GEOTECHNICAL INVESTIGATION

COASTAL RAIL TRAIL AT GILMAN DRIVE

Gilman Drive
La Jolla, California

Prepared By:
SCST, Inc.
6280 Riverdale Street
San Diego, California 92120

Prepared For:
Larry Thornburgh, PE, PLS
Nasland Engineering
4740 Ruffner Street
San Diego, California 92111

Providing Professional Engineering Services Since 1959

SDVOSB . DVBE

SCST, Inc.
Corporate Headquarters
6280 Riverdale Street
San Diego, CA 92120
T 877.215.4321
P 619.280.4321
F 619.280.4717
W www.scst.com

October 17, 2018

SCST Project No. 160504P3
Report No. 1R

Larry Thornburgh, PE, PLS
Nasland Engineering
4740 Ruffner Street
San Diego, CA 92111

Subject: GEOTECHNICAL INVESTIGATION
COASTAL RAIL TRAIL AT GILMAN DRIVE
GILMAN DRIVE AND VILLA LA JOLLA DRIVE
LA JOLLA, CALIFORNIA

Dear Mr. Thornburgh:

SCST, Inc. is pleased to present our report describing the geotechnical investigation performed for the subject project. We conducted the geotechnical investigation in general conformance with the scope of work presented in our agreement dated October 31, 2016. Based on the results of our investigation, we consider the planned construction feasible from a geotechnical standpoint provided the recommendations of this report are followed. If you have questions, please call us at (619) 280-4321.

Respectfully submitted,
SCST, INC.

DANIEL J. RICHARDSON
C 89379
CIVIL

ISAAC B. CHUN
No. 2649
EXP. 12/31/19
GEOTECHNICAL

Daniel Richardson, PE 89379
Project Engineer

Isaac Chun, GE 2649
Principal Engineer

JONATHAN C. GOODMACHER
Exp 12/2019
No 2136
CERTIFIED ENGINEERING GEOLOGIST

Jonathan Goodmacher, CEG 6136
Principal Geologist

DTC:DJR:IC:JG:hu

(1) Addressee via e-mail at larryt@nasland.com
(1) Sam Waisbord via e-mail at samw@nasland.com

TABLE OF CONTENTS

SECTION **PAGE**

TABLE OF CONTENTS

SECTION **PAGE**

ATTACHMENTS

FIGURES

APPENDICES

EXECUTIVE SUMMARY

This report presents the results of the geotechnical investigation SCST, Inc. (SCST) performed for the subject project. We understand that the project will consist of the design and construction of two soil nail walls about 15 feet high, a gravity retaining wall, and associated improvements including a raised median, sidewalk, and asphalt bike path along Gilman and Villa La Jolla Drive in San Diego, California. Site grading will include constructing fill slopes up to about 26 feet thick. The purpose of our work is to provide conclusions and recommendations regarding the geotechnical aspects of the project.

We explored the subsurface conditions by drilling six borings to depths between about 11 and 40 feet and below the existing ground surface using a hand auger and a truck-mounted drill rig equipped with a hollow-stem auger. An SCST Engineer logged the borings and collected samples of the materials encountered for laboratory testing. SCST tested selected samples from the borings to evaluate pertinent soil classification and engineering properties to assist in developing geotechnical conclusions and recommendations.

The materials encountered in the borings consist of fill, young alluvial flood-plain deposits, and Ardath Shale. The fill extends to a depth of about 7 feet below the existing ground surface and consists of loose to medium dense silty to clayey sand, and medium stiff sandy clay. Alluvial deposits were encountered beneath the fill at 5 and 7 feet below the existing ground surface. The alluvial deposits consist of medium dense to dense silty sand with trace gravel. Ardath Shale underlies the entire alignment. In general, the Ardath Shale consisted of well-indurated claystone to sandy claystone with some interbedded sand. Groundwater was not encountered in the borings.

The main geotechnical considerations affecting the proposed construction are the presence of potentially compressible soils, expansive soils, cut/fill transitions, potentially active faults, and difficult excavations in the Ardath Shale Formation. Geologic mapping should take place during construction to identify any local faults zones, and, if discovered, should be brought to the attention of the engineer to modify design to increase relative flexibility of the soil nail wall. Remedial grading will need to be performed to reduce the potential for distress to the planned improvements. To reduce the potential for settlement, the existing fill should be excavated in its entirety below settlement-sensitive improvements and new fills. To reduce the potential for expansive heave, hardscapes should be underlain by at least 2 feet of material with an expansion index of 50 or less. Additionally, the planned improvements should not be underlain by cut/fill transitions or transitions from shallow fill to deep fill. To mitigate such transition s and reduce the potential for differential settlement, the formational materials should be over-excavated and replaced with compacted fill to provide a relatively uniform layer of compacted fill. Cemented zones should be expected within the Ardath Shale Formation. Gravel and cobbles should also be anticipated. The recommendations presented herein may need to be updated once final plans are developed.

1. INTRODUCTION

This report presents the results of the geotechnical investigation SCST, Inc. (SCST) performed for the Gilman Drive segment of the Coastal Rail Trail project. The Coastal Rail Trail is a planned continuous bike route in San Diego County that runs approximately 44 miles between Oceanside and Santa Fe Depot in Downtown San Diego. We understand that this section of the project will consist of the design and construction of two soil nail walls about 15 feet high and providing additional right-of-way on Gilman Drive in La Jolla, California. Figure 1 presents a site vicinity map. The purpose of our work is to provide conclusions and recommendations regarding the geotechnical aspects of the project.

2. SCOPE OF WORK

2.1 FIELD INVESTIGATION

Our subsurface investigation consisted of drilling six borings to between depths of about 4 and 40 feet using both a hand auger and a truck-mounted drill rig equipped with a hollow stem auger on July 20, 2018 and July 25, 2018 along the planned project site. The field investigation was performed under the observation of an SCST Engineer who logged the borings and obtained bulk and drive samples of the materials encountered.

The soils are classified in accordance with the Unified Soil Classification System as illustrated on Figure I-1. Logs and locations of borings are presented on Figures I-2 through I-7 and Figure 2 respectively.

2.2 LABORATORY TESTING

Select representative samples were tested to evaluate pertinent soil classification and engineering properties and enable development of geotechnical conclusions and recommendations. The laboratory tests consisted of particle-size distribution, Atterberg limits, expansion index, corrosivity, direct shear, and natural moisture and density. Appendix II presents the results of the laboratory tests and brief explanations of the test procedures.

2.3 ANALYSIS AND REPORT PREPARATION

The results of the field and laboratory tests were evaluated to develop conclusions and recommendations regarding:

- Subsurface conditions beneath the site
- Potential geologic hazards
- Criteria for seismic design in accordance with the 2016 California Building Code (CBC)

- Site preparation and grading
- Temporary excavations and shoring
- Excavation characteristics
- Soil nail wall design parameters
- Concrete slabs-on-grade
- Soil corrosivity

3. SITE DESCRIPTION

The site is located along the Gilman Drive alignment, between La Jolla Village Drive in the north and Interstate 5 in the south in La Jolla, California. The site is characterized by a towering bluff extending the entire length of the west side of Gilman Drive, incised by drainage courses, and slopes into an alluvial flood-plain on the east side of the alignment. Bluff heights range up to approximately 40 feet. Elevations along the alignment range from about 305 feet on the north to about 160 feet on the south (Mean Sea Level). Dense chaparral-type vegetation covers the site.

4. PROPOSED IMPROVEMENTS

The proposed improvements will consist of a 15-foot-tall soil nail wall constructed in two segments along the bluff on the west side of Gilman Drive. The east side of Gilman drive that currently slopes into an alluvial flood-plain is to be brought up to existing grade for an additional 14 feet wide of new construction that will include a raised median, sidewalk, and asphalt concrete bike path along the project alignment. Additionally, a standard gravity retaining wall is proposed on south portion of the project. Site grading will vary considerably along the length of Gilman Drive, but fills up to about 26 feet thick are anticipated. Fill slopes will be constructed at 2:1 (horizontal:vertical).

5. GEOLOGY AND SUBSURFACE CONDITIONS

Per published geologic mapping, site soils consist of Young Alluvial flood-plain deposits and the Tertiary Ardath Shale (Kennedy and Tan 2007). However, the materials encountered in the borings consist of fill, young alluvial flood-plain deposits, and Ardath Shale. Descriptions of the materials are presented below. Figure 3 presents the regional geology in the vicinity of the site.

Fill (Qf): Fill was encountered in each of the borings. The fill consisted of loose to dense, silty sand and stiff sandy silt. The fill extends to a depth of about 7 feet below the existing ground surface and consists of loose to medium dense, silty to clayey sand, and medium stiff, sandy clay.

Young Alluvial flood-plain deposits (Qya): Young alluvial flood-plane deposits were encountered beneath the fill in Borings B-2 and B-3 at 5 and 7 feet below the existing ground surface, respectively. These deposits consisted of medium dense to dense, silty sand with trace gravel.

Ardath Shale (Ta): In general, the Ardath Shale consisted of well indurated, claystone to sandy claystone with some interbedded sand.

Groundwater: Groundwater was not encountered borings. However, groundwater levels may develop in drainage courses and fluctuate in the future due to rainfall, irrigation, broken pipes, or changes in site drainage. Because groundwater rise or seepage is difficult to predict, such conditions are typically mitigated if and when they occur.

6. GEOLOGIC HAZARDS

6.1 CITY OF SAN DIEGO SEISMIC SAFETY STUDY

Figure 4 shows the approximate site location on the City of San Diego Seismic Safety Study map (2008). Geologic Hazard Categories that the project alignment cross include Category 12 (potentially active faults), 25 (Ardath Shale with neutral or favorable geologic structure), 26 (Ardath Shale with unfavorable geologic structure), and 32 (low potential for liquefaction).

6.2 FAULTING AND SURFACE RUPTURE

The closest known active fault is the Rose Canyon fault zone located about 1 mile (1.5 km) west-southwest of the site. The site is not located in an Alquist-Priolo Earthquake Fault Zone. No active faults are known to underlie or project toward the site. Therefore, the probability of fault rupture is low.

6.3 CBC SEISMIC DESIGN PARAMETERS

A geologic hazard likely to affect the project is ground shaking as a result of movement along an active fault zone in the vicinity of the subject site. The site coefficients and adjusted maximum considered earthquake spectral response accelerations in accordance with the 2016 CBC are presented below:

Site Coordinates:	Latitude 32.862376°
	Longitude -117.236422°

Site Class: D

Site Coefficients,	F_a = 1.002
	F_v = 1.518

Mapped Spectral Response Acceleration at Short Period, S_s = 1.249g

Mapped Spectral Response Acceleration at 1-Second Period, S_1 = 0.484g

Design Spectral Acceleration at Short Period, S_{DS} = 0.833g

Design Spectral Acceleration at 1-Second Period, S_{D1} = 0.489g

Site Peak Ground Acceleration, PGA_M = 0.554g

6.4 LIQUEFACTION AND DYNAMIC SETTLEMENT

Liquefaction occurs when loose, saturated, generally fine sands and silts are subjected to strong ground shaking. The soils lose shear strength and become liquid, potentially resulting in large total and differential ground surface settlements as well as possible lateral spreading during an earthquake. Due to the lack of shallow groundwater, and given the relatively dense nature of the materials beneath the site, the potential for liquefaction and dynamic settlement to occur is considered negligible.

6.5 TSUNAMIS, SEICHES, AND FLOODING

The site is not located within a mapped area on the State of California Tsunami Inundation Maps (Cal EMA, 2009); therefore, damage due to tsunamis is considered low. Seiches are periodic oscillations in large bodies of water such as lakes, harbors, bays, or reservoirs. The site is not located adjacent to any lakes or confined bodies of water; therefore, the potential for a seiche to affect the site is low. The site is not located within a flood zone or dam inundation area (County of San Diego, 2018).

6.6 LANDSLIDES AND SLOPE STABILITY

Evidence of landslides or slope instabilities was not observed. However, the site is located in an area designated as containing unfavorable geologic structure within the Ardath Shale (Zone 26). The potential for landslides or slope instabilities to occur at the site is considered to be moderate.

6.7 SUBSIDENCE

The site is not located in an area of known subsidence associated with fluid withdrawal (groundwater or petroleum); therefore, the potential for subsidence due to the extraction of fluids is negligible.

6.8 HYDRO-CONSOLIDATION

Hydro-consolidation can occur in recently deposited (less than 10,000 years old) sediments that were deposited in a semi-arid environment. Examples of such sediments are eolian sands, alluvial fan deposits, and mudflow sediments deposited during flash floods. The pore space between particle grains can re-adjust when inundated by groundwater causing the material to consolidate. The relatively dense materials underlying the site are not considered susceptible to hydro-consolidation.

7. CONCLUSIONS

The main geotechnical considerations affecting the proposed construction are the presence of potentially compressible soils, expansive soils, cut/fill transitions, potentially active faults, and difficult excavations in the Ardath Shale Formation. Geologic mapping should take place during construction to identify any local faults zones, and if discovered, should be brought to the attention of the engineer to modify design to increase relative flexibility of the soil nail wall. Remedial grading will need to be performed to reduce the potential for distress to the planned improvements. Remedial grading recommendations are provided in Section 8.1.2 of this report. As noted, difficult excavations in formational material should be expected. Contract documents should specify that the contractor mobilize equipment capable of excavating through hard Ardath Shale soils.

