APPENDIX 5.6-A

GEOTECHNICAL INVESTIGATION REPORT

PORTIONS OF THIS APPENDIX HAVE BEEN OMITTED – THEY HAVE BEEN SUBMITTED UNDER CONFIDENTIAL COVER

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REVISED DRAFT REPORT

GEOTECHNICAL INVESTIGATION
ARTESIAN SUBSTATION EXPANSION
SAN DIEGO GAS & ELECTRIC COMPANY
SAN DIEGO COUNTY, CALIFORNIA

Prepared for

Mr. Segenet Assefa, P.E.
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URS Project No. 27661515.40000

September 24, 2015

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September 24, 2015

Mr. Segenet Assefa
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8316 Century Park Court, CP-52G
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Subject: Geotechnical Investigation
Artesian Substation Expansion
San Diego Gas & Electric Company
San Diego County, California
URS Project No. 27661515.40000

Dear Mr. Assefa:

URS Corporation America (URS) is presenting this revised draft geotechnical investigation report for the above-referenced project in accordance with our original proposal dated March 10, 2015 (revised) and an amendment submitted on August 3, 2015. This revised draft report includes the results of the additional subsurface explorations completed. This report provides the findings from our subsurface exploration, a discussion of geologic and geotechnical conditions, and conclusions and recommendations pertaining to the geotechnical aspects of design and construction.

In our opinion, the project site is geotechnically suitable for the proposed substation expansion. However, there is a potential to encounter concretions that could be very resistant to excavation, especially for post-expansion improvements when there is reduced access and a potential for smaller equipment to be used for excavation. Mitigation options for this condition are included in this report.

URS prepared this report exclusively for SDG&E and their consultants for use in project planning and design of the proposed substation expansion.

If you have any questions regarding this report, or if we can be of further service, please contact us.

Sincerely,

URS Corporation

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AC	Asphalt Concrete
ACI	American Concrete Institute
ASTM	ASTM International (formerly American Society for Testing and Materials)
bgs	below ground surface
Cal/OSHA	California Occupational Safety and Health Administration
CBC	California Building Code
CGS	California Geological Survey
E_p	Deformation modulus
EI	Expansion Index
EPRI	Electric Power Research Institute
GLE	Generalized Limit Equilibrium
H:V	Horizontal:Vertical
IBC	International Building Code
IEEE	Institute of Electrical and Electronics Engineers
kcf	kips per cubic foot
ksi	kips per square inch
MCE	Maximum Considered Earthquake
MFAD	Moment Foundation Analysis and Design
ohm-cm	ohms-centimeter (unit of resistivity)
pcf	pounds per cubic foot
pci	pounds per cubic inch
PGA	Peak Ground Acceleration
PI	Plasticity Index
psf	pounds per square foot
RCFZ	Rose Canyon Fault Zone
SDG&E	San Diego Gas & Electric Company
SPT	Standard Penetration Test
tcf	tons per cubic foot
TI	Traffic Index
URS	URS Corporation Americas
USGS	U.S. Geologic Survey

SECTION 1 INTRODUCTION

This report presents San Diego Gas & Electric (SDG&E) with the results of URS Corporation Americas' (URS) geotechnical investigation for the proposed expansion of the Artesian Substation. The site is located southwest of the intersection of Camino Del Sur and Babcock Street within the Del Sur community of San Diego County, as shown on Figure 1, Vicinity Map.

1.1 PROJECT DESCRIPTION

Our understanding of the project is based on the conceptual project drawings prepared by NV5. The proposed improvements are shown on Figure 2, Site Plan. The project will upgrade the existing 69 kiloVolt (kV) Artesian Substation to a 230 kV yard and develop the adjacent parcel, located to the east of the existing substation, as a 69 kV yard. The project will include typical substation features such as transformers, generators, bus supports, switchgears, circuit breakers, A- or H-frames, and a control shelter. Two new 230 kV loop-in transmission steel poles will be constructed west of the existing substation wall, on either side of the existing access road (south of the detention basin).

The area of the detention basin located to the west of the existing 69 kV yard will be expanded as shown on Figure 2. This expansion will result in steepening the existing slope from its current configuration to an inclination of 2:1 Horizontal:Vertical (H:V). Widening of the existing access road to the west of the existing 69 kV yard is also being considered, in addition to new asphalt concrete (AC) access roads within the proposed 230 and 69 kV yards.

Existing 69kV yard equipment will be removed or demolished for upgrade to a 230 kV yard. Minor cut and fill activities are expected within the existing 69 kV yard, with finish grades ranging from 509 to 513 feet Mean Sea Level (MSL).

The expansion area east of the existing 69kV yard will be graded to develop a pad ranging in elevation from 518 feet MSL to 524 feet MSL that slopes down to the northwest. A lower pad will be developed along the western portion of the expansion area at an elevation of approximately 513 feet MSL to accommodate two transformers. This lower pad elevation is bound on the north, east and south by a retaining wall that reaches a maximum height of approximately 5 feet as shown on Figure 2.

A retaining wall will be constructed south of the existing 69kV yard and the proposed expansion area to provide a 15 foot wide access road surfaced with gravel. The height of the retaining wall will range between 7 and 11 feet. In addition, a proposed screen wall will wrap around the proposed expansion area to the south and east, and partially along the northern side.

1.2 SCOPE OF SERVICES

The scope of services included the following tasks:

- Reviewing previous reports and other available geotechnical references;
- Supporting the SDG&E environmental review process and obtaining a permit from County of San Diego Department of Environment Health;
- Advancing twenty four geotechnical borings with a truck mounted drill rig and five hand auger borings to characterize geologic materials in the site area;
- Performing geotechnical laboratory testing;
- Assessing the geologic and seismic setting and evaluating geologic and seismic hazards, including slope stability, fault rupture potential, strong ground motion, and liquefaction and secondary effects;
- Providing seismic design criteria in accordance with the 2013 California Building Code (CBC) and Institute of Electrical and Electronics Engineers (IEEE) for power facilities;
- Developing geotechnical recommendations for design of shallow and deep foundations, concrete slabs-on-grade, retaining and screen walls and asphalt pavement.
- Providing earthwork recommendations for grading, excavation and backfill;
- Providing considerations for geotechnical related construction; and
- Preparing this geotechnical report.

SECTION 2 GEOTECHNICAL INVESTIGATION

The geotechnical investigation included reviewing published geologic information and previous investigations at the site, as well as evaluating data from new subsurface explorations and laboratory testing.

2.1 PREVIOUS STUDIES

URS previously performed a geotechnical investigation for the original substation and submitted the results in a report titled "Geotechnical Investigation for the Proposed Artesian Substation, San Diego, California," dated November 30, 2000 (URS Project No. 58-9911062M.00-SI001). That investigation advanced two (2) hollow-stem auger borings and six (6) large diameter auger borings to depths of 20 to 65 feet below grade. The exploration locations of that investigation are shown on Figure 2 and logs of the borings are included in Appendix A.

The hollow-stem auger borings were converted to gas monitoring wells (GW-1 and GW-2), with probes installed within the upper and lower elevations to monitor the presence of methane. The soil vapor monitoring of these wells indicated that the upper elevations of the site subsurface have little or no detectable methane; the lower probe in GW-2 detected a minor concentration of methane (25 milligram/milliliter) , which was not considered to be a significant occurrence or hazard.

URS also provided observation and testing activities during the earthwork for the original substation construction. The results were summarized in a report dated August 7, 2003. The site was graded to elevations ranging between 506 and 511 feet MSL. The grading operation removed the overlying Mission Valley Formation and exposed Friars Formation at the pad grade. Further, the existing substation pad was undercut a depth of 3 feet and replaced with a cap of Select Fill per SDG&E specifications.

URS was provided with an as-graded report prepared by Geocon, Inc., dated September 30, 2005, for the development of Black Mountain Ranch Village West – Unit 9. The earthwork performed for that project encompassed the proposed substation expansion area east of the existing substation. Based on a review of that report, the proposed expansion area was characterized as an area underlain by concretionary zones (cemented layers in the formational materials) and was undercut to a depth of 5 feet and replaced with engineered fills. This undercutting of an area with concretionary layers was intended to facilitate future developments that include shallow excavations by removing the difficult-to-excavate layers and zones near the finish grade elevation.

2.2 SUBSURFACE EXPLORATIONS

Field explorations were performed in two phases. The initial phase consisted of a geotechnical boring program that included: a) advancing seven (7) hollow-stem auger borings and five (5) hand auger borings; and b) performing percolation tests in the detention basin and in Boring B-1. Borings

Six (6) hollow stem auger borings were advanced within the proposed expansion area and one (1) was advanced in the vicinity of the proposed steel poles, west of the existing 69kV yard. These borings were advanced to depths ranging from 30 to 41.5 feet below ground surface (bgs). Four (4) shallow borings

were advanced with a hand auger to depths ranging from 2 to 3.5 feet bgs at the locations of the proposed retaining wall and one (1) hand auger (for percolation testing described below) was advanced at the bottom of the detention basin. The investigation was performed between April 28 and May 1, 2015.

The second phase of work consisted of drilling seventeen solid-stem auger borings to better evaluate the presence of concretionary zones within the shallow subsurface of the site area. The borings were extended to depths ranging from 10 feet to 15 feet bgs.

The locations of the explorations are shown on Figure 2, Site Plan.

A URS engineering geologist logged the borings based on visual observations and classified the soils according to the Unified Soil Classification System. Relatively undisturbed driven samples, as well as bulk samples, were collected from the borings. The boring program is discussed further in Appendix B, which also presents the logs of the borings. The descriptions on the logs of borings are based on field logging and laboratory testing.

2.2.1 Percolation Testing

Two (2) percolation tests were performed in the western portion of the site. One was performed at the bottom of the existing detention basin (noted as PT-1 on Figure 2), at a depth of approximately 15 inches below the bottom of the basin; the second was performed in Boring B-1 at a depth of 20 feet. The tests were performed in general accordance with the County of San Diego percolation test procedure. A discussion of the test procedure and results are provided in Appendix B.

2.3 LABORATORY TESTING

The materials encountered in the borings were visually classified and evaluated with respect to relative density or consistency and moisture content. The samples were returned to our geotechnical laboratory for further examination and testing. The visual classifications were further evaluated by performing moisture content, unit weight, and plasticity index tests and grain size analyses. The shear strength of the soil was evaluated by correlating with the blow count data and index test results, as well as performing direct shear tests. The corrosion potential of the soils was evaluated using a suite of chemical tests (sulfate, chlorides, resistivity and pH). Pavement subgrade strength and compaction characteristics were evaluated by performing R-Value and compaction curve (optimum moisture-maximum dry unit weight) tests, respectively. Testing was performed in general accordance with ASTM International (ASTM) standards. Results of the geotechnical laboratory testing are presented at the corresponding sample locations on the boring logs in Appendix B; detailed results of the laboratory testing are presented in Appendix C.

SECTION 3 GEOLOGIC AND SITE CONDITIONS

Knowledge of the site conditions was developed from a review of the local geology and available information and current subsurface explorations.

3.1 GEOLOGIC SETTING

The project site is located within the Coastal Plains sub province of the Peninsular Ranges physiographic province. The site is located approximately nine miles inland, situated along the eastern margin of the coastal plain. This area is characterized by eroded mesa surfaces underlain by Tertiary marine and non-marine sedimentary deposits. These sedimentary deposits are underlain at varying depths by Mesozoic age crystalline bedrock. The crystalline bedrock crops out to the north and east of the site where high relief terrain underlain by bedrock becomes evident.

Previous mapping of the site by Eisenberg (1983) and Tan (1987) suggest that the sedimentary deposits within the site are assigned to the Friars Formation and the overlying Mission Valley Formation. This interpretation is compiled on the 2006 Oceanside Quadrangle map as presented on Figure 3, the Regional Geologic Map. The contact between these Tertiary age sedimentary formations is often gradational in the site vicinity. The primary difference between the two formations is a relative increase in fine grained deposits in the Friars Formation. As interpreted here, the grading for the development of the existing substation and the adjacent commercial lot has removed the overlying Mission Valley Formation in the pad areas of the project.

3.2 TECTONIC AND SEISMIC SETTING

The tectonic setting of the San Diego area is influenced by plate boundary interaction between the Pacific and North American lithospheric plates. This crustal interaction occurs along a broad belt of northwest – trending predominantly right-slip faults that span the width of the Peninsular Ranges and extend into the offshore Intercontinental Borderland province. The major southern California fault systems include the San Andres, San Jacinto, Elsinore and Imperial fault zones to the east and north; the San Clemente, Coronado Bank and Rose Canyon fault zones to the west; and the Agua Blanca and San Miguel fault zones to the south. The locations of these faults are shown on Figure 4, Regional Fault and Epicenter Map.

The Rose Canyon fault zone (RCFZ) is the closest major active fault to the project area and dominates the seismic exposure of coastal San Diego. The primary faults comprising the RCFZ run parallel to the coastline offshore from north to south before extending on land in the La Jolla area. From La Jolla the fault zone continues south along the east margin of Mission Bay to the Old Town area, and farther south toward downtown San Diego and San Diego Bay. At its closest point, the RCFZ is located about 10 miles west of the site.

Together with the Newport Inglewood fault zone, the RCFZ is considered a continuous zone comprised of 7 fault segments with a total length of approximately 130 miles (209 km). Recent studies in the San Diego area have determined an estimated slip rate of 1.5mm/year along the RCFZ (Rockwell, 1991). Estimates of a maximum magnitude earthquake for this fault typically range from 6.75 to 7.25.

3.3 SURFACE CONDITIONS

The existing site area is located along the south side of Camino del Sur and extends from the SDG&E access road on the west to Babcock Street on the east as shown on Figure 2. An existing detention basin is present along the west side of the site, and the existing 69kV yard lies to the east of the detention basin. The proposed expansion area is an existing commercial property that lies to the east of the substation and extends to Babcock Street.

The expansion site area is occupied by a variety of modular buildings and trailers with associated decking and access ramps. The western portion of the expansion site is used for general storage and laydown and currently is occupied by a series of shipping containers, small trailers and stockpiles of materials.

Elevations range from approximately 480 feet MSL in the detention basin to approximately 530 MSL at the southeast corner of the pad. The cut slopes above the pad to the south reach an elevation of approximately 545 feet MSL. The elevations within the existing 69 kV substation range between approximately 509 to 513 feet MSL.

Much of the proposed expansion area is surfaced with gravel, while the southeast portion of the site is currently surfaced with asphaltic concrete (AC). There are existing underground utilities within the expansion area including water and electrical service to the various modular and temporary buildings.

A second, small detention basin is located in the northwest corner of the expansion area.

3.4 SUBSURFACE CONDITIONS

Geologic units underlying the site include fill, Friars Formation (Tf) and Mission Valley Formation (Tmv). These units are described in more detail below. Geologic cross sections A-A' through E-E' are presented on Figures 5, 6, and 7. The locations of the cross sections are shown on Figure 2.

3.4.1 Fill

Engineered fill soils placed as a result of undercuts during previous grading discussed in Section 2.1 were encountered in Borings B-2 through B-24 located within the expansion area. The thickness of the fill is approximately 5 feet over most of the expansion area with localized areas up to approximately 7 feet in thickness. The fills were observed to consist of silty sand and clayey sand with the exception of the upper two feet in Boring B-7; approximately 2 feet of gravel has been placed in that area of the site.

The hand auger borings along the southern slopes encountered sandy formational materials at the ground surface, with the exception of HA-1 and HA-2, which encountered 6 to 12 inches of undocumented fill soils. The fills were observed to consist of silty sand with some gravels and cobbles.

3.4.2 Friars Formation (Tf)

Eocene age sedimentary deposits correlating to the Friars Formation underlie the entire site below the fills placed on the graded pads for the existing substation and the expansion area. The Friars Formation in the site area is characterized by sandstones and siltstones with interbedded claystones. From a geotechnical

perspective, these materials are considered dense and very dense silty sands and poorly graded sands, and hard silts and sandy silts and clays. Previous investigators have mapped this unit as undifferentiated with the Delmar Formation due to the lithologic and stratigraphic similarities.

The as-graded report for the Black Mountain Ranch development (Geocon, 2005) notes that the expansion area lies within a zone of deeper undercut of approximately 5 feet. This undercutting was performed to address potential impacts to future site development and utility installations from the presence of concretionary zones and layers within the shallow subsurface below the rough graded pads.

Concretions are zones or layers of mineral accumulation (typically calcium carbonate, and in some instances silica) that result in a hard layer of cementation. Depending upon hardness and thickness, concretions can present difficult excavation or drilling conditions, including heavy ripping and percussion breakers during excavation and very slow drill rates, rock coring or percussive drilling techniques or in some rare instances have required blasting.

The additional seventeen (17) shallow borings performed during the second phase field work were drilled to further evaluate the presence and character of concretions in the site area. Concretions were encountered in the additional borings as noted in the boring logs and shown on the cross sections. In our opinion, the more significant occurrences of concretionary layers are those layers on the order of one foot in thickness (or greater). Such concretionary zones were encountered within 15 feet of the ground surface in Borings B-3, B-4, B-5, and B-7 during the first phase of drilling. B-3 encountered the most significant occurrence of concretions with an approximately 2-foot thick concretion along with two other layers greater than 1-ft in thickness. Concretionary layers on the order of 1 foot in thickness were encountered in 4 of the additional shallow borings (B-14, B-18, B-19, and B-24). A greater concentration of shallow concretions is noted in the western portion of the expansion site. Thinner concretionary layers on the order of 6-inches thick were encountered in many of the borings.

3.4.3 Mission Valley Formation (Tmv)

Tertiary age sedimentary deposits of the Mission Valley Formation are present along the south slopes above the current pad elevations. The Mission Valley Formation is characterized by generally sandy deposits that are very similar to the sandy materials in the underlying Friars Formation. From an engineering perspective the difference between the two formations is not significant for this project, based on local observations of these materials. Sandy and gravelly deposits were encountered in hand-augers HA-1 through HA-4 to the shallow depths explored. Previous projects in the area have encountered difficult drilling or excavation conditions due to concretions within the Mission Valley Formation.

3.5 GROUNDWATER

Our current subsurface explorations did not extend below the groundwater level. However, moist to wet soil conditions (possibly perched water) were encountered at 37 feet bgs in boring B-2 within the Friars Formation. Previous large diameter bucket borings encountered perched water above impermeable layers. Such layers are common in the Mission Valley and Friars Formations.

SECTION 4 SEISMIC AND GELOGIC HAZARDS

This section presents our evaluations of the seismic and geologic hazards at the site based on the results of the previous and current investigations, engineering evaluations and analyses, and professional judgment.

4.1 FAULT RUPTURE

No active or potentially active faults are noted in the site vicinity. The nearest trace of the RCFZ is located approximately 10 miles (16 kilometers) west of the site. Minor unmapped faults may be present in the Tertiary-age sedimentary bedrock, but these are not considered ground-rupture hazards. Fault rupture is not considered a constraint to site development.

4.2 LIQUEFACTION AND SECONDARY EFFECTS

Liquefaction is a phenomenon in which loose to medium dense, saturated, granular materials undergo matrix rearrangement, develop high pore water pressure, and lose shear strength because of cyclic ground vibrations induced by earthquakes. This rearrangement and strength loss is followed by a reduction in bulk volume of the liquefied soils. The secondary effects of liquefaction include sand boils, settlement, reduced soil shear strength, lateral spreading and global instability (flow slides in areas with sloping ground).

The project site is predominately underlain by dense to very dense sands and cohesive materials within tertiary age geologic units. Further, groundwater is expected to occur at depth within the formational soils. Therefore, the potential for liquefaction at the site should be very low.

Strong ground motion can cause the densification of soils, resulting in settlement of the ground surface. This phenomenon is known as seismically-induced settlement or seismic compaction, which typically occurs in dry, loose cohesionless soils. During an earthquake, soil grains may become more tightly packed due to the collapse of voids or pore spaces, resulting in a reduction in the thickness of the soil column. Given the dense or cohesive nature of the subsurface materials, the potential for seismic compaction at the site is considered very low.

4.3 EXPANSION AND COLLAPSE POTENTIAL

The on-site soils are primarily granular materials with a low potential for expansion, however silt and clay layers are present. These fine grained materials are present locally in the subsurface but will be covered by a three-foot thick engineered granular fill at the ground surface. Therefore, expansive soils are not expected to significantly impact the proposed project.

Loose granular soils can be subject to collapse due to wetting and/or inundation. Collapse can occur in dry granular soils that have an unstable soil structure due to deposition or irrigation processes, typically with a skeletal structure that is weakly cemented by soluble salts or clay. Increases in moisture content can cause the inter-particle cementation to reduce, causing changes in volume (collapse), especially when loaded. The surficial soil underlying the site is primarily engineered fill or dense formational soils. Therefore, the potential for collapse at the site should be considered low.

4.4 OTHER HAZARDS

The local geologic conditions indicate that other geologic hazards are not likely to affect the site. Given the geologic and hydrogeologic setting of the site, the potential for subsidence should be low. The site is not located within a designated flood plain and the flood hazard is considered very low. Similarly, the site is located at a distance of about 10 miles from the coastline, therefore a potential for tsunami is considered very low. There are no significant bodies of water nearby, and the potential for seiches to affect the site is considered very low. These hazards should not constitute constraints to proposed improvements.

SECTION 5 DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

The discussions, conclusions, and recommendations presented in this report are based on the information provided to us, results of previous and current subsurface explorations and laboratory testing, engineering evaluations and analyses, literature research, empirical correlations, and professional judgment.

In our opinion, the project site is geotechnically suitable for the proposed substation expansion. There is a potential to encounter concretions that could locally be resistant to excavation, especially for post-expansion improvements when there is reduced access and smaller equipment may be used for excavation.

This section of the report provides recommendations for design and a discussion of construction considerations.

5.1 EARTHWORK

Earthwork activities at the site are expected to include placement of a select fill cap, additional overexcavation and recompaction to address the presence of concretions, retaining wall backfill, underground trench backfill, placement and compaction of substation wearing course, and subgrade preparation and base placement for AC pavements.

Earthwork should be completed according to SDG&E Standard Specifications and the most recent editions of applicable sections of the County of San Diego grading codes and the Standard Specifications for Public Works Construction (*i.e.,* Greenbook). The following sections provide further recommendations for general earthwork that are specific to the geotechnical conditions encountered.

5.1.1 Site Preparation

Vegetation, AC pavement and other construction debris within areas that are to be graded should be cleared and properly disposed of off-site. Roots and other vegetative matter should be removed and disposed either offsite or stockpiled for reuse in landscape areas. Existing infrastructure, including foundations from the existing 69kV yard equipment should be properly demolished and disposed at an appropriate facility offsite. Areas disturbed by demolition activities should be removed and recompacted to the satisfaction of the Geotechnical Engineer.

Following the clearing of vegetation and debris, and upon completion of removals, the surface within areas to receive fill should be scarified, moisture conditioned as necessary, and compacted prior to fill placement.

5.1.2 Remedial Grading

To provide suitable material for a pad wearing surface and installation of near-surface improvements, we recommend placement of a select fill cap, a minimum of 3 feet thick. The upper one foot of soil, or more, should consist of Class 2 Aggregate Base. Due to the proposed grading, the existing 5-foot thick fill cap will be reduced in thickness, and in some areas eliminated. Additional over-excavation and recompaction of existing native soil below the select fill cap should be considered in limited areas to reduce the potential for concretions to negatively affect future below-grade activities, as discussed below.

Based on the borings performed, the most significant shallow concretionary layers appear to be localized in the western portion of the expansion site.

One approach to minimizing the impact of concretions is to over-excavate during mass grading to a depth greater than the excavation needed for the anticipated future improvements. The excavated materials are replaced as properly compacted fill. In the western portion of the expansion site in the area of the planned transformers where the frequency of concretions in the shallow subsurface appears to be the greatest, we recommend an over-excavation of 5 feet below finish grade. This approach should minimize the potential for difficult excavation for most post grading improvements. Additional over-excavation and recompaction may be considered on other portions of the proposed expansion area, depending on the vertical extents of the planned improvements; however, the frequency and thickness of concretions in others areas of the site within 5 feet of finish grade appear to be relatively minimal, based on the borings performed.

5.1.3 Fill Materials

Soil within the select fill cap should meet the following criteria:

- Contain no rocks or hard lumps greater than 3 inches in maximum dimension;
- Have a well-graded particle size distribution containing at least 40% of material smaller than 1/4 inch in size, and a fines content (percent, by weight, passing the No. 200 sieve) not exceeding 35%.
- Have an Expansion Index (EI) of 50 or less when tested in accordance with ASTM D4829;
- Have a Liquid Limit (LL) less than 30 and a Plasticity Index (PI) less than or equal to 15; and
- Not have any perishable, spongy, deleterious or otherwise unsuitable material.

In addition, as recommended above, the upper one foot of soil should be Class 2 Aggregate Base.

On-site soil that will be excavated as part of the grading activities is expected to consist of sandy clay and clayey/silty sand. The majority of this material is not expected to meet the fines content requirements for select fill, and therefore the need for imported material for the select fill cap should be anticipated. For general fill outside of/below the select fill cap, including any overexcavation and recompaction zones, the existing soil should be suitable for re-use as fill or backfill.

The Geotechnical Engineer should review and test all proposed select fill sources (imported or on-site) before their use.

5.1.4 Fill Placement and Compaction

The surface within areas to receive fill should be scarified, moisture conditioned to above the optimum moisture content, and compacted to not less than 90 percent relative compaction, using the latest version of ASTM D1557 as the compaction standard. Recompacted existing materials and general fill should be moisture conditioned to at least 2 percent above the optimum moisture content and compacted to not less than 90 percent relative compaction.

Fill material should be placed in loose horizontal lifts no thicker than 8 inches, or thinner as needed to achieve the specified relative compaction. Each lift should be compacted to not less than 90 percent relative compaction, using the latest version of ASTM D1557 as the compaction standard.

5.2 RETAINING WALLS

A retaining wall with a maximum height of 4 feet is planned at the location of the transformers between the new 69 kV and 230 kV yards. This wall is expected to be a free-standing cast-in-place concrete or masonry wall.

A retaining wall is also planned along the southern edge of the substation expansion, south of the proposed access road, which will retain a 2:1 H:V cut slope. This wall may be designed as free-standing cast-in-place concrete or masonry walls. However we understand, due to site constraints, top-down wall construction methods such as soldier beam and lagging wall, or soil nail wall may also be considered. Preliminary recommendations are provided below for these alternative wall types.

Retaining walls should be designed for earth and seismic pressures. The development at the top of the slope is located far enough from the proposed wall such that surcharge loading will not impact retaining wall design. Hydrostatic pressures should not develop considering the depth to groundwater and assuming proper drainage behind the walls.

5.2.1 Cast-In-Place Concrete or Masonry Retaining Wall

5.2.1.1 Lateral Earth Pressures

Lateral earth pressures behind proposed retaining walls depend on the allowable wall movement, wall inclination, backfill material and backfill slope. Retaining walls that are free to deflect at the top should be designed for an equivalent fluid weighing 35 and 50 pounds per cubic feet (pcf) for level and 2:1 H:V sloping ground, respectively. This earth pressure assumes the free standing walls will have a vertical back and will retain properly processed, placed and compacted coarse grained soils, exhibiting an internal friction angle of at least 34 degrees. We expect excavated on-site soils will be used as retaining wall backfill below the select fill cap; however, if the processed on-site materials cannot support an internal friction angle of at least 34 degrees, then import soils meeting this criteria may be deemed necessary. They also assume compaction within four feet of the wall will be completed with light hand-held or

equivalent equipment; the lateral pressures would be higher if heavy equipment is used for soil compaction next to the walls.

The seismic pressure increment should be estimated using an inverted triangular distribution equal to 21 pcf. To develop the seismic pressure, the seismic pressure increment should be added to the active earth pressure. The seismic pressure increment was developed using the Generalized Limit Equilibrium (GLE) pseudo-static approach using a horizontal ground acceleration coefficient of 0.19g, equal to one-half the design Peak Ground Acceleration (PGA).

5.2.1.2 Foundations

The foundations for the retaining walls may be designed using the allowable bearing pressures, passive pressures and minimum footing dimensions presented in Section 5.3.1 of this report. Retaining walls footings fully embedded into the Mission Valley Formation may be designed using an allowable passive pressure of 400 pcf. We recommend the footings should be embedded in the formational materials.

5.2.1.3 Subsurface Drainage

Retaining walls that are less than five feet high should have a perimeter drain at the base of the wall. The base drain should be a minimum four-inch diameter perforated pipe. The pipe should be surrounded with at least one cubic foot per lineal foot of pipe of ¾-inch crushed rock wrapped with filter fabric, such as Mirafi 140NL, or approved equivalent.

Retaining walls greater than five feet high should have free draining material along the back of the wall in addition to the base drain. The free draining material should be 12 inches wide, as measured horizontally immediately behind the wall, and should consist of ¾-inch crushed rock or gravel wrapped in filter fabric. Panel drainage systems, such as Miradrain 6000 or equivalent, may be used as an alternative to a pipe and filter drainage system.

Adequate weep holes or collector pipes need to be incorporated into the system to provide an outlet for the drained water. Drainage from collector pipes should be directed to a suitable outlet.

5.2.2 Soldier Beam and Lagging Wall

The existing 2:1 H:V slope along the south side of the substation may be retained using cantilevered drilled and concreted H-piles (soldier piles) with wood lagging between the soldier piles to provide support for "top-down" construction. Given the relatively low wall heights and the retained soil conditions, lateral restraint, such as tiebacks are not anticipated for this wall.

5.2.2.1 Lateral Pressures

The walls should be designed to resist lateral pressure exerted by the retained soils plus any additional lateral forces resulting from loads placed near the top of the excavation or potential sliding movement behind the wall. The cantilever wall may be designed using an equivalent fluid pressure (EFP) of 50 pcf retaining a 2:1 H:V sloping backfill.

5.2.2.2 Seismic Pressures

The seismic pressure increment should be estimated using an inverted triangular distribution equal to 21 pcf. To develop the seismic pressure, the seismic pressure increment should be added to the active earth pressure. The seismic pressure increment was developed using the Generalized Limit Equilibrium (GLE) pseudo-static approach using a horizontal ground acceleration coefficient of 0.19g, equal to one-half the design Peak Ground Acceleration (PGA).

5.2.2.3 Solider Piles

The design of soldier piles that are fully embedded below the bottom of the excavation may use an allowable passive soil pressure of 400 pcf (in terms of EFP) and an allowable shaft resistance of 300 psf.

To account for three-dimensional effects, the area generating the passive resistance can be assumed to have a width equal to twice that of the concreted pile diameter. Soldier pile locations should be drilled and filled with concrete for the full depth of the passive resistance zone. The design value assumes a horizontal surface for the soil mass extending at least 10 feet in front of the face of the pile, or three times the height of the surface generating passive pressure, whichever is greater.

5.2.2.4 Drainage

No groundwater is anticipated within the depth of the cuts. Drainage should be provided at the top of the wall (with brow ditches) to assure hydrostatic pressures do not build up behind the wall.

5.2.3 Soil Nail Wall

In a soil nailed retention system, steel bars or dowels are installed in-situ during excavation of a cut. The multiple levels of bars or dowels interconnect the soil mass so that each potential failure surface is crossed by sufficient reinforcing elements to maintain stability. The face of the cut is typically shotcreted to minimize raveling. The natural cementation that exists in the on-site formational soils is very favorable for soil nailing.

No groundwater is anticipated within the depth of the cuts. Drainage should be provided at the top of the wall (with brow ditches) and behind the shotcrete face (with prefabricated panel drains) to assure hydrostatic pressures do not build up behind the wall. Weep holes should be provided at the bottom of the panel drains.

The soils may be considered moderately corrosive and encapsulated soil nails are recommended for use in such soils. Encapsulation is usually accomplished by grouting the nail tendon inside a corrugated synthetic sheath. In addition, the minimum grout cover between the sheath and the borehole wall should be at least ½ inch.

Preliminarily, the soil nails may be designed using ultimate bond strength of 2,000 psf. The design of the wall may be performed using Geotechnical Engineering Circular No. 7 (FHWA, 2015) available computer programs.

5.3 FOUNDATIONS

At the proposed finished grade levels, the site should be primarily underlain by engineered fill. We understand the transformers, generators, switchgears, circuit breakers, control shelter and the containment pad will be supported on conventional spread or continuous footings, or pad foundations. H- or A-frames and steel poles will be supported on drilled piers.

Recommendations and design considerations for foundations are presented in the remainder of this section.

5.3.1 Shallow Foundations

The recommended minimum foundation embedment is 18 inches below the lowest adjacent grade. The recommended minimum foundation width is 18 inches. Footings or pads dimensioned as recommended and supported on engineered fill may be designed using an allowable soil bearing pressure of 3,000 psf. The bearing capacity may be increased by 500 psf for every one foot increase in foundation width[1], and by 1,000 psf for every one foot increase in embedment, but not exceeding 5,000 psf. For small, shallow pads with embedments of 6 to 12 inches, an allowable bearing pressure of 2,000 psf may be used. Allowable bearing pressures may be increased by one third for short term wind or seismic loads. The footings should be fully embedded in engineered fill and should not transition between fill and formational soils.

