Appendix D GEOTECHNICAL INVESTIGATION REPORT

Geotechnical Investigation Report

Biogas Renewable Generation Project
7721 Figueroa Street
Los Angeles, California

Prepared for:
City of Glendale
141 North Glendale Avenue
Glendale, California 91206

Prepared by:
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Project No: 2057123300

January 4, 2016

Sign-off Sheet

This document entitled Geotechnical Investigation Report dated January 4, 2016 was prepared by Stantec Consulting Services Inc. ("Stantec") for the account of the City of Glendale (the "Client"). The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client.

Prepared by ______________________________
(signature)

Jaret Fischer, P.E.

Reviewed by ______________________________
(signature)

James Stone, G.E.

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Stantec

Facility: Biogas Renewable Generation Project
Location: 7721 North Figueroa Street
Los Angeles, California

Consultant: Stantec
Stantec JN: 2057123300

REPORT SUMMARY

Footing Bearing Pressures	4,500 psf
Passive Lateral Pressures	350D psf/ft
D = Depth to bottom of footing	
Coefficient of Friction	0.35
Expansive Soils	o Yes x No
R-Value	30 (estimated)
Automobile Traffic (TI = 4)	4.0" AC / 4.0" AB
Automobile and Truck Traffic (TI = 6)	4.0" AC / 5.0" AB
Artificial Fill Landfill debris encountered in the vicinity of Soil Boring B-8	x Yes o No
Relatively Loose Near-Surface Soils	x Yes o No
Groundwater Within 20 Feet of Surface	o Yes x No
Monitoring Well Installed	o Yes x No
Hydrocarbons Detected	o Yes x No
Existing Underground Tanks	o Yes x No
Existing Structures	x Yes o No

1.0 INTRODUCTION

1.1 AUTHORIZATION AND LIMITATIONS

This report presents the results of a geotechnical investigation performed at the request of the City of Glendale, by Stantec Consulting Services Inc. (Stantec), for the proposed power plant at the Scholl Canyon Landfill, located at 7721 North Figueroa Street in the City of Los Angeles, California. This report has been prepared for the City of Glendale and their project design consultants to be used solely in the design of the proposed project, as described herein. This report may not contain sufficient information for other uses or the purposes of other parties.

1.2 PURPOSE AND SCOPE OF WORK

The objective of this investigation was to assess the nature and engineering properties of the encountered subsurface materials and to provide geotechnical design recommendations for the proposed power plant. The scope of work consisted of the following tasks:

- Review available subsurface information for the Site,
- Drill, log and sample eleven test borings,
- Hand dig, map, and sample seven test pits,
- Conduct a geophysical seismic refraction and electrical resistivity study,
- Perform laboratory testing on selected samples,
- Evaluate geotechnical properties of materials encountered pertinent to the design and construction of the project, and
- Develop conclusions and recommendations regarding:
    - Foundation recommendations for the proposed buildings and equipment,
    - Subgrade preparation beneath new foundations and pavements,
    - Fill and backfill materials along with fill and backfill slope placement and compaction criteria,
    - Appropriate foundation type(s) for support of new structures along with geotechnical criteria for foundation design,
    - Lateral earth pressures for permanent retaining walls,
    - New flexible pavement structural sections for driveway areas,
    - Corrosivity of Site soils with respect to steel and concrete.

1.3 SITE DESCRIPTION

The Site is irregular in shape, approximately 3.9 acres in size, and partially occupied by an existing landfill gas scrubbing and pumping facility. A portion of the site is vacant. The existing facility includes liquid flammable gas compression equipment, a landfill gas flare system, and several small buildings.

2.0 PROJECT DESCRIPTION

Stantec Consulting Services Inc. of Pasadena, California provided the preliminary layout for the proposed project. The proposed development will consist of a new electric generation power plant consisting of engine or turbine generators utilizing landfill gas as fuel. The power plant will include gas and air compressors, pumps, heat exchangers, electrical equipment, and other systems. Several buildings will also be constructed on the site to house the engine generators, an office, control room, and warehouse. The Site location is shown on Figure 1 and the layout of the proposed facility areas are shown on Figure 2.

There were no structural plans or design loads available at the time of this report. Based on our experience with similar projects and the available information, it is assumed that building loads will be relatively light. We understand that the equipment is typically founded on square concrete spread footings approximately two to three feet in width or thickened mat foundations. The foundation loads for the proposed equipment were estimated for the purpose of this report at less than 100 kilopounds (kips) for equipment and less than 3.5 kips per linear foot (klf) for continuous building wall footing loads. If actual design loading conditions differ from those indicated above, the recommendations in this report may have to be re-evaluated.

Grading plans have not yet been finalized. Final grading plan should be reviewed by the Project Geotechnical Engineer. The recommendations in this report may need to be changed based on the final grading plan.

3.0 SUSBURFACE INVESTIGATION

3.1 DRILLING

Eleven test borings were drilled with hollow-stem auger equipment at the locations shown on Figure 2. The borings were logged by a Stantec representative who also collected samples of the materials encountered for examination and laboratory testing. Samples were obtained using a 2.5-inch inner diameter California Modified sampler (ASTM D3550) and during Standard Penetration Testing (SPT, ASTM D1586). The samplers were driven with a 140-pound hammer falling 30 inches. The blows required to drive the samplers each 6 inches (or less) of an 18-inch derive were recorded and are noted on the boring logs.

The logs of the test borings are in Appendix A. Soils are classified according to the Unified Soil Classification explained in Appendix A. Rock is described in terms of its physical characteristics.

3.2 GEOLOGIC TEST PITS

Seven geologic test pits (TP-1 through TP-7) were hand excavated at locations on the southern slope and aligned parallel with the face of the slope. The soil trenches were approximately 4 feet long and 4 feet wide and were excavated to depths ranging from 2 to 3.5 feet bgs. The trenches were continuously logged and mapped at locations shown on Figure 2, and slide hammer soil samples were collected for materials laboratory testing.

3.3 LABORATORY TESTING

The following laboratory tests were performed on samples collected at the Site either in general accordance with the American Society for Testing and Materials (ASTM) or contemporary practices of the soil engineering profession:

- <u>In-Situ Moisture and Density (ASTM D2216)</u>: In-situ moisture and density are calculated by weighing and measuring the drive samples obtained from the borings to determine their in-place moisture and density. These results are used to analyze the density or consistency of the subsurface soils.
- <u>Direct Shear Test (ASTM D3080)</u>: The tests were performed on an undisturbed sandy soil sample in order to obtain the soil shear strength values, which are among the basic soil parameters that are used to estimate soil bearing capacity and lateral earth pressures.
- <u>Sieve Analysis (ASTM D422 and ASTM C136):</u> This test is used to evaluate the distribution of soil grain sizes, which constitute the soil fabric and is used in soil classification and assessment of soil engineering behavior.
- <u>Maximum Dry Density and Optimum Moisture Content (ASTM D1557)</u>: The compaction curve defines the relationship between water content and dry unit weight of soils compacted soils effort. The maximum dry density and optimum water content are used

to determine the relative density of existing soils and to determine the level of compaction during grading activities.

- Chemical Tests for Corrosion Potential (Applicable EPA, ASTM or local test methods): The pH, resistivity, soluble sulfate content, and chloride ion content were evaluated in a near surface soil sample.

The laboratory test results are presented in Appendix B.

3.4 SEISMIC REFRACTION STUDY

A Geophysical Survey that included seismic refraction and electrical resistivity measurements was completed by Southwest Geophysics, Inc. (SGI). Four P-wave refraction profiles, two refraction microtremor (ReMi) profiles, and electrical resistivity profiles were conducted in the locations shown on Figure 2. The results of the geophysical study are included in Appendix C.

4.0 REGIONAL GEOLOGIC CONDITIONS

4.1 REGIONAL PHYSIOGRAPHIC CONDITIONS

The Site is located in the northwestern portion of the Transverse Range Geomorphic Province in the southwestern part of California. The region is separated by an east to west trending series of steep mountain ranges and valleys, subparallel to faults branching from the San Andreas Fault. The Site resides in the portion of the Province drained by the Los Angeles River.

California Highway 134 is located approximately 0.4 miles southwest of the site, California Highway 210 is located approximately 2 miles east of the Site, and the Los Angeles River is located approximately 4.9 miles west of the Site. Based on interpretation of the ground surface elevation contour lines drawn on the topographic map, the Site is located at an elevation of approximately 1,410 to 1,485 feet (1988 NAVD). The topography in the vicinity of the Site is hilly, with a slope to the south then southwest toward the Los Angeles River (USGS, 1995).

4.2 REGIONAL GEOLOGY

Based on information depicted on the 2005 Geologic Map of Los Angeles, the Site is underlain by Mesozoic age quartz diorite deposits composed of plagioclase feldspar (oligoclase-andesine, hornblende, biotite, and minor quartz). Sometimes referred to as the Wilson Diorite, this unit is the most widespread bedrock type in the Glendale area. The bulk of the Verdugo Mountains and the San Rafael Hills are comprised of quartz diorite. The color of the rock is typically a light gray to light brown. The texture is generally medium grained and the structure is massive). In the central part of the San Rafael Hills, just north of Highway 134, at the southeastern margin of Glendale, the mineral grains are aligned, giving the rock a distinct banding or "foliation" resulting in a somewhat layered structure. In this area, the structure dips 60 to 70 degrees to the east and northeast (ECI, 2003).

4.3 REGIONAL HYDROGEOLOGY

According to the California Department of Water Resources (CDWR) Bulletin 118 Report, the Site is not located within a mapped groundwater basin. The closest groundwater basin is the San Fernando Valley Groundwater Basin of the South Coast Hydrologic Region (4-12), located to the west of the Site. The basin is approximately 226 square miles and is bounded on the north and northwest by the Santa Susana Mountains, on the north and northeast by the San Gabriel Mountains, on the east by the San Rafael Hills, on the south by the Santa Monica Mountains and Chalk Hills, and on the west by the Simi Hills (DWR, 2004).

5.0 REGIONAL SEISMIC CONDITIONS

5.1 REGIONAL SEISMICITY

The Site, as is most of California, is located in a seismically active area. The estimated distance of the Site to the nearest expected surface expression of nearby faults is presented in the table below.

Fault	Distance (miles) (1)	Maximum Moment Magnitude (1)
Verdugo	0.3	6.9
Raymond	2.3	6.8
Hollywood	3.3	6.7
Sierra Madre (connected)	3.9	7.2
Elysian Park Thrust	6.1	6.7
Santa Monica	6.2	7.4
Sierra Madre (San Fernando)	10.5	6.7
Clamshell-Sawpit	11.1	6.7
Puente Hills (LA Basin)	11.5	7.0
San Gabriel	12.4	7.3
Elsinore	13.7	7.8
Newport – Inglewood (L.A. Basin)	13.7	7.5
Santa Monica	13.9	7.3
Northridge	15.2	6.9
Puente Hills (Santa Fe Springs)	17.3	6.7
San Jose	19.6	6.7
Puente Hills (Coyote Hills)	19.9	6.9
Malibu Coast	21.0	6.7
Anacapa – Dume	22.7	7.2
Palos Verdes	24.4	7.7

1. Measured from 2008 National Seismic Hazard Maps - USGS (USGS, 2008).

5.2 CALIFORNIA BUILDING CODE SEISMIC CRITERIA

Based on the specified design criteria of the 2016 California Building Code (using available 2015 International Building Code data), the following Site seismic information may be considered for earthquake design.

Design Criteria	Design Value
Site Class	C
Mapped Spectral Response Acceleration for Short Periods S_s (g)	2.912
Mapped Spectral Response Acceleration for 1-second Period S_1 (g)	1.016

Design Criteria	Design Value
Maximum Considered Earthquake Spectral Acceleration for Short Periods S_{MS} (g)	2.912
Maximum Considered Earthquake Spectral Response Acceleration for 1-second Periods S_{M1} (g)	1.321
5-percent Design Spectral Response Acceleration for Short Periods S_{DS} (g)	1.942
5-percent Design Spectral Response Acceleration for 1-second Periods S_{D1} (g)	0.881
Site Coefficient F_a	1.0
Site Coefficient F_v	1.3

5.3 REGIONAL SEISMIC HAZARDS

5.3.1 Fault Rupture Hazard

The Site is not located within a currently mapped California Earthquake Fault Zone. As described above, the nearest fault is the Verdugo Fault, located approximately 0.3 miles southwest of the Site. Based on available geologic data, there is low potential for surface fault rupture from the Verdugo Fault and other nearby active faults propagating to the surface of the Site during the design life of the proposed development.

5.3.2 Liquefaction and Seismically Induced Settlements

Subsurface conditions underlying the Site consist mainly of dense to very dense silty sands over slightly weathered, hard bedrock. In addition, the groundwater level is very deep. The Site is located in an area where water bearing soils are not present. Consequently, the potential for liquefaction beneath this Site is negligible.

6.0 SURFACE AND SUSBURFACE CONDITIONS

6.1 SURFACE CONDITIONS

The Site is bordered by natural slopes on the south and southeast. The north, west and northeast sides abut the existing landfill.

Most of the area to be developed is relatively flat, at an elevation of approximately 1410 feet. The surface begins to steepen in the northeastern portion of the site, rising to almost 1500 feet east of the northeast corner of the site, where a cut slope is proposed. The ground surface has been cleared and is devoid of vegetation, except in limited areas in the northeastern part of the site, where portions of the landfill are exposed at the surface. Existing structures and equipment associated with operation of the landfill are located throughout the area.

6.2 SUBSURFACE CONDITIONS

Except in the northeastern portion, in the vicinity of boring B8, the Site is underlain by Wilson Quartz Diorite rock. The rock has weathered to a dense silty sand soil in the central portion of the Site (borings B2, B3, B4, and B11). The rock encountered beneath the remainder of the Site outside of the northeastern corner is hard, strong and moderately weathered.

Fill, consisting of medium dense to dense silty sand with landfill debris, was encountered in boring B8 in the northeast corner of the site. The fill extended to a depth of about 27 feet. Moderately weathered, hard, strong quartz diorite rock was encountered below the fill and extended to the maximum depth explored in this boring, 36-½ feet.

No groundwater was encountered in the borings. It is anticipated that the groundwater level is below a depth that would affect planned construction.

A more detailed description of the subsurface profile in each borehole is presented on boring logs in Appendix A. The stratigraphy shown represents the predominant materials encountered at various depths. Also, stratification lines indicate the approximate boundary between the major material types. The actual transition may be gradual.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS

The new structures and equipment can be supported on shallow spread footing or mat foundations with bottom levels in weathered rock. Relatively high bearing pressures can be used. Post-construction total and differential settlements will be small.

Foundations for facilities in the northeastern end of the Site, in the vicinity of boring B8, may need to be deepened to extend into weathered rock. Current plans indicate (Figure 6) that 4 to 5 feet of excavation below planned final grade could be needed to reach the rock. Foundations could be constructed in excavations into the rock, or the excavations can be backfilled to typical shallow foundation levels with sand/cement slurry. Final procedures when final facility types and locations have been determined for this area.

A cut slope 40 to 50 feet high currently is proposed at the northeast end of the project area. At present, the slope is configured at 1.75:1 (horizontal:vertical). Based on the shear wave velocities measured in the geophysical survey (Appendix C), and the materials encountered in the borings, the rock in this area is expected to be rippable with a Caterpillar D9R bulldozer equipped with a multi- or single-shank ripper (Caterpillar, Inc., 2000). Shallower parts of the cut area could expose weathered rock susceptible to erosion. Erosion protection will be needed to reduce the potential for sloughing and raveling from the face of the slope.

Regional foliation shown on geologic maps prepared by Dibblee (1989) exhibits a north-south strike accompanied by dips to the east ranging from 55 to 60 degrees. Slopes on the south and east sides of the area to be developed exhibit moderately- to poorly-defined foliation (a planar arrangement of textural or structural features in rock). Mapped foliation shows dominant northwest to north-south strikes accompanied by dips to the north and east, respectively, ranging from 7 to 69 degrees, as shown on Figure 2. Foliation planes are either supported in the down-dip direction or project into the slope, consistent with the description by Dibblee (1989). Based on the mapped geologic data, foliation exposed on the cut slope is expected to be favorably oriented.

7.2 FOUNDATION DESIGN

Shallow spread footings or mat foundations for facilities with bottom levels in the weathered rock can be designed for the following maximum soil bearing pressures:

Load Type	Allowable Bearing Pressure (psf)
Dead Load Only	4,500
Dead Plus Live Load	5,200
Total Load, Including Wind and Seismic Loads	5,980

Footings should be at least 12 inches in width and founded a minimum of 18 inches below the lowest adjacent finish grade.

Resistance to lateral forces should be based upon a passive lateral earth pressure (equivalent fluid pressure) of 350D psf/ft where D corresponds to the embedment depth of the footing in feet, and a coefficient of friction between concrete and rock equal to 0.35. The passive earth pressure and frictional resistance can be combined without reduction.

The following parameters may be used in the foundation design:

Parameter	Value	Units
Modulus of Subgrade Reaction	250	lb/in^3
Shear Wave Velocity, V_s	1,020	ft/sec
Modulus of Elasticity (Young's Modulus), E_s	9,200	lb/in^2
Shear Modulus, G_d	4,000	lb/in^2
Poisson's Ratio, μ	0.2	--

7.3 FOUNDATION CONSTRUCTION

The Project Geotechnical Engineer should review and approve the foundation plans and observe foundation excavations prior concrete placement to check that foundation excavations extend into suitable material. The bottom of the foundation excavations should be clean and free of loose or sloughed material, debris and unsuitable material before concrete is placed.

7.4 CONCRETE SLAB-ON-GRADE FLOORS

If concrete-slab-on-grade floors will be used, the subgrade surface beneath floor areas should be proof-rolled with a smooth-wheel roller prior to slab construction. Any soft, loose, or yielding areas should be removed to the depth and extent directed by the Project Geotechnical Engineer and replaced with suitable material. The subgrade surface should be maintained at or above optimum moisture content until concrete is placed for the slab.

Where floor coverings will be placed, or if required due to proximity to the landfill, a plastic membrane at least 10 mils thick should be placed beneath the slab. The membrane should be underlain by a 4-inch thick layer of clean, free-draining crushed rock to provide uniform support for the slab and serve as a break to the rise of capillary moisture. It is recommended that a specialist be consulted regarding applicable membrane types and installation procedures where resistance to landfill gas migration is required.

Current practice commonly includes a sand layer placed between the plastic membrane and the underside of the slab. The sand can provide a degree of protection to the membrane during construction. However, the sand layer absorbs water during concrete curing and allows the accumulation of water vapor on the bottom of the slab, considerably increasing the time required for slab moisture to reach a level suitable for installation of floor coverings. It is suggested that the concrete slab-on-grade be poured directly on the plastic membrane. Structural design of the slab should consider the potential for edge curling where the slab is poured directly on the membrane.

Slab on grade floors should be at least 6 inches in thick. Minimum reinforcement for concrete slabs-on-grade should be No. 4 deformed reinforcing bars, spaced at 18 inches on center each way. Additional reinforcing and/or slab thickness should be provided as structural conditions dictate. It is essential that during construction the slab reinforcing bars be properly supported on rebar supports to keep the reinforcing bars centralized (mid-height) in the slab during concrete placement.

Other design and construction criteria for concrete floor slabs, such as mix design, strength, durability, reinforcement, joint spacing, etc., should conform to the current specifications of the American Concrete Institute (ACI).

7.5 PERMANENT RETAINING WALLS

For cantilevered retaining walls capable of deflecting a minimum of 0.1% of the wall height at the top of wall, the following lateral earth pressures (equivalent fluid pressures with a triangular pressure distribution) may be used in design up to a wall height of 20 feet. The outside bottom edge of retaining wall foundations should have a minimum setback of 10 feet from the face of the closest adjacent slope. Alternative setbacks may be feasible. The Project Geotechnical Engineer can review retaining wall plans and determine final setback limits when the layout has been finalized.

Active:	40H psf/ft,
Passive:	350D psf/ft,

where H is the vertical height of the wall measured from the ground surface to the heel of the footing (or base of keyway) and D is the embedment depth of the footing measured from the ground surface to the bottom of the toe in front of the retaining wall (unless pavement or hardscape are present, exclude the upper foot when calculating passive resistance to account for erosion). These equivalent fluid pressures should be applied as a triangular pressure distribution behind the retaining wall and assume level backfill behind and in front of retaining wall unless otherwise noted.

Walls restrained against movement should be designed to resist at-rest pressures. An at-rest equivalent fluid pressure of 45H psf/ft is considered appropriate, where H is the vertical height of the wall measured from the ground surface to the heel of the footing (or base of keyway).

The earth pressures are based on predominately granular backfill with drained conditions, the assumption that the retaining wall is vertical, and the ground surface in front and behind the retaining wall is level. For different wall geometries or loading conditions, the above lateral earth pressures will need to be reevaluated. The passive earth pressure indicated above does not include a safety factor; therefore, the retaining wall design should include an appropriate safety factor with respect to the overall performance of the system.

Earthquake forces on the wall can be modeled assuming an inverted triangular pressure distribution ranging from 0 at the base of the wall to 25 psf at the top of the wall.

7.6 PAVEMENT DESIGN

Preliminary flexible pavement structural sections were developed based on the visual onsite soil classifications, an assumed subgrade R-Value of 30, an equivalent single axle load (ESAL) value comparable to the referenced traffic index (TI) value below, and an AASHTO Reliability Factor of 75%. Preliminary flexible pavement sections are as follows:

Traffic Type	Auto Traffic TI = 5.0	Auto and Truck Traffic TI = 7.0
Asphalt Concrete (AC) Thickness	4.0"	4.0"
Class 2 Aggregate Base (AB) Thickness	4.0"	6.0"

*AASHTO Highway Design Manual

Proposed portland cement concrete pavement areas that are subject to vehicle traffic loads, should have a minimum thickness of six inches overlying a minimum of six inches of Class 2 Aggregate Base.

The subgrade surface below new pavements should be proof rolled with a smooth-wheeled roller before aggregate base is placed. The aggregate base for asphalt concrete pavement sections should meet Caltrans specifications for Class 2 base of Processed Miscellaneous Base (PMB), as contained in the "Greenbook" Standard Specifications for Public Works Construction. Aggregate base should be compacted to at least 95% relative compaction with uniform moisture content near optimum, as determined by ASTM D1557.

It is possible that Site grading, use of import fill soils, utility line backfilling, and related earthwork could alter the distribution of near-surface materials, thus requiring re-evaluation of the recommended pavement structural sections. Stantec recommends that at least one near surface soil sample be tested to evaluate the subgrade R-value following rough grading of the pavement areas.

7.7 EXPANSIVE SOIL POTENTIAL

The near-surface materials (upper 8 feet) consist of silty sand and quartz diorite bedrock. The predominantly granular soils and rock are not expansive. Design for expansive soils is not required.

If imported soils are used for earthwork, the proposed materials should be evaluated for expansion potential prior to import. Imported soils should be approved by the Project Geotechnical Engineer prior to utilization.

7.8 CORROSIVE SOIL POTENTIAL

Chemical tests to evaluate corrosive soil potential of near surface soils were performed by Converse Consultants. The test results indicate a soil pH ranging from 7.81 to 7.93, water soluble sulfate of 0.001 to 0.023% by weight, soluble chlorides ranging from 125 ppm to 145 ppm, and saturated resistivity ranging from 1,900 ohm-cm to 14,000 ohm-cm.

Field Wenner four-point resistivity testing was conducted by Southwest Geophysics at the Site. The results of the field resistivity testing indicate variable corrosion potential in the subsurface profile (Appendix C). In general, the resistivity decreases (higher corrosion potential) with increasing water content and salt concentration. In dry arid environments like that of the Site, seasonal low moisture content in near surface soils and evapotranspiration are important factors influencing corrosion potential of the soil profile. The field data (Appendix C) indicate relatively low (5,668 to 9,859 ohm-cm) and apparent moderate corrosion potential to ferrous metal in the near surface materials to a depth of at least four feet (note: the depth of the measured average resistivity in the soil profile is assumed to be equivalent to the probe spacing). Laboratory testing on saturated samples showed much lower resistivities, indicating moderate to severe corrosion potential.

The materials underlying the site form a low corrosive environment with respect to reinforced concrete and mild to severe corrosive environment with respect to ferrous metals. Nevertheless, Type II modified portland cement is recommended for use in concrete in contact with ground. Special corrosion-resistant coatings are not considered necessary for reinforcing steel. Adequate cover should be provided over the reinforcing steel in accordance with good construction practice.

7.9 SITE PREPARATION AND GRADING

7.9.1 Site Preparation

Existing loose soils, debris and vegetation, if any, should be removed from beneath area to be graded and where new facilities will be located. It is expected that earthwork outside of building and equipment areas will be minimal and generally consist of excavations for new utility lines, subgrade preparation for hardscape and pavements, and slopes for drainage. The bottoms of excavations for utility trenches and below pavements and hardscape should be checked by the Project Geotechnical Engineer. Soft, wet, or otherwise unsuitable material should be excavated to the depth and extent determined by the Project Geotechnical Engineer and replaced with compacted fill.

The bottoms of excavations, and the existing ground surface where new fill will be placed, should be scarified to a depth of 12 inches, moisture conditioned to at least 2 percentage points above optimum moisture content and compacted to at least 90% relative compaction. The maximum dry density and optimum moisture content for the evaluation of relative compaction should be determined in accordance with ASTM D 1557. All references to optimum moisture content and relative compaction in this report are based on this test method.

7.9.2 Fill Materials

Excavated materials determined by the geotechnical engineer to be satisfactory can be replaced as compacted fill. It is anticipated the majority of the excavated materials can be used as compacted fill following mixing of clayey and sand soils. The geotechnical engineer should approve the fill material before placement.

Imported soil should consist of predominately granular non-detrimentally expansive (Expansion Index less than 20) material free of organics, debris and rocks greater than 4 inches in any dimension. The EI of the material should be determined in accordance with ASTM D 4829. Stantec should approve the soil to be used as fill prior to importation.

7.9.3 Fill and Backfill Placement and Compaction

Fill and backfill should be placed in 6- to 8-inch thick loose lifts, moisture conditioned to at least 2 percentage points above optimum moisture content, and compacted to at least 90% relative compaction. Fill and backfill placed within the upper 12 inches of finish grade beneath new pavements should be compacted to at least 95% relative compaction.

7.9.4 Cut and Fill Slopes

Maximum cut slope of the existing hill located on the northwest portion of the project shall not exceed 1-½:1 (horizontal:vertical). Fill placed on slopes that are steeper than 5:1 (horizontal:vertical) should be started on a level bench and keyed and benched into the existing hillside as the fill level is raised. Maximum recommended fill slopes are 2:1 (horizontal:vertical).

7.9.5 Surface Drainage

Final surface grades in the new building and equipment area should be designed to collect and direct surface water away from the new features and toward appropriate drainage facilities. In general, we recommend that the ground adjacent to structures slope away at a gradient of at least 2%. Densely vegetated areas where runoff can be impaired should have a minimum gradient of at least 5% within the first 5 feet from the structure.

Drainage patterns established at the time of fine grading should be maintained throughout the life of the project. Site irrigation should be limited to the minimum necessary to sustain landscape growth.