8. RECOMMENDATIONS

8.1 SITE PREPARATION AND GRADING

8.1.1 Site Preparation

Site preparation should begin with the removal of existing improvements, topsoil, vegetation, and debris. Subsurface improvements that are to be abandoned should be removed, and the resulting excavations should be backfilled and compacted in accordance with the recommendations of this report. Pipeline abandonment can consist of capping or rerouting at the project perimeter and removal within the project perimeter. If appropriate, abandoned pipelines can be filled with grout or slurry as recommended by and observed by the geotechnical consultant.

8.1.2 Remedial Grading

To reduce the potential for settlement, the existing fill should be excavated in their entirety beneath retaining walls, settlement sensitive improvements, and areas to receive new fills. Additionally, young alluvial floodplain deposits encountered within 2 feet of the deepest planned retaining wall footing bottom level should also be excavated and replaced with compacted fill. Excavations up to 7 feet are anticipated. Horizontally, the excavations should extend a distance equal to the depth of excavation or up to the limits of grading, whichever is less. An SCST representative should observe conditions exposed in the bottom of the excavation to determine if additional excavation is required.

8.1.3 Keyways and Benching

Keyways should be established at the base of fill slopes. The entire keyway should expose competent material. The keyway should be at least 15 feet wide at the bottom and sloped towards the slope at an inclination of about 2%. The keyway may need to be wider to accommodate compaction equipment. Final keyway recommendations will depend on the final grading plans.

Fill should be benched into sloping ground inclined steeper than 5:1 (horizontal:vertical). The benches should expose competent material as evaluated by the geotechnical consultant.

8.1.4 Subdrains

Subdrains should be installed along the bottom of excavation in natural drainage channels and canyons and at the backs (heel) of keyways where groundwater seepage is expected. The location and extent of subdrains should be evaluated during grading by personnel from SCST. Subdrains should direct water away from improvements towards a suitable drainage facility. Subdrains should consist of a perforated pipe surrounded by crushed rock wrapped in filter fabric or filter material. Subdrain locations should be surveyed.

8.1.5 Excavation Characteristics

It is anticipated that excavations in fill and young alluvial floodplain deposits can generally be achieved with conventional earthwork equipment in good working order. However, hard formational claystone exists on-site, and difficult excavation should be anticipated. Excavations in rock may generate oversized material that will require extra effort to crush or haul offsite. Contract documents should specify that the contractor mobilize equipment capable of excavating and compacting the hard formational materials.

8.1.6 Temporary Excavations

Temporary excavations 3 feet deep or less can be made vertically. Deeper temporary excavations should be laid back no steeper than 1:1 (horizontal:vertical) in fill or alluvium or ¾:1 (horizontal:vertical) in formation. The faces of temporary slopes should be inspected daily by the contractor’s Competent Person before personnel are allowed to enter the excavation. Any zones of potential instability, sloughing or raveling should be brought to the attention of the Engineer and corrective action implemented before personnel begin working in the excavation. Excavated soils should not be stockpiled behind temporary excavations within a distance equal to the depth of the excavation. SCST should be notified if other surcharge loads are anticipated so that lateral load criteria can be developed for the specific situation. If temporary slopes are to be maintained during the rainy season, berms are recommended along the tops of slopes to prevent runoff water from entering the excavation and eroding the slope faces. Slopes steeper than those described above will require shoring. Additionally, temporary excavations that extend below a plane inclined at 1½:1 (horizontal:vertical) downward from the outside bottom edge of existing structures or improvements will require shoring. A shoring system consisting of soldier piles and lagging can be used.

8.1.7 Temporary Shoring

For design of cantilevered shoring, an active soil pressure equal to a fluid weighing 35 pcf can be used for level retained ground or 55 pcf for 2:1 (horizontal:vertical) sloping ground. The surcharge loads on shoring from traffic and construction equipment adjacent to the excavation can be modeled by assuming an additional 2 feet of soil behind the shoring. For design of soldier piles, an allowable passive pressure of 350 psf per foot of embedment over twice the pile diameter up to a maximum of 5,000 psf can be used. Soldier piles should be spaced at least three pile diameters, center to center. Continuous lagging will be required throughout. The soldier piles should be designed for the full anticipated lateral pressure; however, the pressure on the lagging will be less due to arching in the soils. For design of lagging, the earth pressure but can be limited to a maximum value of 400 psf.

8.1.8 Temporary Dewatering

Groundwater seepage may occur locally and should be anticipated in excavations. Dewatering can be accomplished by sloping the excavation bottom to a sump and pumping from the sump. A layer of gravel about 6 inches thick placed in the bottom of the excavation will facilitate groundwater flow and can be used as a working platform.

8.1.9 Compacted Fill

Excavated material, except for vegetation, debris, and rocks greater than 6 inches can be used as compacted fill. Concrete slabs should be underlain by at least 2 feet of material with an expansion index of 50 or less. We expect that some of the on-site materials will meet the expansion index criteria and can be used as compacted fill; some material will not be suitable for reuse. Fill should be moisture conditioned to near optimum moisture content and compacted to at least 90% relative compaction. Fill should be placed in horizontal lifts at a thickness appropriate for the equipment spreading, mixing, and compacting the material, but generally should not exceed 8 inches in loose thickness. The maximum dry density and optimum moisture content for evaluating relative compaction should be determined in accordance with ASTM D 1557. Utility trench backfills, pavements and hardscape subgrades should be compacted to at least 90% relative compaction. The top 12 inches of subgrade beneath pavements should be compacted to at least 95%.

8.1.10 Utility Over-Excavation

Utility alignments underlain by hard formational material may be over-excavated and replaced with compacted fill to facilitate trench excavations. The depth of over-excavation should be based on the anticipated trench excavations.

8.1.11 Oversized Material

Excavations may generate oversized material. Oversized material is defined as rocks greater than 6 inches in largest dimension. Oversized material should either be broken down to no greater than 6 inches in largest dimension for use in compacted fill, used as landscape material, or disposed of offsite.

8.1.12 Bulking and Shrinking Factors

For earthwork estimating purposes, excavated alluvial deposits placed as fill is estimated to shrink about 5% in volume. Excavated claystone is estimated to bulk about 40%.

8.1.13 Imported Soil

Imported soil should consist of predominately granular soil, free of organic matter and rocks greater than 6 inches. Imported soil should have an expansion index of 20 or less and should be inspected and, if appropriate, tested by SCST prior to transport to the site.

8.1.14 Slopes

Permanent fill slopes should be constructed no steeper than 2:1 (horizontal:vertical). Permanent cut slopes in competent rock should be constructed no steeper than 1½:1 (horizontal:vertical). Faces of fill slopes should be compacted either by rolling with a sheepsfoot roller or other suitable compaction equipment or by overfilling and cutting back to design grade. An engineering geologist from SCST should observe all cut slopes during grading to ascertain that no unforeseen adverse geologic conditions are encountered that require revised recommendations. All slopes are susceptible to surficial slope failure and erosion. Water should not be allowed to flow over the tops of slopes. Slopes should be protected or planted with vegetation that will reduce the potential for erosion.

8.1.15 Surface Drainage

Final surface grades around improvements should be designed to collect and direct surface water away from the improvement and toward appropriate drainage facilities. The ground around the improvement should be graded so that surface water flows rapidly away from the improvement without ponding. In general, we recommend that the ground adjacent to the improvement 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 improvement. Drainage patterns established at the time of fine grading should be maintained throughout the life of the proposed improvements. Site irrigation should be limited to the minimum necessary to sustain landscape growth. Should excessive irrigation, impaired drainage, or unusually high rainfall occur, saturated zones of perched groundwater can develop.

8.1.16 Grading Plan Review

SCST should review the grading plans and earthwork specifications to ascertain whether the intent of the recommendations contained in this report have been implemented and that no revised recommendations are needed due to changes in the development scheme.

8.2 CONCRETE FLATWORK

Slabs should be at least 5 inches thick and reinforced with at least No. 4 bars at 18 inches on center each way. Slabs should be provided with weakened plane joints. Joints should be placed in accordance with the American Concrete Institute (ACI) guidelines. The project architect or civil engineer should select the final joint patterns. A 1-inch maximum size aggregate mix is recommended for concrete for exterior slabs. The corrosion potential of on-site soils with respect to reinforced concrete will need to be taken into account in concrete mix design. Coarse and fine aggregate in concrete should conform to the “Greenbook” Standard Specifications for Public Works Construction.

8.3 CONVENTIONAL RETAINING WALLS

8.3.1 Foundations

Shallow spread footings with bottom levels on compacted fill can be used to support site retaining walls. Retaining wall footings should extend at least 24 inches below lowest adjacent finished grade and at least 24 inches wide. An allowable bearing capacity of 2,500 psf can be used for footings supported on compacted fill, with increases of 500 psf for each foot of depth below the minimum and 250 psf for each foot of width beyond the minimum up to a maximum of 5,000 psf.

Lateral loads will be resisted by friction between the bottoms of footings and passive pressure on the faces of footings and other structural elements below grade. An allowable coefficient of friction of 0.35 can be used. Passive pressure can be computed using an allowable lateral pressure of 350 psf per foot of depth below the ground surface for level ground conditions. Reductions for sloping ground should be made. The passive pressure can be increased by ⅓ when considering the total of all loads, including wind or seismic forces. The upper 1 foot of soil should not be relied on for passive support unless the ground is covered with pavements or slabs.

8.3.2 Lateral Earth Pressures

The active earth pressure for the design of unrestrained retaining walls with level backfill can be taken as equivalent to the pressure of a fluid weighing 35 pcf. The at-rest earth pressure for the design of restrained retaining walls with level backfills can be taken as equivalent to the pressure of a fluid weighing 55 pcf. These values assume a granular and drained backfill condition. Higher lateral earth pressures would apply if walls retain expansive clay soils. An additional 20 pcf should be added to these values for walls with a 2:1 (horizontal:vertical) sloping backfill. An increase in earth pressure equivalent to an additional 2 feet of retained soil can be used to account for surcharge loads from light traffic. The above values do not include a factor of safety. Appropriate factors of safety should be incorporated into the design. If other surcharge loads are anticipated, SCST should be contacted for the necessary increase in soil pressure. Figure 5 presents the lateral earth pressure distribution diagram.

Retaining walls should be designed to resist hydrostatic pressures or be provided with a backdrain to reduce the accumulation of hydrostatic pressures. Backdrains may consist of a 2-foot wide zone of ¾-inch crushed rock. The backdrain should be separated from the adjacent soils using a non-woven filter fabric, such as Mirafi 140N or equivalent. Weep holes should be provided, or a perforated pipe should be installed at the base of the backdrain and sloped to discharge to a suitable storm drain facility. As an alternative, a geocomposite drainage system such as Miradrain 6000 or equivalent placed behind the wall and connected to a suitable storm drain facility can be used. The project architect should provide waterproofing specifications and details. Figure 6 presents typical conventional retaining wall backdrain details.

8.3.3 Seismic Earth Pressure

If required, the seismic earth pressure can be taken as equivalent to the pressure of a fluid weighing 20 pcf. This value is for level backfill and does not include a factor of safety. Appropriate factors of safety should be incorporated into the design. This pressure is in addition to the un-factored, static active earth pressure. The passive pressure and bearing capacity can be increased by ⅓ in determining the seismic stability of the wall.

8.3.4 Backfill

Wall backfill should consist of granular, free-draining material. Expansive or clayey soil should not be used. Additionally, fill within 3 feet from the back of the wall should not contain rocks greater than 3 inches in dimension. We anticipate that a portion of the on-site soils will be suitable for wall backfill. Backfill should be compacted to at least 90% relative compaction. Backfill should not be placed until walls have achieved adequate structural strength. Compaction of wall backfill will be necessary to minimize settlement of the backfill and overlying settlement sensitive improvements. However, some settlement should still be anticipated. Provisions should be made for some settlement of concrete slabs and pavements supported on backfill. Additionally, any utilities supported on backfill should be designed to tolerate differential settlement.

8.4 SOIL NAIL WALL

It is anticipated that the soil nails will encounter fill, alluvial deposits, and Ardath Shale. The following design parameters can be used for the design of the soil nails.

- Soil unit weight = 130 pcf
- Internal friction angle = 35 degrees

- Ultimate bond stress = 1,500 psf

Bond stress capacity is influenced by soil and rock conditions, method of construction, and grouting techniques. The contractor should verify bond stress capacity in the field prior to production nail installation.

Free draining conditions have been assumed in the analyses of these walls. We recommend that 2 feet wide drainboard, spaced similar to the nail spacing, of geo-composite drain material, such as Miradrain 6000 or J-Drain 400, be placed over the face of the cuts, and that the drainage be collected at the base of the wall and tight-lined to an appropriate outlet. Weep holes are feasible but may result in staining and algae growth on the wall face and in the street gutter.

8.5 SOIL CORROSIVITY

Representative samples of the on-site soils were tested to evaluate corrosion potential. The test results are presented in Appendix II. The project design engineer can use the sulfate results in conjunction with ACI 318 to specify the water/cement ratio, compressive strength and cementitious material types for concrete exposed to soil. A corrosion engineer should be contacted to provide specific corrosion control recommendations.

9. GEOTECHNICAL ENGINEERING DURING CONSTRUCTION

The geotechnical engineer should review project plans and specifications prior to bidding and construction to check that the intent of the recommendations in this report has been incorporated. Observations and tests should be performed during construction. If the conditions encountered during construction differ from those anticipated based on the subsurface exploration program, the presence of the geotechnical engineer during construction will enable an evaluation of the exposed conditions and modifications of the recommendations in this report or development of additional recommendations in a timely manner.