Resistance to lateral loads on the shallow foundations may be provided by passive resistance along the outside face of the foundation and frictional resistance along the bottom of the foundation. The allowable passive resistance may be taken as equivalent to a fluid weighing 300 pounds pcf for foundations poured neat against existing fill or native materials. An allowable friction coefficient of 0.4 may be used with the dead load to compute the frictional resistance of foundations. If frictional and passive resistances are combined, the allowable friction coefficient should be reduced to 0.3.

The upper 12 inches of soil should be neglected in passive pressure calculations in areas where there will be no hardscape that extends from the outside edge of the foundation to a horizontal distance equal to three times the foundation depth. The resistance from passive pressure should be neglected where utilities or similar excavations may occur in the future.

[1] For example, every foot increase in width beyond 18 inches for continuous footings increases the bearing pressure by 500 psf. For isolated pad foundations, both the length and width should be increased by one foot to increase the bearing pressure by 500 psf.

A maximum total settlement of ½-inch and a differential settlement of ¼-inch have been estimated for uniformly loaded foundations designed for the allowable vertical foundation pressures and other recommendations provided in this report. This settlement is the result of elastic compression of the underlying soil. The majority of the settlement due to loading should occur during construction. Settlement estimates assume that appropriate reinforcement is provided to distribute concentrated loads across the foundation.

5.3.2 Deep Foundations

We anticipate that some new substation equipment may be supported on drilled pier foundations. Drilled pier foundations should have a minimum diameter of 18 inches and a minimum length of eight feet. Axial design recommendations have not been provided in this report since it is expected that design of the equipment would be controlled by lateral loading.

We understand the lateral load resistance of drilled piers subject to high overturning moment loading will be evaluated using the Electric Power Research Institute (EPRI) computer program, Moment Foundation Analysis and Design (MFAD). The design soil parameters required to use the MFAD program include:

- Soil Layer Depths;
- Groundwater Depth;
- Total Unit Weight;
- Internal Friction Angle;
- Cohesion;
- Deformation Modulus; and
- Strength Reduction Factor.

Estimates of the required parameters were developed based on the results of our site observations, subsurface explorations, laboratory testing, engineering evaluation and analysis, empirical correlation, literature research, and professional judgment. The estimated design parameters are presented in the table below. It should be noted that the design parameters presented in the table are intended for use in the MFAD computer program and may not reflect actual strengths. Pressuremeter testing was not performed as part of this project; deformation modulus (E_p) values are provided based on experience with similar materials.

Table 1
Recommended MFAD Design Parameters
SDG&E Artesian Substation Expansion

Location	Material Type	Depth Below Finish Grade (feet)	Unit Weight (pcf)	Friction Angle (degrees)	Cohesion (psf)	Deformation Modulus, E_p (ksi)	Shear Strength Reduction Factor, α
Proposed Expansion Area (future 69 kV yard)	Fill	0 to 5	125	34	200	2.0	1.0
	Friars Formation	>5	125	34	400	4.0	1.0
Proposed 230 kV yard (existing 69 kV yard)	Fill	0 to 4	125	34	200	2.0	1.0
	Friars Formation	>4	125	34	400	4.0	1.0
Proposed Steel Poles (230 kV Loop-In structures)	Weathered Friars Formation	0 to 10	125	34	400	3.0	1.0
	Friars Formation	>10	125	34	400	4.0	1.0

* Recommend Neglect = 1 foot

The fill thickness in the proposed expansion area should be evaluated based on the adopted concretion mitigation option.

Groundwater will likely be deeper than the bottom of the deep foundations and does not need to be considered in the analyses.

5.4 CONCRETE SLABS-ON-GRADE

A modulus of vertical subgrade reaction of 150 pounds per cubic inch (pci) may be used to design the concrete slabs-on-grade constructed on engineered fill. The Structural Engineer should design the thickness and reinforcement of concrete slabs-on-grade to accommodate concentrated loads and heavy distributed loads. Expansion joints and crack control sawcuts should be included at regular intervals.

Groundwater is expected to be below the planned improvements and special waterproofing measures are not anticipated for interior floor slab of the control shelter. However, waterproofing should be considered if minor moisture seepage through the floor slab due to external water sources, such as landscaping or ponding water, is a concern.

5.5 FLEXIBLE PAVEMENTS

AC paving may be utilized for the access roads within the substation that may be subject to automotive and heavier service truck loads. Therefore, we have evaluated pavement structural sections for a range of Traffic Indices (TI) of 5.5, 6.5 and 7.5. Further analysis should be performed when an appropriate TI is evaluated by the project Civil Engineer.

The structural design of flexible AC pavement depends primarily on anticipated traffic conditions, subgrade soils, and construction materials. R-Value tests were performed on near-surface bulk samples collected in our borings, which resulted in R-Values ranging between 9 and 23.

Recommended pavement structural sections were developed using an R-value of 15 as representative of the as-graded conditions (engineered fill), and are presented below. These recommendations are considered conservative and confirmatory R-value tests should be completed on samples obtained from the final subgrade materials (on-site or import) where pavements are planned.

Table 2
Recommended Asphalt Pavement Sections
SDG&E Artesian Substation Expansion

Traffic Index	Recommended Asphalt Thickness (in)	Recommended Class 2 Aggregate Base Thickness (in)
5.5	3.0	10
6.5	4.0	12
7.5	4.5	14

We understand, to be consistent with other substation access road design, it is SDG&E's intent to design the access roads for a TI or 5.5 using 4 inches of AC. We recommend the desired 4 inches of AC be underlain by 8 inches of Class 2 aggregate base to support the proposed traffic load.

The recommended sections assume properly prepared subgrade consisting of at least 12 inches of subgrade soils compacted to a minimum of 95% relative compaction, using the latest version of ASTM D1557 as the compaction standard. The Class 2 aggregate base materials should be placed at a minimum relative compaction of 95 percent. Construction materials (asphalt and aggregate base) should conform to the current Standard Specifications for Public Works Construction (Green Book) or Caltrans Standard Specifications. We recommend that a qualified geotechnical professional observe and test the compaction of subgrade and base materials.

5.6 SURFACE DRAINAGE

Measures should be taken to properly finish grade the site to direct surface water away from foundations, floor slabs and pavement areas.

5.7 STORMWATER CONSIDERATIONS

We understand that the existing detention basin will be expanded within the project area. Based on the results of the percolation tests, an infiltration rate of 4×10^{-4} cm/sec may be used to design the detention basin.

5.8 SEISMIC DESIGN

5.8.1 Strong Ground Motions and CBC Seismic Parameters

The project area will likely be subject to moderate to severe ground shaking in response to a local or more distant large-magnitude earthquake occurring during the expected life of the proposed facilities.

For design in accordance with the 2013 CBC (based on ASCE 7-10), the following parameters should be used. These parameters are developed in the code based on Risk-Targeted Maximum Considered Earthquake (MCE_R) ground motion response accelerations. The evaluation of these parameters assumes a Site Classification C, based on the encountered subsurface conditions.

Table 3
2013 CBC Seismic Coefficients (based on ASCE 7-10)
SDG&E Artesian Substation Expansion

Parameter	Value	Reference
Site Class	C	ASCE 7-10, Table 20.3-1
Mapped Spectral Acceleration - Short Period, S_s (g)	0.946	2013 CBC Figure 1613.3.1(2)[1]
Mapped Spectral Acceleration - 1 Sec. Period, S_1 (g)	0.370	2013 CBC Figure 1613.5(4)[1]
Site Coefficient - Short Period, F_a	1.022	2013 CBC Table 1613.3.3(1)[1]
Site Coefficient - 1 Sec. Period, F_v	1.430	2013 CBC Table 1613.3.3(2)[1]
MCE[2] Spectral Response Acceleration - Short Period, S_{MS} (g)	0.966	2013 CBC Equation 16-37, $S_{MS}=F_aS_S$
MCE[2] Spectral Response Acceleration - 1 Sec. Period, S_{M1} (g)	0.529	2013 CBC Equation 16-38, $S_{M1}=F_vS_1$
Design Spectral Response Acceleration - Short Period, S_{DS} (g)	0.644	2013 CBC Equation 16-39, $S_{DS}=2/3*S_{MS}$
Design Spectral Response Acceleration - 1 Sec. Period, S_{D1} (g)	0.352	2013 CBC Equation 16-40, $S_{D1}=2/3*S_{M1}$

Notes:
1. Calculated using U.S. Seismic Design Maps web application developed by USGS.
2. MCE – Maximum Considered Earthquake.
3. Site coordinates estimated from 'Google Earth' computer program used to evaluate coefficients: 33.02074; -117.13352.

5.8.2 Substation Equipment Seismic Qualification Level

The selection of the seismic qualification level for the performance evaluation of substation equipment is described in IEEE Standard 693-2005 (IEEE, 2006). IEEE provides for the use of the low, moderate or high qualification levels based on the peak ground acceleration level at the site. We understand it is current SDG&E practice to assign a "high" seismic qualification level at all of their substations.

5.9 CORROSION POTENTIAL

Laboratory testing on near surface soil samples resulted in electrical resistivity ranging from 464 to 1,852 ohms-centimeter (ohm-cm); these soils may be considered "moderately to very corrosive" to metallic utility piping and conduits. The results of the near-surface tests, summarized in Table 4 below, indicate that the soil has a considerable to severe potential for sulfate attack to concrete and a potential for chloride attack to concrete.

Table 4
Summary of Corrosivity Test Results
SDG&E Artesian Substation Expansion

Boring	Depth (feet)	pH	Minimum Resistivity (Ohm-cm)	Sulfate Content (ppm)	Chloride Content (ppm)
B-1	2.5	8.3	1,852	198	6.3
B-3	5	7.3	812	64	97
B-4	40	4.1	464	1,050	242
B-5	25	4.7	508	16,600	116
B-6	2.5	7.7	808	289	219
B-7	3.0	7.3	880	126	65

Notes:
(1) ppm = parts per million, ohm-cm = ohm-centimeter.

A corrosion engineer should be consulted for design recommendations. The type of concrete and corrosion protection for steel should be determined by the structural and/or corrosion engineer.

5.10 CONSTRUCTION CONSIDERATIONS

5.10.1 Excavation Characteristics

Excavations will be in fill and formational soils, consisting typically of medium dense to very dense sand and silty sand with layers of hard silt and clay. Concretionary (cemented) layers or zones may be present below the select fill cap and any overexcavated and recompacted soil. The concretionary (cemented) layers will present difficult and potentially very difficult excavation conditions, depending upon the thickness and lateral extent of the cemented layer and the equipment being used to excavate or drill.

Foundation and trench excavations that would extend into the undisturbed formational soils may encounter difficult excavation characteristic as a result of the concretions. Conventional earth moving equipment (bulldozers, scrapers, etc.) should be able to excavate the formational materials with moderate effort except for the concretionary layers, which will require greater effort and will generate oversized material and require special handling. Previous and current borings indicate the presence of concretions ranging from 1 to 2 feet in thickness at the drilled locations. The need for blasting is not anticipated given the subsurface information available, although there is could be a need for heavy ripping during excavation.

This assessment assumes that the excavating equipment is well maintained and operating at factory-specified efficiencies. The choice of excavation method is often a function of economics, level of desired effort, logistics, quality and size of machinery used, permit conditions, and contractor convenience.

5.10.2 Drilled Pier Construction

Construction of drilled pier foundations should be performed in accordance with SDG&E Specification S-76 and ACI 336.1. Groundwater is not expected to occur in quantities that could require "wet" construction methods. Localized zones of coarse-grained soils that could experience caving during drilling could be encountered during construction. Difficult drilling conditions resulting from concretionary layers will likely be encountered in the site area. This could result in refusal to augering and requiring coring or percussive drilling methods to penetrate concretionary layers.

The founding level of drilled piers should be cleaned of all loose or softened material, debris, or other substances that may cause settlement or affect the concrete strength. The bottom of the shaft and the excavation should be dry prior to placing concrete.

Concrete should be placed in excavations in a manner that precludes segregation of particles and any other occurrence that may decrease the strength of the concrete. Caving soils should not be allowed to mix with the fresh concrete.

5.10.3 Temporary Slopes

The design and construction of temporary slopes, as well their maintenance and monitoring during construction, is the responsibility of the Contractor. The Contractor should have a geotechnical or geological professional evaluate the soil conditions encountered during excavation to determine permissible temporary slope inclinations and other measures as required by California OSHA (Cal/OSHA). The Contractor's geotechnical or geological professional may use the factual information provided in this report, as well as any additional data they may need to acquire, to assess the stability of temporary slopes and prepare a specific temporary slope analysis and/or develop parameters to design temporary support systems.

Based on the existing data interpreted from site reconnaissance and subsurface exploration, the design of temporary slopes and benches for planning purposes may assume the conditions summarized below.

Table 5
Cal/OSHA Soil Types
SDG&E Artesian Substation Expansion

Geological Unit	Cal/OSHA Soil Type
Fill	Type C
Mission Valley / Friars Formation	Type C

Existing infrastructure that is within a 2:1 H:V line projected up from the bottom edge (toe) of temporary slopes should be monitored during construction.

The Contractor should note the materials encountered in construction excavations could vary significantly across the site. The above assessment of Cal/OSHA soil type for temporary excavations is based on preliminary engineering classifications of material encountered in widely spaced explorations. The Contractor's geotechnical or geological professional should observe and map mass excavations and temporary slopes at regular intervals during excavation and assess the stability of temporary slopes, as necessary.

The tops of all excavations should be graded to prevent runoff from entering the excavation. Temporary slopes should not be allowed to become soaked with water or to dry out. Surcharge loads should not be permitted near the edge of excavations; they should be located a horizontal distance greater than the depth of the cut, measured horizontally from the top edge of the excavation, unless the cut is properly shored and designed to accommodate the surcharge.

We understand there is a Right-of-Way constraint behind the retaining wall and the wall designer desires to utilize a steeper temporary slope than that recommended based on Cal/OSHA soil type in this Section. Preliminary stability analyses of the temporary excavation with a 2-foot vertical cut at the toe followed by a slope inclined at ¾:1 H:V with a maximum height of 9 feet was performed by URS. The stability analyses were completed using Spencer's method of limit equilibrium slope stability analysis, as incorporated in the SLOPE/W software from GeoSlope, Inc. The calculated minimum Factor of Safety (FOS) met the typically accepted minimum FOS of 1.1 for temporary conditions; results of our analyses are attached to this letter. The analyses used an effective cohesion (c') of 200 pounds per square foot (psf) and effective internal friction angle (φ') of 32 degrees. The slope stability analysis did not consider static groundwater or seepage pressures.

Based on our evaluation, the temporary slopes should be stable if formed at an inclination of ¾:1 H:V (or flatter) with a 2-foot vertical cut at the toe. There may be local raveling and sloughing of the slope surface where pockets of coarse grained materials with few cohesive fines are encountered. Recommendations for maintenance are provided below:

- A Geologist from URS should periodically observe the face of the excavated temporary slope.
- The Contractor shall provide safe working conditions in accordance with Cal/OSHA requirements.
- Surface drainage should be directed away from the slope. Surface drainage should not run over the face of the temporary slope or pond at the crest of the slope.
- All sources of construction surcharge loads should be kept away from the crest of the temporary slope a horizontal distance that is greater than the maximum height of the slope. There should be provisions at the crest of the temporary slope to prevent debris from falling into the excavation.
- A "Competent Person" as defined by Cal/OSHA and designated by Contractor should inspect the temporary slope at least twice daily, or more frequently if required by Cal/OSHA and other reasons (e.g., inclement weather), for evidence of groundwater seepage and movement or other forms of distress. If groundwater seepage, movement or other forms of distress are observed, the Contractor should take all necessary steps to avoid further groundwater seepage, movement or

distress, including suspending activities in the affected area, with the exception of those activities that may be needed to avoid further groundwater seepage movement or distress. The Contractor should immediately report their observations and proposed remedial actions to URS' Geotechnical Engineer. The Contractor should not resume activities until demonstrating that it is safe to do so.

5.11 CONSTRUCTION OBSERVATION AND TESTING

Earthwork and placement of engineered fill should be performed under the observation and testing services of a geotechnical professional supervised by a California-registered Geotechnical Engineer. Tests should be taken to determine the in-place moisture and relative compaction of engineered fill.

A geotechnical or geological professional should observe the construction of the retaining walls that are ultimately selected for the site.

All foundation excavations, and slab and pavement subgrade soils, should be continuously observed by a geotechnical or geologic professional prior to placement of steel and concrete to observe that the subgrade is satisfactory. Foundation excavations should be free of soft, loose and disturbed soils.

A geotechnical or geological professional should observe the construction of each drilled pier under the supervision of a California-registered Geotechnical Engineer. Daily drilled pier observation and construction records should be maintained.

A California-registered Geotechnical Engineer should prepare a final report of foundation installation, and earthwork testing and observation.

SECTION 6 LIMITATIONS

URS has observed only a very small portion of the pertinent subsurface conditions. The recommendations presented in this report are based on the assumption that soil and geologic conditions do not deviate appreciably from those observed in the previous and current subsurface explorations.

We recommend that URS provide observation and testing during fill placement, subgrade preparation and aggregate base placement under concrete slabs and pavements, utility trench backfill, foundation excavations, and other forms of geotechnically significant types of construction to evaluate if the site conditions are as anticipated, or to provide revised recommendations, if necessary. If variations or undesirable geotechnical conditions are encountered during construction, URS should be consulted for further recommendations.

This report is not a contractual statement of geotechnical conditions (baseline report). The contractor should make their own interpretations regarding construction conditions (e.g., excavation characteristics) using the factual information provided in this report.

Geotechnical engineering and the geologic sciences are characterized by uncertainty. Professional judgments presented herein are based partly on our understanding of the proposed construction, and partly on our general experience. Our engineering work and judgments rendered meet current professional standards; we do not guarantee the performance of the project in any respect.

SECTION 7 REFERENCES

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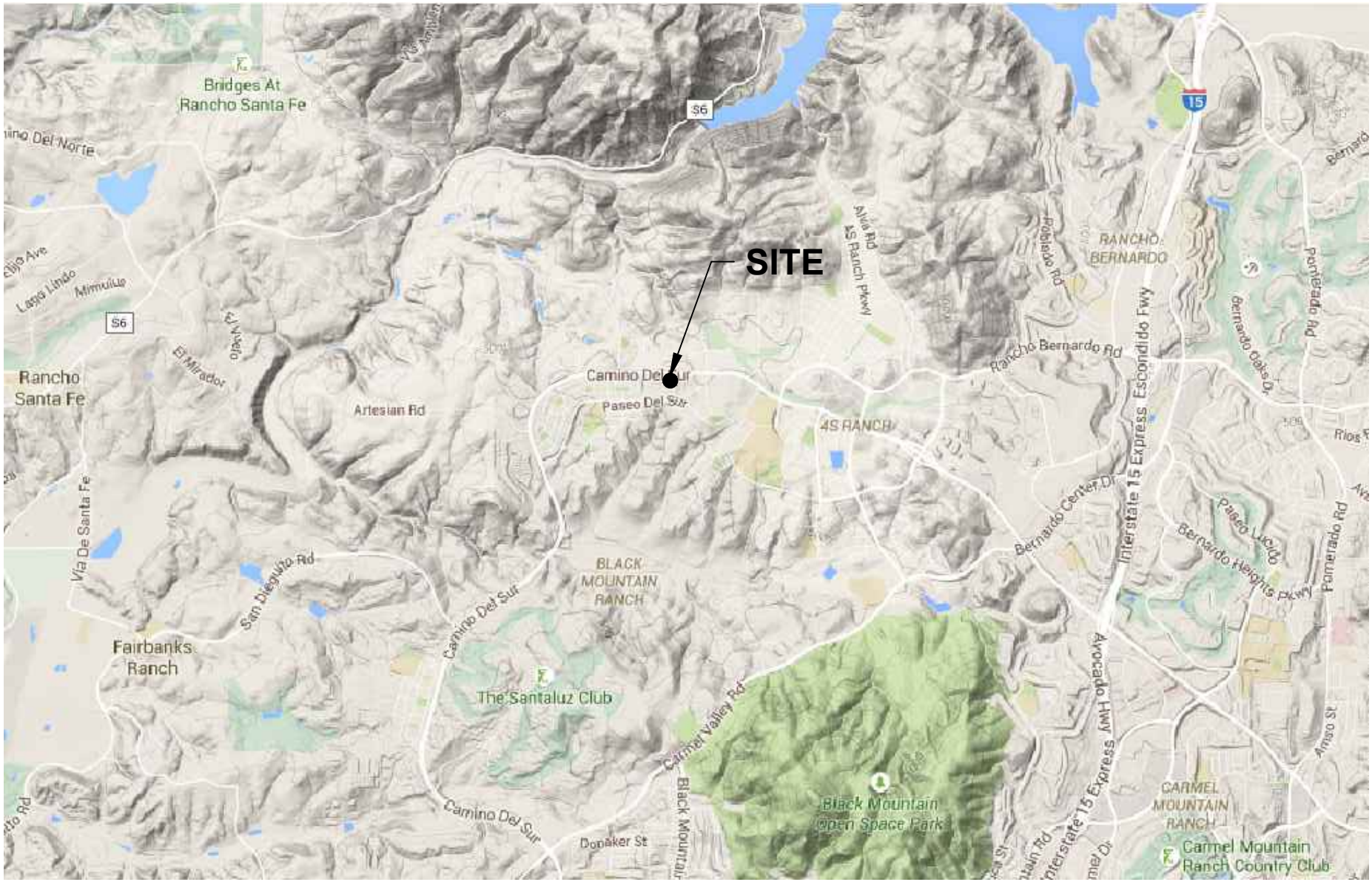

REFERENCE: Google Maps, 2015

VICINITY MAP
SDG&E ARTESIAN SUBSTATION EXPANSION
SAN DIEGO COUNTY, CALIFORNIA

URS	NOT TO SCALE	CHECKED BY: PB	DATE: 06-04-15	FIG. NO: 1
		PM: MEH	PROJ. NO: 27661515.40000	

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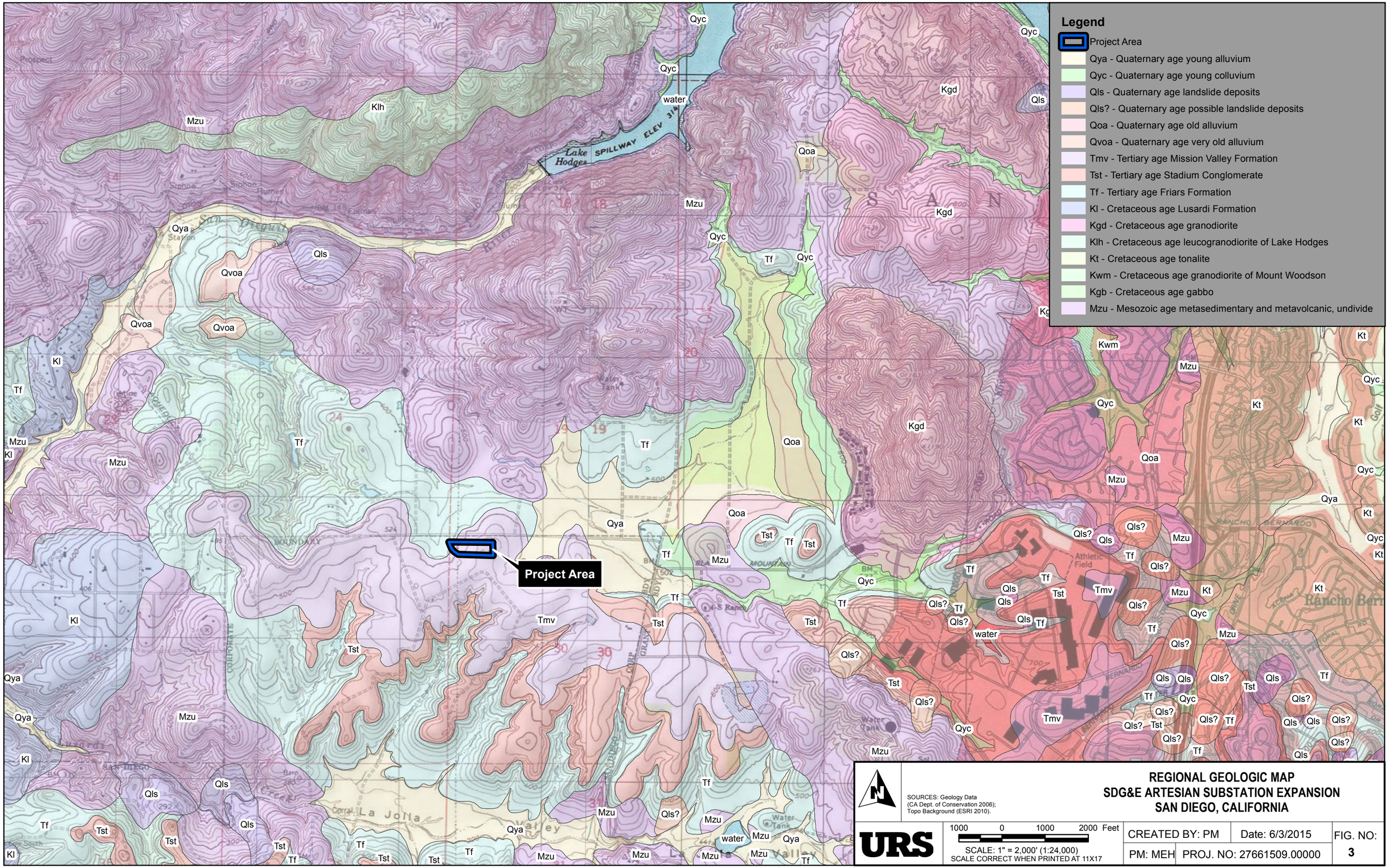
FIGURE 2 – SITE PLAN AND GEOLOGIC MAP

FIGURE 2 HAS BEEN OMITTED – IT HAS BEEN SUBMITTED UNDER CONFIDENTIAL COVER

(Privileged and Confidential pursuant to P.U. Code 583, 454.5(g), GO 66-C and D.06-06-066)



SOURCES: Geology Data (CA Dept. of Conservation 2006); Topo Background (ESRI 2010).

REGIONAL GEOLOGIC MAP
SDG&E ARTESIAN SUBSTATION EXPANSION
SAN DIEGO, CALIFORNIA

URS

1000 0 1000 2000 Feet

SCALE: 1" = 2,000' (1:24,000)
SCALE CORRECT WHEN PRINTED AT 11X17

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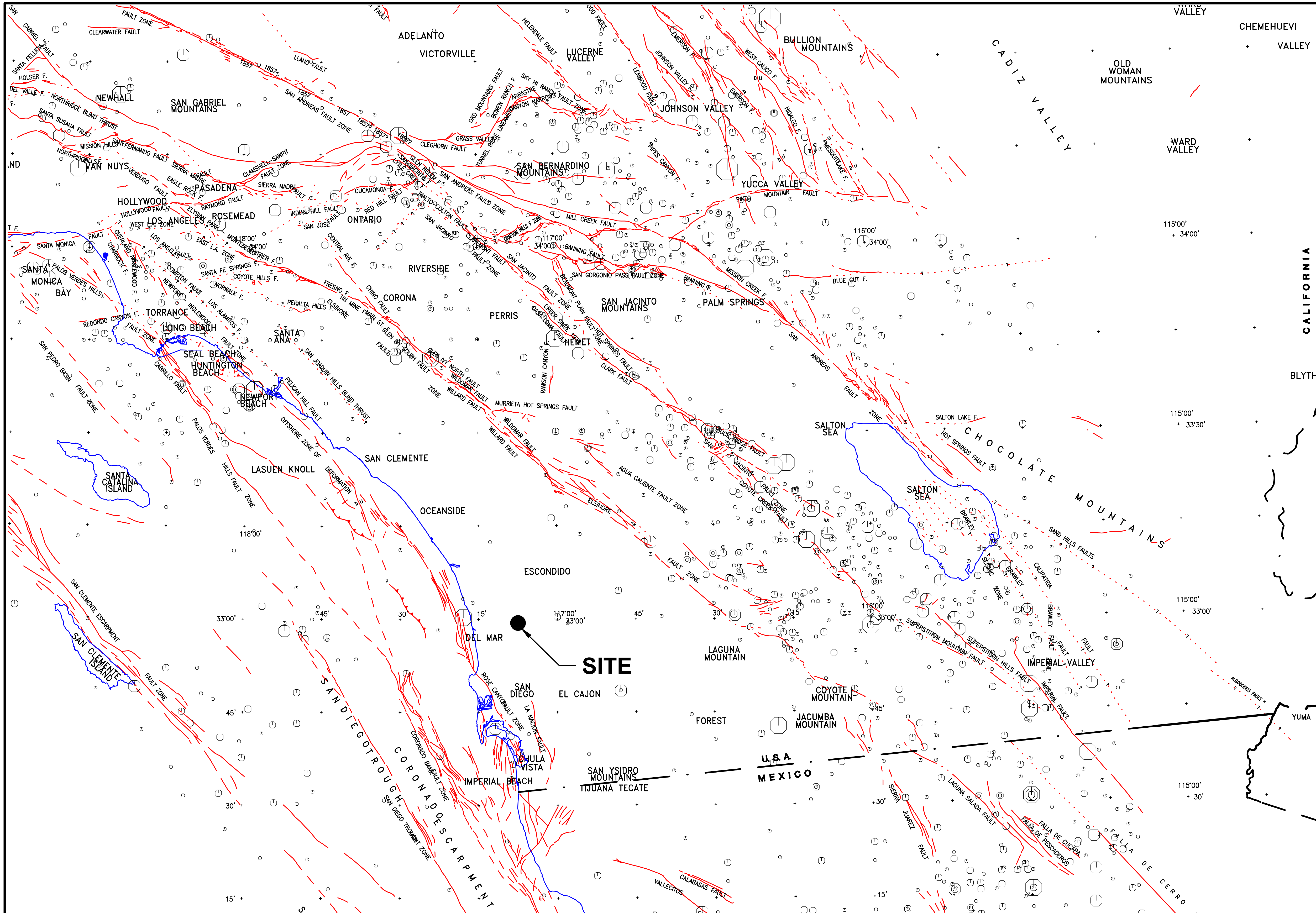

LEGEND:

REPORTED EARTHQUAKE MAGNITUDES.

- 4.0 TO 4.9
- 5.0 TO 5.9
- 6.0 TO 6.9
- 7.0 AND GREATER

SOUTH OF LATITUDE 35°N, EPICENTER AND MAGNITUDE DATA ARE FROM THE CALIFORNIA GEOLOGICAL SURVEY (2000) EARTHQUAKE CATALOG FOR THE PERIOD FROM 1769 TO 2000. ONLY EARTHQUAKES OF MAGNITUDE 4.0 AND LARGER ARE SHOWN. AFTERSHOCKS ARE NOT INCLUDED.

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APPROXIMATE LOCATION OF HOLOCENE AND PLEISTOCENE FAULTS, DOTTED WHERE CONCEALED, QUERIED WHERE CONJECTURAL. FAULT LOCATIONS BASED ON: ZIONY AND JONES, 1989; CDMG GEOLOGIC MAP SERIES OF CALIFORNIA, 1977–1986 (1:250,000 SCALE); CDMG GEOLOGIC MAP SERIES, CALIFORNIA CONTINENTAL MARGIN, 1987 (1:250,000 SCALE); HAUKSSON, 1990; SHAW AND SHEARER, 1999; WRIGHT, 1991; GRANT ET AL. 1999.

