May 10, 2019

Gatzke Dillon & Ballance LLP
2762 Gateway Road
Carlsbad, California 92009

Attention: Mr. Michael Masterson

SUBJECT: REPORT OF GEOTECHNICAL INVESTIGATION
Site Development
SDSU Mission Valley
San Diego, California

Mr. Masterson:

Group Delta Consultants (Group Delta) is submitting this geotechnical investigation report for the grading and civil works (Site Development) that is part of the redevelopment of the former SDCCU site (overall site) into the San Diego State University Mission Valley (SDSU MV) campus. The ultimate development of the site (Full Build Out) will consist of a Stadium, Campus Expansion, Tailgate Park, Hotel and Conference Center, Residential, and Park Space.

Group Delta prepared this report per our Agreement for Consulting Services dated January 23rd, 2019. This issue of the report is the first draft of the Report of Geotechnical Investigation. The purpose of this report is to provide preliminary information to support the collaborative design-build procurement of the Site Development package. Revisions may be needed for design development and to obtain construction permits.

This report provides interpretations of the geologic and geotechnical conditions observed and preliminary recommendations for design and construction of the grading and civil works for Phases 1B to 4. Group Delta is submitting a separate geotechnical report for the Stadium along with another report for subsurface environmental conditions of the overall site. This report does not provide geotechnical recommendations for the Full Build Out, but it does discuss mitigation of geotechnical conditions that could be included in the Site Development package.

We appreciate this opportunity to be of continued professional service. Please contact us with questions or comments, or if you need anything else.

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation by Group Delta Consultants (Group Delta) for the grading and civil works (referred to as the Site Development package) to redevelop the former SDCCU stadium site (overall site) into the San Diego State University Mission Valley (SDSU MV) campus. Figure 1, Site Location, shows the location of the project. Figure 2, Proposed Development, shows the plan layout of the project.

The purpose of this report is to provide preliminary information to support the collaborative design-build procurement of the Site Development package. This report provides interpretations of the geologic and geotechnical conditions observed and preliminary recommendations for design and construction the grading and civil works for Phases 1B to 4. Revisions may be needed for design development and to obtain construction permits.

This report does not provide geotechnical recommendations for the buildings and parking structures planned for the ultimate development of the overall site (referred to as Full Build Out). However, this report discusses potential mitigation of geotechnical conditions that could be included in the Site Development package to facilitate construction of these structures.

Group Delta (2019b) submitted a separate geotechnical investigation report for the Stadium, the Phase 1A Grading, and the portion of Phase 1B Grading, that are the responsibility of Stadium Contractor. Group Delta (2019c) also submitted a report for subsurface environmental conditions of the overall site.

Group Delta developed the recommendations from reviewing the referenced previous studies, recent subsurface exploration and laboratory testing, geologic and geotechnical engineering interpretation and analyses, and our previous experience with similar geologic conditions.

1.1 Scope of Services

This report was prepared in general accordance with the provisions of the referenced proposal (GDC, 2019a). In summary, we provided the following scope of services.

- Review of the previous geologic and geotechnical studies referenced in this report. Plate 1, Geotechnical Map, shows the locations of relevant prior exploratory borings. Appendix A provides the records from these explorations.
- Subsurface exploration consisting of 29 exploratory borings, 10 Cone Penetration Tests (CPTs) and three infiltration tests at the approximate locations shown on Plate 1, Geotechnical Map. Appendix B provides records from these explorations and Appendix D provides the results of the infiltration testing.
- Laboratory testing of soil samples collected from the borings. Laboratory tests included sieve analysis, Plasticity Index, Expansion Index, corrosion (pH, resistivity,
soluble sulfate and chloride), shear strength (direct shear) and compressibility (consolidation). Appendix C provides the laboratory test results.

- Engineering analysis of the field and laboratory data to develop geotechnical parameters and preliminary recommendations for design and construction.
- Preparation of this report with our findings, conclusions and recommendations.

1.2 Site Description

The former SDCCU stadium site occupies about 170 acres in the Mission Valley area of the City of San Diego as shown on Figure 1, Site Location. The existing stadium is in the center of the site. Asphalt paved surface parking covers the remainder of site. The Mission Valley West Light Rail Transit runs east-west near the southern perimeter of the site.

Surface elevations vary from about 45 to 100 feet NAVD 88 from southeast to northwest. The basis of elevations stated further in this report is NAVD 88, unless noted otherwise.

1.3 Proposed Development

We have based our understanding of the project on information in the San Diego State University 100% Design Development Architectural and Landscape Plans (Carrier Johnson, 2019), and the 100% Design Development Civil Plans and the Conceptual Phasing Plan (Rick Engineering, 2019a,b). Figure 2, Proposed Development, shows the plan layout of the project. Plate 1, Geotechnical Map uses the “Opening Day” cut/fill exhibit as the base map.

The site will be developed in two main phases referred to as Opening Day and Full Build Out. The Opening Day configuration comprises the new Aztec Stadium (Stadium), temporary surface parking surrounding the Stadium and Park Space along the southern and eastern perimeter of the overall site. Full Build Out replaces the temporary surface parking with a Campus Expansion, Tailgate Park, Hotel & Conference Center, and Residential areas.

The grading and civil works to prepare the site and planned for in the Site Development package will be completed in the following phases:

Phase 1A: Initial grading of Stadium pad (by Stadium Contractor, not part of this report).
Phase 1B: Demolition of the western portion of SDCCU stadium (by Stadium Contractor) and rough grading of the western half of site.
Phase 2: Construct Stadium (not part of this report)
Phase 3: Demolition of the eastern portion of SDCCU stadium and rough grading for the residential pads.
Phase 4: Precise grading of residential pads.
1.3.1 Cut and Fill Earthwork

Cut and fill earthwork will reform the site to create new streets and building pads and raise it above the 100-year floodplain. Cut and fill volumes are estimated to be 750,000 cubic yards (CY) and 1,065,000 CY with a net import of 315,000 CY, exclusive of shrinkage and bulking, and remedial grading.

Cut will remove some of the fill placed to create the SDCCU stadium pad, form the Stadium lower seating bowl and field level, and form the eastern half of the Stadium Zone of the Campus Expansion (this area will be a designated borrow area for the Stadium grading). The Stadium Contractor will complete all the earthwork in the Stadium site and demolish the southeast portion of the SDCCU stadium.

Fill will raise grades within the former SDCCU stadium field level and create large level areas across the northern and southwest portion of the site. The table below summarizes approximate grading data for the various development areas.

<table>
<thead>
<tr>
<th>Development Area</th>
<th>Finished Subgrade Elevation, feet</th>
<th>Maximum Cut Thickness, feet</th>
<th>Maximum Fill Thickness, feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campus Expansion – Campus Zone</td>
<td>55</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Campus Expansion – Stadium Zone</td>
<td>75</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Tailgate Park</td>
<td>80 to 85</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Hotel &amp; Conference Center</td>
<td>85</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Residential – North (R1 to R9)</td>
<td>70 to 75</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>Residential – South (R10 to R15)</td>
<td>65</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>Park Space (Southwest)</td>
<td>55</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Park Space (Southeast to Northeast)</td>
<td>55</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

A fill slope inclined at 3:1 provides a separation between the eastern portion of the building pads for the Residential areas and Park Space. Cut and fill slopes formed at 2:1 will create new interior streets and the temporary surface parking in the areas west and south of the Stadium.
1.3.2 Civil Site Work

Surface parking covered with asphalt concrete or gravel is planned for Opening Day in areas north, west and south of the Stadium. Above- and below-ground parking structures for the Campus Expansion and Hotel & Conference Center will ultimately replace the Opening Day surface parking.

New interior streets will be 6-Lane Major, 4-Lane Major and 2-Lane Collectors covered with asphalt concrete pavement constructed according to City of San Diego Standard Drawings, Schedule J, Pavement Design Standards. There are multiple paving types for roads, parking lots and trails. This report provides recommendations for Paving Type 2, Asphalt Concrete with Aggregate Base.

The existing Friars Road, Mission Village Drive (including the bridge over Friars Road) and San Diego Mission Road will be widened or reconstructed. A new connection to Fenton Parkway will be needed as well. This report only provides recommendations for new interior streets.

Existing sewer, storm drain, water and dry utilities will be abandoned. There will be new sewer, storm drain, water, dry utilities, and fireline. A new 30-foot wide box culvert will be constructed in the northeast portion of the site extending under the proposed Murphy Creek Road. Gravity flow utilities have a minimum gradient of 0.5 percent.

Storm water improvements include several new infiltration basins in the Park Space area along the southern and eastern portions of the property.

1.3.3 Full Build Out

Full Build Out will consist of the development areas listed below.

- Campus Expansion
- Hotel & Conference Center
- Residential
- Tailgate Park and Park Space

The following sections describe the structures planned for in these areas (except for Stadium that is a separate Group Delta report).

1.3.3.1 Campus Expansion

The Campus Expansion will occupy about 28 acres, and it consists of a Campus Zone south of the Stadium and a Stadium Zone east of the Stadium. The Campus Zone will have 14 buildings that range from 3 to 5 stories with plan areas ranging from 17,000 to 28,000 square feet. The Stadium Zone will have two 5-story buildings with plan areas of 31,000 square feet each. Most of the Campus Zone will have two levels of partially underground parking and most of the Stadium Zone will have a ground level and an underground level of parking.
1.3.3.2 Hotel & Conference Center

The Hotel & Conference Center parcel will occupy about 7 acres north of the Stadium. It will have a 9-story steel and concrete tower, a 3-story wood framed building and a 4-level above ground concrete parking structure.

1.3.3.3 Residential

The 15 Residential parcels will occupy 44 acres of the eastern portion of the overall site. The buildings range from two at 3-stories, eight at 5-stories and five at 21- to 24-stories. The taller structures are steel and concrete construction. The shortest structures are wood-frame construction. Most of the structures use: 1) a “wrap” configuration that consists of a central, above ground multi-story concrete parking structure surrounded by multiple stories of wood-frame construction living units, 2) a concrete podium parking structure with multiple levels of wood-framed living units above the podium, or 3) combinations of these types of construction.

1.3.3.4 Tailgate and Park Space

The Tailgate and Park Space will provide 84 acres of open space. The Tailgate is two active parks that will occupy 8 acres west of the Stadium. The Park Space will be a 34-acre Community River Park along the southern and eastern perimeter of the site. It will consist of active and passive park and green spaces with hiking and biking trails.

1.4 Previous Site Use and Development

AECOM (2015) prepared a Geotechnical and Geologic Evaluation Report for a proposed National Football League stadium to the replace the SDCCU stadium that opened in 1967. This report summarized the prior use and development of the site. Salient information is provided below.

- There were two previous quarries. They were located near the northeast and western perimeters of SDCCU stadium. We noted an anomalously thick clay layer in Group Delta explorations S-2 and CPT-2 that may be related to prior mining.

- About 35 feet of fill, or more in localized areas, was placed around the perimeter of SDCCU stadium. The fill was placed to raise the stadium site above the floodplain and to establish a field level at +50 feet Mean Sea Level (MSL). The fill was sourced from hillsides located north and northwest of the overall site in areas mapped as underlain by the Stadium Conglomerate (Kennedy and Tan, 2008). The Stadium Conglomerate possesses a relatively high percent of gravel, cobbles and boulders.

- Steel H-Piles (HP 8X36, 12X53, 12X74 and 14X102) support the original stadium. AECOM indicated that based on as-built drawings, the piles were driven to refusal and they extend 10 to 20 feet into formational materials. Recorded pile tip elevations on the south side of the stadium ranged from +1 to +9 feet MSL (66 to 77 feet long) and recorded pile tip elevations on the north site of the stadium ranged from -12 to -24 feet MSL (70 to 100 feet long).
long). Tip levels varied because the formational materials were shallower on the south side of the stadium. Batter piles support lateral loads.

- Cast-in-Drilled-Hole (CIDH) piles support the enclosure of the southeast side of the stadium that opened in 1997. AECOM indicated that based on the geotechnical report and structural drawings, the piles were designed considering end bearing and they extend 5 feet into formational materials, or the basal gravels that overlies this formation. Pile diameters ranged from 36 to 72 inches and specified pile tip levels ranged +12.6 to -9 feet MSL (70 to 95 feet long). As-built or construction records were not available.

1.5 Previous Geotechnical Studies

AECOM (2015) and Geocon (2016) completed prior geotechnical and geologic evaluations for the redevelopment of the SDCCU stadium site. These evaluations reviewed existing geotechnical and geologic information and did not include any additional subsurface exploration. Relevant information from these evaluations is included in this report.

It is important to note these evaluations provided different opinions regarding the potential for liquefaction. Geocon made a qualitative evaluation by assuming that most of the alluvial soils are geologically old, and therefore should not be susceptible to liquefaction. AECOM made a quantitative evaluation by using the few geotechnical test borings completed at the site with soil resistance data (Standard Penetration Test blow counts) to estimate about 2 to 6 inches of liquefaction-induced settlement. AECOM therefore concluded there was “moderate to high” potential for liquefaction. Note also that Geocon’s assessment was for the entire site, while AECOM’s assessment was limited to a stadium located in the northeast portion of the site, and an alternate stadium located in the northwest portion of the site. The assessment of liquefaction in this report using site specific subsurface data supersedes these desk study type evaluations.

Additional data is available from the geotechnical studies completed for the Mission Valley West Light Rail Transit (LRT) that runs east-west near the southern perimeter of the overall stadium site. The As-Built Log of Test Borings (dated 1999, as referenced in Gillingham Water and CH2M, 2018) for the portion of the alignment within the site includes 21 geotechnical explorations. The records from these explorations indicate subsurface conditions similar to those interpreted from Group Delta’s current explorations and described in the report.

Large diameter Cast-In-Drilled (CIDH) piles support this segment of the LRT that derive support in the underlying gravels and formational materials. We understand from anecdotal construction information (Curt Scheyhing, 2019 personal communication) that construction of some of these piles experienced unusual difficulties with soft soils that may have been the remnants of prior local mining operations. CIDH pile construction was able to remove gravels with some difficulty using conventional rock drilling and excavating equipment and tooling.
1.6 Previous Environmental Subsurface Explorations

Since 1992, numerous groundwater monitoring wells have been constructed within the overall site. These wells are part of on-going investigation and remediation activities for petroleum hydrocarbon impacts to soil and groundwater resulting from operations at an adjacent tank farm. The records from these well installations include descriptions of soil and rock types and layers observed from drilling cuttings. Most of the well installations did not collect samples of the soil and rock and they did not obtain geotechnical sampler resistance data, such as Standard Penetration Tests. Plate 1, Geotechnical Map, shows the locations of relevant prior exploratory borings. Appendix A provides the records from these explorations. We have used the data from some of these installations to help develop the Geologic Cross Sections.

2.0 FIELD AND LABORATORY INVESTIGATION

2.1 Current Subsurface Exploration

The current subsurface exploration for the Site Development consisted of 16 exploratory borings (designated as B-) and three infiltration tests that were advanced using a combination of hollow stem auger, rotary wash, casing advancement, and rock coring drilling methods to depths ranging from 30 to 85 feet. The 13 explorations from the Stadium (designated as S-) are included in the interpretation and analyses for this report. The borings were completed during February and March 2019.

Ten Cone Penetrometer Tests (CPTs) were also completed. Downhole seismic data were recorded for three of the CPTs, which are further designated as Seismic CPTs (SCPTs). CPT-2 and CPT-26 initially encountered refusal at depths of about 25 feet due to gravel and cobbles causing resistance to further advancement and flexure of the CPT rods. CPT-2 and CPT-26 were reattempted by locating a second CPT location a few feet away from the original location, which was able to be advanced to a depth of about 45 and 40 feet, respectively, where refusal on gravel and cobbles was encountered. SCPT-7 and CPT-11 both encountered relatively shallow refusal on gravel and cobbles at about 17 feet. The CPTs were advanced on March 18 and April 8, 2019.

Note the SDCCU stadium precluded exploration within a large area of the site. The stadium occupies about 20 acres of the overall 170-acre site. Plate 1, Geotechnical Map, shows the approximate locations of the explorations. Appendix B provides records from these explorations.

2.2 Laboratory Testing

Soil samples were collected from the borings for laboratory testing. The geotechnical testing program included sieve analyses and Plasticity Index testing to aid in soil classification using the ASTM Unified Soil Classification System (USCS). Index tests were also conducted to help evaluate the soil expansion potential and corrosivity. Direct shear and consolidation tests were conducted on relatively intact samples to evaluate soil strength and compressibility. The laboratory test results are shown on the Current Exploration Records in Appendix B and in Appendix C.
3.0 GEOLOGY AND SUBSURFACE CONDITIONS

The site is located within the Peninsular Ranges geomorphic province of southern California. This province stretches from the Los Angeles basin to the tip of Baja California. It is characterized as a series of northwest trending mountain ranges separated by subparallel fault zones. The site is located within the coastal plain transected by the west-flowing San Diego River drainage known as Mission Valley and it is underlain at depth by Eocene-age sedimentary deposits mapped as the Friars Formation (Map Symbol Tf).

The Friars Formation consists of six intertonguing, depositionally time-equivalent facies ranging from deep-marine, fine-grained siltstone and claystone to the southwest and continental, coarse-grained sandstone and conglomerate to the northeast. The Friars Formation are nonmarine and near-shore deposits of lagoonal sandstone, siltstone, and claystone. The Friars Formation is found in Mission Valley at elevations below approximately 160 feet Mean Sea Level. Regionally, the Friars Formation dips gently to the southwest between 3 and 5 degrees.

Thick deposits of poorly consolidated, mostly granular alluvium associated with the San Diego River and Murphy Creek drainages, local deposits of slopewash and colluvium, and fill soils associated with the original stadium construction overlies the Friars Formation. These materials are collectively referred to as Surficial Soils - Undifferentiated (Map Symbol su).

Figure 3, Geologic Map depicts the general geology in the site. Plates 2A through 2G are geologic cross sections through the site. The sections below describe the geologic units encountered.

3.1 Friars Formation

As encountered in the explorations completed for this investigation and those conducted for the previous environmental monitoring well installations, the elevation of the top of Friars Formation ranges from 25 feet in the northwest portion of the overall site to less than 0 feet in the central portion of the overall site (including the SDCCU stadium footprint). The elevation of the top of the Friars Formation rises in the southeast portion of the overall site to about 25 feet. Plate 4, Estimated Settlements Summary, provides these elevations for each exploration.

The overall site is located at the confluence of two major drainages - the San Diego River and Murphy Creek. We interpret that the variability of the elevation of the top of Friars Formation occurs from erosion of the San Diego River and Murphy Canyon paleochannels into this formation below the SDCCU stadium. Significant and abrupt declines in elevation occur northwest to southeast from transitions at the margins of the paleochannels. Geologic Cross Sections B-B’ (Plate 2B) and C-C’ (Plate 2C) depicts this paleochannel as the significant drop in the elevation of the Friars Formation across a short horizontal distance. Note the eastern margin of the paleochannel is inferred because we were unable to conduct subsurface exploration in the existing stadium.

As observed in all our deep borings, the Friars Formation generally consists of gray to yellowish brown, interbedded, fine- to coarse-grained silty sandstone with some fine gravel and gray, sandy siltstone with minor amounts of gray claystone. Auger cuttings and drive samples obtained from
these materials were observed to be sand with silt (SP-SM), silty and clayey sand (SM, SC), and lean to fat clay (CL, CH). The apparent density was dense to very dense considering SPT blow counts and the consistency was very stiff to hard considering the undrained shear strength obtained from hand-held Pocket Penetration and Torvane tests.

3.2 Surficial Soils - Undifferentiated

The thickness of the soils in the Surficial Soils - Undifferentiated unit varies across the overall site based on the elevation of the top of Friars Formation. The thickness of these materials ranged from an average of 25 to 60 feet in the northwest portion of the overall site, to more than 50 to 75 feet in the central portion of the overall site. The table below summarizes the thickness within the development areas.

<table>
<thead>
<tr>
<th>Development Area</th>
<th>Thickness, feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campus Expansion – Campus Zone</td>
<td>25 to 80 (deepening to the east)</td>
</tr>
<tr>
<td>Campus Expansion – Stadium Zone</td>
<td>70 to 75</td>
</tr>
<tr>
<td>Hotel &amp; Conference Center</td>
<td>40 to 60 (deepening to the east)</td>
</tr>
<tr>
<td>Residential – North (R1 to R9)</td>
<td>50 to 70 (deepening to the northwest)</td>
</tr>
<tr>
<td>Residential – South (R10 to R15)</td>
<td>30 to 65 (deepening to the west)</td>
</tr>
</tbody>
</table>

The soils in this unit are subdivided into Surface Gravel/Fill, Middle Sand/Fine-Grained Soils, and Basal Gravel. These units are described in more detail in the following sections.

3.2.1 Surface Gravel/Fill

Historical topographic maps indicate that at least three separate active river channels existed through the overall site with the broadest U-shaped meander near Murphy Canyon extending north almost to the current Friars Road alignment (U.S Department of the Interior, 1903). The Murphy Canyon drainage empties into the site from the north. Deposition of coarse-grained alluvium within these river and stream channels has created locally discontinuous gravel layers across the site in the near surface elevations.

Various amounts of fill placed during previous quarrying activities and the original stadium and parking lot construction also cover the site. Historical records indicate that up to 35 feet of fill, or more in localized areas, was placed around the perimeter of the stadium to raise grades above the floodplain. The fill materials were apparently imported from nearby excavations.
These soils were observed in the borings to mostly consist of poorly to well graded sand (SP, SW), silty and clayey sand (SM, SC), silty to clayey gravel (GM, GC) and gravel and cobbles. The apparent density ranged from loose to dense considering SPT blow counts, some of which were erroneously impacted by gravel and cobbles.

### 3.2.2 Middle Sand/Fine-Grained Soils

Sea level transgressions in the last 10,000 years backfilled the San Diego River channels with finer grained alluvial deposits including silt, clay, sand, and finer gravel. The Middle Sand/Fine-Grained Soils unit was encountered in all the explorations.

These soils were observed in the borings to mostly consist of poorly to well graded sand (SP, SW), silty and clayey sand (SM, SC), silty to clayey gravel (GM, GC) and gravel and cobbles. The clay soils observed in the borings were mostly medium plasticity lean clay (CL). The apparent density ranged from loose to dense and the consistency ranged medium stiff to stiff, considering SPT blow counts and hand-held Pocket Penetration and Torvane tests. Some of the SPT test were erroneously impacted by flowing sands or gravel and cobbles.

### 3.2.3 Basal Gravel

The Basal Gravel consists of San Diego River alluvium deposited unconformably on the erosional contact with the Friars Formation. The Basal Gravel appears to be located within the old San Diego River paleochannels that formed from sea level changes and regional uplift over the past several hundred thousand years.

These soils were observed in the borings to mostly consist of sandy coarse gravel and boulders up to two feet in diameter. Since the subsurface exploration used small diameter drilling methods (augers and drill bits less than 8-inches in diameter) maximum clast sizes were not directly observed. However, historical documents, nearby riverbed exposures, and our experience with construction projects in Mission Valley provide us with these data. The apparent density ranged from dense to very dense considering SPT blow counts, most of which were erroneously impacted by the gravel and cobbles.

### 3.3 Groundwater

Groundwater was measured during drilling in the subsurface explorations completed for this investigation (except S-9, S-13, B-14, B-19, B-26, B-29 and B-32 where the drilling method, depth and/or conditions did not allow for measurement) at elevations of 47 to 49 feet along the northern portion of the overall site and at elevations of 37 to 40 feet in the southwest portion of the overall site.

Local variations in groundwater elevation up to 7 feet were measured in adjacent explorations. This variation may be due to: 1) groundwater measurements were conducted when the drilling was finished, and the groundwater level may not have stabilized; 2) groundwater may be locally...
perched on less-permeable, fine grained soils; or 3) a combination of the two. The apparent
gradient across the site from northwest to southwest is approximately 7 degrees as measured in
the explorations.

Groundwater was also measured in select existing monitoring wells constructed by others at the
site following our site investigation. Groundwater was measured at elevations ranging from
approximately 41 to 49 feet. Plate 3 shows an interpretation of the groundwater elevations using
groundwater measurements from: 1) select explorations by Group Delta and 2) select
environmental monitoring wells constructed by others.

The table below summarizes groundwater levels within the development areas.

<table>
<thead>
<tr>
<th>Development Area</th>
<th>Average Finished Subgrade Elevation, Feet</th>
<th>Measured Elevation of Groundwater, Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campus Expansion – Campus Zone</td>
<td>55 (Cut)</td>
<td>43 to 45</td>
</tr>
<tr>
<td>Campus Expansion – Stadium Zone</td>
<td>75 (Cut)</td>
<td>45 to 48</td>
</tr>
<tr>
<td>Hotel &amp; Conference Center</td>
<td>85 (Fill)</td>
<td>43 to 49</td>
</tr>
<tr>
<td>Residential – North (R1 to R9)</td>
<td>70 (Cut)</td>
<td>44 to 49</td>
</tr>
<tr>
<td>Residential – South (R10 to R15)</td>
<td>65 (Cut)</td>
<td>44 to 52</td>
</tr>
</tbody>
</table>

4.0 GEOLOGIC HAZARDS

We anticipate the primary geologic hazards to be strong ground shaking from earthquakes and the
associated soil liquefaction. As shown in Figure 4, Seismic Safety Map, the site is within Geologic
Hazard Category 31, which is characterized as having high potential for liquefaction due to
“shallow groundwater, major drainages, or hydraulic fills”. Geologic hazards for the site are
described below.

4.1 Strong Ground Motion

The site could be subject to moderate to strong ground shaking from a nearby or more distant,
large magnitude earthquakes occurring during the expected life span of the project. This hazard is
managed by structural design of the buildings per the latest edition of the California Building Code
(CBC, 2016) and California State University requirements. Seismic design parameters are provided
in the Recommendations section.
4.2 **Earthquake Induced Ground Failure**

Potentially liquefiable soils underlie the site. Liquefaction is the sudden loss of soil shear strength within saturated, loose to medium dense, sands and non-plastic silts. Liquefaction is caused by the build-up of pore water pressure during strong ground shaking from an earthquake.

We interpret liquefaction-induced settlement to be the most likely secondary effect to occur given the site surface and subsurface conditions. The secondary effects of liquefaction are sand boils, settlement, and instabilities within sloping ground (lateral spreading, seismic deformation and flow sliding). Associated with earthquake-induced ground failure is seismic compaction, which is the densification of loose to medium dense granular soils that are above groundwater.

4.2.1 **Results of Liquefaction Analyses**

Based on the results of analyses to evaluate the triggering of liquefaction, the potential for liquefaction is widespread throughout the Surficial Soils - Undifferentiated that are below groundwater. Significant variations in the estimated liquefaction-induced settlement occur from differences in the thickness of these soils and the depth to groundwater, which varies with changes in surface elevations. In addition, there are local zones of relatively thick non-liquefiable clayey soils.

Provided below is a summary of the main findings of the analyses.

- Total settlement is estimated to range from 1 to 5 inches.
- The estimates of total settlement could increase by about one-third, ranging from 1.5 to 6.5 inches, depending on the assumptions used in the analyses.
- The estimates of total settlement increase by 0.5 inches using seismic design inputs from expected Building Code revisions (ASCE 7-16: PGAM = 0.58g, Mw = 6.89).
- The largest settlements are estimated to occur within the Campus Expansions and the Residential North areas.

The table below provides estimated total dynamic (liquefaction and seismic compaction) settlement within each development area. A summary of these estimated settlements is also included on Plate 4.

<table>
<thead>
<tr>
<th>Exploration</th>
<th>Location</th>
<th>Thickness of Liquefiable Soils, Feet</th>
<th>Total Settlement, Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-14</td>
<td></td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>B-15</td>
<td>Campus Expansion – Campus Zone</td>
<td>25</td>
<td>4</td>
</tr>
<tr>
<td>B-16</td>
<td></td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>B-17</td>
<td></td>
<td>25</td>
<td>4</td>
</tr>
</tbody>
</table>

The table above provides estimated total dynamic (liquefaction and seismic compaction) settlement within each development area. A summary of these estimated settlements is also included on Plate 4.
## ESTIMATED DYNAMIC SETTLEMENT

<table>
<thead>
<tr>
<th>Exploration</th>
<th>Location</th>
<th>Thickness of Liquefiable Soils, Feet</th>
<th>Total Settlement, Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-27</td>
<td>Campus Expansion – Stadium Zone</td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>S-8</td>
<td></td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td>S-5</td>
<td></td>
<td>25</td>
<td>4</td>
</tr>
<tr>
<td>S-13</td>
<td></td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>B-20</td>
<td>Residential - South</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>B-21</td>
<td></td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>B-23</td>
<td></td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>B-24</td>
<td></td>
<td>25</td>
<td>4</td>
</tr>
<tr>
<td>B-26</td>
<td>Residential - North</td>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td>B-27</td>
<td></td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>B-28</td>
<td></td>
<td>25</td>
<td>3</td>
</tr>
<tr>
<td>B-30</td>
<td></td>
<td>35</td>
<td>3</td>
</tr>
<tr>
<td>B-31</td>
<td>Hotel</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>S-1</td>
<td></td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>S-2</td>
<td></td>
<td>10</td>
<td>2</td>
</tr>
</tbody>
</table>

1. Settlement is the combination of liquefaction-induced and seismic compaction. Estimated magnitude of seismic compaction insignificant.
2. Settlement is a “free-field” estimate that does not consider: a) the shear strain due to foundation loading, b) contribution of ejecta-related settlement and c) the ability of thick non-liquefiable soils above groundwater to attenuate the estimated settlement.

Differential settlement over a horizontal distance of 30 to 40 feet may be estimated to be two-thirds of the total settlement. Consequently, differential settlement in some areas exceed thresholds that allow for conventional shallow foundations, such as 1 to 2 inches over 30 feet for multistory structures and 2 to 4 inches over 30 feet for single story structures (ASCE 7-16, Risk Category III). The thickness of non-liquefiable soils at the surface, removal and recompaction of this material, and the placement of fill could attenuate differential settlement to the extent that conventional shallow foundations could be suitable in some areas for certain structures.

Silt and clay soils should not be susceptible to liquefaction or have the potential to lose shear strength from strong ground shaking considering the plasticity characteristics obtained from Plasticity Index testing (Boulanger and Idriss, 2006; Bray and Sancio, 2006).
4.2.2 Methodology

The liquefaction triggering calculations used Standard Penetration Test data (blow counts per foot) and laboratory test data on the percentage of fines (silt and clay) to obtain the resistance of the soil to liquefaction, as recommended by the NCEER Workshops (Youd and Idriss, 2001) and Boulanger and Idriss (2014). Free-field volumetric settlement was estimated using Tokimatsu and Seed (1987) and Pradel (1998). The analyses adopted the following ASCE 7-10 input parameters:

\[
\begin{align*}
\text{Peak Ground Acceleration (PGA}_M\text{):} & \quad 0.46g \\
\text{Earthquake Magnitude (Mw):} & \quad 6.7 \\
\text{Groundwater Level:} & \quad + 50 \text{ feet NAVD 88}
\end{align*}
\]

The PGA_M was developed using the maximum considered earthquake geometric mean (MCE_C) peak ground acceleration adjusted for Site Class effects obtained from the SEAOC/OSHPD Seismic Design Maps Tool in accordance with the 2016 CBC (as referenced in SEAOC/OSHPD, 2019). The controlling magnitude used in the liquefaction evaluation was selected by reviewing deaggregation results obtained from the USGS Unified Hazard Tool (2018b).

4.3 Landslides and Slope Stability

Based on the relatively flat topography of the site and proximity to nearby hillsides, landslides are not design considerations. Cut and fill slopes planned to form the site should possess adequate surface and overall stability if designed and constructed as recommended in this report.

4.4 Tsunami, Seiche, and Flooding

The site is above the mapped tsunami inundation line and it is outside of the mapped tsunami inundation area (CalEMA et al, 2009). The site is not located below any lakes or confined bodies of water so there is no potential for seiches or earthquake induced flooding. The site is outside of mapped high-risk dam inundation areas on the County of San Diego draft dam failure hazard map (County of San Diego, 2018).

We understand that a Conditional Letter of Map Revision (CLOMR) prepared by others is revising the Federal Emergency Management Agency (FEMA) 100-year floodplain in consideration of site grading and elevations changes.

4.5 Subsidence

Subsidence is customarily associated with long term groundwater extraction. The City of San Diego (City) is assessing the feasibility of developing the Mission Valley groundwater basin as a sustainable source of water (Gillingham Water and CH2M, 2018). The City is considering installing three groundwater extraction wells south and southwest of the Stadium site. The City’s consultants should address the potential for subsidence considering the proposed SDSU MV redevelopment. Group Delta should review the assessment made by the City’s consultant.
5.0 GEOTECHNICAL CONDITIONS

Fill and thick alluvium underlies the Stadium site. We have not differentiated the fill soils from alluvial soils as discussed in Section 3.0 (Geology and Subsurface Conditions). A northeast to southwest trending paleochannel (ancient buried stream or river channel) causes the thickness of these undifferentiated soils to increase from 45 to 55 feet in the northwest portion of the overall site to more than 65 to 75 feet in the southeast portion of the overall site. Formational materials (geologically mapped as Friars Formation) underlie these soils.

The Surficial Soils - Undifferentiated unit is predominately coarse-grained soils with apparent densities that vary from loose to dense with a corresponding variable shear strength and stiffness. However, there are also significant zones of gravel and clay. Relatively thick (ranging from 5 to 20 feet) layers of gravel were encountered near the ground surface, at an intermediate depth, or above the formational material in 14 of the 18 explorations. In addition, a relatively thick (ranging from 5 to 10 feet) layer of clay was observed at an intermediate depth in nine of the 18 explorations. Therefore, for geotechnical engineering purposes we subdivided the Surficial Soils - Undifferentiated into Surface Gravel/Fill, Middle Sand/Fine-Grained Soils, and Basal Gravel to emphasize the distribution of the gravel and clay soils, as summarized below.

- The gravel in the Surface Gravel/Fill is not widespread (encountered in 5 of 18 explorations) and it was observed to range from 10 to 15 feet thick. This gravel was observed mostly in explorations located in the western portion of the site.

- The gravel in the Middle Sand/Fine-Grained Soil is not widespread (encountered in 2 of 18 explorations) and it was observed to range from 5 to 10 feet thick. This gravel was observed mostly in explorations located the western portion of the site. There are also zones of clay (encountered in 8 of 18 explorations) that were observed to be 5 to 10 feet thick.

- The Basal Gravel is found along the bottom of the channels eroded into the underlying formational materials. This gravel is more widespread (encountered in 11 of 18 explorations) and it was observed to be 10 to 20 feet thick.

Note that gravel can possess relatively high shear strength and stiffness relative to the other soils, even with the low apparent densities that may exist within the Surface Gravel/Fill. Overburden stresses and confinement should substantially increase the shear strength and stiffness of the Basal Gravel. However, the amount of gravel, cobbles and boulders, the distribution of these sizes, and their roundness or angularity influences their geotechnical engineering characteristics. Apart from the thickness, the current subsurface data only allows for qualitative, rather than quantitative assessment of these properties.

The formational materials are intermediate geomaterials (informally referred to as soft rock) consisting mostly of sandstone with localized, strongly cemented concretions (sediment that...
hardened into rock) and some thin layers of claystone. We interpret the formational materials to have geotechnical engineering characteristics similar to a very dense sand, or where there is claystone, a clay with a hard consistency, all with a corresponding relatively high shear strength and stiffness.

Plates 2A through 2G, Geologic Cross Sections A-A’ through G-G’ depicts the interpreted subsurface conditions. Figures 6A through D, Parameter Plots, provides Standard Penetration Test blow counts (N, corrected for sampler type only with depth) and the Undrained Shear Strength measures from hand-held Pocket Penetration and Torvane tests.

5.1 Expansive Soils

Laboratory tests indicate the soils in proposed cut and borrow areas should have a “Very Low” to “Medium” Potential Expansion. The results of 17 Expansion Index (EI) tests conducted on bulk soils samples obtained from the surface to a depth of about 5 feet below existing surface levels in the proposed cut and borrow areas ranged from 6 to 75, averaging 40 (Low Potential Expansion) with a median of 36 (Low Potential Expansion). Appendix C provides this data.

5.2 Compressible Soils

Compressible soils underlie the site. Most of these soils are sands and gravels that should settle elastically with the initial fill and structure loading. However, there are local zones of thick clay that should experience some time dependent consolidation settlement. The clay has a medium plasticity and we interpret it to be relatively stiff and slightly overconsolidated from Plasticity Index data. The insitu moisture contents are near the Plastic Limit and the Liquidity Indices are less than 0.7, which indicate relatively stiff and low compressibility soils. Most of the long-term settlement should occur in a relatively short time following initial loading. The zones of clay are usually surrounded by sand, which allows horizontal drainage to more quickly dissipate the excess porewater pressures that develop from loading. However, there are local variations in the estimated duration where this condition does not exist.

Provided below is a summary of the main findings of the analyses.

- Total long-term settlement is estimated to range from 1 to 5.5 inches.
- The estimated duration for settlement to be substantially complete in most areas is 1 to 3 months.
- The largest settlements and durations are estimated to occur within the Campus Expansion – South and the Residential North areas. An anomalously high settlement and duration was estimated using data from boring S-2 within the Hotel area.

The table below provides the estimated settlement and durations where new fill will be placed. A summary of these estimated settlements is also included on Plate 4.
### ESTIMATED STATIC SETTLEMENT

<table>
<thead>
<tr>
<th>Exploration</th>
<th>Location</th>
<th>New Fill Thickness, Feet</th>
<th>Depth to Formation, Feet</th>
<th>Saturated Clay Thickness, Feet</th>
<th>Short-Term Settlement, Inches</th>
<th>Long-Term Settlement, Inches</th>
<th>Duration for Substantial Completion, Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-14</td>
<td>Campus Expansion – Campus Zone</td>
<td>5</td>
<td>26</td>
<td>NA</td>
<td>0.5</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>B-15</td>
<td>Campus Expansion – Campus Zone</td>
<td>5</td>
<td>28</td>
<td>NA</td>
<td>0.5</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>B-16</td>
<td>Campus Expansion – Campus Zone</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CUT</td>
</tr>
<tr>
<td>B-17</td>
<td>Campus Expansion – Campus Zone</td>
<td>5</td>
<td>50</td>
<td>NA</td>
<td>1.0</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>B-27</td>
<td>Campus Expansion – Stadium Zone</td>
<td>5</td>
<td>70</td>
<td>10</td>
<td>1.0</td>
<td>1.0</td>
<td>1 - 3</td>
</tr>
<tr>
<td>S-5</td>
<td>Campus Expansion – Stadium Zone</td>
<td>25</td>
<td>59</td>
<td>10</td>
<td>4.0</td>
<td>5.5</td>
<td>1 - 3</td>
</tr>
<tr>
<td>S-8</td>
<td>Campus Expansion – Stadium Zone</td>
<td>20</td>
<td>73</td>
<td>5</td>
<td>4.0</td>
<td>2.0</td>
<td>0.5 - 1</td>
</tr>
<tr>
<td>S-13</td>
<td>Campus Expansion – Stadium Zone</td>
<td>10</td>
<td>75</td>
<td>NA</td>
<td>2.5</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>B-20</td>
<td>Residential – South</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CUT</td>
</tr>
<tr>
<td>B-21</td>
<td>Residential – South</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CUT</td>
</tr>
<tr>
<td>B-22</td>
<td>Residential – South</td>
<td>10</td>
<td>40</td>
<td>NA</td>
<td>1.0</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>B-24</td>
<td>Residential – South</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CUT</td>
</tr>
<tr>
<td>B-26</td>
<td>Residential – North</td>
<td>10</td>
<td>48</td>
<td>NA</td>
<td>1.5</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>B-27</td>
<td>Residential – North</td>
<td>5</td>
<td>70</td>
<td>10</td>
<td>1.0</td>
<td>1.0</td>
<td>1 – 3</td>
</tr>
<tr>
<td>B-28</td>
<td>Residential – North</td>
<td>10</td>
<td>52</td>
<td>10</td>
<td>1.5</td>
<td>3.5</td>
<td>4 – 12</td>
</tr>
<tr>
<td>B-30</td>
<td>Residential – North</td>
<td>15</td>
<td>54</td>
<td>NA</td>
<td>2.5</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>B-31</td>
<td>Hotel</td>
<td>5</td>
<td>61</td>
<td>10</td>
<td>1.0</td>
<td>1.0</td>
<td>1 – 3</td>
</tr>
<tr>
<td>S-1</td>
<td>Hotel</td>
<td>5</td>
<td>57</td>
<td>NA</td>
<td>1.0</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>S-2</td>
<td>Hotel</td>
<td>20</td>
<td>43</td>
<td>15</td>
<td>2.0</td>
<td>4.5</td>
<td>8 - 24</td>
</tr>
</tbody>
</table>

The assessment of settlement and duration is based on engineering analyses using data obtained from widely spaced explorations, where subsurface conditions could vary significantly across the site. Due to these uncertainties, the estimated settlement and duration could vary across relatively short distances.

Note also that higher long-term settlement was estimated in the Stadium site when compared to the Site Development area, and the extent of this possible trend of higher potential settlement to
the east is not known. Much of the Site Development area to east was inaccessible for subsurface exploration due the SDCCU stadium that occupies about 20 acres of the overall 170-acre site. The eastern margin of a north to south trending paleochannel underlies the stadium.

Settlement analyses were conducted using the soil profiles and groundwater conditions encountered in the recent explorations and laboratory test data. The settlement magnitude and areal distribution was estimated with conventional elastic and consolidation soil mechanics methods that used SPT correlations to elastic modulus and index property correlations to consolidation parameters.

Settlement monitoring is recommended to confirm these estimates and to plan the timing for construction of settlement sensitive improvements.

### 5.3 Reactive Soils

Thirteen suites of corrosion tests were completed on bulk soil samples obtained from proposed cut and borrow areas. Appendix C provides the test results.

To assess the sulfate exposure of concrete in contact with the site soils, samples were tested for water-soluble sulfate content. The test results suggest the site soils have a negligible potential for sulfate attack based on commonly accepted criteria. The sulfate content of the finish grade soils should be established at the completion of earthwork.

The pH, resistivity and chloride contents were estimated to assess the reactivity of the site soils with buried metals. The test results suggest the on-site soils are moderately corrosive to very corrosive to buried metals. A Corrosion Consultant should be contacted for specific recommendations.

### 5.4 Reuse of Onsite Soils

Most of the soils from proposed cut and borrow areas at the site should be sand, sand and gravel and gravel that should require minimal processing and generally possess good geotechnical engineering characteristics when used for fill. The On-Site Soils and Materials Management section provide recommendations for processing.

### 5.5 Storm Water Infiltration

Based on the preliminary test results in the table below, the site should support a partial infiltration condition. However, the storm water BMP design will need to consider:

- The depth to groundwater and potential for mounding;
- The potential for future groundwater pumping for the Pure Water San Diego project;
- The potential for flooding at the site, which could inundate the proposed basins;
- Other factors or conditions that arise as the project design develops.
SUMMARY OF PRELIMINARY INFILTRATION TEST RESULTS

<table>
<thead>
<tr>
<th>Test No. (Exploration No.)</th>
<th>Test Method</th>
<th>Corrected Percolation Rate, inches/hour</th>
<th>Unfactored Infiltration Rate, inches/hour</th>
<th>Factored Infiltration Rate, inches/hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-1 (B-19)</td>
<td>Borehole Percolation</td>
<td>0.20</td>
<td>0.02</td>
<td>0.01</td>
</tr>
<tr>
<td>I-2 (B-32)</td>
<td>Borehole Percolation</td>
<td>13.5</td>
<td>1.1</td>
<td>0.49</td>
</tr>
<tr>
<td>I-3 (B-29)</td>
<td>Borehole Percolation</td>
<td>9.9</td>
<td>0.79</td>
<td>0.34</td>
</tr>
</tbody>
</table>

If remedial grading results in different soil conditions in the proposed infiltration zones, further testing may be warranted. The results should only be considered valid for the design assumptions used for testing, including the location and elevation of the soils tested, and the amount of pressure head in the test. The test results performed at this time are preliminary, and final design of the infiltration basins may require additional field testing and exploration in accordance with the applicable Design Manual and/or comments from the governing agency. These results may not be applicable if significant changes to the design occur.

Our field testing considers the guidance provided in the City of San Diego Storm Water Standards (City of San Diego, 2018; referred to as the Design Manual). The Borehole Percolation Test method was performed in general accordance with the Design Manual to approximate infiltration rates of the soils near the proposed infiltration basins. The preliminary testing was conducted at a depth of ranging from 2½ to 5 feet below existing surface levels to approximate the likely infiltration zone above the groundwater table. The factor of safety applied for planning phase feasibility screening is two. A temperature correction factor is also used to account for the difference in water viscosity of rain water (assumed to be 50°F) and the test water (measured to be approximately 60°F).
6.0 CONCLUSIONS

In our opinion, the grading and civil works for the Site Development will need to manage the substantial geotechnical variability observed in the subsurface materials. In addition, the Site Development construction should consider mitigation of static and dynamic settlement to economically manage the low gradient and settlement tolerances of gravity fed utilities and to facilitate the construction of the structures for the Full Build Out.

The site is within a broad east-west trending valley that is part of the San Diego River floodplain and it is located at the confluence of the large Murphy Canyon drainage basin. Consequently, geologically young alluvial soils with variable physical characteristics have filled the valley and there is shallow groundwater. The thickness of these soils can fluctuate substantially across the site. Prior episodes of fill placement and quarrying operations in local areas adds to this variability. Competent geotechnical materials occur at depths ranging from 25 to 80 feet. Specific conclusions are provided below.

- The soils in the Surficial Soils - Undifferentiated unit consist mostly of sand with significant zones of gravel and clay. A north to south trending paleochannel causes large variations of the thickness of this unit at the margins of the channel. The gravel is pervasive while the clay occurs locally. Sandstone with local concretions and thin layers of claystone are below these soils.

- The soils in the Surficial Soils - Undifferentiated unit are mostly coarse-grained with apparent densities that vary from loose to dense with a corresponding variable soil shear strength and stiffness. When excavated, these materials should generally be a good source of fill. There may be some processing of wet soils.

- Gravels within the Surficial Soils - Undifferentiated unit have a higher shear strength and stiffness compared to the other soils. The gravels are resistant to the installation of ground improvement columns and piles, but they provide a high geotechnical resistance. When excavated, they should be a good source of fill with some processing of oversize material.

- There are local zones of thick clay that will experience time dependent settlement that exceeds thresholds that would allow for shallow foundations. Most of the settlement should occur in a relatively short time following initial loading. However, there are local variations where the estimated duration could impact the construction schedule.

- The potential for liquefaction is widespread and there are significant variations in the estimated liquefaction-induced settlement. Consequently, differential settlement is likely to exceed thresholds that would allow for shallow foundations.

- Groundwater will influence deep construction activities, such as CIDH piling and installation of deeper underground utilities. It may also need to be managed during construction of the underground parking for the Campus Expansion – Campus Zones since it was measured to be about 15 feet below the deepest cut.

- New and existing underground utilities below new fill will experience time dependent settlement locally depending on the timing of their installation following grading.
7.0 RECOMMENDATIONS

The remainder of this report presents recommendations for earthwork and the design and construction of the proposed improvements. These recommendations are based on empirical and analytical methods typical of the standards of practice in southern California and San Diego area construction methods and practice. They are provided for preliminary design and may need to be updated for design development, the results of field testing (e.g., pile load testing) or actual subsurface conditions encountered during construction. If these recommendations do not address a specific feature of the project, please contact Group Delta for additions or revisions.

7.1 General

7.1.1 Design Groundwater Level

We preliminarily recommend a design groundwater level of 3 feet higher than the groundwater elevation shown on Plate 3, which is estimated to range between +44 to +52 feet.

Note that changes in rainfall, irrigation, site drainage may produce seepage or perched groundwater at any location within the Surficial Soils - Undifferentiated underlying the site. Such conditions are difficult to predict and are typically mitigated if and where they occur.

7.1.2 Seismic Design

Seismic design parameters should be evaluated by the Structural Engineer per the California State University Seismic Design Requirements (CSU, 2016). For reference, seismic design parameters were also developed in accordance with the 2016 CBC and ASCE 7-10 using the online SEAOC/OSHPD Seismic Design Maps tool (SEAOC/OSHPD, 2019). They are based on: 1) an estimated average shear wave velocity \( V_{s30} \) of about 900 feet per second, 2) an assumed structure fundamental period of less than 0.5 seconds and 3) Risk Category = III (Populous, 2018). Our office should be contacted if the structure fundamental period is 0.5 seconds or greater, as the applicable classification would be Site Class F per Section 20.3.1 of ASCE 7-10 due to the liquefiable soils at the site, which requires site-specific ground motion analysis. The table below provides the parameters.

### 2016 CBC SEISMIC DESIGN PARAMETERS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Class</td>
<td>D*</td>
</tr>
<tr>
<td>MCE(_s) Spectral Response Acceleration for Short Periods, ( S_s )</td>
<td>1.017 g</td>
</tr>
<tr>
<td>MCE(_s) Spectral Response Acceleration at 1-second Period, ( S_1 )</td>
<td>0.390 g</td>
</tr>
<tr>
<td>Site Coefficient ( F_a )</td>
<td>1.093</td>
</tr>
<tr>
<td>Site Coefficient ( F_v )</td>
<td>1.621</td>
</tr>
</tbody>
</table>
### 2016 CBC SEISMIC DESIGN PARAMETERS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latitude: 32.7843°N Longitude: 117.1224°W</td>
<td></td>
</tr>
<tr>
<td>Adjusted MCE&lt;sub&gt;r&lt;/sub&gt; Spectral Response Acceleration at Short Periods, S&lt;sub&gt;M5&lt;/sub&gt;</td>
<td>1.112 g</td>
</tr>
<tr>
<td>Adjusted MCE&lt;sub&gt;r&lt;/sub&gt; Spectral Response Acceleration at 1-second Period, S&lt;sub&gt;M1&lt;/sub&gt;</td>
<td>0.632 g</td>
</tr>
<tr>
<td>Design Spectral Response Acceleration at Short Periods, S&lt;sub&gt;D5&lt;/sub&gt;</td>
<td>0.741 g</td>
</tr>
<tr>
<td>Design Spectral Response Acceleration at 1-second Period, S&lt;sub&gt;D1&lt;/sub&gt;</td>
<td>0.421 g</td>
</tr>
<tr>
<td>MCE Geometric Mean Peak Ground Acceleration, PGA&lt;sub&gt;M&lt;/sub&gt;</td>
<td>0.456 g</td>
</tr>
</tbody>
</table>

*Assumes structure fundamental period is 0.5 seconds or less. Subject to change for longer structure periods.

#### 7.1.3 Surface Drainage

Foundation and slab performance depend on how well surface runoff drains from the site. The ground surface should be graded so that water flows rapidly away from the structures and tops of slopes without ponding. The surface gradient needed to achieve this may depend on the planned landscaping. Planters should be built so that water will not seep into the foundation, slab, or pavement areas. If roof drains are used, the drainage should be channeled by pipe to storm drains or discharged 10 feet or more from buildings. Irrigation should be limited to that needed to sustain landscaping. Excessive irrigation, surface water, water line breaks, or rainfall may cause perched groundwater to develop within the underlying soil.

#### 7.2 Ground Improvement

##### 7.2.1 Purpose and Need

Ground improvement could reduce static and dynamic settlement to economically facilitate construction of the structures for the Full Build Out and mitigate potentially adverse settlement of utilities. Group improvement is typically completed within the footprint of the more lightly loaded buildings to reduce settlement or within the footprint of the heavier loaded to reduce liquefaction-induced loads on the piling used to support these structures. Ground improvement can also be completed to protect Lifelines, which are structures that are critical for communities and must remain operational following an earthquake. They are typically selected major roadways, inflexible essential pipelines, powerlines and communications facilities.

The purposes of ground improvement are to increase the allowable bearing pressure and to reduce the static and dynamic (liquefaction-induced) settlement. The improved ground will often support allowable bearing pressures up to 4,000 pounds per square foot (psf) and provide settlement tolerances ranging from ½ to 1 inch over a horizontal distance of 30 to 40 feet.

The following types of ground improvement may be suitable considering the subsurface conditions at the site.
• Deep Dynamic Compaction  
• Vibro-Replacement  
• Deep Soil Mixing  
• Vertical Drains

Note the variability of the soil physical characteristics, the pervasive gravel, and the observation of the mineral mica and its corresponding structure in the soil can complicate the use of these methods at the site. Therefore, an evaluation of their applicability should consider the following factors:

• Schedule and cost implications associated with a pilot study program with a large upfront equipment mobilization fee.
• Additional evaluation and design period following the pilot study program.
• Difficulty conducting pre-and post-improvement subsurface exploration for quality control where there are pervasive gravels.
• Additional construction costs associated with penetrating through pervasive gravels.

The following sections provide additional discussions of the above ground improvement methods. There is a summary evaluation of their effectiveness at this site, followed by details regarding the specifics of each of the methods. Note Vertical Drains are included mainly to decrease the duration of the time-dependent settlement, or as a secondary measure to increase the effectiveness of the other methods.

### 7.2.2 Summary Assessment of Effectiveness

To assess the effectiveness of these methods, Group Delta undertook a matrix evaluation of the geotechnical conditions at the locations of 26 subsurface explorations. The evaluation focused on conditions observed in the explorations, such as: a) the depth and thickness of potentially liquefiable soils; b) the depth and thickness of gravel, and c) the depth, thickness and saturation of the clay, that could hinder the various methods of ground improvement in mitigating liquefaction-induced settlement.

Provided below is a summary of the evaluation of the effectiveness of Deep Dynamic Compaction (DDC) in terms of Potentially, Marginal and Ineffective:

• Potentially effective at 25% of the locations, mostly in the eastern portion of Residential site.
• Marginally effective at 45% of the locations, mostly in Stadium site (improvement mainly needed in eastern portion of this site).
• Ineffective at 30% of the locations, mostly in Hotel and southern portions of the Campus Extension – Campus and Residential sites.
Since the “Marginally Effective to Ineffective” rankings predominated, this evaluation also indicates the need for a carefully thought out and planned pilot study program to further assess the effectiveness of DDC within the marginally effective areas, along with its ability to manage and consistently improve the soil (i.e., meet performance objectives) given the variability of subsurface conditions interpreted at the site. An additional method of ground improvement may need to be planned for and used where DDC does not entirely meet the performance objectives. FHWA (2017) reports that DDC has been combined with Aggregate Columns (stone columns and rammed aggregate piers).

