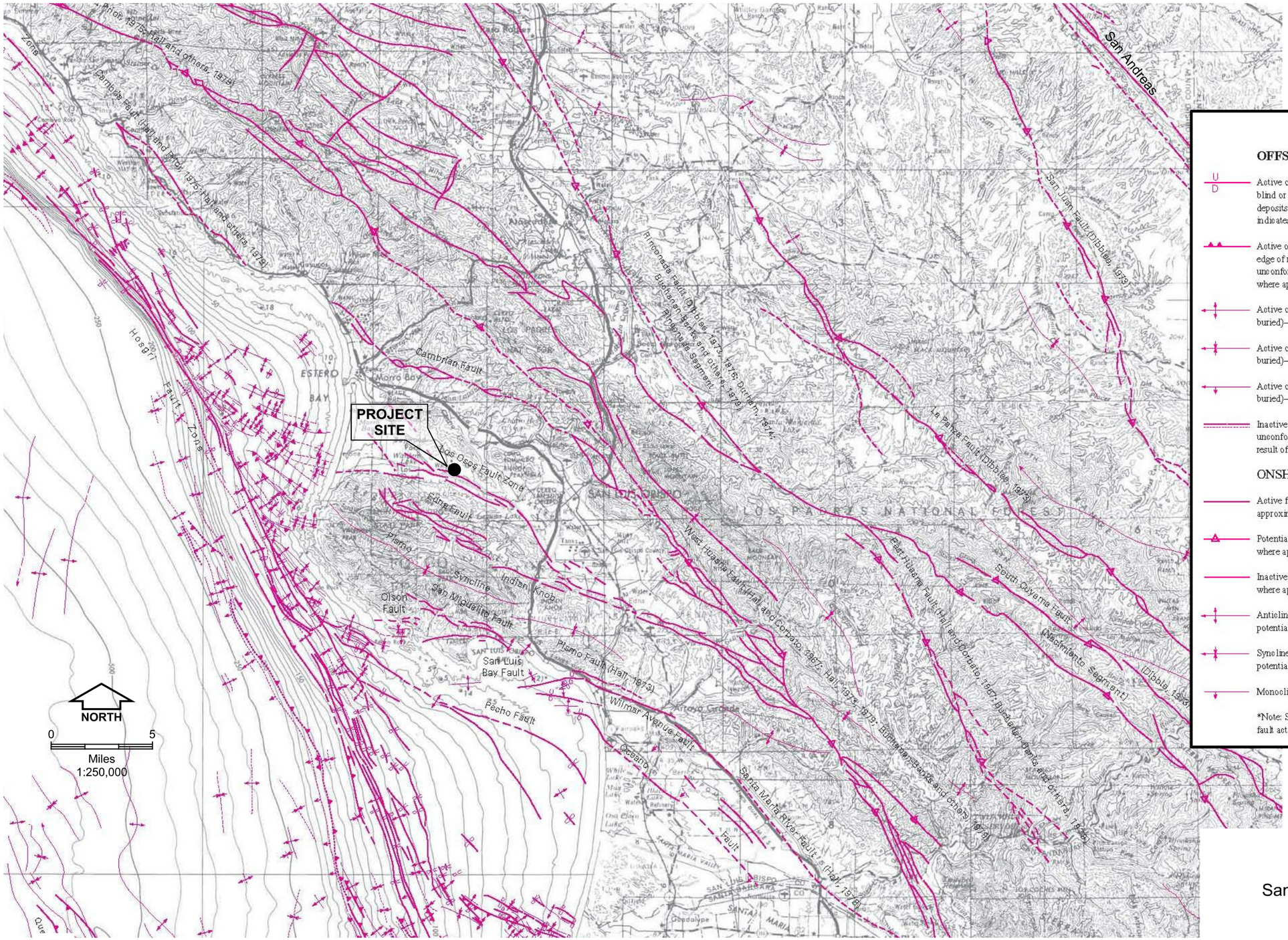
Bedrock exposure

Limit of mapping

LOS OSOS FAULT ZONE AND LINEAMENTS

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE 4



EXPLANATION

OFFSHORE REGION*

- Active or potentially active high angle fault (sea-floor projection of fault tip where blind or buried)—Deforms early/late Pliocene (2.8–3.4 Ma) unconformity or younger deposits or surfaces; U/D (Up/Down) indicates relative sense of displacement, bar indicates dip direction; dashed where approximately located
- Active or potentially active low angle fault (sea-floor projection of fault tip or leading edge of ramp where blind or buried)—Deforms early/late Pliocene (2.8–3.4 Ma) unconformity or younger deposits or surfaces; teeth indicate dip direction; dashed where approximately locate
- Active or potentially active anticline axial trace (sea-floor projection where buried)—Arrow indicates direction of plunge; dashed where approximately located
- Active or potentially active syncline axial trace (sea-floor projection where buried)—Arrow indicates direction of plunge; dashed where approximately located
- Active or potentially active monocline axial trace (sea-floor projection where buried)—Arrow indicates direction of plunge; dashed where approximately located
- Inactive fault (bold) or fold (light)—Does not deform early/late Pliocene (2.8–3.4 Ma) unconformity; where this unconformity and (or) younger sediments are absent as a result of erosion, structures are mapped as potentially active