REGIONAL FAULT AND EPICENTER MAP
SDG&E ARTESIAN SUBSTATION EXPANSION
SAN DIEGO COUNTY, CALIFORNIA

URS

15 0 15 30 km SCALE: 1"= 30 kilometers	CHECKED BY: PB	DATE: 06-04-15	FIG. NO: 4
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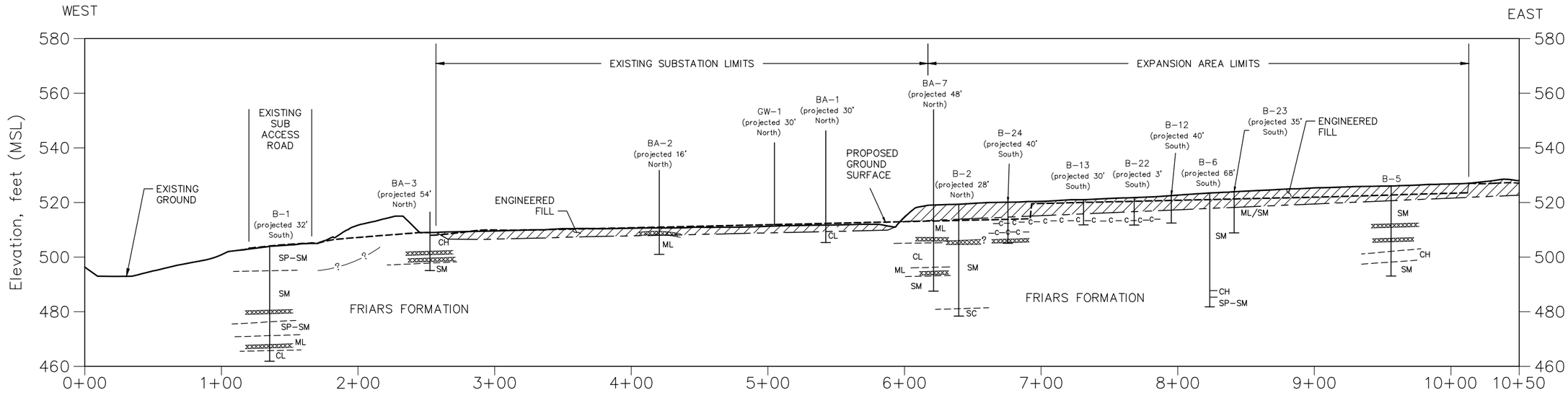
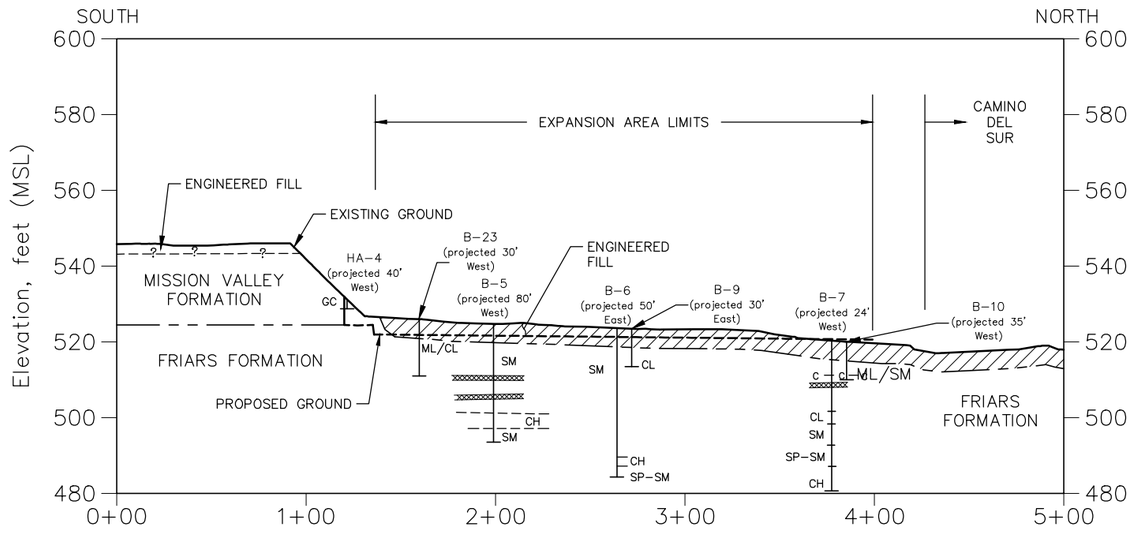


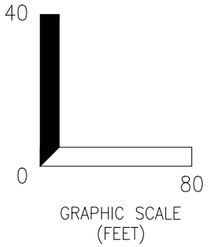
SECTION A-A'



SECTION B-B'

LEGEND

- EXISTING GROUND SURFACE
- PROPOSED GROUND SURFACE
- GEOLOGIC CONTACT
- SM — BORING STICK LOGS WITH UNIFIED SOIL CLASSIFICATION SYMBOL
- CONCRETIONARY ZONES
- —C—C—C—C— MINOR CONCRETIONARY ZONE (≤ 6" THICK)

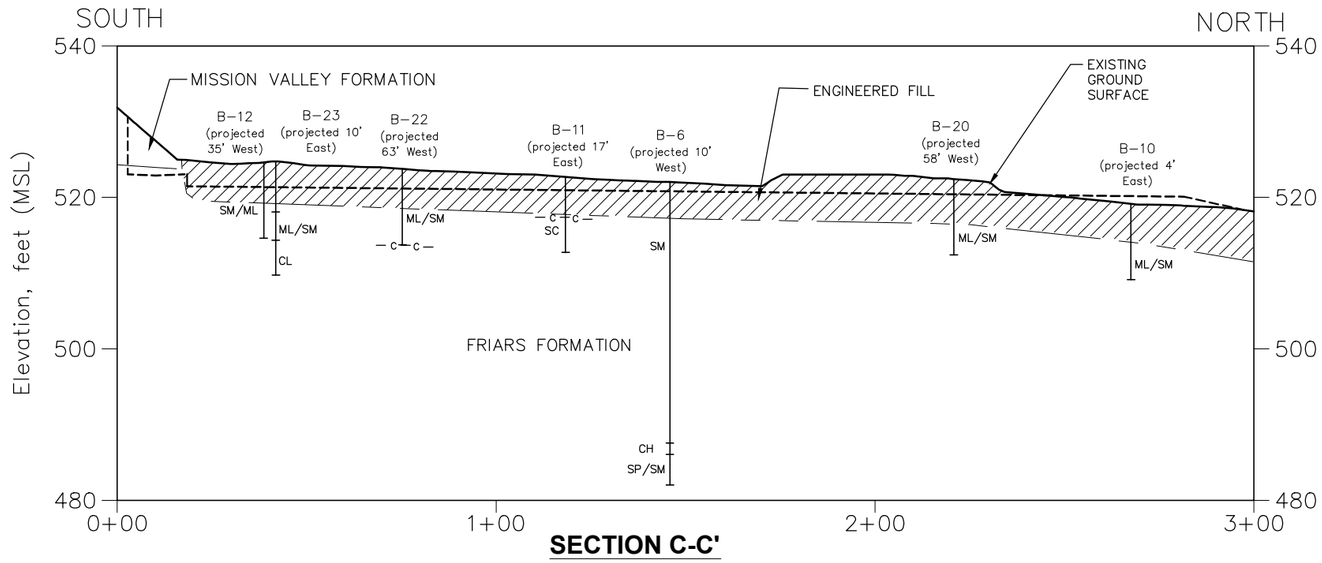


GEOLOGIC CROSS-SECTIONS A-A' AND B-B'
SDG&E ARTESIAN SUBSTATION EXPANSION
SAN DIEGO, CALIFORNIA

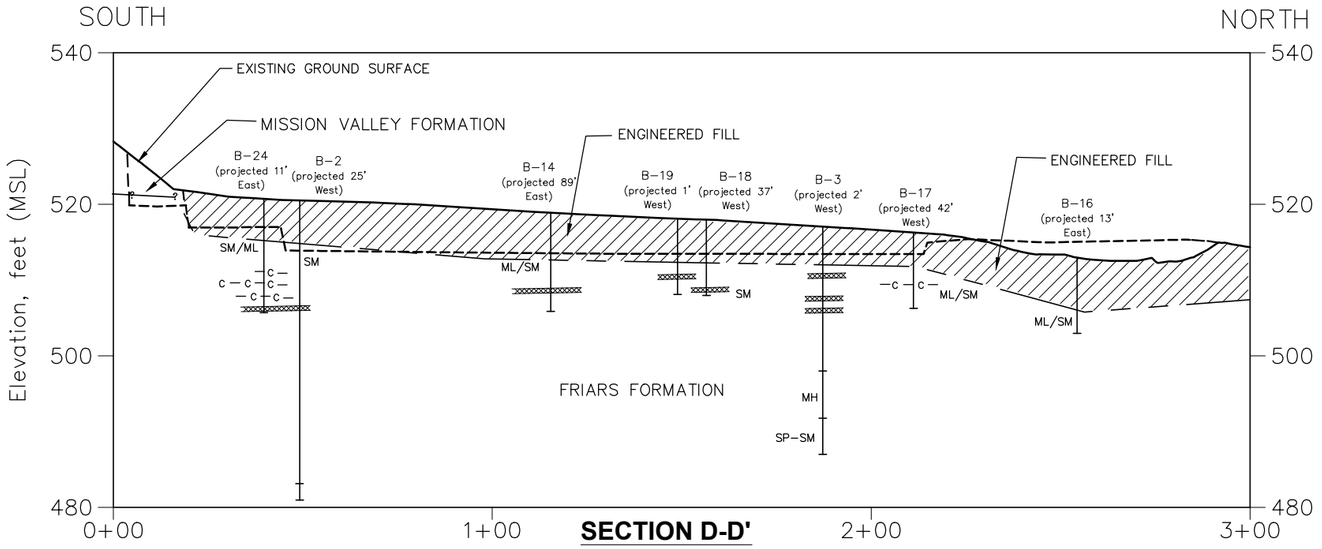
URS

CHECKED BY: PB	DATE: 09-24-15	FIG. NO:
PM: MEH	PROJ. NO: 27661515.40000	5

U:\Projects_Jobs\27661515 (60398881) TSAC SDG&E 11004 Artesian Substation\012 GIS MAPS & CAD\Revised Drawings 5-29-15\Figure 2_Site Plan.dwg Sep 24, 2015 - 3:00pm



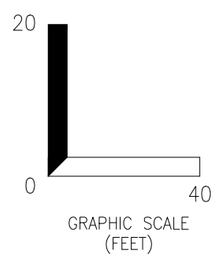
SECTION C-C'



SECTION D-D'

LEGEND

- EXISTING GROUND SURFACE
- PROPOSED GROUND SURFACE
- GEOLOGIC CONTACT
- SM — BORING STICK LOGS WITH UNIFIED SOIL CLASSIFICATION SYMBOL
- CONCRETIONARY ZONES
- —C—C—C—C— MINOR CONCRETIONARY ZONE (< 6" THICK)



GEOLOGIC CROSS-SECTIONS C-C' AND D-D'
SDG&E ARTESIAN SUBSTATION EXPANSION
SAN DIEGO, CALIFORNIA

URS	CHECKED BY: PB	DATE: 09-24-15	FIG. NO: 6
	PM: MEH	PROJ. NO: 27661515.40000	

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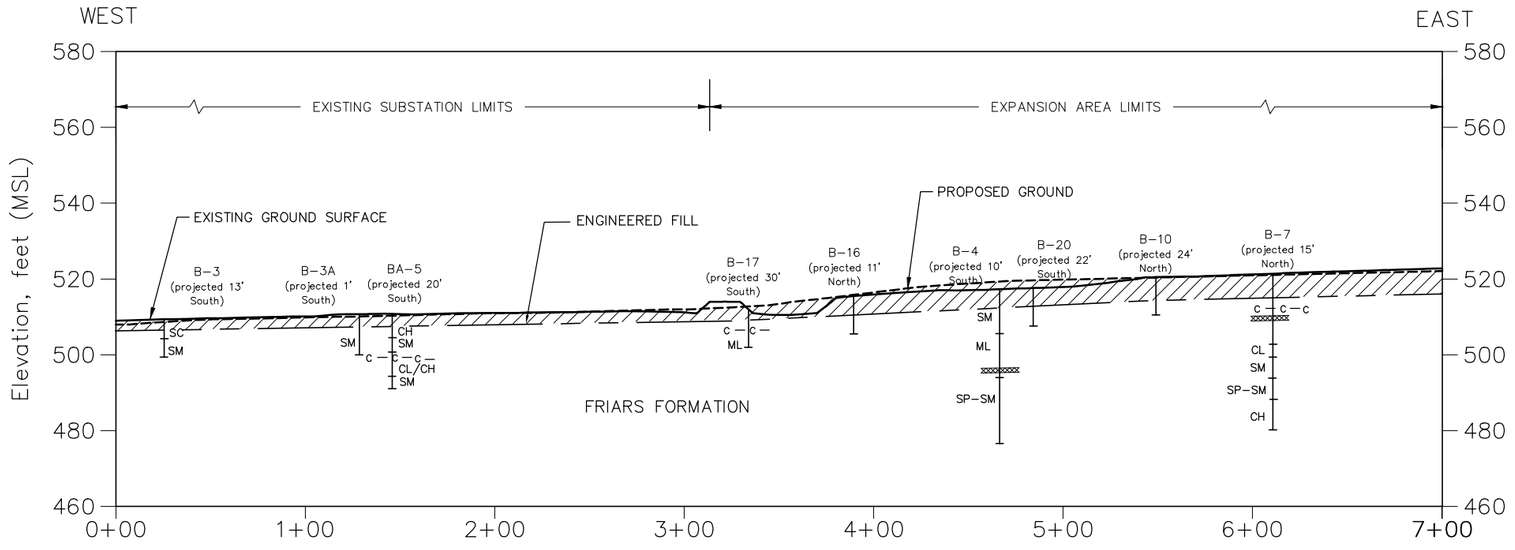
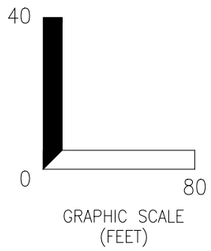


SECTION E-E'

LEGEND

- EXISTING GROUND SURFACE
- PROPOSED GROUND SURFACE
- GEOLOGIC CONTACT
- SM — BORING STICK LOGS WITH UNIFIED SOIL CLASSIFICATION SYMBOL
- CONCRETIONARY ZONES
- —C—C—C—C— MINOR CONCRETIONARY ZONE (< 6" THICK)



GEOLOGIC CROSS-SECTION E-E'
SDG&E ARTESIAN SUBSTATION EXPANSION
SAN DIEGO, CALIFORNIA

URS

CHECKED BY: PB	DATE: 09-24-15	FIG. NO: 7
PM: MEH	PROJ. NO: 27661515.40000	

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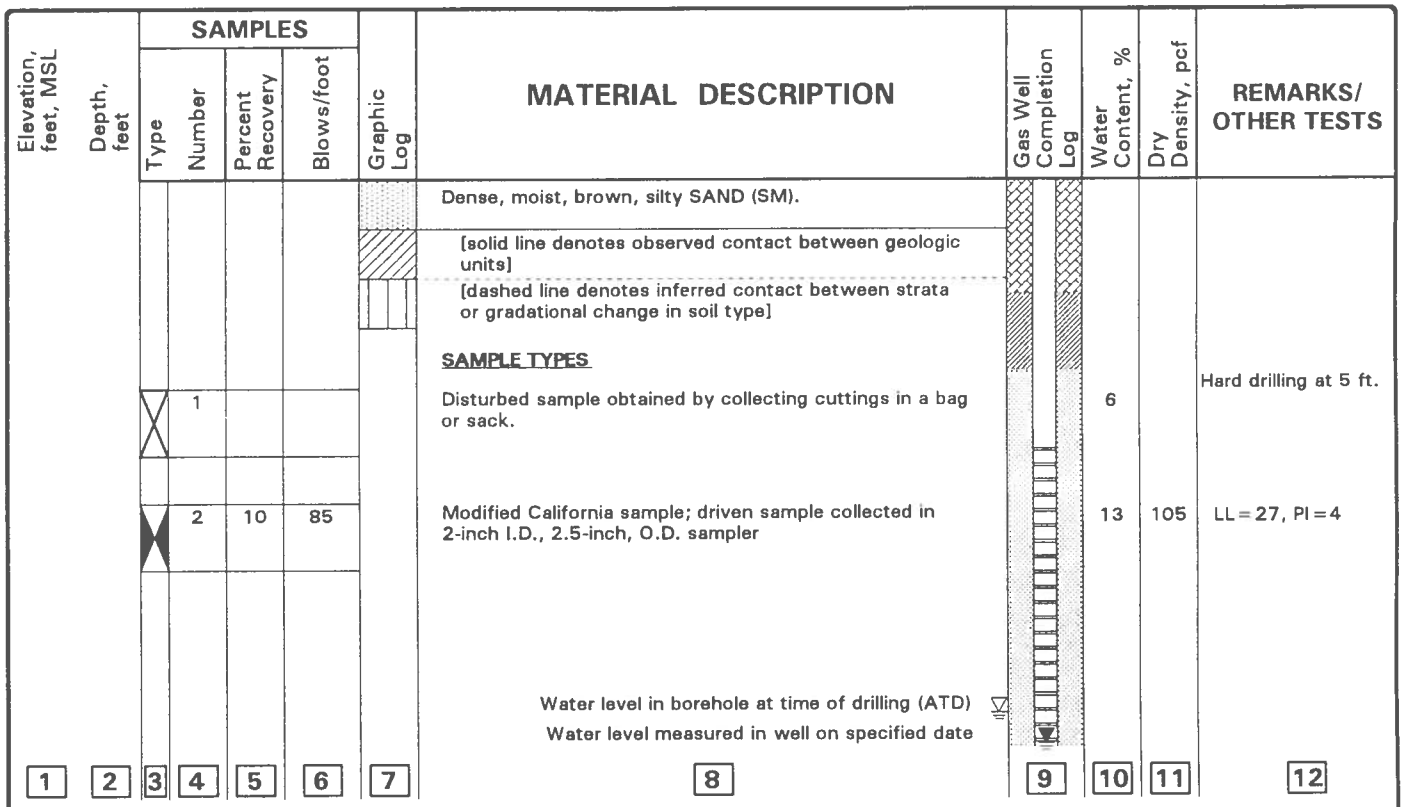
Boring logs from the previous investigation (URS, 2000) for the existing 69 kV yard are provided in this appendix. Additional geotechnical data, including boring logs from other areas of the site and laboratory test data are included in the original report.

Project: SDG&E Artesian Substation
Project Location: San Diego, CA
Project Number: 58-9911062M.00-SI001

Key to Log



COLUMN DESCRIPTIONS

1	**Elevation:**	Elevation (in feet) with respect to arbitrary site datum.
2	**Depth:**	Distance (in feet) below the ground surface.
3	**Sample Type:**	Type of soil sample collected at depth interval depicted; symbols explained above.
4	**Sample Number:**	Sample identification number.
5	**Percent Recovery:**	Percentage of sample recovered for given sample interval; blank if not recorded.
6	**Sample Blows/foot:**	Number of blows required to advance driven sampler 1 foot, or distance indicated, using a 140-lb hammer with a 30-inch drop.
7	**Graphic Log:**	Graphic depiction of subsurface material encountered; symbols explained on Sheet 2 of Key.
8	**Material Description:**	Description of subsurface material encountered, including USCS soil designation.
9	**Well Completion Log:**	Graphic depiction of gas well construction; symbols on sheet 2 of key.
10	**Water Content, %:**	Natural water content of soil determined in lab, expressed as percentage.
11	**Dry Density, pcf:**	Undisturbed dry unit weight of soil determined in lab, in pounds per cubic foot.
12	**Remarks/Other Tests:**	Comments or observations regarding drilling/sampling made by driller or URS's field personnel. Laboratory test results are presented in abbreviated format; refer to Sheet 2 of Key for abbreviations used.

GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System (USCS) and include consistency/relative density (where standard blow count correlation is possible), moisture, and color. Field descriptions may have been modified to reflect results of laboratory tests.

2. Descriptions on these boring logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

Project: SDG&E Artesian Substation Project Location: San Diego, CA Project Number: 58-9911062M.00-SI001	Key to Log Sheet 2 of 2

ABBREVIATIONS FOR LABORATORY TEST RESULTS LISTED IN "REMARKS / OTHER TESTS" COLUMN

SA( ) - Sieve Analysis (percent passing #200 sieve)
UC( ) - Unconfined Compression test (percent in pounds per square foot)
LL - Liquid Limit
PI - Plasticity Index

UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOL VERSUS CORRESPONDING GRAPHIC LOG

Fill
Sand
Silt
Sand/Silt
Gravel

SYMBOLS FOR WELL CONSTRUCTION LOG

AUGER CUTTINGS
CASING IN BENTONITE CHIPS
CASING IN SAND PACK
SAND PACK

Project: SDG&E Artesian Substation	Log of Boring BA-1
Project Location: San Diego, CA	Sheet 1 of 2
Project Number: 58-9911062M.00-SI001	

Date(s) Drilled	3/27/00	Logged By	A. Harker	Checked By	S. Fitzwilliam
Drilling Method	Bucket auger	Drill Bit Size/Type	30"	Total Depth Drilled (feet)	41.0
Drill Rig Type	Earthdrill 45L	Drilling Contractor	Larive Drilling	Hammer Weight/ Drop (lbs/in.)	NA
Groundwater Level and Date Measured	None encountered	Sampler Type	Sack	Approx. Surface Elevation (ft, MSL)	546.0
Comments	See Site Plan			Borehole Backfill	Soil cuttings

Elevation, feet, MSL	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Percent Recovery	SAMPLES: Blows/foot	Graphic Log	MATERIAL DESCRIPTION	Gas Well Completion Log	Water Content, %	Dry Density, pcf	REMARKS/ OTHER TESTS
545	0		1-1				COLLUVIUM Medium dense, moist, brown, clayey fine SAND (SC) with trace cobbles		8		SA(32)
			1-2				HIGHLY WEATHERED MISSION VALLEY FORMATION Dense to very dense, moist, yellowish brown, silty fine SAND (SM) with clay				
	5						← Gravel				
540			1-3				MISSION VALLEY FORMATION Very dense, moist, pale brown, silty fine SANDSTONE (SM) with coarse gravel and manganese stain				
			1-4						8		
	10						Becomes yellowish brown, poorly graded fine SANDSTONE with silt (SP/SM), micaceous and weakly laminated				
535											
							At 14', bedding, N55W 2-4°SW				
	15										
530							← Minor fine gravels				
	20						← Sandstone concretion				
525							Cobbles and gray siltstone rip-up clasts At 20.5', bedding, N50W 14°SW				
							At 24', bedding N70E 15°NW				
	25										
520							Cobbles and coarse gravels, light to pale yellow brown color				
	30		1-5								

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Figure A-2

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Project: SDG&E Artesian Substation
Project Location: San Diego, CA
Project Number: 58-9911062M.00-SI001

Log of Boring BA-1

Sheet 2 of 2

Elevation, feet, MSL	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Percent Recovery	SAMPLES: Blows/foot	Graphic Log	MATERIAL DESCRIPTION	Gas Well Completion Log	Water Content, %	Dry Density, pcf	REMARKS/ OTHER TESTS
515	30	⊠	1-6								
		⊠	1-7				FRIARS FORMATION Very dense, moist, pale yellow to white, fine to medium SANDSTONE with silt (SP/SM) Concretions				
510	35	⊠	1-8				Hard, moist, green CLAYSTONE (CL) with occasional gravels				
505	40						Bottom of boring at 41 feet				
500	45										
495	50										
490	55										
485	60										
	65										

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URS

Figure A-2

Project: SDG&E Artesian Substation Project Location: San Diego, CA Project Number: 58-9911062M.00-SI001	**Log of Boring BA-2** Sheet 1 of 2

Date(s) Drilled	3/27/00	Logged By	A. Harker	Checked By	S. Fitzwilliam
Drilling Method	Bucket auger	Drill Bit Size/Type	30"	Total Depth Drilled (feet)	30.5
Drill Rig Type	Earthdrill 45L	Drilling Contractor	Larive Drilling	Hammer Weight/ Drop (lbs/in.)	3500 lbs/12 in.
Groundwater Level and Date Measured	None encountered	Sampler Type	Sack, ModCal	Approx. Surface Elevation (ft, MSL)	532.5
Comments	See Site Plan			Borehole Backfill	Soil cuttings

Elevation, feet, MSL	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Percent Recovery	SAMPLES: Blows/foot	Graphic Log	MATERIAL DESCRIPTION	Gas Well Completion Log	Water Content, %	Dry Density, pcf	REMARKS/ OTHER TESTS
530	0		2-1				COLLUVIUM Medium dense, moist, brown, poorly graded fine SAND (SP) to sandy CLAY(CL)				
			2-2								
			2-3				MISSION VALLEY FORMATION Dense to very dense, moist, yellowish brown, silty fine SANDSTONE (SM)		8		SA(22)
525	5		2-4				Cross-bedding Fine sandy zone (SP/SM) At 8', bedding, N75W 10°SW				
520	10						Interbedded concretion lenses Gravels Gravels				
515	15		2-5				At 15', bedding, N50W 12-25°SW Green claystone clasts Iron oxide stain				
			2-6				FRIARS FORMATION Hard, moist, green CLAYSTONE (CL) with chunks of yellowish white, soft, fat clay		24		
	20		2-6A				Becomes light green SILTSTONE (ML)				
510							Concretion lens with iron-oxide staining				
505	25		2-7								
	30										

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Figure A-3

Project: SDG&E Artesian Substation
Project Location: San Diego, CA
Project Number: 58-9911062M.00-SI001

Log of Boring BA-2

Sheet 2 of 2

Elevation, feet, MSL	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Percent Recovery	SAMPLES: Blows/foot	Graphic Log	MATERIAL DESCRIPTION	Gas Well Completion Log	Water Content, %	Dry Density, pcf	REMARKS/ OTHER TESTS
	30						Bottom of boring at 30.5 feet				
500											
	35										
495											
	40										
490											
	45										
485											
	50										
480											
	55										
475											
	60										
470											
	65										

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Figure A-3

Project: SDG&E Artesian Substation	Log of Boring BA-3
Project Location: San Diego, CA	Sheet 1 of 1
Project Number: 58-9911062M.00-SI001	

Date(s) Drilled	3/28/00	Logged By	A. Harker	Checked By	S. Fitzwilliam
Drilling Method	Bucket auger	Drill Bit Size/Type	30"	Total Depth Drilled (feet)	20.0
Drill Rig Type	Earthdrill 45L	Drilling Contractor	Larive Drilling	Hammer Weight/ Drop (lbs/in.)	3500 lbs/12 in.
Groundwater Level and Date Measured	None encountered	Sampler Type	Sack, ModCal	Approx. Surface Elevation (ft, MSL)	516.5
Comments	SE corner of site			Borehole Backfill	Soil cuttings

Elevation, feet, MSL	Depth, feet	SAMPLES Type	Number	Percent Recovery	Blows/foot	Graphic Log	MATERIAL DESCRIPTION	Gas Well Completion Log	Water Content, %	Dry Density, pcf	REMARKS/ OTHER TESTS
515	0		3-1				COLLUVIUM Medium dense, moist, brown, clayey SAND (SC) with cobbles and fine to coarse gravel				
			3-2				Stiff, brown to olive green, sandy fat CLAY (CH), with carbonate veins and zones				
510	5		3-3 3-4		6		FRIARS FORMATION Hard, moist, green, fat CLAYSTONE (CH), blocky with carbonate veins		20	105	UC(8300) SA(68), LL=51, PI=21
							Becomes silty CLAYSTONE (CL) with iron oxide staining, micaceous				
505	10		3-5						16		
			3-6				Very dense, moist, light green, poorly graded fine to medium SANDSTONE (SP), with clayey SAND zones (SC)				
							Hard, moist, green, fat CLAYSTONE (CH)				
	15						Concretions				
500							At 16', bedding, N70W 20°NE Concretion zone				
			3-7				Very dense, moist, light yellowish brown, silty fine to coarse SANDSTONE (SM)				
	20						Bottom of boring at 20 feet				
495											
	25										
490											
	30										

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Figure A-4

Project: SDG&E Artesian Substation Project Location: San Diego, CA Project Number: 58-9911062M.00-SI001	**Log of Boring BA-4** Sheet 1 of 2

Date(s) Drilled	3/28/00	Logged By	A. Harker	Checked By	S. Fitzwilliam
Drilling Method	Bucket auger	Drill Bit Size/Type	30"	Total Depth Drilled (feet)	38.0
Drill Rig Type	Earthdrill 45L	Drilling Contractor	Larive Drilling	Hammer Weight/ Drop (lbs/in.)	3500 lbs/12 in.
Groundwater Level and Date Measured	None encountered	Sampler Type	Sack, ModCal	Approx. Surface Elevation (ft, MSL)	543.0
Comments	East central portion of site			Borehole Backfill	Soil cuttings

Elevation, feet, MSL	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Percent Recovery	SAMPLES: Blows/foot	Graphic Log	MATERIAL DESCRIPTION	Gas Well Completion Log	Water Content, %	Dry Density, pcf	REMARKS/ OTHER TESTS
	0		4-1				COLLUVIUM Stiff, moist, brown to reddish brown, sandy CLAY (CL)				
540			4-2				MISSION VALLEY FORMATION Dense to very dense, moist, dark yellowish brown, poorly graded fine SANDSTONE (SP)				
	5		4-3		5/5"		Siltstone and sandstone concretions		8		
535							Yellowish brown, silty fine sand lens				
	10						Dense, moist, light yellowish brown to pale gray, silty SANDSTONE (SM)				
530											
	15		4-4						16	113	UC(10360)
525							Hard, moist, greenish brown, silty CLAYSTONE (CL) to SILTSTONE (ML) with iron staining At 17', bedding, N10W 15°SW At 18', bedding N15E 20°NW				
			4-5				2-3" thick layer of green fat claystone				
	20						Very dense, moist, pale gray, silty fine to coarse SANDSTONE (SM/SP)				
			4-6				Sand lens				
520							Very dense, moist, pale yellow, poorly graded fine to coarse SAND (SP) with fine gravel				
	25		4-7				Becomes wet, gray				Seep at 26-27.5'
			4-8								
515			4-8A				FRIARS FORMATION Hard, wet, brown to green, CLAYSTONE (CH) to SILTSTONE (ML)				
	30										

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Figure A-5

11/30/00 1GL10B1 11082

Project: SDG&E Artesian Substation
Project Location: San Diego, CA
Project Number: 58-9911062M.00-SI001

Log of Boring BA-4

Sheet 2 of 2

Elevation, feet, MSL	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Percent Recovery	SAMPLES: Blows/foot	Graphic Log	MATERIAL DESCRIPTION	Gas Well Completion Log	Water Content, %	Dry Density, pcf	REMARKS/ OTHER TESTS
510	30		4-9				Concretion				
	35		4-10				Very dense, moist, green to light yellow brown, silty fine SANDSTONE (SM)				
505			4-11								
	40						Bottom of boring at 38 feet				
500											
	45										
495											
	50										
490											
	55										
485											
	60										
480											
	65										

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Figure A-5

Project: SDG&E Artesian Substation	Log of Boring BA-5
Project Location: San Diego, CA	Sheet 1 of 2
Project Number: 58-9911062M.00-SI001	

Date(s) Drilled	3/29/00	Logged By	A. Harker	Checked By	S. Fitzwilliam
Drilling Method	Bucket auger	Drill Bit Size/Type	30"	Total Depth Drilled (feet)	35.0
Drill Rig Type	Earthdrill 45L	Drilling Contractor	Larive Drilling	Hammer Weight/ Drop (lbs/in.)	NA
Groundwater Level and Date Measured	None encountered	Sampler Type	Sack, ModCal	Approx. Surface Elevation (ft, MSL)	527.0
Comments	Central portion of site			Borehole Backfill	Soil cuttings

Elevation, feet, MSL	Depth, feet	SAMPLES Type	Number	Percent Recovery	Blows/foot	Graphic Log	MATERIAL DESCRIPTION	Gas Well Completion Log	Water Content, %	Dry Density, pcf	REMARKS/ OTHER TESTS
	0		5-1				COLLUVIUM Stiff, moist, brown, sandy lean CLAY (CL)				
525			5-2				MISSION VALLEY FORMATION Very stiff to dense, moist, light yellowish brown, sandy CLAYSTONE to clayey SANDSTONE (CL/SC)		13		SA(27)
							Sand lens				
	5		5-3				1" thick claystone layer N65°E 15°NW Fine to coarse SANDSTONE (SP) lense 1-2" thick claystone layer N75°E 14°NW				
520			5-4				Hard, moist, yellowish brown, clayey SILTSTONE (ML) 1-2" yellowish brown, claystone layer (N-S 8°W), becomes pale gray				
	10						Becomes yellowish brown 2'x1' claystone clast				
515			5-5 5-5A				Seep FRIARS FORMATION Hard, moist, greenish gray CLAYSTONE (CH)		19		Seep 11.5'
							Pale gray concretion				Seep at 14'
	15						Concretion				
510							Concretion Concretion				
	20						Concretion				
505							Irregular contact				
			5-6				Very dense, moist, light yellowish brown, silty fine to coarse SANDSTONE (SM) with fine gravel		9		
	25						1-2" green claystone layer N75E 13°SE				
			5-7 5-7A				Hard, moist, yellowish brown to green CLAYSTONE (CH/CL)				
500			5-8				At 28', bedding, N55W 33°NE				
	30		5-8A								

URS

Figure A-6

11/30/00 1GL10B1 11062

Project: SDG&E Artesian Substation
Project Location: San Diego, CA
Project Number: 58-9911062M.00-SI001

Log of Boring BA-5

Sheet 2 of 2

Elevation, feet, MSL	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Percent Recovery	SAMPLES: Blows/foot	Graphic Log	MATERIAL DESCRIPTION	Gas Well Completion Log	Water Content, %	Dry Density, pcf	REMARKS/ OTHER TESTS
495	30						← Concretion				
		X	5-9				Very dense, moist, yellowish brown to reddish brown, clayey to silty fine to coarse SANDSTONE (SC/SM)				
490	35						Bottom of boring at 35 feet				
485	40										
480	45										
475	50										
470	55										
465	60										
	65										

URS

Figure A-6

11/30/00 1GL10B1 11062

Project: SDG&E Artesian Substation Project Location: San Diego, CA Project Number: 58-9911062M.00-SI001	**Log of Boring BA-6** Sheet 1 of 2