10. CLOSURE

SCST should be advised of changes in the project scope so that the recommendations contained in this report can be evaluated with respect to the revised plans. Changes in recommendations will be verified in writing. The findings in this report are valid as of the date of this report. Changes in the condition of the site can, however, occur with the passage of time, whether they are due to natural processes or work on this or adjacent areas. In addition, changes in the standards of practice and government regulations can occur. Thus, the findings in this report may be invalidated wholly or in part by changes beyond our control. This report should not be relied upon after a period of two years without a review by us verifying the suitability of the conclusions and recommendations to site conditions at that time.

In the performance of our professional services, we comply with that level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions and in the same locality. The client recognizes that subsurface conditions may vary from those encountered at the boring locations, and our data, interpretations, and recommendations are based solely on the information obtained by us. We will be responsible for those data, interpretations, and recommendations, but shall not be responsible for interpretations by others of the information developed. Our services consist of professional consultation and observation only, and no warranty of any kind whatsoever, express or implied, is made or intended in connection with the work performed or to be performed by us, or by our proposal for consulting or other services, or by our furnishing of oral or written reports or findings.

11. REFERENCES

American Concrete Institute (ACI) (2012), Building Code Requirements for Structural Concrete (ACI 318-11) and Commentary, August.

California Emergency Management Agency, California Geological Survey, University of Southern California (Cal EMA) (2009), Tsunami Inundation Map for Emergency Planning, June 1.

County of San Diego (2018), SanGIS Interactive Map, http://sdgis.sandag.org/map.aspx, accessed September 2018.

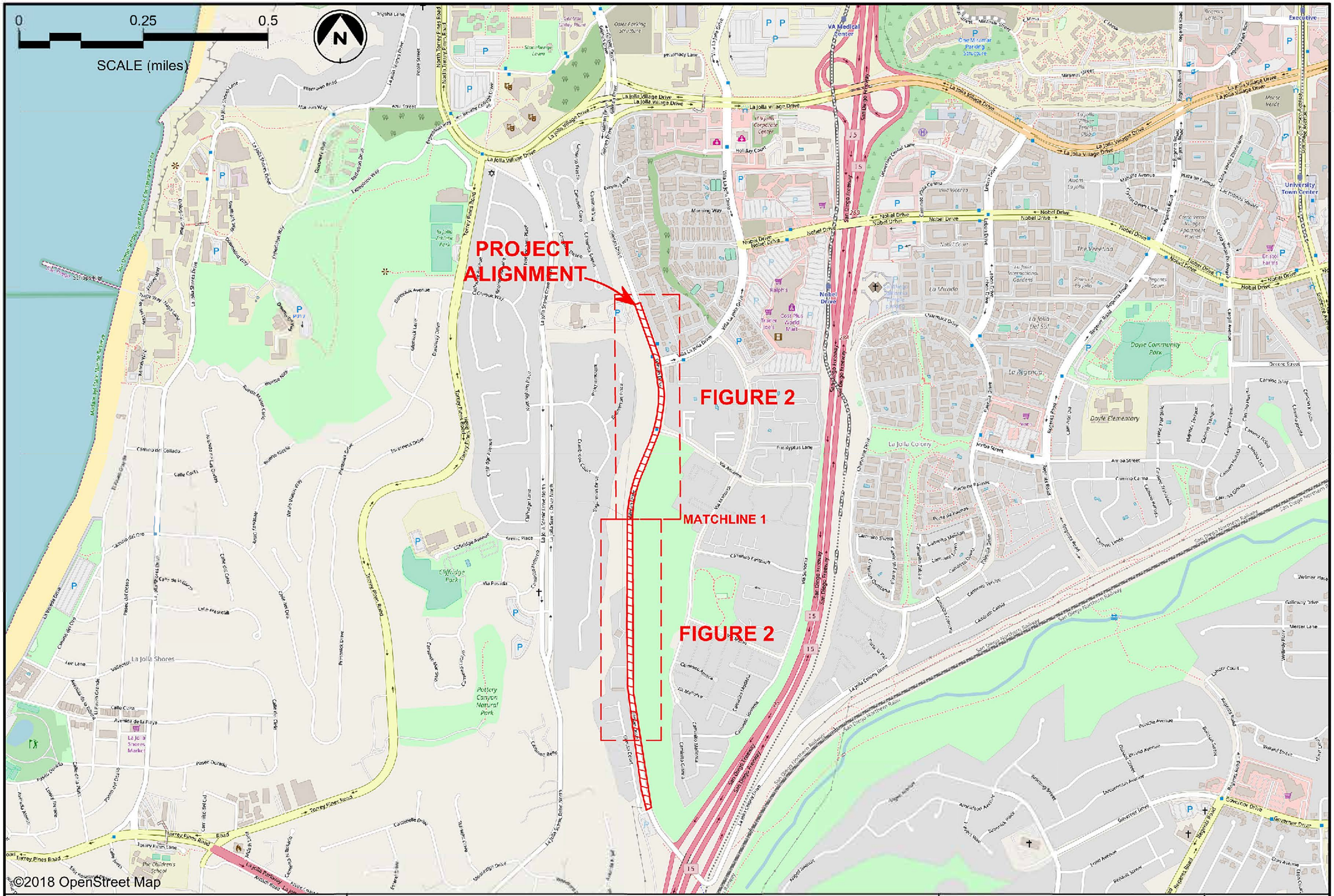
Federal Highway Administration (2015), Geotechnical Engineering Circular No. 7 – Soil Nail Walls, Report No. FHWA-NHI-14-007, dated February.

International Code Council (2012), 2013 California Building Code, California Code of Regulations, Title 24, Part 2, Volume 2 of 2, Based on the 2012 International Existing Building Code, Effective Date: January 1, 2014.

Kennedy, M.P. and Tan, S.S. (2008), Geologic Map of the San Diego 30' x 60' Quadrangle, California, California Geological Survey, Scale 1:100,000.

Public Works Standards, Inc. (2015), The "Greenbook," Standard Specifications for Public Works Construction, 2015 Edition.

U.S. Geological Survey (California Geological Survey), 2006, Quaternary fault and fold database for the United States, accessed August 2, 2018, from USGS web site: http//earthquake.usgs.gov/hazards/qfaults/.



SCST, Inc.

SITE VICINITY MAP

Coastal Rail Trail at Gilman Drive
La Jolla, California

Date:	October, 2018
By:	DTC
Job No.:	160504P3-1

Figure:
1

SCST LEGEND:

⊕	B-6 (4½)	Location of Boring (Depth in Feet)

0 250' 500'

SCALE

NOTE: All Locations are Approximate

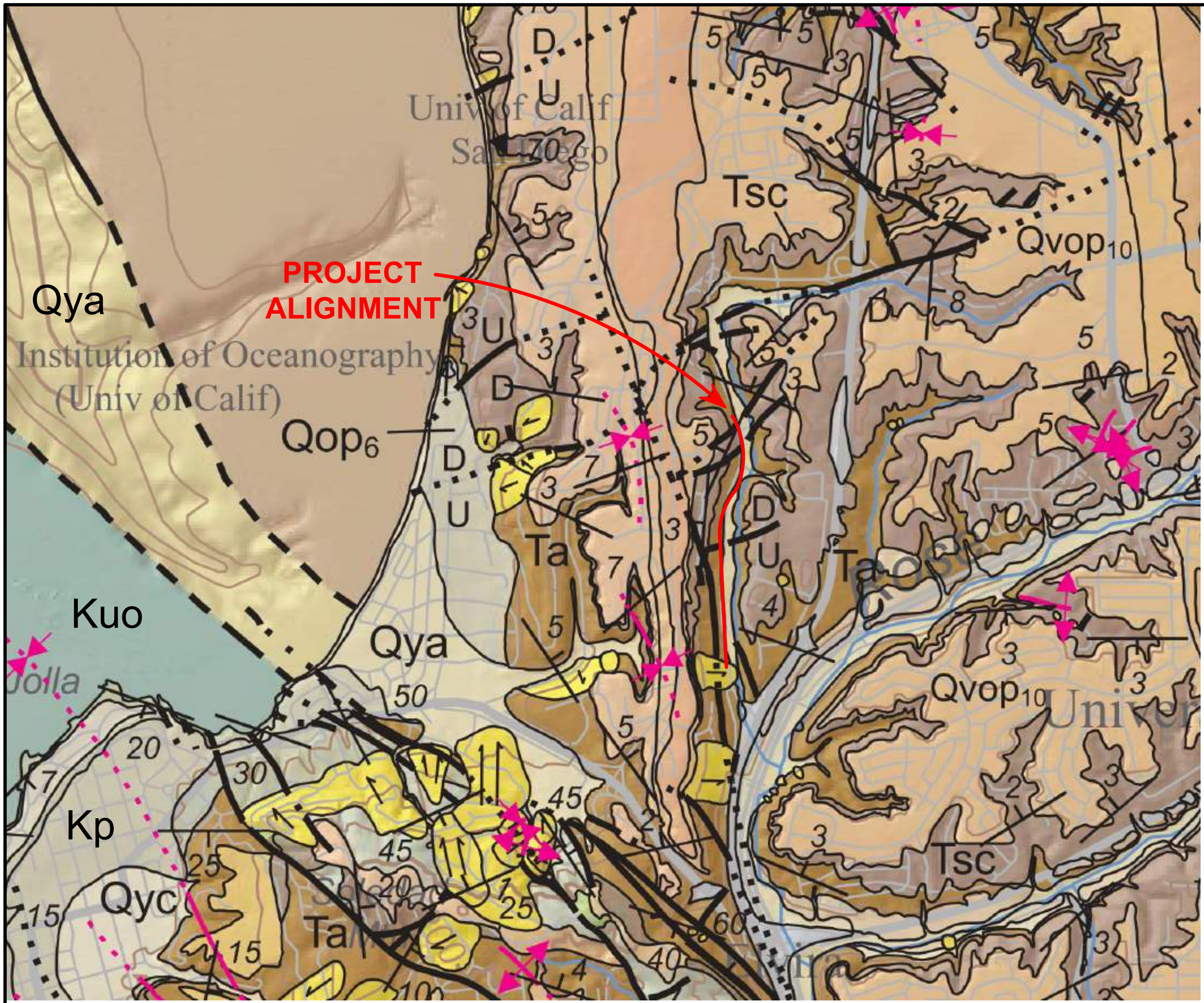
SCST, Inc.

SUBSURFACE EXPLORATION MAP

Coastal Rail Trail at Gilman Drive
La Jolla, California

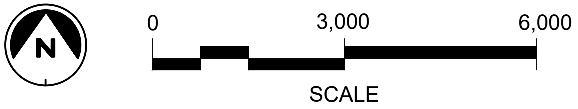
Date: October, 2018
By: DTC
Job No.: 160504P3-1

Figure:
2



EXPLANATION:

Qcf	Canyon fill deposits on offshore region
Qya	Young alluvial flood-plain deposits
Qyc	Young colluvial deposits
Qop	Old paralic deposits, undivided (Unit)
Qvop	Very old paralic deposits, undivided (Unit)
Tsc	Scripps Formation
Ta	Ardath Shale
Kp	Point Loma Formation
Kuo	Undivided rocks of the Rosario Group in the offshore area
	Anticline Fold - Solid where well defined; short dash where inferred
	Syncline Fold - Solid where well defined; short dash where inferred
70 U D	**Fault** - Solid where accurately located; dashed where approximately located; dotted where concealed. U = upthrown block, D = downthrown block. Arrow and number indicate direction and angle of dip of fault plane.
Qls?	**Landslide** - Arrows indicate principal direction of movement. Queried where existence is questionable.
	Strike and **dip** of sedimentary joints Vertical



Reference:
Kennedy, M.P. and Tan, S.S. (2008), Geologic Map of the San Diego 30' x 60' Quadrangle, California, California Geological Survey, Scale 1:100,000.