Drainage on the cut slope at the northeast end of the project should be designed to prevent surface water from flowing over the face of the slope. At least one drainage swale or bench should be provided at the top of the slope and one approximately mid-way down on the face of the slope. Runoff water should be directed to suitable discharge facilities to reduce the potential for ponding at the toe of the slope.

Weathered rock exposed on the face on the cut slope is expected to be readily erodible. Erosion protection such as erosion-resistant vegetation, commercial erosion control mats or other means should be provided to minimize sloughing and raveling.

7.10 POST INVESTIGATION SERVICES

Post investigation services are an important and necessary continuation of this investigation, and it is recommended that Stantec be retained as the Project Geotechnical Engineer to perform such services. Final project grading and foundation plans, foundation details and specifications should be reviewed by Stantec prior to construction to check that the intent of the recommendations presented herein have been applied to the design. Following review of plans and specifications, observation during construction should be performed to correlate the findings of this investigation with the actual subsurface conditions exposed during construction.

During construction, the Project Geotechnical Engineer's representatives should be present at the Site to observe the geotechnical aspects of the project and to observe and test the earthwork.

8.0 CLOSURE

Our conclusions, recommendations and discussions presented herein are (1) based upon an evaluation and interpretation of the findings of the field and laboratory programs, (2) based upon an interpolation of subsurface conditions between and beyond the explorations, (3) subject to confirmation of the actual conditions encountered during construction, and (4) based upon the assumption that sufficient observation and testing will be provided by Stantec during construction.

Any person using this report for bidding or construction purposes should perform such independent investigations as he deems necessary to satisfy himself as to the surface and subsurface conditions to be encountered and the procedures to be used in the performance of work on this project.

This report contains information which is valid as of this date. However, conditions that are beyond our control or that may occur with the passage of time may invalidate, either partially or wholly, the conclusions and recommendations presented herein.

The conclusions in this report are based on interpolation and extrapolation of subsurface conditions encountered at the boring locations. The actual subsurface conditions at unexplored locations may be different. Consequently, the findings and recommendations in this report may require re-evaluation if subsurface conditions different than stated herein are encountered.

Inherent in most projects performed in the heterogeneous subsurface environment, continuing subsurface investigations and analyses may reveal conditions that are different than those presented herein. This facet of the geotechnical profession should be considered when formulating professional opinions on the limited data collected on this project.

The findings and recommendations contained in this report were developed in accordance with generally accepted current professional principles and practice ordinarily exercised, under similar circumstances, by geotechnical engineers and geologists practicing in this locality. No other warranty, express or implied, is made.

9.0 REFERENCES

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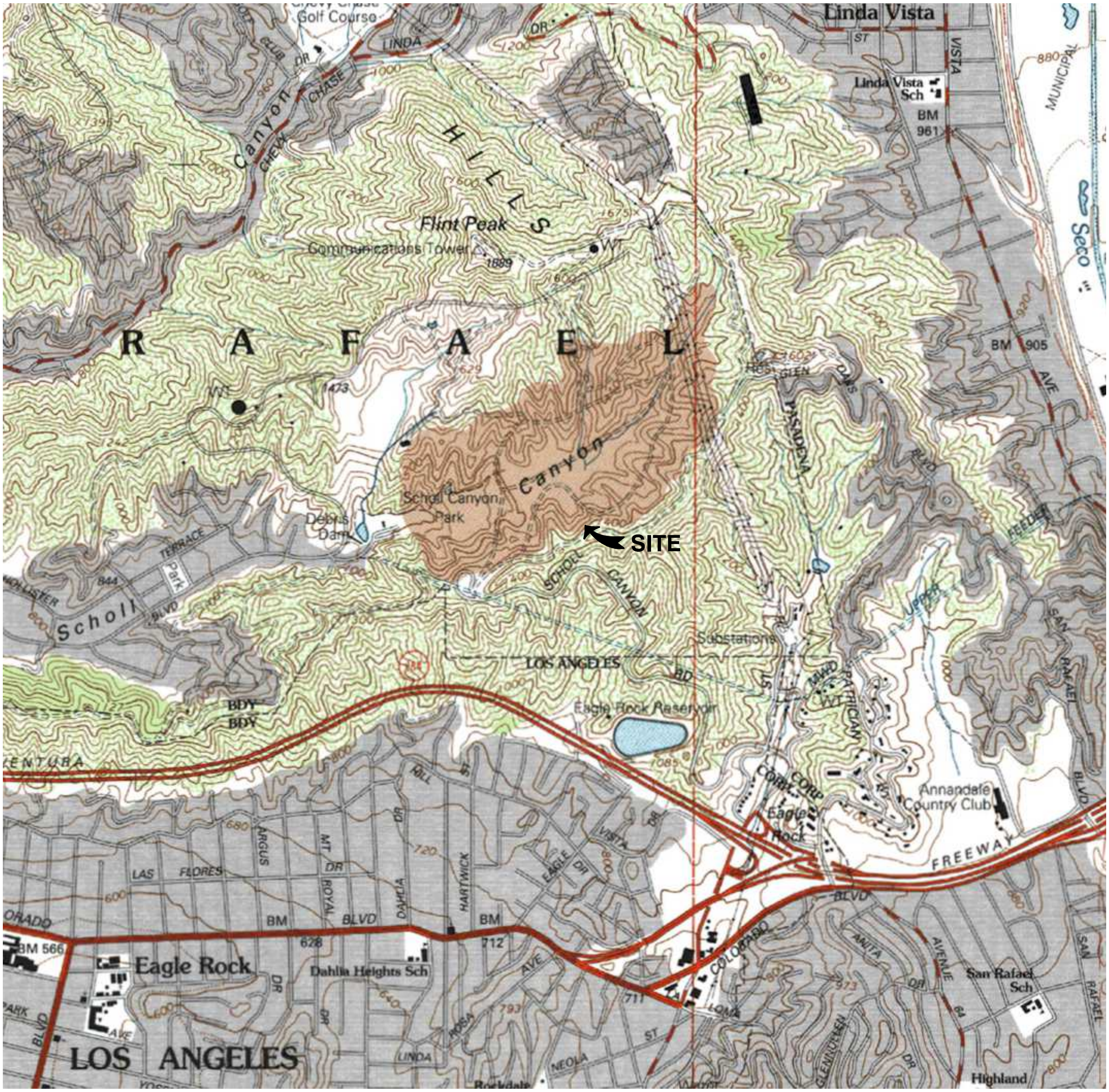
FIGURES



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Stantec	OR: City of Glendale, GLENDALE CALI ORNIA		SITE LOCATION MAP	IGURE
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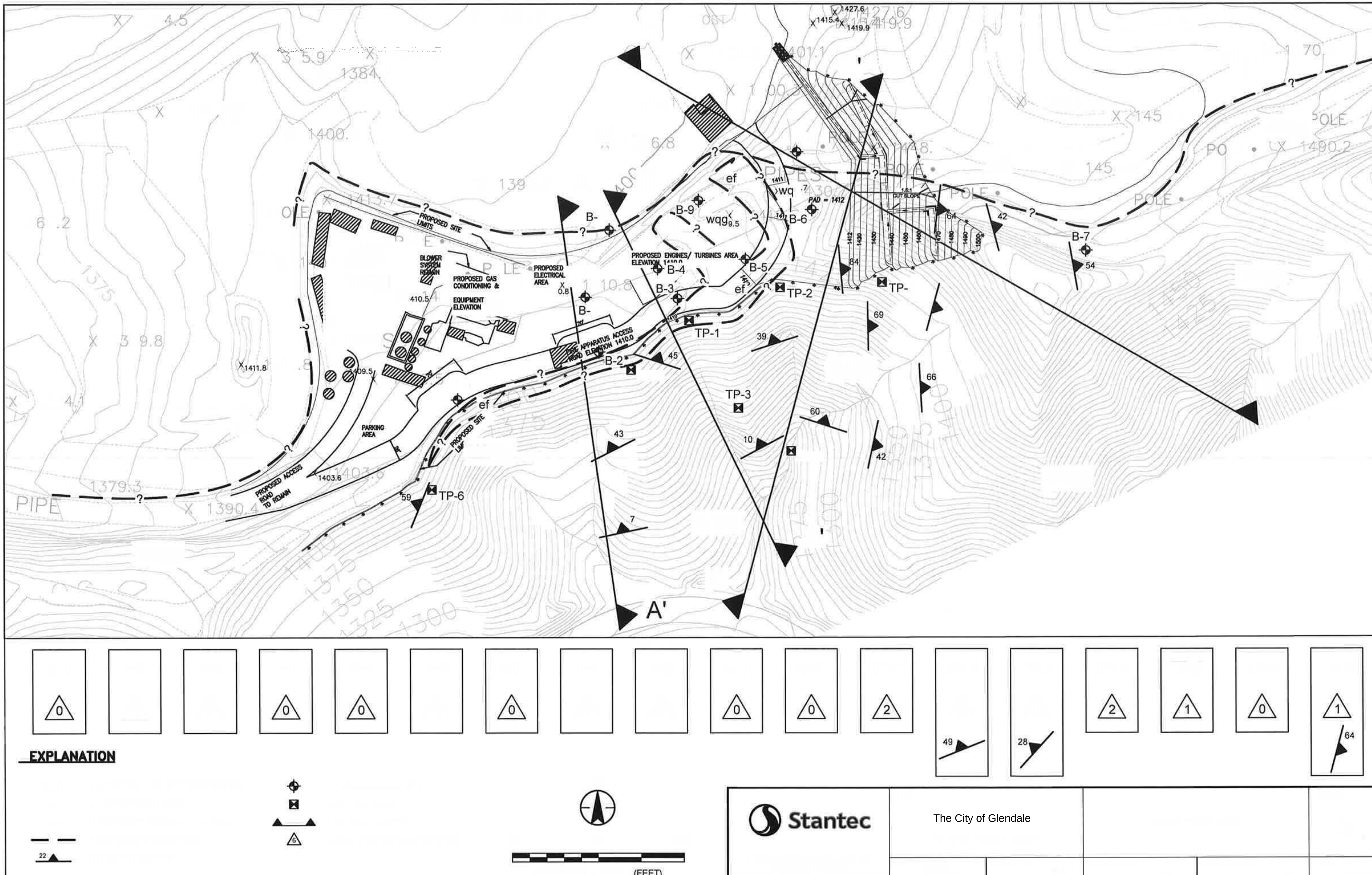

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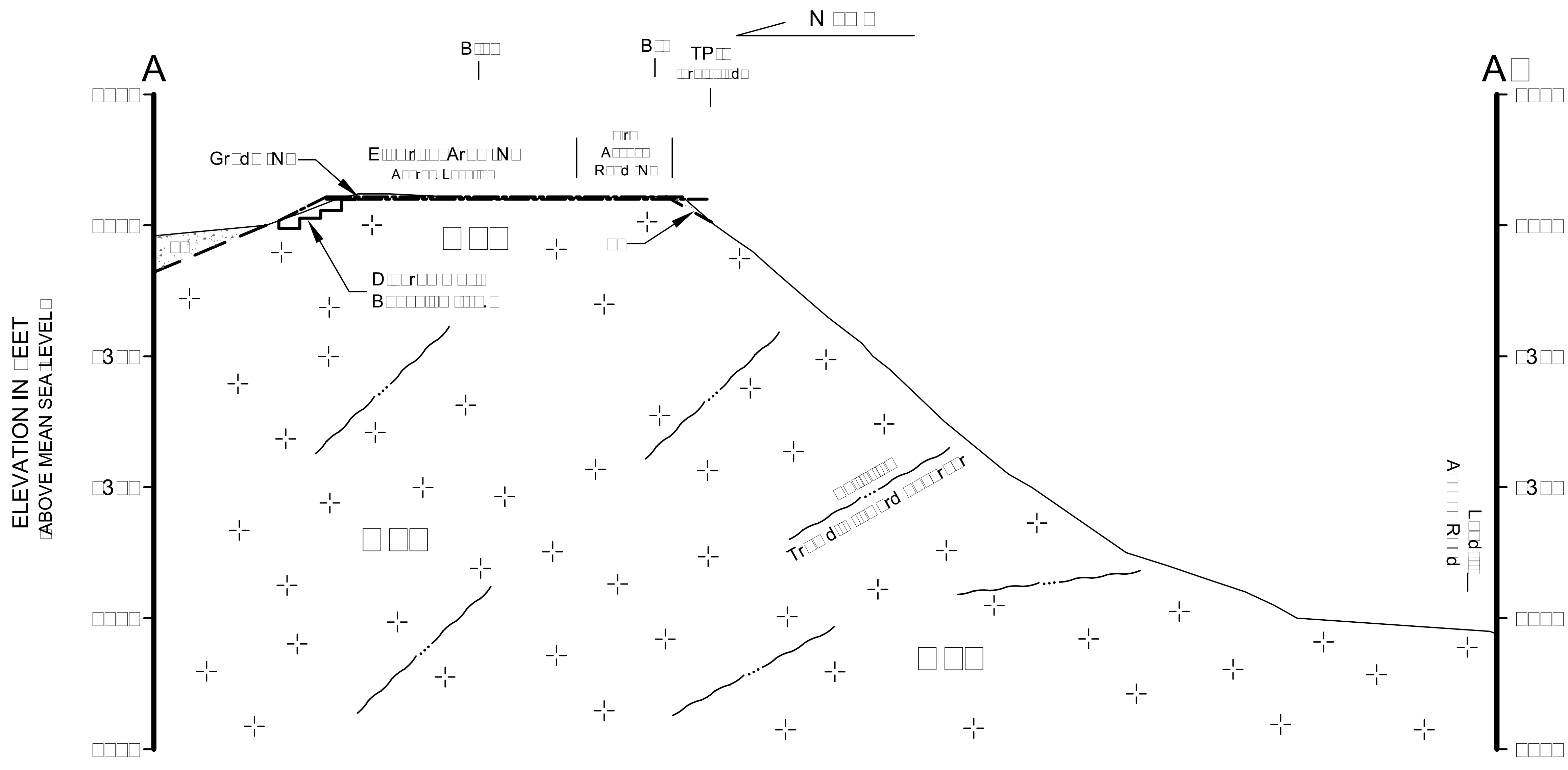

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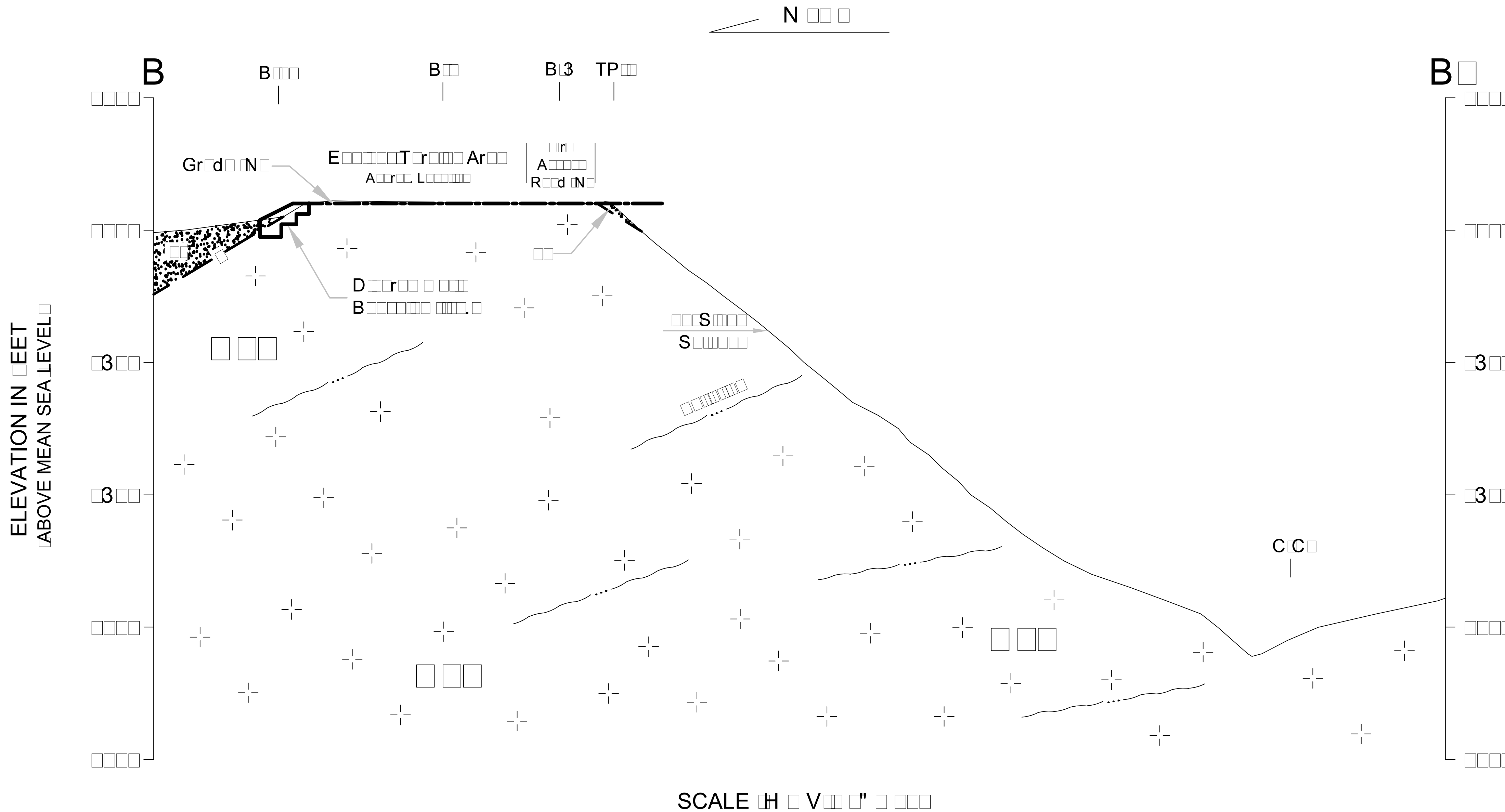

Stantec

BUSINESS CENTER DRIVE
REDLANDS CA
PHONE 33 AX 33

FOR

The City of Glendale

GLENDALE CALIFORNIA

GEOLOGIC CROSS SECTION B B

FIGURE

JOB NUMBER	DRAWN BY	CHECKED BY	APPROVED BY	DATE
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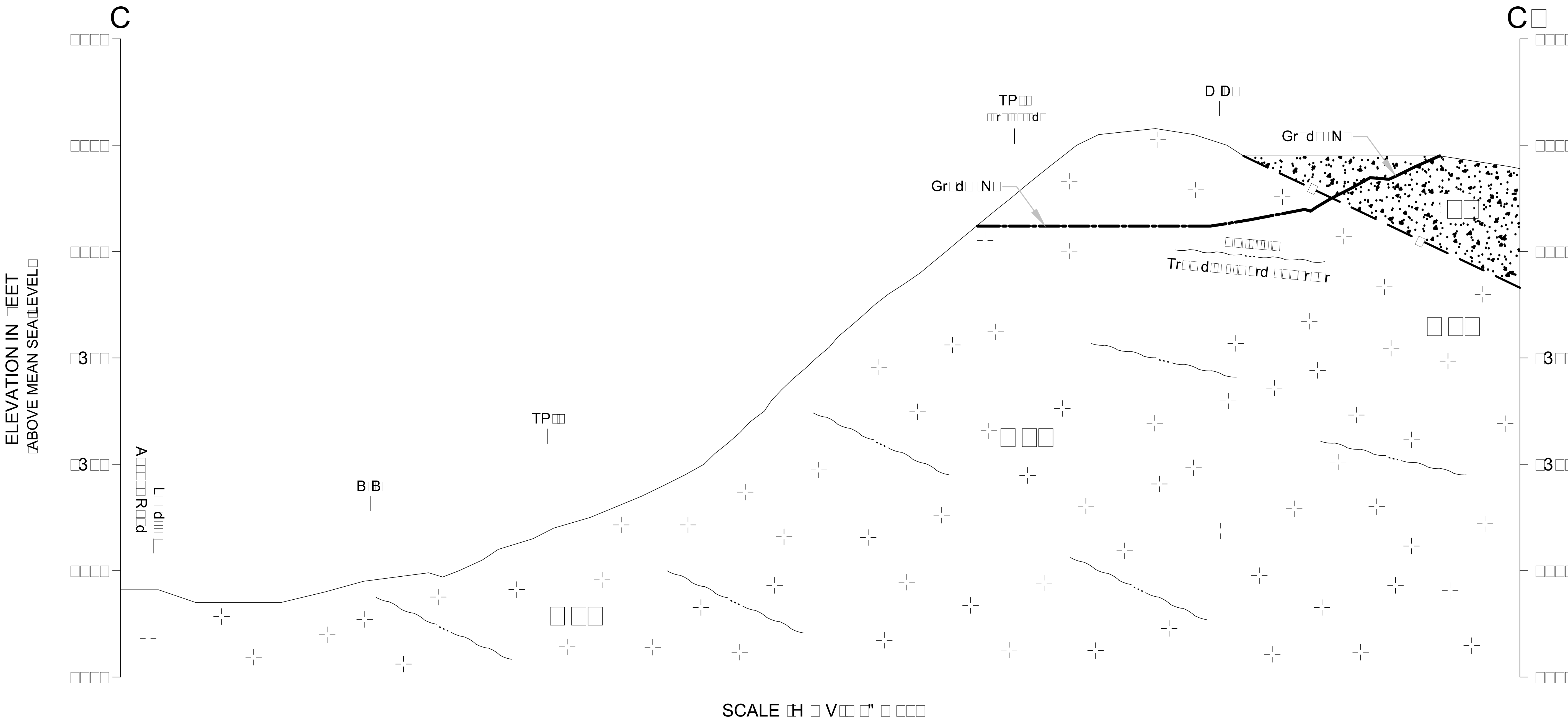

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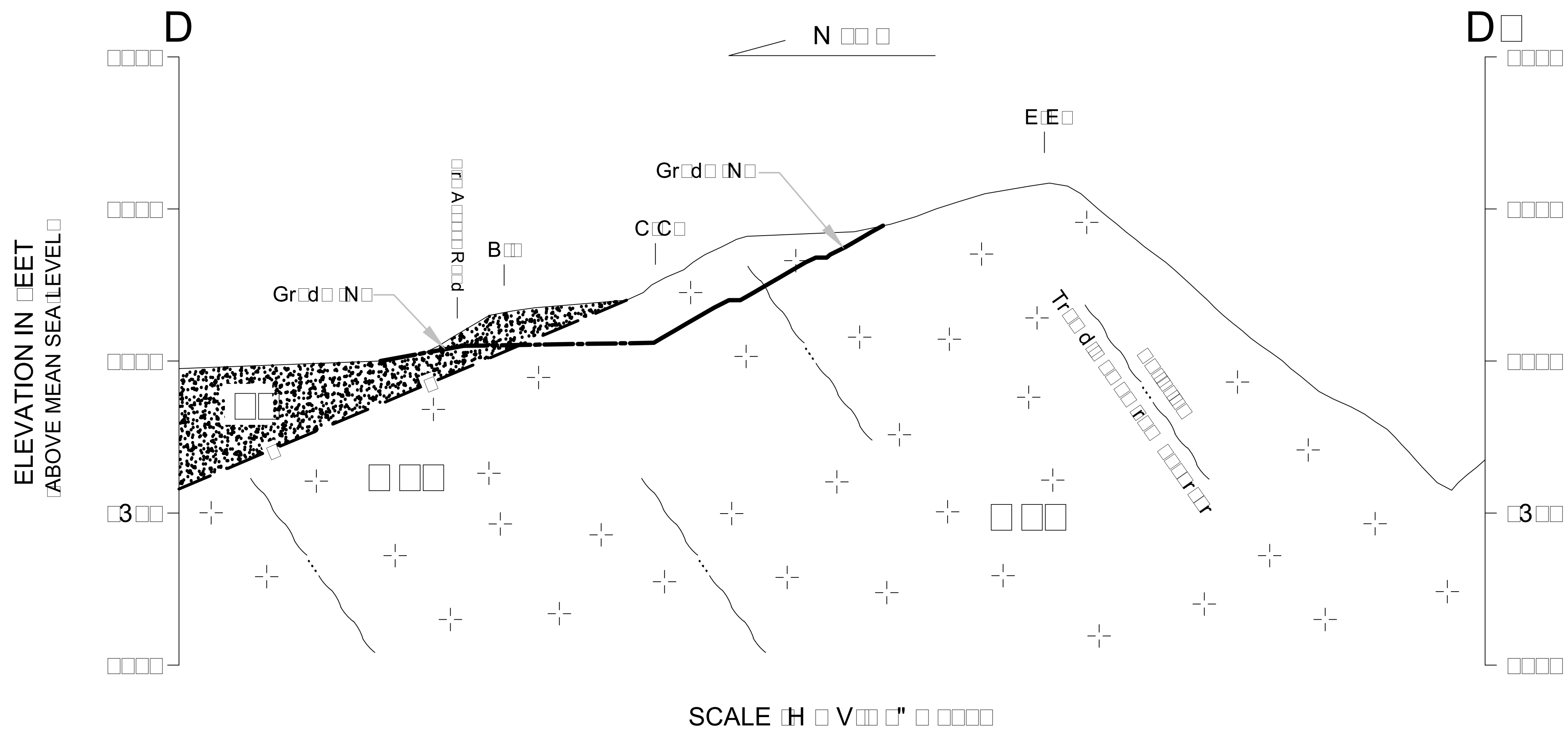
JOB NUMBER 33	DRA N B EJB	CHECKED B J / APPROVED B J	DATE



Stantec	The City of Glendale GLENDALE CALI ORNIA	GEOLOGIC CROSS SECTION D D		IGURE
BUSINESS CENTER DRIVE REDLANDS CA PHONE 33 AX 33	JOB NUMBER 33	DRA N B EJB	CHECKED B J	APPROVED B J	DATE

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APPENDIX A
BORING LOGS

GEO FORM 304 GEOTECHNICAL LEGEND.GPJ SECOR 2/5/06

Headspace

Shown

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Topsoil	- mixture of soil and humus capable of supporting vegetative growth
Peat	- mixture of visible and invisible fragments of decayed organic matter
Till	- unstratified glacial deposit which may range from clay to boulders
Fill	- material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated	- having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	- having cracks, and hence a blocky structure
Varved	- composed of regular alternating layers of silt and clay
Stratified	- composed of alternating successions of different soil types, e.g. silt and sand
Layer	- > 75 mm in thickness
Seam	- 2 mm to 75 mm in thickness
Parting	- < 2 mm in thickness

Terminology describing soil types:
The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488). The classification excludes particles larger than 76 mm (3 inches). The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):
Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	> 20%

Terminology describing compactness of cohesionless soils:
The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test N-Value (also known as N-Index). A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
Very Loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

Terminology describing consistency of cohesive soils:
The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests.