Date(s) Drilled	3/29/00	Logged By	A. Harker	Checked By	S. Fitzwilliam
Drilling Method	Bucket auger	Drill Bit Size/Type	30"	Total Depth Drilled (feet)	41.5
Drill Rig Type	Earthdrill 45L	Drilling Contractor	Larive Drilling	Hammer Weight/ Drop (lbs/in.)	NA
Groundwater Level and Date Measured	None encountered	Sampler Type	Sack	Approx. Surface Elevation (ft, MSL)	502.0
Comments	See Site Plan			Borehole Backfill	Soil cuttings

Elevation, feet, MSL	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Percent Recovery	SAMPLES: Blows/foot	Graphic Log	MATERIAL DESCRIPTION	Gas Well Completion Log	Water Content, %	Dry Density, pcf	REMARKS/ OTHER TESTS
500	0		6-1				COLLUVIUM Stiff, moist, dark brown, sandy CLAY (CL)				
			6-2				HIGHLY WEATHERED FRIARS/RESIDUAL SOIL Dense, moist, light yellowish brown, silty fine to coarse SANDSTONE (SM) with fine gravel		9		
	5		6-3				Becoming sandy CLAYSTONE (CL)				
495			6-4				FRIARS FORMATION Dense, moist, pale yellowish brown, silty SANDSTONE (SM), with iron and manganese staining		15		SA(40)
	10						Pale gray siltstone concretion				
490							Very dense, moist, pale gray, silty fine to coarse SANDSTONE (SM)				
							Gravels				
	15						2-3" green siltstone N85W 15°SW				
485							Becomes silty SANDSTONE to sandy SILTSTONE (SM/ML) with fine gravel				
							Manganese staining				
	20		6-5								
480							Green rip up clast				
			6-5A				Large green CLAYSTONE (CH) clast				
							Bedding N50W 20°SW				
	25						Green claystone rip up clasts				
475							Green claystone clasts Irregular contact N50E 38°NW				
							Hard, moist, green, CLAYSTONE (CL/CH) with iron oxide staining				
			6-6						24		
	30										

URS

Figure A-7

11/30/00 1GL10B1 11062

Project: SDG&E Artesian Substation
Project Location: San Diego, CA
Project Number: 58-9911062M.00-SI001

Log of Boring BA-6

Sheet 2 of 2

Elevation, feet, MSL	Depth, feet	SAMPLES Type	SAMPLES Number	Percent Recovery	Blows/foot	Graphic Log	MATERIAL DESCRIPTION	Gas Well Completion Log	Water Content, %	Dry Density, pcf	REMARKS/ OTHER TESTS
	30						Becomes light green to gray				
470							Increase in silt (ML/CL)				
		X	6-7								
							White siltstone concretion				
	35										
							White siltstone concretion				
465							Hard, moist, yellowish green SILTSTONE (ML) with iron staining				
	40	X	6-8								
460							Bottom of boring at 41.5 feet				
	45										
455											
	50										
450											
	55										
445											
	60										
440											
	65										

URS

Figure A-7

11/30/00 1GL10B1 11062

Project: SDG&E Artesian Substation
Project Location: San Diego, CA
Project Number: 58-9911062M.00-SI001

Log of Boring BA-7

Sheet 1 of 2

Date(s) Drilled	10/6/00	Logged By	A. Harker	Checked By	S. Fitzwilliam
Drilling Method	Bucket auger	Drill Bit Size/Type	30"	Total Depth Drilled (feet)	65.0
Drill Rig Type	Earthdrill 45L	Drilling Contractor	Larive Drilling	Hammer Weight/ Drop (lbs/in.)	NA
Groundwater Level and Date Measured	None encountered	Sampler Type	Sack	Approx. Surface Elevation (ft, MSL)	554.0
Comments	See Site Plan			Borehole Backfill	Soil cuttings

Elevation, feet, MSL	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Percent Recovery	SAMPLES Blows/foot	Graphic Log	MATERIAL DESCRIPTION	Gas Well Completion Log	Water Content, %	Dry Density, pcf	REMARKS/ OTHER TESTS
	0		7-1				COLLUVIUM Dense to hard, moist,reddish brown to brown, clayey SAND to sandy CLAY (SC/CL) with scattered gravel				
			7-2				MISSION VALLEY FORMATION Very dense, moist, yellowish brown, poorly graded fine SANDSTONE with clasts of brown claystone (SP) At 1.5', 1/2" thick claystone layer N45W 11°SW				
550											
	5						Zones of sandy lean CLAYSTONE (CL) with gravel and cobbles				
			7-3				Dense, moist, yellowish brown to reddish brown, silty fine SANDSTONE (SM) At 5', laminations N65E 9°SE				
			7-4								
545							Claystone clasts				
	10						Hard, moist, light gray, sandy SILTSTONE (ML)				
							Laminations N75E 9°SE				
							Very dense, moist, yellowish brown, poorly graded fine SANDSTONE (SP) At 13', N60W 22°SW clay layer				
540			7-5								
	15						Very dense, moist, brown to reddish brown, silty GRAVEL (GM) with sand and claystone clasts				
							Becomes sandy GRAVEL (GP)				
			7-6				Zone of concretions with very dense, moist, yellowish, silty fine SANDSTONE (SM) cemented				Difficult drilling, switch to coring bucket
535											
	20						laminations S60W 15-30°				
							At 23', laminations N75W 10°SW				
530											
	25						Concretionary zone				
							Fine to coarse gravel				
525											
	30										

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Figure A-8

11/30/00 1GL10B1 11062

Project: SDG&E Artesian Substation
Project Location: San Diego, CA
Project Number: 58-9911062M.00-SI001

Log of Boring BA-7

Sheet 2 of 2

Elevation, feet, MSL	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Percent Recovery	SAMPLES Blows/foot	Graphic Log	MATERIAL DESCRIPTION	Gas Well Completion Log	Water Content, %	Dry Density, pcf	REMARKS/ OTHER TESTS
	30		7-7				Gravel and cobble (GM) Zone of hard, moist, green CLAYSTONE (CL)				
520							Very dense, moist, yellowish brown, silty fine to coarse SANDSTONE (CM) with claystone clasts and scattered gravel and cobbles				
	35		7-8								
			7-9				At 37', laminations N50W 12°SW				
			7-10				FRIARS FORMATION Hard, moist, green CLAYSTONE (CH), blocky, omni-slick surfaces				
515			7-11								
	40										
			7-12				Hard, moist, green, SILTSTONE (ML)				
510											
	45		7-13				Concretion zones Very dense, moist, yellowish gray, silty fine to coarse SANDSTONE (SM)				
							Zones of sandy CLAYSTONE (CL)				
			7-14								
505											
	50										
500							Seep at 55', coarsens				
	55						Hard, moist, green CLAYSTONE (CH) Hard, moist, green SILTSTONE (ML)				
			7-15				Concretionary zone with green claystone Very dense, moist, light gray, silty SANDSTONE (SM)				
495	60		7-16								
			7-17								
490											
	65						Bottom of boring at 65 feet Downhole logged to 62 feet				

11/30/00 1GL10B1 11062

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Figure A-8

Project: SDG&E Artesian Substation
Project Location: San Diego, CA
Project Number: 58-9911062M.00-SI001

Log of Boring BA-8

Sheet 1 of 2

Date(s) Drilled	10/9/00	Logged By	A. Harker	Checked By	S. Fitzwilliam
Drilling Method	Bucket auger	Drill Bit Size/Type	30"	Total Depth Drilled (feet)	40)
Drill Rig Type	Earthdrill 45L	Drilling Contractor	Larive Drilling	Hammer Weight/ Drop (lbs/in.)	NA
Groundwater Level and Date Measured	None encountered	Sampler Type	Sack	Approx. Surface Elevation (ft, MSL)	532.0
Comments	See Site Plan			Borehole Backfill	Soil cuttings

Elevation, feet, MSL	Depth, feet	SAMPLES Type	Number	Percent Recovery	Blows/foot	Graphic Log	MATERIAL DESCRIPTION	Gas Well Completion Log	Water Content, %	Dry Density, pcf	REMARKS/ OTHER TESTS
530	0		8-1				COLLUVIUM Stiff, moist, dark brown, sandy CLAY(CL)				
							MISSION VALLEY FORMATION Very dense, moist, pale yellowish brown, silty fine SANDSTONE (SM)				
	5		8-2				At 5', 1" thick siltstone layer N15W 10°SW				
525							Concretion				
							Hard, moist, greenish brown to reddish brown, thinly bedded and laminated CLAYSTONE, SILTSTONE and less SANDSTONE (shaley), locally fat, waxy block clay layers				
	10		8-3				At 9', undulating, stiff, brecciated claystone layer N80W 8°SE				
			8-4								
520							At 12', N75W 10SW				
			8-5								
	15						Dense, moist, orange, silty fine to medium SANDSTONE (SM)				
			8-6				Hard, moist to wet, green CLAYSTONE (CH)				
515											
							Sandy concretionary zone Becomes SILTSTONE (ML)				
	20										
510							Concretionary zone				
	25		8-7								
							Very dense to hard, moist, pale yellowish green, silty fine SANDSTONE to sandy siltstone (SM/ML)				
505			8-8								
			8-8A				Becomes light brownish yellow, silty fine SANDSTONE (SM)				
	30										

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Figure A-9

11/30 00 1GL10B1 11062

Project: SDG&E Artesian Substation
Project Location: San Diego, CA
Project Number: 58-9911062M.00-SI001

Log of Boring BA-8

Sheet 2 of 2

Elevation, feet, MSL	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Percent Recovery	SAMPLES: Blows/foot	Graphic Log	MATERIAL DESCRIPTION	Gas Well Completion Log	Water Content, %	Dry Density, pcf	REMARKS/ OTHER TESTS
	30						Very dense, moist, gray, silty SANDSTONE (SM)				
-500			8-9								
			8-10				Hard, moist, green CLAYSTONE (CH)				
	35		8-11				At 35', waxy surfaces				
							Very dense, moist, gray, silty fine to coarse SANDSTONE (SM)				
-495							Shale				
			8-12				Very dense, moist, gray, poorly graded fine to coarse SANDSTONE (SP)				
	40						Bottom of boring at 40 feet				
-490											
	45										
-485											
	50										
-480											
	55										
-475											
	60										
-470											
	65										

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Figure A-9

11/30/00 1GL10B1 11062

Project: SDG&E Artesian Substation	Log of Boring GW-1
Project Location: San Diego, CA	Sheet 1 of 1
Project Number: 58-9911062M.00-SI001	

Date(s) Drilled	3/16/00	Logged By	A. Harker	Checked By	S. Fitzwilliam
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	30.0
Drill Rig Type	CME 75	Drilling Contractor	West Hazmat Drilling	Hammer Weight/ Drop (lbs/in.)	140/30
Groundwater Level and Date Measured	None encountered	Sampler Type	ModCal	Approx. Surface Elevation (ft, MSL)	542.0
Comments	See Site Plan			Borehole Backfill	Soil cuttings

Elevation, feet, MSL	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Percent Recovery	SAMPLES: Blows/foot	Graphic Log	MATERIAL DESCRIPTION	Gas Well Completion Log	Water Content, %	Dry Density, pcf	REMARKS/ OTHER TESTS
540	0		1-1		50/3"		COLLUVIUM Medium dense, moist, brown, poorly graded fine SAND (SP) with interbedded lean CLAY (CL)				
							← Trace coarse gravel				
	5						MISSION VALLEY FORMATION Very dense, moist, gray, silty SANDSTONE (SM) to yellowish brown, poorly graded fine SANDSTONE (SP)				Gas well probe
535			1-2		50/5"						
	10										
530			1-3		50/5"		← Becomes sandy				
	15										
525			1-4		50/3"						
	20										Gas well probe
520			1-5		50/5"		FRIARS FORMATION Hard, moist light green, SILTSTONE, moderately well indurated (ML)				
	25										
515							← Fine to coarse gravel				
	30		1-6		50/6"		Bottom of boring at 30 feet				

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Figure A-10

11/30/00 1GL1081 11062

Project: SDG&E Artesian Substation	Log of Boring GW-2
Project Location: San Diego, CA	Sheet 1 of 1
Project Number: 58-9911062M.00-SI001	

Date(s) Drilled	3/16/00	Logged By	A. Harker	Checked By	S. Fitzwilliam
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	29.0
Drill Rig Type	CME 75	Drilling Contractor	West Hazmat Drilling	Hammer Weight/ Drop (lbs/in.)	140/30
Groundwater Level and Date Measured	None encountered	Sampler Type	ModCal	Approx. Surface Elevation (ft, MSL)	503.5
Comments	See Site Plan			Borehole Backfill	Soil cuttings

Elevation, feet, MSL	Depth, feet	SAMPLES Type	Number	Percent Recovery	Blows/foot	Graphic Log	MATERIAL DESCRIPTION	Gas Well Completion Log	Water Content, %	Dry Density, pcf	REMARKS/ OTHER TESTS
500	0						COLLUVIUM Stiff to very stiff, moist, dark brown (mottled), lean CLAY (CL)				
	5		2-1		15						Gas well probe
495							FRIARS FORMATION Medium dense to dense, moist, reddish brown, clayey SANDSTONE (SC) Becomes light brown				
490	10		2-2		50/3"		Very dense, pale yellow fine to medium SANDSTONE with silt (SP/SM)				
	15		2-3		50/5"		Becomes silty fine SANDSTONE (SM), micaceous				
485											
	20		2-4		50/3"		Becomes poorly graded fine to coarse SANDSTONE (SP)				
480							Hard to very dense, moist, light brown, sandy CLAYSTONE to clayey SANDSTONE (CL/SC)				Gas well probe
	25		2-5		50/5"		Becomes pale gray Becomes olive green, lean CLAYSTONE (CL)				
475											
	30						Bottom of boring at 29 feet				

11/30/00 1GL10B1 11062

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Figure A-11

The field investigation was performed in two phases. The first phase included: a) advancing seven (7) hollow stem auger borings designated B-1 through B-7 to depths ranging between about 30 and 41.5 feet bgs; b) performing four (4) hand auger borings to depths of 2 to 3.5 feet bgs; and c) performing percolation tests within Boring B-1 and at PT-1. The second phase of drilling included advancing seventeen (17) solid stem auger borings to depths ranging from 10 to 15 feet, to better evaluate the presence of concretionary zones within the shallow subsurface of the expansion site area.

Locations of the field explorations are presented in Figure 2. A Key to Logs is presented as Figure B-1, logs of hollow stem auger borings are presented as Figures B-2 through B-25, and logs of hand-auger borings are presented as HA-1 through HA-4.

To locate underground utilities in the vicinity of the borings, URS notified Underground Service Alert (USA). URS prepared a safe work plan to assist with the field activities, and secured a boring permit from the County of San Diego Department of Environmental Health (County).

B.1 Geotechnical Borings

The first phase of geotechnical borings were performed between April 28 and May 1, 2015 with a truck mounted drilling using 8-inch diameter hollow stem augers. The second phase of borings was performed on September 2, 2015 using a truck mounted drill rig and solid stem augers. A URS engineering geologist logged the borings based on visual observations and classified the soils according to the Unified Soil Classification System. Samples were obtained using a Standard Penetration Test (SPT) sampler and a split-spoon sampler (2.5-inch inside diameter). Blow counts required to drive the samplers the final 12 inches were recorded to evaluate the relative density or consistency of the subsurface material. The reported field blow counts have not been corrected for sampler size. Additionally, bulk samples were collected from shallow depths of select borings.

The borings were backfilled with bentonite grout in accordance with the County. Drilling locations were restored to the previous condition to the extent practical, with asphalt patch placed in paved locations. Drill spoil was collected in 55-gallon drums and stored on site for disposal by SDG&E.

B.2 Percolation Testing

Field percolation tests were completed at PT-1 and Boring B-1 shown on Figure 2, and was conducted in general accordance with the percolation testing procedure outlined by the County of San Diego, Department of Environmental Health guidelines. The test data is presented in Table B-1.

Within PT-1, the test was performed in a 4-inch diameter hole excavated using a posthole digger. The test hole was 24 inches deep and filled with approximately 12 inches of pea gravel. Percolation test within Boring B-1 was performed at a depth of about 20 feet (estimated bottom of the detention basin). The augers were retracted to about 12-14 inches and filled with pea gravel. A perforated PVC pipe was used to maintain the water level.

The test hole was presoaked the evening before the test by filling the hole with water to about 12-14 inches above the pea gravel. The water was then allowed to dissipate and the holes were refilled once more. To collect data in the near surface percolation test in the detention basin, a tape measure was used

to visually track the percolation rate of added water to the substrate. Due to the depth of the percolation test performed in B-1, a sounding pipe was temporarily placed in the bottom of the boring, and the percolation rate was tracked with an electronic sounder. The test hole was filled with water to approximately 12-14 inches above the pea gravel to a fixed reference point. The water drop was measured from the reference point at approximately 10-minute and 30-minute time intervals within Boring B-1 and PT-1, respectively. The readings were continued until the drop rate "stabilized", such that the last 2 readings did not vary more than 0.1 inch. The last water level drop was considered the infiltration rate.

Table B-1
Percolation Test Measurements
SDG&E Artesian Substation Expansion

Date	Note	Time	Elapsed Time (minutes)	Depth (inches)	Drop (inches)	Percolation Rate (mpi)	Infiltration Rate (cm/sec)
Percolation Test at Boring B-1							
4/29/2015	add water	15:58	0	261.96	NA	NA	NA
		16:05	7	261.96	0.00	0	NA
		16:25	20	262.08	0.12	167	3E-04
		16:50	25	262.2	0.12	208	2E-04
4/30/2015		7:57	907	265.44	3.24	280	2E-04
		16:34	517	265.92	0.48	1077	4E-05
	add water	16:40	0	258.36	NA	NA	NA
		17:10	30	258.48	0.12	250	2E-04
		17:40	30	258.72	0.24	125	3E-04
		Average final 2 readings =				351	3E-04
Percolation Test at PT-1							
	add water	16:44	0	10.80	NA	NA	NA
		16:50	6	13.08	2.28	NA	NA
		17:00	10	13.56	0.48	21	2E-03
		17:10	10	14.52	0.96	10	4E-03
		17:20	10	15.60	1.08	9	5E-03
		17:30	10	16.32	0.72	14	3E-03
		17:40	10	17.52	1.20	8	5E-03
5/1/2015	add water	11:24	0	9.36	NA	NA	NA
		11:34	10	13.20	3.84	3	2E-02
		11:44	10	13.32	0.12	83	5E-04
		11:54	10	13.92	0.60	17	3E-03
		12:04	10	14.28	0.36	28	2E-03
		12:14	10	14.40	0.12	83	5E-04
		12:24	10	15.00	0.60	17	3E-03
		12:34	10	15.48	0.48	21	2E-03
		12:50	10	17.04	1.56	6	7E-03
		Average final 2 readings =				32	4E-03

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Key to Logs

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7	8	9	10

COLUMN DESCRIPTIONS

1 **Elevation:** Elevation in feet referenced to NAVD88 or site datum.

2 **Depth:** Depth in feet below the ground surface.

3 **Sample Type:** Type of soil sample collected at depth interval shown; sampler symbols are explained below.

4 **Sample Number:** Sample identification number. Unnumbered sample indicates no sample recovery. "1-1" indicates geotechnical sample. "(B-1@1')" indicates analytical sample.

5 **Blows per foot:** Number of blows required to advance driven sampler 12 inches beyond first 6-inch interval, or distance noted, using a 140-lb hammer with a 30-inch drop.

6 **Graphic Log:** Graphic depiction of subsurface material encountered; typical symbols are explained below.

7 **Material Description:** Description of material encountered; may include relative density/consistency, moisture, color, particle size; texture, weathering, and strength of formation material. If shown, designation in parentheses denotes Munsell color classification.

8 **Water Content:** Water content of soil sample measured in laboratory, expressed as percentage of dry weight of specimen.

9 **Dry Unit Weight:** Dry density of soil sample measured in laboratory, in pounds per cubic foot.

10 **Remarks and Other Tests:** Comments and observations regarding drilling or sampling made by driller or field personnel.

SA	Sieve Analysis, %<#200 sieve
WA	Wash Analysis, %<#200 sieve
LL	Liquid Limit, from Atterberg limits test, %
PI	Plasticity Index (LL-PL), %
DS	Direct Shear test
EI	Expansion Index
CORR	Corrosivity test suite
COMP	Compression test
R-Value	R-Value test
HYD	Hydrometer

TYPICAL MATERIAL GRAPHIC SYMBOLS

- Silty SAND (SM)
- Clayey SAND (SC)
- Poorly Graded SAND with Silt (SP-SM)
- Clayey GRAVEL (GC)
- SILT (ML)
- Elastic SILT (MH)
- Sandy SILT (ML)
- High Plasticity CLAY (CH)
- Lean CLAY (CL)
- Sandy CLAY (CL)
- Sandy SILT (ML) / Silty SAND (SM)
- Fill

TYPICAL SAMPLER GRAPHIC SYMBOLS

- Bag or Grab Sample
- 2.5" I.D Sampler
- Standard Penetration Sampler

OTHER GRAPHIC SYMBOLS

- Minor change in material properties within a stratum
- — — Inferred or gradational contact between strata

GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

Figure B-1

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-1

Sheet 1 of 2

Date(s) Drilled	**04/29/15**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**7.5" Finger Bit**	Total Depth of Borehole	**41.5 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**502 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**2.5" ID/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Completion	**Bentonite Grout / Bentonite Chips**	Location	**33.02100, -117.13509**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
500	0					FRIARS FORMATION Medium dense, moist, light yellowish brown, poorly graded SAND with silt (SP-SM)			
			1						R-Value
			2	12		Becomes dense			CORR
	5		3	35			9		
495						Very dense, moist, light olive brown, silty fine SAND (SM)			
	10		4	50/4"					
490						Becomes dense, olive brown			
	15		5	39			22		LL(52), PI(21)
485						Becomes very dense, light gray to white, with gravel			
	20		6	50/6"					
480						1' Thick concretion			
	25		7	50/2"		Very dense, moist, light gray, poorly graded SAND with silt (SP-SM)	6		WA(10)
475									
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-01

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Figure B-2

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-1

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
470	30		8	50/2"		Hard, moist, light green to olive green, fine sandy SILT (ML)			
465	35		9	50/4"		6" Thick concretion			
	40		10	54		Hard, moist, green, CLAY (CL)	23		LL(49), PI(22)
460						Bottom of boring at 41.5 feet			
455	45								
450	50								
445	55								
440	60								
	65								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-01

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Figure B-2

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-2

Sheet 1 of 2

Date(s) Drilled	**04/29/15**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**7.5" Finger Bit**	Total Depth of Borehole	**40.8 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**520 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**BULK/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Completion	**Bentonite Grout / Bentonite Chips**	Location	**33.02084, -117.13345**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
520	0					FILL 3" gravel over light gray to yellowish brown silty clayey sand			
			1 2	19			14		WA(38)
515	5		3	72		FRIARS FORMAITON Very dense, moist, olive brown, silty fine SAND (SM)			
						Becomes light greenish gray			
510	10		4	50/6"					
						1.5' Thick concretion			
505	15		5	50/3"					
						Becomes light gray, partially oxidized, with clay			
500	20		6	91					
495	25		7	50/6"					
						Becomes light gray to white			
490	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-02

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Figure B-3

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-2

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
490	30		8	50/5"		with zones of oxidation			
485	35		9	50/2"		Very dense, white, moist to wet, clayey SAND (SC)			
480	40			50/4"		Becomes moist Bottom of boring at 40.8' feet	20		WA(26), LL(63), PI(37)
475	45								
470	50								
465	55								
460	60								
455	65								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-02

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Figure B-3

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-3

Sheet 1 of 2

Date(s) Drilled	**04/29/15**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**7.5" Finger Bit**	Total Depth of Borehole	**30.3 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**517 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Completion	**Bentonite Grout / Bentonite Chips**	Location	**33.02122, -117.13338**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					FILL 3" Gravel over light gray to yellowish brown, silty sand with clay			
515			1	18			13		WA(30)
	5		2	31		FRIARS FORMATION Dense, moist, light olive brown, silty SAND (SM)			CORR
510						1.2' thick concretion			
						Becomes very dense			
	10		3	50/1"		2' thick concretion			
505						1.3' thick concretion			
	15		4	91/9"					
500						Hard, moist, dark gray to light green, clayey SILT (MH)			
	20		5	61			16		LL(50), PI(19), WA(57)
495						Becomes olive gray			
	25		6	30		Becomes olive green	28		LL(72). PI(37)
490						Very dense, moist, reddish brown (oxidized), poorly graded SAND with silt (SP-SM)			
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-03

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Figure B-4

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-3

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	30		7	50/4"		Total depth 30.3' bgs			
485									
	35								
480									
	40								
475									
	45								
470									
	50								
465									
	55								
460									
	60								
455									
	65								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-03

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Figure B-4

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-4

Sheet 1 of 2

Date(s) Drilled	**04/30/15**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**7.5" Finger Bit**	Total Depth of Borehole	**41.5 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**517 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**BULK/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Completion	**Bentonite Grout / Bentonite Chips**	Location	**33.02135, -117.13308**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					FILL 3" Gravel over light yellowish brown, silty sand			
515			1			Becomes moist, light olive brown			R-VALUE
			2	27			12		
	5		3	14		FRIARS FORMATION Medium dense, moist, light gray, clayey SAND (SC)	16		WA(40)
510						Becoming light gray to white			
						Very dense, moist, light gray, poorly graded SAND with silt (SP-SM)			
	10		4	50/5"			10		
505						Hard, moist, light green to olive, fine sandy SILT (ML)			
	15		5	50/4"					
500									
	20		6	90/8"			20		WA(74)
495						1' Thick concretion			
						Very dense, moist, light yellowish brown, poorly graded SAND with Silt (SP-SM)			
	25		7	50/5"					
490						Becomes oxidized			
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-04

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Figure B-5

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-4

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	30								
			8	77/10"		Very dense, moist, light green, silty fine SAND (SM)	20		
485									
						Becomes white to light yellowish brown			
	35		9	50/5"					
480									
						Hard, moist, green, fine sandy CLAY (CH)			
	40		10	79		Becomes oxidized	21		LL(61), PI(32), CORR
475						Total Depth 41.5' bgs			
	45								
470									
	50								
465									
	55								
460									
	60								
455									
	65								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-04

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Figure B-5

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-5

Sheet 1 of 2

Date(s) Drilled	**05/1/15**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**7.5" Finger Bit**	Total Depth of Borehole	**31.5 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**526 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**BULK/2.5" ID/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Completion	**Bentonite Grout / Bentonite Chips**	Location	**33.02093, -117.13242**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
525	0					FILL 4" Asphalt over moist, mottled light gray to reddish brown, silty to clayey sand			
			1				15		SA(40), COMP, EI
			2	23			18	102	DS
520	5		3	39		FRIARS FORMATION Dense, moist, light yellowish brown to light gray, silty fine to medium SAND (SM) with clay	13		
						Becomes very dense			
515	10		4	94/8"			13	110	SA(23), DS
						Becomes light gray to light greenish gray			
						1' Thick concretion			
510	15		5	82/10"					
						1.1' Thick concretion			
505	20		6	50/6"		With trace fine biotite mica	14		
						Hard, moist, olive green, CLAY (CH)			
500	25		7	49		Becomes gray			LL(62), PI(33), CORR
						Very dense, moist, mottled light reddish brown and light gray silty SAND (SM) with clay			
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-05

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Figure B-6

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-5

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
495	30		8	55			19		
						Total Depth 31.5' bgs			
490	35								
485	40								
480	45								
475	50								
470	55								
465	60								
	65								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-05

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Figure B-6

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-6

Sheet 1 of 2

Date(s) Drilled	**04/30/15**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**7.5" Finger Bit**	Total Depth of Borehole	**40.4 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**522 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**2.5" ID/SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Completion	**Bentonite Grout / Bentonite Chips**	Location	**33.02111, -117.13286**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					FILL 3" Gravel over moist, brown silty sand			
520			1	27					CORR
	5		2	40		FRIARS FORMATION Medium dense, moist, reddish brown, silty fine to medium SAND (SM), with trace biotite mica	16	105	DS
515						Becomes very dense			
	10		3	88/2"			13		WA(26)
510									
	15		4	87/10"			12	114	DS
505									
	20		5	50/3"		Becomes yellowish brown	8		
500									
	25		6	50/3"		Becomes light gray to white			
495						Becomes slightly to partly oxidized			
	30					Becomes coarse grained			

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-06

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Figure B-7

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-6

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	30		7	50/2"			12		SA(32)
490						Becomes completely oxidized to reddish brown			
	35		8	77/9"		Hard, moist, olive brown to green, CLAY (CH)			
						Becomes gray	17		LL(68), PI(40)
485						Very dense, moist to wet, light reddish brown, poorly graded SAND with Silt (SP-SM)			
	40		9	50/5"					
						Total Depth 40.4' bgs			
480									
	45								
475									
	50								
470									
	55								
465									
	60								
460									
	65								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-06

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Figure B-7

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-7

Sheet 1 of 2

Date(s) Drilled	**04/30/15**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hollow Stem Auger**	Drill Bit Size/Type	**7.5" Finger Bit**	Total Depth of Borehole	**41.3 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**523 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**SPT**	Hammer Data	**140 lbs/30" drop**
Borehole Completion	**Bentonite Grout / Bentonite Chips**	Location	**33.02142, -117.13261**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					FILL 3/4" Pea gravel (recent, temporary fill) 3"-4" Asphalt (previous ground surface)			
520			1	13		Moist, light olive brown, silty SAND			CORR
	5		2	22		With little clay	12		
515						FRIARS FORMATION Very dense, moist, light green, silty fine SAND (SM) with trace biotite mica			
	10		3	75/8"		0.5' Thick concretion			
510						1' Thick concretion Becomes light gray (oxidized)			
	15		4	50/5"			8		SA(18)
505									
	20		5	50/5"		Hard, light green to olive, sandy SILT (MH)	17		WA(65)
500						Very dense, moist, white to light gray, silty fine to medium SAND (SM)			
	25		6	50/3"					
495									
	30					Very dense, moist, light reddish brown (oxidized), poorly graded SAND with Silt (SP-SM)			

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-07

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Figure B-8

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-7

Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	30		7	50/4"					
490						Hard, moist, light green, fine sandy CLAY (CH)			
	35		8	67/9"			20		LL(53), PI(24)
485						Becomes reddish brown (oxidized)			
	40		9	72/10"		Becomes green	17		WA(59)
						Total Depth 41.3' bgs			
480	45								
475									
	50								
470									
	55								
465									
	60								
460									
	65								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-07

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Figure B-8

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-8

Sheet 1 of 1

Date(s) Drilled	**09/02/2015**	Logged By	**A. Avakian**	Checked By	**P. Balasubramanyam**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**6" Finger Bit**	Total Depth of Borehole	**10.0 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**529 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**BULK**	Hammer Data	**N/A**
Borehole Completion	**Soil Cuttings**	Location	**33.02080, -117.13241**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					FILL 3" of mulch on top of moist, light olive brown, clayey SAND, 3" to 9" bgs encountered concretion fragment			
525			1						
	5					3" Thick concretion FRIARS FORMATION Moist, olive yellow, clayey SAND (SC)			
520						3"-6" Thick concretion			
	10					Bottom of boring at 10 fbgs			
515									
	15								
510									
	20								
505									
	25								
500									
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-08

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Figure B-9

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-9

Sheet 1 of 1

Date(s) Drilled	**09/02/2015**	Logged By	**A. Avakian**	Checked By	**P. Balasubramanyam**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**6" Finger Bit**	Total Depth of Borehole	**10.0 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**524 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**BULK**	Hammer Data	**N/A**
Borehole Completion	**Soil Cuttings / Concrete Cap**	Location	**33.02113, -117.13257**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					FILL 4" of asphalt on top of brown, sandy GRAVEL (aggregate base material)			
520	5		1			Moist, pale olive, sandy CLAY, concretion fragment encountered from 2.5' to 2.7' bgs			R-Value
515	10					FRIARS FORMATION Moist, olive yellow, sandy CLAY (CL) Bottom of boring at 10 fbgs			
510	15								
505	20								
500	25								
495	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-09

URS

Figure B-10

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-10

Sheet 1 of 1

Date(s) Drilled	**09/02/2015**	Logged By	**A. Avakian**	Checked By	**P. Balasubramanyam**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**6" Finger Bit**	Total Depth of Borehole	**10.0 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**519 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**No Samples Taken**	Hammer Data	**N/A**
Borehole Completion	**Soil Cuttings**	Location	**33.02144, -117.13280**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					FILL Moist, olive, sandy CLAY			
515						becomes olive yellow, increase sand content			
	5								
						FRIARS FORMATION Moist, greenish gray, sandy SILT (ML) / silty SAND (SM)			
510									
	10					Bottom of boring at 10 fbgs			
505									
	15								
500									
	20								
495									
	25								
490									
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-10