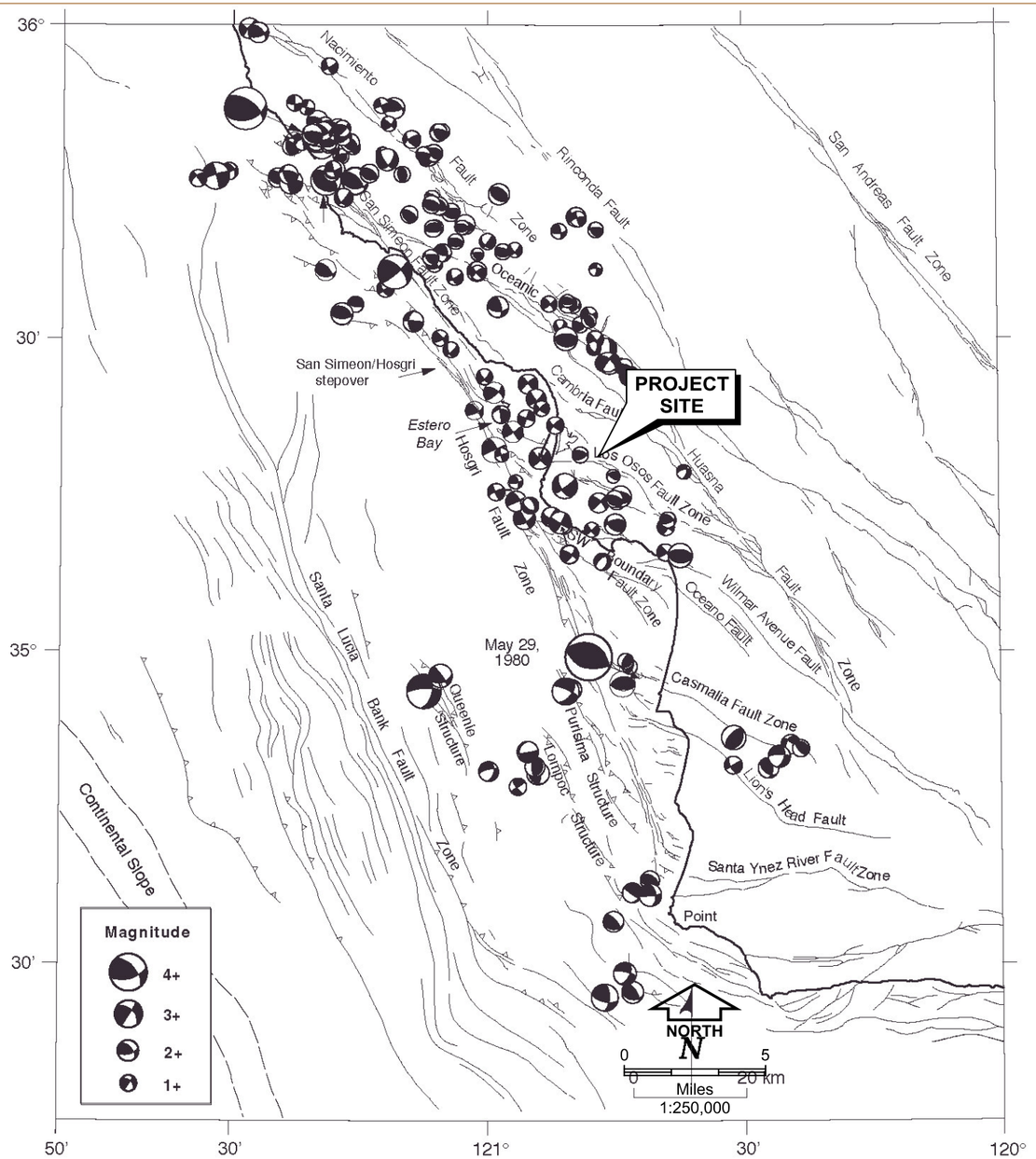
ONSHORE REGION*

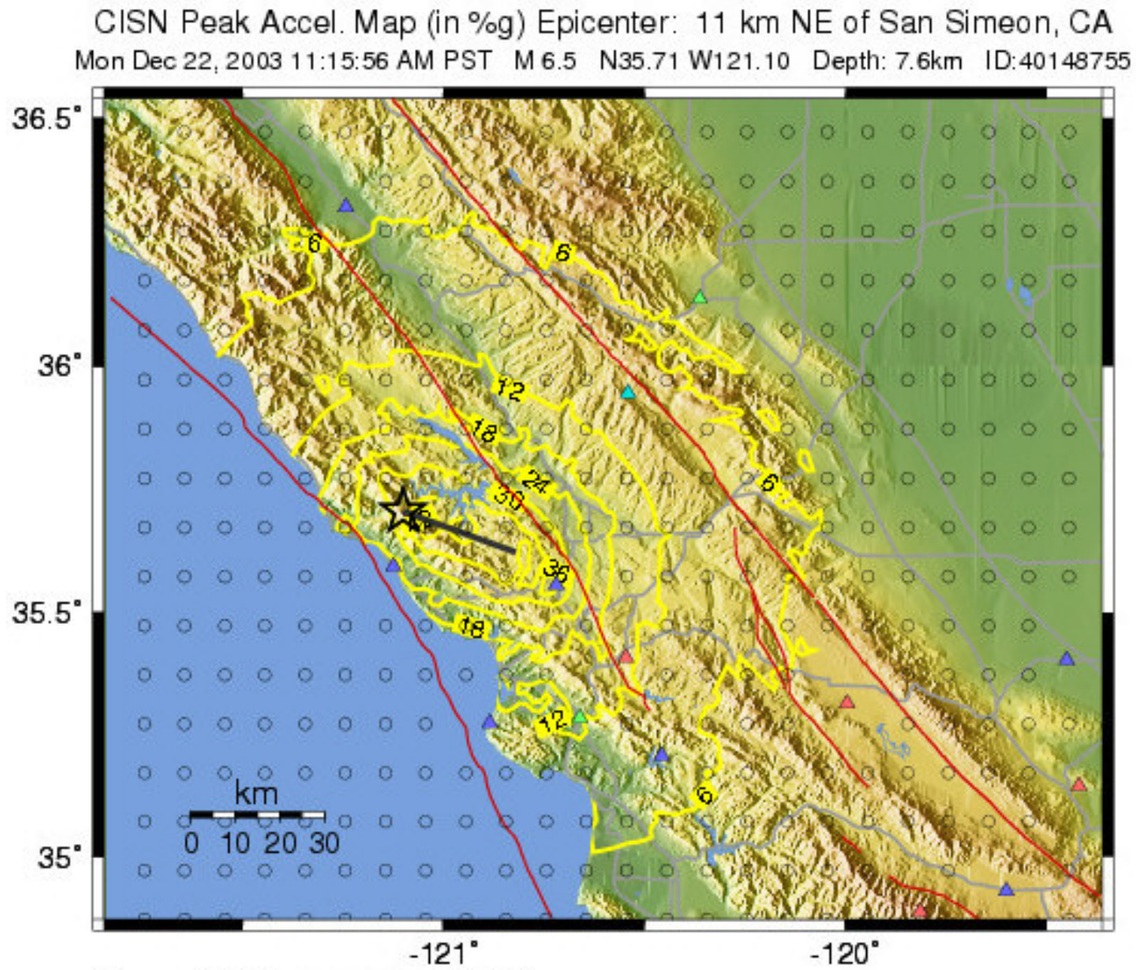
- Active fault trace—Deforms deposits or surfaces ≤500,000 ka; dashed where approximately located
- Potentially active fault trace—May deform deposits or surfaces ≤500,000 ka; dashed where approximately located
- Inactive active fault trace—Does not deform deposits or surfaces ≤500,000 ka; dashed where approximately located
- Anticline axial trace—Arrow indicates direction of plunge; solid where active or potentially active; dotted where inactive
- Syncline axial trace—Arrow indicates direction of plunge; solid where active or potentially active; dotted where inactive
- Monocline axial trace—Solid where active or potentially active; dotted where inactive

*Note: See text for discussion of mapping techniques and age criteria used to identify fault activity.

REGIONAL FAULT MAP
Los Osos Wastewater Project
San Luis Obispo County, California

BASE MAP: Lettis et al. (2004), Faults and Folds in Onshore and Offsore Regions of South-Central California.