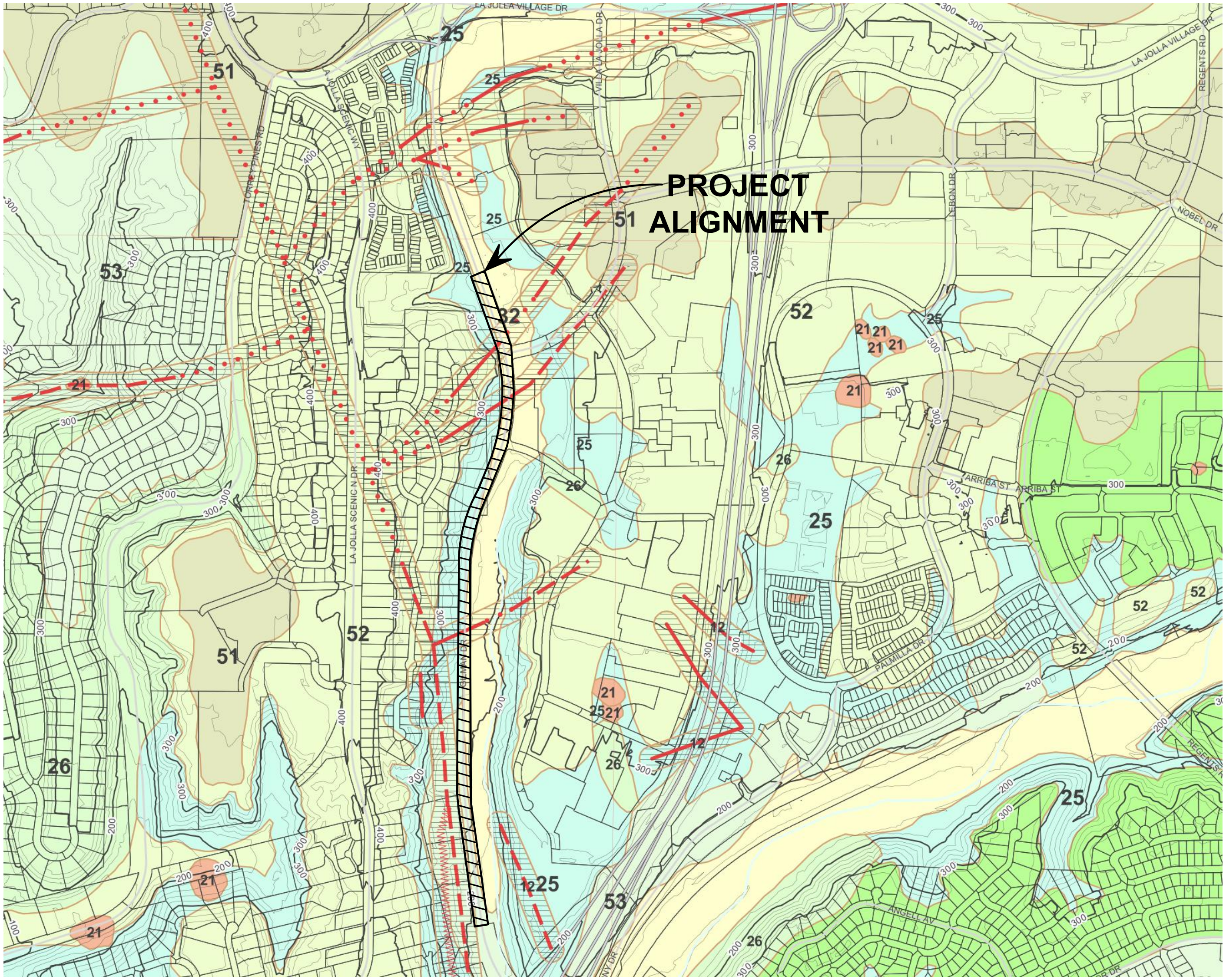
SCST, Inc.

REGIONAL GEOLOGY MAP

Coastal Rail Trail at Gilman Drive
La Jolla, California

Date: October, 2018
By: NNW/DTC
Job No.: 160504P3-1

Figure:
3



EXPLANATION:

FAULT ZONES

▤ 12 Potentially Active, Inactive, Presumed Inactive, or Activity Unknown

LANDSLIDES

🟧 21 Confirmed, known, or highly suspected

▨ 22 Possible or conjectured

SLIDE-PRONE FORMATIONS

▨ 25 Ardath: neutral or favorable geologic structure

▨ 26 Ardath: unfavorable geologic structure

LIQUEFACTION

🟨 32 Low Potential -- fluctuating groundwater minor drainages

OTHER TERRAIN

▨ 51 Level mesas -- underlain by terrace deposits and bedrock nominal risk

▨ 52 Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk

▨ 53 Level or sloping terrain, unfavorable geologic structure, Low to moderate risk

Water (Bays and Lakes)

☐

FAULTS

Fault

Inferred Fault

Concealed Fault

Shear Zone

N

0 0.25 0.5

SCALE (miles)

Reference:
City of San Diego (2008), Seismic Safety Study, Geologic Hazards and Faults, Grid Tile: 30, Development Services Department, April 3, Scale 1:800.

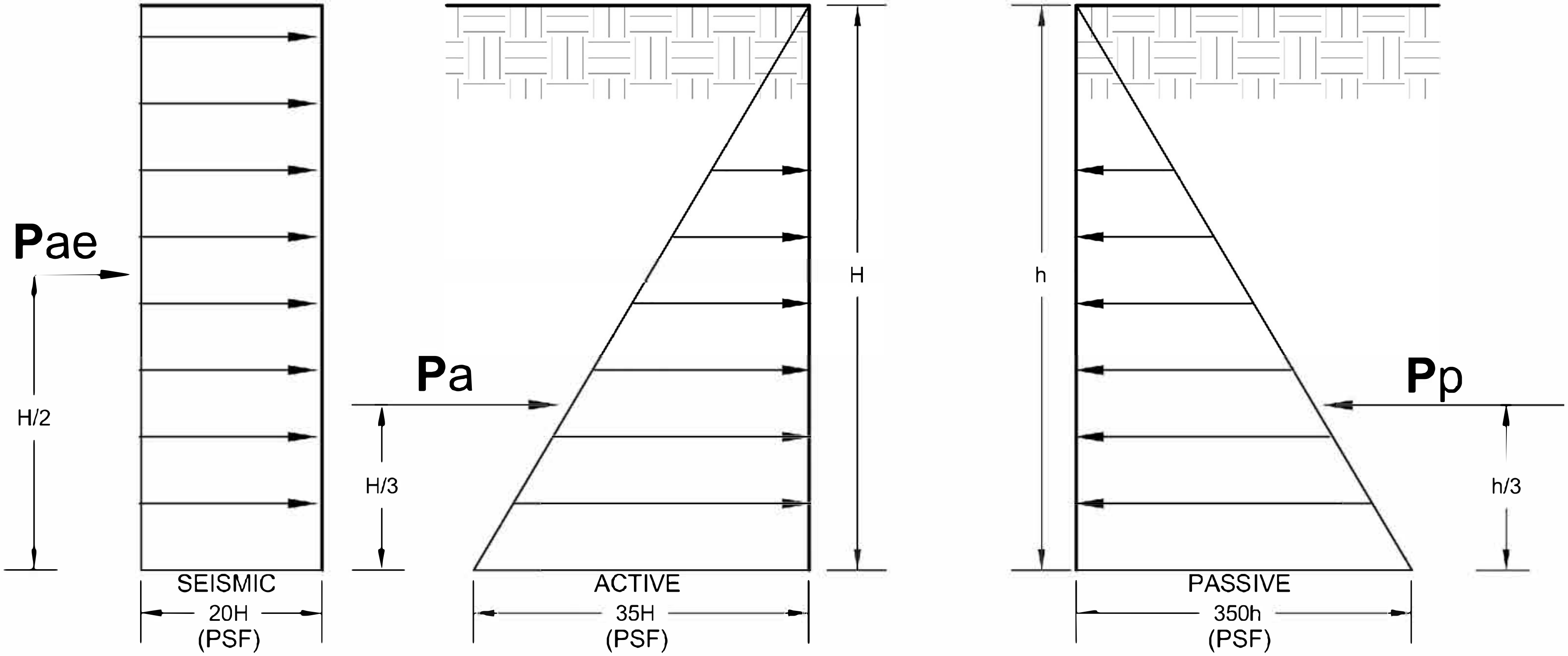
SCST, Inc.

CITY OF SAN DIEGO SEISMIC SAFETY STUDY

Coastal Rail Trail at Gilman Drive
La Jolla, California

Date: October, 2018
By: NNW/DTC
Job No.: 160504P3-1

Figure:
4



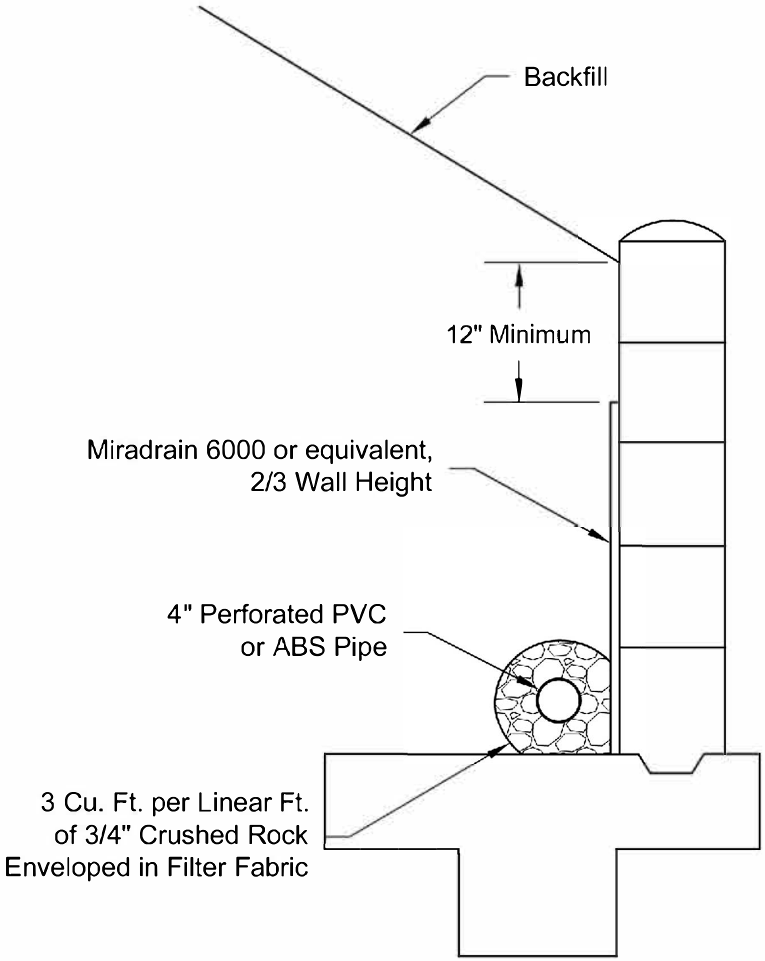
SCST, Inc.

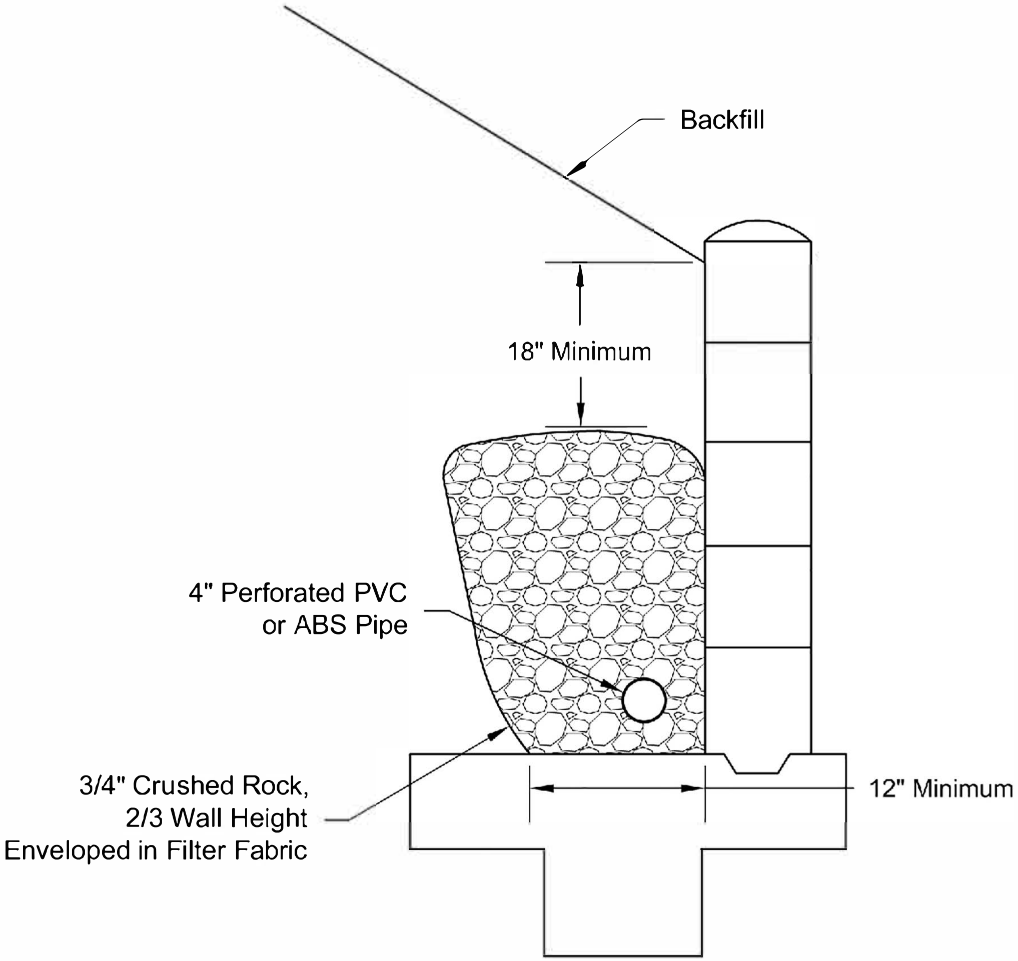
WALL LATERAL EARTH PRESSURE DIAGRAM

Coastal Rail Trail at Gilman Drive
La Jolla, California

Date:	October, 2018
By:	NNW/DTC
Job No.:	160504P3-1

Figure:
5





NOT TO SCALE

NOTES:

1) Dampproof or waterproof back of wall following architect's specifications.
2) 4" minimum perforated pipe, SDR35 or equivalent, holes down, 1% fall to outlet. Provide solid outlet pipe at suitable locations.
3) Drain installation and outlet connection should be observed by the geotechnical consultant.

SCST, Inc.

TYPICAL RETAINING WALL BACKDRAIN DETAILS

Coastal Rail Trail at Gilman Drive
La Jolla, California

Date: October, 2018
By: NNW/DTC
Job No.: 160504P3-1

Figure:
6

APPENDIX I
FIELD INVESTIGATION

Our subsurface investigation consisted of six borings to between depths of about 10 and 40 feet using a hand auger and a truck-mounted drill rig with a hollow stem augur on July 20, 2018 and July 25, 2018 along planned project site on Gilman Drive. The field investigation was performed under the observation of an SCST Engineer who logged the borings and obtained samples of the materials encountered.