Vibro-Replacement and Deep Soil Mixing should be feasible to mitigate liquefaction. However, the gravels could substantially impede installation of these methods. Since this is a constructability concern, further feasibility evaluation should include preliminary consultation with reputable geotechnical contractors that specialize in the methods of these methods of ground improvement.

If feasible, the Geotechnical and Structural Engineer will develop a performance specification for design by a specialist geotechnical contractor. The design is often further evaluated by pilot studies along with pre-and post-improvement subsurface exploration (typically Cone Penetration Testing), which is also used for production ground improvement quality control.

### 7.2.3 Deep Dynamic Compaction

Deep Dynamic Compaction (DDC) uses a crane to drop a static weight from a defined height in a grid pattern over the treatment area to improve soils to a depth ranging from 10 to 35 feet. There is typically more than one pass of compaction over the treatment area to improve the deeper zones first. The design develops the static weight and drop height to determine the applied energy needed to increase the apparent density of the soils to meet the performance objectives.

This method is mostly suitable for coarse grained soils (fines content less 15%) that are not saturated (depth to groundwater is 6 feet or more) and possess a relatively high permeability (SHRP2, 2012). DDC can produce unacceptable levels of noise and vibration and therefore it has not been used in urban areas of San Diego.

### 7.2.4 Vibro-Replacement

Vibro-Replacement systems install “stone columns” that are typically 24 to 36 inches in diameter and filled with compacted gravel, spaced at 6 to 10 feet (center to center) and installed uniformly over the entire treatment area to depths ranging from 30 to 50 feet. The design uses an area replacement ratio over a treatment area and depth to meet the required performance objectives.

This method is suitable for coarse grained soils that are saturated that do not have thick gravel, cobble or boulder obstructions. It has commonly been used to mitigate liquefaction in San Diego. However, the extensive gravels at the site would require predrilling that could substantially
increase the cost. Micaceous soils encountered in our some of our explorations may also reduce the effectiveness of this method.

### 7.2.5 Deep Soil Mixing

Deep Soil Mixing (DSM) mixes a binder (typically cement) with the soils to create a column or panel (an element) with increased shear strength and stiffness and reduced compressibility. Typically, the elements overlap to create a block or cellular structure in the ground that uniformly improves a large volume of soil supporting a foundation or creates cellular structures that confine the soil to mitigate the potential for liquefaction. The design uses an area replacement ratio over a treatment area and depth to meet the required performance objectives.

The method is suitable for most soil types that are saturated and do not have thick gravel, cobble or boulder obstructions. The cross-sectional area and depth of the element is a function of the equipment used and the area replacement ratio. This method has recently been used to mitigate liquefaction in San Diego. The extensive gravels at the site could preclude this method entirely or substantially increase installation costs, which could also limit using this method.

### 7.2.6 Vertical Drains

Vertical drains may be prefabricated and pushed in the ground with a mandrel or be corrugated pipe installed with a vibrating mandrel. They are installed in triangular or gird patterns with a horizontal spacing ranging from 3 to 8 feet. They can: a) increase the effectiveness of DDC and Vibro-Replacement methods in certain soil types, b) partially mitigate the shear strength loss associated with liquefaction and/or c) decrease the duration for substantial completion of long-term settlement by providing a drainage path to more quickly dissipate the excess porewater pressures that develop from dynamic and static loading.

### 7.3 Earthwork

Earthwork should be conducted per applicable requirements of The California State University, the current California Building Code and the project specifications. This report provides the following recommendations for specific aspects of earthwork, which may need to be revised based on the conditions observed during construction.

#### 7.3.1 Site Preparation

General site preparation should begin with the removal of deleterious materials and demolition debris from the site, such as asphalt pavements, concrete slabs and pavements, existing structures, remnant foundations, landscaping and topsoil and any expansive (EI>50) located within 36 inches of the planned finished subgrade elevations. Areas disturbed by demolition should be restored with a subgrade that is stabilized to the satisfaction of the Geotechnical Engineer.
Existing subsurface utilities that will be abandoned should be removed and the excavations backfilled and compacted as described in the Fill Compaction section. Alternatively, abandoned pipes may be grouted using a two-sack sand-cement slurry under the observation of the Geotechnical Engineer.

Areas to receive fill should be scarified 12 inches and recompacted to 90 percent of the maximum dry density based on ASTM D1557. In areas of saturated or “pumping” subgrade, a geogrid such as Tensar BX-1200, Terragrid RX1200 or Mirafi BXG120 may be placed directly on the excavation bottom, and then covered with at least 12 inches of ¾-inch Aggregate Base (AB). Once the subgrade is firm enough to attain compaction within the AB, the remainder of the excavation may be backfilled. It may be necessary to place additional AB to stabilize the subgrade sufficiently to place fill.

### 7.3.2 Remedial Grading

For planning purposes, we recommend removing the existing soils to a depth of 2 feet below existing surface levels (following removal of asphalt paving) across the site to provide a uniform surface for additional fill placement, a uniform fill surface in cut areas and to allow for observation of unsuitable soils (clayey, wet, loose) in the exposed subgrade. Plate 5, Remedial Grading Exhibit, illustrates this recommendation. The recommendation does not consider the following factors that could increase the depth of the remedial grading:

- Some areas may require additional remedial grading based on demolition activities.
- The period of placement for the existing fill (1960s) and the lack of documentation regarding placement may increase its physical variability and consequently increase the need for remedial grading.
- The variability inherent in native subgrades where there may be loose and/or soft areas.
- The findings from additional subsurface exploration and/or observations by the Geotechnical Engineer during earthwork.
- The residential development building areas may require additional remedial grading depending on final product and foundation designs.
- Planned hardscape, graded paths, pavements, concrete slabs, and structural improvements in the park sites could require some remedial grading for subgrade preparation.

The fill may be recompacted provided it is processed as recommended in the On-Site Soils and Materials Management section.

### 7.3.3 Fill Compaction

All fill and backfill should be placed at slightly above optimum moisture content using equipment that can produce a uniformly compacted product. The loose lift thickness should be 8 inches, unless performance observed and testing during earthwork indicates a thinner loose lift is needed, or a thicker loose lift is possible, up to a loose lift thickness of 12 inches. The recommended relative compaction is 90 percent or more, or 95 percent or more where specified, of the
maximum dry density based on ASTM D1557.

A two-sack sand and cement slurry may also be used for structural fill as an alternative to compacted soil. It has been our experience that slurry is often useful in confined areas which may be difficult to access with typical compaction equipment. Samples of the slurry should be fabricated and tested for compressive strength during construction. A 28-day compressive strength of 100 pounds per square inch (psi) or more is recommended for the sand and cement slurry. Gravel (¾-inch) completely wrapped in filter fabric (Mirafi 140N, or approved equivalent) may also be used as backfill in confined areas.

7.3.4 On-Site Soils and Materials Management

The following existing soils and materials are available for processing and reuse.

- Soil
- Asphalt Concrete (AC)
- Portland Cement Concrete (PCC)

The following sections provide recommendations for processing and reuse as fill.

7.3.4.1 Soil

Most of the existing soils above groundwater should be suitable for reuse. They should be processed to produce fill soil with a well graded particle distribution with a suitable moisture content for compaction. Some processing of wet soils should be anticipated. Soil with an EI > 50 should be removed and disposed of offsite. Rocks or concrete fragments greater than 3 inches in maximum dimension should not be reused. They could be stockpiled on site for processing as part of the stadium demolition.

7.3.4.2 Asphalt Concrete

Existing AC should be crushed to less than 1 inch in maximum dimension and blended with approved fill soils. Existing AC can be recycled, reprocessed, and reused as a base course for new AC paving. City of San Diego personnel have anecdotally observed paving fabric in portions of the AC. We did not observe this fabric in the explorations.

7.3.4.3 Portland Cement Concrete

Concrete may be crushed to less than 1 inch in maximum dimension for use as fill. It should be added to other soils to create a well graded fill material. Reinforcing steel should be removed prior to crushing the concrete. Properly crushed concrete will often meet the gradation and quality criteria from Section 200-2.4 of the Standard Specifications for Public Works Construction for use as Crushed Miscellaneous Base (CMB).

7.3.5 Import Soil

The project proposes to import approximately 315,000 CY of soil for use as fill. Imported fill sources should be observed and tested by the Geotechnical Engineer prior to hauling onto the site to determine the suitability for use. Imported soil for common fill should consist of granular soil.
that is free of organic materials, with an Expansion Index less than 50 based on ASTM D4829, and a
gradation that meets the criteria shown in the table below.

### RECOMMENDED GRADATION FOR IMPORT SOIL

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>(% Passing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 inches</td>
<td>100</td>
</tr>
<tr>
<td>3/4 inch</td>
<td>100 - 80</td>
</tr>
<tr>
<td>No. 4</td>
<td>100 - 65</td>
</tr>
<tr>
<td>No. 200</td>
<td>0 - 35</td>
</tr>
</tbody>
</table>

Soils should also have a minimum resistivity value greater than 1,000 ohm-centimeters, chloride
content of less than 500 ppm and sulfate content of less than 1,000 ppm and pH greater than 5.5.

Additional testing per the guidelines provided by the Department of Toxic Substances Control
(DTSC, 2001) is required by the Owner prior to accepting soil for import. Test results should meet
the most stringent State and Federal residential screening levels including the most up-to-date
DTSC-Modified Screening Levels (DTSC-SLs) and United States Environmental Protection Agency
Regional Screening Level (RSL).

During earthwork, soil types may be encountered by the Contractor that do not appear to conform
to those discussed within this report. The Geotechnical Engineer should evaluate the suitability of
these soils for their proposed use.

For each proposed fill source, the Contractor should provide a submittal to the Geotechnical
Engineer demonstrating the proposed site and materials meet the geotechnical and environmental
guidelines for import. Prior to import of the proposed materials, samples of all proposed import
should be tested by the Geotechnical Engineer to evaluate the suitability of these soils for their
proposed use. The following screening tests should be performed for every 1,000 cubic yards of
import, with a minimum of two sets of screening tests for each proposed import site.

- Particle Size Distribution (ASTM D6913)
- Maximum Density (ASTM D1557)
- Expansion Index (ASTM D4829)
- Sulfate Content (ASTM D516)
- Chloride Content (ASTM D512)
- pH & Resistivity (CT 643)

If a long-term, steady source of import material is utilized that consistently meets the import soil
recommendations described above, the import material testing frequency may be reduced at the
discretion of the Geotechnical Engineer and SDSU.
7.3.6 Cut and Fill Slope Construction

Cut and fill slopes should be formed at inclinations no steeper than 2:1 (horizontal to vertical). Fill slopes above cut slopes or natural slopes with gradient steeper than 5:1 should be formed with a keyway at the base and benches into competent materials as fill is placed according to the following dimensions, or as recommended by the Geotechnical Engineer.

- Minimum width of keyway should be 15 feet.
- Base of the keyway should tilt back 2 percent, or a minimum of 1 vertical foot.
- Minimum depth and height for benches should be 4 feet.
- Minimum horizontal thickness of the fill from the face to the forward edge of the bench should be 10 feet.

The face of fill slopes should be thoroughly compacted and tested for in-place density after each 4-foot increase in slope height. When finished pad grade is achieved, the face of the fill slope should be further compacted along a vertical grid that overlaps with appropriate equipment, such as a cable-lowered “sheepsfoot” pad roller, or similar.

7.3.7 Grading Factors

Fill soils derived from cut areas should consist of a heterogeneous mixture of sand, gravel and clay. The grading factors (shrinkage or swell) of these materials will also vary from their in-situ to compacted condition. We estimate soils derived from onsite excavations and cuts that are ultimately placed as compacted fill (at 90 to 95 percent relative compaction per ASTM D1557) will have a net shrink of about five to ten percent by volume. Existing fill soils near the ground surface that are moderately to well compacted should have a grading factor of about 1 (plus or minus five percent shrink/swell).

7.4 Asphalt Concrete Pavements

New interior streets will be 6-Lane Major, 4-Lane Major and 2-Lane Collectors with Traffic Indices of 9.0, 10.5 and 11.0 that are covered with asphalt concrete pavement and constructed according to City of San Diego Standard Drawings, Schedule J, Pavement Design Standards. Temporary surface parking covered with asphalt concrete or gravel is planned for Opening Day in areas north, west and south of the Stadium.

An R-Value of 20 should be assumed for preliminary assessment of Asphalt Concrete surfaced pavements or landscaping type of surfaces. Based on our review of the available geotechnical information, the subgrade R-Value within the upper 36 inches of subgrade could range from 20 to 40 or more, assuming some selective placement of fill to from the subgrade. The design subgrade R-Value should be confirmed by R-Value testing of the actual pavement subgrade soils during fine grading operations within the pavement areas.
Schedule J provides the standard sections for the range of subgrade R-Values for Traffic Indices representative of the planned streets and surface parking. Alternative pavement sections designed in accordance with the Caltrans Design Method, Topic 633.1 (Caltrans, 2018b) that use aggregate base rather than the cement treated base used in the Schedule J are summarized in the table below. A 20-year pavement design life was assumed for the analyses.

<table>
<thead>
<tr>
<th>Traffic Index</th>
<th>Asphalt Section</th>
<th>Base Section (R-Value ~20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.0</td>
<td>5 Inches</td>
<td>17 Inches</td>
</tr>
<tr>
<td>10.5</td>
<td>7 Inches</td>
<td>20 Inches</td>
</tr>
<tr>
<td>11.0</td>
<td>7 Inches</td>
<td>22 Inches</td>
</tr>
</tbody>
</table>

7.5 Underground Utilities

Civil site works include new sewer (8- to 18-inch diameter PVC and temporary 30-inch CMP), storm drain (18- to 36-inch diameter RCP), water and fireline (12-inch diameter), and dry utilities. Gravity flow utilities mostly have a minimum gradient of 0.5 percent. The following sections provide preliminary geotechnical recommendations for design and construction.

7.5.1 Settlement

New and existing underground utilities below new fill will experience time dependent consolidation settlement depending on the timing of their installation following grading. Some form of mitigation will be needed if the utility cannot tolerate the total and differential settlement estimated in the Compressible Soils section. Mitigation could be delaying the installation until the settlement is substantially complete, preloading the utility alignment area (prior to utility installation) with a fill surcharge or the various forms of Ground improvement discussed in this report.

7.5.2 Soil Loads

A soil unit weight of 130 pounds per cubic (pcf) may be used to evaluate soil loads for pipe above groundwater. The permissible depth of cover should be checked were new fill will be placed over underground utilities that will remain.

7.5.3 Thrust Blocks

Lateral resistance for thrust blocks may be determined by a passive pressure value of 200 pounds per square foot (psf) per foot of embedment, assuming a triangular distribution. This value may be used for thrust blocks embedded into the soils in the Surficial Soils - Undifferentiated unit described in this report that are above groundwater.
7.5.4 Modulus of Soil Reaction

The modulus of soil reaction (E’) is used to characterize the stiffness of soil backfill placed along the sides of buried flexible pipelines. To evaluate deflection due to the load associated with trench backfill over the pipe, we recommend using 1,000 pounds per square inch (psi) assuming granular bedding material is placed around the pipe.

7.5.5 Pipe Bedding

Typical pipe bedding as specified in the Standard Specifications for Public Works Construction or City of San Diego Standard Drawings may be used. We recommend using a filter fabric separator (such as Mirafi 140N or an approved similar product) between the soil and open graded rock used for bedding and/or backfill where the alignment is within roadways or near settlement sensitive improvements. The use of a filter fabric separator may be waived by the Geotechnical Engineer based on site specific soil conditions observed in the trench excavation.

7.5.6 Existing Utilities

The permissible depth of cover and settlement tolerances should be checked were new fill will be placed over underground utilities that will remain, particularly the existing fuel pipeline that is 3 feet deep in the eastern portion of the site. The permissible depth of cover and settlement tolerances for construction traffic and equipment loads should also be evaluated.

8.0 CONSTRUCTION CONSIDERATIONS

Construction of the project will need to manage substantial variability within the subsurface materials. Summarized below are the primary geotechnical-related construction considerations known at this time.

- The materials encountered in construction excavations could vary significantly across the site. Excavations should be prepared to encounter thick layers of gravel and cohesionless soils that are prone to caving and/or sloughing.

- Subgrade stabilization may be needed anywhere in the project area. The Contractor should anticipate the need for stabilization of the subgrade using geotextiles or gravel as recommended in the Site Preparation section of this report.

- Settlement monuments should be installed in all fill areas where construction needs to be delayed. Settlement instrumentation and monitoring can be conducted per the latest version of California Test Method 112 (Caltrans, 2012). Figures 7A and 7B (to follow), Settlement Monument Details – Surface Monument and Riser Plate provide details for the instrumentation.
• The variability of the soil physical characteristics, the pervasive gravel, and the observation of the mineral mica and its corresponding structure in the soil can complicate the use of ground improvement at the site, as outlined in the Ground Improvement section of this report.

• Existing piles obstruct underground construction, such as ground improvement and new piling within the footprint of the SDCCU stadium.

• Shallow fuel lines in the eastern portion of the overall site may need to be protected from construction traffic and new fill loads.

9.0 LIMITATIONS

The recommendations in this report are preliminary and subject to revision from changes that occur during design development or from the results of field testing or actual subsurface conditions encountered during construction. Group Delta needs to continue to be part of the project design and construction for these recommendations to remain valid. If another geotechnical consultant provides these services, they should prepare a letter indicating their intent to assume the responsibilities of the project Geotechnical Engineer-of-Record. This letter should also indicate their concurrence with the recommendations in the report or revise them as needed to assume the role of the project Geotechnical Engineer-of-Record.

This report was prepared using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in similar localities. No warranty, express or implied, is made as to the conclusions and professional opinions included in this report.

The findings of this report are valid as of the present date. However, changes in the condition of a property can occur with the passage of time, whether due to natural processes or the work of humans on this or adjacent properties. In addition, changes in applicable or appropriate standards of practice may occur from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.
10.0 REFERENCES


American Concrete Institute (2015). ACI 302.1R-15 Guide for Concrete Floor and Slab Construction.

American Concrete Institute (2006). ACI 360-06 Design of Slabs-on-Ground.


Boulanger, R.W. and Idriss, I.M. (2014). CPT and SPT Based Liquefaction Triggering Procedures, Center for Geotechnical Modeling, Department of Civil & Environmental Engineering, College of Engineering, University of California at Davis, Report No. UCD/CGM-14/01, dated April.


[https://www.dir.ca.gov/title8/1541_1.html](https://www.dir.ca.gov/title8/1541_1.html)


[https://www.sandiegocounty.gov/oes/docs/DRAFT_COSD_DamFailure1.pdf](https://www.sandiegocounty.gov/oes/docs/DRAFT_COSD_DamFailure1.pdf)


Rick Engineering Company (2019a). *San Diego State University Mission Valley, 100% DD Site Development*, April 29.


United States Geological Survey (USGS, 2018a). *7.5-Minute Series Topographic Maps, La Jolla, La Mesa, Point Loma and National City Quadrangles*, Scale 1:24,000.


FIGURES
FIGURE NUMBER: 1
PROJECT NUMBER: SD605
SITE LOCATION

REFERENCE: LA JOLLA, LA MESA, POINT LOMA AND NATIONAL CITY 7.5 MINUTE UAD (USGS, 2018)

SDSU MISSION VALLEY
SAN DIEGO, CALIFORNIA
Geologic Hazard Categories

**FAULT ZONES**
- 12 Potentially Active, Inactive, Presumed Inactive, or Activity Unknown

**SLIDE-PRONE FORMATIONS**
- 23 Friars: neutral or favorable geologic structure

**LIQUEFACTION**
- 31 High Potential — shallow groundwater major drainages, hydraulic fills
- 32 Low Potential — fluctuating groundwater minor drainages

**OTHER TERRAIN**
- 52 Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk
- 53 Level or sloping terrain, unfavorable geologic structure, Low to moderate risk

**Water (Bays and Lakes)**

**FAULTS**
- Fault
- Inferred Fault
- Concealed Fault
- Shear Zone

REFERENCE: CITY OF SAN DIEGO SEISMIC SAFETY STUDY GEOLOGIC HAZARDS AND FAULTS, 04/03/2008

SDSU MISSION VALLEY
SAN DIEGO, CALIFORNIA

SEISMIC SAFETY MAP

PROJECT NUMBER: SD605
FIGURE NUMBER: 4
UNDIFFERENTIATED SURFICIAL SOILS

Elevation (feet, NAVD 88)

N$_{SPT}$ (blows/foot)

BORING NO.
- B-14
- B-15
- B-16
- B-17
- B-18
- B-20
- B-21
- B-22
- B-23
- B-24
- B-25
- B-26
- B-27
- B-28
- B-30
- B-31

PARAMETER PLOTS
EXPLANATION

- SCPT-13: Approximate location of Seismic Cone Penetration Test
- CPT-31: Approximate location of Cone Penetration Test
- B-13: Approximate location of Aztec Stadium Geotechnical Boring
- B-17: Approximate location of Site Development Geotechnical Boring
- RW-111/R-81AD: Approximate location of previous environmental boring or monitoring well data used in this report (all borings/wells not included)
- B-32: Approximate location of infiltration test boring
- G, G': Approximate location and letter designation of geologic cross section
- S, S': Surficial soils - undifferentiated

REFERENCE: Topo map and overall site, provided by Rick Engineering, 03/04/2019

SDSU Mission Valley
San Diego, California
Geotechnical Map
APPROXIMATE REMEDIAL GRADING QUANTITIES

ESTIMATED LIMITS OF 2 FOOT REMEDIAL EXCAVATION = 5,364,993 SF (397,406 CY)
APPENDIX A

PREVIOUS BORING RECORDS
LOG OF BORING HP-53

PROJECT NO.: 51-5890-00
PROJECT NAME: MISSION VALLEY TERMINAL
LOCATION: Western Portion of Site Maintenance Yard
DRILLING METHOD: Hollow Stem Auger
DRILLING EQUIPMENT: CME-85
SAMPLE METHOD: California Sampler
SURFACE ELEVATION: 8" (O.D.)
TOTAL DEPTH OF BOREHOLE: 131 ft

STARTED: 9/27/00
COMPLETED: 9/28/00
BACKFILLED: 9/28/00
LOGGED BY: B. Breitenbach
REVIEWED BY: J. Stock

GROUNDWATER DEPTH/ELEV. (ft)
Y 15.0 / na
Y na / na
Y na / na
MEASUREMENT DATE and TIME
9/27/2000

DESCRIPTION AND CLASSIFICATION

ARTIFICIAL FILL:

CLAYEY SAND with COBBLES (SC), dark brown, moist, dense, medium-grained, no hydrocarbon odor or stains

No recovery (root)

SAME:

Very moist
Flushed hydropunch rods 15" to 17", not enough water - extremely clayey

SAND (SP), light brown, very moist, medium-grained, no hydrocarbon odor or stains

CLAYEY SAND with COBBLES (SC), olive gray, very moist, medium dense, no hydrocarbon odor or stains

SAND (SP), gray, wet, dense, coarse-grained, no hydrocarbon odor or stains

Pushed rods 25' to 27'
Collected water sample
Sand plug in hole

SAME:

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING.
SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION
WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS
ENCOUNTERED.
### Log of Boring HP-53

**Project No.:** 51-5690-00  
**Project Name:** Mission Valley Terminal  
**Location:** Western Portion of Site Maintenance Yard  
**Drilling Method:** Hollow Stem Auger  
**Sampling Method:** California Sampler  
**Surface Elevation:**  
**Total Depth of Borehole:** 131 ft

<table>
<thead>
<tr>
<th>Date</th>
<th>Depth (ft)</th>
<th>Sample</th>
<th>Blow Counts</th>
<th>Type</th>
<th>TP-Hg TPHg</th>
<th>PFOA (ppm)</th>
<th>Graphic Log</th>
<th>Description and Classification</th>
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<tbody>
<tr>
<td></td>
<td>29</td>
<td>HP53-35</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>Same</td>
</tr>
<tr>
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<td>40</td>
<td>HP53-40</td>
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<td></td>
<td></td>
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<td>Same</td>
</tr>
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<td>45</td>
<td>HP53-45</td>
<td></td>
<td></td>
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<td></td>
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<td>Same</td>
</tr>
<tr>
<td></td>
<td>50/5&quot;</td>
<td>HP53-50</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>55</td>
<td>HP53-55</td>
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<td></td>
<td></td>
<td></td>
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<td>Same</td>
</tr>
<tr>
<td></td>
<td>60/5&quot;</td>
<td>HP53-60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Same</td>
</tr>
<tr>
<td></td>
<td>65</td>
<td>HP53-65</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Friars Formation: Clayey Sand (SC), gray with red, (some silt), moist, very dense, coarse</td>
</tr>
</tbody>
</table>

**Groundwater Depth/Level (ft):** 15.0 ft  
**Measurement Date and Time:** 9/27/2000  
**Logged By:** B. Breitenbach  
**Reviewed By:** J. Stock

---

**Kleinfelder**  
5015 Shoreham Place  
San Diego, California 92122

---

This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of the actual conditions encountered.
### Log of Boring HP-53

**Project No.:** 51-5690-00  
**Drilling Method:** Hollow Stem Auger  
**Sampling Method:** California Sampler  
**Location:** Western Portion of Site Maintenance Yard  
**Total Depth of Borehole:** 131 ft

<table>
<thead>
<tr>
<th>Date</th>
<th>SAMPLE</th>
<th>DESCRIPTION AND CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Started:</td>
<td>9/27/00</td>
<td></td>
</tr>
<tr>
<td>Completed:</td>
<td>9/28/00</td>
<td></td>
</tr>
<tr>
<td>Backfilled:</td>
<td>9/28/00</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample</th>
<th>Blow Count (blows/ft)</th>
<th>TPH, TP-Hd (mg/L)</th>
<th>ID</th>
<th>Graphic Log</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 1/8</td>
<td>HP53-70</td>
<td></td>
<td></td>
<td></td>
<td>Same</td>
</tr>
<tr>
<td>75</td>
<td>HP53-75</td>
<td></td>
<td></td>
<td></td>
<td>Same</td>
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<tr>
<td></td>
<td></td>
<td>Pushed hydropunch rods 75 collected water sample</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>HP53-80</td>
<td></td>
<td></td>
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<td>Same</td>
</tr>
<tr>
<td>85</td>
<td>HP53-85</td>
<td></td>
<td></td>
<td></td>
<td>Clayey Sand (SC), gray, very moist, very dense, coarse-grained, pieces of shell</td>
</tr>
<tr>
<td>90</td>
<td>HP53-90</td>
<td></td>
<td></td>
<td></td>
<td>Sandy Clay (CL), gray, moist, very dense, fine-grained, with shell fragments, cobbles</td>
</tr>
<tr>
<td>95</td>
<td>HP53-95</td>
<td></td>
<td></td>
<td></td>
<td>Same</td>
</tr>
<tr>
<td>100 1/8</td>
<td>HP53-100</td>
<td></td>
<td></td>
<td></td>
<td>Same</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pushed hydropunch rods 100 to 101 collected groundwater sample</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Groundwater**

- Depth to Groundwater: 15 ft L.E. (ft)
- Date and Time: 9/27/2000

**Reviewed by:** J. Stock

**Logged by:** B. Breitenbach
**LOG OF BORING HP-53**

**PROJECT NO.:** 51-5690-00  
**PROJECT NAME:** MISSION VALLEY TERMINAL  
**LOCATION:** Western Portion of Site Maintenance Yard

<table>
<thead>
<tr>
<th>DATE</th>
<th>DEPTH (ft)</th>
<th>SAMPLE</th>
<th>BLOW COUNTS (BLOWS/FOOT)</th>
<th>TYPE</th>
<th>ID</th>
<th>TPHg (mg/l)</th>
<th>PIDOA (ppm)</th>
<th>GRAPHIC LOG</th>
<th>DESCRIPTION AND CLASSIFICATION</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>120/2</td>
<td>HP53-105</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SANDY CLAY (CL), dark brown, wet, stiff, appears to contain up to 50% fine sand, no hydrocarbon odor or stains, with occasional gravels and cobbles</td>
</tr>
<tr>
<td>COMPLETED: 9/28/00</td>
<td>110</td>
<td>50/?? HP53-110</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pocket penetrometer - 1.0 tf</td>
</tr>
<tr>
<td></td>
<td>115</td>
<td>HP53-115</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SANDSTONE:</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>HP53-120</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CLAYEY SAND (SC), gray, moist, very dense, fine-grained, contains up to 40% lean clay</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>HP53-130</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Frequent interbedding with lean sandy clay seams</td>
</tr>
<tr>
<td></td>
<td>135</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Grades very fine to fine</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Has some cementiation</td>
</tr>
<tr>
<td></td>
<td>140</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CLAYSTONE:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CLAY with SAND (CL), dark gray, moist, hard</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Less moisture, mild cementation, very low permeability</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Contains some shell fragments</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hydropunch set at 131' to 132'</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Let set for 70 min, no recovery of water</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Boring backfilled with bentonite grout</td>
</tr>
</tbody>
</table>

**KLEINFELDER**  
5015 SHOREHAM PLACE  
SAN DIEGO, CALIFORNIA 92122

**NOTE:**  
Driller out of HP rod - hole terminated

**THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.**

**FIGURE C5**
| DEPTH (ft) | BLOW COUNTS (Blows/foot) | TYPE | ID | TPH (ng/l) | PID/;
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
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<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>50/4</td>
<td>0</td>
<td>HPS4-5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>100</td>
<td>0</td>
<td>HPS4-10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>55</td>
<td>0</td>
<td>HPS4-15</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>55</td>
<td>0</td>
<td>HPS4-20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>25</td>
<td>53</td>
<td>0</td>
<td>HPS4-25</td>
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<tr>
<td>30</td>
<td>44</td>
<td>0</td>
<td>HPS4-30</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**DESCRIPTION AND CLASSIFICATION**

*Topsoil:* 2" thick

**ARTIFICIAL FILL:**
- CLAYEY SAND (SC), brown, moist, dense, fine to medium grained, with fine to coarse gravel and small cobble

**Wet**

**ALLUVIUM:**
- SAND with SILT (SP/SM), dark gray, wet, medium dense, fine to medium grained, no hydrocarbon odor, hydropunch at 21 - 23 ft.
- Large gravel and cobble noted at auger
- Frequent interbeds with seams of fine grained silty sand
- Heaving sands

---

**KLEINFELDER**
5015 SHOREHAM PLACE
SAN DIEGO, CALIFORNIA 92122

**THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.**

**FIGURE C6**
<table>
<thead>
<tr>
<th><strong>DEPTH (ft)</strong></th>
<th><strong>SAMPLE</strong></th>
<th><strong>BLOW COUNTS (BLOWS/FOOT)</strong></th>
<th><strong>TPHg, TPhd (mg/kg)</strong></th>
<th><strong>PID/COVA (ppm)</strong></th>
<th><strong>DESCRIPTION AND CLASSIFICATION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>HP54-35</td>
<td></td>
<td></td>
<td></td>
<td>SILTISH SAND (SM), dark gray, wet, dense, fine to medium grained (predominately fine), no hydrocarbon odor, silt content 15%</td>
</tr>
<tr>
<td>45</td>
<td>HP54-40</td>
<td></td>
<td></td>
<td></td>
<td>Hydropunch at 45 to 47.5 ft.</td>
</tr>
<tr>
<td>50</td>
<td>HP54-45</td>
<td></td>
<td></td>
<td></td>
<td>SAND with SILT (SP/SM), dark gray, wet, dense, fine to medium grained, with mica, no hydrocarbon odor</td>
</tr>
<tr>
<td>55</td>
<td>HP54-50</td>
<td></td>
<td></td>
<td></td>
<td>SILTISH SAND (SM), gray, wet, dense, fine to medium grained, no hydrocarbon odor, has little plasticity</td>
</tr>
<tr>
<td>60</td>
<td>HP54-55</td>
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<td>PRIARS FORMATION:</td>
</tr>
<tr>
<td>65</td>
<td>HP54-60</td>
<td></td>
<td></td>
<td></td>
<td>SANDSTONE consisting of CLAYEY SANDS, gray, moist, very dense, fine to medium grained, no hydrocarbon odor or stains</td>
</tr>
</tbody>
</table>

Note: Soils are still wet

**KLEINFELDER**

5015 SHOREHAM PLACE
SAN DIEGO, CALIFORNIA 92122
# LOG OF BORING HP-54

**PROJECT NO.:** 51-5690-00  
**PROJECT NAME:** MISSION VALLEY TERMINAL  
**LOCATION:** Practice Field  
**DRILLING METHOD:** Hollow Stem Auger  
**EQUIPMENT:** CME-75 w/DH Hammer  
**SAMPLING METHOD:** California Sampler  
**SURFACE ELEVATION:**  
**TOTAL DEPTH OF BOREHOLE:** 80 ft

<table>
<thead>
<tr>
<th>DATE</th>
<th>SAMPLE</th>
<th>DEPTH (ft)</th>
<th>BLOW COUNTS (BLOWS/FOOT)</th>
<th>TYPE</th>
<th>ID</th>
<th>TP-Hg, TPd (ppg)</th>
<th>PID/OVA (ppm)</th>
<th>GRAPHIC LOG</th>
<th>DESCRIPTION AND CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/3/00</td>
<td></td>
<td>100/5.5</td>
<td>HP54-75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Boring stopped at 80 ft.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100/5</td>
<td>HK54-80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Groundwater observed at 15 ft.</td>
</tr>
</tbody>
</table>

- **Groundwater depth:** 15 ft  
- **Borehole backfilled with bentonite grout**  
- **Hydropunch water sample taken at 21 to 23 ft. and 46 to 47.5 ft.**  
- **Hydropunch refusal at greater depths than ~55 to 60 ft.**

**GROUNDWATER LEVEL:**  
- **MEASUREMENT DATE and TIME:**  
- **15.0 / na**  
- **na / na**  
- **na / na**

**LOGGED BY:** K. Wells  
**REVIEWED BY:** J. Stock

---

**KLEINFELDER**  
5015 Shoreham Place  
San Diego, California 92122

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This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of the actual conditions encountered.
**LOG OF BORING HP-55**

**PROJECT NO.:** 51-5690-00

**PROJECT NAME:** MISSION VALLEY TERMINAL

**LOCATION:** Qualcomm Service Station

**DRILLING METHOD:** Hollow Stem Auger

**SAMPLING METHOD:** California Sampler

**TOTAL DEPTH OF BOREHOLE:** 81 ft

**DATE**

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>BLOW COUNTS (BLOW/FOOT)</th>
<th>TYPE</th>
<th>ID</th>
<th>TPhg TPhd (mg/kg)</th>
<th>PIGVA (ppm)</th>
<th>GRAPHIC LOG</th>
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<tr>
<td>0</td>
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<td></td>
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<td></td>
<td>DESCRIPTION AND CLASSIFICATION</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>ARTIFICIAL FILL:</strong></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>CLAYEY SAND (SC), brown, moist, dense, fine to medium grained, with fine to coarse gravel and cobble (gravel and cobble content approximately 20%)</strong></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sand with some Silt (SP-SM), olive brown, moist, fine to medium dense, fine to medium grained, with mica</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No hydrocarbon staining</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>ALLUVIUM:</strong></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>CLAYEY SAND (SC), brown, moist, medium dense, fine grained</strong></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sand with some Silt (SP-SM), olive brown, dense, wet, fine to medium grained (with some coarse), with some large gravel with mica</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hydropunch water sample at 10 to 16 ft.</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Note: minor heaving</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Note: sampler driver on rock</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Flowing fine to coarse sands with gravel and occasional cobbles</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td><strong>FRIARS FORMATION:</strong></td>
</tr>
<tr>
<td>15</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>SANDSTONE (SC), light brown (pale), moist to wet, very dense, fine to medium grained, lightly cemented, sands are clayey when reworked</strong></td>
</tr>
</tbody>
</table>

**KLEINFELDER**

5015 SHOREHAM PLACE
SAN DIEGO, CALIFORNIA 92122

**THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.**

**FIGURE** C7
<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>BLOW-COUNTS (BLOWS/FOOT)</th>
<th>TYPE</th>
<th>TD, TDH (E/M/Kg)</th>
<th>PID/OVA (ppm)</th>
<th>GRAPHIC LOG</th>
</tr>
</thead>
<tbody>
<tr>
<td>50/4&quot;</td>
<td>7</td>
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<tr>
<td>66</td>
<td>8</td>
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**DESCRIPTION AND CLASSIFICATION**

Color change to light gray

Hydropunch water sample at 41 ft. to 42 ft.

Clay fraction is very lean

Interbedded with very dense silty sand (as reworked)

Large gravels and cobbles from 61 ft. to 62.5 ft. (up to 30% gravels and cobbles)

Note: hydropunch water sample was refused due to hard formation

KLEINFELDER
5015 SHOREHAM PLACE
SAN DIEGO, CALIFORNIA 92122
<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>BLOW COUNTS (BLOWS/FOOT)</th>
<th>TYPE</th>
<th>ID</th>
<th>TPHg (mg/kg)</th>
<th>PIDOVA (ppm)</th>
<th>GRAPHIC LOG</th>
<th>DESCRIPTION AND CLASSIFICATION</th>
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<td>Sandstone contains up to 50% lean clay fraction</td>
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<td>Bottom of excavation at 85 ft. Borehole reamed to 10&quot; for well construction (nested wall)</td>
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KLEINFELDER
5015 SHOREHAM PLACE
SAN DIEGO, CALIFORNIA 92122

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.
Asphalt, straight drilled to 15 feet bgs.

GRAVELLY SILTY SAND (SM), very dark brown (10YR-2/2), moist, medium grained, 20-30% low plastic fines, 10-20% fine subangular gravel.

SILT (ML), very dark grayish brown (2.5Y-3/2), moist, soft, medium to high plasticity, micaceous.

CLAY (CH), very dark grayish brown (2.5Y-3/2), moist, medium stiff, medium plasticity.

SAND (SP), very dark grayish brown (2.5Y-3/2), wet, fine grained, trace fines, micaceous.

SILTY SAND (SM), dark grayish brown (10YR-4/2), wet, very fine grained, ~15-20% fines, trace clay.

SANDY SILT (ML), dark gray (10YR-4/1), wet, slight increasing grain size, some stratification, trace fine gravel.

EXPLANATION
- Clay
- Silt
- Sand
- Gravel

WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-33AD

Permit #: [Redacted]
Casing elevation: [Redacted]
Date well drilled: 6/10/02
LFR Field Staff: Adelo Derilo
Approved by: [Redacted]
**WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-33AD (CONTINUED)**

**Visual Description**

**SAND (SP)**, dark grayish brown (10YR-4/2), wet, fine to medium grained, trace fines.

**-same as above.**

**SILTY SANDY GRAVEL (GW)**, olive brown (2.5Y-4/4), wet, fine to coarse, subrounded to rounded gravel, 10-20% fine to medium sand, 1-5% low plastic fines.

**-same as above.**

**FRIARS SANDSTONE (SS)**, gray (5/N), wet, very hard, fine to medium grained, very friable.

**-less friable.**

Bottom of well at 63 feet bgs.
Bottom of boring at 68 feet bgs.

**Lithology Sampling Data**

**Mission Valley Terminal**

Project No. 002-10135-00

Levine Fricke

07/23/02AID/FP
Asphalt. Straight drilled to 15 feet bgs. SANDY SILT (ML), very dark brown (10YR-2/2), moist, low plasticity, 20-40% medium sand, slough. SAND (SP), dark yellowish brown (10YR-4/4), moist, fine grained. SILTY SAND (SM), very dark gray (2.5Y-3/1), moist, fine grained, 30-40% low plastic fines. SAND (SP), dark grayish brown (2.5Y-4/2), wet, fine to medium grained, trace rounded gravel. -fine sand to silt stringer -increasing fines. SANDY CLAY (CH), very dark grayish brown (2.5Y-3/2), wet, high plasticity, 10-20% fine sand, micaceous. SAND (SP), dark grayish brown (2.5Y-4/2), wet, fine to medium grained, micaceous.
GRAVELY SAND (SP), gray (7.5YR-3/1), medium grained, 10-20% fine to medium rounded gravel.

SAND (SP), gray (7.5YR-3/1), medium grained, trace gravels.

SILTY SANDY GRAVEL (GM), very dark grayish brown (2.5Y-3/2), wet, subangular to rounded, fine to large gravel, 20-30% medium to coarse sand, 10-20% medium plastic fines.

- more sand, less fines.
- more sand, less fines.
- more sand, less fines.

FRIARS SANDSTONE (SS), gray (6N), moist, very dense, fine to medium grained.

Bottom of well at 59.7 feet bgs.
Bottom of boring at 60 feet bgs.

WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-34AD (CONTINUED)
Asphalt pavement (3-in thick).

Straight drill to 15 feet.

**SILTY SAND (SM)**, dark brown (10YR-3/3), moist, 30-35% non-plastic fines, micaceous.

**SAND (SP)**, olive gray (5Y-4/2), wet, fine to medium grained, trace fines.

- Increasing grain size.

**SILTY SAND (SM)**, very dark grayish brown (2.5Y-3/2), wet.

**SANDY SILT (ML)** stringer, very dark gray (5Y-3/1).

**SILTY SAND (SM)**, very dark grayish brown (2.5Y-3/2), wet, fine to medium sand, 25-30% non-plastic fines, micaceous.

---

**Permit #:**
**Casing elevation:**
**Date well drilled: 6/13/02**
**LFR Field Staff: Adelo Derilo**

**Approved by:**

---

**EXPLANATION**
- **Clay**
- **Silt**
- **Sand**
- **Gravel**

**WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-35AD**
<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Visual Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>GRAVELLY SAND (SW), dark grayish brown (2.5Y-4/2), wet, fine to coarse grained, trace fine gravel.</td>
</tr>
<tr>
<td>45</td>
<td>SANDY SILT (ML) stringer, very dark gray (5Y-3/1), wet, 20-25% fine sand, trace clay.</td>
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<tr>
<td>50</td>
<td>SAND (SP) stringer, olive brown (2.5Y-4/3), wet, fine to medium sand, trace coarse sand.</td>
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<tr>
<td>55</td>
<td>SILTY SAND GRAVEL (GW), olive brown (2.5Y-4/4), wet, fine to coarse, rounded to subrounded gravel, 10-20% fine to medium sand, 5-10% non-plastic fines.</td>
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<tr>
<td>56</td>
<td>GRAVELLY SAND (SW), olive brown (2.5Y-4/3), wet, fine to coarse sand. -trace fine gravel.</td>
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<tr>
<td>57</td>
<td>SANDY SILT (ML) stringer, very dark gray (5Y-3/1), wet, 20-25% fine sand, trace clay.</td>
</tr>
<tr>
<td>57</td>
<td>SAND (SP) stringer, olive brown (2.5Y-4/3), wet, fine to medium sand, trace coarse sand.</td>
</tr>
<tr>
<td>57</td>
<td>SILTY SAND GRAVEL (GW), olive brown (2.5Y-4/4), wet, fine to coarse, rounded to subrounded gravel, 10-20% fine to medium sand, 5-10% non-plastic fines.</td>
</tr>
<tr>
<td>57</td>
<td>GRAVELLY SAND (SW), dark grayish brown (2.5Y-4/2), wet, fine to coarse grained, trace fine gravel.</td>
</tr>
<tr>
<td>57</td>
<td>SANDY GRAVEL (GW), olive brown (2.5Y-4/4), wet, 30-35% fine to coarse sand, fine to coarse rounded to subrounded gravel to ~3-in diameter.</td>
</tr>
<tr>
<td>56.5</td>
<td>FRIAR SANDSTONE (SS), gray (5N), wet, fine to medium grained, friable, becomes very hard. Bottom of well at 56.5 feet bgs. Bottom of boring at 57 feet bgs.</td>
</tr>
</tbody>
</table>

**WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-35AD (CONTINUED)**

Permit #: [Redacted]
Casing elevation: [Redacted]
Date well drilled: 6/13/02
LFR Field Staff: Adelo Derilo

Approved by: [Redacted]
Asphalt pavement (~4-in thick).

**Silty Sand (SM)**, dark brown (10YR-3/3), moist, fine to very fine grained, 25-30% fines, micaceous.

Straight drilled to 15 feet bgs.

**Silty Sand (SM)**, dark grayish brown (2.5Y-4/2), very moist to wet, fine to very fine sand, 15-20% fines, trace clay.

**Gravely Sand (SW)**, brown (10YR-4/3), wet, fine to coarse sand, well graded, trace rounded to sub-rounded, fine gravels to ~2-in diameter.

**Sandy Silt (ML)**, very dark grayish brown (10YR-3/2), wet, fine to medium grained.

**Gravely Sand (SW)**, fine to coarse grained.

**Sandy Silt (ML)**, very dark grayish brown (2.5Y-3/2), wet.

**Gravely Sand (SW)**, fine to coarse sand.

**Sandy Silt (ML)**, same as above.

**Gravely Sand (SW)**, dark yellowish brown (10YR-4/4), wet, fine to coarse sand.

**Silt (ML)**, very dark gray (5Y-3/1), wet, soft consistency, trace clay, micaceous.

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Mission Valley Terminal

Levine Fricke

Project No. 002-10135-00

Page 1 of 2

05/29/2014/AF

WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-36AD
GRAVELLY SAND (SW), dark grayish brown (2.5Y-4/2), wet, fine to coarse grained, fine gravels to ~2-in diameter.

GRAVEL (GW), brown (10YR-4/3), wet, rounded to sub-rounded, fine gravels to 3-in diameter, fine to coarse sand.

GRAVELLY SAND (SW), dark grayish brown (2.5Y-4/2), wet, fine to coarse sand, fine gravels to ~2-in diameter.

SAND (SP), very dark grayish brown (10YR-3/2), wet, fine to medium grained.

GRAVEL (GW), brown (10YR-4/3), wet, rounded to sub-rounded, fine gravels to ~3-in diameter, fine to coarse sand, trace fines.

SAND (SP), olive gray (5Y-3/2), wet, fine to medium grained, trace fine gravels and pebbles, trace fines.

GRAVEL (GW), brown (10YR-4/3), wet, rounded to sub-rounded fine gravels to ~3-in diameter, fine to coarse sand, well graded.

FRIAR SANDSTONE (SS), dark gray (5Y-4/1), moist, fine to very fine cemented sand.

- becomes harder.

Bottom of well at 55 feet bgs.
Bottom of boring at 60 feet bgs.
Asphalt pavement (3-in thick).

Straight drill to 15 feet.

SANDY CLAY (CL), brown (10YR-4/3), very moist, 15-20% fine sand, 10% silt.

SILTY SAND (SM), very dark grayish brown (2.5Y-4/2), wet, 25-30% non plastic fines.

SAND (SP), olive brown (2.5Y), fine to medium grained.

WELL GRADED SAND (SW)

SANDY CLAY (CL), brown (10YR-4/3), very moist, 15-20% fine sand, 10% silt.

SILTY SAND (SM), very dark gray (5Y-3/1), wet, 30-40% medium plastic fines, micaceous.

WELL GRADED SAND (SW)

SANDY CLAY (CL), brown (10YR-4/3), very moist, 15-20% fine sand, 10% silt.

SILTY SAND (SM), very dark gray (5Y-3/1), wet, 30-40% medium plastic fines, micaceous.

WELL GRADED SAND (SW)
**WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-37AD (CONTINUED)**

**SANDY GRAVEL (GW)**, dark grayish brown (2.5Y-4/2), wet, 30-35% fine to coarse sand, fine to coarse gravel (up to 3").

**SAND (SP)**, olive brown (2.5Y-4/4), wet, fine to medium grained sand, trace coarse grained.

**SILTY SANDY GRAVEL (GW)**, olive brown (2.5Y-4/4), olive brown (2.5Y-4/4), fine to coarse sand, 10-15% fines, fine to coarse, rounded to subrounded sand, to ~3-in diameter.

**SANDY GRAVEL (GW)**, mostly fine to medium sand, fine round to subrounded gravel to ~1.5-in diameter.

- olive brown (2.5Y-4/4), wet, 25-30% fine to coarse sand, fine to coarse rounded to subrounded gravel to ~3-in diameter.

**GRAVELLY SAND (SW)**, dark grayish brown (2.5Y-4/2), wet, fine to coarse sand.

**SANDY GRAVEL (GW)**, olive brown (2.5Y-4/4), wet, 25-30% fine to coarse sand, fine to coarse rounded to subrounded gravel to ~4-in dia., trace fines.

**PRIAR SANDSTONE (SANDSTONE)**, gray (5N), wet, fine to medium grained, friable.

- very hard, less friable.

Bottom of well at 62.5 feet bgs.

**Permit #:**

Casing elevation:

Date well drilled: 6/12/02

LFR Field Staff: Adelo Derilo

Approved by:
Well Constructions and Lithology for Well R-38AD

**Lithology**

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<th>Depth, feet</th>
<th>Visual Description</th>
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<td>Asphalt (3-in). Straight drilled to 15 feet.</td>
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<td>SAND (SP), yellowish brown (10YR-5/4), moist, medium grained, trace gravel, fines.</td>
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<td>15</td>
<td>SILT (MH), very dark grayish brown (10YR-3/2), moist, high plasticity.</td>
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<td>SAND (SP), dark yellowish brown (10YR-4/6), wet, medium grained.</td>
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<td>SILT (MH), very dark grayish brown (10YR-3/2), wet, high plasticity.</td>
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<td>SAND (SP), very dark grayish brown (10YR-3/2), wet, fine to medium grained. - gravelly sand lens.</td>
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<td>40</td>
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</tbody>
</table>

**Permit #:**

Date well drilled: 6/21/02
LFR Field Staff: Rodney Crother

Approved by:

---

**EXPLANATION**

- Clay
- Silt
- Sand
- Gravel

---

WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-38AD

Mission Valley Terminal

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072302RAC/LFR
CLAYEY GRAVELLY SAND (SC), very dark gray (2.5Y-3/1), wet, medium to coarse grained, 10-20% fine to medium gravel, 20-30% high plastic fines, multiple layers ranging from SAND (SW), to gravelly sand, to clayey gravel.

SILTY (ML) to FINE SAND (SP), olive brown (2.5Y-4/4), wet, low plastic, very fine grained.

SAND (SP), very dark grayish brown (2.5Y-3/2), wet, fine to medium grained, trace fine to medium gravels.

SILT WITH SAND (SM), dark grayish brown (2.5Y-4/2), wet, medium plastic, fine grained.

SAND (SP), very dark grayish brown (2.5Y-3/2), wet, fine to medium grained.

-trace fine to medium gravel.

- increasing gravel.

GRAVELLY CLAY (CH), dark gray (2.5Y-4/1), wet, high plastic, 20-30% medium gravel, some very weathered.

SILTY SANDY GRAVEL (GM), olive brown (2.5Y-4/3), wet, subrounded to rounded, fine to coarse gravel, 20-30% fine to coarse sand, 10-20% medium plastic fines.

- clay stringer.

GRAVELLY CLAY (CH), olive brown (2.5Y-4/2), wet, high plastic, 30-40% fine to coarse gravel, trace fine sand.

PRIARS SANDSTONE (SS), light bluish gray (5YB-7/1), moist, very hard, dense, fine grained, trace high plastic fines.

Bottom of well at 63.7 feet bgs.
Bottom of boring at 65 feet bgs.
CLAYEY SAND (SC), very dark gray (3/1-7.5YR), moist, loose, medium to fine sand, 10-20% medium plastic fines.

SANDY CLAY (CH), very dark gray (3/1-5Y), moist, medium plastic, 20-30% fine to medium sand.

SANDY GRAVEL (GP), gray (6/1-7.5YR), moist, 1-2 in. subrounded to rounded gravel, 40-50% medium grained sand, trace red staining.

GRAVELLY SANDY CLAY (CH), brown (10YR-3/3), moist, hard, medium plastic, 10-20% fine to medium rounded gravel, 10-20% fine to medium sand.

SILTY SAND (SM), black (2.5Y-2.5/1), wet, fine to medium grained, 20-30% low plastic fines.

CLAY (CH), black (5Y-2.5/1), wet, moderately hard, high plastic, trace organic pieces.

SILTY SAND (SM), black (2.5Y-2.5/1), wet, fine to medium grained, 20-30% low plastic fines.

CLAY (CH), black (5Y-2.5/1), wet, moderately hard, high plastic, trace organic pieces.

SILTY SAND (SM), black (2.5Y-2.5/1), wet, fine to medium grained, 20-30% low plastic fines.

SAND (SP), grayish brown (10YR-5/2), wet, medium grained, trace orange mottling.

SILTY SAND (SM) grading to SAND (SP), very dark grayish brown (2.5Y-3/2), wet, medium grained, 10-20% low plastic fines, trace large (3-5") rounded cobbles.
<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Visual Description</th>
<th>ID of Samples Analyzed</th>
<th>PI D (ppm)/(blows/ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td><strong>SAND (SP)</strong>, grayish brown (10YR-5/2), wet, hard,</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>fine to medium grained.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-black (5Y-2.5/1), wet, fine grained, trace fines,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>medium cobbles (2-in).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td><strong>SAND (SW)</strong>, very dark grayish brown (10YR-3/2),</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td></td>
<td>wet, loose, fine to coarse sand.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td><strong>SAND (SP)</strong>, brown (10YR-5/3), wet, loose, fine</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>grained.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>SAND (SP)</strong>, very dark grayish brown (10YR-3/2),</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>wet, medium dense, medium grained, trace coarse sand,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>trace fine rounded gravel.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td><strong>CLAYEY SANDY GRAVEL (GC)</strong>, very dark grayish brown</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.5Y-3/2), wet, fine to medium, subrounded to</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>rounded gravel, 10-20% fine to medium sand, 10-20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>medium plastic fines.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td><strong>SANDY GRAVEL (GW)</strong>, very dark grayish brown (10YR-3/2), wet, fine to medium, subrounded to rounded gravel, 20-30% medium to coarse sand.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>65</td>
<td><strong>PRIARS SANDSTONE (SS)</strong>, gray (10YR-8/1), moist,</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td></td>
<td>fine grained, friable.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>SILTY GRAVEL (GM)</strong>, light gray (10YR-7/1), slightly moist, fine to large, subangular to subrounded gravel, 10-30% low plastic fines, red mottling.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>PRIARS SANDSTONE (SS)</strong>, gray (7/N), slightly moist,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>very hard, medium grained.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>SANDY GRAVEL (GP)</strong>, gray (7/N), slightly moist,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>hard, fine to medium, subangular to subrounded gravel, 30-40% medium sand, trace fines.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EXPLANATION**
- Clay
- Silt
- Sand
- Gravel

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**WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-39AD (CONTINUED)**
FRIARS SANDSTONE (SS), gray (7/N), slightly moist, very hard, medium grained.