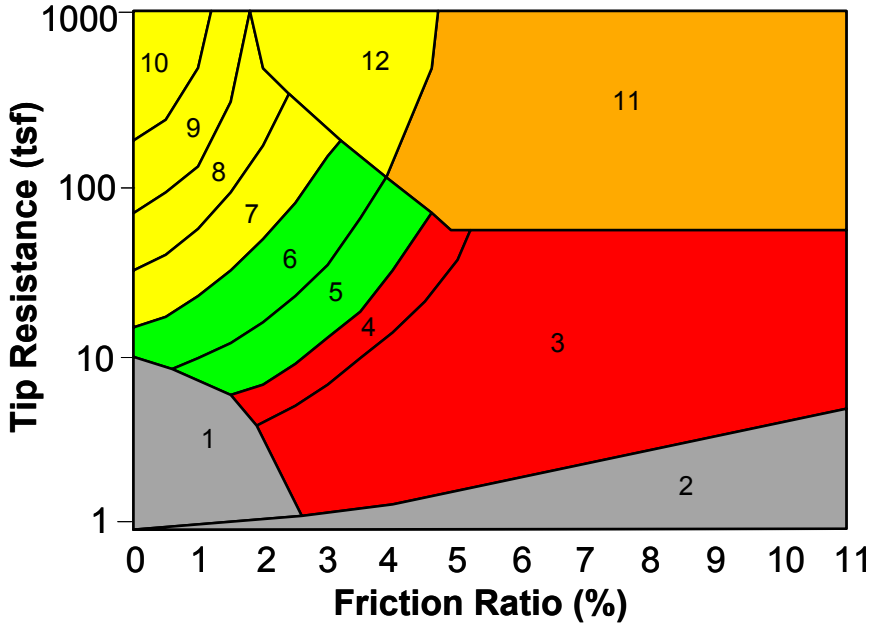


Map showing Quaternary faults and P-wave first-motion focal mechanisms from McLaren and Savage, 2001, (minimum, 20 first motions) from earthquakes along the south central coastal region from Point Piedras Blancas to Point Arguello. Focal mechanisms show (1) predominantly reverse and oblique-reverse motion between the Nacimiento and the San Simeon Fault Zones, (2) a mixture of strike slip, reverse, and oblique motion between the West Huasna-Oceanic and Hosgri Fault Zones, (3) strike slip motion along the northern Hosgri Fault Zone, and (4) reverse motion near the Casmalia Fault Zone and southwest of the Hosgri Fault Zone in the offshore Santa Maria Basin region.

BASE MAP: Lettis et al. (2004), Quarternary Tectonic Setting of South-Central California.

HISTORICAL SEISMICITY MAP
Los Osos Wastwater Project
San Luis Obispo County, California

APPENDIX A



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

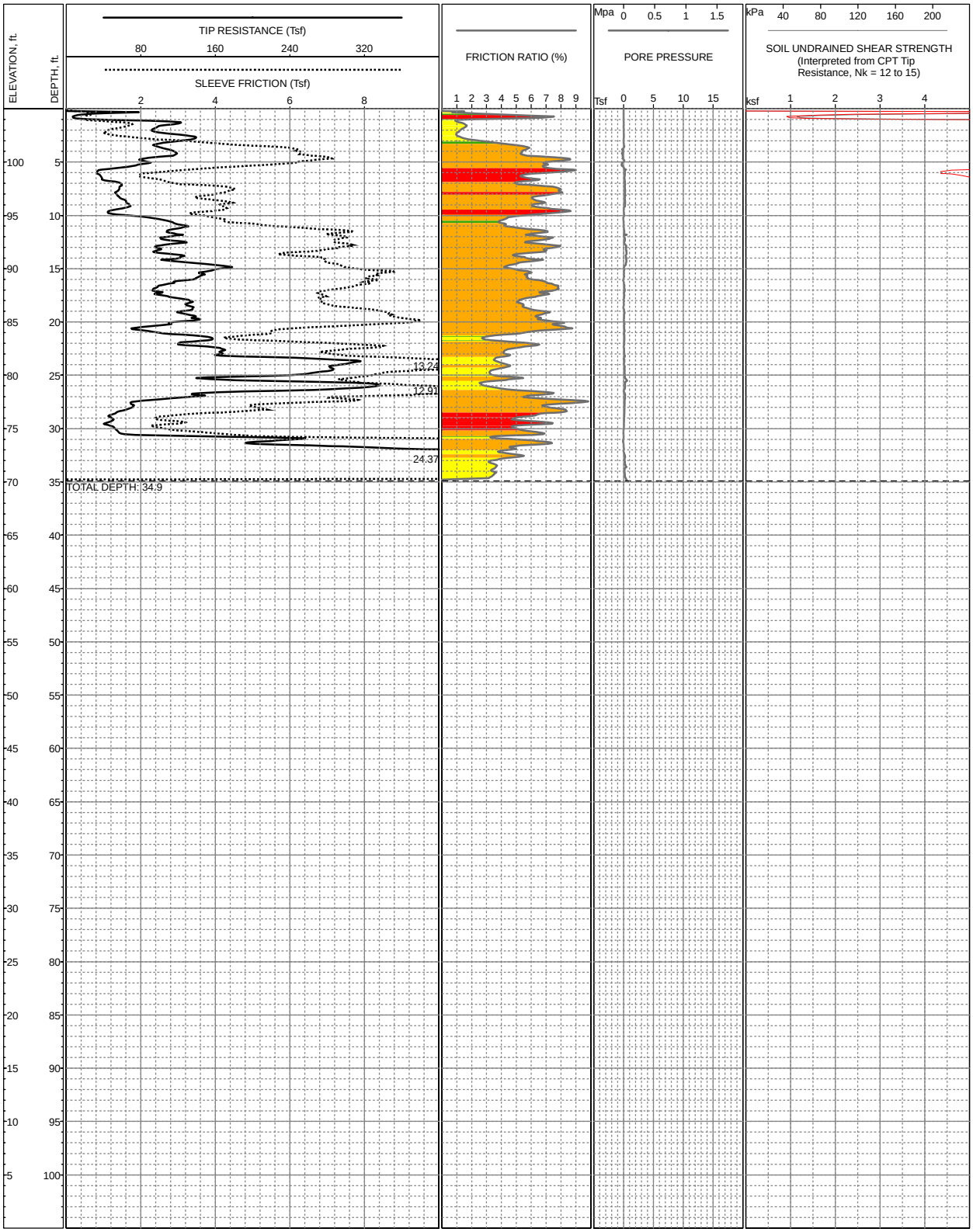
CPT CORRELATION CHART
(Robertson and Campanella, 1984)

KEY TO CPT LOGS

Los Osos Wasterwater Project
San Luis Obispo County, California

PLATE A-1

N:\Projects\3014_SLOcounty\3014-026_LosOsosWastewater\Outputs\Working\mxd\CPT\CPTkey.mxd, 06/11/07, CDean