Consistency	Undrained Shear Strength	
	kips/sq.ft.	kPa
Very Soft	<0.25	<12.5
Soft	0.25 - 0.5	12.5 - 25
Firm	0.5 - 1.0	25 - 50
Stiff	1.0 - 2.0	50 – 100
Very Stiff	2.0 - 4.0	100 - 200
Hard	>4.0	>200

ROCK DESCRIPTION

Terminology describing rock quality:

RQD	Rock Mass Quality
0-25	*Very Poor*
25-50	*Poor*
50-75	*Fair*
75-90	*Good*
90-100	*Excellent*

Rock quality classification is based on a modified core recovery percentage (RQD) in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be due to close shearing, jointing, faulting, or weathering in the rock mass and are not counted. RQD was originally intended to be done on NW core; however, it can be used on different core sizes if the bulk of the fractures caused by drilling stresses are easily distinguishable from *in situ* fractures. The terminology describing rock mass quality based on RQD is subjective and is underlain by the presumption that sound strong rock is of higher engineering value than fractured weak rock.

Terminology describing rock mass:

Spacing (mm)	Joint Classification	Bedding, Laminations, Bands
> 6000	*Extremely Wide*	-
2000-6000	*Very Wide*	*Very Thick*
600-2000	*Wide*	*Thick*
200-600	*Moderate*	*Medium*
60-200	*Close*	*Thin*
20-60	*Very Close*	*Very Thin*
<20	*Extremely Close*	*Laminated*
<6	-	*Thinly Laminated*

Terminology describing rock strength:

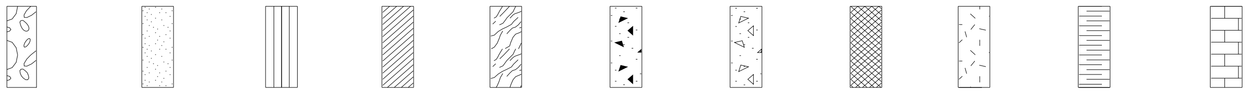
Strength Classification	Unconfined Compressive Strength (MPa)
Extremely Weak	< 1
Very Weak	1 – 5
Weak	5 – 25
Medium Strong	25 – 50
Strong	50 – 100
Very Strong	100 – 250
Extremely Strong	> 250

Terminology describing rock weathering:

Term	Description
Fresh	No visible signs of rock weathering. Slight discolouration along major discontinuities
Slightly Weathered	Discolouration indicates weathering of rock on discontinuity surfaces. All the rock material may be discoloured.
Moderately Weathered	Less than half the rock is decomposed and/or disintegrated into soil.
Highly Weathered	More than half the rock is decomposed and/or disintegrated into soil.
Completely Weathered	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.



Boulders Cobbles Gravel	Sand	Silt	Clay	Organics	Asphalt	Concrete	Fill	Igneous Bedrock	Meta-morphic Bedrock	Sedi-mentary Bedrock

SAMPLE TYPE

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS	Piston sample
BS	Bulk sample
WS	Wash sample
HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond coring bits.

WATER LEVEL MEASUREMENT

▼ measured in standpipe, piezometer, or well

▽ inferred

RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

N-VALUE

Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (64 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (305 mm) into the soil. For split spoon samples where insufficient penetration was achieved and N-values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75). Some design methods make use of N value corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to A size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (305 mm) into the soil. The DCPT is used as a probe to assess soil variability.

OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
γ	Unit weight
G_s	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q_u	Unconfined compression
I_p	Point Load Index (I_p on Borehole Record equals $I_p(50)$ in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer

PROJECT: **Biogas Renewable Generation Project**
LOCATION: **7721 N. Figueroa St., Los Angeles, CA**
PROJECT NUMBER: **2057123300**
DRILLING: STARTED **11/23/15** COMPLETED: **11/23/15**
INSTALLATION: STARTED **11/23/15** COMPLETED: **11/23/15**
DRILLING COMPANY: **2R Drilling**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **Hollow Stem Auger**
SAMPLING EQUIPMENT: **Split Spoon Sampler**

WELL / PROBEHOLE / BOREHOLE NO: **B1** PAGE 1 OF 1

Stantec

NORTHING (ft): **1,878,130** EASTING (ft): **6,503,248**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **1408.237** TOC ELEV (ft):
INITIAL DTW (ft): **NE** BOREHOLE DEPTH (ft): **6.5**
STATIC DTW (ft): **NE** WELL DEPTH (ft): **---**
WELL CASING DIAMETER (in): **---** BOREHOLE DIAMETER (in): **6**
LOGGED BY: **J. Sargent** CHECKED BY: **J. Fischer**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			5" Asphalt concrete						
			WILSON QUARTZ DIORITE (wqd)						
			10YR 3/4 dark yellowish brown; weathered dioritic-granitic bedrock; dry; very dense; moderately fractured.		1220 B1-2	SA, MD	27 50-5"		
5					1225 B1-5		21 35 50		5
			Hole terminated at 6.5 feet.						
10									10
15									15
20									20

PROJECT: **Biogas Renewable Generation Project**	WELL / PROBEHOLE / BOREHOLE NO: **B2** PAGE 1 OF 1
LOCATION: **7721 N. Figueroa St., Los Angeles, CA**	Stantec
PROJECT NUMBER: **2057123300**	
DRILLING: STARTED **11/23/15** COMPLETED: **11/23/15**	NORTHING (ft): **1,878,194** EASTING (ft): **6,503,406**
INSTALLATION: STARTED **11/23/15** COMPLETED: **11/23/15**	LATITUDE: LONGITUDE:
DRILLING COMPANY: **2R Drilling**	GROUND ELEV (ft): **1408.920** TOC ELEV (ft):
DRILLING EQUIPMENT: **CME 75**	INITIAL DTW (ft): **NE** BOREHOLE DEPTH (ft): **6.5**
DRILLING METHOD: **Hollow Stem Auger**	STATIC DTW (ft): **NE** WELL DEPTH (ft): **---**
	WELL CASING DIAMETER (in): **---** BOREHOLE DIAMETER (in): **6**
SAMPLING EQUIPMENT: **Split Spoon Sampler**	LOGGED BY: **J. Sargent** CHECKED BY: **J. Fischer**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			5.5" Asphalt Concrete						
		SM	**SILTY SAND WITH GRAVEL** ; SM; 2.5Y 5/4 light olive brown; 30% fine angular gravel; 50% fine to coarse grained sand; 20% fines; dry; very dense; no staining; no odors (deeply weathered bedrock).		1252 B2-2	SA	35 50-6"		
5					1255 B2-5		50-3"		5
			Hole terminated at 6.5 feet.						
10									10
15									15
20									20

PROJECT: **Biogas Renewable Generation Project**
LOCATION: **7721 N. Figueroa St., Los Angeles, CA**
PROJECT NUMBER: **2057123300**
DRILLING: STARTED **11/24/15** COMPLETED: **11/24/15**
INSTALLATION: STARTED **11/24/15** COMPLETED: **11/24/15**
DRILLING COMPANY: **2R Drilling**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **Hollow Stem Auger**
SAMPLING EQUIPMENT: **Split Spoon Sampler**

WELL / PROBEHOLE / BOREHOLE NO: **B3** PAGE 1 OF 1

Stantec

NORTHING (ft): **1,878,223** EASTING (ft): **6,503,470**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **1408.354** TOC ELEV (ft):
INITIAL DTW (ft): **NE** BOREHOLE DEPTH (ft): **17.5**
STATIC DTW (ft): **NE** WELL DEPTH (ft): **---**
WELL CASING DIAMETER (in): **---** BOREHOLE DIAMETER (in): **6**
LOGGED BY: **J. Sargent** CHECKED BY: **J. Fischer**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			4" Asphalt Concrete						
		SM	**SILTY SAND WITH GRAVEL** ; SM; 2.5Y 5/4 light olive brown; 30% fine angular gravel; 50% fine to coarse grained sand; 20% fines; dry; very dense; no staining; no odors (deeply weathered bedrock); evidence of hydrothermal alteration present.		0855 B3-2	SA, MD	34 50-5"		
5					0900 B3-5		37 50-6"		5
					0902 B3-7		50-4"		
10					0905 B3-10		31 45 50-5"		10
15					0915 B3-15		50-5"		15
			Hole terminated at 17.5 feet.						
20									20

GEO FORM 304 SCHOLL_CANYON_BORING_LOGS.GPJ SECOR INTL.GDT 2/12/16

PROJECT: **Biogas Renewable Generation Project**
LOCATION: **7721 N. Figueroa St., Los Angeles, CA**
PROJECT NUMBER: **2057123300**
DRILLING: STARTED **11/24/15** COMPLETED: **11/24/15**
INSTALLATION: STARTED **11/24/15** COMPLETED: **11/24/15**
DRILLING COMPANY: **2R Drilling**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **Hollow Stem Auger**
SAMPLING EQUIPMENT: **Split Spoon Sampler**

WELL / PROBEHOLE / BOREHOLE NO: **B4** PAGE 1 OF 1

Stantec

NORTHING (ft): **1,878,273** EASTING (ft): **6,503,478**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **1411.254** TOC ELEV (ft):
INITIAL DTW (ft): **NE** BOREHOLE DEPTH (ft): **8.5**
STATIC DTW (ft): **NE** WELL DEPTH (ft): **---**
WELL CASING DIAMETER (in): **---** BOREHOLE DIAMETER (in): **6**
LOGGED BY: **J. Sargent** CHECKED BY: **J. Fischer**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
		SM	**SILTY SAND WITH GRAVEL** ; SM; 10 YR 3/4 dark yellowish brown; 40% fine angular gravel; 40% fine to coarse grained sand; 20% fines; dry; dense; no staining; no odors; (deeply weathered bedrock) evidence of hydrothermal alteration present.		0820 B4-2	SA	10 11 21		
5					0830 B4-5		50-2"		5
					0835 B4-7		50-2"		
			Hole terminated at 8.5 feet.						
10									10
15									15
20									20

PROJECT: **Biogas Renewable Generation Project**
LOCATION: **7721 N. Figueroa St., Los Angeles, CA**
PROJECT NUMBER: **2057123300**
DRILLING: STARTED **11/24/15** COMPLETED: **11/24/15**
INSTALLATION: STARTED **11/24/15** COMPLETED: **11/24/15**
DRILLING COMPANY: **2R Drilling**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **Hollow Stem Auger**
SAMPLING EQUIPMENT: **Split Spoon Sampler**

WELL / PROBEHOLE / BOREHOLE NO:
B5 PAGE 1 OF 1

Stantec

NORTHING (ft): **1,878,314** EASTING (ft): **6,503,565**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **1418.679** TOC ELEV (ft):
INITIAL DTW (ft): **NE** BOREHOLE DEPTH (ft): **6.5**
STATIC DTW (ft): **NE** WELL DEPTH (ft): **---**
WELL CASING DIAMETER (in): **---** BOREHOLE DIAMETER (in): **6**
LOGGED BY: **J. Sargent** CHECKED BY: **J. Fischer**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			WILSON QUARTZ DIORITE (wqd)						
			Dark yellowish brown; weathered dioritic-granitic bedrock; dry; very dense; moderately fractured.		0800 B5-2		8 50-4"		
5					0805 B5-5		50-5"		5
			Hole terminated at 6.5 feet.						
10									10
15									15
20									20

PROJECT: **Biogas Renewable Generation Project**	WELL / PROBEHOLE / BOREHOLE NO: **B6** PAGE 1 OF 1
LOCATION: **7721 N. Figueroa St., Los Angeles, CA**	Stantec
PROJECT NUMBER: **2057123300**	
DRILLING: STARTED **11/23/15** COMPLETED: **11/23/15**	NORTHING (ft): **1,878,356** EASTING (ft): **6,503,665**
INSTALLATION: STARTED **11/23/15** COMPLETED: **11/23/15**	LATITUDE: LONGITUDE:
DRILLING COMPANY: **2R Drilling**	GROUND ELEV (ft): **1433.052** TOC ELEV (ft):
DRILLING EQUIPMENT: **CME 75**	INITIAL DTW (ft): **NE** BOREHOLE DEPTH (ft): **6.5**
DRILLING METHOD: **Hollow Stem Auger**	STATIC DTW (ft): **NE** WELL DEPTH (ft): **---**
	WELL CASING DIAMETER (in): **---** BOREHOLE DIAMETER (in): **6**
SAMPLING EQUIPMENT: **Split Spoon Sampler**	LOGGED BY: **J. Sargent** CHECKED BY: **J. Fischer**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			WILSON QUARTZ DIORITE (wqd)						
			Dark yellowish brown; weathered dioritic-granitic bedrock; dry; very dense; moderately fractured.		1120 B6-2	SA	50-5"		
5					1122 B6-5		50-3"		5
			Hole terminated at 6.5 feet.						
10									10
15									15
20									20

GEO FORM 304 SCHOLL_CANYON_BORING_LOGS.GPJ SECOR INTL.GDT 2/12/16

PROJECT: **Biogas Renewable Generation Project** LOCATION: **7721 N. Figueroa St., Los Angeles, CA** PROJECT NUMBER: **2057123300** DRILLING: STARTED **11/23/15** COMPLETED: **11/23/15** INSTALLATION: STARTED **11/23/15** COMPLETED: **11/23/15** DRILLING COMPANY: **2R Drilling** DRILLING EQUIPMENT: **CME 75** DRILLING METHOD: **Hollow Stem Auger** SAMPLING EQUIPMENT: **Split Spoon Sampler**	WELL / PROBEHOLE / BOREHOLE NO: **B7** PAGE 1 OF 1 Stantec NORTHING (ft): **1,878,310** EASTING (ft): **6,503,952** LATITUDE: LONGITUDE: GROUND ELEV (ft): **1472.598** TOC ELEV (ft): INITIAL DTW (ft): **NE** BOREHOLE DEPTH (ft): **6.5** STATIC DTW (ft): **NE** WELL DEPTH (ft): **---** WELL CASING DIAMETER (in): **---** BOREHOLE DIAMETER (in): **6** LOGGED BY: **J. Sargent** CHECKED BY: **J. Fischer**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			WILSON QUARTZ DIORITE (wqd)						
			Dark yellowish brown; weathered dioritic-granitic bedrock; dry; very dense; moderately fractured.		1048 B7-2	SA	50-4"		
5					1052 B7-5		26 37 50		5
			Hole terminated at 6.5 feet.						
10									10
15									15
20									20

PROJECT: **Biogas Renewable Generation Project**
LOCATION: **7721 N. Figueroa St., Los Angeles, CA**
PROJECT NUMBER: **2057123300**
DRILLING: STARTED **11/23/15** COMPLETED: **11/23/15**
INSTALLATION: STARTED **11/23/15** COMPLETED: **11/23/15**
DRILLING COMPANY: **2R Drilling**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **Hollow Stem Auger**
SAMPLING EQUIPMENT: **Split Spoon Sampler**

WELL / PROBEHOLE / BOREHOLE NO: **B8**

Stantec

NORTHING (ft): **1,878,448** EASTING (ft): **6,503,697**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **1445.945** TOC ELEV (ft):
INITIAL DTW (ft): **NE** BOREHOLE DEPTH (ft): **36.5**
STATIC DTW (ft): **NE** WELL DEPTH (ft): **---**
WELL CASING DIAMETER (in): **---** BOREHOLE DIAMETER (in): **6**
LOGGED BY: **J. Sargent** CHECKED BY: **J. Fischer**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
		SM	**SILTY SAND WITH GRAVEL** ; SM; 7.5 YR 3/3 dark brown; 15% fine gravel; 65% fine to coarse grained sand; 20% fines; moist; medium dense; no staining; no odor (FILL).		918 B8-2	SA	5 8 8		
5					922 B8-5	DS	8 10 12		5
					926 B8-7		3 4 4		
10			With some landfill debris below 15 feet		930 B8-10		3 4 4		10
15					940 B8-10	SA	7 9 7		15
20					945 B8-20		6 5 10		20

PROJECT: **Biogas Renewable Generation Project**	WELL / PROBEHOLE / BOREHOLE NO:
LOCATION: **7721 N. Figueroa St., Los Angeles, CA**	**B8** PAGE 2 OF 2
PROJECT NUMBER: **2057123300**	
DRILLING: STARTED **11/23/15** COMPLETED: **11/23/15**	NORTHING (ft): **1,878,448** EASTING (ft): **6,503,697**
INSTALLATION: STARTED **11/23/15** COMPLETED: **11/23/15**	LATITUDE: LONGITUDE:
DRILLING COMPANY: **2R Drilling**	GROUND ELEV (ft): **1445.945** TOC ELEV (ft):
DRILLING EQUIPMENT: **CME 75**	INITIAL DTW (ft): **NE** BOREHOLE DEPTH (ft): **36.5**
DRILLING METHOD: **Hollow Stem Auger**	STATIC DTW (ft): **NE** WELL DEPTH (ft): **---**
	WELL CASING DIAMETER (in): **---** BOREHOLE DIAMETER (in): **6**
SAMPLING EQUIPMENT: **Split Spoon Sampler**	LOGGED BY: **J. Sargent** CHECKED BY: **J. Fischer**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
				X	955 B8-25		7 10 13		
			WILSON QUARTZ DIORITE (wqd); dark yellowish brown; weathered dioritic-granitic bedrock; dry; very dense; moderately fractured.						
30				X	1010 B8-30	SA	13 35 46		30
35				X	1015 B8-35		21 50-5"		35
			Hole terminated at 36.5 feet.						
40									40
45									45

PROJECT: **Biogas Renewable Generation Project**	WELL / PROBEHOLE / BOREHOLE NO:
LOCATION: **7721 N. Figueroa St., Los Angeles, CA**	**B9** PAGE 1 OF 1
PROJECT NUMBER: **2057123300**	Stantec
DRILLING: STARTED **11/24/15** COMPLETED: **11/24/15**	NORTHING (ft): **1,878,376** EASTING (ft): **6,503,531**
INSTALLATION: STARTED **11/24/15** COMPLETED: **11/24/15**	LATITUDE: LONGITUDE:
DRILLING COMPANY: **2R Drilling**	GROUND ELEV (ft): **1422.006** TOC ELEV (ft):
DRILLING EQUIPMENT: **CME 75**	INITIAL DTW (ft): **NE** BOREHOLE DEPTH (ft): **6.5**
DRILLING METHOD: **Hollow Stem Auger**	STATIC DTW (ft): **NE** WELL DEPTH (ft): **---**
	WELL CASING DIAMETER (in): **---** BOREHOLE DIAMETER (in): **6**
SAMPLING EQUIPMENT: **Split Spoon Sampler**	LOGGED BY: **J. Sargent** CHECKED BY: **J. Fischer**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			WILSON QUARTZ DIORITE (wqd); dark yellowish brown; weathered dioritic-granitic bedrock; dry; very dense; moderately fractured.		740 B9-2	SA	50-6"		
5					745 B9-5		21 32 46		5
			Hole terminated at 6.5 feet.						
10									10
15									15
20									20

PROJECT: **Biogas Renewable Generation Project**
LOCATION: **7721 N. Figueroa St., Los Angeles, CA**
PROJECT NUMBER: **2057123300**
DRILLING: STARTED **12/4/15** COMPLETED: **12/4/15**
INSTALLATION: STARTED **12/4/15** COMPLETED: **12/4/15**
DRILLING COMPANY: **Mike's Excavating Service**
DRILLING EQUIPMENT: **Hand Dug**
DRILLING METHOD:
SAMPLING EQUIPMENT: **Split Spoon Sampler**

WELL / PROBEHOLE / BOREHOLE NO:

TP-1

Stantec

NORTHING (ft):
EASTING (ft):
LATITUDE:
LONGITUDE:
GROUND ELEV (ft):
TOC ELEV (ft):
INITIAL DTW (ft): **NE**
BOREHOLE DEPTH (ft): **3.0**
STATIC DTW (ft): **NE**
WELL DEPTH (ft): **---**
WELL CASING DIAMETER (in): **---**
BOREHOLE DIAMETER (in):
LOGGED BY: **E. Bovenizer**
CHECKED BY: **J. Fischer**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			Earth Fill (ef); silty sand with gravel, mottled brown and dark brown, dry, loose, sand is very fine to coarse grained (FILL)		TP1-0.5	DS			
			Natural Soil (Qns); silty sand with gravell brown; dry; loose; sand is very fine to coarse grained; rootlets (NATIVE)						
			Wilson Quartz Diorite (wqd); quartz diorite; brown and white specked; dry; very hard; medium to large grained; moderately to poorly foliated.						
			Hole terminated at 3 feet.						
5									5
10									10
15									15
20									20

PROJECT: **Biogas Renewable Generation Project**
LOCATION: **7721 N. Figueroa St., Los Angeles, CA**
PROJECT NUMBER: **2057123300**

DRILLING:	STARTED **12/4/15**	COMPLETED: **12/4/15**	
INSTALLATION:	STARTED **12/4/15**	COMPLETED: **12/4/15**	

DRILLING COMPANY: **Mike's Excavating Service**
DRILLING EQUIPMENT: **Hand Dug**
DRILLING METHOD:
SAMPLING EQUIPMENT: **Split Spoon Sampler**

WELL / PROBEHOLE / BOREHOLE NO:

TP-2 PAGE 1 OF 1

Stantec

NORTHING (ft):	EASTING (ft):
LATITUDE:	LONGITUDE:
GROUND ELEV (ft):	TOC ELEV (ft):
INITIAL DTW (ft): **NE**	BOREHOLE DEPTH (ft): **3.0**
STATIC DTW (ft): **NE**	WELL DEPTH (ft): **---**
WELL CASING DIAMETER (in): **---**	BOREHOLE DIAMETER (in):
LOGGED BY: **E. Bovenizer**	CHECKED BY: **J. Fischer**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			Natural Soil (Qns); silty sand with gravell brown; dry; loose; sand is very fine to coarse grained; rootlets (NATIVE)		TP2-0.5	DS			
			Wilson Quartz Diorite (wqd); quartz diorite; brown and white specked; dry; very hard; medium to large grained; moderately to poorly foliated; foliation at 2.5 feet; N68E; 49NW						
			Hole terminated at 3 feet.						
5									5
10									10
15									15
20									20

PROJECT: **Biogas Renewable Generation Project**	WELL / PROBEHOLE / BOREHOLE NO: **TP-3** PAGE 1 OF 1
LOCATION: **7721 N. Figueroa St., Los Angeles, CA**	NORTHING (ft):
PROJECT NUMBER: **2057123300**	EASTING (ft):
DRILLING: STARTED **12/4/15** COMPLETED: **12/4/15**	LATITUDE:
INSTALLATION: STARTED **12/4/15** COMPLETED: **12/4/15**	LONGITUDE:
DRILLING COMPANY: **Mike's Excavating Service**	GROUND ELEV (ft):
DRILLING EQUIPMENT: **Hand Dug**	TOC ELEV (ft):
DRILLING METHOD:	INITIAL DTW (ft): **NE**
SAMPLING EQUIPMENT: **Split Spoon Sampler**	BOREHOLE DEPTH (ft): **3.0**
	STATIC DTW (ft): **NE**
	WELL DEPTH (ft): **---**
	WELL CASING DIAMETER (in): **---**
	BOREHOLE DIAMETER (in):
	LOGGED BY: **E. Bovenizer**
	CHECKED BY: **J. Fischer**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			Wilson Quartz Diorite (wqd); quartz diorite; brown and white specked; dry; very hard; medium to large grained; moderately to poorly foliated; upper foot is weathered; foliation at 1.5 feet; N42E; 28NW		TP3-0.5	DS			
			Hole terminated at 3 feet.						
5									5
10									10
15									15
20									20

PROJECT: **Biogas Renewable Generation Project**
LOCATION: **7721 N. Figueroa St., Los Angeles, CA**
PROJECT NUMBER: **2057123300**
DRILLING: STARTED **12/4/15** COMPLETED: **12/4/15**
INSTALLATION: STARTED **12/4/15** COMPLETED: **12/4/15**
DRILLING COMPANY: **Mike's Excavating Service**
DRILLING EQUIPMENT: **Hand Dug**
DRILLING METHOD:
SAMPLING EQUIPMENT: **Split Spoon Sampler**

WELL / PROBEHOLE / BOREHOLE NO:

TP-4 PAGE 1 OF 1

Stantec

NORTHING (ft):
EASTING (ft):
LATITUDE:
LONGITUDE:
GROUND ELEV (ft):
TOC ELEV (ft):
INITIAL DTW (ft): **NE**
BOREHOLE DEPTH (ft): **3.0**
STATIC DTW (ft): **NE**
WELL DEPTH (ft): **---**
WELL CASING DIAMETER (in): **---**
BOREHOLE DIAMETER (in):
LOGGED BY: **E. Bovenizer**
CHECKED BY: **J. Fischer**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			Natural Soil (Qns); silty sand with gravell brown; dry; loose; sand is very fine to coarse grained; rootlets (NATIVE)		TP4-1.0	DS			
			Wilson Quartz Diorite (wqd); quartz diorite; brown and white specked; dry; very hard; medium to large grained; moderately to poorly foliated		TP4-3.0	DS			
			Hole terminated at 3.5 feet.						
5									5
10									10
15									15
20									20

GEO FORM 304 SCHOLL_CANYON_BORING_LOGS.GPJ SECOR INTL.GDT 2/12/16

PROJECT: **Biogas Renewable Generation Project**
LOCATION: **7721 N. Figueroa St., Los Angeles, CA**
PROJECT NUMBER: **2057123300**

WELL / PROBEHOLE / BOREHOLE NO: **TP-5** PAGE 1 OF 1

Stantec

DRILLING: STARTED **12/4/15**	COMPLETED: **12/4/15**	NORTHING (ft):	EASTING (ft):
INSTALLATION: STARTED **12/4/15**	COMPLETED: **12/4/15**	LATITUDE:	LONGITUDE:
DRILLING COMPANY: **Mike's Excavating Service**		GROUND ELEV (ft):	TOC ELEV (ft):
DRILLING EQUIPMENT: **Hand Dug**		INITIAL DTW (ft): **NE**	BOREHOLE DEPTH (ft): **3.0**
DRILLING METHOD:		STATIC DTW (ft): **NE**	WELL DEPTH (ft): **---**
		WELL CASING DIAMETER (in): **---**	BOREHOLE DIAMETER (in):
SAMPLING EQUIPMENT: **Split Spoon Sampler**		LOGGED BY: **E. Bovenizer**	CHECKED BY: **J. Fischer**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			Natural Soil (Qns); silty sand with gravell brown; dry; loose; sand is very fine to coarse grained; rootlets (NATIVE)						
			Wilson Quartz Diorite (wqd); quartz diorite; brown and white specked; dry; very hard; medium to large grained; moderately to poorly foliated; upper 1.5 feet is weathered						
				⋈	TP5-3	DS			
			Hole terminated at 3.5 feet.						
5									5
10									10
15									15
20									20

PROJECT: **Biogas Renewable Generation Project**	WELL / PROBEHOLE / BOREHOLE NO:
LOCATION: **7721 N. Figueroa St., Los Angeles, CA**	**TP-6** PAGE 1 OF 1
PROJECT NUMBER: **2057123300**	
DRILLING: STARTED **12/4/15** COMPLETED: **12/4/15**	NORTHING (ft): / EASTING (ft):
INSTALLATION: STARTED **12/4/15** COMPLETED: **12/4/15**	LATITUDE: / LONGITUDE:
DRILLING COMPANY: **Mike's Excavating Service**	GROUND ELEV (ft): / TOC ELEV (ft):
DRILLING EQUIPMENT: **Hand Dug**	INITIAL DTW (ft): **NE** / BOREHOLE DEPTH (ft): **3.0**
DRILLING METHOD:	STATIC DTW (ft): **NE** / WELL DEPTH (ft): **---**
	WELL CASING DIAMETER (in): **---** / BOREHOLE DIAMETER (in):
SAMPLING EQUIPMENT: **Split Spoon Sampler**	LOGGED BY: **E. Bovenizer** / CHECKED BY: **J. Fischer**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			Wilson Quartz Diorite (wqd); quartz diorite; brown and white specked; dry; very hard; medium to large grained; moderately to poorly foliated						
			Hole terminated at 3 feet.						
5									5
10									10
15									15
20									20