The soils are classified in accordance with the Unified Soil Classification System as illustrated on Figure I-1. Logs and location of borings are presented on Figures I-2 through I-7 and Figure 2 respectively.

SUBSURFACE EXPLORATION LEGEND

UNIFIED SOIL CLASSIFICATION CHART

SOIL DESCRIPTION		GROUP SYMBOL	TYPICAL NAMES
I. COARSE GRAINED, more than 50% of material is larger than No. 200 sieve size.			
GRAVELS More than half of coarse fraction is larger than No. 4 sieve size but smaller than 3".	CLEAN GRAVELS	GW	Well graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly graded gravels, gravel sand mixtures, little or no fines.
	GRAVELS WITH FINES (Appreciable amount of fines)	GM	Silty gravels, poorly graded gravel-sand-silt mixtures.
		GC	Clayey gravels, poorly graded gravel-sand, clay mixtures.
SANDS More than half of coarse fraction is smaller than No. 4 sieve size.	CLEAN SANDS	SW	Well graded sand, gravelly sands, little or no fines.
		SP	Poorly graded sands, gravelly sands, little or no fines.
		SM	Silty sands, poorly graded sand and silty mixtures.
		SC	Clayey sands, poorly graded sand and clay mixtures.
II. FINE GRAINED, more than 50% of material is smaller than No. 200 sieve size.			
	SILTS AND CLAYS (Liquid Limit less than 50)	ML	Inorganic silts and very fine sands, rock flour, sandy silt or clayey-silt-sand mixtures with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		OL	Organic silts and organic silty clays or low plasticity.
	SILTS AND CLAYS (Liquid Limit greater than 50)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity.
III. HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils.

SAMPLE SYMBOLS

☒ - Bulk Sample
CAL - Modified California Sampler
CK - Undisturbed Chunk sample
MS - Maximum Size of Particle
ST - Shelby Tube
SPT - Standard Penetration Test sampler

GROUNDWATER SYMBOLS

▽ - Water level at time of excavation or as indicated

≀≀ - Water seepage at time of excavation or as indicated

LABORATORY TEST SYMBOLS

AL - Atterberg Limits
CON - Consolidation
COR - Corrosivity Tests (Resistivity, pH, Chloride, Sulfate)
DS - Direct Shear
EI - Expansion Index
MAX - Maximum Density
RV - R-Value
SA - Sieve Analysis

SCST, Inc.

Coastal Rail Trail at Gilman Drive La Jolla, California			
By:	DTC	Date:	October, 2018
Job Number:	160504P3-1	Figure:	I-1

LOG OF BORING B-1

Date Drilled: 7/20/2018
Equipment: CME-95 w/8-inch HSA
Elevation (ft): 248

Logged by: DJR
Reviewed by: EMW
Depth to Groundwater (ft): Not Encountered

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES		DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf	LABORATORY TESTS
			DRIVEN	BULK					
1	CL	**Fill (Qf):** SANDY CLAY, medium stiff, brown, moist, fine to coarse grained.		☒					SA
2									
3		**BORING TERMINATED AT 3 FEET ON UNMARKED UTILITY**							
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

SCST, Inc.

Coastal Rail Trail at Gilman Drive
La Jolla, California

By:	DTC	Date:	October, 2018
Job Number:	160504P3-1	Figure:	I-2

LOG OF BORING B-2

Date Drilled: 7/20/2018
Equipment: CME-95 w/8-inch HSA
Elevation (ft): 238

Logged by: DJR
Reviewed by: EMW
Depth to Groundwater (ft): Not Encountered

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVEN	SAMPLES BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
	SC	**Fill (Qf):** CLAYEY SAND, medium dense, brown, moist, fine to coarse grained, trace gravel.		☒					
1				☒					AL SA COR EI
2				☒					
3									
4									
5	SM	**YOUNG ALLUVIAL FLOODPLAIN DEPOSITS (Qya):** SILTY SAND, medium dense, brown with mottled orange, moist, fine to coarse grained.	CAL		23	20	7.2	120.1	AL SA
6									
7									
8									
9									
10		Brownish yellow, medium to fine grained	CAL		36	31	11.4	103.0	
11									
12									
13									
14									
15		**ARDATH SHALE (Ta):** CLAYSTONE, brown to gray with mottled orange, moist, well indurated.	CAL		50/5	>50	19.9	107.5	DS
16									
17									
18									
19			CAL		50/5	>50	16.9	107.7	
20									

BORING CONTINUED ON I-4

SCST, Inc.

Coastal Rail Trail at Gilman Drive
La Jolla, California

By:	DTC	Date:	October, 2018
Job Number:	160504P3-1	Figure:	I-3

LOG OF BORING B-2 (CONTINUED)

Date Drilled: 7/20/2018
Equipment: CME-95 w/8-inch HSA
Elevation (ft): 238

Logged by: DJR
Reviewed by: EMW
Depth to Groundwater (ft): Not Encountered

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVEN	SAMPLES BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf	LABORATORY TESTS
		ARDATH SHALE (Ta): SANDY CLAYSTONE, gray with mottled orange, moist, well indurated.							
21									
22									
23									
24									
25									
26			SPT		75	>50			
27									
28									
29									
30									
31			SPT		90/10	>50			
32									
33									
34									
35									
36		Gray with layers of orange, brown and mottled white.	SPT		50/5	>50			
37									
38									
39									
40									

SCST, Inc.

Coastal Rail Trail at Gilman Drive
La Jolla, California

By:	DTC	Date:	October, 2018
Job Number:	160504P3-1	Figure:	I-4

LOG OF BORING B-2 (CONTINUED)

Date Drilled: 7/20/2018
Equipment: CME-95 w/8-inch HSA
Elevation (ft): 238

Logged by: DJR
Reviewed by: EMW
Depth to Groundwater (ft): Not Encountered

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES		DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf	LABORATORY TESTS
			DRIVEN	BULK					
41		**ARDATH SHALE (Ta):** SANDY CLAYSTONE, dark brown and gray with mottled orange, moist, well indurated.	SPT		83/4	>50			
42		**BORING TERMINATED AT 41½ FEET**							
43									
44									
45									
46									
47									
48									
49									
50									
51									
52									
53									
54									
55									
56									
57									
58									
59									
60									

SCST, Inc.

Coastal Rail Trail at Gilman Drive
La Jolla, California

By:	DTC	Date:	October, 2018
Job Number:	160504P3-1	Figure:	I-5

LOG OF BORING B-3

Date Drilled: 7/20/2018
Equipment: CME-95 w/8-inch HSA
Elevation (ft): 239

Logged by: DJR
Reviewed by: EMW
Depth to Groundwater (ft): Not Encountered

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVEN	SAMPLES BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf	LABORATORY TESTS
	SM	**Fill (Qf):** SILTY SAND with GRAVEL, loose, brown, moist, fine to coarse grained.		☒					
1									
2									
3									
4									
5		Medium dense, light to dark brown, moist, fine to coarse grained.							
6			SPT		13	17			
7									
8	ML	**YOUNG ALLUVIAL FLOODPLAIN DEPOSITS (Qya):** SANDY SILT, medium dense, light brown, moist, fine to coarse grained.		☒					
9									SA
10									
11		Dense	CAL		50/4	37	15.5	111.3	
12									
13									
14									
15		**ARDATH SHALE (Ta):** CLAYSTONE, brown, moist, well indurated, interbedded with sand layers.							
16			SPT		81/12	>50			
17									
18									
19									
20									

BORING CONTINUED ON I-7

SCST, Inc.

Coastal Rail Trail at Gilman Drive
La Jolla, California

By:	DTC	Date:	October, 2018
Job Number:	160504P3-1	Figure:	I-6

LOG OF BORING B-3 (CONTINUED)

Date Drilled: 7/20/2018
Equipment: CME-95 w/8-inch HSA
Elevation (ft): 239

Logged by: DJR
Reviewed by: EMW
Depth to Groundwater (ft): Not Encountered

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVEN	SAMPLES BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf	LABORATORY TESTS
21		**ARDATH SHALE (Ta):** CLAYSTONE, brown, moist, well indurated, interbedded with sand layers.	CAL		50/5	>50	7.8	108.4	
22									
23									
24									
25		Gray to brown with mottled orange.							
26			SPT		82/11	>50			
27									
28									
29									
30									
31			SPT		50/2	>50			
32									
33									
34									
35									
36		Gray with layers of orange, brown and mottled white.	SPT		90/8	>50			
37									
38									
39									
40									

SCST, Inc.

Coastal Rail Trail at Gilman Drive
La Jolla, California

By:	DTC	Date:	October, 2018
Job Number:	160504P3-1	Figure:	I-7

LOG OF BORING B-3 (CONTINUED)

Date Drilled: 7/20/2018
Equipment: CME-95 w/8-inch HSA
Elevation (ft): 239

Logged by: DJR
Reviewed by: EMW
Depth to Groundwater (ft): Not Encountered

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES		DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf	LABORATORY TESTS
			DRIVEN	BULK					
41		**ARDATH SHALE (Ta):** SANDY CLAYSTONE, dark brown and gray with mottled orange, moist, well indurated.	SPT		50/4	>50			
42		**BORING TERMINATED AT 41½ FEET**							
43									
44									
45									
46									
47									
48									
49									
50									
51									
52									
53									
54									
55									
56									
57									
58									
59									
60									

BORING TERMINATED AT 60 FEET

SCST, Inc.

Coastal Rail Trail at Gilman Drive
La Jolla, California

By:	DTC	Date:	October, 2018
Job Number:	160504P3-1	Figure:	I-8

LOG OF BORING B-4

Date Drilled: 7/20/2018
Equipment: CME-95 w/8-inch HSA
Elevation (ft): 228

Logged by: DJR
Reviewed by: EMW
Depth to Groundwater (ft): Not Encountered

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVEN	SAMPLES BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf	LABORATORY TESTS
	CL	**Fill (Qf):** SANDY lean CLAY, medium stiff, light brown, moist, fine to coarse grained, few fine gravel.		☒					
1									AL SA COR EI
2									
3									
4		Brown							
5		**ARDATH SHALE (Ta):** CLAYSTONE, brown, moist, well indurated, interbedded with sand layers.	CAL		50/4	>50	16.2	108.7	DS
6									
7				☒					
8									
9									
10		Gray.							
11			SPT		86/10	>50			
12		**BORING TERMINATED AT 11½ FEET**							
13									
14									
15									
16									
17									
18									
19									
20									

SCST, Inc.

Coastal Rail Trail at Gilman Drive
La Jolla, California

By:	DTC	Date:	October, 2018
Job Number:	160504P3-1	Figure:	I-9

LOG OF BORING B-5

Date Drilled: 7/20/2018
Equipment: Hand Auger
Elevation (ft): 246

Logged by: DJR
Reviewed by: EMW
Depth to Groundwater (ft): Not Encountered

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES		DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf	LABORATORY TESTS
			DRIVEN	BULK					
	SM	**Fill (Qf):** SILTY SAND, medium dense, light brown, moist, fine to coarse grained, few fine gravel.		☒					
1									
2									
3									
4		Dense.	CAL				5.4	100	
		BORING TERMINATED AT 4 FEET							
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

SCST, Inc.

Coastal Rail Trail at Gilman Drive
La Jolla, California

By:	DTC	Date:	October, 2018
Job Number:	160504P3-1	Figure:	I-10

LOG OF BORING B-6

Date Drilled: 7/20/2018
Equipment: Hand Auger
Elevation (ft): 246

Logged by: DJR
Reviewed by: EMW
Depth to Groundwater (ft): Not Encountered

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVEN	SAMPLES BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf	LABORATORY TESTS
1 2 3	SM	**Fill (Qf):** SILTY SAND, loose to medium dense, light brown, moist, fine to coarse grained, few fine gravel.		☒					SA AL
4		Dense, gray.	CAL	☒					
5		**BORING TERMINATED AT 4½ FEET**							
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

SCST, Inc.

Coastal Rail Trail at Gilman Drive
La Jolla, California

By:	DTC	Date:	October, 2018
Job Number:	160504P3-1	Figure:	I-11

APPENDIX II
LABORATORY TESTING

Laboratory tests were performed to provide geotechnical parameters for engineering analyses. The following tests were performed:

- **CLASSIFICATION:** Field classifications were verified in the laboratory by visual examination. The final soil classifications are in accordance with the Unified Soil Classification System.

- **PARTICLE-SIZE DISTRIBUTION:** The particle-size distribution was determined on three samples in accordance with ASTM D422.