SANDY GRAVEL (GP), gray (7/N), slightly moist, hard, fine to medium subangular to subrounded gravel, 30-40% medium sand, trace fines.

Bottom of well at 60.5 feet bgs.
Bottom of boring at 67.5 feet bgs.
Asphalt pavement (~4-in thick).

Straight drilled to 15 feet bgs.

SILTY SAND (SM), very dark grayish brown (2.5Y-3/2), moist, 20-25% non-plastic fines.

FINE SAND (SP) stringer, moist, fine to very fine.

SILTY FINE SAND (SM), dark grayish brown (2.5Y-4/2), moist, 25-30% non-plastic fines.

FINE SAND (SP), dark grayish brown (2.5Y-4/2), moist, mostly fine sand.

SILTY SAND (SM), olive brown (2.5Y-4/3), moist to very moist, trace clay, 25-30% fines.

SAND (SP), dark grayish brown (2.5Y-4/20, very moist to wet, fine to medium grained.

GRAVELLY SAND (SW), brown (10YR-4/3), wet, fine to coarse sand.

SAND (SP), dark grayish brown (2.5Y-4/2), wet, fine

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EXPLANATION

- Clay
- Silt
- Sand
- Gravel

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WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-40AD

Mission Valley Terminal

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072302AID/PR
to medium sand, some fines.

**Silty Fine Sand (SM)**
dark grayish brown (2.5Y-4/2), wet, fine to very fine sand, 25-30% non-plastic fines, micaceous.

**Sand (SP)**
dark grayish brown (2.5Y-4/2), wet, fine to medium grained.

-same as above.

**Silty Sand (SM)**
stringer, dark gray (5Y-4/1), wet.

**Sand (SP)**
very dark grayish brown (10YR-3/2), wet, fine to medium grained.

-same as above.

**Silt (ML)**
stringer.

**Sand (SP)**
stringer.

**Silt (ML)**
very dark gray (5Y-3/1), trace fine sand, low to medium plastic, trace fine gravel.

**Silty Sand (SM)**
olive gray (2.5Y-4/2), wet, 20-25% fines, micaceous.

**Sandy Gravel (GW)**
dark grayish brown (2.5Y-4/2), wet, fine to coarse sand, trace fine gravel and pebbles.

**Gravelly Sand (GW)**
olive brown (2.5Y-4/4), wet, fine to coarse, rounded to subrounded gravel to ~4-in dia., 20-30% fine to coarse sand, trace fines, well graded.

**Friar Sandstone (SS)**
dark gray (5Y-4/1), wet.
fine to medium grained friable.

Bottom of well at 69.5 feet bgs.
Bottom of boring at 71 feet bgs.
Asphalt. Straight drilled to 15 feet.

SANDY GRAVELLY CLAY (CH), dark brown (7.5YR-3/3), moist, medium plastic, 10-20% fine to medium, subrounded gravel, 5-10% fine to coarse sand.

SAND (SP), dark yellowish brown (10YR-4/4), moist, fine grained.

SANDY CLAY (CH), strong brown (7.5YR-4/6), moist, medium to high plasticity, 10-20% fine sand.

SAND (SP), dark yellowish brown (10YR-3/6), wet, fine to medium grained.

SANDY CLAYEY GRAVEL (GC), strong brown (7.5YR-4/6), wet, fine to medium, subrounded to rounded gravel, 10-20% medium plastic fines, 5-10% fine to medium sand.

- decreasing sand.
- increasing gravel size.

GRAVEL/SAND (SW), gray (7.5Y-6/1), wet, medium to coarse sand, 20-30% fine rounded gravel.

- decreasing gravel.
- fine to medium sand, trace gravel.

SILTY GRAVELLY SAND (SM), olive brown
(2.5Y-4/3), wet, fine to medium sand, 30-40% medium subrounded to rounded gravel, 5-10% low plastic fines.

**FRIARS SANDSTONE (SS)**, light brownish gray (10YR-6/2), moist, hard, fine grained, friable.

**CLAYEY GRAVELLY SAND (SC)**, gray (5Y-6/1), moist, hard, fine grained, 20-30% rounded, weathered gravel, 5-10% high plastic fines, some dark red staining.

- Increasing fines.
- Siltstone, gray (2.5Y-5/1), dry, very hard, low plasticity, trace orange mottling.
- Silt and sandstone, gray (2.5Y-5/1), dry, very hard, very fine sand, 50% low plastic fines, some orange mottling.

Bottom of well at 36.5 feet bgs.
Bottom of boring at 41 feet bgs.
### Lithology Sample Analysis

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Visual Description</th>
<th>飽和度</th>
<th>ID of Samples Analyzed</th>
<th>P.I.D (ppm) / Penetration Rate (blows/ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>Sand</td>
<td>30-35% non-plastic fines, micaceous.</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Gravelly Sand (SW)</td>
<td>brown (10YR-4/3), wet, fine to coarse sand.</td>
<td>25</td>
<td>-color grades to dark grayish brown (2.5Y-4/2), wet.</td>
</tr>
<tr>
<td>35</td>
<td>Sandy Clayey Silt (ML)</td>
<td>dark olive gray (5Y-3/2), wet, 10-15% fine sand, 5-10% clay, low to medium plastic, micaceous.</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Silty Sand (SML)</td>
<td>dark olive gray (5Y-3/2), wet, 25-30% fines, micaceous.</td>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>

### WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-42AD

- **Asphalt.**
- Straight Drill to 15 feet bgs.

### WELL CONSTRUCTION

- **Casing elevation:**
- **Approx. Groundwater Level:**
- **Permit #:**
- **Date well drilled:** 6/17/02
- **LFR Field Staff:** Adelo Derilo
- **Approved by:**

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**EXPLANATION**
- Green: Clay
- Red: Silt
- Blue: Sand
- Orange: Gravel

**Mission Valley Terminal**

**Project No. 002-10123-00**

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07/2002AID/TP
SANDY SILT (ML), very dark grayish brown (2.5Y-3/2), wet, 25-30% fine sand, micaceous.

SAND (SP), very dark grayish brown (2.5Y-3/2), wet, fine to medium sand, 5-10% non-plastic fines.

- trace fine gravels to ~2-in diameter.

SILTY SAND (SM), stringer.

SANDY CLAYEY SILT (ML), very dark grayish brown (2.5Y-3/2), wet, 25-30% fine sand, 10-15% clay, slight to medium plastic.

SILTY SAND (SM), very dark grayish brown (2.5Y-3/2), wet, 25-30% fines, ~5% clay.

SANDY GRAVEL (GW), olive brown (2.5Y-4/4), wet, 25-30% fine to coarse sand, fine to coarse rounded to subrounded gravel to ~4-in diameter.

SAND (SP), dark olive gray (5Y-3/2), wet, fine to medium grained, trace fine gravel.

SANDY GRAVEL (GW)

FRIAR SANDSTONE (SS), wet, very hard, fine to medium sand.

Bottom of well at 67.5 feet bgs.
Bottom of boring at 68 feet bgs.
Asphalt pavement (~3 inches).

Straight drilled to 6 feet bgs. Air vacuum cleared to approximately 5 feet bgs.

SILTY GRAVEL WITH SAND (GM), olive gray (5Y-5/2), moist, fine gravel/cobble to ~4-in diameter, fine to coarse sand.

SANDY SILT (ML), very dark gray (10YR-3/1), moist, 15-20% fine sand, trace fine gravel.

SILTY GRAVEL WITH SAND (GM), mottled brownish gray to olive gray, fine to coarse, rounded to sub-rounded gravel/cobbles to ~3-inch diameter.

POORLY GRADED SAND (SP), olive gray (5Y-4/2), moist, fine grained, micaceous, trace non-plastic fines.

POORLY GRADED SAND (SP), dark grayish brown.

POORLY GRADED SAND (SP), olive gray (5Y-4/2), moist, fine grained, micaceous, trace non-plastic fines.

POORLY GRADED SAND (SP), dark grayish brown.

EXPLANATION

- Clay
- Silt
- Sand
- Gravel

WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-45 AD

Date well drilled: 2/16/03 - 2/17/03
LFR Field Staff: Adelo Derilo
Approved by:

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**WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-45 AD (CONTINUED)**

Date well drilled: 2/16/03 - 2/17/03
LFR Field Staff: Adelo Derilo
Approved by:

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**WELL GRADED SAND (SW)**, grayish brown (2.5Y-5/4), wet, fine to coarse grained.

**SANDY SILT (ML)**, stringer, dark gray (2.5Y-3/4), wet, 15-25% fines, micaceous.

**WELL GRADED SAND (SW)**, same as SW above.

**CLAYEY SILT (ML)**, very dark gray (10YR-3/1), wet, trace fine sand, slightly plastic, micaceous.

**Silty SAND (SM)**, dark grayish brown (2.5Y-4/2), wet, 15-25% non-plastic fines, micaceous.

**WELL GRADED SAND (SW)**, dark gray (10YR-4/2), fine to coarse grained.

**POORLY GRADED SAND (SP)**, dark olive gray (5Y-3/2), fine grained, trace fine gravel at ~50.5 feet bgs.

**ELASTIC SILT (MH)**, very dark gray (10YR-3/1), high plasticity, trace fine sand.

**POORLY GRADED SAND (SP)**, fine to medium grained.

**WELL GRADED SAND (SW)**, light olive brown (2.5Y-5/3), wet, fine to coarse grained, trace fine gravels.

**SANDY SILT (ML)**, stringer, 10-15% fine sand, slightly plastic.

**WELL GRADED SAND (SW)**, same as SW above.

**SANDY SILT (ML)**, stringer, same as ML above.

**POORLY GRADED SAND (SP)**, olive brown (2.5Y-4/3), fine to medium grained.

**WELL GRADED GRAVEL WITH SAND (GW)**, olive brown (2.5Y-4/4), wet, rounded to subrounded, fine gravel to ~3-inch diameter, 30-40% fine to coarse sand.

**SLITY SAND (SM)**, olive gray (5Y-4/2), fine grained, 25-30% non-plastic fines.

**POORLY GRADED SAND (SP)**, olive (5Y-4/3), fine to medium grained.

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**EXPLANATION**

- **Clay**
- **Silt**
- **Sand**
- **Gravel**

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**WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-45 AD (CONTINUED)**
WELL CONSTRUCTION

Depth, feet

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
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<td>75</td>
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</tbody>
</table>

WELL GRADED GRAVEL WITH SAND (GW), rounded to subrounded fine gravel to ~5-inches diameter, increased amount and size of gravel from ~69 to 76 feet bgs.

FRIAR SANDSTONE (SS), dark gray (4/N), moist, fine grained, friable.

Bottom of well at 77 feet bgs.
Bottom of boring at 79 feet bgs.

Materials used:
Filter Pack
- 2 1/2 bags #2/12 sand
Annular Seal
- 1 1/2 bags bentonite chips
- 6 bags bentonite grout

---

Date well drilled: 2/16/03 - 2/17/03
LFR Field Staff: Adelo Derilo

Approved by:

WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-45 AD (CONTINUED)
**WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-46 AD**

**Date well drilled:** 2/18/03  
**LFR Field Staff:** Adelo Derilo  
**Approved by:**

---

**WELL CONSTRUCTION**

- **Flush Mounted**
- **Well Plug**

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Graphic Log</th>
<th>Visual Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Concrete</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Bentonite Grout</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>2-inch dia SCH40 PVC Blank Casing</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Continued</td>
<td></td>
</tr>
</tbody>
</table>

**LITHOLOGY**

- **Asphalt pavement (~3-inches).**
  - **FILL** materials, sand and gravel, mottled.
  - Brown to gray with red streak.

- **Silty Gravel with Sand (GM),** mottled, dark brown to grayish brown, rounded to subrounded, fine gravel to ~2-in diameter.

- **Sandy Silt (ML)**, dark grayish brown (10YR-4/2), moist, 25-30% fine to medium grained sand.
  - Very dark gray (10YR-3/1), moist, 15-20% fine sand.
  - Micaceous.

- **Well Graded Sand (SW),** gray (10YR-6/1), dry, fine to medium sand, 10-15% fine gravel.

- **Silty Sand (SM),** very dark grayish brown

**SAMPLING DATA**

<table>
<thead>
<tr>
<th>ID of Samples Analyzed</th>
<th>P.I.D (ppm)/Penetration Rate (blows/ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

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Date well drilled: 2/18/03
LFR Field Staff: Adelo Derilo
Approved by:

Materials used:
Filter Pack
- 2 bags #2/12 sand
Annular Seal
- 2 bags bentonite chips
- 3 1/2 bags bentonite grout

EXPLANATION
- Clay
- Silt
- Sand
- Gravel

WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-46 AD (CONTINUED)
Asphalt pavement (~3 inches).
Straight drilled to ~6 feet bgs. Air vacuum cleared to ~5 feet bgs.

**SILTY GRAVEL WITH SAND (GM)**, mottled brownish gray to olive gray, rounded to subrounded, fine to coarse gravel and cobbles to ~4 to 5 inches diameter.

**SAND (SP)**, lens of ~3-inch, light olive brown (2.5Y-5/3), dry, fine to medium grained.
-color grades to grayish brown.
-color grades to olive gray.

**SANDY SILT (ML)**, very dark grayish brown (2.5Y-3/5), moist, hard, 85-90% fines, 10-15% fine sand.

**POORLY GRADED SAND (SP)**, (2.5Y-3/2), moist, fine grained.

Date well drilled: 2/19/03 - 2/20/03
LFR Field Staff: Adelo Derilo
Approved by:

**WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-47 AD**

Mission Valley Terminal
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Project No. 10180
<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Graphic Log</th>
<th>Visual Description</th>
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</thead>
<tbody>
<tr>
<td>40</td>
<td>Bentonite Grout</td>
<td>2-inch dia SCH40 PVC Blank Casing</td>
</tr>
<tr>
<td>45</td>
<td>2-inch dia SCH40 PVC Blank Casing</td>
<td>2-inch dia SCH40 PVC Blank Casing</td>
</tr>
<tr>
<td>50</td>
<td>2-inch dia SCH40 PVC Blank Casing</td>
<td>2-inch dia SCH40 PVC Blank Casing</td>
</tr>
<tr>
<td>55</td>
<td>2-inch dia SCH40 PVC Blank Casing</td>
<td>2-inch dia SCH40 PVC Blank Casing</td>
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<tr>
<td>60</td>
<td>2-inch dia SCH40 PVC Blank Casing</td>
<td>2-inch dia SCH40 PVC Blank Casing</td>
</tr>
<tr>
<td>65</td>
<td>2-inch dia SCH40 PVC Blank Casing</td>
<td>2-inch dia SCH40 PVC Blank Casing</td>
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<tr>
<td>70</td>
<td>2-inch dia SCH40 PVC Blank Casing</td>
<td>2-inch dia SCH40 PVC Blank Casing</td>
</tr>
</tbody>
</table>

**Silty Sand (SM)**, dark gray (10YR-4/1), wet, 70-75% fine grained sand, 25-30% non-plastic fines.

**Poorly Graded Sand (SP)**, dark gray (10YR-4/1), wet, fine to medium grained, micaceous.

**Wet Graded Sand (SW)**, olive gray (5Y-4/2), wet, fine to coarse grained sand, rounded to subrounded fine gravel.

**Sandy Silt (ML)**, very dark gray (10YR-3/1), wet, 10-15% fine sand, slightly plastic.

**Poorly Graded Sand (SP)**, olive gray (5Y-4/2), wet, fine to medium grained, micaceous.

**Silty Sand (SM)**, very dark gray (5Y-3/1), wet, 10-15% non-plastic fines, micaceous.

**Wet Graded Sand (SW)**, olive gray (5Y-4/2), wet, fine to coarse grained sand, rounded to subrounded, fine gravel to ~2-inch diameter.

**Poorly Graded Sand (SP)**, olive gray (5Y-4/2), wet, fine to medium grained, fine gravel to ~2-inch diameter.

**Occasionally Found:**
- Bentonite Chips
- Bentonite Grout
- #2/12 Sand
- 2-inch dia SCH40 PVC Blank Casing

**EXPLANATION**
- Clay
- Silt
- Sand
- Gravel

**Date well drilled:** 2/19/03 - 2/20/03
**LFR Field Staff:** Adelo Derilo

Approved by:
**FRIAR SANDSTONE (SS)**, gray (5Y-6/1), moist, fine grained, friable.

Bottom of well at 77 feet bgs.
Bottom of boring at 81 feet bgs.

Materials used:
- Filter Pack - 3 bags #2/12 sand
- Annular Seal - 2 bags bentonite chips
- 6 bags bentonite grout

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### WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-47 AD (CONTINUED)

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Graphic Log</th>
<th>Visual Description</th>
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<tbody>
<tr>
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<td><strong>FRIAR SANDSTONE (SS)</strong>, gray (5Y-6/1), moist, fine grained, friable.</td>
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<tr>
<td>80</td>
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<td>Bottom of well at 77 feet bgs. Bottom of boring at 81 feet bgs.</td>
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</tbody>
</table>

Materials used:
- Filter Pack - 3 bags #2/12 sand
- Annular Seal - 2 bags bentonite chips
- 6 bags bentonite grout

---

**Explaination**

- **Clay**
- **Silt**
- **Sand**
- **Gravel**

Date well drilled: 2/19/03 - 2/20/03
LFR Field Staff: Adelo Derilo
Approved by:

---

Mission Valley Terminal
Page 3 of 3
004401AID/tpf
**WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-48 AD**

**WELL CONSTRUCTION**

- Asphalt pavement (~3 inches).
- Straight Drilled to ~6 feet bgs. Air vacuum cleared to ~5 feet bgs.
- **SILTY GRAVEL WITH SAND (GM)**, mottled gray to reddish brown, rounded to subrounded fine gravels and cobbles to ~4-inches diameter.

**LITHOLOGY**

- -grades to dark brown, increased amount of fine to coarse grained sand.
- **SANDY SILT (ML)** stringer, dark gray (5Y-4/1), moist, 15-20% fine sand, micaceous.
- **POORLY GRADED SAND (SP)**, very dark grayish brown (2.5Y-3/2), moist, fine grained, micaceous.
- **WELL GRADED SAND (SW)**, gray (10YR-6/1), dry, fine to coarse grained.
- **POORLY GRADED SAND (SP)**, olive brown (2.5Y-4/4), moist, fine to medium grained.
- **SANDY SILT (ML)**, very dark gray (10YR-3/1), moist, 60-70% low plastic fines, 30-40% fine sand, micaceous.
- **POORLY GRADED SAND (SP)**, dark grayish brown (2.5Y-3/2), wet, fine to medium grained sand, micaceous.
- **SILTY SAND (SM)**, dark grayish brown (2.5Y-3/2), micaceous.

**EXPLANATION**

- Clay
- Silt
- Sand
- Gravel

**SAMPLING DATA**

- Date well drilled: 2/21/03 - 2/22/03
- LFR Field Staff: Adelo Derilo/Charlotte Berghoffer
- Approved by:

**Mission Valley Terminal**

---

030403AID/CXB/tpf
SILTY SAND (SM), dark grayish brown (2.5Y-3/2), wet, 70-80% fine to medium sand, 20-30% low plastic fines, micaceous.

POORLY GRADED SAND WITH GRAVEL (SP), olive gray (5Y-4/2), wet, medium to coarse sands, slightly micaceous, with some gravels.

ELASTIC SILT (MH), black (5Y-2.5/1), moist, trace fine sand.

SANDY SILT (ML), very dark gray (5Y-3/1), moist, 40-60% non-plastic fines, 40-50% fine sand, micaceous.

SILT WITH SAND (ML), very dark gray (5Y-3/1), moist, 75-85% plastic fines, 15-25% fine sand, slightly micaceous.

ELASTIC SILT (MH) stringer, black (5Y-2.5/1), moist, trace fine sand.

POORLY GRADED SAND (SP), dark gray (2.5Y-4/1), wet, medium grained, micaceous.

SILTY SAND (SM), very dark gray (5Y-3/1), moist, 80-90% fine sand, 10-20% non-plastic fines, micaceous.

POORLY GRADED SAND (SP), olive gray (5Y-4/2), wet, medium to coarse sand.

SILTY SAND (SM), very dark gray (5Y-3/1), moist, 60-70% fine to medium sand, 30-40% non-plastic fines, slightly micaceous.

WELL GRADED SAND WITH GRAVEL (SW), olive gray (5Y-4/2), wet, 80-90% medium to coarse sands, 10-20% gravels 1 to 2 inches diameter.

WELL GRADED GRAVEL WITH SAND (GW), olive (5Y-3/1), wet, 70-80% gravels, 10-20% coarse sands, gravels up to 6 inch diameter.

Date well drilled: 2/21/03 - 2/22/03
LFR Field Staff: Adelo Derilo/Charlotte Berghoffer
Approved by:

Mission Valley Terminal
Page 2 of 3
030403AID/CXB/tpf
**FRIAR SANDSTONE (SS)**, dark gray (5Y-4/1), moist, fine grained sand.

Bottom of well at 75.5 feet bgs.
Bottom of boring at 86 feet bgs.

Materials used:
- Filter Pack
  - 3 bags #2/12 sand
- Annular Seal
  - 2 bags bentonite chips
  - 6 bags bentonite grout
Date well drilled: 5/4/05
LFR Field Staff: Adelo Derilo
Approved by: Levine Fricke

WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-60AD

WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-60AD

Continued

Concrete
Bentonite Grout
2-in. dia. SCH40 PVC Blank Casing
6-inch dia. Borehole

Asphalt pavement (~4 in. thick).
Cleared by air-knife to ~5 feet bgs.

SILTY GRAVEL (GM), mottled reddish brown to gray, moist, fine to coarse gravel with cobbles to ~5 in. diameter, trace fine sand.

5

POORLY GRADED SAND (SP), dark grayish brown (2.5Y-4/2), moist, fine to medium grained, micaceous.

10

SILTY GRAVEL (GM), brown (10YR-4/3), moist, fine gravel with trace fine sand.

15

POORLY GRADED SAND (SP), grayish brown (10YR-5/2), moist, fine to medium grained, trace fine gravels.

20

SILTY SAND (SM) lens.

25

WELL GRADED SAND (SW), brown (10YR-5/3), wet, fine to coarse grained, trace fine gravels.

30

EXPLANATION
- Clay
- Silt
- Sand
- Gravel

Mission Valley Terminal - Qualcomm Stadium

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002405AM0020
POORLY GRADED SAND (SP), olive brown (2.5Y-4/3), wet, fine to medium grained, micaceous.

WELL GRADED SAND (SW), dark grayish brown (2.5Y-4/2), wet, fine to coarse grained, trace coarse gravel to ~2.5 in. diameter.

WELL GRADED GRAVEL WITH SAND (GW), very dark gray (2.5Y-3/2), wet, fine to coarse gravel, fine to coarse sand, trace cobbles.

FRIAR SANDSTONE (SS), mottled yellow to gray, soft, highly weathered.
- dark gray (GLEY1-4/N), less weathered.

---

**EXPLANATION**
- Clay
- Silt
- Sand
- Gravel

Date well drilled: 5/4/05
LFR Field Staff: Adelo Derilo
Approved by: [Signature]

Mission Valley Terminal - Qualcomm Stadium
Date well drilled: 5/4/05
LFR Field Staff: Adelo Derilo
Approved by: CAREG C-66471

Materials used:
- Filter Pack
  - 1.42 cubic feet of #2/12 sand
- Annular Seal
  - 0.875 cubic feet of bentonite pellets transition seal
  - 9.275 cubic feet of bentonite grout
  - 0.525 cubic feet of concrete surface seal

Drilling Method - Sonic Drilling
Drilling Company - Prosonic Corporation
WELL CONSTRUCTION

Date well drilled: 5/3/05
LFR Field Staff: Adelo Derilo
Approved by: [Signature]

LITHOLOGY

- Asphalt pavement (~4 in. thick), Cleared by air-knife to 5 feet bgs.
- **POORLY GRADED SAND (SP)**, brown (10YR-4/3), moist, fine to medium grained, micaceous.
- **WELL GRADED SAND (SW)**, olive brown (2.5Y-4/3), wet, fine to coarse grained, micaceous.
- **SILTY SAND (SM)**, very dark grayish brown (2.5Y-3/2), wet, fine sand with silt, micaceous.
- **WELL GRADED SAND (SW)**, dark grayish brown (10YR-3/2), wet, fine to coarse grained, trace fine gravel.
- **POORLY GRADED SAND (SP)**, very dark gray (5Y-3/1), wet, mostly fine sand, trace fines, micaceous.

EXPLANATION

- Clay
- Silt
- Sand
- Gravel

WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-61AD
WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-61AD (CONTINUED)

Date well drilled: 5/3/05
LFR Field Staff: Adelo Derilo
Approved by: Cawle (CRCE 66471)

Materials used:
- Filter Pack
  - 1.42 cubic feet of #2/12 sand
- Annular Seal
  - 1.05 cubic feet of bentonite pellets transition seal
  - 6.125 cubic feet of bentonite grout
  - 0.525 cubic feet of concrete surface seal

Drilling Method - Sonic Drilling
Drilling Company - Prosonic Corporation

WELL CONSTRUCTION

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Bentonite Grout</th>
<th>2-in. dia. SCH40 PVC Blank Casing</th>
<th>Bentonite Pellets</th>
<th>6-in. dia. Borehole</th>
<th>#2/12 Sand</th>
<th>2-in. dia. SCH40 PVC Well Screen (0.010&quot; slot)</th>
<th>Bottom Cap</th>
<th>Slough</th>
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<td>40 50</td>
<td>46 65</td>
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<td>45</td>
<td>50</td>
<td>55</td>
<td>55</td>
<td>50</td>
</tr>
</tbody>
</table>

LITHOLOGY

**WELL GRADED SAND (SW)**, very dark grayish brown (10YR-3/2), wet, fine to coarse grained, trace fine gravels.

- trace coarse gravels and cobbles to ~3-in. diameter.

**POORLY GRADED SAND (SP)**, very dark gray (5Y-3/1), wet, mostly fine grained, trace fines, micaceous.

**WELL GRADED GRAVEL WITH SAND (GW)**, very dark grayish brown (2.5Y-3/2), wet, fine to coarse gravel, fine to coarse sand, cobbles to ~4-in. diameter, trace fines.

**FRIAR SANDSTONE (SS)**, gray (5Y-6/1), moist, traces of fine to coarse gravels and pulverized fines, slightly weathered.

Bottom of boring at 57 feet bgs.
Bottom of well at 51 feet bgs.

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052405AID/sco
Mission Valley Terminal - Qualcomm Stadium

WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-62AD

Date well drilled: 5/2/05
LFR Field Staff: Adelo Derilo
Approved by: C. Garce (C-66471)

Asphalt pavement (~4-in. thick)
Cleared by air-knife to ~5 feet bgs.

POORLY GRADED SAND (SP), brown (10YR-5/3),
moist, fine to medium grained, micaceous.

SILTY SAND (SM), dark brown (10YR-3/3), moist,
fine sand with silt.

SANDY SILT (ML), very dark grayish brown
(10YR-3/2), moist, trace clay, medium plasticity.

POORLY GRADED SAND (SP), dark olive gray
(5Y-3/2), wet, fine to medium grained, trace fines,
micaceous.

WELL GRADED SAND (SW), olive gray (5Y-4/2),
wet, fine to coarse grained, trace fine gravels,
micaceous.

POORLY GRADED SAND (SP), olive gray (5Y-4/2),
wet, fine to medium grained, micaceous.

WELL GRADED SAND (SW), olive gray (5Y-4/2),
wet, fine to coarse grained, trace fine gravels,
micaceous.

POORLY GRADED SAND (SP), olive gray (5Y-4/2),
wet, fine to medium grained, micaceous.

WELL GRADED SAND (SW), olive gray (5Y-4/2),
wet, fine to coarse grained, trace fine gravels,
micaceous.

Concrete
Bentonite Grout
2-in. dia. SCH40 PVC Blank Casing
6-in. dia. Borehole

EXPLANATION

- Clay
- Silt
- Sand
- Gravel

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05.26.05AID/920

Levine Fricke
Project No. 002-10180-32
-trace fine to coarse gravel.

WELL GRADED GRAVEL WITH SAND (GW), dark olive gray (5Y-3/2), wet, fine to coarse gravel with cobbles to ~5 in. diameter, trace fines.

FRIAR SANDSTONE (SS), light gray (5Y-7/1).

Materials used:
- Filter Pack
  - 1.617 cubic feet of #2/12 sand
- Annular Seal
  - 1.05 cubic feet of bentonite pellets transition seal
  - 6.475 cubic feet of bentonite grout
  - 0.525 cubic feet of concrete surface seal

Drilling Method - Sonic Drilling
Drilling Company - Prosonic Corporation

Date well drilled: 5/2/05
LFR Field Staff: Adelo Derilo
Approved by: [Signature]
Asphalt pavement (~4-in. thick).
Cleared by air-knife to ~5 feet bgs.

SILTY GRAVEL (GM), mottled brown to gray, moist,
fine to coarse gravel, trace sand.

SANDY SILT (ML), very dark grayish brown
(10YR-3/2), moist, low plasticity.

SILTY GRAVEL (GM), mottled brown to gray, moist,
fine to coarse gravel, trace sand.

SANDY SILT (ML), dark grayish brown (10YR-4/2),
moist.

SILTY GRAVEL (GM), mottled brown to gray, moist,
fine to coarse gravel, trace sand with cobbles to ~5-in.
diameter.

SILTY SAND (SM), dark olive gray (5Y-3/2), moist,
fine sand with silt and some fine to coarse gravel.

Date well drilled: 5/5/05
LFR Field Staff: Adelo Derilo
Approved by: C. Levine Fricke

WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-63AD

Mission Valley Terminal - Qualcomm Stadium
Page 1 of 2
WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-63AD (CONTINUED)

Date well drilled: 5/5/05
LFR Field Staff: Adelo Derilo
Approved by: 

Mission Valley Terminal - Qualcomm Stadium
Page 2 of 2

WELL CONSTRUCTION

Materials used:
Filter Pack
- 1.42 cubic feet of #2/12 sand
Annular Seal
- 1.05 cubic feet of bentonite pellets
- 6.125 cubic feet of bentonite grout
- 0.525 cubic feet of concrete surface seal

Drilling Method - Sonic Drilling
Drilling Company - Prosonic Corporation

LITHOLOGY

POORLY GRADED SAND (SP), dark olive gray (5Y-3/2), wet, fine to medium sand, micaceous.

SILTY CLAY (CL), very dark gray (5Y-3/1), wet, soft, highly plastic.

POORLY GRADED SAND (SP), dark olive gray (5Y-3/2), wet, fine to medium sand, micaceous.

WELL GRADED SAND (SW), dark olive gray (5Y-3/2), wet, fine to coarse grained.

WELL GRADED GRAVEL (GW), dark grayish brown (2.5Y-4/2), wet, fine to coarse gravel with cobbles to ~6-in. diameter.

FRIAR SANDSTONE (SS), light gray (5Y-7/1), friable, highly weathered.
- color grades to reddish brown.
- hard, color grades to light gray (5Y-7/1).

Bottom of boring at 57 feet bgs.
Bottom of well at 51 feet bgs.

Drilling Company - Prosonic Corporation
Asphalt pavement (~4-in. thick).
Cleared by air-knife to ~5 feet bgs.

SILTY GRAVEL (GM), mottled dark brown to light gray, fine to coarse gravel with some cobbles to ~5-in. diameter.

SANDY SILT (ML), brown (7.5YR-4/3), moist.

SILTY GRAVEL (GM), mottled brown to gray.

POORLY GRADED SAND (SP), very dark grayish brown (2.5Y-3/2), moist, fine to medium grained, trace fines.

WELL GRADED SAND (SW), very dark grayish brown

EXPLANATION
- Clay
- Silt
- Sand
- Gravel

WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-64AD

Date well drilled: 4/29/05
LFR Field Staff: Adelo Derilo
Approved by:  

Mission Valley Terminal - Qualcomm Stadium
Project No. 002-10180-32
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(2.5Y-3/2), wet, fine to coarse grained.

**POORLY GRADED SAND (SP)**, very dark grayish brown (2.5Y-3/2), wet, fine to medium grained, micaceous.

**WELL GRADED GRAVEL (GW)**.

**SANDY SILT (ML)**, very dark brown (10YR-2/2), very moist, medium plasticity, trace clay.

**WELL GRADED GRAVEL WITH SAND (GW)**, olive brown (2.5Y-4/4), wet, fine to coarse gravel, fine to coarse sand.

**SILTY SAND (SM)**, dark olive gray (5Y-3/2), wet, micaceous.

**WELL GRADED GRAVEL (GW)**.

**FRIAR SANDSTONE (SS)**, mottled yellowish brown to light gray, highly weathered. Bottom of boring at 57 feet bgs. Bottom of well at 56 feet bgs.

Materials used:
- Filter Pack - 1.42 cubic feet of #2/12 sand
- Annular Seal - 1.05 cubic feet of bentonite pellets transition seal
- 7.0 cubic feet of bentonite grout
- 0.525 cubic feet of concrete surface seal

Drilling Method - Sonic Drilling
Drilling Company - Prosonic Corporation
Asphalt pavement (~4-in. thick).
Cleared by air-knife to ~5 feet bgs.

SILTY GRAVEL (GM), mottled grayish to brownish, moist, fine to coarse gravel with trace of cobbles to ~4-in. diameter.

SILTY SAND (SM), very dark grayish brown (2.5Y-3/2), moist, fine sand with silt.

POORLY GRADED SAND (SP), dark grayish brown (2.5Y-4/2), wet, fine to medium grained, trace fine gravel.

SANDY SILT (ML), very dark grayish brown (5Y-3/1), wet, non-plastic, micaceous.

POORLY GRADED SAND (SP), very dark grayish brown (2.5Y-3/2), wet, to medium grained, micaceous.

WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-66AD

Mission Valley Terminal - Qualcomm Stadium

Date well drilled: 4/28/05
LFR Field Staff: Adelo Derilo
Approved by: [Signature]

Project No. 002-10180-32

Mission Valley Terminal - Qualcomm Stadium

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WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-66AD (CONTINUED)

Date well drilled: 4/28/05
LFR Field Staff: Adelo Derilo
Approved by: [Signature]

Mission Valley Terminal - Qualcomm Stadium
Page 2 of 3
052705AD/050
FRIAR SANDSTONE (SS), weathered, mottled orange-gray. Bottom of boring at 72 feet bgs. Bottom of well at 71 feet bgs.

Materials used:
- Filter Pack: 1.519 cubic feet of #2/12 sand
- Annular Seal: 1.05 cubic feet of bentonite pellets transition seal
- 9.45 cubic feet of bentonite grout
- 0.525 cubic feet of concrete surface seal

Drilling Method - Sonic Drilling
Drilling Company - Prosonic Corporation
**WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-67AD**

**Date well drilled:** 4/27/05  
**LFR Field Staff:** Adelo Derilo  
**Approved by:** [Signature]

---

**Well Construction and Lithology**:  
**Asphalt pavement (~4-in. thick).** Cleared by air-knife to ~5 feet bgs.

- **SILTY GRAVEL WITH SAND (GM)**, mottled gray to reddish brown, moist, fine to coarse grained, some cobbles to ~5-in. diameter, trace clay.

- **SILTY SAND (SM)**, dark olive gray (5Y-3/2), moist, fine sand with silt, trace clay, low plasticity.

- **POORLY GRADED SAND (SP)**, very dark grayish brown (10YR-3/2), wet, fine to medium grained, trace fine gravel.

- **WELL GRADED SAND (SW)**, very dark gray (2.5Y-3/1), wet, fine to coarse grained, trace fines, micaceous.

---

**EXPLANATION**

- **Clay**
- **Silt**
- **Sand**
- **Gravel**

---

**Graphic Log**

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<tr>
<th>Depth, feet</th>
<th>Visual Description</th>
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</table>

**Lithology Sampling Data**

- **ID of Samples Analyzed**
- **P I D (ppm)/Penetration Rate (blows/ft.)**

---

**Well Construction and Lithology**

**Mission Valley Terminal - Qualcomm Stadium**

---

**Page 1 of 3**
WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-67AD (CONTINUED)

**Graphic Log**

- **Bentonite Grout**
- **2-in. dia. SCH40 PVC Blank Casing**
- **6-in. dia. Borehole**
- **#2/12 Sand**
- **2-in. dia. SCH40 PVC Well Screen (0.010" slot)**
- **Bottom Cap**

**Visual Description**

- **WELL GRADED SAND (SW)**: very dark gray (2.5Y-3/1), wet, fine to coarse grained, trace fines, trace fine gravel, micaceous.
- **POORLY GRADED SAND (SP)**: very dark grayish brown (10YR-3/2), wet, fine to medium grained, trace fine gravel.
- **WELL GRADED SAND (SW)**: very dark gray (2.5Y-3/1), wet, fine to coarse grained, trace fines, trace fine gravels to ~3-in. diameter, micaceous.
- **WELL GRADED GRAVEL (GW)**
- **WELL GRADED SAND (SW)**: very dark gray (2.5Y-3/1), wet, fine to coarse grained, trace fine gravels to ~3-in. diameter, micaceous.
- **WELL GRADED GRAVEL (GW)**
- **WELL GRADED SAND (SW)**: very dark gray (2.5Y-3/1), wet, fine to coarse grained, trace fine gravels to ~3-in. diameter, micaceous.

**Sample Retained**

- **CLAY**
- **SILT**
- **SAND**
- **GRAVEL**

**Date well drilled:** 4/27/05

**LFR Field Staff:** Adelo Derilo

**Approved by:** [Signature]

**Mission Valley Terminal - Qualcomm Stadium**

**Project No. 002-10180-32**
Bottom of boring at 77 feet bgs.
Bottom of well at 68 feet bgs.

Materials used:
Filter Pack
- 1.519 cubic feet of #2/12 sand
Annular Seal
- 1.05 cubic feet of bentonite pellets transition seal
- 9.1 cubic feet of bentonite grout
- 0.525 cubic feet of concrete surface seal

Drilling Method - Sonic Drilling
Drilling Company - Prosonic Corporation

Date well drilled: 4/27/05
LFR Field Staff: Adelo Derilo
Approved by: [Signature]

Mission Valley Terminal - Qualcomm Stadium
Page 3 of 3
052705A010/520
Asphalt pavement (~4-in. thick). Cleared by air-knife to ~5 feet bgs.

SILTY GRAVEL WITH SAND (GM), mottled brownish gray to reddish brown, moist, fine to coarse gravel, fine sand, trace cobbles to ~4-in. diameter.

SILTY SAND (SM), very dark gray (2.5Y-3/1), moist, fine sand with silt.

POORLY GRADED SAND (SP), very dark gray (2.5Y-3/1), wet, fine to medium grained, trace fines, micaceous.

SANDY Silt (ML) lens, micaceous.

WELL GRADED SAND (SW), very dark gray (2.5Y-3/1), wet, fine to coarse grained, trace fines, micaceous.

POORLY GRADED SAND (SP), very dark gray (2.5Y-3/1), wet, fine to medium grained, trace fines, micaceous.

WELL GRADED SAND (SW), very dark gray (2.5Y-3/1), wet, fine to coarse grained, trace fine gravel, micaceous.

---

EXPLANATION

- Clay
- Silt
- Sand
- Gravel

---

Date well drilled: 4/26/05
LFR Field Staff: Adelo Derilo

Approved by: [Signature]

WELL CONSTRUCTION AND LITHOLOGY FOR WELL R-68AD

Mission Valley Terminal - Qualcomm Stadium
**POORLY GRADED SAND (SP)**, very dark gray (2.5Y-3/1), wet, fine to medium grained, trace fines, micaceous.

**WELL GRADED SAND (SW)**, very dark gray (2.5Y-3/1), wet, fine to coarse grained, trace fine gravel, micaceous.

**SANDY SILT (ML)** lens.

**SILTY SAND (SM)**, very dark gray (2.5Y-3/1), wet, fine sand with silt, low plasticity, micaceous.

**WELL GRADED GRAVEL WITH SAND (GW)**, fine to coarse gravel, trace cobbles.

**FRIAR SANDSTONE (SS)**, gray (5Y-6/1).

Bottom of boring at 67 feet bgs.
Bottom of well at 63 feet bgs.

Materials used:
- **Filter Pack**
  - 1.42 cubic feet of #2/12 sand
- **Annular Seal**
  - 1.05 cubic feet of bentonite pellets transition seal
  - 8.225 cubic feet of bentonite grout
  - 0.525 cubic feet of concrete surface seal

Drilling Method - Sonic Drilling
Drilling Company - Prosonic Corporation
<table>
<thead>
<tr>
<th>Sample Type Number</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL</td>
<td>GRAVELLY CLAY (CL), dark yellowish brown (10YR 3/4) and very dark grayish brown (10YR 3/2), moist, low to moderate plasticity, trace cobble (~4&quot; dia.).</td>
</tr>
<tr>
<td>SP</td>
<td>POORLY GRADED SAND (SP), very dark gray (10YR 3/1), moist, fine to medium grained.</td>
</tr>
<tr>
<td></td>
<td>-as above, wet.</td>
</tr>
<tr>
<td></td>
<td>WELL GRADED SAND (SW), olive gray (5Y 4/2), wet, fine to coarse grained.</td>
</tr>
<tr>
<td></td>
<td>POORLY GRADED SAND (SP), very dark gray (10YR 3/1), wet, fine to medium grained, trace coarse grained, trace gravel.</td>
</tr>
</tbody>
</table>

**Well Diagram**

- **Asphalt (~4" thick).**
- **Air knife to 5 feet bgs.**
- **Concrete.**
- **Bentonite Chips.**
- **6" dia. Borehole.**
- **2" dia. SCH40 PVC Blank Casing.**

(Continued Next Page)
POORLY GRADED SAND (SP), very dark gray (10YR 3/1), wet, fine to medium grained, trace coarse grained, trace gravel.

-as above, cobbles (1 to 2" dia.).

-as above, few gravel, trace cobbles.

-as above, fine to coarse grained.

GRAVELLY SAND (SW), very dark gray (10YR 3/1), wet, fine grained to gravel, well graded, cobbles (1 to 4" dia.).

2" dia. SCH40 PVC Blank Casing

6" dia. Borehole

Bentonite Chips

#2/12 Sand

2" dia. SCH40 PVC Well Screen (0.010" slot)
**FRIARS FORMATION (SS),** light gray (2.5Y 5/1) to dark gray (2.5Y 4/1), weathered interface, fine to medium grained.

Bottom of boring at 62 feet bgs.
Bottom of well at 47.5 feet bgs.

---

**SILTSTONE, dark gray, wood pieces.**

---

**GRAVELLY SAND (SW),** very dark gray (10YR 3/1), wet, fine grained to gravel, well graded, cobbles (1 to 4" dia.). (continued)

-as above.

---

**FRIARS FORMATION (SS),** light gray (2.5Y 5/1) to dark gray (2.5Y 4/1), weathered interface, fine to medium grained.

---

**Filter Pack - 1.2 cubic feet of #2/12 Sand**
**Annular Seal - 6.5 cubic feet of bentonite chips**
**Surface Seal - 0.5 cubic foot of concrete**
**Bottom Plug - 2.7 cubic feet of bentonite pellets**
CH

DATE: 8/6/08

GRAVEL WITH SAND (GP), brown (10YR 4/3), wet, loose, subangular to subrounded gravel (up to 3" dia.), trace silt, fine to coarse grained sand, cobbles (up to 4" dia.).

POORLY GRADED SAND (SP), brown (10YR 5/3), wet, loose, fine to coarse grained sand.

- as above, medium to coarse grained sand.

---

SILTY SAND (SM), brown (10YR 5/3), wet, loose, fine to coarse grained sand.

- as above, trace fine gravel (up to 1" dia.).

- as above, trace fine gravel (up to 1" dia.).

- as above, some fine grained sand.

CLAY (CH), brown (7.5YR 3/3), moist, hard, trace fine grained sand, high plasticity.

- as above, very hard.

- as above, hard.

- as above, brown (10YR 5/3), some fine grained sand.

---

GROUND ELEVATION 48.63 ft-msl

HOLE DIAMETER 6 inches

TOP OF CASING ELEVATION 48.17 ft-msl

HOLE DEPTH 32.0 ft

FIRST ENCOUNTERED WATER 7.0 ft bgs/ Elev 41.6 ft

STABILIZED WATER 8.85 ft TOC

LOGGED BY Tania Alarcon

DATE 4/28/08

---

**WELL NUMBER R-81AD**

**PROJECT NAME** Mission Valley Terminal

**CLIENT** KMEP

**PROJECT LOCATION** Qualcomm Stadium

**PROJECT NUMBER** 002-10180-92

**LOCATION** Qualcomm - SW Parking Lot

**OVA EQUIPMENT** Mini Rae 2000

**GROUND ELEVATION** 48.63 ft-msl

**HOLE DIAMETER** 6 inches

**TOP OF CASING ELEVATION** 48.17 ft-msl

**HOLE DEPTH** 32.0 ft

**FIRST ENCOUNTERED WATER** 7.0 ft bgs/ Elev 41.6 ft

**STABILIZED WATER** 8.85 ft TOC

**WELL DIAGRAM**

---

**SAMPLE TYPE**

**U.S.C.S.**

**LOG**

**DEPTHS**

**LITHOLOGIC DESCRIPTION**

**ELEVATIONS**

**WELL DIAGRAM**

---

**APPROVED BY:**

**DATE:** 8/6/08

---

**DRILLING CONTRACTOR** Boart Longyear

**DRILLING METHOD** Sonic Drilling

**STAMP (IF APPLICABLE) AND/OR NOTES**

Developed on 5/8/08 using Smeal Development rig. Purged approximately 30 gallons.
# Materials Used

- **Filter Pack**: 1.2 cubic feet of #2/12 Sand
- **Annular Seal**: 2.4 cubic feet of bentonite chips
- **Surface Seal**: 0.5 cubic foot of concrete
- **Bottom Plug**: 1.6 cubic feet of bentonite chips

---

## Lithologic Description

- **FRIARS FORMATION (SS)**, highly weathered sandstone, iron staining, moderate induration.
  
  - as above.
  - as above, light gray (5Y 7/2).
  - as above, strong induration.
  - as above, some iron staining.

- **Bottom of boring at 32 feet bgs.**
  - Bottom of well at 23.5 feet bgs.
SANDY CLAY (CL), dark grayish brown (10YR 4/2), wet, soft to firm, medium plasticity, fine to medium grained sand, trace fine to coarse gravel, subangular to subrounded cobbles (up to 4" dia.).

SP

POORLY GRADED SAND (SP), very dark gray (10YR 3/1), wet, loose, medium to coarse grained, some fine to coarse gravel (up to 2" dia.), cobbles (up to 4" dia.).

-as above, olive gray to dark greenish gray motting, cobbles (up to 4.5" dia.).

-as above, black staining.

-as above, low to medium plasticity.

-as above, very dark greenish gray (GLEY1 3/10Y), increase sand with depth.

SANDY CLAY (CL), dark grayish brown (10YR 4/2), moist, hard, high plasticity, some fine grained sand, trace subrounded gravel (up to 2" dia.).

CLAY (CH), very dark grayish brown (10YR 3/2), moist, soft to firm, medium plasticity, fine to coarse grained sand.

No core recovery.

(Tagged from open hole.)

Developed on 5/8/08 using Smeal Development rig. Purged approximately 45 gallons.

Air knife to 5 feet bgs.

HOLE DIAMETER 6 inches

TOP OF CASING ELEVATION 46.98 ft-msl

FIRST ENCOUNTERED WATER 9.5 ft bgs/ Elev 37.7 ft

STABILIZED WATER 8.90 ft TOC

Logged by Tania Alarcon

Date 4/29/08

Sample Type Number

Lithologic Description

Elevations PID (ppm)

Well Diagram

Depth (feet)

5

10

15

20

25

30

35

40

45

50

55

60

65

70

75

80

85

90

95

100
<table>
<thead>
<tr>
<th>DEPTH (feet)</th>
<th>MATERIAL</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>CL</td>
<td>SANDY CLAY (CL), very dark gray (10YR 3/1), very soft, medium plasticity, trace gravel (up to 2&quot; dia.).</td>
</tr>
<tr>
<td>26.0</td>
<td>SM</td>
<td>SILTY SAND (SM), black (10YR 2/1), loose, fine to medium grained.</td>
</tr>
<tr>
<td>27.0</td>
<td>SP</td>
<td>POORLY GRADED SAND (SP), dark gray (10YR 4/1), loose, fine to medium grained.</td>
</tr>
<tr>
<td>28.0</td>
<td>SP</td>
<td>POORLY GRADED SAND (SP), dark gray (10YR 4/1), loose, fine to medium grained, increasing grain size with depth.</td>
</tr>
<tr>
<td>29.5</td>
<td>ML</td>
<td>SILT (ML), very dark gray (10YR 3/1), very soft, low plasticity.</td>
</tr>
<tr>
<td>30.5</td>
<td>CH</td>
<td>SANDY CLAY (CH), very dark gray (10YR 3/1), soft to firm, high plasticity, increasing sand with depth.</td>
</tr>
<tr>
<td>32.0</td>
<td>SP</td>
<td>POORLY GRADED SAND (SP), dark gray (10YR 4/1), loose, medium to coarse grained.</td>
</tr>
<tr>
<td>33.0</td>
<td>SM</td>
<td>SILTY SAND (SM), very dark gray (10YR 3/1), fine grained.</td>
</tr>
<tr>
<td>34.0</td>
<td>SP</td>
<td>POORLY GRADED SAND (SP), dark gray (10YR 4/1), loose, medium to coarse grained.</td>
</tr>
<tr>
<td>35.0</td>
<td>GP</td>
<td>GRAVEL WITH SAND (GP), very dark gray (10YR 3/1), fine to coarse gravel (up to 3&quot; dia.), medium to coarse grained sand.</td>
</tr>
<tr>
<td>38.0</td>
<td>SS</td>
<td>FRIARS FORMATION (SS), weathered, light gray to brown mottling.</td>
</tr>
<tr>
<td>40.0</td>
<td></td>
<td>-as above, some iron staining.</td>
</tr>
</tbody>
</table>

**MATERIALS USED**

- Bentonite Grout
- 6" dia. Borehole
- Bentonite Pellets
- 2" dia. SCH40 PVC Blank Casing
- #2/12 Sand
- 2" dia. SCH40 PVC Well Screen (0.010" slot)
- Bottom Cap
- Bentonite Chips

---

*Approvals*

- APPROVED BY: [Signature]
- DATE: 8/6/08

*Notes*

(Continued Next Page)
### MATERIALS USED

Filter Pack - 1.2 cubic feet of #2/12 Sand  
Transition Seal - 1.0 cubic foot of bentonite pellets  
Annular Seal - 3.9 cubic feet of bentonite grout  
Surface Seal - 0.5 cubic foot of concrete  
Bottom Plug - 1.4 cubic feet of bentonite chips

---

**ELEVATIONS**  

**DEPTH (feet)**

**LITHOLOGIC DESCRIPTION**

- as above, light gray (10YR 7/1).

**DEPTH (feet)**

<table>
<thead>
<tr>
<th>MATERIALS USED</th>
<th>DEPTH (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter Pack - 1.2 cubic feet of #2/12 Sand</td>
<td>45</td>
</tr>
<tr>
<td>Transition Seal - 1.0 cubic foot of bentonite pellets</td>
<td>47.0</td>
</tr>
<tr>
<td>Annular Seal - 3.9 cubic feet of bentonite grout</td>
<td>47.0</td>
</tr>
<tr>
<td>Surface Seal - 0.5 cubic foot of concrete</td>
<td>47.0</td>
</tr>
<tr>
<td>Bottom Plug - 1.4 cubic feet of bentonite chips</td>
<td>47.0</td>
</tr>
</tbody>
</table>

**Bottom of boring at 47 feet bgs.**  
**Bottom of well at 38.5 feet bgs.**
<table>
<thead>
<tr>
<th>DEPTH (feet)</th>
<th>SAMPLE TYPE NUMBER</th>
<th>U.S.C.S.</th>
<th>GRAPHIC LOG</th>
<th>LITHOLOGIC DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
<td>Air knife to 5 feet bgs.</td>
</tr>
<tr>
<td>5.0</td>
<td></td>
<td>CLAYEY SAND WITH GRAVEL (SC), very dark grayish brown (10YR 3/2), moist, fine to medium grained sand, trace coarse grained sand, poorly graded, gravel to cobbles (up to 3&quot; dia.).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.5</td>
<td></td>
<td>CLAYEY SAND WITH GRAVEL (SC), dark grayish brown (10YR 4/2), moist, fine to coarse grained sand, well graded.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.517</td>
<td></td>
<td>POORLY GRADED SAND (SP), dark gray (2.5Y 4/1), wet, fine to medium grained, trace coarse grained.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.0</td>
<td></td>
<td>CLAYEY SAND WITH GRAVEL (SC), dark grayish brown (10YR 4/2), wet, fine to medium grained sand, poorly graded.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.5</td>
<td></td>
<td>POORLY GRADED SAND (SP), dark gray (2.5Y 4/1), wet, fine to medium grained, trace coarse grained, trace clay, trace gravel.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depth (ft)</td>
<td>Sample Type Number</td>
<td>U.S.C.S.</td>
<td>Graphic Log</td>
<td>Lithologic Description</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------</td>
<td>---------</td>
<td>-------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>25</td>
<td>SP</td>
<td></td>
<td></td>
<td>POORLY GRADED SAND (SP), dark gray (2.5Y 4/1), wet, fine to medium grained, trace coarse grained, trace clay, trace gravel. (continued)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-as above, gravel</td>
</tr>
<tr>
<td>28.0</td>
<td></td>
<td></td>
<td></td>
<td>-as above, trace gravel and cobbles (4&quot; dia.)</td>
</tr>
<tr>
<td>30</td>
<td>SM</td>
<td></td>
<td></td>
<td>SILTY SAND (SM), very dark gray (2.5Y 3/1), wet, fine to medium grained, poorly graded.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-as above, gravel</td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td>-as above, trace gravel</td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MATERIALS USED

(Continued Next Page)

APPROVED BY: Carla C. Strick Date: 8/6/08
SILTY SAND (SM), very dark gray (2.5Y 3/1), wet, fine to medium grained, poorly graded. (continued)

SILTY SAND WITH GRAVEL (SM), dark gray (2.5Y 4/1), wet, medium to coarse grained sand, moderately graded, gravel to cobble (4" dia.).

SILTY SAND (SM), very dark gray (2.5Y 3/1), wet, fine to medium grained, poorly graded.

-as above, few gravel (1 to 2" dia.).

CLAYEY SAND WITH GRAVEL (SC), dark gray (2.5Y 4/1), wet, fine to medium grained sand, poorly graded, low plasticity fines, gravel to cobbles (5" dia.).