URS

Figure B-11

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-11

Sheet 1 of 1

Date(s) Drilled	**09/02/2015**	Logged By	**A. Avakian**	Checked By	**P. Balasubramanyam**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**6" Finger Bit**	Total Depth of Borehole	**10.0 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**523 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**BULK**	Hammer Data	**N/A**
Borehole Completion	**Soil Cuttings**	Location	**33.02103, -117.13276**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					FILL Moist, light olive brown, sandy CLAY / clayey SAND			
						3" to 5" thick concretion fragment			
520									
	5		1						
						FRIARS FORMATION Moist, light olive gray, clayey SAND (SC), concretion encountered from 6.5 to 6.8 fbgs			
515									
	10					Bottom of boring at 10 fbgs			
510									
	15								
505									
	20								
500									
	25								
495									
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-11

URS

Figure B-12

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-12

Sheet 1 of 1

Date(s) Drilled	**09/02/2015**	Logged By	**A. Avakian**	Checked By	**P. Balasubramanyam**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**6" Finger Bit**	Total Depth of Borehole	**10.0 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**523 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**BULK**	Hammer Data	**N/A**
Borehole Completion	**Soil Cuttings**	Location	**33.02081, -117.13293**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
520	0					FILL Moist, olive to light olive brown, sandy CLAY			
						3" Thick concretion fragment			
515	5		1			FRIARS FORMATION Moist, light olive gray, sandy SILT (ML) / silty SAND (SM)			
510	10					Bottom of boring at 10 fbgs			
505	15								
500	20								
495	25								
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-12

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Figure B-13

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-13

Sheet 1 of 1

Date(s) Drilled	**09/02/2015**	Logged By	**A. Avakian**	Checked By	**P. Balasubramanyam**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**6" Finger Bit**	Total Depth of Borehole	**10.0 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**521.5 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**No Samples Taken**	Hammer Data	**N/A**
Borehole Completion	**Soil Cuttings**	Location	**33.02083, -117.13314**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
520	0					FILL Moist, olive, sandy CLAY			
515	5					FRIARS FORMATION Moist, light olive gray, sandy SILT (ML) / silty SAND (SM) 4" to 6" Thick concretion			
510	10					Bottom of boring at 10 fbgs			
505	15								
500	20								
495	25								
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-13

URS

Figure B-14

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-14

Sheet 1 of 1

Date(s) Drilled	**09/02/2015**	Logged By	**A. Avakian**	Checked By	**P. Balasubramanyam**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**6" Finger Bit**	Total Depth of Borehole	**13.0 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**520.5 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**No Samples Taken**	Hammer Data	**N/A**
Borehole Completion	**Soil Cuttings**	Location	**33.02102, -117.13307**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
520	0					FILL Moist, olive, sandy CLAY			
						6" Thick concretion fragment			
515	5								
						FRIARS FORMATION Moist, light olive gray, sandy SILT (ML) / silty SAND (SM)			
						1.0' Thick concretion			
510	10								
						>6" Thick concretion			
						Bottom of boring at 13 fbgs (refusal on concretion)			
505	15								
500	20								
495	25								
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-14

URS

Figure B-15

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-15

Sheet 1 of 1

Date(s) Drilled	**09/02/2015**	Logged By	**A. Avakian**	Checked By	**P. Balasubramanyam**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**6" Finger Bit**	Total Depth of Borehole	**10.0 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**518.5 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**No Samples Taken**	Hammer Data	**N/A**
Borehole Completion	**Soil Cuttings**	Location	**33.02120, -117.13313**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					FILL Moist, olive, sandy CLAY			
515						FRIARS FORMATION Moist, light olive gray, sandy SILT (ML) / silty SAND (SM)			
	5					6" Thick concretion			
510									
	10					Bottom of boring at 10 fbgs			
505									
	15								
500									
	20								
495									
	25								
490									
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-15

URS

Figure B-16

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-16

Sheet 1 of 1

Date(s) Drilled	**09/02/2015**	Logged By	**A. Avakian**	Checked By	**P. Balasubramanyam**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**6" Finger Bit**	Total Depth of Borehole	**10.0 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**515.5 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**No Samples Taken**	Hammer Data	**N/A**
Borehole Completion	**Soil Cuttings**	Location	**33.02140, -117.13332**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
515	0					FILL Moist, olive, sandy CLAY			
510	5					FRIARS FORMATION Moist, light olive gray, sandy SILT (ML) / silty SAND (SM)			
505	10					Bottom of boring at 10 fbgs			
500	15								
495	20								
490	25								
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-16

URS

Figure B-17

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-17

Sheet 1 of 1

Date(s) Drilled	**09/02/2015**	Logged By	**A. Avakian**	Checked By	**P. Balasubramanyam**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**6" Finger Bit**	Total Depth of Borehole	**10.0 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**515 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**No Samples Taken**	Hammer Data	**N/A**
Borehole Completion	**Soil Cuttings**	Location	**33.02128, -117.13350**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
515	0					FILL Moist, olive, sandy CLAY			
						2" Thick concretion			
510	5					FRIARS FORMATION Moist, light olive gray, sandy SILT (ML) / silty SAND (SM)			
						6" Thick concretion			
505	10					Bottom of boring at 10 fbgs			
500	15								
495	20								
490	25								
485	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-17

URS

Figure B-18

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-18

Sheet 1 of 1

Date(s) Drilled	**09/02/2015**	Logged By	**A. Avakian**	Checked By	**P. Balasubramanyam**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**6" Finger Bit**	Total Depth of Borehole	**10.0 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**517.5 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**BULK**	Hammer Data	**N/A**
Borehole Completion	**Soil Cuttings**	Location	**33.02113, -117.13348**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					FILL Moist, olive, sandy CLAY			
515									
	5		1			FRIARS FORMATION Moist, light olive gray, sandy SILT (ML) / silty SAND (SM)			R-Value
510						1.0' Thick concretion			
	10					Bottom of boring at 10 fbgs			
505									
	15								
500									
	20								
495									
	25								
490									
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-18

URS

Figure B-19

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-19

Sheet 1 of 1

Date(s) Drilled	**09/02/2015**	Logged By	**A. Avakian**	Checked By	**P. Balasubramanyam**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**6" Finger Bit**	Total Depth of Borehole	**10.0 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**518.5 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**No Samples Taken**	Hammer Data	**N/A**
Borehole Completion	**Soil Cuttings**	Location	**33.02111, -117.13336**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					FILL Moist, olive, sandy CLAY			
515									
	5					FRIARS FORMATION Moist, light olive gray, sandy SILT (ML) / silty SAND (SM) 1.0' Thick concretion			
510									
	10					Bottom of boring at 10 fbgs			
505									
	15								
500									
	20								
495									
	25								
490									
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-19

URS

Figure B-20

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-20

Sheet 1 of 1

Date(s) Drilled	**09/02/2015**	Logged By	**A. Avakian**	Checked By	**P. Balasubramanyam**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**6" Finger Bit**	Total Depth of Borehole	**10.0 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**518 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**No Samples Taken**	Hammer Data	**N/A**
Borehole Completion	**Soil Cuttings**	Location	**33.02131, -117.13301**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	0					FILL Moist, olive, sandy CLAY			
515						becomes olive yellow, increase fine to medium sand content			
	5								
						FRIARS FORMATION Moist, light olive gray, sandy SILT (ML) / silty SAND (SM)			
510									
	10					Bottom of boring at 10 fbgs			
505									
	15								
500									
	20								
495									
	25								
490									
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-20

URS

Figure B-21

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-21

Sheet 1 of 1

Date(s) Drilled	**09/02/2015**	Logged By	**A. Avakian**	Checked By	**P. Balasubramanyam**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**6" Finger Bit**	Total Depth of Borehole	**10.0 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**521.5 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**No Samples Taken**	Hammer Data	**N/A**
Borehole Completion	**Soil Cuttings**	Location	**33.02103, -117.13291**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
520	0					FILL Moist, olive, sandy CLAY			
515	5					FRIARS FORMATION Moist, light olive gray, sandy SILT (ML) / silty SAND (SM) 2" Thick concretion			
510	10					Bottom of boring at 10 fbgs			
505	15								
500	20								
495	25								
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-21

URS

Figure B-22

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-22

Sheet 1 of 1

Date(s) Drilled	**09/02/2015**	Logged By	**A. Avakian**	Checked By	**P. Balasubramanyam**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**6" Finger Bit**	Total Depth of Borehole	**10.0 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**522 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**No Samples Taken**	Hammer Data	**N/A**
Borehole Completion	**Soil Cuttings**	Location	**33.02091, -117.13302**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
520	0					FILL Moist, olive, sandy CLAY			
515	5					FRIARS FORMATION Moist, light olive gray, sandy SILT (ML) / silty SAND (SM)			
						4" to 6" Thick concretion			
510	10					Bottom of boring at 10 fbgs			
505	15								
500	20								
495	25								
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-22

URS

Figure B-23

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-23

Sheet 1 of 1

Date(s) Drilled	**09/02/2015**	Logged By	**A. Avakian**	Checked By	**P. Balasubramanyam**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**6" Finger Bit**	Total Depth of Borehole	**15.0 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**525 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**No Samples Taken**	Hammer Data	**N/A**
Borehole Completion	**Soil Cuttings**	Location	**33.02082, -117.13278**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
525	0					FILL Moist, olive yellow, clayey SAND			
						6" Thick concretion fragment			
520	5					2" Thick concretion fragment			
						FRIARS FORMATION Moist, light olive gray, sandy SILT (ML) / silty SAND (SM)			
515	10					Moist, light yellowish brown, sandy CLAY (CL)			
						becomes dark greenish gray			
510	15					Bottom of boring at 15 fbgs			
505	20								
500	25								
495	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-23

URS

Figure B-24

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring B-24

Sheet 1 of 1

Date(s) Drilled	**09/02/2015**	Logged By	**A. Avakian**	Checked By	**P. Balasubramanyam**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**6" Finger Bit**	Total Depth of Borehole	**15.5 feet**
Drill Rig Type	**CME 75**	Drilling Contractor	**Tri-County Drilling**	Approximate Surface Elevation	**521 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**No Samples Taken**	Hammer Data	**N/A**
Borehole Completion	**Soil Cuttings**	Location	**33.02081, -117.13332**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
520	0					FILL Moist, olive, sandy CLAY			
						3" Thick concretion fragment			
515	5					FRIARS FORMATION Moist, light olive gray, sandy SILT (ML) / silty SAND (SM)			
						6" Thick concretion			
510	10					6" Thick concretion			
						6" Thick concretion			
	15					1.0' Thick concretion			
505						Bottom of boring at 15.5 fbgs			
500	20								
495	25								
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 B-24

URS

Figure B-25

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring HA-1

Sheet 1 of 1

Date(s) Drilled	**04/28/15**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hand Auger**	Drill Bit Size/Type	**4" Hand Auger**	Total Depth of Borehole	**3.3 feet**
Drill Rig Type	**NA**	Drilling Contractor	**NA**	Approximate Surface Elevation	**520 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**Grab**	Hammer Data	**NA**
Borehole Completion	**Soil Cuttings**	Location	**33.02069, -117.13449**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
520	0					FILL - moist, yellowish brown, silty sand, with some cobbles			
			1			MISSION VALLEY FORMATION Moist, yellowish brown silty, medium SAND (SM)	5		WA(18)
						Total Depth 3.25' bgs			
515	5								
510	10								
505	15								
500	20								
495	25								
490	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 HA-1

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Figure B-26

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring HA-2

Sheet 1 of 1

Date(s) Drilled	**04/28/15**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hand Auger**	Drill Bit Size/Type	**4" Hand Auger**	Total Depth of Borehole	**3.0 feet**
Drill Rig Type	**NA**	Drilling Contractor	**NA**	Approximate Surface Elevation	**525 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**Grab**	Hammer Data	**NA**
Borehole Completion	**Soil Cuttings**	Location	**33.02068, -117.13397**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
525	0					FILL - moist, yellowish brown, silty sand, with some cobbles			
			1			MISSION VALLEY FORMATION Moist, yellowish brown, clayey medium SAND (SC)	7		LL(44), PI(22)
						Total Depth 3.0' bgs			
520	5								
515	10								
510	15								
505	20								
500	25								
495	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 HA-2

URS

Figure B-27

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring HA-3

Sheet 1 of 1

Date(s) Drilled	**04/28/15**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hand Auger**	Drill Bit Size/Type	**4" Hand Auger**	Total Depth of Borehole	**2.3 feet**
Drill Rig Type	**NA**	Drilling Contractor	**NA**	Approximate Surface Elevation	**532 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**Grab**	Hammer Data	**NA**
Borehole Completion	**Soil Cuttings**	Location	**33.02069, -117.13312**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
530	0		1			MISSION VALLEY FORMATION Moist, yellowish brown silty, medium SAND (SM)	9		WA(14)
						Total Depth 2.25' bgs			
525	5								
520	10								
515	15								
510	20								
505	25								
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 HA-3

URS

Figure B-28

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring HA-4

Sheet 1 of 1

Date(s) Drilled	**04/28/15**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hand Auger**	Drill Bit Size/Type	**4" Hand Auger**	Total Depth of Borehole	**3.3 feet**
Drill Rig Type	**NA**	Drilling Contractor	**NA**	Approximate Surface Elevation	**533 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**Grab**	Hammer Data	**NA**
Borehole Completion	**Soil Cuttings**	Location	**33.02072, -117.13255**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
530	0		1			MISSION VALLEY FORMATION Moist, yellowish brown, clayey medium GRAVEL (GC)	8		LL(50), PI(29)
						Total Depth 3.25' bgs			
525	5								
520	10								
515	15								
510	20								
505	25								
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 HA-4

URS

Figure B-29

Project: SDG&E Artesian Substation Expansion
Project Location: San Diego, California
Project Number: 27661515.20000

Log of Boring PT-1

Sheet 1 of 1

Date(s) Drilled	**04/28/15**	Logged By	**D. Rector**	Checked By	**P. Balasubramanyam**
Drilling Method	**Hand Dug**	Drill Bit Size/Type	**8" Diameter Hole**	Total Depth of Borehole	**2.8 feet**
Drill Rig Type	**Post Hole Digger**	Drilling Contractor	**NA**	Approximate Surface Elevation	**483 feet MSL**
Water Level Depth	**Not Encountered**	Sampling Method(s)	**Grab**	Hammer Data	**NA**
Borehole Completion	**Soil Cuttings**	Location	**33.02131, -117.13505**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
480	0					TOPSOIL - Moist, olive brown, sandy SILT (ML)			
			1			MISSION VALLEY FORMATION Moist, light olive green, clayey SAND (SC)	13		WA(23) HYD (35)
						Total Depth 2.8' bgs			
475	5								
470	10								
465	15								
460	20								
455	25								
	30								

Report: GEO_10_SNA; File: 27661515.GPJ; 9/24/2015 PT-1

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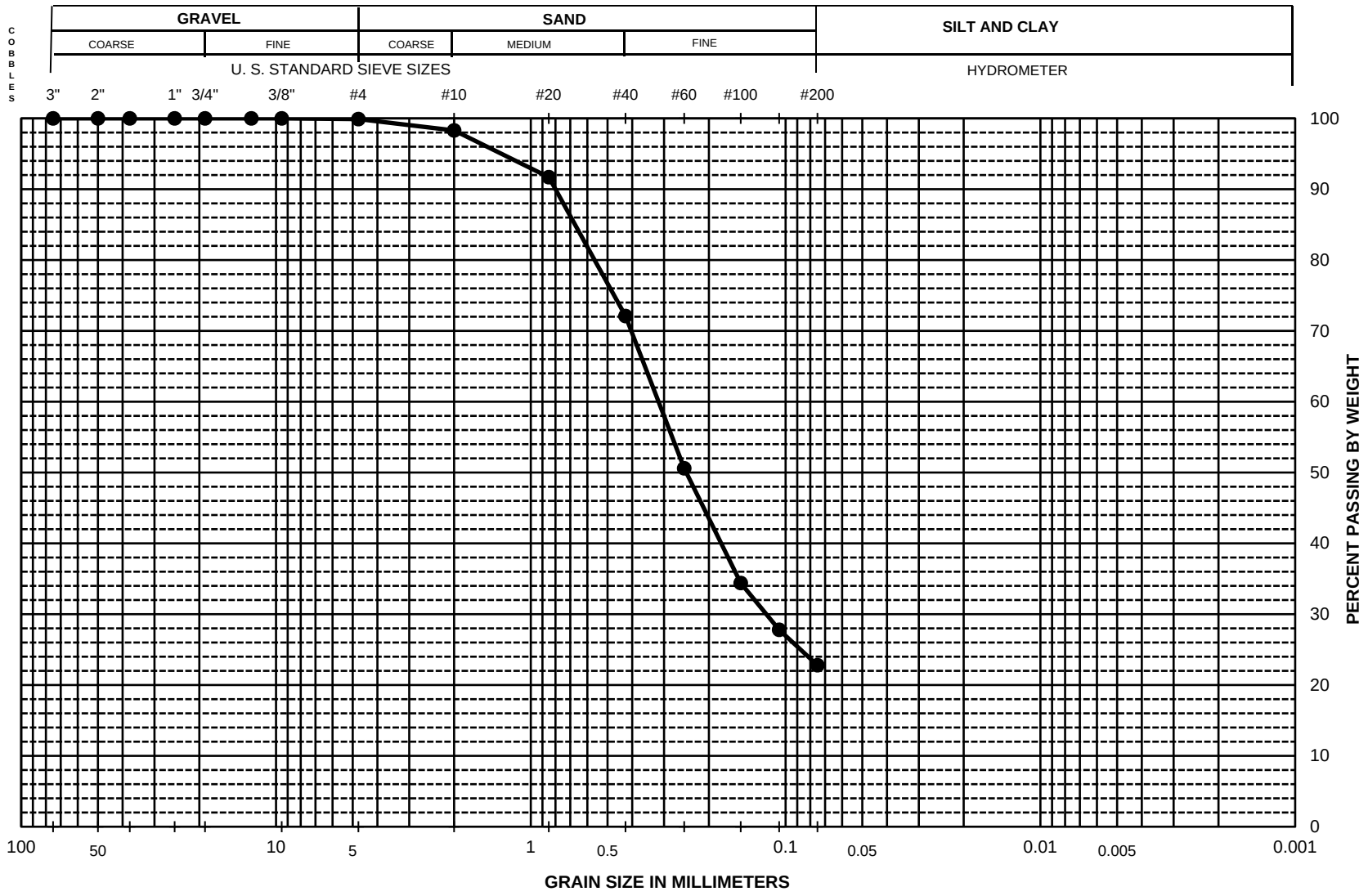
Figure B-30

Geotechnical laboratory testing was performed in general accordance with ASTM standards. Results of laboratory testing performed are presented on Figures C-1 through C-27. The results of moisture content and fines content are shown at the corresponding sample locations on the boring logs in Appendix B.

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	100.0
#4	4.75	99.9
#10	2.00	98.3
#20	0.850	91.7
#40	0.425	72.1
#60	0.250	50.6
#100	0.150	34.4
#140	0.106	27.8
#200	0.075	22.8

Hydrometer Analysis

% Cobbles	---
% Gravel	0.1
% Sand	77.1
% Fines	22.8

D_{85}	0.671
D_{60}	0.315
D_{50}	0.245
D_{30}	0.119
D_{15}	#N/A
D_{10}	#N/A
C_u	----
C_c	-----

Boring No.	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 2 μm	Description and Classification
B-5	4	10.0	●	12.7	---	---	---	**Reddish brown silty Sand (SM)**

PROJECT NAME: **SDG&E Artesian Substation Expansion**

PROJECT NUMBER: **27661515.20000**

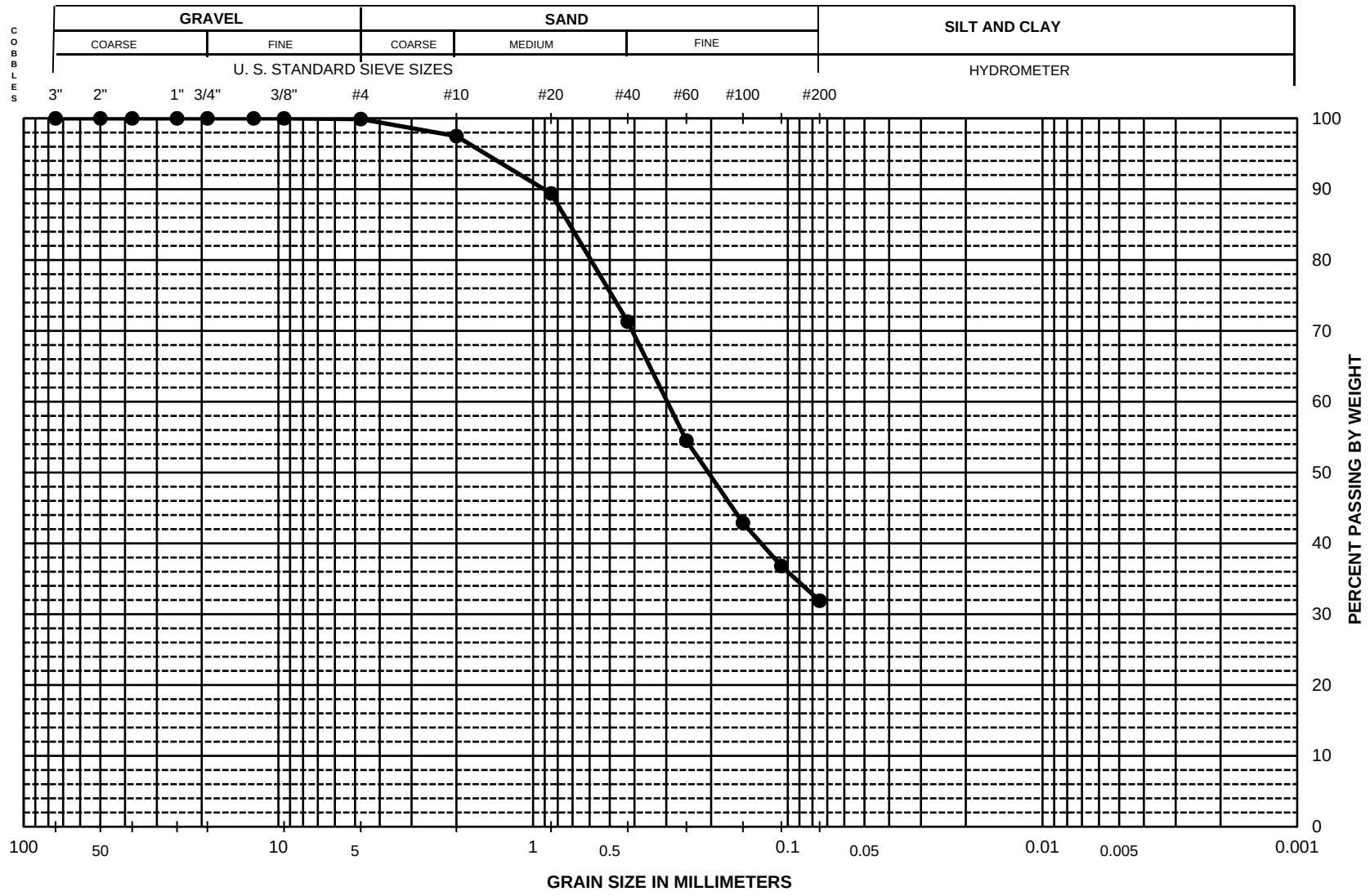
PARTICLE-SIZE DISTRIBUTION CURVES

Figure C-1

J:\27661515 TSAC SDG&E 11004 Artesian Substation\009 FIELD & LAB DATA\Lab Testing\Appendix C\Sieve SDGE Artesian B-5 010

URS

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	100.0
#4	4.75	99.9
#10	2.00	97.5
#20	0.850	89.4
#40	0.425	71.3
#60	0.250	54.5
#100	0.150	42.9
#140	0.106	36.8
#200	0.075	31.9

Hydrometer Analysis

% Cobbles	---
% Gravel	0.1
% Sand	68.0
% Fines	31.9

D_{85}	0.718
D_{60}	0.297
D_{50}	0.205
D_{30}	#N/A
D_{15}	#N/A
D_{10}	#N/A
C_u	----
C_c	-----

Boring No.	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 2 μm	Description and Classification
B-6	7	30.0	●	12.3	---	---	---	**Yellowish Brown silty Sand (SM)**

PROJECT NAME: **SDG&E Artesian Substation Expansion**

PROJECT NUMBER: **27661515.20000**

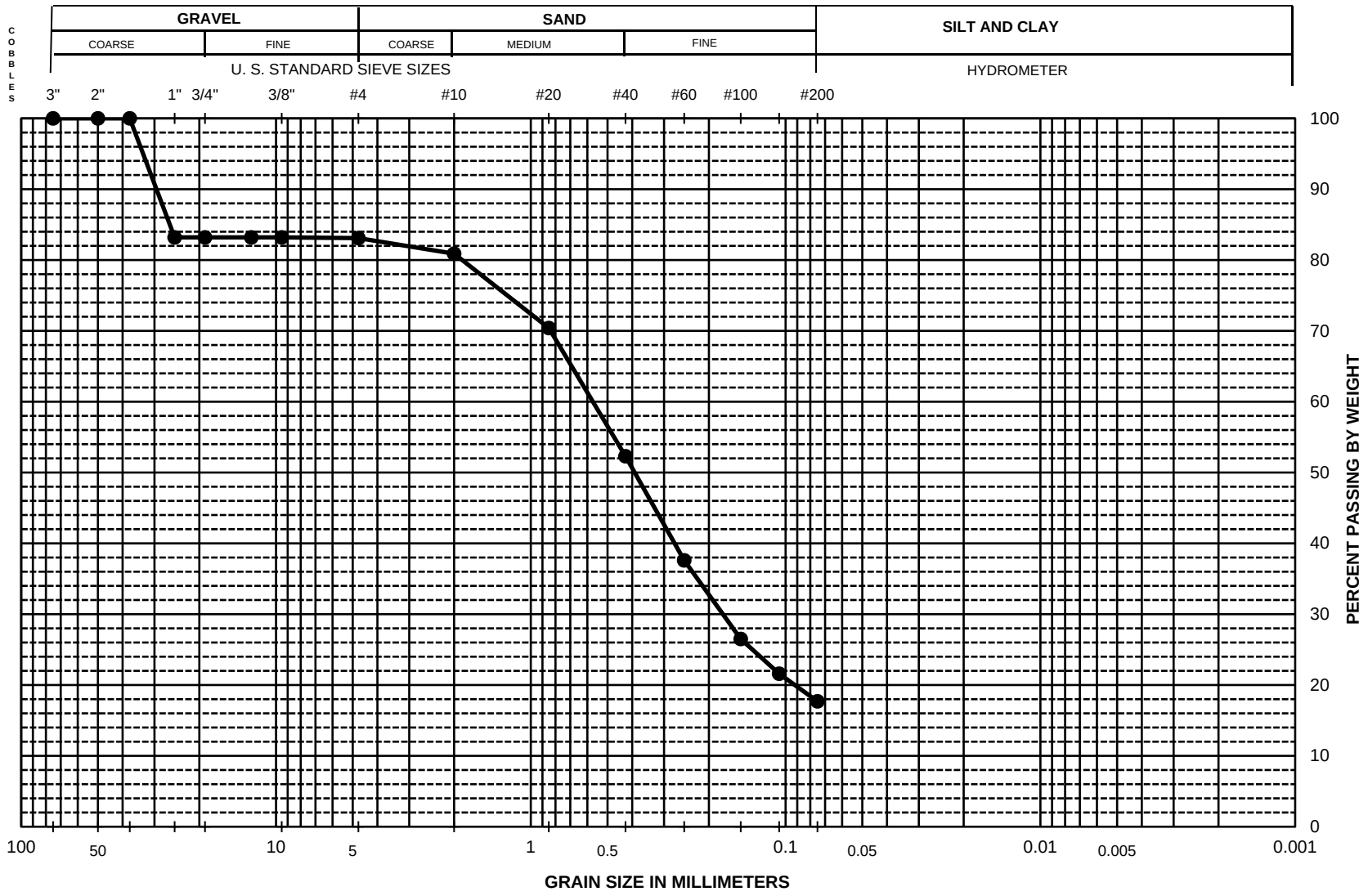
PARTICLE-SIZE DISTRIBUTION CURVES

Figure C-2

J:\27661515 TSAC SDG&E 11004 Artesian Substation\009 FIELD & LAB DATA\Lab Testing\Appendix C\Sieve SDGE Artesian B-6 030

URS

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	83.2
3/4"	19.00	83.2
1/2"	12.50	83.2
3/8"	9.50	83.2
#4	4.75	83.1
#10	2.00	80.9
#20	0.850	70.4
#40	0.425	52.3
#60	0.250	37.6
#100	0.150	26.5
#140	0.106	21.6
#200	0.075	17.7
Hydrometer Analysis		

% Cobbles	---
% Gravel	16.9
% Sand	65.4
% Fines	17.7

D_{85}	#DIV/0!
D_{60}	0.571
D_{50}	0.391
D_{30}	0.176
D_{15}	#N/A
D_{10}	#N/A
C_u	----
C_c	-----

Boring No.	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 2 μm	Description and Classification
B-7	4	15.0	●	7.9	---	---	---	**Light Gray silty Sand with gravel (SM)**

PROJECT NAME: **SDG&E Artesian Substation Expansion**

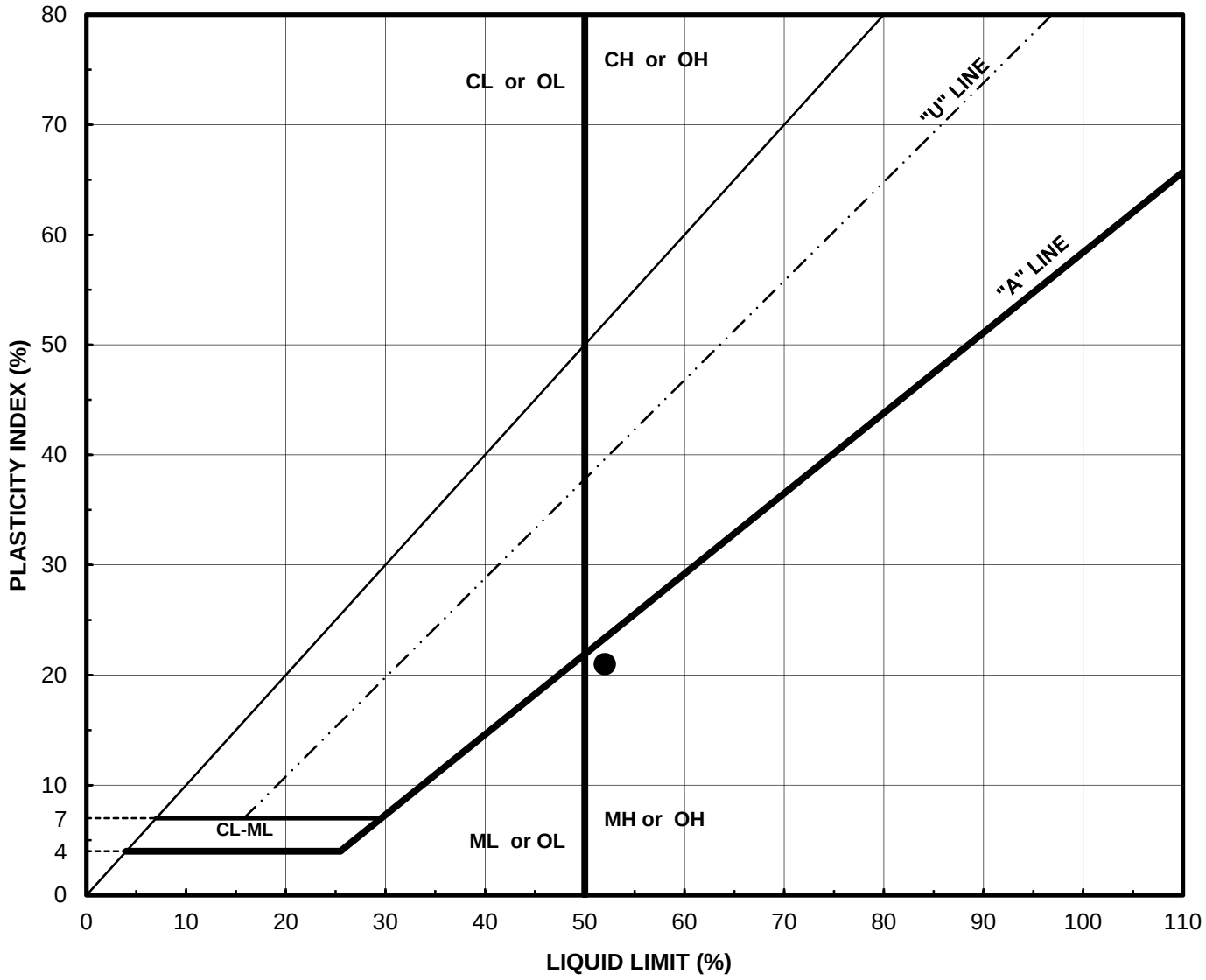
PROJECT NUMBER: **27661515.20000**

PARTICLE-SIZE DISTRIBUTION CURVES

Figure C-3

J:\27661515 TSAC SDG&E 11004 Artesian Substation\009 FIELD & LAB DATA\Lab Testing\Appendix C\Sieve SDGE Artesian B-7 015