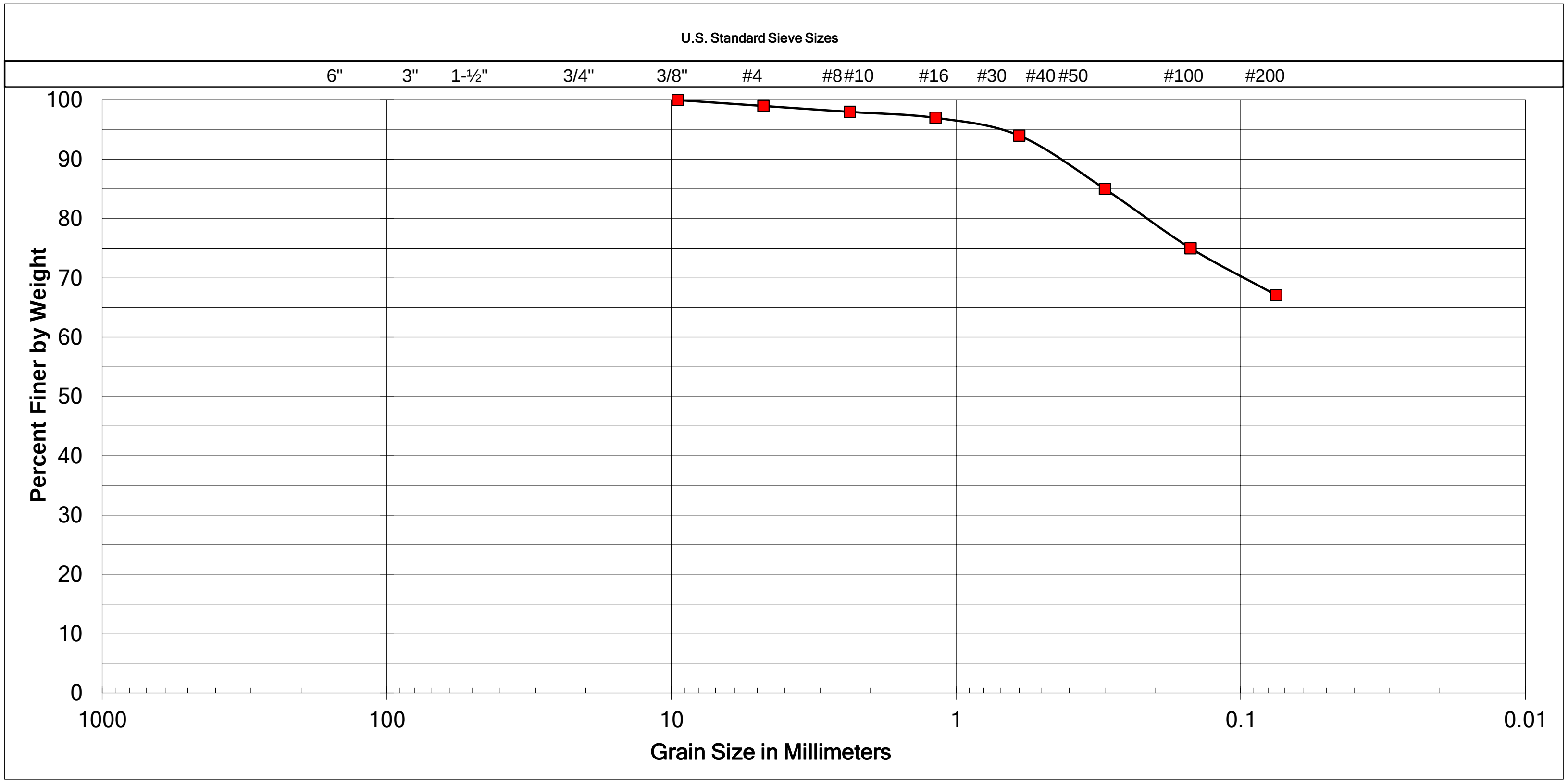
- **ATTERBERG LIMITS:** The Atterberg limits were determined on three samples in accordance with ASTM D4318.

- **EXPANSION INDEX:** The expansion index was determined on two samples in accordance with ASTM D4829. Figure III-4 presents the test results.

- **CORROSIVITY**: Corrosivity tests were performed on two samples. The pH and minimum resistivity were determined in general accordance with California Test 643. The soluble sulfate content was determined in accordance with California Test 417. The total chloride ion content was determined in accordance with California Test 422.

- **DIRECT SHEAR:** A direct shear test was performed in accordance with ASTM D3080. The shear stress was applied at a constant rate of strain of 0.003 inch per minute.

- **NATURAL MOISTURE AND DENSITY**: Corrosivity tests were performed on two samples. The pH and minimum resistivity were determined in general accordance with California Test 643. The soluble sulfate content was determined in accordance with California Test 417. The total chloride ion content was determined in accordance with California Test 422.



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

SAMPLE LOCATION
B-1 at 0 to 3 Feet
SAMPLE NUMBER
31039

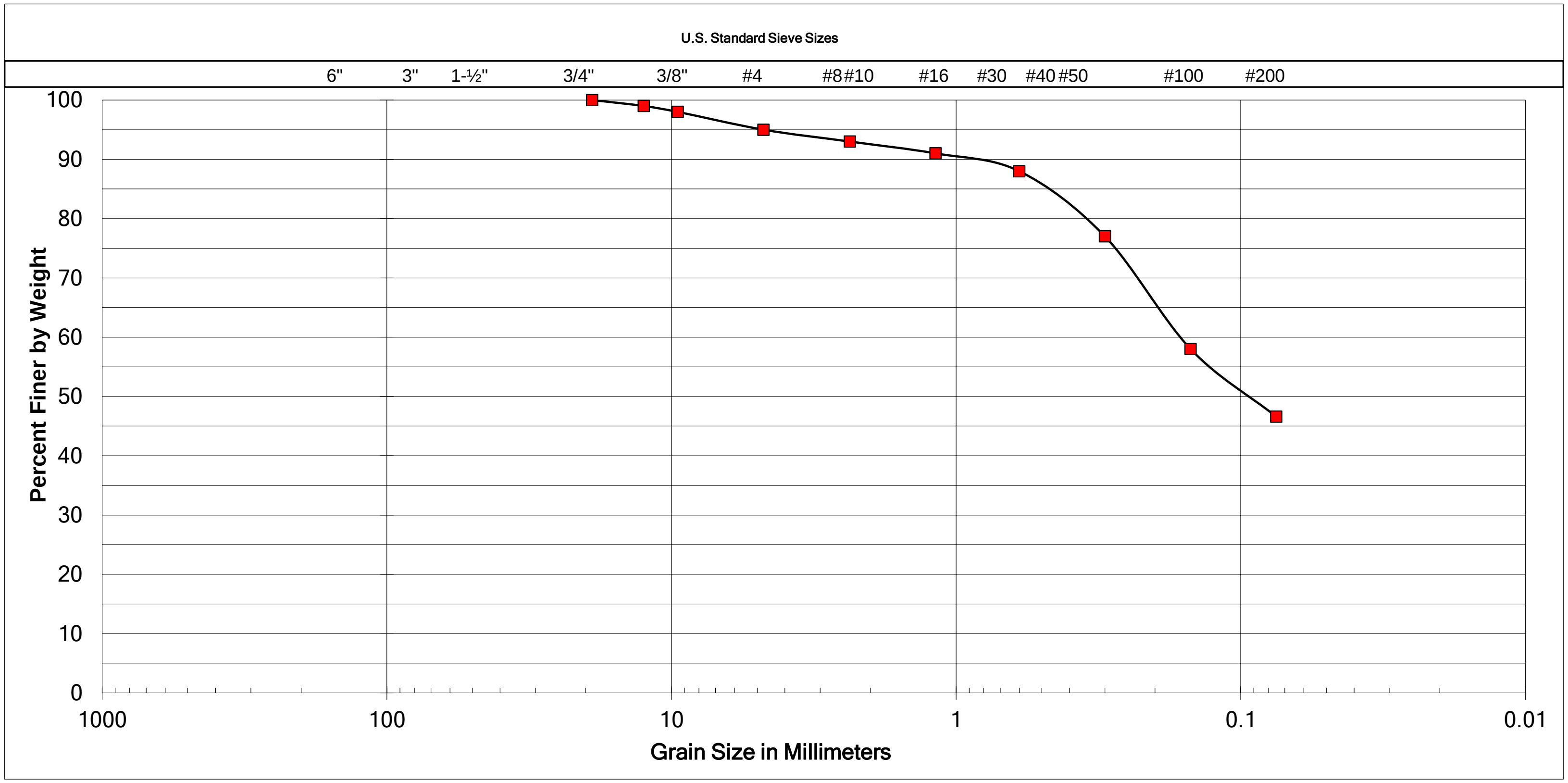
UNIFIED SOIL CLASSIFICATION:	CL
DESCRIPTION	SANDY CLAY

ATTERBERG LIMITS	
LIQUID LIMIT	-
PLASTIC LIMIT	-
PLASTICITY INDEX	-

SCST, Inc.

Coastal Rail Trail at Gilman Drive
La Jolla, California

By:	DTC	Date:	October, 2018
Job Number:	160504P3-1	Figure:	II-1



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

SAMPLE LOCATION
B-2 at 0 to 3 Feet
SAMPLE NUMBER
31040

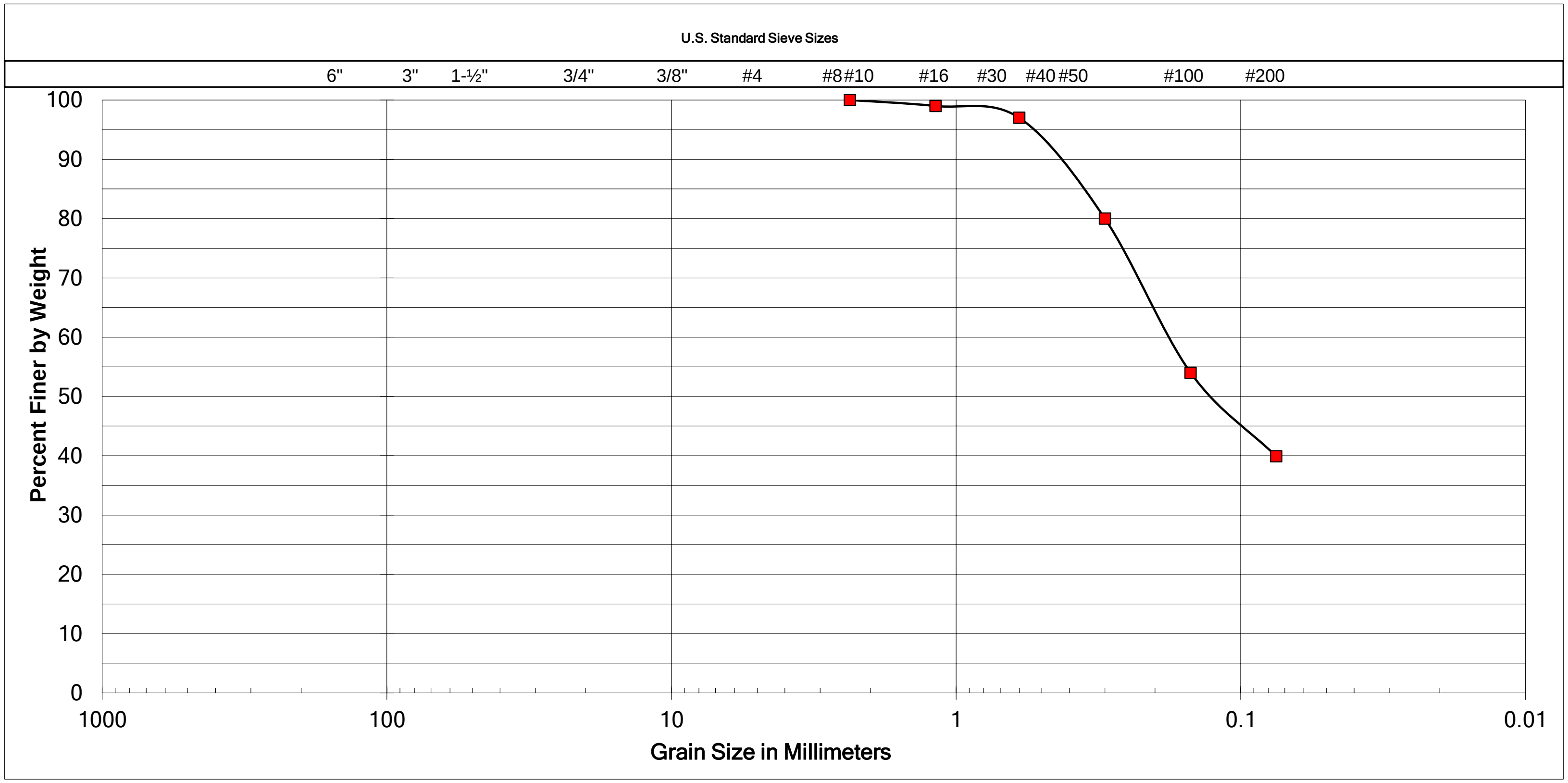
UNIFIED SOIL CLASSIFICATION:	SC
DESCRIPTION	CLAYEY SAND

ATTERBERG LIMITS	
LIQUID LIMIT	29
PLASTIC LIMIT	20
PLASTICITY INDEX	9

SCST, Inc.