FRIARS FORMATION (SS), gray (7.5YR 5/1), weathered sandstone.

Bottom of boring at 67 feet bgs.
Bottom of well at 57.5 feet bgs.

MATERIALS USED
Filter Pack - 1.2 cubic feet of #2/12 Sand
Transition Seal - 1.0 cubic foot of bentonite pellets
Annular Seal - 7.1 cubic feet of bentonite grout
Surface Seal - 0.5 cubic foot of concrete
Bottom Plug - 1.8 cubic feet of bentonite chips
<table>
<thead>
<tr>
<th>U.S.C.S.</th>
<th>SAMPLE TYPE NUMBER</th>
<th>DEPTHS</th>
<th>LITHOLOGIC DESCRIPTION</th>
<th>ELEVATIONS</th>
<th>WELl DIAGRAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>Asphalt at surface.</td>
<td>82.7</td>
<td>Air knife to 5 feet bgs.</td>
<td>12&quot; Emco</td>
<td>Wheaton Flush Mounted Well Box</td>
</tr>
<tr>
<td>5.0</td>
<td>SILTY SAND WITH GRAVEL (SM), brown (10YR 4/3) to gray (N4) mottled coloring, dry, loose, fine to coarse subrounded sand, appreciable silt, subrounded to subangular fine to coarse gravel, some pulverized cobbles.</td>
<td>78.2</td>
<td>0.0</td>
<td>6&quot; Dia. Borehole</td>
<td></td>
</tr>
<tr>
<td>SM</td>
<td>-as above.</td>
<td>0.0</td>
<td>0.0</td>
<td>Bentonite Grout</td>
<td></td>
</tr>
<tr>
<td>GM</td>
<td>SILTY GRAVEL WITH SAND (GM), brown (10YR 4/3) to gray (N4) mottled coloring, dry, loose, 50% fine gravel, 30% fine to coarse subrounded sand, 20% silt, pulverized cobbles.</td>
<td>69.2</td>
<td>0.0</td>
<td>2&quot; Dia. SCH40 PVC Blank Casing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-as above.</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Continued Next Page)
<table>
<thead>
<tr>
<th>DEPT (feet)</th>
<th>SAMPLE TYPE NUMBER</th>
<th>U.S.C.S.</th>
<th>DEPTHS</th>
<th>LITHOLOGIC DESCRIPTION</th>
<th>ELEVATIONS</th>
<th>WELL DIAGRAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.0</td>
<td>GM</td>
<td>0.0</td>
<td>61.2</td>
<td>SILTY GRAVEL WITH SAND (GM), brown (10YR 4/3) to gray (N4) mottled coloring, dry, loose, 50% fine gravel, 30% fine to coarse subrounded sand, 20% silt, pulverized cobbles.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39.0</td>
<td>GM</td>
<td>44.2</td>
<td>44.0</td>
<td>SILTY GRAVEL WITH SAND (GM), black organic material, trace plant roots, organic smell.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SILTY SAND WITH GRAVEL (SM), brown (10YR 4/3) to gray (N4) mottled coloring, loose, soft, 40% silt, 30% fine to coarse subrounded sand, 20% fine gravel and pulverized cobbles.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MATERIALS USED

(Continued Next Page)
Silty Gravel with Sand (GM), dry, loose, soft, 40% fine gravel and pulverized cobbles, 30% silt, 30% fine to coarse sand.

No recovery.

Silty Gravel with Sand (GM), dry, loose, soft, 40% fine gravel and pulverized cobbles, 30% silt, 30% fine to coarse sand.

Silty Gravel (GM), damp, loose, soft, predominantly fine to coarse gravel with pulverized cobbles.

Silty Sand (SM), brown (10YR 4/3), wet, loose, soft, 60% fine to coarse subrounded sand, 40% silt.

Sandy Silt (ML), brown (10YR 4/3), wet, dense, firm, 75% silt, 25% fine sand.

-as above.

Silty Sand (SM), brown (10YR 4/3), wet, loose, soft, fine to coarse sand with appreciable silt.

- Bentonite Pellets

2" Dia. SCH40 PVC Blank Casing

6" Dia. Borehole

Bentonite Grout

MATERIALS USED
### MATERIALS USED

- 16.33 cubic feet of Bentonite grout
- 1.25 cubic feet of Bentonite pellets transition seal
- 1.75 cubic feet of #2/12 Monterey Sand
- 1.00 cubic foot of concrete surface seal

---

**LITHOLOGIC DESCRIPTION**

<table>
<thead>
<tr>
<th>DEPTH (feet)</th>
<th>SAMPLE TYPE</th>
<th>U.S.C.S.</th>
<th>GRAPHIC LOG</th>
<th>LITHOLOGIC DESCRIPTION</th>
<th>ELEVATIONS</th>
<th>WELL DIAGRAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>SM</td>
<td></td>
<td></td>
<td>SILTY SAND (SM), brown (10YR 4/3), wet, loose, soft, fine to coarse sand with appreciable silt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>SM</td>
<td></td>
<td></td>
<td>-as above.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>SM</td>
<td></td>
<td></td>
<td>SILTY SAND WITH GRAVEL (SM), brown (10YR 4/3), wet, loose, soft, fine to coarse sand with appreciable silt, increase fine gravel and pulverized cobbles.</td>
<td>78.0</td>
<td>5.2</td>
</tr>
<tr>
<td>85</td>
<td>SM</td>
<td></td>
<td></td>
<td>-as above.</td>
<td>85.0</td>
<td>-1.8</td>
</tr>
</tbody>
</table>

Bottom of boring at 85 feet bgs.  
Bottom of well at 78.5 feet bgs.
POORLY GRADED SAND (SP), yellowish brown (10YR-5/6), medium grained.

SANDY CLAY (CL), dark brown (10YR-3/3), moist, high plasticity.

POORLY GRADED SAND (SP), light yellowish brown (10YR-6/4), moist, medium grained.

EXPLANATION

LFR Field Staff: Craig Burnett

Date well drilled: 8/28/06
LFR Field Staff: Craig Burnett

Approved by: C. H. C. E. C. G. H. E. C.

WELL CONSTRUCTION AND LITHOLOGY FOR WELL RW-7A
### WELL CONSTRUCTION AND LITHOLOGY FOR WELL RW-7A (CONTINUED)

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Graphic Log</th>
<th>Visual Description</th>
<th>Sample ID</th>
<th>P I D (ppm)/Penetration Rate (blows/ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>#2/16 Sand</td>
<td>WELL GRADED GRAVEL WITH SAND (GW), dark yellowish brown (10YR-3/4), wet, medium to coarse sand with cobbles.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td>FRIAR FORMATION (SS), reddish gray (2.5YR-5/1), moist, fine to medium grained, slightly cemented.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td>Bottom of boring at 60 feet bgs. Bottom of well at 59 feet bgs.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Materials used:
- 18.3 cubic feet of #2/13 sand
- 1.05 cubic feet of annular seal

Drilling Company: Prosonic Corporation
Drilling Method: Sonic
Sampling Method: Continuous Core

Date well drilled: 8/28/06
LFR Field Staff: Craig Burnett
Approved by: [Signature]

Mission Valley Terminal
Project No. 10180-56
Page 2 of 2
080509CMR/rev
WELL CONSTRUCTION AND LITHOLOGY FOR WELL RW-48

Date well drilled: 7/19/06
LFR Field Staff: Craig Burnett
Approved by: C.M. Cargill

- **Asphalt (6”).**
  - **POORLY GRADED SAND (SP),** brown (10YR-4/3), dry, medium grained.

- **SILTY SAND (SM),** very dark brown (10YR-2/2), moist, fine to medium grained, no plasticity.

- **CLAYEY SAND (SC),** brown (10YR-4/3), moist, very fine grained with medium grained sand, moderate plasticity.
  - **POORLY GRADED SAND (SP),** dark yellowish brown (10YR-3/6), dry, medium grained.
  - **SANDY SILT (ML),** very dark brown (10YR-2/2), moist, fine grained, moderate plasticity.
  - **POORLY GRADED SAND (SP),** brown (10YR-4/3), moist, medium grained.
  - **POORLY GRADED SAND (SP),** dark yellowish brown (10YR-3/4), moist, fine to medium grained.
  - **POORLY GRADED SAND (SP),** dark yellowish brown (10YR-4/4), moist, fine to medium grained.
  - **POORLY GRADED SAND (SP),** dark yellowish brown (10YR-4/3), moist, medium to coarse grained.
  - **CLAY (CL),** very dark brown (10YR-2/2), moist, high plasticity, occasional mica flakes.
  - **POORLY GRADED SAND (SP),** dark yellowish brown (10YR-3/4), moist, medium to coarse grained.

**EXPLANATION**
- **Clay**
- **Silt**
- **Sand**
- **Gravel**

**WELL CONSTRUCTION AND LITHOLOGY FOR WELL RW-48**
Continued

WELL CONSTRUCTION AND LITHOLOGY FOR WELL RW-48 (CONTINUED)

L o g

<table>
<thead>
<tr>
<th>Depth, feet</th>
<th>Visual Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>6-in. dia. Stainless Steel wire-wrapped screen (0.010&quot; slot)</td>
</tr>
<tr>
<td>50</td>
<td>Bottom of boring at 64 feet bgs.</td>
</tr>
<tr>
<td>55</td>
<td>Bottom of well at 57 feet bgs.</td>
</tr>
<tr>
<td>60</td>
<td>WELL GRADED GRAVEL (GW), dark yellowish brown (10YR-4/4), wet, rounded to subrounded medium to coarse sand.</td>
</tr>
<tr>
<td>60</td>
<td>-as above, dark grayish brown (10YR-4/2).</td>
</tr>
<tr>
<td></td>
<td>FRIAR FORMATION (SS), reddish gray (2.5YR-5/1), moist, fine to medium grained, slightly cemented.</td>
</tr>
</tbody>
</table>

Materials used:
- 3.27 cubic feet of bottom plug bentonite chips
- 16.4 cubic feet of #2/16 sand
- 2.1 cubic feet of annular bentonite seal

Drilling Company: Prosonic Corporation
Drilling Method: Sonic
Sampling Method: Continuous Core

Date well drilled: 7/19/06
LFR Field Staff: Craig Burnett
Approved by: [Signature]

EXPLANATION
- Clay
- Silt
- Sand
- Gravel

Interval Sampled
Sample Retained
Air knife to 5 feet bgs.

WELL GRADED GRAVEL (GM), dark brown (10YR 3/3), moist, some areas damp, no dry strength, loose, coarse gravel (up to 5" dia.), some silt, very low plasticity, gray to brown mottled gravel, subrounded to subangular cobbles.

POORLY GRADED SAND (SP) with silt and gravel, dark brown to gray mottled, moist, no dry strength, soft, loose, fine to medium subrounded sand with trace coarse sand, non-plastic, non-cohesive, quartz and micas.

- First encountered water 17.0 ft bgs/ Elev 39.6 ft
- Stabilized water 17.67 ft bgs/ Elev 38.9 ft

Developed on 5/6/08 using Smeal Development rig. Purged approximately 475 gallons.
**LITHOLOGIC DESCRIPTION**

<table>
<thead>
<tr>
<th>DEPTHS</th>
<th>ELEVATIONS</th>
<th>PID (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>26.0</td>
<td>30.6</td>
<td>5.8</td>
</tr>
<tr>
<td>32.0</td>
<td>24.6</td>
<td>9.7</td>
</tr>
<tr>
<td>41.5</td>
<td>15.1</td>
<td>7.9</td>
</tr>
</tbody>
</table>

POORELY GRADED SAND (SP) with silt and gravel, dark brown to gray mottled, moist, no dry strength, soft, loose, fine to medium subrounded sand with trace coarse sand, non-plastic, non-cohesive, quartz and micas.

SILTY SAND (SM), black (10YR 2/2) to brown mottled, wet, medium soft, loose, fine to medium subrounded sand, some coarse sand, very low plasticity to no plasticity, poorly graded, micas and quartz.

SILTY SAND (SM), black (10YR 2/2) to brown mottled, wet, medium soft, loose, fine to medium subrounded sand, some coarse sand, very low plasticity to no plasticity, poorly graded, micas and quartz.
**PROJECT NAME**  Mission Valley Terminal - Qualcomm Stadium

**CLIENT**  Kinder Morgan Energy Partners

**WELL NUMBER** RW-49

**MATERIALS USED**
- Filter pack - 18.5 cubic feet of #2/16 sand
- Annular Seal - 1.0 cubic foot of bentonite chips
- 1.5 cubic feet of cement grout

**LITHOLOGIC DESCRIPTION**

<table>
<thead>
<tr>
<th>DEPTH (feet)</th>
<th>SAMPLE TYPE NUMBER</th>
<th>U.S.C.S.</th>
<th>GRAPHIC LOG</th>
<th>LITHOLOGIC DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>SM</td>
<td></td>
<td></td>
<td>SILTY SAND (SM), black (10YR 2/2) to brown mottled, wet, medium soft, loose, fine to medium subrounded sand, some coarse sand, very low plasticity to no plasticity, poorly graded, micas and quartz. (continued) -as above, with trace gravel.</td>
</tr>
<tr>
<td>50</td>
<td>SM</td>
<td>50.0</td>
<td></td>
<td>WELL GRADED SAND WITH GRAVEL (SW), brown to gray mottling, wet, soft, loose, no dry strength, medium to coarse subrounded sand, trace silt, cobbles (6 to 7&quot; dia.), micas and quartz. -as above, increase gravel with depth.</td>
</tr>
<tr>
<td>55</td>
<td>SW</td>
<td></td>
<td></td>
<td>FRIARS FORMATION (SS), gray sandstone, hard, arenite, cemented, weathered interface.</td>
</tr>
<tr>
<td>60</td>
<td>SW</td>
<td></td>
<td></td>
<td>Bottom of boring at 66 feet bgs. Bottom of well at 65 feet bgs.</td>
</tr>
<tr>
<td>65</td>
<td>SS</td>
<td>64.0</td>
<td></td>
<td>Stainless Steel Sump Slough</td>
</tr>
<tr>
<td>66</td>
<td>SS</td>
<td>66.0</td>
<td></td>
<td>6&quot; dia. SS Wire-wrap Screen (0.010&quot; slot)</td>
</tr>
<tr>
<td>10&quot; dia.</td>
<td>Borehole</td>
<td>50</td>
<td></td>
<td>#2/16 Sand</td>
</tr>
<tr>
<td>55</td>
<td>Borehole</td>
<td>55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>Borehole</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>Borehole</td>
<td>65</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**APPROVED BY:**  [Signature]  DATE: 8/6/08
SW

5.0

WELL GRADED SAND (SW) with silt and gravel, light reddish brown (5YR 6/3) to dark gray (5YR 4/1) mottling, damp, inconsistent dry strength, fine to medium subrounded sand, subangular fine to coarse gravel with trace cobbles (up to 5cm), low plasticity fines, micas.

SP

15.5

POORLY GRADED SAND (SP), light brown to black mottling, wet, loose, soft, no dry strength, fine to medium subrounded sand, no plasticity, micas, quartz, and feldspar.

Concrete vault

Cement Grout

Hydrated Bentonite Chips

6" dia. SCH40 PVC Blank Casing

#2/16 Sand

6" dia. SS Wire-wrap Screen (0.010" slot)

10" dia. Borehole

Air knife to 5 feet bgs.
POORLY GRADED SAND (SP), light brown to black mottling, wet, loose, soft, no dry strength, fine to medium subrounded sand, no plasticity, micas, quartz, and feldspar.

SILTY SAND (SM), black (2.5Y 2.5/1), wet, fine to medium subrounded sand, appreciable amounts of silt and clay, low plasticity, micas.

POORLY GRADED SAND (SP), light brown to black mottling, wet, loose, soft, no dry strength, fine to medium subrounded sand, no plasticity, micas, quartz, and feldspar.

WELL GRADED SAND (SW) with silt and gravel, dark grayish brown (10YR 3/2), loose, soft, fine to coarse subrounded sand, fine to coarse gravel, trace cobbles (up to 2.5 inches), trace silt, no plasticity, micas, quartz, and feldspar.

MATERIALS USED

6" dia. SS Wire-wrap Screen (0.010" slot)

#2/16 Sand

10" dia. Borehole
WELL NUMBER RW-51

**Project Name:** Mission Valley Terminal - Qualcomm Stadium  
**Client:** Kinder Morgan Energy Partners

**Materials Used**
- Filter pack - 18 cubic feet of #2/16 sand
- Annular seal - 0.5 cubic foot of bentonite chips  
  0.7 cubic foot of cement grout

**Graphic Log**

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Sample Type</th>
<th>U.S.C.S. Graphic Log</th>
<th>Lithologic Description</th>
<th>Elevations (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>SW</td>
<td></td>
<td>WELL GRADED SAND (SW) with silt and gravel, dark grayish brown (10YR 3/2), loose, soft, fine to coarse subrounded sand, fine to coarse gravel, trace cobbles (up to 2.5 inches), trace silt, no plasticity, micas, quartz, and feldspar.</td>
<td>0.5</td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>SW</td>
<td></td>
<td>WELL GRADED SAND (SW) with silt and gravel, dark grayish brown (10YR 3/2), loose, soft, fine to coarse subrounded sand, fine to coarse gravel, trace cobbles (up to 2.5 inches), trace silt, no plasticity, micas, quartz, and feldspar.</td>
<td>-9.5</td>
</tr>
<tr>
<td>65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>SS</td>
<td></td>
<td>FRIARS FORMATION (SS), dark gray (10YR 4/1), no cementation, fine to coarse grained sand.</td>
<td>-13.5</td>
</tr>
</tbody>
</table>

- Increasing clay and fines with depth.

**Well Diagram**

- 6" dia. SS Wire-wrap Screen (0.010" slot)
- 10" dia. Borehole
- Stainless Steel Sump
- Slough

- Bottom of boring at 66 feet bgs.
- Bottom of well at 61 feet bgs.

**Materials Used**
- Filter pack - 18 cubic feet of #2/16 sand
- Annular seal - 0.5 cubic foot of bentonite chips  
  0.7 cubic foot of cement grout

**Approved By:**

**Date:** 8/6/08
**PROJECT NAME:** Mission Valley Terminal  
**CLIENT:** KMEP  
**PROJECT LOCATION:** Qualcomm Stadium  
**PROJECT NUMBER:** 002-10180-92  
**LOCATION:** Qualcomm - West Parking Lot  
**OVA EQUIPMENT:** Mini Rae 2000  
**GROUND ELEVATION:** 67.90 ft-msl  
**HOLE DIAMETER:** 10 inches  
**TOP OF CASING ELEVATION:** NA  
**HOLE DEPTH:** 87.0 ft  
**FIRST ENCOUNTERED WATER:** 33.0 ft bgs/ Elev 34.9 ft  
**STABILIZED WATER:** 29.3 ft bgs/ Elev 38.6 ft  
**LOGGED BY:** Dana Brodie  
**DATE:** 5/1/08  
**DRILLING CONTRACTOR:** Boart Longyear  
**DRILLING METHOD:** Sonic Drilling  

---

**GROUND DESCRIPTION:**

- **SANDY GRAVELLY CLAY (CL),** mottled brown (10YR 5/3) and olive gray (5Y 5/2), moist, hard, no plasticity, fine to coarse grained sand, gravel to cobbles (4" dia.).
  
  - as above, dark grayish brown (10YR 4/2), more coarse grained sand.
  
  - as above, mottled very dark grayish brown (2.5Y 3/2), very dark brown (10YR 2/2) and dark olive gray (5Y 3/2).

- **GRAVELLY SANDY CLAY (CL),** mottled dark brown (10YR 3/3) and dark olive gray (5Y 3/2), moist, hard, no plasticity, fine to medium grained sand.
  
  - as above, pale yellow (2.5Y 8/2), moist, no plasticity, fine to coarse grained sand, gravel to cobbles (4" dia.).

---

**GRAPHIC LOG:**

- **CONCRETE VAULT**
- **10" dia. Borehole**
- **Bentonite Chips**
- **Bentonite Grout**
- **6" dia. SCH40 PVC Blank Casing**

---

**APPROVED BY:** Carol Carr  
**DATE:** 8/6/08
<table>
<thead>
<tr>
<th>DEPTH (feet)</th>
<th>SAMPLE TYPE NUMBER</th>
<th>CLAYEY SAND (SC), dark olive gray (5Y 3/2), moist, fine grained, trace medium grained, poorly graded.</th>
<th>U.S.C.S.</th>
<th>DEPTHS</th>
<th>LITHOLOGIC DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>CL</td>
<td>-as above, trace coarse grained.</td>
<td></td>
<td>24.0</td>
<td>GRAVELLY SANDY CLAY (CL), pale yellow (2.5Y 8/2), moist, no plasticity, fine to coarse grained sand, gravel to cobbles (4” dia.).</td>
</tr>
<tr>
<td>30</td>
<td>SC</td>
<td>-as above, olive gray (5Y 5/2), wet.</td>
<td>29</td>
<td>38.4</td>
<td>SILTY SAND (SM), gray (2.5Y 6/1), moist, fine to medium grained, poorly graded.</td>
</tr>
<tr>
<td>35</td>
<td></td>
<td>-as above, more coarse grained, trace gravel.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td>-as above, more coarse grained.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td>-as above, gravel (1” dia.).</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MATERIALS USED**

- Bentonite Chips
- 6” dia. SCH40 PVC Blank Casing
- 10” dia. Borehole
- 6” dia Stainless Steel Well Screen (0.010” slot)
- #2/12 Sand

---

(Continued Next Page)
<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Sample Type</th>
<th>U.S.C.S.</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>SP</td>
<td>10YR 3/1</td>
<td>Poorly Graded Sand, very dark gray (5Y 3/1), wet, fine to medium grained, trace clay.</td>
</tr>
<tr>
<td>54.0</td>
<td>CL</td>
<td>10YR 4/1</td>
<td>Sandy Clay, dark gray (10YR 4/1), wet, soft, moderate plasticity, fine to medium grained sand.</td>
</tr>
<tr>
<td>54.2</td>
<td>SM</td>
<td>10YR 3/1</td>
<td>Silty Sand, very dark gray (10YR 3/1), wet, fine grained, poorly graded.</td>
</tr>
<tr>
<td>55.0</td>
<td>SW</td>
<td>10YR 5/1</td>
<td>Well Graded Sand, gray (10YR 5/1), wet, fine to coarse grained.</td>
</tr>
<tr>
<td>58.5</td>
<td>SM</td>
<td>10YR 3/1</td>
<td>Silty Sand, dark gray (10YR 3/1), fine to medium grained sand, poorly graded, trace cobbles.</td>
</tr>
<tr>
<td>68.5</td>
<td>SW</td>
<td>10YR 3/1</td>
<td>Gravelly Sand, dark gray (10YR 3/1), fine to medium grained sand, few coarse grained sand, moderately graded, gravel (1 to 3&quot; dia.), trace fines.</td>
</tr>
</tbody>
</table>

Materials Used:

- Stainless Steel Well Screen (0.010" slot)
- 6" dia
- 10" dia Borehole
- #2/12 Sand

(Continued Next Page)
**FRIARS FORMATION (SS)**, gray (10YR 5/1), weathered sandstone.

- **Filter Pack**: 18.7 cubic feet of #2/12 Sand
- **Transition Seal**: 1.8 cubic foot of bentonite chips
- **Annular Seal**: 5.8 cubic feet of bentonite grout
- **Bottom Plug**: 2.7 cubic feet of bentonite chips

---

**Materials Used**

- Filter Pack - 18.7 cubic feet of #2/12 Sand
- Transition Seal - 1.8 cubic foot of bentonite chips
- Annular Seal - 5.8 cubic feet of bentonite grout
- Bottom Plug - 2.7 cubic feet of bentonite chips

---

**APPROVED BY: C. CARCE C.6911**
**DATE: 8/6/08**
### Lithologic Description

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Sample Type Number</th>
<th>U.S.C.S.</th>
<th>Graphic Log</th>
<th>Depths</th>
<th>Lithologic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Air knife to 5 feet bgs.</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>5.0</td>
<td>CLAYEY GRAVEL WITH SAND (GC), brown (10YR 5/3), moist, coarse to subrounded gravel, cobbles (up to 3.5&quot; dia.), some fine to medium grained sand.</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>7.0</td>
<td>SILTY GRAVEL WITH SAND (GM), light olive brown (2.5Y 5/4), moist, fine to coarse gravel, angular to subrounded (up to 3&quot; dia.), fine to medium grained sand, some fines. -as above, brown to light olive gray (5Y 6/2) mottled, cobbles (up to 4&quot; dia.).</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>9.5</td>
<td>SANDY CLAY (CL), dark brown (10YR 3/3), moist, hard, medium plasticity, fine grained sand with gravel (up to 1.5&quot; dia.). -as above, dark brown to dark gray mottled, cobbles (up to 5&quot; dia.).</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>12.5</td>
<td>SILTY SAND (SM), dark gray (10YR 4/1), moist, fine to medium grained sand, poorly graded, some clay, some gravel (up to 3&quot; dia.).</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>13.5</td>
<td>SANDY CLAY (CL), dark brown to dark gray mottled, moist, firm, medium plasticity, fine to coarse grained sand, with gravel and cobbles (up to 5&quot; dia.).</td>
</tr>
<tr>
<td>15.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>POORLY GRADED SAND (SP), very dark gray (10YR 3/1), wet, fine to medium grained, some fines, trace gravel and cobbles (up to 5&quot; dia.). -as above, dark gray (10YR 4/1), fine to coarse grained, pocket of clay at 16.5 feet bgs, black (10YR 2/1), plastic. -as above, less fines and more coarse grained sand with depth, some gravel (up to 2&quot; dia.).</td>
</tr>
</tbody>
</table>

### Well Diagram

- Concrete Vault
- Bentonite Chips
- 6" dia. SCH40 PVC Blank Casing
- #2/12 Sand
- 6" dia Stainless Steel Well Screen (0.010" slot)
- 10" dia. Borehole

---

Developed on 5/8/08 using Smeal Development rig. Purged approximately 490 gallons.
<table>
<thead>
<tr>
<th>DEPTH (feet)</th>
<th>SAMPLE TYPE NUMBER</th>
<th>U.S.C.S.</th>
<th>DEPTHS</th>
<th>LITHOLOGIC DESCRIPTION</th>
<th>ELEVATIONS</th>
<th>MATERIALS USED</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>SP</td>
<td>21.0</td>
<td></td>
<td>WELL GRADED SAND (SW), 3.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>light gray to light brown</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>mottled, fine to coarse</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>grained.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>ML</td>
<td>22.0</td>
<td></td>
<td>SILT (ML), very dark</td>
<td>32.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>gray (10YR 3/1), firm,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>medium plasticity, some</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>clay, trace fine grained</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>sand.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>CL</td>
<td>22.5</td>
<td></td>
<td>CLAY (CL), black (10YR 2/1),</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>firm, medium plasticity.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-as above, trace fine</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>gravel.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>ML</td>
<td>24.5</td>
<td></td>
<td>SILT (ML), very dark</td>
<td>28.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>gray (10YR 3/1), firm,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>medium plasticity, trace</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>clay.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>ML</td>
<td>29.5</td>
<td></td>
<td>-as above, with fine to</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>medium grained sand.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>SP</td>
<td>35.0</td>
<td></td>
<td>POORLY GRADED SAND (SP),</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>dark gray (10YR 4/1),</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>fine to medium grained,</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>trace coarse sand,</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>trace fines.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>ML</td>
<td>36.0</td>
<td></td>
<td>SILT (ML), very dark gray</td>
<td>18.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(10YR 3/1), soft, medium</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>plasticity, some clay.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>SW</td>
<td>37.0</td>
<td></td>
<td>GRAVELLY SAND (SW), dark</td>
<td>17.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>gray (10YR 4/1), fine to</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>coarse grained, trace</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>subrounded gravel (up to 1.5</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&quot; dia.), some fines.</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>-as above, fine to medium</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>grained sand, gravel (up to 3</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&quot; dia.).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SM</td>
<td>39.5</td>
<td></td>
<td>SILTY SAND WITH GRAVEL (SM),</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>very dark to dark gray,</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>fine to coarse grained,</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>trace gravel (up to 2&quot; dia.),</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>low plasticity.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>GW</td>
<td>41.0</td>
<td></td>
<td>WELL GRADED GRAVEL WITH</td>
<td>13.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SAND (GW) mixture, very</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>dark grayish brown (10YR 3/2),</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>fine to coarse grained,</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>trace angular to subrounded</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>gravel (up to 2&quot; dia.).</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>-as above, trace</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>rounded gravel (up to 1&quot; dia.).</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>-as above, increase coarse</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>grained sand with depth,</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>gravel (up to 3&quot; dia.).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MATERIALS USED**

- #2/12 Sand Stainless Steel Well Screen (0.010" slot)
- 10" dia. Borehole
- 6" dia Stainless Steel Well Screen
- 3" dia Stainless Steel Well Screen

**APPROVED BY:**

[Signature]

**DATE:** 8/6/08
### Lithologic Description

- **GW**: Well-graded gravel with sand (GW), very dark grayish brown (10YR 3/2), increasing gravel and cobble size with depth, fine to coarse grained sand.
- **SS**: Friars Formation (SS), gray (10YR 5/1), iron staining at 66 feet bgs.
- **SM**: Silty sand (SM), very dark gray (10YR 3/1), fine grained sand.
- **SW**: Gravelly sand (SW), very dark grayish brown (10YR 3/2), fine to coarse grained, with gravel (up to 3” dia.), increasing gravel with depth.

### Materials Used

- **Filter Pack**: 20.7 cubic feet of #2/12 Sand
- **Annular Seal**: 1.4 cubic feet of bentonite chips

### Approvals

- **Approved By**: C. Carr C-66471
- **Date**: 8/6/08
**WELL NUMBER RW-101**

**PROJECT NAME** Mission Valley Terminal  
**CLIENT** KMEP  
**PROJECT LOCATION** Qualcomm Stadium  
**PROJECT NUMBER** 002-10180-92  
**LOCATION** Qualcomm - SW Parking Lot  
**OVA EQUIPMENT** Mini Rae 2000

**GROUND ELEVATION** 45.70 ft-msl  
**HOLE DIAMETER** 10 inches  
**TOP OF CASING ELEVATION** NA  
**HOLE DEPTH** 57.0 ft  
**FIRST ENCOUNTERED WATER** 7.5 ft bgs/ Elev 38.2 ft  
**STABILIZED WATER** 7.5 ft bgs/ Elev 38.2 ft

**LOGGED BY** Tania Alarcon  
**DATE** 4/30/08

---

**Air knife to 5 feet bgs.**

**GM**

5.0

SILTY GRAVEL WITH SAND (GM), brown (10YR 5/3), moist, fine to coarse angular to subrounded gravel, fine to coarse grained sand, cobbles (up to 3.5" dia.), some silt.

- as above, dark gray (5Y 4/1), wet.

8.0

POORLY GRADED SAND (SP), very dark gray (10YR 3/1), fine to coarse grained, increasing grain size with depth, trace gravel (up to 1" dia.), trace fines.

- as above, dark gray (5Y 4/1), medium to coarse grained.
- as above, very dark gray (10YR 3/1), fine to coarse grained, no gravel.

16.5

WELL GRADED SAND (SW), dark gray (10YR 4/1), fine to coarse grained, trace fine gravel.

---

**CONTRACTOR** Boart Longyear  
**DRILLING METHOD** Sonic Drilling

**DEPTHS**

- 5 ft
- 10 ft
- 15 ft
- 20 ft

**ELEVATIONS**

- Stabilized Water: 7.5 ft bgs/ Elev 38.2 ft
- First Encountered Water: 7.5 ft bgs/ Elev 38.2 ft
- Top of Casing Elevation: NA

**SAMPLE TYPE**

- Number

**LITHOLOGIC DESCRIPTION**

(Continued Next Page)
### WELL GRADED GRAVEL WITH SAND (GW), very dark gray (10YR 3/1), subangular to subrounded, fine to coarse gravel, cobbles (up to 6" dia.), fine to coarse grained sand.

- as above, trace clay.

- as above, dark gray (10YR 4/1), cobbles (up to 7" dia.).

### WELL GRADED SAND (SW), fine to coarse grained, trace fine gravel.

- as above, fine to medium grained, trace fines, cobble (3.5" dia.).

- as above, black (10YR 2/1), some clay.

- as above, very dark gray (10YR 3/1), fine to coarse grained, gravel (up to 2.5" dia.), increasing gravel with depth.

### POORLY GRADED SAND (SP), very dark gray (10YR 3/1), fine to medium grained.

- as above, fine to coarse grained, some gravel (up to 3" dia.).

### SW

- as above, trace clay.

### MATERIALS USED

- 2" dia SCH40 PVC Well Screen (0.010" slot)

- 6" dia. Borehole

- #2/12 Sand

(Continued Next Page)
Bottom of boring at 57 feet bgs.
Bottom of well at 54.5 feet bgs.

MATERIALS USED
Filter Pack - 17.2 cubic feet of #2/12 Sand
Annular Seal - 1.4 cubic feet of Bentonite chips
DRILLING CONTRACTOR: Boart Longyear

DRILLING METHOD: Sonic

STAMP (IF APPLICABLE) AND/OR NOTES:
FID did not work properly due to heavy rain and high humidity.
Developed on 2/26/09 using Smeel Development rig.
Purged approximately 535 gallons.

LOGGED BY: Darren Burgott
DATE: 2/16/09 - 2/17/09

DEPT. (feet) | SAMPLE TYPE NUMBER | U.S.C.S. | GRAPHIC LOG | DEPTHS | LITHOLOGIC DESCRIPTION | ELEVATIONS | FID (ppm) | WELL DIAGRAM
---|---|---|---|---|---|---|---|---
0.3 | | | | | Asphalt (3" thick) | | | Concrete Vault
5.0 | | | | | No soil recovery. | | | 6" dia. SCH40 PVC Blank Casing
7.0 | | | | | SILTY SAND (SM), dark brown (10YR 3/3), moist, fine sand, 15% silt. | | | Concrete
11.0 | | | | | SANDY SILT (ML), dark brown (10YR 3/3), moist, firm, low plasticity, 20% fine sand, 5% clay, trace coarse sand. | | | Hydrated Bentonite Chips
12.5 | | | | | WELL GRADED SAND (SW), dark yellowish brown (10YR 3/4), moist, fine grained, some gravel. | | | #2/16 Sand
16.0 | | | | | SANDY SILT (ML), dark brown (10YR 3/3), moist firm, low plasticity, 20% fine sand, 10% clay, 5% coarse sand. | | | 6" dia. SS Wire-wrap Screen (0.010" slct)
- | | | | | -as above, with roots. | | | 10" dia. Borehole
- | | | | | -as above, no roots, increasing clay.

(Continued Next Page)

APPROVED BY: [Signature] 
DATE: 4/22/2009
-as above, decreasing clay, increasing fine sand.

POORLY GRADED SAND (SP), dark yellowish brown (10YR 3/4), moist, fine grained, 15% silt, micaceous.

-clayey silt lens at 28.5 feet bgs.

-as above, increasing silt and clay, wet.

SANDY SILT (ML), brown (10YR 5/3), wet, fine sand, 5% clay, micaceous.

POORLY GRADED SAND (SP), dark yellowish brown (10YR 3/4), wet, fine grained, 20% silt, micaceous.

SILT (ML), brown (10YR 5/3), wet, soft, non-plastic, micaceous.

-as above, increasing fine sand.

-clay lens at 40 feet bgs.

POORLY GRADED SAND (SP), dark yellowish brown (10YR 3/4), wet, fine grained, 10% silt, micaceous.
<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>SAMPLE TYPE NUMBER</th>
<th>U.S.C.S. GRAPHIC LOG</th>
<th>DEPTHS</th>
<th>LITHOLOGIC DESCRIPTION</th>
<th>ELEVATIONS</th>
<th>FID (rpm)</th>
<th>WELL DIAGRAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>SP</td>
<td></td>
<td></td>
<td>POORLY GRADED SAND (SP), dark yellowish brown (10YR 3/4), wet, fine grained, 10% silt, micaceous.</td>
<td></td>
<td></td>
<td>#2/16 Sand</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>48.0</td>
<td>-as above, 10% gravel.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>GW</td>
<td></td>
<td></td>
<td>WELL GRADED GRAVEL (GW), dark yellowish brown (10YR 3/4), wet, subrounded gravel, fine to coarse sand, micaceous.</td>
<td></td>
<td></td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50.0</td>
<td></td>
<td></td>
<td></td>
<td>Wire-wrap Screen (0.010&quot; slot)</td>
</tr>
<tr>
<td>55</td>
<td>SP</td>
<td></td>
<td></td>
<td>POORLY GRADED SAND (SP), dark yellowish brown (10YR 3/4), wet, fine to medium grained, trace coarse grained.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>54.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>GW</td>
<td></td>
<td></td>
<td>WELL GRADED GRAVEL (GW), dark yellowish brown (10YR 3/4), wet, subrounded gravel, fine to medium sand, few cobbles, micaceous.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>58.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>SM</td>
<td></td>
<td></td>
<td>SILTY SAND (SM), dark grayish brown (10YR 4/2), wet, fine to medium sand, low plasticity, micaceous.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>60.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>GM</td>
<td></td>
<td></td>
<td>SILTY GRAVEL (GM), dark yellowish brown (10YR 3/4), wet, fine to medium sand, subrounded gravel, micaceous, rhyolite, dacite, quartzite clasts, few cobbles.</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>62.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>SS</td>
<td></td>
<td></td>
<td>FRIARS SANDSTONE (SS), bluish gray (5/3 5/1), moist, weak, fine sand, 35% silt, 5% clay, weak foliation.</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>66.5</td>
<td>Bottom of boring at 66.5 feet bgs.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bottom of well at 63 feet bgs.</td>
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<td></td>
</tr>
</tbody>
</table>

**MATERIALS USED**
- Filter Pack - ~18 cubic feet of #2/16 Sand
- Annular Seal - ~1 cubic foot of Bentonite chips

**APPROVED BY:**

**DATE:** 4/22/2009
### Construction Details

**Date Start/Finish:** 4/14/11  
**Drilling Company:** Cascade Drilling  
**Driller's Name:** Val Godoy  
**Drilling Method:** Rotary Sonic  
**Sampling Method:** 10' x 6' Dia. Sonic Core Barrel  
**Rig Type:** Sonic Drill

**Well/Boring ID:** RW-109P (Pilot Boring)  
**Client:** Kinder Morgan Energy Partners  
**Location:** Mission Valley Terminal - Qualcomm Stadium  
9950 San Diego Mission Rd  
San Diego, CA 92108  
**Reviewed By:** [Signature]

**Noting:** 1865761.16  
**Easting:** 6293593.55  
**Casing Elevation:** NA  
**Borehole Depth:** 74' bgs  
**Borehole Diameter:** 8.5"  
**Surface Elevation:** 63.11' MSL  
**Descriptions By:** James Gonzales

### Stratigraphic Description

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample ID</th>
<th>Recovery (feet)</th>
<th>PID/FID (ppm)</th>
<th>Sieve Analysis Sample</th>
<th>USCS Code</th>
<th>Geologic Column</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td></td>
<td>0.0/NA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td></td>
<td>0.3/0.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td>0.4/0.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td></td>
<td>0.2/0.0</td>
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</tr>
</tbody>
</table>

- **Air knife to 5' bgs on 4/12/11. Soil logged from air knife cuttings.**
- **Silty Gravel (GM), fine to coarse subangular gravel, subrounded cobbles (up to 5" dia.), some fine grained sand with trace medium to coarse grained sand, poorly sorted, trace clay, low plasticity silt, no dilatancy, dry, medium dense, mottled gray to brown coloring.**
- **No recovery from 10' to 16' bgs.**
- **Slough from 16' to 18' bgs, interpreted as Silty Gravel (GM) with cobbles.**
- **Silty Gravel (GM), mostly fine to coarse subangular gravel, subrounded cobbles (up to 5" dia.), some fine grained sand with trace medium to coarse grained sand, poorly sorted, trace clay, low plasticity silt, no dilatancy, dry, medium dense, mottled gray to brown coloring.**

### Remarks

- Drilled approximately 66 feet NE of well RW-109.
- Material Used: 59 cubic feet of Bentonite Grout / Chips. Surface capped with cold asphalt.

### Water Level Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Depth</th>
<th>Elev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/14/11</td>
<td>27' ATD</td>
<td>NA</td>
</tr>
</tbody>
</table>

Depth measured from top of casing.
## Stratigraphic Description

<table>
<thead>
<tr>
<th>Depth</th>
<th>Elevation</th>
<th>Recovery (feet)</th>
<th>PID/FID (ppm)</th>
<th>Sieve Analysis Sample</th>
<th>USCS Code</th>
<th>Geologic Column</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td></td>
<td>1.4/0.0</td>
<td></td>
<td></td>
<td>GM</td>
<td>gray to brown coloring.</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td>0.0/0.0</td>
<td></td>
<td></td>
<td>SP</td>
<td>POORLY GRADED SAND WITH GRAVEL (SP), mostly fine to coarse grained, subrounded, some fine to coarse subrounded gravel, trace subrounded gravel, trace silt, dry, gray (2.5Y 5/1) sand, brown to gray gravel and cobbles.</td>
</tr>
<tr>
<td>40</td>
<td></td>
<td>0.0/0.0</td>
<td></td>
<td></td>
<td>SP-SW</td>
<td>Silt from 28' to 30' bgs, interpreted as POORLY GRADED SAND WITH GRAVEL (SP) to WELL GRADED SAND (SW).</td>
</tr>
<tr>
<td>35</td>
<td></td>
<td>0.0/0.0</td>
<td></td>
<td></td>
<td>SM</td>
<td>WELL GRADED SAND (SW), mostly fine to coarse grained, subrounded, poorly sorted, trace silt, trace subangular fine gravel, wet, loose, soft, olive brown (2.5Y 4/3) micaceous.</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td>1.3/2.4</td>
<td></td>
<td></td>
<td>SW</td>
<td>SILTY SAND (SM), low plasticity silt, no dilatency, fine subrounded sand, olive brown (2.5Y 4/3).</td>
</tr>
</tbody>
</table>

### Remarks:
- ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level; ATD = At Time of Drilling
- Drilled approximately 66 feet NE of well RW-109.
- Material Used: 59 cubic feet of Bentonite Grout / Chips. Surface capped with cold asphalt.

## Water Level Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Depth</th>
<th>Elev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/14/11</td>
<td>27' ATD</td>
<td>NA</td>
</tr>
</tbody>
</table>

Depth measured from top of casing
### Stratigraphic Description

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Elevation (feet)</th>
<th>Recovery (feet)</th>
<th>PID/FID (ppm)</th>
<th>Sieve Analysis</th>
<th>Sample</th>
<th>USCS Code</th>
<th>Geologic Column</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>25</td>
<td>0.1/0.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>30</td>
<td>0.0/0.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>40</td>
<td>0.9/1.1</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Remarks:**
- No recovery from 38' to 44' bgs.
- WELL GRADED SAND (SW), fine to coarse grained, subrounded, poorly sorted, trace silt, trace subangular fine gravel, wet, loose, soft, olive brown (2.5Y 4/3), micaceous.
- SILTY SAND (SM), low plasticity silt and fine to medium subrounded sand, low density, loose, dark olive brown (2.5Y 3/3).
- Slough from 50' to 52' bgs, interpreted as SILTY SAND (SM) to WELL GRADED SAND WITH GRAVEL (SW).
- WELL GRADED SAND WITH GRAVEL (SW), fine to coarse subrounded sand, some subangular to subrounded fine to coarse gravel (up to 2" dia.), wet, loose, soft, dark olive brown (2.5Y 3/3), brown to gray mottled coloring.

**Well/Boring Construction**
- Borehole backfilled with Bentonite Grout / Chips
- Material Used: 59 cubic feet of Bentonite Grout / Chips. Surface capped with cold asphalt.

**Water Level Data**

<table>
<thead>
<tr>
<th>Date</th>
<th>Depth</th>
<th>Elev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/14/11</td>
<td>27’ ATD</td>
<td>NA</td>
</tr>
</tbody>
</table>

**Remarks:**
- ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level; ATD = At Time of Drilling
- Drilled approximately 66 feet NE of well RW-109.
- Material Used: 59 cubic feet of Bentonite Grout / Chips. Surface capped with cold asphalt.

**Depth measured from top of casing**
**Client:** Kinder Morgan Energy Partners  
**Well/Boring ID:** RW-109P (Pilot Boring)  
**Site Location:** Mission Valley Terminal - Qualcomm Stadium  
9950 San Diego Mission Rd  
San Diego, CA 92108  
**Borehole Depth:** 74' bgs

### Stratigraphic Description

<table>
<thead>
<tr>
<th>Depth</th>
<th>Elevation</th>
<th>Sample ID</th>
<th>Recovery (feet)</th>
<th>PID/FID (ppm)</th>
<th>Sieve Analysis Sample</th>
<th>USCS Code</th>
<th>Geologic Column</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>-60</td>
<td>0</td>
<td>RW-109-62</td>
<td>0.4/1.3</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>-65</td>
<td>60</td>
<td>RW-109-67</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>-70</td>
<td>65</td>
<td>RW-109-73</td>
<td>2.2/1.9</td>
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<td></td>
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<td></td>
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<tr>
<td>-10</td>
<td>70</td>
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<tr>
<td>-5</td>
<td>75</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

- **WELL GRADED SAND (SW), fine to coarse grained sand, subrounded, trace silt, wet, loose, soft, micaceous.**
- **WELL GRADED SAND WITH GRAVEL (SW), fine to coarse grained sand, subrounded, some fine to coarse subangular gravel, trace cobbles (up to 3.5" dia.), trace silt, loose, soft.**

- **FRIARS SANDSTONE (SS), gray.**

**Remarks:** ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level; ATD = At Time of Drilling

- Drilled approximately 66 feet NE of well RW-109.
- Material Used: 59 cubic feet of Bentonite Grout / Chips. Surface capped with cold asphalt.

**Water Level Data**

<table>
<thead>
<tr>
<th>Date</th>
<th>Depth</th>
<th>Elev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/14/11</td>
<td>27' ATD</td>
<td>NA</td>
</tr>
</tbody>
</table>

Depth measured from top of casing
Drill Site: RW-109 (GWE Well)

Client: Kinder Morgan Energy Partners
Location: Mission Valley Terminal - Qualcomm Stadium
9950 San Diego Mission Rd
San Diego, CA 92108


Material Used: 18 cubic ft of Sand, 27 cubic ft of Bentonite Grout/Chips, 2 cubic ft of Concrete Seal.

---

**Date Start/Finish:** 6/3/11 - 6/4/11  
**Drilling Company:** Cascade Drilling  
**Driller's Name:** Val Godoy  
**Drilling Method:** Rotary Sonic  
**Sampling Method:** 10' x 6" Dia. Sonic Core Barrel  
**Rig Type:** Sonic Drill

**Elevation:**

- **Easting:** 6293537.80  
- **Nording:** 1865726.60  
- **Casing Elevation:** NA  
- **Borehole Depth:** 71' bgs  
- **Borehole Diameter:** 10"  
- **Surface Elevation:** 60.15' MSL  
- **Descriptions By:** James Gonzales

**Descriptive Column**

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Stratigraphic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4' bgs</td>
<td>Air knife to 5' bgs on 4/12/11. Soil logged from air knife cuttings. Silty Gravel (GM) with cobbles, mostly silt and fine grained sand, mostly fine to coarse subangular gravel, subrounded cobbles (up to 5&quot; dia.), trace medium to coarse grained sand, poorly sorted, trace clay, low plasticity, no dilatancy, dry, medium dense, mottled gray to brown coloring.</td>
</tr>
<tr>
<td>4-7' bgs</td>
<td>Concrete Vault (0-4' bgs)</td>
</tr>
<tr>
<td>7-9' bgs</td>
<td>Bentonite Chips (1-9' bgs)</td>
</tr>
<tr>
<td>9-40' bgs</td>
<td>Bentonite Grout (9-40' bgs)</td>
</tr>
<tr>
<td>40-60' bgs</td>
<td>Concrete (4-7' bgs)</td>
</tr>
<tr>
<td>60-80' bgs</td>
<td>10&quot; Dia. Borehole</td>
</tr>
</tbody>
</table>

**Remarks:** ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level

Drill Site: RW-109 (GWE Well)
### Stratigraphic Description

<table>
<thead>
<tr>
<th>Depth Range (feet bgs)</th>
<th>Lithology Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-22</td>
<td>No recovery from 20' to 22' bgs.</td>
</tr>
<tr>
<td>25-30</td>
<td>Silty gravel (GM) as above, moist.</td>
</tr>
<tr>
<td>28-30</td>
<td>Silt from 28' to 30' bgs, interpreted as POORLY GRADED SAND WITH GRAVEL (SP) to WELL GRADED SAND (SW).</td>
</tr>
<tr>
<td>30-35</td>
<td>Silty sand (SM), mostly fine sand and silt, low plasticity, medium dense, olive brown (2.5Y 4/3).</td>
</tr>
<tr>
<td>38-44</td>
<td>Silty sand (SM), mostly low plasticity silt, no dilatancy, some fine subrounded sand, olive brown (2.5Y 4/3).</td>
</tr>
</tbody>
</table>

**Remarks:** ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level


Material Used: 18 cubic ft of Sand, 27 cubic ft of Bentonite Grout/Chips, 2 cubic ft of Concrete Seal.
**Well/Boring ID:** RW-109 (GWE Well)  
**Site Location:**  
Mission Valley Terminal - Qualcomm Stadium  
9950 San Diego Mission Rd  
San Diego, CA 92108  
**Borehole Depth:** 71’ bgs

**Client:** Kinder Morgan Energy Partners  
**Well/Boring ID:** RW-109 (GWE Well)  
**Borehole Depth:** 71’ bgs

**Remarks:** ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level


Material Used: 18 cubic ft of Sand, 27 cubic ft of Bentonite Grout/Chips, 2 cubic ft of Concrete Seal.

---

**Stratigraphic Description**

**Sample ID**

- No recovery from 38’ to 44’ bgs.
- WELL GRADED SAND (SW), mostly fine to coarse grained, subrounded, poorly sorted, trace silt, trace subangular fine gravel, wet, loose, soft, olive brown (2.5Y 4/3), micaceous.
- SILTY SAND (SM), low plasticity silt and fine to medium subrounded sand, low density, loose, dark olive brown (2.5Y 3/3).
- Slough from 50’ to 52’ bgs, interpreted as SILTY SAND (SM) to WELL GRADED SAND WITH GRAVEL (SW).
- WELL GRADED SAND WITH GRAVEL (SW), mostly fine to coarse subrounded sand, some subangular to subrounded fine to coarse gravel (up to 2” dia.), wet, loose, soft, dark olive brown (2.5Y 3/3), brown to gray mottled coloring.

---

**Project Notes:**

- Bentonite Grout (9-40’ bgs)
- Bentonite Chips (40-40 bgs)
- 6” Dia. SCH40 PVC Blank Casing (1-50’ bgs)
- #3 Sand (45-71’ bgs)
- 6” Dia. SS Wire-wrapped Wet Screen 0.030” Slot (50-70’ bgs)
- 10” Dia. Borehole

Material Used: 18 cubic ft of Sand, 27 cubic ft of Bentonite Grout/Chips, 2 cubic ft of Concrete Seal.
### Construction Data

**Date Start/Finish:** 4/15/11  
**Drilling Company:** Cascade Drilling  
**Driller’s Name:** Val Godoy  
**Drilling Method:** Rotary Sonic  
**Sampling Method:** 10’ x 6” Dia. Sonic Core Barrell  
**Rig Type:** Sonic Drill  

**Elevation**  
- **Casing Elevation:** NA  
- **Easting:** 6293489.21  
- **Northing:** 1865429.40  
- **Borehole Depth:** 68’ bgs  
- **Borehole Diameter:** 8.5”  
- **Surface Elevation:** 54.56’ MSL  
- **Well/Boring ID:** RW-110P (Pilot Boring)  
- **Client:** Kinder Morgan Energy Partners  
- **Location:** Mission Valley Terminal - Qualcomm Stadium  
  - 9950 San Diego Mission Rd  
  - San Diego, CA 92108  

**Reviewed By:** Scott Beaded  
**Data File:** RW-110P.dat  

---

### Stratigraphic Description

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Recovery (feet)</th>
<th>PID/FID (ppm)</th>
<th>Sieve Analysis Sample</th>
<th>USCS Code</th>
<th>Geologic Column</th>
<th>Stratigraphic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Air to 5’ bgs on 4/12/11. Soil logged from air knife cuttings.</td>
<td>Silty Gravel (GM), fine to coarse subangular gravel, cobbles (up to 3-4” dia.), some fine grained sand with some medium and coarse grained sand, low plastic silt, dry to moist, brown to gray mottled coloring.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>GM</td>
<td>Silty Gravel (GM) as above.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No recovery from 10’ to 14’ bgs, interpreted as Silty Gravel (GM).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>GM</td>
<td></td>
</tr>
</tbody>
</table>

---

### Remarks:

- ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level; ATD = At Time of Drilling
- Drilled approximately 115 ft east of well RW-110.
- Material Used: 54 cubic feet of Bentonite Grout / Chips. Surface capped with cold asphalt.

### Water Level Data

- **Date:** 4/15/11  
- **Depth:** 19’ ATD  
- **Elev.:** NA

Depth measured from top of casing
## Site Location:
Mission Valley Terminal - Qualcomm Stadium  
9950 San Diego Mission Rd  
San Diego, CA 92108

### Client:
Kinder Morgan Energy Partners

### Well/Boring ID:
RW-110P (Pilot Boring)

### Borehole Depth:
68' bgs

---

### DEPTH | ELEVATION | Sample ID | Recovery (feet) | PID/FID (ppm) | Sieve Analysis Sample | USCS Code | Geologic Column | Stratigraphic Description | Well/Boring Construction
---|---|---|---|---|---|---|---|---|---
35 | 35 | | | | | | WELL GRADED SAND (SW), fine to coarse grained, subrounded, trace silt, moderate dilatancy, wet, low density, loose, dark olive brown (2.5Y 3/3), micaceous. |
30 | 30 | | 0.3/0.0 | | | | POORLY GRADED SAND (SP), mostly medium to coarse grained sand, some fine grained sand, subrounded, rapid dilatancy, wet, low density, dark olive brown (2.5Y 3/3), micaceous. |
25 | 25 | | 0.5/0.0 | | | | No recovery from 30' to 37' bgs. |
20 | 20 | RW-110-39 | | | | | WELL GRADED SAND (SW), mostly fine to medium grained sand, subrounded, some coarse subrounded sand, moderate dilatancy, trace silt, trace subangular gravel. |

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### Remarks: ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level; ATD = At Time of Drilling
Drilled approximately 115 ft east of well RW-110.  