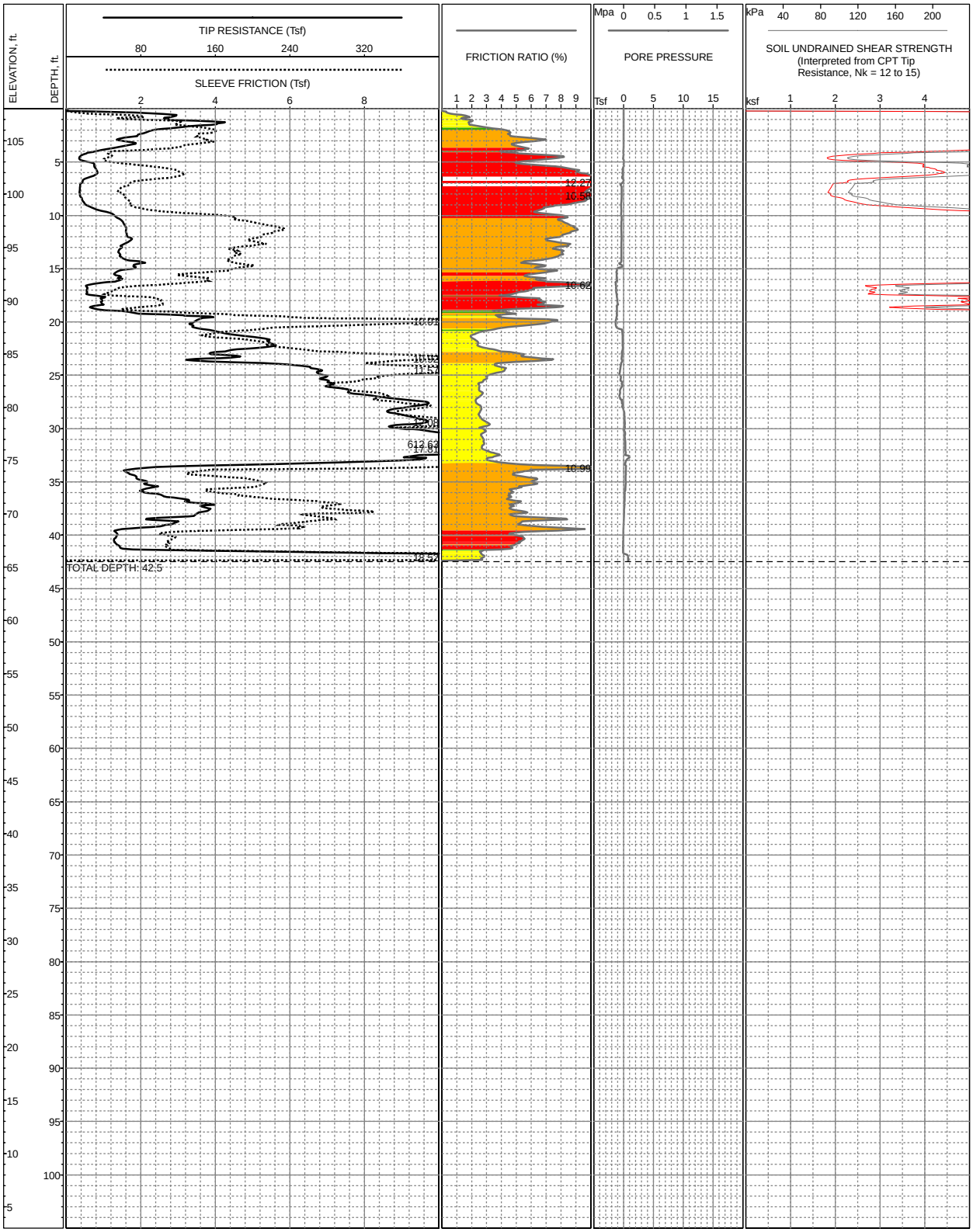
LOCATION: Southeast corner of Los Osos Mortuary property.
SURFACE EL: 105ft +/- (MSL)
COMPLETION DEPTH: 34.9ft
TESTDATE: 5/8/2007

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF C-1

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE A-2



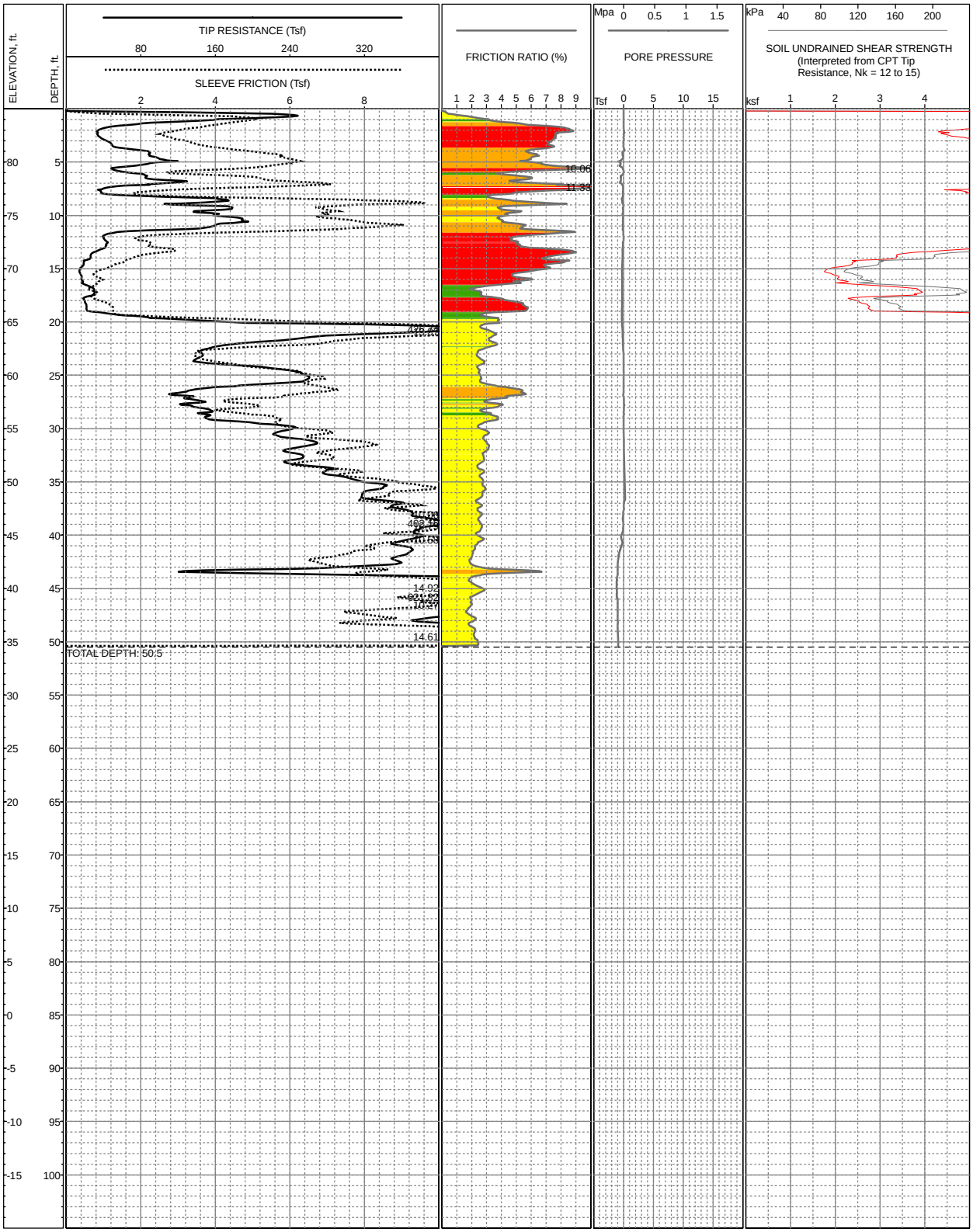
LOCATION: Southwest corner of Los Osos Mortuary property.
SURFACE EL: 108ft +/- (MSL)
COMPLETION DEPTH: 42.5ft
TESTDATE: 5/8/2007