Coastal Rail Trail at Gilman Drive
La Jolla, California

By:	DTC	Date:	October, 2018
Job Number:	160504P3-1	Figure:	II-2



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

SAMPLE LOCATION
B-2 at 5½ to 6½ Feet
SAMPLE NUMBER
31041

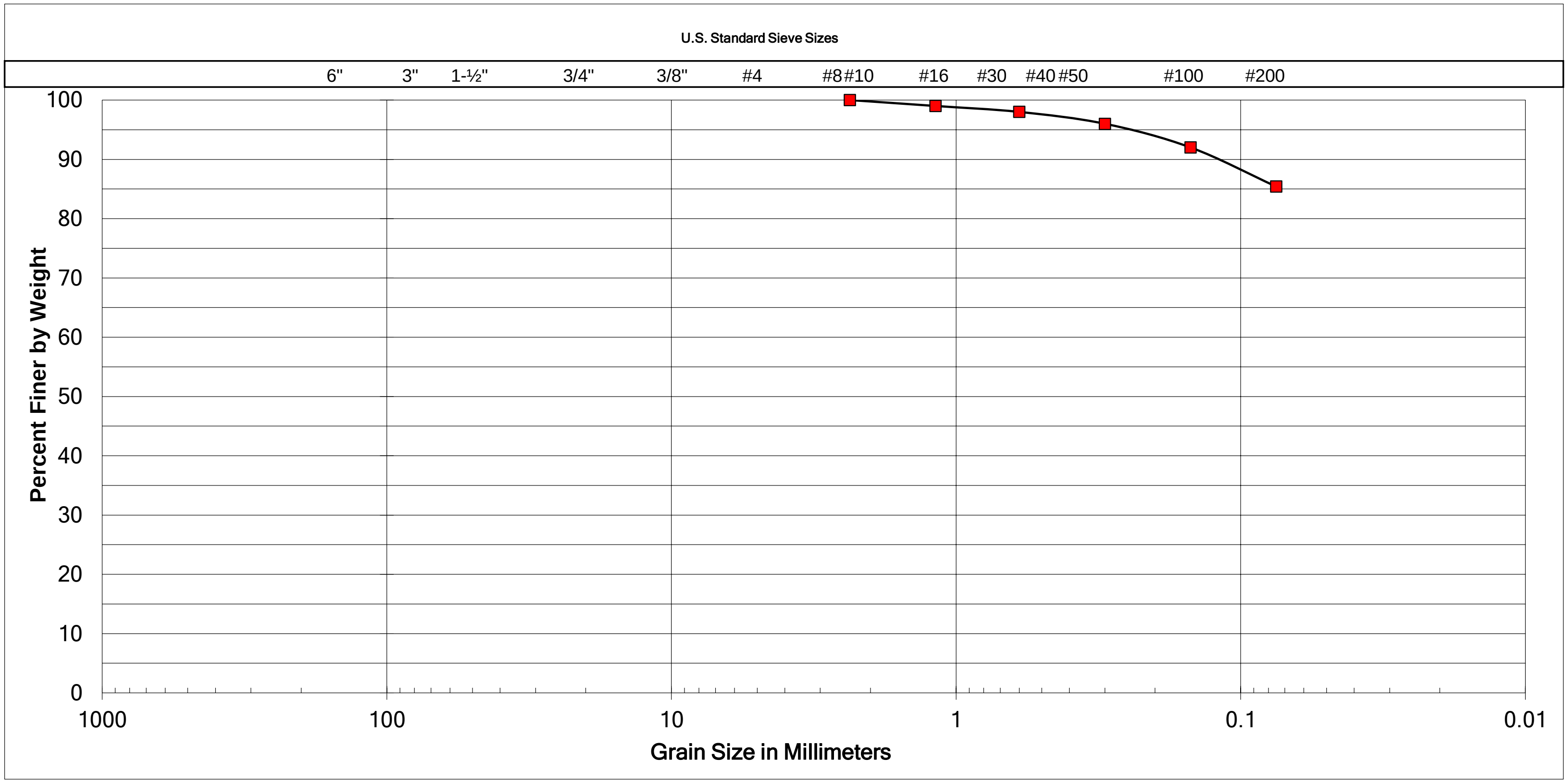
UNIFIED SOIL CLASSIFICATION:	SM
DESCRIPTION	SILTY SAND

ATTERBERG LIMITS	
LIQUID LIMIT	-
PLASTIC LIMIT	-
PLASTICITY INDEX	-

SCST, Inc.

Coastal Rail Trail at Gilman Drive
La Jolla, California

By:	DTC	Date:	October, 2018
Job Number:	160504P3-1	Figure:	II-3



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

SAMPLE LOCATION
B-3 at 7½ to 10 Feet
SAMPLE NUMBER
31048

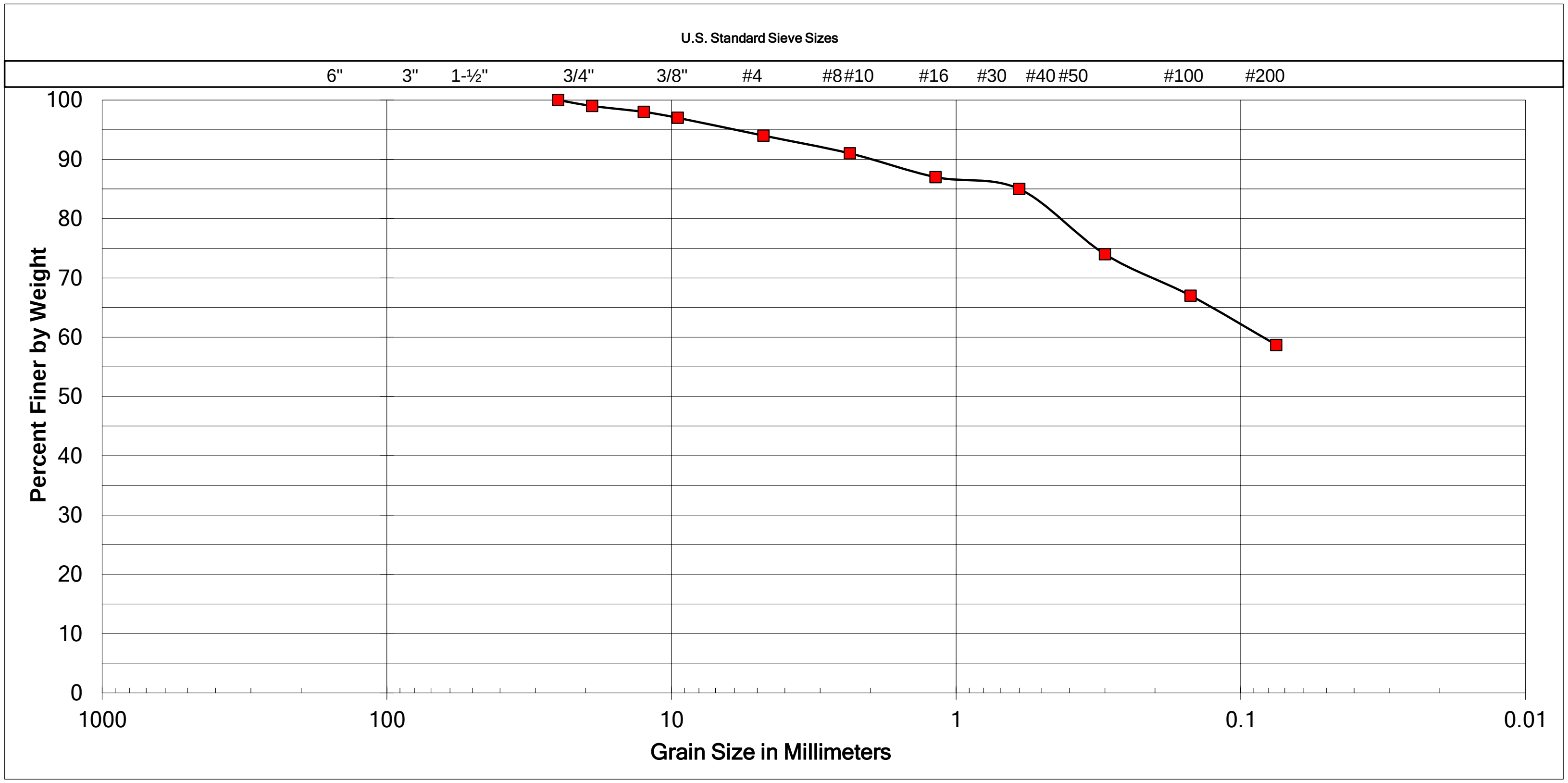
UNIFIED SOIL CLASSIFICATION:	ML
DESCRIPTION	SANDY SILT

ATTERBERG LIMITS	
LIQUID LIMIT	-
PLASTIC LIMIT	-
PLASTICITY INDEX	-

SCST, Inc.

Coastal Rail Trail at Gilman Drive
La Jolla, California

By:	CN	Date:	October, 2018
Job Number:	160504P3-1	Figure:	II-4



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

SAMPLE LOCATION
B-4 at 0 to 4 Feet
SAMPLE NUMBER
31049

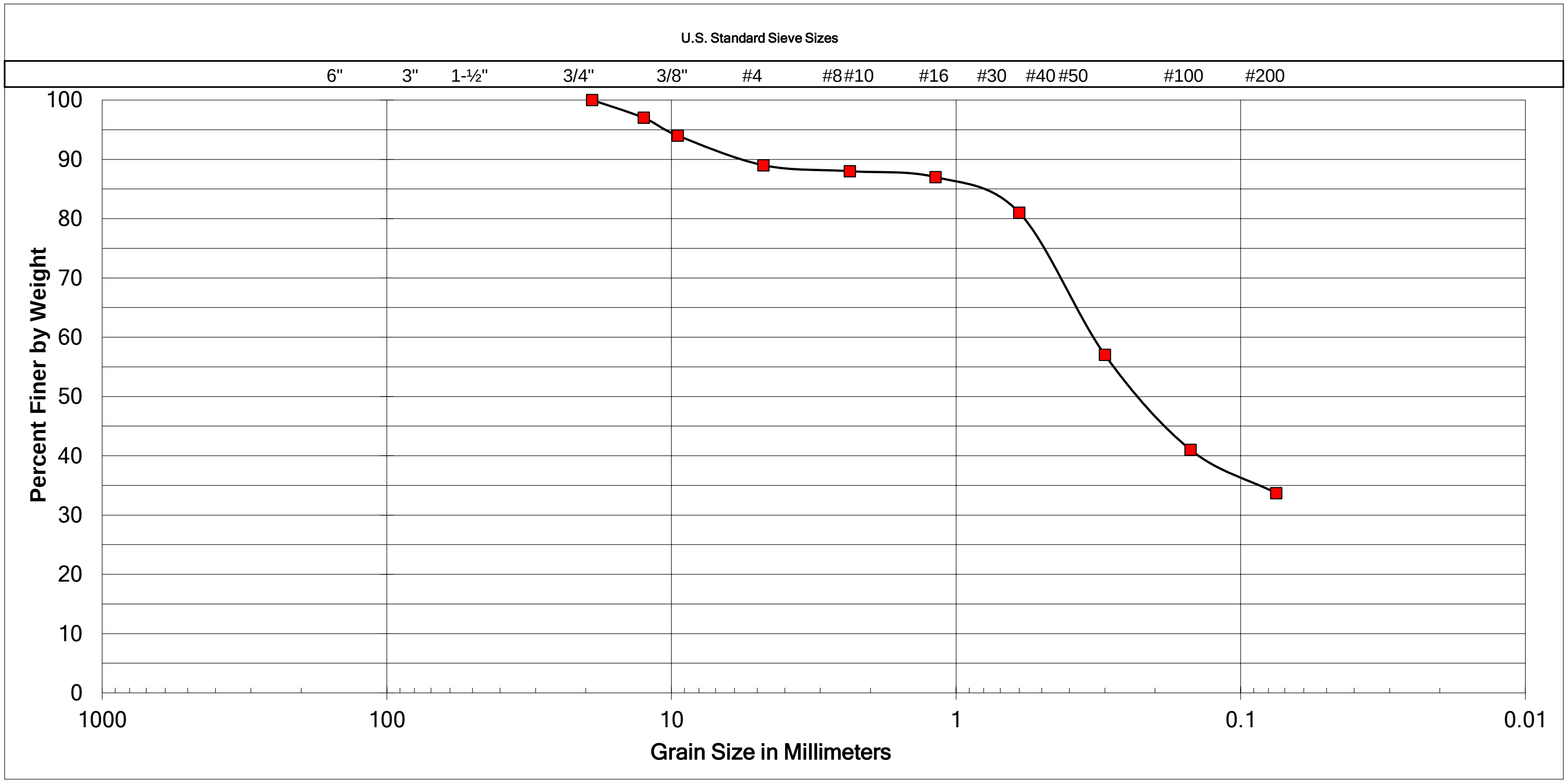
UNIFIED SOIL CLASSIFICATION:	CL
DESCRIPTION	SANDY lean CLAY

ATTERBERG LIMITS	
LIQUID LIMIT	40
PLASTIC LIMIT	23
PLASTICITY INDEX	17

SCST, Inc.

Coastal Rail Trail at Gilman Drive
La Jolla, California

By:	DTC	Date:	October, 2018
Job Number:	160504P3-1	Figure:	II-5



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

SAMPLE LOCATION
B-6 at 0 to 3 Feet
SAMPLE NUMBER
31350

UNIFIED SOIL CLASSIFICATION:	SM
DESCRIPTION	SILTY SAND

ATTERBERG LIMITS	
LIQUID LIMIT	NP
PLASTIC LIMIT	NP
PLASTICITY INDEX	NP

SCST, Inc.