PROJECT: **Biogas Renewable Generation Project**	WELL / PROBEHOLE / BOREHOLE NO:
LOCATION: **7721 N. Figueroa St., Los Angeles, CA**	**TP-7** PAGE 1 OF 1
PROJECT NUMBER: **2057123300**	

Stantec

DRILLING: STARTED **12/4/15**	COMPLETED: **12/4/15**	NORTHING (ft):	EASTING (ft):
INSTALLATION: STARTED **12/4/15**	COMPLETED: **12/4/15**	LATITUDE:	LONGITUDE:
DRILLING COMPANY: **Mike's Excavating Service**		GROUND ELEV (ft):	TOC ELEV (ft):
DRILLING EQUIPMENT: **Hand Dug**		INITIAL DTW (ft): **NE**	BOREHOLE DEPTH (ft): **3.0**
DRILLING METHOD:		STATIC DTW (ft): **NE**	WELL DEPTH (ft): **---**
SAMPLING EQUIPMENT: **Split Spoon Sampler**		WELL CASING DIAMETER (in): **---**	BOREHOLE DIAMETER (in):
		LOGGED BY: **E. Bovenizer**	CHECKED BY: **J. Fischer**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			Natural Soil (Qns); silty sand with gravell brown; dry; loose; sand is very fine to coarse grained; rootlets (NATIVE)						
			Wilson Quartz Diorite (wqd); quartz diorite; brown and white specked; dry; very hard; medium to large grained; moderately to poorly foliated; foliation at 1.5 feet; N15E; 64SE	X	TP7-1.0	DS			
				X	TP7-2.0	DS			
			Hole terminated at 3 feet.						
5									5
10									10
15									15
20									20

PROJECT: **Biogas Renewable Generation Project**
LOCATION: **7721 N. Figueroa St., Los Angeles, CA**
PROJECT NUMBER: **2057123300**
DRILLING: STARTED **11/23/15** COMPLETED: **11/23/15**
INSTALLATION: STARTED **11/23/15** COMPLETED: **11/23/15**
DRILLING COMPANY: **2R Drilling**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **Hollow Stem Auger**
SAMPLING EQUIPMENT: **Split Spoon Sampler**

WELL / PROBEHOLE / BOREHOLE NO:

B10 PAGE 1 OF 1

Stantec

NORTHING (ft): **1,878,339** EASTING (ft): **6,503,445**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **1403.152** TOC ELEV (ft):
INITIAL DTW (ft): **NE** BOREHOLE DEPTH (ft): **6.5**
STATIC DTW (ft): **NE** WELL DEPTH (ft): **---**
WELL CASING DIAMETER (in): **---** BOREHOLE DIAMETER (in): **6**
LOGGED BY: **J. Sargent** CHECKED BY: **J. Fischer**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			WILSON QUARTZ DIORITE (wqd); dark yellowish brown; weathered dioritic-granitic bedrock; dry; very dense; moderately fractured.		1410 B10-2	SA	22 20 30		
5					1415 B10-5		50-5"		5
			Hole terminated at 6.5 feet.						
10									10
15									15
20									20

PROJECT: **Biogas Renewable Generation Project**
LOCATION: **7721 N. Figueroa St., Los Angeles, CA**
PROJECT NUMBER: **2057123300**
DRILLING: STARTED **11/23/15** COMPLETED: **11/23/15**
INSTALLATION: STARTED **11/23/15** COMPLETED: **11/23/15**
DRILLING COMPANY: **2R Drilling**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **Hollow Stem Auger**
SAMPLING EQUIPMENT: **Split Spoon Sampler**

WELL / PROBEHOLE / BOREHOLE NO:

Stantec

B11 PAGE 1 OF 1

NORTHING (ft): **1,878,249**
EASTING (ft): **6,503,378**
LATITUDE:
LONGITUDE:
GROUND ELEV (ft): **1409.831**
TOC ELEV (ft):
INITIAL DTW (ft): **NE**
BOREHOLE DEPTH (ft): **11.5**
STATIC DTW (ft): **NE**
WELL DEPTH (ft): **---**
WELL CASING DIAMETER (in): **---**
BOREHOLE DIAMETER (in): **6**
LOGGED BY: **J. Sargent**
CHECKED BY: **J. Fischer**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Geotechnical Lab Testing	Blow Count	PID Reading (ppmv)	Depth (feet)
			SILTY SAND WITH GRAVEL ; 2.5Y 4/4 olive brown ; 30% fine to coarse gravel; 50% fine to coarse grained sand; 20% fines; moist; medium dense; no staining; no odor (deeply weathered bedrock).		1320 B11-2	SA, MD	9 8 7		
5					1325 B11-5		2 6 22		5
			WILSON QUARTZ DIORITE (wqd); dark yellowish brown; weathered dioritic-granitic bedrock; dry; very dense; moderately fractured.		1330 B11-7	SA, DS	40 50-4"		
10					1335 B11-10		27 50-4"		10
			Hole terminated at 11.5 feet.						
15									15
20									20

GEO FORM 304 SCHOLL_CANYON_BORING_LOGS.GPJ SECOR INTL.GDT 2/12/16

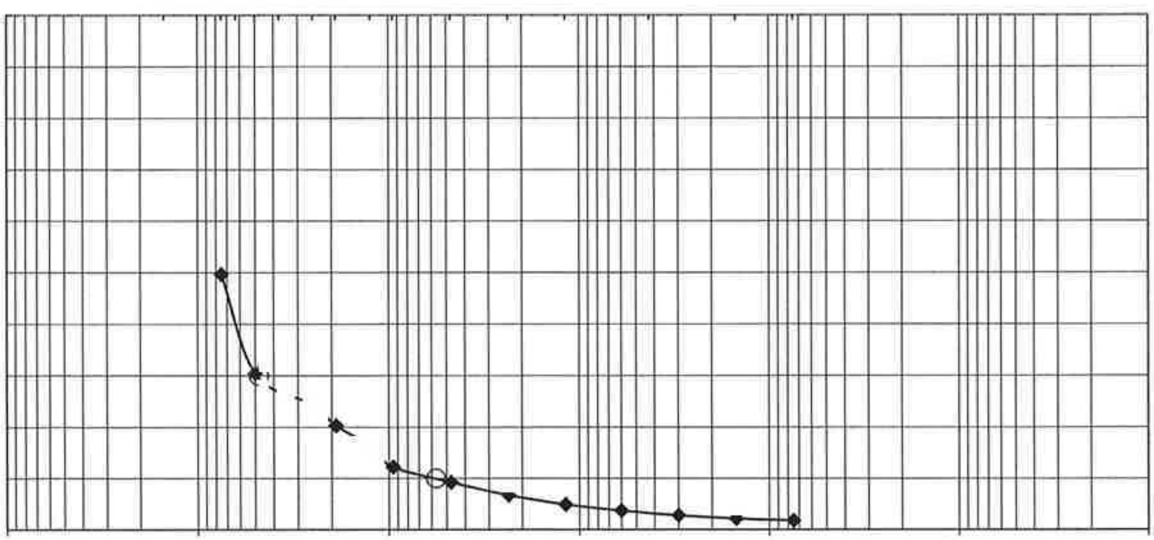
APPENDIX B
LABORATORY TEST RESULTS

SUMMARY OF MOISTURE DENSITY TEST RESULTS
ASTM D 2216

Boring Location	Sample Depth (ft)	Wet Density (lb/ft^3)	Dry Density (lb/ft^3)	Moisture Content (percent)
B1-2	2	147.3	143.4	2.7
B3-2	2	146.5	140.7	4.1
B11-2	2	120.9	116.2	4.0

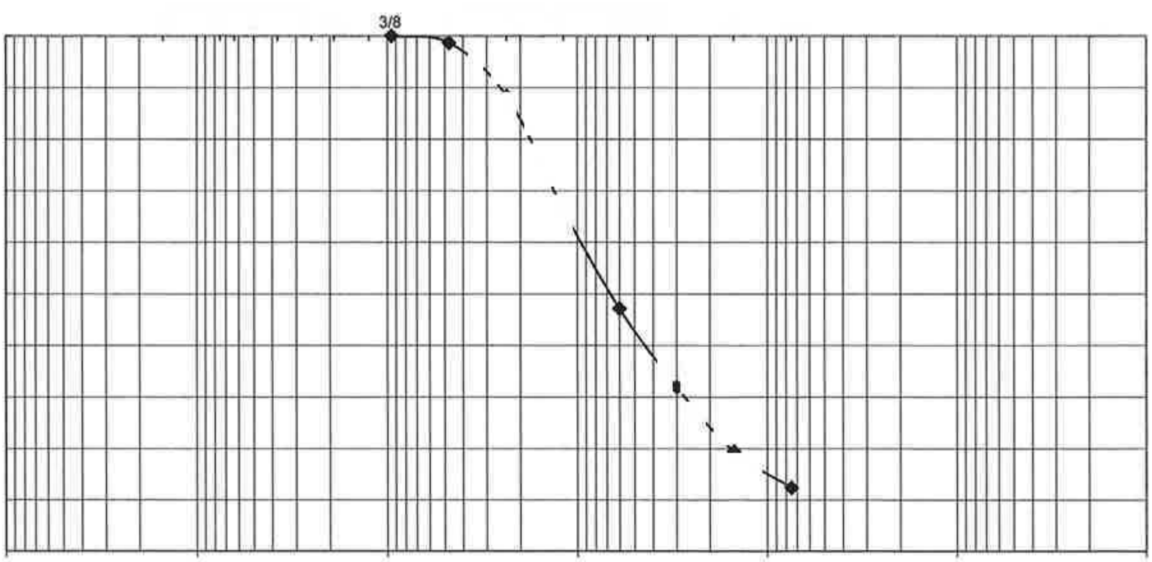
Stantec

Classification determined by ASTM D 2487, -200



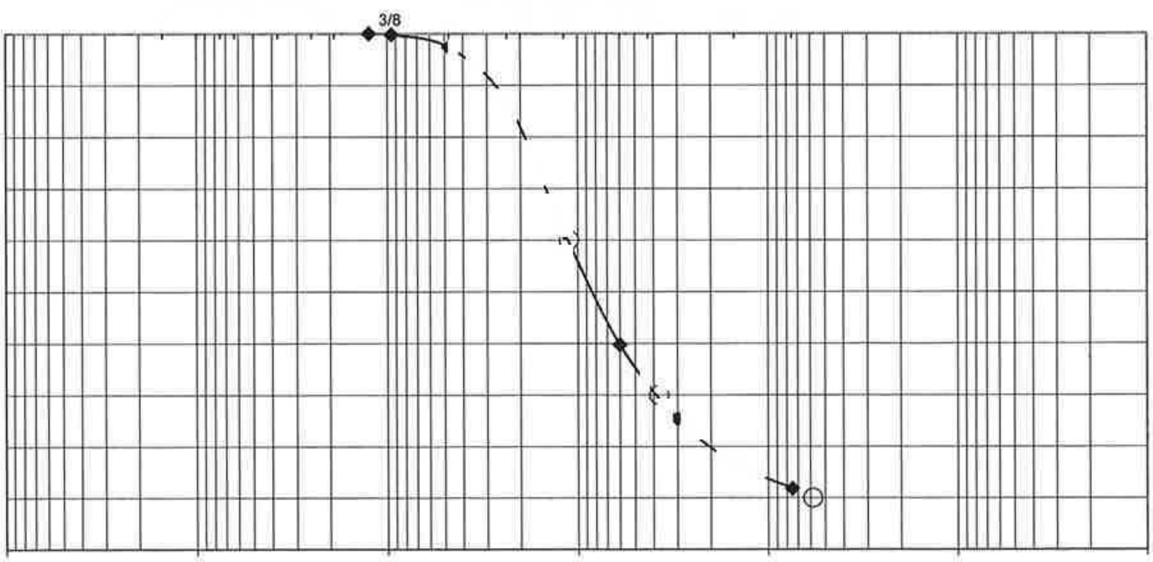
Stantec

Classification determined by ASTM D 2487. -200



Stantec

determined by ASTM D 2487. -200



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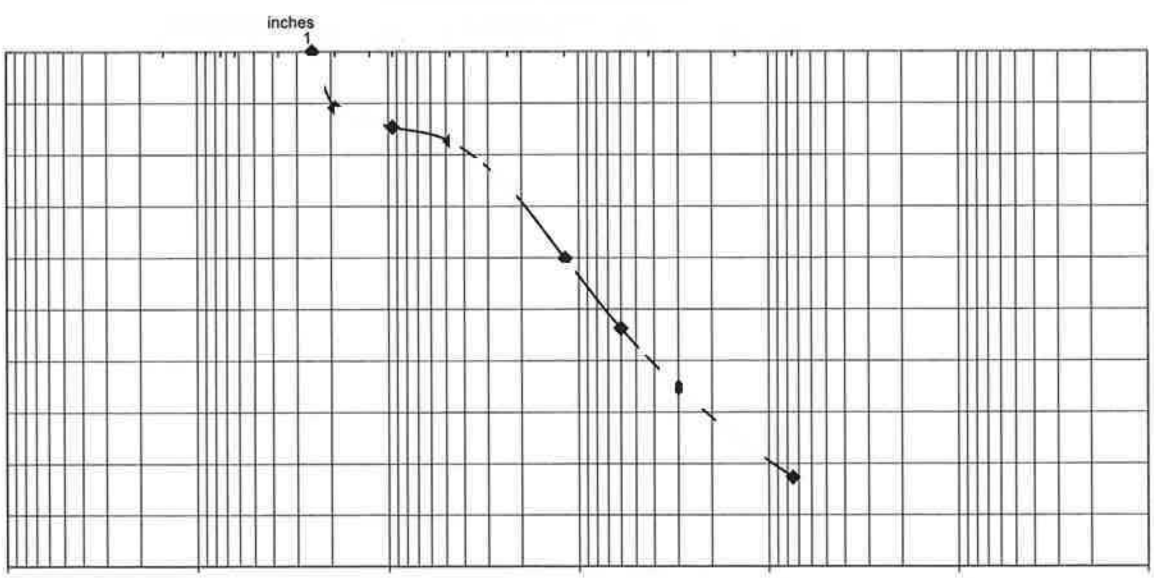
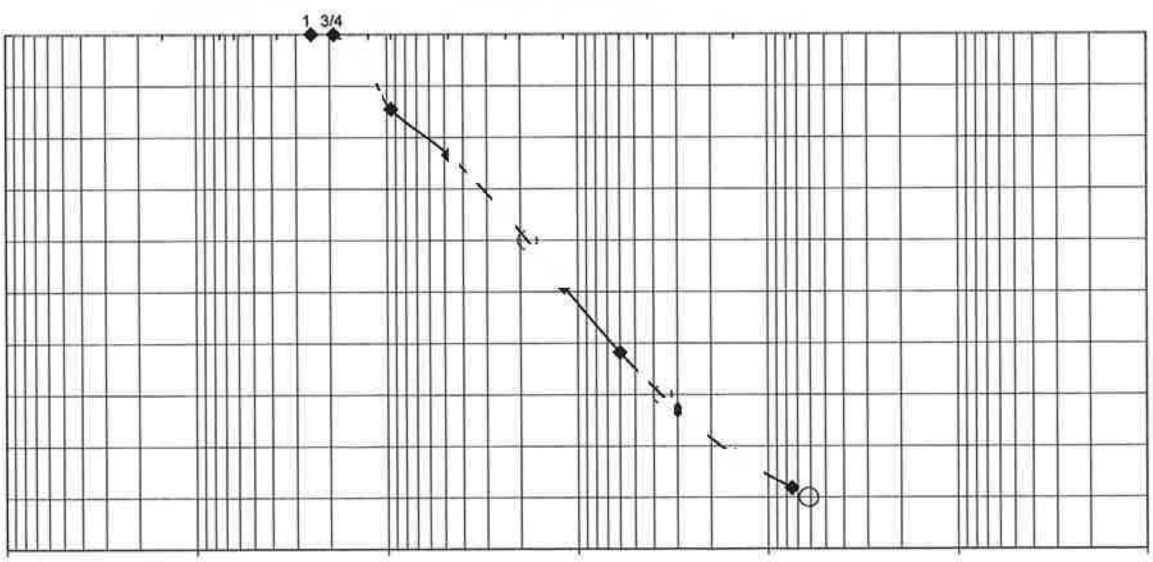
Classification determined by ASTM D 2487. -200



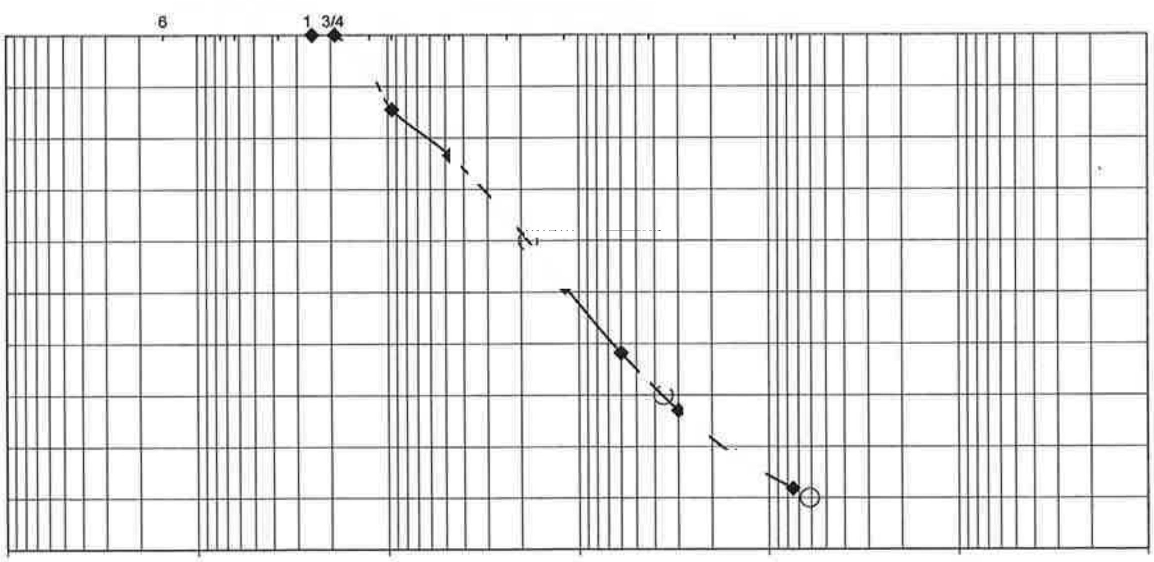
Stantec

determined by ASTM D 2487. -200



Stantec

determined by ASTM D 2487. -200



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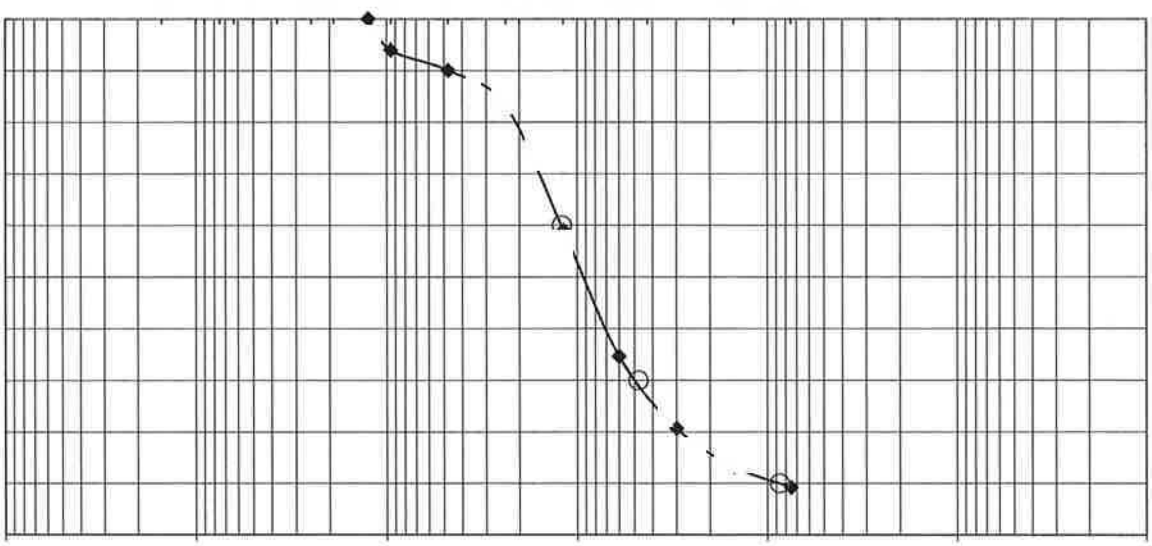

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"			

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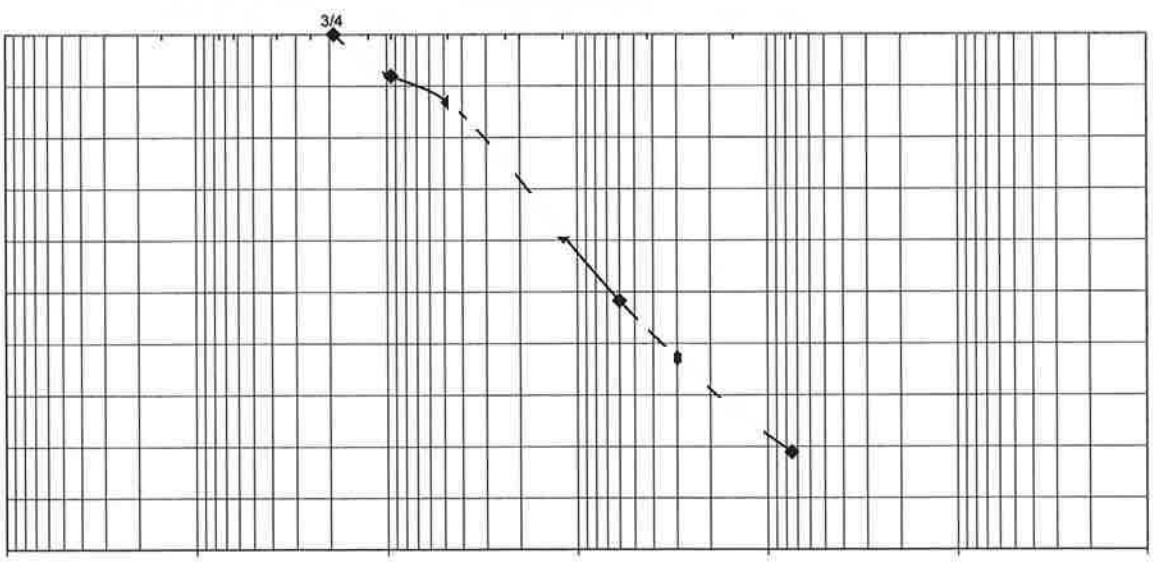

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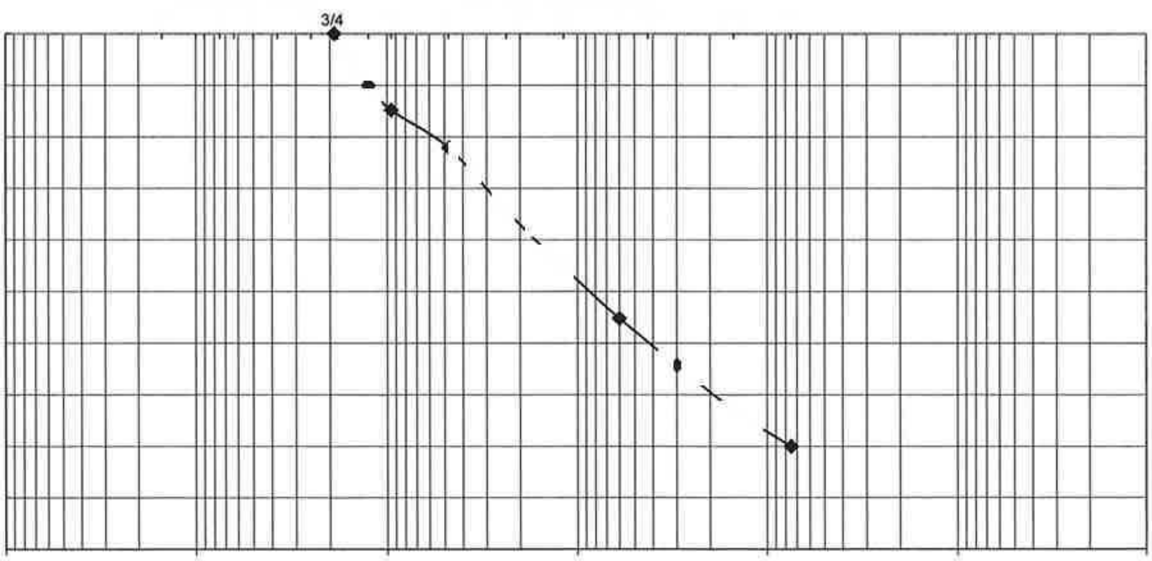
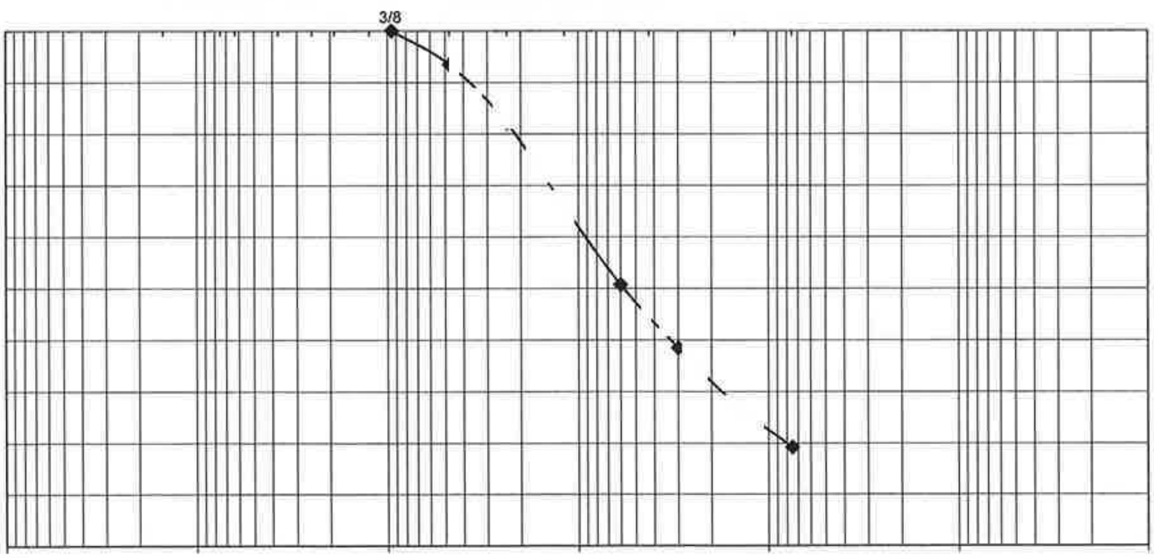
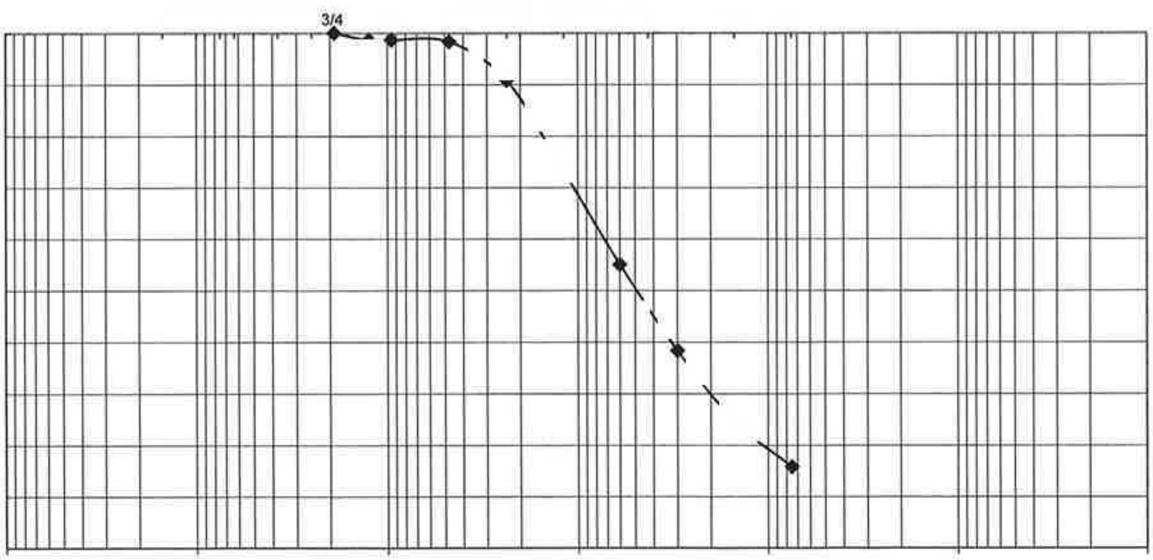