Material Used: 54 cubic feet of Bentonite Grout / Chips.  
Surface capped with cold asphalt.

---

### Water Level Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Depth</th>
<th>Elev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/15/11</td>
<td>19' ATD</td>
<td>NA</td>
</tr>
</tbody>
</table>

Depth measured from top of casing.
**Client:** Kinder Morgan Energy Partners  
**Well/Boring ID:** RW-110P (Pilot Boring)  
**Site Location:**  
Mission Valley Terminal - Qualcomm Stadium  
9950 San Diego Mission Rd  
San Diego, CA 92108

**Borehole Depth:** 68' bgs

### Data File: RW-110P.dat

**Date:** 4/15/11  
**Created/Edited by:** SCO

---

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>ELEVATION</th>
<th>Recovery (feet)</th>
<th>PID/FID (ppm)</th>
<th>Sieve Analysis Sample</th>
<th>USCS Code</th>
<th>Geologic Column</th>
<th>Stratigraphic Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RW-110-42</td>
<td>40</td>
<td>0.7/0.0</td>
<td>SW</td>
<td>-decreasing fines, increasing coarse grained sand with depth, increasing subangular and subrounded gravel.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RW-110-44</td>
<td>45</td>
<td>0.2/0.0</td>
<td>SM</td>
<td>SILTY SAND (SM), fine subrounded sand, slow dilatancy, low plastic silt, well sorted, medium to low density, black (2.5Y 2.5/1).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RW-110-47</td>
<td>50</td>
<td>0.3/0.0</td>
<td>SW</td>
<td>-as above, decreasing fines.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RW-110-56</td>
<td>55</td>
<td>0.2/0.0</td>
<td>SW</td>
<td>WELL GRADED SAND (SW), fine to medium grained sand, subrounded, moderate to rapid dilatancy.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RW-110-58</td>
<td>60</td>
<td>0.3/0.0</td>
<td>SW</td>
<td>-as above, mostly medium to coarse grained sand, subrounded, rapid dilatancy, trace subangular fine gravel, low density, black (2.5Y 2.5/1).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RW-110-58</td>
<td>65</td>
<td>0.2/0.0</td>
<td>SW</td>
<td>-as above, wet.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Remarks:

- ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level; ATD = At Time of Drilling
- Drilled approximately 115 ft east of well RW-110.
- Material Used: 54 cubic feet of Bentonite Grout / Chips. Surface capped with cold asphalt.

### Water Level Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Depth</th>
<th>Elev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/15/11</td>
<td>19' ATD</td>
<td>NA</td>
</tr>
</tbody>
</table>

Depth measured from top of casing
### Stratigraphic Description

FRIARS SANDSTONE (SS), weathered gray sandstone, weakly cemented, moist, light to dark gray.

### Remarks:
- ft bgs = feet below ground surface; NA = Not Applicable/Avaliable; MSL = Mean Sea Level; ATD = At Time of Drilling
- Drilled approximately 115 ft east of well RW-110.
- Material Used: 54 cubic feet of Bentonite Grout / Chips. Surface capped with cold asphalt.

### Water Level Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Depth</th>
<th>Elev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/15/11</td>
<td>19' ATD</td>
<td>NA</td>
</tr>
</tbody>
</table>

Depth measured from top of casing
**Date Start/Finish:** 6/1/11 - 6/2/11  
**Drilling Company:** Cascade Drilling  
**Driller's Name:** Val Godoy  
**Drilling Method:** Rotary Sonic  
**Sampling Method:** 10' x 6" Dia. Sonic Core Barrell  
**Rig Type:** Sonic Drill  

**Well/Boring ID:** RW-110 (GWE Well)  
**Client:** Kinder Morgan Energy Partners  
**Location:** Mission Valley Terminal - Qualcomm Stadium  
9950 San Diego Mission Rd  
San Diego, CA 92108  
**Reviewed By:** [Signature]  

**Remarks:** ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level

Drilled approximately 115 ft west of pilot boring RW-110P. Lithology determined from pilot boring RW-110P. Actual Friars Sandstone contact determined from well RW-110.  

Material Used: 21 cubic ft of #8 Sand, 20 cubic ft of Bentonite Grout/Chips, 2 cubic ft of Concrete Seal.

<table>
<thead>
<tr>
<th>Depth (ft bgs)</th>
<th>Sample ID</th>
<th>Recovery (feet)</th>
<th>PID/FID (ppm)</th>
<th>Sieve Analysis Sample</th>
<th>Geologic Column</th>
<th>Stratigraphic Description</th>
<th>Well/Boring Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Air knife to 5' bgs on 4/12/11. Soil logged from air knife cuttings.</td>
<td>[Diagram of Stratigraphy]</td>
</tr>
<tr>
<td>43</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SILTY GRAVEL (GM) with cobbles, mostly low plastic silt and fine grained sand, fine to-coarse subangular gravel, cobbles (up to 3-4&quot; dia.), some medium and coarse grained sand, dry to moist, brown to gray mottled coloring.</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
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<td></td>
<td>No recovery from 10' to 14' bgs, interpreted as SILTY GRAVEL (GM).</td>
<td>[Diagram of Stratigraphy]</td>
</tr>
<tr>
<td>33</td>
<td></td>
<td></td>
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<td></td>
<td>SILTY GRAVEL (GM) with cobbles as above.</td>
<td>[Diagram of Stratigraphy]</td>
</tr>
<tr>
<td>20</td>
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<td>[Diagram of Stratigraphy]</td>
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<td>[Diagram of Stratigraphy]</td>
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<td></td>
<td></td>
<td>[Diagram of Stratigraphy]</td>
<td>[Diagram of Stratigraphy]</td>
</tr>
</tbody>
</table>

**Well/Boring Dimensions:**
- **Elevation:**
  - Stratigraphic Description
  - **Well/Boring Control**
    - **EASTING:** 6293374.76
    - **NORTHING:** 1865424.21
    - **Casing Elevation:** NA
    - **Borehole Depth:** 63' bgs
    - **Borehole Diameter:** 10"
    - **Surface Elevation:** 50.48' MSL
    - **Descriptions By:** James Gonzales
### Stratigraphic Description

**WELL GRADED SAND (SW),** fine to coarse grained, subrounded, trace silt, moderate dilatancy, wet, low density, loose, dark olive brown (2.5Y 3/3), micaceous.

**POORLY GRADED SAND (SP),** mostly medium to coarse grained sand, some fine grained sand, subrounded, rapid dilatancy, wet, low density, dark olive brown (2.5Y 3/3), micaceous.

No recovery from 30' to 37' bgs.

**WELL GRADED SAND (SW),** mostly fine to medium grained sand, subrounded, some coarse subrounded sand, moderate dilatancy, trace silt, trace subangular gravel.

**Remarks:** ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level

Drilled approximately 115 ft west of pilot boring RW-110P. Lithology determined from pilot boring RW-110P. Actual Friars Sandstone contact determined from well RW-110.

Material Used: 21 cubic ft of #8 Sand, 20 cubic ft of Bentonite Grout/Chips, 2 cubic ft of Concrete Seal.
Drilled approximately 115 ft west of pilot boring RW-110P. Lithology determined from pilot boring RW-110P. Actual Friars Sandstone contact determined from well RW-110.

Material Used: 21 cubic ft of #8 Sand, 20 cubic ft of Bentonite Grout/Chips, 2 cubic ft of Concrete Seal.
### Well/Boring Description

**Client:** Kinder Morgan Energy Partners  
**Site Location:** Mission Valley Terminal - Qualcomm Stadium  
**Site Address:** 9950 San Diego Mission Rd  
**City:** San Diego  
**State:** CA  
**Zip Code:** 92108

**Well/Boring ID:** RW-110 (GWE Well)  
**Borehole Depth:** 63' bgs

<table>
<thead>
<tr>
<th>DEPTH (ft bgs)</th>
<th>Sample ID</th>
<th>Recovery (ft)</th>
<th>PID/FID (ppm)</th>
<th>Sieve Analysis Sample</th>
<th>USCS Code</th>
<th>Geologic Column</th>
<th>Stratigraphic Description</th>
<th>Well/Boring Construction</th>
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<tbody>
<tr>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WELL GRADED SAND (SW), fine to coarse grained, moderate to rapid dilatancy, non-cohesive, loose, soft, black (2.5Y 2.5/1).</td>
<td><img src="#" alt="Integrated Bottom Cap" /></td>
</tr>
<tr>
<td>-20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FRIARS SANDSTONE (SS), weathered gray sandstone, weakly cemented, moist, light to dark gray.</td>
<td>![#8 Mesh Sand](35-63' bgs)</td>
</tr>
<tr>
<td>65</td>
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<tr>
<td>-25</td>
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</table>

**Remarks:** ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level  

Drilled approximately 115 ft west of pilot boring RW-110P. Lithology determined from pilot boring RW-110P. Actual Friars Sandstone contact determined from well RW-110.  

Material Used: 21 cubic ft of #8 Sand, 20 cubic ft of Bentonite Grout/Chips, 2 cubic ft of Concrete Seal.
### Well/Boring ID: RW-111P (Pilot Boring)

**Client:** Kinder Morgan Energy Partners  
**Location:** Mission Valley Terminal - Qualcomm Stadium  
9950 San Diego Mission Rd  
San Diego, CA 92108

**Date Start/Finish:** 4/19/11  
**Drilling Company:** Cascade Drilling  
**Driller's Name:** Val Godoy  
**Drilling Method:** Rotary Sonic  
**Sampling Method:** 10' x 6” Dia. Sonic Core Barrell  
**Rig Type:** Sonic Drill

**Casing Elevation:** 1865177.82  
**Easting:** 6293419.52  
**Elevation:** NA  
**Borehole Depth:** 65' bgs  
**Borehole Diameter:** 8.5”  
**Surface Elevation:** 49.61’ MSL

**Reviewed By:** [Signature]

---

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>ELEVATION</th>
<th>Sample ID</th>
<th>Recovery (feet)</th>
<th>PID/FID (ppm)</th>
<th>Sieve Analysis Sample</th>
<th>USCS Code</th>
<th>Stratigraphic Description</th>
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<td>Air knife to 5’ bgs on 4/14/11. Soil logged from air knife cuttings. Asphalt at surface. Silty Gravel (GM), low to medium plastic silt, no dilatancy, subrounded to subangular fine to coarse gravel, some subrounded to subangular cobbles (up to 3-4” dia.), poorly sorted, moist, dense, mottled gray to brown coloring.</td>
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<td>GW</td>
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<td>-as above, moist.</td>
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<td>-as above, dark yellowish brown (10YR 4/4).</td>
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<tr>
<td>30</td>
<td>SW</td>
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<td>WELL GRADED GRAVEL WITH SAND (GW), fine to coarse grained sand, subrounded, moderate dilatancy, fine to coarse subangular gravel, some silt, trace subrounded cobbles, poorly sorted, wet, very dark brown (10YR 2/2).</td>
</tr>
</tbody>
</table>

**Remarks:** ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level; ATD = At Time of Drilling

Drilled approximately 7 ft east of well RW-111.  
Material Used: 52 cubic feet of Bentonite Grout / Chips.  
Surface capped with cold asphalt.

---

**Water Level Data**

<table>
<thead>
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<th>Depth</th>
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</thead>
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<tr>
<td>4/19/11</td>
<td>13-17' ATD</td>
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Depth measured from top of casing
### Stratigraphic Description

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<th>PIQ/HID (ppm)</th>
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<th>USCS Code</th>
<th>Geologic Column</th>
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<tbody>
<tr>
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<td>20</td>
<td>0.0/0.0</td>
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<td></td>
<td></td>
<td>SW</td>
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<td>35</td>
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<td>1.9/0.0</td>
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<td>0.0/0.0</td>
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<td></td>
<td>SW</td>
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<tr>
<td>25</td>
<td>10</td>
<td>1.9/0.0</td>
<td></td>
<td></td>
<td></td>
<td>SW</td>
</tr>
</tbody>
</table>

### Remarks:

- ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level; ATD = At Time of Drilling
- Drilled approximately 7 ft east of well RW-111.
- Material Used: 52 cubic feet of Bentonite Grout / Chips. Surface capped with cold asphalt.

### Water Level Data

- **Date:** 4/19/11
- **Depth:** 13-17' ATD
- **Elev.:** NA

Depth measured from top of casing
### Client:
Kinder Morgan Energy Partners

### Site Location:
Mission Valley Terminal - Qualcomm Stadium  
9950 San Diego Mission Rd  
San Diego, CA 92108

### Well/Boring ID: RW-111P (Pilot Boring)

### Borehole Depth: 65' bgs

### Stratigraphic Description and Construction

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>ELEVATION</th>
<th>Sample ID</th>
<th>Recovery (feet)</th>
<th>PID/FID (ppm)</th>
<th>Sieve Analysis Sample</th>
<th>USCS Code</th>
<th>Geologic Column</th>
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</table>

- as above, increasing cobbles.
- as above, some fine gravel, soft, dark yellowish brown (10YR 3/4).

WELL GRADED GRAVEL WITH SAND (GW), fine to coarse grained sand, subrounded, moderate dilatancy, fine to coarse subrounded to subangular gravel, some subrounded cobbles (up to 3-4" dia.), trace to some non-plastic silt, very poorly sorted, wet, loose, mottled gray to brown coloring.

No recovery from 55' to 60' bgs.

Borehole backfilled with Bentonite Grout / Chips

### Remarks:
- ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level; ATD = At Time of Drilling
- Drilled approximately 7 ft east of well RW-111.
- Material Used: 52 cubic feet of Bentonite Grout / Chips. Surface capped with cold asphalt.

### Water Level Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Depth</th>
<th>Elev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/19/11</td>
<td>13-17' ATD</td>
<td>NA</td>
</tr>
</tbody>
</table>

Depth measured from top of casing

---

Project: CM010143.0091  
Data File: RW-111P.dat  
Template: G:\Rockware\LogPlot 2001\LogFiles\Templates\boring_well geoprobe 2007 analytical USCS WL.ldfx  
Date: 8/4/2011  
Created/Edited by: SCO  
Page: 3 of 4
**Client:** Kinder Morgan Energy Partners  

**Well/Boring ID:** RW-111P (Pilot Boring)  

**Site Location:**  
Mission Valley Terminal - Qualcomm Stadium  
9950 San Diego Mission Rd  
San Diego, CA 92108  

**Borehole Depth:** 65' bgs  

### Stratigraphic Description

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>ELEVATION</th>
<th>Sample ID</th>
<th>Recovery (feet)</th>
<th>PID/FID (ppm)</th>
<th>USCS Code</th>
<th>Geologic Column</th>
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<tr>
<td>-10</td>
<td>60</td>
<td>0/0/0</td>
<td>0.0</td>
<td>0.0</td>
<td>FRIARS SANDSTONE (SS), partially cemented siltstone to sandstone, weathered gray.</td>
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</tr>
<tr>
<td>-15</td>
<td>65</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Borehole backfilled with Bentonite Grout / Chips</td>
</tr>
</tbody>
</table>

### Remarks:
- ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level; ATD = At Time of Drilling
- Drilled approximately 7 ft east of well RW-111.  
- Material Used: 52 cubic feet of Bentonite Grout / Chips. Surface capped with cold asphalt.

### Water Level Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Depth</th>
<th>Elev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/19/11</td>
<td>13-17' ATD</td>
<td>NA</td>
</tr>
</tbody>
</table>

**Depth measured from top of casing**

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**Data File:** RW-111P.dat  
**Template:** G:\Rockware\LogPlot 2001\LogFiles\Templates\boring_well geoprobe 2007 analytical USCS WL.ldfx  
**Page:** 4 of 4
### Construction Date Start/Finish: 5/25/11
Drilling Company: Cascade Drilling
Driller’s Name: Val Godoy
Drilling Method: Rotary Sonic
Sampling Method: 10’ x 6” Dia. Sonic Core Barrel
Rig Type: Sonic Drill

### Well/Boring ID: RW-111 (GWE Well)
Client: Kinder Morgan Energy Partners
Location: Mission Valley Terminal - Qualcomm Stadium
9950 San Diego Mission Rd
San Diego, CA 92108

### Remarks:
- Drilled approximately 7 ft west of pilot boring RW-111P. Lithology determined from pilot boring RW-111P. Actual Friars Sandstone contact determined from well RW-111.
- Material Used: 18 cubic ft of #8 Sand, 18 cubic ft of Bentonite Grout/Chips, 2 cubic ft of Concrete Seal.

### Stratigraphic Description

**Geologic Column**

- **GM**
  - Silty Gravel (GM), low to medium plastic silt, no dilatancy, subrounded to subangular fine to coarse gravel, some subrounded cobbles (up to 3-4” dia.), poorly sorted, moist, dense, mottled gray to brown coloring.
  - as above, moist.
  - as above, dark yellowish brown (10YR 4/4).

- **GW**
  - Well Graded Gravel with Sand (GW), fine to coarse grained sand, subrounded, moderate dilatancy, fine to coarse subangular gravel, some silt, trace sub-rounded cobbles, poorly sorted, wet, very dark brown (10YR 2/2).
  - as above, moist.
  - POORLY GRADED SAND (SP), fine to medium grained sand, subrounded, moderate dilatancy, some coarse subrounded sand, some non-plastic silt, moderately sorted, very dark brown (10YR 2/2), micaeous.
  - WELL GRADED SAND (SW), fine to coarse grained sand, subrounded, rapid dilatancy, trace sub-rounded fine to coarse gravel, trace silt, moderately sorted, wet, loose, soft, dark yellowish brown (10YR 3/4).
  - as above, increasing silt content.

### Depth Elevation

<table>
<thead>
<tr>
<th>Depth</th>
<th>Sample ID</th>
<th>Recovery (feet)</th>
<th>PIP/FID (ppm)</th>
<th>Sieve Analysis Sample</th>
<th>USCS Code</th>
<th>Stratigraphic Description</th>
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</thead>
<tbody>
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<td>0</td>
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<td></td>
<td>Air knife to 5’ bgs on 4/14/11. Soil logged from air knife cuttings. Asphalt at surface.</td>
</tr>
<tr>
<td>4</td>
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<td>SILTY GRAVEL (GM), low to medium plastic silt, no dilatancy, subrounded to subangular fine to coarse gravel, some subrounded cobbles (up to 3-4” dia.), poorly sorted, moist, dense, mottled gray to brown coloring.</td>
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<tr>
<td>10</td>
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<td>WELL GRADED GRAVEL WITH SAND (GW), fine to coarse grained sand, subrounded, moderate dilatancy, fine to coarse subangular gravel, some silt, trace sub-rounded cobbles, poorly sorted, wet, very dark brown (10YR 2/2).</td>
</tr>
<tr>
<td>15</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>POORLY GRADED SAND (SP), fine to medium grained sand, subrounded, moderate dilatancy, some coarse subrounded sand, some non-plastic silt, moderately sorted, very dark brown (10YR 2/2), micaeous.</td>
</tr>
<tr>
<td>20</td>
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<td></td>
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<td></td>
<td>WELL GRADED SAND (SW), fine to coarse grained sand, subrounded, rapid dilatancy, trace sub-rounded fine to coarse gravel, trace silt, moderately sorted, wet, loose, soft, dark yellowish brown (10YR 3/4).</td>
</tr>
<tr>
<td>25</td>
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<td></td>
<td></td>
<td></td>
<td>- as above, increasing silt content.</td>
</tr>
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</table>

**Geologic Column**

- **GM**
  - Silty Gravel (GM), low to medium plastic silt, no dilatancy, subrounded to subangular fine to coarse gravel, some subrounded cobbles (up to 3-4” dia.), poorly sorted, moist, dense, mottled gray to brown coloring.
  - as above, moist.
  - as above, dark yellowish brown (10YR 4/4).

- **GW**
  - Well Graded Gravel with Sand (GW), fine to coarse grained sand, subrounded, moderate dilatancy, fine to coarse subangular gravel, some silt, trace sub-rounded cobbles, poorly sorted, wet, very dark brown (10YR 2/2).
  - as above, moist.
  - POORLY GRADED SAND (SP), fine to medium grained sand, subrounded, moderate dilatancy, some coarse subrounded sand, some non-plastic silt, moderately sorted, very dark brown (10YR 2/2), micaeous.
  - WELL GRADED SAND (SW), fine to coarse grained sand, subrounded, rapid dilatancy, trace sub-rounded fine to coarse gravel, trace silt, moderately sorted, wet, loose, soft, dark yellowish brown (10YR 3/4).
  - as above, increasing silt content.

- **SP**
  - POORLY GRADED SAND (SP), fine to medium grained sand, subrounded, moderate dilatancy, some coarse subrounded sand, some non-plastic silt, moderately sorted, very dark brown (10YR 2/2), micaeous.
  - WELL GRADED SAND (SW), fine to coarse grained sand, subrounded, rapid dilatancy, trace sub-rounded fine to coarse gravel, trace silt, moderately sorted, wet, loose, soft, dark yellowish brown (10YR 3/4).
  - as above, increasing silt content.

- **SW**
  - WELL GRADED SAND (SW), fine to coarse grained sand, subrounded, rapid dilatancy, trace sub-rounded fine to coarse gravel, trace silt, moderately sorted, wet, loose, soft, dark yellowish brown (10YR 3/4).
  - as above, increasing silt content.
### Project Information
- **Client:** Kinder Morgan Energy Partners
- **Well/Boring ID:** RW-111 (GWE Well)
- **Site Location:** Mission Valley Terminal - Qualcomm Stadium
  9950 San Diego Mission Rd
  San Diego, CA 92108
- **Borehole Depth:** 57.5' bgs

### Well/Boring Description
- **Client:** Kinder Morgan Energy Partners
- **Site Location:** Mission Valley Terminal - Qualcomm Stadium
  9950 San Diego Mission Rd
  San Diego, CA 92108
- **Well/Boring ID:** RW-111 (GWE Well)
- **Borehole Depth:** 57.5' bgs

### Stratigraphic Description

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<th>Depth (feet)</th>
<th>Sample ID</th>
<th>Recovery (feet)</th>
<th>USCS Code</th>
<th>Geologic Column</th>
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### Remarks
- Drilled approximately 7 ft west of pilot boring RW-111P. Lithology determined from pilot boring RW-111P. Actual Friars Sandstone contact determined from well RW-111.
- Material Used: 18 cubic ft of #8 Sand, 18 cubic ft of Bentonite Grout/Chips, 2 cubic ft of Concrete Seal.
**Well/Boring ID:** RW-111 (GWE Well)

**Site Location:**
Mission Valley Terminal - Qualcomm Stadium
9950 San Diego Mission Rd
San Diego, CA 92108

**Client:** Kinder Morgan Energy Partners

**Borehole Depth:** 57.5’ bgs

### Depth Table

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<th>Recovery (feet)</th>
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#### Stratigraphic Description

**GW**
- WELL GRADED GRAVEL WITH SAND (GW), fine to coarse grained sand, subrounded, moderate dilatancy, fine to coarse subrounded to subangular gravel, some subrounded cobbles (up to 3-4” dia.), trace to some non-plastic silt, very poorly sorted, wet, loose, mottled gray to brown coloring.

**SW**
- as above, increasing cobbles.
- as above, some fine gravel, soft, dark yellowish brown (10YR 3/4).

**SS**
- FRIARS SANDSTONE (SS), weathered, gray.
- No recovery from 55’ to 57’ bgs.
- as above, increasing cobbles.

#### Well/Boring Construction

- 10” Dia. Borehole
- #8 Mesh Sand (32-57.5’ bgs)
- 6” Dia. SS Wire-wrapped Well Screen 0.040” Slot (37-57’ bgs)
- Integrated Bottom Cap

### Remarks
- ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level

Drilled approximately 7 ft west of pilot boring RW-111P. Lithology determined from pilot boring RW-111P. Actual Friars Sandstone contact determined from well RW-111.

Material Used: 18 cubic ft of #8 Sand, 18 cubic ft of Bentonite Grout/Chips, 2 cubic ft of Concrete Seal.
### Geologic Column

<table>
<thead>
<tr>
<th>Depth</th>
<th>Sample ID</th>
<th>Recovery (feet)</th>
<th>PID/FID (ppm)</th>
<th>Sieve Analysis Sample</th>
<th>USCS Code</th>
<th>Stratigraphic Description</th>
</tr>
</thead>
<tbody>
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<td>45</td>
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<td></td>
<td></td>
<td></td>
<td>Air knife to 5’ bgs on 4/15/11. Soil logged from air knife cuttings. Asphalt at surface. WELL GRADED GRAVEL WITH SAND (GW), fine to medium grained sand, trace coarse grained sand, fine to coarse gravel and cobbles (up to 2-3” dia.).</td>
</tr>
<tr>
<td>40</td>
<td></td>
<td>0.5/0.0</td>
<td></td>
<td></td>
<td></td>
<td>POORLY GRADED SAND (SP), mostly fine to medium grained sand, subrounded, moderate to rapid dilatancy, trace fine gravel, trace silt, moist, very dark grayish brown (2.5Y 3/2). -as above, rapid dilatancy, trace coarse grained sand, subrounded, trace silt, no plasticity, loose, soft, very dark grayish brown (10YR 3/3).</td>
</tr>
<tr>
<td>35</td>
<td></td>
<td>0.9/0.0</td>
<td></td>
<td></td>
<td></td>
<td>WELL GRADED SAND (SW), fine to coarse grained sand, subrounded to subangular, moderate to rapid dilatancy, trace non-plastic silt, trace sub-rounded to subangular fine to coarse gravel, trace sub-rounded cobbles (up to 2-3” dia.), wet, loose, soft, very dark brown (10YR 2/2). -as above, increasing gravel and cobbles, none to very trace fine sand matrix, rapid dilatancy.</td>
</tr>
<tr>
<td>30</td>
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<td>1.0/0.0</td>
<td></td>
<td></td>
<td></td>
<td>Borehole backfilled with Bentonite Grout / Chips</td>
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</table>

### Water Level Data

<table>
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<tr>
<th>Date</th>
<th>Depth</th>
<th>Elev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/18/11</td>
<td>9-12’</td>
<td>NA</td>
</tr>
</tbody>
</table>

### Remarks:
- ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level; ATD = At Time of Drilling
- Drilled approximately 120 ft NW of well RW-112.
- Material Used: 48 cubic feet of Bentonite Grout / Chips. Surface capped with cold asphalt.
### Stratigraphic Description

**Well/Boring ID:** RW-112P (Pilot Boring)

**Borehole Depth:** 60’ bgs

**Client:** Kinder Morgan Energy Partners

**Site Location:**
Mission Valley Terminal - Qualcomm Stadium
9950 San Diego Mission Rd
San Diego, CA 92108

**Depth measured from top of casing**

#### Water Level Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Depth</th>
<th>Elev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/18/11</td>
<td>9-12' ATD</td>
<td>NA</td>
</tr>
</tbody>
</table>

**Remarks:** ft bgs = feet below ground surface; NA = Not Applicable/Avaliable; MSL = Mean Sea Level; ATD = At Time of Drilling

Drilled approximately 120 ft NW of well RW-112.

Material Used: 48 cubic feet of Bentonite Grout / Chips. Surface capped with cold asphalt.

---

**DEPT** | **ELEV.** | **Sample ID** | **Recovery (feet)** | **PID/FID (ppm)** | **Sieve Analysis Sample** | **USCS Code** | **Geologic Column** |
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<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>25</td>
<td>RW-112-26</td>
<td>0.2/0.0</td>
<td></td>
<td></td>
<td></td>
<td>WELL GRADED SAND (SW), mostly fine to coarse grained sand, subrounded to subangular, moderate to rapid dilatancy, trace non-plastic silt, non-cohesive, wet, loose, soft, very dark gray (10YR 3/1), micaceous.</td>
</tr>
<tr>
<td>25</td>
<td>20</td>
<td>RW-112-34</td>
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<td>SILT (ML), mostly low plastic silt, no dilatancy, some fine subrounded sand, trace medium and coarse sand, moist to wet, black (10YR 2/1).</td>
</tr>
<tr>
<td>30</td>
<td>25</td>
<td>RW-112-38</td>
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<td>WELL GRADED SAND (SW), fine to coarse grained sand, subrounded, with trace gravel.</td>
</tr>
<tr>
<td>35</td>
<td>20</td>
<td></td>
<td>0.0/0.0</td>
<td></td>
<td></td>
<td></td>
<td>SILT (ML) as above.</td>
</tr>
<tr>
<td>20</td>
<td>25</td>
<td></td>
<td>0.0/0.0</td>
<td></td>
<td></td>
<td></td>
<td>WELL GRADED SAND (SW), mostly fine to coarse grained sand, subrounded, rapid dilatancy, no plasticity, some subrounded fine to coarse gravel and cobbles, dark brown (10YR 3/3).</td>
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<tr>
<td>25</td>
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<td>0.0/0.0</td>
<td></td>
<td></td>
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<td>POORLY GRADED SAND (SP), mostly fine to medium grained sand, subrounded, moderate dilatancy, some non-plastic silt, trace coarse grained sand, wet, medium dense, loose, dark brown (10YR 3/3).</td>
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<tr>
<td>20</td>
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<td>0.0/0.0</td>
<td></td>
<td></td>
<td></td>
<td>WELL GRADED SAND (SW), fine to coarse subrounded gravel, trace subrounded cobbles, wet, loose, soft, dark brown (10YR 3/3).</td>
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<td>20</td>
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<td>0.0/0.0</td>
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<td></td>
<td>SILT (ML), medium plastic silt, no dilatancy, firm, dense, stiff, dark brown.</td>
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<tr>
<td>20</td>
<td>25</td>
<td></td>
<td>0.0/0.0</td>
<td></td>
<td></td>
<td></td>
<td>WELL GRADED SAND (SW), fine to coarse subrounded sand, rapid dilatancy.</td>
</tr>
</tbody>
</table>
### Project: RW-112P (Pilot Boring)

**Client:** Kinder Morgan Energy Partners  
**Well/Boring ID:** RW-112P  
**Site Location:** Mission Valley Terminal - Qualcomm Stadium  
9950 San Diego Mission Rd  
San Diego, CA 92108  
**Borehole Depth:** 60' bgs

#### Stratigraphic Description

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<th>Elevation</th>
<th>Sample ID</th>
<th>Recovery (feet)</th>
<th>PID/FID (ppm)</th>
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<th>USCS Code</th>
<th>Geologic Column</th>
</tr>
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<tbody>
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<td>RW-112-48</td>
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<td>GW</td>
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<td></td>
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<td></td>
<td></td>
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</table>

- as above, moderate to rapid dilatancy, trace non-plastic silt, trace subangular fine gravel, wet.

- as above, increasing cobbles (up to 3" dia.).

#### Water Level Data

<table>
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<th>Elev.</th>
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</thead>
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<td>9-12'</td>
<td>ATD</td>
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<tr>
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</tr>
</tbody>
</table>

**Remarks:** ft bgs = feet below ground surface; NA = Not Applicable/Avoidable; MSL = Mean Sea Level; ATD = At Time of Drilling

Drilled approximately 120 ft NW of well RW-112.

Material Used: 48 cubic feet of Bentonite Grout / Chips. Surface capped with cold asphalt.

Depth measured from top of casing
Client: Kinder Morgan Energy Partners

Site Location:
Mission Valley Terminal - Qualcomm Stadium
9950 San Diego Mission Rd
San Diego, CA 92108

Well/Boring ID: RW-112P (Pilot Boring)
Borehole Depth: 60’ bgs

<table>
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<th>PID/FID (ppm)</th>
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<th>Geologic Column</th>
<th>Stratigraphic Description</th>
<th>Well/Boring Construction</th>
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<tr>
<td>-15</td>
<td>60</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>FRIARS SANDSTONE (SS), weathered, partially cemented silt and sand, wet, dense, gray (10YR 5/1).</td>
<td></td>
</tr>
<tr>
<td></td>
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<tr>
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<tr>
<td>-30</td>
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</tbody>
</table>

Remarks: ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level; ATD = At Time of Drilling

Drilled approximately 120 ft NW of well RW-112.

Material Used: 48 cubic feet of Bentonite Grout / Chips. Surface capped with cold asphalt.

Water Level Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Depth</th>
<th>Elev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/18/11</td>
<td>9-12' ATD</td>
<td>NA</td>
</tr>
</tbody>
</table>

Depth measured from top of casing
Drilled approximately 120 ft SE of pilot boring RW-112P. Lithology determined from pilot boring RW-112P. Actual Friars Sandstone contact determined from well RW-112.

Material Used: 20 cubic ft of #8 Sand, 13 cubic ft of Bentonite Grout/Chips, 2 cubic ft of Concrete Seal.
### Stratigraphic Description

<table>
<thead>
<tr>
<th>Depth</th>
<th>Sample ID</th>
<th>Recovery (ft)</th>
<th>PID/FID (ppm)</th>
<th>Sieve Analysis Sample</th>
<th>USCS Code</th>
<th>Geologic Column</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WELL GRADED SAND (SW), mostly fine to coarse grained sand, subrounded to subangular, moderate to rapid dilatancy, trace non-plastic silt, non-cohesive, wet, loose, soft, very dark gray (10YR 3/1), micaceous.</td>
</tr>
<tr>
<td>25</td>
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<td></td>
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<td></td>
<td>SILT (ML), mostly low plastic silt, no dilatancy, some fine subrounded sand, trace medium and coarse sand, moist to wet, black (10YR 2/1).</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WELL GRADED SAND (SW), fine to coarse grained sand, subrounded, with trace gravel.</td>
</tr>
<tr>
<td>35</td>
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<td></td>
<td>SILT (ML) as above.</td>
</tr>
<tr>
<td>35</td>
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<td></td>
<td>WELL GRADED SAND (SW), mostly fine to coarse grained sand, subrounded, rapid dilatancy, no plasticity, some subrounded fine to coarse gravel and cobbles, dark brown (10YR 3/3).</td>
</tr>
<tr>
<td>40</td>
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<td></td>
<td></td>
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<td>POORLY GRADED SAND (SP), mostly fine to medium grained sand, subrounded, moderate dilatancy, some non-plastic silt, trace coarse grained sand, wet, medium dense, loose, dark brown (10YR 3/3).</td>
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<tr>
<td>50</td>
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<td>WELL GRADED SAND (SW), mostly fine to coarse grained sand, subrounded, rapid dilatancy, some fine to coarse subrounded gravel, trace subrounded cobbles, wet, loose, soft, dark brown (10YR 3/3).</td>
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<tr>
<td>55</td>
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<td></td>
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<td></td>
<td>SILT (ML), medium plastic silt, no dilatancy, firm, dense, stiff, dark brown.</td>
</tr>
</tbody>
</table>

### Well/Boring Construction

- **Bentonite Grout** (9-21' bgs)
- **Bentonite Chips** (21-26' bgs)
- **6" Dia. SCH40 PVC Blank Casing** (1-31' bgs)
- **#8 Mesh Sand** (26-53' bgs)
- **6" Dia. S6 Wire-wrapped Well Screen 0.040" Slot** (31-51' bgs)
- **10" Dia. Borehole**

### Remarks:
- ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level
- Drilled approximately 120 ft SE of pilot boring RW-112P. Lithology determined from pilot boring RW-112P. Actual Friars Sandstone contact determined from well RW-112.
- Material Used: 20 cubic ft of #8 Sand, 13 cubic ft of Bentonite Grout/Chips, 2 cubic ft of Concrete Seal.
**Client:** Kinder Morgan Energy Partners  
**Well/Boring ID:** RW-112 (GWE Well)  
**Borehole Depth:** 53' bgs

**Site Location:**  
Mission Valley Terminal - Qualcomm Stadium  
9950 San Diego Mission Rd  
San Diego, CA 92108

<table>
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<th>DEPTH ELEVATION</th>
<th>Recovery (feet)</th>
<th>PID/FID (ppm)</th>
<th>Sieve Analysis Sample</th>
<th>USCS Code</th>
<th>Stratigraphic Description</th>
<th>Well/Boring Construction</th>
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<tbody>
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<td>10' Dia. Borehole</td>
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<td>#8 Mesh Sand (26-53' bgs)</td>
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<td></td>
</tr>
<tr>
<td>6&quot; Dia. SS Wire- wrapped Well Screen 0.040&quot; Slot (31-51' bgs)</td>
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<tr>
<td>Integrated Bottom Cap</td>
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</tr>
</tbody>
</table>

**Remarks:** ft bgs = feet below ground surface; NA = Not Applicable/Available; MSL = Mean Sea Level

Drilled approximately 120 ft SE of pilot boring RW-112P. Lithology determined from pilot boring RW-112P. Actual Friars Sandstone contact determined from well RW-112.

Material Used: 20 cubic ft of #8 Sand, 13 cubic ft of Bentonite Grout/Chips, 2 cubic ft of Concrete Seal.
APPENDIX B

CURRENT EXPLORATION RECORDS

Field exploration included a visual reconnaissance of the site, the drilling of 32 exploratory borings, and the advancement of 10 cone penetration tests (CPTs). The borings were drilled between February 11 and March 16, 2019 and the CPTs were advanced on March 18 and April 8, 2019. The maximum depth of exploration was about 101½ feet below surrounding grades. The approximate exploration locations are shown in Plate 1. Logs of the explorations are provided in Figures B-01 through B-42, immediately after the Boring Record Legends.

The exploratory borings were advanced by Pacific Drilling and Tri-County Drilling using several truck mounted drill rigs. Disturbed samples were collected from the borings using a 2-inch outside diameter unlined Standard Penetration Test (SPT) sampler. Less disturbed samples were collected using a 3-inch outside diameter ring lined sampler (a modified California sampler). Bulk samples were also collected. The samples were sealed in plastic bags, labeled, and returned to the laboratory for testing. A summary of the exploratory boring locations, elevations and depths is shown on the following page.

The drive samples were collected from the exploratory borings using several different automatic hammers with average Energy Transfer Ratios (ETR) ranging from approximately 79 to 89 percent. For each sample, the 6-inch incremental blow counts was recorded on the logs. The field blow counts (N) were normalized to approximate the standard 60 percent ETR, as shown on the logs (N_{60}). The California ring samples were also corrected for the 3-inch sampler diameter using Burmister’s correction factor. Blowcounts that were influenced by flowing/heaving sands, gravel and cobbles are noted on the logs with a caret (^) as being inaccurate. Where sampler refusal was encountered (i.e., unable to drive the sampler more than the first six inches with 50 hammer blows), the blowcount is denoted as “REF”.

The exploratory borings were logged using the Caltrans Soil and Rock Logging, Classification and Presentation Manual (2010) as a guideline. The Friars Formation materials are described in general accordance with Section 2.6.1.3 (i.e., Description of Poorly Indurated Rock) of the Caltrans Manual (2010).

The CPT soundings were advanced by Kehoe Testing and Engineering in general accordance with ASTM D5778. The CPT soundings were carried out by KTE using an integrated electronic cone system manufactured by Vertek. The CPTs were advanced using a 30-ton CPT rig. The cone used during the program was a 15 cm² cone and recorded the following parameters at approximately 2.5 cm depth intervals:

- Cone Resistance (q_c)
- Sleeve Friction (f_s)
- Dynamic Pore Pressure (u)
- Inclination
- Penetration Speed
APPENDIX B

CURRENT EXPLORATION RECORDS (Continued)

CPT-2 and CPT-26 initially encountered refusal at depths of about 25 feet due to gravel and cobbles causing resistance to further advancement and flexure of the CPT rods. CPT-2 and CPT-26 were reattempted by locating a second CPT location a few feet away from the original location, which was able to be advanced to a depth of about 45 and 40 feet, respectively, where refusal on gravel and cobbles was encountered. SCPT-7 and CPT-11 both encountered relatively shallow refusal on gravel and cobbles at about 17 feet.

At locations SCPT-5, SCPT-7 and SCPT-13, shear wave velocity measurements were obtained at various depths. The shear wave was generated using an air-actuated hammer located inside the front jack of the CPT rig. The cone was equipped with a triaxial geophone, which recorded the shear wave signal generated by the air hammer. The above parameters were recorded and viewed in real time using a laptop computer. A summary of the collected shear wave measurements is presented in Figure B-42. Note: SCPT-13 was intentionally advanced through the previously grouted borehole of boring S-13 to obtain shear wave velocity measurements. Therefore, the CPT parameters (q_c, f_s and u) are not representative of the actual soil conditions at that location and are not presented in this report.

Note: the exploration locations were measured in the field using a Garmin GPSMAP 64st Global Positioning System (GPS) receiver and by visually estimating, pacing or taping distances from nearby landmarks, if available. The exploration elevations were estimated by interpolation using the referenced plans provided by Rick Engineering (see Plate 1). The locations and elevations provided should not be considered more accurate than is implied by the scale of the map and the accuracy of the equipment used to locate the explorations. The lines designating the interface between differing soil materials on the logs may be abrupt or gradational. Further, soil conditions at locations between the explorations may be substantially different from those at the specific locations we explored. The Boring Records are part of a geotechnical report which must be considered in its entirety.

<table>
<thead>
<tr>
<th>Exploration ID</th>
<th>Latitude [°]</th>
<th>Longitude [°]</th>
<th>Top Elevation NAVD 88 [FT]</th>
<th>Exploration Depth [FT]</th>
<th>Bottom Elevation NAVD 88 [FT]</th>
<th>Figure No.</th>
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### Exploratory Borings Summary (see Plate 1)

<table>
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<th>Exploration ID</th>
<th>Latitude [&quot;]</th>
<th>Longitude [&quot;]</th>
<th>Top Elevation NAVD 88 [FT]</th>
<th>Exploration Depth [FT]</th>
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### Exploratory Cone Penetration Test Soundings Summary (see Plate 1)

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### Description Sequence Examples:

- SANDY lean CLAY (CL); very stiff; yellowish brown; moist; mostly fines; some SAND, from fine to medium; few gravels; medium plasticity; PP=2.75.
- Well-graded SAND with SILT and GRAVEL and COBBLES (SW-SM); dense; brown; moist; mostly SAND, from fine to coarse; some fine GRAVEL; few fines; weak cementation; 10% GRANITE COBBLES; 3 to 6 inches; hard; subrounded.
- Clayey SAND (SC); medium dense, light brown; wet; mostly fine sand; little fines; low plasticity.

### HOLE IDENTIFICATION

Holes are identified using the following convention:

\[ H - YY - NNN \]

Where:

- \( H \): Hole Type Code
- YY: 2-digit year
- NNN: 3-digit number (001-999)

### Hole Type Code and Description

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<td>A</td>
<td>Auger boring (hollow or solid stem, bucket)</td>
</tr>
<tr>
<td>R</td>
<td>Rotary drilled boring (conventional)</td>
</tr>
<tr>
<td>RC</td>
<td>Rotary core (self-cased wire-line, continuously-sampled)</td>
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<tr>
<td>RW</td>
<td>Rotary core (self-cased wire-line, not continuously sampled)</td>
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<td>P</td>
<td>Rotary percussion boring (Air)</td>
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<tr>
<td>HD</td>
<td>Hand driven (1-inch soil tube)</td>
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<tr>
<td>HA</td>
<td>Hand auger</td>
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<tr>
<td>D</td>
<td>Driven (dynamic cone penetrometer)</td>
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<td>CPT</td>
<td>Cone Penetration Test</td>
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<tr>
<td>O</td>
<td>Other (note on LCTB)</td>
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### Minimum Required Sequence:

USCS Group Name (Group Symbol); Consistency or Density; Color; Moisture; Percent or Proportion of Soil; Particle Size; Plasticity (optional).

○ = optional for non-Caltrans projects

### Where applicable:

Cementation; % cobbles & boulders; Description of cobbles & boulders; Consistency field test result

**GROUP SYMBOLS AND NAMES**

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<th>Graphic / Symbol</th>
<th>Group Names</th>
<th>Graphic / Symbol</th>
<th>Group Names</th>
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<td>SANDY CLAY with GRAVEL</td>
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**FIELD AND LABORATORY TESTING**

- C: Consolidation (ASTM D 2435)
- CL: Collapse Potential (ASTM D 5933)
- CP: Compaction Curve (CTM 216)
- CR: Compression, Sulfates, Chlorides (CTM 643, CTM 417, CTM 422)
- CU: Consolidated Undrained Triaxial (ASTM D 4767)
- DS: Direct Shear (ASTM D 3099)
- EL: Expansion Index (ASTM D 4829)
- M: Moisture Content (ASTM D 2216)
- GC: Organic Content (ASTM D 2974)
- P: Permeability (CTM 220)
- PA: Particle Size Analysis (ASTM D 422)
- PI: Plastic Limit, Plasticity Index (AASHTO T 199)
- PL: Point Load Index (ASTM D 5731)
- PM: Pressure Meter
- R: R-Value (CTM 301)
- SE: Sand Equivalent (CTM 217)
- SG: Specific Gravity (AASHTO T 100)
- SL: Silt Limit (ASTM D 427)
- SW: Swell Potential (ASTM D 4546)
- UC: Unconfined Compression - Soil (ASTM D 2166)
- UU: Unconfined Compression - Rock (ASTM D 2938)
- UW: Unit Weight (ASTM D 4677)
- -200: Passing No. 200 Sieve (ASTM D 1140)

**SAMPLER GRAPHIC SYMBOLS**

- Standard Penetration Test (SPT)
- Standard California Sampler
- Modified California Sample (4" ID, 3" OD)
- Shelby Tube
- Piston Sampler
- NX Rock Core
- HQ Rock Core
- Bulk Sample
- Other (see remarks)

**DRILLING METHOD SYMBOLS**

- Auger Drilling
- Rotary Drilling
- Dynamic Cone or Hand Driven
- Diamond Core

**WATER LEVEL SYMBOLS**

- First Water Level Reading (during drilling)
- Static Water Level Reading (after drilling, date)

---

**Definitions for Change in Material**

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<td>Estimated Material Change</td>
<td>Change in material cannot be accurately located either because the change is gradational or because of limitations of the drilling and sampling methods.</td>
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<tr>
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<td>Material changes from soil characteristics to rock characteristics.</td>
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**REFERENCE:** Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010).

---

**Project No. SD605**

SDSU Mission Valley
Site Development

**BORING RECORD LEGEND #2**
REFERENCE: Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010), with the exception of consistency of cohesive soils vs. $N_{60}$.
### PAVEMENT:
Approximately 4 inches of ASPHALT CONCRETE.

### UNDIFFERENTIATED SURFICIAL SOILS:
- **CLAYEY SAND (SC)**: brown; moist; mostly fine sand; some fines; trace gravel; low to medium plasticity. (2% Gravel; 52% Sand; 46% Fines)
- **Poorly-graded SAND with silt and gravel (SP-SM)**: light brown; moist; mostly fine to medium sand; few fines; little gravel and cobbles; nonplastic; trace mica. (10% fines)
- Gravel stuck in sampler shoe.

- **Sandy SILT (ML)**: dense; brown to dark brown; moist; mostly fines; some fine to medium sand; few gravel. (55% Fines)

---

### Drill Log

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<th>MOISTURE (%)</th>
<th>DRY DENSITY (lb/ft³)</th>
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---

**NOTES:**
- ETR ~ 89%, $N_{10} = 1.48N_{SP} = 0.99N_{MC}$

**DESCRIPTION AND CLASSIFICATION:**

---

**FIGURE B-1 a**

---

**GROUP DELTA CONSULTANTS, INC.**
9245 Activity Road, Suite 103
San Diego, California 92126

---

**THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.**
UNDIFFERENTIATED SURFICIAL SOILS (continued):

Clayey SAND (SC); medium dense; dark brown; moist; mostly fine to medium sand; some fines; medium to high plasticity; some iron oxide staining.

Silty SAND (SM); medium dense; dark brown; moist; mostly fine sand; some fines; nonplastic; trace mica; no bedding.

Well-graded SAND with silt and gravel (SW-SM); brown; wet; mostly fine to coarse sand; little coarse gravel; few fines; nonplastic; trace mica.

Silty SAND (SM); medium dense; dark brown; moist; mostly fine sand; some fines; nonplastic; trace mica; no bedding.

(52% Sand; 48% Fines)

(43% Fines)

(30% Fines)

Wet; micaceous.

(30% Fines)

(16% Gravel; 78% Sand; 6% Fines)

Slow and difficult drilling on GRAVELS and COBBLES (Estimated 20% COBBLES)
UNDIFFERENTIATED SURFICIAL SOILS

(continued): Slow and difficult drilling on GRAVELS and COBBLES (Estimated 20% COBBLES)

Silty SAND with gravel (SM); very dense; brown; wet; mostly fine to coarse sand; little fines and coarse gravel; low plasticity; trace mica.
Sampler refusal. (14% Fines)

Friars Formation: *Poorly-indurated SANDSTONE; fine to medium grained; massive; yellowish brown; moist; moderately weathered; very soft; unfractured (Silty SAND (SM); very dense; mostly fine to medium sand; little fines; low plasticity; mottled; weakly cemented).
(18% Fines)

Total Depth = 60 feet (Target depth reached).

Groundwater measured during drilling at a depth of 34 feet.

Boring backfilled on 3/8/19 shortly after drilling with bentonite grout and capped with black-dyed rapid set concrete.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

^ = Inaccurate blowcounts.

All soils encountered may include up to 10% COBBLES (subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered. Cobble-rich layers encountered in this exploration were approximately 10 to 15 feet thick.

*Geologic Description; (Disturbed Soil Description).
PAVEMENT: Approximately 3 inches of ASPHALT CONCRETE.

UNDIFFERENTIATED SURFICIAL SOILS:
- Clayey SAND (SC); medium dense; brown (10YR 4/3); moist; mostly fine to coarse sand; some fines; few gravel; medium plasticity; micaceous.
- PID = 0.5 ppm
  (10% Gravel; 56% Sand; 34% Fines)

- Sandy lean CLAY (CL); stiff; dark grayish brown (2.5Y 4/2); moist; mostly fines; some fine to medium sand; trace fine gravel; medium plasticity.
  PP = 1.25 tsf; PID = 0.5 ppm
  (51% Fines)

- No gravel; micaceous.
  PP = 1.25 tsf; PID = 0.6 ppm

- Medium stiff; trace fine gravel; iron oxide staining.
  PP = 0.75 tsf; PID = 0.4 ppm

FIGURE B-2 a
UNDIFFERENTIATED SURFICIAL SOILS (continued):
- Sandy lean CLAY (CL); soft to medium stiff; dark grayish brown (2.5Y 4/2); wet; mostly fines; some fine to medium sand; trace fine gravel; medium plasticity; sample disturbed.
  - PP = 0.5 tsf; PID = 0.3 ppm (58% Fines)
- Lean CLAY with sand (CL); medium stiff; dark grayish brown (10YR 4/2); mostly fines; little fine to medium sand; trace fine gravel; medium plasticity.
  - PP = 0.5 tsf; PID = 0.8 ppm
- Clayey SAND (SC); medium dense; dark grayish brown (10YR 4/2); wet; mostly fine to medium sand; some fines; trace fine gravel; medium plasticity.
  - PID = 0.3 ppm (35% Fines)
- Loose; grayish brown (10YR 5/2); mostly medium to coarse sand; low to medium plasticity.
  - PID = 0.3 ppm (38% Fines)

FRIARS FORMATION: *Poorly-indurated SANDSTONE; fine to coarse grained; massive; gray (2.5Y 5/1); highly weathered; very soft; unfractured; (poorly graded SAND with silt (SP-SM); medium dense; wet; mostly fine to coarse sand; few to little fines; trace gravel; nonplastic; weakly cemented; iron oxide staining).
**FRIARS FORMATION (continued):**

*Poorly-indurated CLAYSTONE; fine grained; massive; gray (2.5Y 5/1); moderately weathered; very soft; unfractured (fat CLAY with sand (CH); hard; moist; mostly fines; few to little fine sand; high plasticity). PID = 0.1 ppm

*POORLY INDURATED SANDSTONE; fine to coarse grained; massive; gray (2.5YR 5/1); moderately weathered; very soft; unfractured; (silty SAND (SM); very dense; wet; mostly fine sand; some fines; nonplastic, weakly to moderately cemented). PID = 0 ppm

**Total Depth** = 61 feet (Target depth reached).

Groundwater measured during drilling at a depth of 23.8 feet.

Boring backfilled on 2/19/19 shortly after drilling with bentonite grout and capped with black-dyed rapid set concrete.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

All soils encountered may include up to 10% COBBLES (granitic, subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings.

*Geologic Description; (Disturbed Soil Description).
**PAVEMENT:** Approximately 4 inches of ASPHALT CONCRETE.

**UNDIFFERENTIATED SURFICIAL SOILS:** Clayey SAND (SC); dark yellowish brown (10YR 4/4); moist; mostly fine to coarse sand; some fines; trace gravel; low plasticity.

(0% Gravel; 68% Sand; 32% Fines).

Slow and difficult drilling on GRAVELS and COBBLES.

Silty SAND (SM); dense; yellowish brown (10YR 5/4); moist; mostly fine to coarse sand; little fines; trace gravel; nonplastic.

PID=0.6 ppm

Sandy lean CLAY (CL); brown (10YR 5/3); moist; mostly fines; some fine sand; trace gravel; medium plasticity; trace iron oxide staining.

Hard.

PP=4.0 tsf (59% Fines)

Very stiff; very dark grayish brown (10YR 3/2); micaceous.

PP=3.0 tsf; PID=0.5 ppm

Clayey SAND (SC); dense; dark yellowish brown (10YR 4/4); moist; mostly fine sand; some fines; low plasticity.

(44% Fines)

Slow and difficult drilling on GRAVEL and COBBLES. (Estimated 10-20% COBBLES).

Equipment failure (sheared drive cap).
UNDIFFERENTIATED SURFICIAL SOILS (continued):
Slow and difficult drilling on GRAVEL and COBBLES.
(Estimated 10 to 20% COBBLES).

Silty SAND with gravel (SM); grayish brown (10YR 5/2); wet; mostly fine to coarse sand; some gravel; little fines; nonplastic.
(34% Gravel; 52% Sand; 14% Fines).

Gravel in sampler; PID=0

Sandy lean CLAY (CL); dark yellowish brown (10YR 4/4); wet; mostly fines; some fine to coarse sand; trace gravel; medium plasticity.
(59% Fines).

Clayey GRAVEL with sand (GC); wet; dark yellowish brown (10YR 4/4); mostly gravel; some fine to coarse sand and fines; low plasticity.

Equipment failure (sheared drive cap at 36 ft). Switch to casing advancement with tri-cone drill bit.
(Estimated 30-40% COBBLES).

FRIARS FORMATION:
*Poorly-indurated
SANDSTONE; fine to medium grained; massive; gray (2.5Y 6/1); wet; moderately weathered; very soft; unfractured (Clayey SAND (SC); very dense; mostly fine to medium sand; little fines; trace fine gravel; low plasticity; weakly cemented).
(16% Fines).