Coastal Rail Trail at Gilman Drive
La Jolla, California

By:	DTC	Date:	October, 2018
Job Number:	180504P3-1	Figure:	II-6

EXPANSION INDEX

ASTM D2489

SAMPLE	DESCRIPTION	EI
B-2 at 0 to 3½ Feet	Brown CLAYEY SAND	31
B-4 at 0 to 4 Feet	Light Brown SANDY lean CLAY	72

Classification of Expansive Soil[1]

EXPANSIVE INDEX	POTENTIAL EXPANSION
1-20	Very Low
21-50	Low
51-90	Medium
91-130	High
Above 130	Very High

1. ASTM - D4829

RESISTIVITY, pH, SOLUBLE CHLORIDE and SOLUBLE SULFATE

pH & Resistivity (Cal 643, ASTM G51)

Soluble Chlorides (Cal 422)

Soluble Sulfate (Cal 417)

SAMPLE	RESISTIVITY (Ω-cm)	pH	CHLORIDE (%)	SULFATE (%)
B-2 at 0 to 3½ Feet	2760	7.28	0.002	0
B-4 at 0 to 4 Feet	979	8.04	0.007	0.016

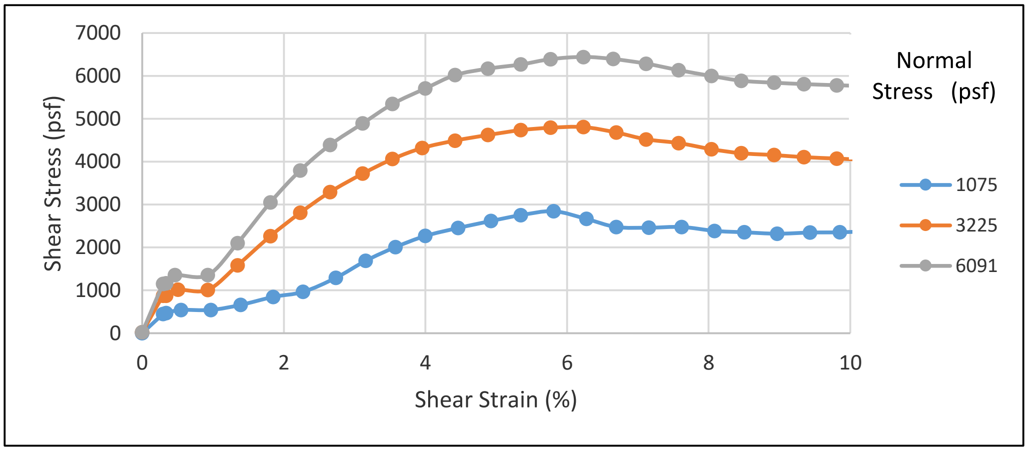
Sulphate Exposure Classes[2]

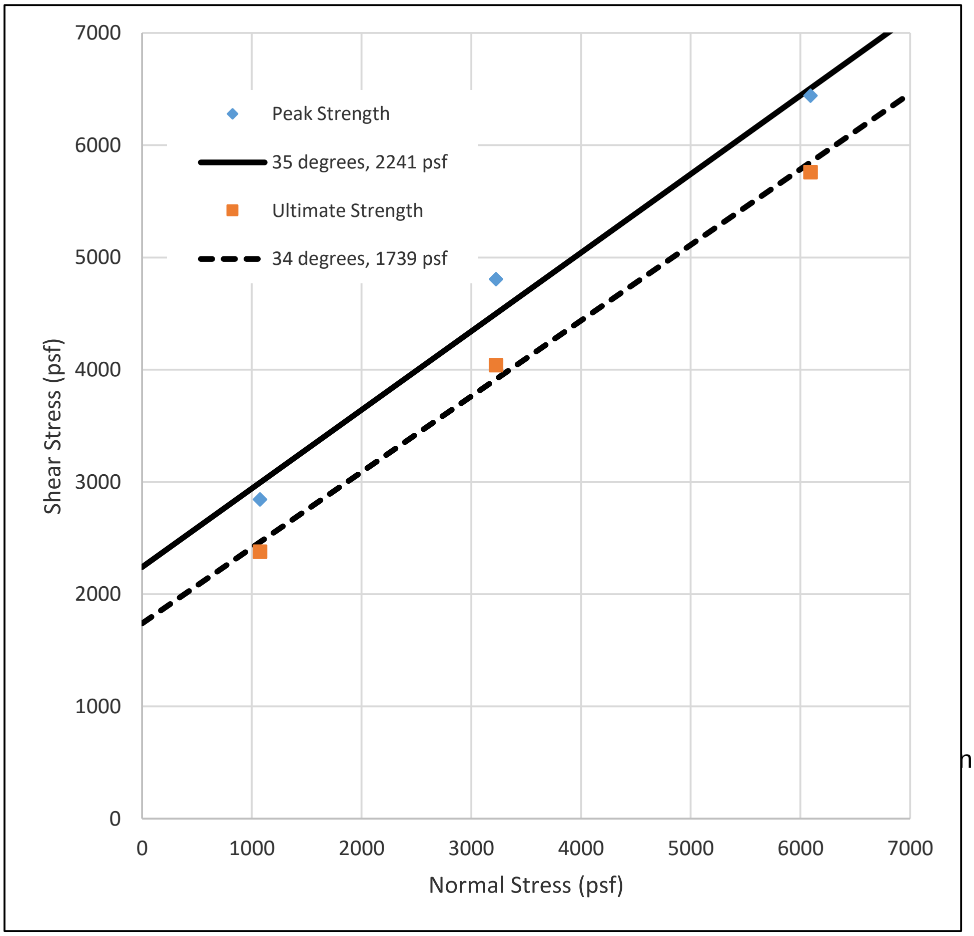
CLASS	SEVERITY	WATER-SOLUBLE SULFATE (SO_4) IN SOIL, PERCENT BY MASS
S0	Not applicable	$SO_4 < 0.10$
S1	Moderate	$0.10 \leq SO_4 < 0.20$
S2	Severe	$0.20 \leq SO_4 \leq 2.00$
S3	Very Severe	$SO_4 > 2.00$

2. ACI 318, Table 19.3.1.1

SCST, Inc.

Coastal Rail Trail at Gilman Drive La Jolla, California			
By:	DTC	Date:	October, 2018
Job Number:	180504P3-1	Figure:	II-7





nia

SAMPLE ID: B-2 at 16½ Feet

Light Brown CLAYSTONE

NOTES: Insitu

Strain Rate: 0.003 in/min

Sample was consolidated and drained

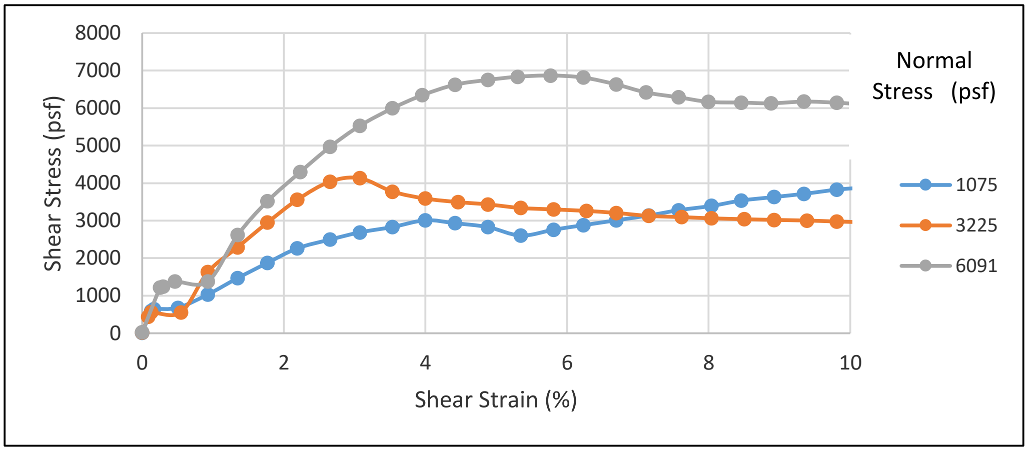
	Peak	Ultimate
Φ	35 °	34 °
c	2241 psf	1739 psf

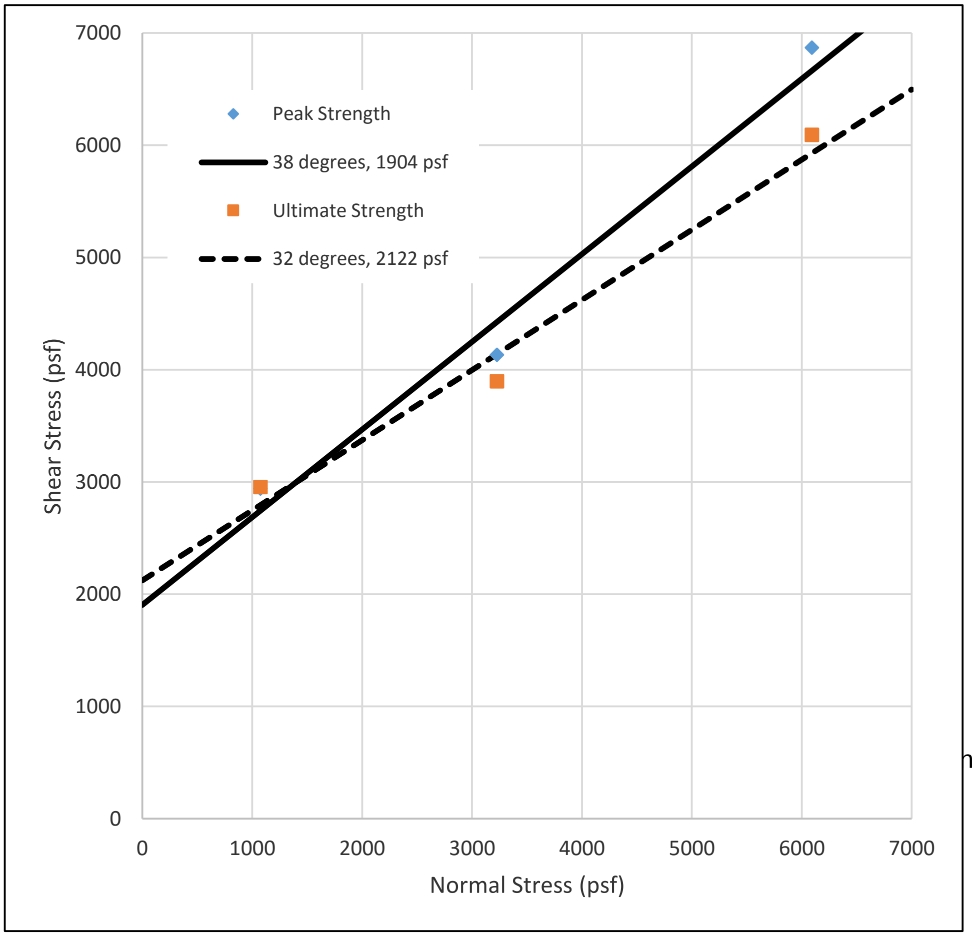
	Initial	Final
γ_d	107.0 pcf	107.0 pcf
w_c	19.9 %	23.6 %
Saturation	95 %	100 %

SCST Inc.

Coastal Rail Trail at Gilman Drive
La Jolla, California

By:	DTC	Date:	October, 2018
Job Number:	160504P3-1	Figure:	II-8





nia

SAMPLE ID: B-4 at 6½ Feet

Light Brown CLAYSTONE

NOTES: Insitu
Strain Rate: 0.003 in/min
Sample was consolidated and drained

	Peak	Ultimate
Φ	38 ^{o}	32 ^{o}
c	1904 psf	2122 psf

	Initial	Final
γ_d	108.7 pcf	111.6 pcf
w_c	16.2 %	23.2 %
Saturation	80 %	100 %

SCST Inc.

Coastal Rail Trail at Gilman Drive
La Jolla, California

By:	DTC	Date:	October, 2018
Job Number:	160504P3-1	Figure:	II-9

SCST
— AN ATLAS COMPANY —

GEOTECHNICAL ADDENDUM

July 11, 2019

SCST No. 160504P3
Report No. 3

Larry Thornburgh, PE, PLS
Nasland Engineering
4740 Ruffner Street
San Diego, CA 92111

Subject: GEOTECHNICAL ADDENDUM
COASTAL RAIL TRAIL AT GILMAN DRIVE
GILMAN DRIVE AND VILLA LA JOLLA DRIVE
LA JOLLA, CALIFORNIA

Reference: SCST, Inc. (2018), “Geotechnical Investigation, Coastal Rail Trail at Gilman Drive, Gilman Drive and Villa La Jolla Drive, La Jolla, California”, Report 160504P3-01R October 17.

Dear Mr. Thornburgh:

SCST, LLC (SCST), an Atlas company, has prepared this report to provide a record of supplemental geotechnical recommendations for the subject project as discussed with Libby Engineers, Inc. The recommendations contained in our referenced report remain applicable except as updated or revised herein.

UPDATED RECOMMENDATIONS

SOIL NAIL WALL

The following additional design parameters can be used for the design of the soil nails.

- Equivalent Fluid Pressure, active = 35 pcf + 20 pcf for 2:1 back slope (triangular loading)
- Equivalent Fluid Pressure, seismic = 20 pcf (rectangular loading)
- Temporary excavations 5 feet deep or less can be made vertically
- Failure plane is at 61 degrees from horizontal
- No geotechnical requirement for additional unbonded length beyond failure plan is required

If you have questions, please call us at (619) 280-4321.

Respectfully Submitted,
SCST, LLC

REGISTERED PROFESSIONAL ENGINEER
DANIEL J. RICHARDSON
C 89379
Exp. 12/31/20
CIVIL
STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
ISAAC B. CHUN
No. 2649
EXP. 12/31/19
GEOTECHNICAL
STATE OF CALIFORNIA

Daniel Richardson, PE C89379
Project Engineer

Isaac Chun, PE, GE 2649
Principal Engineer

DR:IC:hu

(1) Addressee via e-mail at larryt@nasland.com
(1) Sam Waisbord via e-mail at samw@nasland.com