Stantec



Stantec

ASTM D 2487. -200



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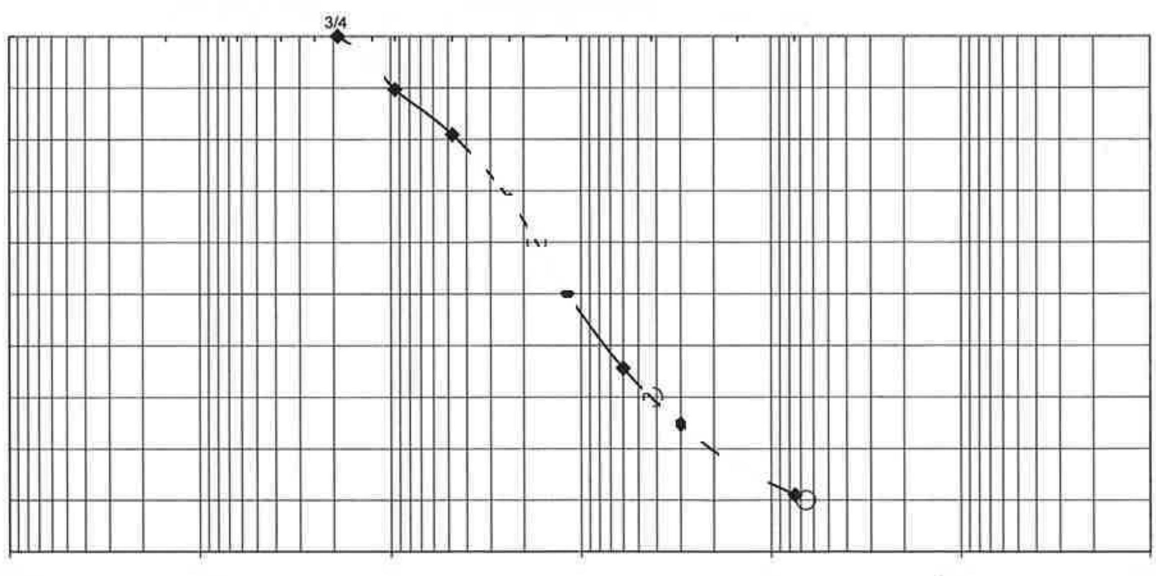

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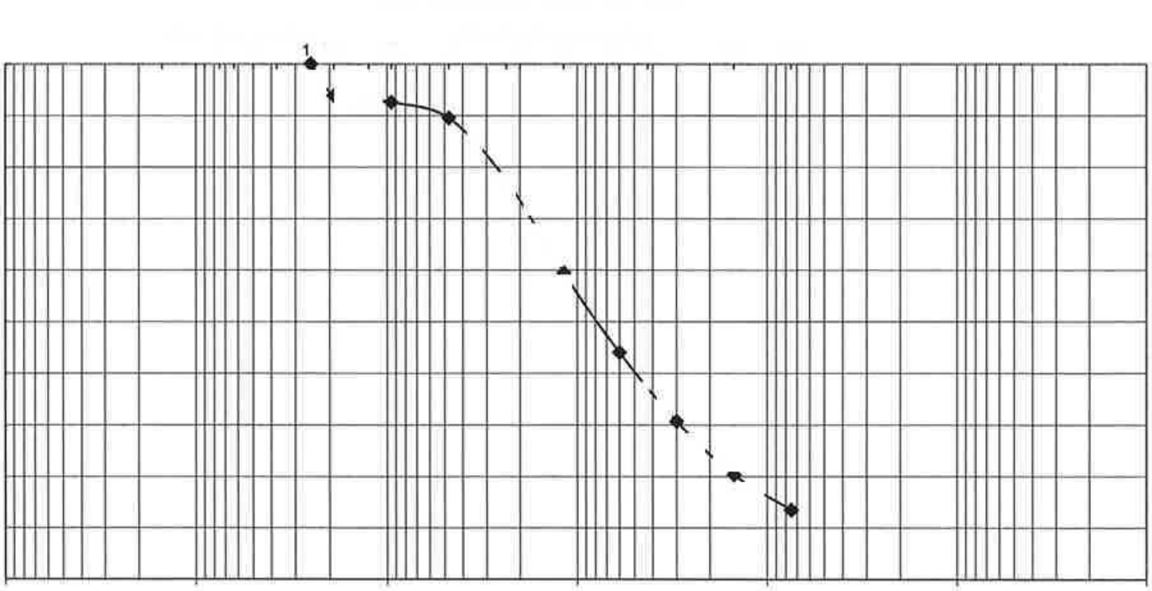
Classification determined by ASTM D 2487. -200



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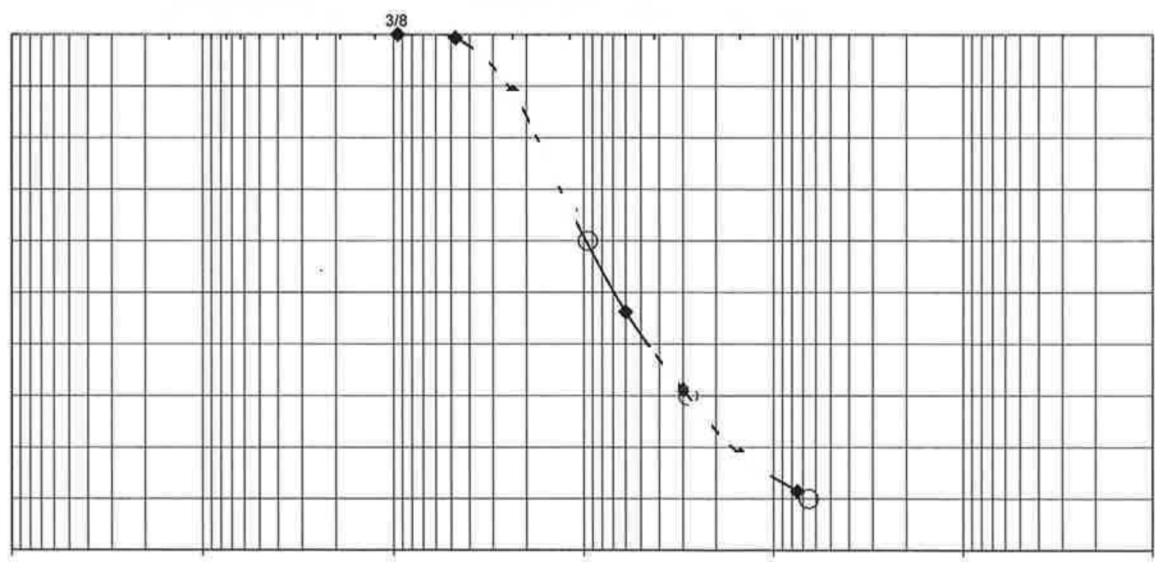
Classification determined by ASTM D 2487. -200



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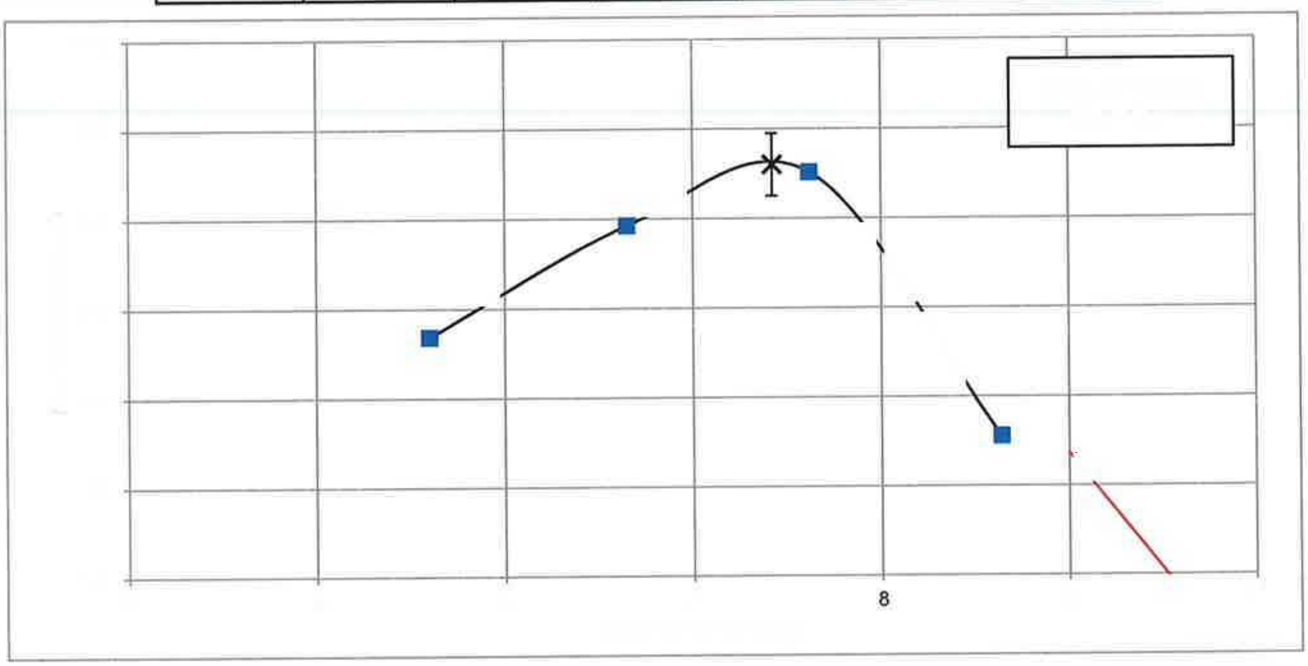

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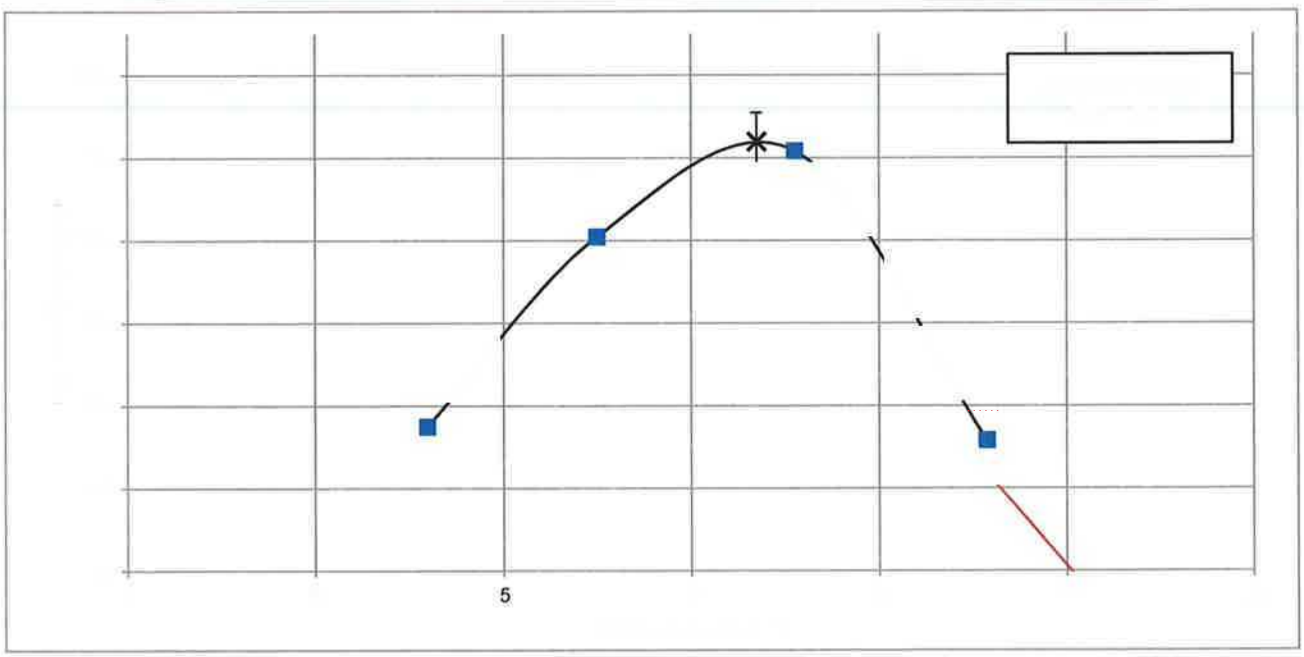

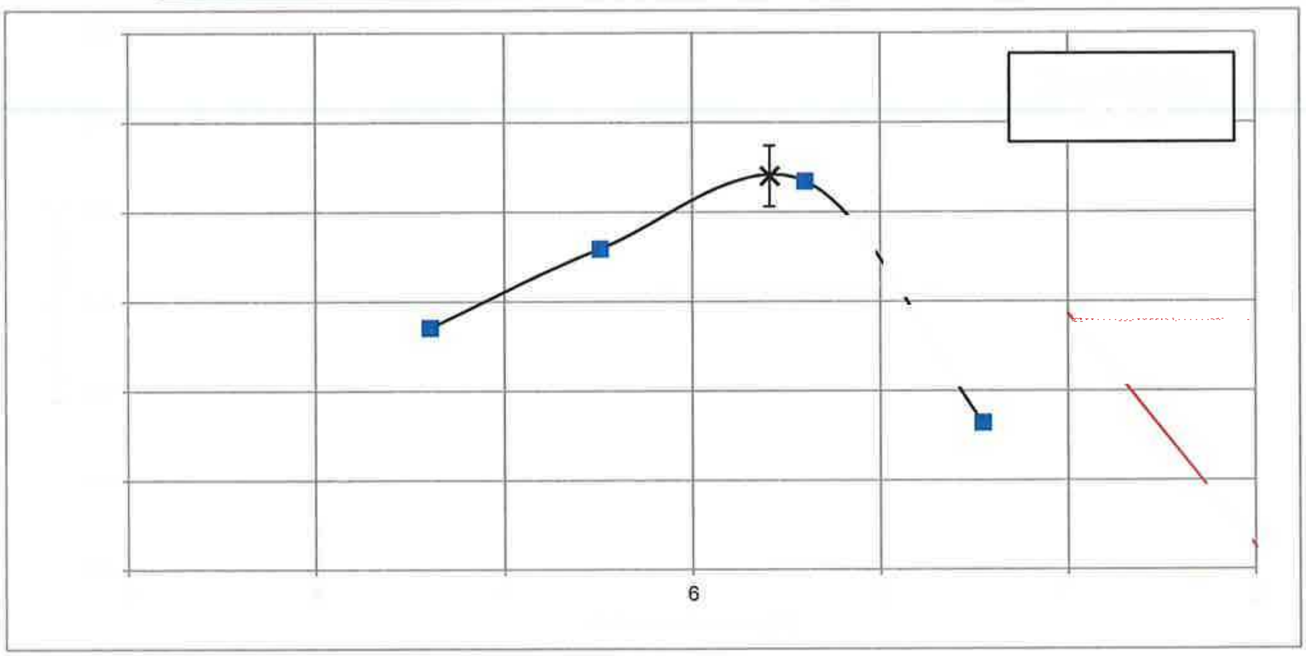
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Converse Consultants

Geotechnical Engineering, Environmental and Groundwater Science, Inspection and Testing Services

December 31, 2015

Mr. Jaret Fischer
Stantec Consulting Inc.
25864-F Business Center Drive
Redlands, CA 92374

Subject: **LABORATORY TEST RESULTS**
2057123300 – Scholl Canyon
Converse Project No. 15-81-104-20

Dear Mr. Fischer:

Presented below are the results of the laboratory tests that you requested for the above-referenced project. We received the samples from your office on December 7, 2015. The following tests were performed in accordance with the relevant standard:

- Ten (10) Direct Shear Tests (ASTM D3080)

We appreciate the opportunity to be of continued service to Stantec Consulting Inc. If you should have any questions or need additional information, please feel free to contact us at (909) 796-0544.

CONVERSE CONSULTANTS

Jordan Roper, P.E.
Project Engineer

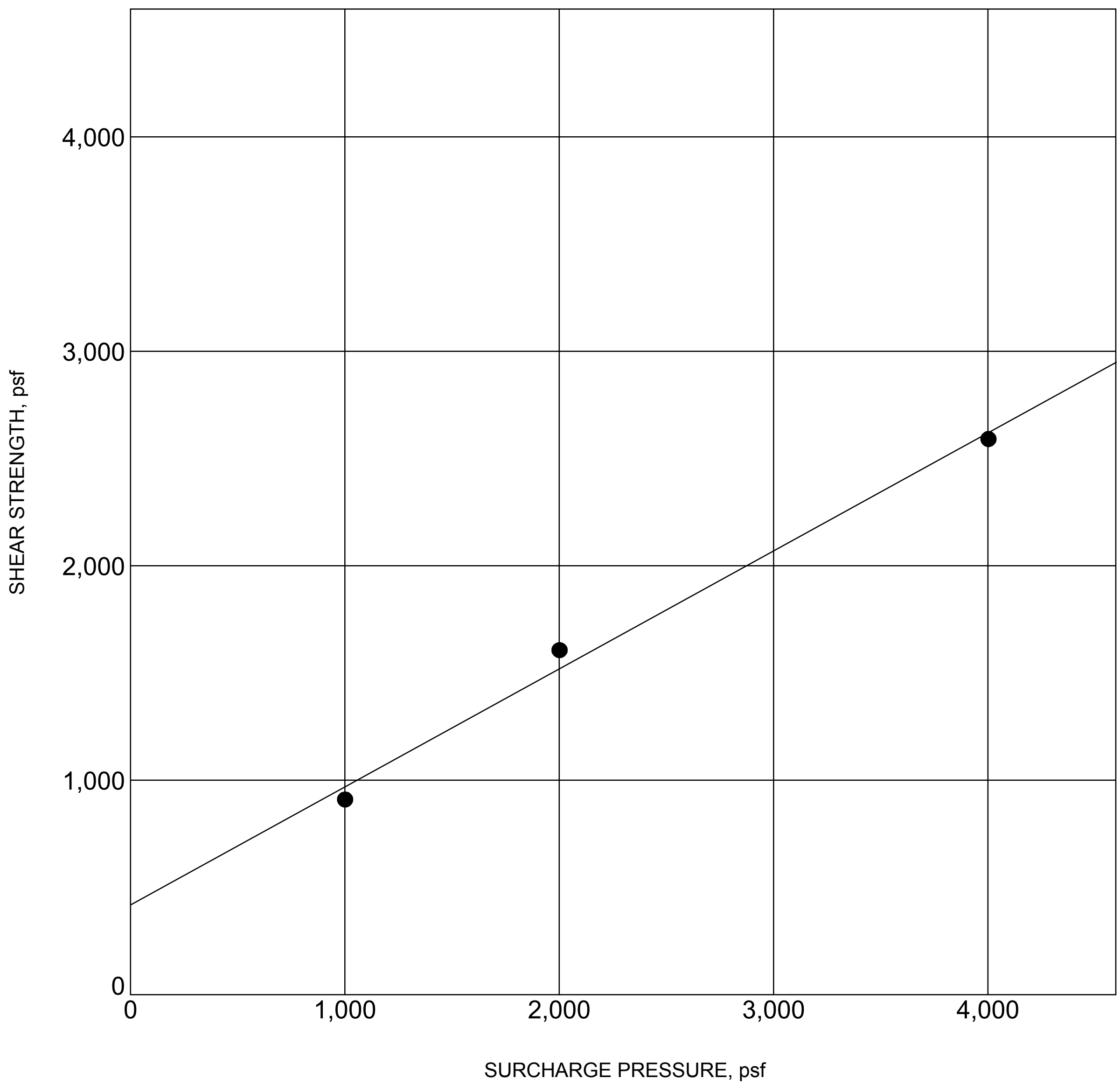
KVG/JR

Encl: Table No. 1, *Direct Shear Test Results*
Drawing No. 1 - 10, *Direct Shear Test Results*

Table No. 1, Direct Shear Test Results

Sample ID	Depth (feet)	Soil Description	Cohesion (psf)	Friction Angle (degrees)
TP-1	0.5	Silty Sand with Gravel (SM), Fine to Coarse-Grained, Yellow-Brown	420	29
TP-2*	0.5	Silty Sand with Gravel (SM), Fine to Coarse Grained, Olive-Brown	0	39
TP-3	0.5	Silty Sand with Gravel (SM), Fine to Coarse Grained, Olive-Brown	310	36
TP-4	1.0	Silty Sand (SM), Fine to Coarse Grained, Yellow-Brown	290	30
TP-4	3.0	Silty Sand (SM), Fine to Coarse Grained, Yellow-Brown	520	26
TP-5	3.0	Silty Sand (SM), Fine to Coarse Grained, Yellow-Brown	140	40
TP-6*	1.0	Silty Sand with Gravel (SM), Fine to Coarse Grained, Yellow-Brown	680	44
TP-7	1.0	Silty Sand with Clay (SM), Fine to Coarse Grained, Yellow-Brown	210	36
B-8	10.0	Sand with Gravel and Silt (SP-SM), Fine to Coarse Grained, Olive-Brown	110	36
B-11	7.0	Silty Sand (SM), Fine to Coarse Grained, Olive-Yellow	150	33

* Test results may not be representative of the soil type due to the presence of gravel in the shear plane



BORING NO. :	**TP-1**	DEPTH (ft) :	**0.5**
DESCRIPTION :	**Silty Sand with Gravel (SM), Fine to Coarse-Grained, Yellow Brown**		
COHESION (psf) :	**420**	FRICTION ANGLE (degrees):	**29**
MOISTURE CONTENT (%) :	**4.7**	DRY DENSITY (pcf) :	**106.6**

NOTE: Ultimate Strength.

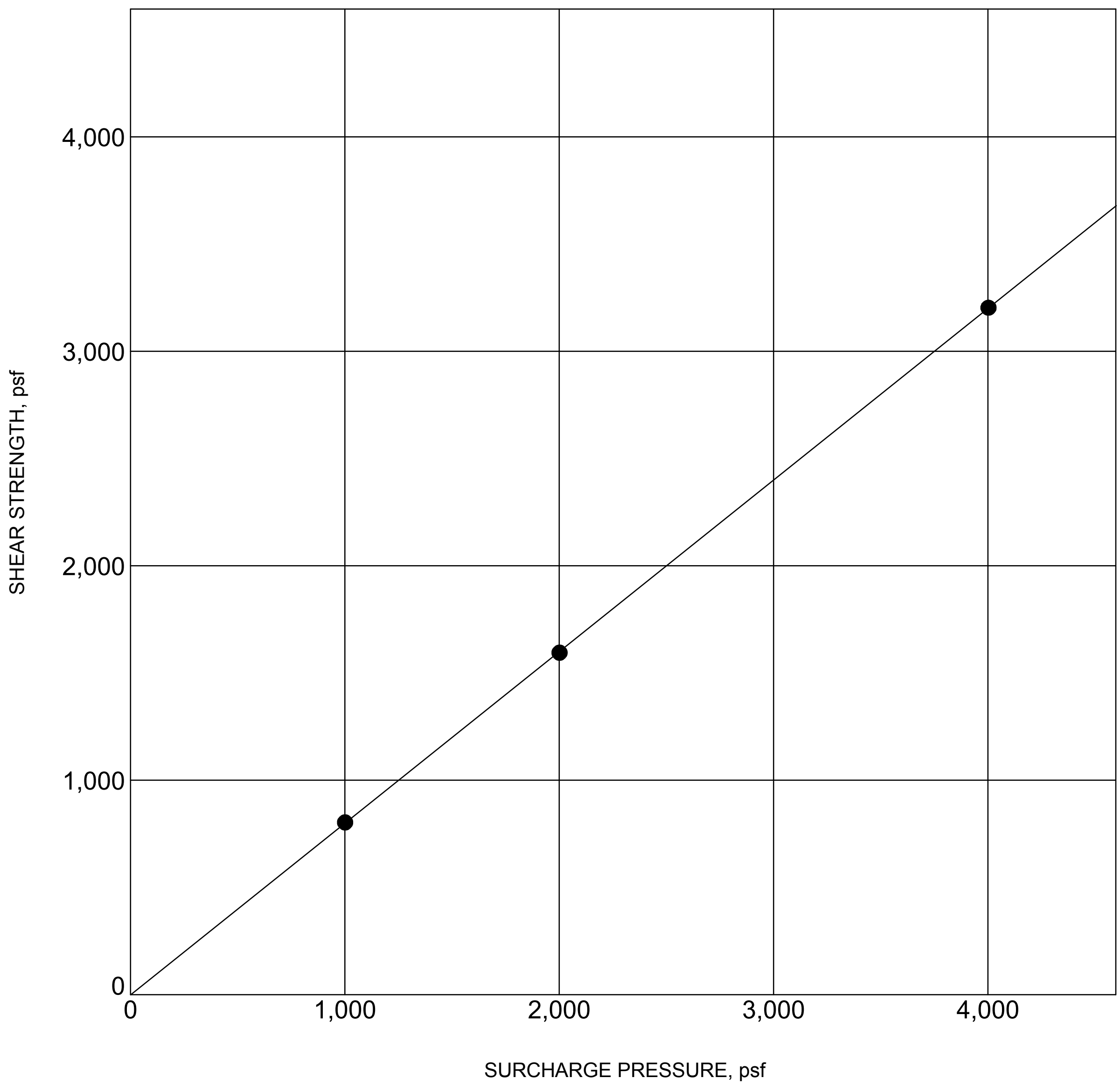
DIRECT SHEAR TEST RESULTS

Converse Consultants

Scholl Canyon
Job #: 2057123300
For: Stantec

Project No. **15-81-104-20**

Drawing No. **1**



BORING NO.	:	**TP-2**	DEPTH (ft)	:	**0.5**
DESCRIPTION	:	**Silty Sand with Gravel (SM), Fine to Coarse-Grained, Yellow Brown**			
COHESION (psf)	:	**0**	FRICTION ANGLE (degrees):		**39**
MOISTURE CONTENT (%)	:	**5.5**	DRY DENSITY (pcf)	:	**100.8**

NOTE: Ultimate Strength.