URS

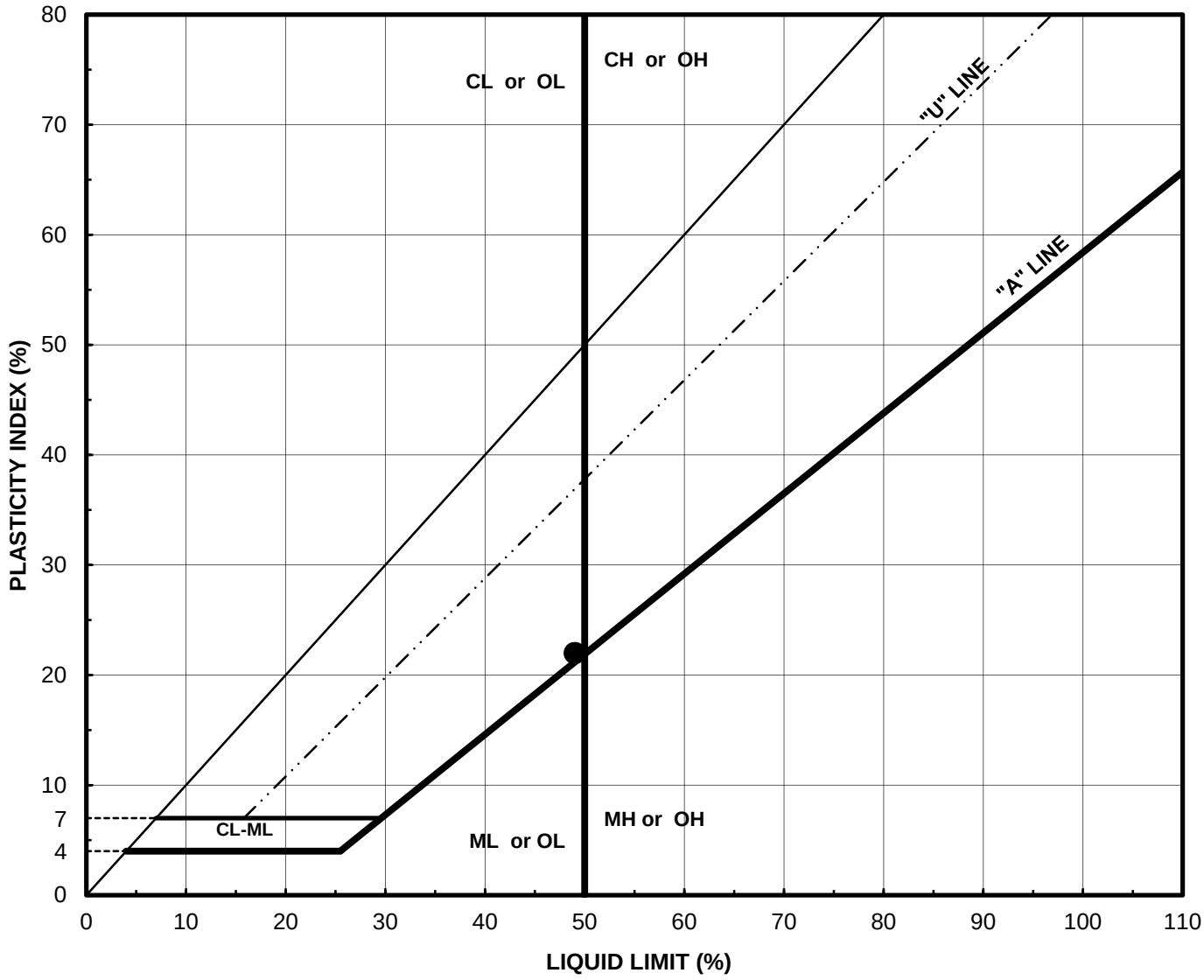


Boring Number	Sample Number	Depth (ft)	Water Content (%)	LL	PI	DESCRIPTION / CLASSIFICATION
B-1	5	15.0	21.6	52	21	Olive Brown silty Sand (SM)

Project Name: **SDG&E Artesian Substation Expansion** **PLASTICITY CHART**

Project Number: **27661515.20000** **Figure C-4**

URS



Boring Number	Sample Number	Depth (ft)	Water Content (%)	LL	PI	DESCRIPTION / CLASSIFICATION
B-1	10	40.0	23.3	49	22	Light grayish olive Clay (CL)

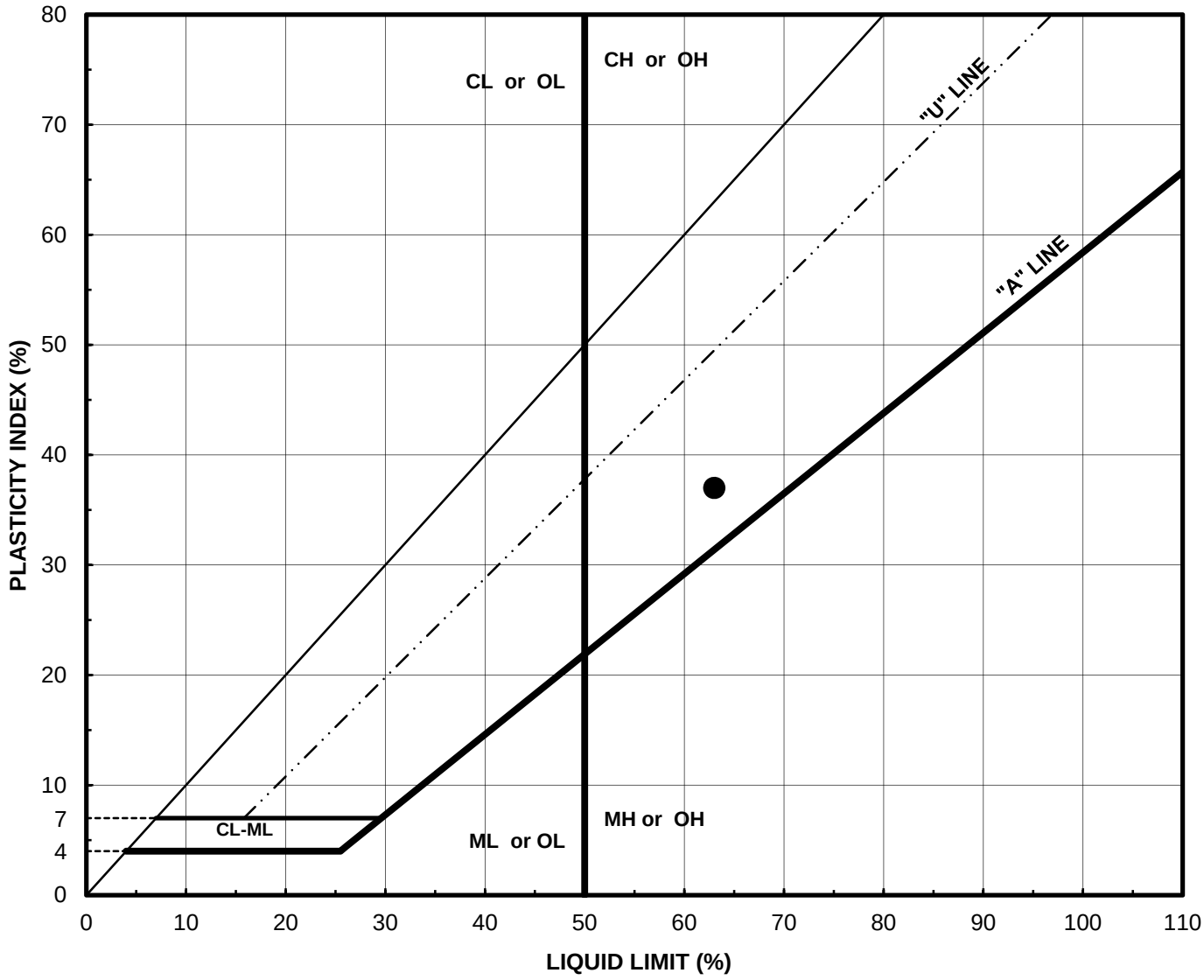
Project Name: SDG&E Artesian Substation Expansion

Project Number: 27661515.20000

PLASTICITY CHART

Figure C-5

URS



Boring Number	Sample Number	Depth (ft)	Water Content (%)	LL	PI	DESCRIPTION / CLASSIFICATION
B-2	10	40.0	20.5	63	37	White clayey Sand (SC)

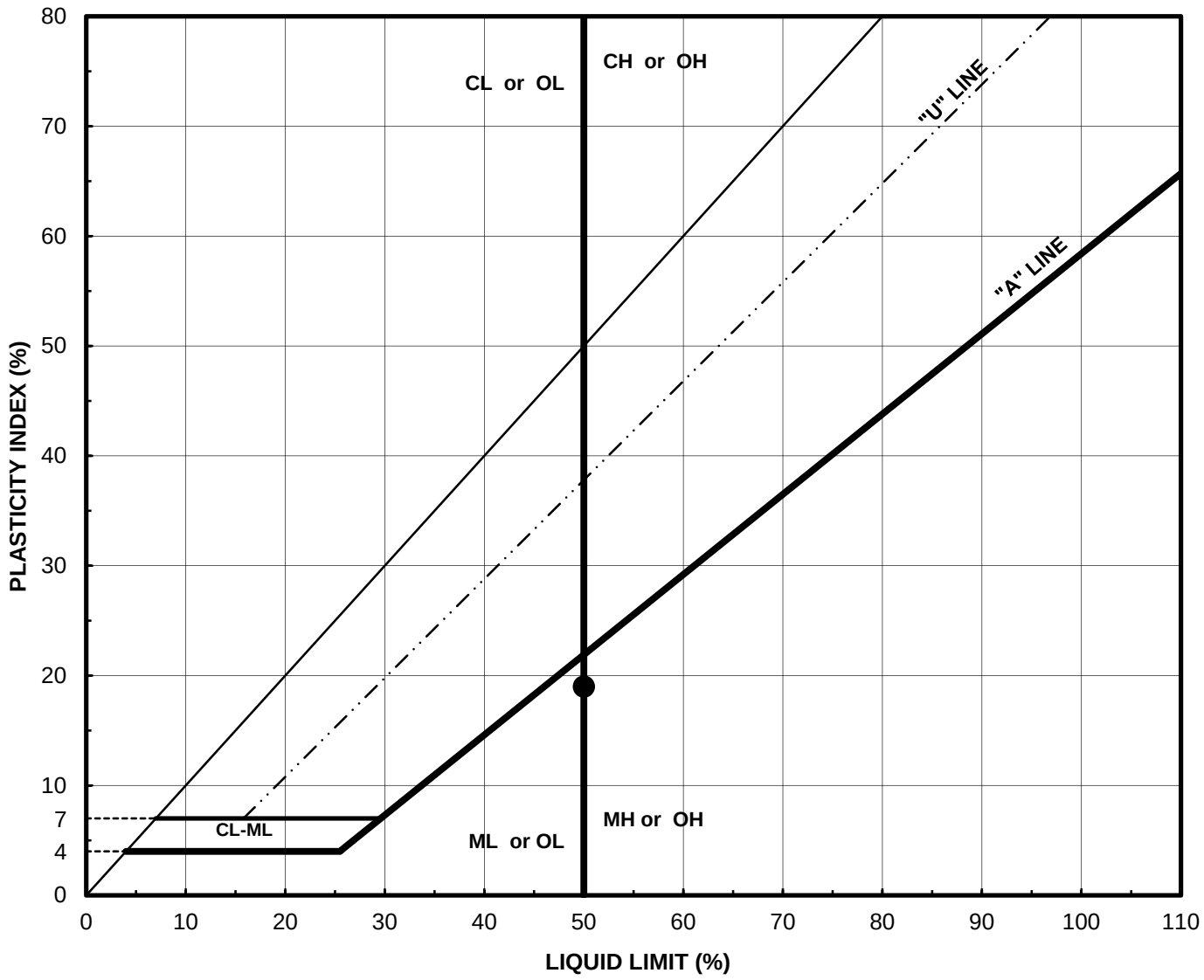
Project Name: **SDG&E Artesian Substation Expansion**

Project Number: **27661515.20000**

PLASTICITY CHART

Figure C-6

URS



Boring Number	Sample Number	Depth (ft)	Water Content (%)	LL	PI	DESCRIPTION / CLASSIFICATION
B-3	5	20.0	16.2	50	19	Dark Gray sandy Silt (MH)

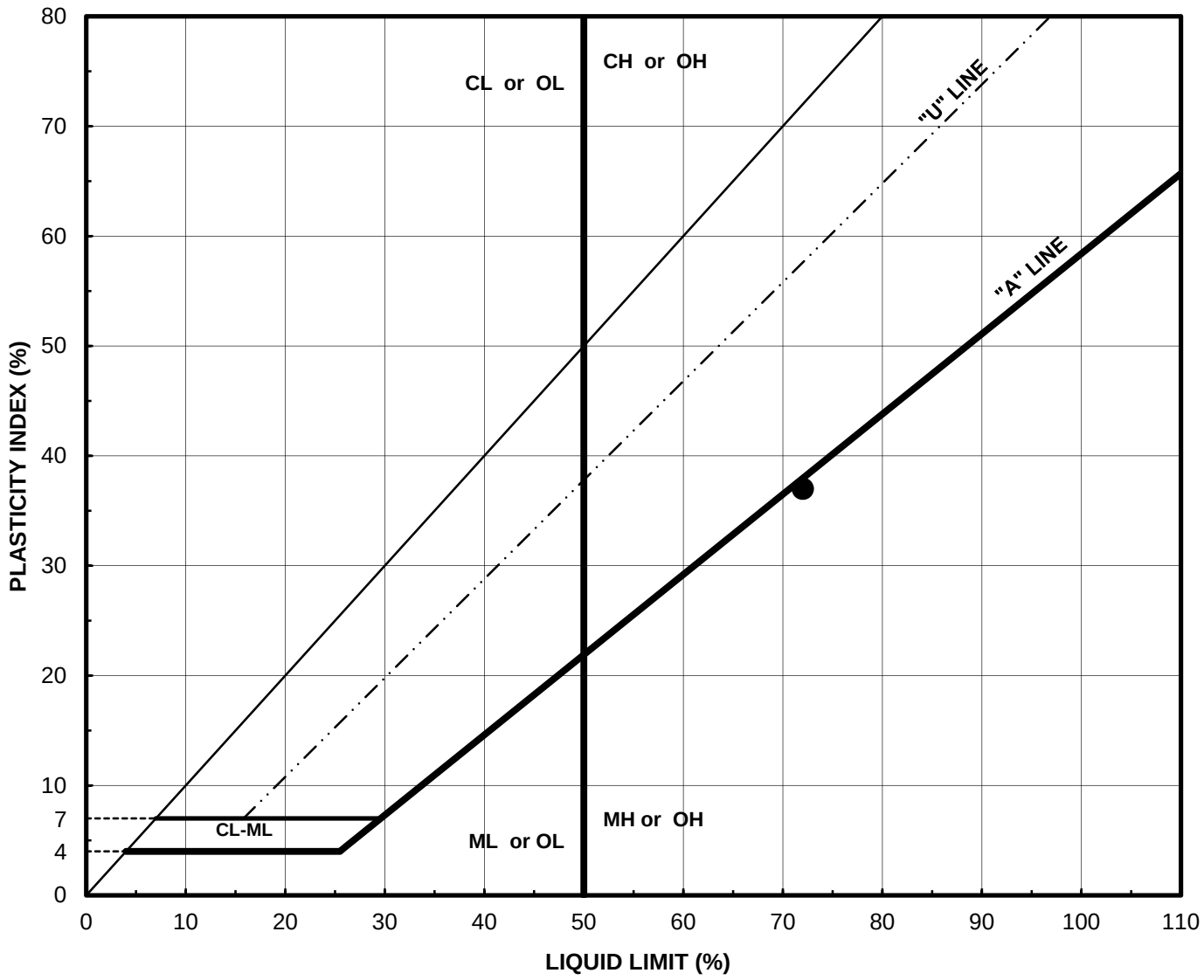
Project Name: **SDG&E Artesian Substation Expansion**

Project Number: **27661515.20000**

PLASTICITY CHART

Figure C-7

URS



Boring Number	Sample Number	Depth (ft)	Water Content (%)	LL	PI	DESCRIPTION / CLASSIFICATION
B-3	6	25.0	28.5	72	37	Olive gray Silt (MH)

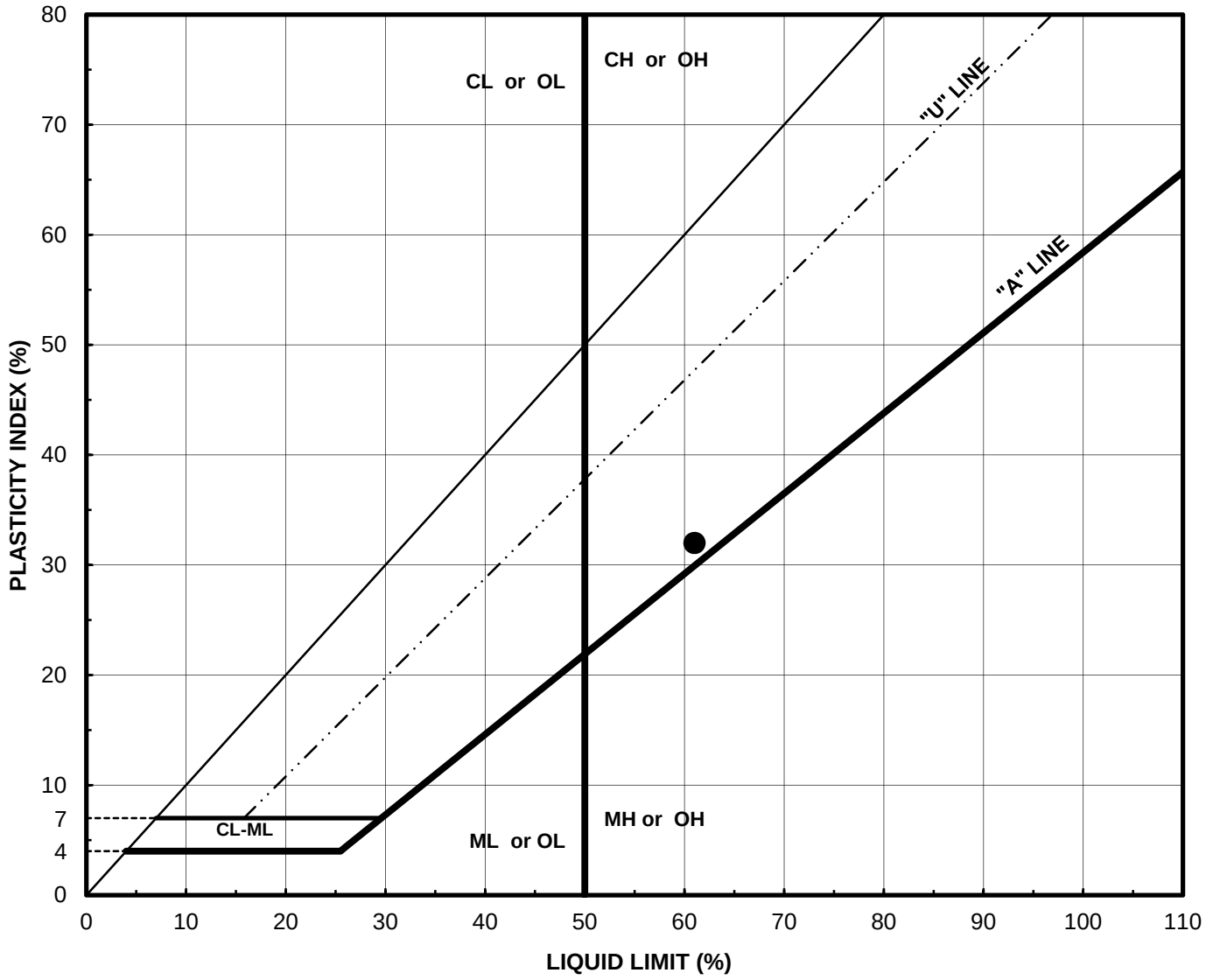
Project Name: **SDG&E Artesian Substation Expansion**

Project Number: **27661515.20000**

PLASTICITY CHART

Figure C-8

URS



Boring Number	Sample Number	Depth (ft)	Water Content (%)	LL	PI	DESCRIPTION / CLASSIFICATION
B-4	10	40.0	20.9	61	32	Green Clay (CH)

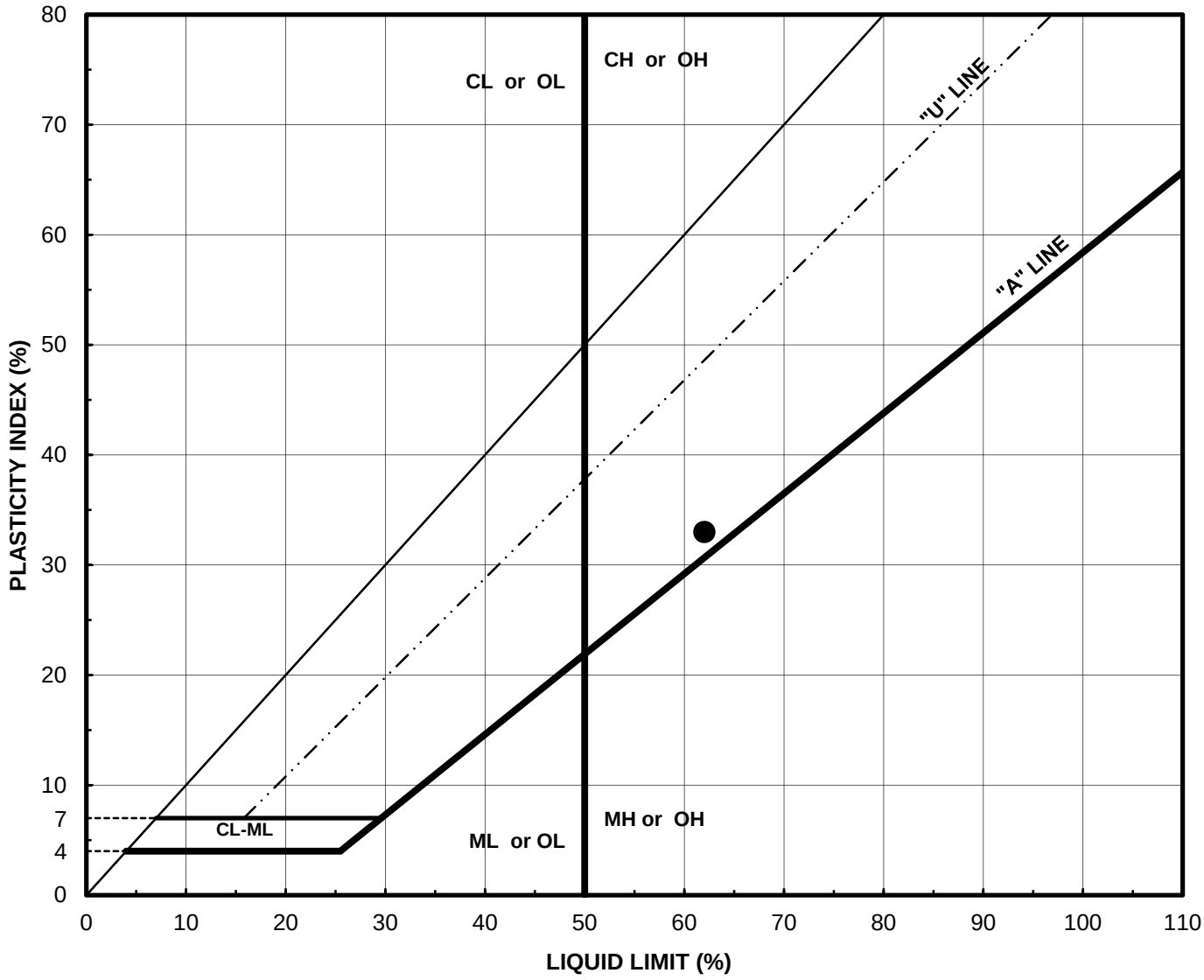
Project Name: SDG&E Artesian Substation Expansion

Project Number: 27661515.20000

PLASTICITY CHART

Figure C-9

URS



Boring Number	Sample Number	Depth (ft)	Water Content (%)	LL	PI	DESCRIPTION / CLASSIFICATION
B-5	7	25.0	NA	62	33	Olive green Clay (CH)

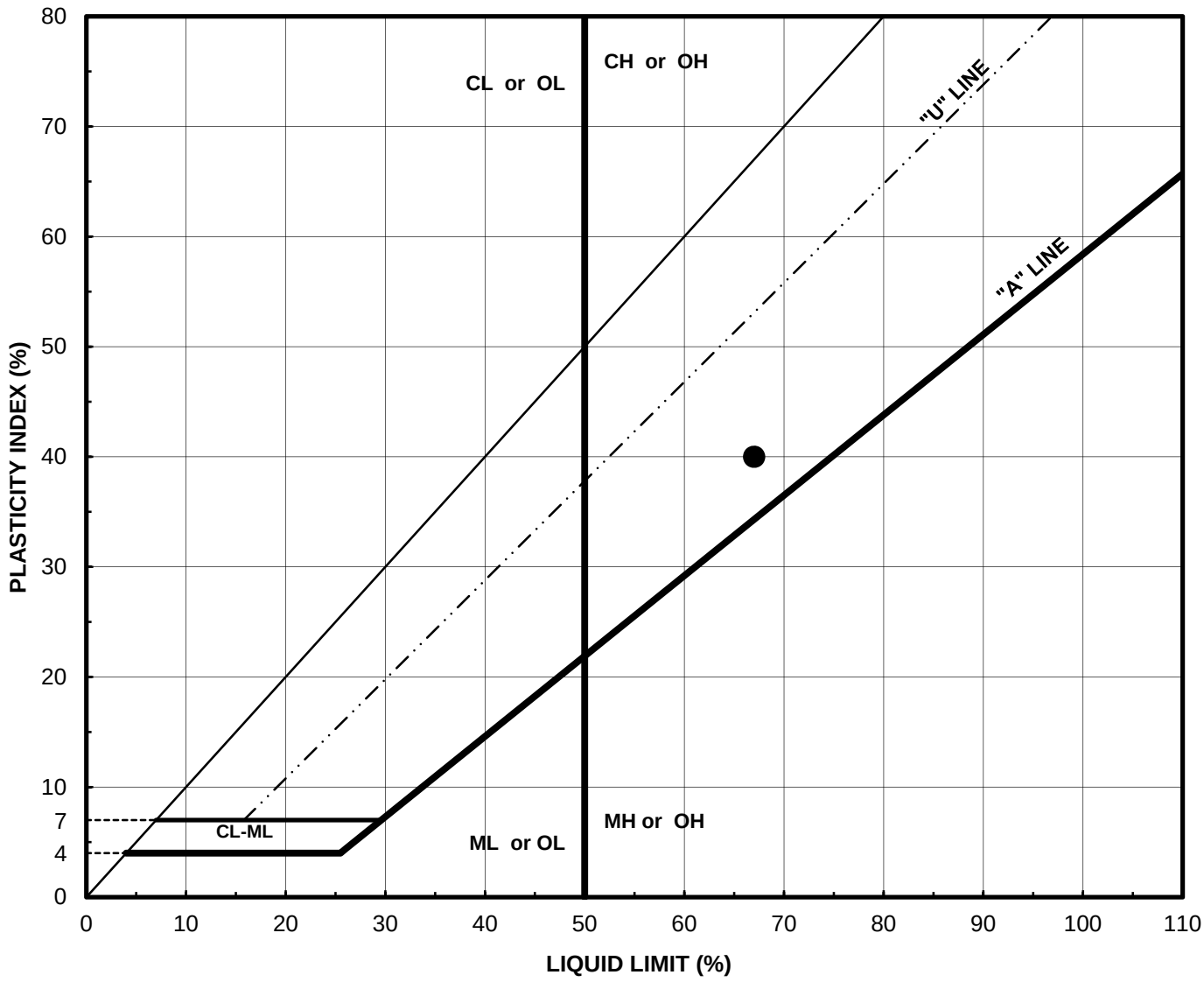
Project Name: **SDG&E Artesian Substation Expansion**

Project Number: **27661515.20000**

PLASTICITY CHART

Figure C-10

URS



Boring Number	Sample Number	Depth (ft)	Water Content (%)	LL	PI	DESCRIPTION / CLASSIFICATION
B-6	8	35.0	17.1	67	40	Olive brown Clay (CH)

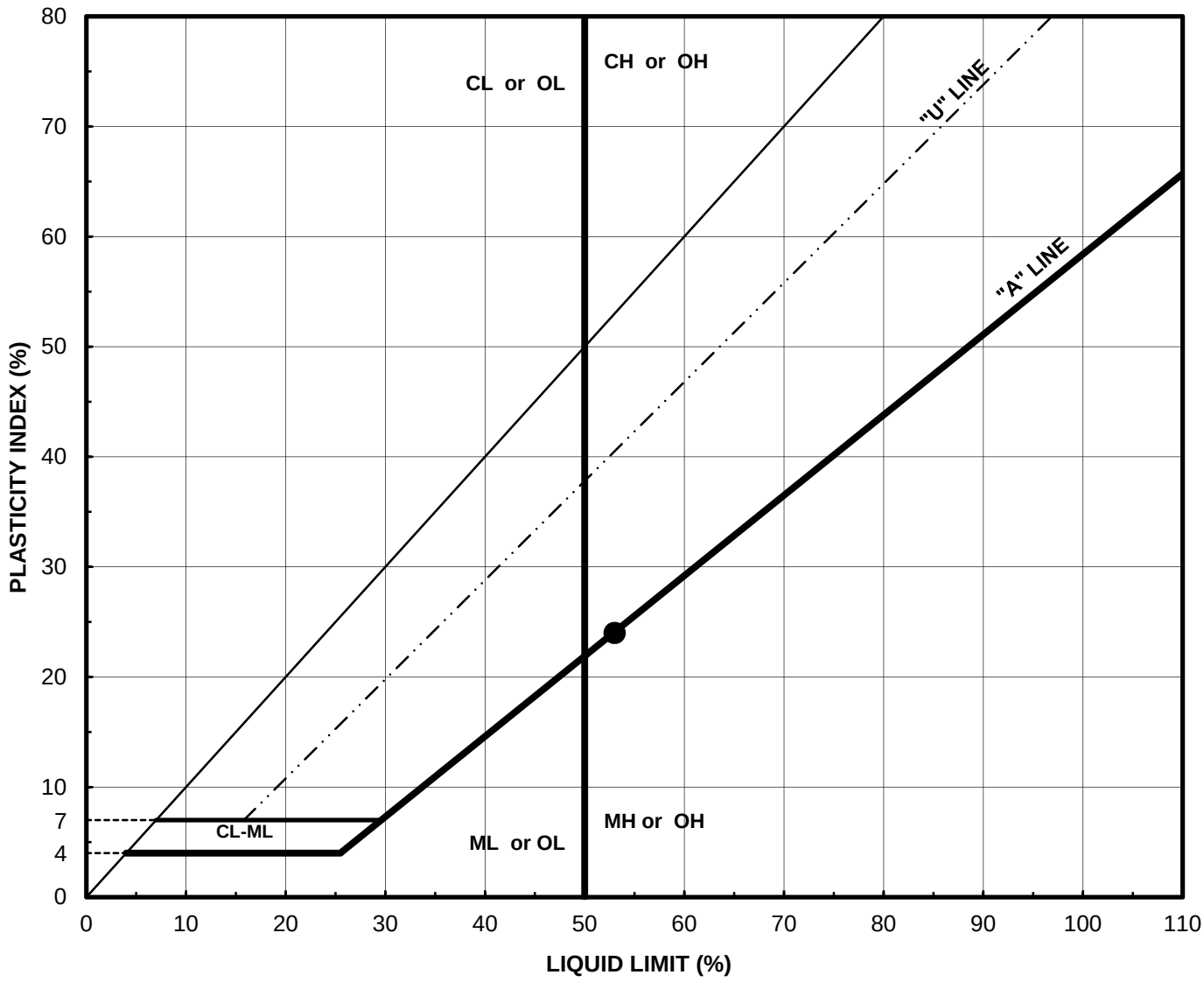
Project Name: **SDG&E Artesian Substation Expansion**

Project Number: **27661515.20000**

PLASTICITY CHART

Figure C-11

URS



Boring Number	Sample Number	Depth (ft)	Water Content (%)	LL	PI	DESCRIPTION / CLASSIFICATION
B-7	8	35.0	19.7	53	24	Light green clayey Sand (SC)