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF C-2

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE A-3



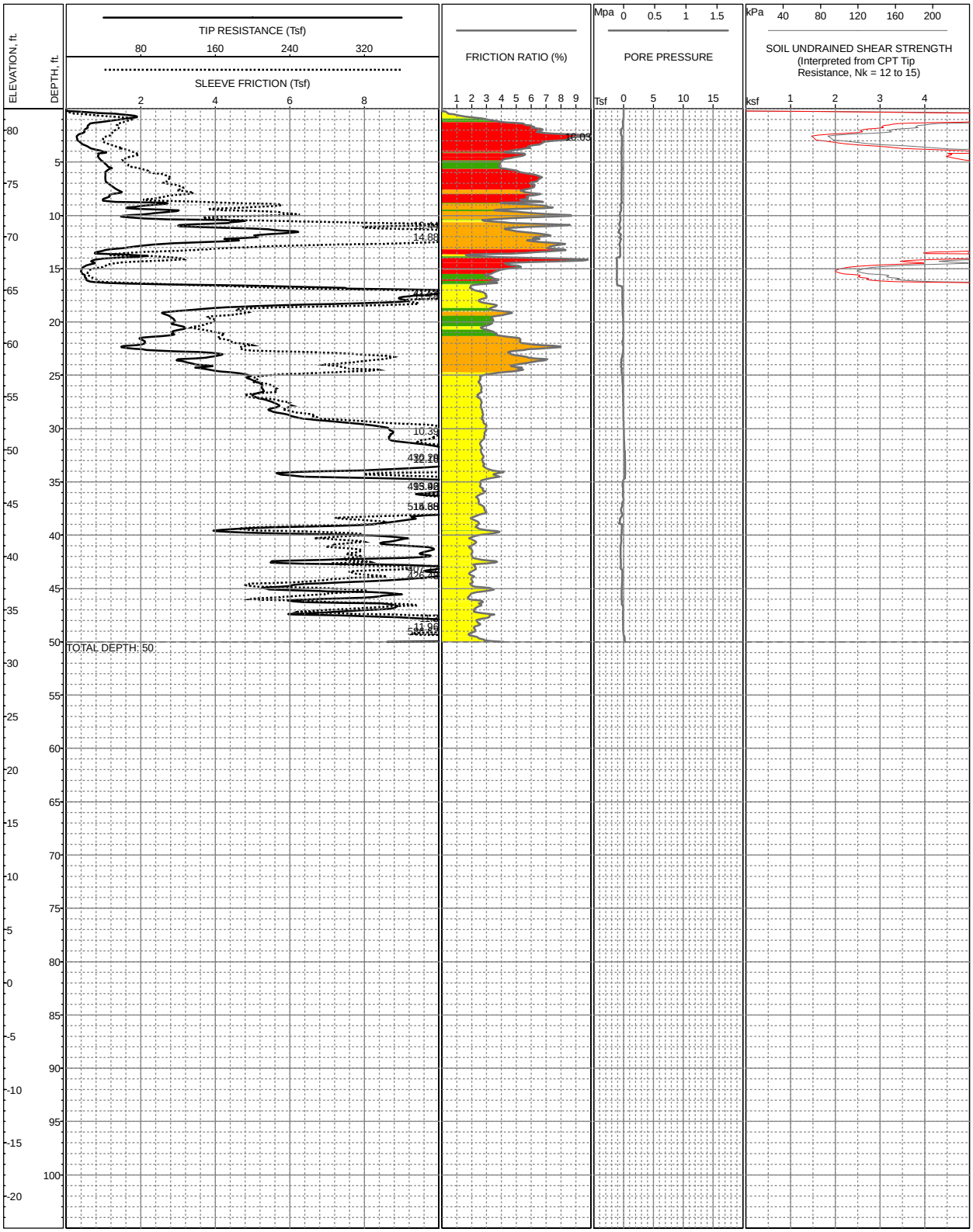
LOCATION: Southeast corner of Giacomazzi property.
SURFACE EL: 85ft +/- (MSL)
COMPLETION DEPTH: 50.5ft
TESTDATE: 5/8/2007

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF C-3

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE A-4



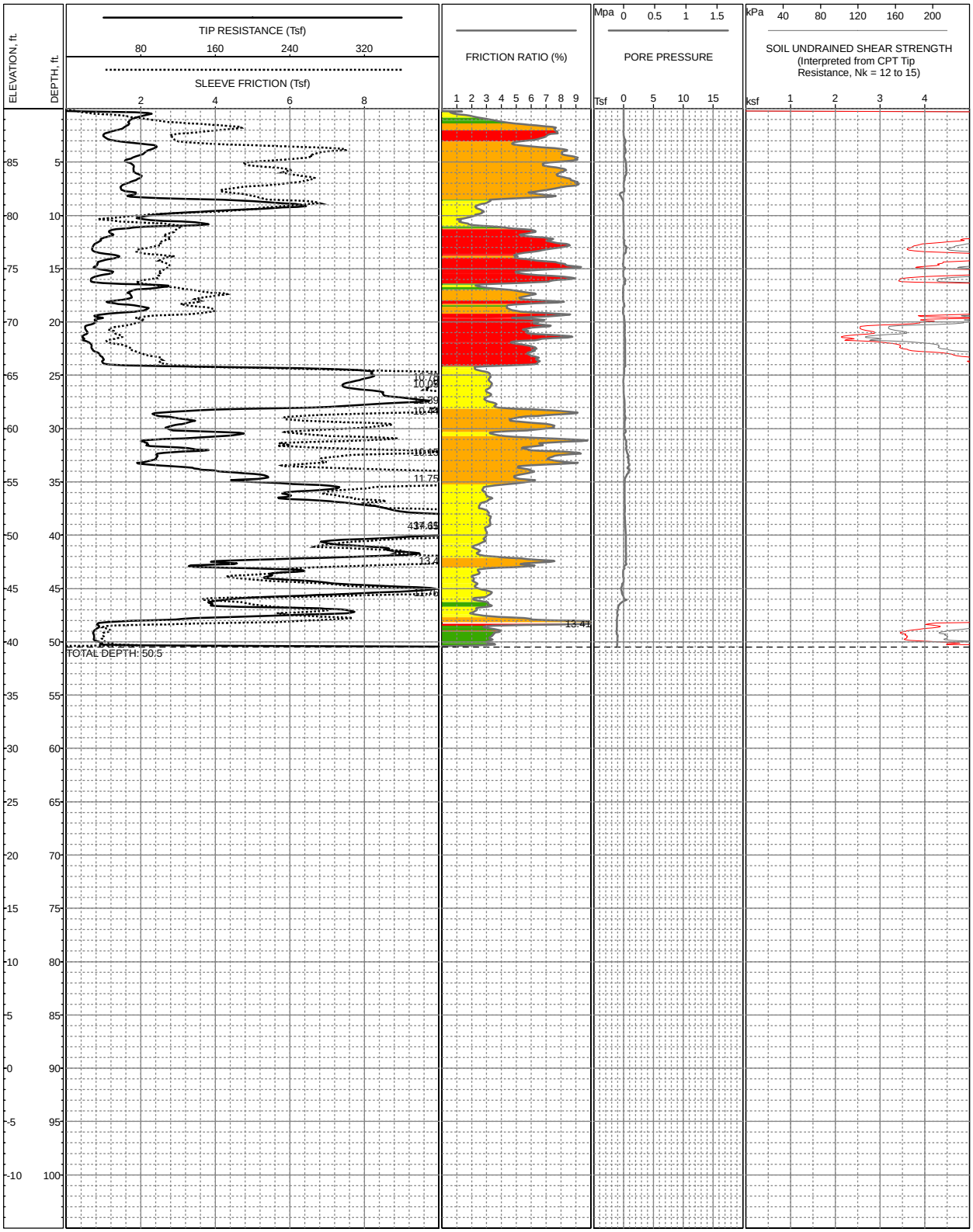
LOCATION: Southern access road of Giacomazzi property, 500 feet west of southeast corner.
SURFACE EL: 82ft +/- (MSL)
COMPLETION DEPTH: 50ft
TESTDATE: 5/8/2007