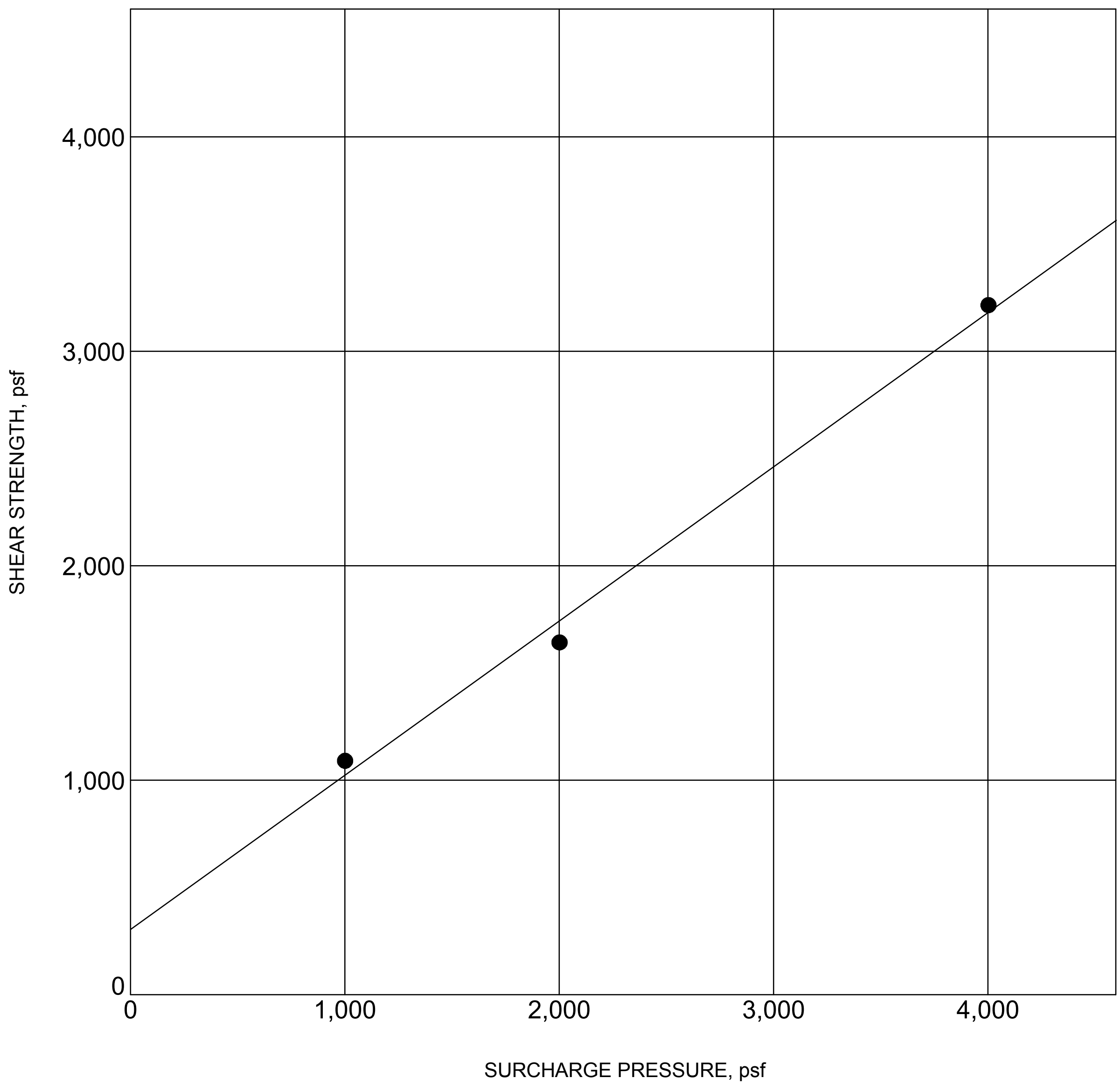
DIRECT SHEAR TEST RESULTS

Converse Consultants

Scholl Canyon
Job #: 2057123300
For: Stantec

Project No. **15-81-104-20**

Drawing No. **2**



BORING NO. :	**TP-3**	DEPTH (ft) :	**0.5**
DESCRIPTION :	**Silty Sand with Gravel (SM), Fine to Coarse-Grained, Olive Brown**		
COHESION (psf) :	**310**	FRICTION ANGLE (degrees):	**36**
MOISTURE CONTENT (%) :	**5.3**	DRY DENSITY (pcf) :	**104.5**

NOTE: Ultimate Strength.

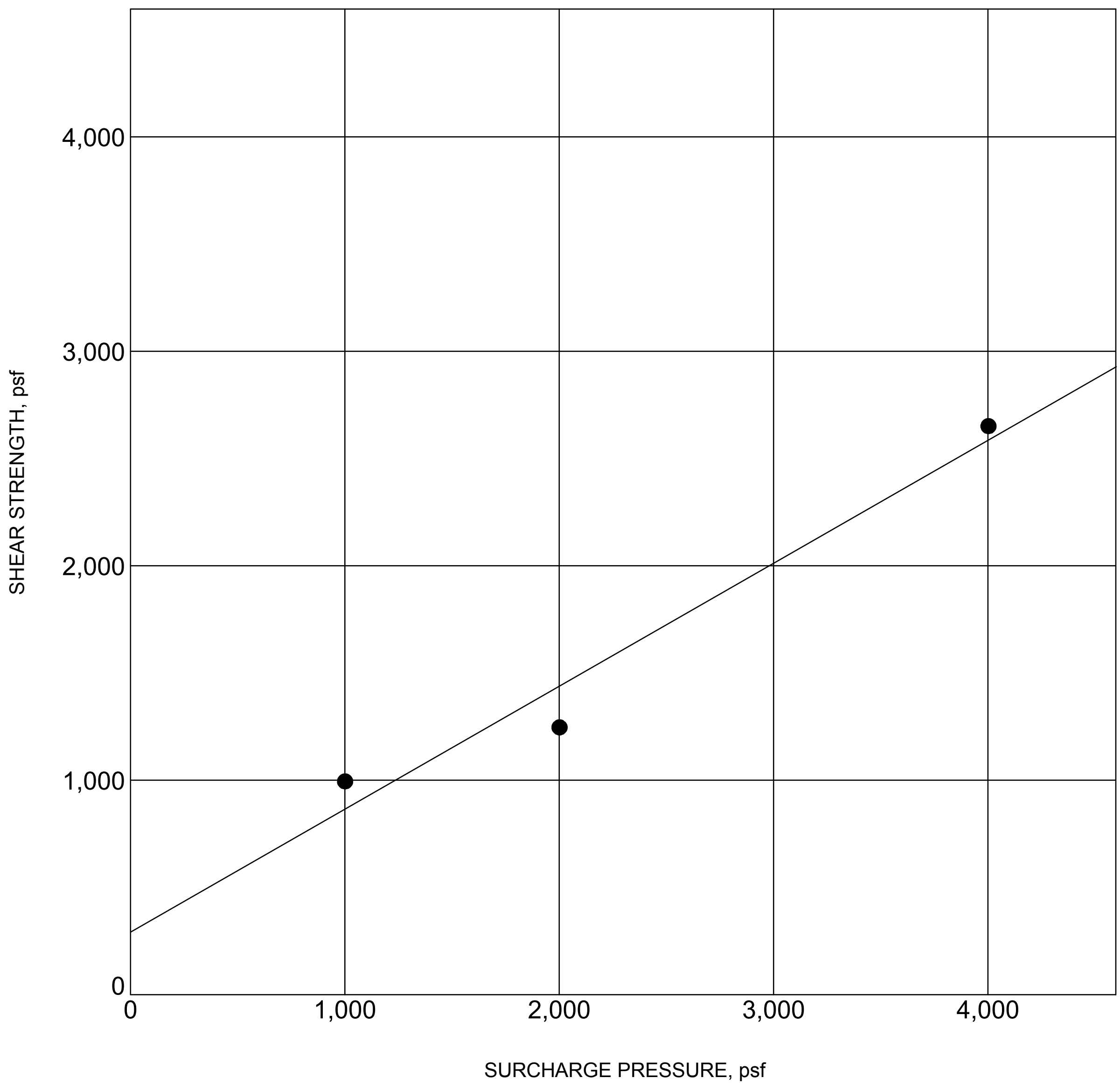
DIRECT SHEAR TEST RESULTS

Converse Consultants

Scholl Canyon
Job #: 2057123300
For: Stantec

Project No. **15-81-104-20**

Drawing No. **3**



BORING NO. :	**TP-4**	DEPTH (ft) :	**1.0**
DESCRIPTION :	**Silty Sand (SM), Fine to Coarse-Grained, Yellow Brown**		
COHESION (psf) :	**290**	FRICTION ANGLE (degrees):	**30**
MOISTURE CONTENT (%) :	**4.0**	DRY DENSITY (pcf) :	**104.8**

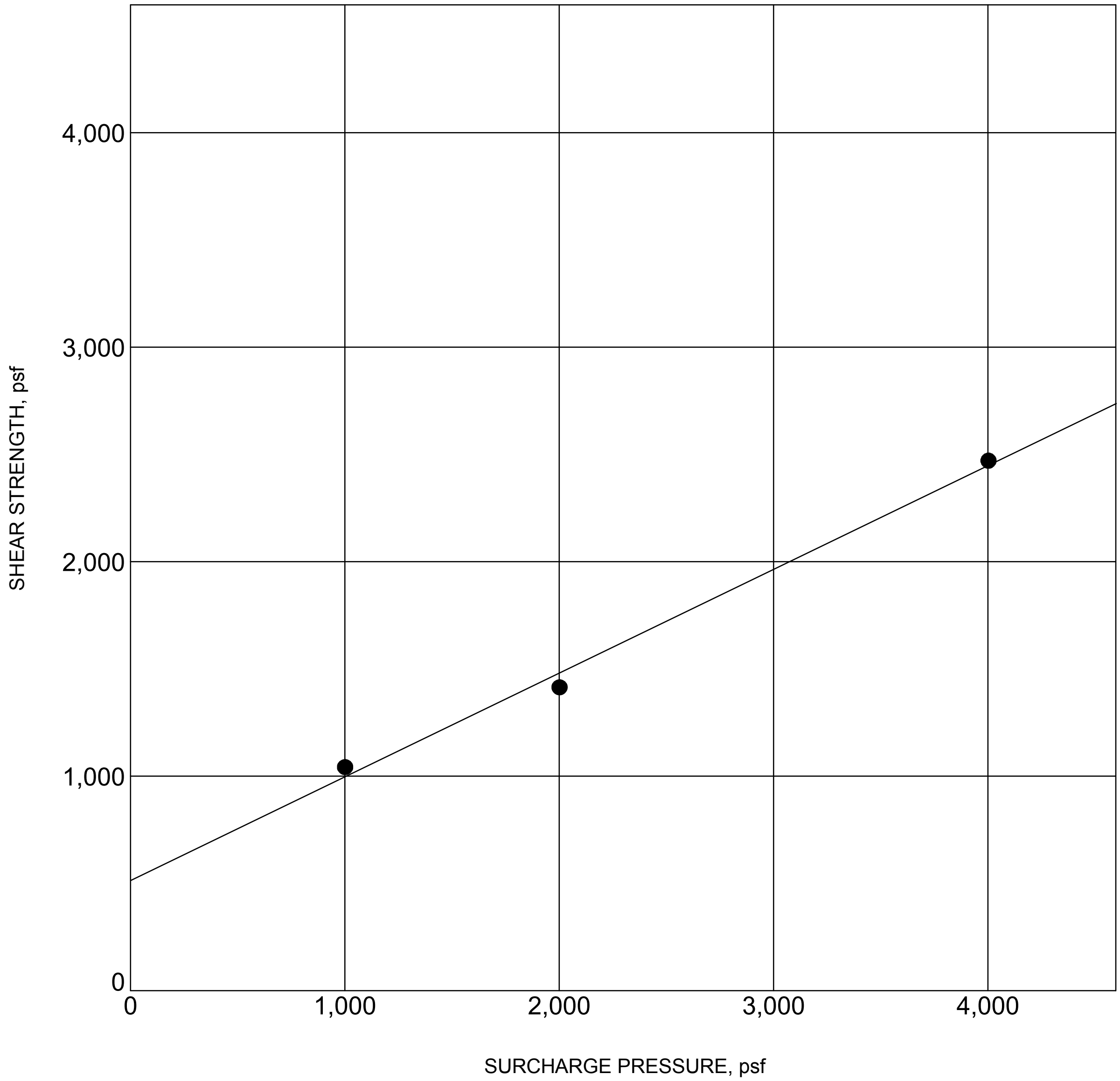
NOTE: Ultimate Strength.

DIRECT SHEAR TEST RESULTS

Converse Consultants

Scholl Canyon
Job #: 2057123300
For: Stantec

Project No.	Drawing No.
15-81-104-20	**4**



BORING NO. :	TP-4	DEPTH (ft) :	3.0
DESCRIPTION :	Silty Sand (SM), Fine to Coarse-Grained, Yellow Brown		
COHESION (psf) :	520	FRICTION ANGLE (degrees):	26
MOISTURE CONTENT (%) :	7.7	DRY DENSITY (pcf) :	112.4

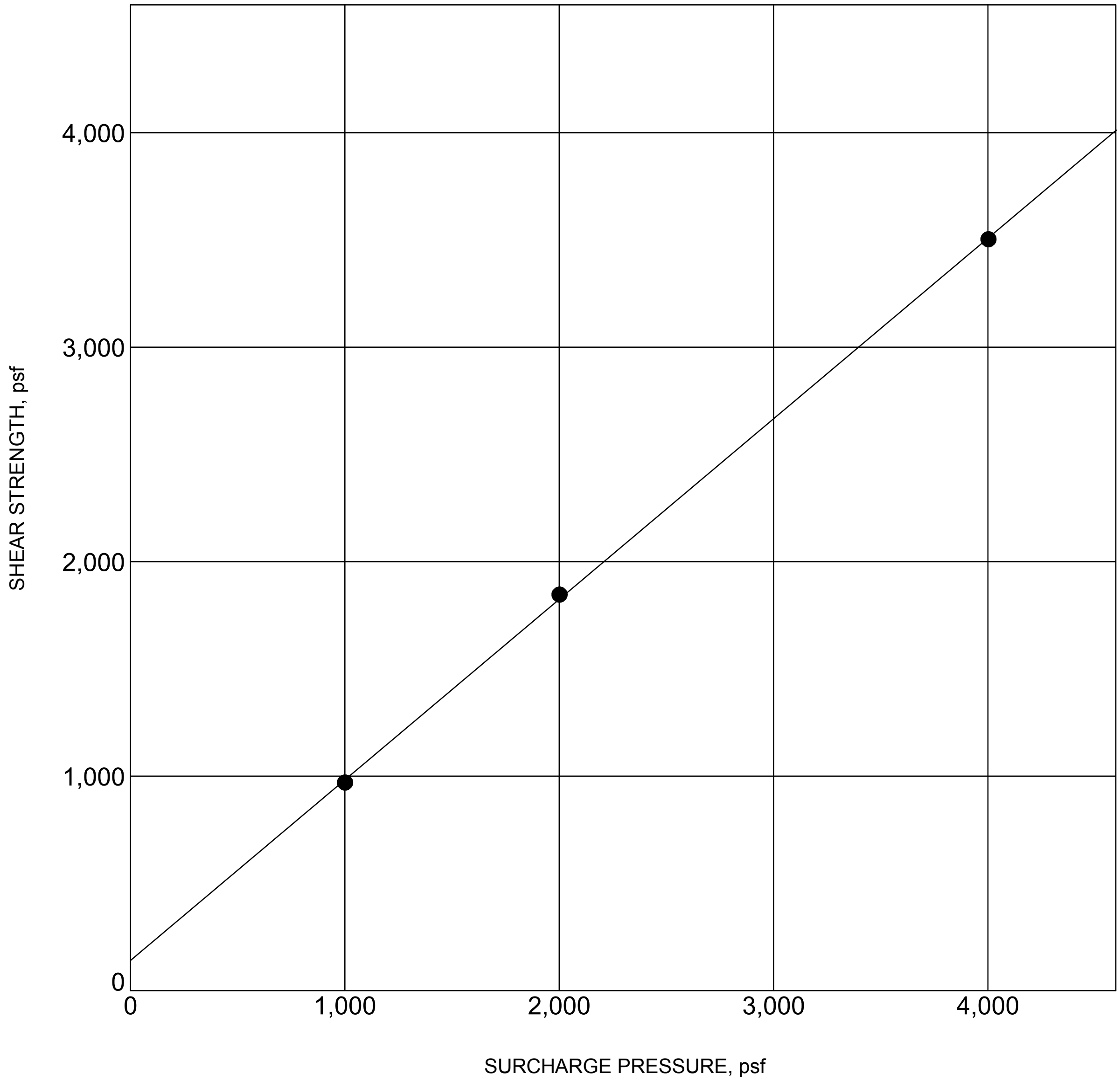
NOTE: Ultimate Strength.

DIRECT SHEAR TEST RESULTS

Converse Consultants

Scholl Canyon
Job #: 2057123300
For: Stantec

Project No.	Drawing No.
15-81-104-20	**5**



BORING NO. :	**TP-5**	DEPTH (ft) :	**3.0**
DESCRIPTION :	**Silty Sand (SM), Fine to Coarse-Grained, Yellow Brown**		
COHESION (psf) :	**140**	FRICTION ANGLE (degrees):	**40**
MOISTURE CONTENT (%) :	**6.0**	DRY DENSITY (pcf) :	**117.1**

NOTE: Ultimate Strength.

DIRECT SHEAR TEST RESULTS

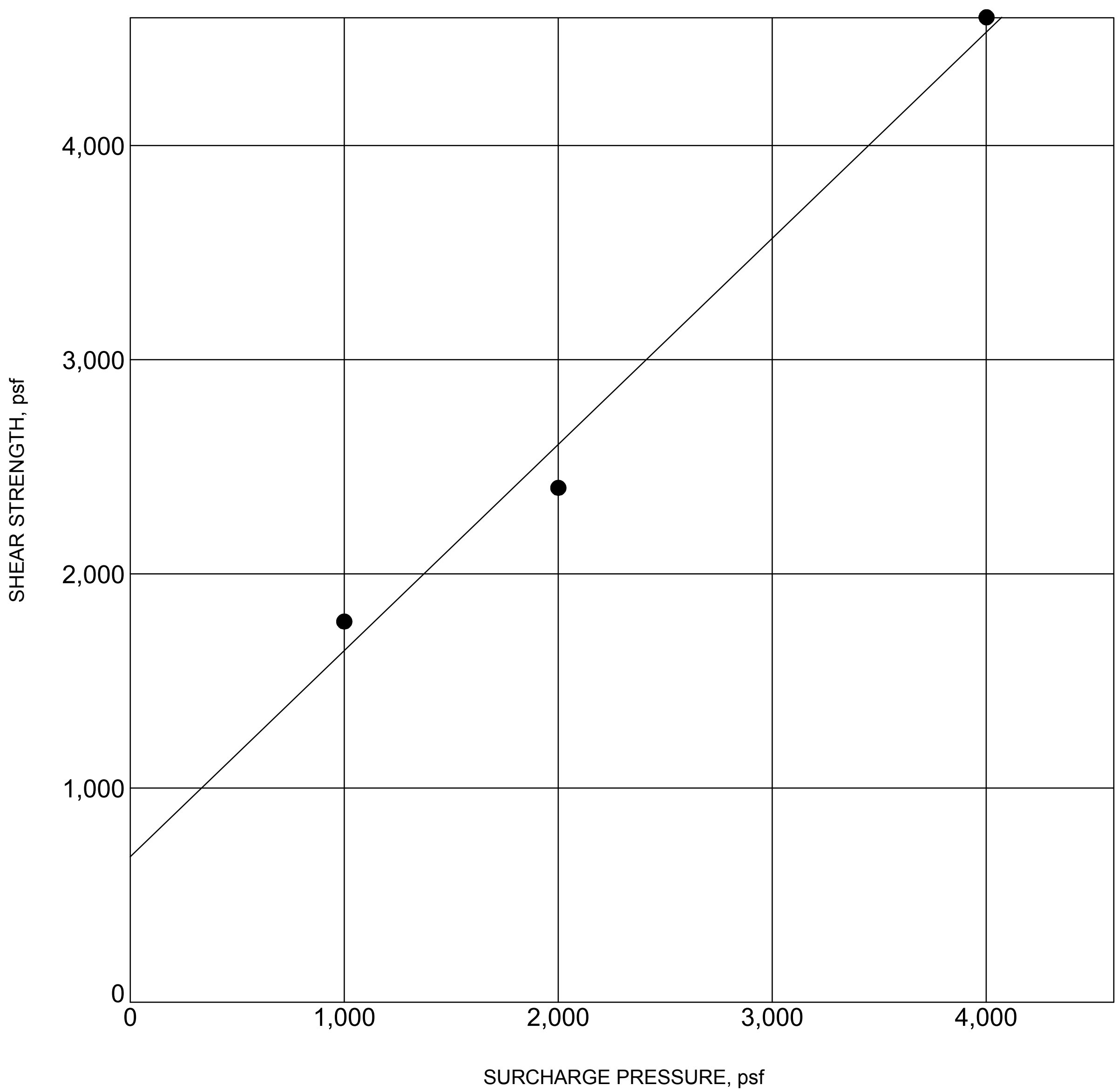
[redacted]

Converse Consultants

Scholl Canyon
Job #: 2057123300
For: Stantec

Project No. **15-81-104-20**

Drawing No. **6**



BORING NO.	:	**TP-6**	DEPTH (ft)	:	**1.0**
DESCRIPTION	:	**Silty Sand (SM), Fine to Coarse-Grained, Yellow Brown**			
COHESION (psf)	:	**680**	FRICTION ANGLE (degrees):		**44**
MOISTURE CONTENT (%)	:	**4.2**	DRY DENSITY (pcf)	:	**121.3**

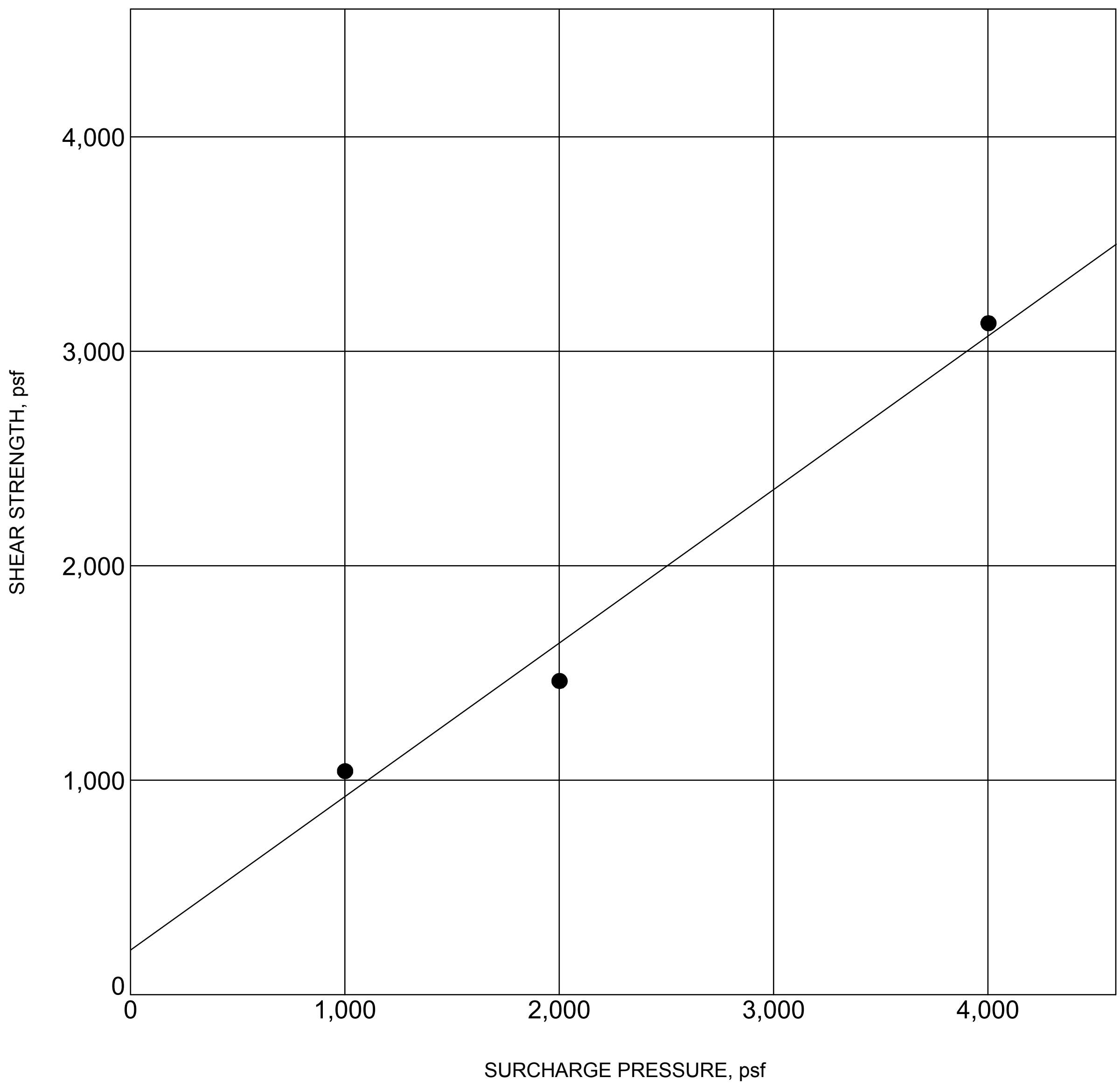
NOTE: Ultimate Strength.

DIRECT SHEAR TEST RESULTS

Converse Consultants

Scholl Canyon
Job #: 2057123300
For: Stantec

Project No.	Drawing No.
15-81-104-20	**7**



BORING NO. :	**TP-7**	DEPTH (ft) :	**1.0**
DESCRIPTION :	**Silty Sand with Clay (SM), Fine to Coarse-Grained, Yellow**		
COHESION (psf) :	**210**	FRICTION ANGLE (degrees):	**36**
MOISTURE CONTENT (%) :	**7.3**	DRY DENSITY (pcf) :	**109.3**

NOTE: Ultimate Strength.