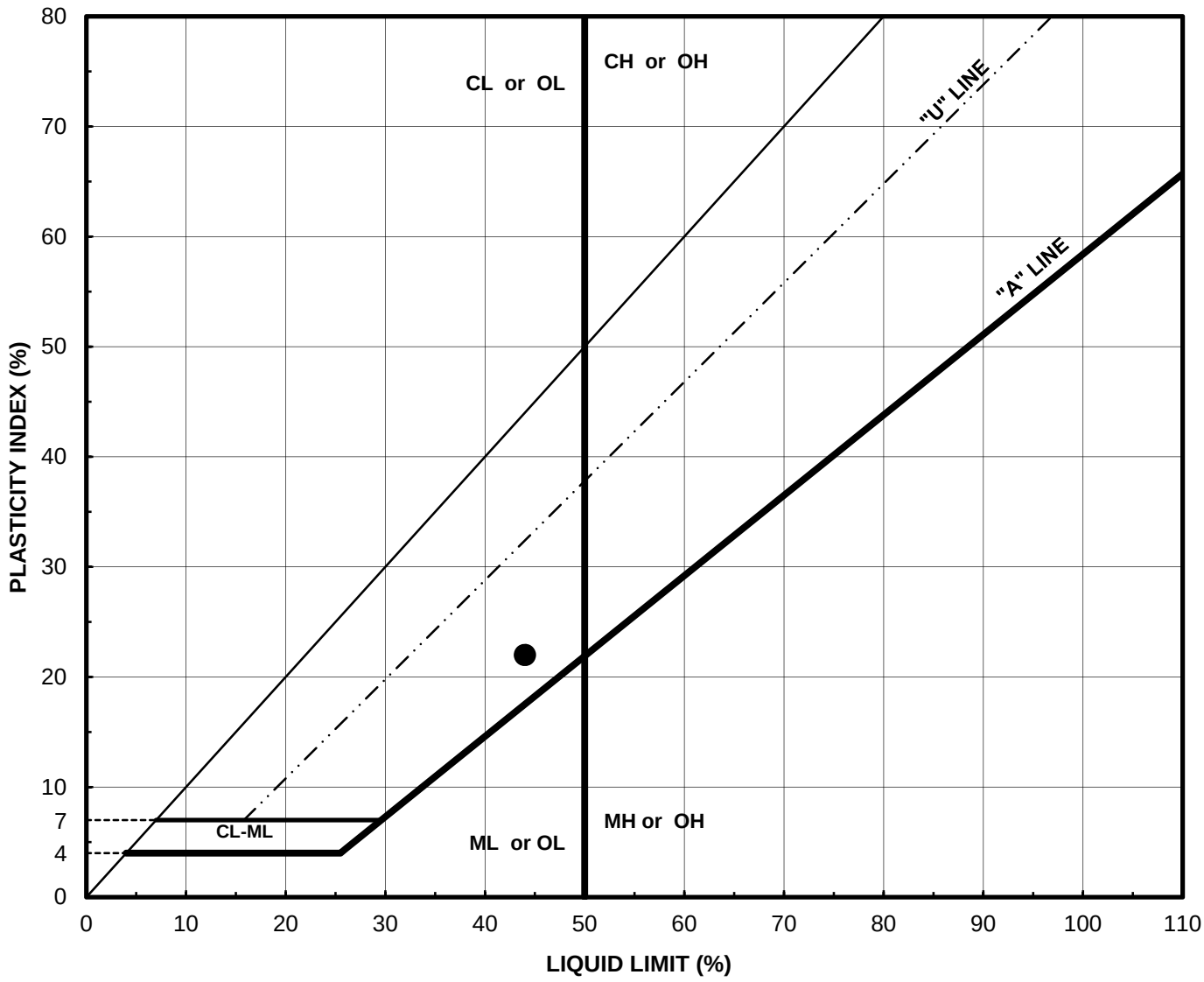
Project Name: **SDG&E Artesian Substation Expansion**

Project Number: **27661515.20000**

PLASTICITY CHART

Figure C-12

URS



Boring Number	Sample Number	Depth (ft)	Water Content (%)	LL	PI	DESCRIPTION / CLASSIFICATION
HA-2		3.0	6.6	44	22	Yellowish Brown clayey Sand (SC)

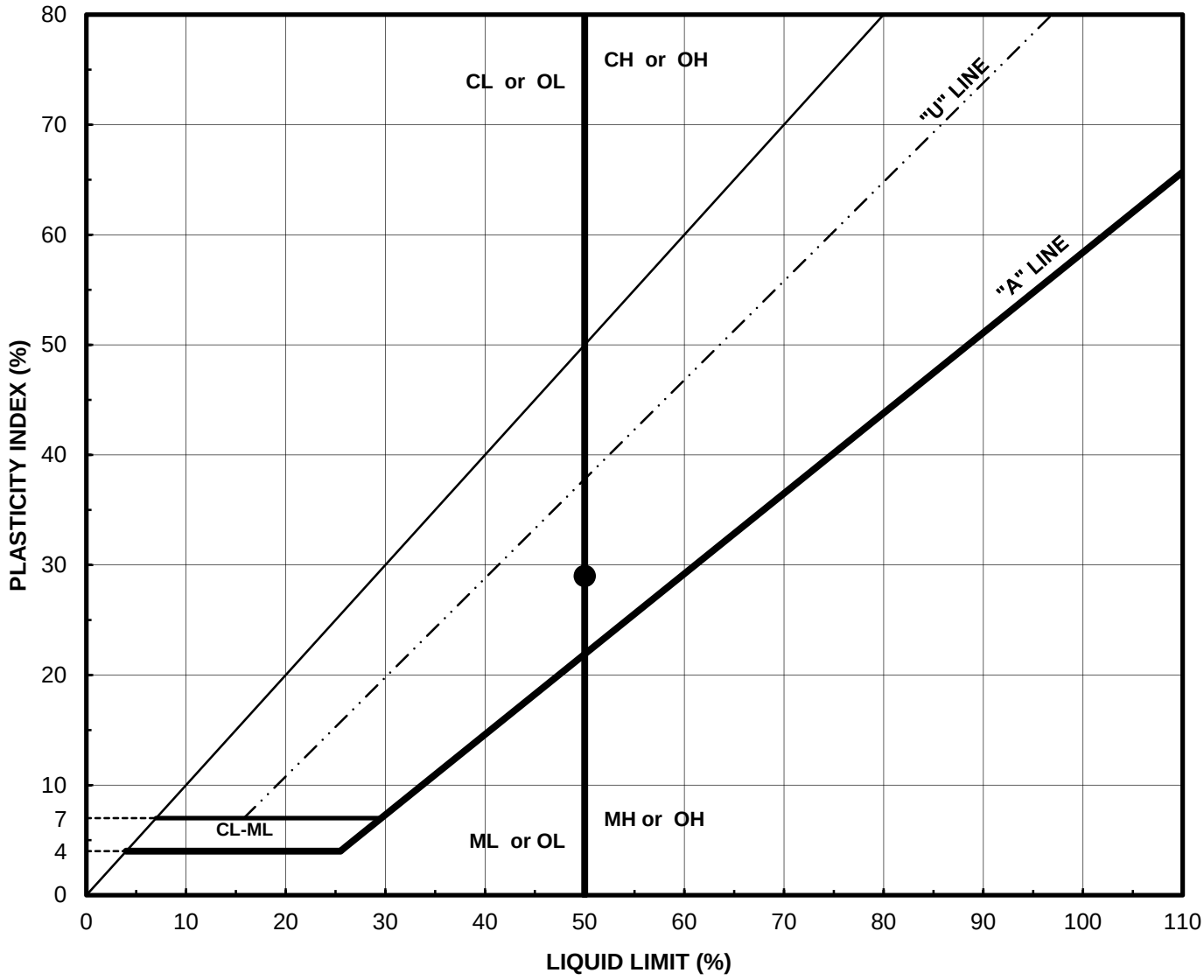
Project Name: **SDG&E Artesian Substation Expansion**

Project Number: **27661515.20000**

PLASTICITY CHART

Figure C-13

URS

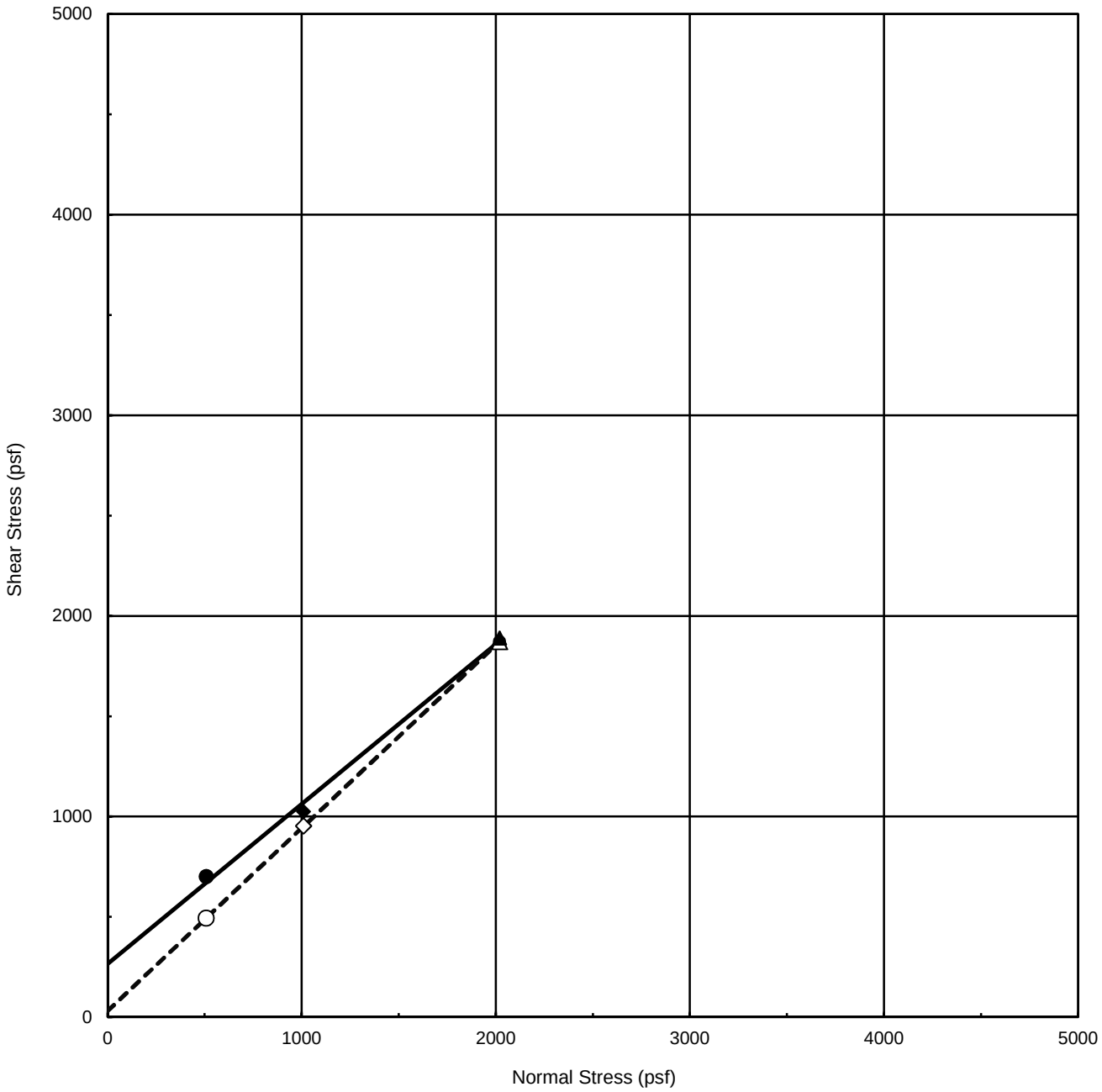


Boring Number	Sample Number	Depth (ft)	Water Content (%)	LL	PI	DESCRIPTION / CLASSIFICATION
HA-4	1	3.0	8.4	50	29	Olive yellow clayey Sand (SC)

Project Name: **SDG&E Artesian Substation Expansion** **PLASTICITY CHART**

Project Number: **27661515.20000** **Figure C-14**

URS



Peak Values are : ● ,solid trend line Ultimate Values are: ❍ ,dashed trend line

Exploration No.:	B-5		Strength Intercept (C) :	265.9	psf	Peak	31.6	psf	Ultimate
Sample No.:	2			12.7	kPa		1.5	kPa	
Depth (ft | m)	2.5	0.8	Friction Angle (ϕ) :	39	degree		42	degree	

Description: **White clayey Sand (SC)** Shear rate : 0.0040 (in/min) , 0.0102 (cm/min)

	SYMBOL	% Water Content	Total Unit Weight (pcf)	Total Unit Weight (kN/m^3)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m^3)	Normal Stress (psf)	Normal Stress (kPa)	Peak Stress (psf)	Peak Stress (kPa)	Ultimate Stress (psf)	Ultimate Stress (kPa)
	Initial / Set up	17.7	120.5	18.9	102.4	16.1	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	● spec. 1	22.7	123.2	19.4	100.4	15.8	508	24	701	34	494	24
pre-shear	◆ spec. 2	21.6	127.3	20.0	104.7	16.5	1010	48	1025	49	953	46
pre-shear	▲ spec. 3	20.4	130.2	20.5	108.1	17.0	2020	97	1890	90	1872	90

URS

SDG&E Artesian Substation Expansion

Project Number: 27661515.20000

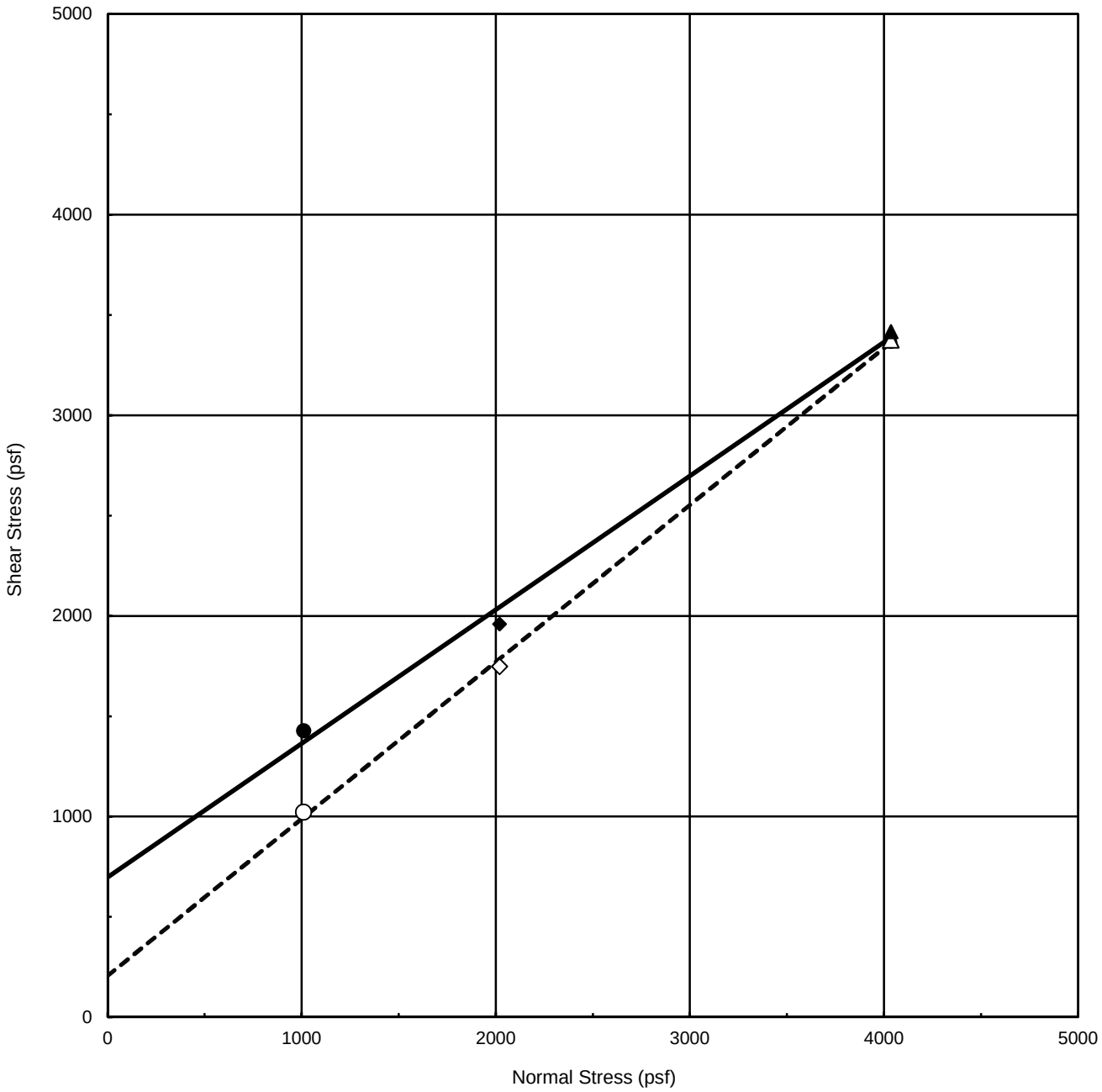
Test Date: 5/18/2015

DIRECT SHEAR TEST

ASTM D 3080

Figure C-15

DS Plot SDGE Artesian B-5 002



Peak Values are : ● ,solid trend line Ultimate Values are: ❍ ,dashed trend line

Exploration No.:	B-5		Strength Intercept (C) :	697.0	psf	Peak	206.8	psf	Ultimate
Sample No.:	4			33.4	kPa		9.9	kPa	
Depth (ft | m)	10.0	3.0	Friction Angle (ϕ) :	34	degree		38	degree	

Description: **Yellowish brown clayey Sand (SC)** Shear rate : 0.0040 (in/min) , 0.0102 (cm/min)

	SYMBOL	% Water Content	Total Unit Weight (pcf)	Total Unit Weight (kN/m^3)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m^3)	Normal Stress (psf)	Normal Stress (kPa)	Peak Stress (psf)	Peak Stress (kPa)	Ultimate Stress (psf)	Ultimate Stress (kPa)
	Initial / Set up	12.7	124.2	19.5	110.2	17.3	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	● spec. 1	18.5	133.7	21.0	112.9	17.7	1010	48	1427	68	1022	49
pre-shear	◆ spec. 2	18.8	136.5	21.4	114.9	18.1	2020	97	1959	94	1748	84
pre-shear	▲ spec. 3	19.0	135.5	21.3	113.9	17.9	4036	193	3417	164	3376	162

URS

SDG&E Artesian Substation Expansion

Project Number: 27661515.20000

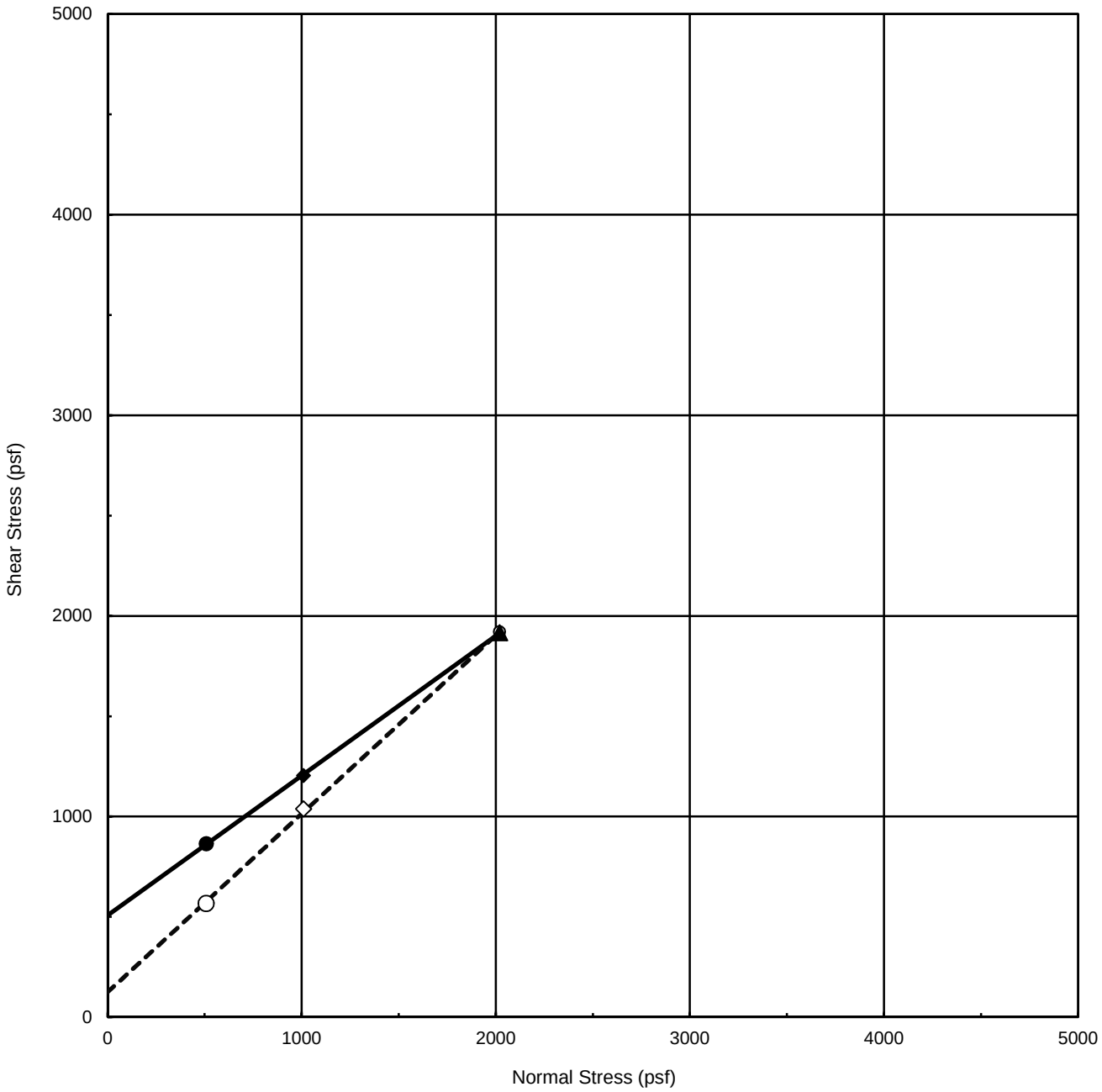
Test Date: 5/18/2015

DIRECT SHEAR TEST

ASTM D 3080

Figure C-16

DS Plot SDGE Artesian B-5 010



Peak Values are : ● ,solid trend line Ultimate Values are: ❍ ,dashed trend line

Exploration No.:	B-6		Strength Intercept (C) :	506.8	psf	Peak	125.2	psf	Ultimate
Sample No.:	2			24.3	kPa		6.0	kPa	
Depth (ft | m)	5.0	1.5	Friction Angle (ϕ) :	35	degree		42	degree	

Description: **Pale olive silty, clayey Sand (SC-SM)** Shear rate : 0.0040 (in/min) , 0.0102 (cm/min)

	SYMBOL	% Water Content	Total Unit Weight (pcf)	Total Unit Weight (kN/m^3)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m^3)	Normal Stress (psf)	Normal Stress (kPa)	Peak Stress (psf)	Peak Stress (kPa)	Ultimate Stress (psf)	Ultimate Stress (kPa)
	Initial / Set up	15.8	121.1	19.0	104.6	16.4	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	● spec. 1	23.9	127.3	20.0	102.8	16.1	508	24	865	41	567	27
pre-shear	◆ spec. 2	26.8	126.7	19.9	99.9	15.7	1010	48	1204	58	1038	50
pre-shear	▲ spec. 3	26.7	126.5	19.9	99.9	15.7	2020	97	1916	92	1916	92

URS

SDG&E Artesian Substation Expansion

Project Number: 27661515.20000

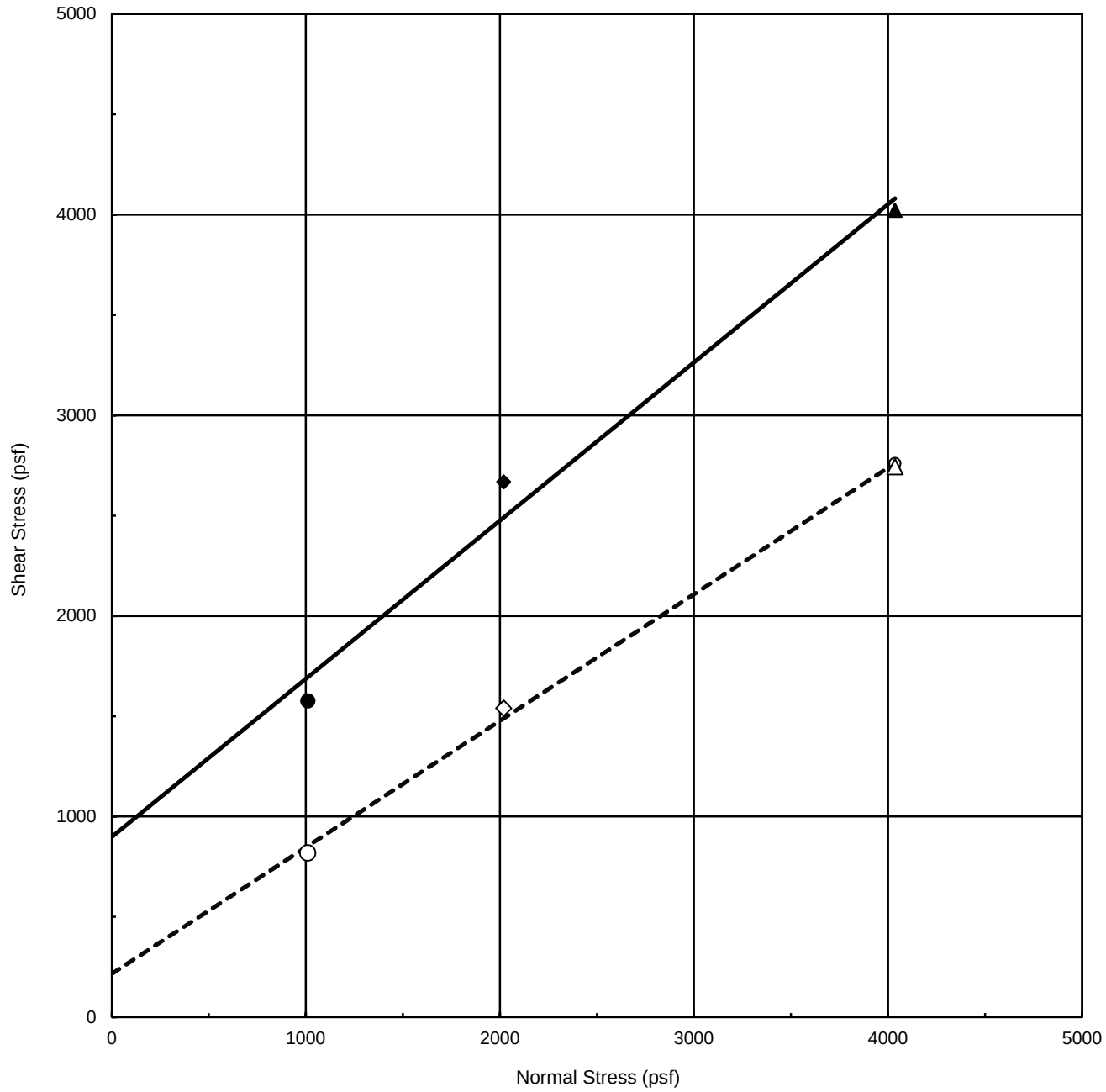
Test Date: 5/20/2015

DIRECT SHEAR TEST

ASTM D 3080

Figure C-17

DS Plot SDGE Artesian B-6 005



Peak Values are : ● ,solid trend line Ultimate Values are: ❍ ,dashed trend line

Exploration No.:	B-6		Strength Intercept (C) :	898.7	psf	Peak	216.0	psf	Ultimate
Sample No.:	4			43.0	kPa		10.3	kPa	
Depth (ft | m)	15.0	4.6	Friction Angle (ϕ) :	38	degree		32	degree	

Description: **Olive yellow silty Sand (SM)** Shear rate : 0.0040 (in/min) , 0.0102 (cm/min)

	SYMBOL	% Water Content	Total Unit Weight (pcf)	Total Unit Weight (kN/m^3)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m^3)	Normal Stress (psf)	Normal Stress (kPa)	Peak Stress (psf)	Peak Stress (kPa)	Ultimate Stress (psf)	Ultimate Stress (kPa)
	Initial / Set up	11.9	127.7	20.1	114.1	17.9	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	● spec. 1	17.9	135.0	21.2	114.5	18.0	1010	48	1577	76	819	39
pre-shear	◆ spec. 2	17.0	136.7	21.5	116.9	18.4	2020	97	2668	128	1540	74
pre-shear	▲ spec. 3	16.8	137.2	21.6	117.4	18.5	4036	193	4022	193	2744	131

URS

SDG&E Artesian Substation Expansion

Project Number: 27661515.20000

Test Date: 5/20/2015

DIRECT SHEAR TEST

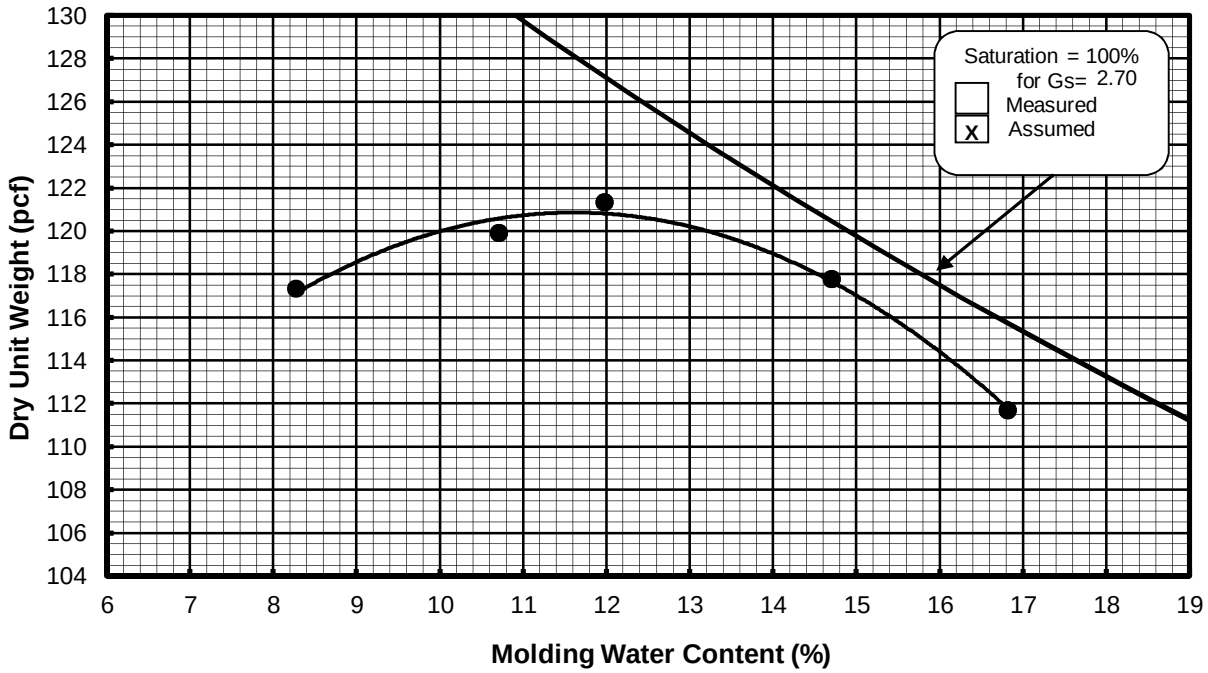
ASTM D 3080

Figure C-18

DS Plot SDGE Artesian B-6 015

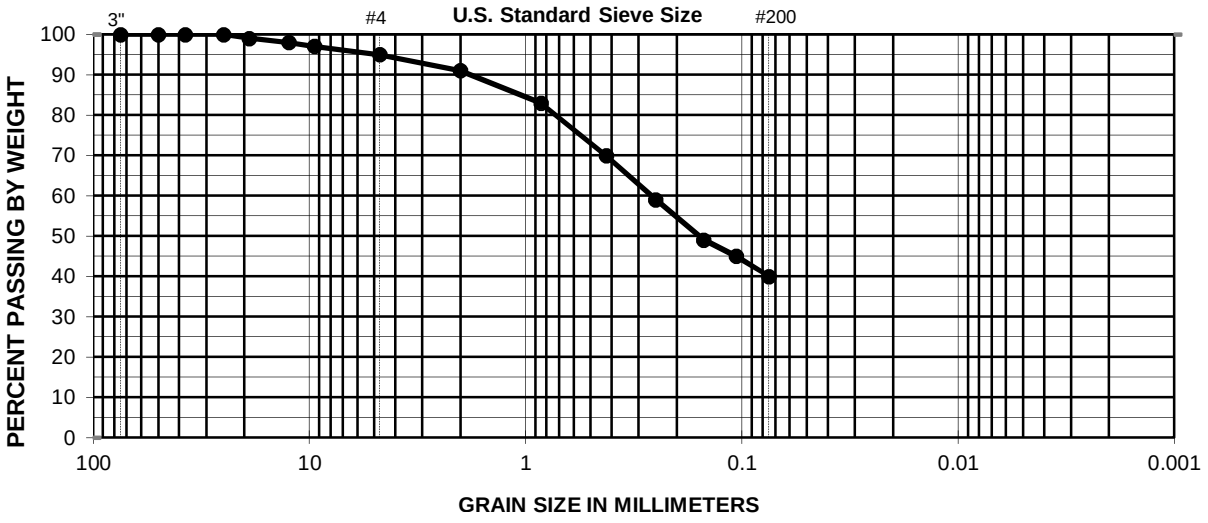
COMPACTION CURVE

Test Method: ● ASTM D 1557 ■ ASTM D 698 ◆ CA-DWR: S-10 ❍ Other Effort
Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