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF C-4

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE A-5



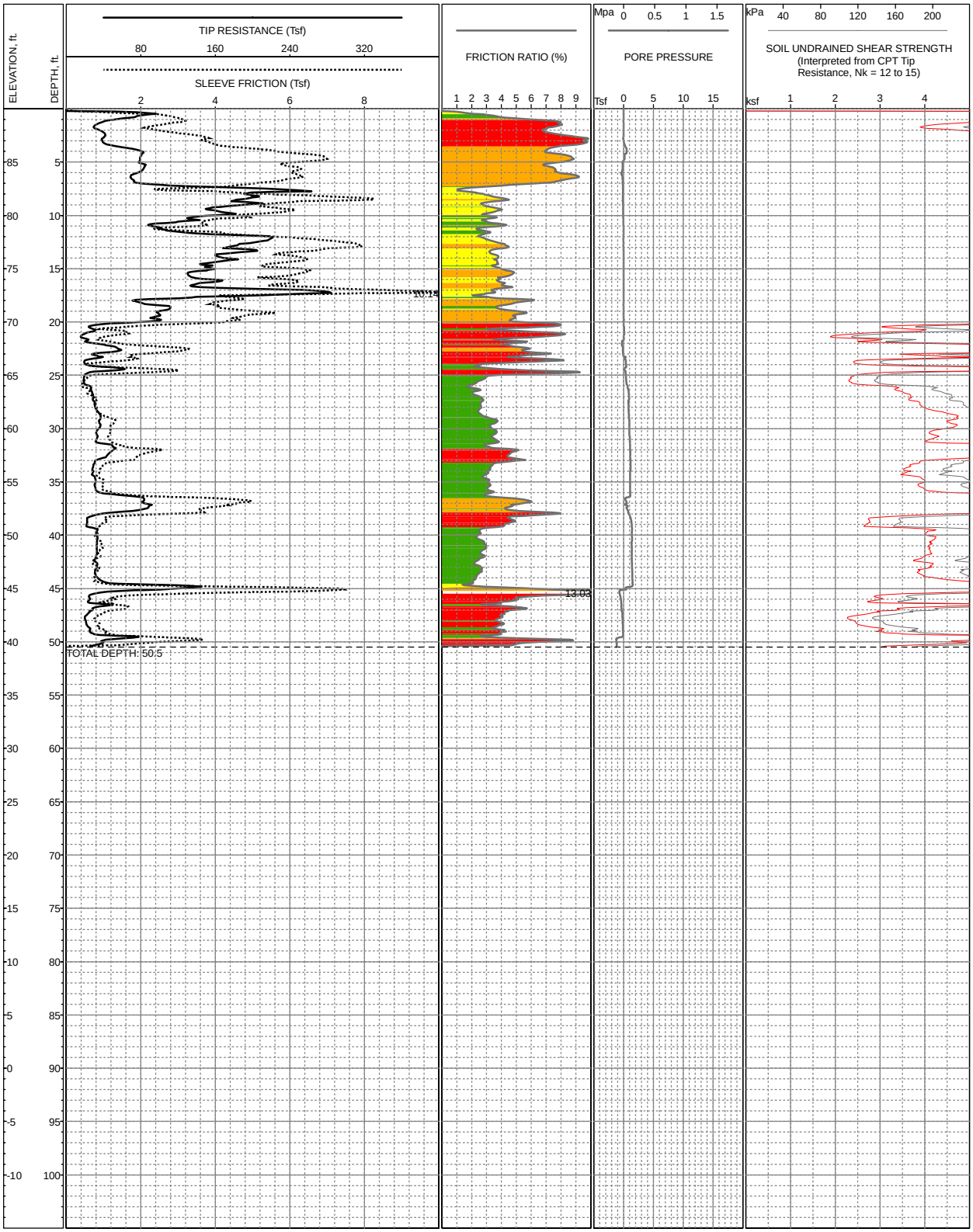
LOCATION: Southern access road of Giacomazzi property, 900 feet west of southeast corner.
SURFACE EL: 90ft +/- (MSL)
COMPLETION DEPTH: 50.5ft
TESTDATE: 5/8/2007

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF C-5

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE A-6



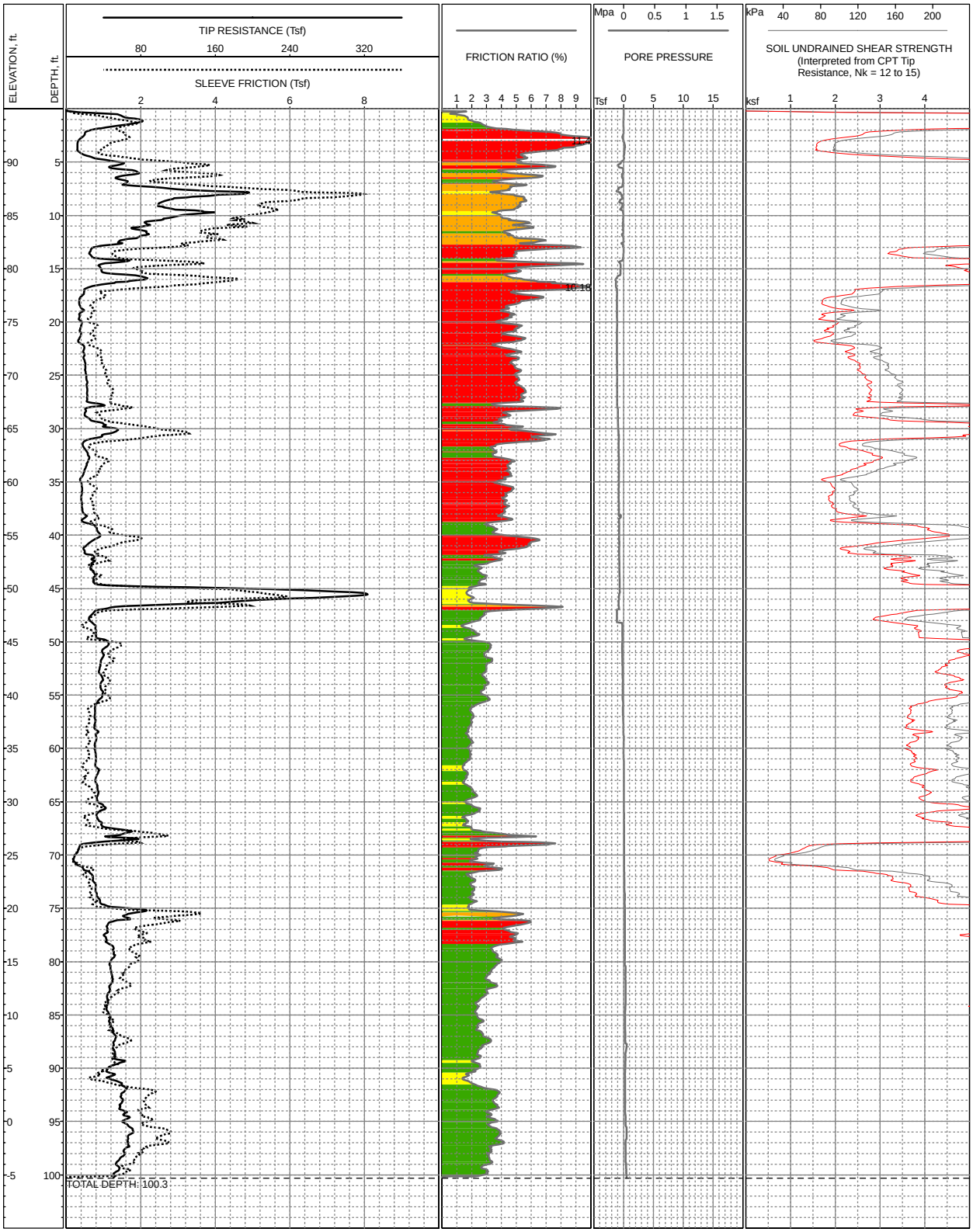
LOCATION: Southwest corner of Giacomazzi property.
SURFACE EL: 90ft +/- (MSL)
COMPLETION DEPTH: 50.5ft
TESTDATE: 5/8/2007