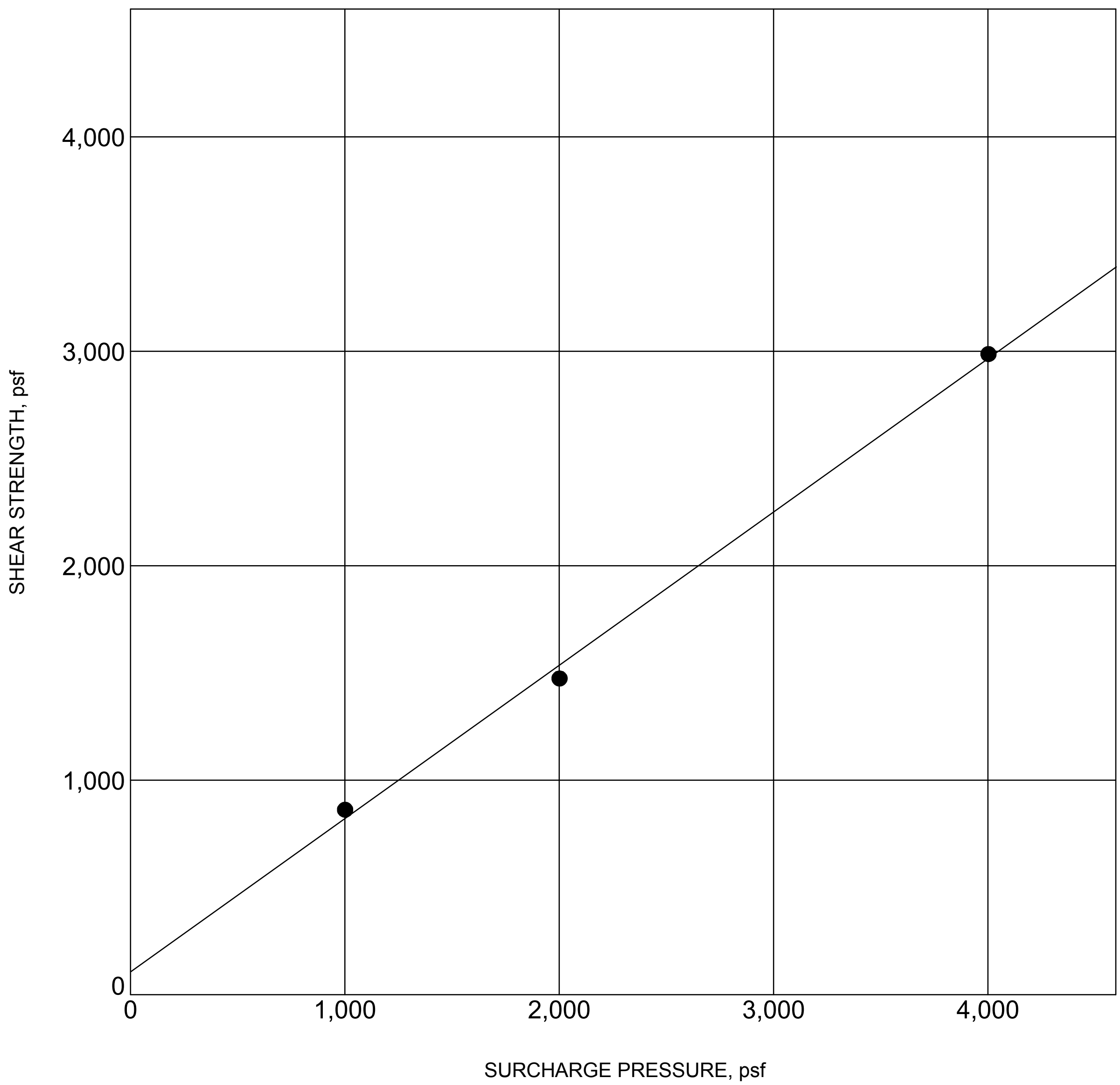
DIRECT SHEAR TEST RESULTS

Converse Consultants

Scholl Canyon
Job #: 2057123300
For: Stantec

Project No. **15-81-104-20**

Drawing No. **8**



BORING NO.	:	**B-8**	DEPTH (ft)	:	**10.0**
DESCRIPTION	:	**Sand with Gravel and Silt (SP-SM), Fine to Coarse-Grained, Olive Yellow**			
COHESION (psf)	:	**110**	FRICTION ANGLE (degrees):		**36**
MOISTURE CONTENT (%)	:	**6.3**	DRY DENSITY (pcf)	:	**108.1**

NOTE: Ultimate Strength.

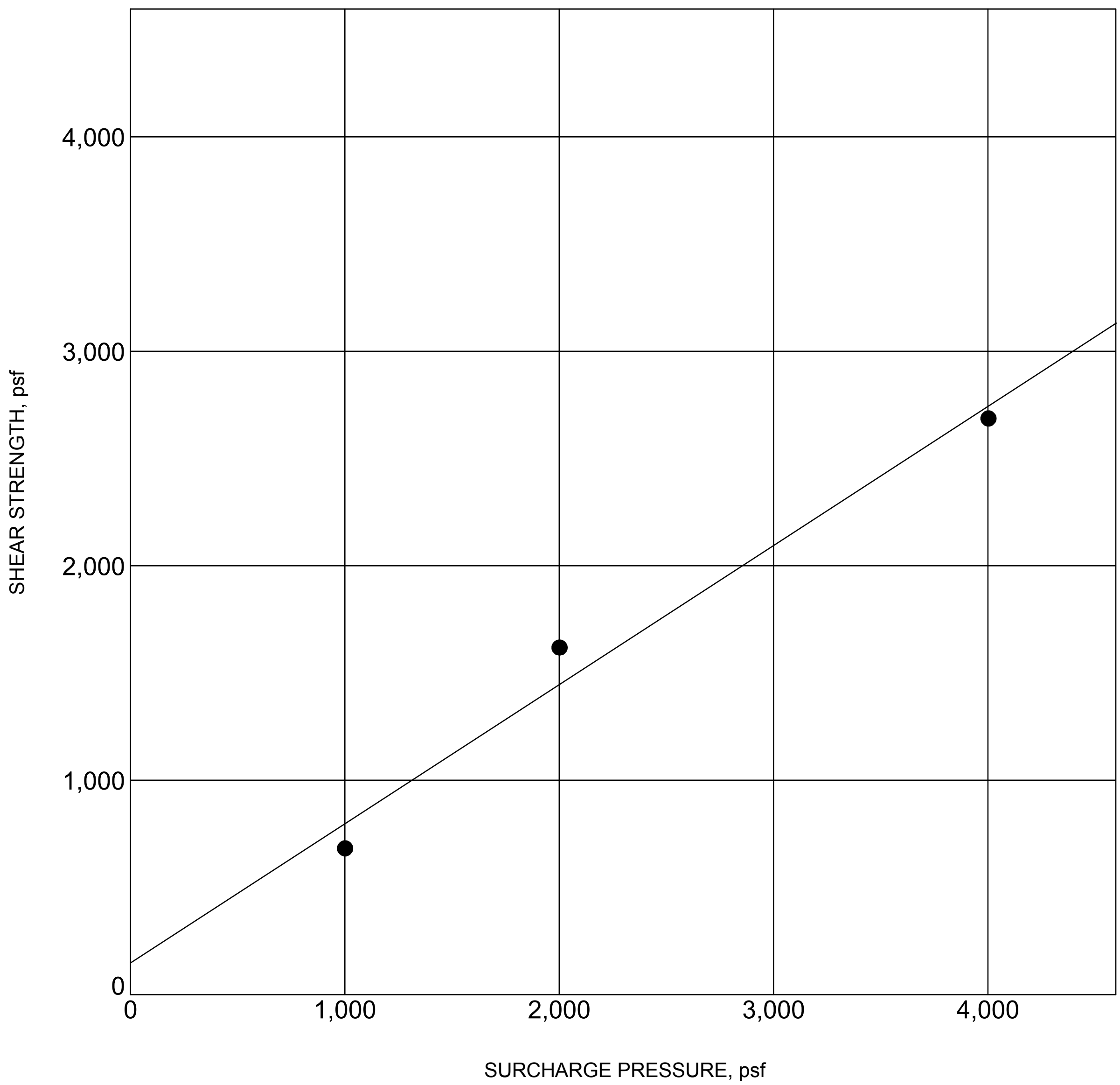
DIRECT SHEAR TEST RESULTS

Converse Consultants

Scholl Canyon
Job #: 2057123300
For: Stantec

Project No. **15-81-104-20**

Drawing No. **9**



BORING NO. :	**B-11**	DEPTH (ft) :	**7.0**
DESCRIPTION :	**Silty Sand (SM), Fine to Coarse-Grained, Olive Yellow**		
COHESION (psf) :	**150**	FRICTION ANGLE (degrees):	**33**
MOISTURE CONTENT (%) :	**10.7**	DRY DENSITY (pcf) :	**116.4**

NOTE: Ultimate Strength.

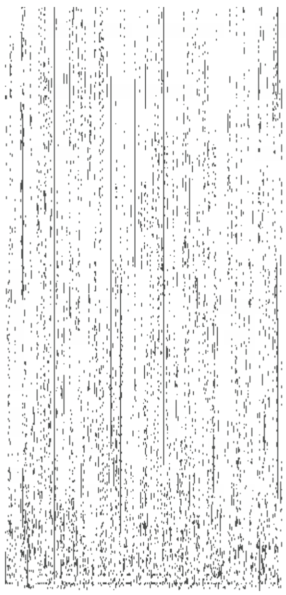
DIRECT SHEAR TEST RESULTS

Converse Consultants

Scholl Canyon
Job #: 2057123300
For: Stantec

Project No. **15-81-104-20**

Drawing No. **10**



APPENDIX C
GEOPHYSICAL SURVEY

GEOPHYSICAL SURVEY
SCHOLL CANYON LANDFILL
LOS ANGELES, CALIFORNIA

PREPARED FOR:
Stantec
25864-F Business Center Drive
Redlands, CA 92374-4515

PREPARED BY:
Southwest Geophysics, Inc.
8057 Raytheon Road, Suite 9
San Diego, CA 92111

December 17, 2015
Project No. 115574

SOUTHWEST GEOPHYSICS, INC.
YOUR SUBSURFACE SOLUTION

December 17, 2015
Project No. 115574

Mr. Jaret Fischer
Stantec
25864-F Business Center Drive
Redlands CA 92374-4515

Subject: Geophysical Survey
Scholl Canyon Landfill / Biogas Renewable Generation Project
Los Angeles, California

Dear Mr. Fischer:

In accordance with your authorization, we have performed a geophysical evaluation pertaining to the Scholl Canyon Landfill project located in Los Angeles, California. Specifically, our survey consisted of performing four P-wave refraction profiles, two refraction microtremor (ReMi) profiles, and collection of electrical resistivity data at one test location at the subject site. The purpose of our study was to characterize the subsurface conditions in the study area. This data report presents our survey methodology, equipment used, analysis, and results.

We appreciate the opportunity to be of service on this project. Should you have any questions related to this report, please contact the undersigned at your convenience.

Sincerely,
SOUTHWEST GEOPHYSICS, INC.

Aaron T. Puente.
Project Geologist/Geophysicist

Hans van de Vrugt, C.E.G., P.Gp.
Principal Geologist/Geophysicist

ATP/HV/hv

Distribution: Addressee (electronic)

8057 Raytheon Road, Suite 9 • San Diego • California 92111 • Telephone 858-527-0849 • Fax 858-225-0114

TABLE OF CONTENTS

1. INTRODUCTION

In accordance with your authorization, we have performed a geophysical evaluation pertaining to the Scholl Canyon Landfill project located in Los Angeles, California (Figure 1). Specifically, our survey consisted of performing four P-wave refraction profiles, two refraction microtremor (ReMi) profiles, and collection of electrical resistivity data at one test location at the subject site. The purpose of our study was to characterize the subsurface conditions in the study area. This data report presents our survey methodology, equipment used, analysis, and results.

2. SCOPE OF SERVICES

Our scope of services included:

- Performance of four P-wave refraction profiles: SL-1 through SL-4.
- Performance of two ReMi profiles: RL-1 and RL-2
- Collection of in-situ electrical resistivity measurements at one test location: R-1.
- Compilation and analysis of the data collected.
- Preparation of this illustrated data report presenting our findings.

3. SITE DESCRIPTION AND PROJECT DESCRIPTION

The project site is located along Scholl Canyon Road just north of the Ventura Freeway (134) in Los Angeles, California (Figure 1). The site is occupied by an active landfill facility. Specifically, our survey was conducted near the existing generator and power plant. Figures 2, 3a and 3b depict the general conditions in the study area.

It is our understanding that upgrades to the power plant are proposed and that your office is conducting a geotechnical evaluation of the site. The results of our survey will be used in the design and construction of the project.

4. SURVEY METHODOLOGY

As previously indicated, the primary purpose of our services was to characterize the subsurface conditions at pre-selected locations through the collection of P-wave refraction, ReMi and electrical resistivity data. The following sections provide an overview of the methodologies used during our study.

4.1 P-wave Refraction Survey

The seismic P-wave refraction method uses first-arrival times of refracted seismic waves to estimate the thicknesses and seismic velocities of subsurface layers. Seismic P-waves (compression waves) generated at the surface are refracted at boundaries separating materials of contrasting velocities. These refracted seismic waves are then detected by a series of surface vertical component 14-Hz geophones, and recorded with a 24-channel Geometrics Geode seismograph. The travel times of the seismic P-waves are used in conjunction with the shot-to-geophone distances to obtain thickness and velocity information on the subsurface materials. In general, the effective depth of evaluation for a seismic refraction traverse is approximately one-third to one-fifth the length of the traverse.

Seismic lines SL-1 through SL-4 were conducted roughly east to west with geophones spaced 5 feet apart for line lengths of 125 feet. Multiple shot points (signal generator locations) were conducted at the ends of the lines and at equally spaced intervals along the lines. The P-wave signal (shot) was generated using a 20-pound hammer and an aluminum plate.

The refraction method requires that subsurface velocities increase with depth. A layer having a velocity lower than that of the layer above will not generally be detectable by the seismic refraction method and, therefore, could lead to errors in the depth calculations of subsequent layers. In addition, lateral variations in velocity, such as those caused by buried boulders, fractures, dikes, etc. can result in the misinterpretation of the subsurface conditions.

4.2 ReMi Survey

The refraction microtremor technique uses recorded surface waves (specifically Rayleigh waves) which are contained in the background noise to develop a shear wave velocity profile of the site down to a depth, in this case, up to approximately 100 feet. Fifteen records, 32 seconds long were collected with a 24-channel Geometrics Geode seismograph and twenty-four 4.5-Hz vertical component geophones. The ReMi method does not require an increase of material velocity with depth. Therefore, low velocity zones (velocity inversions) are detectable with ReMi. The depth of exploration is dependent on the length of the line and the frequency content of the background noise. The results of the ReMi method are displayed as a one dimensional profile which represents the average condition across the length of the line.

4.3 Electrical Resistivity Survey

Electrical resistivity data were collected at one test location selected by your office. The data were collected in general accordance with ASTM G57 using an Advanced Geosciences, Inc. (AGI) MiniSting earth resistivity meter and four stainless steel electrodes in a Wenner configuration. The MiniSting can generate up to 800 volts (V) and 500 milliamps (mA) and allows for the direct measurement of resistance. Soil resistance measurements were collected at electrode spacings of approximately 2, 4, 6, 8, 10, 15, 20, and 30 feet. Stainless steel electrodes were hammered into place and the soils surrounding the electrodes were moistened with water where necessary. The soundings were performed along two orientations (generally north-south and east-west) in order to assess possible lateral variations in the study area. The roughly north-south oriented line is designated as R-1a and the roughly east-west oriented line is designated as R-1b. Figure 2 illustrates the approximate locations of the lines.

5. DATA ANALYSIS AND RESULTS

The following sections provide a summary of our analysis and results.

5.1 P-wave Refraction Survey

Collected P-wave data were processed using SIPwin (Rimrock Geophysics, 2003) and SeisOpt® Pro™ (Optim, 2008). SIPwin was used to evaluate first arrival times and SeisOpt® Pro™ was used for analysis and interpretation. SeisOpt® Pro™ uses a nonlinear optimization technique called adaptive simulated annealing. The resulting velocity model provides a tomography image of the estimated geologic conditions. Both vertical and lateral velocity information is contained in the tomography model. Changes in layer velocity are revealed as gradients rather than discrete contacts, which typically are more representative of actual conditions.

Figures 4a through 4d display the results of the seismic P-wave profiles (SL-1 through SL-4). The models reveal that the depth to higher velocity material (bedrock) is highly variable across the study area. In addition, significant lateral variations in the velocity models are also evident in the profiles.

5.2 ReMi Survey

Collected ReMi data were processed using SeisOpt® ReMi™ software (Optim, 2005), which uses the refraction microtremor method (Louie, 2001). The program generates phase-velocity dispersion curves for each record and provides an interactive dispersion modeling tool where the user determines the best fitting model. The result is a one-dimensional shear-wave velocity model of the site with roughly 5 to 15 percent accuracy.

Table 1 and Figures 5a and 5b display the results for RL-1 and RL-2. The ReMi models represent an average shear wave velocity across the profile length. The results reveal that the subsurface conditions vary slightly across the site. In particular, the RL-2 model reveals a velocity inversion in the near surface. Based on our analysis of the collected data, the average Shear-wave velocity down to a depth of 100 feet (Vs100) is 2,543 feet per second (ft/sec) for RL-1 and 2,405 ft/sec for RL-2 (CBC, 2010). These values correspond to site classifications of **B** for RL-1 and **C** for RL-2.

5.3 Electrical Resistivity Survey

The resistivity results are presented on Figure 6. In general, the quality of the collected data is very good. The standard deviation between multiple readings is 0.1 percent or less. In general, the results of the resistivity survey are fairly consistent for the orthogonal pair indicating laterally homogeneous electrical conditions in the subsurface at the test area. The results also indicate an increase in resistivity with depth (larger spacing measurements).

Table 1 – ReMi Results		
Line No.	**Depth (feet)**	**Shear Wave Velocity (feet/second)**
RL-1	0 – 8	771
	8– 14	1,404
	14– 23	1,449
	23 – 43	2,511
	43 – 86	5,177
	86 – 100	6,012
RL-2	0 – 8	1,269
	8– 14	1,065
	14 – 24	1,291
	24 –50	2,172
	50 – 100	5,041

6. LIMITATIONS

The field evaluation and geophysical analyses presented in this report have been conducted in general accordance with current practice and the standard of care exercised by consultants performing similar tasks in the project area. No warranty, express or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be present. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface surveying will be performed upon request.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Southwest Geophysics, Inc. should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document. This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

7. SELECTED REFERENCES

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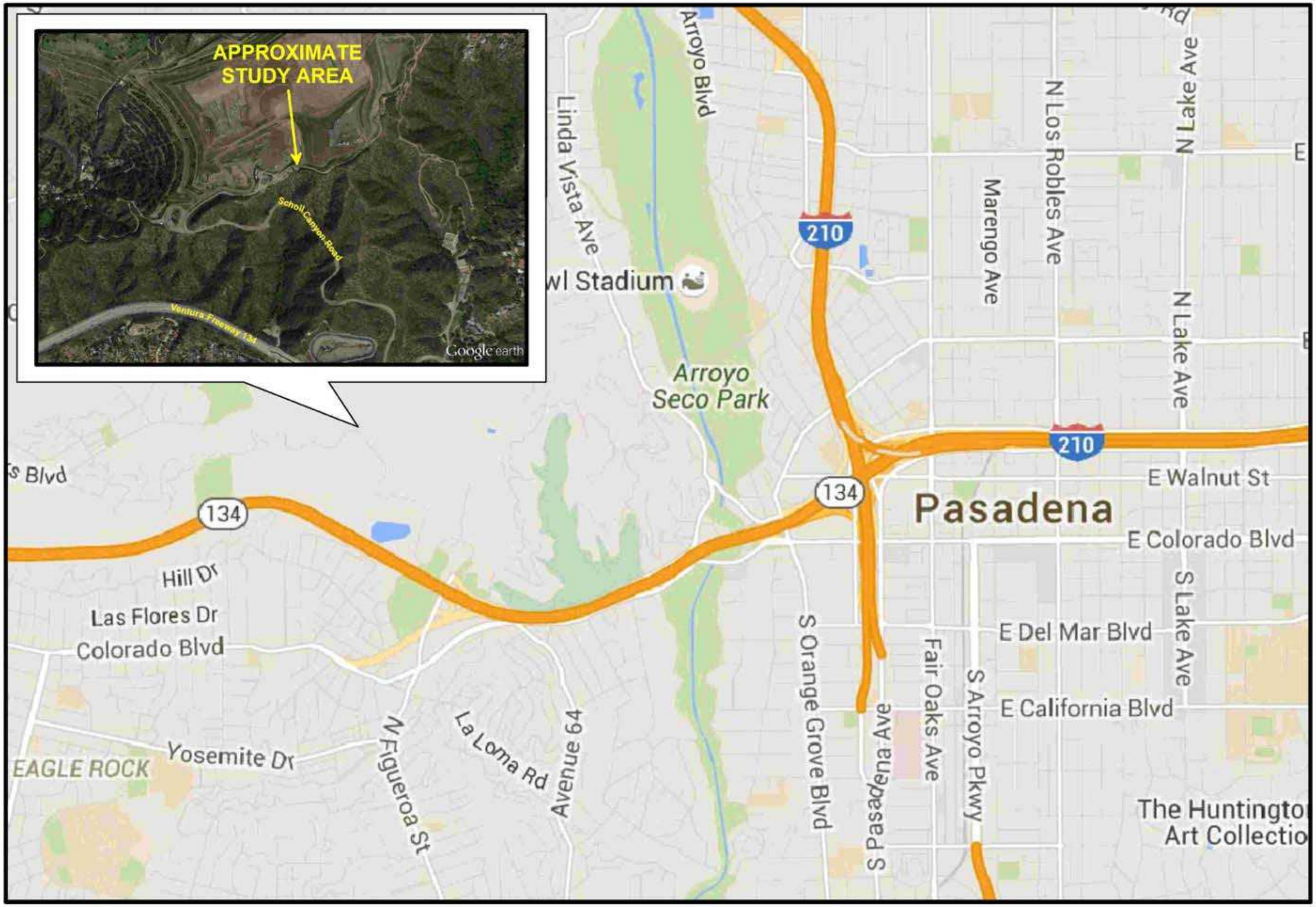
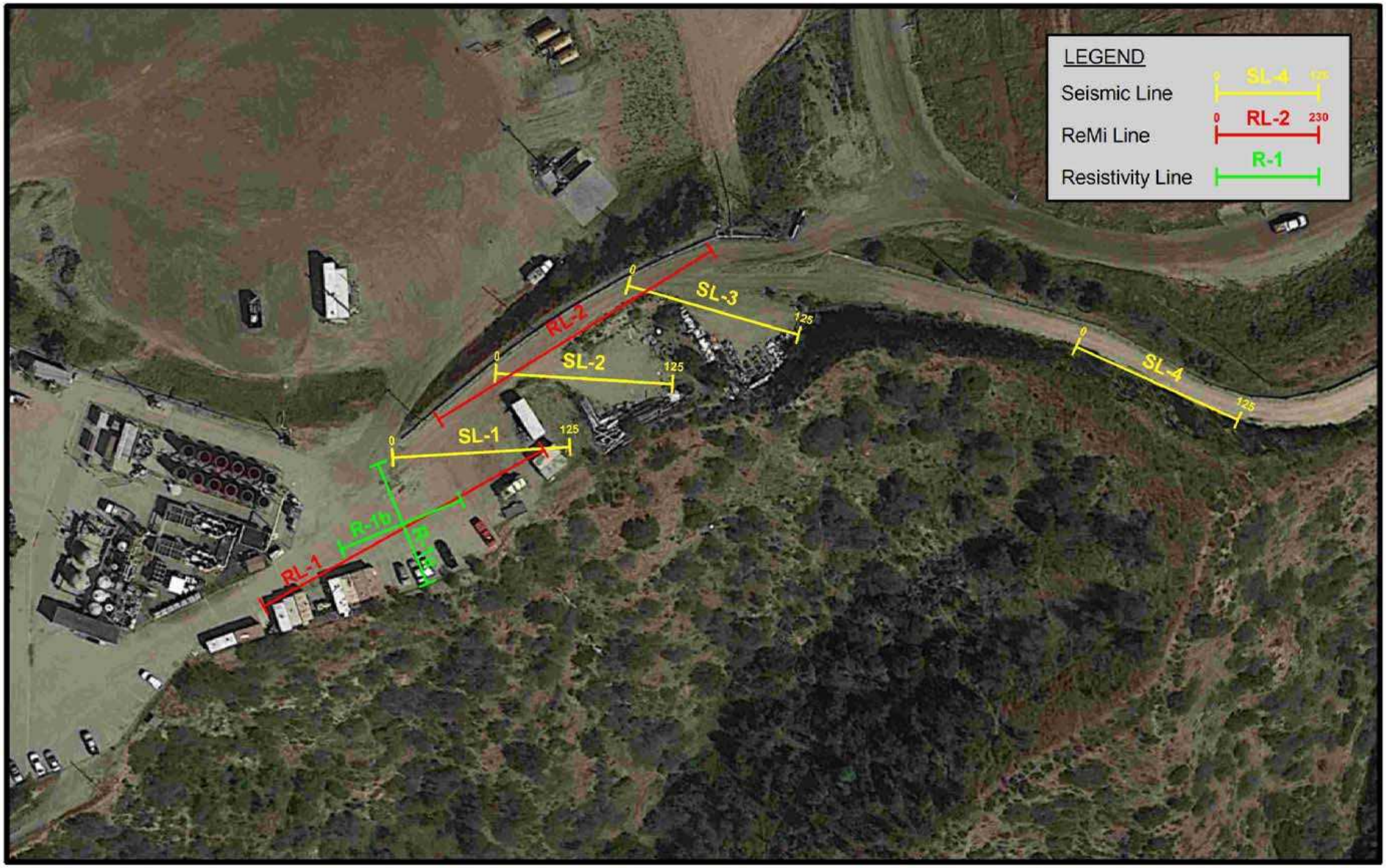


SITE LOCATION MAP	N	Scholl Canyon Landfill Los Angeles, California Project No.: 115574 Date: 12/15	SOUTHWEST GEOPHYSICS INC. Figure 1



LINE LOCATION MAP	N	Scholl Canyon Landfill Los Angeles, California Project No.: 115574 Date: 12/15	SOUTHWEST GEOPHYSICS INC. Figure 2

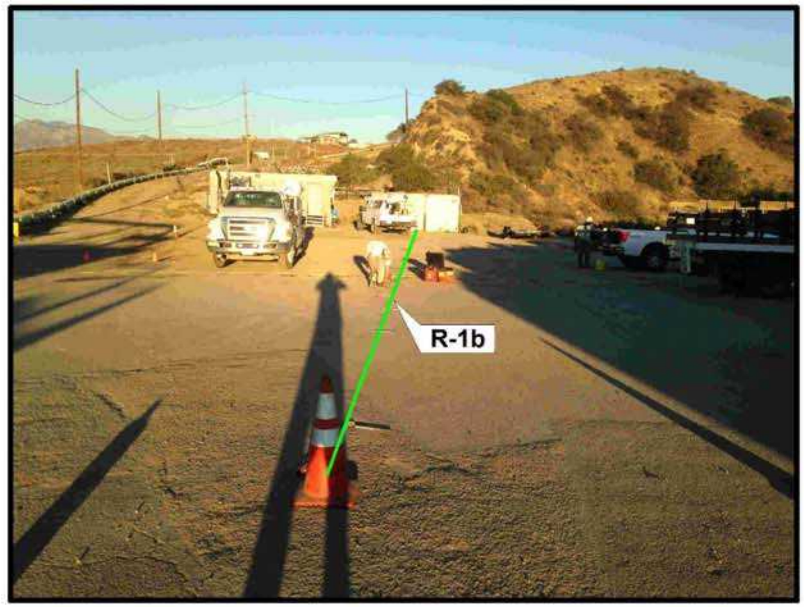
SITE PHOTOGRAPHS
(SL-1 through SL-4)

Scholl Canyon Landfill
Los Angeles, California

Project No.: 115574 | Date: 12/15

SOUTHWEST GEOPHYSICS INC.