Total Depth = 46.5 feet (Target Depth Reached).

Hollow stem auger (0 to 36 ft); Casing advancement (36 to 46.5 ft).
Groundwater measured during drilling at a depth of 28.2 feet.

Boring backfilled on 3/1/19 shortly after drilling with bentonite grout and capped with black-dyed rapid set concrete.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

^ = Inaccurate blowcounts.

All soils encountered may include up to 10% COBBLES (granitic, subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered.

Cobble-rich layers encountered in this exploration were approximately 5 to 10 feet thick.

*Geologic Description; (Disturbed Soil Description).
### PAVEMENT
Approximately 4 inches of ASPHALT CONCRETE.

### UNDIFFERENTIATED SURFICIAL SOILS
- **Clayey SAND (SC)**; brown; moist; mostly fine sand; little fines; trace fine gravel; low plasticity.
  - (1% Gravel; 78% Sand; 21% Fines)
  - Medium dense; trace mica.

- **Lean CLAY with sand (CL)**; brown; moist; mostly fines; little to some sand; medium to high plasticity.
  - Stiff; brown; interbedded.
  - PP = 1.75 tsf
  - (71% Fines)

- **Sandy lean CLAY (CL)**; stiff to very stiff; brown; moist; mostly fines; some sand; medium plasticity; thin layers; trace mica; some mottling.
  - PP = 1.75 tsf
  - (71% Fines)
  - Very stiff; dark brown; low to medium plasticity; no bedding; organics present.
  - PP = 2.75 tsf
  - (59% Fines)
UNDIFFERENTIATED SURFICIAL SOILS (continued):
Poorly-graded SAND with gravel and cobbles (SP); brown; wet; mostly medium to coarse sand; little to some gravel and cobbles; trace mica; sampler refusal on cobbles.

Slow and difficult drilling on GRAVEL and COBBLES. Water and polymer added to hole to mitigate caving soils. (Estimated 20% COBBLES)

FRIARS FORMATION: *Poorly-indurated SANDSTONE; fine to medium grained; massive; yellow brown; wet; moderately weathered; very soft; unfractured; *(Silty SAND (SM); very dense; mostly fine to medium sand; little fines; nonplastic; moderately cemented).

(0% Gravel; 82% Sand; 18% Fines)

Total Depth = 40.5 feet (Target depth reached).

Groundwater measured after drilling at a depth of 21 feet.

Polymer/water mixture added down hollow stem for heaving sand.

Boring backfilled on 3/8/19 with bentonite grout and capped with black dyed rapid set concrete.

^ = Inaccurate blowcount.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

All soils encountered may include up to 10% COBBLES (granitic, subrounded, 3- to 12-inch diameter), estimated...
Based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered. Cobble-rich layers encountered in this exploration were approximately 5 to 10 feet thick.

*Geologic Description; (Disturbed Soil Description).
PAVEMENT: Approximately 4 inches of ASPHALT CONCRETE.

UNDIFFERENTIATED SURFICIAL SOILS: Clayey SAND with gravel (SC); yellowish brown (10YR 5/4); moist; mostly fine to coarse sand; some fines; little gravel; medium plasticity. (19% Gravel; 46% Sand; 35% Fines)

Rig chatter at 3.5 ft on gravel and potential cobble layer.

Loose; trace organics (plant roots).

Silty SAND (SM); medium dense; brown (7.5 YR 5/2); moist; mostly fine sand; few to little fines; nonplastic; grading to poorly-graded SAND. (20% Fines)

Poorly-graded SAND (SP); medium dense; brown (7.5YR 5/2); moist; mostly fine sand; trace fines; nonplastic.

Lean CLAY with sand (CL); soft; dark grayish brown (10YR 4/2); moist; mostly fines; little fine sand; medium to high plasticity. PP=0.25 tsf; PID=0.6 ppm

Medium stiff; dark gray (Gley 4/N); wet; medium plasticity. PP=0.5 tsf; TV=0.4 tsf PID=0.2 ppm (75% fines)
UNDIFFERENTIATED SURFICIAL SOILS (continued):
Poorly-graded SAND (SP); medium dense; gray (10YR 5/1); wet; mostly fine to medium sand; trace fines; nonplastic; micaceous.
PID=0.8 ppm (1% Fines)

Poorly-graded SAND with silt (SP-SM); medium dense; gray (10YR 5/1); wet; mostly fine to medium sand; few to little fines; nonplastic; trace mica.
PID=5.2 ppm (12% Fines)

Difficult drilling on GRAVEL and COBBLES from 32 to 34 ft. (Estimated 10-20% COBBLES)

Well-graded SAND with silt (SW-SM); dense; very dark gray (7.5YR 3/1); wet; mostly fine to medium sand; few to little fines; nonplastic; trace mica.
PID=0.3 ppm (12% Fines)

Heaving sands. Switch to mud rotary (Tricone rotary drill bit)
Medium dense; yellowish brown (10YR 5/4); few to little fine to medium gravel; few fines.
(14% Gravel; 76% Sand; 10% Fines)

No gravel; micaceous; trace oxide staining.
(9% Fines)
**UNDIFFERENTIATED SURFICIAL SOILS (continued):**

Well-graded SAND with silt (SW-SM); very dense; gray (75YR 5/1); wet; mostly fine to medium sand; few gravel; trace fines; nonplastic; trace mica.

Slow and difficult drilling on GRAVEL and COBBLES from 53 to 59 ft.

(Estimated 10 to 20% COBBLES)

**FRIARS FORMATION:**

*Poorly-indurated SANDSTONE; fine to medium grained; massive; gray (2.5YR 6/1); moderately weathered; very soft; unfractured (Silty SAND (SM); mostly fine to medium sand; some fines; low plasticity; weakly to moderately cemented).*

(48% Fines)

Total Depth = 61.0 feet (Target depth reached).

Groundwater measured during drilling at a depth of 21 feet.

Boring backfilled on 3/8/19 shortly after drilling with bentonite grout and capped with black-dyed rapid set concrete.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

^ = Inaccurate blowcount.

All soils encountered may include up to 10% COBBLES (granitic, subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered.

Cobble-rich layers encountered in this exploration were approximately 2 to 10 feet thick.

*Geologic Description; (Disturbed Soil Description).
PAVEMENT:

Approximately 4 inches of ASPHALT CONCRETE.

UNDIFFERENTIATED SURFICIAL SOILS:

Lean CLAY with sand (CL); dark yellowish brown (10YR 4/6); moist; mostly fines; some fine sand; low plasticity.

PID = 0.6 ppm

Few gravel.

Sandy SILT (ML); dense; dark yellowish brown (10YR 4/5); moist; mostly fines; some fine sand; nonplastic.

PID = 0.3 ppm

Lean CLAY (CL); medium stiff to very stiff; dark yellowish brown (10YR 4/4); moist; mostly fines; few to little fine sand; low plasticity.

PP = 3.75 tsf; TV = 0.33 tsf; PID = 0

(87% Fines)

Silty SAND (SM); medium dense; grayish brown (10YR 5/2); moist; mostly fine to medium sand; few to little fine; trace fine gravel; nonplastic; trace mica.

PID = 0

(0% Gravel; 87% Sand; 13% Fines)

Sandy lean CLAY (CL); stiff; very dark grayish brown (10YR 3/2); moist; mostly fines; little to some fine sand; trace gravel; medium plasticity; trace mica.

PP = 1.5 tsf; TV = 0.70 tsf; PID = 0.3 ppm

(66% Fines)

Slow and difficult drilling on GRAVEL and COBBLES from 22 to 35 feet.

(Estimated 10-20% COBBLES)
**UNDIFFERENTIATED SURFICIAL SOILS (continued):**

- Silty GRAVEL with sand (GM); yellowish brown (10YR 5/4); wet; mostly fine to coarse gravel; some fine to coarse sand; little fines; nonplastic.
  
  *(Estimated 10 to 20% COBBLES)*

Sampler refusal on gravel and cobbles.

**FRIARS FORMATION:** *Poorly-indurated SANDSTONE; fine to medium grained; massive; grayish brown (10YR 5/2); wet; moderately weathered; very soft; unfractured; (Silty SAND (SM); very dense; mostly fine to medium sand; some fines; nonplastic; weakly cemented; Iron oxide staining.)*

Gray (7.5YR 5/1); little fines.

(26% Fines)

Total Depth = 41.5 feet (Target depth reached).

Groundwater measured during drilling at a depth of 22.3 feet.

Boring backfilled on 3/7/19 shortly after drilling with bentonite grout and capped with black-dyed rapid set concrete.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

^ = Inaccurate blowcount.

All soils encountered may include up to 10% COBBLES (granitic, subrounded, 3- to 12-inch diameter), estimated 39%

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**Boring Record**

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**Group Delta Consultants, Inc.**

9245 Activity Road, Suite 103
San Diego, California 92126

**FIGURE**

B-6 b
based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered. Cobble-rich layers encountered in this exploration were approximately 10 to 13 feet thick.

*Geologic Description; (Disturbed Soil Description).
### PAVEMENT

Approximately 3 inches of ASPHALT CONCRETE.

### UNDIFFERENTIATED SURFICIAL SOILS

Sandy lean CLAY (CL); dark brown (7.5YR 3/2); moist; mostly fines; some fine to coarse sand; trace gravel; low plasticity; grades finer with depth.

Little gravel.

Stiff to very stiff; trace iron oxide staining; gravel in sampler.

**PP=1.0 tsf**

Sandy lean CLAY (CL); stiff; dark yellowish brown (10YR 4/6); moist; mostly fines; some fine sand; trace gravel; low plasticity; trace mica.

**PP=1.5 tsf**

Silty SAND (SM); medium dense; yellowish brown (10YR 5/4); moist; mostly fine sand; little to some fines; nonplastic; trace mica.

(28% Fines)

No recovery; wet.

---

### BORING RECORD

**SITE LOCATION**

9449 Friars Road, San Diego, California

**DRILLING COMPANY**

Pacific Drilling

**DRILLING METHOD**

Hollow Stem Auger

**LOGGED BY**

S. Narveson

**CHECKED BY**

C. Vonk

**PROJECT NAME**

SDSU Mission Valley

**PROJECT NUMBER**

SD605

**BORING**

S-7

**START**

3/11/2019

**FINISH**

3/11/2019

**SHEET NO.**

1 of 5

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### SAMPLING METHOD

Hammer: 140 lbs., Drop: 30 in. (Automatic)

**ETR ~ 79%,**

**N_{60} = 1.32N_{spf} = 0.88N_{MC}**

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### BORING RECORD TABLE

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**NOTES**

**DESCRIPTION AND CLASSIFICATION**

**PAVEMENT:**

Approximately 3 inches of ASPHALT CONCRETE.

**UNDIFFERENTIATED SURFICIAL SOILS:**

Sandy lean CLAY (CL); dark brown (7.5YR 3/2); moist; mostly fines; some fine to coarse sand; trace gravel; low plasticity; grades finer with depth.

(1% Gravel; 34% Sand; 65% Fines)

Little gravel.

Stiff to very stiff; trace iron oxide staining; gravel in sampler.

**PP=1.0 tsf**

Sandy lean CLAY (CL); stiff; dark yellowish brown (10YR 4/6); moist; mostly fines; some fine sand; trace gravel; low plasticity; trace mica.

**PP=1.5 tsf**

Silty SAND (SM); medium dense; yellowish brown (10YR 5/4); moist; mostly fine sand; little to some fines; nonplastic; trace mica.

(28% Fines)

No recovery; wet.
**FRIARS FORMATION:** *Poorly-indurated SANDSTONE; fine to medium grained; massive; brownish gray (10Y 5/2); wet; moderately to highly weathered; very soft; unfractured (Silty SAND (SM); very dense; mostly fine to medium sand; few to little fines; nonplastic; trace mica; weakly cemented). (86% Sand; 14% Fines)*

No recovery; possible moderately to strongly cemented material.

Little fines; weakly to moderately cemented. (17% Fines)

Gray (10YR 5/1); (Clayey SAND with gravel (SC); little gravel; low plasticity).

Thinly bedded.
Friars Formation, (continued):

*Poorly-indurated SANDSTONE; fine to coarse grained; massive; gray (10YR 5/1); wet; moderately weathered; very soft; unfractured; (Clayey SAND (SC); very dense; wet; mostly fine sand; few to little fines; nonplastic; weakly to moderately cemented). (17% Fines)

Friable.

Sampler refusal on strongly cemented concretion (3 inch diameter concretion stuck in sampler).

No recovery; possible moderately to strongly cemented material.

GROUP DELTA CONSULTANTS, INC.
9245 Activity Road, Suite 103
San Diego, California 92126

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.
**Friars Formation (continued):** Poorly-indurated sandstone; fine to coarse grained; massive; gray (Gley 6/N); wet; moderately weathered; very soft; unfractured; (Clayey sand (SC); very dense; mostly fine sand; little fines; low plasticity; weakly cemented).

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**This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of the actual conditions encountered.**
FRIARS FORMATION, (continued):

*Poorly-indurated SANDSTONE; fine to coarse grained; laminated; gray (Gley 6/N); wet; moderately weathered; very soft; unfractured; (Clayey SAND (SC); very dense; mostly fine sand; little fines; low plasticity; weakly to moderately cemented).

Total Depth = 100.9 feet (Target depth reached).

Groundwater measured during drilling at a depth of 16.8 feet.

Boring backfilled on 3/11/19 with bentonite grout and capped with cold patch asphalt.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

^ = Inaccurate blowcount.

All soils encountered may include up to 10% COBBLES (granitic, subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings.

*Geologic Description; (Disturbed Soil Description).
### PAVEMENT
Approximately 5 inches of ASPHALT CONCRETE.

### UNDIFFERENTIATED SURFICIAL SOILS
- **Clayey SAND (SC):**
  - Dark yellowish brown (10YR 4/4); moist; mostly sand; some fines; little gravel; low plasticity.
  - (18% Gravel; 55% Sand; 27% Fines).
  - PID = 1.2 ppm
  - Some GRAVEL and COBBLES from 3ft to 5ft.

- **Clayey SAND (SC):**
  - Reddish brown (5YR 4/3); moist; mostly sand; low plasticity; gravel lodged in sampler.
  - (41% Fines).
  - PID = 1.0 ppm

- **Silty GRAVEL with sand (GM):**
  - Yellowish brown (10YR 5/4); moist; mostly gravel; little sand; little fines; nonplastic.
  - Gravel stuck in sampler shoe.
  - PID = 0.8 ppm
  - Slow and difficult drilling on GRAVEL and COBBLES from 6ft to 14ft.

- **Clayey GRAVEL with sand (GC):**
  - Brown (10YR 4/3); moist; mostly gravel; little fines and sand; low plasticity.

- **Clayey SAND (SC):**
  - Dark gray (7.5YR 4/1); moist; mostly fine sand; some fines; low plasticity; organic odor.
  - PID = 2.5 ppm

- **Poorly-graded SAND (SP):**
  - Medium dense; very pale brown (10YR 7/3); moist; mostly fine to medium sand; trace fines; nonplastic; trace mica.
  - Thinly bedded felsic and mafic minerals from 20ft to 20.5ft in sample.
  - PID = 1.6 ppm
  - (95% Sand; 5% Fines).

### TABLE: Soils Classification

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UNDIFFERENTIATED SURFICIAL SOILS (continued):

- Well graded SAND (SW); loose; grayish brown (10YR 5/2); wet; mostly fine to coarse sand; trace fines; nonplastic; trace mica.
  - PID = 0.6 ppm (4% Fines).

- Sandy lean CLAY (CL); medium stiff; very dark gray (10YR 3/2); wet; mostly fines; some fine sand; medium plasticity; micaceous.
  - PID = 0.4 ppm; PP = 0.75 tsf

- Poorly-graded SAND (SP); gray (10YR 5/1); wet; mostly fine to medium sand; few gravel; trace fines; nonplastic; trace mica.
  - Packed sampler.
  - PID = 6.7 ppm (9% Gravel; 87% Sand; 4% Fines)

- Medium dense; trace mica.
  - PID = 24.1 ppm (5% Fines)

- Fat CLAY (CH); medium stiff; dark gray (10YR 4/1); wet; mostly fines; little fine sand; high plasticity; grading to silty sand.
  - PP = 1 tsf; TV = 0.25 tsf (86% Fines)

- Silty SAND (SM); medium dense; dark gray (10YR 4/1); wet; mostly fine sand; some fines; nonplastic; grading to sand with silt.

- Poorly-graded SAND with silt (SP-SM); dark gray (10YR 5/1); wet; mostly fine to medium sand; few fines; nonplastic; micaceous.
  - Packed sampler.
  - PID = 1.0 ppm (6% Fines)
**UNDIFFERENTIATED SURFICIAL SOILS (continued):**

Clayey SAND (SC); dense; dark gray (10YR 5/1); wet; mostly fine to medium sand; little fines; trace gravel; low plasticity; micaceous.

PID=0.3 ppm (19% Fines)

Silty SAND (SM); dark gray (10YR 5/1); wet; mostly fine to medium sand; few fines and gravel; low plasticity; micaceous. Sampler packed.

PID=0.8 ppm (12% Fines)

Moderately difficult drilling on GRAVELS and COBBLES from 56ft to 62ft. Poorly-graded GRAVEL (GP); dark grayish brown (2.5YR 4/2); wet; mostly gravel; few sand; trace fines; nonplastic; trace mica. (Estimated 10 to 20% COBBLES).

Slow and difficult drilling on GRAVELS and COBBLES from 62ft to 73ft. (Estimated 20 to 30% COBBLES)

No recovery; sampler refusal on gravel and cobbles.

---

**FRIARS FORMATION:** *Poorly indurated SANDSTONE;*

(see next page)
**Friars Formation (continued):** Poorly-indurated SANDSTONE; fine grained; massive; gray (7.5YR 5/1); moderately weathered; very soft; unfractured (Silty SAND (SM); very dense; wet; mostly fine sand; few fines; nonplastic; weakly to moderately cemented). (46% Fines)

Total Depth = 75.5 feet (Target depth reached).

Groundwater measured during drilling at a depth of 22.4 feet.

Boring backfilled on 3/14/19 shortly after drilling with bentonite grout and capped with black-dyed rapid set concrete.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

^ = Inaccurate blowcounts.

*Geologic Description; (Disturbed Soil Description).

All soils encountered may include up to 10% COBBLES (granitic, subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered. Cobble-rich layers encountered in this exploration were approximately 10 to 20 feet thick.
PAVEMENT: Approximately 4 inches of ASPHALT CONCRETE.

UNDIFFERENTIATED SURFICIAL SOILS:

- Clayey SAND with gravel (SC); brown (7.5YR 4/4); moist; mostly fine to coarse sand; some fines; little gravel; low plasticity. PID=1.3 ppm (17% Gravel; 48% Sand; 35% Fines)
- Increasing gravel content; difficult drilling from 3 to 4 feet on GRAVELS and COBBLES. Medium plasticity; gravel in sampler. PID=0.8 ppm
- Slow and difficult drilling from 7 to 19 feet on GRAVEL and COBBLES from 7 to 19 ft. Clayey GRAVEL (GC); brown (7.5 YR 4/2); moist; mostly gravel; little sand; little fines; nonplastic. (Estimated 20 to 30% COBBLES).
- Equipment failure- sheared drive cap at 11 ft.
- Switch to rotary casing advancement due to slow and difficult drilling.

Poorly graded SAND with silt (SP-SM); wet; gray (7.5 YR 6/1); mostly fine sand; few fines; trace fine gravel; nonplastic. Packed sampler. PID=0.4 ppm
UNDIFFERENTIATED SURFICIAL SOILS (continued):

- Silty SAND (SM); brown (7.5Y 5/4); wet; mostly fine to medium sand; little fines; nonplastic; trace mica; iron oxide staining throughout sample.

(F0% Gravel; 78% Sand; 22% Fines)

FRIARS FORMATION:

- *Poorly-indurated CLAYSTONE; fine grained; massive; dark gray (10YR 4/1); wet; moderately weathered; very soft; unfractured (FAT CLAY (CH); hard; mostly fines; trace sand; highly plastic).
- PP>4 tsf; PID=1.8 ppm

*Poorly-indurated SANDSTONE; fine to coarse grained; massive; gray (10YR 5/1); wet; moderately weathered; very soft; unfractured (Poorly-graded SAND with silt (SP-SM); very dense; mostly fine sand; few fines; nonplastic; weakly cemented).
- PID=1.4 ppm

Note: Total Depth = 36.5 feet (Target depth reached).

Groundwater was not measured during drilling because fluid was added to the hole prior to encountering groundwater.

Boring backfilled on 3/6/19 with bentonite grout and capped with black-dyed rapid set concrete.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

^ = Inaccurate blowcount.

All soils encountered may include up to 10% COBBLES (granitic, subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered. Cobble-rich layers encountered in this exploration were approximately 10 to 13 feet thick.

*Geologic Description; (Disturbed Soil Description).
**PAVEMENT:** Approximately 4 inches of ASPHALT CONCRETE.

**UNDIFFERENTIATED SURFICIAL SOILS:** Clayey SAND with gravel (SC); yellowish brown (10YR 5/4); moist; mostly fine to coarse sand; some fines; few to little gravel; low to medium plasticity. Dark gray (7.5YR 4/1).

![Diagram of soil layers with descriptions and classifications](image)

- **Light brownish gray (10YR 6/2); gravel in sampler.**
  - PP=1.25 tsf; PID=1.5 ppm

- **Poorly-graded SAND with silt (SP-SM); medium dense; gray (10YR 5/1); moist; mostly fine sand; few fines; nonplastic.**
  - PID=1.4 ppm

- **Poorly-graded SAND (SP); loose; grayish brown (10YR 5/2); moist; mostly fine to medium sand; trace fines; nonplastic; micaceous.**
  - PID=6.2 ppm
  - (0% Gravel; 97% Sand; 3% Fines)

---

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San Diego, California 92126

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UNDIFFERENTIATED SURFICIAL SOILS (continued):

1. Poorly-graded SAND with silt (SP-SM); medium dense; grayish brown (10YR 5/2); wet; mostly fine sand; few fines; nonplastic.
   - 9% Fines

2. Well-graded SAND (SW); loose; grayish brown (10YR 6/1); wet; mostly fine to coarse sand; trace fines and fine gravel; nonplastic; trace mica.
   - PID = 1.9 ppm
   - (1% Fines)

3. Sandy lean CLAY (CL); medium stiff to stiff; very dark gray (2.5Y 3/1); wet; mostly fines; little sand; few gravel; medium plasticity; trace mica.
   - PP = 1.0 tsf; TV = 0.4 tsf; PID = 1.1 ppm
   - (62% Fines)

   - Medium Stiff.
   - PP = 0.5 tsf; TV = 0.3 tsf; PID = 1.3 ppm

   - Medium stiff to stiff; no gravel; trace mica.
   - PP = 1.0 tsf; TV = 0.5 tsf; PID = 1.2 ppm
   - (62% Fines)
**UNDIFFERENTIATED SURFICIAL SOILS (continued):**

Poorly-graded SAND with silt (SP-SM); dense; dark gray (10YR 5/1); wet; mostly fine sand; few to little fines; nonplastic; micaceous.

PID = 0.6 ppm (11% Fines)

Slow and difficult drilling on GRAVEL and COBBLES from 54 feet and 60 feet.

Silty GRAVEL with sand (GM); wet; dark gray (10YR 5/1); mostly gravel; little to some sand; little fines; nonplastic; trace mica.

PID = 1.4 ppm (Estimated 20% COBBLES)

Poorly-graded SAND with silt (SP-SM); dark gray (10YR 5/1); wet; mostly fine sand; few to little fines; nonplastic.

Packed sampler.

**FRIARS FORMATION:** Poorly-indurated SANDSTONE; fine grained; massive; gray (7.5YR 5/1); wet; moderately weathered; very soft; unfractured; (Silty SAND (SM): very dense; wet; mostly fine sand; some fines; nonplastic; weakly cemented).

(0% Gravel; 61% Sand; 39% Fines)
**Total Depth** = 71.3 feet (Target depth reached).

Groundwater measured during drilling at a depth of 22.1 feet.

Boring backfilled on 3/12/19 with bentonite grout and capped with black dyed rapid set concrete.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

^ = Inaccurate blowcount.

All soils encountered may include up to 10% COBBLES (granitic, subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings.

*Geologic Description; (Disturbed Soil Description).
PAVEMENT: Approximately 3.5 inches of ASPHALT CONCRETE

UNDIFFERENTIATED SURFICIAL SOILS: Sandy lean CLAY (CL); stiff; dark brown (7.5YR 3/3); moist; mostly fines; some sand; trace gravel; medium plasticity. PP=1.5 tsf; PID=9.5 ppm (1% Gravel; 33% Sand; 66% Fines)

Medium stiff to very stiff; gravel in sampler. PP=2.25 tsf; TV=0.45 tsf (59% Fines)

Intermittent difficult drilling on GRAVEL and COBBLES from 7 to 12 ft.

Poorly graded SAND with clay and gravel (SP-SC); dark yellowish brown (10YR 4/6); wet; mostly fine to coarse sand; some gravel; few fines; low plasticity; trace mica; packed sampler PID=1.3 ppm (34% Gravel; 57% Sand; 9% Fines)

Difficult drilling on GRAVEL and COBBLES from 18 to 19 ft.

Silty SAND (SM); dense; gray (2.5Y 5/1); wet; mostly fine sand; little fines; trace fine gravel; nonplastic; trace iron oxide staining. PID=0.4 ppm (22% Fines)
UNDIFFERENTIATED SURFICIAL SOILS (continued):
Silty SAND (SM); gray (2.5Y 5/1); wet; mostly fine sand; little fines; trace fine gravel; nonplastic; no recovery; heaving/flowing sands.

FRIARS FORMATION: *Poorly-indurated SANDSTONE; fine to medium grained; massive; gray (2.5Y N/5/1); wet; moderately weathered; very soft; unfractured; (Silty SAND (SM); very dense; mostly fine to medium sand; little fines; nonplastic; weakly cemented).

\[ \text{PID}=0.1 \text{ ppm} \]
\[ \text{22\% Fines} \]

Switch to mud rotary at 30 feet (tricone rotary drill bit).\n
Total Depth = 36.5 feet (Target depth reached).

Groundwater measured during drilling at a depth of 10 feet.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

All soils encountered may include up to 10% COBBLES (granitic, subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered. Cobble-rich layers encountered in this exploration were approximately 1 to 2 feet thick.

\[ ^{\text{a}}=\text{Inaccurate blowcount.} \]

*Geologic Description (Disturbed Soil Description)
PAVEMENT: Approximately 4 inches of ASPHALT CONCRETE

UNDIFFERENTIATED SURFICIAL SOILS: Clayey SAND (SC); brown (10YR 4/3); mostly fine to coarse sand; some fines; few gravel; low to medium plasticity. PID=1.2 ppm
(5% Gravel; 48% Sand; 47% Fines)

Very dark gray (10YR3/1).

Medium dense; yellowish brown (10YR 5/4); little fines; low plasticity; trace mica.

Clayey GRAVEL (GC); moist; dark grayish brown (10YR 4/2); mostly fine to coarse gravel; some fines; little sand; medium plasticity; gravel stuck in sampler.
(47% Fines)

Clayey SAND with gravel (SC); dark grayish brown (10YR 4/2); moist; mostly fine to coarse sand; little gravel; little to some fines; low plasticity; trace mica.

PID= 1.4 ppm
(18% Gravel; 54% Sand; 28% Fines)

Silty GRAVEL with sand (GM); dark grayish brown (10YR 4/2); wet; mostly fine to medium gravel; some sand; little fines; nonplastic; trace mica.

PID=0.9 ppm

FRIARS FORMATION:*Poorly indurated SANDSTONE; (see next page)
**FRIARS FORMATION (continued):**

- *Poorly-indurated SANDSTONE; fine grained; massive; dark gray (2.5Y 4/1); wet; moderately weathered; very soft; unfractured; (Silty SAND (SM); mostly fines; few fine sand; high plasticity).
  - **PID=0.5 ppm; (61% Fines)**

- *Poorly-indurated CLAYSTONE; fine grained; massive; dark gray (2.5Y 4/1); wet; moderately weathered; very soft; unfractured; (Sandy fat CLAY (CH); hard; mostly fines; few fine sand; high plasticity).
  - **PID=0.5 ppm; (61% Fines)**

- *Poorly-indurated SANDSTONE; fine grained; massive; gray (7.5YR 6/1); wet; moderately weathered; very soft; unfractured; (Silty SAND (SM); very dense; wet; mostly fine sand; little fines; nonplastic; weakly cemented).
  - **PID=0.7 ppm. (23% Fines)**

- Gray (7.5YR 5/1); (Clayey SAND (SC); little fines; low plasticity).
  - **PID=0.3 ppm**

---

**Groundwater measured during drilling at a depth of 21.8 feet.**

**Boring backfilled on 3/8/19 with bentonite grout and capped with black-dyed rapid set concrete.**

**This Boring Record is part of a geotechnical report which must be considered in its entirety.**

**All soils encountered may include up to 10% COBBLES (granitic, subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings.**

---

**Notes:**

- **ETR ~ 79%, N
  \[ \frac{N_{sp}}{N_{MC}} = 1.32 \] NMC**

---

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**NOTES:**

- **Inaccurate blowcount.**
- **Geologic Description; (Disturbed Soil Description).**

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**FIGURE B-12 b**

- **GRAPHIC LOG:**
  - **DESCRIPTION AND CLASSIFICATION:**
  - **GRAPHIC LOG:**
  - **GROUNDWATER (ft) TOTAL DEPTH (ft) DEPTHELEV. GROUNDWATER (ft)**

---

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PAVEMENT: Approximately 3 inches of ASPHALT CONCRETE.

UNDIFFERENTIATED SURFICIAL SOILS: Clayey SAND (SC); grayish brown (10YR 5/2); moist; mostly fine sand; little fines; little gravel; medium plasticity.

PID = 3.3 ppm (23% Gravel; 56% Sand; 21% Fines)

Slow and difficult drilling on GRAVEL and COBBLES. (Estimated 20% COBBLES).

Clayey GRAVEL (GC); dense; grayish brown (10YR 5/2); moist; mostly gravel and gravel-sized freshly broken rock fragments; little to some fines; little sand; medium plasticity.

No recovery.

Sandy lean CLAY with gravel (CL); grayish brown; moist; mostly fines; some sand; little gravel. (Estimated 10 to 20% COBBLES).

Slow and difficult drilling on GRAVEL and COBBLES from 20 to 30 ft. Clayey GRAVEL (GC); very dense; dark grayish brown; wet; mostly fine to coarse gravel; some sand; little fines; medium plasticity.

Gravel stuck in sampler.

PID = 0.4 ppm (Estimated 20% COBBLES)
UNDIFFERENTIATED SURFICIAL SOILS (continued):
No recovery.
Clayey GRAVEL (GC) (continued).

Poorly-graded SAND with silt (SP-SM); wet; gray (7.5YR 5/1); mostly fine to medium sand; few fines; trace gravel; nonplastic; micaceous.

Dense; no gravel; trace mica.

PID=0.8 ppm
(0% Gravel; 94% Sand; 6% Fines)

Medium dense; trace iron oxide staining.

PID=0.8 ppm
(7% Fines)

Switch to mud rotary drilling (Tricone rotary drill bit).

Dark gray (2.5Y 4/1); wet.

PID=4.8 ppm
Clayey SAND (SC); medium dense; dark gray (7.5YR 4/1); wet; mostly fine to coarse sand; some fines; few gravel; low plasticity; trace mica. PID=0.2 ppm

Well-graded SAND with silt and gravel (SW-SM); dense; dark gray (7.5YR 4/1); wet; mostly fine to coarse sand; few fines; little gravel; nonplastic. PID=0 9% Fines

Sampler refusal; gravel stuck in shoe of sampler. PID=1.8 ppm

Slow and difficult drilling on GRAVELS and COBBLES from 60 to 75 ft. (Estimated 20% COBBLES). PID=0

## Undifferentiated Surficial Soils (continued)

### Summary Information

**Location:** SDSU Mission Valley  
**Drilling Date:** 2/13/2019  
**Project Name:** SD605  
**Boring:** S-13  
**Drilling Method:** HSA (0-45') / Mud Rotary (45-101.5')  
**Logged By:** S. Narveson  
**Checked By:** C. Vonk  
**Drilling Company:** Pacific Drilling  
**Drilling Equipment:** Diedrich D50  
**Sampling Method:** Hammer: 140 lbs., Drop: 30 in. (Automatic)  

### Soil Description

- **S12:** Sample No. 9, Elevation 10 ft, Penetration (B') 20, Moisture (NB) 26.  
- **S13:** Sample No. 17, Elevation 17 ft, Penetration (B') 16, Moisture (NB) 15.  
- **S14:** Sample No. 50/5, Elevation 60 ft, Penetration (B') 50, Moisture (NB) 5.  
- **S15:** Sample No. 50/5.5, Elevation 70 ft, Penetration (B') 50.5, Moisture (NB) 5.5.

**Other Tests:**

- ETR ~ 79%, $N_{60} = 1.32N_{spf} = 0.88N_{MC}$

---

### Graphical Log

- UNDIFFERENTIATED SURFICIAL SOILS (continued):

**Description and Classification**

- **S12**
  - Sample No. 9, Elevation 10 ft, Penetration (B') 20, Moisture (NB) 26.

**Notes:**

- **S12:** Sample refusal; gravel stuck in shoe of sampler. PID=1.8 ppm

- **S13:** Slow and difficult drilling on GRAVELS and COBBLES from 60 to 75 ft. (Estimated 20% COBBLES). PID=0

---

### Table: Boring Log

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<th>Sample No.</th>
<th>Elevation (ft)</th>
<th>Penetration (B')</th>
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**This Summary Applies Only at the Location of This Boring and at the Time of Drilling. Subsurface Conditions May Differ at Other Locations and May Change at This Location With the Passage of Time. The Data Presented Is a Simplification of the Actual Conditions Encountered.**

**Figure B-13 c**
**Boring Record**

**Site Location:** 9449 Friars Road, San Diego, California

**Drilling Company:** Pacific Drilling

**Drilling Method:** HSA (0-45') / Mud Rotary (45-101.5')

**Logged By:** S. Narveson

**Checked By:** C. Vonk

**Drilling Equipment:** Diedrich D50

**Boring Dia. (in):** 8/4

**Total Depth (ft):** 101.5

**Ground Elev (ft):** 75

**Drilling Equipment:**

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**Friars Formation:** *Poorly-indurated*

SANDSTONE: fine to coarse grained; massive; gray (2.5Y 6/1); moderately to highly weathered; very soft; unfractured; (Clayey SAND (SC); dense; wet; mostly fine sand; little fines; low plasticity; weakly to moderately cemented).

Very dense.

PID=0

(25% Fines)

Slow and difficult drilling 82 to 84 ft; moderately to strongly cemented SANDSTONE and possible concretions.

Slow and difficult drilling from 89 to 92 ft; moderately to strongly cemented SANDSTONE and made possible concretions.

No recovery; possible concretions.

Slow and difficult drilling from 97 to 98 ft; moderately to strongly cemented SANDSTONE and possible concretions.
FRIARS FORMATION (continued): *Poorly-indurated SANDSTONE; fine to coarse grained; massive; gray (2.5Y 6/1); moderately to highly weathered; very soft; unfractured; (Silty SAND (SM); very dense; wet; mostly fine to coarse sand; little fines; low plasticity; weakly to moderately cemented.

Total Depth = 101.5 feet (Target depth reached).

Groundwater not measured.

Boring backfilled on 2/25/19 and 2/26/19 with bentonite grout and capped with cold patch asphalt.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

^ = Inaccurate blowcount

All soils encountered may include up to 10% COBBLES (granitic, subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered.

Cobble-rich layers encountered in this exploration were approximately 10 to 20 feet thick.

---

This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of the actual conditions encountered.
PAVEMENT: Approximately 4 inches of ASPHALT CONCRETE.

UNDIFFERENTIATED SURFICIAL SOILS: Clayey SAND (SC); brown (7.5YR 4/3); moist; mostly fine to medium sand; some fines; few gravel; low plasticity.

Medium dense; dark gray (10YR 5/1); little fines; trace gravel; micaceous.

(1% Gravel; 86% Sand; 13% Fines)

PID = 0.8 ppm.

Lean CLAY with sand (CL); stiff to very stiff; reddish brown (5YR 4/4); moist; mostly fines; little fine sand; trace fine gravel; medium plasticity; trace mica.

PP = 2.5 tsf; TV = 0.9 tsf; PID = 0.6 ppm

(66% Fines)

Clayey GRAVEL with sand (GC); reddish brown (5YR 4/3) and gray (10YR 5/1) gravels; moist; mostly gravel with fresh broken rock fragments; little sand; little fines; low plasticity.

Gravel in sampler.

Polymer/water mix added to hollow stem.

PID = 1 ppm.

Slow and difficult drilling on GRAVEL and COBBLES from 7ft to 25ft.

(Estimated 10 to 30% COBBLES)

Poorly graded GRAVEL with silt and sand (GP-GM); dense; brown (10YR 4/3); wet; mostly gravel; some sand; few fines; nonplastic.

Gravel in sampler.

PID = 0.9 ppm.

(10% Fines)

(Estimated 20% COBBLES)

No recovery; sampler refusal on gravel and cobbles.

5-inch diameter cobble in spoils.
**Borings**

**Friars Formation:** Poorly-indurated sandstone; fine to medium grained; massive; pinkish gray (7.5YR 6/2); highly weathered; very soft; unfractured (Silty Sand (SM); very dense; wet; mostly fine to medium sand; little fines; nonplastic; weakly cemented).

PID = 0.9 ppm (79% Sand; 21% Fines)

**Poorly-indurated Claystone:** Fine grained; massive; reddish gray (5YR 5/2); moderately weathered; very soft; unfractured (sandy lean clay (CL); hard; wet; mostly fines; some fine sand; medium to high plasticity).

PID = 0.3 ppm (19% Fines)

**Total Depth = 31.5 feet (Target depth reached).**

Groundwater was not measured during drilling because Polymer/water mix added down hollow stem to control heaving sands prior to encountering groundwater.

Boring backfilled on 3/13/2019 shortly after drilling with neat portland cement and capped with black-dyed rapid set concrete.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

^ = Inaccurate blowcounts.

*Geologic Description; (Disturbed Soil Description).

All soils encountered may include up to 10% COBBLES (subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered. Cobble-rich layers encountered in this exploration were approximately 15 to 20 feet thick.

---

**Boring Record**

**Site Location:** 9449 Friars Road, San Diego, California

**Drilling Company:** Tri-County Drilling

**Drilling Method:** Hollow Stem Auger

**Logged By:** S. Narveson

**Checked By:** C. Vonk

**Sampling Method:** Hammer: 140 lbs., Drop: 30 in. (Automatic)

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**Description and Classification**

Friars Formation:

- Poorly-indurated sandstone: fine to medium grained; massive; pinkish gray (7.5YR 6/2); highly weathered; very soft; unfractured (Silty Sand (SM); very dense; wet; mostly fine to medium sand; little fines; nonplastic; weakly cemented).

PID = 0.9 ppm (79% Sand; 21% Fines)

- Poorly-indurated claystone: fine grained; massive; reddish gray (5YR 5/2); moderately weathered; very soft; unfractured (sandy lean clay (CL); hard; wet; mostly fines; some fine sand; medium to high plasticity).

PID = 0.3 ppm (19% Fines)

---

**Groundwater was not measured during drilling because Polymer/water mix added down hollow stem to control heaving sands prior to encountering groundwater.**

Boring backfilled on 3/13/2019 shortly after drilling with neat portland cement and capped with black-dyed rapid set concrete.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

^ = Inaccurate blowcounts.

*Geologic Description; (Disturbed Soil Description).

All soils encountered may include up to 10% COBBLES (subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered. Cobble-rich layers encountered in this exploration were approximately 15 to 20 feet thick.

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**Boring Record**

**Site Location:** 9449 Friars Road, San Diego, California

**Drilling Company:** Tri-County Drilling

**Drilling Method:** Hollow Stem Auger

**Logged By:** S. Narveson

**Checked By:** C. Vonk

**Sampling Method:** Hammer: 140 lbs., Drop: 30 in. (Automatic)

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**Description and Classification**

Friars Formation:

- Poorly-indurated sandstone: fine to medium grained; massive; pinkish gray (7.5YR 6/2); highly weathered; very soft; unfractured (Silty Sand (SM); very dense; wet; mostly fine to medium sand; little fines; nonplastic; weakly cemented).

PID = 0.9 ppm (79% Sand; 21% Fines)

- Poorly-indurated claystone: fine grained; massive; reddish gray (5YR 5/2); moderately weathered; very soft; unfractured (sandy lean clay (CL); hard; wet; mostly fines; some fine sand; medium to high plasticity).

PID = 0.3 ppm (19% Fines)

---

**Groundwater was not measured during drilling because Polymer/water mix added down hollow stem to control heaving sands prior to encountering groundwater.**

Boring backfilled on 3/13/2019 shortly after drilling with neat portland cement and capped with black-dyed rapid set concrete.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

^ = Inaccurate blowcounts.

*Geologic Description; (Disturbed Soil Description).

All soils encountered may include up to 10% COBBLES (subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered. Cobble-rich layers encountered in this exploration were approximately 15 to 20 feet thick.
**PAVEMENT:** Approximately 5 inches of ASPHALT CONCRETE.

**UNDIFFERENTIATED SURFICIAL SOILS:** Clayey SAND with gravel (SC); light brown (10YR 5/3); moist; mostly fine to coarse sand; some fines; little to some gravel and gravel-sized freshly broken rock fragments; medium plasticity. (26% Gravel; 44% Sand; 30% Fines)

Brown (7.5YR 4/3); little to some fines; approximately ~2.5-inch diameter gravel clast in sample number R2-1. PP=2.25 tsf; PID=0.3 ppm (27% Fines)

Silty SAND (SM); medium dense; dark gray (2.5Y 4/1); moist; mostly fine to coarse sand; some fines; nonplastic; trace mica.

PID=0.7 ppm

Clayey SAND with gravel (SC); dense; grayish brown (10YR 5/2); wet; mostly fine to coarse sand; some fines; little gravel; medium plasticity.

Gravel in sampler.

PID=1.0 ppm

Slow and difficult drilling on GRAVEL and COBBLES. (Estimated 10 to 20% COBBLES)

Silty SAND with gravel (SM); yellowish brown (10YR 5/4); wet; mostly fine to coarse sand; some fines; little gravel; nonplastic.

Gravel in sampler.

PID=10.1 ppm

**GROUP DELTA CONSULTANTS, INC.**

9245 Activity Road, Suite 103
San Diego, California 92126

*THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.*

**FIGURE B-15 a**
UNDIFFERENTIATED SURFICIAL SOILS (continued):

- Silty SAND with gravel (SM); dark grayish brown (10YR 6/2); wet; mostly fine to coarse sand; some fines; little gravel; nonplastic; gravel in bottom of sample.

FRIARS FORMATION:

- *Poorly indurated SANDSTONE; fine grained; massive; light brownish gray (10YR 6/2); highly weathered; very soft; unfractured (Silty SAND (SM); very dense; wet; mostly fine sand; little fines; nonplastic; weakly cemented).
- Gray (10YR 6/1); strongly cemented concretion in sampler.

(0% Gravel; 86% Sand; 14% Fines)

Total Depth = 36.3 feet (Target depth reached).

Groundwater measured during drilling at a depth of 12.2 feet on 2/11/19.

Marl M5 (0 to 26.3 feet); Deidrich D50 (26.3 to 36.3 feet).

Boring backfilled on 2/11/19 shortly after drilling with bentonite grout and capped with black-dyed rapid set concrete. Boring redrilled on 3/15/19, backfilled with bentonite grout and capped with black-dyed rapid set concrete.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

^ = Inaccurate blowcounts.

*Geologic Description; (Disturbed Soil Description).

All soils encountered may include up to 10% COBBLES (subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered. Cobble-rich layers encountered in this exploration were approximately 1 to 5 feet thick.
BORING RECORD

SITE LOCATION
9449 Friars Road, San Diego, California

PROJECT NAME
SDSU Mission Valley

PROJECT NUMBER
SD605

BORED BORING
B-16

START
2/13/2019

FINISH
2/15/2019

SAMPLING METHOD
Hammer: 140 lbs., Drop: 30 in. (Automatic)

ELEVATION

DEPTH (feet)

SAMPLE NO.

SAMPLE TYPE

SAMPLE NO.

DESIRED PENETRATION (feet)

BLOW N

N

MOISTURE (%)

MOISTURE (lo) (%)

OTHER TESTS

DEPTH (feet)

REMARKS

DESCRIPTION AND CLASSIFICATION

PAVEMENT:
Approximately 3 inches of ASPHALT CONCRETE over 6 inches of AGGREGATE BASE.

UNDIFFERENTIATED SURFICIAL SOILS:
Silty SAND (SM); medium dense; grayish brown (2.5Y 5/2); moist; mostly fine to medium sand; some fines; trace gravel and cobbles; nonplastic.

Clayey SAND (SC); medium dense; grayish brown (2.5Y 5/2); moist; mostly fine to medium sand; some fines; trace gravel and cobbles; low plasticity.

PVOID = 0.0 ppm
(4% Gravel; 57% SAND; 39% fines)

Clayey SAND (SC); dense; dark grayish brown (10YR 4/2); moist; mostly fine sand; some fines; few to little gravel and gravel-sized freshly broken rock fragments; low plasticity.

PVOID = 0.0 ppm
(38% Fines)

Slow and difficult drilling on GRAVEL and COBBLES.
(Estimated 20% COBBLES)

No recovery; sampler refusal.

Clayey SAND (SC); dense; moist; mostly fine sand; some fines; few to little gravel; low to medium plasticity.

PP = 1.0 tsf
(35% Fines)

GROUP DELTA CONSULTANTS, INC.
9245 Activity Road, Suite 103
San Diego, California 92126

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
B-16 a
UNDIFFERENTIATED SURFICIAL SOILS (continued):

Hard drilling on GRAVEL and COBBLES.
No recovery; sampler refusal.
(Estimated 20-30% COBBLES)

Silty SAND (SM); medium dense; dark gray (5YR 4/1);
moist; mostly fine sand; some fines; few gravel;
nonplastic; micaceous; 1/2 inch clay lense in bottom
1/3rd of sample.

PID=0.3 ppm
(6% Gravel; 62% Sand; 32% Fines)
No recovery; dense.
Loose; dark gray (2.5Y 4/1); wet; mostly medium to
coarse sand; trace mica.

PID=13.6 ppm
(57% Fines)
Poorly-graded SAND with silt (SP-SM); dense; dark
grayish brown (10YR 4/2); wet; mostly medium to
course sand; few fines; trace gravel; nonplastic;
well-graded in bottom rings of sample.
PID=0.0 ppm
(9% Fines)
Switch to mud rotary drilling (Tricone rotary drill bit) at
45 feet.
**UNDIFFERENTIATED SURFICIAL SOILS (continued):**

Poorly-graded SAND (SP); medium dense; gray (10YR 5/1); wet; mostly fine to medium sand; trace fines and fine gravel; nonplastic; trace mica.

PID = 41.2 ppm (4% Fines)

Heaving sands; packed sampler

Silty GRAVEL with sand (GM); very dense; dark grayish brown (2.5Y 4/2); wet; mostly gravel, cobbles and gravel-sized freshly broken rock fragments; little fines; little to some fine to coarse sand; nonplastic. PID = 1.4 ppm

Very slow and difficult drilling on GRAVEL and COBBLES (caving; drill bit getting stuck downhole). (Estimated 30% COBBLES)
**UNDIFFERENTIATED SURFICIAL SOILS (continued):**

Silty GRAVEL with sand (GM); very dense; light olive brown (2.5Y 5/3); wet; mostly gravel and gravel-sized freshly broken rock fragments; little fines; little to some fine to coarse sand; nonplastic.

*Estimated 20% COBBLES*

PID = 0.0 ppm

**FRIARS FORMATION:**

*Poorly indurated SANDSTONE; fine to coarse grained; massive; gray (2.5Y 5/1); moderately to highly weathered; very soft; unfractured; (Poorly graded SAND with clay (SP-SC); very dense; wet; mostly fine sand; few to little fines; low plasticity; weakly cemented).*

PID = 0.0 ppm

Unable to sample at 85 feet due to gravel caving into borehole.

Total Depth = 85 feet (Target depth reached).

Groundwater measured during drilling at a depth of 39.9 feet.

Boring backfilled on 2/15/19 shortly after drilling with bentonite grout and capped with black-dyed rapid set concrete.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

*Inaccurate blowcounts.

*Geologic Description; (Disturbed Soil Description).

All soils encountered may include up to 10% COBBLES (subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered. Cobble-rich layers encountered in this exploration were approximately 3 to 20 feet thick.
PAVEMENT: Approximately 4 inches of ASPHALT CONCRETE.

UNDIFFERENTIATED SURFICIAL SOILS:

Clayey SAND (SC); yellowish brown (10YR 5/4); moist; mostly fine to coarse sand; trace gravel; low to medium plasticity; few cobbles.

PID=0.0 ppm (1% Gravel; 61% Sand; 38% Fines)

Slow and difficult drilling on GRAVEL and COBBLES. (Estimated 10% COBBLES)

Clayey SAND with gravel (SC); dense; dark yellowish brown (10YR 4/2); moist; mostly fine to coarse sand, gravel, and gravel-sized freshly broken rock fragments; some fines; medium plasticity; sample disturbed in upper 12 inches.

PP=1.75 tsf; PID=34.0 ppm (43% Fines)

Clayey GRAVEL (GC); very dense; yellowish brown (10YR 5/4); moist; mostly gravel; some fines; little sand; low plasticity; low recovery.

Slow and difficult drilling on GRAVEL and COBBLES. (Estimated 20% COBBLES)

Sandy lean CLAY to clayey SAND (CL to SC); very stiff/medium dense; dark yellowish brown (10YR 4/2); moist; mostly fines and fine to coarse sand; few gravel; low to medium plasticity; 2 inch diameter gravel in sampler shoe.

PP=2.5 tsf; PID=1.4 ppm (60% Fines)

PID=11.1 ppm (38% Fines)

Poorly-graded SAND with silt (SP-SM); dark grayish brown (2.5Y 4/2); wet; mostly medium sand; little fines; few gravel; nonplastic.
UNDIFFERENTIATED SURFICIAL SOILS (continued):

Poorly-graded SAND with silt (SP-SM); very dense; dark grayish brown (2.5Y 4/2); wet; mostly medium sand; few fines; few gravel; nonplastic; trace mica; few cobbles. PID=11.7 ppm

Switch to mud rotary drilling (Tricone rotary drill bit) at 25 feet.

Slow and difficult drilling on GRAVEL and COBBLES. (Estimated 20% COBBLES)

Silty SAND (SM); dense; dark gray (2.5Y 4/1); wet; mostly medium to coarse sand; little fines; nonplastic; micaceous. PID=0 ppm (17% Fines)

Very dark gray (2.5Y 3/1); mostly fine sand; some fines; trace mica. PID=0.4 ppm (36% Fines)

Dark grayish brown (10YR 4/2); micaceous. (34% Fines)

Interbedded COBBLES, GRAVEL, and SAND.

This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of the actual conditions encountered.
**Friars Formation:** *Poorly indurated Sandstone; fine to coarse grained; massive; gray (7.5YR 6/1); moderately weathered; very soft; unfractured; (Silty Sand (SM); very dense; wet; mostly fine sand; little fines; nonplastic; weakly to moderately cemented). PID = 0 ppm (78% Sand; 22% Fines)

(Trace gravel; iron oxide staining). PID = 0 ppm

{Poorly-indurated Claystone.}

*Poorly indurated Sandstone; fine to coarse grained; massive; blueish gray (Gley 10B 5/1); moderately weathered; very soft; unfractured; (Poorly-graded Sand with silt (SP-SM); very dense; wet; mostly medium sand; few to little fines; nonplastic; weakly cemented). PID = 0 ppm (11% Fines)

Thinly bedded.

PID = 0 ppm

Total Depth = 71.5 feet (Target depth reached). Groundwater measured during drilling at a depth of 23.6'.

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**Graphic Log Description and Classification**

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**Notes:**

ETR ~ 79%, N<sub>60</sub> = 1.32N<sub>sp</sub> = 0.88N<sub>mc</sub>

---

**Group Delta Consultants, Inc.**

9245 Activity Road, Suite 103
San Diego, California 92126

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

**Figure B-17 c**
Boring backfilled on 2/12/19 shortly after drilling with bentonite grout and capped with black-dyed rapid set concrete.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

^ = Inaccurate blowcounts.

*Geologic Description; (Disturbed Soil Description).

All soils encountered may include up to 10% COBBLES (subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered. Cobble-rich layers encountered in this exploration were approximately 1 to 8 feet thick.
PAVEMENT: Approximately 4 inches of ASPHALT CONCRETE.

UNDIFFERENTIATED SURFICIAL SOILS: Clayey SAND (SC); moist; brown (10YR 5/3); mostly sand; some fines; few to little gravel; medium plasticity.
PID=0.1 ppm
(14% Gravel; 44% Sand; 42% Fines)

Medium dense; greenish gray (Gley 10G 6/1); moist; mostly fine to coarse sand; some fines; few gravel; low plasticity.
PID=0 ppm

Grayish brown (2.5Y 5/2); wet; mostly fine to medium sand; trace to few gravel; medium plasticity.
PID=0.3 ppm

Hole caving at 14 feet; flowing/heaving sands.

Slough: Poorly graded SAND with silt (SP-SM); dark gray (5Y 4/1); wet; mostly fine to medium sand; few to little fines; nonplastic; trace mica.
PID=0.4 ppm

Unable to sample at 20 feet due to hole caving.

Total Depth = 20 feet (Target depth reached).

Groundwater measured during drilling at a depth of 8.1 feet.

Boring backfilled on 2/11/19 shortly after drilling with bentonite grout and capped with black-dyed rapid set concrete.
This Boring Record is part of a geotechnical report which must be considered in its entirety.

^ = Inaccurate blowcounts.

*Geologic Description; (Disturbed Soil Description).

All soils encountered may include up to 10% COBBLES (granitic, subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

^ = Inaccurate blowcounts.

*Geologic Description; (Disturbed Soil Description).

All soils encountered may include up to 10% COBBLES (granitic, subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings.
**PAVEMENT:** Approximately 5 inches of ASPHALT CONCRETE.

**UNDIFFERENTIATED SURFICIAL SOILS:** Clayey SAND (SC); light olive brown (2.5Y 5/3); moist; mostly fine to coarse sand; some fines; trace fine gravel; medium plasticity.