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF C-6

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE A-7



LOCATION: Eastern edge of Giacomazzi property, adjacent to existing garage.
SURFACE EL: 95ft +/- (MSL)
COMPLETION DEPTH: 100.3ft
TESTDATE: 5/8/2007

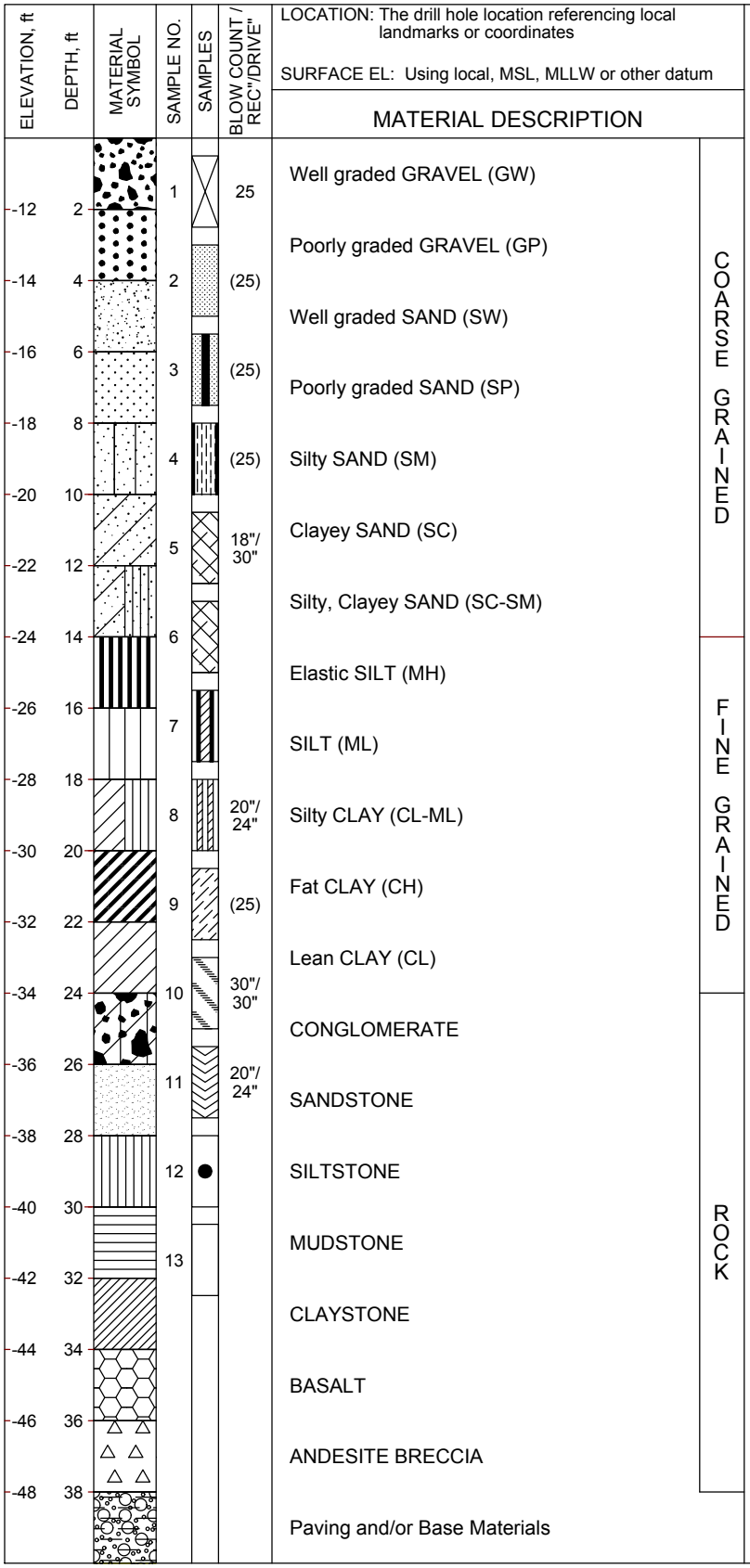
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF C-7

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE A-8

APPENDIX B



General Notes

Soil Texture Symbol

Sloped line in symbol column indicates transitional boundary

Samplers and sampler dimensions (unless otherwise noted in report text) are as follows:

Symbol for:

1	SPT Sampler, driven 1-3/8" ID, 2" OD
2	CA Liner Sampler, driven 2-3/8" ID, 3" OD
3	CA Liner Sampler, disturbed 2-3/8" ID, 3" OD
4	Thin-walled Tube, pushed 2-7/8" ID, 3" OD
5	Bulk Bag Sample (from cuttings)
6	CA Liner Sampler, Bagged
7	Hand Auger Sample
8	CME Core Sample
9	Pitcher Sample
10	Lexan Sample
11	Vibracore Sample
12	No Sample Recovered
13	Sonic Soil Core Sample

Sampler Driving Resistance

Number of blows with 140 lb. hammer, falling 30" to drive sampler 1 ft. after seating sampler 6"; for example,

Blows/ft	Description
25	25 blows drove sampler 12" after initial 6" of seating
86/11"	After driving sampler the initial 6" of seating, 36 blows drove sampler through the second 6" interval, and 50 blows drove the sampler 5" into the third interval
50/6"	50 blows drove sampler 6" after initial 6" of seating
Ref/3"	50 blows drove sampler 3" during initial 6" seating interval

Blow counts for California Liner Sampler shown in ( )

Length of sample symbol approximates recovery length

Classification of Soils per ASTM D2487 or D2488

Geologic Formation noted in bold font at the top of interpreted interval

Strength Legend

Q = Unconfined Compression
u = Unconsolidated Undrained Triaxial
t = Torvane
p = Pocket Penetrometer
m = Miniature Vane

Water Level Symbols

- Initial or perched water level
- Final ground water level
- Seepages encountered

Rock Quality Designation (RQD) is the sum of recovered core pieces greater than 4 inches divided by the length of the cored interval.