Figure 3a



SITE PHOTOGRAPHS
(RL-1, RL-2, R-1a and R-1b)

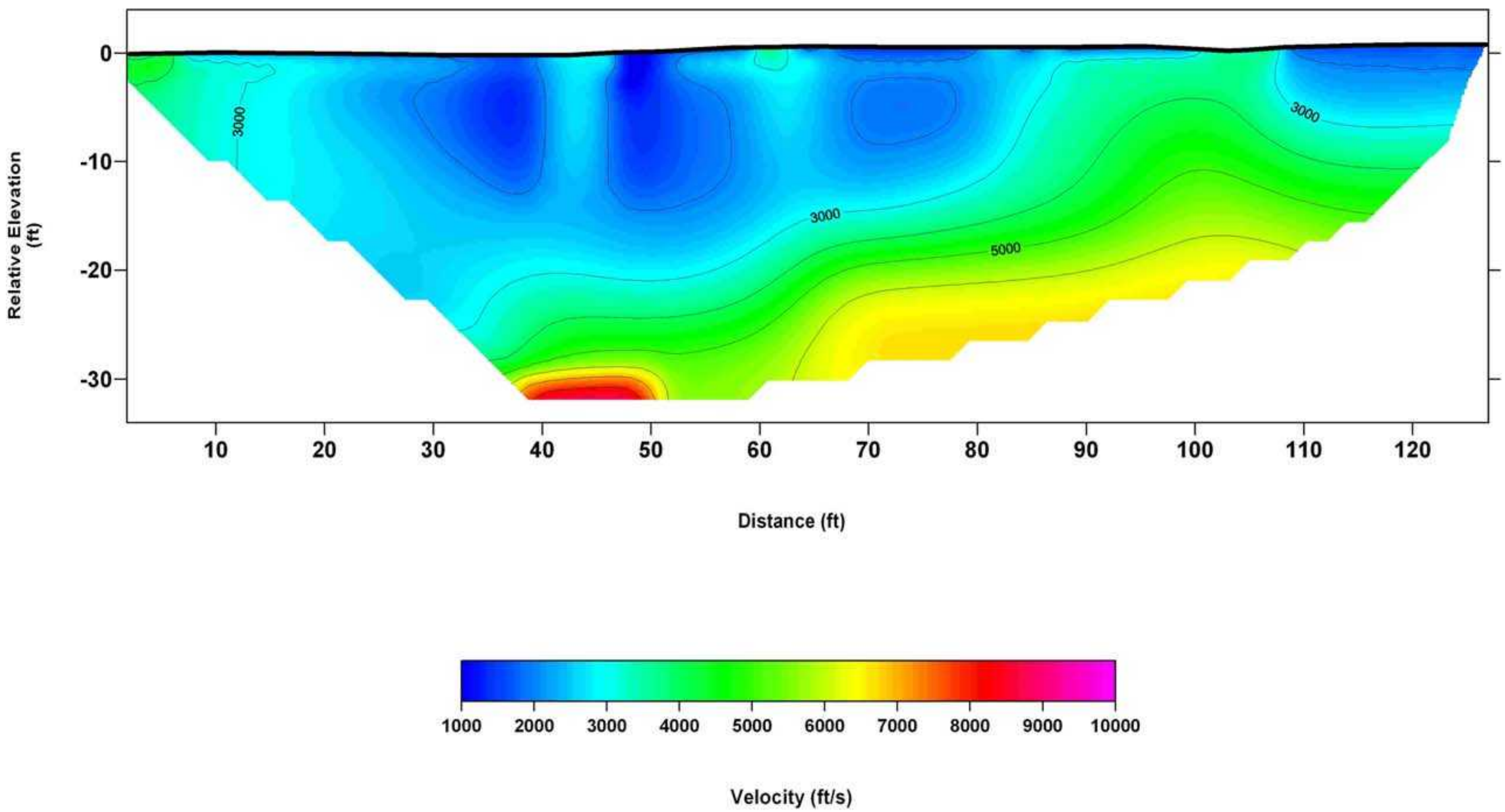
Scholl Canyon Landfill
Los Angeles, California

Project No.: 115574 | Date: 12/15

SOUTHWEST GEOPHYSICS INC.

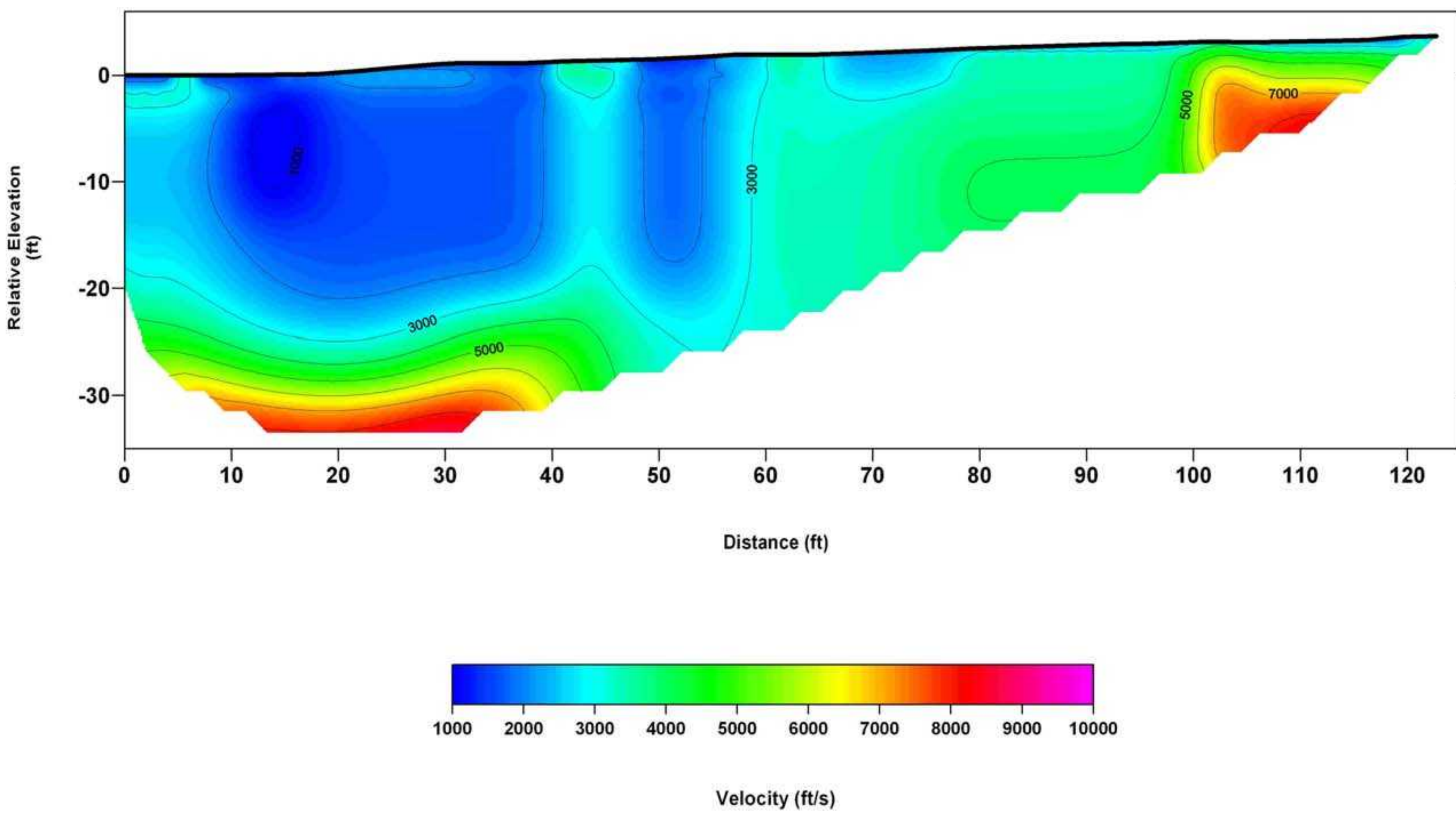
Figure 3b

TOMOGRAPHY MODEL



SEISMIC PROFILE SL-1	Scholl Canyon Landfill Los Angeles, California Project No.: 115574 / Date: 12/15	SOUTHWEST GEOPHYSICS INC. Figure 4a	**Note: Contour Interval = 1,000 feet per second**

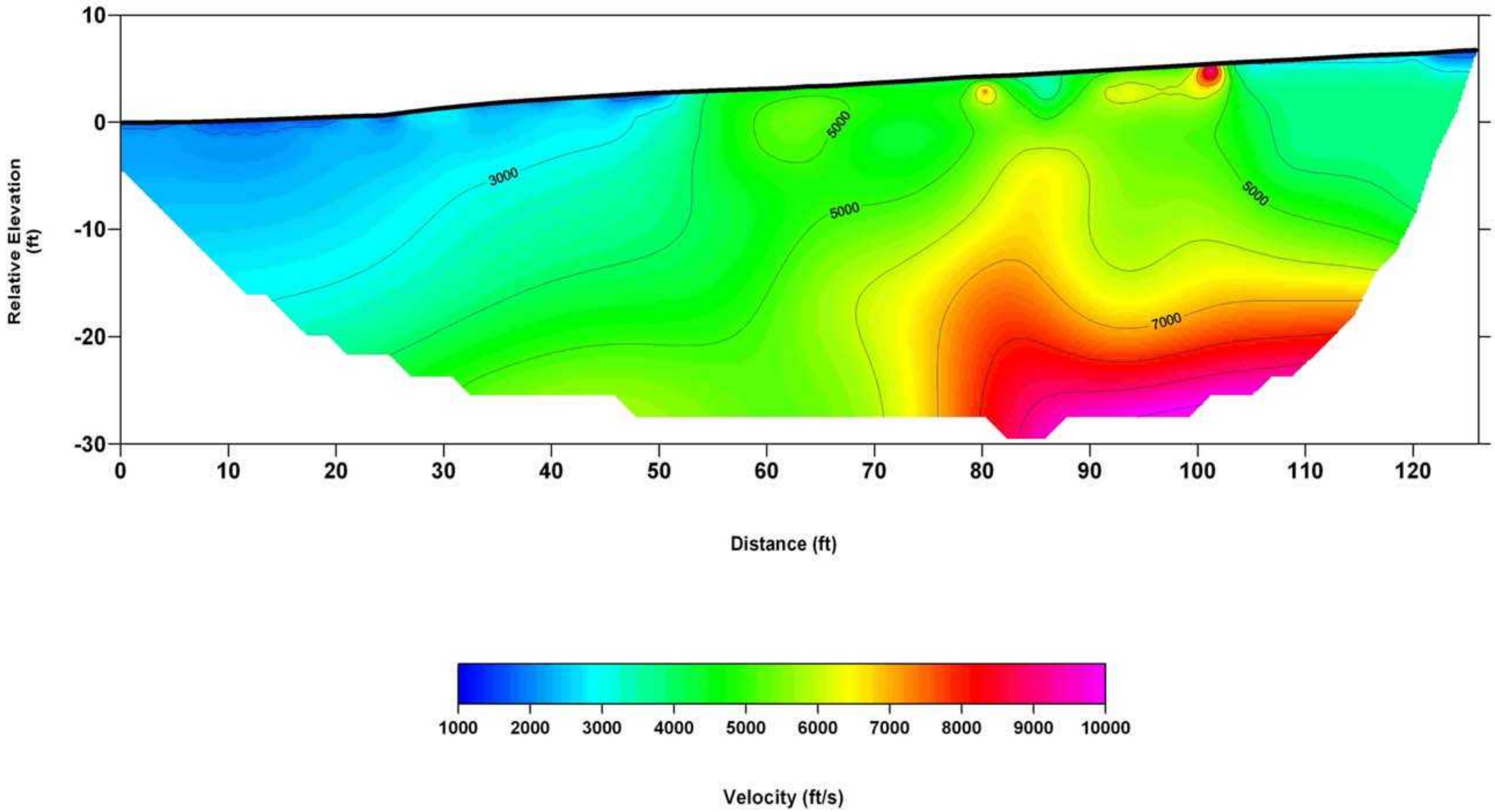
TOMOGRAPHY MODEL



SEISMIC PROFILE SL-2	Scholl Canyon Landfill Los Angeles, California		SOUTHWEST GEOPHYSICS INC. Figure 4b
	Project No.: 115574	Date: 12/15	

Note: Contour Interval = 1,000 feet per second

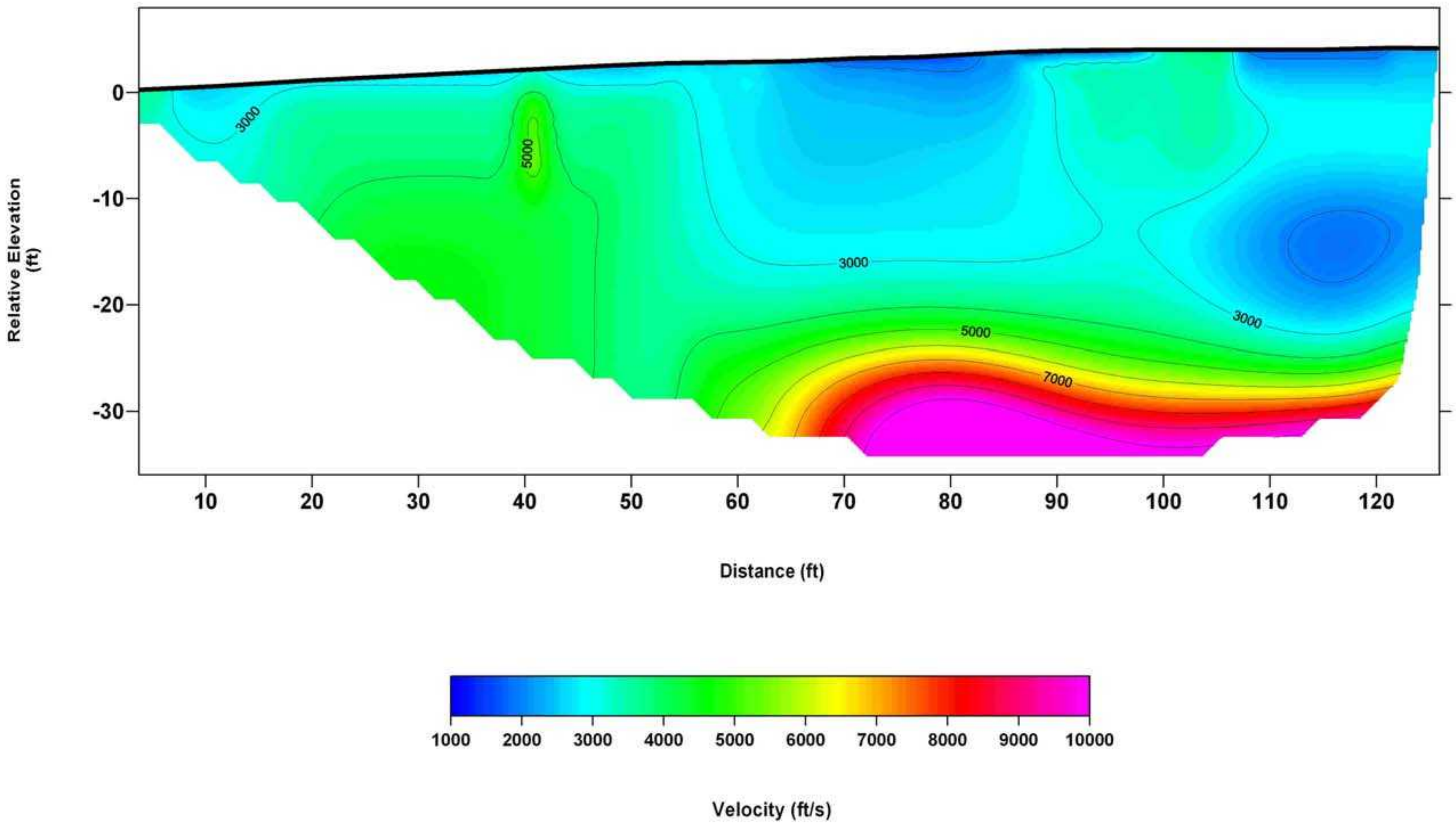
TOMOGRAPHY MODEL



SEISMIC PROFILE SL-3	Scholl Canyon Landfill Los Angeles, California Project No.: 115574 · Date: 12/15	SOUTHWEST GEOPHYSICS INC. Figure 4c

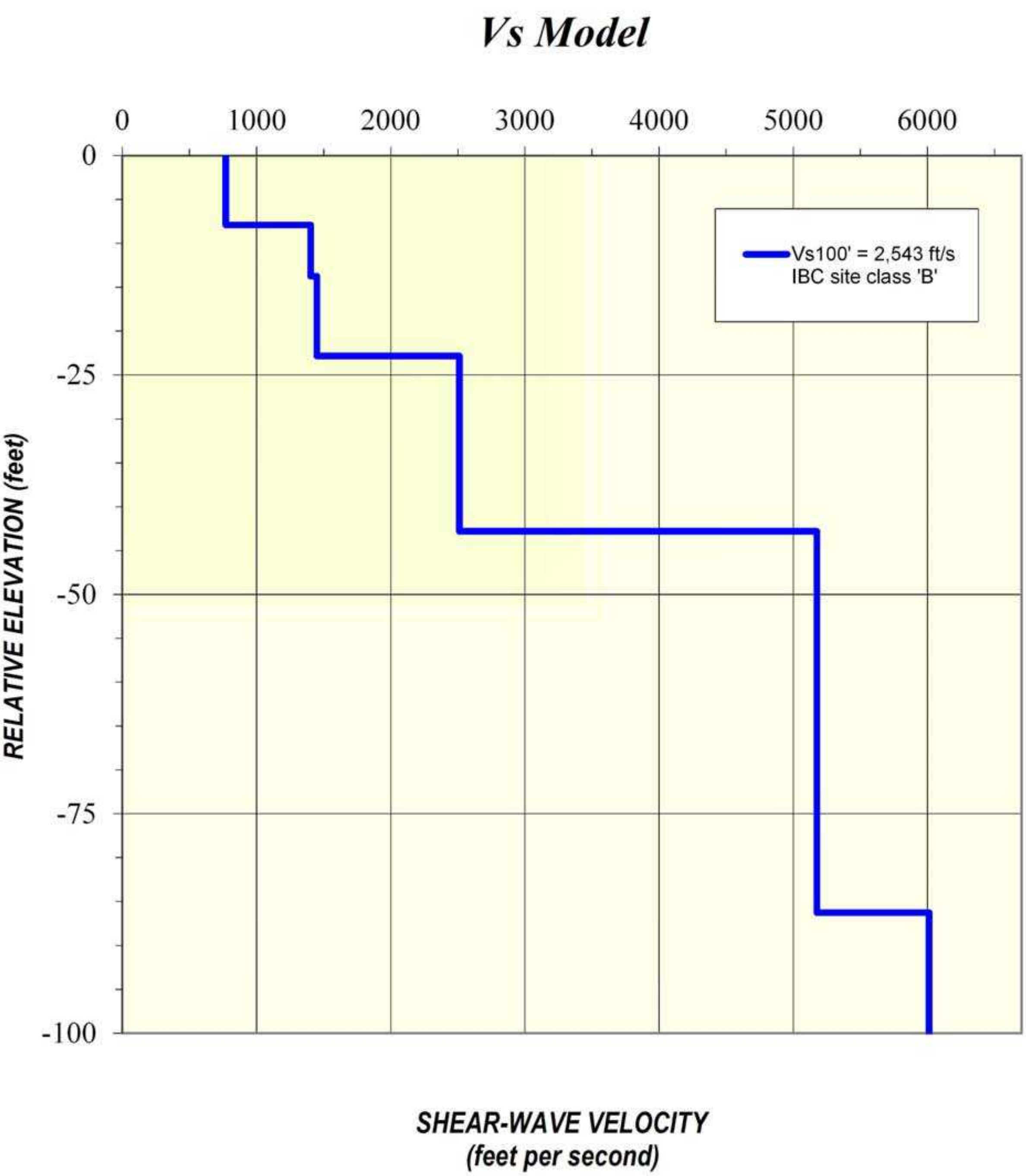
Note: Contour Interval = 1,000 feet per second

TOMOGRAPHY MODEL



SEISMIC PROFILE SL-4	Scholl Canyon Landfill Los Angeles, California Project No.: 115574 Date: 12/15	SOUTHWEST GEOPHYSICS INC. Figure 4d

Note: Contour Interval = 1,000 feet per second



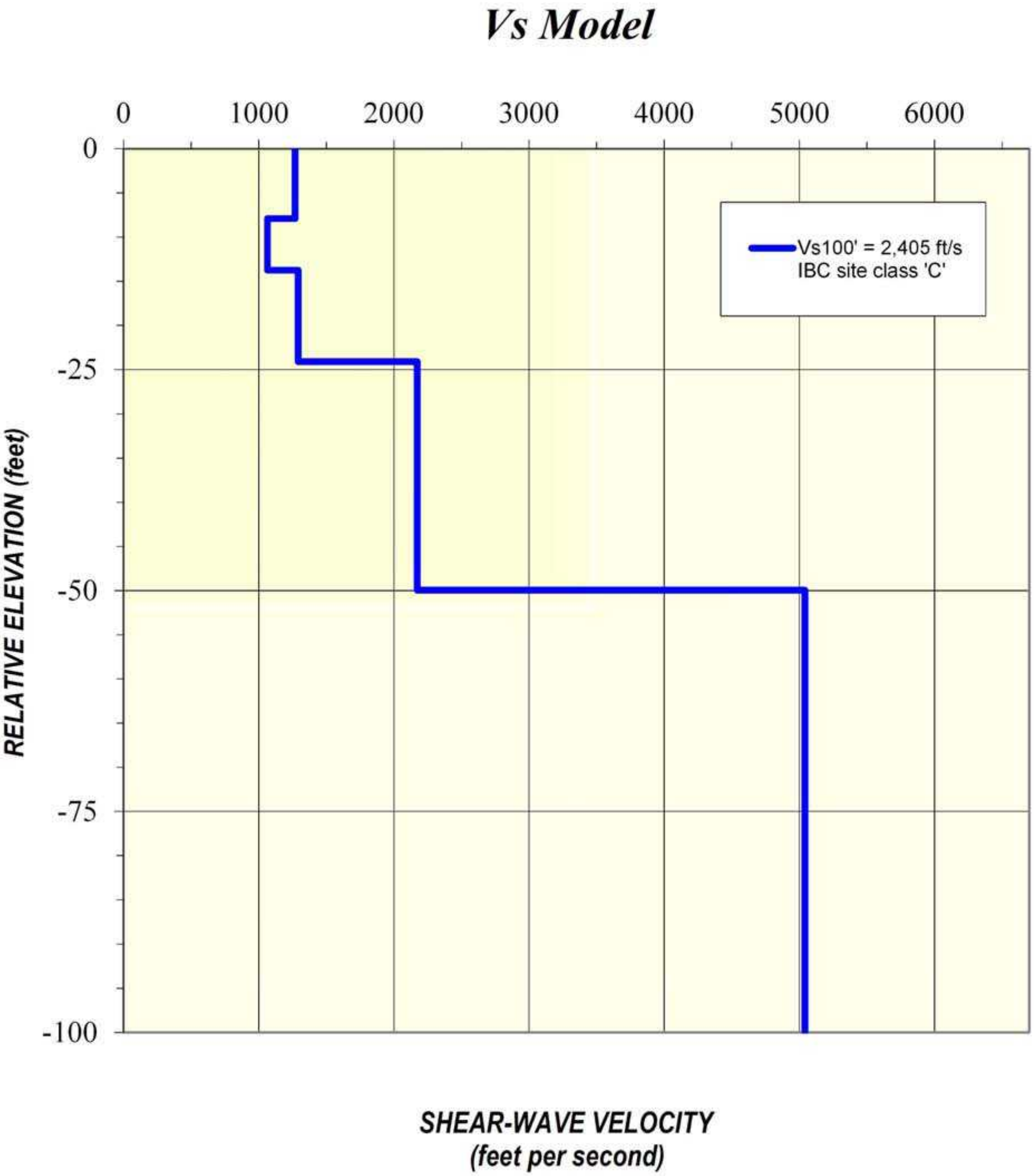
ReMi RESULTS
RL-1

Scholl Canyon Landfill
Los Angeles, California

Project No.: 115574 | Date: 12/15

SOUTHWEST GEOPHYSICS INC.

Figure 5a



ReMi RESULTS
RL-2

Scholl Canyon Landfill
Los Angeles, California

Project No.: 115574 | Date: 12/15

SOUTHWEST GEOPHYSICS INC.

Figure 5b

(Boring/Orientation)	(ft)	(mA)	(Ohms)	(%)	(ohm-cm)	(ohm-ft)
R-1a	2	200	17.080	0.1	6542.03	214.63
(N-S)	4	100	12.870	0.0	9859.00	323.46
	6	100	9.095	0.1	10450.77	342.87
	8	100	7.016	0.1	10749.15	352.66
	10	100	6.014	0.1	11517.49	377.87
	15	100	4.457	0.0	12803.49	420.06
	20	100	3.803	0.1	14566.35	477.90
	30	50	2.839	0.0	16311.02	535.14
R-1b	2	200	14.800	0.0	5668.74	185.98
(E-W)	4	200	11.510	0.1	8817.18	289.28
	6	100	8.813	0.0	10126.74	332.24
	8	100	7.465	0.0	11437.06	375.23
	10	100	6.482	0.1	12413.76	407.28
	15	100	5.521	0.1	15860.01	520.34
	20	20	4.324	0.0	16561.90	543.37
	30	100	3.039	0.1	17460.09	572.84

ELECTRICAL RESISTIVITY RESULTS

Scholl Canyon Landfill
Los Angeles, California

Project No.: 115574

Date: 12/15

SOUTHWEST GEOPHYSICS INC.

Figure 6