(6% Gravel; 60% Sand; 34% Fines)

With gravel; little fine to coarse gravel.

Total Depth = 4.4 feet (Target depth reached).

Groundwater not encountered.

Boring converted to a percolation test hole on 03/12/2019 shortly after drilling, and backfilled on 03/13/2019 and patched with black-dyed rapid set concrete after completion of percolation testing.

This Boring Record is part of a geotechnical report which must be considered in its entirety.
PAVEMENT: Approximately 4 inches of ASPHALT CONCRETE.

UNDIFFERENTIATED SURFICIAL SOILS: Clayey SAND (SC); yellowish brown (10YR 5/4); moist; mostly fine to coarse sand; little fines; trace gravel; low to medium plasticity.
PID=0.8 ppm (3% Gravel; 72% Sand; 25% Fines) Brown (7.5YR 5/2); low plasticity; gravel in sampler.
Slow and difficult drilling on GRAVEL and COBBLES. (Estimated 10 to 20% COBBLES).
No recovery. Sampler refusal on gravel and cobbles.

Sampler refusal on gravel and cobbles.

Clayey SAND (SC); Dense; grayish brown (10YR 5/2); moist; mostly fine to coarse sand; little to some fines; trace gravel; low plasticity.
PID=0.3 ppm (27% Fines)
Slow and difficult drilling on GRAVEL and COBBLES. (Estimated 10% to 20% COBBLES).
No recovery.

Clayey SAND (SC); medium dense; dark yellowish brown (10YR 3/4); moist; mostly sand; some fines; few gravel; medium plasticity; trace mica.
PP=1 tsf (40% Fines)
Silty SAND (SM); medium dense; gray (25Y 5/1); moist; mostly fine to medium sand; little fines; trace gravel.
P=0.3 ppm

<table>
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<tr>
<th>DEPTH (feet)</th>
<th>ELEVATION</th>
<th>SAMPLE NO.</th>
<th>PENETRATION RESISTANCE (ROWS / 6&quot;)</th>
<th>BLOWN &quot;N&quot;</th>
<th>MOISTURE (%)</th>
<th>DRY DENSITY (pcf)</th>
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<th>PID ppm</th>
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This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of the actual conditions encountered.
REFUNDIFFERENTIATED SURFICIAL SOILS (continued):

Sandy lean CLAY (CL); stiff to very stiff; very dark yellowish brown (2.5YR 3/2); moist; mostly fines; some fine sand; few gravel; low-medium plasticity. PP= 2.25 tsf; PID=0.1 ppm

Silty SAND (SM); dense; dark gray (2.5YR 4/1); moist; mostly fine sand; little fines; nonplastic; trace mica. PID=0.3 ppm

Poorly graded SAND with silt (SP-SM); medium dense; dark gray (7.5Y 4/1); wet; mostly fine to medium sand; few fines; trace gravel; nonplastic.

Sandy lean CLAY (CL); medium stiff; brown (7.5YR 4/2); wet; mostly fines; some fine sand; medium plasticity; PP=1 tsf; PID= 0.3 ppm

Trace mica; PID=0 ppm.

Slow and difficult drilling on GRAVEL and COBBLES. (Estimated 20 to 30% COBBLES). Sampler refusal on gravel and gobbles; no recovery. Equipment failure- sheared drive cap at 45 ft.

GROUP DELTA CONSULTANTS, INC.
9245 Activity Road, Suite 103
San Diego, California 92126

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**UNDIFFERENTIATED SURFICIAL SOILS (continued):**
Silty GRAVEL with sand (GM); grayish brown (10YR 5/2); wet; mostly gravel; some sand; little fines; non-plastic. 
Estimated 20 to 30% COBBLES.
Blueish gray (GLEY 2 5PB 5/1).

Equipment failure—sheared drive cap at 52 ft. Switch to coring.

**FRIARS FORMATION:** *Poorly indurated SANDSTONE; fine to coarse grained; massive; gray (2.5YR 6/1); wet; moderately to highly weathered; very soft; unfractured; (Silty SAND (SM); very dense; wet; mostly fine to medium sand; little fines; trace fine gravel; nonplastic; weakly cemented).*

Total Depth = 61.3 feet (Target depth reached).
Groundwater measured during drilling at a depth of 33.4 feet.
Boring backfilled on 3/4/19 shortly after drilling with bentonite grout and patched with black-dyed rapid set concrete.
This Boring Report is part of a geotechnical report which must be considered in its entirety.

\[ N_d = 1.32 N_{sp} = 0.88 N_{uc} \]

---

**GROUP DELTA CONSULTANTS, INC.**
9245 Activity Road, Suite 103
San Diego, California 92126

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PAVEMENT: Approximately 6 inches of ASPHALT CONCRETE.

UNDIFFERENTIATED SURFICIAL SOILS: Clayey SAND (SC); dark grayish brown (10YR 4/2); moist; mostly fine to medium sand; some fines; trace fine gravel; low plasticity.

(4% Gravel; 51% Sand; 45% Fines)

Medium dense; dark gray (5Y 4/1).
PP=1 tsf; PID=2.3 ppm.
(47% Fines)

Hard drilling on GRAVEL and COBBLES:
(Estimated 10-20% COBBLES)

Sandy lean CLAY (CL); very stiff; very dark gray (2.5Y 3/1); moist; mostly fines; some fine sand; medium plasticity.
PP=3.25 tsf; PID=0.8 ppm.

Poorly-graded SAND (SP); dense; olive gray (5Y 4/2); wet; mostly fine to medium sand; trace fines; nonplastic.
(4% Fines)

Switch rig from Marl M5 to CME 75 at 11.5 feet.

Silty SAND (SM); loose; dark gray (2.5Y 4/1); wet; mostly fine to medium sand; few to little fines; nonplastic; trace mica.
PID=1.1 ppm.
(87% Sand; 13% Fines)

Poorly graded SAND with silt and gravel (SP-SM);
dense; dark gray (2.5Y 3/1); wet; mostly fine sand; few to little fines; little gravel; nonplastic; micaceous; thinly bedded.
PID=1.9 ppm.
(11% Fines)
**UNDIFFERENTIATED SURFICIAL SOILS (continued):**

Sandy lean CLAY (CL); stiff; olive brown (2.5Y 4/3); wet; mostly fines; some fine sand; low plasticity; trace mica.

- PP = 2.0 tsf; TV = 0.55 tsf; PID = 2.9 ppm.
- (56% Fines)

Heaving sands, sampler packed.

*Well graded SAND with gravel (SW); dark gray (7.5YR 4/1); wet; mostly fine to coarse sand; little gravel; trace fines; nonplastic. (5% Fines)*

- Slow and difficult drilling on GRAVEL and COBBLES from 33' to 39'.
- (Estimated 20 to 30% COBBLES)
- Polymer/water added to hollow stem to control heaving sands.

**FRIARS FORMATION:**

*Poorly-indurated SANDSTONE; fine to coarse grained; massive; gray (7.5YR 6/1); wet; moderately weathered; very soft; unfractured (Silty SAND (SM); very dense; mostly fine sand; some fines; nonplastic; weakly cemented; iron oxide staining in lower 1/3" of sample). PID = 0.6 ppm. (70% Sand; 30% Fines)*

- Light gray (7.5Y 7/1); no iron oxide staining.

- Total Depth = 45.9 feet (Target depth reached).
- Switch rig from Marl M5 to CME 75 below 11.5 feet.
- Polymer/water mix added down hollow stem to control heaving sands.
Groundwater measured during drilling at a depth of 10.8 feet bgs. Boring backfilled on 3/13/2019 shortly after drilling with bentonite grout and capped with black-dyed rapid set concrete. This Boring Record is part of a geotechnical report which must be considered in its entirety.

^ = Inaccurate blowcounts.

*Geologic Description; (Disturbed Soil Description).

All soils encountered may include up to 10% COBBLES (subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evalution of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered. Cobble-rich layers encountered in this exploration were approximately 1 to 8 feet thick.

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### BORING RECORD

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</table>

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9245 Activity Road, Suite 103
San Diego, California 92126

FIGURE
B-21 c
**PAVEMENT:** Approximately 5 inches of ASPHALT CONCRETE.

**UNDIFFERENTIATED SURFICIAL SOILS:** Clayey SAND with gravel (SC); olive brown (2.5Y 4/3); moist; mostly fine to medium sand; little fines; little fine to medium gravel; low plasticity.

(24% Gravel; 53% Sand; 23% Fines)

No recovery. Cuttings:

Sandy lean CLAY (CL); olive gray (5Y 4/2); moist; mostly fines; some fine sand; trace fine gravel; low plasticity.

PID=3.7 ppm.

Poorly-graded SAND with silt and gravel (SM); medium dense; dark grayish brown (10YR 4/2); wet; mostly fine to medium sand; few fines; little fine to coarse gravel; nonplastic; trace mica.

PID=19.8 ppm.

(7% Fines)

Clayey SAND with gravel (SC); dense; dark grayish brown (2.5Y 4/2); wet; mostly fine to medium sand; some fines; little fine gravel; low plasticity.

PID=2.1 ppm.

(35% Fines)

Very dense; PID=1.2 ppm

Total Depth = 21.5 feet (target depth reached).

Groundwater measured during drilling at a depth of 7.0 feet bgs.
Boring backfilled on 3/11/19 shortly after drilling with bentonite grout and capped with cold patch asphalt. This Boring Record is part of a geotechnical report which must be considered in its entirety.

All soils encountered may include up to 10% COBBLES (subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings.
This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of the actual conditions encountered.

**PAVEMENT:** Approximately 5 inches of ASPHALT CONCRETE.

**UNDIFFERENTIATED SURFICIAL SOILS:** Clayey SAND (SC); very dark grayish brown (10YR 3/2); moist; mostly fine to coarse sand; some fines; low plasticity. PID= 1.7 ppm (68% Sand; 32% Fines)

- Slow and difficult drilling on GRAVEL at 4'.

- Poorly graded SAND (SP); loose; light olive brown (2.5Y 6/3); moist; mostly fine to medium sand; trace fines; nonplastic; trace mica. Coarse gravel in sampling shoe. PID=3.3 ppm. (1% Fines)

- Medium dense; wet; few cobbles (<4''). PID=2.8 ppm. (97% Sand; 3% Fines)

- Poorly-graded SAND with gravel (SP); light olive brown (2.5Y 6/3); wet; mostly fine to medium sand; some coarse gravel; nonplastic; trace mica; gravel (<3'') in sampling shoe. PID=3.3 ppm. (4% Fines)

- Poorly-graded SAND with silt (SP-SM); light olive brown (2.5Y 6/3); wet; mostly fine sand; few to little fines; few cobbles (<5''); nonplastic. PID=59.7 ppm (12% Fines)

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**SAMPLE NO.**

- **DEPTH (feet):**
  - B1: 55
  - S2: 5
  - R3-1: 45
  - S4: 15
  - R5-1: 35

- **ELEVATION (feet):**
  - B1: 55
  - S2: 5
  - R3-1: 45
  - S4: 15
  - R5-1: 35

- **DEPTH/ELEV.**
  - B1: 55
  - S2: 5
  - R3-1: 45
  - S4: 15
  - R5-1: 35

- **GROUND ELEV (feet):**
  - 58

- **TOTAL DEPTH (feet):** 70.4

- **GROUNDWATER (ft):**
  - 9.2 / 48.8

---

**NOTES**

- ETR ~ 89%, N_60 = 1.48N_{spp} = 0.99N_{MC}
UNDIFFERENTIATED SURFICIAL SOILS (continued):
Poorly-graded SAND with silt and gravel (SP-SM); very dense; dark gray (2.5 Y 4/1); wet; mostly fine sand; some gravel; few to little fines; nonplastic.
PP=0.5 tsf; PID=149.4 ppm.
(30% Gravel; 58% Sand; 12% Fines)

FRIARS FORMATION:
*Poorly-indurated
SANDSTONE; fine to coarse grained; massive; grayish brown (2.5Y 5/2); wet; moderately weathered; very soft; unfractured (Silty SAND (SM); very dense; mostly fine to medium sand; little fines; nonplastic; weakly cemented). PID=32.2 ppm.
(20% Fines)

Poorly-indurated SILTSTONE; fine grained; massive; grayish brown (2.5Y 5/2); wet; moderately weathered; very soft; unfractured (Sandy Silt (ML); hard; mostly fines; some sand; trace gravel; nonplastic; 2" beds of yellowish oxide staining).
PID=6.6 ppm.
(1% Gravel; 49% Sand; 50% Fines)
**Friars Formation (continued):**

Poorly-indurated SANDSTONE; fine to coarse grained; massive; grayish brown (2.5Y 5/2); wet; moderately weathered; very soft; unfractured (Silty SAND (SM); very dense; mostly fine to medium sand; little fines; nonplastic; weakly to moderately cemented).

PID = 11.2 ppm (20% Fines)

Sampler refusal on strongly cemented sandstone concretion.

PID = 7.3 ppm

Total Depth = 70.4 feet (target depth reached).

Groundwater measured during drilling at a depth of 9.2 feet bgs.

Boring backfilled on 3/16/2019 shortly after drilling with

---

**TABLE:**

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<th>DEPTH (feet)</th>
<th>ELEVATION (feet)</th>
<th>SAMPLE NO.</th>
<th>SAMPLE TYPE</th>
<th>PENETRATION REGIONS (BOWS / 6 IN)</th>
<th>BLOWN'S*</th>
<th>MOISTURE (%)</th>
<th>DRY DENSITY (pcf)</th>
<th>OTHER TESTS</th>
<th>GRAPHIC LOG</th>
<th>DESCRIPTION AND CLASSIFICATION</th>
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<td>Poorly-indurated SANDSTONE: fine to coarse grained; massive; grayish brown (2.5Y 5/2); wet; moderately weathered; very soft; unfractured (Silty SAND (SM); very dense; mostly fine to medium sand; little fines; nonplastic; weakly to moderately cemented). PID = 11.2 ppm (20% Fines)</td>
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<td>27</td>
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<td>(Gray (2.5Y 5/1)). PID = 4.0 ppm (28% Fines)</td>
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<td>Sampler refusal on strongly cemented sandstone concretion. PID = 7.3 ppm</td>
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**NOTES:**

ETR ~ 89%, N60 = 1.48N100, = 0.99N100

---

**PROJECT:** SDSU Mission Valley

**SITE LOCATION:** 9449 Friars Road, San Diego, California

**START:** 3/16/2019

**FINISH:** 3/16/2019

**LOGGED BY:** A. Bieda

**CHECKED BY:** C. Vonk

---

**DEEP BORING COMPANY:** Tri-County Drilling

**DEEP BORING EQUIPMENT:** Deidrich D120

**BORING DIA. (in):** 8

**TOTAL DEPTH (ft):** 70.4

**GROUND ELEV (ft):** 58

**DEPTH/ELEV. GROUNDWATER (ft):** 9.2 / 48.8

---

**GROUND WATER:** Measured during drilling at a depth of 9.2 feet bgs.

---

**SAFETY:**

**NOTE:** This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of the actual conditions encountered.
Portland cement grout and capped with black-dyed rapid set concrete. This Boring Record is part of a geotechnical report which must be considered in its entirety.

\[^{\text{^a}}\] = inaccurate blowcounts

*Geologic Description; (Disturbed Soil Description).

All soils encountered may include up to 10% COBBLES (subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings.

---

<table>
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<tr>
<th>ELEVATION (feet)</th>
<th>SAMPLE TYPE</th>
<th>PENETRATION (BLOW/6 IN)</th>
<th>BLOW/FT &quot;N&quot;</th>
<th>MOISTURE (%)</th>
<th>DRY/DENSITY (loch)</th>
<th>OTHER TESTS</th>
<th>DEPTH (feet)</th>
<th>GRAPHIC LOG</th>
<th>DESCRIPTION AND CLASSIFICATION</th>
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<td>Portland cement grout and capped with black-dyed rapid set concrete.</td>
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<td>All soils encountered may include up to 10% COBBLES (subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings.</td>
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### PAVEMENT:
Approximately 4 inches of ASPHALT CONCRETE.

### UNDIFFERENTIATED SURFICIAL SOILS:
Clayey SAND (SC); light brownish gray (2.5Y 6/2); moist; mostly fine to medium sand; some fines; trace gravel; medium plasticity.

- 2% Gravel
- 56% Sand
- 42% Fines

PID = 0.4 ppm.

Medium dense; no gravel.

- 30% Fines

PID = 2 ppm.

Dense; trace gravel.

- 2% Gravel
- 60% Sand
- 38% Fines

PID = 0.7 ppm.

Medium dense; very dark grayish brown (2.5Y 3/2);
trace fine gravel.

PID = 45.9 ppm.

Poorly graded SAND (SP); medium dense; light olive brown (2.5Y 5/3); moist; mostly fine to medium sand; trace fines; nonplastic.

PID = 2.7 ppm.

(4% Fines)
UNDIFFERENTIATED SURFICIAL SOILS (continued):
Poorly graded SAND with silt (SP-SM); medium dense; light olive brown (2.5Y 5/3); wet; mostly fine to medium sand; few fines; nonplastic; trace mica.
PID=2.5 ppm. (93% Sand; 7% Fines)
Dense.
PID=18.6 ppm. (8% Fines)
PID=1.1 ppm. (93% Sand; 7% Fines)
Very dark grayish brown (10YR 3/2); trace fine gravel.
Trace mica.
PID=7.9 ppm. (7% Fines)
UNDIFFERENTIATED SURFICIAL SOILS (continued):

Poorly-graded SAND with silt (SP-SM); very dense; very dark grayish brown (10YR 3/2); wet; mostly fine to medium sand; few fines; trace fine gravel; nonplastic; micaceous.
PID=10.6 ppm.
(9% Fines)

Switch to Deidrich D-50 to continue drilling on 3/13/2019.

Poorly graded SAND (SP); dark greenish brown (10YR 4/2); wet; mostly fine to medium sand; trace fines; nonplastic; trace mica.

Coarse gravel in sampling shoe.
PID=8.1 ppm.
(96% Sand; 4% Fines)

Difficult drilling on GRAVEL and COBBLES; equipment failure- drive cap sheared.
(Estimated 30 to 40% COBBLES)

Poorly-graded SAND with silt (SP-SM); dark greenish brown (10YR 4/2); wet; mostly fine to medium sand; few fines; nonplastic; trace mica; coarse gravel in sampler shoe.
PID=6.5 ppm.
(6% Fines)

FRIARS FORMATION:

"Poorly-indurated SANDSTONE; fine to coarse grained; laminated; dark gray (5YR 4/1); wet; moderately weathered; very soft; unfractured (Silty SAND (SM); very dense; dark gray (5Y 4/1); mostly fine sand; little fines; nonplastic; weakly cemented).
PID=0.7 ppm.
(17% Fines)

Total Depth = 66.5 feet (target depth reached).

Groundwater measured during drilling at a depth of 25.7 feet bgs.

Boring backfilled on 3/13/2019 shortly after drilling with bentonite grout and capped with black-dyed rapid set concrete.

This Boring Record is part of a geotechnical report which must be considered in its entirety.
**Geologic Description; (Disturbed Soil Description).**

All soils encountered may include up to 10% COBBLES (subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings.

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### BORING RECORD

**SITE LOCATION**
9449 Friars Road, San Diego, California

**PROJECT NAME**
SDSU Mission Valley

**PROJECT NUMBER**
SD605

**BORING**
B-24

**DRILLING COMPANY**
Pacific Drilling

**DRILLING METHOD**
Hollow Stem Auger

**LOGGED BY**
A. Bieda

**CHECKED BY**
C. Vonk

**DRILLING EQUIPMENT**
Unimog Marl M5 & Deidrich D50

**SAMPLING METHOD**
Hammer: 140 lbs., Drop: 30 in. (Automatic)

**NOTES**
ETR ~ 81% (Marl M5) / ~ 79% (Diedrich D50)

### BORING LOG

<table>
<thead>
<tr>
<th>SAMPLING METHOD</th>
<th>OTHER TESTS</th>
<th>DEPTH (feet)</th>
<th>GRAPHIC LOG</th>
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<td>DESCRIPTION AND CLASSIFICATION</td>
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* = inaccurate blowcounts

*Geologic Description; (Disturbed Soil Description).

All soils encountered may include up to 10% COBBLES (subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings.
PAVEMENT: Approximately 4 inches of ASPHALT CONCRETE Over 1-inch AGGREGATE BASE.

UNDIFFERENTIATED SURFICIAL SOILS:
- Silty SAND (SM); moist; olive brown (2.5Y 4/3); mostly fine to medium sand; little fines; trace fine gravel; nonplastic. (2% Gravel; 77% Sand; 21% Fines)
- Sandy lean CLAY (CL); medium stiff to stiff; dark grayish brown (2.5Y 4/2); moist; mostly fines; some fine sand; low plasticity; trace mica.
- Poorly graded SAND with silt (SP-SM); medium dense; light olive brown (2.5Y 5/3); moist; mostly fine to medium sand; few fines; trace fine gravel; nonplastic. (8% Fines)
- Silty SAND (SM); medium dense; olive (5Y 4/4); wet; mostly fine to medium sand; little fines; trace gravel; nonplastic; trace mica. PID=2.5 ppm (2% Gravel; 78% Sand; 20% Fines)
- Poorly graded SAND (SP); medium dense; olive (5Y 4/4); wet; mostly fine to medium sand; trace fines; nonplastic; trace mica. PID=1.9 ppm (1% Fines)
- Hole caving at 20 ft; flowing/heaving sands; unable to sample.

Total Depth = 20 feet (Target depth reached).

Groundwater measured during drilling at a depth of 9.2 feet.

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<tr>
<th>BORING DIA. (in)</th>
<th>TOTAL DEPTH (ft)</th>
<th>GROUND ELEV (ft)</th>
<th>DEPTHELEV GROUNDWATER (ft)</th>
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PAVEMENT: Approximately 4 inches of ASPHALT CONCRETE.

UNDIFFERENTIATED SURFICIAL SOILS: Silty SAND (SM); dark brown (10YR 3/3); moist; mostly fine sand; some fines; nonplastic. PID=0.9 ppm

Medium dense; light grayish brown (10YR 6/2); little fines; trace mica. PID=4.0 ppm (14% Fines)

Poorly-graded SAND (SP); medium dense; light grayish brown (10YR 6/2); moist; mostly fine sand; trace fines; nonplastic. PID=0.3 ppm. (95% Sand; 5% Fines)

Poorly-graded SAND with silt (SP-SM); medium dense; light grayish brown (10YR 6/2); wet; mostly fine sand; few fines; nonplastic. PID=3.6 ppm (6% Fines)

Poorly-graded SAND (SP); medium dense; yellowish brown (10YR 5/4); wet; mostly fine to medium sand; trace gravel; trace mica; nonplastic. PID=0.3 ppm. (1% Gravel; 94% Sand; 5% Fines)

Gray (7.5YR 6/1); mostly fine to coarse sand; trace fines; trace gravel; trace mica; nonplastic; packed sampler. PID=0.5 ppm (5% Fines)
**UNDIFFERENTIATED SURFICIAL SOILS (continued):**

Poorly-graded SAND with silt (SP-SM); medium dense; dark gray (10YR 4/1); wet; mostly fine to medium sand; few fines; nonplastic. (92% Sand; 8% Fines)

**Poorly-graded SAND (SP); medium dense; gray (10YR 5/1); wet; mostly fine to medium sand; trace fines; nonplastic; trace mica. PID=42.9 ppm (3% Fines)**

Dark gray (10YR 4/1). PID=6.9 ppm (96% Sand; 4% Fines)

Slow and difficult drilling on GRAVEL and COBBLES from 38 to 48 feet. Well-graded GRAVEL with sand (GW); dense; wet; mostly fine to coarse, subrounded to rounded gravel; little fine to coarse sand; trace fines; nonplastic. (Estimated 10-20% COBBLES)

Equipment failure at 43 feet - broken gimble. Switch to mud rotary (tri-cone drill bit).

**FRIARS FORMATION:** *Poorly-indurated SANDSTONE; fine to coarse grained; massive; bluish gray (GLEY 2 5PB 6/1); ... (SEE NEXT PAGE)*

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**GROUP DELTA CONSULTANTS, INC.**

9245 Activity Road, Suite 103
San Diego, California 92126

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# FRIARS FORMATION (continued)

Moderately weathered; very soft; unfractured (Silty SAND (SM); very dense; wet; mostly fine sand; little fines; nonplastic; weakly cemented).

<table>
<thead>
<tr>
<th>PID = 0.9 ppm (16% Fines)</th>
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<tbody>
<tr>
<td>Groundwater not measured.</td>
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Boring backfilled on 3/15/2019 shortly after drilling with bentonite grout and capped with black-dyed rapid set concrete.

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All soils encountered may include up to 10% COBBLES (subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaulation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered. Cobble-rich layers encountered in this exploration were approximately 10 to 15 feet thick.
PAVEMENT: Approximately 4 inches of ASPHALT CONCRETE.

UNDIFFERENTIATED SURFICIAL SOILS: Clayey SAND (SC); grayish brown (2.5Y 5/2); moist; mostly fine sand; some fines; few fine gravel; medium plasticity.
PID=17.4 ppm
(8% Gravel; 53% Sands; 39% Fines)
Gravel in shoe.
PP=1.25 tsf; PID=41.6 ppm

Very dense; light yellowish brown (2.5Y 6/4); little fine to coarse gravel.
PID=12.5 ppm
(26% Fines)

Very slow and difficult drilling on GRAVEL and COBBLES from 7 to 12.5 feet.
(Estimated 30% COBBLES)

Clayey SAND with gravel (SC); light yellowish brown (2.5Y 6/4); moist; mostly fine to coarse sand; some fine to coarse gravel; little fines; medium plasticity.
PID=19.4 ppm
PID=26.2 ppm
(38% Gravel; 42% Sand; 20% Fines)

SILT with sand (ML); very dark greenish gray (GLEY 1 3/1); moist; mostly fines; little fine sand; nonplastic.

Poorly-graded SAND (SP); medium dense; grayish brown (10YR 5/2); moist; mostly fine to medium sand; trace fines; nonplastic; trace mica.
PID=13.7 ppm
(5% Fines)
**UNDIFFERENTIATED SURFICIAL SOILS (continued):**

<table>
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<tr>
<th>Sample No.</th>
<th>Type</th>
<th>Depth (ft)</th>
<th>Blows/n&quot;</th>
<th>Moisture (%)</th>
<th>N&lt;sub&gt;p&lt;/sub&gt;</th>
<th>Plasticity</th>
<th>PID (ppm)</th>
<th>Notes</th>
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<tr>
<td>R7-1</td>
<td>Sandy lean CLAY (CL); stiff; dark grayish brown (10YR 4/2); moist; mostly fines; some fine sand; medium plasticity. PP=1.75 tsf; PID=70.2 ppm (61% Fines)</td>
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<td>11</td>
<td>28.5</td>
<td>PI</td>
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<td>R7-2</td>
<td>Clayey SAND (SC); medium dense; dark gray (2.5Y 4/1); wet; mostly fine sand; some fines; low plasticity; micaceous. PID=26.5 ppm (53% Sand; 47% Fines)</td>
<td>35</td>
<td>20</td>
<td>28</td>
<td>26.3</td>
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<td>PA</td>
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<tr>
<td>S8</td>
<td>Poorly-graded SAND (SP); very dense; dark brown (10YR 3/3); wet; mostly fine to medium sand; trace fines; nonplastic. PID=7.5 ppm (95% Sand; 5% Fines)</td>
<td>35</td>
<td>53</td>
<td>50</td>
<td>17.3</td>
<td>109</td>
<td>PA</td>
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<td>R9-1</td>
<td>Silty SAND (SM); medium dense; dark gray (2.5Y 4/1); wet; mostly fine to medium SAND; little fines; low plasticity; micaceous. PID=162.9 ppm (77% Sand; 23% Fines)</td>
<td>30</td>
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<td>23.9</td>
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<td>PA</td>
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<td>R9-2</td>
<td>Poorly graded SAND (SP); very dense; dark brown (10YR 3/3); wet; mostly fine to medium sand; trace fines; nonplastic.</td>
<td>45</td>
<td>57</td>
<td>54</td>
<td>22.1</td>
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This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of the actual conditions encountered.
GROUP DELTA CONSULTANTS, INC.  
9245 Activity Road, Suite 103  
San Diego, California 92126

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CONDITIONS ENCOUNTERED.

FIGURE
B-27 c
Groundwater measured during drilling at a depth of 24.6 feet bgs.

Boring backfilled on 3/15/2019 shortly after drilling with Portland cement grout and capped with black-dyed rapid set concrete.

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^ = inaccurate blowcounts

*Geologic Description; (Disturbed Soil Description).

All soils encountered may include up to 10% COBBLES (subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered.

Cobble-rich layers encountered in this exploration were approximately 4 to 6 feet thick.

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<th>DEPTH (feet)</th>
<th>ELEVATION (feet)</th>
<th>SAMPLE TYPE</th>
<th>PENETRATION (feet/6 in)</th>
<th>BLOWN'N</th>
<th>MOISTURE (%)</th>
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PAVEMENT: Approximately 4 inches of ASPHALT CONCRETE.

UNDIFFERENTIATED SURFICIAL SOILS:
- Clayey SAND (SC): medium dense; grayish brown (10YR 5/2); moist; mostly fine to medium sand; some fines; trace gravel; medium plasticity; micaceous. PID=1.4 ppm (3% Gravel; 59% Sand; 38% Fines)
- Dark gray (2.5Y 4/1). PID=6.8 ppm

Grading from Sandy lean CLAY (CL) to Clayey SAND (SC):
- CL: medium stiff; dark gray (2.5Y 4/1); moist; mostly fines; some fine sand; medium plasticity; PP=0.5 tsf; PID=1.8 ppm.
- SC: medium dense; dark gray (2.5Y 4/1); moist; mostly fine sand; some fines; medium plasticity; trace mica.

Clayey SAND (SC): medium dense; grayish brown (10YR 5/2); moist; mostly fine to medium sand; some fines; medium plasticity. PP=1.0 tsf; PID=5.1 ppm (38% Fines)

Sandy lean CLAY (CL): soft; dark grayish brown (10YR 4/2); moist; mostly fines; some fine sand; medium plasticity; trace mica. PP=0.5 tsf; PID=5.8 ppm (58% Fines)

Poorly-graded SAND (SP): medium dense; olive brown (2.5Y 4/3); wet; mostly fine to medium sand; trace fines; nonplastic; trace mica. PID=7.5 ppm (5% Fines)

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UNDIFFERENTIATED SURFICIAL SOILS (continued):

Silty SAND (SM); medium dense; dark grayish brown (2.5Y 4/2); wet; mostly fine to medium sand; little fines; nonplastic.  
PID=0.8 ppm  
(76% Sand; 24% Fines)

Poorly-graded SAND with silt (SP-SM); dense; very dark grayish brown (10YR 3/2); wet; mostly fine to medium sand; few fines; nonplastic; micaceous.  
PID=5.1 ppm  
(11% Fines)

Poorly-graded SAND (SP); dense; grayish brown (10YR 5/2); wet; mostly fine to medium sand; trace fines; nonplastic; trace mica.  
PID=1.8 ppm  
(95% Sand; 5% Fines)

Silty SAND with gravel (SM); dense; very dark grayish brown (10YR 3/2); wet; mostly fine to medium sand; little fine to coarse gravel; few to little fines; low plasticity.  
(13% Fines)

Slow and difficult drilling through GRAVEL and COBBLES from 42 to 52 feet.  
(Estimated 20-30% COBBLES)
### UNDIFFERENTIATED SURFICIAL SOILS (continued):

Slow and difficult drilling on GRAVEL and COBBLES. 
Estimated 20-30% COBBLES

- **Friars Formation:** Poorly-indurated SANDSTONE; fine to coarse grained; massive with minor bedding; moderately weathered; gray (10Y 5/1); very soft; unfractured (Silty SAND (SM); very dense; wet; mostly fine sand; little fines; nonplastic; weakly cemented).
  - PID=4.1 ppm
  - (25% Fines)

- Fine gravel in shoe of sampler.
  - PID=8.0 ppm

**Groundwater measured during drilling at a depth of 17.5 feet bgs.**

Boring backfilled on 3/16/2019 shortly after drilling with Portland cement grout and capped with black-dyed rapid set concrete.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

*Geologic Description; (Disturbed Soil Description).

All soils encountered may include up to 10% COBBLES (subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered. Cobble-rich layers encountered in this exploration were approximately 10 feet thick.

---

**Figures:**
- B-28 a
- B-28 b
- B-28 c

---

**Notes:**
- ETR ~ 89%, $N_{10} = 1.48N_{spt} = 0.99N_{mc}$
- This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of the actual conditions encountered.
PAVEMENT: Approximately 4 inches of ASPHALT CONCRETE over 1-inch AGGREGATE BASE.

UNDIFFERENTIATED SURFICIAL SOILS: Clayey SAND (SC); grayish brown (2.5Y 5/2); moist; mostly fine to medium sand; some fines; trace fine gravel; low plasticity. PID=16.9 ppm (2% Gravel; 64% Sand; 34% Fines)

Total Depth = 4.8 feet (Target depth reached).

Groundwater not encountered.

Boring converted to a percolation test hole on 03/12/2019 shortly after drilling, and backfilled on 03/13/2019 and patched with black-dyed rapid set concrete after completion of percolation testing.

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GROUP DELTA CONSULTANTS, INC.
9245 Activity Road, Suite 103
San Diego, California 92126

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**PAVEMENT:** Approximately 4 inches of ASPHALT CONCRETE.

**UNDIFFERENTIATED SURFICIAL SOILS:** Clayey SAND (SC); loose; dark brown (10YR 3/3); moist; mostly fine sand; some fines; low plasticity. PID= 10.5 ppm (62% Sand; 38% Fines)

Silty SAND (SM); medium dense; dark yellowish brown (10YR 4/2); moist; mostly fine to medium sand; little fines; nonplastic. PID=12.0 ppm (21% Fines)

Some fines; trace mica. PID=10.5 ppm (57% Sand; 43% Fines)

Dark grayish brown (10YR 4/2); wet; little fines; micaceous. PID=10.3 ppm (17% Fines)

Poorly-graded SAND with silt (SP-SM); medium dense; dark grayish brown (10YR 4/2); wet; mostly fine to medium sand; few fines; nonplastic; micaceous; thinly bedded. PID=13.5 ppm (6% Fines)
### UNDIFFERENTIATED SURFICIAL SOILS (continued):

- **Silty SAND (SM); medium dense; dark grayish brown (2.5Y 4/2); wet; mostly fine sand; little fines; nonplastic; micaceous. PID = 60.2 ppm**

- **Poorly-graded SAND with silt (SP-SM); medium dense; grayish brown (2.5Y 5/2); wet; mostly fine to medium sand; few fines; nonplastic. PID = 181.4 ppm**

- **Very dense; few gravel; micaceous. PID = 151.3 ppm. (13% Gravel; 78% Sand; 9% Fines)**

- **Increasing gravel content; light rig chatter from 41 to 44 feet.**

- **Slow and difficult drilling on GRAVEL and COBBLES from 44 to 54 feet. (Estimated 30% COBBLES)**
**FRIARS FORMATION:** *Poorly-indurated SANDSTONE; fine to coarse grained; massive; moderately weathered; very soft; bluish gray (GLEY 2 5PB 6/1); unfractured (Silty SAND (SM); very dense; mostly fine sand; little fines; nonplastic; weakly cemented)*

$\text{PID} = 37.6 \text{ ppm} (21\% \text{ Fines})$

- **Total Depth:** 55.8 feet (target depth reached).
- **Groundwater measured during drilling at a depth of 12.1 feet bgs.**
- **Boring backfilled on 3/16/2019 shortly after drilling with Portland cement grout and capped with black-dyed rapid set concrete.**
- **This Boring Record is part of a geotechnical report which must be considered in its entirety.**
- **All soils encountered may include up to 10% COBBLES (subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaulation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered.**
- **Cobble-rich layers encountered in this exploration were approximately 10 to 15 feet thick.**
PAVEMENT:
Approximately 4 inches of ASPHALT CONCRETE.

UNDIFFERENTIATED SURFICIAL SOILS:

Silty SAND (SM); medium dense; dark brown (10YR 3/3); moist; mostly fine sand; some fines; trace fine gravel; nonplastic; trace mica.
PID=1.7 ppm

Clayey SAND (SC); dark brown (10YR 3/3); moist; mostly fine sand; some fines; trace gravel; low plasticity; micaceous.
(2% Gravel; 60% Sand; 38% Fines)

Silty SAND (SM); medium dense; grayish brown (10YR 5/2); moist; mostly fine sand; little fines; nonplastic.
PID=1.3 ppm
(16% Fines)

Clayey SAND (SC); medium dense; dark grayish brown (10YR 4/2); moist; mostly fine sand; some fines; trace gravel; low plasticity; micaceous; thinly bedded.
PID=2.5 ppm
(45% Fines)

Trace mica.
PP=0.5 tsf; PID=1.2 ppm
(1% Gravel; 52% Sand; 47% Fines)

Silty SAND (SM); medium dense; dark grayish brown (10YR 4/2); moist; mostly fine sand; little fines; nonplastic.
(22% Fines)
### UNDIFFERENTIATED SURFICIAL SOILS (continued):

- **Silty SAND (SM)**; light grayish brown (10YR 6/2); wet; mostly fine to medium sand; few to little fines; nonplastic; trace mica; sampler packed. PID=1.5 ppm (87% Sand; 13% Fines)

- **Polymer/water added to hollow stem to control heaving sands.**

- **Sandy lean CLAY (CL)**; soft to medium stiff; dark yellowish brown (10YR 4/4); wet; mostly fine; some fine sand; medium plasticity; micaceous. PP=0.25 tsf; TV=0.4 tsf; PID=8.2 ppm (56% Fines)

- **Clayey SAND (SC)**; very loose; dark yellowish brown (10YR 4/4); wet; mostly fine sand; some fines; medium plasticity.

- **Poorly-graded SAND with silt (SP-SM)**; medium dense; gray (10YR 5/1); wet; mostly fine to medium sand; few fines; trace fine gravel; nonplastic. (2% Gravel; 92% Sand; 6% Fines)

- **Slow and difficult drilling on GRAVEL and COBBLES from 44 to 61 feet.** Poorly-graded GRAVEL with sand (GP); dark gray (7.5YR 4/1); wet; mostly fine to coarse, rounded to subrounded gravel; little sand; trace to few fines; nonplastic; micaceous. (Estimated 20% COBBLES) PID=22.9 ppm
**UNDIFFERENTIATED SURFICIAL SOILS (continued):**

Poorly-graded GRAVEL with sand (GP); very dense; dark gray (7.5YR 4/1); wet; mostly fine to coarse, rounded to subrounded gravel; little sand; trace to few fines; nonplastic; micaceous.

Dark grayish brown (10YR 4/2); mostly fine to coarse gravel and freshly broken rock fragments; some sand; trace to few fines; nonplastic.

**PID=2.3 ppm**

Increasing COBBLES from 55 to 61 feet (Estimated 30% COBBLES)

**FRIARS FORMATION:**

*Poorly-indurated SANDSTONE; fine to coarse grained; massive; bluish gray (GLEY 2 5PB 6/1); moderately weathered; very soft; unfractured (Silty SAND (SM); very dense; wet; mostly fine sand; little fines; nonplastic; weakly cemented).

Dark grayish brown (10YR 4/2); mostly fine to coarse gravel and freshly broken rock fragments; some sand; trace to few fines; nonplastic. PID=2.3 ppm

Increasing COBBLES from 55 to 61 feet (Estimated 30% COBBLES)

(80% Sand; 20% Fines)

Total Depth = 65.9 feet (target depth reached).

Groundwater measured during drilling at a depth of 21.3 feet bgs.

Polymer/water mixture added to hollow stem for heaving sands.

Boring backfilled on 3/16/2019 shortly after drilling with Portland cement grout and capped with black-dyed rapid set concrete.

This Boring Record is part of a geotechnical report which must be considered in its entirety.

^ = inaccurate blowcounts

*Geologic Description; (Disturbed Soil Description).
All soils encountered may include up to 10% COBBLES (subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered. Cobble-rich layers encountered in this exploration were approximately 15 to 20 feet thick.

---

**BORING RECORD**

**PROJECT NAME**
SDSU Mission Valley

**PROJECT NUMBER**
SD605

**BORING**
B-31

**SITE LOCATION**
9449 Friars Road, San Diego, California

**START**
3/16/2019

**FINISH**
3/16/2019

**DRILLING COMPANY**
Tri-County Drilling

**LOGGED BY**
S. Narveson

**CHECKED BY**
C. Vonk

**DRILLING METHOD**
Hollow Stem Auger

**DRILLING EQUIPMENT**
CME 75

**BORING DIA.** (in) 8

**TOTAL DEPTH** (ft) 65.9

**GROUND ELEV** (ft) 66

**DEPTHELEV. GROUNDWATER** (ft) 21.3 / 44.7

**SAMPLING METHOD**
Hammer: 140 lbs., Drop: 30 in. (Automatic)

**ELEVATION** (feet)

**DEPTH** (feet)

**MOISTURE (%)**
N

**GRAPHIC LOG**

**DESCRIPTION AND CLASSIFICATION**

All soils encountered may include up to 10% COBBLES (subrounded, 3- to 12-inch diameter), estimated based on drill rig chatter, excessive auger inclination, and visual evaluation of drill cuttings. Percent COBBLES greater than 10% are noted in the boring record description and classification, where encountered. Cobble-rich layers encountered in this exploration were approximately 15 to 20 feet thick.

---

**GROUP DELTA CONSULTANTS, INC.**
9245 Activity Road, Suite 103
San Diego, California 92126

**FIGURE**
B-31 d
PAVEMENT:
Approximately 5 inches of ASPHALT CONCRETE.

UNDIFFERENTIATED SURFICIAL SOILS:
Clayey SAND with gravel (SC); grayish brown (2.5Y 5/2); moist; mostly fine to medium sand; some fines; trace fine gravel; low plasticity.
PID=8.0 ppm
Rig chatter from 3 ft to 4 ft; Gravel layer.
(2% Gravel; 59% Sand; 39% Fines)

Total Depth = 5 feet (Target depth reached).
Groundwater not encountered.
Boring converted to a percolation test hole on 03/12/2019 shortly after drilling, and backfilled on 03/13/2019 and patched with black-dyed rapid set concrete after completion of percolation testing.

This Boring Record is part of a geotechnical report which must be considered in its entirety.
Project:  Group Delta Consultants / SDSU Mission Valley
Location:  San Diego, CA

Total depth: 17.48 ft, Date: 4/8/2019

SCPT-7

Figure B-35
## CPT Shear Wave Measurements

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\[
\text{S-Wave Velocity from Surface} = \frac{\text{Travel Distance}}{\text{S-Wave Arrival}}
\]

\[
\text{Interval S-Wave Velocity} = \frac{\text{(Travel Dist2-Travel Dist1)}}{\text{(Time2-Time1)}}
\]
APPENDIX C

LABORATORY TESTING

Laboratory testing was conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions and in the same locality. No warranty, express or implied, is made as to the correctness or serviceability of the test results, or the conclusions derived from these tests. Where a specific laboratory test method has been referenced, such as ASTM or Caltrans, the reference only applies to the specified laboratory test method, which has been used only as a guidance document for the general performance of the test and not as a “Test Standard”. A brief description of the tests follows.

**Classification:** Soils were visually classified according to the Unified Soil Classification System as established by the American Society of Civil Engineers per ASTM D2487. The soil classifications are shown on the boring logs in Appendix C.

**Particle Size Analysis:** Particle size analyses were performed in general accordance with ASTM D422, and were used to supplement visual classifications. The test results are summarized on the Boring Records in Appendix B and are presented in detail in Figures C-1.1 through C-1.80.

**Atterberg Limits:** ASTM D4318 was used to determine the liquid and plastic limits, and plasticity index of selected soil samples. The test results are presented with the associated gradation analyses in Figures C-1.1 through C-1.80 and are also summarized in Figure C-1.81 and C-1.82.

**Expansion Index:** The expansion potential of selected soil samples was estimated in general accordance with ASTM D4829. The test results are summarized in Figure C-2, along with a summary of previous expansion index tests we conducted at the site. Figure C-2 also presents common criteria for evaluating the expansion potential based on the expansion index.

**pH and Resistivity:** To assess the potential for reactivity with buried metals, selected soil samples were tested for pH and minimum resistivity using Caltrans test method 643. The corrosivity test results are summarized in Figure C-3, along with previous corrosion tests we conducted on site.

**Sulfate Content:** To assess the potential for reactivity with concrete, selected soil samples were tested for water soluble sulfate. The sulfate was extracted from the soil under vacuum using a 10:1 (water to dry soil) dilution ratio. The extracted solution was tested for water soluble sulfate in general accordance with ASTM D516. The test results are also presented in Figure C-3, along with common criteria for evaluating soluble sulfate content.

**Chloride Content:** Soil samples were also tested for water soluble chloride. The chloride was extracted from the soil under vacuum using a 10:1 (water to dry soil) dilution ratio. The extracted solution was then tested for water soluble chloride using a calibrated ion specific electronic probe in general accordance with ASTM D512. The test results are also shown in Figure C-3.

**Direct Shear:** The shear strength of selected partially intact samples of the soils from the site were assessed using direct shear testing performed in general accordance with ASTM D3080. The test results are shown in Figures C-4.1 through C-4.4.

**Consolidation:** The one-dimensional consolidation properties of a selected sample was evaluated in general accordance with ASTM D2435. The sample was inundated with water under a nominal seating load, allowed to swell, and then subjected to controlled stress increments while restrained laterally and drained axially. The test results are presented in Figure C-5.
COARSE    FINE    COARSE    MEDIUM    FINE    SILT AND
GRANULAR  SAND    CLAY

SAMPLE
BORING NUMBER: S-1
SAMPLE DEPTH: 2' - 5'

UNIFIED SOIL CLASSIFICATION: SC
DESCRIPTION: CLAYEY SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --
Sample Unified Soil Classification: SC

Atterberg Limits:
- Liquid Limit: --
- Plastic Limit: --
- Plasticity Index: --

Sample Details:
- Boring Number: S-1
- Sample Depth: 25' - 26.5'
- Description: Clayey Sand
SOIL CLASSIFICATION

UNIFIED SOIL CLASSIFICATION: SW-SM

DESCRIPTION: WELL GRADED SAND WITH SILT AND GRAVEL

COARSE | FINE | COARSE | MEDIUM | FINE | SILT AND CLAY
---|---|---|---|---|---
GRAVEL | SAND | |

BORING NUMBER: S-1
SAMPLE DEPTH: 40' - 40.8'

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --
**COARSE**  |  **FINE**  |  **COARSE**  |  **MEDIUM**  |  **FINE**  |  **SILT AND**  |  **CLAY**  
---|---|---|---|---|---|---
GRAVEL | SAND | | | | | 

**SAMPLE**
- BORING NUMBER: S-2
- SAMPLE DEPTH: 0.5' - 5'

**UNIFIED SOIL CLASSIFICATION:** SC

**DESCRIPTION:** CLAYEY SAND

**ATTERBERG LIMITS**
- LIQUID LIMIT: --
- PLASTIC LIMIT: --
- PLASTICITY INDEX: --

**SOIL CLASSIFICATION**

Project No. SD605

**FIGURE C-1.4**
COARSE | FINE | COARSE | MEDIUM | FINE | SILT AND
GRavel | Sand | Clay

SAMPLE
BORING NUMBER: S-3
SAMPLE DEPTH: 0.5' - 5'

UNIFIED SOIL CLASSIFICATION: SC
DESCRIPTION: CLAYEY SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

SOIL CLASSIFICATION
Project No. SD605
FIGURE C-1.5
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SM

BORING NUMBER: S-3
SAMPLE DEPTH: 30' - 31.5'
DESCRIPTION: SILTY SAND WITH GRAVEL

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

SOIL CLASSIFICATION

GROUP DELTA

Project No. SD605
FIGURE C-1.6
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SC

ATTERBERG LIMITS
- LIQUID LIMIT: --
- PLASTIC LIMIT: --
- PLASTICITY INDEX: --

DESCRIPTION: CLAYEY SAND

U.S. Standard Sieve Sizes

Percent Finer by Weight

Grain Size in Millimeters

% Finer
0 10 20 30 40 50 60 70 80 90 100

Gravel
Sand
Clay

COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE
BORING NUMBER: S-4
SAMPLE DEPTH: 0.5' - 4'

GROUP DELTA

SOIL CLASSIFICATION
Project No. SD605
FIGURE C-1.7
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**SAMPLE**
- **SAMPLE NUMBER:** S-4
- **SAMPLE DEPTH:** 15' - 16.5'

**UNIFIED SOIL CLASSIFICATION:** CL

**DESCRIPTION:** SANDY LEAN CLAY

**ATTERBERG LIMITS**
- **LIQUID LIMIT:** --
- **PLASTIC LIMIT:** --
- **PLASTICITY INDEX:** --

**SOIL CLASSIFICATION**

- **Project No. SD605**
- **FIGURE C-1.8**
COARSE  FINE  COARSE  MEDIUM  FINE  SILT AND  GRAVEL  SAND  CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SM

BORING NUMBER: S-4
SAMPLE DEPTH: 35' - 36.5'

DESCRIPTION: SILTY SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SC

BORING NUMBER: S-5
SAMPLE DEPTH: 0.5' - 5'

DESCRIPTION: CLAYEY SAND WITH GRAVEL

ATTERBERG LIMITS
LIQUID LIMIT: 38
PLASTIC LIMIT: 15
PLASTICITY INDEX: 23

SOIL CLASSIFICATION

U.S. Standard Sieve Sizes

Percent Finer by Weight

Grain Size in Millimeters

COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAND

CLAY

UNIFIED SOIL CLASSIFICATION: SC

DESCRIPTION: CLAYEY SAND WITH GRAVEL

GROUPE DELTA

Project No. SD605
FIGURE C-1.10
**UNIFIED SOIL CLASSIFICATION:** SW

**DESCRIPTION:** WELL GRADED SAND WITH SILT

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**SAMPLE**
- **BORING NUMBER:** S-5
- **SAMPLE DEPTH:** 40' - 41.5'

**ATTERBERG LIMITS**
- **LIQUID LIMIT:** --
- **PLASTIC LIMIT:** --
- **PLASTICITY INDEX:** --

**GROUP DELTA**

**SOIL CLASSIFICATION**

Project No. SD605

**FIGURE C-1.11**
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: CL

BORING NUMBER: S-6
SAMPLE DEPTH: 0.5' - 5'
DESCRIPTION: LEAN CLAY WITH SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

SOIL CLASSIFICATION

U.S. Standard Sieve Sizes

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<td>#50</td>
<td>98</td>
</tr>
<tr>
<td>#100</td>
<td>98</td>
</tr>
<tr>
<td>#200</td>
<td>92</td>
</tr>
</tbody>
</table>

28% Sand ↔ 72% Fines

0% Gravel → 72
SOIL CLASSIFICATION

Sample:
- Boring Number: S-6
- Sample Depth: 15' - 16.5'

Unified Soil Classification:
- SM

Description:
- Silty Sand

Atterberg Limits:
- Liquid Limit: --
- Plastic Limit: --
- Plasticity Index: --
**SAMPLE**
- BORING NUMBER: S-7
- SAMPLE DEPTH: 0.5' - 5'

**UNIFIED SOIL CLASSIFICATION:** CL

**DESCRIPTION:** SANDY LEAN CLAY

**ATTERBERG LIMITS**
- LIQUID LIMIT: 39
- PLASTIC LIMIT: 14
- PLASTICITY INDEX: 25

**SOIL CLASSIFICATION**

**COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY**

**SAMPLE UNIFIED SOIL CLASSIFICATION:** CL

**BORING NUMBER:** S-7

**LIQUID LIMIT:** 39

**PLASTICITY INDEX:** 25

**DESCRIPTION:** SANDY LEAN CLAY

**U.S. Standard Sieve Sizes**

Grain Size in Millimeters

Percent Finer by Weight

- 1% Gravel
- 34% Sand
- 65% Fines

**GROUP DELTA**

Project No. SD605

FIGURE C-1.14
COARSE  FINE  COARSE  MEDIUM  FINE  SILT AND
GRAVEL  SAND  CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SM
BORING NUMBER: S-7
SAMPLE DEPTH: 25' - 26.5'
DESCRIPTION: SILTY SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

SOIL CLASSIFICATION

PROJECT NO. SD605
FIGURE C-1.15
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SC

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

BORING NUMBER: S-8
SAMPLE DEPTH: 0.5' - 2.5'

DESCRIPTION: CLAYEY SAND WITH GRAVEL

SOIL CLASSIFICATION

Project No. SD605
FIGURE C-1.16
**UNIFIED SOIL CLASSIFICATION:** SP

**DESCRIPTION:** POORLY GRADED SAND

**BORING NUMBER:** S-8

**SAMPLE DEPTH:** 20' - 21.5'

**ATTERBERG LIMITS**
- **LIQUID LIMIT:** --
- **PLASTIC LIMIT:** --
- **PLASTICITY INDEX:** --
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SP
BORING NUMBER: S-8
SAMPLE DEPTH: 30' - 31.5'
DESCRIPTION: POORLY GRADED SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

U.S. Standard Sieve Sizes

<table>
<thead>
<tr>
<th>Grain Size in Millimeters</th>
<th>Percent Finer by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot;</td>
<td>100</td>
</tr>
<tr>
<td>1 1/4&quot;</td>
<td>95</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>92</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>91</td>
</tr>
<tr>
<td>#4</td>
<td>89</td>
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<tr>
<td>#8</td>
<td>78</td>
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<tr>
<td>#16</td>
<td>53</td>
</tr>
<tr>
<td>#30</td>
<td>25</td>
</tr>
<tr>
<td>#50</td>
<td>10</td>
</tr>
<tr>
<td>#100</td>
<td>4% Fines</td>
</tr>
<tr>
<td>#200</td>
<td>9% Gravel</td>
</tr>
</tbody>
</table>

87% Sand ↔

GROUP DELTA
SOIL CLASSIFICATION
Project No. SD605
FIGURE C-1.18
SAMPLE
BORING NUMBER: S-9
SAMPLE DEPTH: 0.5' - 5'

UNIFIED SOIL CLASSIFICATION: SC
DESCRIPTION: CLAYEY SAND WITH GRAVEL

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SM

BORING NUMBER: S-9
SAMPLE DEPTH: 25' - 26.5'

DESCRIPTION: SILTY SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SC
ATTERBERG LIMITS
LIQUID LIMIT: 39
PLASTIC LIMIT: 15
PLASTICITY INDEX: 24