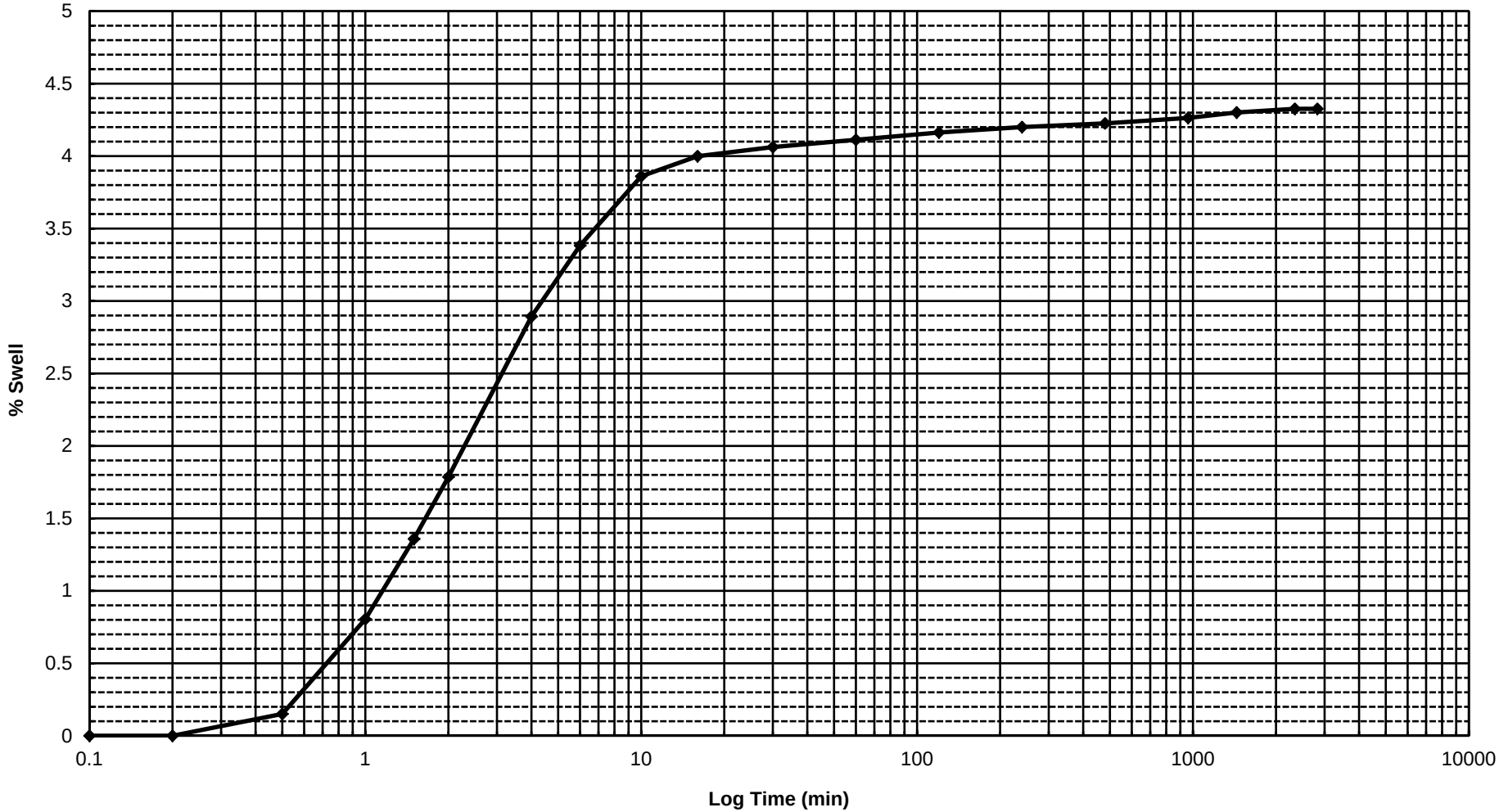


NOTATION: ● Representative of entire sample ◆ Representative of compacted specimen ■ Representative of compacted specimen and entire sample

Boring Number	Sample Number	Depth (ft.)	Optimum WC (%)	Maximum DUW (pcf)	Description and/or Classification
B-5	1	0 ~ 5	12.0	121.0	Pale olive clayy Sand (SC)

PROJECT NAME: SDG&E Artesian Substation Expansion
PROJECT NUMBER: 27661515.20000

COMPACTION AND INDEX PROPERTY DATA **Figure C-19**



Expansion Index, EI @ S=50%:	0 to 20	21 to 50	51 to 90	91 to 130	> 130
Potential Expansion:	Very Low	Low	Medium	High	Very High

Boring No.	Sample No.	Depth (ft)	WC (%)	DUW (pcf)	Saturation (%)	EI S (%)	Description and/or Classification
B-5	1	0 ~ 5	10.7	99.2	45	43	Light Reddish Brown clayey Sand (SC)

PROJECT NAME: **SDG&E Artesian Substation Expansion**
PROJECT NUMBER: **27661515.20000**

EXPANSION INDEX TEST
ASTM D 4829

FIGURE No. C-20

R-VALUE TEST DATA CTM 301 / ASTM D2844

Project: SDG&E-Artesian Substation Ex.	Project No: 27661427	Date: 5/15/2015
Boring Trench No: B-1	Sample No: 1	Sample Depth: 0-5'
Field Description:		
Lab Description: Yellow Olive Brown Clayey SAND (SC)		

Specimen Number	1	2	3	4
Mold Number	4	6	5	
Water Adjustment (g)	+20	+30	+40	
Compactor Pressure (psi)	250	175	110	
Exudation Pressure (psi)	600	468	229	
Gross Weight (g)	3187.6	3199.0	3219.8	
Mold Tare (g)	2115.0	2115.9	2118.5	
Wet Weight (g)	1072.6	1083.1	1101.3	
Sample Height (in)	2.40	2.43	2.51	
Initial Dial Reading	0.0522	0.0110	0.0718	
Final Dial Reading	0.0544	0.0125	0.0727	
Expansion (in $x10^{-4}$)	22	15	9	
Stability(psi) at 2,000 lbs (160 psi)	40 / 88	50 / 106	62 / 132	/
Turns Displacement	3.51	3.82	3.43	
R-Value Uncorrected	37	25	13	
R-Value Corrected	33	23	13	
Moisture Content (%)	11.6	12.3	13.0	
Dry Density (pcf)	121.4	120.3	117.7	
Assumed Traffic Index	4.0	4.0	4.0	
G.E. by Stability	0.69	0.79	0.89	
G.E. by Expansion	0.73	0.50	0.30	
G_f	1.25			

Moisture Content				
Dish No.	DDD	GGG	M	
Weight of Moist Soil and Dish (g)	221.7	259.7	243.5	
Weight of Dry Soil and Dish (g)	203.9	236.8	221.3	
Water Loss (g)	17.8	22.9	22.2	
Weight of Dish (g)	50.1	50.0	50.4	
Dry Soil (g)	153.8	186.8	170.9	
Moisture Content (%)	11.6	12.3	13.0	

R-Value by Exudation = 15

R-Value by Expansion = 31

R-Value at Equilibrium = 15 by Exudation

The data above is based upon processing and testing samples as received from the field. Test procedures in accordance with latest revisions to Department of Transportation, State of California, Materials & Research Test Method No. 301 and/or ASTM Standard D2844

Remarks: A traffic index of 4.0 was used for calculation purposes. NMG Project No. 11066-01

Set up by: RLG Run by: BAJ/TG

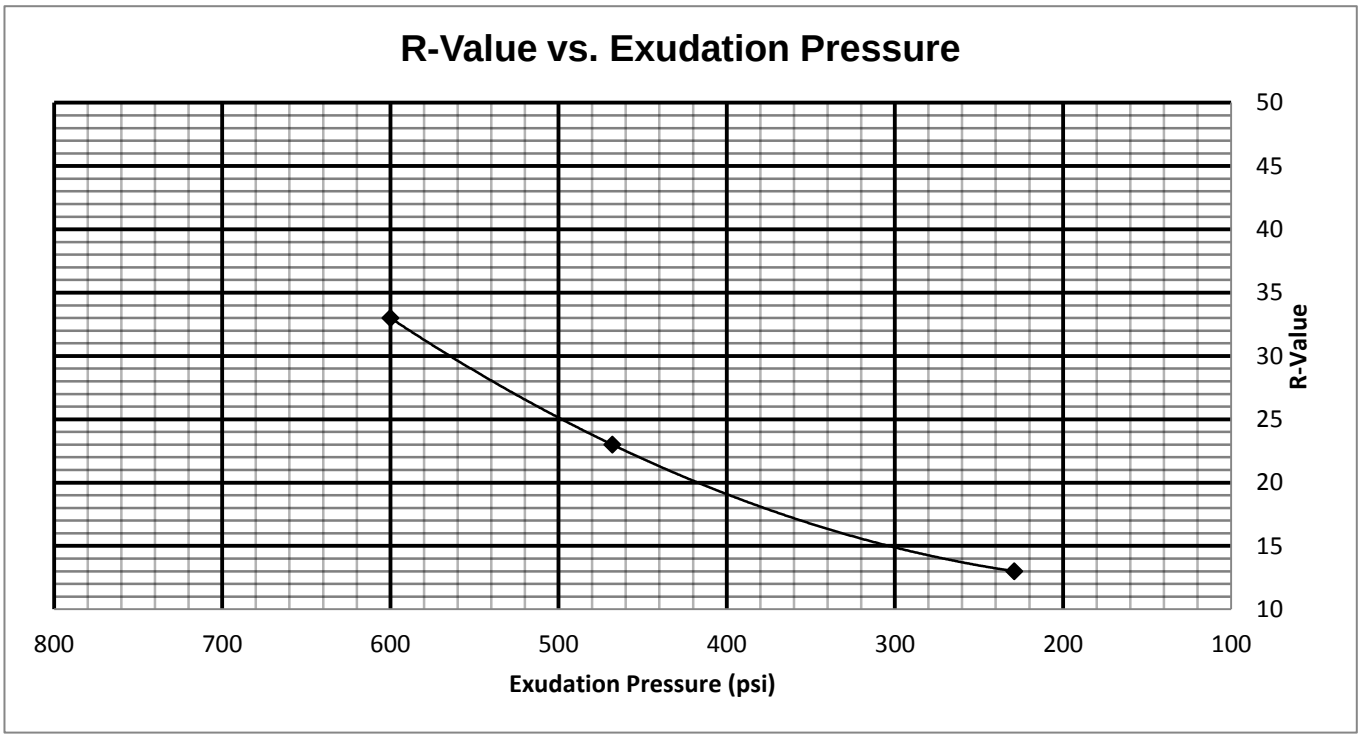
Calculated by: BAJ Checked by: GEH Date Completed: 5/18/2015

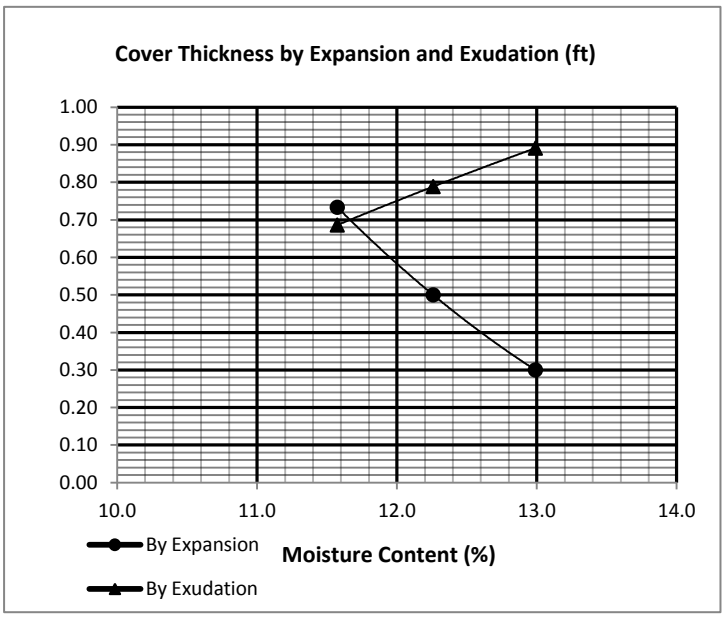
NMG Geotechnical, Inc.

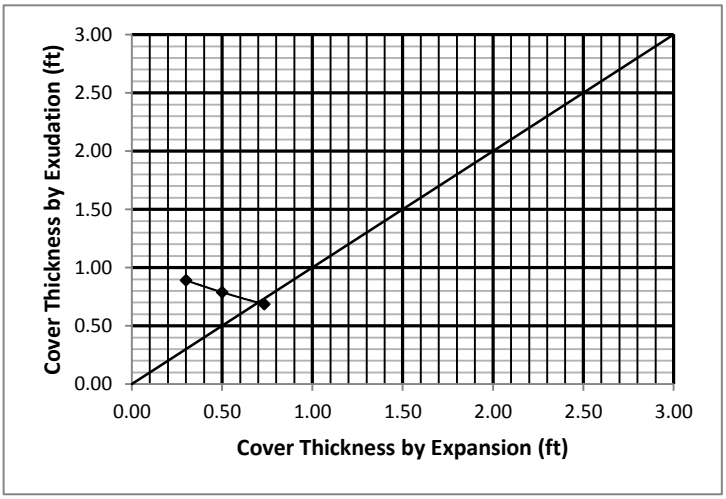
Figure C-21

R-VALUE GRAPHICAL PRESENTATION

Project: SDG&E-Artesian Substation Ex.	Project No: 27661427	Date: 5/15/2015
Boring Trench No: B-1	Sample No: 1	Sample Depth: 0-5'
Field Description:		
Lab Description: Yellow Olive Brown Clayey SAND (SC)		







Cover Thickness (ft) = 0.71

The data above is based upon processing and testing samples as received from the field. Test procedures in accordance with latest revisions to Department of Transportation, State of California, Materials & Research Test Method No. 301 and/or ASTM Standard D2844

Remarks:	A traffic index of 4.0 was used for calculation purposes. NMG Project No. 11066-01				
Set up by:	RLG	Run by:	BAJ/TG		
Calculated by:	BAJ	Checked by:	GEH	Date Completed:	5/18/2015

NMG Geotechnical, Inc.

Figure C-21

R-VALUE TEST DATA CTM 301 / ASTM D2844

Project: SDG&E-Artesian Substation Ex.	Project No: 27661427	Date: 6/2/2015
Boring Trench No: B-4	Sample No: 1	Sample Depth: 0-5'
Field Description:		
Lab Description: Light Olive Clayey SAND		

Specimen Number	1	2	3	4
Mold Number	1	2	3	
Water Adjustment (g)	+30	+40	+55	
Compactor Pressure (psi)	225	210	125	
Exudation Pressure (psi)	476	352	223	
Gross Weight (g)	3212.3	3235.2	3218.7	
Mold Tare (g)	2046.0	2114.9	2099.5	
Wet Weight (g)	1166.3	1120.3	1119.2	
Sample Height (in)	2.49	2.53	2.58	
Initial Dial Reading	0.0518	0.0520	0.0516	
Final Dial Reading	0.0535	0.0530	0.0523	
Expansion (in $x10^{-4}$)	17	10	7	
Stability(psi) at 2,000 lbs (160 psi)	58 126	62 132	68 140	
Turns Displacement	3.33	3.77	3.66	
R-Value Uncorrected	17	12	9	
R-Value Corrected	17	12	10	
Moisture Content (%)	12.1	12.7	13.9	
Dry Density (pcf)	126.6	119.1	115.4	
Assumed Traffic Index	4.0	4.0	4.0	
G.E. by Stability	0.85	0.90	0.92	
G.E. by Expansion	0.57	0.33	0.23	
G_f	1.25			

Moisture Content				
Dish No.	CC	D	QQ	
Weight of Moist Soil and Dish (g)	257.7	258.5	254.6	
Weight of Dry Soil and Dish (g)	235.3	235.1	229.6	
Water Loss (g)	22.4	23.4	25.0	
Weight of Dish (g)	49.6	50.5	49.7	
Dry Soil (g)	185.7	184.6	179.9	
Moisture Content (%)	12.1	12.7	13.9	

R-Value by Exudation = 11

R-Value by Expansion = 29

R-Value at Equilibrium = 11 by Exudation

The data above is based upon processing and testing samples as received from the field. Test procedures in accordance with latest revisions to Department of Transportation, State of California, Materials & Research Test Method No. 301 and/or ASTM Standard D2844

Remarks: A traffic index of 4.0 was used for calculation purposes. NMG Project No. 11066-01

Set up by: Run by: BAJ/GEH

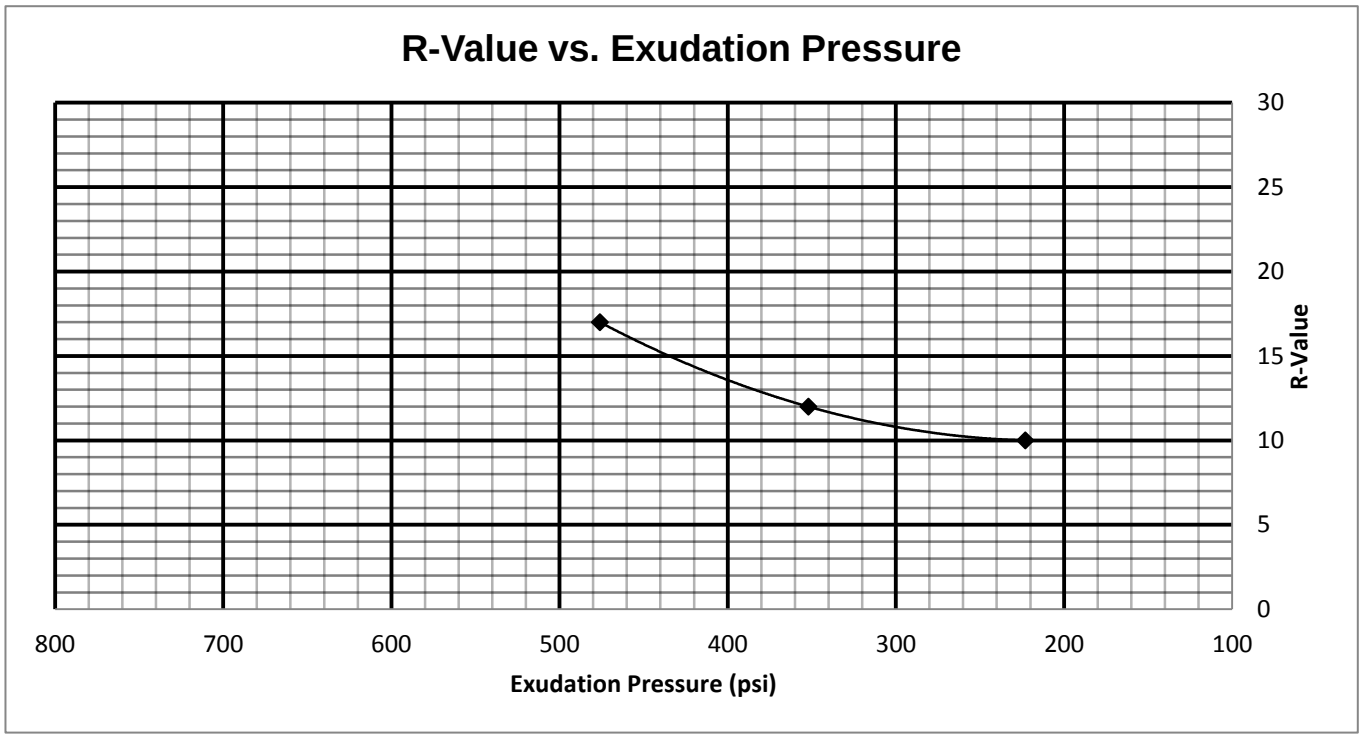
Calculated by: GEH Checked by: Date Completed: 6/3/2015

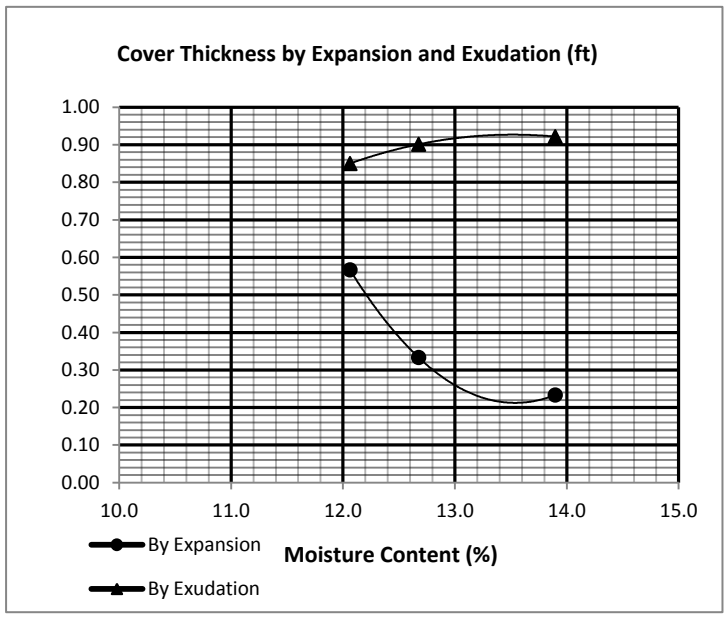
NMG Geotechnical, Inc.

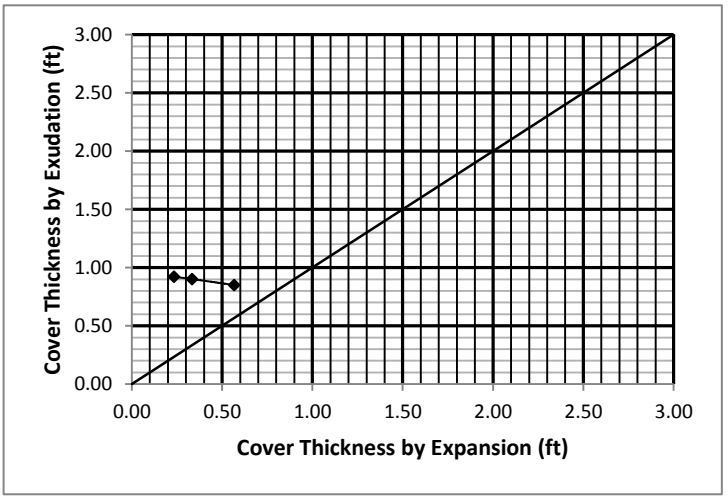
Figure C-22

R-VALUE GRAPHICAL PRESENTATION

Project: SDG&E-Artesian Substation Ex.	Project No: 27661427	Date: 6/2/2015
Boring Trench No: B-4	Sample No: 1	Sample Depth: 0-5'
Field Description:		
Lab Description: Light Olive Clayey SAND		







Cover Thickness (ft) = 0.73

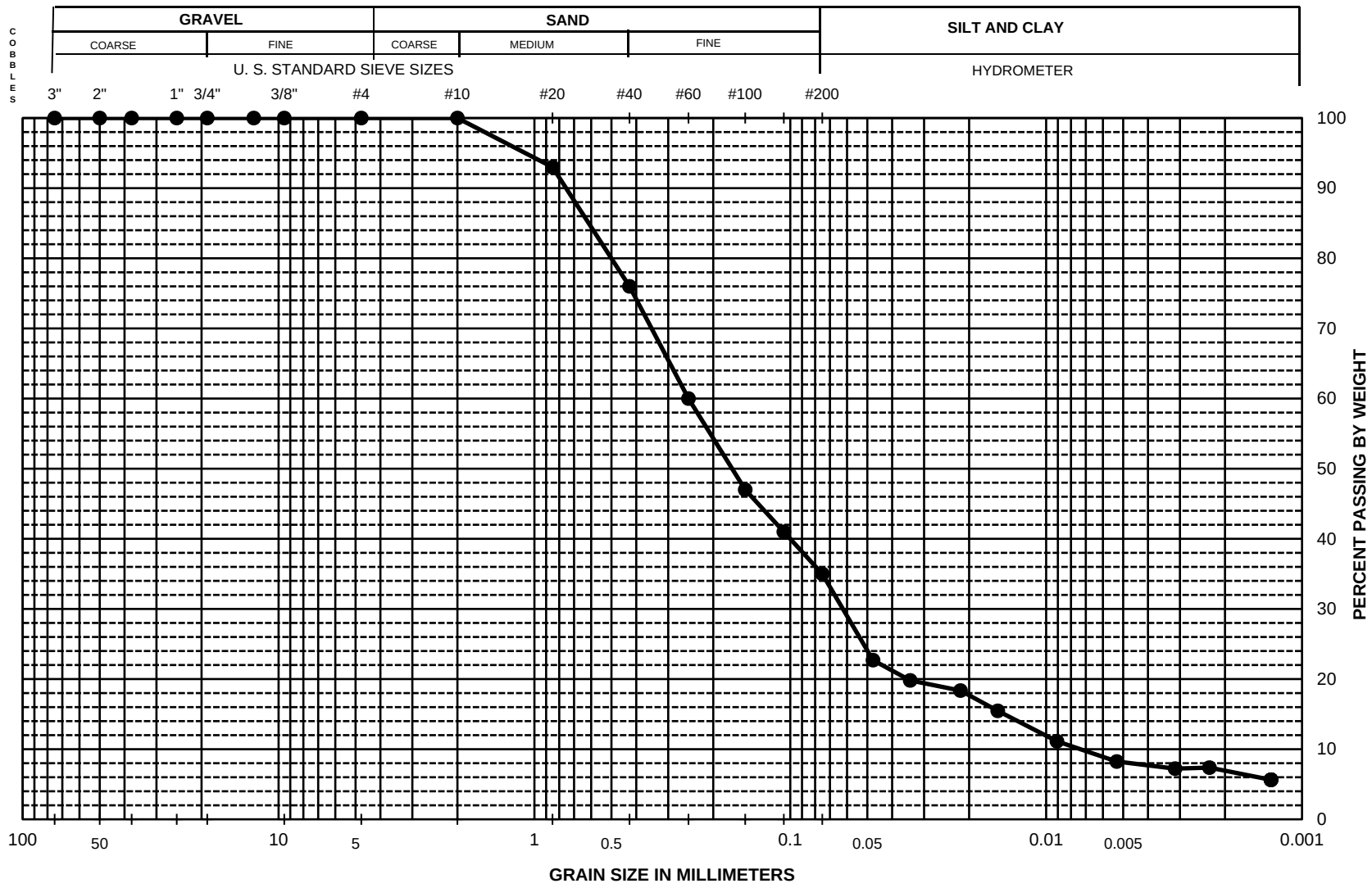
The data above is based upon processing and testing samples as received from the field. Test procedures in accordance with latest revisions to Department of Transportation, State of California, Materials & Research Test Method No. 301 and/or ASTM Standard D2844

Remarks:	A traffic index of 4.0 was used for calculation purposes. NMG Project No. 11066-01			
Set up by:		Run by:	BAJ/GEH	
Calculated by:	GEH	Checked by:	Date Completed:	6/3/2015

NMG Geotechnical, Inc.

Figure C-22

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	100.0
#4	4.75	100.0
#10	2.00	100.0
#20	0.850	93.0
#40	0.425	76.0
#60	0.250	60.0
#100	0.150	47.0
#140	0.106	41.0
#200	0.075	35.0
Hydrometer Analysis	0.0475	22.7
	0.0340	19.8
	0.0216	18.4
	0.0155	15.5
	0.0091	11.1
	0.0053	8.2
	0.0031	7.2
	0.0023	7.4
	0.0013	5.6
	0.0013	5.6

% Cobbles	---
% Gravel	0.0
% Sand	65.0
% Fines	35.0

D_{85}	0.613
D_{60}	0.250
D_{30}	0.062
D_{15}	0.015
D_{10}	0.007
C_u	34.0
C_c	2.1

Boring No.	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 2 μm	Description and Classification
PT-1	2	2.5	●	15.4	---	---	7	**Light olive green clayey Sand (SC)**

PROJECT NAME: **SDG&E Artesian Substation Expansion**

PROJECT NUMBER: **27661515.20000**

PARTICLE-SIZE DISTRIBUTION CURVES

Figure C-23

J:\27661515 TSAC SDG&E 11004 Artesian Substation\009 FIELD & LAB DATA\Lab Testing\Appendix C\Sieve Hydrometer SDGE Artesian PT-1 002

URS

SCST ENGINEERING
SDVOSB . DVBE . SBE

Corporate Headquarters
6280 Riverdale Street
San Diego, CA 92120
t 619.280.4321
f 877.215.4321
f 619.280.4717
w www.scst.com

Job Name: SDGE Atesian **Job Number:** GF150440
Client: G-Force **Location:**
Date: 9/17/2015 **By:** DRB
Sample I.D.: B-9 @ 2-6
Description: Light Brown Clayey Sand

CTM 301 Resistance Value of Treated and Untreated Bases, Subbases and Basement Soils

Test Specimen		A	B	C	D
Date Tested		9/17/2015	9/17/2015	9/17/2015	
Compactor Air Pressure	PSI	105	225	350	
Initial Moisture	%	6.7	6.7	6.7	
Soil Wt. Added	GRAMS	1050	1080	1100	
Water Added	ML	80	63	53	
Water Added	%	8.1	6.2	5.1	
Moisture At Compaction	%	14.8	12.9	11.8	
Weight of Briquette & Tare	GRAMS	3181	3180	3202	
Net Weight of Briquette	GRAMS	1121	1135	1143	
Briquette Height	IN	2.52	2.48	2.49	
Density	PCF	117.4	122.8	124.4	
Exudation Pressure	PSI	165	400	590	
Expansion Pressure	PSF	0	87	242	
PH at 1000 Pounds	PSI	55	37	21	
PH at 2000 Pounds	PSI	131	99	56	
Displacement	Turns	3.95	3.30	3.15	
R' Value		12	32	60	
Stabilometer Thickness	FT	1.27	0.98	0.58	
Expansion Thickness	FT	0	0.67	1.87	
Expansion Dial Reading		0000	0020	0056	
R' Value Modifier		0	0	0	
Corrected R-Value		12	32	60	
R-Value by Exudation Pressure			23		
Gravel Equivalent		0.9	0.9	0.9	
Traffic Index		4.5	4.5	4.5	
R-Value by Expansion Pressure			38		
R-Value at Equivalent			23		

Reviewed By: 9/21/15
Laboratory Manager Date
Darren Hicks

Figure C-24

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619.280.4717
www.scst.com

Job Name: SDGE, Artosion **Job Number:** GF150440
Client: G-Force **Location:**
Date: 9/17/2015 **By:** DRB
Sample I.D.: B-18e, 3-7
Description: Light Olive Sandy Clay

CTM 301 Resistance Value of Treated and Untreated Bases, Subbases and Basement Soils

Test Specimen		A	B	C	D
Date Tested		9/17/2015	9/17/2015	9/17/2015	
Compactor Air Pressure	PSI	115	65	225	
Initial Moisture	%	6.2	6.2	6.2	
Soil Wt. Added	GRAMS	1010	1000	1060	
Water Added	ML	85	102	70	
Water Added	%	8.9	10.8	7	
Moisture At Compaction	%	15.1	17	13.2	
Weight of Briquette & Tare	GRAMS	3206	3211	3238	
Net Weight of Briquette	GRAMS	1087	1095	1122	
Briquette Height	IN	2.46	2.55	2.43	
Density	PCF	116.3	111.2	123.6	
Exudation Pressure	PSI	350	255	620	
Expansion Pressure	PSF	30	52	364	
PH at 1000 Pounds	PSI	55	64	32	
PH at 2000 Pounds	PSI	133	144	93	
Displacement	Turns	3.65	4.15	3.20	
R' Value		12	6	36	
Stabilometer Thickness	FT	1.27	1.35	0.95	
Expansion Thickness	FT	0.23	0.4	2.8	
Expansion Dial Reading		0007	0012	0084	
R' Value Modifier		0	0	-2	
Corrected R-Value		12	6	34	
R-Value by Exudation Pressure			9		
Gravel Equivalent		1.22	1.22	1.22	
Traffic Index		4.5	4.5	4.5	
R-Value by Expansion Pressure			15		
R-Value at Equivalent			9		

Reviewed By: 9/21/15
Laboratory Manager Date
Darren Hicks

Figure C-25