KEY TO TERMS & SYMBOLS USED ON LOGS

PLATE B-1

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	LOCATION: Giacomazzi property, near center of property. SURFACE EL: 70 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
						PASO ROBLES FORMATION (Qtp) Topsoil: Sandy Fat CLAY (CH): firm, brown, dry							
						- moist							
68	2					- grades to Clayey SAND (SC): medium dense, brown, moist							
						Lean CLAY (CL): stiff, red-brown, moist							
66	4					Lean CLAY with sand (CL): stiff, red-brown, moist							
						Lean CLAY (CL): stiff to very stiff, red-brown, moist							
64	6					Clayey SAND (SC): medium dense, brown, moist							
						Lean CLAY with sand (CL): very stiff, red-brown, moist, iron oxide staining							
62	8												
60	10												
58	12												
56	14												

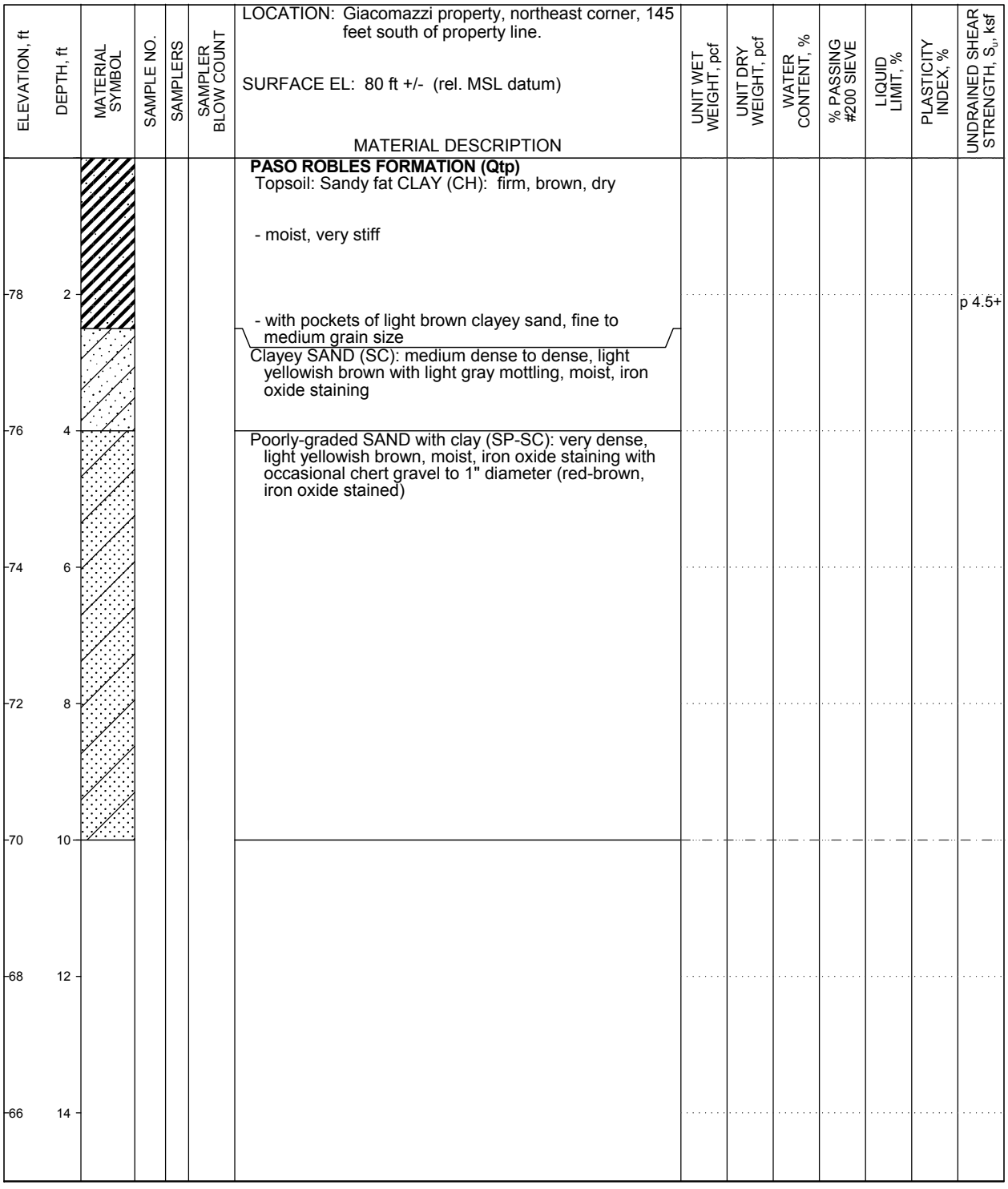
The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 12.5 ft
DEPTH TO WATER: Not Encountered
BACKFILLED WITH: Cuttings
DRILLING DATE: May 8, 2007

DRILLING METHOD: 3-inch-dia. Hand Auger
HAMMER TYPE:
DRILLED BY: Fugro West, Inc.
LOGGED BY: CLovato
CHECKED BY: C Lovato

LOG OF NO. H-1
Los Osos Wastewater Project
San Luis Obispo County, California

PLATE B-2



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: 10.0 ft
DEPTH TO WATER: Not Encountered
BACKFILLED WITH: Cuttings
DRILLING DATE: May 8, 2007

DRILLING METHOD: 3-inch-dia. Hand Auger
HAMMER TYPE:
DRILLED BY: Fugro West, Inc.
LOGGED BY: CLovato
CHECKED BY: C Lovato

LOG OF NO. H-2

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE B-3

LOCATION: Giacomazzi property, northern property line.

SURFACE EL: 80 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
						PASO ROBLES FORMATION (Qtp) Topsoil: Clayey SAND (SC): medium dense, brown, moist							
78	2					Sandy lean CLAY (CL): firm, light brown with gray and red-brown mottling, moist							
76	4					- stiff, gray							p 3.0
74	6					- very stiff, red-brown							
72	8												
70	10												
68	12												
66	14												

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: 10.0 ft
DEPTH TO WATER: Not Encountered
BACKFILLED WITH: Cuttings
DRILLING DATE: May 8, 2007

DRILLING METHOD: 3-inch-dia. Hand Auger
HAMMER TYPE:
DRILLED BY: Fugro West, Inc.
LOGGED BY: CLovato
CHECKED BY: C Lovato

LOG OF NO. H-3

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE B-4

LOCATION: Giacomazzi property, western property line.

SURFACE EL: 82 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
						PASO ROBLES FORMATION (Qtp) Topsoil: Sandy lean CLAY (CL): firm, dark brown, moist							
80	2					Lean CLAY with sand (CL): stiff, brown, with dark brown mottling, moist							
						- dark brown, with gypsum							
78	4					- brown							
						- very stiff							
76	6												
74	8												
						Clayey SAND with gravel (SC): dense, red-brown, moist							
72	10					- grades to sandy CLAY (CL)/Clayey SAND (SC)							
70	12												
68	14												

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: 12.0 ft
DEPTH TO WATER: Not Encountered
BACKFILLED WITH: Cuttings
DRILLING DATE: May 8, 2007

DRILLING METHOD: 3-inch-dia. Hand Auger
HAMMER TYPE:
DRILLED BY: Fugro West, Inc.
LOGGED BY: JHollenback
CHECKED BY: C Lovato

LOG OF NO. H-4

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE B-5