BORING NUMBER: S-10
SAMPLE DEPTH: 0.5' - 5'

DESCRIPTION: CLAYEY SAND WITH GRAVEL

UNIFIED SOIL CLASSIFICATION: SC

FIGURE C-1.21
COARSE  FINE  COARSE  MEDIUM  FINE  SILT AND
GRAVEL  SAND  CLAY

SAMPLE  UNIFIED SOIL CLASSIFICATION: SP
BORING NUMBER: S-10
SAMPLE DEPTH: 20' - 21.5'
DESCRIPTION: POORLY GRADED SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --
SAMPLE
BORING NUMBER: S-10
SAMPLE DEPTH: 70' - 71.3'

UNIFIED SOIL CLASSIFICATION: SM
DESCRIPTION: SILTY SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
Pластичность индекс: --

SOIL CLASSIFICATION

Project No. SD605
FIGURE C-1.23
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: CL

ATTERBERG LIMITS
LIQUID LIMIT: 38
PLASTIC LIMIT: 13
PLASTICITY INDEX: 25

DESCRIPTION: SANDY LEAN CLAY

PROJECT NO. SD605
FIGURE C-1.24

U.S. Standard Sieve Sizes

Percent Finer by Weight

Grain Size in Millimeters

COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE
BORING NUMBER: S-11
SAMPLE DEPTH: 0.5' - 5'
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SP-SM

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

BORING NUMBER: S-11
SAMPLE DEPTH: 15' - 16.5'

DESCRIPTION: POORLY GRADED SAND WITH SILT AND GRAVEL

U.S. Standard Sieve Sizes

Percent Finer by Weight

Grain Size in Millimeters

<table>
<thead>
<tr>
<th>Grain Size in Millimeters</th>
<th>Percent Finer by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>3''</td>
<td>100</td>
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<tr>
<td>1 1/2''</td>
<td>91</td>
</tr>
<tr>
<td>3/4''</td>
<td>54</td>
</tr>
<tr>
<td>3/8''</td>
<td>45</td>
</tr>
<tr>
<td>#4</td>
<td>29</td>
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<td>#100</td>
<td>45</td>
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<td>#200</td>
<td>34</td>
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<tr>
<td>0.001</td>
<td>9% Fines</td>
</tr>
<tr>
<td>0.01</td>
<td>9% Fines</td>
</tr>
<tr>
<td>0.10</td>
<td>57% Sand</td>
</tr>
<tr>
<td>0.20</td>
<td>34% Gravel</td>
</tr>
<tr>
<td>0.30</td>
<td>9% Fines</td>
</tr>
</tbody>
</table>

SILT AND CLAY

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td></td>
<td>DESCRIPTION: POORLY GRADED SAND WITH SILT AND GRAVEL</td>
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</tbody>
</table>

Project No. SD605
FIGURE C-1.25

GROUP DELTA
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SC
ATHERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

BORING NUMBER: S-12
SAMPLE DEPTH: 0.5' - 5'
DESCRIPTION: CLAYEY SAND

项目编号 SD605

FIGURE C-1.26
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SC
BORING NUMBER: S-12
SAMPLE DEPTH: 15' - 16.5'
DESCRIPTION: CLAYEY SAND WITH GRAVEL

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

SOIL CLASSIFICATION

U.S. Standard Sieve Sizes

Percent Finer by Weight

Grain Size in Millimeters

U.S. Standard Sieve Sizes

COARSE | FINE | COARSE | MEDIUM | FINE | SILT AND CLAY
--- | --- | --- | --- | --- | ---
GRAVEL | SAND | }

Project No. SD605
FIGURE C-1.27
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SC

ATTERBERG LIMITS
LIQUID LIMIT: 0
PLASTIC LIMIT: 0
PLASTICITY INDEX: 0

BORING NUMBER: S-13
SAMPLE DEPTH: 2.5'-4'

DESCRIPTION: CLAYEY SAND WITH GRAVEL

SOIL CLASSIFICATION

GROUP DELTA
Project No. SD605
FIGURE C-1.28
COARSE  FINE  COARSE  MEDIUM  FINE  SILT AND
GRAVEL  SAND  CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SP-SM
BORING NUMBER: S-13
SAMPLE DEPTH: 35' - 36.5'
DESCRIPTION: POORLY GRADED SAND WITH SILT

ATERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

SOIL CLASSIFICATION

U.S. Standard Sieve Sizes

Grain Size in Millimeters

Percent Finer by Weight

0 10 20 30 40 50 60 70 80 90 100

0.001 0.01 0.1 1 10 100

Gravel
Sand
Clay

3" 1½" 3/4" 3/8" #4 #2 #16 #30 #50 #100 #200

3% Fines → ← 0% Gravel

94% Sand

6% Fines

GROUP DELTA

FIGURE C-1.29
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SC

ATTERBERG LIMITS
    LIQUID LIMIT: --
    PLASTIC LIMIT: --
    PLASTICITY INDEX: --

SOIL CLASSIFICATION

U.S. Standard Sieve Sizes

<table>
<thead>
<tr>
<th>COARSE</th>
<th>FINE</th>
<th>COARSE</th>
<th>MEDIUM</th>
<th>FINE</th>
<th>SILT AND</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRAVEL</td>
<td>SAND</td>
<td></td>
<td></td>
<td></td>
<td>CLAY</td>
</tr>
</tbody>
</table>

SAMPLE
BORING NUMBER: B-14
SAMPLE DEPTH: 2.5’ - 4’

DESCRIPTION: CLAYEY SAND
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SM

BORING NUMBER: B-14
SAMPLE DEPTH: 25' - 26.5'
DESCRIPTION: SILTY SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

FIGURE C-1.31
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SC
ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

BORING NUMBER: B-15
SAMPLE DEPTH: 0.5' - 5'

DESCRIPTION: CLAYEY SAND WITH GRAVEL

SOIL CLASSIFICATION

U.S. Standard Sieve Sizes

Percent Finer by Weight

Grain Size in Millimeters

3" 1½" 3/4" 3/8" #4 #8 #16 #30 #50 #100 #200

30% Fines

0 10 20 30 40 50 60 70 80 90 100

26% Gravel

44% Sand

0.001 0.01 0.1 1 10 100

30% Fines
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SM

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

BORING NUMBER: B-15
SAMPLE DEPTH: 35.5’ - 36’

DESCRIPTION: SILTY SAND

SOIL CLASSIFICATION
**SOIL CLASSIFICATION**

Project No. SD605

**FIGURE C-1.34**

**SAMPLE**
- **BORING NUMBER:** B-16
- **SAMPLE DEPTH:** 2.5’ - 5’

**UNIFIED SOIL CLASSIFICATION:** SC

**DESCRIPTION:** CLAYEY SAND

**ATTERBERG LIMITS**
- **LIQUID LIMIT:** --
- **PLASTIC LIMIT:** --
- **PLASTICITY INDEX:** --

---

**U.S. Standard Sieve Sizes**

- **Percent Finer by Weight**
  - 4% Gravel
  - 57% Sand
  - 39% Fines

- **Grain Size in Millimeters**
  - 3'' 1½'' 3/4'' 3/8'' #4 #8 #16 #30 #50 #100 #200

**TABLE**

<table>
<thead>
<tr>
<th>COARSE</th>
<th>FINE</th>
<th>COARSE</th>
<th>MEDIUM</th>
<th>FINE</th>
<th>SILT AND</th>
<th>CLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRAVEL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SAND</td>
<td></td>
</tr>
</tbody>
</table>
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SM

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

BORING NUMBER: B-16
SAMPLE DEPTH: 30' - 31.5'
DESCRIPTION: SILTY SAND

U.S. Standard Sieve Sizes

Percent Finer by Weight

Grain Size in Millimeters

COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLING

GROUP DELTA

SOIL CLASSIFICATION

Project No. SD605
FIGURE C-1.35
SAMPLE
BORING NUMBER: B-17
SAMPLE DEPTH: 0.5' - 5'

UNIFIED SOIL CLASSIFICATION: SC
DESCRIPTION: CLAYEY SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

SOIL CLASSIFICATION
Project No. SD605
FIGURE C-1.36
COARSE  FINE  COARSE  MEDIUM  FINE  SILT AND
GRANULAR  SILT  CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SM
BORING NUMBER: B-17
SAMPLE DEPTH: 50' - 51'
DESCRIPTION: SILTY SAND

UNIFIED SOIL CLASSIFICATION: SM
ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --
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<thead>
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<th>Sample</th>
<th>Unified Soil Classification</th>
<th>Atterberg Limits</th>
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<td>Liquid Limit: 38</td>
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<td></td>
<td>Plastic Limit: 15</td>
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<tr>
<td></td>
<td></td>
<td>Plasticity Index: 23</td>
</tr>
</tbody>
</table>

**Sample Details:**
- **Boring Number:** B-18
- **Sample Depth:** 0.5' - 5'
- **Description:** Clayey Sand

**Soil Classification Diagram:**
- Coarse: Gravel
- Fine: Sand
- Uncoarsened: Fines
- Sand: 44%
- Gravel: 14%
- Fines: 42%

**U.S. Standard Sieve Sizes:**
- Percent finer by weight
- Grain size in millimeters
- Sieve sizes range from #30 to #100.
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION:

SC

ATTERBERG LIMITS

LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

SAMPLE NUMBER: B-19
SAMPLE DEPTH: 0.5' - 4.4'
DESCRIPTION: CLAYEY SAND

SOIL CLASSIFICATION

PROJECT NO. SD605
FIGURE C-1.39
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SC

BORING NUMBER: B-20
SAMPLE DEPTH: 0.5’ - 2.5’

DESCRIPTION: CLAYEY SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SP
ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

BORING NUMBER: B-20
SAMPLE DEPTH: 35' - 36.5'
DESCRIPTION: POORLY GRADED SAND WITH SILT
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SC

ATTERBERG LIMITS
- LIQUID LIMIT: --
- PLASTIC LIMIT: --
- PLASTICITY INDEX: --

COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE
BORING NUMBER: B-21
SAMPLE DEPTH: 0.5' - 5'

DESCRIPTION: CLAYEY SAND

U.S. Standard Sieve Sizes

Percent Finer by Weight

Grain Size in Millimeters

3" 1½" 3/4" 3/8" #4 #8 #16 #30 #50 #100 #200

45% Fines

←4% Gravel

51% Sand

0.001

0 10 20 30 40 50 60 70 80 90 100

0 10 20 30 40 50 60 70 80 90 100

0 1 0.1 0.01 0.001

SOIL CLASSIFICATION

GROUP DELTA

SOIL CLASSIFICATION

Project No. SD605
FIGURE C-1.42
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SM

BORING NUMBER: B-21
SAMPLE DEPTH: 15' - 16.5'

DESCRIPTION: SILTY SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

SOIL CLASSIFICATION

Project No. SD605
FIGURE C-1.43
SAMPLE
BORING NUMBER: B-21
SAMPLE DEPTH: 40' - 41.5'

UNIFIED SOIL CLASSIFICATION: SM
DESCRIPTION: SILTY SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

SOIL CLASSIFICATION

GROUP DELTA

Project No. SD605
FIGURE C-1.44
**SAMPLE**
- **BORING NUMBER:** B-22
- **SAMPLE DEPTH:** 1' - 3'

**UNIFIED SOIL CLASSIFICATION:** SC

**DESCRIPTION:** CLAYEY SAND WITH GRAVEL

**ATTERBERG LIMITS**
- **LIQUID LIMIT:** --
- **PLASTIC LIMIT:** --
- **PLASTICITY INDEX:** --

### Soil Classification

<table>
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<tr>
<th>Grain Size in Millimeters</th>
<th>Percent Finer by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
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<td>20</td>
<td>30</td>
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<td>10</td>
<td>20</td>
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**U.S. Standard Sieve Sizes**

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<th>reek</th>
<th>3&quot;</th>
<th>1½&quot;</th>
<th>3/4&quot;</th>
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<th>#8</th>
<th>#16</th>
<th>#30</th>
<th>#50</th>
<th>#100</th>
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<tr>
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<td></td>
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<td>Grain Size in Millimeters</td>
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</tr>
</tbody>
</table>

- 24% Gravel
- 53% Sand
- 23% Fines

**SOIL CLASSIFICATION**

**PROJECT NO.** SD605

**FIGURE C-1.45**
COARSE    FINE    COARSE    MEDIUM    FINE
GRANULAR   GRANULAR   GRANULAR   GRANULAR   GRANULAR
SAND        SAND        SAND        SAND        SAND
CLAY

SAMPLE
BORING NUMBER: B-23
SAMPLE DEPTH: 0.5' - 5'

UNIFIED SOIL CLASSIFICATION: SM
DESCRIPTION: SILTY SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

U.S. Standard Sieve Sizes

Percent Finer by Weight

Grain Size in Millimeters

COARSE FINE COARSE MEDIUM FINE SILT AND
GRANULAR GRANULAR GRANULAR GRANULAR GRANULAR
SAND        SAND        SAND        SAND        SAND
CLAY

Project No. SD605
FIGURE C-1.46
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SP

BORING NUMBER: B-23
SAMPLEDEPTH: 10.5’ - 11’

DESCRIPTION: POORLY GRADED SAND

<table>
<thead>
<tr>
<th>COARSE</th>
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<th>COARSE</th>
<th>MEDIUM</th>
<th>FINE</th>
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<tbody>
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<td>SAND</td>
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<table>
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<th>SILT AND</th>
<th>CLAY</th>
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<table>
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<th>ATTERBERG LIMITS</th>
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<tbody>
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<td>LIQUID LIMIT: --</td>
</tr>
<tr>
<td>PLASTIC LIMIT: --</td>
</tr>
<tr>
<td>PLASTICITY INDEX: --</td>
</tr>
</tbody>
</table>

FIGURE C-1.47

U.S. Standard Sieve Sizes

- Percent Finer by Weight
- Grain Size in Millimeters

- 3'' 1½'' 3/4'' 3/8'' #4 #8 #16 #30 #50 #100 #200
- 0% Gravel
- 97% Sand
- 3% Fines
- 43
- 20
COARSE  FINE  COARSE  MEDIUM  FINE  SILT AND
GRAVEL  SAND  CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SP-SM
ATTERBERG LIMITS
LIQUID LIMIT:  --
PLASTIC LIMIT:  --
PLASTICITY INDEX:  --

DESCRIPTION: POORELY GRADED SAND WITH SILT AND GRAVEL

BORING NUMBER:  B-23
SAMPLE DEPTH:  25' - 25.9'

U.S. Standard Sieve Sizes

<table>
<thead>
<tr>
<th>Grain Size in Millimeters</th>
<th>Percent Finer by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot;</td>
<td>0</td>
</tr>
<tr>
<td>1½&quot;</td>
<td>12%</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>30%</td>
</tr>
<tr>
<td>#4</td>
<td>58%</td>
</tr>
<tr>
<td>#8</td>
<td>46%</td>
</tr>
<tr>
<td>#16</td>
<td>32%</td>
</tr>
<tr>
<td>#30</td>
<td>19%</td>
</tr>
<tr>
<td>#50</td>
<td>12%</td>
</tr>
<tr>
<td>#100</td>
<td>30% Gravel</td>
</tr>
<tr>
<td>#200</td>
<td>58% Sand</td>
</tr>
<tr>
<td>1&quot;</td>
<td>12% Fines</td>
</tr>
</tbody>
</table>

Project No. SD605
FIGURE C-1.48

GROUP DELTA
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SM / ML
ATTERBERG LIMITS
BORING NUMBER: B-23 LIQUID LIMIT: --
SAMPLE DEPTH: 40 - 41.5’ PLASTIC LIMIT: --
DESCRIPTION: SILTY SAND / SANDY SILT PLASTICITY INDEX: --

SOIL CLASSIFICATION

GROUP DELTA

Project No. SD605
FIGURE C-1.49
SAMPLE
BORING NUMBER: B-24
SAMPLE DEPTH: 0.5' - 5'

UNIFIED SOIL CLASSIFICATION: SC
DESCRIPTION: CLAYEY SAND

COARSE FINE
COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

SOIL CLASSIFICATION

GROUP DELTA
Project No. SD605
FIGURE C-1.50
Fines → 2% Gravel
60% Sand ←
38% Fines

SOIL CLASSIFICATION

SAMPLE
BORING NUMBER: B-24
SAMPLE DEPTH: 10' - 11.5'

UNIFIED SOIL CLASSIFICATION: SC
DESCRIPTION: CLAYEY SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SP

BORING NUMBER: B-24
SAMPLE DEPTH: 25' - 26.5'

DESCRIPTION: POORLY GRADED SAND WITH SILT

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

GROUP DELTA

SOIL CLASSIFICATION

Project No. SD605
FIGURE C-1.52
COARSE  FINE  COARSE  MEDIUM  FINE  SILT AND
GRANULE  GRAVEL  SAND  CLAY

SAMPLE
BORING NUMBER: B-24
SAMPLE DEPTH: 35' - 36.5'

UNIFIED SOIL CLASSIFICATION: SP-SM
DESCRIPTION: POORLY GRADED SAND WITH SILT

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --
**SAMPLE**
- **BORING NUMBER:** B-24
- **SAMPLE DEPTH:** 55' - 56.5'

**UNIFIED SOIL CLASSIFICATION:** SP

**DESCRIPTION:** POORLY GRADED SAND

**ATTERBERG LIMITS**
- **LIQUID LIMIT:** --
- **PLASTIC LIMIT:** --
- **PLASTICITY INDEX:** --
**SAMPLE**

BORING NUMBER: B-25

SAMPLE DEPTH: 0' - 5'

**UNIFIED SOIL CLASSIFICATION:** SM

**DESCRIPTION:** SILTY SAND

**ATTERBERG LIMITS**

- LIQUID LIMIT: --
- PLASTIC LIMIT: --
- PLASTICITY INDEX: --
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SM

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

BORING NUMBER: B-25
SAMPLE DEPTH: 10' - 11.5'

DESCRIPTION: SILTY SAND

U.S. Standard Sieve Sizes

Percent Finer by Weight

Grain Size in Millimeters

COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAND CLAY

COARSE FINE COARSE MEDIUM FINE SILT AND

SILT AND

SAND

GRAVEL

SAMPLE

BORING NUMBER: B-25
SAMPLE DEPTH: 10' - 11.5'

UNIFIED SOIL CLASSIFICATION: SM

DESCRIPTION: SILTY SAND

SOIL CLASSIFICATION

GROUP DELTA

Project No. SD605
FIGURE C-1.56
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SP

BORING NUMBER: B-26
SAMPLE DEPTH: 5.5' - 6'
DESCRIPTION: POORLY GRADED SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

SOIL CLASSIFICATION
Project No. SD605
FIGURE C-1.57
**SAMPLE**
BORING NUMBER: B-26
SAMPLE DEPTH: 15' - 16.5'

**UNIFIED SOIL CLASSIFICATION:** SP
**DESCRIPTION:** POORLY GRADED SAND

**ATTERBERG LIMITS**
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SP

BORING NUMBER: B-26
SAMPLE DEPTH: 25' - 26'

DESCRIPTION: POORLY GRADED SAND WITH SILT

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

SOIL CLASSIFICATION
Project No. SD605
FIGURE C-1.59
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SP

BORING NUMBER: B-26
SAMPLE DEPTH: 35' - 36.5'

DESCRIPTION: POORLY GRADED SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --
SAMPLE
BORING NUMBER: B-27
SAMPLE DEPTH: 0.5' - 5'

UNIFIED SOIL CLASSIFICATION: SC
DESCRIPTION: CLAYEY SAND

ATTERBERG LIMITS
LIQUID LIMIT: 36
PLASTIC LIMIT: 15
PLASTICITY INDEX: 21

SOIL CLASSIFICATION

GROUP DELTA

Project No. SD605
FIGURE C-1.61
SOIL CLASSIFICATION

SAMPLE
BORING NUMBER: B-27
SAMPLE DEPTH: 15.5' - 16'

UNIFIED SOIL CLASSIFICATION: SC
DESCRIPTION: CLAYEY SAND WITH GRAVEL

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

GROUP DELTA

Project No. SD605
FIGURE C-1.62
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SC

SAMPLE NUMBER: B-27 LIQUID LIMIT: --
SAMPLE DEPTH: 30’ - 31.5’ PLASTIC LIMIT: --

DESCRIPTION: CLAYEY SAND PLASTICITY INDEX: --

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
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<tr>
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<td></td>
<td>GRAVEL</td>
<td></td>
<td>FINE</td>
<td></td>
<td>MEDIUM</td>
<td></td>
</tr>
<tr>
<td>CLAY</td>
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<td></td>
</tr>
</tbody>
</table>

SOIL CLASSIFICATION

Project No. SD605
FIGURE C-1.63
COARSE | FINE | COARSE | MEDIUM | FINE | SILT AND
| GRAVEL | SAND | CLAY |

SAMPLE
BORING NUMBER: B-27
SAMPLE DEPTH: 35.5' - 36'

UNIFIED SOIL CLASSIFICATION: SP
DESCRIPTION: POORLY GRADED SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SM
ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

BORING NUMBER: B-27
SAMPLE DEPTH: 40' - 41.5'
DESCRIPTION: SILTY SAND

SOIL CLASSIFICATION

Project No. SD605
FIGURE C-1.65
SAMPLE
BORING NUMBER: B-27
SAMPLE DEPTH: 70' - 70.6'

UNIFIED SOIL CLASSIFICATION: SM
DESCRIPTION: SILTY SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY
SAMPLE UNIFIED SOIL CLASSIFICATION: SC
ATTERBERG LIMITS
BORING NUMBER: B-28 LIQUID LIMIT: --
SAMPLE DEPTH: 0.5' - 5' PLASTIC LIMIT: --
DESCRIPTION: CLAYEY SAND PLASTICITY INDEX: --

U.S. Standard Sieve Sizes

Percent Finer by Weight

Grain Size in Millimeters

COARSE FINE COARSE MEDIUM FINE SILT AND
GRANITY
GRAVEL SAND CLAY

SAMPLE
BORING NUMBER: B-28
SAMPLE DEPTH: 0.5' - 5'

UNIFIED SOIL CLASSIFICATION: SC
DESCRIPTION: CLAYEY SAND

SOIL CLASSIFICATION

GROUP DELTA

Project No. SD605
FIGURE C-1.67
SAMPLE
BORING NUMBER: B-28
SAMPLE DEPTH: 25.5' - 26'

UNIFIED SOIL CLASSIFICATION: SM
DESCRIPTION: SILTY SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

PROJECT NO. SD605
FIGURE C-1.68
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION:
SP

ATTERBERG LIMITS
BORING NUMBER: B-28 LIQUID LIMIT: --
SAMPLE DEPTH: 35'-36.5' DESCRIPTION:
POORLY GRADED SAND PLASTIC LIMIT: --
PLASTICITY INDEX: --

SOIL CLASSIFICATION
PROJECT NO. SD605

FIGURE C.169

U.S. Standard Sieve Sizes

Percent Finer by Weight

Grain Size in Millimeters

3" 1½" 3/4" 3/8" #4 #8 #16 #30 #50 #100 #200
5% Fines→
←0% Gravel
95% Sand ↔

0
10
20
30
40
50
60
70
80
90
100

0.01

0.001

0.0001
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SC

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

SAMPLE
SAMPLE NUMBER: B-29
SAMPLE DEPTH: 0.5 - 4.8'

DESCRIPTION:
CLAYEY SAND

SOIL CLASSIFICATION

U.S. Standard Sieve Sizes

Percent Finer by Weight

Grain Size in Millimeters

3" 1½" 3/4" 3/8" #4 #10 #16 #30 #50 #100 #200

0.001 0.01 0.1 1

0 10 20 30 40 50 60 70 80 90 100

0 10 20 30 40 50 60 70 80 90 100

100 98 94 92 88 69 54 48 34 26 24 21 20 18 16 12

34% Fines → 2% Gravel
64% Sand ↔ 34% Fines

GROUP DELTA

SOIL CLASSIFICATION

Project No. SD605
FIGURE C-1.70
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SC

ATTERBERG LIMITS
LIQUID LIMIT: 29
PLASTIC LIMIT: 14
PLASTICITY INDEX: 15

SAMPLE
BORING NUMBER: B-30
SAMPLE DEPTH: 0.5' - 5'

DESCRIPTION: CLAYEY SAND

SOIL CLASSIFICATION

Project No. SD605
FIGURE C-1.71
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SM

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

BORING NUMBER: B-30
SAMPLE DEPTH: 10' - 11.5'
DESCRIPTION: SILTY SAND

U.S. Standard Sieve Sizes

COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SM
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SM

BORING NUMBER: B-30
SAMPLE DEPTH: 25' - 26.5'

DESCRIPTION: SILTY SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

SOIL CLASSIFICATION
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SP
BORING NUMBER: B-30
SAMPLE DEPTH: 40' - 41.5'
DESCRIPTION: POORLY GRADED SAND WITH SILT

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

SOIL CLASSIFICATION
Project No. SD605
FIGURE C-1.74
COARSE    FINE    COARSE   MEDIUM   FINE    SILT AND
          GRAVEL   SAND    CLAY

SAMPLE
BORING NUMBER: B-31
SAMPLE DEPTH: 2.5' - 5'

UNIFIED SOIL CLASSIFICATION: SC
DESCRIPTION: CLAYEY SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

U.S. Standard Sieve Sizes

Grain Size in Millimeters

Percent Finer by Weight

0 10 20 30 40 50 60 70 80 90 100

0.001

0.01

0.1

1

10

100

3'' 1½'' 3/4'' 3/8'' #4 #8 #16 #30 #50 #100 #200

38% Fines

60% Sand

2% Gravel

Project No. SD605
FIGURE C-1.75

SOIL CLASSIFICATION
COARSE | FINE | COARSE | MEDIUM | FINE | SILT AND CLAY
---|---|---|---|---|---
GRAVEL | SAND | | | | |

**SAMPLE**
- BORING NUMBER: B-31
- SAMPLE DEPTH: 15' - 16.5'

**UNIFIED SOIL CLASSIFICATION:** SC
**DESCRIPTION:** CLAYEY SAND

**ATTERBERG LIMITS**
- LIQUID LIMIT: --
- PLASTIC LIMIT: --
- PLASTICITY INDEX: --
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SM
BORING NUMBER: B-31
SAMPLE DEPTH: 25' - 26.5'
DESCRIPTION: SILTY SAND

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --
COARSE FINE COARSE MEDIUM FINE SILT AND GRAVEL SAND CLAY

SAMPLE UNIFIED SOIL CLASSIFICATION: SP

BORING NUMBER: B-31
SAMPLE DEPTH: 40' - 41.5'
DESCRIPTION: POORLY GRADED SAND WITH SILT

UNIFIED SOIL CLASSIFICATION: SP

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

SOIL CLASSIFICATION

PROJECT NO. SD605
FIGURE C-1.78
**Sample Classification and Description**

**Sample Information**
- **Boring Number:** B-31
- **Sample Depth:** 65' - 65.9'

**Unified Soil Classification:** SM

**Description:** Silty Sand

**Atterberg Limits**
- **Liquid Limit:** --
- **Plastic Limit:** --
- **Plasticity Index:** --

---

### U.S. Standard Sieve Sizes

<table>
<thead>
<tr>
<th>Grain Size in Millimeters</th>
<th>Percent Finer by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>100</td>
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<td>0.01</td>
<td>95</td>
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<td>0.0000000001</td>
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<td>0.00000000001</td>
<td>10</td>
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<tr>
<td>0.000000000001</td>
<td>0</td>
</tr>
</tbody>
</table>

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**Graphical Data**

- 0% Gravel
- 80% Sand
- 20% Fines

---

**Table**

<table>
<thead>
<tr>
<th>Coarse</th>
<th>Fine</th>
<th>Coarse</th>
<th>Medium</th>
<th>Fine</th>
<th>Silts and Clay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravel</td>
<td>Sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Group Delta**

Project No. SD605

**Figure C-1.79**
SAMPLE
SAMPLE NUMBER: B-32
SAMPLE DEPTH: 0.5 - 5'

UNIFIED SOIL CLASSIFICATION: SC
DESCRIPTION: CLAYEY SAND

COARSE   FINE   COARSE   MEDIUM   FINE   SILT AND
GRAVEL   SAND   CLAY

ATTERBERG LIMITS
LIQUID LIMIT: --
PLASTIC LIMIT: --
PLASTICITY INDEX: --

U.S. Standard Sieve Sizes

SOIL CLASSIFICATION

GROUP DELTA

FIGURE C-1.80
## ATTERBERG LIMITS RESULTS
(ASTM D4318)

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>DESCRIPTION</th>
<th>LIQUID LIMIT</th>
<th>PLASTIC LIMIT</th>
<th>PLASTICITY INDEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-2 @ 10’ – 11.5’</td>
<td>Sandy Lean CLAY (CL)</td>
<td>40</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td>S-2 @ 26’ – 26.5’</td>
<td>Sandy Lean CLAY (CL)</td>
<td>39</td>
<td>17</td>
<td>22</td>
</tr>
<tr>
<td>S-2 @ 50’ – 51’</td>
<td>Fat CLAY with sand (CH)</td>
<td>51</td>
<td>24</td>
<td>27</td>
</tr>
<tr>
<td>S-3 @ 10.5’ – 11’</td>
<td>Sandy Lean CLAY (CL)</td>
<td>42</td>
<td>18</td>
<td>24</td>
</tr>
<tr>
<td>S-3 @ 34’ – 36’</td>
<td>Sandy Lean CLAY (CL)</td>
<td>42</td>
<td>14</td>
<td>28</td>
</tr>
<tr>
<td>S-4 @ 10’ – 11.5’</td>
<td>Lean CLAY with sand (CL)</td>
<td>48</td>
<td>19</td>
<td>29</td>
</tr>
<tr>
<td>S-4 @ 20’ – 21.5’</td>
<td>Lean CLAY with sand (CL)</td>
<td>42</td>
<td>16</td>
<td>26</td>
</tr>
<tr>
<td>S-5 @ 0.5’ – 5’</td>
<td>Clayey SAND with gravel (SC)</td>
<td>38</td>
<td>15</td>
<td>23</td>
</tr>
<tr>
<td>S-5 @ 20.5’ – 21’</td>
<td>Lean CLAY with sand (CL)</td>
<td>46</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td>S-6 @ 20’ – 21.5’</td>
<td>Sandy Lean CLAY (CL)</td>
<td>42</td>
<td>16</td>
<td>26</td>
</tr>
<tr>
<td>S-7 @ 0.5’ – 5’</td>
<td>Sandy Lean CLAY (CL)</td>
<td>39</td>
<td>14</td>
<td>25</td>
</tr>
<tr>
<td>S-8 @ 40.5’ – 41’</td>
<td>Fat CLAY (CH)</td>
<td>59</td>
<td>21</td>
<td>38</td>
</tr>
<tr>
<td>S-9 @ 30’ – 31’</td>
<td>Fat CLAY (CH)</td>
<td>66</td>
<td>22</td>
<td>44</td>
</tr>
<tr>
<td>S-10 @ 0.5’ – 5’</td>
<td>Clayey SAND with gravel (SC)</td>
<td>39</td>
<td>15</td>
<td>24</td>
</tr>
<tr>
<td>S-10 @ 35’ – 36.5’</td>
<td>Sandy Lean CLAY (CL)</td>
<td>45</td>
<td>16</td>
<td>29</td>
</tr>
<tr>
<td>S-10 @ 45’ – 46.5’</td>
<td>Sandy Lean CLAY (CL)</td>
<td>46</td>
<td>17</td>
<td>29</td>
</tr>
<tr>
<td>S-11 @ 0.5’ – 5’</td>
<td>Sandy Lean CLAY (CL)</td>
<td>38</td>
<td>13</td>
<td>25</td>
</tr>
<tr>
<td>S-11 @ 10’ – 11.5’</td>
<td>Sandy Lean CLAY (CL)</td>
<td>38</td>
<td>15</td>
<td>23</td>
</tr>
<tr>
<td>S-12 @ 35’ – 36’</td>
<td>Sandy fat CLAY (CH)</td>
<td>53</td>
<td>21</td>
<td>32</td>
</tr>
<tr>
<td>S-13 @ 0.5’ – 5’</td>
<td>Clayey SAND with gravel (SC)</td>
<td>40</td>
<td>17</td>
<td>23</td>
</tr>
<tr>
<td>B-14 @ 5’ – 6.5’</td>
<td>Sandy Lean CLAY (CL)</td>
<td>40</td>
<td>17</td>
<td>23</td>
</tr>
<tr>
<td>B-15 @ 6’ – 6.5’</td>
<td>Clayey SAND with gravel (SC)</td>
<td>36</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td>B-16 @ 20’ – 21.5’</td>
<td>Clayey SAND (SC)</td>
<td>34</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>B-16 @ 41’ – 41.5’</td>
<td>Sandy Fat CLAY (CH)</td>
<td>55</td>
<td>28</td>
<td>27</td>
</tr>
<tr>
<td>B-17 @ 20’ – 21.5’</td>
<td>Clayey SAND (SC)</td>
<td>35</td>
<td>16</td>
<td>19</td>
</tr>
<tr>
<td>B-18 @ 0.5’ – 5’</td>
<td>Clayey SAND (SC)</td>
<td>38</td>
<td>15</td>
<td>23</td>
</tr>
<tr>
<td>B-21 @ 5’ – 6.5’</td>
<td>Clayey SAND (SC)</td>
<td>33</td>
<td>18</td>
<td>15</td>
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</table>
### ATTERBERG LIMITS RESULTS (CONTINUED)
(ASTM D4318)

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>DESCRIPTION</th>
<th>LIQUID LIMIT</th>
<th>PLASTIC LIMIT</th>
<th>PLASTICITY INDEX</th>
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</thead>
<tbody>
<tr>
<td>B-21 @ 25’ – 26.5’</td>
<td>Sandy Lean CLAY (CL)</td>
<td>33</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>B-22 @ 15’ – 16.5’</td>
<td>Clayey SAND (SC)</td>
<td>33</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td>B-23 @ 60’ – 61’</td>
<td>Silty SAND (SM)</td>
<td>NP</td>
<td>NP</td>
<td>NP</td>
</tr>
<tr>
<td>B-27 @ 0.5’ – 5’</td>
<td>Clayey SAND (SC)</td>
<td>36</td>
<td>15</td>
<td>21</td>
</tr>
<tr>
<td>B-27 @ 25.5’ – 26’</td>
<td>Sandy Lean CLAY (CL)</td>
<td>41</td>
<td>21</td>
<td>20</td>
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<tr>
<td>B-27 @ 50’ – 51.5’</td>
<td>Lean CLAY (CL)</td>
<td>47</td>
<td>16</td>
<td>31</td>
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<tr>
<td>B-28 @ 15’ – 16.5’</td>
<td>Sandy Lean CLAY (CL)</td>
<td>41</td>
<td>18</td>
<td>23</td>
</tr>
<tr>
<td>B-30 @ 0.5’ – 5’</td>
<td>Clayey SAND (SC)</td>
<td>29</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>B-31 @ 30’ – 31.5’</td>
<td>Sandy Lean CLAY (CL)</td>
<td>36</td>
<td>20</td>
<td>16</td>
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</table>

NP = Nonplastic
## EXPANSION TEST RESULTS
(ASTM D4829)

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>DESCRIPTION</th>
<th>EXPANSION INDEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-2 @ 0.5’ – 5’</td>
<td>Clayey SAND (SC)</td>
<td>26</td>
</tr>
<tr>
<td>S-6 @ 0.5’ – 5’</td>
<td>Lean CLAY with sand (CL)</td>
<td>75</td>
</tr>
<tr>
<td>S-7 @ 0.5’ – 5’</td>
<td>Sandy Lean CLAY (CL)</td>
<td>50</td>
</tr>
<tr>
<td>S-10 @ 0.5’ – 5’</td>
<td>Clayey SAND with gravel (SC)</td>
<td>20</td>
</tr>
<tr>
<td>S-11 @ 0.5’ – 5’</td>
<td>Sandy Lean CLAY (CL)</td>
<td>63</td>
</tr>
<tr>
<td>S-12 @ 0.5’ – 5’</td>
<td>Clayey SAND (SC)</td>
<td>25</td>
</tr>
<tr>
<td>S-13 @ 0.5’ – 5’</td>
<td>Clayey SAND (SC)</td>
<td>70</td>
</tr>
<tr>
<td>B-14 @ 0.5’ – 2.5’</td>
<td>Clayey SAND (SC)</td>
<td>6</td>
</tr>
<tr>
<td>B-16 @ 2.5’ – 5’</td>
<td>Clayey SAND (SC)</td>
<td>55</td>
</tr>
<tr>
<td>B-19 @ 0.5’ – 4.4’</td>
<td>Clayey SAND (SC)</td>
<td>31</td>
</tr>
<tr>
<td>B-20 @ 0.5’ – 2.5’</td>
<td>Clayey SAND (SC)</td>
<td>36</td>
</tr>
<tr>
<td>B-21 @ 0.5’ – 5’</td>
<td>Clayey SAND (SC)</td>
<td>52</td>
</tr>
<tr>
<td>B-24 @ 0.5’ – 5’</td>
<td>Clayey SAND (SC)</td>
<td>55</td>
</tr>
<tr>
<td>B-27 @ 0.5’ – 5’</td>
<td>Clayey SAND (SC)</td>
<td>36</td>
</tr>
<tr>
<td>B-28 @ 0.5’ – 5’</td>
<td>Clayey SAND (SC)</td>
<td>32</td>
</tr>
<tr>
<td>B-30 @ 0.5’ – 5’</td>
<td>Clayey SAND (SC)</td>
<td>18</td>
</tr>
<tr>
<td>B-31 @ 2.5’ – 5’</td>
<td>Clayey SAND (SC)</td>
<td>34</td>
</tr>
</tbody>
</table>

## EXPANSION INDEX

<table>
<thead>
<tr>
<th>EXPANSION INDEX</th>
<th>POTENTIAL EXPANSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 20</td>
<td>Very low</td>
</tr>
<tr>
<td>21 to 50</td>
<td>Low</td>
</tr>
<tr>
<td>51 to 90</td>
<td>Medium</td>
</tr>
<tr>
<td>91 to 130</td>
<td>High</td>
</tr>
<tr>
<td>Above 130</td>
<td>Very High</td>
</tr>
</tbody>
</table>
## CORROSIVITY TEST RESULTS

( ASTM D516, CTM 643)

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>pH</th>
<th>RESISTIVITY [OHM-CM]</th>
<th>SULFATE CONTENT [%]</th>
<th>CHLORIDE CONTENT [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-2 @ 0.5’ – 5’</td>
<td>8.6</td>
<td>1,950</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>S-6 @ 0.5’ – 5’</td>
<td>7.1</td>
<td>1,135</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>S-7 @ 0.5’ – 5’</td>
<td>8.0</td>
<td>600</td>
<td>0.03</td>
<td>0.07</td>
</tr>
<tr>
<td>S-10 @ 0.5’ – 5’</td>
<td>7.9</td>
<td>980</td>
<td>&lt;0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>S-11 @ 0.5’ – 5’</td>
<td>8.2</td>
<td>940</td>
<td>&lt;0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>B-16 @ 2.5’ – 5’</td>
<td>8.6</td>
<td>970</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>B-17 @ 0.5’ – 5’</td>
<td>8.5</td>
<td>1,080</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>B-20 @ 0.5’ – 2.5’</td>
<td>8.3</td>
<td>1,120</td>
<td>&lt;0.01</td>
<td>0.01</td>
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<tr>
<td>B-21 @ 0.5’ – 5’</td>
<td>8.5</td>
<td>1,960</td>
<td>&lt;0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>B-24 @ 0.5’ – 5’</td>
<td>8.8</td>
<td>880</td>
<td>&lt;0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>B-26 @ 0.5’ – 5’</td>
<td>8.4</td>
<td>2,210</td>
<td>&lt;0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>B-27 @ 0.5’ – 5’</td>
<td>7.9</td>
<td>720</td>
<td>0.02</td>
<td>0.01</td>
</tr>
<tr>
<td>B-30 @ 0.5’ – 5’</td>
<td>8.6</td>
<td>1,320</td>
<td>0.01</td>
<td>0.01</td>
</tr>
</tbody>
</table>

### SULFATE CONTENT [%]

- 0.00 to 0.10: Negligible
- 0.10 to 0.20: Moderate
- 0.20 to 2.00: Severe
- Above 2.00: Very Severe

### SULFATE EXPOSURE

- 0.00 to 0.10: Negligible
- 0.10 to 0.20: Moderate
- 0.20 to 2.00: Severe
- Above 2.00: Very Severe

### CEMENT TYPE

- II, IP(MS), IS(MS)
- V
- V plus pozzolan

### SOIL RESISTIVITY [OHM-CM]

- 0 to 1,000: Very Corrosive
- 1,000 to 2,000: Corrosive
- 2,000 to 5,000: Moderately Corrosive
- 5,000 to 10,000: Mildly Corrosive
- Above 10,000: Slightly Corrosive

### CHLORIDE (CI) CONTENT [%]

- 0.00 to 0.03: Negligible
- 0.03 to 0.15: Corrosive
- Above 0.15: Severely Corrosive

---

**GROUP DELTA**

LABORATORY TEST RESULTS

Project No. SD605

FIGURE C-3
SAMPLE: S-2 @ 46' - 46.5'

Description:
Clayey SAND (SC)

STRAIN RATE: 0.0020 IN/MIN
(Sample was consolidated and drained)

SAMPLE: S-2 @ 46' - 46.5'

Description:
Clayey SAND (SC)

STRAIN RATE: 0.0020 IN/MIN
(Sample was consolidated and drained)

DIRECT SHEAR TEST RESULTS

Project No. SD605
FIGURE C-4.1
SAMPLE: S-7 @ 50.4’ - 50.9’

Description:
Silty SAND (SM)

STRAIN RATE: 0.0030 IN/MIN
(Sample was consolidated and drained)

DIRECT SHEAR TEST RESULTS

Peak Strength Test Results

- 40 Degrees, 0 PSF Cohesion
- Ultimate Strength Test Results
- 36 Degrees, 0 PSF Cohesion

SHEAR STRESS [PSF] vs STRAIN [%]

PEAK
- $\phi'$: 40 °
- $C'$: 0 PSF

ULTIMATE
- $\phi'$: 36 °
- $C'$: 0 PSF

IN-SITU
- $\gamma_d$: 103.2 PCF
- $w_c$: 22.0 %

AS-TESTED
- $\gamma_d$: 103.2 PCF
- $w_c$: 23.3 %

Project No. SD605
FIGURE C-4.2
SAMPLE: B-15 @ 35.5' - 36'

Description: Gray silty SAND (SM)

Peak Strength Test Results
- 35 Degrees, 1100 PSF Cohesion

Ultimate Strength Test Results
- 32 Degrees, 275 PSF Cohesion

Strain Rate: 0.0030 IN/MIN
(Sample was consolidated and drained)

IN-SITU
- $\gamma_d$: 119.7 PCF
- $w_c$: 6.1%

AS-TESTED
- $\gamma_d$: 119.7 PCF
- $w_c$: 15.1%

Project No. SD605
FIGURE C-4.3
SAMPLE:
B-17 @ 60.5' - 70'

Description:
Poorly graded SAND with silt (SP-SM)

STRAIN RATE: 0.0030 IN/MIN
(Sample was consolidated and drained)

<table>
<thead>
<tr>
<th></th>
<th>PEAK</th>
<th>ULTIMATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poorly graded SAND with silt (SP-SM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;(\phi)&quot;</td>
<td>35 °</td>
<td>32 °</td>
</tr>
<tr>
<td>&quot;C&quot;</td>
<td>600 PSF</td>
<td>350 PSF</td>
</tr>
<tr>
<td>(\gamma_d)</td>
<td>105.3 PCF</td>
<td>105.3 PCF</td>
</tr>
<tr>
<td>(w_c)</td>
<td>19.7 %</td>
<td>22.2 %</td>
</tr>
</tbody>
</table>
BORING NUMBER/DEPTH: S-5 @ 21' - 21.5'
DESCRIPTION: Lean CLAY with sand (CL)

<table>
<thead>
<tr>
<th>INITIAL</th>
<th>FINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0000</td>
<td>0.8410</td>
</tr>
<tr>
<td>72.2</td>
<td>85.9</td>
</tr>
<tr>
<td>2.96</td>
<td>2.96</td>
</tr>
<tr>
<td>1.56</td>
<td>1.16</td>
</tr>
<tr>
<td>50.1</td>
<td>39.0</td>
</tr>
<tr>
<td>95.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

SAMPLE HEIGHT [IN]
DRY DENSITY [PCF]
SPECIFIC GRAVITY (ASSUMED)
VOID RATIO (\(e\))
WATER CONTENT [%]
DEGREE OF SATURATION [%]
APPENDIX D
STORM WATER INFILTRATION TEST RESULTS
BOREHOLE PERCOLATION TEST

Project Name: SDSU Mission Valley  
Date Drilled: 3/12/2019  
Borehole Radius (*r): 4 in.

Project Number: SD605  
Date Tested: 3/13/2019  
Casing Diameter: 4 in.

Test Hole Number: I-1  
Tested By: TSL  
Depth of Hole: 4.4 ft

Drilling Method: Hollow-Stem Auger  
Average Temp. of Water: 60 F  
Average Test Depth: 2.4' - 4.4'

UNFACTORED INFILTRATION RATES* DURING TEST

![Graph showing infiltration rate over time]

Preliminary Factored Infiltration Rate\(^1\): 0.01 in./hr.

Feasibility Screening Factor of Safety, F.S.\(^2\): 2

Temperature Correction Factor\(^2,3\): 0.86

<table>
<thead>
<tr>
<th>Factored Infiltration Rate(^2)</th>
<th>Design Condition(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 0.05</td>
<td>No Infiltration</td>
</tr>
<tr>
<td>0.05 to 0.5</td>
<td>Partial Infiltration</td>
</tr>
<tr>
<td>Above 0.50</td>
<td>Full Infiltration</td>
</tr>
</tbody>
</table>

*Porchet method used to convert percolation rate to infiltration rate. See Appendix D for details.

1: Rate Factored by Factor of Safety and Temperature Correction Factor.


3: Factor based on as-tested water temperature of 60 F and rainfall temperature of 50 F.
# Borehole Percolation Test

**Project Name:** SDSU Mission Valley  
**Date Drilled:** 3/12/2019  
**Project Number:** SD605  
**Date Tested:** 3/13/2019  
**Test Hole Number:** I-1  
**Tested By:** TSL  
**Drilling Method:** Hollow-Stem Auger  
**Average Temp. of Water:** 60 F  
**Average Test Depth:** 2.4’ - 4.4’

<table>
<thead>
<tr>
<th>Reading Number</th>
<th>Time Interval (min.)</th>
<th>Cumulative Time (min.)</th>
<th>Initial Depth to Water (ft.)</th>
<th>Final Depth to Water (ft.)</th>
<th>Average Height of Water (Head) (in.)</th>
<th>Measured Drop in Water Level (in.)</th>
<th>Corrected Drop in Water Level(^\d) (in.)</th>
<th>Corrected Percolation Rate(^\d) (in./hour)</th>
<th>Unfactored Infiltration Rate*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-soak</td>
<td>-</td>
<td>-</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>1</td>
<td>30</td>
<td>30</td>
<td>2.35</td>
<td>2.37</td>
<td>24.48</td>
<td>0.24</td>
<td>0.13</td>
<td>0.26</td>
<td>0.02</td>
</tr>
<tr>
<td>2</td>
<td>38</td>
<td>68</td>
<td>2.37</td>
<td>2.40</td>
<td>24.18</td>
<td>0.36</td>
<td>0.20</td>
<td>0.31</td>
<td>0.02</td>
</tr>
<tr>
<td>3</td>
<td>34</td>
<td>102</td>
<td>2.40</td>
<td>2.43</td>
<td>23.82</td>
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<td>0.20</td>
<td>0.35</td>
<td>0.03</td>
</tr>
<tr>
<td>4</td>
<td>47</td>
<td>149</td>
<td>2.43</td>
<td>2.46</td>
<td>23.46</td>
<td>0.36</td>
<td>0.20</td>
<td>0.25</td>
<td>0.02</td>
</tr>
<tr>
<td>5</td>
<td>49</td>
<td>198</td>
<td>2.40</td>
<td>2.42</td>
<td>23.88</td>
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<td>0.16</td>
<td>0.01</td>
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<tr>
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<td>46</td>
<td>244</td>
<td>2.42</td>
<td>2.46</td>
<td>23.55</td>
<td>0.42</td>
<td>0.23</td>
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<tr>
<td>7</td>
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<td>273</td>
<td>2.46</td>
<td>2.47</td>
<td>23.28</td>
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<td>0.14</td>
<td>0.01</td>
</tr>
<tr>
<td>8</td>
<td>40</td>
<td>313</td>
<td>2.47</td>
<td>2.50</td>
<td>23.01</td>
<td>0.42</td>
<td>0.23</td>
<td>0.35</td>
<td>0.03</td>
</tr>
<tr>
<td>9</td>
<td>30</td>
<td>343</td>
<td>2.50</td>
<td>2.52</td>
<td>22.71</td>
<td>0.18</td>
<td>0.10</td>
<td>0.20</td>
<td>0.02</td>
</tr>
</tbody>
</table>

1: Porosity of gravel assumed to be 0.4 to correct drop in water. See Appendix D for details.  
*Porchet method used to convert percolation rate to infiltration rate. See Appendix D for details.

**Stabilized, Unfactored Infiltration Rate*: 0.02 inch/hour

---

**SAN DIEGO STATE UNIVERSITY**  
**MISSION VALLEY**  
**SAN DIEGO, CALIFORNIA**  

**BOREHOLE PERCOLATION TEST - I-1**  
**INfiltration RATE**  

**GROUP DELTA**  
**PROJECT NUMBER:** SD605  
**FIGURE NUMBER:** D-1.2
**BOREHOLE PERCOLATION TEST**

Project Name: SDSU Mission Valley  
Date Drilled: 3/12/2019  
Borehole Radius (*r): 4 in.

Project Number: SD605  
Date Tested: 3/13/2019  
Casing Diameter: 4 in.

Test Hole Number: I-2  
Tested By: TSL  
Depth of Hole: 5.0 ft

Drilling Method: Hollow-Stem Auger  
Average Temp. of Water: 60 F  
Average Test Depth: 2.9' - 5'

**UNFACTORED INFILTRATION RATES* DURING TEST**

<table>
<thead>
<tr>
<th>Infiltration Rate (in./hour)</th>
<th>Duration of Test (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfactored Infiltration Rate*</td>
<td></td>
</tr>
</tbody>
</table>

**Preliminary Factored Infiltration Rate¹: 0.49 in./hr.**

**Feasibility Screening Factor of Safety, F.S.²: 2**

**Temperature Correction Factor²³: 0.86**

<table>
<thead>
<tr>
<th>Factored Infiltration Rate²</th>
<th>Design Condition²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 0.05</td>
<td>No Infiltration</td>
</tr>
<tr>
<td>0.05 to 0.5</td>
<td>Partial Infiltration</td>
</tr>
<tr>
<td>Above 0.50</td>
<td>Full Infiltration</td>
</tr>
</tbody>
</table>

*Porchet method used to convert percolation rate to infiltration rate. See Appendix D for details.

1: Rate Factored by Factor of Safety and Temperature Correction Factor.


3: Factor based on as-tested water temperature of 60 F and rainfall temperature of 50 F.
### BOREHOLE PERCOLATION TEST

**Project Name:** SDSU Mission Valley  
**Project Number:** SD605  
**Test Hole Number:** I-2  
**Date Drilled:** 3/12/2019  
**Date Tested:** 3/13/2019  
**Borehole Radius (*r):** 4 in.  
**Casing Diameter:** 4 in.  
**Depth of Hole:** 5.0 ft  
**Drilling Method:** Hollow-Stem Auger  
**Average Temp. of Water:** 60 F  
**Average Test Depth:** 2.9’ - 5’

**DATA SHEET**

<table>
<thead>
<tr>
<th>Reading Number</th>
<th>Time Interval (min.)</th>
<th>Cumulative Time (min.)</th>
<th>Initial Depth to Water (ft.) [from ground surface]</th>
<th>Final Depth to Water (ft.)</th>
<th>Average Height of Water (Head) (in.)</th>
<th>Measured Drop in Water Level (in.)</th>
<th>Corrected Drop in Water Level (in.)</th>
<th>Corrected Percolation Rate (in./hour)</th>
<th>Unfactored Infiltration Rate* (in./hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-soak</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
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**Stabilized, Unfactored Infiltration Rate*: 1.14 inch/hour

1: Porosity of gravel assumed to be 0.4 to correct drop in water. See Appendix D for details.

*Porchet method used to convert percolation rate to infiltration rate. See Appendix D for details.
**BOREHOLE PERCOLATION TEST**

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>SDSU Mission Valley</th>
<th>Date Drilled:</th>
<th>3/12/2019</th>
<th>Borehole Radius (*r):</th>
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<td>Project Number:</td>
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<td>Tested By:</td>
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<td>Depth of Hole:</td>
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<td>Average Temp. of Water:</td>
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<td>Average Test Depth:</td>
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**UNFACTORED INFILTRATION RATES* DURING TEST**

![Graph showing infiltration rates over time with preliminary factored infiltration rate 0.34 in./hr.]

- **Preliminary Factored Infiltration Rate\(^1\):** 0.34 in./hr.
- **Feasibility Screening Factor of Safety, F.S. \(^2\):** 2
- **Temperature Correction Factor\(^2\,\,3\):** 0.86

<table>
<thead>
<tr>
<th>Factored Infiltration Rate(^2)</th>
<th>Design Condition(^2)</th>
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<tr>
<td>Below 0.05</td>
<td>No Infiltration</td>
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<td>0.05 to 0.5</td>
<td>Partial Infiltration</td>
</tr>
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<td>Above 0.5</td>
<td>Full Infiltration</td>
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\(^{1}\) Porchet method used to convert percolation rate to infiltration rate. See Appendix D for details.


\(^{3}\) Factor based on as-tested water temperature of 60 F and rainfall temperature of 50 F.
BOREHOLE PERCOLATION TEST

<table>
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<tr>
<th>Reading Number</th>
<th>Time Interval (min.)</th>
<th>Cumulative Time (min.)</th>
<th>Initial Depth to Water (ft.)</th>
<th>Final Depth to Water (ft.)</th>
<th>Average Height of Water (Head) (in.)</th>
<th>Measured Drop in Water Level (in.)</th>
<th>Corrected Drop in Water Level1 (in.)</th>
<th>Corrected Percolation Rate1 (in./hour)</th>
<th>Unfactored Infiltration Rate*</th>
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<td>ΔH</td>
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<td>-</td>
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